# QUEENSLAND URBAN UTILITIES 

## SP464 James Street, Lowood

Contract :
C1011-045 Order No: C1314-146
Job Number : 43402225

## ELECTRICAL INSTALLATION

## OPERATIONS and MAINTENANCE MANUAL

INSTALLATION BY:
SJ Electric Group(Qld) Pty Ltd
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## 1. General

### 1.1 General Workplace Health and Safety

- The Workplace Health and Safety Act (2011) sets out the laws about Workplace Health and Safety for all workplaces, workplace activities and specified high risk plant. The Electrical Safety Act (2002) sets out the laws covering electrical safety. Nothing in this document is designed, in any way, to undermine the authority of the Acts.
- All reasonable care must always be taken to ensure the plant is without risk to the health and safety of personnel operating and maintaining plant and equipment.
- Employers have an obligation to ensure the workplace health and safety of all personnel at work.
- It is employer responsibility to ensure that all persons entering or working on the premises use appropriate personal protective equipment.
- Personal protective equipment includes gloves, safety glasses, hard hats, ear protection, safe foot ware and, where necessary, specialist protective clothing for hazardous areas.
- Any item of equipment should always be isolated before maintenance or repairs commence to ensure that inadvertent operation of the item does not result in risk to the health and safety of any person.
- Where the item is isolated, any total or partial shutdown should not allow a hazardous situation to be created.
- Where the item cannot be isolated, another person should be stationed at the controls of the item and an effective means of direct communication should exist between the persons carrying out the maintenance and the person at the controls.


## General Operating Principles

- All persons working the premises must be qualified Electrical Engineers or electrical trades persons capable of performing the required tasks competently. All personnel must also be familiar with plant and equipment.
- Adequate information, instruction, training and supervision must be provided to enable personnel to perform work without risk to health and safety.
- Work in an orderly way.
- Plan work in advance to avoid hazardous situations.
- Warn others of any hazards.
- Make inquiries before starting work, particularly on any unfamiliar installation or equipment.
- Before any work begins ensure that any instructions received or given are fully understood.
- Concentrate on the task on hand.
- Do not distract others or allow yourself to be distracted by foolish actions.
- Work from a safe and convenient position that provides a maximum working space that you do not have to over reach, you cannot slip, trip or stumble and so endanger yourself and others.
- Keep the working area tidy and free of unwanted materials and equipment.
- Use insulated tools where possible.
- Inspect tools and equipment regularly and ensure that any necessary maintenance is carried out.
- Keep yourself in good health.
- Do not work if ill or over tired, to the extent that your concentration, movement or alertness is affected. Illness or fatigue can endanger yourself and others.


### 1.2 Project Overview

Contract C1011-045 Order No: C1314-146 was for the manufacture and testing of six (6) new sewage pump station switchboards at various locations and the relocation of an existing switchboard at Rosebeery Parade, Woodend.

Equipment provided by SJ Electric ensures safe and efficient operation of the pump station. Equipment supplied and installed by SJ Electric includes: -

- Switchboards
- Field Wiring

The switchboard incorporates the latest technology in motor control, power monitoring, and instrumentation. It is important engineers, technicians and operators are familiar with the equipment installed before attempting any adjustments, modifications or maintenance.

The following Sections of this manual contain a comprehensive description of all equipment supplied, by SJ Electric. It is recommended that this manual be referred to before carrying out any work on any equipment.

### 1.3 Plant Maintenance

To ensure proper operation of the plant the following should be observed: -

- The plant should be kept clean and tidy at all times. Not only is this of aesthetic value, it extends equipment life.
- Check that all plant and equipment is operating correctly. Correctly operating equipment promotes overall plant efficiency.
- All items and areas of equipment should be cleaned regularly.


## WARNING

- Avoid directly hosing any drive motor or electrical item.
- All maintenance, service, modifications and significant deviations from Normal operating conditions should be recorded in the Plant Service Log
- After a month of operation, check the tension of all bolts associated with the plant and thereafter periodically. Bolted connections on painted surfaces can loosen due to thinning of the paint underneath the bolt head-bearing surface. Motor mounting bolts and other bolted connections subjected to vibration should be periodically checked for loosening.


## WARNING

- Before starting work on any item ensure that the power supply is isolated, tagged off, and the item cannot be started.
- The importance of preventative maintenance cannot be over-emphasized. Regular maintenance and suitable care of the equipment will ensure a long and reliable service life of the equipment.
- Many stoppages can be avoided by following the recommended maintenance procedures. Do not wait until you hear the grinding of equipment that has broken down. If you see any item wearing down, replace it, before it causes damage to other associated items.


## Preventive Maintenance

Maintenance procedures recommended to extend switchboard life are outlined as follows: -

- Switchboard exterior should be regularly wiped down with a solvent base cleaner such as "Spray \& Wipe". This will ensure longevity of the powdercoated surface.
- Accessible areas like distribution boards and motor starter panels should be cleaned with a vacuum cleaner to remove dust and foreign matter.
- PLC panels should be maintained as dust free as possible. Dusting with a dry rag is recommended - taking care not allows dust inside the I/O modules or processor.
- When removing or installing PLC modules care should be taken to ensure that power is turned off to the rack before modules are removed or installed.
- Connections and efficient operation of circuit breakers, contactors and isolators should be checked every 12 months - especially where connected to busbars.
- Busbar connections should be checked every 12 months.
- Globes for indicator lights should be checked on a weekly basis with any faulty lamps replaced.
- Cubicle Fans Filter should be inspected and cleaned frequently.


### 1.4 Electrical Control System

## General Description

The switchboards are manufactured from 3 mm aluminium and are suitable for location outdoors; the switchboards have been designed by QUU and contain several separate sections including:

- Incoming Section.
- Motor Starter Section.
- Distribution Section.
- RTU Section.


### 1.5 Control and Monitoring System.

The control and monitoring of the system is performed by the Queensland Urban Utilities telemetry system and was not included in this contract.

## 2. Manufacturers Technical Data

## TECHNICAL DATA SHEET

## Equipment Type:

## Location:

Model Numbers:various
Manufacturer:
Supplier:
NHP Pty Ltd
16 Riverview Place
Murarrie(07) 39094999

## CIRCUIT BREAKER PRODUCTS PRICE LIST 2013

## NF-

## CPB



Sales 1300 NHP NHP
PROUDLY SUPPORTING
AJS:GALIAN MADE AND OWNED

## SP464 James St Lowood SPS - Electrical Installation OM Manual Terasaki and NHP

The Terasaki Electric Company, Japan, was founded in 1923 in the industrial city of Osaka. In its early beginnings it started with the manufacture of air circuit breakers. Terasaki later expanded its operations in the late 40 s when they entered the marine industry manufacturing a complete line of moulded case circuit breakers.
Terasaki is world famous for its installations of marine switchgear, including air and moulded case circuit breakers in a majority of the world's ocean-going marine vessels.
Terasaki has developed systems beyond basic switchgear requirements for guidance and monitoring of ships on the high seas.
Terasaki is very proud of its achievements in this area, proving that quality and reliability of Terasaki products is recognised where service conditions are sometimes arduous and severe.
In the 1960s Terasaki expanded their production facilities to enable them to enter the industrial market as well as continuing to expand within the well established marine business. Terasaki have a total of four factories throughout Japan, mainly in the Osaka area, as well as affiliated companies in the UK, Malaysia, Spain, Italy, Finland, Sweden, Brazil and China.
Terasaki were the pioneers and the first circuit breaker company to introduce current limiting circuit breakers to the world in 1963 utilising the contact repulsion principle, which was first introduced in the TL range of moulded case circuit breakers.
NHP was appointed sole agent for Terasaki products in Australia in 1979 and in New Zealand in 1999. From that time until now, NHP has established Terasaki products as a standard in the market.

Prices shown in published catalogues or price lists are recommended selling prices only and there is no obligation on the part of any reseller to maintain the same prices. Prices are subject to change without notice and all orders are accepted by the Company on the condition that they will be invoiced at the prices ruling at the date of despatch.
Prices are nett unless otherwise stated, are shown in Australian Dollars, are valid only for sales within Australia and are subject to GST.
Products offered for sale in this pocket book are subject to our standard Conditions of Sale, applicable at the date the order is placed. NHP standard Conditions of Sale can be viewed on our website at http://ecat.nhp.com.au or by requesting a copy from any NHP office. NHP has a policy of continuous product improvement and we reserve the right to alter any product at any time without notice. All detail is subject to change without notice and should be confirmed at the time of purchase. All price lists and quotations are issued on an Errors \& Omissions Excepted basis (E\&OE).

Miniature circuit breakers (MCBs) and acc. Safe-T MCBs, Din-T MCBs Din-T6, 10, 10H and 15, Din-Safe RCDs and safety switches, Din-T MCB accessories. Surge diverters, contactors and time switches.

Panelboards, loadcentres and accessories
Insulated and metal loadcentres, general purpose, multi-purpose and premier panelboards, busbar chassis and fuses.

Tembreak 1 and 2
Moulded Case Circuit Breakers (MCCBs)
Thermal magnetic and electronic type MCCBs, earth leakage switches, DC and plug-in MCCBs.

Chassis assemblies for theTemBreak range
Temway XA / XB, PXB, XB SS and XC series, chassis to suit 125-250 AF MCCBs, terminal covers and HC high current chassis.

## MCCB transfer switches and controllers

Manual, basic and automatic transfer switches, logic panels, transfer switch options and accessories.

## TemBreak 630 A - 1600 A and 1000 V mining MCCBs

Thermal-magnetic and electronic MCCBs, 1000 V mining MCCBs and MCCB isolating switches.

Air Circuit Breakers and Arc detection relays
Standard air circuit breakers, main power circuit terminals, overcurrent relays and serial communication options. Arc detection relays.

## Earth leakage relays

Surface mounting type TZS, DIN rail mounting type RD3A and RD1B, panel mounting type RD1DF, RD1EP, RD3E2 and RD1G2 and mining earth leakage relays.

## Technical reference

MCB, MCCB general technical information, motor starting tables, DC applications, discrimination (selectivity) cascading, Type ' 1 ' and '2' co-ordination data. Electronic MCCB setting details.

## SP464 James St Lowood SPS - Electrical Installation OM Manual

This price list catalogue is segregated into sections. A guide to the contents of each section is situated at the front of the price list catalogue, and the first page of each section has its own index for easier product selection.
A product listing index is situated at the front of this price list.
Each page has a bold section number for prompt page location and is identified by both its section number and its page number eg. 1-16 signifies this is section 1 page 16. All catalogue numbers are bold and shaded.

## All prices are in \$AUS (exclusive of GST)

Prices for equipment fitted with coils, apply to standard voltages only. Non-standard voltages shown are available on request at additional cost.
An alphanumeric index by catalogue number is located at the rear of the price list catalogue. Items prefixed $\mathbf{I}$ in the alphanumeric index are available on indent only. These items are not stocked and will be brought in only on a customer request, the item can not be returned for credit. For more infomation on indent items please contact NHP customer service. Items prefixed $\mathbf{A}$ in the alphanumeric index are assembled to customer order/ requirements.
Current NHP standard conditions of sale apply to this price list catalogue.
The prices in this price list catalogue are recommended prices only (exclusive of GST) and there is no obligation on resellers to comply with the recommendation.



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## SP464 James St Lowood SPS - Electrical Installation OM Manual

 National Manufacturing and Distribution CentreNHP prides itself on being able to provide customers with tailored solutions that suit their individual needs. Whilst we have significant stockholdings and expertise at all our locations throughout Australia and New Zealand, the purpose of our National Manufacturing and Distribution Centre in Laverton, Melbourne is to develop these solutions through manufacturing, assembly, servicing and design and engineering.

## SIZE

Warehouse $7,000 \mathrm{~m} 2$ Manufacturing $5,000 \mathrm{~m} 2$

## STAFF

270+ Employees

## OPERATING HOURS

6.00am - 11.30pm, Monday-Friday

## STOCKHOLDING

- 45,000+ line items ( 20,000 stocked)
- Approximately \$70 M


## ITEM THROUGHPUT

- Approximately 5,500 per day (6,000 lines throughout Australasia)


## FACTS

- Orders released for picking before 3.00 pm are despatched the same day.
- The Supply Chain team strives to achieve $95 \%$ customer service based on an 'on time in full, first time' measurement.


NHP NATIONAL MANUFACTURING AND DISTRIBUTION CENTRE

## Creating a sustainable future

## Adopting emerging technologies to support sustainable practices

A major push towards more sustainable practices by many in the industrial electrical industry is today clear for all and a major focus at NHP is to provide sustainable solutions for our customers as well as throughout our own operations.

In 2010 we designed and constructed our very own Sustainability Centre - located at our existing National Manufacturing and Distribution Centre in Laverton, Melbourne.

Housing cutting-edge technology and equipment enabling research \& development and testing, the Centre aids investigation into ways to effectively introduce and manage sustainable practices. Sustainable technologies within the centre include:

- A horizontal axis wind generator
- Solar photo-voltaic systems
- Grid interactive systems
- Off-grid hybrid systems
- Dual axis solar tracker, and


ONE OF NHP'S ELECTRIC CARS ON DISPLAY AT THE SUSTAINABILITY CENTRE IN LAVERTON, MELBOURNE

- Energy Management \& control systems

NHP are also proud participants in the Victorian Government's electric vehicle trial which will provide valuable insights to assist in future business planning, as well as help the wider community understand the process, timelines and barriers for transitioning to electric vehicle technologies in the future.

These initiviatives highlight our commitment to sustainable practices across all facets of the workplace. Our aim is to remain at the forefront of the industry, as leaders in providing alternative energy solutions for commercial and industrial applications.

Working closely with Melbourne University, RMIT University and Victoria University, NHP is also proud
 to educate young electrical engineers


## SP464 James St Lowood SPS - Electrical Installation OM Manual Products and Brands

To assist customers in finding what they want, we have classified our extensive product range into the following categories.

1. Market Categories

## AUTOMATION SYSTEMS

The automation system relies on information from the field to control the process. NHP's switching and sensing suite of products cover all field sensing requirements including standard and hazardous area applications.

## $A$ Allen-Bradley

Rockwell Software
Prosoft ${ }^{\text {ºn }}$
SPECTRUM CONTROLS
WAGO
ESA
MITSUBISHI
CARLO GAVAZZI

```
POWER DISTRIBUTION \& PROTECTION
```

Most processes, even if automated, still require some manual control and NHP provides a complete range of control products and systems for this purpose.


## ENCLOSURES \&

CIIMATE CONTROL

NHP has a complete range of mild steel, stainless and plastic enclosure options in a variety of IP ratings and configurations including modular switchboard systems.

To complement NHP's enclosure systems, a wide range of climate control solutions are also available.

## CUBIC



COSMOTEC STEGO


## SIGNALLING DEVICES

With an extensive range of audible and visual signalling devices, NHP provides solutions for hundreds of applications, be it general safety warning, process control, fire or evacuation.

## TERMINATION \& WIRINGSYSTEMS

NHP has a wide range of screw and screw-less terminals, terminal accessories (such a DIN rail and jumper pins), cable ducting and pre-wired cable looms for Allen Bradley automation systems which significantly reduces labour intensive wire termination.
sprecher+ schuh


AB Allen-Bradley
BOCCHIOTTI
ERICO

## TIMERS \& CONTROL RELAYS

NHP offers a range of control relays and timers that can be used in conjunction with a conventional automation system to switch higher loads or in stand alone applications where the only basic single function control is required.

## klaxon

MOFLASH*

rem/live
cario gavazzi

AB A//en-Brad/ey

## FIELD SWITCHING \& SENSING

The automation system relies on information from the field to control the process. NHP's switching and sensing suite of products cover all field sensing requirements including standard and hazardous area applications.

## AB Allen-Bradley

CARLO GAVAZZI
STEUTE

## OPERATOR <br> CONTROL DEVICES

Most processes, even if automated, still require some manual control and NHP provides a complete range of control products and systems for this purpose.

## sprecher+ <br> schuh

AB Allen-Bradley

## ELEKTRA

SPOHN + BURKHARDT
TER

## PLUGS \& SOCKETS

Divided into two distinct product ranges, NHP's plugs and sockets provide solutions for a wide range of applications and are available in a wide range of amperages and pin configurations.

## NHE $\|^{\text {m }}$

PROCONECT

## SAFETY PRODUCTS

NHP offer a large variety of quality safety products that meet international standards, with products ranging from emergency stop switches, light curtains, and safety monitoring relays all the way up to fully integrated safety PLC systems and SIL3 rated Safety Critical Shutdown systems.

## $A B$ Allen-Bradley <br> Guardimastei

## HAZARDOUS AREA <br> EQUIPMENT

NHP provided a world class range of hazardous area equipment for explosive environments including light fittings, enclosures and terminal boxes, control stations and intrinsically safe automation products.

## CORTEM <br> GROUP

WAGO
STEUTE
ALLEN-BRADLEY

## RENEWABLE ENERGY <br> PRODUCTS

NHP offers a large selection of products and solutions tailored towards renewable energy applications including Solar and Wind.

SANTERNO


AB Allen-Bradley
_socomec
Innovative Power Solutions

## METERING

Energy Metering is the essential component to understanding your energy consumption and power quality. NHP has a complete range of energy meters and power quality analysers to meet the most demanding of applications.

## IME



## AB Allen-Bradley

## SERVICES \& TRAINING

NHP has a wide range of services including technical support, field service and maintenance contracts, repair services and training.

## AB Allen-Bradley

## SP464 James St Lowood SPS - Electrical Installation OM Manual Products and Brands

## 2. Application Classes

## HAZARDOUS AREA <br> EQUIPMENT

When servicing important industries such as the oil and gas, petrochemical and grain handling there is no room for complacency. At NHP our aim is to provide a world class range of hazardous area equipment for the hazardous market which includes light fittings, terminal boxes, control stations and an extensive suite of automation products. NHP has been in this field for many years and has acquired a comprehensive knowledge on explosion protection products, so wherever explosive atmospheres are prevalent, NHP can provide the safest solution.

## WAGO

STEUTE
ALLEN-BRADLEY

## PROCESS CONTROL

Like the principles which drive the process industry, NHP is committed to delivering products of continuous quality to assist our customers in achieving process optimisation. Encompassing a wide range of industries including oil refining, petrochemicals, water and sewage treatment, food processing, and pharmaceuticals, the NHP process control product portfolio offers complete system integration.

## SAFETY

For any industrial application, the safety of employees and the general population is of major importance. NHP has a long history in the safety industry and can be a trusted destination for all your safety application needs. NHP offer a large variety of quality products that meet all relevant international standards, with products ranging from simple emergency stop switches, to light curtains, safety monitoring relays all the way up to fully integrated safety PLC systems. Our product range extends further into SIL3 rated Safety Critical Shutdown systems.

## AB Allen-Bradley

 Guardilmartei AustrolNHP
STEUTE
KATKO

Rockwell Software
3. Application Solutions

## ENERGY MANAGEMENT

NHP can provide Energy Management Metering and Software solutions that monitor and record energy information so operators can identify consumption trends and take corrective actions. Real-time measurements of these electrical parameters, such as voltage variations or distortions, may have alarm thresholds set to warn managers if preset limits are reached. These real-time measurements also allow site managers to anticipate overload conditions that could, for example, trip a circuit breaker. NHP can provide a wide range of products to complement any Energy Management Solution.

## SUSTAINABILITY

With an increasing focus on the state of global warming and the requirement to decrease our carbon footprint, the use of sustainability is becoming a popular phenomenon. Our partnerships with many of the industries best suppliers from around the world means that NHP offer a large selection of products and solutions tailored towards renewable energy applications including Solar and Wind. From high DC rated protection and switching devices, solar panel control and monitoring products through to a range of inverters and power factor correction, NHP has an extensive offering.

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With technology constantly evolving, so too are the ways in which we communicate and at NHP we recognise that what works today, will not necessarily work tomorrow. In line with this approach, NHP ensures it remains at the cutting edge of new communication platforms to ultimately provide timely, relevant and most of all valuable information to our customers.

By utilising the latest platforms such as smart phone and tablet technology (complete with a range of iTunes and Android compatible Apps), the social networking revolution, Quick Response (QR) codes, and much more, NHP are able to share the right messages in the right ways - the ways that our customers want to receive them.


## Events

Setting the industry standard for events

While NHP is renowned for providing quality products and service to our customers, we also know how to put on a great event.

Be it a customer function, new product launch, a road show or training and seminars, NHP looks to provide an event that will not only get people interested in coming along, but also to keep them entertained and informed from when they arrive.

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NHP NATIONAL MANUFACTURING AND DISTRIBUTION CENTRE

NHP Electrical Engineering Products (NHP) specialises in motor control, power distribution and automation systems.
NHP offers the Australasian market the complete industrial electrical and automation solutions package.As authorised distributors for Rockwell Automation and their Allen-Bradley ${ }^{\text {© }}$ products in our designated areas of Australia and throughout all of New Zealand, NHP is partnered with the leading global provider of industrial automation solutions and switchgear components.

An Australian owned company, NHP is committed to serving the Australasian industry with quality products and customer support. This is achieved through a 1000+ strong team which is distributed across 25 branches and 24 regional locations throughout Australia and New Zealand.

While NHP stock an impressive 45,000+ line items, we are much more than a component supplier. NHP source the highest quality products from leading global suppliers, and customise these into solutions for the local Australian and New Zealand markets, providing a complete fit to purpose systems and solutions service.

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Put simply, NHP is 'easy to do business with'.

"Corporate DNA"
The NHP Value Proposition


## THINK MAJOR PROJECTS. THINK NHP.

When it comes to Major Projects, our staff involvement is always driven by long term results, actively seeking to support you with the right product and technical solutions before, during and after project completion.

## Major Projects Team

No matter what the project, from the initial stages of concept design, through to post-commissioning and future upgrades, NHP's Major Projects Team is there to see the project through together with you - our customer.
Our quality people have a diverse reach across Australia and New Zealand and their vast industry experience is sure to be there for you when you need it.

Think Major Projects. Think NHP.

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## Miniature circuit breakers Safe-T \& Din-T



| Miniature Circuit Breakers | Safe-T | DIN-T6 | Din-T10 |
| :--- | :--- | :--- | :--- |
| Standard (AS/NZS) ${ }^{1}$ ) | $\left.3111 / 2184^{2}\right)$ | 60898 | 60898 |

No. poles \& module width

| 1P | 25 mm | 18 mm | 18 mm |
| :---: | :---: | :---: | :---: |
| 2P | 50 mm | 36 mm | 36 mm |
| 3 P | 75 mm | 54 mm | 54 mm |
| 4P | 100 mm | - | 72 mm |
| Mounting | Clip tray | DIN rail | DIN rail |
| Current ratings | $6 \mathrm{~A}-100 \mathrm{~A}$ | 2A-63A | 0.5A-63 A |
| Short circuit rating (kA) | 6 kA | 6 kA | 10 kA |
| Curve types | General | C \& D | B, C \& D |
| Rated AC voltage 1P/2,3,4P | 240/415 V | 240/415 V | 240/415 V |
| Rated DC voltage | 250 V -2P 5 kA | $\begin{aligned} & 48 \mathrm{~V} 1 \mathrm{P} \\ & 110 \mathrm{~V} 2 \mathrm{P} \end{aligned}$ | $\begin{aligned} & 48 \mathrm{~V} 1 \mathrm{P} \\ & 110 \mathrm{~V} 2 \mathrm{P} \end{aligned}$ |
| Sealable in ON-Off position | No | Yes | Yes |
| Trip-free mechanism | Yes | Yes | Yes |
| Centre trip position | Yes | No | No |
| Padlock facility- non captive | Yes | Yes | Yes |
| Padlock facility- captive | Yes | Yes | Yes |
| Busbar connection- On-top | Fork | Pin | Pin |
| Busbar connection- OFF-bottom | Fork | Fork/Pin | Fork/Pin |
| Terminal size- On-top | - | $35 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ |
| Terminal size- OFF-bottom | - | $35 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ |

Notes: ') UL listed MCB refer to NHP.
${ }^{2}$ ) AS only.


| Din-T15 | Din-T10H | Din-T 2-in-1 | Din-T DC | Din-T Easy-Fit |
| :---: | :---: | :---: | :---: | :---: |
| 60947-2 | 60947-2 | 60898 | 60898 | 60898 |
| 18 mm | 27 mm | 18 mm | 18 mm | 18 mm |
| 36 mm | 54 mm | 18 mm | 36 mm | - |
| 54 mm | 81 mm | 36 mm | - | 54 mm |
| 72 mm | 108 mm | 36 mm | 81 mm | - |
| DIN rail | DIN rail | DIN rail | DIN rail | DIN rail |
| 0.5 A - 63 A | 80 A-125 A | $2 \mathrm{~A}-40 \mathrm{~A}$ | 0.5 A-63 A | 6 A-63 A |
| $15 \mathrm{kA}-50 \mathrm{kA}$ | 10 kA | 6 kA | $6 \mathrm{kA} \mathrm{T15}$ | 6 kA |
| C | C \& D | C | B \& C | C |
| 240/415 V | 240/415 V | 240/415 V | 240/415 V | 240/415 V |
| $\begin{aligned} & \hline 48 \mathrm{~V} 1 \mathrm{P} \\ & 110 \mathrm{~V} 2 \mathrm{P} \end{aligned}$ | $\begin{aligned} & 125 \mathrm{~V} 2 \mathrm{P} \\ & 250 \mathrm{~V} 4 \mathrm{P} \end{aligned}$ | - | $\begin{array}{\|l\|} \hline 250 \mathrm{~V} 1 \mathrm{P} \\ 500 \mathrm{~V} 2 \mathrm{P} \\ 880 \mathrm{~V} 4 \mathrm{P} \end{array}$ | - |
| Yes | Yes | Yes | Yes | Yes |
| Yes | Yes | Yes | Yes | Yes |
| No | No | No | No | No |
| Yes | Yes | Yes | Yes | Yes |
| Yes | Yes | No | Yes | No |
| Pin | Pin | Pin | Fork/Pin | - |
| Fork/Pin | Pin | Pin | Fork/Pin | Pin |
| $35 \mathrm{~mm}^{2}$ | 70 mm ${ }^{2}$ | $16 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ | $\begin{aligned} & 4 \mathrm{~mm}^{2} \\ & 6 \mathrm{~A}-20 \mathrm{~A} \\ & 35 \mathrm{~mm}^{2} \\ & 25 \mathrm{~A}-63 \mathrm{~A} \end{aligned}$ |
| $35 \mathrm{~mm}^{2}$ | $70 \mathrm{~mm}^{2}$ | $16 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ |

## Miniature circuit breakers Safe-T \& Din-T

| Residual Current Devices |  | Din-Safe DSRCD | Din-Safe DSRCBS |
| :---: | :---: | :---: | :---: |
| Standard (AS/NZS) ${ }^{1}$ ) | $\left.3111 / 3190{ }^{2}\right)$ | 61008 | 61009 |
| No. poles \& module width | $1 \mathrm{P}+\mathrm{N}-25 \mathrm{~mm}$ | $\begin{aligned} & \text { 2P-36mm, } \\ & 4 \mathrm{P}-72 \mathrm{~mm} \end{aligned}$ | $1 \mathrm{P}+\mathrm{N}-18 \mathrm{~mm}$ |
| Mounting | Clip tray | DIN rail | DIN rail |
| Current ratings | $\begin{aligned} & 10 \mathrm{~A}, \\ & 16 \mathrm{~A}, \\ & 20 \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & 40 \mathrm{~A}, 63 \mathrm{~A}, \\ & 80 \mathrm{~A}, 100 \mathrm{~A} \& \\ & 125 \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & 6 \mathrm{~A}, 10 \mathrm{~A}, \\ & 16 \mathrm{~A}, 20 \mathrm{~A}, \\ & 25 \mathrm{~A} \& 32 \mathrm{~A} \\ & \hline \end{aligned}$ |
| Trip senstivity | 10 mA \& 30 mA | 30 mA , 100 mA , 300 mA , 500 mA | 30 mA |
| Sensitivity type | AC | AC, A, Al, S \& B | AC \& A |
| Short circuit rating (kA) | 6 kA | Inc - 10 kA MCB or fuse backup | 6 kA |
| Curve types | General | - | B \& C |
| Rated AC voltage | 240 V | $240 \mathrm{~V} / 415 \mathrm{~V}$ | 240 V |
| Sealable in ON-Off position | No | Yes | Yes |
| Trip-free mechanism | Yes | Yes | Yes |
| Centre trip position | Yes | No | No |
| Padlock- non captive | No | Yes | Yes |
| Padlock-captive | Yes | No | No |
| Busbar connection- On-top | Fork | Pin | - |
| Busbar connection- OFF-bottom | Fork | Fork/Pin | Pin |
| Terminal size- On-top | - | $50 \mathrm{~mm}^{2}$ | 16 mm ${ }^{2}$ |
| Terminal size- OFF-bottom | - | $50 \mathrm{~mm}^{2}$ | $35 \mathrm{~mm}^{2}$ |

Notes: ') UL listed MCB refer to NHP.
${ }^{2}$ ) AS only.

|  |  |
| :--- | :--- |
|  |  |

## Safe-T series

6-100 A

6 kA
Standard AS 3111 AS 2184 1)

- Approval No. V99347
- UL 489 fluorescent switching duty ${ }^{1}$ )
- Lloyd's register
- Current range 6-100 A 1, 2, 3 and 4 pole
- Clip-tray mounting. Suits CT type busbar chassis
- General purpose light and power distribution


## Technical data

Interrupting capacity: 6 kA at $250 \mathrm{~V} \mathrm{AC} \mathrm{(sym)} 1$ pole 6 kA at 400 V AC (sym) $2 \& 3$ pole 5 kA at 125 V DC 2 pole
Thermal setting: Fixed $\left(40^{\circ} \mathrm{C}\right)$
Magnetic setting: Fixed
Tropic proofed: Standard

Shunt Trip-Coil rating

| Voltage (V) | Current peak <br> (A) |
| :--- | :--- |
| $120-440$ V AC | $4.88(440 \mathrm{~V})$ |
| $48-250 \mathrm{~V} \mathrm{DC}$ | $2.32(250 \mathrm{~V})$ |

## Warnings

Short time rated coil.
Coil burnout will result if coil remains energised.


Shunt trip wiring diagram


Notes: 1) Fluorescent light switching duty - UL 489 All Safe-T MCBs are by design suitable for fluorescent light switching duty as per the requirements of UL 489 issued by Underwriters Laboratories (USA). Performance standards to regularly switch banks of fluorescent lights ON and OFF require the MCB to withstand the higher inrush current (up to 30 times normal rating). If the MCB cannot withstand this inrush current, contact erosion and excess temperature rise will be experienced. Safe-T MCBs have been designed to withstand this type of duty. (Refer NHP)
Backup fuse data, refer to page 9-10. Accessories, refer to page 1-9.

Safe-T series
6-100 A

| Amp rating | Cat. No. | 1 pole Price \$ | Cat. No. | 2 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 6 | SAFET6106 | 61.50 | SAFET6206 | 190.00 |
| 10 | SAFET6110 | 61.50 | SAFET6210 | 190.00 |
| 16 | SAFET6116 | 61.50 | SAFET6216 | 190.00 |
| 20 | SAFET6120 | 61.50 | SAFET6220 | 190.00 |
| 25 | SAFET6125 | 61.50 | SAFET6225 | 190.00 |
| 32 | SAFET6132 | 61.50 | SAFET6232 | 190.00 |
| 40 | SAFET6140 | 61.50 | SAFET6240 | 190.00 |
| 50 | SAFET6150 | 61.50 | SAFET6250 | 190.00 |
| 63 | SAFET6163 | 61.50 | SAFET6263 | 190.00 |
| 80 | SAFET6180 | 138.00 | SAFET6280 | 355.00 |
| 100 | SAFET61100 | 138.00 | SAFET62100 | 355.00 |
| 63 | SAFET6163NA ${ }^{2}$ ) | 65.50 | SAFET6263NA ${ }^{2}$ ) | 164.00 |
| 100 | SAFET61100NA ${ }^{\mathbf{2}}$ ) | 103.00 | SAFET62100NA ${ }^{2}$ ) | 220.00 |


| Amp rating | Cat. No. | 3 pole Price \$ | Cat. No. | $\begin{array}{r} \left.3 P+N^{1}\right) \\ \text { Price } \$ \end{array}$ |
| :---: | :---: | :---: | :---: | :---: |
| 6 | SAFET6306 | 225.00 | SAFET6406 | 315.00 |
| 10 | SAFET6310 | 225.00 | SAFET6410 | 315.00 |
| 16 | SAFET6316 | 225.00 | SAFET6416 | 315.00 |
| 20 | SAFET6320 | 225.00 | SAFET6420 | 315.00 |
| 25 | SAFET6325 | 225.00 | SAFET6425 | 315.00 |
| 32 | SAFET6332 | 225.00 | SAFET6432 | 315.00 |
| 40 | SAFET6340 | 225.00 | SAFET6440 | 315.00 |
| 50 | SAFET6350 | 225.00 | SAFET6450 | 315.00 |
| 63 | SAFET6363 | 225.00 | SAFET6463 | 315.00 |
| 80 | SAFET6380 | 405.00 | SAFET6480 | 495.00 |
| 100 | SAFET63100 | 405.00 | SAFET64100 | 495.00 |
| 63 | SAFET6363NA ${ }^{2}$ ) | 200.00 | SAFET6463NA ${ }^{2}$ ) | 285.00 |
| 100 | SAFET63100NA ${ }^{2}$ ) | 285.00 | SAFET64100NA ${ }^{2}$ ) | 440.00 |

[^0]
## Safe-T series <br> 6-100 A fitted with shunt trip

| Amp rating | Cat. No. | 1 pole Price \$ | Cat. No. | 2 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 6 | SAFET6106SHT | 190.00 | SAFET6206SHT | 325.00 |
| 10 | SAFET6110SHT | 190.00 | SAFET6210SHT | 325.00 |
| 16 | SAFET6116SHT | 190.00 | SAFET6216SHT | 325.00 |
| 20 | SAFET6120SHT | 190.00 | SAFET6220SHT | 325.00 |
| 25 | SAFET6125SHT | 190.00 | SAFET6225SHT | 325.00 |
| 32 | SAFET6132SHT | 190.00 | SAFET6232SHT | 325.00 |
| 40 | SAFET6140SHT | 190.00 | SAFET6240SHT | 325.00 |
| 50 | SAFET6150SHT | 190.00 | SAFET6250SHT | 325.00 |
| 63 | SAFET6163SHT | 190.00 | SAFET6263SHT | 325.00 |
| 80 | SAFET6180SHT | 270.00 | SAFET6280SHT | 475.00 |
| 100 | SAFET61100SHT | 270.00 | SAFET62100SHT | 475.00 |
| 63 | SAFET6163NASHT ${ }^{2}$ ) | 184.00 | SAFET6263NASHT ${ }^{2}$ ) | 285.00 |
| 100 | SAFET61100NASHT ${ }^{2}$ ) | 225.00 | SAFET62100NASHT ${ }^{\mathbf{2}}$ ) | 350.00 |
| Amp rating | Cat. No. | 3 pole Price \$ | Cat. No. | $\begin{array}{r} \left.3 P+N^{1}\right) \\ \text { Price } \$ \end{array}$ |
| 6 | SAFET6306SHT | 350.00 | SAFET6406SHT | 440.00 |
| 10 | SAFET6310SHT | 350.00 | SAFET6410SHT | 440.00 |
| 16 | SAFET6316SHT | 350.00 | SAFET6416SHT | 440.00 |
| 20 | SAFET6320SHT | 350.00 | SAFET6420SHT | 440.00 |
| 25 | SAFET6325SHT | 350.00 | SAFET6425SHT | 440.00 |
| 32 | SAFET6332SHT | 350.00 | SAFET6432SHT | 440.00 |
| 40 | SAFET6340SHT | 350.00 | SAFET6440SHT | 440.00 |
| 50 | SAFET6350SHT | 350.00 | SAFET6450SHT | 440.00 |
| 63 | SAFET6363SHT | 350.00 | SAFET6463SHT | 440.00 |
| 80 | SAFET6380SHT | 540.00 | SAFET6480SHT | 630.00 |
| 100 | SAFET63100SHT | 540.00 | SAFET64100SHT | 630.00 |
| 63 | SAFET6363NASHT ${ }^{2}$ ) | 335.00 | SAFET6463NASHT ${ }^{2}$ ) | 425.00 |
| 100 | SAFET63100NASHT ${ }^{2}$ ) | 425.00 | SAFET64100NASHT ${ }^{2}$ ) | 560.00 |

## Operation

For remote tripping of Safe-T MCB (1 to 4 poles), manual resetting of MCB required. Inline shunt trip requires no extra pole spaces; refer to page 1-10 for connection diagram.

## Application

Emergency stop and isolation of industrial socket outlets.

Notes: ') Neutral pole is switched but does not provide overcurrent or short circuit protection.
${ }^{2}$ ) NA - Non-Auto MCB without overcurrent or short circuit protection, suitable for main switch.
Backup fuse data, refer to page 9-10.
Accessories to suit Safe-T MCBs, refer to page 1-9.

## Safe-T series

Options, hardware and accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Handle lock | Yellow | TAA5LY ${ }^{1}$ ) | 3.30 |
| Padlock attachment | 1 pole | TKB50SGL ${ }^{1}$ ) | 21.20 |
| Padlock attachment | 3 pole | TKC50SG ${ }^{1}$ ) | 21.20 |
| Padlock attachment | 12 pack and resin | SAFETLCK $12{ }^{1}$ ) | 159.00 |
| kits (captive) | 24 pack and resin | SAFETLCK $24{ }^{1}$ ) | 210.00 |
|  | $35 \mathrm{~mm}^{2}$ Safe-T (6-63 A) | 7T1ST ${ }^{1}$ ) | 13.00 |
| Tunnel terminal | $\begin{aligned} & 70 \mathrm{~mm}^{2} \text { Safe-T } \\ & (80-100 \mathrm{~A}) \end{aligned}$ | 7T2ST ${ }^{1}$ ) | 15.60 |
| T-off plastic caps |  | TH250TOPC | 0.60 |
| Pole fillers |  | SAFETPF | 1.80 |
| Clip-tray (per 12 pole | pieces) | TDB50SG12 | 20.20 |
| Link bar (1 phase) | 18 pole | LB18 | 27.00 |
| Link bar (3 phase) | 12 pole | LB3PH12 | 153.00 |
| 120 A | 18 pole | LB3PH18 | 215.00 |



3 phase wiring harness


3 phase link bars
 1 phase link bar


TAA5LY


TKC50SG
Locking attachments

Notes: ${ }^{1}$ ) Doesn't suit SRCB.

# Safe-T series (RCBO) <br> Single pole width residual current circuit breakers 

Standard AS 3111 AS 3190
Approval No. N15251

- Current rating: 10, 16 and 20 A
- Voltage $240 \mathrm{~V} \mathrm{AC} 50 / 60 \mathrm{~Hz}$ (not suitable for $415 / 440 \mathrm{~V}$ )
- Short circuit protection 6000 A

Earth leakage protection 30 mA and 10 mA

## Operation



Safe-T single pole width residual current circuit breakers offer overload, short circuit and earth leakage protection in a single module width unit.
Mounting arrangements are identical to those throughout the Safe-T MCB range utilising the NHP clip-tray mounting system in panelboards and loadcentres.

| Amp <br> rating | No. of <br> poles | Modules | Trip sensi- <br> tivity (mA) | Cat. No. $\left.{ }^{1}\right)$ | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 10 | 1 | 1 | 30 | SRCB 1030 | $\mathbf{3 2 5 . 0 0}$ |
| 16 | 1 | 1 | 30 | SRCB 1630 | $\mathbf{3 2 5 . 0 0}$ |
| 20 | 1 | 1 | 30 | SRCB 2030 | $\mathbf{3 2 5 . 0 0}$ |
| 10 | 1 | 1 | 10 | SRCB 1010 | $\mathbf{3 6 0 . 0 0}$ |
| 16 | 1 | 1 | 10 | SRCB 1610 | $\mathbf{3 6 0 . 0 0}$ |
| 20 | 1 | 1 | 10 | SRCB 2010 | $\mathbf{3 6 0 . 0 0}$ |

* For other current ratings or for 3 phase, refer to ELR relay page 1-11.

Accessories

| Description |  |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| Padlock attachment kit (captive) |  | 12 pack and resin | SRCBLCK 12 | 275.00 |
|  |  | 24 pack and resin | SRCBLCK 24 | 450.00 |
| Adaptor <br> kit | Eaton, Cu | ler-Hammer (Quicklag) | SRCBWA | 26.40 |
|  | Heinema |  | SRCBHA | 26.40 |



Notes: ${ }^{1}$ ) Neutral not switched.
Nuisance tripping may be experienced in VFD and motor starting applications, refer NHP.

# Safe-T series (ELR) 

## Earth leakage relay

Standard AS 3190
Approval No. N15380
NHP clip-tray mounting (CT chassis)

## Application

The ELR is identical in width to the single pole Safe-T MCB. The ELR is clip-tray mountable alongside the Safe-T MCB
 when fitted to the CT chassis, as found in the CST/CPS series panelboards.
When the ELR is combined with a Safe-T MCB fitted with a shunt trip, the resulting combination offers overload, short circuit and earth leakage protection and can be retrofitted into an existing installation or installed in a new installation.

## Suitable for commercial and industrial applications.

Test function
A test button is provided on the unit to functionally test the detection and tripping circuits.
It is recommended a functional test be performed monthly.

| No. of <br> Poles | Sensitivity <br> $\left.(\mathbf{m A})^{1}\right)$ | Voltage <br> (AC) |  | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 1 | 10 | 240 | $50 / 60 \mathrm{~Hz}$ | ELR24010 | $\mathbf{5 9 0 . 0 0}$ |
| 1 | 30 | 240 | $50 / 60 \mathrm{~Hz}$ | ELR24030 | $\mathbf{5 9 0 . 0 0}$ |
| 1 | 100 | 240 | $50 / 60 \mathrm{~Hz}$ | ELR240100 | $\mathbf{5 9 0 . 0 0}$ |
| 1 | 300 | 240 | $50 / 60 \mathrm{~Hz}$ | ELR240300 | $\mathbf{5 9 0 . 0 0}$ |
| 1 | 30 | $415-440$ | $50 / 60 \mathrm{~Hz}$ | ELR44030 | $\mathbf{5 9 0 . 0 0}$ |

## Technical data

- Operation:

Instantaneous

- Frequency:
$40-60 \mathrm{~Hz}$
- Output ratings:

I peak 8 A , I average 0.5 A

- Toroid window
$4 \times 35 \mathrm{~mm}^{2}$
(aperture diameter 35 mm )
■ Dimensions:
$\mathrm{H}=152 \mathrm{~mm}$
$\mathrm{W}=25 \mathrm{~mm}$
$D=60 \mathrm{~mm}$
- Weight: $\quad 0.16 \mathrm{~kg}$



## Notes: Nuisance tripping may be experienced in VFD and motor starting applications, refer NHP.

## Din-T series <br> General features

## Advantages of the Din-T series miniature circuit breakers

- Short circuit breaking capacity of 6,10 and 15 kA at 415 V AC
- Increased rating up to 63 kA when backed up with HRC fuses
(Refer page 9-10)
- Rated current range from 0.5 A to 125 A
- Silver graphite contacts
- Input connection by lifting cage terminal with capacity of up to $35 \mathrm{~mm}^{2}$ giving fast and practical connection
- Output terminals offer finger and hand protection with a capacity of up to $35 \mathrm{~mm}^{2}$
- Snap fixing with two stop locations, for normal DIN rail mounting
- Approval number N17481

■ Conforms to AS/NZS 60898 and AS 60947-2 as applicable

## Brief description

The Din-T series miniature circuit breakers have inverse time delayed thermal and instantaneous magnetic trips and are suitable for mounting in distribution boards or in switchgear panels and consumer units.

## Operation

Protection against overheating of electrical conductors, excess currents due to overload, short circuit or earth fault.

## Application

In switching, control, distribution and measurement systems for domestic, commercial and industrial installations.

## Tripping characteristics

## Thermal release

In case of overload, the release is initiated by a bi-metal strip. Standards AS/ NZS 60898 and AS 60947 define the range of release for specific overload values. Reference ambient temperatures are $30^{\circ} \mathrm{C}$ and $40^{\circ} \mathrm{C}$ for the respective standards.

## Magnetic release

In case of short circuit, an electromagnet with plunger ensures instantaneous tripping. AS/NZS 60898 describes the characteristics for the following curve types:

| Curve Type | Test current | Application |
| :--- | :--- | :--- |
| B | $3-5 \times I_{n}$ | Resistive loads |
| C | $5-10 \times I_{n}$ | Protection of general distribution loads <br> -lighting <br> - ocket outlets <br> - motors etc. |
| D | Protection of circuits having high inrush <br> transient currents <br> - high inertia motor starting <br> - transformers <br> - welders |  |

## Din-T series

General features

## Handle

Sealable and padlockable with quick-make and quick-break type mechanism. The handle is sealable in ON and OFF position. Due to the free-tripping mechanism, the MCB contacts open through overload or short circuit even when the handle is sealed in the ON position on all types.

## Input terminal ('OFF' side)

Box terminal with lifting screw for copper and aluminium conductors: maximum capacity $1 \times 35 \mathrm{~mm}^{2}$ or $2 \times 16 \mathrm{~mm}^{2}$.
When unscrewing the screw, the head lifts; however, on pushing the screw head, the box terminal opens. This system enables the MCBs to be linked with a cable and fork or pin type bus comb. The MCB is delivered with a half open box terminal and a lifted screw head.

## Output terminal ('ON' side)

Box terminal with captive terminal screw for copper and aluminium conductors: max. $1 \times 35 \mathrm{~mm}^{2}$ or $2 \times 16 \mathrm{~mm}^{2}$.
The box terminals are always delivered in the open position. Output terminal screw has IP 20 protection against direct finger contact by standard design.

Arc chamber
Contains arc extinction plates, (de-ionising type) designed to break up and dissipate the arc which is generated during interruption of all types of faults.

## Electromagnet

Operating the plunger which opens the contacts instantaneously.

## Arc magnetic blowout system

Short circuit currents do not flow through the bi-metal but are directed by the blowout magnet in such a way that the arc is transferred to a special arc runner, therefore taking the bi-metal out of the circuit, which ensures the thermal trip characteristics remain unchanged after an MCB has been exposed to a fault current.

- This combination of the electromagnet (with a plunger rapidly opening the contacts), the blowout magnet and the arc chamber, results in an extremely high short circuit breaking capacity, and very low let through energy.
Catalogue Number construction for Din-T MCBs (6, 10, 10H and 15)

| DTCB - XX |  | $X \quad$ - |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  | eType |
|  |  |  |  |  |  | ent (A) | B | $3 \ln -5 \ln$ |
| series code | Sho | t circuit |  |  | 05 | 0.5 | C | $5 \mathrm{ln}-10 \mathrm{ln}$ |
| Din-T | cap | city (A) |  |  | 01 | 1 | D | $10 \mathrm{ln}-20 \mathrm{ln}$ |
| Circuit Breaker | 6 | 6000 |  | rity | 02 | 2 |  |  |
|  | 10 | 10000 | 1 | 1 pole | 03 | 3 |  |  |
|  | 10 H | 10000 | 2 | 2 pole | 04 | 4 |  |  |
|  | 15 | 15000 | 3 | 3 pole | 06 | 6 |  |  |
|  | DC | 6000 | 1 N | $1 \mathrm{P}+\mathrm{N}$ | 10 | 10 |  |  |
|  | D6 | 6000 | 4 | $3 P+N$ | 13 | 13 |  |  |
|  | E6 | 6000 | 11 | $1 \mathrm{P}+1 \mathrm{P}$ | Etc |  |  |  |

## Din-T6

## Series 2-63 A

6 kA 'C' curve

- Standard AS/NZS 60898
- Approval No. N17481
- Current range 2-63 amps 1, 2 and 3 pole
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits CD, NC or GB chassis
- General purpose light, power and motor starting


Curve type: C (5-10 In)
Single pole

| $\ln (\mathbf{A})$ | Cat. $\mathbf{N o}$. | Price $\mathbf{\$} \boldsymbol{\operatorname { l n } ( \mathbf { A } )}$ | Cat. No. | Price $\mathbf{\$}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | DTCB6102C | $\mathbf{3 7 . 0 0}$ | 20 | DTCB6120C | $\mathbf{3 7 . 0 0}$ |
| 4 | DTCB6104C | $\mathbf{3 7 . 0 0}$ | 25 | DTCB6125C | $\mathbf{3 7 . 0 0}$ |
| 6 | DTCB6106C | $\mathbf{3 7 . 0 0}$ | 32 | DTCB6132C | $\mathbf{3 7 . 0 0}$ |
| 10 | DTCB6110C | $\mathbf{3 7 . 0 0}$ | 40 | DTCB6140C | $\mathbf{3 7 . 0 0}$ |
| 13 | DTCB6113C | $\mathbf{3 7 . 0 0}$ | 50 | DTCB6150C | $\mathbf{3 7 . 0 0}$ |
| 16 | DTCB6116C | $\mathbf{3 7 . 0 0}$ | 63 | DTCB6163C | $\mathbf{3 7 . 0 0}$ |

Double pole

| $\ln (A)$ | Cat. No. | Price $\mathbf{\$} \ln (\mathbf{A})$ | Cat. No. | Price \$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | DTCB6202C | $\mathbf{1 3 1 . 0 0}$ | 20 | DTCB6220C | $\mathbf{1 3 1 . 0 0}$ |
| 4 | DTCB6204C | $\mathbf{1 3 1 . 0 0}$ | 25 | DTCB6225C | $\mathbf{1 3 1 . 0 0}$ |
| 6 | DTCB6206C | $\mathbf{1 3 1 . 0 0}$ | 32 | DTCB6232C | $\mathbf{1 3 1 . 0 0}$ |
| 10 | DTCB6210C | $\mathbf{1 3 1 . 0 0}$ | 40 | DTCB6240C | $\mathbf{1 3 1 . 0 0}$ |
| 13 | DTCB6213C | $\mathbf{1 3 1 . 0 0}$ | 50 | DTCB6250C | $\mathbf{1 3 1 . 0 0}$ |
| 16 | DTCB6216C | $\mathbf{1 3 1 . 0 0}$ | 63 | DTCB6263C | $\mathbf{1 3 1 . 0 0}$ |

Triple pole

| In (A) | Cat. No. | Price \$ | $\ln (\mathrm{A})$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | DTCB6302C | 166.00 | 20 | DTCB6320C | 166.00 |
| 4 | DTCB6304C | 166.00 | 25 | DTCB6325C | 166.00 |
| 6 | DTCB6306C | 166.00 | 32 | DTCB6332C | 166.00 |
| 10 | DTCB6310C | 166.00 | 40 | DTCB6340C | 166.00 |
| 13 | DTCB6313C | 166.00 | 50 | DTCB6350C | 166.00 |
| 16 | DTCB6316C | 166.00 | 63 | DTCB6363C | 166.00 |

Notes: The LINE-side is the OFF or bottom of the MCB, and connects to CD, NC or GB chassis tee-offs.
Suitable for the following side mounted accessories:

- AUX/ALM switches - refer page 1-40
- Shunt trip and UVT Trip - refer page 1-39
- Clip-on RCD module and Din-Safe-M module- refer page 1-32
- Din-T terminals and accessories - refer page 1-50


## Din-T6

Series 2-63 A

## 6 kA 'D' curve

- Standard AS/NZS 60898
- Approval No. N17481
- Current range 2-63 amps 1, 2 and 3 pole
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits CD, NC or GB chassis
- Motor starting and transformer applications


Curve type: D (10-20 In)
Single pole

| $\boldsymbol{\operatorname { l n } ( \mathbf { A } )}$ | Cat. No. | Price $\mathbf{\$} \boldsymbol{\operatorname { l n } ( A )}$ | Cat. No. | Price \$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | DTCB6102D | $\mathbf{5 1 . 0 0}$ | 20 | DTCB6120D | $\mathbf{5 1 . 0 0}$ |
| 4 | DTCB6104D | $\mathbf{5 1 . 0 0}$ | 25 | DTCB6125D | $\mathbf{5 1 . 0 0}$ |
| 6 | DTCB6106D | $\mathbf{5 1 . 0 0}$ | 32 | DTCB6132D | $\mathbf{5 1 . 0 0}$ |
| 10 | DTCB6110D | $\mathbf{5 1 . 0 0}$ | 40 | DTCB6140D | $\mathbf{5 4 . 5 0}$ |
| 13 | DTCB6113D | $\mathbf{5 1 . 0 0}$ | 50 | DTCB6150D | $\mathbf{5 4 . 5 0}$ |
| 16 | DTCB6116D | $\mathbf{5 1 . 0 0}$ | 63 | DTCB6163D | $\mathbf{5 4 . 5 0}$ |

Double pole

| In $(\mathbf{A})$ | Cat. No. | Price $\boldsymbol{\$} \ln (\mathbf{A})$ | Cat. No. | Price $\boldsymbol{\$}$ |  |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 2 | DTCB6202D | $\mathbf{1 5 3 . 0 0}$ | 20 | DTCB6220D | $\mathbf{1 5 3 . 0 0}$ |
| 4 | DTCB6204D | $\mathbf{1 5 3 . 0 0}$ | 25 | DTCB6225D | $\mathbf{1 5 3 . 0 0}$ |
| 6 | DTCB6206D | $\mathbf{1 5 3 . 0 0}$ | 32 | DTCB6232D | $\mathbf{1 5 3 . 0 0}$ |
| 10 | DTCB6210D | $\mathbf{1 5 3 . 0 0}$ | 40 | DTCB6240D | $\mathbf{1 6 4 . 0 0}$ |
| 13 | DTCB6213D | $\mathbf{1 5 3 . 0 0}$ | 50 | DTCB6250D | $\mathbf{1 6 4 . 0 0}$ |
| 16 | DTCB6216D | $\mathbf{1 5 3 . 0 0}$ | 63 | DTCB6263D | $\mathbf{1 6 4 . 0 0}$ |

Triple pole

| $\boldsymbol{\operatorname { l n } ( \mathbf { A } )}$ | Cat. $\mathbf{N o}$ | Price $\boldsymbol{\$} \ln (\mathbf{A})$ |  | Cat. No. | Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | DTCB6302D | $\mathbf{2 1 5 . 0 0}$ | 20 | DTCB6320D | $\mathbf{2 1 5 . 0 0}$ |
| 4 | DTCB6304D | $\mathbf{2 1 5 . 0 0}$ | 25 | DTCB6325D | $\mathbf{2 1 5 . 0 0}$ |
| 6 | DTCB6306D | $\mathbf{2 1 5 . 0 0}$ | 32 | DTCB6332D | $\mathbf{2 1 5 . 0 0}$ |
| 10 | DTCB6310D | $\mathbf{2 1 5 . 0 0}$ | 40 | DTCB6340D | $\mathbf{2 2 5 . 0 0}$ |
| 13 | DTCB6313D | $\mathbf{2 1 5 . 0 0}$ | 50 | DTCB6350D | $\mathbf{2 2 5 . 0 0}$ |
| 16 | DTCB6316D | $\mathbf{2 1 5 . 0 0}$ | 63 | DTCB6363D | $\mathbf{2 2 5 . 0 0}$ |

Notes: The LINE-side is the OFF or bottom of the MCB, and connects to CD, NC or GB chassis tee-offs.
Suitable for the following side mounted accessories:

- AUX/ALM switches - refer page 1-40
- Shunt trip and UVT Trip - refer page 1-39
- Clip-on RCD module and Din-Safe-M module- refer page 1-32
- Din-T terminals and accessories - refer page 1-50


## Din-T6

2-in-1 Double the capacity of your load centre

6 kA 'C' curve

- Standard AS/NZS 60898
- Approval No. NSW24783
- Current range 2-40 A
- C curve tripping characteristics
- Saves up to $50 \%$ space
- DIN rail mounting
- General purpose light and power

Curve type: C (5-10 In)


1 pole + 1 pole
Single module width ( 18 mm )

| In (A) | Cat. No. | Price \$ | In (A) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 2 | DTCBD61102C | 182.00 | 2 | DTCBD6202C | 171.00 |
| 4 | DTCBD61104C | 182.00 | 4 | DTCBD6204C | 171.00 |
| 6 | DTCBD61106C | 182.00 | 6 | DTCBD6206C | 171.00 |
| 10 | DTCBD61110C | 182.00 | 10 | DTCBD6210C | 171.00 |
| 16 | DTCBD61116C | 182.00 | 16 | DTCBD6216C | 171.00 |
| 20 | DTCBD61120C | 182.00 | 20 | DTCBD6220C | 171.00 |
| Must be same phase. |  |  | 25 | DTCBD6225C | 171.00 |
|  |  |  | 32 | DTCBD6232C | 171.00 |
|  |  |  | 40 | DTCBD6240C | 171.00 |

3 pole
Double module width ( 36 mm )

4 pole
Double module width ( 36 mm )

| $\ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$}$ |  |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 2 | DTCBD6302C | $\mathbf{2 7 5 . 0 0}$ | 2 | DTCBD6402C | $\mathbf{3 9 0 . 0 0}$ |
| 4 | DTCBD6304C | $\mathbf{2 7 5 . 0 0}$ | 4 | DTCBD6404C | $\mathbf{3 9 0 . 0 0}$ |
| 6 | DTCBD6306C | $\mathbf{2 7 5 . 0 0}$ | 6 | DTCBD6406C | $\mathbf{3 9 0 . 0 0}$ |
| 10 | DTCBD6310C | $\mathbf{2 7 5 . 0 0}$ | 10 | DTCBD6410C | $\mathbf{3 9 0 . 0 0}$ |
| 16 | DTCBD6316C | $\mathbf{2 7 5 . 0 0}$ | 16 | DTCBD6416C | $\mathbf{3 9 0 . 0 0}$ |
| 20 | DTCBD6320C | $\mathbf{2 7 5 . 0 0}$ | 20 | DTCBD6420C | $\mathbf{3 9 0 . 0 0}$ |
| 25 | DTCBD6325C | $\mathbf{2 7 5 . 0 0}$ | 25 | DTCBD6425C | $\mathbf{3 9 0 . 0 0}$ |
| 32 | DTCBD6332C | $\mathbf{2 7 5 . 0 0}$ | 32 | DTCBD6432C | $\mathbf{3 9 0 . 0 0}$ |
| 40 | DTCBD6340C | $\mathbf{2 7 5 . 0 0}$ | 40 | DTCBD6440C | $\mathbf{3 9 0 . 0 0}$ |

Notes: 16 mm tunnel terminals.
Not suitable for chassis mounting.
Compatible with NHP Terasaki auxiliaries and accessories.

## Din-T DC

## Series 0.5-63 A

6 kA 'C' curve

- Standard AS/NZS 60898
- Approval No. NSW 24265
- Current range 0.5-63 A 1P and 2P
- C curve tripping characteristic

DC Voltage $250 \mathrm{~V} 1 \mathrm{P}, 500 \mathrm{~V} 2 \mathrm{P}$

- AC Voltage 230 V 1P, 400 V 2P
- Sealable and lockable handle
- DIN rail mounting


1 Pole


2 Pole

Industrial applications

## Operation

Din-T DC MCBs are equipped with a permanent magnet which aids arc extinguishing under fault conditions, making this range of MCBs suitable for voltages up to 250 V DC ( 1 pole), 500 V DC ( 2 pole) and 880 V DC ( 4 pole). Din-T DC 1P and 2P MCBs are also suitable for AC voltages. Polarity labeling must be respected due to the permanent magnet in the MCB.

Curve type: C (5-10 In)
Single pole
Double pole

| In $(\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \boldsymbol{\operatorname { l n } ( \mathbf { A } )}$ | Cat. No. | Price $\boldsymbol{\$}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 0.5 | DTCBDC105C | $\mathbf{1 2 6 . 0 0}$ |  |  |  |
| 1 | DTCBDC101C | $\mathbf{1 2 6 . 0 0}$ | 1 | DTCBDC201C | $\mathbf{2 6 5 . 0 0}$ |
| 2 | DTCBDC102C | $\mathbf{1 2 6 . 0 0}$ | 2 | DTCBDC202C | $\mathbf{2 6 5 . 0 0}$ |
| 4 | DTCBDC104C | $\mathbf{1 2 6 . 0 0}$ | 4 | DTCBDC204C | $\mathbf{2 6 5 . 0 0}$ |
| 6 | DTCBDC106C | $\mathbf{1 2 6 . 0 0}$ | 6 | DTCBDC206C | $\mathbf{2 6 5 . 0 0}$ |
| 10 | DTCBDC110C | $\mathbf{1 2 6 . 0 0}$ | 10 | DTCBDC210C | $\mathbf{2 6 5 . 0 0}$ |
| 16 | DTCBDC116C | $\mathbf{1 2 6 . 0 0}$ | 16 | DTCBDC216C | $\mathbf{2 6 5 . 0 0}$ |
| 20 | DTCBDC120C | $\mathbf{1 2 6 . 0 0}$ | 20 | DTCBDC220C | $\mathbf{2 6 5 . 0 0}$ |
| 25 | DTCBDC125C | $\mathbf{1 2 6 . 0 0}$ | 25 | DTCBDC225C | $\mathbf{2 6 5 . 0 0}$ |
| 32 | DTCBDC132C | $\mathbf{1 2 6 . 0 0}$ | 32 | DTCBDC232C | $\mathbf{2 6 5 . 0 0}$ |
| 40 | DTCBDC140C | $\mathbf{1 2 6 . 0 0}$ | 40 | DTCBDC240C | $\mathbf{2 6 5 . 0 0}$ |
| 50 | DTCBDC150C | $\mathbf{1 2 6 . 0 0}$ | 50 | DTCBDC250C | $\mathbf{2 6 5 . 0 0}$ |
| 63 | DTCBDC163C | $\mathbf{1 2 6 . 0 0}$ | 63 | DTCBDC263C | $\mathbf{2 6 5 . 0 0}$ |



## Din-T DC

## Series 0.5-63 A

## 6 kA 'B' curve

- Standard AS/NZS60898
- Approval No. NSW 24265
- Current range 10-63 A 4P
- B curve tripping characteristic

DC Voltage 880 V 4P (1000 V PV systems)

- Sealable and lockable handle
- DIN rail mounting

- Industrial applications


## Operation

Din-T DC MCBs are equipped with a permanent magnet which aids arc extinguishing under fault conditions, making this range of MCBs suitable for voltages up to 250 V DC ( 1 pole), 500 V DC (2 pole) and 880 V DC ( 4 pole). Din-T DC 1P and 2P MCBs are also suitable for AC voltages. Polarity labeling must be respected due to the permanent magnet in the MCB.

Curve type: B ( $3-5 I_{\mathrm{n}}$ )
Four pole

| In $(A)$ | Cat. No. | Price $\boldsymbol{\$}$ |
| :--- | :--- | :---: |
| 10 | DTCBDC410B | $\mathbf{5 8 0 . 0 0}$ |
| 16 | DTCBDC416B | $\mathbf{5 8 0 . 0 0}$ |
| 20 | DTCBDC420B | $\mathbf{5 8 0 . 0 0}$ |

Connection diagram


Notes: Suitable for the following side mounted accessories:

- AUX/ALM switch - refer page 1-40
- Shunt trip - refer page 1-39
- UVT trip - refer page 1-39
- Clip-on RCD module - refer page 1-32
- Din-T terminals and accessories - refer page 1-50


## Din-T10

Series 6-63 A

## 10 kA 'B' curve

- Standard AS/NZS 60898
- Approval No. N17481
- Current range 6-63 A 1, 2, and 3 pole
- Sealable and lockable handleDIN rail mounting
- Padlockable in OFF position
- Suits NC, CD or GB type chassis
- Resistive load applications



## Curve type: B (3-5In)

| Single pole |  | Double pole |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| In (A) | Cat. No. | Price \$ | $\ln (\mathrm{A})$ | Cat. No. | Price \$ |
| 6 | DTCB10 1 06B | 66.50 | 6 | DTCB10 2 06B | 188.00 |
| 10 | DTCB10 1 10B | 66.50 | 10 | DTCB10 2 10B | 188.00 |
| 16 | DTCB10 1 16B | 66.50 | 16 | DTCB10 2 16B | 188.00 |
| 20 | DTCB10 1 20B | 66.50 | 20 | DTCB10 2 20B | 188.00 |
| 25 | DTCB10 1 25B | 66.50 | 25 | DTCB10 2 25B | 188.00 |
| 32 | DTCB10 1 32B | 66.50 | 32 | DTCB10 2 32B | 188.00 |
| 40 | DTCB10 1 40B | 78.50 | 40 | DTCB10 2 40B | 194.00 |
| 50 | DTCB10 1 50B | 91.00 | 50 | DTCB10 2 50B | 220.00 |
| 63 | DTCB10 1 63B | 109.00 | 63 | DTCB10 2 63B | 230.00 |

Triple pole

| $\ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :--- |
| 6 | DTCB10 3 06B | $\mathbf{2 2 0 . 0 0}$ |
| 10 | DTCB10 3 10B | $\mathbf{2 2 0 . 0 0}$ |
| 16 | DTCB10 3 16B | $\mathbf{2 2 0 . 0 0}$ |
| 20 | DTCB10 3 20B | $\mathbf{2 2 0 . 0 0}$ |
| 25 | DTCB10 3 25B | $\mathbf{2 2 0 . 0 0}$ |
| 32 | DTCB10 3 32B | $\mathbf{2 2 0 . 0 0}$ |
| 40 | DTCB10 3 40B | $\mathbf{2 3 0 . 0 0}$ |
| 50 | DTCB10 3 50B | $\mathbf{3 0 5 . 0 0}$ |
| 63 | DTCB10 3 63B | $\mathbf{3 6 5 . 0 0}$ |

## Notes: The LINE-side is the OFF or bottom of the MCB, and connects to NC, GB

 or CD chassis tee-offs.A range of UL standard MCBs is available on indent (Ref DTCBUL10...C) Suitable for the following side mounted accessories:

- AUX/ALM switch - refer page 1-40
- Shunt trip and UVT trip - refer page 1-39
- Clip-on RCD module - refer page 1-32
- Din-T terminals and accessories - refer page 1-50

Series 0.5-63 A

10 kA 'C' curve

- Standard AS/NZS 60898
- Approval No. N17481
- Current range 0.5-63 A 1, 2, 3 and 4 pole
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits NC, CD or GB chassis
- General purpose light, power and motor starting


Curve type: C (5-10 $\left.I_{n}\right)$

| Single pole |  | Double pole |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| In (A) | Cat. No. | Price \$ | $\ln (\mathrm{A})$ | Cat. No. | Price \$ |
| 0.5 | DTCB10 1 05C | 58.50 | 0.5 | DTCB10 $205 C$ | 179.00 |
| 1 | DTCB10 101 C | 58.50 | 1 | DTCB10 $201 C$ | 179.00 |
| 2 | DTCB10 1 02C | 58.50 | 2 | DTCB10 $202 C$ | 179.00 |
| 4 | DTCB10 1 04C | 58.50 | 4 | DTCB10 2 04C | 179.00 |
| 6 | DTCB10 1 06C | 58.50 | 6 | DTCB10 2 06C | 179.00 |
| 10 | DTCB10 1 10C | 58.50 | 10 | DTCB10 2 10C | 179.00 |
| 13 | DTCB10 1 13C | 58.50 | 13 | DTCB102 13C | 179.00 |
| 16 | DTCB10 1 16C | 58.50 | 16 | DTCB10 2 16C | 179.00 |
| 20 | DTCB10 1 20C | 58.50 | 20 | DTCB10 2 20C | 179.00 |
| 25 | DTCB10 1 25C | 58.50 | 25 | DTCB10 2 25C | 179.00 |
| 32 | DTCB10 1 32C | 58.50 | 32 | DTCB10 2 32C | 179.00 |
| 40 | DTCB10 1 40C | 58.50 | 40 | DTCB10 2 40C | 179.00 |
| 50 | DTCB10 1 50C | 58.50 | 50 | DTCB10 2 50C | 179.00 |
| 63 | DTCB10 1 63C | 58.50 | 63 | DTCB102 63C | 179.00 |

Triple pole
Four pole

| $\ln (\mathrm{A})$ | Cat. No. | Price \$ $\ln (\mathrm{A})$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 0.5 | DTCB10305C | 215.00 |  |  |
| 1 | DTCB10 301C | 215.001 | DTCB10 4 01C | 255.00 |
| 2 | DTCB10302C | 215.002 | DTCB10 4 02C | 255.00 |
| 4 | DTCB10 3 04C | 215.004 | DTCB10404C | 255.00 |
| 6 | DTCB10 3 06C | 215.006 | DTCB10 4 06C | 255.00 |
| 10 | DTCB10 3 10C | 215.0010 | DTCB10 4 10C | 255.00 |
| 13 | DTCB103 13C | 215.0013 | DTCB10413C | 255.00 |
| 16 | DTCB10 3 16C | 215.0016 | DTCB10 4 16C | 255.00 |
| 20 | DTCB10320C | 215.0020 | DTCB10 4 20C | 255.00 |
| 25 | DTCB10 3 25C | 215.0025 | DTCB10 4 25C | 255.00 |
| 32 | DTCB10 3 32C | 215.0032 | DTCB10 4 32C | 255.00 |
| 40 | DTCB10 3 40C | 215.0040 | DTCB10 4 40C | 265.00 |
| 50 | DTCB10 3 50C | 215.0050 | DTCB10 4 50C | 280.00 |
| 63 | DTCB10363C | 215.0063 | DTCB10463C | 290.00 |

Series 0.5-63A

## 10 kA 'D' curve

- Standard AS/NZS 60898
- Approval No. N17481
- Current range 0.5-63 A 1, 2, 3 and 4 pole
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits NC, CD or GB type chassis
- Motor starting and transformer applications


Curve type: D ( $10-20 I_{\mathrm{n}}$ )
Single pole

| $\ln (\mathbf{A})$ | Cat. No. | Price $\$ \ln (\mathrm{~A})$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 0.5 | DTCB10 1 05D | 66.500 .5 | DTCB10 2 05D | 188.00 |
| 1 | DTCB10 1 01D | 66.501 | DTCB10 2 01D | 188.00 |
| 2 | DTCB10 1 02D | 66.502 | DTCB10 2 02D | 188.00 |
| 4 | DTCB10 1 04D | 66.504 | DTCB10 2 04D | 188.00 |
| 6 | DTCB10 1 06D | 66.506 | DTCB10 2 06D | 188.00 |
| 10 | DTCB10 1 10D | 66.5010 | DTCB10 2 10D | 188.00 |
| 13 | DTCB10 1 13D | 66.5013 | DTCB10 2 13D | 188.00 |
| 16 | DTCB10 1 16D | 66.5016 | DTCB10 2 16D | 188.00 |
| 20 | DTCB10 1 20D | 66.5020 | DTCB10 2 20D | 188.00 |
| 25 | DTCB10 1 25D | 66.5025 | DTCB10 2 25D | 188.00 |
| 32 | DTCB10 1 32D | 66.5032 | DTCB10 2 32D | 188.00 |
| 40 | DTCB10 1 40D | 84.5040 | DTCB10 2 40D | 205.00 |
| 50 | DTCB10 1 50D | 109.0050 | DTCB10 2 50D | 230.00 |
| 63 | DTCB10 1 63D | 133.0063 | DTCB102 63D | 255.00 |


| Triple pole |  | Four pole |  |  | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\mathbf{I n}(\mathrm{A})$ | Cat. No. | Price \$ | In (A) | Cat. No. |  |
| 0.5 | DTCB10 3 05D | 220.00 | 0.5 | - |  |
| 1 | DTCB10 3 01D | 220.00 | 1 | - |  |
| 2 | DTCB10 3 02D | 220.00 | 2 | - |  |
| 4 | DTCB10 3 04D | 220.00 | 4 | DTCB10 4 04D | 265.00 |
| 6 | DTCB10 3 06D | 220.00 | 6 | DTCB10 4 06D | 265.00 |
| 10 | DTCB10 3 10D | 220.00 | 10 | DTCB10 4 10D | 265.00 |
| 13 | DTCB10 3 13D | 220.00 | 13 | DTCB10 4 13D | 265.00 |
| 16 | DTCB10 3 16D | 220.00 | 16 | DTCB10 4 16D | 265.00 |
| 20 | DTCB10 3 20D | 220.00 | 20 | DTCB10 4 20D | 265.00 |
| 25 | DTCB10 3 25D | 220.00 | 25 | DTCB10 4 25D | 265.00 |
| 32 | DTCB10 3 32D | 220.00 | 32 | DTCB10 4 32D | 265.00 |
| 40 | DTCB10 3 40D | 230.00 | 40 | DTCB10 4 40D | 280.00 |
| 50 | DTCB10 3 50D | 305.00 | 50 | DTCB10 4 50D | 365.00 |
| 63 | DTCB10 3 63D | 365.00 | 63 | DTCB10 4 63D | 550.00 |

## Din-T10H

Series 80-125 A

10 kA 'C' Curve
7.5 kA 'D' Curve

- Standard AS/NZS 60947-2
- Current range 80-125 A 1, 2, 3 and 4 pole

Module width $=27 \mathrm{~mm}$

- DIN rail mounting

- Suits NCH or CDH hybrid type chassis
- Industrial applications

Curve type: C (5-10 $\left.I_{n}\right)$
Single pole

## Double pole

| In $(\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \mathbf{\operatorname { l n } ( A )}$ | Cat. No. | Price $\mathbf{\$}$ |  |
| :--- | :--- | :---: | :--- | :--- | ---: |
| 80 | DINT10H180C | $\mathbf{1 2 8 . 0 0}$ | 80 | DINT10H280C | $\mathbf{3 3 0 . 0 0}$ |
| 100 | DINT10H1100C | $\mathbf{1 5 1 . 0 0}$ | 100 | DINT10H2100C | $\mathbf{3 5 0 . 0 0}$ |
| 125 | DINT10H1125C | $\mathbf{1 8 9 . 0 0}$ | 125 | DINT10H2125C | $\mathbf{4 7 0 . 0 0}$ |

Triple pole Four pole

| $\ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$}$ |  |
| :--- | :--- | ---: | :--- | ---: | ---: |
| 80 | DINT10H380C | $\mathbf{4 0 0 . 0 0} 80$ | DINT10H480C | $\mathbf{7 0 0 . 0 0}$ |  |
| 100 | DINT10H3100C | $\mathbf{4 0 0 . 0 0}$ | 100 | DINT10H4100C | $\mathbf{7 0 0 . 0 0}$ |
| 125 | DINT10H3125C | $\mathbf{5 9 0 . 0 0}$ | 125 | DINT10H4125C | $\mathbf{1 0 4 0 . 0 0}$ |

Curve type: D ( $10-20 I_{n}$ )
Single pole
Double pole

| $\boldsymbol{l n}(\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$}$ |  |
| :--- | :--- | :---: | :--- | :--- | :---: |
| 80 | DINT10H180D | $\mathbf{1 8 2 . 0 0}$ | 80 | DINT10H280D | $\mathbf{3 5 5 . 0 0}$ |
| 100 | DINT10H1100D | $\mathbf{1 8 2 . 0 0}$ | 100 | DINT10H2100D | $\mathbf{4 0 0 . 0 0}$ |
| 125 | DINT10H1125D | $\mathbf{2 1 0 . 0 0}$ | 125 | DINT10H2125D | $\mathbf{5 3 0 . 0 0}$ |

Triple pole
Four pole

| $\ln (\mathbf{A})$ | Cat. No. | Price $\mathbf{\$} \ln (\mathbf{A})$ | Cat. No. | Price \$ |  |
| :--- | :--- | ---: | :--- | :--- | ---: |
| 80 | DINT10H380D | $\mathbf{4 5 5 . 0 0} 80$ | DINT10H480D | $\mathbf{7 8 0 . 0 0}$ |  |
| 100 | DINT10H3100D | $\mathbf{4 5 5 . 0 0}$ | 100 | DINT10H4100D | $\mathbf{7 8 0 . 0 0}$ |
| 125 | DINT10H3125D | $\mathbf{6 5 0 . 0 0}$ | 125 | DINT10H4125D | $\mathbf{1 1 4 0 . 0 0}$ |

Notes: The LINE-side is the OFF or bottom of the MCB, and connects to NCH or CDH chassis tee-offs.
Din-T10H MCBs do not fit NC or CD chassis with 18 mm pole pitch.
All poles include overcurrent and short circuit protection.
Suitable for the following side mounted accessories:

- AUX/ALM switch - refer page 1-40
- Shunt trip - refer page 1-39
- Din-T terminals and accessories - refer page 1-50


## Din-T15

Series 6-63A
$15 \mathrm{kA}, 20 \mathrm{kA}, 25 \mathrm{kA}, 50 \mathrm{kA}$ ' $\mathrm{C}^{\prime}$ curve

- Standard AS/NZS 60947-2
- Current rating 6-63 A 1, 2, 3 and 4 pole
- Sealable and lockable handle
- DIN rail mounting
- Suits NC or CD type chassis
- Industrial applications

Curve type: C (5-10 In)
Single pole Double pole

| In (A) | Cat. No. | Price $\boldsymbol{\$}$ In (A) | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 6 | DTCB15 1 06C | $\mathbf{1 5 0 . 0 0} 6$ | DTCB15 2 06C | $\mathbf{2 7 0 . 0 0}$ |
| 10 | DTCB15 1 10C | $\mathbf{1 5 0 . 0 0} 10$ | DTCB15 2 10C | $\mathbf{2 7 0 . 0 0}$ |
| 13 | DTCB15 1 13C | $\mathbf{1 5 0 . 0 0} 13$ | DTCB15 2 13C | $\mathbf{2 7 0 . 0 0}$ |
| 16 | DTCB15 1 16C | $\mathbf{1 5 0 . 0 0} 16$ | DTCB15 2 16C | $\mathbf{2 7 0 . 0 0}$ |
| 20 | DTCB15 1 20C | $\mathbf{1 5 0 . 0 0} 20$ | DTCB15 2 20C | $\mathbf{2 7 0 . 0 0}$ |
| 25 | DTCB15 1 25C | $\mathbf{1 5 0 . 0 0} 25$ | DTCB15 2 25C | $\mathbf{2 7 0 . 0 0}$ |
| 32 | DTCB15 1 32C | $\mathbf{1 5 0 . 0 0} 32$ | DTCB15 2 32C | $\mathbf{2 7 0 . 0 0}$ |
| 40 | DTCB15 1 40C | $\mathbf{1 5 0 . 0 0} 40$ | DTCB15 2 40C | $\mathbf{2 7 0 . 0 0}$ |
| 50 | DTCB15 1 50C | $\mathbf{1 5 0 . 0 0} 50$ | DTCB15 2 50C | $\mathbf{2 7 0 . 0 0}$ |
| 63 | DTCB15 1 63C | $\mathbf{1 5 0 . 0 0} 63$ | DTCB15 2 63C | $\mathbf{2 7 0 . 0 0}$ |

Triple pole
Four pole

| In (A) | Cat. No. | Price \$ In (A) | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 6 | DTCB15 3 06C | $\mathbf{4 2 0 . 0 0} 6$ | DTCB15 4 06C | $\mathbf{4 9 0 . 0 0}$ |
| 10 | DTCB15 3 10C | $\mathbf{4 2 0 . 0 0} 10$ | DTCB15 4 10C | $\mathbf{4 9 0 . 0 0}$ |
| 13 | DTCB15 3 13C | $\mathbf{4 2 0 . 0 0} 13$ | DTCB15 4 13C | $\mathbf{4 9 0 . 0 0}$ |
| 16 | DTCB15 3 16C | $\mathbf{4 2 0 . 0 0} 16$ | DTCB15 4 16C | $\mathbf{4 9 0 . 0 0}$ |
| 20 | DTCB15 3 20C | $\mathbf{4 2 0 . 0 0} 20$ | DTCB15 4 20C | $\mathbf{4 9 0 . 0 0}$ |
| 25 | DTCB15 3 25C | $\mathbf{4 2 0 . 0 0} 25$ | DTCB15 4 25C | $\mathbf{4 9 0 . 0 0}$ |
| 32 | DTCB15 3 32C | $\mathbf{4 2 0 . 0 0} 32$ | DTCB15 4 32C | $\mathbf{4 9 0 . 0 0}$ |
| 40 | DTCB15 3 40C | $\mathbf{4 2 0 . 0 0} 40$ | DTCB15 40C | $\mathbf{4 9 0 . 0 0}$ |
| 50 | DTCB15 3 50C | $\mathbf{4 2 0 . 0 0} 50$ | DTCB15 450C | $\mathbf{4 9 0 . 0 0}$ |
| 63 | DTCB15 3 63C | $\mathbf{4 2 0 . 0 0} 63$ | DTCB15 463C | $\mathbf{4 9 0 . 0 0}$ |

Short circuit capacity

| In $(\mathbf{A})$ | No. poles | Voltage (V) | Icu $(\mathbf{k A})$ |
| :--- | :--- | :--- | :--- |
| $6-25$ | $\frac{1}{2-4}$ | 240 | 25 |
| $32-40$ | $\frac{1}{2-4}$ | $240 / 415$ | $50 / 25$ |
| $50-63$ | $\frac{1}{2-4}$ | 240 | 20 |

Notes: The LINE-side is the OFF or bottom of the MCB, and connects to chassis. $\mathrm{lcs}=50 \% \mathrm{lcu}$.

## Din-T6 <br> Easy-Fit MCB and RCCBs - Tool-free connection

## 6 kA 'C' curve

- Standard AS/NZS 60898
- Approval No. NSW 24783
- Current range 2-63 A
- C curve tripping characteristic
- Cable clamping technology
- Line side- Plug in or screw in busbar comb
- Load side- Screw-less cable connection up to 20 A
- DIN rail mounting

- General purpose light and power

Curve type: C (5-10 In)
Single pole
Triple pole

| $\ln (\mathrm{A})$ | Cat. No. | Price \$ | $\ln (\mathrm{A})$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 | DTCBE6106C ${ }^{1}$ ) | 40.50 | 6 | DTCBE6306C ${ }^{1}$ ) | 166.00 |
| 10 | DTCBE6110 ${ }^{1}$ ) | 40.50 | 10 | DTCBE6310C ${ }^{1}$ ) | 166.00 |
| 16 | DTCBE6116C ${ }^{1}$ ) | 40.50 | 16 | DTCBE6316C ${ }^{1}$ ) | 166.00 |
| 20 | DTCBE6120 ${ }^{1}$ ) | 40.50 | 20 | DTCBE6320 ${ }^{1}$ ) | 166.00 |
| 25 | DTCBE6125C ${ }^{\text {2 }}$ ) | 40.50 | 25 | DTCBE6325C ${ }^{\text { }}$ ) | 166.00 |
| 32 | DTCBE6132C ${ }^{2}$ ) | 40.50 | 32 | DTCBE6332 ${ }^{\text {2 }}$ ) | 166.00 |
| 40 | DTCBE6140C ${ }^{2}$ ) | 40.50 | 40 | DTCBE6340 ${ }^{2}$ ) | 166.00 |
| 50 | DTCBE6150 ${ }^{2}$ ) | 40.50 | 50 | DTCBE6350 ${ }^{2}$ ) | 166.00 |
| 63 | DTCBE6163C ${ }^{2}$ ) | 40.50 | 63 | DTCBE6363C ${ }^{2}$ ) | 166.00 |

## Din-Safe RCD

- Standard AS/NZS 61008
- Approval No NSW 17482
- Current range 40-63 A
- 2 pole and 4 pole configurations
- 30 mA sensititvity
- Cable clamping technology
- Line side- Screw terminal
- Load side- Screw terminal or plug in busbar comb
- DIN rail mounting


| No. poles | Trip sens. | Amp <br> rating | Voltage | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $2 \mathrm{P}(1 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 240 V | DSRCDE24030 | $\mathbf{2 5 0 . 0 0}$ |
|  |  | 63 A | 240 V | DSRCDE26330 | $\mathbf{2 8 5 . 0 0}$ |
| $4 \mathrm{P}(3 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | $240 / 415 \mathrm{~V}$ | DSRCDE44030 | $\mathbf{3 3 5 . 0 0}$ |

[^1]
## Din-Safe

Safety switches (RCCB)


| No. poles | Trip sens. | Amp rating Voltage |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $2 \mathrm{P}(1 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 240 V | DSRCD24030 | 240.00 |
|  |  | 63 A | 240 V | DSRCD26330 | 265.00 |
|  |  | 80 A | 240 V | DSRCD28030 | 295.00 |
|  | 100 mA | 40 A | 240 V | DSRCD240100 | 290.00 |
|  |  | 80 A | 240 V | DSRCD280100 | 355.00 |
|  | 300 mA | 40 A | 240 V | DSRCD240300 | 330.00 |
|  |  | 80 A | 240 V | DSRCD280300 | 370.00 |
| $4 \mathrm{P}(3 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 415 V | DSRCD44030 | 315.00 |
|  |  | 63 A | 415 V | DSRCD46330 | 335.00 |
|  |  | 80 A | 415 V | DSRCD48030 | 375.00 |
|  |  | 100 A | 415 V | DSRCD410030 | 560.00 |
|  | 100 mA | 40 A | 415 V | DSRCD440100 | 340.00 |
|  |  | 63 A | 415 V | DSRCD463100 | 425.00 |
|  |  | 80 A | 415 V | DSRCD480100 | 475.00 |
|  |  | 100 A | 415 V | DSRCD4100100 | 560.00 |
|  | 300 mA | 40 A | 415 V | DSRCD440300 | 370.00 |
|  |  | 100 A | 415 V | DSRCD4100300 | 560.00 |
|  | 500 mA | 100 A | 415 V | DSRCD4100500 | 570.00 |

High immunity type

| $2 \mathrm{P}(1 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 240 V | DSRCD24030AI | $\mathbf{2 9 0 . 0 0}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | 63 A | 240 V | DSRCD26330AI | $\mathbf{3 3 5 . 0 0}$ |
| $4 \mathrm{P}(3 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 415 V | DSRCD44030AI | $\mathbf{3 5 0 . 0 0}$ |
|  |  | 415 V | DSRCD46330AI | $\mathbf{4 3 5 . 0 0}$ |  |

Selective type ( 40 ms delay)

| $2 \mathrm{P}(1 \mathrm{P}+\mathrm{N})$ | 100 mA | 63 A | 240 V | DSRCD263100S | 365.00 |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 300 mA | 63 A | 240 V | DSRCD263300S | 400.00 |
| 4P (3P+N) | 100 mA | 63 A | 415 V | DSRCD463100S | 445.00 |
|  |  | 100 A | 415 V | DSRCD4100100S | 610.00 |
|  | 300 mA | 63 A | 415 V | DSRCD463300S | 510.00 |
|  |  | 100 A | 415 V | DSRCD4100300S | 620.00 |

Notes: 30 mA tripping characteristics: $0.5 \times \Delta \mathrm{n}=$ no tripping, $1 \times \Delta \mathrm{n}=\mathrm{T} \leq 300 \mathrm{mS}$, $2 \times \Delta \mathrm{n}=\mathrm{T} \leq 150 \mathrm{mS}, 5 \times \Delta \mathrm{n}=\mathrm{T} \leq 40 \mathrm{mS}$


## Din-Safe <br> Safety switches (RCCB)

Standard AS/NZS 61008

- Approval No. N17482
- Current ratings $40,63,80$ and 100 A
- 2 and 4 pole configuration
- Accepts Din-T side mounting accessories
- Handle sealable and padlockable



## Type A RCD

| No. poles | Trip sens | Amp rating Voltage |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $2 \mathrm{P}(1 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 240 V | DSRCD24030A | 265.00 |
|  |  | 63 A | 240 V | DSRCD26330A | 340.00 |
|  |  | 80 A | 240 V | DSRCD28030A | 400.00 |
|  | 100 mA | 40 A | 240 V | DSRCD240100A | 365.00 |
|  |  | 80 A | 240 V | DSRCD280100A | 365.00 |
| $4 \mathrm{P}(3 \mathrm{P}+\mathrm{N})$ | 30 mA | 40 A | 415 V | DSRCD44030A | 375.00 |
|  |  | 63 A | 415 V | DSRCD46330A | 395.00 |
|  |  | 100 A | 415 V | DSRCD410030A | 630.00 |
|  | 100 mA | 63 A | 415 V | DSRCD463100A | 445.00 |
|  |  | 80 A | 415 V | DSRCD480100A | 560.00 |

Type B

| $4 \mathrm{P}(3 \mathrm{P}+\mathrm{N})$ | 30 mA | 63 A | 240 V | DSRCD46330B | 2780.00 |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 100 mA | 63 A | 240 V | DSRCD463100B | 2780.00 |
|  | 500 mA | 125 A | 415 V | DSRCD4125500B | 2780.00 |
|  | 300 mA | 63 A | 415 V | DSRCD463300BS ${ }^{1}$ ) | 2780.00 |

Notes: ${ }^{1}$ ) Selective type.
30 mA tripping characteristics: $0.5 \times \Delta \mathrm{n}=$ no tripping, $1 \times \Delta \mathrm{n}=\mathrm{T} \leq 300 \mathrm{mS}$, $2 \times \Delta \mathrm{n}=\mathrm{T} \leq 150 \mathrm{mS}, 5 \times \Delta \mathrm{n}=\mathrm{T} \leq 40 \mathrm{mS}$

Din-Safe
Safety switches (RCCB)

Connection details


Circuit diagrams


Dimensions (mm)


## Din-Safe <br> Compact single pole width residual current circuit breaker (RCBO) Same dimensions as a standard MCB

6 kA

- Standard AS/NZS 61009
- Approval No. NSW24576
- Current range 6-32 A
- C curve tripping characteristic
- Short circuit, overcurrent and earth leakage protection
- Sensitivity 30 mA
- DIN rail mounting
- Dual DIN clip
- Suits NC, CD and GB chassis

- Suitable for loadcenters and panelboards
- General purpose light and power

Curve type: C (5-10 In)

| Trip sens. | No. of poles | Voltage | Short circuit cap. | In ( A$)$ | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 mA | 1 pole | $\begin{aligned} & 240 \mathrm{~V} \\ & \mathrm{AC} \end{aligned}$ | 6 kA | 6 | DSRCBS0630C | 320.00 |
|  |  |  |  | 10 | DSRCBS1030C | 320.00 |
|  |  |  |  | 16 | DSRCBS1630C | 320.00 |
|  |  |  |  | 20 | DSRCBS2030C | 320.00 |
|  |  |  |  | 25 | DSRCBS2530C | 320.00 |
|  |  |  |  | 32 | DSRCBS3230C | 320.00 |

Curve type: B (3-5 In)

| Trip sens. | No. of poles | Voltage | Short circuit cap. | $\ln (\mathrm{A})$ | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 mA | 1 pole | $\begin{aligned} & 240 \mathrm{~V} \\ & \mathrm{AC} \end{aligned}$ | 6 kA | 6 | DSRCBS0630B | 320.00 |
|  |  |  |  | 10 | DSRCBS1030B | 320.00 |
|  |  |  |  | 16 | DSRCBS1630B | 320.00 |
|  |  |  |  | 20 | DSRCBS2030B | 320.00 |
|  |  |  |  | 25 | DSRCBS2530B | 320.00 |
|  |  |  |  | 32 | DSRCBS3230B | 320.00 |

Dimensions (mm)


Connection diagram


Notes: ') Insert 'A' at end of part number for Type A RCD e.g. DSRCBS-20-30-CA. Nuisance tripping may be experienced in VFD and motor starting applications, refer NHP.

## Din-Safe

Single pole width residual current circuit breaker (RCBO)

## 10 kA

- Standard AS/NZS 61009
- Approval No. N17482
- One module wide ( 18 mm )
- Short circuit, overcurrent and earth leakage protection
- Short circuit capacity 10 kA
- Sensitivity 10 and 30 mA
- Suits NC, CD or GB chassis
- Type 'A' RCD


Curve type: C (5-10In)

| Trip <br> sens. | No. of <br> poles | Voltage | Short <br> circuit <br> cap. | In (A) | Cat. No. $\left.{ }^{1}{ }^{2}\right)$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

## Dimensions (mm)



Connection diagram


Notes: The LINE-side is the OFF or bottom of the MCB, and connects to chassis tee-offs.
${ }^{1}$ ) Neutral not switched.
${ }^{2}$ ) Will not accept Din-T side mounting accessories.
30 mA tripping characteristics: $0.5 \times \mathrm{I} \Delta \mathrm{n}=$ no tripping, $1 \times \mathrm{I} \Delta \mathrm{n}=\mathrm{T} \leq 300 \mathrm{mS}$

$$
2 \times \mathrm{I} \Delta \mathrm{n}=\mathrm{T} \leq 150 \mathrm{mS}, 5 \times \mathrm{I} \Delta \mathrm{n}=\mathrm{T} \leq 40 \mathrm{mS}
$$

Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.

## Din-Safe MCB (RCBO)

10 kA MCB without Pigtail (RCBO)

- Standard AS/NZS 61009
- Approval No. N17482
- Switched neutral
- Suits 3 P+N NC or GB chassis or special CD chassis
- Suits loadcenters


Din-Safe MCB is a combined MCB/RCD providing overload, short circuit and earth leakage protection in the one integral unit.

Curve type: C (5-10 In)
Type AC RCD

| Trip sens. | No. of poles | Voltage (AC) | Phase | In ( A$)$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 mA | 2 Pole | 110/240 | $1 \mathrm{P}+\mathrm{N}$ | 6 | DSRCB0630 | 275.00 |
|  |  |  |  | 10 | DSRCB1030 | 275.00 |
|  |  |  |  | 16 | DSRCB1630 | 275.00 |
|  |  |  |  | 20 | DSRCB2030 | 275.00 |
|  |  |  |  | 25 | DSRCB2530 | 275.00 |
|  |  |  |  | 32 | DSRCB3230 | 275.00 |
|  |  |  |  | 40 | DSRCB4030 | 275.00 |

Type A RCD

| Trip <br> sens. | No. of <br> poles | Voltage <br> (AC) | Phase | In (A) | Cat. No. |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |

Notes: 30 mA tripping characteristics: $0.5 \times \mathrm{I} \mathrm{n}=$ no tripping, $1 \times \mathrm{I} \Delta \mathrm{n}=\mathrm{T} \leq 300 \mathrm{mS}$ $2 \times \mathrm{I} \Delta \mathrm{n}=\mathrm{T} \leq 150 \mathrm{mS}, 5 \times \mathrm{I} \mathrm{n}=\mathrm{T} \leq 40 \mathrm{mS}$

## Din-Safe <br> MCB (RCBO)

## 10 kA MCB with Pigtail (RCBO)

- Standard AS/NZS 61009
- Approval No. N17482
- Un-switched neutral
- Suits NC, CD or GB chassis

Complete with revised terminal configuration and neutral pigtail, will fit standard Din-T 3 ph chassis.


Curve type: C (5-10 In)
Type AC RCD

| Trip sens. | No. of poles | Voltage (AC) | Phase | In (A) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 mA 2 Pole |  | 110/240 | $1 \mathrm{P}+\mathrm{N}$ | 6 | DSRCB0630P | 280.00 |
|  |  | 10 |  | DSRCB1030P | 280.00 |
|  |  | 16 |  | DSRCB1630P | 280.00 |
|  |  | 20 |  | DSRCB2030P | 280.00 |
|  |  | 25 |  | DSRCB2530P | 280.00 |
|  |  | 32 |  | DSRCB3230P | 280.00 |
|  |  | 40 |  | DSRCB4030P | 280.00 |

Notes: 30 mA tripping characteristics: $0.5 \times \mathrm{l} \Delta \mathrm{n}=$ no tripping, $1 \times 1 \Delta \mathrm{n}=\mathrm{T} \leq 300 \mathrm{mS}$ $2 \times \mathrm{I} \mathrm{n}=\mathrm{T} \leq 150 \mathrm{mS}, 5 \times \mathrm{I} \mathrm{n}=\mathrm{T} \leq 40 \mathrm{mS}$

## Din-Safe-M <br> Add-on earth leakage modules

Standard AS/NZS 3190
Approval No N11974

- Current ratings 32 and 63 amps
- Sensitivity I n 30, 100 and 300 mA
- Suits Din-T6, 10 and 15
- Can identify trip is either earth leakage or overload/short circuit

Tripping characteristics

| $0.5 \times I \Delta n$ | no tripping |
| :--- | :--- |
| $1 \times I \Delta n$ | $\mathrm{t} \leq 300 \mathrm{~ms}$ |
| $5 \times \mathrm{I} \mathrm{n}$ | $\mathrm{t} \leq 40 \mathrm{~ms}$ |



Din-Safe-M modules to suit Din-T6, 10 and 15

| No. of poles ${ }^{1}$ ) | Sensitivity | MCB rating ${ }^{3}$ ) | Width mods. ${ }^{2}$ ) | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\left.1 \mathrm{P}+\mathrm{N}^{4}\right)$ | 30 mA | 32 A | 2 | DSRCM32301PN | 435.00 |
|  |  | 63 A | 2 | DSRCM63301PN | 550.00 |
|  | 100 mA | 32 A | 2 | DSRCM321001PN | 455.00 |
|  |  | 63 A | 2 | DSRCM631001PN | 570.00 |
|  | 300 mA | 32 A | 2 | DSRCM323001PN | 510.00 |
|  |  | 63 A | 2 | DSRCM633001PN | 620.00 |
| 3P | 30 mA | 63 A | 3 | DSRCM63303P | 590.00 |
|  | 100 mA | 63 A | 3 | DSRCM631003P | 640.00 |
| $3 P+N$ | 30 mA | 32 A | 2 | DSRCM32303PN | 495.00 |
|  |  | 63 A | 3 | DSRCM63303PN | 580.00 |
|  | 100 mA | 32 A | 2 | DSRCM321003PN | 580.00 |
|  |  | 63 A | 3 | DSRCM631003PN | 640.00 |
|  | 300 mA | 32 A | 2 | DSRCM323003PN | 580.00 |
|  |  | 63 A | 3 | DSRCM633003PN | 640.00 |

Din-Safe-M space requirements
Without MCB fitted MCB fitted MCB fitted Type neutral not switched neutral not switched neutral switched

| $1 \mathrm{P}+\mathrm{N} 32 / 63$ A 2 modules $(36 \mathrm{~mm})$ | 3 modules $(54 \mathrm{~mm})$ | 4 modules $(72 \mathrm{~mm})$ |  |
| :--- | :--- | :--- | :--- |
| $3 \mathrm{P}+\mathrm{N} 32 \mathrm{~A}$ | 2 modules $(36 \mathrm{~mm})$ | 5 modules $(90 \mathrm{~mm})$ | 6 modules $(108 \mathrm{~mm})$ |
| $3 \mathrm{P}+\mathrm{N} 63 \mathrm{~A}$ | 3 modules $(54 \mathrm{~mm})$ | 6 modules $(108 \mathrm{~mm})$ | 7 modules $(126 \mathrm{~mm})$ |
| 3 P 63 A | 3 modules $(54 \mathrm{~mm})$ | 6 modules $(108 \mathrm{~mm})$ | N/A |

Notes: ${ }^{1}$ 1 $1 \mathrm{P}+\mathrm{N}$ and $3 \mathrm{P}+\mathrm{N}$ type supply neutral connected by 'pigtail' cable.
${ }^{2}$ ) Dimensions of Din-Safe-M unit only; add MCB width for total installed width.
${ }^{3}$ ) 'MCB rating' refers to the max. MCB rating the module can be fitted to.
$\left.{ }^{4}\right) 1 \mathrm{P}+\mathrm{N}$ suitable for 415 V 2 P applications. Not suitable for Din-T10H MCBs.

## Din-Safe-M

Modules to be combined with Din-T MCBs

## Operation

The combined Din-T MCB/Din-Safe-M earth leakage module has two operating toggles which indicate the reason for the trip action taking place.

When an overload or short circuit occurs the Din-T MCB will operate. In this case the Din-Safe-M toggle will remain in the ON position.

- If an earth leakage fault occurs both toggles will move to the OFF position. In order to reset the MCB the Din-Safe-M unit must be reset first.
- In both instances - if the cause of the trip operation has not been rectified, a trip operation will occur as soon as the MCB is turned to the ON position. The trip free mechanism of the MCB ensures that a successful trip operation takes place even when the toggle is held in the ON position.


## Assembly

- Place the MCB and Din-Safe-M unit on a flat surface. Be sure that both the MCB and the Din-Safe-M toggles are in the ON position.
- Slide the two units towards each other inserting the connecting bars or links into the MCB tunnel terminal, ensuring no undue pressure is applied to the metal tripping pin of the Din-Safe-M unit.
- Push in the connecting clips, locking the unit together.

Check that the MCB trips when the toggle on the Din-Safe-M is moved to the OFF position.

- Tighten the busbar connections between the MCB and the Din-Safe-M and fit the insulating cover supplied.
- If the pigtail and N connections are reversed, the breaker will trip as soon as load is energised. Reset Din-Safe-M module before switching MCB 'ON'.
- In the case of a three phase 3 wire system (no neutral) use 3 phase models. $3 \mathrm{P}+\mathrm{N}$ models will operate satisfactorily but test button will only function if neutral pigtail is connected.

- Din-Safe-M modules are an earth leakage module only. To complete the functional unit a Din-T6, Din-T10 or Din-T15 MCB must be added as shown.


# Din-Safe-M <br> Modules to be combined with Din-T MCBs 

## Testing

The MCB/Din-Safe-M combination must be connected with the line conductors to the LINE side (OFF/Bottom side) of the MCB and the load conductors connected to the Din-Safe-M terminals. The MCB/Din-Safe-M combination must be tested with the supply connected before connecting the load. First switch the Din-Safe-M unit 'ON' then the MCB. When the test button is pressed, both handles should trip. It is recommended that the test button is operated periodically to test the detection and tripping functions of the combined unit.

Both $1 \mathrm{P}+\mathrm{N}$ and $3 \mathrm{P}+\mathrm{N}$ models have a neutral pigtail connection. 3 P modules have no neutral connection at all.

## Din-Safe-M 1P+N with 1 pole MCB (neutral not switched)



Din-Safe-M 3P + N with 3 pole MCB (neutral not switched)


Din-Safe-M 1P+N with 2 pole MCB witching active and neutral


Din-Safe-M 3P+N with 4 pole
MCB switching active and neutral


Connection diagram


## Accessories

## Mounting of add-on devices onto MCBs, RCCBs and RCBOs

| Type/Description | $\begin{gathered} \text { Din-T, } \\ \text { DC, } \\ 6,10,15 \end{gathered}$ | $\begin{gathered} \text { Din-T } \\ 10 \mathrm{H} \\ \hline \end{gathered}$ | DSRCB, DSRCD | DSRCM | DINTMS | Change -over switch |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DTAUXAL <br> Signal or AUX contact | L-R | - | R | R | L-R | L-R |
| DTAUXALG <br> Signal or AUX contact, gold | L-R | - | R | R | L-R | L-R |
| DINT10HHS <br> Signal or AUX + AUX contact | - | R | - | - | - | - |
| DTPBS <br> Panelboard switch | L-R | - | R | - | - | - |
| DINTSHT <br> Shunt trip | - | L | - | - | - | - |
| DTSHT <br> Shunt trip | L-R | - | R | R | - | - |
| DTUVT <br> Undervoltage trip | L-R | - | R | R | - | - |
| DTMD <br> Motor operator | L-R | - | R | R | - | - |

$\mathbf{L}=$ Left mounting $\quad \mathbf{R}=$ Right mounting

## Accessories

Mounting on the left-hand side

$2 \times$ DTAUXAL/G Motor


Notes: The above accessories will not fit to Din-T10H MCBs.
Shunts and auxilaries, refer to pages 1-39 and 1-40.

## Accessories

Mounting on the right-hand side


Notes: DSRCBH and DSRCBS - Single pole RCD/MCB will not accept side mounted accessories. DINTMS - Main switches will accept side mounting auxiliary contacts only.

## Din-TMS 63-100 A

## Main switch DIN rail mount

Standard IEC 60947-3

- Double-break contacts
- Padlockable handle
- Handle sealable in ON and OFF position
- DIN rail mount
- Suits NC, CD or GB type chassis

Din-T main switches have the same profile as Din-T MCBs and
 are suitable for use as a main switch (isolator) in loadcentres and distribution boards

| No. of poles | Rated current (A) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
|  | 63 | DINTMS631 | 42.00 |
| 1 | 80 | DINTMS801 | 45.00 |
|  | 100 | DINTMS1001 | 48.00 |
|  | 63 | DINTMS632 | 56.00 |
| 2 | 80 | DINTMS802 | 67.00 |
|  | 100 | DINTMS1002 | 75.00 |
|  | 63 | DINTMS633 | 86.50 |
| 3 | 80 | DINTMS803 | 102.00 |
|  | 100 | DINTMS1003 | 115.00 |

$63 A-100 A$
side mounts to
$N C$ chassis
$63 A-80 A$ side
mounts to
$C D$ chassis

Dimensions (mm)


Notes: AUX/ALM switch, refer to page 1-40.
The LINE-side is the OFF or bottom of the isolator, and connects to NC or CD chassis tee-offs.

## Din-T <br> Shunt and undervoltage trip

## Din-T shunt trip

- Couples to left or right side of MCB
- Modular width - 18 mm
- Busbar cavity both ends
- Field assembly
- Continuously rated
- Terminals for remote indication


## Operation

The shunt trip makes it possible to remotely switch the MCB by energising C1 \& C2 terminals of the shunt trip.


Shunt trip - Din-T6, 10 \& 15

| Rated <br> voltage | Current <br> rating | Operating <br> time (ms) | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- |
| 110 to 415 V AC | $110 \mathrm{~V}-0.3 \mathrm{~A}$ | 10 |  |  |
| 110 to 125 V DC | $240 \mathrm{~V}-0.6 \mathrm{~A}$ | 4 | DTSHT110415V | $\mathbf{1 5 8 . 0 0}$ |
| 24 to 60 V AC | $24 \mathrm{~V}-1.0 \mathrm{~A}$ | 2 | 10 |  |
| 24 to 48 V DC | $48 \mathrm{~V}-2.0 \mathrm{~A}$ | 4 | DTSHT2460V | $\mathbf{1 5 8 . 0 0}$ |

Shunt trip - Din-T 10H

| Rated voltage | Current rating | Operating time (ms) | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & 110 \text { to } 415 \mathrm{~V} \mathrm{AC} \\ & 110 \text { to } 125 \mathrm{~V} \text { DC } \end{aligned}$ | $\begin{aligned} & 110 \mathrm{~V}-0.3 \mathrm{~A} \\ & 240 \mathrm{~V}-0.6 \mathrm{~A} \\ & 415 \mathrm{~V}-1.0 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 10 \\ & 4 \\ & 2 \end{aligned}$ | DINTSHT110415U | 164.00 |
| $\begin{aligned} & 24 \text { to } 60 \mathrm{~V} \mathrm{AC} \\ & 24 \text { to } 48 \mathrm{~V} \text { DC } \end{aligned}$ | $\begin{aligned} & 24 \mathrm{~V}-1.0 \mathrm{~A} \\ & 48 \mathrm{~V}-2.0 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 10 \\ & 4 \end{aligned}$ | DINTSHT2460U | 164.00 |

Din-T undervoltage trip ${ }^{2}$ )

- Couples to left or right side of MCB
- Modular width - 18 mm
- Busbar cavity both ends
- Field assembly

The Din-T UVT trips the MCB when the operating voltage threshold is lower than $0.5 \times \mathrm{Un}$. Adjustable time delay up to 300 ms eliminates nuisance tripping.


DTUVT240VAC

| Rated voltage | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :---: |
| 230 V AC | DTUVT240VAC | $\mathbf{1 7 1 . 0 0}$ |
| $12 \mathrm{~V} \mathrm{AC} / D C$ | DTUVT12VDC | $\mathbf{1 7 1 . 0 0}$ |
| $24 \mathrm{~V} \mathrm{AC/DC}$ | DTUVT24VDC | $\mathbf{1 7 1 . 0 0}$ |

[^2]
## Notes: ${ }^{1)}$ Shunt fits to left side of Din-T10H MCBs only.

${ }^{2}$ ) UVT does not suit Din-T10H MCBs.

## Din-T <br> Auxiliary contacts for MCBs

Suitable for Din-T 6, 10 \& 15
Suitable for 2P RCBO and 2P \& 4P RCCB $\left.{ }^{1}\right)^{3}$ )

- Stack up to 4 units left or right side ${ }^{2}$ )
- Field fittable, includes all fitting accessories
- Includes busbar cavity for chassis mounting
- Changeover contact
- Current rating 5 A

Din-T auxiliary contact - Din-T 6, 10, 15, DSRCBH, DSRCB


| Contact <br> function | Contact <br> material | Module width | Cat. No. | Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| H or S | Silver | 0.5 | DTAUXAL | $\mathbf{1 0 2 . 0 0}$ |
| H or S | Gold | 0.5 | DTAUXALG | $\mathbf{1 2 3 . 0 0}$ |

'H' = auxiliary switch 'S' = alarm switch
Din-T auxiliary contact - Din-T10H

| Contact <br> function | Contact <br> material | Module width | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| $\mathrm{H}+\mathrm{H} / \mathrm{S}$ | Silver | 0.5 | DINT10H - HS $^{\mathbf{2}}$ ) | $\mathbf{1 1 4 . 0 0}$ |

Din-T auxiliary contact - DSRCBS

| Contact <br> function | Contact <br> material | Module width | Cat. No. ${ }^{\mathbf{3}}$ ) | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| H | Silver | 0.5 | DSRCBSAX | $\mathbf{1 0 2 . 0 0}$ |
| H or S | Silver | 0.5 | DSRCBSAXAL | $\mathbf{1 1 4 . 0 0}$ |
| H or S | Gold | 0.5 | DSRCBSAXALG | $\mathbf{1 2 5 . 0 0}$ |

Notes: ${ }^{1}$ ) DTAUXAL type contact fits right side only on 2P RCBO and 2/4P RCCB.
${ }^{2}$ ) Auxiliary contacts for Din-T10H MCBs are not stackable and fit to right side only.
$\left.{ }^{3}\right)$ Fit right hand side only.

## Din-T <br> Motor operator for MCBs

## Din-T motor operator DTMD

- Suitable for Din-T 6, 10 \& 15

Suitable for $2 P$ RCBO and $2 P$ \& $4 P$ RCCB

- Field fittable, includes all fitting accessories

Fits left or right side of device

- Padlockable in the OFF position
- Manual operation is possible


DTMD240VAC

Rated

| Roltage | Module width | Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: |
| 240 V AC | 3 | DTMD240VAC | $\mathbf{6 6 0 . 0 0}$ |


| Technical |  |
| :--- | :--- |
| Rated voltage Un | 240 V AC |
| Impulse to switch ON/OFF | $>50 \mathrm{~ms}$ |
| Closing time | 500 ms |
| Opening time | 200 ms |
| Electrical endurance | 10,000 ops |
| Terminal capacity | $2.5 \mathrm{~mm}^{2}$ |
| Weight | 380 g |

## DIN mount housing

## to suit $\mathbf{2 2 . 5} \mathbf{~ m m}$ devices

- DIN rail mount
- Mounts 22.5 mm panelmount devices
- Suitable for loadcentres and panelboards


Holder is DIN rail mounted, and is designed to allow mounting of 22.5 mm panelmount devices in loadcentres and Concept family of panelboards. Ideal for mounting pilot lights, pushbuttons and key selector switches.

| Description | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| Holder DIN profile suit 22.5 mm devices | M22IVS | $\mathbf{2 3 . 4 0}$ |

## Panelboard switch (DTPBS)

The panelboard switch coupled to a main device is intended to switch off any 2-63 A MCB in case the front cover of the enclosure is removed. It is a mechanical safety device, which reduces the risk of electric shock in case of manipulation of the panelboard.

The panelboard switch can easily be coupled either to the right or left-hand side of the main device, according to the instructions below.

| No. modules wide ${ }^{1}$ ) | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| 0.5 | DTPBS | 59.00 |

## Kilowatt hour meters

- 8 Digit LCD
- Displays - Total active energy
- Total reactive energy
- Partial active energy
- Partial reactive energy
- Power demand
- Maxium demand (power)
- Active energy: Class 1
- Input current 1 A or 5 ACT


CE4DTO4A2

| No. modules wide ${ }^{1}$ ) | Cat. No. $^{2}$ ) | Price \$ |
| :--- | :--- | ---: |
| KWH meter DIN 4 module | CE4DT 14A2 | $\mathbf{5 6 0 . 0 0}$ |
| KWH meter DIN 4 module (CUMMS) | CE4DT 14A6 | $\mathbf{6 4 0 . 0 0}$ |

Notes: ${ }^{1}$ ) 'DTSP' - 0.5 module width spacer available if required when DTPBS used.
${ }^{2}$ ) CE4DT Price Schedule ' Y 8 '.

# Busbar comb 

Din-T MCBs

Current rating 100 A
Pin type busbars

| No. of poles | 1 Phase ${ }^{1}$ ) <br> Cat. No. | Price \$ | 3 Phase <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 8 Way | IBC108P | $\mathbf{1 0 . 6 0}$ | - |  |
| 12 Way | IBC112P | $\mathbf{1 7 . 8 0}$ | ICL123 | $\mathbf{4 9 . 0 0}$ |
| 15 Way | IBC115P | $\mathbf{2 1 . 2 0}$ | ICL153 | $\mathbf{6 1 . 0 0}$ |
| 18 Way | IBC118P | $\mathbf{2 9 . 6 0}$ | ICL183 | $\mathbf{7 2 . 5 0}$ |
| 21 Way | IBC121P | $\mathbf{3 6 . 0 0}$ | ICL213 | $\mathbf{9 4 . 5 0}$ |
| 55 Way | IBC155P | $\mathbf{7 7 . 5 0}$ | - |  |
| 57 Way | - |  | ICL573 | $\mathbf{2 2 5 . 0 0}$ |

Pin type busbar
Cat. No.
Price $\$$

| 1P+N 56 Way pin type busbar comb | ICL562 | $\mathbf{1 2 8 . 0 0}$ |
| :--- | :--- | ---: |
| 1P+N 6 Way pin type busbar comb | ICL62 | $\mathbf{1 8 . 2 0}$ |
| IP+N 10 Way pin type busbar comb | ICL102 | $\mathbf{2 6 . 0 0}$ |
| 3P+Aux 56 Way pin type busbar comb | ICL563A ${ }^{2}$ ) | $\mathbf{2 0 0 . 0 0}$ |
| 3P+N 56 Way pin type busbar comb | ICL564 | $\mathbf{2 5 5 . 0 0}$ |


| Fork type busbar | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 56 Way 1 phase fork type busbar comb | ICL561F | $\mathbf{7 8 . 0 0}$ |
| 57 Way 3 phase fork type busbar comb | ICL573F | $\mathbf{2 3 0 . 0 0}$ |
|  |  |  |
| End caps | Cat. No. | Price \$ |
| 1P end cap to suit IBC style buscomb | IBCEC1 | $\mathbf{2 . 0 0}$ |
| 2P and 3P end cap to suit ICL style buscomb | ICLEC23 ${ }^{\text {3 }}$ ) | $\mathbf{4 . 0 0}$ |
| 3P+N end cap to suit ICL style buscomb | ICLEC4 ${ }^{\text {3 }}$ ) | $\mathbf{4 . 0 0}$ |



ICL123
ICLTOC
T-off cap (strip of 5)

> ICL573F

Notes: ${ }^{1}$ ) IBC busbar combs come complete with endcaps.
${ }^{2}$ ) $16 \times 3 \mathrm{MCB}$ connections and $16 \times 9 \mathrm{~mm}$ spaces (AUXs).
${ }^{3}$ ) ICL end caps do not suit IBC busbar combs.

# Din-T <br> Modular changeover switch 

Standard IEC 60669-1
Handle sealable and lockable in ON or OFF position

- Terminal protection IP 20
- Captive terminal screws with cross head


## Without OFFI-II



No. of Price \$

| In $(\mathbf{A})$ | No. of Poles | Modules | Connection | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 32 | 1 | 1 |  | DTCS3212 | $\mathbf{4 7 . 5 0}$ |
| 32 | 2 | 1 |  | DTCS3222 | $\mathbf{7 1 . 5 0}$ |

With OFF I-O-II

| In $(\mathbf{A})$ | No. of Poles | No. of <br> Modules | Connection | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :---: |
| 32 | 1 | 1 |  | DTCS3213 | $\mathbf{5 9 . 0 0}$ |
| 32 | 2 | 1 |  | DTCS3223 | $\mathbf{8 3 . 0 0}$ |

## Din-T

Pushbuttons and pilot lights

- Modular size

DIN rail mounting

- Terminal protection IP 20
- Contacts, 16 A @ 250 V AC


| Description | No. of Poles | No. of Modules | Contacts | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Pushbutton | 2 | 1 | $\mathrm{N} / \mathrm{O}+\mathrm{N} / \mathrm{C}$ | DTPB11 | 35.50 |
| Pushbutton illuminated | 1 | 1 | N/O | DTPB10L ${ }^{1}$ ) | 54.00 |
| Pilot light base | 1 | 1 |  | DTPLB ${ }^{2}$ ) | 25.40 |
| $\begin{aligned} & \text { Lamp } 240 \mathrm{~V} \\ & \text { neon } \end{aligned}$ | - | - |  | DTPLL240 | 3.60 |
| Lamp 24 V <br> (filament) | - | - |  | DTPLL24 | 3.60 |
| Lens red | - | - |  | DTPLLRD | 3.30 |
| Lens green | - | - |  | DTPLLGR | 3.30 |
| Lens orange | - | - |  | DTPLLOR | 3.30 |
| Lens clear | - | - |  | DTPLLCL | 3.30 |

Notes: 1) Order lens separately. 240 V lamp built-in and cannot be changed.
${ }^{2}$ ) Order lens and lamp separately.

## MCB LOCKING SOLUTIONS - LockDIN ${ }^{\text {TM }}$

The miniature circuit breaker locking solution for NHP DIN-T circuit breakers.


The first comprehensive system for safe and secure locking of DIN miniature circuit breakers (MCBs)

- Designed specifically for the mining industry
- Easy to install and retrofit to existing Concept•Premier and Concept•TOUGH panelboards
- Can be used with DINsafe RCBOs
- Accepts 2.5-6.5 mm padlocks, hasps and
 scissor arrangements
- Can only be used with the NHP DIN-T range
- Can be used with 1, 2 and 3 pole DIN-T MCBs


## LOCK DIN ${ }^{\text {Tm }}$

Din-T lockdogs provide a captive locking attachment for Din-T MCBs and RCDs.

The system is designed to be used in conjunction with Concept Premier and Concept Tough Panelboards. If a switchboard is being specifically designed to accommodate the new LOCK DIN™, then extra depth is required between escutcheon and door to accommodate the padlocks being used on site.
The LOCK DIN ${ }^{\text {TM }}$ is designed to be clipped onto the line side of the MCB. This requires the line terminal screw to be tightened before installation. The escutcheon cut out needs to be increased by 16 mm over the line terminal to allow for the extended profile of the MCB with the LOCK DIN ${ }^{\text {™ }}$ fitted.


## LOCK DIN ${ }^{\text {TM }}$

| Description | Cat. No. | Price \$ |
| :---: | :---: | :---: |
| Locking devices |  |  |
| LH locking assembly for MCBs and single pole RCBOs | DTLLA | 51.00 |
| RH locking assembly for MCBs and single pole RCBOs | DTLLARH | 51.00 |
| LH locking assembly for 2 pole RCBOs | DTLLAB | 51.00 |
| RH locking assembly for 2 pole RCBOs | DTLLABRH | 51.00 |
| Locking assembly for DINT-10H MCB | DTLLA10H | 61.00 |
| 12 pack LH locking assembly for MCBs and single pole RCBOs | DTLLABULK | 570.00 |
| 12 pack RH locking assembly for MCBs and single pole RCBOs | DTLLARHBULK | 570.00 |
| Pole fillers and blanking devices |  |  |
| 12 pack locking blank for MCBs and single pole RCBOs | DTLLB | 12.00 |
| Locking blank for DSRCM (add on RCCB), 3 pole MCBs | DTLCM | 4.70 |
| Dummy MCB (for total touch protection) | DTLDM | 12.00 |
| 12 pack pole filler (extended length to suit 63 mm cutout) | DTLPF | 12.00 |
| Escutcheons and labels |  |  |
| Concept premier escutcheon size 124 way to suit LockDIN | CPPES100DTL | 210.00 |
| Concept premier escutcheon size 248 way to suit LockDIN | CPPES200DTL | 250.00 |
| Concept premier escutcheon size 360 way to suit LockDIN | CPPES300DTL | 290.00 |
| Concept premier escutcheon size 484 way to suit LockDIN | CPPES400DTL | 330.00 |
| Concept premier escutcheon size 596 way to suit LockDIN | CPPES500DTL | 375.00 |
| Concept tough escutcheon size 248 way to suit LockDIN | CTES248RDCOLD | 570.00 |
| Concept tough escutcheon size 396 way to suit LockDIN | CTES396RDCOLD | 670.00 |
| Centre escutcheon label 1-48 | LABLE148DT | 22.80 |
| Centre escutcheon label 49-96 | LABLE4996DT | 22.80 |



## Meter Isolator LOCK DIN ${ }^{\text {TM }}$

The Lockable Meter Isolator from NHP utilises the captive locking system known as LOCK DIN ${ }^{\text {TM }}$. LOCK DIN ${ }^{\text {TM }}$ has been designed for safe and secure captive locking of Terasaki DIN-T MCBs. When you combine LOCK DIN ${ }^{\text {m }}$ with a sealable enclosure and Terasaki MCB you have a complete system suitable for meter isolation and supply capacity/ service protection. ')

DTPC Complete kits include: enclosure, MCB and LOCK DIN ${ }^{\text {Tm }}$
No. of

| poles | Amps | kA | Curve | Cat. No. | Price \$ |
| :--- | :---: | :---: | :--- | :--- | :--- |
| Enclosure type-DTPC (2 pole) |  |  |  |  |  |
| 1 pole | kA | A | C | DTPC2LDCB | $\mathbf{1 0 9 . 0 0}$ |

Enclosure type - DTPC (4 pole)

| 3 pole | 63 kA | 6 kA | C | DTPC4LDCB | $\mathbf{2 5 0 . 0 0}$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | D | DTPC4LDCBV | $\mathbf{5 4 0 . 0 0}$ |  |

ILC Complete kits include: enclosure, MCB and LOCK DIN ${ }^{\text {TM }}$

| No. of <br> poles Amps $\quad$ kA | Curve No. |
| :--- | :--- | :--- | :--- | :--- |


| Enclosure type - ILC (4 pole) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 pole | 63 kA | 6 A | C | ILC4SLDCB1P | 156.00 |
|  |  |  | D | ILC4SLDCB1PD | 161.00 |
|  | 80-125 A | 10 kA | C | ILC4SLDCB_1P ${ }^{\text {2 }}$ ) | 365.00 |
|  |  |  | D | ILC4SLDCB_1PD ${ }^{\text {2 }}$ ) | 440.00 |
| 3 pole | 63 A | 6 kA | C | ILC4SLDCB3P | 290.00 |
|  |  | 10 kA | D | ILC4SLDCB3PD | 300.00 |
|  | 80-125 A | 10 kA | C | ILC4SLDCB_3P ${ }^{\text {2 }}$ ) | 950.00 |
|  |  |  | D | ILC4SLDCB_3PD ${ }^{2}$ ) | 1020.00 |



Notes: ${ }^{1}$ ) As the service and installations rules vary from region to region please consult these to check suitability.
${ }^{2}$ ) Insert 80, 100 or 125 for required amp rating.

## Meter Isolator <br> LOCK DINTM

Enclosures only, to suit meter isolator

| To suit | Enclosure type | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- |
| 1 P MCB $<63 \mathrm{~A}$ | DTPC (2 pole) | DTPC2LD | $\mathbf{1 9 . 2 0}$ |
| $1-3$ P MCB $<63 \mathrm{~A}$ | DTPC (4 pole) | DTPC4LD | $\mathbf{2 3 . 4 0}$ |
| $1-3$ P MCB $<63 \mathrm{~A}$ | ILC (4 pole) | ILC4SLD | $\mathbf{7 1 . 5 0}$ |
| $1-3 P$ MCB 80-125 A | ILC (4 pole) | ILC4SLD10H | $\mathbf{7 7 . 0 0}$ |
| 2 P RCBO 6-40 A | DTPC ( 2 pole) | DTPC2LDRCBO | $\mathbf{1 9 . 8 0}$ |

DTPC enclosure


Dimensions (mm)

| No. of poles | Height | Width | Depth |
| :--- | :--- | :--- | :--- |
| 2 pole | 139 | 51 | 61 |
| 4 pole | 139 | 88 | 61 |

ILC enclosure


Dimensions (mm)

| No. of poles | Height | Width | Depth |
| :--- | :--- | :--- | :--- |
| 4 pole | 175 | 90 | 100 |


| Description | Cat. No. | Price \$ |
| :---: | :---: | :---: |
| Lateral pin terminal $35 \mathrm{~mm}^{2}$ (short type) | DTTLT35PN | 10.80 |
| Lateral pin terminal $35 \mathrm{~mm}^{2}$ (long type) | DTTLT35LPN | 10.80 |
| Din-T lock dog (Non-captive) | DTLD | 23.00 |
| Din-T lock dog captive (LOCK DIN) Refer page $1-46$ | - |  |
| Din-T lock dog captive (1-4 pole) ${ }^{1}$ ) | DCLD6 | 57.00 |
| Din-T lock dog to suit DINT10H | DTLDH | 30.50 |
| Lateral spade terminal $35 \mathrm{~mm}^{2}$ (short type) | DTTLT35SP | 10.80 |
| Axial spade terminal $25 \mathrm{~mm}^{2}$ (insulated) | DTTAX25SP | 10.80 |
| Axial pin terminal $25 \mathrm{~mm}^{2}$ (insulated) | DTTAX25PN | 10.80 |
| Axial pin terminal $50 \mathrm{~mm}^{2}$ (insulated) | DTTAX50PN | 18.20 |
| 3 way neutral link suit RCCB | DTTAX16PN3 | 19.40 |
| $35 \mathrm{~mm}^{2}$ main terminal | DTCF35 | 17.60 |
| $185 \mathrm{~mm}^{2}$ main terminal | NEB185 | 88.00 |
| Pole filler (1 strip of 4 poles, $8 \times 9 \mathrm{~mm}$ segments) | DTPF | 4.30 |
| Busbar comb Refer page 1-43 | - |  |
| End cap (strip offs) (T-off cap) | ICLTOC | 4.60 |
| 1/2 module spacer (9 mm wide) | DTSP | 4.40 |
| Din-T terminal cover 5 mm | DTTC5 | 4.70 |
| Din-T terminal cover 35 mm | DTTC35 | 16.60 |
| Din-T 10H terminal cover | DINT10HTC | 5.40 |
| Din-T 1P RCBO terminal cover | DSRCBHTC | 7.50 |



Notes: ${ }^{1}$ ) Suitable for padlock hasp size 4.5 to 6.5 mm .

## SP4 4 Uames St Lowood SPS - Electrical Installatione@sb Mannual

## Din-T series MCBs <br> Accessories



## Din-T

## Series contactors




## Application

Din-T contactors are electromagnetically controlled switches used to control single or multiphase high power loads while the control itself can be low power. Applications include switching and control of lighting equipment, heating, ventilation, pumps, heat pumps and other equipment.

## Features

Except for the 20 A version, all Din-T contactors have DC coils, resulting in noise-free silent operation. As all DC coil contactors have an internal diode rectifier bridge they can be operated by both DC and AC power supplies. The built-in varistor protects the coil against an overvoltage of up to 5 kV . The switch position of contacts is visible via a flag indicator on the front of the contactor.

| Current <br> Ith | Contact <br> config. | Coil volts | No. of <br> Mods. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 20 A | $1 \mathrm{NO} / 1 \mathrm{NC}$ | 240 V AC | 1 | DTC2011240 | $\mathbf{1 5 1 . 0 0}$ |
| 20 A | $2 \mathrm{~N} / \mathrm{O}$ | 24 V AC | 1 | DTC202024 | $\mathbf{1 5 1 . 0 0}$ |
| 20 A | $2 \mathrm{~N} / \mathrm{O}$ | 240 V AC | 1 | DTC2020240 | $\mathbf{1 5 1 . 0 0}$ |
| 20 A | $2 \mathrm{~N} / \mathrm{C}$ | 240 V AC | 1 | DTC2002240 | $\mathbf{1 5 1 . 0 0}$ |
| 24 A | $4 \mathrm{~N} / \mathrm{O}$ | $12 \mathrm{~V} \mathrm{AC/DC}$ | 2 | DTC244012 | $\mathbf{1 7 5 . 0 0}$ |
| 24 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 2 | DTC2440240 | $\mathbf{1 7 5 . 0 0}$ |
| 24 A | $4 \mathrm{~N} / \mathrm{C}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 2 | DTC2404240 | $\mathbf{1 7 5 . 0 0}$ |
| 24 A | $4 \mathrm{~N} / \mathrm{O}$ | $24 \mathrm{~V} \mathrm{AC/DC}$ | 2 | DTC244024 | $\mathbf{1 7 5 . 0 0}$ |
| 40 A | $4 \mathrm{~N} / \mathrm{O}$ | $24 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC404024 | $\mathbf{3 1 0 . 0 0}$ |
| 40 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC4040240 | $\mathbf{3 1 0 . 0 0}$ |
| 63 A | $4 \mathrm{~N} / \mathrm{O}$ | $24 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC634024 | $\mathbf{4 3 0 . 0 0}$ |
| 63 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC6340240 | $\mathbf{4 3 0 . 0 0}$ |

Din-T hour run counter

- DIN rail mounting
- Synchronous motor drive
- 99,999.99 hours
- Permanent visual display non-resettable
- Protection IP 20


| No. Modules | Voltage | Cat. No. ${ }^{1}$ ) |
| :--- | :--- | :--- |
| 2 | 230 V AC | DTHR |

Notes: ${ }^{1)}$ Cannot be reset.

## Din-T

Series contactors

Technical data

| Type | DTC20 | DTC24 | DTC40 | DTC63 |
| :---: | :---: | :---: | :---: | :---: |
| Rated continuous current $I_{\text {th }}$ | 20 A | 24 A | 40 A | 63 A |
| AC 1/AC 7a switching of heaters |  |  |  |  |
| Rated operational current $\mathrm{le}^{1}$ ) | 20 A | 24 A | 40 A | 63 A |
| $\begin{array}{r} \text { Rated output AC } 1240 \mathrm{~V} 1 \varnothing \\ 415 \mathrm{~V} 3 \varnothing \\ \hline \end{array}$ | 4 kW | 5.3 kW | 8.7 kW | 13.3 kW |
|  | - | 16.0 kW | 26.0 kW | - |
| AC 3/AC 7b switching of motors |  |  |  |  |
| Rated operational current le ${ }^{1}$ ) | 9 A | 9 A | 22 A | 30 A |
| Rated output AC $3240 \mathrm{~V} 1 \varnothing$ | 1.3 kW | 1.3 kW | 3.7 kW | 5.0 kW |
| 415 V $3 \varnothing$ | - | 4.0 kW | 11.0 kW | 15.0 kW |

AC 5a switching of electric discharge lamp controls ${ }_{2}$ ) (uncompensated)

| Rated operational current $\mathrm{I}_{\mathrm{e}}{ }^{1}$ ) | 8 A | 10 A | 30 A | 44 A |
| :---: | :---: | :---: | :---: | :---: |
| AC 5b switching of incandescent lamps ${ }^{2}$ ) |  |  |  |  |
| Rated operational current $\mathrm{I}_{\mathrm{e}}{ }^{1}$ ) | 6 A | 7 A | 15 A | 22 A |
| Switching on capacity |  |  |  |  |
| cos_ $=0.95$ at 220-230 V 1 phase | 100 A | - | - | - |
| cos_= 0.65 at 380-400 V 3 phase | - | 90 A | 220 A | 300 A |

## Switching off capacity

| cos_ $=0.95$ at $220-230 \mathrm{~V}$ 1phase | 80 A | - | - | - |
| :--- | :--- | :--- | :--- | :--- |
| cos_ $=0.65$ at $380-400 \mathrm{~V}$ 3phase | - | 72 A | 176 A | 240 A |
| Ohmic loss per contact In | 1.0 W | 1.5 W | 3.0 W | 6.0 W |

## Endurance and mechanical switching

| Max. switching frequency at AC <br> 1/AC 7a | 300 h | 300 h | 300 h | 300 h |
| :--- | :--- | :--- | :--- | :--- |
| Max. switching frequency at AC <br> $3 / \mathrm{AC} 7 \mathrm{~b}$ | 600 h | 600 h | 600 h | 600 h |
| Mechanical service life | 106 | 106 | 106 | 106 |
| Electrical service life at AC 1/AC 7a | 150,000 | 150,000 | 150,000 | 150,000 |
| Electrical service life at AC 3/AC 7b | 150,000 | 500,000 | 170,000 | 240,000 |
| Terminal capacity max. | $1 \times 10 \mathrm{~mm}^{2}$ | $2 \times 4 \mathrm{~mm}^{2}$ | $1 \times 25 \mathrm{~mm}^{2}$ | $2 \times 10 \mathrm{~mm}^{2}$ |

## Magnetic control system

Control voltage range

$$
85 \ldots 110 \% \times \text { Un }
$$

| Rated operating frequency | $50 / 60 \mathrm{~Hz}$ | $\mathrm{DC}, 40 \ldots 450 \mathrm{~Hz}$ |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Operating temperature range |  | $-22^{\circ} \mathrm{C}$ to $\left.+55^{\circ} \mathrm{C} 3\right)$ |  |  |
| Max. pull-in coil power loss | $8 \mathrm{VA} / 5 \mathrm{~W}$ | $4 \mathrm{VA} / 4 \mathrm{~W}$ | $5 \mathrm{VA} / 5 \mathrm{~W}$ | $65 \mathrm{VA} / 65 \mathrm{~W}$ |
| Max. holding coil power loss | $3.2 \mathrm{VA} / 1.2 \mathrm{~W}$ | $4 \mathrm{VA} / 4 \mathrm{~W}$ | $5 \mathrm{VA} / 5 \mathrm{~W}$ | $4.2 \mathrm{VA} / 4.2 \mathrm{~W}$ |
| Switching on delay | $9 \ldots . .12 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ |
| Switching off delay | $10 \ldots . .12 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ | $<40 \mathrm{~ms}$ |
| Terminal capacity max. | $1 \times 4 \mathrm{~mm}^{2}$ or $2 \times 2.5 \mathrm{~mm}^{2}$ |  |  |  |

Notes: ${ }^{1}$ ) When parallel switching 2 current paths the rated current le will be multiplied by 1.6 .
${ }^{2}$ ) For additional lamp switching data refer to NHP.
${ }^{3}$ ) If several contactors are mounted side by side in a row fit a half-module spacer (Cat. No. DTSP) between every second contactor.

64tre James St Lowood SPS - Electrical Installationes, Magnual
Din
Series contactors

Standard AS/NZS 60947.4.1
Voltage $240 / 415 \mathrm{~V} \mathrm{AC}$
Switch position indicator
DIN rail mount

## Application



Din contactors are electromagnetically controlled switches used to control single or multiphase high power loads while the control itself can be low power. Applications include switching and control of lighting equipment, heating, ventilation, pumps, heat pumps and other equipment.

| Current <br> Ith | Contact <br> config. | Coil volts | No. of <br> Mods. | Cat. No. | Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 20 A | $2 \mathrm{~N} / \mathrm{O}$ | 24 V AC | 1 | DTC202024L | $\mathbf{7 8 . 0 0}$ |
| 20 A | $2 \mathrm{~N} / \mathrm{O}$ | 240 V AC | 1 | DTC2020240L | $\mathbf{7 8 . 0 0}$ |
| 25 A | $4 \mathrm{~N} / \mathrm{O}$ | $12 \mathrm{~V} \mathrm{AC/DC}$ | 2 | DTC254012L | $\mathbf{9 8 . 5 0}$ |
| 25 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{VAC} / \mathrm{DC}$ | 2 | DTC2540240L | $\mathbf{9 8 . 5 0}$ |
| 25 A | $4 \mathrm{~N} / \mathrm{C}$ | $240 \mathrm{~V} \mathrm{AC} / \mathrm{DC}$ | 2 | DTC2504240L | $\mathbf{9 8 . 5 0}$ |
| 40 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC4040240L | $\mathbf{2 3 5 . 0 0}$ |
| 63 A | $4 \mathrm{~N} / \mathrm{O}$ | $240 \mathrm{~V} \mathrm{AC/DC}$ | 3 | DTC6340240L | $\mathbf{2 6 0 . 0 0}$ |

Technical data

| Type | DTC20...L | DTC25...L | DTC40...L | DTC63...L |  |
| :--- | :--- | :--- | :--- | :--- | :---: |
| Rated continuous current $\mathrm{I}_{\mathrm{th}}$ | 20 A | 25 A | 40 A | 63 A |  |
| AC 1/AC 7a switching of heaters |  |  |  |  |  |
| Rated operational current $\mathrm{I}_{\mathrm{e}}$ | 20 A | 25 A | 40 A | 63 A |  |
| Rated output kW | 4 | 5.4 | 8.4 | 13 |  |
| AC 7b | 7 A | 8.5 A | 15 A | 25 A |  |
| Rated operational current $\mathrm{I}_{\mathrm{e}}$ | 1.2 | 1.5 | 2.4 | 3.8 |  |
| Rated output kW |  |  |  |  |  |


| Switching on capacity (A) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| AC 1/7a $\cos \varnothing 0.8$ Ue 1.05 | 30 | 37.5 | 60 | 94.5 |
| AC 7b $\cos \varnothing 0.45$ Ue 1.05 | 160 | 200 | 320 | 504 |
| Performance |  |  |  |  |
| AC 1/7a $\cos \varnothing 0.8$ Ue 1.05 | 20 | 25 | 40 | 63 |
| AC 7b $\cos \varnothing 0.45$ Ue 0.17 | 4 | 5.4 | 8.4 | 13 |
| General |  |  |  |  |
| Terminal capacity $\mathrm{mm}^{2}$ | 6 | 10 | 25 | 25 |

Control voltage range 85-110\% x Un
Frequency 50 Hz
Rated insulation voltage 500 V
Pick up time 50 mS
Mechanical life $>3 \times 10^{4}$
Electrical life $>1 \times 10^{5}$

# Din-T <br> Impulse switch 

## Din-T impulse switch

- Standard IEC 60669-2-2
- Visual indication of contact position
- Manual or electrical operation
- Terminal protection IP 20
- 16 A 240 V AC contact rating


## Function



Impulse switches are electromechanical switches used to control medium power loads while the control itself remains low power. The device switches between 2 stable positions each time a brief pulse is required to switch positions. The device can also be switched manually.

| Diagram | Coil Voltage | No. of poles | No. of mods. | In | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\frac{9}{b}-\sum_{i}^{0}-$ | 12 VAC | 1 | 1 | 16 A | DTIS1012VAC | 66.00 |
|  | 24 V AC | 1 | 1 | 16 A | DTIS1024VAC | 66.00 |
|  | 48 V AC | 1 | 1 | 16 A | DTIS1048VAC | 66.00 |
|  | 240 V AC | 1 | 1 | 16 A | DTIS10240VAC | 66.00 |
|  | 12 VDC | 1 | 1 | 16 A | DTIS1012VDC | 66.00 |
|  | 24 VDC | 1 | 1 | 16 A | DTIS1024VDC | 66.00 |
| $\frac{90}{6}-\int_{i}^{b}-a$ | 12 VAC | 2 | 1 | 16 A | DTIS2012VAC | 96.00 |
|  | 24 VAC | 2 | 1 | 16 A | DTIS2024VAC | 96.00 |
|  | 48 V AC | 2 | 1 | 16 A | DTIS2048VAC | 96.00 |
|  | 240 V AC | 2 | 1 | 16 A | DTIS20240VAC | 96.00 |
|  | 12 VDC | 2 | 1 | 16 A | DTIS2012VDC | 96.00 |
|  | 24 VDC | 2 | 1 | 16 A | DTIS2024VDC | 96.00 |
|  | 12 VDC | 2 | 1 | 32 A | DTIS123212VDC | 187.00 |
| $\frac{9}{b}-b_{0}^{b}$ | 12 VAC | 2 | 1 | 16 A | DTIS1112VAC | 96.00 |
|  | 24 VAC | 2 | 1 | 16 A | DTIS1124VAC | 96.00 |
|  | 48 VAC | 2 | 1 | 16 A | DTIS1148VAC | 96.00 |
|  | 240 V AC | 2 | 1 | 16 A | DTIS11240VAC | 96.00 |
|  | 12 VDC | 2 | 1 | 16 A | DTIS1112VDC | 96.00 |
|  | 24 VDC | 2 | 1 | 16 A | DTIS1124VDC | 96.00 |
|  | 12 VDC | 2 | 1 | 32 A | DTIS113212VDC | 187.00 |

## Add on power contact ${ }^{2}$ )

| Diagram | Coil <br> Voltage | No. of poles | No. of mods. | In | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\hat{i}_{1}^{b}$ |  | 2 | 1 | 16 A | DTIS2NO | 83.00 |
| $\{d \&$ |  | 2 | 1 | 16 A | DTIS2CO | 83.00 |
|  |  | 2 | 1 | 32 A | DTIS132PWR | 187.00 |

Notes: ${ }^{1}$ ) When stacking in rows ensure adequate ventilation, insert spacer (DTSP) every second device.
${ }^{2}$ ) Only suitable for 32 A DTIS.
32 A unit available - refer NHP.

## 

## Sprecher + Schuh CA 8 contactors

## Features

- Ideally suited for heating, lighting, hot water and storage heating applications
- Small size (2.5 pole width), panel or DIN rail mounting
- Contactors can be mechanically interlocked
- Large range of snap-on accessories ${ }^{1}$ )
- Conforms to AS/NZS 60947 with world-wide approvals


Maximum current ratings (amps) at 415 volts

| Cat. No. ${ }^{1}$ ) | CA 8-5-10_AC ${ }^{2}$ ) |  |  | (A 8-9-10_AC ${ }^{2}$ ) [CA 8-12-10_AC ${ }^{2}$ )] |  |  | $\begin{aligned} & \text { 4-POLE } \\ & \text { CA 8-9-M40_AC } \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Price ${ }^{3}$ ) | 99.50 |  |  | 113.00 [137.00] |  |  | 143.00 |  |
| Heating loads AC 1 |  |  |  |  | $\begin{aligned} & \frac{0}{0} \frac{\bar{\omega}}{\bar{N}} \\ & \sim \stackrel{N}{0} \end{aligned}$ |  |  | ¢ O $\square$ $\square$ |
| Amps per phase $40^{\circ} \mathrm{C}$ (A) | 20 | 34 | 50 | 20 | 34 | 50 | 20 | 64 |
| Amps per phase $60^{\circ} \mathrm{C}$ (A) | 16 | 27 | 40 | 16 | 27 | 40 | 16 | 51 |

Lighting loads

| Tungsten per phase (A) | 4 | - | - | 7 | - | - | 7 | - |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Fluorescent $40^{\circ} \mathrm{C}$ (A) | 18 | 30 | 45 | 18 | 30 | 45 | 18 | 57 |
| Fluorescent $60^{\circ} \mathrm{C}$ (A) | 14.5 | 24 | 35 | 14.5 | 24 | 35 | 14.5 | 45 |

Motor loads

| Amps 415 volt AC 3 | 5.3 | $9.0[12]$ | 9.0 |
| :--- | :--- | :--- | :--- |
| $\mathrm{~kW} @ 60^{\circ} \mathrm{C}$ | 2.6 | $4.5[6.1]$ | 4.5 |

Emergency lighting test unit

|  | Cat. No. | Price \$ |  |
| :--- | :--- | :--- | :---: |
| Standard switch operated <br> emergency lighting test unit | reset - test | ELTS ${ }^{4}$ ) | $\mathbf{2 3 5 . 0 0}$ |
| Key operated emergency <br> lighting test unit | reset - test | ELTK ${ }^{4}$ ) | $\mathbf{2 5 0 . 0 0}$ |



Notes: ${ }^{1)}$ For further information refer to Part A Section 1 Price List Catalogue.
${ }^{2}$ ) Supplied with $1 \mathrm{~N} / \mathrm{O}$ auxiliary contact. For $1 \mathrm{~N} / \mathrm{C}$ auxiliary contact specify 01 instead of 10 when ordering.
${ }^{3}$ ) Price is for standard AC coil voltage. Specify voltage when ordering
${ }^{4}$ ) Cat. No. ELTS and ELTK use Price Schedule 'A4'

## SP464PJames St Lowood SPS - Electrical Installatione@AB Magnual

## DIN rail mounted surge diverters Electrical network

## Features:

- Compact sizeStatus indication (via flag)
DIN rail mounting
- Thermal disconnectionRemote indication (via volt free contact)



## PSC Series

The PSC pluggable range consists of Class $1+2$ (according to IEC 61643-11) surge protective devices (lightning arrestor) $(10 / 350 \mu \mathrm{~s})$ and surge protector ( $8 / 20 \mu \mathrm{~s}$ ) with low Up (protection of downstream equipments) for singlephase and three-phase electrical power networks.
These units are ideal for protection of service entrances and distribution panels in areas exposed to lightning activity or externally generated heavy transients.

| No. of phases $l_{\text {imp }}$ |  | $\mathrm{I}_{\text {max }}$ | Connection $\mathrm{IN}_{\mathrm{N}}$ |  | $\mathrm{U}_{\text {c }}$ | $\mathrm{U}_{\mathrm{p}}$ | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1P | 12.5 kA | 65 kA | L-N | 20 kA | 275 V | $\leq 1.3 \mathrm{kV}$ | CPTPSC1-12/2301R |
| 1P | 25 kA | 65 kA | N-PE | 25 kA | 255 V | $\leq 1.5 \mathrm{kV}$ | CPTPSC1-25N |
| 1P | 25 kA | 100 kA | L-N | 25 kA | 275 V | $\leq 1.3 \mathrm{kV}$ | CPTPSC1-25/2301R |
| 1P | 50 kA | 65 kA | N-PE | 50 kA | 255 V | $\leq 1.5 \mathrm{kV}$ | CPTPSC1-50N |
| 1P | 100 kA | 100 kA | N-PE | 50 kA | 255 V | $\leq 1.5 \mathrm{kV}$ | CPTPSC1-100N |
| $1 \mathrm{P}+\mathrm{N}$ | 12.5 kA | 65 kA | L+N-PE | 20 kA | 275 V | $\leq 1.3 \mathrm{kV}$ | CPTPSC2-12/23018 $\left.\left.{ }^{\prime}\right)^{2}\right)^{3}$ ) |
| $1 \mathrm{P}+\mathrm{N}$ | 25 kA | 100 kA | L+N-PE | 25 kA | 275 V | $\leq 1.3 \mathrm{kV}$ | (PPTPSC2-25/23018 $\left.\left.{ }^{12}\right)^{2}\right)^{4}$ ) |
| $3 \mathrm{P}+\mathrm{N}$ | 12.5 kA | 65 kA | L+L+L+N-PE | 20 kA | 440 V | $\leq 1.3 \mathrm{kV}$ | CPTPS (4-12/4001 $\left.\left.\left.{ }^{1}\right)^{2}\right)^{3}\right)^{3}$ |
| $3 \mathrm{P}+\mathrm{N}$ | 25 kA | 100 kA | L+L+L+N-PE | 25 kA | 440 V | $\leq 1.3 \mathrm{kV}$ | CPTPS (4-25/4001 $\left.\left.\left.{ }^{1}\right)^{2}\right)^{3}\right)$ |


| Accessories | For use with | Cat. No. |
| :--- | :--- | :--- |
| Replacement module - | CPTPSC1-12/230IR, CPTPSC2- | CPTPSC-12-230MOD |
| limp 12.5 kA | 12/230IR \& CPTPSC4-12/400IR |  |
| Replacement module - | CPTPSC1-25/230IR, CPTPSC2- | CPTPSC-25-230MOD |
| limp 25 kA | $25 / 230$ IR \& CPTPSC4-25/400IR |  |

Notes: ${ }^{1}$ ) $\mathrm{U}_{\mathrm{p}}$ listed above is between L-N. The $\mathrm{U}_{\mathrm{p}}$ between $\mathrm{N}-\mathrm{PE}$ is $\leq 1.5 \mathrm{kV}$. ${ }^{2}$ ) $U_{c}$ listed above is between L-N. The $U_{c}$ between N-PE is 255 V .
${ }^{3}$ ) $\mathrm{I}_{\text {imp }}$ listed above is between L-N. The $\mathrm{I}_{\text {imp }}$ between N-PE is 25 kA
${ }^{4}$ ) $\mathrm{I}_{\text {imp }}$ listed above is between L-N. The $\mathrm{I}_{\text {imp }}$ between N-PE is 50 kA .
${ }^{5}$ ) $I_{\text {imp }}$ listed above is between L-N. The $I_{\text {imp }}$ between N-PE is 100 kA .

## SP464 PJames St Lowood SPS - Electrical Installatione@Ab Mannual

DIN rail mounted surge diverters Electrical network

Dimensions (mm)


CPTPSC412230IR CPTPSC225230IR


CPTPSC425400IR

Notes: CPTPSC425400IR dimensions are $\mathrm{H} \times \mathrm{W} \times \mathrm{D}(\mathrm{mm}): 90 \times 155 \times 76$.

## DIN rail mounted surge diverters Electrical network

## PSM Series

The PSM pluggable range consists of Class 2 (according to IEC) surge protective devices designed for protection against transient overvoltages in singlephase and three-phase electrical power networks.
These units are ideal for protection of distribution and branch panels, electronic equipment etc.

| No. of phases |  | Connec | $\mathrm{I}_{\mathrm{N}}$ | $\mathrm{U}_{\mathrm{c}}$ | $\mathbf{U}_{\mathrm{p}}$ | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 P | 20 kA | L-N | 10 kA | 275 V | $<1.4 \mathrm{kV}$ | CPTPSM1-20/230 IR |
| 1 P | 20 kA | N-PE | 10 kA | 255 V | $<1.5 \mathrm{kV}$ | CPTPSM1-20N |
| 1 P | 40 kA | L-N | 20 kA | 275 V | $<1.3 \mathrm{kV}$ | CPTPSM1-40/230 IR |
| 1 P | 40 kA | N-PE | 20 kA | 275 V | $<1.5 \mathrm{kV}$ | CPTPSM1-40N |
| $1 \mathrm{P}+\mathrm{N}$ | 20 kA | L+N-PE | 10 kA | 275 V | $<1.4 \mathrm{kV}$ | (CPTPSM2-20/230 IR $\left.^{1}\right)^{2}$ ) |
| $1 \mathrm{P}+\mathrm{N}$ | 40 kA | $\mathrm{L}+\mathrm{N}-\mathrm{PE}$ | 20 kA | 275 V | $<1.3 \mathrm{kV}$ | CPTPSM2-40/230 IR $\left.{ }^{1}\right)^{3}$ ) |
| $3 \mathrm{P}+\mathrm{N}$ | 20 kA | $\begin{aligned} & \text { L+L+L+ } \\ & \text { N-PE } \end{aligned}$ | 10 kA | 440 V | $<1.4 \mathrm{kV}$ | (PPTPSM4-20/400 IR $\left.^{1}\right)^{2}$ ) |
| $3 \mathrm{P}+\mathrm{N}$ | 40 kA | $\begin{aligned} & \hline \mathrm{L}+\mathrm{L}+\mathrm{L}+ \\ & \mathrm{N}-\mathrm{PE} \\ & \hline \end{aligned}$ | 20 kA | 440 V | $<1.3 \mathrm{kV}$ | CPTPSM4-40/400 (R $\left.{ }^{1}\right)^{3}$ ) |

## Accessories

Replacement module -
Imax 20 kA
Replacement module -
Imax 40 kA

For use with
CPTPSM1-20/230IR, CPTPSM220/230IR \& CPTPSM4-20/400IR
CPTPSM1-40/230IR, CPTPSM2-
40/230IR \& CPTPSM4-40/400IR

Cat. No.
CPTPSM-20-230MOD

CPTPSM-40-230MOD

Notes: ${ }^{1}$ ) $U_{p}$ listed above is between L-N. The $U_{p}$ between N-PE is $\leq 1.5 \mathrm{kV}$.
${ }^{2}$ ) $U_{c}$ listed above is between L-N. The $U_{c}$ between N-PE is 255 V .
${ }^{3}$ ) $U_{c}$ listed above is between $L-N$. The $U_{c}$ between N-PE is 265 V .

SP464PJames St Lowood SPS - Electrical Installationteßsh Mannual
DIN rail mounted surge diverters Electrical network

Dimensions (mm)


1P+N PSM models

$3 P+N$ PSM models

Safe-T (6-63 A) MCBs


Safe-T (80-100 A) MCBs


Safe-T (6-63 A)


Safe-T (80-100 A)


Safe-T (SRCB) RCBO


Safe-T (ELR) earth leakage relay


SIDE VEW


Din-T 6, 10, 15 / Din-T DC - MCBs


Din-T 10H - MCBs


Din-Safe-2 P RCBO


DSRCBS

$1 \mathrm{P}+\mathrm{N}(32 \& 63 \mathrm{~A}) 3 \mathrm{P}+\mathrm{N}(32 \mathrm{~A}) \quad 3 \mathrm{P}+\mathrm{N}(63 \mathrm{~A}) \quad 3 \mathrm{P}(63 \mathrm{~A})$


## Din-T shunt trip

## To suit:

Din-T 6, 10, 15, Din-T DC

To suit:
Din-T 10H


## Din-T undervoltage trip

To suit:
Din-T 6, 10, 15, Din-T DC (not Din-T10H)


## Auxiliary contacts for MCBs

Din-T 6, 10, 15, Din-T DC


Din-T-motor operator

Din-T 10H


Din-T - panelboard switch


Din-T - changeover switch


## Din-T - pushbutton



## Din-T-impulse switch

Din-T-contactor


Din-T - Pilot light


## 

## Time switches

## Talento range

Digital \& Analogue
$24 \mathrm{hr}, 7$ day and yearly programming

- 17.5 mm wide and standard DIN housing
- 1, 2 and 4 channel flexibility
- Economical synchronous operation and quartz precision with reserve
- Manual overide
- Pulse switching capability (TAL 471,472 PLUS)


Specifications
Supply voltage:

$$
220-240 \mathrm{~V} 50 \mathrm{~Hz}
$$

Contact rating: 16 A / 240 V AC 1
(resistive load)

* Other voltages available, contact NHP.

TAL371 PRO
Analogue $\mathbf{2 4}$ hr \& 7 day - 16 A rating (resistive load)

| Pro- <br> gramme | Reserve | Min. <br> switch <br> time | Contact | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 24 hr | - | 30 min | $1 \mathrm{~N} / \mathrm{O}$ | TAL111MINI | $\mathbf{1 0 2 . 0 0}$ |
| 24 hr | - | 30 min | $1 \mathrm{C} / \mathrm{O}$ | TAL111 | $\mathbf{1 0 5 . 0 0}$ |
| 24 hr | 50 hr | 30 min | $1 \mathrm{~N} / \mathrm{O}$ | TAL211MINI | $\mathbf{1 5 1 . 0 0}$ |
| 24 hr | 150 hr | 30 min | $1 \mathrm{C} / \mathrm{O}$ | TAL211 | $\mathbf{2 0 0 . 0 0}$ |
| 7 day | - | 3 hr | $1 \mathrm{C} / \mathrm{O}$ | TAL171 | $\mathbf{1 4 8 . 0 0}$ |
| 7 day | 150 hr | 3 hr | $1 \mathrm{C} / \mathrm{O}$ | TAL271 | $\mathbf{2 1 5 . 0 0}$ |

Digital 24 hr, 7 day \& yearly - 16 A rating (resistive load)

| Programme Reserve | Min. switch time | No. of memory locations | Contact | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 24hr/7 days 3 yrs | 1 min | 50 | $1 \mathrm{C} / \mathrm{O}$ | TAL371MP240VAC | 145.00 |
| $24 \mathrm{hr} / 7$ days 3 yrs | 1 min | 70 | $1 \mathrm{C} / \mathrm{O}$ | TAL371PRO | 210.00 |
| $24 \mathrm{hr} / 7$ days 3 yrs | 1 min | 70 | $2 \mathrm{C} / \mathrm{O}$ | TAL372PRO | 330.00 |
| $24 \mathrm{hr} / 7$ days 3 yrs | 1 min | 100 | $1 \mathrm{C} / \mathrm{O}$ | TAL471PRO | 270.00 |
| $24 \mathrm{hr} / 7$ days 3 yrs | 1 min | 100 | $2 \mathrm{C} / \mathrm{O}$ | TAL472PRO | 390.00 |
| Astro 3 yrs | Daylight Switch |  | $1 \mathrm{C} / \mathrm{O}$ | TAL791PRO | 430.00 |
| Yearly 3 yrs | 1 sec | 800 | $2 \mathrm{C} / \mathrm{O}$ | TAL892PLUSTOP | 760.00 |
|  |  |  |  | TAL892PLUSTOP | 760.00 |
| Yearly 3 yrs | 1 sec | 800 | $4 \mathrm{C} / \mathrm{O}$ | AND |  |
|  |  |  |  | TALCEPLUSTOP | 365.00 |



## Pole covers

Safe-T and Din-T
Safe-T pole coversStandard AS/NZS 3132

- Degree of protection IP 30
- Surface mounting
- Colour - Black
- Supplied complete with clip tray

| Pole capacity | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 1 | SAFE-TPC1 | $\mathbf{1 8 . 2 0}$ |
| 3 | SAFE-TPC23 | $\mathbf{3 2 . 5 0}$ |

Dimensions (mm)

| Pole capacity | H | W | D |
| :--- | :--- | :--- | :--- |
| 1 | 160 | 30 | 64 |
| 3 | 160 | 80 | 64 |
|  |  | Price schedule 'T1' |  |

Din-T pole covers for Din-T series MCBs

- Standard AS/NZS 3132
- Suits Din-T6, 10, 10H, 15 MCBs and associated DIN equipment
- Made from high impact resistant material
- Degree of protection IP 30
- Surface mounting
- Colour-Grey
- 2 and 4 way lead sealable


| Capacity | Cat. ${ }^{\text {No. }}{ }^{\text {1 }}$ ) | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| 1 Pole | CSPC1 | $\mathbf{7 . 3 0}$ |
| 2 Pole | DTPC2 | $\mathbf{1 3 . 0 0}$ |
| 4Pole | DTPC4 | $\mathbf{1 6 . 8 0}$ |
| 6 Pole | DTPC6 | $\mathbf{3 1 . 5 0}$ |
| 8 Pole | DTPC8 | $\mathbf{4 1 . 0 0}$ |
| 1 Pole (Suits 1P MCB with LockDIN) | DTPC2LD | $\mathbf{1 9 . 2 0}$ |
| 3 Pole (Suits 3P MCB with LockDIN) | DTPC4LD | $\mathbf{2 3 . 4 0}$ |

Dimensions (mm)

| Pole capacity | $\mathbf{H}$ | W | D |
| :--- | :--- | :--- | :--- |
| 1 | 130 | 32 | 62 |
| 2 | 139 | 51 | 61 |
| 4 | 139 | 88 | 61 |
| 6 | 165 | 140 | 72 |
| 8 | 198 | 200 | 72 |



Notes: ${ }^{1}$ ) Will not accept DSRCBH single pole RCDs.

## Insulated loadcentres

## ILC series

- Standard AS/NZS 3132
- Suits Din-T6, 10, 10H, 15 MCBs and associated DIN equipment
- Made from high impact resistance material
- Comprehensive cable entry facilities at top, bottom, sides and rear
- Modern consumer unit designed with an attractive styling for new buildings, replacing
 old units, or adding extensions


## Ordering details

| Pole capacity | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| 4 | ILC 4S | $\mathbf{6 5 . 5 0}$ |
| 8 | ILC 8S | $\mathbf{7 9 . 0 0}$ |
| $1-3$ (Suits $\leq 63$ A Din-T MCB with Lockdin) | ILC4SLD | $\mathbf{7 1 . 5 0}$ |
| $1-3$ (Suits 80-125 A Din-T MCB with Lockdin) | ILC4SLD10H | $\mathbf{7 7 . 0 0}$ |

Optional accessories

| Description | Cat. No. | Price \$ |  |
| :--- | :--- | :--- | ---: |
| Comb type <br> busbars | REFER PAGE | $\mathbf{1 - 4 3}$ |  |
| Main switches | REFER PAGE | $\mathbf{1 - 3 8}$ |  |
| Earth and neutral bar kit | $\frac{4 \times 10 \mathrm{~mm}^{2}}{2 \times 16 \mathrm{~mm}^{2}+8 \mathrm{x}}$ | ILC 4EN | $\mathbf{2 7 . 0 0}$ |
| Lead sealing bracket |  | ILC 8EN | $\mathbf{3 1 . 0 0}$ |

Technical data

- Maximum load 120 amp
- Maximum operating voltage 415 V AC
- Degree of protection IP 43
- Material: self-extinguishing halogen-free polystyrene
- Colour: Base: Grey RAL 7035

Door: Clear
Dimensions (mm)

| Cat. No. | H | W | D |
| :--- | :--- | :--- | :--- |
| ILC $4 S$ | 175 | 90 | 100 |
| ILC $8 S$ | 175 | 170 | 120 |

Notes: Earth and neutral kit ordered separately.
Bus comb ordered separately.
Will not accept DSRCBH single pole RCDs.

## Insulated loadcentres

DIN-T - surface mount

Standard AS/NZS 3439-3

- Suits NHP Din-T MCBs and


Ordering details

| Pole <br> cap. | No. of <br> rows | Neutral <br> bar | Earth <br> bar | Trans. door <br> Cat. No. | White door <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: |
| 8 | 1 | $4 / 4$ | 8 | CSB08ST | CSB08SW | $\mathbf{6 7 . 5 0}$ |
| 12 | 1 | $5 / 3 / 3$ | 12 | CSB12ST | CSB12SW | $\mathbf{7 8 . 0 0}$ |
| 18 | 1 | $9 / 3 / 3 / 3$ | 18 | CSB18ST | CSB18SW | $\mathbf{1 1 9 . 0 0}$ |
| 24 | 2 | $10 / 3 / 3 / 3 / 3$ | 24 | CSB24ST | CSB24SW | $\mathbf{1 5 6 . 0 0}$ |
| 36 | 3 | $12 / 12 / 12$ | 36 | CSB36ST | CSB36SW | $\mathbf{1 9 7 . 0 0}$ |

Dimensions

| Pole capacity | Width $(\mathbf{m m})$ | Height $(\mathbf{m m})$ | Depth $(\mathbf{m m})$ |
| :--- | :--- | :--- | :--- |
| 8 | 185 | 200 | 94 |
| 12 | 256 | 200 | 97 |
| 18 | 363 | 220 | 97 |
| 24 | 269 | 326 | 97 |
| 36 | 306 | 473 | 102 |

## Insulated loadcentres

## DIN-T - flush mount

- Standard AS/NZS 3439-3
- Suits NHP Din-T MCBs and associated DIN equipment
- Flush mount
- Degree of protection IP 40
- Split earth neutral bars
- Removable earth and neutral bar support
- Transparent or white door
- Door hinged at the top
- Supplied complete with Buscomb

Ordering details

| Pole <br> cap. | No. of <br> rows | Neutral <br> bar | Earth <br> bar | Trans. door <br> Cat. No. | White door <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: |
| 12 | 1 | $5 / 3 / 3$ | 12 | CSB12FT | CSB12FW | $\mathbf{7 8 . 0 0}$ |
| 18 | 1 | $9 / 3 / 3 / 3$ | 18 | CSB18FT | CSB18FW | $\mathbf{1 1 9 . 0 0}$ |
| 24 | 2 | $10 / 3 / 3 / 3 / 3$ | 24 | CSB24FT | CSB24FW | $\mathbf{1 5 6 . 0 0}$ |
| 36 | 3 | $12 / 12 / 12$ | 36 | CSB36FT | CSB36FW | $\mathbf{1 9 7 . 0 0}$ |

Metal backing plate long

| Pole capacity | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| 12 | CSB12FMPL | $\mathbf{3 7 . 0 0}$ |
| 18 | CSB18FMPL | $\mathbf{3 7 . 0 0}$ |
| 24 | CSB24FMPL | $\mathbf{4 2 . 0 0}$ |
| 36 | CSB36FMPL | $\mathbf{4 2 . 0 0}$ |

Dimensions

| Pole capacity | Description | Width $(\mathbf{m m})$ | Height $(\mathbf{m m})$ | Depth $(\mathbf{m m})$ |
| :--- | :--- | :--- | :--- | :--- |
| $\mathbf{1 2}$ | Base | 270 | 211 | 66 |
| $\mathbf{1 2}$ | Cover | 304 | 246 | 29 |
| $\mathbf{1 8}$ | Base | 380 | 232 | 76 |
| 18 | Cover | 412 | 267 | 29 |
| 24 | Base | 270 | 304 | 76 |
| 24 | Cover | 305 | 358 | 29 |
| 36 | Base | 308 | 470 | 76 |
| 36 | Cover | 342 | 503 | 29 |

Flush enclosure - cut out dimensions (mm)

| Enclosure type | Width | Height |
| :--- | :--- | :--- |
| 12 way | 259 | 199 |
| 18 way | 365 | 213 |
| 24 way | 259 | 311 |
| 36 way | 296 | 458 |

## Insulated loadcentres

## Din-Modula 150 series

Standard AS/NZS 3439.3
Suits Din-T6, 10, 10H \& 15 MCBs and associated
DIN equipment
IP 40 protection rating

- Totally insulated
- Maximum 100 amp load

150 mm centre distance between DIN rails with 30 mm behind the mounting frame

- The range consists of 36,54 and 72 pole enclosures

- Neutral and earth bars rated at 100 amps

These enclosures have generous 150 mm wiring space between and 30 mm behind equipment rails. The removable mounting frame serves to ease cabling and wiring greatly. Din-Modula 150 is designed for indoor use and to accept the Din-T 6, 10, 10H and 15 MCB range, time switches, contactors and main switches.

## Technical data

- Material: Base: Grey impact resistant polystyrene Door: Clear polycarbonate
- Halogen free

Ordering details

| No. <br> of rows | Pole <br> cap. | Neutral <br> bar | Earth <br> bar | Surface <br> Cat. No. |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2 | 36 | $1 \times 18$ | $1 \times 18$ | DM15036 | Price $\boldsymbol{\$}$ |

Optional accessories

| Description | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| Neutral19-36 | DM150NAA | $\mathbf{3 9 . 5 0}$ |
| Neutral 37-54 | DM150NAB | $\mathbf{7 2 . 5 0}$ |
| Neutral 55-72 | DM150NAC | $\mathbf{7 2 . 5 0}$ |
| Locking device | DM150LD | $\mathbf{4 6 . 0 0}$ |
| Coupling kit | DM150JK | $\mathbf{2 3 . 4 0}$ |

Dimensions (mm)

| Cat. No. | H | W | D |
| :--- | :--- | :--- | :--- |
| DM15036 | 450 | 355 | 142 |
| DM15054 | 600 | 355 | 142 |
| DM15072 | 750 | 355 | 142 |

Notes: ${ }^{1}$ ) Will not accept DSRCBH single pole RCDs. Neutral bar extension kits must be ordered separately. When flush mount required order separately by description.

## Insulated loadcentres

MCE weatherproof series

- Suits Din-T6, 10, 10H, 15 and DC MCBs
- Suits DSRCBS 1P and DSRCB 2P RCBOs
- IP $65-$ IK 08
- Maximum 120 A load
- Totally insulated
- Base polycarbonate, RAL 7035
- Cover polycarbonate, transparent
- UV resistant UL508
- 5 and 9 pole
- Pre-punched knockouts


The MCE weatherproof enclosure was designed to meet the tough demands of Australia's enviroment. The MCE is ideal for roof mounted applications such as used in solar (photovoltaic) applications.

Ordering details

| No. <br> of rows | Pole <br> capacity | Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: |
| 1 | 5 | MCEPCN5MFM | $\mathbf{8 8 . 0 0}$ |
| 1 | 9 | MCEPCN9MFM | $\mathbf{1 4 0 . 0 0}$ |

No earth or neutral bars

Dimensions (mm)

| Pole capacity | H | W | D |
| :--- | :--- | :--- | :--- |
| 5 | 200 | 116 | 105 |
| 9 | 200 | 190 | 105 |

## Insulated loadcentres

## Din-Modula weatherproof series

Standard AS/NZS 3439.3

■Suits Din-T6, 10, 10 H \& 15 MCBs
IP 55-IK07 protection
Maximum 120 amp load
Padlocking possible
■ Door changeable left or right side

- Totally insulated

- Halogen free

The Din-Modula weatherproof was designed with maximum flexibility in mind.
Using the connection set, two or more enclosures can be joined together maintaining the IP protection rating. A further feature of flexibility is that of the adjustable height DIN rail. Grey impact resistant polystyrene base and clear polycarbonate door.
Din-Modula weatherproof was designed for use with the Din-T 6, 10, 10H and 15 MCB range in wet area applications, out of direct sunlight. Split neutral and earth bars are provided. For accessories, refer to page 1-43 \& 1-50.

## Accessories

- Circuit identification labels
- Split neutral and earth bars
- Weatherproof sealing caps for mounting screws
- Pole fillers
- Locking bracket to suit a padlock
- Connection set-for joining enclosures together at extra cost
- 125 mm DIN rail centres

Ordering details

| No. <br> of rows | Pole <br> cap. | Neutral <br> bar | Earth <br> bar | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| 1 | 12 | $8 / 4$ | 8 | DMWP12 | $\mathbf{2 2 0 . 0 0}$ |
| 2 | 24 | $18 / 6$ | 18 | DMWP24 | $\mathbf{2 8 0 . 0 0}$ |
| 3 | 36 | $24 / 12$ | 18 | DMWP36 | $\mathbf{3 7 0 . 0 0}$ |

Optional accessories

| Description | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| Locking device | DMWPLD | $\mathbf{2 8 . 0 0}$ |
| connection set | DMWPCS | $\mathbf{1 3 . 0 0}$ |

Dimensions (mm)

| Pole capacity | H | W | D |
| :--- | :--- | :--- | :--- |
| 12 | 250 | 285 | 138 |
| 24 | 375 | 285 | 138 |
| 36 | 500 | 285 | 138 |

## Metal loadcentres

## NLC loadcentres for 'Din-T' MCBs

- Suits Din-T6, 10, 10 H \& 15 MCBs and associated DIN equipment
■
1 mm zinc annealed steel
■ Polyester powder coated N42 grey
- Earth and neutral bars provided
- DIN rail fitted
- IP 30 (IP 40 with door)

- Commercial and light industrial applications

Ordering details

|  |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: | | Surface |
| :--- |
| mount |
| enclosure | 4)

Load center supplied standard as base and escutcheon. Door and flush escutcheon supplied as optional extras.
Earth and neutral bars $-2 \times 25 \mathrm{~mm}^{2}$, remaining $16 \mathrm{~mm}^{2}$
Options and accessories

| Description | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| Locking kit includes bracket and fasteners | DSLK | $\mathbf{3 0 . 5 0}$ |
| (CLO01) | ADD EACH | $\mathbf{1 . 9 0}$ |
| Fitting of Din-T MCB single pole | ADD EACH | $\mathbf{1 . 9 0}$ |
| Fitting of Din-T MCBs two and three pole | ADD | $\mathbf{3 8 0 . 0 0}$ |
| NSW Public Works Department E1 type lock |  |  |

## Dimensions (mm)

| Pole cap. | A $^{\mathbf{3}} \mathbf{)}$ | B | $\left.\mathbf{C}^{3}\right)$ |
| :--- | :--- | :--- | :--- |
| 8 | 268 | 192 | 245 |
| 12 | 343 | 267 | 245 |
| 15 | 418 | 342 | 245 |
| 18 | 493 | 417 | 245 |
| 21 | 568 | 492 | 245 |
| 24 | 693 | 549 | 245 |



Notes: ${ }^{1}$ ) Doors and flush escutcheons supplied loose.
${ }^{2}$ ) Door has provision for lock. Lock kit ordered separately.
${ }^{3}$ ) Dimensions ' $A$ ' and ' $C$ ' increased by 50 mm when flush mounted. With door depth $=98 \mathrm{~mm}$.
${ }^{4}$ ) Accepts DSRCBH single pole RCDs.

## Metal loadcentres <br> TLC loadcentres for 'Safe-T' MCBs

            Suitable for Safe-T MCBs and Safe-T RCDs 1 mm zinc annealed steel Polyester powder coated N42 grey
    Earth and neutral bars provided

- Circuit schedule labels provided
- MCB clip tray fitted
- IP 30 (IP 40 with door)
- Australian made
- Commercial and light industrial applications


Ordering details

| Pole cap. | Surface mount enclosure ${ }^{2}$ ) Cat. No. | Price \$ | Door ${ }^{1}$ ) <br> Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 6 | TLC6S | 126.00 | LD6/8 | 67.50 |
| 12 | TLC12S | 164.00 | LD12/15 | 78.00 |
| 18 | TLC18S | 205.00 | LD18/21 | 83.00 |

Options and accessories

| Description | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| Safe-T pole fillers | SAFETPF | $\mathbf{1 . 8 0}$ |
| Locking kit includes bracket and fasteners (CL001) | DSLK | $\mathbf{3 0 . 5 0}$ |
| Fitting of Safe-T MCB 1, 2 and 3 pole | ADD | $\mathbf{1 . 9 0}$ |
| DIN mount adaptor for time clock and contactors | TLCDMA | $\mathbf{3 3 . 0 0}$ |
| NSW Public Works Department E1 type lock | ADD | $\mathbf{3 8 0 . 0 0}$ |

Dimensions (mm)

| Pole cap. | A | B | C |
| :--- | :--- | :--- | :--- |
| 6 | 268 | 192 | 245 |
| 12 | 418 | 342 | 245 |
| 18 | 568 | 492 | 245 |



Notes: ${ }^{1}$ ) Doors supplied loose.
${ }^{\text {2 }}$ ) Accepts DSRCBH single pole RCDs.

## NHP - The panelboard innovators

## CONCEPT

The NHP CONCEPT family range of panelboards keeps a common and attractive appearance throughout the range.

## CONCEPT



## The economical panelboard:

The 'CONCEPT' panelboard is designed for those wanting a visually attractive, economical panelboard, but also offering a robust enclosure with an excellent range of standard features. This type of panelboard is designed to be stocked nationally as an 'off the shelf' panelboard.

## CONCEPT.PLUS

## The multipurpose panelboard:

For those wanting an 'off the shelf' panelboard which offers a large range of features and options. The CONCEPT.PLUS is a multipurpose panelboard that offers among its many features: indoor rated panelboard with dust seal option, six modular sizes, and accessory boxes that can be added to extend the height or width of the panelboard. CONCEPT•PLUS panelboards are available for either DIN or NEMA (Safe-T) MCBs.

## CONCEPT•PREMIER

## The premium panelboard:

The CONCEPT.PREMIER panelboard range has all the features of CONCEPT•PLUS, but also includes important additional features, such as a greater box depth, weatherproof rating, the option of stainless steel enclosures, a floor mounting plinth, plus others.
CONCEPT.PREMIER panelboards are available for Safe-T, Din-T, 125 A and 250 A MCCBs or combinations thereof.

## CONCEPT•TOUGH

The heavy-duty panelboard:
The CONCEPT•TOUGH panelboard range has all the features of CONCEPT.PREMIER plus more, the CONCEPT•TOUGH has an increase in depth, width and material thickness for extra strength. The increase in depth allows the use of a wider range of padlock/locking facilities on isolators and circuit breakers between the door and escutcheon. This extra depth also allows larger accessory items to be mounted below the escutcheon such as contactors and change-over switches. The CONCEPT•TOUGH has a vast amount of wiring space and very generously sized glandplate entry and exit points due to the extra width. This package is all put together in a rigid 2 mm fully welded construction for those extra tough applications.

## Quick reference table

| Features and options | CONCEPT | CONCEPT-PLUS |
| :---: | :---: | :---: |
| Circuit Breaker Types | Din-T | Din-T/ Safe-T |
| Enclosure Details \& Accessory Spacing |  |  |
| Width | 485 mm | 585 mm |
| Depth | 151 mm | 185 mm |
| IP Rating | IP 40 | IP $42{ }^{1}$ ) |
| Material | 1 mm | 1.6 mm |
| Pole capacity | 24-60 | 18-96 |
| Colours available (doors) | Grey \& Orange | Grey \& Orange |
| Spare DIN rail - rail mounting space | 12 Poles | 18 Poles |
| Largest contactor under PB escutcheon | CA 7-43 | CA 7-85 |
| Largest contactor in accessory module | - | CA 6-180 |
| Main Switches, Busbars, Earth \& Neutral Bars |  |  |
| STD Main switch rating | 160 A or 250 A | 160 or 250 A standard |
| Maximum main switch sizes available | 250 A | 400 A |
| Dual Earth \& Neutral bars | - | - |
| Lock type on door (keylock) | Flush | Flush |
| Chassis type | Din chassis | NC-GB-CT |
| Common Features |  |  |
| Horizontal DIN rail | $\checkmark$ | $\checkmark$ |
| Knockouts for MCBs \& accessories | $\checkmark$ | $\checkmark$ |
| Door reversible RHS to LHS | $\checkmark$ | $\checkmark$ |
| Door hinged independent of escutcheon | $\checkmark$ | $\checkmark$ |
| Optional Accessories \& Features |  |  |
| Emergency lighting kits - option | $\checkmark$ | $\checkmark$ |
| Split chassis - option | $\checkmark$ | $\checkmark$ |
| Special colours - option | $\checkmark$ | $\checkmark$ |
| Rain \& dust hood | - | - |
| Custom 'modular' assemblies - option | - | $\checkmark$ |
| Accessory / header boxes - option | - | $\checkmark$ |
| Brass or aluminium gland plates - option | - | $\checkmark$ |
| Removable gland plates - standard | - | $\checkmark$ |
| Can fit MCCBs - option | - | $\checkmark$ |
| Fault current limiter DIN fuses - option | - | $\checkmark$ |
| Flush surround kits - option | $\checkmark$ | $\checkmark$ |
| Hinged escutcheon | - | optional |
| Dust seal | - | optional |
| Floor mounting plinth - option | - | $\checkmark$ |
| Wall mounting brackets - option | - | - |
| '3 point locking' door - on Lge encl. ${ }^{2}$ ) | - | - |
| Stainless steel enclosure - option | - | - |

[^3]
## Quick reference table

| Features and options | CONCEPT•PREMIER | CONCEPT•TOUGH |  |  |
| :--- | :--- | :--- | :---: | :---: |
| Circuit Breaker Types | Din-T/ Safe-T/ <br> 125 \& 250 A MCCBs | Din-T / Safe-T/ <br> 125 \& 250 A MCCBs |  |  |
| Enclosure Details \& Accessory Spacing |  |  |  |  |
| Width | 640 mm | 800 mm |  |  |
| Depth | 240 mm | 300 mm |  |  |
| IP Rating | IP 66 | IP 66 |  |  |
| Material | 1.6 mm | 2.0 mm |  |  |
| Pole capacity | $18-96$ | $18-96$ |  |  |
| Colours available (doors) | Grey \& Orange | Grey \& Orange |  |  |
| Spare DIN rail rail mounting space | 18 Poles | 18 Poles |  |  |
| Largest contactor under PB escutcheon | CA 6-180 | CA 6-180 |  |  |
| Largest contactor in accessory module | CA 6-420 | CA 6-420 |  |  |
| Main Switches, Busbars, Earth \& Neutral Bars |  |  |  |  |
| STD Main switch rating | 160 or 250 A standard | - |  |  |
| Maximum main switch sizes available | $<800$ A | $<800$ A |  |  |
| Dual Earth \& Neutral bars |  |  |  |  |
| Lock type on door (keylock) | T-handle, flush <br> (series 2) | Chrome plated <br> LHandle |  |  |
| Chassis type | CD-NC-GB-XA-XB | CD-NC-GB-XA-XB |  |  |

## Common Features

| Horizontal DIN rail | $\checkmark$ | $\checkmark$ |
| :--- | :--- | :--- |
| Knockouts for MCBs \& accessories | $\checkmark$ | $\checkmark$ |
| Door reversible RHS to LHS | $\checkmark$ | - |
| Door hinged independent of escutcheon | $\checkmark$ | $\checkmark$ |

## Optional Accessories \& Features

| Emergency lighting kits - option | $\checkmark$ | $\checkmark$ |
| :--- | :---: | :---: |
| Split chassis - option | $\checkmark$ | $\checkmark$ |
| Special colours - option | $\checkmark$ | $\checkmark$ |
| Rain \& dust hood | $\checkmark$ | $\checkmark$ |
| Custom 'modular' assemblies - option | $\checkmark$ | $\checkmark$ |
| Accessory / header boxes - option | $\checkmark$ | accessory only |
| Brass or aluminium gland plates - option | $\checkmark$ | $\checkmark$ |
| Removable gland plates - standard | $\checkmark$ | $\checkmark$ |
| Can fit MCCBs - option | $\checkmark$ | $\checkmark$ |
| Fault current limiter DIN fuses - option | $\checkmark$ | $\checkmark$ |
| Flush surround kits - option | $\checkmark$ | - |
| Hinged escutcheon | standard | standard |
| Dust seal | standard | standard |
| Floor mounting plinth - option | $\checkmark$ | $\checkmark$ |
| Wall mounting brackets - option | $\checkmark$ | standard |
| '3 point locking' door - on Lge encl. ' $)$ | $\checkmark$ | $\checkmark$ |
| Stainless steel enclosure - option | $\checkmark$ | $\checkmark$ |

Notes: For a more complete listing of accessory details refer to accessory pages relating to individual panelboards.
${ }^{1}$ ) On large enclosures $\geq 1000 \mathrm{~mm}$.

## CONCEPT <br> The economical panelboard for Din-T MCBs

Standard AS/NZS 3439-3
Type tested busbar system

- Compact 160 A or 250 A main switch
- Door fitted independent of escutcheon
- Left or right hand door hinging
- Lockable door

E Australian made

- Commercial and industrial applications



## Application

The Concept range is an economical panelboard designed for the commercial and light industrial sectors. It will accept Din-T circuit breakers and associated accessory devices.

## Features

- Two-tone colour scheme, make a colour change by simply changing the door colour.
- The door is field changeable from right to left hinged and is totally independent of the escutcheon.
- Gloss white escutcheon has been dished to allow a wide range of accessories to fit under the door.
- Knockouts provided in the escutcheon for up to 12 modules of extra standard DIN rail equipment.
- Compact main switch with a 160 A or 250 A rating.

E Earth and neutral bars, circuit identification and schedule cards supplied.
Technical data
$\begin{array}{ll}\text { Material type: } & 1 \mathrm{~mm} \text { steel } \\ \text { Finish: } & \text { Polyester powder coated }\end{array}$
Colour (AS 2700-1995): Base - charcoal gloss
Door - N42 storm grey or X15 orange
Escutcheon - bright white gloss
Protection degree: IP 30 without door
IP 40 with door, IP42 with rain hood
Busbar ratings: 250 A
20 kA for 0.2 seconds
Main Switch: $\quad 160$ A 3 pole 415 V AC top mount
250 A 3 pole 415 V AC top mount

## CONCEPT

The economical panelboard for Din-T MCBs


CONCEPT
Surface mount panelboard with grey door

| Suits D <br> Main switch | Pole cap. | $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 160 A | 24 | 1 | 700 | CON 24 M160 G | 1190.00 |
|  | 36 | 2 | 800 | CON 36 M160 G | 1300.00 |
|  | 48 | 3 | 900 | CON 48 M160 G | 1400.00 |
|  | 60 | 4 | 1000 | CON 60 M160 G | 1540.00 |
| 250 A | 24 | 1 | 700 | CON 24 M250 G | 1400.00 |
|  | 36 | 2 | 800 | CON 36 M250 G | 1500.00 |
|  | 48 | 3 | 900 | CON 48 M250 G | 1620.00 |
|  | 60 | 4 | 1000 | CON 60 M250 G | 1740.00 |

Width $=485 \mathrm{~mm}$, Depth $=151 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

## CONCEPT

| Surface mount panelboard with orange door Suits Din-T MCBs (DIN) refer to section one |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Main switch | Pole cap. | $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Cat. No. | Price \$ |
| 160 A | 24 | 1 | 700 | CON 24 M160 O | 1190.00 |
|  | 36 | 2 | 800 | CON 36 M160 O | 1300.00 |
|  | 48 | 3 | 900 | CON 48 M160 O | 1400.00 |
|  | 60 | 4 | 1000 | CON 60 M160 O | 1540.00 |
| 250 A | $\underline{24}$ | 1 | 700 | CON 24 M250 0 | 1400.00 |
|  | 36 | 2 | 800 | CON 36 M250 0 | 1500.00 |
|  | 48 | 3 | 900 | CON 48 M250 0 | 1620.00 |
|  | 60 | 4 | 1000 | CON 60 M250 O | 1740.00 |

Width $=485 \mathrm{~mm}$, Depth $=151 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

## CONCEPT

The economical panelboard for Din-T MCBs

| Accessories Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Split chassis kit (supplied loose) |  | STKCD | 119.00 |
| Emergency lighting kit ${ }^{1}$ ) (supplied loose) | Rotary control switch | CPELK1 | 430.00 |
|  |  | CPELK1W | 445.00 |
|  | Key operated control switch unwired | CPELK2 | 495.00 |
| Pole fillers (Din-T) |  | DTPF | 4.30 |
| Flush kit | SIZE 1 CON | CONFK1 | 285.00 |
|  | SIZE 2 CON | CONFK2 | 285.00 |
|  | SIZE 3 CON | CONFK3 | 285.00 |
|  | SIZE 4 CON | CONFK4 | 285.00 |
| Spare Key (set of 2) | CL001 $\times 2$ | KEYCL001 | 7.80 |
| Spare Key (set of 2) | $92268 \times 2$ | KEY92268 | 7.80 |
| Door lock | CL001 | CPDHANDLECL001 | 36.50 |
|  | 92268 | CPDHANDLE92268 | 36.50 |
|  | NSW PWD ELOCK | CPDHANDLEELOCK | 290.00 |
|  | Padlockable | CPDHANDLEPADLCK | 78.00 |
|  | Non-lockable | CPDHANDLENOLOCK | 36.50 |

Notes: ${ }^{1}$ ) Emergency lighting kits can be field fitted to Concept panelboards utilising horizontal DIN knockouts at top of board. Kits include control switch, timer, 24 A 4 Pole N/C contactor, labels and wiring diagram to complete control circuit which complies with AS 2293.1.

## CONCEPT•PLUS <br> Multi-purpose panelboards <br> for Din-T or Safe-T MCBs

Standard AS/NZS 3439-3
IP 42
6 modular sizes up to 96 poles
Accessory module
Type tested busbar chassis system

- Compact 250 A main switch

Generous wiring room
Removable gland plates

- Flush door handle
- Left or right hand door hinging
- Commercial and industrial applications



## Application

The Concept Plus range of panelboards provide a unique enclosure system for the NHP range of Din-T and Safe-T MCBs and associated accessory devices.

## Features

- Two-tone colour scheme, make a colour change simply by changing the door colour
- The door is field changeable from right to left hinged and is totally independent of the escutcheon
- Gloss white escutcheon has been dished to allow a wide range of accessories to fit under the door
- Knockouts provided in the escutcheon for up to 18 modules of standard DIN rail equipment
- Removable gland plates aid on-site installation of cables
- New compact main switch with a fully enclosed rating of 160 A and 250 A
- Earth and neutral bars, circuit identification and schedule cards supplied standard


## Technical data

Material type: $\quad 1.6 \mathrm{~mm}$ steel, polyester powder coated
Colour (AS 2700-1995): Base-Charcoal gloss
Door - N42 Storm grey or X15 orange Escutcheon - bright white
Protection degree: IP 42 - with door (Dust seal option)
Busbar ratings: SafeT-250 A CT (355 A option)
Din-T-250 A NC (400 A option)
Din-T-250 A Grizz-Bar
Main switch (options): Safe-T 100 A Non-auto (chassis mount CST)
Din-T M/S 100 A (chassis mount CDT)
160 A 3 pole 415 V AC (top mount)
250 A 3 pole 415 V AC (top mount)
200 A MCCB (top mount)
Neutral and earth bars: $2 \times 8 \mathrm{~mm}$ studs; tunnel terminals with 2 screws 10 kA 1 second.

## 

## CONCEPT•PLUS 2

Multi-purpose panelboards
for Din-T MCBs


CONCEPT•PLUS 2
Din-T - Surface mount with grey door
Suits Din-T MCBs (DIN) refer to section one

| Main switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 700 | CDT 18G2 | 1090.00 |
|  | $\underline{24}$ | 1 | 700 | CDT 24G2 | 1190.00 |
|  | 36 | 2 | 900 | CDT 36G2 | 1300.00 |
|  | 48 | 2 | 900 | CDT 48G2 | 1460.00 |
|  | 60 | 3 | 1100 | CDT 60G2 | 1630.00 |
|  | 72 | 4 | 1300 | CDT 72G2 | 1780.00 |
|  | 84 | 4 | 1300 | CDT 84G2 | 2060.00 |
|  | 96 | 5 | 1500 | CDT 96G2 | 2390.00 |
| 160 A | 18 | 1 | 700 | CDT 18M160G2 | 1340.00 |
|  | 24 | 1 | 700 | CDT 24M160G2 | 1440.00 |
|  | 36 | 2 | 900 | CDT 36M160G2 | 1550.00 |
|  | 48 | 2 | 900 | CDT 48M160G2 | 1710.00 |
|  | 60 | 3 | 1100 | CDT 60M160G2 | 1880.00 |
| 250 A | 18 | 1 | 700 | CDT 18M250G2 ${ }^{1}$ ) | 1460.00 |
|  | 24 | 1 | 700 | CDT 24M250G2 ${ }^{1}$ ) | 1570.00 |
|  | 36 | 2 | 900 | CDT 36M250G2 | 1670.00 |
|  | 48 | 2 | 900 | CDT 48M250G2 | 1840.00 |
|  | 60 | 3 | 1100 | CDT 60M250G2 | 2000.00 |
|  | 72 | 4 | 1300 | CDT 72M250G2 | 2160.00 |
|  | 84 | 4 | 1300 | CDT 84M250G2 | 2440.00 |
|  | 96 | 5 | 1500 | CDT 96M250G2 | 2760.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CDT18-M250-G2 = CDT18G2 + EVA3250H.

## 

## CONCEPT•PLUS 2

Multi-purpose panelboards for Din-T MCBs


CONCEPT•PLUS 2
Din-T - Surface mount with orange door
Suits Din-T MCBs (DIN) refer to section one

| Main switch | Pole cap. | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 700 | CDT 1802 | 1090.00 |
|  | 24 | 1 | 700 | CDT $2402{ }^{2}$ ) | 1190.00 |
|  | 36 | 2 | 900 | CDT 3602 ${ }^{2}$ ) | 1300.00 |
|  | 48 | 2 | 900 | CDT 4802 ${ }^{\text {2 }}$ ) | 1460.00 |
|  | 60 | 3 | 1100 | CDT $6002{ }^{2}$ ) | 1630.00 |
|  | 72 | 4 | 1300 | CDT 7202 | 1780.00 |
|  | 84 | 4 | 1300 | CDT 8402 | 2060.00 |
|  | 96 | 5 | 1500 | CDT 9602 | 2390.00 |
| 160 A | 18 | 1 | 700 | CDT 18M16002 | 1340.00 |
|  | 24 | 1 | 700 | CDT 24M16002 ${ }^{\text {2 }}$ ) | 1440.00 |
|  | 36 | 2 | 900 | CDT 36M16002 ${ }^{\text {2 }}$ ) | 1550.00 |
|  | 48 | 2 | 900 | CDT 48M16002 | 1710.00 |
|  | 60 | 3 | 1100 | CDT 60M16002 ${ }^{1}$ ) | 1880.00 |
| 250 A | 18 | 1 | 700 | CDT 18M25002 ${ }^{1}$ ) | 1460.00 |
|  | 24 | 1 | 700 | CDT 24M25002 $\left.{ }^{1}\right)^{2}$ ) | 1570.00 |
|  | 36 | 2 | 900 | CDT 36M25002 ${ }^{\text {2 }}$ ) | 1670.00 |
|  | 48 | 2 | 900 | CDT 48M25002 ${ }^{2}$ ) | 1840.00 |
|  | 60 | 3 | 1100 | CDT 60M25002 ${ }^{\text {2 }}$ ) | 2000.00 |
|  | 72 | 4 | 1300 | CDT 72M25002 ${ }^{\text {2 }}$ ) | 2160.00 |
|  | 84 | 4 | 1300 | CDT 84M25002 ${ }^{\text {2 }}$ ) | 2440.00 |
|  | 96 | 5 | 1500 | CDT 96M25002 $\left.{ }^{1}\right)^{2}$ ) | 2760.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CDT18-M250-O2 = CDT18O2 + EVA3250H.
${ }^{2}$ ) Enclosure with orange base replace "O" with "OO" e.g. CDT36002.

## 

## CONCEPT•PLUS 2

## Multi-purpose panelboards



CONCEPT•PLUS 2
for Din-T MCBs

Din-T - Surface mount with grey door
Suits Din-T MCBs (DIN) refer to section one

| Main switch | Pole capacity | $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 700 | CDTE18G2 | 1190.00 |
|  | 36 | 2 | 900 | CDTE36G2 | 1400.00 |
|  | 48 | 3 | 1100 | CDTE48G2 | 1660.00 |
|  | 72 | 4 | 1300 | CDTE72G2 | 1890.00 |
|  | 96 | 5 | 1500 | CDTE96G2 | 2490.00 |
| 160 A | 18 | 1 | 700 | CDTE18M160G2 | 1440.00 |
|  | 36 | 2 | 900 | CDTE36M160G2 | 1650.00 |
|  | 48 | 3 | 1100 | CDTE48M160G2 | 1910.00 |
|  | 72 | 4 | 1300 | CDTE72M160G2 | 2140.00 |
|  | 96 | 5 | 1500 | CDTE96M160G2 | 2740.00 |
| 250 A | 18 | 1 | 700 | CDTE18M250G2 | 1560.00 |
|  | 36 | 2 | 900 | CDTE36M250G2 | 1770.00 |
|  | 48 | 3 | 1100 | CDTE48M250G2 | 2040.00 |
|  | 72 | 4 | 1300 | CDTE72M250G2 | 2260.00 |
|  | 96 | 5 | 1500 | CDTE96M250G2 | 2860.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: NC 250 topfeed chassis
24P horizontal DIN rail cut-out below chassis Made to order

## 

## CONCEPT•PLUS 2

## Multi-purpose panelboards



CONCEPT•PLUS 2
for Din-T MCBs


Extra row
horizontal
DIN Rail
24 Poles
Din-T - Surface mount with orange door
Suits Din-T MCBs (DIN) refer to section one

| Main switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 700 | CDTE1802 | 1190.00 |
|  | 36 | 2 | 900 | CDTE3602 | 1400.00 |
|  | 48 | 3 | 1100 | CDTE4802 | 1660.00 |
|  | 72 | 4 | 1300 | CDTE7202 | 1890.00 |
|  | 96 | 5 | 1500 | CDTE9602 | 2490.00 |
| 160 A | 18 | 1 | 700 | CDTE18M16002 | 1440.00 |
|  | 36 | 2 | 900 | CDTE36M16002 | 1650.00 |
|  | 48 | 3 | 1100 | CDTE48M16002 | 1910.00 |
|  | 72 | 4 | 1300 | CDTE72M16002 | 2140.00 |
|  | 96 | 5 | 1500 | CDTE96M16002 | 2740.00 |
| 250 A | 18 | 1 | 700 | CDTE18M25002 | 1560.00 |
|  | 36 | 2 | 900 | CDTE36M25002 | 1770.00 |
|  | 48 | 3 | 1100 | CDTE48M25002 | 2040.00 |
|  | 72 | 4 | 1300 | CDTE72M25002 | 2260.00 |
|  | 96 | 5 | 1500 | CDTE96M25002 | 2860.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: NC 250 topfeed chassis
24P horizontal DIN rail cut-out below chassis Made to order

## 

## CONCEPT•PLUS 2

## Multi-purpose panelboards <br> for Din-T MCBs

CONCEPT•PLUS 2
Din-T - Surface mount with grey door
Suits DIN-T-MCBs (DIN) refer to section one
100-160 A main switch = S160NJ3160 MCCB


| Main switch | Pole <br> cap. | Box <br> size | Height <br> $(\mathbf{m m})$ | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
|  | 24 | 1 | 700 | CDT24MCCB160G2 | $\mathbf{1 8 0 0 . 0 0}$ |
|  | 42 | 2 | 900 | CDT42MCCB160G2 | $\mathbf{1 9 9 0 . 0 0}$ |
| $\left.100-160 \mathrm{~A}^{1}\right)$ | 60 | 3 | 1100 | CDT60MCCB160G2 | $\mathbf{2 2 0 0 . 0 0}$ |
|  | 78 | 4 | 1300 | CDT78MCCB160G2 | $\mathbf{2 6 0 0 . 0 0}$ |
|  | 96 | 5 | 1500 | CDT96MCCB160G2 | $\mathbf{2 9 9 0 . 0 0}$ |

160-200 A main switch $=$ E250NJ3250 MCCB

| Main switch | Pole <br> cap. | Box <br> size | Height <br> $(\mathbf{m m})$ | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  | 24 | 1 | 700 | CDT24MCCB200G2 | $\mathbf{1 9 5 0 . 0 0}$ |
| $\left.160-200 A^{2}\right)$ | 42 | 2 | 900 | CDT42MCCB200G2 | $\mathbf{2 1 5 0 . 0 0}$ |
|  | 60 | 3 | 1100 | CDT60MCCB200G2 | $\mathbf{2 3 5 0 . 0 0}$ |
|  | 78 | 4 | 1300 | CDT78MCCB200G2 | $\mathbf{2 7 5 0 . 0 0}$ |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

[^4]Enclosed busbar distribution system for Din-T, MCBs and RCBOs.


The Concept range of busbar chassis assemblies have been specifically designed for incorporating into the Concept family of panelboards

- Models from 6 to 108 poles
- Standard AS/NZS 3439.1
- 250 A and new 400 A rating
- Improved withstand ratings
- Retrofitable with CD chassis
- Improved form rating


## CONCEPT•PLUS CONCEPT•PREMIER © TERASAKI

## CONCEPT•PLUS 2

Multi-purpose panelboards
for Din-T MCBs C/W isolation chassis


Suits Din-T MCBs (DIN) refer to section one

| Main switch | Pole capacity | Box <br> size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 700 | CDG 24G2 | 1550.00 |
|  | 36 | 2 | 900 | CDG 36G2 | 1750.00 |
|  | 48 | 2 | 900 | CDG 48G2 | 2010.00 |
|  | 60 | 3 | 1100 | CDG 60G2 | 2320.00 |
|  | 72 | 4 | 1300 | CDG 72G2 | 2550.00 |
|  | 84 | 4 | 1300 | CDG 84G2 | 2990.00 |
|  | 96 | 5 | 1500 | CDG 96G2 | 3400.00 |
| 160 A | 24 | 1 | 700 | CDG 24M160G2 ${ }^{1}$ ) | 1750.00 |
|  | 36 | 2 | 900 | CDG 36M160G2 ${ }^{1}$ ) | 1950.00 |
|  | 48 | 2 | 900 | CDG 48M160G2 ${ }^{1}$ ) | 2150.00 |
|  | 60 | 3 | 1100 | CDG 60M160G2 ${ }^{1}$ ) | 2480.00 |
| 250 A | 24 | 1 | 700 | CDG 24M250G2 ${ }^{1}$ ) | 1910.00 |
|  | 36 | 2 | 900 | CDG 36M250G2 ${ }^{1}$ ) | 2110.00 |
|  | 48 | 2 | 900 | CDG 48M250G2 ${ }^{1}$ ) | 2370.00 |
|  | 60 | 3 | 1100 | CDG 60M250G2 ${ }^{1}$ ) | 2680.00 |
|  | 72 | 4 | 1300 | CDG 72M250G2 ${ }^{1}$ ) | 2850.00 |
|  | 84 | 4 | 1300 | CDG 84M250G2 ${ }^{1}$ ) | 3350.00 |
|  | 96 | 5 | 1500 | CDG 96M250G2 ${ }^{1}$ ) | 3750.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CDG18-M250-G2 = CDG18G2+EVA3250H

## CONCEPT•PLUS 2

Multi-purpose panelboards for Din-T MCBs C/W isolation chassis


CONCEPT•PLUS 2

$\left.\begin{array}{lllllr}\begin{array}{l}\text { Main } \\ \text { switch }\end{array} & \begin{array}{l}\text { Pole } \\ \text { capacity }\end{array} & \begin{array}{l}\text { Box } \\ \text { size }\end{array} & \begin{array}{l}\text { Height } \\ (\mathbf{m m})\end{array} & \text { Cat. No. }{ }^{2} \text { ) }\end{array}\right]$ Price \$

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CDG18-M250-O2 = CDG18O2+EVA3250H
${ }^{2}$ ) Enclosure with orange base replace " O " with "OO" e.g. CDG360O2.

## 

## CONCEPT•PLUS 2 <br> Energy metering panelboards <br> for Din-T MCBs



## Application

The Concept•Plus energy metering range of panelboards have been designed to meet the energy metering requirements of today's market.

## CONCEPT.PLUS

160 A Energy metering panelboards with grey door
CT connect meters rated 75 A for light circuits and 120 A for power circuits

| Pole <br> capacity size | Light <br> poles | Power <br> poles | Main <br> switch | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: |
| 36 | 1100 mm 12 | 24 | 160 A | CDM36M160G | $\mathbf{3 3 7 0 . 0 0}$ |
| 48 | 1300 mm 18 | 30 | 160 A | CDM48M160G | $\mathbf{3 5 3 0 . 0 0}$ |
| 60 | 1300 mm 18 | 42 | 160 A | CDM60M160G | $\mathbf{3 7 9 0 . 0 0}$ |

## CONCEPT.PLUS

250 A Energy metering panelboards with grey door
CT connect meters rated 120 A for light circuits and 200 A for power circuits

| Pole <br> capacityBox <br> size | Light <br> poles | Power <br> poles | Main <br> switch | Cat. No. | Price \$ |
| :--- | :---: | :---: | :--- | :--- | :--- | ---: |
| 60 | 1300 mm 18 | 42 | 250 A | CDM60M250G | $\mathbf{3 8 9 0 . 0 0}$ |
| 72 | 1500 mm 24 | 48 | 250 A | CDM72M250G | $\mathbf{4 1 0 0 . 0 0}$ |
| 84 | 1500 mm 30 | 54 | 250 A | CDM84M250G | $\mathbf{4 4 1 0 . 0 0}$ |
| 96 | 1700 mm 36 | 60 | 250 A | CDM96M250G | $\mathbf{4 5 1 0 . 0 0}$ |

## CONCEPT•PLUS

Retro fit energy metering kits with grey door

| Main <br> switch | Box size | Light | Power <br> poles | Cat. No. ${ }^{1}$ ) | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| - | 400 mm | - | 250 A | CDMRFG | $\mathbf{1 6 1 0 . 0 0}$ |
| 250 A | 600 mm | - | 250 A | CDMRFSM250AG6 | $\mathbf{2 0 2 0 . 0 0}$ |
| 250 A | 600 mm | 125 A | 250 A | CDMRFDM250AG6 | $\mathbf{2 7 5 0 . 0 0}$ |

Width $=585 \mathrm{~mm}$, depth $=185 \mathrm{~mm}$, includes (door $=20 \mathrm{~mm}$ )
Notes: ${ }^{1}$ ) Delete M160 and M250 if no main switch is required. Replace G with O for Orange door.
For other combinations or options refer to NHP.
Metering boards are not suitable for utility metering.

## CONCEPT•PLUS

Multi-purpose panelboards for Safe-T MCBs


CONCEPT•PLUS
Safe-T - Surface mount with grey door Suits Safe-T-MCBs (NEMA) refer section one

| Main switch | Pole cap. | $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Cat. No. | $\begin{array}{r} \text { No } \\ \mathrm{M} / \mathrm{S} \\ \text { Price \$ } \\ \hline \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 700 | CST 24G | 1300.00 |
|  | 36 | 2 | 900 | CST 36G | 1410.00 |
|  | 48 | 3 | 1100 | CST 48G | 1550.00 |
|  | 60 | 4 | 1300 | CST 60G | 1710.00 |
|  | 72 | 5 | 1500 | CST 72G | 1860.00 |
|  | 96 | 6 | 1700 | CST 96G | 2490.00 |
| 160 A | 24 | 1 | 700 | CST 24M160G ${ }^{1}$ ) | 1550.00 |
|  | 36 | 2 | 900 | CST 36M160G ${ }^{1}$ ) | 1660.00 |
|  | 48 | 3 | 1100 | CST 48M160G ${ }^{1}$ ) | 1790.00 |
|  | 60 | 4 | 1300 | CST 60M160G ${ }^{1}$ ) | 1960.00 |
| 250 A | 24 | 1 | 700 | CST 24M250G ${ }^{1}$ ) | 1670.00 |
|  | 36 | 2 | 900 | CST 36M250G ${ }^{1}$ ) | 1780.00 |
|  | 48 | 3 | 1100 | CST 48M250G ${ }^{1}$ ) | 1920.00 |
|  | 60 | 4 | 1300 | CST 60M250G ${ }^{1}$ ) | 2090.00 |
|  | 72 | 5 | 1500 | CST 72M250G ${ }^{1}$ ) | 2230.00 |
|  | 96 | 6 | 1700 | CST 96M250G ${ }^{1}$ ) | 2860.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CST24M250G $=$ CST24G + CST250MS.

## 

## CONCEPT•PLUS

## Multi-purpose panelboards for Safe-T MCBs



CONCEPT.PLUS
Safe-T - Surface mount with orange door
Suits Safe-T-MCBs (NEMA) refer section one

| Main switch | Pole cap. | $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Cat. No. | $\begin{array}{r} \text { No } \\ \mathrm{M} / \mathrm{S} \\ \text { Price \$ } \\ \hline \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 700 | CST 240 | 1300.00 |
|  | 36 | 2 | 900 | CST 360 | 1410.00 |
|  | 60 | 4 | 1300 | CST 600 | 1710.00 |
|  | 72 | 5 | 1500 | CST 720 | 1860.00 |
|  | 96 | 6 | 1700 | CST 960 | 2490.00 |
| 160 A | 24 | 1 | 700 | CST 24M1600 ${ }^{1}$ ) | 1550.00 |
|  | 36 | 2 | 900 | CST 36M1600 ${ }^{1}$ ) | 1660.00 |
|  | 60 | 4 | 1300 | CST 60M1600 ${ }^{1}$ ) | 1960.00 |
| 250 A | 24 | 1 | 700 | CST 24M2500 ${ }^{1}$ ) | 1670.00 |
|  | 36 | 2 | 900 | CST 36M2500 ${ }^{1}$ ) | 1780.00 |
|  | 60 | 4 | 1300 | CST 60M2500 ${ }^{1}$ ) | 2090.00 |
|  | 72 | 5 | 1500 | CST 72M2500 ${ }^{1}$ ) | 2230.00 |
|  | 96 | 6 | 1700 | CST 96M2500 ${ }^{1}$ ) | 2860.00 |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switch supplied loose i.e. CST24M250O = CST24O + CST250MS.

## CONCEPT•PLUS 2

Multi-purpose panelboards accessory modules

CONCEPT•PLUS 2 (Series 2)
Accessory modules with grey door ${ }^{1}$ )

| Box <br> size | Height <br> $(\mathbf{m m})$ | Cat. No. with <br> escutcheon | Price \$ |
| :--- | :--- | :--- | :--- | :--- |$|$| 0 | 400 | 24 (1 row 24 way) | CPACC24G2 |
| :--- | :--- | :--- | :--- |

Box Height
size (mm)

| Cat. No. without <br> escutcheon | Price $\mathbf{\$}$ |
| :--- | :---: |
| CPACCSOG2 | $\mathbf{7 4 0 . 0 0}$ |
| CPACCSHG2 | $\mathbf{8 7 0 . 0 0}$ |


| Box <br> size | Height $(\mathrm{mm})$ | Cat. No. <br> with blank <br> escutcheon | Price \$ |
| :--- | :--- | :--- | ---: |
| 0 | 400 | CPACCSOGE2 | $\mathbf{7 4 0 . 0 0}$ |
| H | 600 | CPACCSHGE2 | $\mathbf{8 7 0 . 0 0}$ |
| 1 | 700 | CPACCS1GE2 | $\mathbf{9 0 0 . 0 0}$ |
| 2 | 900 | CPACCS2GE2 | $\mathbf{1 0 2 0 . 0 0}$ |
| 3 | 1100 | CPACCS3GE2 | $\mathbf{1 1 3 0 . 0 0}$ |
| 4 | 1300 | CPACCS4GE2 | $\mathbf{1 3 2 0 . 0 0}$ |
| 5 | 1500 | CPACCS5GE2 | $\mathbf{1 4 3 0 . 0 0}$ |
| 6 | 1700 | CPACCS6GE2 | $\mathbf{1 6 1 0 . 0 0}$ |

Width $=585 \mathrm{~mm}$, Depth $=185 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

| Height (mm) | Cat. No. | Price \$ |
| :--- | ---: | ---: |
| 94 mm | CPBGTS1 | $\mathbf{4 6 . 5 0}$ |
| 194 mm | CPBGTS2 | $\mathbf{6 7 . 5 0}$ |
| 294 mm | CPBGTS3 | $\mathbf{8 8 . 0 0}$ |
| 494 mm | CPBGTSH | $\mathbf{1 1 4 . 0 0}$ |
| 594 mm | CPBGTS4 | $\mathbf{1 4 5 . 0 0}$ |
| 994 mm | CPBGTS6 | $\mathbf{2 3 0 . 0 0}$ |

Gear trays for Concept Plus must be 100 mm shorter than enclosure size.
Earth and neutral bar kit to suit accessory module

| No. of ways | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 24 | CEN24 | $\mathbf{8 8 . 0 0}$ |
| 36 | CEN36 | $\mathbf{9 5 . 0 0}$ |
| 48 | CEN48 | $\mathbf{1 1 8 . 0 0}$ |
| 60 | CEN60 | $\mathbf{1 4 4 . 0 0}$ |
| 72 | CEN72 | $\mathbf{1 5 8 . 0 0}$ |
| 84 | CEN84 | $\mathbf{1 9 3 . 0 0}$ |
| 96 | CEN96 | $\mathbf{2 1 5 . 0 0}$ |

Includes 2 bars mounting supports and fasteners.

Notes: ${ }^{1}$ ) For orange enclosure replace G with O e.g. CPACC24G2 with CPACC24O2

## CONCEPT•PLUS

## Multi-purpose panelboards options and accessories

|  | Description |  |  |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $2$ | Top mount main switch kits (supplied loose) | 160 A | 3 pole | CDT, CDG | EVA3160H | 305.00 |
|  |  |  |  | CST | CST160MS | 305.00 |
|  |  | 250 A | 3 pole | CDT, CDG | EVA3250H | 435.00 |
|  |  |  |  | CST | CST250MS | 435.00 |
|  | IP 52B sealing kit (Charcoal Base) |  |  |  | CPIP52G | 210.00 |
|  | Chassis mount | 80 A | 3 pole | CDT | DINTMS803 | 102.00 |
|  |  | 100 A | 3 pole | CDT | DINTMS1003 | 115.00 |
|  |  | 100 A | 3 pole | CST | SAFET63100NA | 285.00 |
|  | Flush surround kit (supplied loose) ( 45 mm width) |  |  | Size 1 | CPBFK1 | 300.00 |
|  |  |  |  | Size 2 | CPBFK2 | 300.00 |
|  |  |  |  | Size 3 | CPBFK3 | 300.00 |
|  |  |  |  | Size 4 | CPBFK4 | 300.00 |
|  |  |  |  | Size 5 | CPBFK5 | 300.00 |
|  |  |  |  | Size 6 | CPBFK6 | 300.00 |
|  | Dust door seal fits all box sizes |  |  |  | CPDRUBBER | 197.00 |
|  | Blue cover to suit 160 A and 250 A isolator |  |  |  | 1LS2VS | 12.00 |
|  | Floor mount plinth ( 100 mm height) ${ }^{3}$ ) |  |  |  | CPPLINTH | 365.00 |
|  | Gland plate options |  |  |  |  |  |
|  | Open end-cap (cut-out for cable entry) |  |  |  | CPECS | 104.00 |
| Steel gland plate (suits open end-cap) |  |  |  |  | CPGPS | 54.00 |
|  | Brass gland plate (suits open end-cap) (3 mm) |  |  |  | CPGPB | 220.00 |
|  | Aluminium gland plate (suits open end-cap) ( 3 mm ) |  |  |  | CPGPA | 67.50 |
|  | Emergency lighting kit (supplied loose) |  |  |  |  |  |
|  | Rotary control switch (unwired) |  |  |  | CPELK ${ }^{1}$ ) | 430.00 |
| Rotary control switch (complete wired loom) |  |  |  |  | CPELK1W ${ }^{1}$ ) | 445.00 |
| Key operated control switch (unwired) |  |  |  |  | CPELK2 ${ }^{1}$ ) | 495.00 |
| Door locks (suit Series 2) |  |  | CL001 |  | CPDHANDLECL001 | 36.50 |
|  |  |  | 92268 |  | CPDHANDLE92268 | 36.50 |
|  |  |  | NSW PWD E LOCK |  | CPDHANDLEELOCK | 290.00 |
|  |  |  | Pad lockable |  | CPDHANDLEPADLCK | 78.00 |
|  |  |  | Non lockable |  | CPDHANDLENOLOCK | 36.50 |
| Spare key (set of 2) |  |  | CL001 x 2 |  | KEYCL001 | 7.80 |
|  |  |  | $92268 \times$ |  | KEY92268 | 7.80 |
|  | Escutcheon Hinge Kit ${ }^{\text {2 }}$ |  |  |  | CPESC | 50.00 |
|  | White liner ${ }^{5}$ ) |  |  |  | CPWIL_ ${ }^{4}$ ) | 83.00 |

Notes: ${ }^{1}$ ) Emergency lighting kits can be field fitted utilising horizontal DIN knockouts at top of board. Kits include control switch, timer, 24 A 4 P N/C contactor, labels and wiring diagram to AS 2293.1.
${ }^{2}$ ) Qty 1 required for size 1-4 enclosure, Qty 2 required for size 5-6 enclosure.
${ }^{3}$ ) Plinth is designed for bottom cable entry; if panelboard is freestanding additional support is required.
${ }^{4}$ ) Insert enclosure size, e.g. size 5 CPWIL5.
${ }^{5}$ ) White insert to transform interior of DB white without having to respray, 2 required per DB.

## CONCEPT•PLUS

Multi-purpose panelboards options and accessories

| Accessories |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Description |  |  | Cat. No. | Price \$ |
| External lighting kits (Time clock, contactor, bypass switch) | 1 channe contacto | mer, 2 N/O 20 A | CPEXTLKC | 300.00 |
|  | 1 channe | 20 A contactor | CPEXTLK1 | 395.00 |
|  | 2 channe | 20 A contactor | CPEXTLK2 | 710.00 |
| Split chassis kit (supplied loose) | CT250 A | CST | STK250ND/TH | 119.00 |
|  | CT355 A | CST | STK300TH | 119.00 |
| Pole fillers | Din-T | CDT | DTPF | 4.30 |
|  | Safe-T | CST | SAFE-TPF | 1.80 |

## Factory fitted options

| Description | Cat. No. | Price \$ |
| :---: | :---: | :---: |
| Connection kits 250 A MCCB to CD chassis | CD250CKT2 | 280.00 |
| 200 A MCCB to NC chassis (Direct) | NCCK200CP ${ }^{1}$ ) | 182.00 |
| 250 A MCCB to NC chassis (TAG) | NCCK250CP ${ }^{1}$ ) | 490.00 |
| Support bracket to mount 250 MCCB | CPBS250 | 83.00 |
| Optional main switches |  |  |
| -160 A DIN switch fuse | ISO3160SFH | 500.00 |
| - 250 A MCCB non-auto | S250NN3 | 500.00 |
| - 250 A MCCB | S250NJ | 1480.00 |
| - 315 A S+S load-break | LE 73151753 | 1090.00 |
| - 400 A MCCB non-auto | S400NN3 | 1650.00 |
| Feeder MCCB |  |  |
| - 125 A 3 pole | DINT10H3125C | 590.00 |
| - 160 A 3 pole | S160NJ3160 | 1080.00 |
| Fault current limiters |  |  |
| - 160 A DIN size 00 | Refer NHP | - |
| - 200 A DIN size 1 | Refer NHP | - |
| Load shedding / emergency power contactor | Refer NHP | - |
| kWh metering IME energy meters | Refer Page | 1-42 |
| Cable duct (fitted) |  |  |
| - CDT ... max. $100 \times 100 \mathrm{~mm}$ | Refer NHP | - |
| - CST ... max. $60 \times 100 \mathrm{~mm}$ | Refer NHP | - |
| Special colours (doors) |  |  |
| - Standard powder coat (per Interpon chart) | Refer NHP | - |

Notes: ${ }^{1}$ ) Connection kit includes, connection tags, terminal covers and bracket.

# CONCEPT•PREMIER <br> <br> Suits Din-T and Safe-T MCBs, E125, S125 and S160, <br> <br> Suits Din-T and Safe-T MCBs, E125, S125 and S160, S250 MCCBs 

 S250 MCCBs}

Standard AS/NZS 3439-3
IP 66 rated enclosure

- 316 Stainless steel option

7 modular sizes 600 mm to 2000 mm

- Very generous amount of wiring room
- Accesssory module
- Type tested busbar/chassis system
- Removable gland plates (with gaskets)
- 3 point door locking on sizes 1000 mm and above
- Thandle door lock
- Flush handle door lock (series 2)
- Australian made
- Commercial, industrial and heavy industrial applications


## Application

The CONCEPT•PREMIER range of Panelboards provides a unique enclosure system for NHP Din-T and Safe-T MCBs and E125, S125 and S160, S250 MCCBs.

## Features

- Two-tone colour scheme, make a colour change by simply changing the door colour
- The door is field changeable from right to left hinged and is totally independent of the escutcheon
- Gloss white hinged escutcheon has been dished to allow a wide range of accessories to fit under the door
- D handles fitted to the lift-off escutcheon to allow easy fitting and removal
- Knockouts provided in the escutcheon for up to 18 modules of standard DIN rail equipment (Din-T \& Safe-T Panelboards only)
- Removable gland plates aid on-site installation of cable and trunking systems
- Compact main switch with a fully enclosed rating of 160 A and 250 A (Din-T and Safe-T Panelboards only)
- Mount up to a CA 6-170 contactor behind the escutcheon or a CA 6-420 in an accessory module wihout an escutcheon
- Dual earth and neutral bars, circuit identification and schedule cards supplied standard
- $30 \%$ Larger gland plate opening in series 2



## CONCEPT•PREMIER <br> Suits Din-T and Safe-T MCBs, E125, S125 and S160, S250 MCCBs

| Technical data |  |
| :---: | :---: |
| Material type: | 1.6 mm steel, polyester powder coated |
|  | 1.6 mm 316 Stainless steel option |
| Colour | Base - Charcoal gloss |
| (AS 2700-1995): | Door - N42 Storm Grey or X15 Orange (other colours refer NHP) <br> Escutcheon - Bright white gloss |
| Protection degree: | IP 30 - without door IP 66 - with door |
| Busbar ratings: | SafeT-250 A CT (355 A option) |
|  | Din-T-250 A CD (355 A option) |
|  | Din-T-250 A NC (400 A option) |
|  | Din-T-250 A GB |
|  | S125 MCCB - 630 A XA (800 A option) |
| Main Switch (options): | Safe-T 100 A non-auto (chassis mount Safe-T) Din-T M/S 80/100 A (chassis mount Din-T) |
| Neutral and earth bars: | $160 \mathrm{~A}, 250 \mathrm{~A}, 400 \mathrm{~A}, 630 \mathrm{~A}, \& 800 \mathrm{~A} 3$ pole 415 V AC (top mount) |
|  | Din-T \& Safe-T Panelboards - (dual bars) $2 \times 8 \mathrm{~mm}$ studs \& 2 screw tunnel terminals ( 16 mm ) <br> MCCBs Panelboards $-2 \times 10 \mathrm{~mm}$ studs, $8 \times 8 \mathrm{~mm}$ studs \& 1 screw tunnel terminals ( 35 mm ) |

## 

## CONCEPT•PREMIER

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with grey door

| Main Switch | Pole capacity | refer to Box size | ction o Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 800 | CPD 18G | 1870.00 |
|  | 24 | 1 | 800 | CPD 24G | 1970.00 |
|  | 36 | 2 | 1000 | CPD 36G | 2180.00 |
|  | 48 | 2 | 1000 | CPD 48G | 2310.00 |
|  | 60 | 3 | 1200 | CPD 60G | 2540.00 |
|  | 72 | 4 | 1400 | CPD 72G | 3100.00 |
|  | 84 | 4 | 1400 | CPD 84G | 3620.00 |
|  | 96 | 5 | 1600 | CPD 96G | 4250.00 |
| 160 A | 18 | 1 | 800 | CPD 18M160G ${ }^{\text {1 }}$ ) | 2120.00 |
|  | 24 | 1 | 800 | CPD 24M160G | 2220.00 |
|  | 36 | 2 | 1000 | CPD 36M160G ${ }^{1}$ ) | 2430.00 |
|  | 48 | 2 | 1000 | CPD 48M160G ${ }^{1}$ ) | 2560.00 |
|  | 60 | 3 | 1200 | CPD 60M160G ${ }^{1}$ ) | 2790.00 |
| 250 A | 18 | 1 | 800 | CPD 18M250G ${ }^{1}$ ) | 2240.00 |
|  | 24 | 1 | 800 | CPD 24M250G ${ }^{1}$ ) | 2340.00 |
|  | 36 | 2 | 1000 | CPD 36M250G ${ }^{1}$ ) | 2550.00 |
|  | 48 | 2 | 1000 | CPD 48M250G | 2690.00 |
|  | 60 | 3 | 1200 | CPD 60M250G ${ }^{1}$ ) | 2920.00 |
|  | 72 | 4 | 1400 | CPD 72M250G ${ }^{\text {1 }}$ ) | 3480.00 |
|  | 84 | 4 | 1400 | CPD 84M250G ${ }^{1}$ ) | 3990.00 |
|  | 96 | 5 | 1600 | CPD 96M250G ${ }^{1}$ ) | 4630.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ') Main switches are supplied loose. i.e. CPD 24 M250 G = CPD 24G + CDT250MS.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT•PREMIER

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with orange door

| Suits <br> Main <br> Switch | MCBs (D <br> Pole capacity | Box size | Height (mm) | Cat. No. ${ }^{2}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 800 | CPD 180 | 1870.00 |
|  | 24 | 1 | 800 | CPD 240 | 1970.00 |
|  | 36 | 2 | 1000 | CPD 360 | 2180.00 |
|  | 48 | 2 | 1000 | CPD 480 | 2310.00 |
|  | 60 | 3 | 1200 | CPD 600 | 2540.00 |
|  | 72 | 4 | 1400 | CPD 720 | 3100.00 |
|  | 84 | 4 | 1400 | CPD 840 | 3620.00 |
|  | 96 | 5 | 1600 | CPD 960 | 4250.00 |
| 160 A | 18 | 1 | 800 | CPD 18M1600 ${ }^{1}$ ) | 2120.00 |
|  | 24 | 1 | 800 | CPD 24M1600 ${ }^{\text { }}$ ) | 2220.00 |
|  | 36 | 2 | 1000 | CPD 36M1600 ${ }^{\text {¹ }}$ | 2430.00 |
|  | 48 | 2 | 1000 | CPD 48M1600 ${ }^{1}$ ) | 2560.00 |
|  | 60 | 3 | 1200 | CPD 60M1600 ${ }^{\text {¹ }}$ | 2790.00 |
| 250 A | 18 | 1 | 800 | CPD 18M2500 ${ }^{\text {1 }}$ ) | 2240.00 |
|  | 24 | 1 | 800 | CPD 24M2500 ${ }^{1}$ ) | 2340.00 |
|  | 36 | 2 | 1000 | CPD 36M2500 ${ }^{1}$ ) | 2550.00 |
|  | 48 | 2 | 1000 | CPD 48M2500 ${ }^{1}$ ) | 2690.00 |
|  | 60 | 3 | 1200 | CPD 60M2500 ${ }^{1}$ ) | 2920.00 |
|  | 72 | 4 | 1400 | CPD 72M2500 ${ }^{1}$ ) | 3480.00 |
|  | 84 | 4 | 1400 | CPD 84M2500 ${ }^{\text {1 }}$ ) | 3990.00 |
|  | 96 | 5 | 1600 | CPD 96M2500 ${ }^{\text {² }}$ ) | 4630.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPD 24 M250 O = CPD 240 + CDT250MS.
${ }^{2}$ ) Enclosures with orange base replace " O " with "OO" e.g. CPD36OO.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT•PREMIER SS

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with stainless steel door
Suits Din-T MCBs (DIN) refer to section one

\begin{tabular}{|c|c|c|c|c|c|}
\hline Main Switch \& Pole capacity \& Box size \& Height (mm) \& Cat. No. \& Price \$ <br>
\hline \multirow[t]{8}{*}{-

- 

-} \& 18 \& 1 \& 800 \& CPD 18SS \& 6850.00 <br>
\hline \& 24 \& 1 \& 800 \& CPD 24SS \& 6950.00 <br>
\hline \& 36 \& 2 \& 1000 \& CPD 36SS \& 7890.00 <br>
\hline \& 48 \& 2 \& 1000 \& CPD 48SS \& 7980.00 <br>
\hline \& 60 \& 3 \& 1200 \& CPD 60SS ${ }^{2}$ ) \& 9050.00 <br>
\hline \& 72 \& 4 \& 1400 \& CPD 72SS ${ }^{2}$ ) \& 10150.00 <br>
\hline \& 84 \& 4 \& 1400 \& CPD 84SS ${ }^{2}$ ) \& 10320.00 <br>
\hline \& 96 \& 5 \& 1600 \& CPD 96SS ${ }^{2}$ ) \& 11100.00 <br>
\hline \multirow{5}{*}{160 A} \& 18 \& 1 \& 800 \& CPD 18M160SS ${ }^{1}$ ) \& 7160.00 <br>
\hline \& 24 \& 1 \& 800 \& CPD 24M160SS ${ }^{1}$ ) \& 7240.00 <br>
\hline \& 36 \& 2 \& 1000 \& CPD 36M160SS ${ }^{1}$ ) \& 8140.00 <br>
\hline \& 48 \& 2 \& 1000 \& CPD 48M160SS ${ }^{1}$ ) \& 8290.00 <br>
\hline \& 60 \& 3 \& 1200 \& CPD 60M160SS ${ }^{1}$ ) \& 9330.00 <br>
\hline \multirow{8}{*}{250 A} \& 18 \& 1 \& 800 \& CPD 18M250SS ${ }^{1}$ ) \& 7310.00 <br>
\hline \& 24 \& 1 \& 800 \& CPD 24M250SS ${ }^{1}$ ) \& 7420.00 <br>
\hline \& 36 \& 2 \& 1000 \& CPD 36M250SS ${ }^{1}$ ) \& 8290.00 <br>
\hline \& 48 \& 2 \& 1000 \& CPD 48M250SS ${ }^{1}$ ) \& 8460.00 <br>
\hline \& 60 \& 3 \& 1200 \& CPD 60M250SS ${ }^{1}$ ) \& 9490.00 <br>
\hline \& 72 \& 4 \& 1400 \& CPD 72M250SS ${ }^{1}$ ) \& 10480.00 <br>
\hline \& 84 \& 4 \& 1400 \& CPD 84M250SS ${ }^{1}$ ) \& 10690.00 <br>
\hline \& 96 \& 5 \& 1600 \& CPD 96M250SS ${ }^{1}$ ) \& 11400.00 <br>
\hline
\end{tabular}

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPD 24 M250 SS = CPD 24SS + CDT250MS.
$\left.{ }^{2}\right)$ Made to order.

- Stainless steel panelboards are fully assembled from stocked components.
- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT•PREMIER

The premium panelboard suits Din-T MCBs
C/W isolation chassis


Din-T - Surface mount with grey door

| Main Switch | Pole capacity | refer to Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 800 | (PGG 24G ${ }^{2}$ ) | 2300.00 |
|  | 36 | 2 | 1000 | (PG 36G ${ }^{2}$ ) | 2600.00 |
|  | 48 | 2 | 1000 | (PPG 48G ${ }^{2}$ ) | 2850.00 |
|  | 60 | 3 | 1200 | CPG 60G ${ }^{2}$ ) | 3200.00 |
|  | 72 | 4 | 1400 | (PGG 72G ${ }^{2}$ ) | 3850.00 |
|  | 84 | 4 | 1400 | (PGG 84G ${ }^{2}$ ) | 4550.00 |
|  | 96 | 5 | 1600 | (PGG 96G ${ }^{2}$ ) | 5250.00 |
| 160 A | 24 | 1 | 800 | CPG 24M160G ${ }^{1}$ ) | 2550.00 |
|  | 36 | 2 | 1000 | CPG 36M160G ${ }^{1}$ ) | 2850.00 |
|  | 48 | 2 | 1000 | CPG 48M160G ${ }^{1}$ ) | 3050.00 |
|  | 60 | 3 | 1200 | CPG 60M160G ${ }^{1}$ ) | 3450.00 |
| 250 A | 24 | 1 | 800 | CPG 24M250G ${ }^{1}$ ) | 2650.00 |
|  | 36 | 2 | 1000 | CPG 36M250G ${ }^{1}$ ) | 2950.00 |
|  | 48 | 2 | 1000 | CPG 48M250G ${ }^{1}$ ) | 3200.00 |
|  | 60 | 3 | 1200 | CPG 60M250G ${ }^{1}$ ) | 3550.00 |
|  | 72 | 4 | 1400 | CPG 72M250G ${ }^{1}$ ) | 4200.00 |
|  | 84 | 4 | 1400 | CPG 84M250G ${ }^{1}$ ) | 4900.00 |
|  | 96 | 5 | 1600 | CPG 96M250G ${ }^{1}$ ) | 5600.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ') Main switches are supplied loose. i.e. CPG 24 M250 G = CPG 24G + EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER

The premium panelboard suits Din-T MCBs
C/W isolation chassis


CONCEPT•PREMIER
Din-T - Surface mount with orange door


| Suits Din-T MCBs (DIN) refer to section one |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Main Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| - | 24 | 1 | 800 | CPG $240{ }^{2}$ ) | 2300.00 |
|  | 36 | 2 | 1000 | (PG 360 ${ }^{2}$ ) | 2600.00 |
|  | 48 | 2 | 1000 | CPG $480{ }^{2}$ ) | 2850.00 |
|  | 60 | 3 | 1200 | CPG 600 ${ }^{2}$ ) | 3200.00 |
|  | 72 | 4 | 1400 | (PGG 720 ${ }^{2}$ ) | 3850.00 |
|  | 84 | 4 | 1400 | CPG 840 ${ }^{2}$ ) | 4550.00 |
|  | 96 | 5 | 1600 | (PGG 960 ${ }^{2}$ ) | 5250.00 |
| 160 A | 24 | 1 | 800 | CPG 24M1600 ${ }^{\text { }}$ ) | 2550.00 |
|  | 36 | 2 | 1000 | CPG 36M1600 ${ }^{\text { }}$ ) | 2850.00 |
|  | 48 | 2 | 1000 | CPG 48M1600 ${ }^{\text { }}$ ) | 3050.00 |
|  | 60 | 3 | 1200 | CPG 60M1600 ${ }^{\text { }}$ ) | 3450.00 |
| 250 A | 24 | 1 | 800 | CPG 24M2500 ${ }^{\text { }}$ ) | 2650.00 |
|  | 36 | 2 | 1000 | CPG 36M2500 ${ }^{\text {1 }}$ ) | 2950.00 |
|  | 48 | 2 | 1000 | CPG 48M2500 ${ }^{\text { }}$ ) | 3200.00 |
|  | 60 | 3 | 1200 | (PGG 60M2500 ${ }^{\text {1 }}$ ) | 3550.00 |
|  | 72 | 4 | 1400 | CPG 72M2500 ${ }^{\text { }}$ ) | 4200.00 |
|  | 84 | 4 | 1400 | CPG 84M2500 ${ }^{\text {1 }}$ ) | 4900.00 |
|  | 96 | 5 | 1600 | CPG 96M2500 ${ }^{\text { }}$ ) | 5600.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ') Main switches are supplied loose. i.e. CPG 24 M250 O = CPG $240+$ EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with grey door


Notes: 400 NC chassis universal feed.

## 

## CONCEPT•PREMIER 2

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with grey door
Suits Din-T MCBs (DIN) refer to section one

| Main Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 800 | CPD 18G2 | 1870.00 |
|  | 24 | 1 | 800 | CPD 24G2 | 1970.00 |
|  | 36 | 2 | 1000 | CPD 36G2 | 2180.00 |
|  | 48 | 2 | 1000 | CPD 48G2 | 2310.00 |
|  | 60 | 3 | 1200 | CPD 60G2 | 2540.00 |
|  | 72 | 4 | 1400 | CPD 72G2 | 3100.00 |
|  | 84 | 4 | 1400 | CPD 84G2 | 3620.00 |
|  | 96 | 5 | 1600 | CPD 96G2 | 4250.00 |
| 160 A | 18 | 1 | 800 | CPD 18M160G2 ${ }^{1}$ ) | 2120.00 |
|  | 24 | 1 | 800 | CPD 24M160G2 ${ }^{1}$ ) | 2220.00 |
|  | 36 | 2 | 1000 | CPD 36M160G2 ${ }^{1}$ ) | 2430.00 |
|  | 48 | 2 | 1000 | CPD 48M160G2 ${ }^{1}$ ) | 2560.00 |
|  | 60 | 3 | 1200 | CPD 60M160G2 ${ }^{1}$ ) | 2790.00 |
| 250 A | 18 | 1 | 800 | CPD 18M250G2 ${ }^{1}$ ) | 2240.00 |
|  | 24 | 1 | 800 | CPD 24M250G2 ${ }^{1}$ ) | 2340.00 |
|  | 36 | 2 | 1000 | CPD 36M250G2 ${ }^{1}$ ) | 2550.00 |
|  | 48 | 2 | 1000 | CPD 48M250G2 ${ }^{1}$ ) | 2690.00 |
|  | 60 | 3 | 1200 | CPD 60M250G2 ${ }^{1}$ ) | 2920.00 |
|  | 72 | 4 | 1400 | CPD 72M250G2 ${ }^{1}$ ) | 3480.00 |
|  | 84 | 4 | 1400 | CPD 84M250G2 ${ }^{1}$ ) | 3990.00 |
|  | 96 | 5 | 1600 | CPD 96M250G2 ${ }^{\text { }}$ ) | 4630.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ') Main switches are supplied loose. i.e. CPD 24 M250 G = CPD 24G + EVA3250H.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT.PREMIER 2

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with orange door
Suits Din-T MCBs (DIN) refer to section one

| Main <br> Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 800 | CPD 1802 | 1870.00 |
|  | 24 | 1 | 800 | CPD 2402 | 1970.00 |
|  | 36 | 2 | 1000 | CPD 3602 | 2180.00 |
|  | 48 | 2 | 1000 | CPD 4802 | 2310.00 |
|  | 60 | 3 | 1200 | CPD 6002 | 2540.00 |
|  | 72 | 4 | 1400 | CPD 7202 | 3100.00 |
|  | 84 | 4 | 1400 | CPD 8402 | 3620.00 |
|  | 96 | 5 | 1600 | CPD 9602 | 4250.00 |
| 160 A | 18 | 1 | 800 | CPD 18M16002 ${ }^{1}$ ) | 2120.00 |
|  | 24 | 1 | 800 | CPD 24M16002 ${ }^{1}$ ) | 2220.00 |
|  | 36 | 2 | 1000 | CPD 36M16002 ${ }^{1}$ ) | 2430.00 |
|  | 48 | 2 | 1000 | CPD 48M16002 ${ }^{1}$ ) | 2560.00 |
|  | 60 | 3 | 1200 | CPD 60M16002 ${ }^{1}$ ) | 2790.00 |
| 250 A | 18 | 1 | 800 | (PD 18M25002 ${ }^{1}$ ) | 2240.00 |
|  | 24 | 1 | 800 | CPD 24M25002 ${ }^{1}$ ) | 2340.00 |
|  | 36 | 2 | 1000 | CPD 36M25002 ${ }^{1}$ ) | 2550.00 |
|  | 48 | 2 | 1000 | CPD 48M25002 ${ }^{1}$ ) | 2690.00 |
|  | 60 | 3 | 1200 | CPD 60M25002 ${ }^{1}$ ) | 2920.00 |
|  | 72 | 4 | 1400 | (PD 72M25002 ${ }^{1}$ ) | 3480.00 |
|  | 84 | 4 | 1400 | (PD 84M25002 ${ }^{1}$ ) | 3990.00 |
|  | 96 | 5 | 1600 | (PD 96M25002 ${ }^{1}$ ) | 4630.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ') Main switches are supplied loose. i.e. CPD 24 M250 O = CPD $240+$ EVA3250H.

- Enclosures with orange base replace "O" with "OO" e.g. CPD3600.
- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER 2 SS

The premium panelboard suits Din-T MCBs


CONCEPT•PREMIER
Din-T - Surface mount with stainless steel door
Suits Din-T MCBs (DIN) refer to section one

| Main Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 18 | 1 | 800 | CPD 18SS2 | 6850.00 |
|  | 24 | 1 | 800 | CPD 24SS2 | 6950.00 |
|  | 36 | 2 | 1000 | CPD 36SS2 | 7890.00 |
|  | 48 | 2 | 1000 | CPD 48SS2 | 7980.00 |
|  | 60 | 3 | 1200 | CPD 60SS2 ${ }^{2}$ ) | 9050.00 |
|  | 72 | 4 | 1400 | (PD 72SS2 ${ }^{2}$ ) | 10150.00 |
|  | 84 | 4 | 1400 | CPD 84SS2 ${ }^{2}$ ) | 10320.00 |
|  | 96 | 5 | 1600 | (PD 96SS2 ${ }^{2}$ ) | 11100.00 |
| 160 A | 18 | 1 | 800 | CPD 18M160SS2 ${ }^{1}$ ) | 7160.00 |
|  | 24 | 1 | 800 | CPD 24M160SS2 ${ }^{1}$ ) | 7240.00 |
|  | 36 | 2 | 1000 | CPD 36M160SS ${ }^{1}$ ) | 8140.00 |
|  | 48 | 2 | 1000 | CPD 48M160SS2 ${ }^{1}$ ) | 8290.00 |
|  | 60 | 3 | 1200 | CPD 60M160SS2 ${ }^{1}$ ) | 9330.00 |
| 250 A | 18 | 1 | 800 | CPD 18M250SS2 ${ }^{1}$ ) | 7310.00 |
|  | 24 | 1 | 800 | CPD 24M250SS ${ }^{1}$ ) | 7420.00 |
|  | 36 | 2 | 1000 | CPD 36M250SS2 ${ }^{1}$ ) | 8290.00 |
|  | 48 | 2 | 1000 | CPD 48M250SS2 ${ }^{1}$ ) | 8460.00 |
|  | 60 | 3 | 1200 | CPD 60M250SS ${ }^{1}$ ) | 9490.00 |
|  | 72 | 4 | 1400 | CPD 72M250SS2 ${ }^{1}$ ) | 10480.00 |
|  | 84 | 4 | 1400 | CPD 84M250SS2 ${ }^{1}$ ) | 10690.00 |
|  | 96 | 5 | 1600 | CPD 96M250SS2 ${ }^{1}$ ) | 11400.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPD 24 M250 SS2 = CPD 24SS2 + EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER 2

The premium panelboard suits Din-T MCBs
C/W isolation chassis


CONCEPT•PREMIER
Din-T - Surface mount with grey door

## Suits Din-T MCBs (DIN) refer to section one

| Main Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Surch-- | 24 | 1 | 800 | (PPG 24G2 ${ }^{2}$ ) | 2300.00 |
|  | 36 | 2 | 1000 | (PGG6G2 ${ }^{2}$ ) | 2600.00 |
|  | 48 | 2 | 1000 | (PPG 48G2 ${ }^{2}$ ) | 2850.00 |
|  | 60 | 3 | 1200 | (PPG 60G2 ${ }^{2}$ ) | 3200.00 |
|  | 72 | 4 | 1400 | (PGG72G2 ${ }^{\text {) }}$ | 3850.00 |
|  | 84 | 4 | 1400 | (PPG 84G2 ${ }^{2}$ ) | 4550.00 |
|  | 96 | 5 | 1600 | (PGG 96G2 ${ }^{2}$ ) | 5250.00 |
| 160 A | $\underline{24}$ | 1 | 800 | CPG 24M160G2 ${ }^{1}$ ) | 2550.00 |
|  | 36 | 2 | 1000 | (PPG 36M160G2 ${ }^{1}$ ) | 2850.00 |
|  | 48 | 2 | 1000 | CPG 48M160G2 ${ }^{1}$ ) | 3050.00 |
|  | 60 | 3 | 1200 | CPG 60M160G2 ${ }^{1}$ ) | 3450.00 |
| 250 A | 24 | 1 | 800 | CPG 24M250G2 ${ }^{1}$ ) | 2650.00 |
|  | 36 | 2 | 1000 | CPG 36M250G2 ${ }^{1}$ ) | 2950.00 |
|  | 48 | 2 | 1000 | CPG 48M250G2 ${ }^{1}$ ) | 3200.00 |
|  | 60 | 3 | 1200 | CPG 60M250G2 ${ }^{1}$ ) | 3550.00 |
|  | 72 | 4 | 1400 | CPG 72M250G2 ${ }^{1}$ ) | 4200.00 |
|  | 84 | 4 | 1400 | CPG 84M250G2 ${ }^{1}$ ) | 4900.00 |
|  | 96 | 5 | 1600 | CPG 96M250G2 ${ }^{1}$ ) | 5600.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPG 24 M250 G2 $=$ CPG $24 \mathrm{G} 2+$ EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER 2

The premium panelboard suits Din-T MCBs
C/W isolation chassis


Din-T - Surface mount with orange door

| Suits <br> Main <br> Switch | MCBs (D <br> Pole capacity | refer to Box size | ection o <br> Height <br> (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 800 | CPG 2402 ${ }^{2}$ ) | 2300.00 |
|  | 36 | 2 | 1000 | (PPG 3602 ${ }^{2}$ ) | 2600.00 |
|  | 48 | 2 | 1000 | CPG 4802 ${ }^{2}$ ) | 2850.00 |
|  | 60 | 3 | 1200 | CPG 6002 ${ }^{2}$ ) | 3200.00 |
|  | 72 | 4 | 1400 | CPG 7202 ${ }^{2}$ ) | 3850.00 |
|  | 84 | 4 | 1400 | CPG 8402 ${ }^{2}$ ) | 4550.00 |
|  | 96 | 5 | 1600 | CPG 9602 ${ }^{2}$ ) | 5250.00 |
| 160 A | 24 | 1 | 800 | CPG 24M16002 ${ }^{1}$ ) | 2550.00 |
|  | 36 | 2 | 1000 | CPG 36M16002 ${ }^{1}$ ) | 2850.00 |
|  | 48 | 2 | 1000 | CPG 48M16002 ${ }^{1}$ ) | 3050.00 |
|  | 60 | 3 | 1200 | CPG 60M16002 ${ }^{1}$ ) | 3450.00 |
| 250 A | 24 | 1 | 800 | CPG 24M25002 ${ }^{1}$ ) | 2650.00 |
|  | 36 | 2 | 1000 | CPG 36M25002 ${ }^{1}$ ) | 2950.00 |
|  | 48 | 2 | 1000 | CPG 48M25002 ${ }^{1}$ ) | 3200.00 |
|  | 60 | 3 | 1200 | CPG 60M25002 ${ }^{1}$ ) | 3550.00 |
|  | 72 | 4 | 1400 | CPG 72M25002 ${ }^{1}$ ) | 4200.00 |
|  | 84 | 4 | 1400 | CPG 84M25002 ${ }^{1}$ ) | 4900.00 |
|  | 96 | 5 | 1600 | CPG 96M25002 ${ }^{1}$ ) | 5600.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPG 24 M250 O2 $=$ CPG $2402+$ EVA3250H.
$\left.{ }^{2}\right)$ Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT•PREMIER

The premium panelboard suits Safe-T MCBs


Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPS 24 M250 G = CPS 24G + EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## CONCEPT•PREMIER

The premium panelboard suits Safe-T MCBs


Safe-T - Surface mount with orange door
Suits Safe-T MCBs (NEMA) refer to section one

| Main Switch | Pole capacity | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | 24 | 1 | 800 | CPS $240{ }^{2}$ ) | 2060.00 |
|  | 36 | 2 | 1000 | CPS 360 ${ }^{2}$ ) | 2260.00 |
|  | 48 | 3 | 1200 | CPS $480{ }^{2}$ ) | 2410.00 |
|  | 60 | 4 | 1400 | CPS $600^{2}$ ) | 2580.00 |
|  | 72 | 5 | 1600 | CPS $720^{2}$ ) | 3220.00 |
|  | 96 | 6 | 1800 | CPS $960{ }^{2}$ ) | 4360.00 |
| 160 A | 24 | 1 | 800 | CPS 24M1600 ${ }^{1}$ ) | 2310.00 |
|  | 36 | 2 | 1000 | CPS 36M1600 ${ }^{1}$ ) | 2510.00 |
|  | 48 | 3 | 1200 | CPS 48M1600 ${ }^{1}$ ) | 2660.00 |
|  | 60 | 4 | 1400 | CPS 60M1600 ${ }^{1}$ ) | 2830.00 |
| 250 A | 24 | 1 | 800 | CPS 24M2500 ${ }^{1}$ ) | 2440.00 |
|  | 36 | 2 | 1000 | CPS 36M2500 ${ }^{1}$ ) | 2640.00 |
|  | 48 | 3 | 1200 | CPS 48M2500 ${ }^{1}$ ) | 2780.00 |
|  | 60 | 4 | 1400 | CPS 60M2500 ${ }^{1}$ ) | 2960.00 |
|  | 72 | 5 | 1600 | CPS 72M2500 ${ }^{1}$ ) | 3590.00 |
|  | 96 | 6 | 1800 | CPS 96M2500 ${ }^{1}$ ) | 4730.00 |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: ${ }^{1}$ ) Main switches are supplied loose. i.e. CPS 24 M250 O = CPS $240+$ EVA3250H.
${ }^{2}$ ) Made to order.

- Larger main switches and other options and accessories available.
- Refer NHP for delivery confirmation regarding types with main switches.


## 

## CONCEPT•PREMIER CPX

The premium panelboard
Suits E125, S125 MCCBs


CONCEPT•PREMIER CPX
MCCB - Surface mount with grey door

| Pole cap. | Box size | Height (mm) | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 18 | 2 | 1000 | CPX18G ${ }^{\mathbf{~}}$ ) | $\mathbf{3 6 8 0 . 0 0}$ |
| 24 | 2 | 1000 | CPX24G $^{\mathbf{1}}$ ) | $\mathbf{4 1 0 0 . 0 0}$ |
| 36 | 3 | 1200 | CPX36G ${ }^{\mathbf{1}}$ ) | $\mathbf{4 4 6 0 . 0 0}$ |
| 42 | 4 | 1400 | CPX42G | $\mathbf{4 8 8 0 . 0 0}$ |
| 48 | 4 | 1400 | CPX48G | $\mathbf{4 9 3 0 . 0 0}$ |
| 60 | 5 | 1600 | CPX60G | $\mathbf{5 2 9 0 . 0 0}$ |
| 72 | 6 | 1800 | CPX72G | $\mathbf{5 7 1 0 . 0 0}$ |

## CONCEPT•PREMIER CPX

MCCB - Surface mount with orange door

| Pole cap. | Box size | Height (mm) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 18 | 2 | 1000 | CPX180 ${ }^{1}$ ) | 3680.00 |
| 24 | 2 | 1000 | CPX240 ${ }^{1}$ ) | 4100.00 |
| 36 | 3 | 1200 | CPX360 | 4460.00 |
| 42 | 4 | 1400 | CPX420 | 4880.00 |
| 48 | 4 | 1400 | CPX480 | 4930.00 |
| 60 | 5 | 1600 | CPX600 | 5290.00 |
| 72 | 6 | 1800 | CPX720 | 5710.00 |

## CONCEPT•PREMIER CPX

MCCB - Surface mount stainless steel

| Pole cap. | Box size | Height (mm) | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 18 | 2 | 1000 | CPX18SS | $\mathbf{8 5 6 0 . 0 0}$ |
| 24 | 2 | 1000 | CPX24SS | $\mathbf{8 7 7 0 . 0 0}$ |
| 36 | 3 | 1200 | CPX36SS | $\mathbf{1 0 2 2 0 . 0 0}$ |
| 42 | 4 | 1400 | CPX42SS | $\mathbf{1 1 4 6 0 . 0 0}$ |
| 48 | 4 | 1400 | CPX48SS | $\mathbf{1 1 6 7 0 . 0 0}$ |
| 60 | 5 | 1600 | CPX60SS | $\mathbf{1 3 1 2 0 . 0 0}$ |
| 72 | 6 | 1800 | CPX72SS | $\mathbf{1 4 2 7 0 . 0 0}$ |

Width $=640 \mathrm{~mm}$, Depth $=240 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: CPX panelboards are fully assembled from stocked components. Cat. No. refers to panelboard suitable for E125, S125 MCCBs. Refer to NHP for panelboard suitable for S160, S250 MCCBs. ${ }^{1}$ ) Units stocked.

## CONCEPT•PREMIER

The premium panelboard options and accessories

| $\begin{aligned} & \text { Box } \\ & \text { size } \end{aligned}$ | Height (mm) | Pole cap. | With escutcheon Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| H | 600 | 24 | CPPACC24G | 1030.00 |
| H | 600 | 48 | CPPACC48G | 1060.00 |
| Box size | Height (mm) |  | Without escutcheon Cat. No. ${ }^{1}$ ) | Price \$ |
| H | 600 |  | CPPACCG | 950.00 |
| Box size | Height (mm) |  | With blank escutcheon Cat. No. ${ }^{1}$ ) | Price \$ |
| H | 600 |  | CPPACCGE | 1020.00 |
| 1 | 800 |  | CPPACCS1GE | 1250.00 |
| 2 | 1000 |  | CPPACCS2GE | 1450.00 |
| 3 | 1200 |  | CPPACCS3GE | 1660.00 |
| 4 | 1400 |  | CPPACCS4GE | 1970.00 |
| 5 | 1600 |  | CPPACCS5GE | 2280.00 |
| 6 | 1800 |  | CPPACCS6GE | 2590.00 |
| 7 | 2000 |  | CPPACCS7GE | 2910.00 |
| Width $=640 \mathrm{~mm}$ Depth $=240 \mathrm{~mm}$ includes door (Door $=20 \mathrm{~mm}$ )Gear trays to suit Accessory Module |  |  |  |  |
|  |  |  |  |  |
| White mounting plate Height (mm) |  |  | Cat. No. | Price \$ |
| 94 |  |  | CPBGTS1 | 46.50 |
| 194 |  |  | CPBGTS2 | 67.50 |
| 294 |  |  | CPBGTS3 | 88.00 |
| 494 |  |  | CPBGTSH | 114.00 |
| 594 |  |  | CPBGTS4 | 145.00 |
| 994 |  |  | CPBGTS6 | 230.00 |

Gear trays for Concept Premier must be 200 mm shorter than enclosure size.
Earth and neutral bar kit to suit Accessory Module

| No Ways | Cat. No. | Price \$ |
| :--- | ---: | ---: |
| 24 | CEN24 | $\mathbf{8 8 . 0 0}$ |
| 36 | CEN36 | $\mathbf{9 5 . 0 0}$ |
| 48 | CEN48 | $\mathbf{1 1 8 . 0 0}$ |
| 60 | CEN60 | $\mathbf{1 4 4 . 0 0}$ |
| 72 | CEN72 | $\mathbf{1 5 8 . 0 0}$ |
| 84 | CEN84 | $\mathbf{1 9 3 . 0 0}$ |
| 96 | CEN96 | $\mathbf{2 1 5 . 0 0}$ |

Includes 2 bars, mounting supports and fasteners.
Notes: ') Replace " $G$ " with " $\mathrm{O}^{\prime}$ for orange door, replace " G with "SS" for stainless steel.

## SP46 Janmesisit Lowood SRE cEElectricalnnistalatienneßBaMAnual

## CONCEPT•PREMIER 2

The premium panelboard options and accessories


Accessory modules

| Box <br> size | Height <br> $(\mathrm{mm})$ | Pole <br> cap. | With <br> escutcheon <br> Cat. No. $\left.{ }^{\prime}\right)$ | Price \$ |
| :--- | :--- | :--- | :--- | ---: |

Width $=640 \mathrm{~mm}$ Depth $=240 \mathrm{~mm}$ includes door $($ Door $=20 \mathrm{~mm})$

## Notes: ') Replace " $\mathrm{G}^{\prime}$ with " $\mathrm{O}^{\prime}$ for orange door, replace " G with " SS " for stainless steel.

## CONCEPT•PREMIER

The premium panelboard options and accessories

Options and accessories
Description
Cat. No.
Price $\$$



[^5]
## 

## CONCEPT•PREMIER

The premium panelboard
Options and accessories

| Accessories |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Description |  |  | Cat. No. | Price \$ |
| Top mount main switch kit (supplied loose) | 160 A 3 pole | CPD | CDT160MS | 305.00 |
|  |  | CPG, CPS | EVA3160H | 305.00 |
|  | 250 A 3 pole | CPD | CDT250MS | 435.00 |
|  |  | CPG, CPS | EVA3250H | 435.00 |
| Blue cover to suit 160 A and 250 A isolator |  |  | 1LS2VS | 12.00 |
| Split chassis kits | CPD | CD chassis | STKCD | 119.00 |
|  | CPS | $\begin{aligned} & \text { CT chassis } \\ & 250 \mathrm{~A} \\ & \hline \end{aligned}$ | STK250NDTH | 119.00 |
|  | CPS | $\begin{aligned} & \text { CT chassis } \\ & 355 \mathrm{~A} \\ & \hline \end{aligned}$ | STK300TH | 119.00 |
| Connection kits | 250 A MCCB to CD chassis |  | CD250CKT2 | 280.00 |
|  | 200 A MCCB to NC chassis (Direct) |  | NCCK200CPP | 187.00 |
|  | 250 A MCCB to NC chassis (TAG) |  | NCCK250CPP | 500.00 |
|  | 400 A MCCB to NC chassis (TAG) |  | NCCK400CPP | 590.00 |
|  | 400 A SLB to NC chassis (TAG) |  | NCCK4002CPP | 820.00 |
| Support bracket to mount S250 |  |  | CPPBS250 | 83.00 |
| Pole Fillers |  | Din-T | DTPF | 4.30 |
|  |  | Safe-T | SAFETPF | 1.80 |
|  |  | S 125 | XAB2 | 3.80 |
|  |  | S 250 | XAB3 | 3.80 |
| Door handles (T handle) |  | CL001 | CPPDCL001 | 67.50 |
|  |  | 92268 | CPPD92268 | 78.00 |
| Tee-off plastic caps |  | CD-Din-T | CD250TOPC | 0.60 |
|  |  | NC-Din-T | NC250TOPC | 0.80 |
|  |  | GB-Din-T | GBTOC |  |
|  |  | Safe-T | TH250TOPC | 0.60 |
| Spare Key (set of 2) |  | CL001 | KEYCL001 | 7.80 |
|  |  | 92268 | KEY92268 | 7.80 |
| NSW PWD E lock (series 1) |  |  | CPPPWDNSW | 295.00 |
| Traffolite labelling available |  |  | REFER NHP | - |
| Special paint colour |  |  | REFER NHP | - |
| PVC wiring duct |  |  | REFER NHP | - |
| kWh meter |  |  | REFER PAGE 1-42 | - |

# CONCEPT•TOUGH <br> The heavy-duty panelboard <br> Suits Din-T MCBs, E125, S125 and S160, S250 MCCBs 

Standard AS/NZS 3439.3

IP 66 rated enclosure

- 2.0 mm fully welded construction

316 Stainless steel option

- 6 mm Aluminium gland plates
- 4 modular sizes 500 mm to 2000 mm

E Very generous amounts of wiring room

- Type tested busbar/chassis system
- Removable gland plates (with gaskets)
- Lift-off hinged escutcheon
- Chrome hinges and door handle
- 3 point door locking
- Australian made
- Padlockable door handle
- Commercial, industrial and heavy industrial applications


## Application

The CONCEPT•TOUGH range of Panelboards provides a unique enclosure system for NHP Din-T MCBs, E125, S125 and S160, S250 MCCBs.

## Features

- The lift-off hinged door is totally independent of the escutcheon.
- Generous space between door and escutcheon to allow a wide range of accessories/locking facilities to fit behind the door.
- D handles fitted to the lift-off escutcheon to allow easy fitting and removal.
- Knockouts provided in the escutcheon for up to 18 modules of standard DIN rail equipment (Din-T Panelboards only)
- Removable gland plates aid on-site installation of cable and trunking systems.
- Compact main switch with a fully enclosed rating of 160 A and 250 A (Din-T Panelboards only).
- Large gland plates to allow for incoming/outgoing cables.
- Dual earth and neutral bars, circuit identification and two schedule cards supplied standard.
- 6 mm aluminum gland plate


## CONCEPT•TOUGH

## The heavy-duty panelboard

Suits Din-T MCBs, E125, S125 and S160, S250 MCCBs

## Technical data

| Material type: | 2.0 mm steel, polyester powder coated |
| :--- | :--- |
|  | 6 mm Aluminium gland plates |
|  | 2.0 mm 316 Stainless steel option |
| Colour | Base - Orange gloss / Charcoal gloss |

(AS 2700-1995): Door - X15 Orange or N42 Storm Grey (other colours refer NHP)
Escutcheon - Bright white gloss
Protection degree: IP 40 - without door
IP 66 - with door
Busbar ratings: Din-T Panelboards - 250 A CD chassis ( 355 A option)

- 250 A NC chassis (400 A option)

S 125 MCCBs Panelboard - 630 A (std), 36 kA for 1 second

- 800 A (optional)

| Main switch | Din-T M/S 80/100 A (chassis mount Din-T) |
| :--- | :--- |
| (options): | $160 \mathrm{~A}, 250 \mathrm{~A}, 400 \mathrm{~A}, 630 \mathrm{~A} \& 800 \mathrm{~A} 3$ pole 415 V AC |
| (top mount) |  |

S 125 MCCBs Panrlboard $2 \times 10 \mathrm{~mm}$ studs, $8 \times 8 \mathrm{~mm}$ studs \& 1 screw tunnel terminals $(35 \mathrm{~mm}) 400 \mathrm{~A}$

## 

## CONCEPT•TOUGH

## The heavy-duty panelboard Suits Din-T MCBs

CONCEPT•TOUGH


Din-T - Surface mount orange

| Pole capacity | Box size | Height $(\mathbf{m m})$ | Cat. No. ${ }^{\text {1 }}$ ) | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 18 | 2 | 1000 | CTD180 | $\mathbf{5 9 1 0 . 0 0}$ |
| 24 | 2 | 1000 | CTD240 | $\mathbf{6 2 3 0 . 0 0}$ |
| 36 | 2 | 1000 | CTD360 | $\mathbf{6 5 4 0 . 0 0}$ |
| 48 | 2 | 1000 | CTD480 | $\mathbf{6 7 4 0 . 0 0}$ |
| 60 | 3 | 1500 | CTD600 | $\mathbf{8 0 9 0 . 0 0}$ |
| 72 | 3 | 1500 | CTD720 | $\mathbf{8 5 1 0 . 0 0}$ |
| 84 | 3 | 1500 | CTD840 | $\mathbf{8 9 2 0 . 0 0}$ |
| 96 | 3 | 1500 | CTD960 | $\mathbf{9 2 3 0 . 0 0}$ |

CONCEPT•TOUGH
Din-T - Surface mount stainless steel-orange

| Pole capacity | Box size | Height $(\mathbf{m m})$ | Cat. No. $\left.{ }^{\text { }}\right)$ | Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 18 | 2 | 1000 | CTD18SSO | $\mathbf{2 0 0 2 0 . 0 0}$ |
| 24 | 2 | 1000 | CTD24SSO | $\mathbf{2 0 2 3 0 . 0 0}$ |
| 36 | 2 | 1000 | CTD36SSO | $\mathbf{2 0 2 7 0 . 0 0}$ |
| 48 | 2 | 1000 | CTD48SSO | $\mathbf{2 0 5 8 0 . 0 0}$ |
| 60 | 3 | 1500 | CTD60SSO | $\mathbf{2 4 0 1 0 . 0 0}$ |
| 72 | 3 | 1500 | CTD72SSO | $\mathbf{2 4 3 2 0 . 0 0}$ |
| 84 | 3 | 1500 | CTD84SSO | $\mathbf{2 4 5 3 0 . 0 0}$ |
| 96 | 3 | 1500 | CTD96SSO | $\mathbf{2 4 7 3 0 . 0 0}$ |

Delete "O" for raw stainless enclosure e.g. CTD18SS.
CONCEPT•TOUGH
Accessory modules with orange doors

| Pole capacity | Box size | Height $(\mathbf{m m})$ | Cat. No. $\left.{ }^{1}\right)$ | Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 0 | 1 | 500 | CTACCO | $\mathbf{3 9 9 0 . 0 0}$ |
| 24 | 1 | 500 | CTACC24HO ${ }^{2}$ ) | $\mathbf{4 2 5 0 . 0 0}$ |
| 24 | 1 | 500 | CTACC24O | $\mathbf{4 2 5 0 . 0 0}$ |

Width $=800 \mathrm{~mm}$, Depth $=300 \mathrm{~mm}$ includes door. $($ Door $=20 \mathrm{~mm})$

Notes: 1) CTD panelboard are fully assembled from stocked components. Correct box size when fitting 160 A or 250 A isolator. Made to order.
$\left.{ }^{2}\right) 24$ pole horizontal on DIN Rail (18P suit lock DIN, 3P suit STD DIN).

## CONCEPT•TOUGH

## The heavy-duty panelboard

Suits E125, S125 MCCBs


CONCEPT•TOUGH

\begin{tabular}{|c|c|c|c|c|c|}
\hline Main switch \& Pole capacity \& $$
\begin{aligned}
& \text { Box } \\
& \text { size }
\end{aligned}
$$ \& Height (mm) \& Cat. No. \& Price \$ <br>
\hline \multirow[t]{6}{*}{-

_} \& 18 \& 2 \& 1000 \& CTX180 \& 7420.00 <br>
\hline \& 24 \& 2 \& 1000 \& CTX240 \& 7680.00 <br>
\hline \& 36 \& 3 \& 1500 \& CTX360 \& 8140.00 <br>
\hline \& 48 \& 3 \& 1500 \& CTX480 \& 8660.00 <br>
\hline \& 60 \& 3 \& 1500 \& CTX600 \& 11050.00 <br>
\hline \& 72 \& 4 \& 2000 \& CTX720 \& 11620.00 <br>

\hline \multirow{6}{*}{$$
\begin{aligned}
& 400 \mathrm{~A} \\
& \mathrm{~S} 400 \mathrm{CJ}
\end{aligned}
$$} \& 18 \& 3 \& 1500 \& CTX18M4000 \& POA <br>

\hline \& 24 \& 3 \& 1500 \& CTX24M4000 \& POA <br>
\hline \& 36 \& 3 \& 1500 \& CTX36M4000 \& POA <br>
\hline \& 48 \& 4 \& 2000 \& CTX48M4000 \& POA <br>
\hline \& 60 \& 4 \& 2000 \& CTX60M4000 \& POA <br>
\hline \& 72 \& 4 \& 2000 \& CTX72M4000 \& POA <br>
\hline
\end{tabular}

CONCEPT•TOUGH
MCCB - Surface mount stainless steel-orange

| Main <br> switch | Pole <br> capacity | Box <br> size | Height <br> $(\mathbf{m m})$ | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
|  | 18 | 2 | 1000 | CTX18SSO | $\mathbf{2 3 2 9 0 . 0 0}$ |
|  | 24 | 2 | 1000 | CTX24SSO | $\mathbf{2 3 6 0 0 . 0 0}$ |
|  | 36 | 3 | 1500 | CTX36SSO | $\mathbf{2 4 1 2 0 . 0 0}$ |
|  | 48 | 3 | 1500 | CTX48SSO | $\mathbf{2 4 5 9 0 . 0 0}$ |
|  | 30 | 3 | 1500 | CTX60SSO | $\mathbf{2 9 6 2 0 . 0 0}$ |
|  | 72 | 4 | 2000 | CTX72SSO | $\mathbf{3 0 1 9 0 . 0 0}$ |

Width $=800 \mathrm{~mm}$, Depth $=300 \mathrm{~mm}$ includes door. (Door $=20 \mathrm{~mm}$ )
Delete " O " for raw stainless steel enclosure e.g. CTX18SS.

Notes: Made to order.
CTX panelboards are fully assembled from stocked components.
Cat. No. refers to Panelboard suitable for E125, S125 MCCB.
Refer to NHP for Panelboard suitable for S160, S250 MCCB.

## Panelboard hardware

to suit the CONCEPT family of panelboards
with Din-T or Safe-T MCBs
Earth and neutral bars - 165 A

| No. <br> tunnels | Numbering | Single screw <br> Cat. No. | Price \$ | Double screw <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: | :--- | ---: |
| 18 | $1-18$ | TGPEN181S | $\mathbf{5 5 . 0 0}$ | TGPEN182S | $\mathbf{5 7 . 0 0}$ |
| 24 | $1-24$ | TGPEN241S | $\mathbf{6 5 . 5 0}$ | TGPEN242S | $\mathbf{6 7 . 5 0}$ |
| 30 | $1-30$ | - | - | TGPEN302S | $\mathbf{8 3 . 0 0}$ |
| 36 | $1-36$ | - | - | TGPEN362S | $\mathbf{9 3 . 5 0}$ |
| 42 | $1-42$ | - | - | TGPEN422S | $\mathbf{9 3 . 5 0}$ |
| 48 | $1-48$ | - | - | TGPEN482S | $\mathbf{9 8 . 5 0}$ |
| 60 | $1-60$ | - | - | TGPEN602S | $\mathbf{1 3 5 . 0 0}$ |
| 72 | $1-72$ | - | - | TGPEN722S | $\mathbf{1 6 1 . 0 0}$ |
| 84 | $1-84$ | - | - | TGPEN842S | $\mathbf{1 9 7 . 0 0}$ |
| 96 | $1-96$ | - | - | TGPEN962S | $\mathbf{2 3 5 . 0 0}$ |


|  | Numbering <br> Pole cap.(odd/even) | Double screw <br> odd numbers <br> Cat. No. | Price $\mathbf{\$}$ | Double screw <br> even numbers <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 9 | $1-17 \& 2-18$ | TGPEN92SODD | $\mathbf{4 1 . 5 0}$ | TGPEN92SEVE | $\mathbf{4 1 . 5 0}$ |
| 18 | $1-35 \& 2-36$ | TGPEN182SODD | $\mathbf{6 2 . 5 0}$ | TGPEN182SEVE | $\mathbf{6 2 . 5 0}$ |
| 24 | $1-47 \& 2-48$ | TGPEN242SODD | $\mathbf{7 2 . 5 0}$ | TGPEN242SEVE | $\mathbf{7 2 . 5 0}$ |
| 30 | $1-59 \& 2-60$ | TGPEN302SODD | $\mathbf{8 8 . 0 0}$ | TGPEN302SEVE | $\mathbf{8 8 . 0 0}$ |
| 36 | $1-71 \& 2-72$ | TGPEN362SODD | $\mathbf{1 0 4 . 0 0}$ | TGPEN362SEVE $\mathbf{1 0 4 . 0 0}$ |  |
| 42 | $1-83 \& 2-84$ | TGPEN422SODD | $\mathbf{1 1 4 . 0 0}$ | TGPEN422SEVE $\mathbf{1 1 4 . 0 0}$ |  |
| 48 | $1-95 \& 2-96$ | TGPEN482SODD | $\mathbf{1 2 5 . 0 0}$ | TGPEN482SEVE $\mathbf{1 2 5 . 0 0}$ |  |

165 A bars $-2 \times \mathrm{M} 8$ studs \& $2 \times 25 \mathrm{~mm}$ tunnel terminals, remainder 2 screw 16 mm terminals

Earth and neutral bars - 300 A

| No. <br> tunnels | Numbering | Single screw <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: |
| $\mathbf{1 8}$ | $1-18$ | CPEN18 | $\mathbf{8 8 . 0 0}$ |
| 24 | $1-24$ | CPEN24 | $\mathbf{1 0 1 . 0 0}$ |
| 36 | $1-36$ | CPEN36 | $\mathbf{1 3 0 . 0 0}$ |
| 48 | $1-48$ | CPEN48 | $\mathbf{1 4 0 . 0 0}$ |
| 60 | $1-60$ | CPEN60 | $\mathbf{1 7 1 . 0 0}$ |
| 72 | $1-72$ | CPEN72 | $\mathbf{1 9 2 . 0 0}$ |
| 84 | $1-84$ | CPEN84 | $\mathbf{2 2 5 . 0 0}$ |
| 96 | $1-96$ | CPEN96 | $\mathbf{2 6 5 . 0 0}$ |



## Panelboard hardware to suit the CONCEPT family of panelboards with Din-T or Safe-T MCBs

| Pole capacity | Numbering (odd/even) | Double screw odd numbers Cat. No. | Price \$ | Double screw even numbers Cat. No. | Price $\$ 2$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 9 | 1-17 \& 2-18 | CPEN9ODD | 78.00 | CPEN9EVE | 78.00 |
| 18 | 1-35 \& 2-36 | CPEN180DD | 98.50 | CPEN18EVE | 98.50 |
| 24 | 1-47 \& 2-48 | CPEN240DD | 111.00 | CPEN24EVE | 111.00 |
| 30 | 1-59 \& 2-60 | CPEN300DD | 130.00 | CPEN30EVE | 130.00 |
| 36 | 1-71 \& 2-72 | CPEN360DD | 140.00 | CPEN36EVE | 140.00 |
| 48 | 1-95 \& 2-96 | CPEN480DD | 150.00 | CPEN48EVE | 150.00 |

300 A bars- $2 \times \mathrm{M} 10 \& 2 \times \mathrm{M} 8$ studs and $6 \times 25 \mathrm{~mm}$ tunnel terminals, remainder 2 screw 16 mm terminals.
(Studs suitable for $2 \times 185 \mathrm{~mm}$ lugs and 50 mm and 70 mm lugs)

Earth and neutral bars - 400 A rated

| Ways | (Hex head screws) | Tunnel terminals | Double screw even numbers Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 8 way | $2 \times \mathrm{M} 10 \& 8 \times \mathrm{M} 8$ studs | - | CPXEN8 | 109.00 |
| 12 way | $\begin{aligned} & 2 \times \mathrm{M} 10 \& 8 \times \mathrm{M} 8 \\ & \text { studs } \end{aligned}$ | $4 \times 35 \mathrm{~mm}^{2}$ tunnel term. | CPXEN12 | 140.00 |
| 18 way | $\begin{aligned} & 2 \times \mathrm{M} 10 \& 8 \times \mathrm{M} 8 \\ & \text { studs } \end{aligned}$ | $10 \times 35 \mathrm{~mm}^{2}$ tunnel term. | CPXEN18 | 250.00 |
| 36 way | $3 \times \mathrm{M} 10 \& 8 \times \mathrm{M} 8$ studs | $28 \times 35 \mathrm{~mm}^{2}$ tunnel term. | CPXEN36 | 320.00 |

## Extras

| Description | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| Neutral bar extension-suits 165 A E/N bars | NEB185 | $\mathbf{8 8 . 0 0}$ |
| -connection $2 \times 185$ mm lugs | $\mathbf{8 8 . 0 0}$ |  |
| Neutral bar extension - 300 A - suits 165 A E/N | NEB33S | $\mathbf{8 . 9 0}$ |
| Neutral bar mounting insulators (pair) | TGPINS | $\mathbf{4 . 2 0}$ |
| Neutral bar insulated support (each) | CPBMN | $\mathbf{3 . 0 0}$ |
| A4 Schedule card | CPSCHEDULECARD | $\mathbf{1 3 . 0 0}$ |
| Schedule card holder (plastic) | CPSCHEDULEHOLD | $\mathbf{4 6 . 5 0}$ |
| Touch-up paint charcoal | spray can 150 g | $\mathbf{3 9 2 . 0 0 0 0 1}$ |
| Touch-up paint grey | spray can 150 g | $\mathbf{3 9 2 . 3 5 5 5 4}$ |
| Touch-up paint orange $\quad$ spray can 150 g | $\mathbf{3 9 2 . 3 5 5 5 5}$ | $\mathbf{4 6 . 5 0}$ |
| Touch-up paint bright white spray can 150 g | $\mathbf{3 9 2 . 0 0 0 0 2}$ | $\mathbf{4 6 . 5 0}$ |

# NC Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs 

Standard AS/NZS 3439-1
-
Current rating 250 A and 400 A
Encapsulated busbar (no insulation coating required)
Withstand rating $250 \mathrm{~A} / 25 \mathrm{kA} 0.1 \mathrm{~s}$ ( 20 kA 0.3 s )

- Withstand rating $400 \mathrm{~A} / 30 \mathrm{kA} 0.1 \mathrm{~s}$ ( 25 kA 0.3 s )

Busbar direct connect to 160 A \& 250 A switch

- Top and bottom feed standard (top feed only pictured)
- Tee-offs $50 \%$ capped
- IP 20 (maintained when fitted with 160 A \& 250 A switch)
- IP 20 Connection kits to 250 A MCCB
- Interchangeable with CD chassis



## Application

The Concept range of busbar chassis assemblies have been specifically designed for incorporation into the Concept family of panelboards, providing a secure mounting platform and connection system for the NHP Din-T range of MCBs. The busbars are fully enclosed therefore not requiring an insulated coating for electrical isolation. The new NC chassis are type tested and are mounted on a box section steel pan, powdercoated white.

CONCEPT Din-T-250 chassis
Suits Din-T MCBs ( 18 mm pole pitch)

| Pole <br> capacity | Cut-out <br> length $(\mathrm{mm})$ | Pan height <br> $\left.(\mathrm{mm})^{2}\right)$ | Cat. No. $\left.{ }^{1}\right)$ | 250 A <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 12 | 111 | 134 | NC212/183U | $\mathbf{2 0 0 . 0 0}$ |
| 18 | 165 | 188 | NC218/183U | $\mathbf{2 2 5 . 0 0}$ |
| 24 | 219 | 242 | NC224/183U | $\mathbf{2 8 0 . 0 0}$ |
| 30 | 273 | 296 | NC230/183U | $\mathbf{3 1 0 . 0 0}$ |
| 36 | 327 | 350 | NC236/183U | $\mathbf{3 5 0 . 0 0}$ |
| 42 | 381 | 404 | NC242/183U | $\mathbf{3 8 0 . 0 0}$ |
| 48 | 435 | 458 | NC248/183U | $\mathbf{4 2 5 . 0 0}$ |
| 54 | 489 | 512 | NC254/183U | $\mathbf{4 7 5 . 0 0}$ |
| 60 | 543 | 566 | NC260/183U | $\mathbf{4 9 5 . 0 0}$ |
| 72 | 651 | 674 | NC272/183U | $\mathbf{6 6 0 . 0 0}$ |
| 78 | 705 | 728 | NC278/183U | $\mathbf{7 8 0 . 0 0}$ |
| 84 | 759 | 782 | NC284/183U | $\mathbf{8 5 0 . 0 0}$ |
| 96 | 867 | 890 | NC296/183U | $\mathbf{9 9 0 . 0 0}$ |

[^6]
# NC Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs 

CONCEPT Din-T - 400 A chassis
Suits Din-T MCBs ( 18 mm pole pitch)

| Pole <br> capacity | Cut-out <br> length $(\mathrm{mm})$ | Pan height <br> $\left.(\mathrm{mm})^{2}\right)^{2}$ | Cat. No. $\left.{ }^{1}\right)$ | 400 A <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 12 | 111 | 134 | NC412/183U | $\mathbf{3 7 5 . 0 0}$ |
| 18 | 165 | 188 | NC418/183U | $\mathbf{4 2 5 . 0 0}$ |
| 24 | 219 | 242 | NC424/183U | $\mathbf{4 8 0 . 0 0}$ |
| 30 | 273 | 296 | NC430/183U | $\mathbf{5 4 0 . 0 0}$ |
| 36 | 327 | 350 | NC436/183U | $\mathbf{5 8 0 . 0 0}$ |
| 42 | 381 | 404 | NC442/183U | $\mathbf{6 2 0 . 0 0}$ |
| 48 | 435 | 458 | NC448/183U | $\mathbf{7 1 0 . 0 0}$ |
| 54 | 489 | 512 | NC454/183U | $\mathbf{7 5 0 . 0 0}$ |
| 60 | 543 | 566 | NC460/183U | $\mathbf{7 9 0 . 0 0}$ |
| 72 | 651 | 674 | NC472/183U | $\mathbf{9 3 0 . 0 0}$ |
| 78 | 705 | 728 | NC478/183U | $\mathbf{1 0 0 0 . 0 0}$ |
| 84 | 759 | 782 | NC484/183U | $\mathbf{1 0 9 0 . 0 0}$ |
| 96 | 867 | 890 | NC496/183U | $\mathbf{1 2 5 0 . 0 0}$ |
| 108 | 975 | 998 | NC4108/183TF | $\mathbf{1 3 8 0 . 0 0}$ |

CONCEPT Din-T-250 A chassis 4P
Suits Din-T 2P RCBOs ( 18 mm pole pitch)

| Pole capacity | Cut-out ' $\mathrm{C}^{\prime}$ length (mm) | Pan height $\left.(\mathrm{mm})^{2}\right)$ | Cat. No. ${ }^{1}$ ) | $\begin{array}{r} 250 \text { A } \\ \text { Price } \end{array}$ |
| :---: | :---: | :---: | :---: | :---: |
| 24 | 219 | 242 | NC224/184U | 430.00 |
| 36 | 327 | 350 | NC236/184U | 520.00 |
| 48 | 435 | 458 | NC248/184U | 630.00 |
| 60 | 543 | 566 | NC260/184U | 750.00 |
| 72 | 651 | 674 | NC272/184U | 980.00 |

Chassis colours - Red, Black, White, Black, Blue, Black
CONCEPT Din-T-250 A chassis 3P+N
Suits Din-T 4P MCBs ( 18 mm pole pitch)

| Pole <br> capacity | Cut-out 'C' <br> length $(\mathbf{m m})$ | Pan height <br> $\left.(\mathrm{mm})^{2}\right)$ | Cat. No. ${ }^{\text {1 }}$ ) | $\mathbf{2 5 0} \mathbf{A}$ <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 24 | 219 | 242 | NC224183PNU | $\mathbf{4 3 0 . 0 0}$ |
| 48 | 435 | 458 | NC248183PNU | $\mathbf{6 3 0 . 0 0}$ |
| 72 | 651 | 674 | NC272183PNU | $\mathbf{9 8 0 . 0 0}$ |
| 96 | 887 | 890 | NC296183PNU | $\mathbf{1 3 3 0 . 0 0}$ |

[^7]
## 

## NC Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs

CONCEPT Din-T - 400 A chassis

| Suits Din-T10 <br> Pole capacity | H MCBs ( 27 m <br> Cut-out 'C' length (mm) | m pole pitch Pan height $\left.(\mathrm{mm})^{2}\right)$ | Cat. No. ${ }^{1}$ ) | $\begin{array}{r} 400 \mathrm{~A} \\ \text { Price } \$ \\ \hline \end{array}$ |
| :---: | :---: | :---: | :---: | :---: |
| 6 | 84 | 107 | NCH46/273U | 385.00 |
| 12 | 165 | 188 | NCH412/273U | 560.00 |
| 18 | 244 | 267 | NCH418/273U | 760.00 |
| 24 | 327 | 350 | NCH424/273U | 920.00 |

CONCEPT Din-T - 400 A chassis
Suits Din-T MCBs and Din-T10H MCBs ( $27 / 18 \mathrm{~mm}$ pole pitch)

| Pole capacity $\mathbf{2 7} \mathrm{mm}$ | Pole capacity 18 mm | Cut-out ' $\mathrm{C}^{\prime}$ <br> length <br> (mm) | Pan height $\left.(\mathrm{mm})^{2}\right)$ | Cat. No. ${ }^{1}$ ) | $\begin{array}{r} 400 \mathrm{~A} \\ \text { Price \$ } \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 | 12 | 192 | 215 | NCH46/1227/183U | 500.00 |
| 6 | 24 | 300 | 323 | NCH46/2427/183U | 560.00 |
| 6 | 36 | 408 | 431 | NCH46/3627/183U | 590.00 |
| 6 | 48 | 516 | 539 | NCH46/4827/183U | 630.00 |
| 12 | 30 | 435 | 458 | NCH412/3027/183U | 660.00 |
| 12 | 42 | 543 | 566 | NCH412/4227/183U | 790.00 |
| 12 | 60 | 705 | 728 | NCH412/6027/183U | 980.00 |

CONCEPT Din-T 250 A chassis $1 \mathrm{P}+\mathrm{N}$ (DC)
Suits 2P Din-T DC MCBs ( 18 mm pitch)

| Pole <br> capacity | Cut-out 'C' <br> length $(\mathbf{m m})$ | Pan height <br> $(\mathbf{m m})$ | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | :--- |
| 24 | 219 | 242 | NC224182U | $\mathbf{2 8 0 . 0 0}$ |
| 36 | 327 | 350 | NC236182U | $\mathbf{3 5 0 . 0 0}$ |
| 48 | 435 | 458 | NC248182U | $\mathbf{4 2 5 . 0 0}$ |
| 60 | 543 | 566 | NC260182U | $\mathbf{4 9 5 . 0 0}$ |

Chassis colours - Red and black.

## Escutcheon critical cut-out dimensions



[^8]
## NC Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs

Accessories for NC chassis


## Connection kits

| S160, E/S 250 MCCB direct connect to NC <br> Chassis | NCCK200 | $\mathbf{1 3 5 . 0 0}$ |
| :--- | :--- | ---: |
| S160, E/S 250 MCCB TAG connect to NC chassis | NCCK250 | $\mathbf{3 5 5 . 0 0}$ |
| E/S 400 MCCB TAG connect to NC chassis | NCCK400 | $\mathbf{5 1 0 . 0 0}$ |
| SLB 400 TAG connect to NC chassis | NCCK4002 | $\mathbf{7 2 0 . 0 0}$ |
| Support bracket to mount S250 | NCS250GT | $\mathbf{7 8 . 0 0}$ |
| Support bracket 400 A chassis NCCK400 | CPPBNC400GT | $\mathbf{4 1 . 5 0}$ |

# GB Isolation Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs 

Standard AS/NZS 3439.1

Current rating 250 A 3 P \& 4P
Tee-Off isolator (AC20)
Integrated and switchable $4^{\text {th }}$ pole
Padlocking option

- Enclosed busbar
- 1, 2, 3 \& 4 pole toggle conversion kit
- Withstand rating 250 A Icw 25 kA 0.1 S and 10 kA 1.0 S
- Withstand rating 250 A Icc 63 kA - S250PE
- Busbar direct connect 160 A \& 250 A switch
- IP 20 direct connect switch and MCCB connection kits

- Interchangeable with NC or CD chassis

The Concept range of busbar chassis assemblies have been specifically designed for incorporation into the Concept family of panelboards, providing a secure mounting platform and connection system for the NHP Din-T range of MCBs. The busbars are fully enclosed therefore not requiring an insulated coating for electrical isolation. The new GB chassis has an isolation switch for each individual TEE-OFF, are type tested and are mounted on a box section steel pan, powdercoated white.

CONCEPT Din-T - 250 A chassis
Suits Din-T MCBs ( 18 mm pole pitch)

| Connection | Pole capacity | Cut-out length (mm) | Bar Height $(\mathrm{mm})^{2}$ ) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Top Feed ${ }^{1}$ ) | 12 | 110 | 140 | GB212183TF | 450.00 |
|  | 24 | 218 | 248 | GB224183TF | 610.00 |
|  | 36 | 326 | 356 | GB236183TF | 790.00 |
|  | 48 | 434 | 464 | GB248183TF | 960.00 |
|  | 60 | 542 | 572 | GB260183TF | 1150.00 |
|  | 72 | 650 | 680 | GB272183TF | 1350.00 |
|  | 84 | 758 | 788 | GB284183TF | 1610.00 |
|  | 96 | 866 | 896 | GB296183TF | 1810.00 |
| Universal Feed | 18 | 110 | 140 | GB212183U | 560.00 |
|  | $\underline{24}$ | 218 | 248 | GB224183U | 720.00 |
|  | 36 | 326 | 356 | GB236183U | 910.00 |
|  | 48 | 434 | 464 | GB248183U | 1080.00 |
|  | 60 | 542 | 572 | GB260183U | 1270.00 |
|  | 72 | 650 | 680 | GB272183U | 1470.00 |
|  | 84 | 758 | 788 | GB284183U | 1730.00 |
|  | 96 | 866 | 896 | GB296183U | 1930.00 |

Notes: ${ }^{1}$ ) For bottom feed replace TF with BF.
${ }^{2}$ ) Add 41 mm for busbar tags at top or bottom as applicable.
Chassis cannot be split, use a top feed and bottom feed in lieu.

# GB Isolation Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs 

CONCEPT Din-T - 250 A chassis 4 pole Suits Din-T 2P RCBOs ( 18 mm pole pitch)

|  | Pole <br> Connection <br> capacity | Cut-out ' ${ }^{\prime}$ ' <br> length <br> $(\mathbf{m m})$ | Pan <br> Height <br> $\left.(\mathbf{m m})^{2}\right)$ | Cat. No. 1) | Price \$ |
| :--- | :--- | :--- | :--- | :--- | ---: |

Chassis colours - Red, Black, White, Black, Blue, Black
CONCEPT Din-T-250 A chassis 3PN
Suits Din-T 4P MCBs ( 18 mm pole pitch)

| Connection | Pole capacity | Cut-out ' $C^{\prime}$ length (mm) | Pan Height $(\mathrm{mm})^{2}$ ) | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Top Feed ') | 24 | 218 | 248 | GB224183PNTF | 790.00 |
|  | 48 | 434 | 464 | GB248183PNTF | 1220.00 |
|  | 72 | 650 | 680 | GB272183PNTF | 1700.00 |
|  | 96 | 866 | 896 | GB296183PNTF | 2250.00 |
| Universal Feed | 24 | 218 | 248 | GB224183PNU | 980.00 |
|  | 48 | 434 | 464 | GB248183PNU | 1440.00 |
|  | 72 | 650 | 680 | GB272183PNU | 1900.00 |
|  | 96 | 866 | 896 | GB296183PNU | 2450.00 |

Chassis colours - Red, White, Blue, Black
CONCEPT Din-T - 250 A chassis 1P + N (DC)
Suits 2P Din-T DC MCBs ( 18 mm pole pitch)

| Connection | Pole capacity | Cut-out ' ${ }^{\prime}$ ' length mm | Pan Height (mm) ${ }^{2}$ ) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Top Feed ${ }^{1)}$ | 24 | 218 | 248 | GB224182TF | 610.00 |
|  | 48 | 434 | 464 | GB248182TF | 960.00 |
|  | 72 | 650 | 680 | GB272182TF | 1350.00 |
|  | 96 | 866 | 896 | GB296182TF | 1810.00 |

Chassis colours - Red and Black

[^9]
# GB Isolation Chassis <br> Concept Panelboard busbar chassis assemblies for Din-T MCBs 

CONCEPT Din-T - 250 A chassis
Suits 1P Din-T MCBs (18 mm pole pitch)

| Connection | Pole capacity | Cut-out ' ${ }^{\prime}$ ' length mm | Pan Height $(\mathrm{mm})^{2}$ ) | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Top Feed ${ }^{1}$ ) | 24 | 218 | 248 | GB224181TF | 610.00 |
|  | 48 | 434 | 464 | GB248181TF | 960.00 |
|  | 72 | 650 | 680 | GB272181TF | 1350.00 |
|  | 96 | 866 | 896 | GB296181TF | 1810.00 |

Chassis colours - Red
Accessories for GB chassis

|  | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| Description | GBTOC | $\mathbf{1 . 5 0}$ |
| Bee-off cap | GBBBC | $\mathbf{4 . 0 0}$ |
| Busbar cap | GBLM | $\mathbf{5 0 . 0 0}$ |
| Padlock mechanism (factory fit) | GBTB1 | $\mathbf{2 . 0 0}$ |
| Togglebar 1P | GBTB2 | $\mathbf{2 . 0 0}$ |
| Togglebar 2P | GBTB3 | $\mathbf{2 . 0 0}$ |
| Togglebar 3P | GBTB4 | $\mathbf{2 . 0 0}$ |
| Togglebar 4P | GBSPP3P | $\mathbf{5 . 0 0}$ |
| Back cover 3P - Katko switch | GBSPP4P | $\mathbf{6 . 0 0}$ |
| Back cover 4P - Katko switch | GBIB | $\mathbf{5 . 0 0}$ |
| Interpole barrier | DINTT100 | $\mathbf{1 0 . 0 0}$ |
| Through terminal 100 A | GBL148L | $\mathbf{1 0 . 0 0}$ |
| Label escutcheon 1-47 LH | GBL148R | $\mathbf{1 0 . 0 0}$ |
| Label escutcheon 2-48 RH | GBL4996L | $\mathbf{1 0 . 0 0}$ |
| Label escutcheon 49-95 LH | GBL4996R | $\mathbf{1 0 . 0 0}$ |
| Label escutcheon 50-96 RH | GBPL3P | $\mathbf{2 . 0 0}$ |
| Label - R,W,B main bars 3P | GBPL4P | $\mathbf{2 . 0 0}$ |
| Label - R, W, B, N main bar 4P | GBUSL | $\mathbf{2 . 0 0}$ |
| Label - blank pole label |  |  |

[^10]
## CD Chassis <br> Concept•Plus and Concept•Premier busbar chassis assemblies for Din-T MCBs

■ Standard AS/NZS 3439.1

- Current rating 250 A and 355 A
- Withstand rating $250 \mathrm{~A} / 20 \mathrm{kA}$ for $0.2 \mathrm{sec}(9 \mathrm{kA}$ for 1 sec$)$
- Withstand rating $355 \mathrm{~A} / 25 \mathrm{kA}$ for $0.3 \mathrm{sec}(20 \mathrm{kA}$ for 1 sec$)$
- Splayed busbar to suit 160 A \& 250 A switch
- Top and bottom feed
- Tee-offs stripped and $50 \%$ capped
- Top power feed stripped and capped
- Full 35 mm DIN rail, improved MCB mounting security
- Improved insulation coating


## Application

The Concept range of busbar chassis assemblies have been specifically designed for incorporation into the Concept•Plus and Concept•Premier range of multipurpose panelboards, providing a secure mounting platform and connection system for the NHP Din-T range of MCBs. The busbars are fully dipped and type tested and are mounted on a box section steel pan, powder coated white.

CONCEPT Din-T-250 A chassis
Suits Din-T MCBs ( 18 mm pole pitch)

| Pole capacity | Cut-out ' ${ }^{\prime}$ ' length (mm) | Pan height (mm) ${ }^{1}$ ) | Cat. No. | 250 A <br> Price $\$$ |
| :---: | :---: | :---: | :---: | :---: |
| 12 | 110 | 152 | CD212/183U | 200.00 |
| 18 | 164 | 206 | CD218/183U | 225.00 |
| 24 | 218 | 260 | CD224/183U | 265.00 |
| 30 | 272 | 314 | CD230/183U | 310.00 |
| 36 | 326 | 368 | CD236/183U | 350.00 |
| 42 | 380 | 422 | CD242/183U | 380.00 |
| 48 | 434 | 476 | CD248/183U | 425.00 |
| 54 | 488 | 530 | CD254/183U | 475.00 |
| 60 | 542 | 584 | CD260/183U | 495.00 |
| 72 | 650 | 692 | CD272/183U | 660.00 |
| 78 | 704 | 746 | CD278/183U | 780.00 |
| 84 | 758 | 800 | CD284/183U | 850.00 |
| 96 | 866 | 908 | CD296/183U | 990.00 |

[^11]
## 

## CD Chassis

Concept•Plus and Concept•Premier busbar chassis assemblies for Din-T MCBs

CONCEPT Din-T - 400 A chassis
Suits Din-T MCBs ( 18 mm pole pitch)

| Pole <br> capacity <br> Cut-out 'C' <br> length <br> $(\mathbf{m m})$Pan height <br> $\left.(\mathbf{m m})^{\prime}\right)$ | Cat. No. | $\mathbf{3 5 5} \mathbf{A}$ <br> Price \$ |  |  |
| :--- | :--- | :--- | :--- | ---: |
| $\mathbf{1 2}$ | 110 | 152 | CD312/183U | $\mathbf{3 4 0 . 0 0}$ |
| 18 | 164 | 206 | CD318/183U | $\mathbf{3 8 5 . 0 0}$ |
| 24 | 218 | 260 | CD324/183U | $\mathbf{4 4 0 . 0 0}$ |
| 30 | 272 | 314 | CD330/183U | $\mathbf{4 9 5 . 0 0}$ |
| 36 | 326 | 368 | CD336/183U | $\mathbf{5 3 0 . 0 0}$ |
| 42 | 380 | 422 | CD342/183U | $\mathbf{5 7 0 . 0 0}$ |
| 48 | 434 | 476 | CD348/183U | $\mathbf{6 5 0 . 0 0}$ |
| 54 | 488 | 530 | CD354/183U | $\mathbf{6 8 0 . 0 0}$ |
| 60 | 542 | 584 | CD360/183U | $\mathbf{7 2 0 . 0 0}$ |
| 72 | 650 | 692 | CD372/183U | $\mathbf{8 5 0 . 0 0}$ |
| 78 | 704 | 746 | CD378/183U | $\mathbf{9 1 0 . 0 0}$ |
| 84 | 758 | 800 | CD384/183U | $\mathbf{1 0 0 0 . 0 0}$ |
| 96 | 866 | 908 | CD396/183U | $\mathbf{1 1 3 0 . 0 0}$ |

CONCEPT Din-T 355 A chassis
Suits Din-T and Din-T10H MCBs ( $27 / 18 \mathrm{~mm}$ pole pitch)

| Pole <br> cap. <br> $\mathbf{2 7} \mathbf{m m}$ | Pole <br> cap. <br> $\mathbf{1 8} \mathbf{m m}$ | Cut-out <br> length <br> 'C' $(\mathbf{m m})$ | Pan <br> Height <br> $(\mathbf{m m})$ | Cat. No. ${ }^{\text {' }}$ ) |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 6 | 12 | 191 | 228 | CDH36/1227/183U | $\mathbf{4 9 0 . 0 0}$ |
| 6 | 24 | 299 | 380 | CDH36/2427/183U | $\mathbf{5 5 0 . 0 0}$ |
| 6 | 36 | 407 | 488 | CDH36/3627/183U | $\mathbf{5 8 0 . 0 0}$ |
| 12 | 30 | 434 | 471 | CDH312/3027/183U | $\mathbf{6 4 0 . 0 0}$ |
| 12 | 42 | 542 | 579 | CDH312/4227/183U | $\mathbf{7 7 0 . 0 0}$ |
| 12 | 60 | 704 | 741 | CDH312/6027/183U | $\mathbf{9 5 0 . 0 0}$ |

Accessories CD chassis

| Description | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| Split tariff kit 250/355 A (supplied loose) | STKCD | $\mathbf{1 1 9 . 0 0}$ |
| Split tariff kit (supplied \& fitted) | REFER NHP | - |
| Plastic tee-off cap 250/355 A | CD250TOPC | $\mathbf{0 . 6 0}$ |

[^12]
## CT Chassis <br> Concept•Plus and Concept•Premier busbar chassis assemblies for Safe-T MCBs

■ Standard AS/NZS 3439.1

- Current rating 250 A and 355 A
- Withstand rating $250 \mathrm{~A} / 20 \mathrm{kA}$ for 0.2 sec
- Withstand rating $355 \mathrm{~A} / 20 \mathrm{kA}$ for 1 sec
- Splayed busbar to suit 160 A \& 250 A switch
- Top and bottom feed
- Tee-offs stripped and $50 \%$ capped
- Top power feed stripped and capped
- 25 mm pole pitch, Safe-T MCBs
- Improved insulation coating


CONCEPT Safe-T-250 \& 355 A chassis
Suits Safe-T MCBs

| Pole capacity | Cut-out 'C <br> length <br> (mm) | Pan height $\left.(\mathrm{mm})^{1}\right)^{2}$ ) | Cat. No. | $\begin{array}{r} 250 \mathrm{~A} \\ \text { Price \$ } \\ \hline \end{array}$ |
| :---: | :---: | :---: | :---: | :---: |
| 12 | 147 | 221 | CT 212/253 | 225.00 |
| 18 | 222 | 296 | CT 218/253 | 255.00 |
| 24 | 297 | 371 | CT 224/253 | 280.00 |
| 30 | 372 | 446 | CT 230/253 | 295.00 |
| 36 | 447 | 521 | CT 236/253 | 370.00 |
| 42 | 522 | 596 | CT 242/253 | 395.00 |
| 48 | 597 | 671 | CT 248/253 | 440.00 |
| 60 | 747 | 821 | CT 260/253 | 540.00 |
| 72 | 897 | 971 | CT 272/253 | 740.00 |
| 84 | 1047 | 1121 | CT 284/253 | 830.00 |
| 96 | 1197 | 1271 | CT 296/253 | 1020.00 |

[^13]
## CT Chassis <br> Concept•Plus and Concept•Premier busbar <br> chassis assemblies for Safe-T MCBs

| Pole capacity | Cut-out ' $C^{\prime}$ length (mm) | Pan height $\left.\left.(\mathrm{mm})^{1}\right)^{2}\right)$ | Cat. No. | 355 A <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 12 | 147 | 221 | CT 312/253 | 370.00 |
| 18 | 222 | 296 | CT 318/253 | 425.00 |
| 24 | 297 | 371 | CT 324/253 | 495.00 |
| 30 | 372 | 446 | CT 330/253 | 540.00 |
| 36 | 447 | 521 | CT 336/253 | 590.00 |
| 42 | 522 | 596 | CT 342/253 | 680.00 |
| 48 | 597 | 671 | CT 348/253 | 750.00 |
| 60 | 747 | 821 | CT 360/253 | 860.00 |
| 72 | 897 | 971 | CT 372/253 | 1030.00 |
| 84 | 1047 | 1121 | CT 384/253 | 1120.00 |
| 96 | 1197 | 1271 | CT 396/253 | 1220.00 |

Accessories CT chassis

| Description | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| Split tariff kit 250 A (supplied loose) | STK250ND/TH | $\mathbf{1 1 9 . 0 0}$ |
| Split tariff kit (supplied and fitted) | REFER NHP | - |
| Plastic tee-off cap 250/355 A | TH250TOPC | $\mathbf{0 . 6 0}$ |

Escutcheon critical cut-out dimensions - CT type


Notes: ${ }^{1}$ ) Add 25 mm for flared busbar at top of chassis.
${ }^{2}$ ) Add 22 mm for straight busbar at bottom of chassis.
4 pole and other special configurations available to special order refer NHP.

## 

## Panelboard DIN switch-fuse

## Features

- Compact size suited for panelboard use
- Fuse covers are supplied standard
- Non-captive escutcheon mounting handle supplied standard


Ordering details

| Description | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 160 A fuse switch 3 P | ISO 3160SFH | $\mathbf{5 0 0 . 0 0}$ |
| 200 mm extension shaft ${ }^{1}$ ) | L2000KT | $\mathbf{2 9 . 6 0}$ |

Technical data
Fuse switch ratings
ISO 3160 SFH
Rated insulation voltage, Ui (V) 1000
$\begin{array}{ll}\text { Rated impulse withstand voltage, Uimp (kV) } & 12\end{array}$
Rated thermal current, Ith (A) 160
Rated operational voltage, Ue (V) 690
Rated operational current, le (A)
AC 21/22 $415 \mathrm{~V} \quad 160$

| AC 23 | 415 V |
| :--- | :--- |
| 125 |  |

Rated fused short circuit current
Back-up fuse (A)160
RMS value (kA) ..... 50
Peak value (kA) ..... 11
Rated short circuit making capacity (kA) ..... 11
Rated breaking capacity (A) ..... 1000
Mechanical data
Electrical endurance (no. of ops) ..... 2000
Mechanical endurance (no. of ops) ..... 20000
Terminals/bolt size $\mathrm{Cu}\left(\mathrm{mm}^{2}\right)$ ..... 6-70
Maximum terminal torque (Nm) ..... 4.5
Fuse type ..... DIN size 00
Weight, less fuses (kg) ..... 1.5

Notes: ${ }^{1}$ ) Extension shaft required for CONCEPT•PREMIER panelboards.

## Modular panelboards

Concept•Plus and Concept•Premier form a highly featured innovative range of panelboards for commercial and industrial applications. The widely accepted Concept-Plus can be used for a variety of indoor applications, while the Concept•Premier is suited to indoor or outdoor use. Application versatility is also increased because panelboards can be combined with accessory modules or simply bolted together to form custom modular constructions combining power distribution and control equipment.


Maximum contactor size in panelboard CONCEPT•PLUS: CA 7-85 (85 A AC 3)
CONCEPT•PREMIER: CA 6-180 (170 A AC 3)
*The above modular panelboard represents one possible combination of enclosures and equipment.

## TemBreak 1 and 2 MCCBs

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## The TemBreak 1 \& 2 product lines

## TemBreak 2

Moulded Case Circuit Breakers
Rated current $\left(\mathrm{I}_{\mathrm{n}}\right)$ from 12 A to 1600 A .
Breaking Capacity ( $\mathrm{I}_{\mathrm{cu}}$ ) from 25 kA to 200 kA at $400 / 415 \mathrm{~V} \mathrm{AC}$.


TemBreak 1
Moulded Case Circuit Breakers
Rated current $\left(I_{n}\right)$ from 630 A to 3200 A.
Breaking Capacity ( $\mathrm{I}_{\mathrm{cu}}$ ) from 50 kA to 125 kA at $400 / 415 \mathrm{~V} \mathrm{AC}$.


800 A


3200 A

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2

## Easy selection guide - TemBreak 2 MCCBs

 The TemBreak 2 range of products includes:- Moulded Case Circuit Breakers (MCCBs)
- Earth Leakage MCCBs
- Switch-Disconnectors in the same compact moulded case frame sizes as MCCBs
- A comprehensive range of accessories which are common to MCCBs and Switch-Disconnectors. All internal accessories are common to all frame sizes.


## Catalogue Number construction



# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## About TemBreak 2

1. Field installable accessories

3


- Accessories can be fitted by the switchboard builder or added by the end-user. All internal accessories are common for TemBreak 2 MCCBs.
- Handles and motor operators can be rapidly fitted using the locking pegs. It takes less than 10 seconds to secure a handle or motor to the MCCB.
- All accessories are endurance tested to the same level as the host MCCB.

2. Higher kA ratings in Small Frame sizes

125 A Frame models now feature versions to 65 kA , while 250 A Frame models go to 200 kA .

3. Modular and Common sizes

All current ratings up to 1600 A can be supplied in 9 frame sizes.

- 400 A and 630 A MCCB are a common size. (400 AF)
- The compact 125 A size offers the same features and performance but with reduced dimensions.
- 800/ 1000 are a common size1250/ 1600 A common height and width
- 160/250 A common size


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## About TemBreak 2


5. Increased Thermal-Magnetic flexibility


Overload protection is adjustable between $63 \%$ and $100 \%$ of the rating.
Short-circuit protection is adjustable on all thermal magnetic models.
Short-circuit protection settings are suitable for motor starting on all models, including the compact 125 A and 250 A frames.
6. Electronic protection in a 250 A Frame


The adjustability of an electronic MCCB in a 250 A Frame MCCB. OCR Ratings range from 16 A to 250 A .

# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## About TemBreak 2

7. 250 A Frame MCCBs:

12 A-250 A on a common chassis

3

8. Compact Transfer Switches


250 AF MCCBs are available ranging from:

- 12 A - 250 A @ 25, 30 kA (E/S 160-250)
- $32 \mathrm{~A}-250 \mathrm{~A} @ 36,65 \mathrm{kA}(\mathrm{S} 160-250)$
- $16 \mathrm{~A}-250 \mathrm{~A} @ 70 \mathrm{kA}$ (S250PE)

A mechanical interlock is used with two MCCBs, and is compatible with motor operators and handles. An automatic changeover system can be assembled by a switchboard builder or end-user, from components. Alternatively, pre-assembled transfer switches are available.

Changeover pair with link interlock and motor operators


Viewed from side (250 A frame)

## 9. Transfer Switch Controller options



- Timer / Relay controller TLP2 - offers a simple system of logic control from easy to obtain NHP components
- Temlogic 2 electronic controller for transfer switches. (TL101)
- Suitable for Tembreak 1 and 2 MCCBs.


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## About TemBreak 2

10. Visual safety


Coloured indicators display the ON or OFF status. The indicators are fully covered if the breaker trips, so that black is the only visible colour.
11. Direct opening


Under the heading "Measures to minimise the risk in the event of failure", IEC 60204-1 Safety of Machinery-Electrical Equipment of Machinery includes the following recommendation:
■ "-the use of switching devices having positive (or direct) opening operation."

- MCCBs, motors, auxiliaries, alarms (heavy duty) are all direct opening


## 12. ZS Integral Earth Leakage MCCB

The Terasaki earth leakage MCCB is contained
 within a standard 125/160/250/400/630/800 A frame size.

## 13. Metering MCCBs

- TemBreak 2 metering \& Modbus comms MCCBs 100 A to 1000 A
- 250 AF ( 16 A to 250 A) MCCB with Modbus energy metering output
- External meter display option for all metering MCCBs
- Choice of Ammeter only or multifunction energy metering display
All new TemBreak 2 MCCB range extension to 800 A to 1600 A


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

Accessories to suit TemBreak 2, 125-1600 AF
Accessory fitting combinations

General purpose types

Heavy duty types

3


Standard TemBreak 2 MCCBs 125 A - 1600 A
Permissible combinations and locations

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit TemBreak 2, 125-1600 AF Accessory fitting combinations

| Frame size (A) | 125 | $\begin{aligned} & 160 \text { and } \\ & 250 \end{aligned}$ | $\begin{aligned} & \hline 400 \text { and } \\ & 630 \end{aligned}$ | $\begin{aligned} & 800 \text { and } \\ & 1000 \end{aligned}$ | $\begin{aligned} & 1250 \text { and } \\ & 1600 \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| E | E125 | E250 | $\begin{aligned} & \text { E400 } \\ & \text { E630 } \end{aligned}$ |  |  |
| S | $\begin{aligned} & \text { S125 } \\ & \text { ZS125 ') } \end{aligned}$ | $\begin{aligned} & \text { S160 } \\ & \text { S250 } \\ & \text { ZS250 1) } \end{aligned}$ | $\begin{aligned} & \text { S400 } \\ & \text { S630 } \\ & \text { ZS630 1) } \end{aligned}$ | $\begin{aligned} & \text { S800 } \\ & \text { S1000 } \\ & \text { ZS800 } \end{aligned}$ | $\begin{aligned} & S 1250 \\ & S 1600 \end{aligned}$ |
| H |  | $\begin{aligned} & \mathrm{H} 125 \\ & \mathrm{H} 160 \\ & \mathrm{H} 250 \end{aligned}$ | H400 | H800 |  |
| L |  | $\begin{aligned} & \text { L125 } \\ & \text { L160 } \\ & \text { L250 } \end{aligned}$ | L400 | L800 |  |
| AUX <br> ALA <br> SHT |  |  |  | $س\\|\cdot\\|$ |  |
| AUX <br> ALA <br> UVT |  |  |  |  |  |
| AUX <br> ALA <br> SHT |  |  |  |  |  |
| AUX <br> ALA <br> UVT |  |  |  |  |  |

$\square$Auxilliary Switch = ALA

Alarm Switch = ALA
Shunt Trip $=$ SHT
Undervoltage Trip = UVT

Notes: ${ }^{1}$ ) Shunts and UVTs cannot be installed in ZS ELCBs.
General purpose and heavy duty status indication switches cannot be mixed in the same MCCB.
It is not possible to install a shunt trip and an undervoltage trip in an MCCB as they occupy the same location. Undervoltage trips can provide remote tripping if necessary by wiring a normally closed contact or pushbutton in series with the protected supply.
Undervoltage trips with time delays require an external time delay controller which clips to the side of the MCCB.

## Special ‘EA’ TemBreak 2 MCCBs 125 A - 250 A

## Permissible combinations EA (extra auxiliary)

 version and locations- Auxiliary contact blocks: Depending on the auxiliary type and MCCB size, up to 4 auxiliary switches can be fitted in the LEFT and RIGHT pockets.
- Alarm contact blocks: a maximum of 2 can be installed in an MCCB. One LEFT, one RIGHT.
One Shunt Trip or one Under-Voltage Trip can be installed in the RIGHT side. Both cannot be mounted in an MCCB together as they occupy the same position. When auxiliaries or alarms are fitted in the RIGHT side, shunts and UVT's cannot be fitted.


For more specific information on internal accessory combinations and maximum allowable, refer to the table below.

Permissible combinations of EA MCCBs ${ }^{1}$ )


ZS Intergral Earth leakage MCCB - internal accessory fitting.

| MCCB <br> type <br> 3-4 pole | MCCB left side |  |  |  |  | MCCB right side |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | General purpose type |  | Heavy duty type |  |  | Right side pocket area occupied by earth leakage circuitry. Shunts and UVT's cannot be installed. |
|  | Auxiliary | Alarm | or | Auxiliary | Alarm |  |
| 125 A | 2 | 1 |  | 1 | 1 |  |
| $\begin{aligned} & 160 / \\ & 250 \mathrm{~A} \\ & \hline \end{aligned}$ | 2 |  |  | 2 |  |  |

Notes: ${ }^{1}$ ) Certain MCCB models will be stocked with the extra auxiliary option. They are S125GJ, S160NJ (20 / 32 A) S160GJ, S250GJ. Other MCCB "EA" types are available on indent.
ZS integral Earth leakage MCCBs only accept auxiliaries and alarms.
See table above for auxilary and alarm options.

## TemBreak 1 standard combinations of internally mounted accessories

| AUX |  | Auxiliary switch |  | － | $\longrightarrow$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ALT |  | Alarm switch |  |  | $\rightarrow$ |  |
| SHT |  | Shunt trip |  |  | $\rightarrow$ |  |
| UVT |  | Undervoltage trip |  |  | $\rightarrow$ |  |
|  | handle | Right pol |  |  |  |  |
| UVT rating |  |  |  |  |  |  |
| A．Inst type <br> AC $100 \sim 120 \mathrm{~V}$ <br> AC $200 \sim 240 \mathrm{~V}$ <br> AC $380 \sim 450 \mathrm{~V}$ <br> DC 24 V <br> DC 48 V <br> DC 60 V <br> DC 100 ～ 115 V <br> DC 200 ～ 230 V |  | XM30PB | XS 125PJ <br> XS－125C <br> XS－125N | XS 160PJ XS－250NJ XH－250NJ |  | $\begin{aligned} & \text { XS2000 } \\ & \text { XS2500 } \\ & \text { XS3200 } \end{aligned}$ |
| B．Time delay type <br> AC $100 \sim 120 \mathrm{~V}$ <br> AC $200 \sim 240 \mathrm{~V}$ <br> AC $380 \sim 450 \mathrm{~V}$ <br> SHT rating <br> AC $100 \sim 115 \mathrm{~V}$ <br> AC $200 \sim 480 \mathrm{~V}$ <br> AC 24 V <br> AC 48 V <br> DC 12 V <br> DC 24 V <br> DC 30 V <br> DC 48 V <br> DC 60 V <br> DC 100 ～ 115 V <br> DC 125 <br> DC 200 ～ 230 V |  |  |  |  |  |  |
|  | AUX | 凹H1］ | ■－1］ | ■ H－ | H1］ | H相 |
|  | ALT | HI | H1 | 凹H1 | HI | H1 |
|  | $\square^{\text {SHT }}$ | 回 | O－ | 田 | － | $\square$ |
|  | UVT |  | $\square$ | $\square$ | $\square$ | $\square H$ |
|  | A AUX | H1 | －11 | H1 | H䀦 | －$\square^{-1 m}$ |
|  | A AUX | －（1） | －7－ | －H吅 | － 7 罒 | －－ |
|  | AUX <br> UVT |  | $\square$ | $\square \square \square$ | － －1］$^{\text {d }}$ | $\square$－ |
|  | SALT | OHI | －－I | － | － | $\square \square^{\square-1}$ |
|  | ¢ ${ }^{\text {alt }}$ | $\square{ }^{\square}$ | $\square-1$ | $\square$－ | $\square \square$ | $\square \square^{\square}$ |
|  | AUX |  |  |  |  |  |
|  | ALT | 回口 | ■－口 | －70 | －$\dagger$ d | 口Н血 |
|  | AUX <br> ALT <br> UVT |  | $\square \square \square$ | $\square \square$ | $\square$－近 | $\square \square \mathrm{m}$ |

Notes： 2 pole type is the same as the 3 pole type with the centre pole omitted． If provided with UVT for AC，use the UVT controller．

## TemBreak 2 MCCB kA ratings 20 A - 630 A

| Ampere | 400/ | 5 V | kA r |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Range | 25 | 30 | 36 | 50 | 65 | 70 | 85 | 125 | 200 |
| 12.5-125 | 25 |  |  |  |  |  |  |  |  |
| 16-125 | 25 |  |  |  |  |  |  |  |  |
| 15-100 | 65 |  |  |  | 65 |  |  |  |  |
| 12.5-125 |  |  | 36 | ${ }^{1}$ ) |  |  |  |  |  |
| 12.5-125 |  |  |  |  | 65 |  |  |  |  |
| 12.5-125 |  |  |  |  |  |  |  | 125 |  |
| 12.5-125 |  |  |  |  |  |  |  |  | 200 |
| 12.5-160 | 25 |  |  |  |  |  |  |  |  |
| 12.5-160 |  |  | 36 |  |  |  |  |  |  |
| 32-160 |  |  |  |  | 65 |  |  |  |  |
| 100-160 |  |  |  |  |  |  |  | 125 |  |
| 100-160 |  |  |  |  |  |  |  |  | 200 |
| 12.5-250 | 25 |  |  |  |  |  |  |  |  |
| 160-250 |  |  | 36 |  |  |  |  |  |  |
| 160-250 |  |  |  |  | 65 |  |  |  |  |
| $16-250$ |  |  |  |  |  | 70 |  |  |  |
| 160-250 |  |  |  |  |  |  |  | 125 |  |
| $16-250$ |  |  |  |  |  |  |  | 125 |  |
| 160-250 |  |  |  |  |  |  |  |  | 200 |
| 252-400 | 25 |  |  |  |  |  |  |  |  |
| 160-400 |  |  | 36 |  |  |  |  |  |  |
| 160-400 |  |  |  | 50 |  |  |  |  |  |
| 100-400 |  |  |  | 50 |  |  |  |  |  |
| 160-400 |  |  |  |  |  | 70 |  |  |  |
| 100-400 |  |  |  |  |  | 70 |  |  |  |
| 100-400 |  |  |  |  |  |  | 85 |  |  |
| 100-400 |  |  |  |  |  |  |  | 125 |  |
| 252-400 |  |  |  |  |  |  |  |  | 200 |
| 252-630 |  |  | 36 |  |  |  |  |  |  |
| 252-630 |  |  |  | 50 |  |  |  |  |  |
| 252-630 |  |  |  |  |  | 70 |  |  |  |
| Isolator switches |  |  |  | Short time rating for 0.3 |  |  |  | seconds Icw (kA) |  |
| 125 |  |  |  |  |  |  | 2 |  |  |
| 160 |  |  |  |  |  |  |  | 3 |  |
| 250 |  |  |  |  |  |  |  | 3 |  |
| 400 |  |  |  |  |  |  |  |  | 5 |
| 630 |  |  |  |  |  |  |  |  | 5 |

## Colour Key

MCCB labels are similarly colour coded via a coloured rectangle around the catalogue number on the breaker.

| Motor Circuit Range - XM | High kA range - H |
| :--- | :--- | :--- |
| Economy Range-E | Limitor Range-L |
| Standard range-S | Isolators/ Non-auto - N |


| Thermal Magnetic OCR | Electronic OCR | Catalogue Number |
| :---: | :---: | :---: |
| Yes | - | E125NJ |
| Yes | - | S125NF |
| Yes | - | S100GF |
| Yes | - | S125NJ |
| Yes | - | S125GJ/Z5125GJ |
| Yes | - | H125NJ |
| Yes | - | L125NJ |
| Yes | - | S160NF |
| Yes | - | S160NJ |
| Yes | - | S160GJ/ZS250GJ |
| Yes | - | H160NJ |
| Yes | - | L160NJ |
| Yes | - | E250NJ |
| Yes | - | S250NJ |
| Yes | - | S250GJ/Z5250GJ |
| - | Yes | S250PE |
| Yes | - | H250NJ |
| - | Yes | H250NE |
| Yes | - | L250NJ |
| Yes | - | E400NJ |
| Yes | - | S400CJ |
| Yes | - | S400NJ |
| - | Yes | S400NE |
| Yes | - | S400GJ/ ZS400GF |
| - | Yes | S400GE |
| - | Yes | S400PE |
| - | Yes | H400NE |
| - | Yes | L400NE |
| - | Yes | E630NE |
| - | Yes | S630CE |
| - | Yes | S630GE |


| S125NN |
| :--- |
| S160NN |
| S250NN |
| S400NN |
| S630NN |

Notes: ${ }^{1}$ ) 20-32 A trip unit versions rated 30 kA .
A TemBreak 1 to TemBreak 2 cross reference can be found at the rear of this section.
See page 3-12 for colour key.

## TemBreak 1 XM Motor Circuit MCCBs to 12 A, \& 630 A - 3000 A MCCBs

TemBreak 2 MCCB 400A to 1600A kA Ratings / XM30PB

| Ampere Range | $400 / 415 \mathrm{~V} \mathrm{I}_{\mathrm{cu}} \mathrm{kA}$ rating |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 25 | 30 | 36 | 50 | 65 | 70 | 85 | 125 | 200 |
| 0.7-12 |  |  |  |  |  |  | 85 |  |  |
| 500-630 |  |  |  | 50 |  |  |  |  |  |
| 396-800 |  |  | 36 |  |  |  |  |  |  |
| 700-800 |  |  |  | 50 |  |  |  |  |  |
| 396-800 |  |  |  | 50 |  |  |  |  |  |
| 396-800 | 65 |  |  |  |  | 70 |  |  |  |
| 252-800 |  |  |  |  |  | 70 |  |  |  |
| 250-800 |  |  |  |  |  |  |  | 125 |  |
| 250-800 |  |  |  |  |  |  |  |  | 200 |
| 400-1000 |  |  |  |  |  | 70 |  |  |  |
| 500-1250 |  |  |  |  |  |  | 85 |  |  |
| 640-1600 |  |  |  |  |  |  | 85 |  |  |

Isolator switches
Short time rating for 0.3
seconds $\mathrm{I}_{\mathrm{cw}}(\mathrm{kA})$

| 800 | 10 |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 1000 | 10 |  |  |  |
| 1250 |  | 15 |  |  |
| 1600 |  |  | 20 |  |

TemBreak 1 MCCBs 2000A to 3200A

| Ampere Range | 400/415 V Icu kA rating |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 25 | 30 | 36 | 50 | 65 | 70 | 85 | 125 | 200 |
| 1000-2000 |  |  |  |  |  |  | 85 |  |  |
| 1250-2500 |  |  |  |  |  |  | 85 |  |  |
| 1600-3200 |  |  |  |  |  |  | 85 |  |  |


| Motor Circuit Range -XM | High kA range - H |
| :--- | :--- | :--- |
| $\square$ Economy Range -E | Limitor Range -L |
| Standard range -S | Isolators/ Non-auto - N |


| Thermal Magnetic | Electronic OCR | Catalogue Number |
| :--- | :--- | :--- |
| Hydraulic-mag | - | XM30PB |
| Yes | - | ZS630NF |
| Yes | - | S800CJ |
| Yes | - | ZS800NF |
| Yes | - | S800NJ |
| Yes | - | S800RJ |
| - | Yes | S800RE |
|  | Yes | H800NE |
|  | Yes | L800NE |
|  | Yes | S1000NE |
| - | Yes | S1250GE |
| - | Yes | S1600NE |
|  |  |  |


| S800NN |
| :--- |
| S1000NN |
| S1250NN |
| S1600NN |

Thermal Magnetic
Electronic OCR
Yes
Yes
Yes

Catalogue Number
XS2000NE
XS2500NE
XS3200NE


630/800 AF MCCB


1250/1600 AF MCCB

## MCCB types and setting ranges

MCCBs with a common colour have the same physical dimensions

| Ampere Range | 415 V kA |  | Adjustment |  |
| :---: | :---: | :---: | :---: | :---: |
|  | $I_{\text {cu }}$ | $I_{\text {cs }}$ | Thermal $\mathrm{I}_{\mathrm{R}}$ | Magnetic $I_{\text {M }}$ |
| 12.5-125 | 25 | 19 | 0.63-100\% | $6-10$ or 12M |
| $16-125$ | 25 | 13 | Fixed | Fixed |
| 15-100 | 65 | 33 | Fixed | Fixed |
| 12.5-125 | 36 | 36 | 0.63-100\% | $6-10$ or 12M |
| 12.5-125 | 65 | 36 | 0.63-100\% | $6-10$ or 12M |
| 12.5-125 | 125 | 85 | 0.63-100\% | $6-10$ or 12M |
| 12.5-125 | 200 | 150 | 0.63-100\% | $6-10$ or 12M |
| 16-160 | 25 | 19 | Fixed | Fixed |
| 12.5-160 ${ }^{3}$ ) | 36 | 36 | 0.63-100\% | 6-12M |
| 32-160 | 65 | 36 | 0.63-100\% | 6-12M |
| 100-160 | 125 | 85 | 0.63-100\% | 6-12M |
| 100-160 | 200 | 150 | 0.63-100\% | 6-12M |
| 12.5-250 | 25 | 19 | 0.63-100\% | 6-10 or 12M |
| 160-250 | 36 | 36 | 0.63-100\% | 6-10M |
| 160-250 | 65 | 36 | 0.63-100\% | 6-10M |
| 16-250 | 70 | 70 | - | - |
| 160-250 | 125 | 85 | 0.63-100\% | 6-10M |
| 16-250 | 125 | 85 | - | - |
| 160-250 | 200 | 150 | 0.63-100\% | 6-10M |
| 252-400 | 25 | 25 | 0.63-100\% | 6-12M |
| 160-400 | 36 | 36 | 0.63-100\% | 6-12M |
| 160-400 | 50 | 50 | 0.63-100\% | 6-12M |
| 100-400 | 50 | 50 | - | 6-12M |
| 160-400 | 70 | 50 | 0.63-100\% | 6-12M |
| 100-400 | 70 | 50 | - | - |
| 160-400 | 85 | 85 | - | - |
| 100-400 | 125 | 85 | - | - |
| 100-400 | 200 | 150 | - | - |
| 252-630 | 36 | 36 | - | - |
| 252-630 | 50 | 50 | - | - |
| 252-630 | 70 | 50 | - | - |

Notes: ${ }^{1)}$ The STD settings are not adjustable, however by selecting different curve types, the STD setting will vary between $2.5-10 \times I_{R}$ : for 250/400 A MCCBs and $2.5-8 \times I_{R}$ : for 630 A MCCBs.
${ }^{3}$ ) 20-32 A trip unit versions rated 30 kA .
Electronic OCR Adjustment Dimensions (mm)

| Range $I_{\text {R }}$ | STD $x I_{R} /$ INST $x$ (R $\left.\left.{ }^{1}\right)^{2}\right)$ | Catalogue Number H |  | W | D |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - | - | E125NJ | 155 | 90 | 68 |
| - | - | S125NF | 155 | 30 | 68 |
| - | - | S100GF | 155 | 60 | 68 |
| - | - | S125NJ | 155 | 90 | 68 |
| - | - | S125GJ | 155 | 90 | 68 |
| - | - | H125NJ | 165 | 105 | 103 |
| - | - | L125NJ | 165 | 105 | 103 |
| - | - | S160NF | 165 | 35 | 68 |
| - | - | S160NJ | 165 | 105 | 68 |
| - | - | S160GJ | 165 | 105 | 68 |
| - | - | H160NJ | 165 | 105 | 103 |
| - | - | L160NJ | 165 | 105 | 103 |
| - | - | E250NJ | 165 | 105 | 68 |
| - | - | S250NJ | 165 | 105 | 68 |
| - | - | S250GJ | 165 | 105 | 68 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | S250PE | 165 | 105 | 103 |
| - | - | H250NJ | 165 | 105 | 103 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | H250NE | 165 | 105 | 103 |
| - | - | L250NJ | 165 | 105 | 103 |
| - | - | E400NJ | 260 | 140 | 103 |
| - | - | S400CJ | 260 | 140 | 103 |
| - | - | S400NJ | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | S400NE | 260 | 140 | 103 |
| - | - | S400GJ | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | S400GE | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | S400PE | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, $10 / 13$ or 14 | H400NE | 260 | 140 | 140 |
| 40-100\% | 2.5, 5, 10 / 13 or 14 | L400NE | 260 | 140 | 140 |
| 40-100\% | 2.5, 5, 8 / 10 or 14 | E630NE | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, 8 / 10 or 14 | S630CE | 260 | 140 | 103 |
| 40-100\% | 2.5, 5, 8/10 or 14 |  | 260 | 140 | 103 |


| S125NN | $\mathbf{1 5 5}$ | $\mathbf{9 0}$ | $\mathbf{6 8}$ |
| :--- | :--- | :--- | :--- |
| S160NN | 165 | 105 | 68 |
| S250NN | 165 | 105 | 68 |
| S400NN | 260 | 140 | 103 |
| S630NN | 260 | 140 | 103 |

Notes: ${ }^{2}$ ) The Instantaneous settings are not adjustable, however by selecting different curve types, the INST instantaneous setting will vary from 13 or $14 \times I_{R}$ : for 400 A MCCBs and 10 or $14 x I_{R}$ for 630 A MCCBs. Refer curve examples \& setting data in Section 9.

## ZS ELCB / XM30PB / 800 A to 3200 A MCCB types and setting ranges

MCCBs with a common colour have the same physical dimensions

| Ampere Range | 415 V kA |  | Thermal Magnetic Trip Unit Adjustment |  | Electronic OCR Adjustment |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{I}_{\mathrm{Cu}}$ | $\mathrm{I}_{\text {CS }}$ | Thermal $\mathrm{I}_{\text {R }}$ | Magnetic $\mathrm{I}_{\mathrm{M}}$ | Range $\mathrm{I}_{\mathrm{R}}$ |
| 0.7-12 | 85 | 85 | - | - | - |
| 12.5-125 | 65 | 36 | 0.63-100\% | - | - |
| 100-250 | 65 | 36 | 0.63-100\% | - | - |
| 250-400 | 70 | - | - | 6-12M | - |
| 500-630 | 50 | - | - | 6-10M | - |
| 396-800 | 36 | 36 | 0.63-100\% | 5-10M | - |
| 396-800 | 50 | 50 | 0.63-100\% | 5-10M | - |
| 700-800 | 50 | - | - | 6-10M | - |
| 396-800 | 70 | 50 | 0.63-100\% | 5-10M | - |
| 252-800 | 70 | 50 | - | - | 40-100\% |
| 250-800 | 125 | 94 | - | - | 40-100\% |
| 250-800 | 200 | 150 | - | - | 40-100\% |
| 400-1000 | 70 | 50 | - | - | 40-100\% |
| 500-1250 | 85 | 65 | - | - | 40-100\% |
| 640-1600 | 85 | 65 | - | - | 40-100\% |
| 1000-2000 | 85 | 64 | - | - | 50-100\% |
| 1250-2500 | 85 | 64 | - | - | 50-100\% |
| 1600-3200 | 85 | 64 | - | - | 50-100\% |

Isolator switches

Short time rating for
0.3 seconds ICW (kA)

Rated short-circuit Making capacity ICM (kA)

| 800 | 10 | 17 | 17 |
| :--- | :--- | :--- | :--- |
| 1000 | 10 | 32 |  |
| 1250 | 15 | 45 |  |
| 1600 | 20 |  |  |

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 TERASAKI| $\begin{aligned} & \operatorname{STD} x I_{R} / \text { INST } x \\ & I_{R}(1) \end{aligned}$ | Catalogue Number | Dimensions 3P (mm) |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | H | W | D |
| - | XM30PB | 148 | 78 | 97 |
| - | ZS125GJ | 155 | 90 | 68 |
| - | ZS250GJ | 165 | 105 | 68 |
| - | ZS400GF | 260 | 140 | 103 |
| - | ZS630NF | 273 | 210 | 103 |
| - | S800CJ | 273 | 210 | 103 |
| - | S800NJ | 273 | 210 | 103 |
| - | ZS800NF | 273 | 210 | 103 |
| - | S800RJ | 273 | 210 | 103 |
| $2.5,5,10 / 12$ or 14 | S800RE | 273 | 210 | 103 |
| $2.5,5,10 / 12$ or 14 | H800NE | 273 | 210 | 140 |
| $2.5,5,10 / 12$ or 14 | L800NE | 273 | 210 | 140 |
| $2.5,5,10 / 10$ or 14 | S1000NE | 273 | 210 | 103 |
| $2.5,5,10 / 12$ or 14 | S1250GE | 370 | 210 | 120 |
| $2.5,5,10$ / 12 or 14 | S1600NE | 370 | 210 | 140 |
| LSI Adjustable | XS2000NE | 450 | 320 | 185 |
| LSI Adjustable | XS2500NE | 450 | 320 | 185 |
| LSI Adjustable | XS3200NE | 450 | 320 | 185 |


|  | S800NN | 273 | 210 | 103 |
| :--- | :--- | :--- | :--- | :--- |
|  | S1000NN | 273 | 210 | 103 |
|  | S1250NN | 370 | 210 | 120 |
|  | S1600NN | 370 | 210 | 140 |

# TemBreak T2SW Add-on current and voltage metering blocks 

Block dimensions (mm) excluding MCCB

|  | $\begin{aligned} & 125 \mathrm{AF} \\ & 3 \mathrm{P} \\ & \hline \end{aligned}$ | 4P | $\begin{aligned} & 250 \mathrm{AF} \\ & 3 \mathrm{P} \end{aligned}$ | 4P | $\begin{aligned} & 400 / \\ & 630 \mathrm{AF} \\ & 3 P \\ & \hline \end{aligned}$ | 4P |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Height ${ }^{2}$ ) | 85 | 85 | 85 | 85 | 86 | 86 |
| Width | 90 | 120 | 105 | 140 | 140 | 185 |
| Depth ${ }^{3}$ ) | 66 | 66 | 66 | 66 | 88 | 88 |

3
Ordering details

| Suit MCCB typ | Pole | Pri- <br> mary | T2SW block Cat. No. | Price \$ | Optional <br> load side terminal cover Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E125, S125 | 3 | 125 A | T2SW3P1251255K | 900.00 | T2SW3P125TC | 55.00 |
| E125, S125 | 4 | 125 A | T2SW4P1251255K | 1190.00 | T2SW4P125TC | 66.50 |
| $\begin{aligned} & \hline \text { H125, E/S/ } \\ & \text { H16/25 } \\ & \hline \end{aligned}$ | 3 | 150 A | T2SW3P2501505K | 940.00 | T2SW3P250TC | 110.00 |
| $\begin{aligned} & \hline \text { H125, E/S/ } \\ & \text { H16/25 } \\ & \hline \end{aligned}$ | 3 | 250 A | T2SW3P2502505K | 940.00 | T2SW3P250TC | 110.00 |
| $\begin{aligned} & \hline \text { H125, E/S/ } \\ & \text { H16/25 } \end{aligned}$ | 4 | 150 A | T2SW4P2501505K | 1230.00 | T2SW4P250TC | 148.00 |
| $\begin{aligned} & \hline \text { H125, E/S/ } \\ & \text { H16/25 } \\ & \hline \end{aligned}$ | 4 | 250 A | T2SW4P2502505K | 1230.00 | T2SW4P250TC | 148.00 |
| $\begin{aligned} & \text { E/S/H400, } \\ & \mathrm{E} / \mathrm{S} 630 \end{aligned}$ | 3 | 400 A | T2SW3P6304005K | 1230.00 | T2SW3P630TC | 110.00 |
| $\begin{aligned} & \hline \text { E/S/H400, } \\ & \text { E/S630 } \end{aligned}$ | 3 | 600 A | T2SW3P6306005K | 1230.00 | T2SW3P630TC | 110.00 |
| $\begin{aligned} & \text { E/S/H400, } \\ & \text { E/S630 } \end{aligned}$ | 4 | 400 A | T2SW4P6304005K | 1630.00 | T2SW4P630TC | 160.00 |
| $\begin{aligned} & \mathrm{E} / \mathrm{S} / \mathrm{H} 400, \\ & \mathrm{~F} / \mathrm{S} 30 \end{aligned}$ | 4 | 600 A | T2SW4P6306005K | 1630.00 | T2SW4P630TC | 160.00 |


| Suit <br> MCCB type | Frame <br> size |  <br> Voltage <br> voltage termi- |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Poles terminals nal quantity |  |  |  |  |  | | T2SW block |
| :--- |
| Cat. No. |

Notes: ${ }^{1}$ ) Voltage lugs supplied for mounting on external bars for 125 A 3 pole block.
${ }^{2}$ ) Height excludes connection bars
${ }^{3}$ ) Refer NHP for additional dimension data

## TemBreak co-ordination motor protection

Circuit breakers - XM30PB

## 85 kA

Current rating: 0.7-12 A
Approvals and tests: Standards: AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)
Trip unit: Fixed hydraulic-magnetic


|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 85 | 85 |

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 148 |
| $W$ | 78 |
| D (less toggle) | 97 |
| Weight $(\mathrm{kg})$ | 1.3 |


| Amp rating NRC | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 0.7 | XM30PB0.7 3P | $\mathbf{5 0 0 . 0 0}$ |
| 1.4 | XM30PB1.4 3P | $\mathbf{5 0 0 . 0 0}$ |
| 2.0 | XM30PB2.0 3P | $\mathbf{5 0 0 . 0 0}$ |
| 2.6 | XM30PB2.6 3P | $\mathbf{5 0 0 . 0 0}$ |
| 4 | XM30PB4 3P | $\mathbf{5 0 0 . 0 0}$ |
| 5 | XM30PB5 3P | $\mathbf{5 0 0 . 0 0}$ |
| 8 | XM30PB8 3P | $\mathbf{5 0 0 . 0 0}$ |
| 10 | XM30PB10 3P | $\mathbf{5 0 0 . 0 0}$ |
| 12 | XM30PB12 3P | $\mathbf{5 0 0 . 0 0}$ |

Notes: NRC: Nominal rated current.

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## Accessories to suit XM30PB

Internal accessories - factory fit

|  |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
|  | 110 V AC SHT ( $100-115 \mathrm{~V}$ ) | 2H1931BAA | 131.00 |
|  | 240 V AC SHT ( $200-480 \mathrm{~V}$ ) | 2H1931BBA | 131.00 |
|  | 24 V DC SHT | 2H1931BCA | 131.00 |
|  | 48 V DC SHT | 2H1931BDA | 131.00 |
| Shunt | 110 V DC SHT ( $100-115 \mathrm{~V}$ ) | 2H1931BEA | 131.00 |
| Shunt trip | 24 V AC SHT | 2H1932BAD | 131.00 |
|  | 48 V AC SHT | 2H1932BBA | 131.00 |
|  | 12 V DC SHT | 2H1932BDA | 131.00 |
|  | 125 V DC SHT | 2H1932BGA | 131.00 |
|  | 200 V DC SHT (200-230 V) | 2H1932BHA | 131.00 |
| Auxiliary | AUX SW right/left hand 1C | UXXB0001D | 86.50 |
| switches | AUX SW right/left hand 2C | UXXB0003C | 127.00 |
| Alarm switches | Alarm SW right/left hand | UXLB0006C | 84.00 |
| Alarm \& auxiliary switches | Alarm/AUX SW right/left hand 1 C | UXLB0008C | 120.00 |

External accessories - user fit

|  |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Solderless terminals | 3 P solderless terminals (6) | TXBD0009A | 36.50 |
| Handle operators | IP55 Grey variable depth handle + 357 mm shaft | T1HS03R5GM | 240.00 |
|  | T1HS escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 90 mm T pin shaft for T 2 HS no flexi coupling | T2HS250SHAFT | 47.00 |
|  | IP65 Grey variable depth handle + 420 mm shaft | T1HP03R6BNA4 | 141.00 |
|  | Padlock attachment for T2HP/HS mechanism | T1HP30PALK | 44.50 |
|  | IP55 direct mount fixed depth handle | TFJ21PB | 235.00 |
| Trapped Key interlock | Prosafe shot bolt lock HS handles xx code | TKNHPXX | 520.00 |
|  | Prosafe standard key xx code for above | TKNNHPKEYXX | 130.00 |
|  | Cam for T2HS handle shafts Key codes A to Z are available. Specify by changing the key code above. | 14997702 | 235.00 |
| TemPlug | 3 P Templug | UPX330PB ${ }^{1}$ ) | 270.00 |
| Terminal Cover | Line side terminal screw cover | XM30TSC | 21.80 |

Notes: ') Price schedule 'T3' applies for this item.

## CAPTIVE LOCK ATTACHMENTS

## Securely locks off Terasaki Tembreak2

 circuit breakers.

- Consists of a fully moulded front cover with built-in padlockable flap
- Off position padlockable as standard
- Knockout provided for ON position padlocking
- Internal accessory fitting not affected
- Locking not padlock size dependant
- Suits one lock up to 8 mm
- Accepts multiple padlock hasps
- XKA captive locks for MCCBs to 800 A also available
- Can be field fitted
- Suits MCCBs up to 630 A
- Suits ZS earth leakage MCCBs
- Accepts a compression seal


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Thermal magnetic type <br> E125NJ 

## 25 kA

Current rating: $12.5-125 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:


3 |  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 25 | 19 |
| DC use | 250 | 25 | 19 |

Trip unit: Adjustable thermal ( 0.63 Ir to $100 \% \mathrm{Ir}$ ) and adjustable magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 155 |
| $W$ | 90 |
| $D$ (less toggle) | 68 |
| Toggle cut-out | 104 |


| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12.5-20$ | $120-240$ | E125 N 3 20 | $\mathbf{4 4 0 . 0 0}$ |

Notes: ${ }^{1)}$ Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting NRC: Nominal rated current Magnetic only MCCBs are available on request. For 4 pole MCCBs refer S125GJ type.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Thermal magnetic type S125NF 

## 25 kA

Current rating: 16-125 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 230 | 25 | 13 |

Trip unit: Fixed thermal magnetic
Dimensions (mm)

| Poles | $\mathbf{1}$ |
| :--- | :--- |
| H | 155 |
| W | 30 |
| D (less toggle) | 68 |
| Toggle cut-out | 104 |


| Ampere <br> Rating NRC | Ir | Im | Cat. No. | 1 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | :--- |
| 16 | 16 | 208 | S125 NF 1 16 | $\mathbf{1 6 5 . 0 0}$ |
| 20 | 20 | 260 | S125 NF 1 20 | $\mathbf{1 6 5 . 0 0}$ |
| 25 | 25 | 325 | S125 NF 1 25 | $\mathbf{1 6 5 . 0 0}$ |
| 32 | 32 | 420 | S125 NF 1 32 | $\mathbf{1 6 5 . 0 0}$ |
| 40 | 40 | 520 | S125 NF 1 40 | $\mathbf{1 6 5 . 0 0}$ |
| 50 | 50 | 650 | S125 NF 1 50 | $\mathbf{1 6 5 . 0 0}$ |
| 63 | 63 | 820 | S125 NF 1 63 | $\mathbf{1 6 5 . 0 0}$ |
| 80 | 80 | 1040 | S125 NF 1 80 | $\mathbf{2 3 5 . 0 0}$ |
| 100 | 100 | 1300 | S125 NF 1 100 | $\mathbf{3 1 0 . 0 0}$ |
| 125 | 125 | 1550 | S125 NF 1 125 | $\mathbf{3 1 0 . 0 0}$ |



[^14]
# TemBreak 2 Thermal magnetic type S100GF 

## 65 kA

Current rating: 15-100 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 230 | 85 | 85 |
|  | $380 / 415$ | 65 | 33 |
| DC use |  | 40 | 40 |



Black TemBreak 2 MCCB

Trip unit: Fixed thermal magnetic
Dimensions (mm)

| Poles | $\mathbf{2}$ |
| :--- | :--- |
| H | 155 |
| W | 60 |
| D (less toggle) | 68 |
| Toggle cut-out required $52^{1}$ ) or 104 |  |

## Accessories

Has mounting provision for any 1 (one) of the following:TemBreak 2 accessories UVT or Shunt or a combination of up to 2 Auxiliaries plus 1 Alarm.
Will accept standard TemBreak 2 external accessories such as: interpole barriers, terminal connection options, toggle locks, and 2 pole terminal covers.
Refer accessories pages. Will not accept motors or handles due to the 60 mm width of the MCCB.

| Ampere <br> Rating NRC Ir Im Cat. No. | 2 pole <br> Price \$ |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| 15 | 15 | 180 | S100 GF 2 15 | $\mathbf{3 1 5 . 0 0}$ |
| 20 | 20 | 240 | S100 GF 2 20 | $\mathbf{3 1 5 . 0 0}$ |
| 30 | 30 | 360 | S100 GF 2 30 | $\mathbf{3 1 5 . 0 0}$ |
| 40 | 40 | 480 | S100 GF 2 40 | $\mathbf{3 1 5 . 0 0}$ |
| 50 | 50 | 600 | S100 GF 2 50 | $\mathbf{3 1 5 . 0 0}$ |
| 60 | 60 | 720 | S100 GF 2 60 | $\mathbf{3 1 5 . 0 0}$ |
| 75 | 75 | 900 | S100 GF 2 75 | $\mathbf{3 5 5 . 0 0}$ |
| 100 | 100 | 1200 | S100 GF 2 100 | $\mathbf{4 3 0 . 0 0}$ |

Notes: ${ }^{1)}$ S100GF 2 Pole MCCBs require a 52 mm cut-out as the toggle area is 50 mm high.
Ir: thermal rating
Im: magnetic rating
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Thermal magnetic type S125NJ 

## 36 kA

Current rating: $12.5-125 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| ACs |  |  |  |
| AC use | $380 / 400$ | 36 | 36 |
| DC use | 250 | 25 | 19 |



Trip unit: Adjustable thermal ( 0.63 Ir to $100 \% \mathrm{Ir}$ ) and adjustable magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 155 |
| W | 90 |
| D (less toggle) | 68 |
| Toggle cut-out | 104 |


| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | S125 NJ 320 | 480.00 |
| 32 | 20-32 | 192-384 | S125 NJ 332 | 480.00 |
| 50 | 32-50 | 300-600 | S125 NJ 350 | 480.00 |
| 63 | 40-63 | 378-756 | S125 NJ 363 | 480.00 |
| 100 | 63-100 | 600-1200 | S125 NJ 3100 | 680.00 |
| 125 | 80-125 | 750-1250 | S125 NJ 3125 | 810.00 |

[^15] Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
Magnetic only MCCBs are available on request.
For 4 pole MCCBs refer S125GT types.

# SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI 

# TemBreak 2 Thermal magnetic type <br> S125GJ 

## 65 kA

Current rating: 12.5-125 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 400$ | 65 | 36 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( 0.63 Ir to $100 \% \mathrm{Ir}$ ) and adjustable magnetic

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 155 | 155 |
| W | 90 | 120 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | S125 GJ $320{ }^{\text {2 }}$ ) | 750.00 |
| 32 | 20-32 | 192-384 | S125 GJ $332^{2}$ ) | 750.00 |
| 50 | 32-50 | 300-600 | S125 GJ 3 50 ${ }^{\text {2 }}$ ) | 750.00 |
| 63 | 40-63 | 378-756 | S125 GJ $363{ }^{\text {2 }}$ ) | 750.00 |
| 100 | 63-100 | 600-1200 | S125 GJ $3100{ }^{2}$ ) | 900.00 |
| 125 | 80-125 | 750-1250 | S125 GJ $3125{ }^{\text {2 }}$ ) | 1000.00 |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | S125 GJ $420^{2}$ ) | 990.00 |
| 32 | 20-32 | 192-384 | S125 GJ $432{ }^{\text {2 }}$ ) | 990.00 |
| 50 | 32-50 | 300-600 | S125 GJ $4560^{2}$ ) | 990.00 |
| 63 | 40-63 | 378-756 | S125 GJ $463^{2}$ ) | 990.00 |
| 100 | 63-100 | 600-1200 | S125 GJ $410{ }^{2}$ ) | 1210.00 |
| 125 | 80-125 | 750-1250 | S125 GJ $4125{ }^{\text {² }}$ ) | 1330.00 |

Notes: ${ }^{1)}$ Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting
${ }^{2}$ ) To obtain MCCBs that accept additional internal auxiliary circuits add "EA" to the above Cat. No.'s. E.g.: S125GJ3125EA. Otherwise leave blank. Refer NHP for availability. Refer page 3-9 for details.
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

## SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI

## TemBreak 2 690V AC High Fault Interruption MCCB <br> L125PJ

## 70 kA

Current rating: 12.5-125 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 690 V | 70 | 33 |



Trip unit: Adjustable thermal ( 0.63 Ir to $100 \%$ Ir) and adjustable magnetic Adjustable magnetic 6 Im to 12 lm , trip unit: 20 A to 100 A 6 Im to 10 Im , trip unit: 125 A

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 165 |
| W | 105 |
| (less toggle) | 103 |
| Toggle cut-out | 48 |
|  | 105 on chassis ${ }^{1}$ ) |


| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Adj. Im <br> Min. - Max. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12.5-20$ | $120-240$ | L125 PJ 3 20 | $\mathbf{7 3 0 . 0 0}$ |
| 32 | $20-32$ | $192-384$ | L125 PJ 3 32 | $\mathbf{7 3 0 . 0 0}$ |
| 50 | $32-50$ | $300-600$ | L125 PJ 3 50 | $\mathbf{7 3 0 . 0 0}$ |
| 63 | $40-63$ | $378-756$ | L125 PJ 3 63 | $\mathbf{7 3 0 . 0 0}$ |
| 100 | $63-100$ | $600-1200$ | L125 PJ 3 100 | $\mathbf{8 3 0 . 0 0}$ |
| 125 | $80-125$ | $750-1250$ | L125 PJ 3 125 | $\mathbf{8 3 0 . 0 0}$ |

[^16]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type H125NJ

## 125 kA

Current rating: 12.5-125 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 125 | 85 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( 0.63 Ir to $100 \% \mathrm{Ir}$ ) and adjustable magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 155 |
| W | 105 | 140 |
| D (less toggle) | 105 | 103 |
| Toggle cut-out | 104 | 104 |

*H125NJ is a 250 AF MCCB
3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | H125 NJ 320 | 960.00 |
| 32 | 20-32 | 192-384 | H125 NJ 332 | 960.00 |
| 50 | 32-50 | 300-600 | H125 NJ 350 | 960.00 |
| 63 | 40-63 | 378-756 | H125 NJ 363 | 960.00 |
| 100 | 63-100 | 600-1200 | H125 NJ 3100 | 1110.00 |
| 125 | 80-125 | 750-1250 | H125 NJ 3125 | 1110.00 |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir $^{\text {1 }}$ ) <br> Min. - Max. | Adj. Im <br> Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12.5-20$ | $120-240$ | H125 NJ 4 20 | $\mathbf{1 2 9 0 . 0 0}$ |

[^17]
## TemBreak 2 Thermal magnetic type <br> L125NJ

## 200 kA

Current rating: 12.5-125 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 200 | 150 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( 0.63 Ir to $100 \% \mathrm{Ir}$ ) and adjustable magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

*L125NJ is a 250 AF MCCB
3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im <br> Min. - Max. | Cat. No. | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12.5-20$ | $120-240$ | L125 NJ 3 20 | $\mathbf{1 0 9 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 4 pole Price $\$$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | L125 NJ 420 | 1440.00 |
| 32 | 20-32 | 192-384 | L125 NJ 432 | 1440.00 |
| 50 | 32-50 | 300-600 | L125 NJ 450 | 1440.00 |
| 63 | 40-63 | 378-756 | L125 NJ 463 | 1440.00 |
| 100 | 63-100 | 600-1200 | L125 NJ 4100 | 1570.00 |
| 125 | 80-125 | 750-1250 | L125 NJ 4125 | 1570.00 |

[^18]
## Accessories to suit 125 A TemBreak 2



Internal accessories
Cat. No.
Price $\$$

$\square$

|  | CBs |  |  |
| :---: | :---: | :---: | :---: |
|  | 110 V AC | T2SH00A10TA ${ }^{1}$ ) | 255.00 |
| SH | 230-240 V AC | T2SH00A2OTA ${ }^{1}$ ) | 255.00 |
|  | 400-415 V AC | T2SH00A40TA ${ }^{1}$ ) | 255.00 |
|  | $24 \mathrm{~V} \mathrm{DC} \mathrm{(Suits} 24 \mathrm{~V} \mathrm{AC}$ ) | T2SH00D02TA ${ }^{1}$ ) | 255.00 |
|  | 48 VDC | T2SH00D04TA ${ }^{1}$ ) | 255.00 |
|  | 110 VDC | T2SH00D10TA ${ }^{1}$ ) | 255.00 |
|  | 230 VDC | T2SH00D20TA ${ }^{1}$ ) | 255.00 |
| Undervoltage trips | Instantaneous operati |  |  |
|  | 110 V AC | T2UV00A10NTA | 270.00 |
|  | 200-240 V AC | T2UV00A20NTA | 270.00 |
|  | 380-450 V AC | T2UV00A40NTA | 270.00 |
| UV | $\underline{24 V D C}$ | T2UV00D02NTA | 270.00 |
|  | 110 VDC | T2UV00D10NTA | 270.00 |
|  | 230 V DC | T2UV00D20NTA | 270.00 |


|  | Time delaye | HP |  |
| :---: | :---: | :---: | :---: |
| Auxiiary | General type (2 A @ 240 V Inductive) |  |  |
| \& Alarm | 1 C/O Auxiliary | T2AX00M3STA | 134.00 |
| switches | $1 \mathrm{C} / \mathrm{O}$ Auxiliary - with 0.7 m wire leads | T2AX00M3SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O}$ Alarm | T2AL00M3STA | 134.00 |
|  | $1 \mathrm{C} / \mathrm{O}$ Alarm - with 0.7 m wire leads | T2AL00M3SWA | 146.00 |

Heavy-duty type (4 A @ 240 V Inductive)

| AX | 1N/O Auxiliary | T2AX00B1STA | 146.00 |
| :--- | :--- | :--- | ---: |
| AL | 1N/C Auxiliary | T2AX00B2STA | 146.00 |
|  | 1N/O Alarm | T2AL00B1STA | 146.00 |
|  | 1N/C Alarm | T2AL00B2STA | 146.00 |
|  | Micro switching type (very low voltages) |  |  |
|  | 1C/O Auxiliary | T2AX00M3RTA | 187.00 |
|  | 1C/O Alarm | T2AL00M3RTA | 187.00 |

Notes: ${ }^{1}$ ) Wire lead types available.

## Accessories to suit 125 A TemBreak 2

$\left.\begin{array}{llll}\text { External accessories } & \text { Cat. No. } & \text { Price } \mathbf{\$} \\ \hline \begin{array}{llll}\text { Motor } \\ \text { operators }\end{array} & \text { Suits MCCB types } & & \\ & \text { E125, S125 }\end{array}\right)$

| Motor | Motor connection cable loom for electrical interlocking for transfer switches |  |  |
| :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { T2MC12 cable } 500 \mathrm{~mm} \\ & 125 / 250 \mathrm{AF} \\ & \hline \end{aligned}$ | T2MM25L05A | 60.50 |
|  | T2MC12 cable 1500 mm 125/250AF | T2MM25L15A | 73.00 |

Motor options: Contact NHP for key locking and auto-reset.

| MCCB identification labels | T12CAPLAB | $\mathbf{3 . 5 0}$ |
| :--- | :--- | :--- |



T2 HB Direct mounted handle


Variable depth T2HP handle


T2 MC Motor operator


T2HS Variable depth handle

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

Accessories to suit 125 A TemBreak 2

| External accessories |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Operating handles Direct mounting, fixed depth, IP 54 | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { E125, S125 } \end{aligned}$ |  |  |
|  | Grey/black | T2HB12UR5BN | 175.00 |
|  | Red/yellow | T2HB12UR5RN | 199.00 |
|  | H125, L125 |  |  |
| HB | Grey/black | T2HB25UR5BN | 189.00 |
|  | Red/yellow | T2HB25UR5RN | 210.00 |
|  | Optional MCCB identification labels | T12CAPLAB | 3.50 |
| Door interlocking variable depth handle | E125, S125 |  |  |
|  | Grey IP 55 handle + 357 mm shaft | T2HS12R5GM | 280.00 |
|  | Red/ yellow IP 55 handle 357 mm shaft | T2HS12R5RM | 290.00 |
|  | Escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 90 mm T pin shaft for T2HS - no flexi coupling | T2HS250SHAFT | 47.00 |
| HS | Grey/ black IP65 handle + 420 mm shaft | T2HP12R6BN | 290.00 |
|  | Red/ yellow IP65 handle + 420 mm shaft | T2HP12R6RN | 300.00 |
| HP | Padlock attachment for T2HP/HS mechanism | T2HP25PALK | 49.50 |
|  | Optional MCCB identification labels | T12CAPLAB | 3.50 |


| H125, L125 |  |  |
| :---: | :---: | :---: |
| IP 55 handle + 357 mm shaft | T2HS25R5GM | 280.00 |
| Red/ yellow IP 55 handle + 357 mm shaft | T2HS25R5RM | 290.00 |
| Large escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
| 90 mm T pin shaft for T2HS no flexi coupling | T2HS250SHAFT | 47.00 |
| Grey/ black IP 65 handle + 420 mm shaft | T2HP25R6BN | 290.00 |
| Red/ yellow IP 65 handle + 420 mm shaft | T2HP25R6RN | 300.00 |
| Padlock attachment for T2HP/ HS mechanism | T2HP25PALK | 49.50 |
| Optional MCCB identification labels | T12CAPLAB | 3.50 |

T2HS handle mechanism with T2HP25PALK mechanism lock


T2HS handle with T2HSESC100 escutcheon plate

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## Accessories to suit 125 A TemBreak 2

External accessories
Cat. No.
Price \$

| Mechanical Interlocks | Link Interlock - suitable for manual or motorised operation. Will accept handles. Suitable for front or rear connect type MCCBs. |  |  |
| :---: | :---: | :---: | :---: |
| Link type | Suits MCCB types E125, S125 |  |  |
|  | Common 3 or 4 pole right side section | T2ML12RA | 113.00 |
|  | 3 pole left side section | T2ML12L3A | 127.00 |
|  | 4 pole left side section | T2ML12L4A | 127.00 |
| ML | MCCB identification labels | T12CAPLAB | 3.50 |
|  | H125, L125 |  |  |
|  | Common 3 or 4 pole right side section | T2ML25RA | 113.00 |
|  | 3 pole left side section | T2ML25L3A | 127.00 |
|  | 4 pole left side section | T2ML25L4A | 127.00 |
|  | MCCB identification labels | T12CAPLAB | 3.50 |



Link interlock on MCCBs, T2ML


Link interlock on MCCBs with motors and electrical interlocking cable T2MM

## Notes: Handles supplied with shaft

Refer to Section 5 if MCCB labels are required or refer to NHP.

## Accessories to suit 125 A TemBreak 2

xternal accessories
Cat. No.
Price $\$$
Slide type Manual operation, padlockable. Does not allow motors, handles or interlock other front mounted accessories to be fitted.

## Suitable for front or rear connection

 E125, S125 MCCB types| MS | 3 pole | T2MS123SFA | 120.00 |
| :---: | :---: | :---: | :---: |
|  | 4 pole | T2MS124SFA | 134.00 |
|  | H125, L125 |  |  |
|  | 3 pole | T2MS253LFA | 120.00 |
|  | 4 pole | T2MS254LFA | 134.00 |
| Cable interlock | Allows an MCCB to be mounted horizontally, vertically or diagonally. Accepts Motors and handles. |  |  |
|  | Suitable for 3 or 4 pole MCCBs E125, S125 MCCB types |  |  |
|  | Interlock kit less wire | T2MW12CA ${ }^{1}$ ) | 265.00 |
|  | MCCB identification labels | T12CAPLAB | 3.50 |
|  | H125, L125 |  |  |
| MW | Interlock kit less wire | T2MW25CA | 275.00 |
|  | MCCB identification labels | T12CAPLAB | 3.50 |
|  | Wire for above interlocks Wire 1.0 M | T2MW00SA ${ }^{2}$ ) | 63.00 |
|  | Wire 1.5 M | T2MW00LA ${ }^{2}$ ) | 73.00 |



Slide interlock on MCCBs, T2MS


Cable interlock on MCCBs, T2MW

Notes: ${ }^{1}$ ) Order one interlock kit for each MCCB.
${ }^{2}$ ) One wire length will cover two MCCBs.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 125 A TemBreak 2

| External accessories |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Terminal | Front connected MCCBs |  |  |
| Covers Flush$\text { IP } 20$ | Suits MCCB types E125, S125 |  |  |
|  | 1 pole cover set of 2 | T2CS121SG | 10.60 |
| CS | 3 pole cover set of 2 | T2CS123SG | 44.00 |
|  | 4 pole cover set of 2 | T2CS124SG | 55.00 |
|  | H125, L125 |  |  |
|  | 3 pole cover set of 2 | T2CS253SG | 54.00 |
|  | 4 pole cover set of 2 | T2CS254SG | 60.50 |
| Short terminal covers | E125, S125 |  |  |
|  | 3 pole cover set of 2,22 mm long | T2CF123SSNBA | 60.50 |
|  | 4 pole cover set of $2,22 \mathrm{~mm}$ long | T2CF124SSNBA | 71.00 |
| Standard terminal covers | E125, S125 |  |  |
|  | 1 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF121SLNG | 35.00 |
|  | 2 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF122SLNG | 49.50 |
| CF | 3 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF123SLNG | 64.50 |
|  | 4 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF124SLNG | 73.00 |
|  | H125, L125 |  |  |
|  | 3 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF253LLNG | 71.00 |
|  | 4 pole cover set of $2,40 \mathrm{~mm}$ long | T2CF254LLNG | 77.50 |



## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 125 A TemBreak 2

External accessories
Cat. No.
Price $\$$

| Terminal covers rear connect | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { E125, S125 } \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole cover set of 2 | T2CR123SG | 44.00 |
| CR | 4 pole cover set of 2 | T2CR124SG | 55.00 |
|  | H125, L125 |  |  |
|  | 3 pole cover set of 2 | T2CR253SG | 54.00 |
|  | 4 pole cover set of 2 | T2CR254SG | 60.50 |
| Terminal and cover | A clip that provides additional terminal cover position locking also allows a sealing device to be fitted. |  |  |
| locking clip | All sizes 125, 250, 400, 630 AF | T2CF00L | 9.10 |
| Interpole Barriers $\left.{ }^{1}\right)^{2}$ ) | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { E125, S125 } \end{aligned}$ |  |  |
| BA | Interpole barrier (Qty 2) | T2BA123SHA | 17.40 |
|  | H125, L125 |  |  |
|  | Interpole barrier (Qty 2) | T2BA253LHA | 20.00 |
| Toggle locks | Non Captive: Fits up to 3 padlocks or a multiple lock device |  |  |
|  | 2,3 and 4 pole E/S125 lock | T2HL25B | 31.50 |
|  | 1 pole S125NF lock | UXKB0013A | 61.00 |
|  | Captive: Allows a single padlock | multiple padlock dev |  |
|  | E125, S125 |  |  |
| HL | For 3/4 pole MCCBs $1 \times 8 \mathrm{~mm}$ hole | T2HL12CAP | 33.50 |
|  | For 1 pole MCCBs, $1 \times 8 \mathrm{~mm}$ hole | T2HLS125NFCAP | 92.00 |
|  | H125, L125 |  |  |
|  | Lock with one 8 mm hole | T2HL25CAP | 33.50 |



T2CF locking clip


Inter pole barriers


Non captive lock attachment


Captive lock attachment

Notes: ${ }^{1}$ ) Line side interpole barriers or terminal covers must be installed with MCCBs.
${ }^{2}$ ) Interpole Barriers are supplied with MCCBs as standard; 2 barriers with 3 pole MCCBs, and 3 barriers with 4 pole MCCBs.

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## Accessories to suit 125 A TemBreak 2

External accessories
Cat. No.
Price \$
ProSafe Allen-Bradley ProSafe locks can be used with T2HS variable depth
lock option') handles. Refer NHP for direct mounting handle options.

## Suits MCCB types E/S/H/L 125

| TKN | Prosafe shot bolt lock HS handles xx code | TKNHPXX | 520.00 |
| :---: | :---: | :---: | :---: |
|  | Prosafe standard key xx code for above | TKNNHPKEYXX | 130.00 |
|  | Cam for T2HS handle shafts Key codes A to Z are available. Specify by changing the key code above. | 14997702 | 235.00 |
| Extention Busbars | E125, S125 |  |  |
|  | 1 set of 2 of straight bars | T2FB251BA | 26.80 |
|  | 3 pole set of 6 straight bars | T2FB123BA | 77.50 |
|  | 4 pole set of 8 straight bars | T2FB124BA | 103.00 |
| FB | H125, L125 |  |  |
|  | 1 set of straight terminal bars | T2FB251BA | 26.80 |
|  | 3 pole, set of 6, flanged bars | T2FB253BA | 77.50 |
|  | 4 pole, set of 8, straight bars | T2FB254BA | 103.00 |
| Tunnel clamp terminals | E125, S125 |  |  |
|  | 3 pole set of 6 terminals $50 \mathrm{~mm}^{2}$ | T2FW12S3A | 107.00 |
|  | 4 pole set of 8 terminals $50 \mathrm{~mm}^{2}$ | T2FW12S4A | 141.00 |
|  | H125, L125 |  |  |
| FW | 3 pole set of 6 terminals 35-120 $\mathrm{mm}^{2}$ | T2FW25L3B | 173.00 |
|  | 4 pole set of 8 terminals 35-120 $\mathrm{mm}^{2}$ | T2FW25L4B | 240.00 |



T2FW Tunnel clamp terminals and optional T2CS terminal cover


T2FB Attached busbar

ProSafe key Interlock and cam

Notes: ') Contact NHP for lock options.

## Accessories to suit 125 A TemBreak 2

| Extern | ies | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Rear connect terminal studs | Suits MCCB types E125, S125 ${ }^{1}$ ) |  |  |
|  | 3 pole kit, set of 6 studs | T2RP123SA | 200.00 |
|  | 4 pole kit, set of 8 studs | T2RP124SA | 270.00 |
| RP | H125, L125 |  |  |
|  | 3 pole kit, set of 6 studs | T2RP253LA | 390.00 |
|  | 4 pole kit, set of 8 studs | T2RP254LA | 540.00 |
| TemPlug | Suits MCCB types TemPlug MCCB line-side plug-in attachment E125, S125 |  |  |
| UP | 3 pole TemPlug | T2UPX3125 | 305.00 |
|  | H125, L125 |  |  |
|  | 3 pole TemPlug (65 kA limit) | T2UPXE3250 | 350.00 |
|  | Templugs suit 6.3 mm busbar as standard, 10 mm types indent |  |  |
| OCR sealing c SF | 125/250 A thermal magnetic | T2SF25NTA | 26.80 |

PM Plug-in MCCBs (refer rear of section 3)

DR Draw-out MCCBs (refer NHP)


T2CR Rear connect term cover
Notes: ${ }^{1}$ ) 125 A rear connect studs will not fit to S125NF single pole MCCBs. S160NF single pole MCCBs will accept rear studs.

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## Accessories to suit 125 A TemBreak 2

External accessories
Cat. No.
Price \$

| Pole fillers | Suits MCCB types E/S/H/L125 |  |  |
| :---: | :---: | :---: | :---: |
| PF | Pole filler 1 strip for a 46 mm high cut-out ${ }^{1}$ ) | DTPF | 4.30 |
|  | Pole filler, 30 mm wide for a 104 mm cut-out | XAB2 | 3.80 |
| DIN Rail Adaptor | Allows a 125 AF MCCB to be mounted on standard 35 mm DIN rail E125, S125 |  |  |
| DA | Metal DIN rail adaptor | T2DA12A | 63.00 |
| Door flange | Provides an attractive panel cut-out surround for MCCBs or motors Suits MCCB types <br> E/S/H/L125 |  |  |
| DF | MCCB IP 30 gland and gasket | T2DF25A | 127.00 |
|  | MOTOR IP 30 gland and gasket | T2DM25A | 215.00 |
| Door mounting flush plate FP | A kit that allows an MCCB to be mounted directly onto a door |  |  |
|  | 3 pole kit E125, S125 | T2FP12S3B | 82.50 |
|  | 4 pole kit E125, S125 | T2FP12S4A | POA |
| Wire lead terminal block | 125/250 AF left side | T2TF25LGA | 189.00 |
| TF | 125/250 AF right side | T2TF25RGA | 189.00 |



Door flange Provides an attractive panel cut-out surround for MCCBs or motors Suits MCCB types

Notes: $\left.{ }^{1}\right) 1$ strip is 8 off, 9 mm segments. Order 2 strips for each 125 A MCCB.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S160NF

25 kA
Current rating: 16-160 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 230 | 25 | 19 |
|  | 125 | 15 | 8 |
| DC use | 125 | 15 | - |



Trip unit: Fixed thermal and magnetic
Dimensions (mm)

| Poles | $\mathbf{1}$ |
| :--- | :--- |
| $H$ | 165 |
| $W$ | 35 |
| $D$ (less toggle) | 68 |
| Toggle cut-out | 104 |


| Ampere <br> Rating NRC | Ir | Im | Cat. No. | 1 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | :--- |
| 16 | 16 | 160 | S160 NF 1 16 | $\mathbf{1 6 5 . 0 0}$ |
| 20 | 20 | 200 | S160 NF 1 20 | $\mathbf{1 6 5 . 0 0}$ |
| 25 | 25 | 250 | S160 NF 1 25 | $\mathbf{1 6 5 . 0 0}$ |
| 32 | 32 | 320 | S160 NF 1 32 | $\mathbf{1 6 5 . 0 0}$ |
| 40 | 40 | 400 | S160 NF 1 40 | $\mathbf{1 6 5 . 0 0}$ |
| 50 | 50 | 500 | S160 NF 1 50 | $\mathbf{1 6 5 . 0 0}$ |
| 63 | 63 | 630 | S160 NF 1 63 | $\mathbf{1 6 5 . 0 0}$ |
| 80 | 80 | 800 | S160 NF 1 80 | $\mathbf{2 2 0 . 0 0}$ |
| 100 | 100 | 1000 | S160 NF 1 100 | $\mathbf{3 1 0 . 0 0}$ |
| 125 | 125 | 1250 | S160 NF 1 125 | $\mathbf{3 1 0 . 0 0}$ |
| 160 | 160 | 1600 | S160 NF 1 160 | $\mathbf{3 4 0 . 0 0}$ |



Optional captive lock attachment

Notes: For Shunt Trips, Interpole Barriers and Terminal Covers refer to accessories pages.
Ir: thermal rating
Im: magnetic rating
NRC: Nominal rated current S160NF will accept rear terminal studs.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Thermal magnetic type S160NJ 

## 30 / 36 kA

Current rating: $12.5-160 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:


20-32A:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 30 | 25 |
| DC use | 250 | 40 | 40 |

50-250 A:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 36 | 36 |
| DC use | 250 | 40 | 40 |

Trip unit: Adj thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adj magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere Rating NRC | $\begin{aligned} & I_{\mathrm{r}}{ }^{1} \\ & \text { Min. - Max. } \end{aligned}$ | $\begin{aligned} & \left.I_{\mathrm{m}}{ }^{1}\right) \\ & \text { Min. - Max. } \end{aligned}$ | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | S160 NJ $320{ }^{\text {2 }}$ ) | 480.00 |
| 32 | 20-32 | 192-384 | S160 NJ $332{ }^{\text {2 }}$ ) | 480.00 |
| 50 | 32-50 | 300-600 | S160 NJ 350 | 480.00 |
| 63 | 40-63 | 378-756 | S160 NJ 363 | 480.00 |
| 100 | 63-100 | 600-1200 | S160 NJ 3100 | 680.00 |
| 125 | 80-125 | 750-1500 | S160 NJ 3125 | 810.00 |
| 160 | 100-160 | 960-2080 | S160 NJ 3160 | 1080.00 |

4 Pole

| Ampere <br> Rating NRC | $\begin{aligned} & \left.I_{r}{ }^{1}\right) \\ & \text { Min. - Max. } \end{aligned}$ | $\begin{aligned} & \left.I_{m}{ }^{1}\right) \\ & \text { Min. - Max. } \end{aligned}$ | Cat. No. | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5-20 | 120-240 | S160 NJ 420 | 630.00 |
| 32 | 20-32 | 192-384 | S160 NJ 432 | 630.00 |
| 50 | 32-50 | 300-600 | S160 NJ 450 | 630.00 |
| 63 | 40-63 | 378-756 | S160 NJ 463 | 630.00 |
| 100 | 63-100 | 600-1200 | S160 NJ 4100 | 900.00 |
| 125 | 80-125 | 750-1500 | S160 NJ 4125 | 1090.00 |
| 160 | 100-160 | 960-2080 | S160 NJ 4160 | 1425.00 |

Notes: ${ }^{1)}$ Adj. Ir: Adjustable thermal setting - Adj. Im: Adjustable magnetic setting
${ }^{2}$ ) To obtain MCCBs that accept additional internal auxiliary circuits add "EA" to the above Cat. No.'s. E.g.: S125GJ3125EA.
Some types are stocked. Refer to NHP for availability. Refer page 3-9 for details.
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

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# TemBreak 2 Thermal magnetic type S160GJ 

65 kA
Current rating: 32-160 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 65 | 36 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |


| 3 Pole <br> Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. ${ }^{2}$ ) | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 50 | $32-50$ | $300-600$ | S160 G 3 50 | $\mathbf{7 5 0 . 0 0}$ |
| 63 | $40-63$ | $378-756$ | S160 GJ 3 63 | $\mathbf{7 5 0 . 0 0}$ |
| 100 | $63-100$ | $600-1200$ | S160 GJ 3 100 | $\mathbf{9 0 0 . 0 0}$ |
| 125 | $80-125$ | $750-1500$ | S160 GJ 3 125 | $\mathbf{1 0 0 0 . 0 0}$ |
| 160 | $100-160$ | $960-2080$ | S160 GJ 3 160 ${ }^{\text {2 }}$ ) | $\mathbf{1 2 1 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{\text {T }}$ ) <br> Min. - Max. | Cat. No. ${ }^{2}$ ) | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 50 | $32-50$ | $300-600$ | S160 G 4 50 | $\mathbf{9 9 0 . 0 0}$ |
| 63 | $40-63$ | $378-756$ | S160 GJ 4 63 | $\mathbf{9 9 0 . 0 0}$ |
| 100 | $63-100$ | $600-1200$ | S160 GJ 4 100 | $\mathbf{1 2 1 0 . 0 0}$ |
| 125 | $80-125$ | $750-1500$ | S160 GJ 4 125 | $\mathbf{1 3 3 0 . 0 0}$ |
| 160 | $100-160$ | $960-2080$ | S160 GJ 4 160 ${ }^{\text {2 }}$ ) | $\mathbf{1 6 2 0 . 0 0}$ |

[^19] Adj. Im: Adjustable magnetic setting
${ }^{2}$ ) To obtain MCCBs that accept additional internal auxiliary circuits add "EA" to the above Cat. No.'s. E.g.: S160GJ3160EA. Otherwise leave blank.
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type H160NJ

## 125 kA

Current rating: 100-160 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage Icu | Ics |  |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 125 | 85 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to 13 I m )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{~}{ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 160 | $100-160$ | $960-2080$ | H160 NJ 3 160 | $\mathbf{1 6 5 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. I ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{\text {1 }}$ ) <br> Min. - Max. | Cat. No. | 4 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 160 | $100-160$ | $960-2080$ | H160 NJ 4 160 | $\mathbf{2 2 1 0 . 0 0}$ |

[^20] NRC: Nominal rated current

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type L160NJ

## 200 kA

Current rating: 100-160 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 200 | 150 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to $13 \mathrm{I}_{\mathrm{m}}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere | Adj. Ir ${ }^{1}$ ) <br> Rating NRC <br> Min. - Max. | Adj. Im ${ }^{1}$ ') <br> Min. - Max. | Cat. No. | 3 pole <br> Price |
| :--- | :--- | :--- | :--- | ---: |
| 160 | $100-160$ | $960-2080$ | L160 NJ 3 160 | $\mathbf{2 0 3 0 . 0 0}$ |

4 Pole

| Ampere | Adj. Ir $^{1}$ ) <br> Min. - Max. | Adj. Im $^{1}$ ) <br> Min. - Max. | Cat. No. | 4 pole <br> Price |
| :--- | :--- | :--- | :--- | ---: |
| 160 | $100-160$ | $960-2080$ | L160 NJ 4 160 | $\mathbf{2 7 1 0 . 0 0}$ |

Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting NRC: Nominal rated current

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type E250NJ

## 25 kA

Current rating: $12.5-250 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage $\mathbf{I c u}$ |  | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 230 | 25 | 19 |
| DC use | 250 | 25 | - |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic
Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 165 |
| W | 105 |
| D (less toggle) | 68 |
| Toggle cut-out | 104 |


| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{\text {1 }}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12.5-20$ | $120-240$ | E250 NJ 3 20 | $\mathbf{4 4 0 . 0 0}$ |
| 32 | $20-32$ | $192-384$ | E250 NJ 3 32 | $\mathbf{4 4 0 . 0 0}$ |
| 50 | $32-50$ | $300-600$ | E250 NJ 3 50 | $\mathbf{4 4 0 . 0 0}$ |
| 63 | $40-63$ | $378-756$ | E250 NJ 3 63 | $\mathbf{4 4 0 . 0 0}$ |
| 100 | $63-100$ | $600-1200$ | E250 NJ 3 100 | $\mathbf{6 3 0 . 0 0}$ |
| 125 | $80-125$ | $750-1500$ | E250 NJ 3 125 | $\mathbf{7 8 0 . 0 0}$ |
| 160 | $100-160$ | $960-2080$ | E250 NJ 3 160 | $\mathbf{1 0 3 0 . 0 0}$ |
| 250 | $160-250$ | $1500-2500$ | E250 NJ 3 250 | $\mathbf{1 4 0 0 . 0 0}$ |

[^21]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S250NJ

## 36 kA

Current rating: 160-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:


|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 36 | 36 |
| DC use | 250 | 40 | 40 |

Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic

$$
\left(6 I_{\mathrm{m}} \text { to } 10 \mathrm{I}_{\mathrm{m}}\right)
$$

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-2500 | S250 NJ 3250 |  |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 4 pole Price $\$$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-2500 | S250 NJ 4250 | 1860 |

Notes: ${ }^{1)}$ Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
Magnetic only MCCBs are available on request.
For smaller amp trip units in the same 36 kA frame size, refer S160NJ MCCBs.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S250GJ

65 kA
Current rating: 160-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 65 | 36 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 I_{m}$ to $10 I_{m}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere | Adj. Ir ${ }^{1}$ ) | Adj. Im ${ }^{\text {1 }}$ ) |
| :--- | :--- | :--- | :--- | ---: | ( | Cat. No. ${ }^{2}$ ) |
| :--- |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. ${ }^{2}$ ) | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-2500 | S250 GJ 4250 | 2240.00 |

Fixed low magnetic and standard magnetic only types

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Fixed <br> magnetic | Cat. No. ${ }^{2}$ ) | 3 pole <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | 750 A | S250 GJ 3 SO23160 | $\mathbf{1 7 8 0 . 0 0}$ |
| 250 | $160-250$ | 1000 A | S250 GJ3250M1000 | $\mathbf{1 8 7 0 . 0 0}$ |
| 250 | Magnetic <br> trip only | 2500 A | S250 GJ3 250MAG | $\mathbf{1 9 1 0 . 0 0}$ |

Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting
${ }^{2}$ ) To obtain MCCBs that accept additional internal auxiliary circuits add ' $E A^{\prime}$ to the above Cat. Nos. E.g.: S250GJ3250EA. Otherwise leave blank.
NRC: Nominal rated current
For smaller amp trip units in the same 65 kA frame size, refer S160GJ MCCBs.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## MCCBs with Electronic Overcurrent Relays

TemBreak 2 Moulded Case Circuit Breakers to 1600 A are available with electronic overcurrent relays 250 A to 1600 A . Current ratings range from 16 A to 1600 A. The overcurrent relays are easy to adjust - simply select the current rating via a dial adjustment, and depending on the application, a dial selectable pre-set characteristic curve can also be selected.

## STANDARD Overcurrent Relay

## Features:

Electronic overcurrent protection, for general and selectivity applications 250 A and 1600 A: 7 characteristic curves, ( 630 A: 6 characteristic curves)

- Long Time, Short Time \& Instantaneous trip times vary depending on the characteristic curve selected
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
(dial settings are via incremental steps)


## OCR Options:

- Ground fault trip on 400-1600 A models
- Neutral pole protection for 4 pole MCCBs
- Pre-trip alarm
- Special curve characteristics are available

Right:
Typical OCR adjustment and setting detail shown on electronic MCCBs
(400/630 A shown)


Notes: Additional ELECTRONIC MCCB setting information can be found in Section 9.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S250PE

## 70 kA

Current rating: 16-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 70 | 70 |



## Overcurrent relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
OCR Options:
- Neutral pole protection for 4 pole MCCBs only
- Pre-trip alarm

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

## TemBreak 2 Electronic type S250PE

| 3 Pole <br> Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | Price \$ |
| :--- | :--- | :--- | ---: |
| 40 | $16-40$ | S250 PE 3 40 | $\mathbf{1 6 1 0 . 0 0}$ |
| 125 | $50-125$ | S250 PE 3 125 | $\mathbf{1 7 3 0 . 0 0}$ |
| 250 | $100-250$ | S250 PE 3 250 | $\mathbf{2 1 0 0 . 0 0}$ |
| 4 Pole <br> Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. |  |  |
| 40 | $16-40$ | Cat. No. ${ }^{1}$ ) |  |
| 125 | $50-125$ | S250 PE 440 | $\mathbf{1 9 3 2 . 0 0}$ |
| 250 | $100-250$ | S250 PE 4 125 | $\mathbf{2 4 3 0 . 0 0}$ |

Price Adder - For OCR options.

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | Price \$ |
| :--- | :--- | :--- | ---: |
| 3 P OCR options: | PTA $^{2}$ ) | S250 PE 3 AP 3 | $\mathbf{1 8 7 . 0 0}$ |
| 4 P OCR options: | PTA $^{2}$ ) | S250 PE 4 AP 4 | $\mathbf{1 8 7 . 0 0}$ |
|  | S250 PE 4 AN 4 | $\mathbf{1 8 7 . 0 0}$ |  |

Notes: ${ }^{1}$ ) The STD and Instantaneous pickup current (Isd \& Ii ) settings are not individually adjustable, however by selecting different curve types and different Ir settings the values will vary. Curve $1 \& 2 \mathrm{lsd}=2.5 \times \mathrm{I}_{R}$, curve 3 lsd $=5 \times I_{R}$, curve $4-7 \mathrm{Isd}=10 \times \mathrm{I}_{R} \cdot \mathrm{I}_{R}$ dial setting $0.4-0.9 \mathrm{Ii}=14 \times \mathrm{I}_{R}$ and $\mathrm{I}_{\mathrm{R}}$ dial setting $0.95-1.0 \mathrm{li}=10 \times \mathrm{I}_{\mathrm{R}}$. Refer curve examples and setting data in Section 9. NRC $=$ Nominal rated current,$I_{R}=$ Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous
${ }^{2}$ ) To order a MCCB with the above options insert the required option after the pole to make up the Cat. No. E.g.: S250PE 4 APN 250 is a S250PE 4 Pole 250 A MCCB c/w Pre-trip Alarm and Neutral Protection.

## TemBreak 2 Thermal magnetic type H250NJ

## 125 kA

Current rating: 100-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 125 | 85 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to $10 \mathrm{I}_{\mathrm{m}}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere | Adj. Ir | Adj. Im |  | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| Rating NRC | Min. - Max. | Min. - Max. | Cat. No. | C |
| 250 | $160-250$ | $1500-2500$ | H250 NJ 3250 | $\mathbf{2 0 2 0 . 0 0}$ |

4 Pole

| Ampere | Adj. Ir <br> Min. | Adj. Im <br> Min. - Max. | Cat. No. | 4 pole <br> Price |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | $1500-2500$ | H250 NJ 4 250 | $\mathbf{2 7 0 0 . 0 0}$ |

# TemBreak 2 Electronic MCCB with Energy Metering Output S250PE _AC 

## 70 kA

Current rating: 16-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 70 |

## MCCB Standard features:



- Electronic, for metering, selectivity, motor starting or general use
- 7 dial selectable characteristic suited to different applications
- Base current Ir adjustable from 40\%-100\% of current In.
- STD setting 2.5-10 $\left.\left(x I_{R}\right)^{2}\right)$
- INST setting $14\left(\operatorname{Max} 13 \times I_{n}\right)^{2}$ )
- Energy (multifunction) metering output, A, V, P, kW, kWh, E, Pf, F
- Trip event log, Alarm event log
- Modbus RTU 485 communications output
- External door mounting meter option (T2ED not incl. in below pricing)
- Neutral Pole protection option for 4 pole MCCBs only (AN)
- Pre-Trip Alarm (AP) option


## Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 165 |
| W | 105 |
| $D$ (less toggle) | 103 |
| Toggle cut-out | 48 |
|  | 105 on chassis |



| Ampere <br> Rating NRC | Adj. Ir Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole <br> Price \$ | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 40 | 16-40 | S250 PE 340 AC | 3260.00 |  |
|  |  | S250 PE 440 AC |  | 4100.00 |
| 125 | 50-125 | S250 PE 3125 AC | 3760.00 |  |
|  |  | S250 PE 4125 AC |  | 4500.00 |
| 250 | 100-250 | S250 PE 3250 AC | 3970.00 |  |
|  |  | S250 PE 4250 AC |  | 4760.00 |

[^22]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type H250NE

## 125 kA

Current rating: 16-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :---: | :---: | :---: |
| AC use | $380 / 415$ | 125 | 85 |



Overcurrent relay:
Electronic, for general and selectivity applications
■ 7 dial selectable characteristic curves suited for a variety of applications

- Base current $\mathrm{I}_{\mathrm{r}}$ is adjustable from $40 \%-100 \%$ of the nominal rated current $\mathrm{I}_{\mathrm{n}}$.
OCR Options:
- Neutral pole protection for 4 pole MCCBs only
- Pre-trip alarm

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| $W$ | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

## TemBreak 2 Electronic type H250NE

| 3 Pole <br> Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | ---: |
| 40 | $16-40$ | H250 NE 3 40 | $\mathbf{1 6 7 0 . 0 0}$ |
| 125 | $50-125$ | H250 NE 3 125 | $\mathbf{2 0 5 0 . 0 0}$ |
| 250 | $100-250$ | H250 NE 3 250 | $\mathbf{2 5 6 0 . 0 0}$ |


| 4 Pole <br> Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{\text {1 }}$ ) | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 40 | $16-40$ | H250 NE 4 40 | $\mathbf{3 5 8 0 . 0 0}$ |
| 125 | $50-125$ | H250 NE 4 125 | $\mathbf{3 2 2 0 . 0 0}$ |
| 250 | $100-250$ | H250 NE 4 250 | $\mathbf{3 4 1 0 . 0 0}$ |

Price Adder - For OCR options.

| Ampere Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole Price \$ | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{2}$ ) | H250 NE 3 AP 3 | 187.00 |  |
| 4P OCR options: | PTA ${ }^{2}$ ) | H250 NE 4 AP 3 |  | 187.00 |
|  | NP ${ }^{2}$ ) | H250 NE 4 AN 3 |  | 187.00 |
|  | PTA + NP ${ }^{2}$ ) | H250 NE 4 APN 3 |  | 365.00 |

## Notes: (for pages 3-56 and 3-57)

1) The STD and Instantaneous pickup currents (Isd \& li) settings are not individually adjustable, however by selecting different curve types and different $\mathbb{R}$ settings the values will vary. Curve $\left.1 \& 2\right|_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 \mathrm{I}_{\mathrm{sd}}=$ $5 \times I_{R}$, curve $4-7 I_{S_{d}}=10 \times I_{R}$. $I_{R}$ dial setting $0.4-0.9 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.95-1.0 \mathrm{I}_{\mathrm{i}}=13 \times \mathrm{I}_{\mathrm{R}}$. Refer curve examples \& setting data in section 9 .
${ }^{2}$ ) To order a MCCB with the above options add the required amp rating to the end of the catalogue number to complete it. Eg: H250NE 4 AN 250 is a H250NE 4 Pole 250 A MCCB c/w Neutral Protection.
NRC = Nominal rated current, IR = Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous
For additional information on installation, options and applications refer Section 9, Part C catalogue or NHP.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Electronic MCCB with Energy Metering Output H250NE _AC 

## 125 kA

Current rating: 16-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 125 | 85 |

## MCCB Standard features:



- Electronic, for metering, selectivity, motor starting or general use
- 7 dial selectable characteristic suited to different applications
- Base current Ir adjustable from 40\%-100\% of current In
- STD setting 2.5-10(xIR) ${ }^{2}$ )
- INST setting $\left.14(\operatorname{Max} 13 \times \mathrm{In})^{2}\right)$

Energy (multifunction) metering output, A, V, P, kW, kWh, E, Pf, F

- Trip event log, Alarm event log

Modbus RTU 485 communications output

- External door mounting meter option (T2ED not incl. in below pricing)
- Neutral Pole protection options for 4 pole MCCBs only (AN)
- Pre-Trip Alarm (AP) option

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 165 |
| W | 105 |
| D (less toggle) | 103 |
| Toggle cut-out | 48 |
|  | 105 on chassis |



105 on chassis

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. |  | Cat. No. $\left.{ }^{1}\right)$ |
| :--- | :--- | :--- | :--- | ---: | ---: |

Notes: See page 3-56 for notes.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type L250NJ

## 200 kA

Current rating: 100-250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 200 | 150 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to $10 \mathrm{I}_{\mathrm{m}}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 103 | 103 |
| Toggle cut-out | 104 | 104 |

3 Pole

| Ampere <br> Rating NRC | Adj. $I_{r}{ }^{1}$ ) <br> Min. - Max. | Adj. $I_{\mathrm{m}}{ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-2500 | L250 NJ 3250 | 2340.00 |

4 Pole

| Ampere Rating NRC | Adj. $I_{r}{ }^{1}$ ) <br> Min. - Max. | Adj. $I_{m}{ }^{1}$ ) <br> Min. - Max. | Cat. No. | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-2500 | L250 NJ 4250 | 3120.00 |

Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting NRC: Nominal rated current

## Accessories to suit 160-250 AF TemBreak 2

## External accessories

Cat. No.
Price $\$$

| Shunt trips | Internal accessories are common for MCCBs 125 A to 630 A . All have <br> screw terminals except those indicated below with wire leads as <br> standard |
| :--- | :--- |



## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Motor operators | Suits MCCB types S/H/L160, E/S/H/L250 |  |  |
| :---: | :---: | :---: | :---: |
|  | 110 V AC | T2MC25A10NB | 1620.00 |
| MC | 230-240 V AC | T2MC25A24NB | 1630.00 |
|  | 24 V DC | T2MC25D02NB | 1630.00 |
|  | 48 V DC | T2MC25D04NB | 1620.00 |
|  | 110 V DC | T2MC25D10NB | 1620.00 |
| Motor connection cable loom for electrical interlocking |  |  |  |
| Motor | T2MC 25 cable 500 mm , 250AF only | T2MM25L05A | 60.50 |
| Accessories | T2MC 25 cable $1500 \mathrm{~mm}, 250 \mathrm{AF}$ only | T2MM25L15A | 73.00 |
|  | Motor options: Contact NHP for key locking and auto-reset. |  |  |
|  | MCCB identification labels | T25CAPLAB | 3.50 |

T2SH
Shunt trip

T2AX
T2AL
Auxiliary \&
Alarm switches

T2UV
Undervoltage
trip


Motor operators 250 A motor fitted to MCCB

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Operating <br> handles <br> Direct <br> mounting, <br> fixed depth, | Suits MCCB types <br> S/H/L160, E/S/H/L250 | Grey/black |  |
| :--- | :--- | :--- | ---: |
| IP 54 |  |  |  |, | Red/yellow | T2HB25UR5BN | $\mathbf{1 8 9 . 0 0}$ |
| :--- | :--- | :--- |
| MCCB identification labels | T25CAPLAB | $\mathbf{2 1 0 . 0 0}$ |
|  |  |  |


| Door interlocking variable depth handle | S/H/L160, E/S/H/L250 |  |  |
| :---: | :---: | :---: | :---: |
|  | Grey IP 55 handle + 357 mm shaft | T2HS25R5GM | 280.00 |
|  | Red/ yellow IP 55 handle + 357 mm shaft | T2HS25R5RM | 290.00 |
| HS <br> HP | Large escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 90 mm T pin shaft for T2HS no flexi coupling | T2HS250SHAFT | 47.00 |
|  | Grey/ black IP 65 handle + 420 mm shaft | T2HP25R6BN | 290.00 |
|  | Red/ yellow IP 65 handle + 420 mm shaft | T2HP25R6RN | 300.00 |
|  | Padlock attachment for T2HP/HS mechanism | T2HP25PALK | 49.50 |
|  | MCCB identification labels | T25CAPLAB | 3.50 |



T2HS variable depth handle IP 55


Operating handles
Direct mounting, fixed depth, IP 54


T2HP Variable depth handle IP 65


Mechanism Padlock attachment

## Accessories to suit 160-250 AF TemBreak 2

| Mechanical Interlocks Link type | Link Interlock - suitable for manual or motorised operation. Will accept handles. Suitable for front or rear connect type MCCBs |  |  |
| :---: | :---: | :---: | :---: |
|  | S/H/L160, E/S/H/L250 |  |  |
| ML | Common 3 or 4 pole right side section | T2ML25RA | 113.00 |
|  | 3 pole left side section | T2ML25L3A | 127.00 |
|  | 4 pole left side section | T2ML25L4A | 127.00 |
|  | MCCB identification labels | T25CAPLAB | 3.50 |

Left section 3 or 4 pole (T2ML25L4A shown)

> Common right section
> (T2ML25RA shown)


Link interlocked 250 A MCCBs


T2HS handle with optional T2HSESC100 escutcheon plate

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Slide type interlock | Manual operation, padlockable. Does not allow motors, handles or other front mounted accessories to be fitted. |  |  |
| :---: | :---: | :---: | :---: |
|  | Suitable for front or rear connection S160, E250, S250 |  |  |
| MS | 3 pole | T2MS253SFA | 120.00 |
|  | 4 pole | T2MS254SFA | 134.00 |
|  | H160, L160, H250, L250 |  |  |
|  | 3 pole | T2MS253LFA | 120.00 |
|  | 4 pole | T2MS254LFA | 134.00 |


| Cable interlock | Allows an MCCB to be mounted horizontally, vertically or diagonally. Accepts Motors and handles. |  |  |
| :---: | :---: | :---: | :---: |
|  | Suitable for 3 or 4 pole MCCBs S/H/L160, E/S/H/L250 |  |  |
|  | Interlock kit less wire | T2MW25CA ${ }^{1}$ ) | 275.00 |
| MW | Wire for above interlocks Wire 1.0 M | T2MW00SA ${ }^{2}$ ) | 63.00 |
|  | Wire 1.5 M | T2MW00LA ${ }^{2}$ ) | 73.00 |
|  | MCCB identification labels | T25CAPLAB | 3.5 |



T2MS
Slide type


Notes: ${ }^{1}$ ) Order one interlock kit for each MCCB.
${ }^{2}$ ) Order one wire length for each pair of interlocked MCCBs.

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Terminal Covers | Suits MCCB types S/H/L160, E/S/H/L250 |  |  |
| :---: | :---: | :---: | :---: |
| Flush | 1 pole cover set of 2 | T2CS251SG | 10.00 |
|  | 3 pole cover set of 2 | T2CS253SG | 54.00 |
| CS | 4 pole cover set of 2 | T2CS254SG | 60.50 |


| Short <br> terminal <br> covers | S160, E250, S250 - except S250-PE |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| FC | pole cover set of $2,30 \mathrm{~mm}$ long |  |  | T2CF253SSNBA |

CF

| Standard terminal covers FC | S160, E250, S250 - except S250-PE |  |  |
| :---: | :---: | :---: | :---: |
|  | 1 pole cover set of 2,55 mm long | T2CF161SLNG | 40.00 |
|  | 3 pole cover set of 2, 55 mm long | T2CF253SLNG | 67.00 |
| CF | 4 pole cover set of 2 | T2CF254SLNG | 77.50 |
|  | H/L160, S250-PE, H/L250 |  |  |
|  | 3 pole cover set of 2, 55 mm long | T2CF253LLNG | 71.00 |
|  | 4 pole cover set of 2,55 mm long | T2CF254LLNG | 77.50 |



T2CF Standard term covers

Single pole terminal T2CF Short terminal covers cover


T2CS Flush IP 20 Cover

Accessories to suit 160 - 250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Terminal covers | Rear Connect MCCBs <br> S/H/L160, E/S/H/L250 |  |  |
| :---: | :---: | :---: | :---: |
| CR | 3 pole cover set of 2 | T2CR253SG | 54.00 |
|  | 4 pole cover set of 2 | T2CR254SG | 60.50 |
| Terminal locking clip | A clip that provides additional terminal cover position locking, and <br> cover also allows a lead seal to be fitted |  |  |
|  | All sizes 125, 250, 400, 630 AF | T2CF00L | 9.10 |
| Interpole Barriers $\left.{ }^{1}\right)^{2}$ ) | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { S160, E250, S250 - except S250-PE } \\ & \hline \end{aligned}$ |  |  |
| BA | Interpole barrier (Qty 2) | T2BA253SHA | 20.00 |
|  | H/L160, S250-PE, H/L250 |  |  |
|  | Interpole barrier (Qty 2) | T2BA253LHA | 20.00 |
| Toggle locks | Non Captive: Fits up to 3 padlocks or a multiple lock device |  |  |
|  | All 250 AF MCCBs (1-4 pole) |  |  |
|  | Lock with $5 \mathrm{~mm} \times 16.5 \mathrm{~mm}$ slot | T2HL25B | 31.50 |
| HL | Captive: Allows a single padlock or multiple padlock device |  |  |
|  | Suits 3/4 pole 250 AF MCCBs |  |  |
|  | Lock with one 8 mm holes | T2HL25CAP | 33.50 |
|  | For 1 pole MCCBs, $1 \times 8 \mathrm{~mm}$ hole | T2HLS160NFCAP | 92.00 |



T2CF locking clip


Inter pole barriers T2BA


Non captive lock attachment T2HL25B


T2HL25CAP Captive lock attachment

Notes: ${ }^{1}$ ) Line side interpole barriers or terminal covers must be installed with MCCBs.
${ }^{2}$ ) Interpole Barriers are supplied with MCCBs as standard; 2 barriers with 3 pole MCCBs, and 3 barriers with 4 pole MCCBs.

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No. Price \$

| ProSafe Allen-Bradley ProSafe locks can be used with T2HS variable depth <br> handle  <br> lock option ${ }^{1}$ )  |
| :--- | :--- |

## Suits MCCB types <br> E/S/H/L 160-250

| TKN | Prosafe shot bolt lock HS handles xx code | TKNHP | 520.00 |
| :---: | :---: | :---: | :---: |
|  | Prosafe standard key xx code for above | TKNNHPKEY | 130.00 |
|  | Cam for T2HS handle shafts Key codes A to Z are available. Specify by changing the key code above. | 14997702 | 235.00 |
| Attached Busbar | S/H/L160, E/S/H/L250 |  |  |
|  | 2 straight terminal bars | T2FB251BA | 26.80 |
| FB | 3 Pole, set of 6, flanged bar set | T2FB253BA | 77.50 |
|  | 3 Pole, set of 6, flanged bar set ${ }^{2}$ ) | TXJD0050B | 75.50 |
|  | 4 Pole, set of 8, straight bar set | T2FB254BA | 103.00 |
| Tunnel clamp S/H/L160, E/S/H/L250 |  |  |  |
| terminals | 3 Pole, set of 6 clamps 35-120 $\mathrm{mm}^{2}$ ) | T2FW25L3B | 173.00 |
| FW | 4 Pole, set of 8 clamps $35-120 \mathrm{~mm}^{2} \text { ) }$ | T2FW25L4B | 240.00 |



Notes: ${ }^{1}$ ) Contact NHP for lock options.

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Rear connect terminal studs | Suits MCCB types S160, | 1) Not S25 |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole kit, set of 6 studs | T2RP253SB | 375.00 |
|  | 4 pole kit, set of 8 studs | T2RP254SB | 480.00 |
| RP | H160, L160, H250, L250, S250PE |  |  |
|  | 3 pole kit, set of 6 studs | T2RP253LA | 390.00 |
|  | 4 pole kit, set of 8 studs | T2RP254LA | 540.00 |


| TemPlug | Suits MCCB types TemPlug MCCB line-side plug-in attachment |  |  |
| :---: | :--- | :--- | ---: |
|  | S160, E/S/250 |  |  |
|  | UP |  |  |
|  | T2UPX3250 TemPlug |  | $\mathbf{3 3 0 . 0 0}$ |
|  | S250PE | T2UPXE3250 | $\mathbf{3 5 0 . 0 0}$ |


|  | Templugs suit 6.3 mm busbar ( 10 mm bar option) |  |  |
| :---: | :---: | :---: | :---: |
| OCR sealing cover | 250 A thermal magnetic | T2SF25NTA | 26.80 |
| SF | 250 A electronic | T2SF25NEA | 26.80 |
| Electronic OCR checker | 230 V AC | TNS2 | 6590.00 |



Notes: ${ }^{1}$ ) S160NF single pole MCCBs will accept T2RP25 rear connect studs.

## Accessories to suit 160-250 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Pole fillers | Suits MCCB types S/H/L160, E/S/H/L250 |  |  |
| :---: | :---: | :---: | :---: |
|  | Pole filler 1 strip for a 46 mm high cut-out ${ }^{1}$ ) | DTPF | 4.30 |
|  | Pole filler 35 mm wide for a 104 mm cut-out | XAB3 | 3.80 |


| Door flange <br> DF | Provides an attractive panel cut-out surround for MCCBs or motors |  |  |
| :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { Suits MCCB sizes } \\ & \text { S/H/L160, E/S/H/L250 } \end{aligned}$ |  |  |
|  | MCCB IP 30 gland and gasket | T2DF25A | 127.00 |
|  | MOTOR IP 30 gland and gasket | T2DM25A | 215.00 |
| Door mounting flush plate | A kit that allows an MCCB to be mounted directly onto a door |  |  |
|  | S160, E250, S250 - except for S250PE |  |  |
| FP | 3 pole kit | T2FP25S3B | 82.50 |
|  | 4 pole kit | T2FP25S4A | POA |
| Wire lead terminal block | 250 AF left side | T2TF25LGA | 189.00 |
|  | 250 AF right sideblock | T2TF25RGA | 189.00 |
| TF |  |  |  |



Notes: ${ }^{1}$ ) Order 2 strips per MCCB.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type E400NJ

## 25 kA

Current rating: 252-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 25 | 25 |
| DC use | 250 | 25 | 19 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to $13 \mathrm{I}_{\mathrm{m}}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 260 |
| $W$ | 140 |
| $D$ (less toggle) | 103 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max.. | Adj. Im ${ }^{1}$ Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 400 | $250-400$ | $2400-4800$ | E400 NJ 3 400 | $\mathbf{1 9 3 0 . 0 0}$ |

Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S400CJ

## 36 kA

Current rating: 160-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 36 | 36 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic

$$
\left(6 I_{m} \text { to } 12 I_{m}\right)
$$

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 260 |
| $W$ | 140 |
| D (less toggle) | 103 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | $1500-3000$ | S400 CJ 3 250 | $\mathbf{1 9 3 0 . 0 0}$ |
| 400 | $250-400$ | $2400-4800$ | S400 CJ 3 400 | $\mathbf{1 9 7 0 . 0 0}$ |

Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
Magnetic only MCCBs are available on request.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S400NJ

## 50 kA

Current rating: 160-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 50 | 50 |
| DC use | 250 | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic ( $6 \mathrm{I}_{\mathrm{m}}$ to $12 \mathrm{I}_{\mathrm{m}}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 260 | 260 |
| W | 140 | 185 |
| D (less toggle) | 103 | 103 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{\text {1 }}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | $1500-3000$ | S400 NJ 3 250 | $\mathbf{2 0 2 0 . 0 0}$ |
| 400 | $250-400$ | $2400-4800$ | S400 NJ 3 400 | $\mathbf{2 0 2 0 . 0 0}$ |

## 4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{\text {1 }}$ ) <br> Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | $1500-3000$ | S400 NJ 4 250 | $\mathbf{2 7 0 0 . 0 0}$ |
| 400 | $250-400$ | $2400-4800$ | S400 NJ 4 400 | $\mathbf{2 7 0 0 . 0 0}$ |

[^23]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S400NE

## 50 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 50 | 50 |



Overcurrent relay:
Electronic, for general and selectivity applications

- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-10 (x Ir) )
- INST setting 13-14 (x Ir) )

OCR Options:

- Refer S400GE

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 260 | 260 |
| $W$ | 140 | 185 |
| D (less toggle) | 103 | 103 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 NE 3 250 | $\mathbf{2 1 8 0 . 0 0}$ |
| 400 | $160-400$ | S400 NE 3 400 | $\mathbf{2 1 8 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 NE 4 250 | $\mathbf{2 1 8 0 . 0 0}$ |
| 400 | $160-400$ | S400 NE 4400 | $\mathbf{2 8 9 0 . 0 0}$ |

Notes: ${ }^{1}$ ) For additional information on OCR setting and options refer section 9 or Part C catalogue.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# TemBreak 2 Thermal magnetic type S400GJ 

## 70 kA

Current rating: 250-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:


|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 70 | 50 |
| DC use | 250 | TBA |  |

Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and adjustable magnetic

$$
\left(6 I_{m} \text { to } 12 I_{m}\right)
$$

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $H$ | 260 | 260 |
| $W$ | 140 | 185 |
| $D$ (less toggle) | 103 | 103 |

3 Pole

| Ampere | Adj. Ir ${ }^{\text {1 }}$ ) <br> Min. | Adj. Im ${ }^{\text { }}$ ) <br> Min. - Max. | Cat. No. | 3 pole <br> Price |
| :--- | :--- | :--- | :--- | ---: |
| 250 | $160-250$ | $1500-3000$ | S400 GJ 3 250 | $\mathbf{2 3 1 0 . 0 0}$ |
| 400 | $250-400$ | $2400-4800$ | S400 GJ 3 400 | $\mathbf{2 3 1 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Adj. Im ${ }^{1}$ <br> Min. - Max. | Cat. No. | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 250 | 160-250 | 1500-3000 | S400 GJ 4250 | 3080.00 |
| 400 | 250-400 | 2400-4800 | S400 GJ 4400 | 3080.00 |

[^24]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S400GE

## 70 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 70 | 50 |



Overcurrent relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-10 (x Ir $)^{1}$ )
- INST setting 13-14 (x Ir ) )


## OCR Options:

- Ground fault trip (400 A OCR only)
- Neutral pole protection for 4 pole MCCBs ONLY
- Pre-trip alarm

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $H$ | 260 | 260 |
| $W$ | 140 | 185 |
| D (less toggle) | 103 | 103 |

Notes: ') Add overcurrent relay sensor AMP rating where" " + " is shown.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S400GE

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 GE 3 250 | $\mathbf{2 5 5 0 . 0 0}$ |
|  |  | S400 GE 3 400 | $\mathbf{2 5 5 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 GE 4 250 | $\mathbf{3 3 8 0 . 0 0}$ |
|  |  | S400 GE 4 400 | $\mathbf{3 4 0 0 . 0 0}$ |

## S400GE with additional protection options

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{1}$ ) | S400 GE 3 AP 400 | 2750.00 |
|  | $\left.\mathrm{GF}^{1}\right)^{2}$ ) | S400 GE 3 AG 400 | 2720.00 |
|  | PTA + GF $\left.{ }^{1}\right)^{2}$ ) | S400 GE 3 APG 400 | 2925.00 |
| 4 P OCR options: | PTA ${ }^{1}$ ) | S400 GE 4 AP 400 | 3590.00 |
|  | NP ${ }^{1}$ ) | S400 GE 4 AN 400 | 3590.00 |
|  | PTA + NP ${ }^{1}$ ) | S400 GE 4 APN 400 | 3780.00 |
|  | $\mathrm{GF}+\mathrm{NP}{ }^{1}$ ) | S400 GE 4 AGN 400 | 3780.00 |

Notes: ${ }^{1}$ ) For additional information on OCR setting and options refer section 9 or Part C catalogue.
${ }^{2}$ ) Where a neutral is present, a 4th Neutral pole CT is required for 3 pole GF MCCBs, and must be ordered separately using Cat. No.: T2GB40N04A. Refer page 3-100.

# SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI 

## TemBreak 2 Electronic XOW Metering MCCBs S400GE _X1L / X1S

## 70 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |



XOW Over Current Relay:

- Ammeter or Energy Metering types
- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $I_{n}$

MCCB Standard features:

## S400GE _ X1L

- Ammeter, Adjustable LSI

- Trip event log, Alarm event log, Test function

S400GE _X1S
Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H

- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications
- External door mounting meter option (T2ED not incl. in below pricing)


## Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H (less attached busbar) | 260 | 260 |
| W | 140 | 185 |
| D (less toggle) | 103 | 103 |



|  | Ampere <br> Rating NRC |  | dj. Max. | Cat. No. ${ }^{1}$ ) | 3 pole Price \$ | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| MCCB with ammeter | 250 | 100 | 250 | S400 GE 3250 X1L | 4650.00 |  |
|  |  |  |  | S400 GE 4250 X1L |  | 5690.00 |
|  | 400 | 160 | 400 | S400 GE 3400 X1L | 4900.00 |  |
|  |  |  |  | S400 GE 4400 X1L |  | 5880.00 |
| MCCB with energy meter | 250 | 100 | 250 | S400 GE 3250 X1S | 6550.00 |  |
|  |  |  |  | S400 GE 4250 X1S |  | 7750.00 |
|  | 400 | 160 | 400 | S400 GE 3400 X1S | 6800.00 |  |
|  |  |  |  | S400 GE 4400 X1S |  | 8160.00 |

Notes: NRC: Nominal rated current, Ir: Current adjustment dial setting,
STD = Short Time Delay, INST = instantaneous
For additional information on installation, options and applications refer Section 9, Part C catalogue or NHP.

## SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI

## TemBreak 2690 V AC High Fault Interruption MCCB L400PE

## 70 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2
Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 690 | 70 | 50 |



## Over Current Relay:

- Electronic, for general \& selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from 40\%-100\% of the nominal rated current In
- STD setting $\left.\quad 2.5-10\left(\mathrm{x}_{\mathrm{R}}\right)^{1}\right)$
- INST setting $\quad 14\left(\operatorname{Max} 13 \times I_{n}\right)^{1}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H (less attached busbar) | 260 |
| W | 140 |
| D (less toggle) | 140 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price S |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | L400 PE 3 250 | $\mathbf{3 2 4 0 . 0 0}$ |
| 400 | $252-400$ | L400 PE 3 400 | $\mathbf{3 2 4 0 . 0 0}$ |

[^25]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S400PE

## 85 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 85 | 85 |



Overcurrent relay:

- Electronic, for general and selectivity applications

■ 7 dial selectable characteristic curves suited for a variety of applications

- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-10 (x Ir ) ')
- INST setting 13-14 (x If) )


## OCR Options:

- Ground fault trip (400 A OCR only)
- Neutral pole protection for 4 pole MCCBs ONLY
- Pre-trip alarm

Notes: ${ }^{1}$ ) Add overcurrent relay sensor AMP rating where " + " is shown.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S400PE

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 260 | 260 |
| W | 140 | 185 |
| D (less toggle) | 103 | 103 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 PE 3 250 | $\mathbf{2 7 8 0 . 0 0}$ |
| 400 | $160-400$ | S400 PE 3400 | $\mathbf{2 7 8 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | S400 PE 4 250 | $\mathbf{3 4 8 0 . 0 0}$ |
| 400 | $160-400$ | S400 PE 4400 | $\mathbf{3 4 8 0 . 0 0}$ |

Price Adder - For OCR options

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{1}$ ) | S400 PE 3 AP + | 187.00 |
|  | GF $\left.\left.{ }^{1}\right)^{2}\right)$ | S400 PE 3 AG 400 | 187.00 |
|  | PTA + GF $\left.{ }^{1}\right)^{2}$ ) | S400 PE 3 APG 400 | 375.00 |
| 4 P OCR options: | PTA ${ }^{1}$ ) | S400 PE 4 AP + | 187.00 |
|  | NP ${ }^{1}$ ) | S400 PE 4 AN + | 187.00 |
|  | PTA + NP ${ }^{1}$ ) | S400 PE 4 APN + | 375.00 |
|  | $\mathrm{GF}+\mathrm{NP}^{1}$ ) | S400 PE 4 AGN 400 | 375.00 |

Notes: ${ }^{1)}$ For additional information on OCR setting and options refer section 9 or Part C catalogue.
${ }^{2}$ ) Where a neutral is present, a 4th Neutral pole CT is required for 3 pole GF MCCBs, and must be ordered separately using Cat. No.: T2GB40N04A. Refer to page 3-100.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type H400NE

## 125 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 125 | 85 |



Overcurrent relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-10 (x Ir $)^{1}$ )
- INST setting 13-14 (x /r $)^{\prime}$ )


## OCR Options:

- Ground fault trip (400 A OCR only)
- Neutral pole protection for 4 pole MCCBs
- Pre-trip alarm


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type H400NE

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $H$ | 260 | 260 |
| $W$ | 140 | 185 |
| $D$ (less toggle) | 140 | 140 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | H400 NE 3 250 | $\mathbf{3 2 4 0 . 0 0}$ |
| 400 | $160-400$ | H400 NE 3 400 | $\mathbf{3 2 4 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 4 pole <br> Price S |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | H400 NE 4 250 | $\mathbf{4 3 2 0 . 0 0}$ |
| 400 | $160-400$ | H400 NE 4400 | $\mathbf{4 3 2 0 . 0 0}$ |

Price Adder - For OCR options

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{1}$ ) | H400 NE 3 AP + | 187.00 |
|  | $\left.\mathrm{GF}^{1}\right)^{2}$ ) | H400 NE 3 AG 400 | 187.00 |
|  | PTA + GF ${ }^{1}{ }^{2}$ ) | H400 NE 3 APG 400 | 375.00 |
| 4 P OCR options: | PTA ${ }^{1}$ ) | H400 NE 4 AP + | 187.00 |
|  | NP ${ }^{1}$ ) | H400 NE 4 AN + | 187.00 |
|  | PTA + NP ${ }^{1}$ ) | H400 NE 4 APN + | 375.00 |
|  | GF + NP ${ }^{1}$ ) | H400 NE 4 AGN 400 | 375.00 |

Notes: ${ }^{1)}$ For additional information on OCR setting and options refer section 9 or Part C catalogue.
${ }^{2}$ ) Where a neutral is present, a 4th Neutral pole CT is required for 3 pole GF MCCBs, and must be ordered separately using Cat. No.: T2GB40N04A. Refer to page 3-100.

# SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI 

## TemBreak 2 Electronic XOW Metering MCCBs H400NE _X1L / X1S

## 125 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 125 | 85 |



XOW Over Current Relay:

- Ammeter or Energy Metering types
- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $\mathrm{I}_{n}$

MCCB Standard features:
H400NE _ X1L


- Trip event log, Alarm event log, Test function


## H400NE X1S

Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H

- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications
- External door mounting meter option (T2ED not incl. in below pricing)

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H (less attached busbar) | 260 | 260 |
| W | 140 | 185 |
| D (less toggle) | 103 | 103 |



|  | Ampere <br> Rating NRC |  | dj. Max. | Cat. No. | 3 pole Price \$ | 4 pole Price $\$$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| MCCB with ammeter | 250 | 100 | 250 | H400 NE 3250 X1L | 5350.00 |  |
|  |  |  |  | H400 NE 4250 X1L |  | 6540.00 |
|  | 400 | 160 | 400 | H400 NE 3400 X1L | 5350.00 |  |
|  |  |  |  | H400 NE 4400 X1L |  | 6540.00 |
| MCCB with energy meter | 250 | 100 | 250 | H400 NE 3250 X1S | 7150.00 |  |
|  |  |  |  | H400 NE 4250 X1S |  | 8250.00 |
|  | 400 | 160 | 400 | H400 NE 3400 X1S | 7150.00 |  |
|  |  |  |  | H400 NE 4400 X1S |  | 8250.00 |

Notes: NRC: Nominal rated current, Ir: Current adjustment dial setting,
STD = Short Time Delay, INST = instantaneous
For additional information on installation, options and applications refer Section 9, Part C catalogue or NHP.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type L400NE

## 200 kA

Current rating: 100-400 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 200 | 150 |



Overcurrent relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-10 (x/r) ${ }^{1}$ )
- INST setting 13-14 (x Ir $)^{1}$ )

OCR Options:

- Ground fault trip (400 A OCR only)
- Neutral pole protection for 4 pole MCCBs
- Pre-trip alarm

Notes: ${ }^{1)}$ Add Over Current Relay sensor AMP rating where " + " is shown.

## TemBreak 2 Electronic type L400NE

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $H$ | 260 | 260 |
| $W$ | 140 | 185 |
| $D$ (less toggle) | 140 | 140 |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | L400 NE 3250 | $\mathbf{3 3 7 0 . 0 0}$ |
| 400 | $160-400$ | L400 NE 3 400 | $\mathbf{3 3 7 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{\text {1 }}$ ) | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 250 | $100-250$ | L400 NE 4 250 | $\mathbf{4 3 8 0 . 0 0}$ |
| 400 | $160-400$ | L400 NE 4400 | $\mathbf{4 3 8 0 . 0 0}$ |

Price Adder - For OCR options.

| Description |  | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{2}$ ) | L400 NE 3 AP + | 187.00 |
|  | $\left.\left.\mathrm{GF}^{2}\right)^{3}\right)$ | L400 NE 3 AG 400 | 187.00 |
|  | PTA + GF $\left.{ }^{2}\right)^{3}$ ) | L400 NE 3 APG 400 | 375.00 |
| 4 P OCR options: | PTA ${ }^{2}$ ) | L400 NE 4 AP + | 187.00 |
|  | NP ${ }^{2}$ ) | L400 NE 4 AN + | 187.00 |
|  | PTA + NP ${ }^{2}$ ) | L400 NE 4 APN + | 375.00 |
|  | $\mathrm{GF}+\mathrm{NP}{ }^{2}$ ) | L400 NE 4 AGN 400 | 375.00 |

Notes: ') Add Over Current Relay sensor AMP rating where" + " is shown.
${ }^{\text {2 }}$ ) For additional information on OCR setting and options refer section 9 or Part C catalogue.
${ }^{3}$ ) Where a neutral is present, a 4th Neutral pole CT is required for 3 pole GF MCCBs, and must be ordered separately using Cat. No.: T2GB40N04A. Refer to page 3-100.


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## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type E630NE

## 36 kA

Current rating: 252-630 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 36 | 36 |



## Overcurrent relay:

- Electronic, for general and selectivity applications

■ 6 dial selectable characteristic curves suited for a variety of applications

- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-8 (x Ir) ${ }^{\text {1 }}$ )

INST setting 10-14 (x Ir) )
OCR Options:

- Ground fault trip

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 260 |
| $W$ | 140 |
| $D$ (less toggle) | 103 |

3 Pole

| Ampere | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 630 | $252-630$ | E630 NE 3 630 | $\mathbf{2 7 0 0 . 0 0}$ |

Notes: ${ }^{1)}$ The STD and instantaneous pickup current (Isd \& li ) settings are not individually adjustable, however by selecting different curve types and different Ir settings the values will vary. Curve $1 \& 2 \mathrm{Isd}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve 3 Isd $=5 \times \mathrm{I}_{R}$, curve $4-6 \mathrm{Isd}=8 \times \mathrm{I}_{R} . \mathrm{I}_{R}$ dial setting $0.4-0.63 \mathrm{li}=14 \times \mathrm{I}_{\mathrm{R}}$ and $\mathrm{I}_{\mathrm{R}}$ dial setting $0.8-1.0 \mathrm{li}=10 \times \mathrm{IR}$. Refer curve examples and setting data in Section 9.
NRC = Nominal rated current, $\mathrm{I}_{\mathrm{R}}=$ Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S630CE

## 50 kA

Current rating: 252-630 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | $380 / 415$ | 50 | 50 |



## Overcurrent relay:

Electronic, for general and selectivity applications

- 6 dial selectable characteristic curves suited for a variety of applications

Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.

- STD setting 2.5-8 (x Ir) ${ }^{1}$ )

INST setting 10-14 (x Ir) ')
OCR Options:

- Refer S630GE

Dimensions (mm)
Refer page 3-86
3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| 630 | $252-630$ | S630 CE 3 630 | $\mathbf{2 9 2 0 . 0 0}$ |

4 Pole

| Ampere | Adj. Ir |  |  |
| :--- | :--- | ---: | ---: |
| Rating NRC | Min. - Max. | Cat. No. | 4 pole <br> Price \$ |
| 630 | $252-630$ | S630 CE 4 630 | $\mathbf{3 8 8 0 . 0 0}$ |

Notes: ${ }^{1}$ ) The STD and instantaneous pickup currents (Isd \& li) settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curve $1 \& 2 \mathrm{Isd}=2.5 \times \mathrm{I}_{\mathrm{R}}$ curve 3 Isd $=5 \times \mathrm{I}_{\mathrm{R}}$, curve $4-6 \mathrm{Isd}=8 \times \mathrm{I}_{\mathrm{R}}$. $\mathrm{I}_{\mathrm{R}}$ dial setting $0.4-0.63 \mathrm{li}=14 \times \mathrm{I}_{\mathrm{R}}$ and $\mathrm{I}_{\mathrm{R}}$ dial setting $0.8-1.0 \mathrm{li}=10 \times \mathrm{I}$. Refer curve examples and setting data in Section 9.
NRC = Nominal rated current, $\mathrm{I}_{\mathrm{R}}=$ Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous

## T1HS /T2HS HANDLES

For Terasaki moulded case circuit breakers up to 1600 A .


- IP55 rated plastic handle
- Long variable depth shaft supplied standard
- Heavy duty metal locking lever standard
- Internal door interlocking components are all metal
- All handles mount in a 31-37 mm hole
- Short lever handles on MCCBs to 250 A, longer types 400-1600 A
- 105 mm 2 or 130 mm 2 escutcheon plates are optional
- Handles are padlockable in the OFF position as standard
- ON padlocking optional via on site handle modification
- Accepts up to three 4-8 mm locks or multi lock devices
- Door opens when handle is switched to OFF position
- Door will not open when handle is padlocked OFF
- Door defeat function standard
- Padlock option for handle mechanism mounted on MCCB
- Door defeat non functional when padlocked OFF
- All handle mechanisms allow MCCB dial setting viewing and access
- For IP 65 applications T1HP/T2HP handles are available
- ON indication flag on handle mechanism
- Prosafe trapped key interlock options


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S630GE

## 70 kA

Current rating: $252-630 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage Icu | Ics |
| :--- | :--- | :--- |
| AC use | $380 / 415 \quad 70$ | 50 |



## Overcurrent relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current $I r$ is adjustable from $40 \%-100 \%$ of the nominal rated current In.
- STD setting 2.5-8 (x Ir) ${ }^{\text {1 }}$ )
- INST setting 10-14 (x Ir ) )


## OCR Options:

- Ground fault trip
- Neutral pole protection for 4 pole MCCBs ONLY
- Pre-trip alarm

Notes: ${ }^{1}$ ) The STD and instantaneous pickup currents (Isd \& li) settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curve $1 \& 2 \mathrm{Isd}=2.5 \times \mathrm{I}_{\mathrm{R}}$ curve 3 Isd $=5 \times \mathrm{I}_{\mathrm{R}}$, curve $4-6 \mathrm{Isd}=8 \times \mathrm{I}_{R} . \mathrm{I}_{R}$ dial setting $0.4-0.63 \mathrm{li}=14 \times \mathrm{I}_{\mathrm{R}}$ and $I_{R}$ dial setting
$0.8-1.0 \mathrm{li}=10 \times \mathrm{I}_{\mathrm{R}}$. Refer curve examples and setting data in Section 9 .
NRC = Nominal rated current, $I_{R}=$ Current adjustment dial setting,
STD = Short Time Delay, INST = instantaneous

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S630GE

Dimensions (mm)
Refer page 3-86
3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price S |
| :--- | :--- | :--- | ---: |
| 630 | $252-630$ | S630 GE 3630 | $\mathbf{3 1 3 0 . 0 0}$ |

4 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 4 pole <br> Price $\$$ |
| :--- | :--- | :--- | ---: |
| 630 | $252-630$ | S630 GE 4630 | $\mathbf{4 1 8 0 . 0 0}$ |

MCCB price with OCR option fitted.

| Description | Cat. No. | Price \$ |
| :---: | :---: | :---: |
| PTA ${ }^{1}$ ) | S630 GE 3 AP 630 | 3330.00 |
| 3 P OCR options:GF $\left.{ }^{1}\right)^{2}$ ) | S630 GE 3 AG 630 | 3330.00 |
| PTA + GF $\left.{ }^{1}\right)^{2}$ ) | S630 GE 3 APG 630 | 3530.00 |
| PTA ${ }^{1}$ ) | S630 GE 4 AP 630 | 4370.00 |
| OCR options: ${ }^{\text {P }}{ }^{1}$ ) | S630 GE 4 AN 630 | 4370.00 |
| ( ${ }^{\left.\text {PTA + NP }{ }^{1}\right)}$ | S630 GE 4 APN 630 | 4570.00 |
| GF + NP ${ }^{1}$ ) | S630 GE 4 AGN 630 | 4570.00 |

Notes: ${ }^{1}$ ) To order a MCCB with the above options insert the required option after the pole to make up the Cat. No. E.g.: S630GE 3 AG 630 is a S630GE 3 Pole 630 A MCCB c/w Ground Fault protection.
${ }^{2}$ ) Where a neutral is present, a 4th Neutral pole CT is required for 3 pole GF MCCBs and must be ordered separately using Cat. No.: T2GB40N06A. Refer to page 3-100.

## TemBreak Electronic XOW Metering MCCBs S630GE _X1L / X1S

## 70 kA

Current rating: 252-630 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |



## XOW Over Current Relay:

- Ammeter or Energy Metering types
- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $\mathrm{I}_{n}$

MCCB Standard features:

## S630PE_X1L

- Ammeter, Adjustable LSI
- Trip event log, Alarm event log, Test function


## S630PE _ X1S

- Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H
- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications

External door mounting meter option (T2ED not incl. in below pricing)

| Dimensions (mm) <br> Poles |  |  | 3 | 4 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| H (less attached busbar) |  |  | 260 | 260 |  |  |
| W |  |  | 140 | 185 |  |  |
| D (less toggle) |  |  | 103 | 103 |  |  |
|  | Ampere Rating NRC |  | dj. <br> . Max. | Cat. No. | 3 pole Price \$ | 4 pole Price $\$$ |
| MCCB with ammeter | 630 | 252630 |  | S630 GE 3630 X1L | 5500.00 |  |
|  |  |  |  | S630 GE 4630 X1L |  | 6600.00 |
| MCCB with energy meter | 6302 | 252630 |  | S630 GE 3630 X1S | 7340.00 |  |
|  |  |  |  | S630 GE 4630 X1S |  | 8800.00 |

Notes: NRC: Nominal rated current, $\mathrm{I}_{\mathrm{r}}$ : Current adjustment dial setting,
STD = Short Time Delay, INST = instantaneous
For additional information on installation, options and applications refer Section 9, Part C catalogue or NHP.

## Accessories to suit 400 / 630 AF TemBreak 2



External accessories
Cat. No.
Price \$
Shunt trips Internal accessories are common for MCCBs 125 A to 630 A . All have screw terminals except those indicated below with wire leads as standard

|  |  |  |  |
| :---: | :---: | :---: | :---: |
|  | For 3 and 4 pole MCCB |  |  |
|  | 110 V AC | T2SH00A10TA ${ }^{1}$ ) | 255.00 |
|  | 230-240 V AC | T2SH00A20TA ${ }^{1}$ ) | 255.00 |
| SH | 400-415 V AC | T2SH00A40TA ${ }^{1}$ ) | 255.00 |
|  | 24 V DC (Suits 24 V AC) | T2SH00D02TA ${ }^{1}$ ) | 255.00 |
|  | 48 V DC | T2SH00D04TA ${ }^{1}$ ) | 255.00 |
|  | 110 V DC | T2SH00D10TA ${ }^{1}$ ) | 255.00 |
|  | 230 V DC | T2SH00D20TA ${ }^{1}$ ) | 255.00 |
| Undervo | Instantaneous opera |  |  |
| trips | 110 V AC | T2UV00A10NTA | 270.00 |
|  | 200-240 V AC | T2UV00A20NTA | 270.00 |
|  | 380-450 V AC | T2UV00A40NTA | 270.00 |
| UV | 24 V DC | T2UV00D02NTA | 270.00 |
|  | 110 V DC | T2UV00D10NTA | 270.00 |
|  | 230 V DC | T2UV00D20NTA | 270.00 |


| Auxiliary \& Alarm switches | Time delayed operation ( 500 ms ) - refer NHP |  |  |
| :---: | :---: | :---: | :---: |
|  | General type (2 A @ 240 V Inductive) |  |  |
|  | $1 \mathrm{C} / \mathrm{O}$ Auxiliary | T2AX00M3STA | 134.00 |
|  | $1 \mathrm{C} / \mathrm{O}$ Auxiliary - with 0.7 m wire leads | T2AX00M3SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O}$ Alarm | T2AL00M3STA | 134.00 |
|  | $1 \mathrm{C} / \mathrm{O}$ Alarm - with 0.7 m wire leads | T2AL00M3SWA | 146.00 |

AX Heavy-duty type (4 A @ 240 V Inductive)

AL

| 1 N/O Auxiliary | T2AX00B1STA | 146.00 |
| :--- | :--- | :--- |
| 1 N/C Auxiliary | T2AX00B2STA | 146.00 |
| 1 N/O Alarm | T2AL00B1STA | 146.00 |
| 1 N/C Alarm | T2AL00B2STA | $\mathbf{1 4 6 . 0 0}$ |

Micro switching type (very low voltages)

| 1C/O Auxiliary | T2AX00M3RTA | 187.00 |
| :--- | :--- | :--- |
| 1 C/O Alarm | T2ALOOM3RTA | 187.00 |

Notes: ${ }^{1}$ ) Wire lead types available.

## Accessories to suit 400 / 630 AF TemBreak 2

| External accessories |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Motor operators | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { E400, S400, H400, L400, E630, } \end{aligned}$ |  |  |
|  | 110-240 V AC | T2MC40A10NB | 2420.00 |
|  | 24-48V DC | T2MC40D02NB | 2420.00 |
|  | 110 V DC | T2MC40D10NB | 2420.00 |
| MC | Motor connection cable loom for Electrical interlocking |  |  |
|  | T2MC40 cable 600 mm .400 AF only | T2MM40L06A | 60.50 |
|  | T2MC40 cable 2100 mm . 400AF only | T2MM40L21A | 80.00 |
|  | Motor options: Contact NHP for key locking and auto-reset. |  |  |
|  | MCCB identification labels | T40CAPLAB | 3.50 |



| Operatinghandles | Suits MCCB types <br> E400, S400, H400, L400, E630, S630 |  |  |
| :---: | :---: | :---: | :---: |
| Direct | Grey/black | T2HB40UR5BN | 240.00 |
| mounting, | Red/yellow | T2HB40UR5RN | 265.00 |
| $\text { IP } 54$ | MCCB identification labels | T40CAPLAB | 3.50 |


| Door interlocking variable depth handles | E400, S400, H400, L400, E630, S630 |  |  |
| :---: | :---: | :---: | :---: |
|  | Grey IP55 handle +320 mm shaft | T2HS40R5GM | 370.00 |
|  | Red/yellow IP55 handle + 320 mm shaft | T2HS40R5RM | 315.00 |
|  | Large escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
| HS | 390 mm T pin shaft for T2HS no flexi coupling | T2HS400SHAFT | 47.00 |
|  | Grey/black IP65 handle + 445 mm shaft | T2HP40R6BN | 315.00 |
| HP | Red/yellow IP65 handle + 445 mm shaft | T2HP40R6RN | 330.00 |
|  | Padlock attachment for T2HP/HS mechanism | T2HP40PALK | 49.50 |
|  | MCCB identification labels | T40CAPLAB | 3.50 |



T2HP40 Variable depth handle


T2HP40PALK Mechanism padlock attachment


T2HS handle with optional escutcheon plate, type T2HSESC100


T2HB fixed depth "direct mount" handle

Notes: Handles supplied with key locks available on request for T2HP handles.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Mechanical Interlocks Link type | Link Interlock - suitable for motorised operation. Suitable for front or rear contact MCCBs |  |  |
| :---: | :---: | :---: | :---: |
|  | E400, S400, H400, L400, E630 | $3{ }^{1}$ ) |  |
| ML | Common 3 or 4 pole right side section | T2ML40RB | 350.00 |
|  | 3 pole left side section | T2ML40L3B | 133.00 |
|  | 4 pole left side section | T2ML40L4B | 133.00 |
|  | MCCB identification labels | T40CAPLAB | 3.50 |

Link Interlock - suitable for manual handle operation only. Suitable for front or rear contact MCCBs
MH
E400, S400, H400, L400, E630, S630

| Common 3 or 4 pole right side <br> section | T2MLH40RB | $\mathbf{3 5 0 . 0 0}$ |
| :--- | :--- | ---: |
| 3 pole left side section | T2MLH40L3B | $\mathbf{1 3 3 . 0 0}$ |
| 4 pole left side section | T2MLH40L4B | $\mathbf{1 3 3 . 0 0}$ |
| MCCB identification | T40CAPLAB | $\mathbf{3 . 5 0}$ |



T2ML Interlock for motorised operation

Notes: Refer to Section 5 if MCCB labels are required or refer to NHP.
${ }^{1}$ ) A handle or motor must be fitted in addition to the interlock.

## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.
Price \$

| Slide type interlock | Manual operation, padlockable. Does not allow motors, handles or other front mounted accessories to be fitted. |  |  |
| :---: | :---: | :---: | :---: |
|  | Suitable for front or rear connection E400, S400, E630, S630 |  |  |
| MS | 3 pole | T2MS403SFA | 220.00 |
|  | 4 pole | T2MS404SFA | 210.00 |
| Cable interlock | Allows an MCCB to be mounted horizontally, vertically or diagonally. |  |  |
|  | $\begin{aligned} & \text { Suitable for } 3 \text { or } 4 \text { pole MCCBs } \\ & \text { E400, } \mathrm{S} 400, \mathrm{H} 400, \mathrm{~L} 400, \mathrm{E} 630, \mathrm{~S}^{1} \text { ) } \end{aligned}$ |  |  |
|  | Interlock kit less wire for motorised operation | T2MW40CB | 330.00 |
| MW | Interlock kit less wire for manual handle operation | T2MWH40CB | 330.00 |
|  | Wire for above interlocks Wire 1.0 M | T2MW00SA ${ }^{\text {2 }}$ ) | 63.00 |
|  | Wire 1.5 M | T2MW00LA ${ }^{\text {2 }}$ ) | 73.00 |
|  | MCCB identification labels | T40CAPLAB | 3.5 |

T2MW50CB Interlock and motor


T2MWH4CB
Interlock and handle

T2MW40 wire interlocked MCCBs, showing either a motor or handle installed

Notes: 1) A handle or motor must be fitted in addition to the interlock.
${ }^{2}$ ) Use one wire length for each MCCB pair.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.
Price $\$$

| Standard terminal covers FC | E400, S400, H400, L400, E630, S630 ${ }^{\text {2 }}$ ) |  |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole cover set of 2, 180 mm wide | T2CF403SWNG ${ }^{1}$ ) | 190.00 |
| CF | 3 pole cover set of 2, 140 mm wide | T2CF403SLNG ${ }^{1}$ ) | 190.00 |
|  | 4 pole cover set of 2 , 185 mm wide | T2CF404SLNG | 205.00 |
|  | 4 pole cover set of 2 , 238 mm wide | T2CF404SWNG | 205.00 |



Notes: ') For 400/630 A MCCBs, 'Flush' and 'rear' covers are the same item.
${ }^{2}$ ) Locking clip T2FOOL tool supplied standard.

## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.

| Terminal covers ${ }^{3}$ ) | Rear Connect/ or flush front connect cover.E400, S400, H400, L400, E630, S630 |  |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole cover set of 2 | T2CR403SG | 93.50 |
| CS/CR | 4 pole cover set of 2 | T2CR404SG | 111.00 |

Terminal A clip that provides additional terminal cover position locking, and cover locking also allows a lead seal to be fitted

| clip | All sizes $125,250,400,630 \mathrm{AF}$ | T2CF00L | $\mathbf{9 . 1 0}$ |
| :--- | :--- | :--- | :--- |


| Interpole Barriers $\left.{ }^{1}\right)^{2}$ ) | E400, S400, E630, S630 |  |  |
| :---: | :---: | :---: | :---: |
|  | Interpole barrier (Qty 2) | T2BA403SHA | 21.60 |
|  | H400, L400 |  |  |
| BA | Interpole barrier (Qty 2) | T2BA403LHA | POA |



T2CR / T2CS
Flush cover with 'knock-outs' for optional rear connect use.


T2CF00L
Locking clip


T2BA
Interpole barriers

Notes: ${ }^{1}$ ) Line side interpole barriers or terminal covers must be installed with MCCBs.
${ }^{2}$ ) Interpole Barriers are supplied with MCCBs as standard; 2 barriers with 3 pole MCCBs, and 3 barriers with 4 pole MCCBs.
${ }^{3}$ ) For 400/630 A MCCBs, "flush" and "rear" covers are the same item.

## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.
Price \$

| ProSafe lock option | ProSafe locks can be mounted with T2HS variable depth handle operation. Refer NHP for direct mounting handle options. |  |  |
| :---: | :---: | :---: | :---: |
|  | Suits MCCB types <br> E/S/H/L 400-630 |  |  |
|  | Prosafe shot bolt lock HS handles xx code | TKNHP | 520.00 |
| TKN | Prosafe standard key xx code for above | TKNNHPKEY_ | 130.00 |
|  | Cam for T2HS handle shafts Key codes A to Z are available. Specify by changing the key code above. | 14997702 | 235.00 |
| Toggle locks | Non Captive: Fits up to 3 padlocks or a multiple lock device |  |  |
| HL | E400, S400, H400, L400, E630, S630 |  |  |
|  | Lock with three 8 mm holes | T2HL40A | 73.00 |
|  | Captive: Allows a single padlock or multiple padlock device |  |  |
|  | E400, S400, H400, L400, E630, S630 |  |  |
|  | Lock with two 8 mm holes | T2HL40CAP | 73.00 |
| Attached Busbar | E400, S400, H400, L400, E630, S630 |  |  |
|  | 3 Pole, set of 6, wide bar, 400 A | 2H1384DAA | 225.00 |
| FB | 3 Pole, set of 6, wide bar set, 630 A | T2FB463BA | 240.00 |
|  | 4 Pole, set of 8 , wide bar set, 630 A | T2FB464BA | 305.00 |

Tunnel clamp E400, S400, H400, L400, E630, S630
terminals

| FW | 3 Pole, set of 6 clamps $240 \mathrm{~mm}^{2}$ |  | T2FW40L3A |
| :--- | :--- | :--- | :--- |



T2FB Attached flat bar


T2HL Toggle lock (captive)


T2FW Tunnel clamp terminals


T2HL Toggle lock (non-captive)

## Accessories to suit 400 / 630 AF TemBreak 2

## External accessories

Cat. No.
Price $\$$

| Rear connect terminal studs | Suits MCCB types E400, S400 |  |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole kit, set of 6 studs | T2RP403SA | 650.00 |
| RP | 4 pole kit, set of 8 studs | T2RP404SA | 870.00 |
|  | H400, L400 |  |  |
|  | 3 pole kit, set of 6 studs | T2RP403LA | 670.00 |
|  | 4 pole kit, set of 8 studs | T2RP404LA | 940.00 |
|  | E630, S630 |  |  |
|  | 3 pole kit, set of 6 studs | T2RP463SA | 740.00 |
|  | 4 pole kit, set of 8 studs | T2RP464SA | 980.00 |


| TemPlug | $\begin{array}{l}\text { Suits MCCB types } \\ \\ \\ \text { TemPlug MCCB line-side } \\ \text { plug-in attachment }\end{array}$ |
| :--- | :--- |


| UP | E400, S400 |  |  |
| :---: | :---: | :---: | :---: |
|  | 3 pole TemPlug | T2UPX3400 | 405.00 |
|  | E630, S630 |  |  |
|  | 3 pole TemPlug | T2UPX3630 | 770.00 |
|  | Templugs suit 6.3 mm busbar ( 10 mm optional) |  |  |
| External | 400 ACT | T2GB40N04A | 290.00 |
| neutral CT | 630 ACT | T2GB40N06A | 440.00 |
| GB |  |  |  |
| Electronic | 110 V AC | TNS2110V | POA |
| OCR checker | 230 V AC | TNS2240V | POA |



## Accessories to suit 400 / 630 AF TemBreak 2

External accessories
Cat. No.
Price \$
Door flange Provides an attractive panel cut-out surround for MCCBs or motors Suits MCCB sizes E400, S400, H400, L400, E630, S630

| DF | MCCB IP 30 gland and gasket | T2DF40A | 132.00 |
| :---: | :---: | :---: | :---: |
|  | MOTOR IP 30 gland and gasket | T2DM40A | 260.00 |
| Door mounting flush plate | A kit that allows an MCCB to be mounted directly onto a door |  |  |
|  | E400, S400, E630, S630 |  |  |
|  | 3 pole kit | T2FP40S3A | 280.00 |
| FP | 4 pole kit | T2FP40S4A | POA |
| Wire lead | left side | T2TF40LGA | 189.00 |
| terminal block | right side | T2TF40RGA | 189.00 |

block
TF

TNS
Electronic OCR checker


T2TF
Wire lead terminal block

T2DF/DM
Door flange


T2FP
Door mounting flush plate


# MOULDED CASE CIRCUIT BREAKERS 



- 12 t switch to assist in obtaining selectivity
- Powerful interrupting capacities
- Icw for 0.5 sec of 38 kA
- Limitation of system damage
- Electronic trip unit with long, short and instantaneous adjustments
- Adjustment range 50-100 \% of nominal current rating
- Standards AS/NZS 3947-2


## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S800CJ

## 36 kA

Current rating: 630-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 36 | 36 |
| DC use | 250 | 50 | 50 |



## Trip unit:

Adjustable thermal: $63 \% \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$

- Adjustable magnetic: 5 to $10 \times \mathrm{I}_{\mathrm{m}}$

Dimensions (mm)

| Poles | $\mathbf{3}$ |  |
| :--- | :--- | :--- |
| H | 273 |  |
| $W$ | 210 |  |
| D (less toggle) | 103 |  |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Adj. Im <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 630 | $396-630$ | $3150-6300$ | S800 CJ 3 630 | $\mathbf{2 5 0 0 . 0 0}$ |
| 800 | $504-800$ | $4000-8000$ | S800 CJ 3 800 | $\mathbf{2 5 5 0 . 0 0}$ |

Notes: Magnetic only available on application.
For additional information on applications refer section 9
or Part C catalogue.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
Replaces: XS630CJ and XS800NJ for applications up to 36 kA . Note: check
exact ratings or dimensions to suit your application requirement.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S800NJ

## 50 kA

Current rating: 630-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 50 | 50 |
| DC use | 250 | 50 | 50 |



Trip unit:
Adjustable thermal: $63 \% \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$
Adjustable magnetic: 5 to $10 \times \mathrm{I}_{\mathrm{m}}$
Dimensions (mm)

| Poles | 3 |  |
| :--- | :--- | :--- |
| $H$ | 273 |  |
| $W$ | 210 |  |
|  |  |  |
| $D$ (less toggle) | 103 |  |

3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Adj. Im <br> Min. - Max. | Cat. No. | 3 pole <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 630 | $396-630$ | $3150-6300$ | S800 NJ 3 630 | $\mathbf{2 9 0 0 . 0 0}$ |
| 800 | $504-800$ | $4000-8000$ | S800 NJ 3 800 | $\mathbf{3 1 5 0 . 0 0}$ |

[^26]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Thermal magnetic type S800RJ

## 70 kA

Current rating: 630-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| Ics |  |  |  |
| AC use | 415 | 70 | 50 |
| DC use | 250 | 50 | 50 |



Trip unit:
Adjustable thermal: $63 \% \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$
Adjustable magnetic: 5 to $10 \times \mathrm{I}_{\mathrm{m}}$
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| $W$ | 210 | 280 |
| D (less toggle) | 103 | 103 |



Ampere

| Rating <br> NRC | Adj. Ir <br> Min. - Max. | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole <br> Price \$ | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 630 | 396-630 | 3150-6300 | S800 RJ 3630 | 3910.00 |  |
|  |  |  | S800 RJ 4630 |  | 4350.00 |
| 800 | 504-800 | 4000-8000 | S800 RJ 3800 | 4500.00 |  |
|  |  |  | S800 RJ 4800 |  | 4950.00 |

Notes: Magnetic only available on application.
For additional information on applications refer section 9
or Part C catalogue.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
Replaces: XH630SE and XH800SE. Note: check exact ratings or dimensions
to suit your application requirement .

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 Electronic type S800NE

## 50 kA

Current rating: 252-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:
3

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 50 | 50 |



Over Current Relay:

- Electronic, for general \& selectivity applications

■ 7 dial selectable characteristic curves suited for a variety of applications

- Base current Ir is adjustable from 40\%-100\% of the nominal rated current In
- STD setting 2.5-10 $\left(x I_{R}\right)^{1}$ )
- INST setting $14\left(\operatorname{Max} 12 \times I_{n}\right)^{1}$ )

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |



| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: | ---: |
| 630 | $252-630$ | S800 NE 3 630 | $\mathbf{3 2 5 0 . 0 0}$ |  |
|  |  | S800 NE 4 630 |  | $\mathbf{3 7 4 0 . 0 0}$ |
| 800 | $320-800$ | S800 NE 3 800 | $\mathbf{3 9 9 0 . 0 0}$ |  |
|  |  | S800 NE 4 800 |  | $\mathbf{4 5 6 0 . 0 0}$ |

Notes: ${ }^{1}$ ) The STD and Instantaneous pickup currents $\left(I_{\text {sd }} \& I_{i}\right)$ settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curves $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 \mathrm{I}_{\mathrm{sd}}$ $=5 \times I_{R}$, curves $4-7 I_{\text {sd }}=10 \times I_{R} . I_{R}$ dial setting $0.4-0.8 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.9-1.0 \mathrm{I}_{\mathrm{i}}=12 \times \mathrm{I}_{\mathrm{R}}$.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
Replaces: XS630SE and XS800SE. Note: check exact ratings or dimensions to suit your application requirement.

# SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI 

# TemBreak 2 Electronic type S800RE 

## 70 kA

Current rating: 252-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |

Over Current Relay:

- Electronic, for general \& selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In
- STD setting 2.5-10 $\left.\left(x I_{R}\right)^{2}\right)$
- INST setting $\left.14\left(\operatorname{Max~} 12 \times I_{n}\right)^{2}\right)$

OCR options:

- Ground Fault TripNeutral Pole protection
Pre-Trip Alarm

| Ampere Rating NRC | Adj. Ir Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole Price \$ | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 630 | 252-630 | S800 RE 3630 | 3150.00 |  |
|  |  | S800 RE 4630 |  | 3810.00 |
| 800 | 320-800 | S800 RE 3800 | 4200.00 |  |
|  |  | S800 RE 4800 |  | 4850.00 |
| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole Price \$ | 4 pole Price $\$$ |
| 3 P OCR options: | s: $\quad$ PTA $\left.{ }^{3}\right)$ | S800 RE 3 AP \# | 180.00 |  |
|  | GF ${ }^{3}$ ) | S800 RE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{3}$ ) | S800 RE 3 APG \# | 360.00 |  |
| 4 P OCR options: | s: $\quad$ PTA $\left.{ }^{3}\right)$ | S800 RE 4 AP \# |  | 180.00 |
|  | $\mathrm{AP}^{3}$ ) | S800 RE 4 AN \# |  | 180.00 |
|  | $\underline{\text { PTA + NP }{ }^{3} \text { ) }}$ | S800 RE 4 APN \# |  | 360.00 |
|  | $\mathrm{GF}+\mathrm{NP}^{3}$ ) | S800 RE 4 AGN \# |  | 360.00 |

Notes: ${ }^{1}$ ) "\#" add OCR trip unit rating where shown with OCR options.
${ }^{2}$ ) The STD and Instantaneous pickup currents $\left(I_{\text {sd }} \& I_{i}\right)$ settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curve $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 I_{\text {sd }}=5 \times I_{R}$, curve 4-7 $I_{\text {sd }}=10 \times I_{R}$.
$I_{R}$ dial setting $0.4-0.8 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.9-1.0 I_{i}=12 \times I_{R}$.
${ }^{3}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: S800RE 4 AGN 800 is an S800RE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
For additional information on OCR settings, options and applications refer section 9 or part C catalogue.
Replaces: XH630SE and XH800SE. Note: check exact ratings or dimensions to suit your application requirement.

# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## TemBreak 2 Electronic XOW Metering MCCBs S800RE_X1L/X1S

## 70 kA

Current rating: 320-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |

## XOW Over Current Relay:



- Ammeter or Energy Metering types
- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $\mathrm{I}_{n}$

MCCB Standard features:

## S800RE _ X1L

- Ammeter, Adjustable LSI


Trip event log, Alarm event log, Test function S800RE _X1S
Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H

- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications
- External door mounting meter option (T2ED not incl. in below pricing)

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |



|  | Amper Rating NRC | Ir Adj. Min.-Max. | Cat. No. ${ }^{1}$ ) | 3 pole Price \$ | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MCCB with ammeter | 800 | 320-800 | S800 RE 3800 X1L | 6450.00 |  |
|  |  |  | S800 RE 4800 X1L |  | 7740.00 |
| $\begin{aligned} & \text { MCCB with } \\ & \text { energy meter } 800 \end{aligned}$ |  | 320-800 | S800 RE 3800 X1S | 7900.00 |  |
|  |  | S800 RE 4800 X1S |  | 9480.00 |

Notes: NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
For additional information on OCR settings, options and applications refer section 9 or part $C$ catalogue.

# TemBreak 2 Electronic type H800NE 

## 125 kA

Current rating: 252-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 125 | 94 |



Over Current Relay:

- Electronic, for general \& selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In
- STD setting 2.5-10 $\left(x I_{R}\right)^{2}$ )
- INST setting $\left.14\left(\operatorname{Max} 12 \times I_{n}\right)^{2}\right)$
- OCR Options:
- Ground Fault Trip
- Neutral Pole protection

Pre-Trip Alarm

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole <br> Price \$ | 4 pole <br> Price |
| :---: | :---: | :---: | :---: | :---: |
| 630 | 252-630 | H800 NE 3630 | 4230.00 |  |
|  |  | H800 NE 4630 |  | 4810.00 |
| 800 | 320-800 | H800 NE 3800 | 4590.00 |  |
|  |  | H800 NE 4800 |  | 5220.00 |
| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole <br> Price \$ | 4 pole Price \$ |
| 3 P OCR options | s: PTA ${ }^{3}$ | H800 NE 3 AP \# | 180.00 |  |
|  | GF ${ }^{\text {) }}$ | H800 NE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{3}$ ) | H800 NE 3 APG \# | 180.00 |  |
| 4 P OCR options: | s: PTA ${ }^{3}$ | H800 NE 4 AP \# |  | 180.00 |
|  | $\mathrm{AP}^{3}$ ) | H800 NE 4 AN \# |  | 180.00 |
|  | PTA + NP ${ }^{3}$ ) | H800 NE 4 APN \# |  | 360.00 |
|  | $\mathrm{GF}+\mathrm{NP}^{3}$ ) | H800 NE 4 AGN \# |  | 360.00 |

Notes: ${ }^{1}{ }^{1}$ "\#" add OCR trip unit rating where shown with OCR options.
${ }^{2}$ ) The STD and Instantaneous pickup currents $\left(I_{\text {sd }} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curve $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 I_{s d}=5 \times I_{R}$, curve 4-7 $I_{s d}=10 \times I_{R}$.
$I_{R}$ dial setting $0.4-0.8 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.9-1.0 I_{i}=12 \times I_{R}$.
${ }^{3}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: H800NE 4 AGN 800 is an H800NE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
For additional information on OCR settings, options and applications refer section 9 or part C catalogue.
Replaces: TL630NE and TL800NE. Note: check exact ratings or dimensions to suit your application requirement.

# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## TemBreak 2 Electronic XOW Metering MCCBs H800NE_X1L/X1S

## 125 kA

Current rating: 320-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 125 | 94 |

## XOW Over Current Relay:

- Ammeter or Energy Metering types
- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $\mathrm{I}_{n}$

MCCB Standard features:

## H800NE X X1L



- Ammeter, Adjustable LSI

- Trip event log, Alarm event log, Test function


## H800NE X1S

Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H

- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications
- External door mounting meter option ((T2ED not incl. in below pricing)

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 140 | 140 |



|  | Ampere Rating NRC | Ir Adj. Min.-Max. | Cat. No. | 3 pole Price \$ | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MCCB with | 800 | 320-800 | H800 NE 3800 X1L | 7150.00 |  |
| ammeter |  | 320-800 | H800 NE 4800 X1L |  | 8500.00 |
| $\begin{aligned} & \text { MCCB with } \\ & \text { energy meter } 800 \end{aligned}$ |  | 320-800 | H800 NE 3800 X1S | 8650.00 |  |
|  |  | H800 NE 4800 X1S |  | 10300.00 |

Notes: NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
For additional information on OCR settings, options and applications refer section 9 or part C catalogue.

# SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI 

# TemBreak 2 Electronic type L800NE 

## 200 kA

Current rating: 252-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC | Ics |  |  |
| AS | 415 | 200 | 150 |

## Over Current Relay:



E Electronic, for general \& selectivity applications

- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from 40\%-100\% of the nominal rated current In
- STD setting 2.5-10 $\left.\left(x I_{R}\right)^{2}\right)$
- INST setting $\left.14\left(\operatorname{Max~} 12 \times I_{n}\right)^{2}\right)$

OCR options:

- Ground Fault TripNeutral Pole protection
Pre-Trip Alarm
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 140 | 140 |


| Ampere Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. ${ }^{1}$ ) | 3 pole Price \$ | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 630 | 252-630 | L800 NE 3630 | 4520.00 |  |
|  |  | L800 NE 4630 |  | 5350.00 |
| 800 | 320-800 | L800 NE 3800 | 4960.00 |  |
|  |  | L800 NE 4800 |  | 5960.00 |
| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole Price \$ | 4 pole Price \$ |
| 3 P OCR options: | s: PTA ${ }^{3}$ ) | L800 NE 3 AP \# | 180.00 |  |
|  | GF ${ }^{\text {3 }}$ | L800 NE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{3}$ ) | L800 NE 3 APG \# | 180.00 |  |
| 4 P OCR options: | s: PTA ${ }^{3}$ ) | L800 NE 4 AP \# |  | 180.00 |
|  | $\mathrm{AP}^{3}$ ) | L800 NE 4 AN \# |  | 180.00 |
|  | PTA + NP ${ }^{3}$ ) | L800 NE 4 APN \# |  | 360.00 |
|  | $\mathrm{GF}+\mathrm{NP}^{3}$ ) | L800 NE 4 AGN \# |  | 360.00 |

Notes: ${ }^{1)}$ " ${ }^{2}$ " add OCR trip unit rating where shown with OCR options.
${ }^{2}$ ) The STD and Instantaneous pickup currents $\left(I_{\text {sd }} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $I_{R}$ settings the values will vary. Curve $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 I_{\text {sd }}=5 \times I_{R}$, curve 4-7 $I_{\text {sd }}=10 \times I_{R}$.
$I_{R}$ dial setting $0.4-0.8 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.9-1.0 I_{i}=12 \times I_{R}$.
${ }^{3}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: L800NE 4 AGN 800 is an L800NE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
For additional information on OCR settings, options and applications refer section 9 or part C catalogue.

## SP464 James St Lowood SPS - Electrical Installation OM Manual <br> TERASAKI

## TemBreak 2 690V AC High Fault Interruption MCCB L800PE

## 70 kA

Current rating: 252-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

## Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 690 | 70 | 50 |



## Over Current Relay:

Electronic, for general \& selectivity applications

- 7 dial selectable characteristic curves suited for a variety of applications

Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In

- STD setting 2.5-10 $\left(x I_{R}\right)^{1}$ )
- INST setting $\left.14\left(\operatorname{Max} 12 \times I_{n}\right)^{1}\right)$

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $H$ | 273 |
| $W$ | 210 |
| D (less toggle) | 140 |

## 3 Pole

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price S |
| :--- | :--- | :--- | ---: |
| 630 | $252-630$ | L800 PE 3 630 | $\mathbf{5 3 4 0 . 0 0}$ |
| 800 | $320-800$ | L800 PE 3800 | $\mathbf{5 4 6 0 . 0 0}$ |

Notes: ${ }^{1}$ ) The STD and Instantaneous pickup currents $\left(I_{\text {sd }} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $I_{R}$ settings the values will vary. Curves $1 \& 2 I_{s d}=2.5 \times I_{R}$, curve $3 I_{s d}=5 \times I_{R}$, curves $4-7 I_{s d}=10 \times I_{R}$. $I_{R}$ dial setting $0.4-0.9 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.95-1.0 \mathrm{Ii}=13 \times I_{R}$. Not suitable for reverse connection either individually or on a chassis.
Suitable for general motor starting and power distribution applications
Refer NHP for 4 pole version availability.
Refer NHP for additional information.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting

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# TemBreak 2 Electronic type S1000NE 

## 70 kA

Current rating: 400-1000 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |



Over Current Relay:
Electronic, for general \& selectivity applications
$\square 7$ dial selectable characteristic curves suited for a variety of applications
Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In

- STD setting 2.5-10 $\left.\left(x I_{R}\right)^{1}\right)$
- INST setting $14\left(\operatorname{Max} 12 \times I_{n}\right)^{1}$ )

OCR Options:

- Ground Fault Trip
- Neutral Pole protection
- Pre-Trip Alarm

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| $W$ | 210 | 280 |
| D (less toggle) | 103 | 103 |


| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price $\$$ | 4 pole <br> Price $\$$ |
| :--- | :--- | :--- | ---: | ---: |
| 1000 | $400-1000$ | S1000 NE 3 1000 | $\mathbf{3 8 5 0 . 0 0}$ |  |
|  |  | S1000 NE 4 1000 |  | $\mathbf{4 8 1 2 . 0 0}$ |


| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole Price \$ | 4 pole <br> Price $\$$ |
| :---: | :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{2}$ ) | S1000 NE 3 AP \# | 180.00 |  |
|  | GF ${ }^{2}$ ) | S1000 NE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{2}$ ) | S1000 NE 3 APG \# | 360.00 |  |
| 4 P OCR options: | PTA ${ }^{2}$ ) | S1000 NE 4 AP\# |  | 180.00 |
|  | $\mathrm{AP}^{2}$ ) | S1000 NE 4 AN \# |  | 180.00 |
|  | PTA + NP ${ }^{2}$ ) | S1000 NE 4 APN \# |  | 360.00 |
|  | $\left.\mathrm{GF}+\mathrm{NP}^{2}\right)$ | S1000 NE 4 AGN \# |  | 360.00 |

[^27]
# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## TemBreak 2 Electronic XOW Metering MCCBs S1000NE_X1L/X1S

## 70 kA

Current rating: 400-1000 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity:

|  | Voltage |  | Icu |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 70 | 50 |

## XOW Over Current Relay:

Ammeter or Energy Metering types

- Adjustable LSI setting for grading applications
- Base current adjustable from $40 \%-100 \%$ of $\mathrm{I}_{n}$

MCCB Standard features:

## S1000NE_X1L



- Trip event log, Alarm event log, Test function


## S1000NE_X1S

Energy (multifunction) meter: A, V, P, kW, kWh, E, Pf, F, H

- Adjustable LSI
- Backlit LCD display
- Ground fault, Pre trip alarm, Phase rotation \& Neutral pole protection
- Trip and Alarm event log, Test function, Trip indication contact output
- Modbus RTU 485 communications
- External door mounting meter option (T2ED not incl. in below pricing)


## Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 273 | 273 |
| $W$ | 210 | 280 |
| D (less toggle) | 103 | 103 |


|  | Ampere Rating NRC | Ir Adj. Min.-Max. | Cat. No. | 3 pole Price \$ | 4 pole Price $\$$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MCCB with ammeter | 1000 | 400-1000 | S1000 NE 31000 X1L | 7750.00 |  |
|  |  |  | S1000 NE 41000 X1L |  | 9300.00 |
| $\begin{aligned} & \text { MCCB with } \\ & \text { energy meter } 1000 \end{aligned}$ |  | 400-1000 | S1000 NE 31000 X1S | 9450.00 |  |
|  |  | S1000 NE 41000 X1S |  | 11340.00 |

Notes: NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
For additional information on OCR settings, options and applications refer section 9 or part $C$ catalogue.

## Accessories for 800-1000 A MCCBs



Internal accessories
Cat. No.
Price \$

| Shunt trips | Internal accessories are common for MCCBs 800 A to 1600 A. All have screw terminals except those indicated below with wire leads as indicated. |  |  |
| :---: | :---: | :---: | :---: |
|  | For 3 and 4 pole MCCBs |  |  |
|  | 110 V AC | T2SH00A10TA | 255.00 |
|  | 230-240 V AC | T2SH00A20TA | 255.00 |
| SH | 400-415 V AC | T2SH00A40TA | 255.00 |
|  | 12 V DC | T2SH00D01TA | 255.00 |
|  | 24 V DC (suits 24 V AC) | T2SH00D02TA | 255.00 |
|  | 48 V DC | T2SH00D04TA | 255.00 |
|  | 110 V DC | T2SH00D10TA | 255.00 |
|  | 230 V DC | T2SH00D20TA | 255.00 |
| Undervoltage Instantaneous operation |  |  |  |
| UV | 110 V AC | T2UV80A10NTA | 270.00 |
|  | 200-240 V AC | T2UV80A20NTA | 270.00 |
|  | 380-450 V AC | T2UV80A40NTA | 270.00 |
|  | 24 V DC | T2UV80D02NTA | 270.00 |
|  | 110 V DC | T2UV80D10NTA | 270.00 |
|  | 230 V DC | T2UV80D20NTA | 270.00 |
|  | Time delay types are available - refer NHP for details. |  |  |
| Auxiliary \& Alarm switches | General type (2 A @ 240 V Inductive) |  |  |
|  | $1 \mathrm{C} / \mathrm{O}$ Auxiliary with terminals | T2AX00M3STA | 134.00 |
|  | $1 \mathrm{C} / \mathrm{O} 1^{\text {st }}$ Auxiliary with 700 mm leads | T2AX00M3SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O} 2^{\text {nd }}$ Auxiliary with 700 mm leads | T2AX00M4SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O} 3^{\text {rd }}$ Auxiliary with 700 mm leads | T2AX00M5SWA | 146.00 |

$1^{\text {st }}, 2^{\text {nd }}, 3^{\text {rd }}$ aux have different numbered wire leads, otherwise identical.

| 1 C/O Alarm | T2ALOOM4STA | 129.00 |
| :--- | :--- | :--- |
| 1 C/O Alarm with 700 mm wire leads | T2ALOOM5SWA | 141.00 |

AL
Heavy-duty type (4 A @ 240 V Inductive)

| 1 N/O Auxiliary | T2AX00B1STA | 146.00 |
| :--- | :--- | :--- |
| 1 N/C Auxiliary | T2AX00B2STA | 146.00 |
| 1 N/O Alarm | T2ALOOB1STA | 146.00 |
| 1 N/C Alarm | T2ALOOB2STA | 146.00 |

Micro switching type (very low voltages and currents)

| 1 C/O Auxiliary | T2AX00M3RTA | 187.00 |
| :--- | :--- | :--- |
| 1 C/O Alarm | T2ALOOM3RTA | 187.00 |

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## Accessories for 800-1000 A MCCBs

External accessories Cat. No. Price \$

| $\begin{array}{llll}\text { Operating } \\ \text { handles }\end{array}$ | Suits MCCB types |  |  |  |
| :--- | :--- | :--- | :--- | :--- |
| Direct | $800-1000$ AF |  |  |  |$)$ IP 54


| Door interlocking variable depth handles | 800 A to 1000 A |  |  |
| :---: | :---: | :---: | :---: |
|  | T2HS compact handle |  |  |
|  | Grey IP55 handle + 320 mm shaft | T2HS80R6GM | 470.00 |
|  | Red/yellow IP55 handle + 320 mm shaft | T2HS80R6RM | 470.00 |
| HS | METAL compact handle |  |  |
|  | Silver IP 65 handle + 320 mm shaft | T2HP80R6ME | 470.00 |
|  | T2HP square handle |  |  |
|  | Grey, IP 55 handle +320 mm shaft | T2HP80R6BN | 690.00 |
| HP | Red/yellow, IP 55 handle + 320 mm shaft | T2HP80R6RN | 470.00 |
|  | Handle options |  |  |
|  | Large escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 390 mm T pin shaft for T2HS no flexi coupling | T2HS400SHAFT | 47.00 |
|  | Handle shaft CAM for trapped key interlock | 14997702 | 235.00 |
|  | MCCB/handle mech padlock attachment | T2HP80PALK | 47.50 |
|  | MCCB identification labels | T80CAPLAB | 3.50 |
| External | S1250, S1600 |  |  |
| Neutral CT | Optional neutral CT, Ground Fault MCCBs | T2GBX6N12A | 410.00 |
| GB | Optional neutral CT, Ground Fault MCCBs | T2GBX6N16A | 410.00 |



T2HB fixed depth
"direct mount" handle


T2HS handle


T2HP handle

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## Accessories for 800-1000 A MCCBs

External accessories
Cat. No.
Price \$

| Mechanical Interlock | Link Interlock - suitable for manual or motorised operation. Will accept handles. Suitable for front or rear connect type MCCBs. |  |  |
| :---: | :---: | :---: | :---: |
|  | Suits MCCB types 800 A to 1000 A |  |  |
| ML | 3 or 4 pole right side section | T2ML80RA | 365.00 |
|  | 3 pole left side section | T2ML80L3A | 140.00 |
|  | 4 pole left side section | T2ML80L4A | 140.00 |
|  | Slide type - manual operation, padlockable. Does not allow motors, handles or other front mounted accessories to be fitted. Suitable for front or rear connection. |  |  |
| MS | S800, S1000 |  |  |
|  | 3 pole | T2MS803SFA | 240.00 |
|  | 4 pole | T2MS804SFA | 260.00 |
|  | H800 |  |  |
|  | 3 pole | T2MS803LFA | 260.00 |
|  | 4 pole | T2MS804LFA | 280.00 |

Cable interlock - allows an MCCB can be mounted horizontally, vertically or diagonally. Accepts Motors and handles.
Suitable for 3 or 4 pole MCCBs
800 A to 1000 A

| Interlock kit less wire | T2MW80CA | $\mathbf{3 3 5 . 0 0}$ |
| :--- | :--- | :--- |

ML

| Wire for above interlocks |  |  |
| :--- | :--- | :--- |
| Wire 1.0 m | T2MW00SA | $\mathbf{6 3 . 0 0}$ |
| Wire 1.5 m | T2MW00LA | $\mathbf{7 3 . 0 0}$ |



Link interlock


Cable interlock

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## Accessories for 800-1000A MCCBs

| External accessories |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Terminal covers - front | $\begin{aligned} & \text { Suits MCCB types } \\ & \text { t } \mathbf{8 0 0 , S 1 0 0 0} \end{aligned}$ |  |  |
| connected MCCBs Rear connect terminal covers RC | 3 pole cover set of 2 | T2CR803SHGA | 170.00 |
|  | 4 pole cover set of 2 | T2CR804SHGA | 210.00 |
|  | H800 |  |  |
|  | 3 pole cover set of 2 | T2CR803LHGA | 210.00 |
| CR | 4 pole cover set of 2 | T2CR804LHGA | 240.00 |
| Terminal covers for plug in base | S800, S1000, H800 |  |  |
|  | 3 pole cover set | T2CB803GHNA | 170.00 |
| CB | 4 pole cover set | T2CB804GHNA | 210.00 |
| Extended terminal covers FC | Terminal covers are the same width as the MCCB |  |  |
|  | S800, S1000, H800 |  |  |
| CF | 3 pole cover set | T2CF803SLHGA | 205.00 |
|  | 4 pole cover set | T2CF804SLHGA | 260.00 |
| Terminal cover locking clip | 800 A to 1000 A |  |  |
|  | A clip that provides additional terminal cover locking, and also allows a lead seal to be fitted | T2CF00LA | 8.80 |
| Interpole Barriers $\left.{ }^{1}\right)^{2}$ ) | S800, S1000 |  |  |
|  | Interpole barrier (Qty 2) | T2BA803SHA | 10.00 |
|  | H800 |  |  |
|  | Interpole barrier (Qty 2) | T2BA803LHA | 10.00 |



Notes: ${ }^{1}$ ) Line side interpole barriers or terminal covers must be installed with MCCBs.
${ }^{2}$ ) Interpole Barriers are supplied with MCCBs as standard; 2 barriers with 3 pole MCCBs, and 3 barriers with 4 pole MCCBs.

## Accessories for 800-1000 A MCCBs

External accessories
Cat. No.
Price $\$$

| Toggle locks | Non Captive: Fits up to 3 padlocks or a multiple lock device |  |  |
| :---: | :---: | :---: | :---: |
|  | Suits MCCB types$800 \mathrm{~A}, 1000$ A |  |  |
|  | Lock with $5 \mathrm{~mm} \times 16.5 \mathrm{~mm}$ slot | T2HL40A | 73.00 |
| HL | Captive: Allows a single padlock or multiple padlock device |  |  |
|  | 800 A, 1000 A |  |  |
|  | Lock with single 8 mm hole | T2HL80CAP | 125.00 |
| Motor operators | 800-1000 A |  |  |
|  | 110-240 V AC | T2MC80A10NA | 2570.00 |
|  | 24-48V DC | T2MC80D10NA | 2570.00 |

E400, S400, H400, L400, E630, S63
MC

| 0.6 m connector 400 A to 1000 A | T2MM40L06A | $\mathbf{6 0 . 5 0}$ |
| :--- | :--- | :--- |
| $\mathbf{2 . 1 \mathrm { m } \text { connector } 4 0 0 \mathrm { A } \text { to } 1 0 0 0 \mathrm { A }}$ | T2MM40L21A | $\mathbf{8 0 . 0 0}$ |
| 0.6 m connector 125 A to 1000 A | T2MM40S06A | $\mathbf{5 8 . 5 0}$ |
| 2.1 m connector 125 A to 1000 A | T2MM40S21A | $\mathbf{7 0 . 5 0}$ |

1. Motor options: Contact NHP for key locking and auto reset.


Door Flange Provides an attractive panel cut-out surround for MCCBs or MOTORS
800 to 1000 A

| FW | et | T2FW40L3A | 415.00 |
| :---: | :---: | :---: | :---: |
|  | MOTOR IP 30 gland and gasket | T2FW40L4A | 560.00 |
| Wire Lead Terminal | MCCB mounted terminal block connected to internal accessories. This accessory is a FACTORY FIT ITEM. |  |  |
| Block | Terminal block and wiring loom RIGHT side | T2TF40RGA | 189.00 |
| TF | Terminal block and wiring loom LEFT side | T2TF40LGA | 189.00 |

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## Accessories for 800-1000 A MCCBs



Notes: ${ }^{1}$ ) Up to 4 control wiring plug kits can be used in a base.
${ }^{2}$ ) Internal accessories are used with the above plugs and sockets

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# TemBreak 2 Electronic type S1250GE 

## 85 kA

Current rating: 500-1250 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage |  |
| :---: | :---: | :---: |
| Icu | Ics |  |
| AC use | 415 | 85 |
|  | 400 | 100 |



## Over Current Relay:

Electronic, for general \& selectivity applications

- dial selectable characteristic curves suited for a variety of applications

Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In

- STD setting 2.5-10 $\left.\left(x I_{R}\right)^{1}\right)$
- INST setting $\left.14\left(\operatorname{Max} 12 \times I_{n}\right)^{1}\right)$

OCR Options:
Ground Fault Trip

- Neutral Pole protection
- Pre-Trip Alarm

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 370 | 370 |
| $W$ | 210 | 280 |
| D (less toggle) | 120 | 120 |


| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: | ---: |
| 1000 | $400-1250$ | S1250 GE 3 1250 | 8650.00 |  |
|  |  | S1250 GE 4 1250 |  | $\mathbf{1 0 2 5 0 . 0 0}$ |


| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole Price \$ | 4 pole <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{2}$ ) | S1250 GE 3 AP \# | 180.00 |  |
|  | GF ${ }^{2}$ ) | S1250 GE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{2}$ ) | S1250 GE 3 APG \# | 180.00 |  |
| 4 P OCR options: | PTA ${ }^{2}$ ) | S1250 GE 4 AP \# |  | 180.00 |
|  | $\mathrm{AP}^{2}$ ) | S1250 GE 4 AN \# |  | 180.00 |
|  | PTA + NP ${ }^{2}$ ) | S1250 GE 4 APN \# |  | 360.00 |
|  | $\left.\mathrm{GF}+\mathrm{NP}^{2}\right)$ | S1250 GE 4 AGN \# |  | 360.00 |

[^28]
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# TemBreak 2 Electronic type S1600NE 

## 85 kA

Current rating: 640-1600 A
Approvals and Tests: Standards AS/NZS 3947-2 and
IEC 60947-2
Interrupting capacity:

|  | Voltage | Icu | Ics |
| :--- | :--- | :--- | :--- |
| AC use | 415 | 85 | 65 |
|  | 400 | 100 | 76 |



Over Current Relay:
Electronic, for general \& selectivity applications

- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from $40 \%-100 \%$ of the nominal rated current In
- STD setting 2.5-10 $\left(x I_{R}\right)^{1}$ )
- INST setting $14\left(\operatorname{Max} 12 \times I_{n}\right)^{1}$ )
- OCR Options:
- Ground Fault Trip
- Neutral Pole protection

Pre-Trip Alarm

| Ampere <br> Rating NRC | Adj. Ir <br> Min. - Max. | Cat. No. | 3 pole <br> Price \$ | 4 pole <br> Price \$ |
| :--- | :--- | :--- | ---: | ---: |
| 1000 | $400-1250$ | S1600 NE 3 1250 | $\mathbf{9 8 2 0 . 0 0}$ |  |
|  |  | S1600 NE 4 1250 |  | $\mathbf{1 1 5 0 0 . 0 0}$ |


| Price Adder for OCR options. Add to above MCCB price |  | MCCB Cat. No. with option | 3 pole Price \$ | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 3 P OCR options: | PTA ${ }^{2}$ ) | S1600 NE 3 AP \# | 180.00 |  |
|  | GF ${ }^{2}$ ) | S1600 NE 3 AG \# | 180.00 |  |
|  | PTA + GF ${ }^{2}$ ) | S1600 NE 3 APG \# | 180.00 |  |
| 4P OCR options: | PTA ${ }^{2}$ ) | S1600 NE 4 AP \# |  | 180.00 |
|  | AP ${ }^{2}$ ) | S1600 NE 4 AN \# |  | 180.00 |
|  | PTA + NP ${ }^{2}$ ) | S1600 NE 4 APN \# |  | 360.00 |
|  | $\left.\mathrm{GF}+\mathrm{NP}^{2}\right)$ | S1600 NE 4 AGN \# |  | 360.00 |

Notes: ${ }^{1}$ ) The STD and Instantaneous pickup currents ( $\left(l_{\text {sd }} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $\mathrm{I}_{\mathrm{R}}$ settings the values will vary. Curve $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 I_{\text {sd }}=5 \times I_{R}$, curve $4-6 I_{\text {sd }}=8 \times I_{R}$. $I_{R}$ dial setting $0.4-0.63 I_{i}=14 x$ $I_{R}$ and $I_{R}$ dial setting $0.8-1.0 \mathrm{li}=10 \times I_{R}$.
${ }^{2}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: S1600NE 4 AGN 800 is an S1600NE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
For additional information on OCR settings, options and applications refer section 9 or part C catalogue.
Replaces: XS1600SE. Note: check exact ratings or dimensions to suit your application requirement.

## Accessories for 1250-1600 A MCCBs



Internal accessories
Cat. No.
Price \$

| Shunt trips | Internal accessories are common for MCCBs 800 A to 1600 A. All have screw terminals except those indicated below with wire leads as indicated. |  |  |
| :---: | :---: | :---: | :---: |
|  | For 3 and 4 pole MCCBs |  |  |
|  | 110 V AC | T2SH00A10TA | 255.00 |
|  | 230-240 V AC | T2SH00A20TA | 255.00 |
| SH | 400-415 V AC | T2SH00A40TA | 255.00 |
|  | 12 V DC | T2SH00D01TA | 255.00 |
|  | 24 V DC (suits 24 V AC ) | T2SH00D02TA | 255.00 |
|  | 48 V DC | T2SH00D04TA | 255.00 |
|  | 110 V DC | T2SH00D10TA | 255.00 |
|  | 230 V DC | T2SH00D20TA | 255.00 |
| Undervoltage Instantaneous operation |  |  |  |
| UV | 110 V AC | T2UV80A10NTA | 270.00 |
|  | 200-240 V AC | T2UV80A20NTA | 270.00 |
|  | 380-450 V AC | T2UV80A40NTA | 270.00 |
|  | 24 V DC | T2UV80D02NTA | 270.00 |
|  | 110 V DC | T2UV80D10NTA | 270.00 |
|  | 230 V DC | T2UV80D20NTA | 270.00 |
|  | Time delay types are available - refer NHP for details. |  |  |
| Auxiliary \& Alarm switches | General type (2 A @ 240 V Inductive) |  |  |
|  | $1 \mathrm{C} / \mathrm{O}$ Auxiliary with terminals | T2AX00M3STA | 134.00 |
|  | $1 \mathrm{C} / \mathrm{O} 1^{\text {st }}$ Auxiliary with 700 mm leads | T2AX00M3SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O} 2^{\text {nd }}$ Auxiliary with 700 mm leads | T2AX00M4SWA | 146.00 |
|  | $1 \mathrm{C} / \mathrm{O} 3^{\text {rd }}$ Auxiliary with 700 mm leads | T2AX00M5SWA | 146.00 |

$1^{\text {st }}, 2^{\text {nd }}, 3^{\text {rd }}$ aux have different numbered wire leads, otherwise identical.

| 1 C/O Alarm | T2ALOOM4STA | 129.00 |
| :--- | :--- | :--- |
| 1 C/O Alarm with 700 mm wire leads | T2ALOOM5SWA | $\mathbf{1 4 1 . 0 0}$ |

AL
Heavy-duty type (4 A @ 240 V Inductive)

| 1 N/O Auxiliary | T2AX00B1STA | 146.00 |
| :--- | :--- | :--- |
| 1 N/C Auxiliary | T2AX00B2STA | 146.00 |
| 1 N/O Alarm | T2ALOOB1STA | 146.00 |
| 1 N/C Alarm | T2ALOOB2STA | 146.00 |

Micro switching type (very low voltages and currents)

| 1 C/O Auxiliary | T2AX00M3RTA | 187.00 |
| :--- | :--- | :--- |
| 1 C/O Alarm | T2ALOOM3RTA | 187.00 |

## Accessories for 1250-1600 A MCCBs

External accessories
Cat. No.
Price $\$$

| Operatinghandles | $\begin{aligned} & \text { Suits MCCB types } \\ & 1250-1600 A \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: |
| Direct | Grey/black IP 54 | T2HBX6UR5BN | 560.00 |
| mounting, | Red/yellow IP 54 | T2HBX6UR5RN | 560.00 | IP 54


| Door interlocking variable depth handles | 1250-1600 A |  |  |
| :---: | :---: | :---: | :---: |
|  | T2HS compact handle |  |  |
|  | Grey IP55 handle + 320 mm shaft | T2HSX6R6GM | 550.00 |
|  | Red/yellow IP55 handle + 320 mm shaft | T2HSX6R6RM | 550.00 |
| HS | METAL compact handle |  |  |
|  | Silver IP 65 handle + 320 mm shaft | T2HPX6R6ME | 830.00 |
|  | T2HP square handle |  |  |
|  | Grey, IP 55 handle +320 mm shaft | T2HPX6R6BN | 550.00 |
| HP | Red/yellow, IP 55 handle + 320 mm shaft | T2HPX6R6RN | 550.00 |
|  | Handle options |  |  |
|  | Large escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 390 mm T pin shaft for T2HS no flexi coupling | T2HS400SHAFT | 47.00 |
|  | Handle shaft CAM for trapped key interlock | 14997702 | 235.00 |
|  | MCCB/handle mech padlock attachment | T2HPX6PALK | 85.00 |
|  | MCCB identification labels | TX6CAPLAB | 3.50 |



T2HB fixed depth "direct mount" handle


T2HS handle


T2HP handle

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## Accessories for 1250-1600 A MCCBs

| External accessories |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Mechanical Interlock | Rear cable interlock - allows an MCCB can be mounted horizontally, vertically or diagonally. Accepts motors and handles. <br> Suitable for 3 or 4 pole MCCBS |  |  |
| MW | Suits MCCB types1250-1600 A |  |  |
|  | Interlock kit less wire - Factory fit item | T2MWX6CA | 445.00 |
|  | Wire for above interlocks |  |  |
|  | Wire 1.0 m | T2MW00S | 60.50 |
|  | Wire 1.5 m | T2MW00L | 70.50 |
| MS | Slide type - manual operation, padlockable. Does not allow motors, handles or other front mounted accessories to be fitted. Suitable for front or rear connection. |  |  |
|  | S1250, S1600 |  |  |
|  | 3 pole | T2MSX63SFA | 360.00 |
|  | 4 pole | T2MSX64SFA | 450.00 |
| MB | Rear walking beam interlock - allows 2 MCCBs to be interlocked side by side. Combinations of 3 and 4 pole types are possible. |  |  |
|  | 1250-1600 A |  |  |
|  | For 3 pole S1250 | T2MBX33P | 850.00 |
|  | For 4 pole S1250 Factory fit only | T2MBX34P | 1130.00 |
|  | For 3 pole S1600 | T2MBX63P | 850.00 |
|  | For 4 pole S1600 Factory fit only | T2MBX64P | 1130.00 |

## Accessories for 1250-1600A MCCBs

External accessories
Cat. No.
Price $\$$
Terminal Terminal covers are the same width as the MCCB
covers - front Suits MCCB types
connected S1250
MCCBs

| 3 pole cover | T2CFX33SLHGA | $\mathbf{2 2 5 . 0 0}$ |
| :--- | :--- | :--- |
| 4 pole cover | T2CFX34SLHGA | $\mathbf{2 8 0 . 0 0}$ | terminal covers FC

Terminal covers are not available for S1600 MCCBs

| Terminal | 800 A to 1600 A |  |  |
| :---: | :---: | :---: | :---: |
| cover locking clip CF | A clip that provides additional terminal cover locking, and also allows a lead seal to be fitted | T2CF00LA | 8.80 |
| Interpole | S1250, S1600 |  |  |
| Barriers ${ }^{\text {² }}{ }^{\text {2 }}$ | Interpole barrier (Qty 2) | T2BAX63LHA | 10.00 |


| External | S1250, S1600 |  |  |  |
| :---: | :--- | :--- | :--- | :--- |
| Neutral CT | Optional neutral CT, Ground Fault <br> GB | T2GBX6N12A | $\mathbf{4 3 0 . 0 0}$ |  |
|  | MCCBs | Optional neutral CT, Ground Fault <br> MCCBs | T2GBX6N16A | $\mathbf{4 3 0 . 0 0}$ |



Extended terminal covers FC


Terminal cover locking clip

Notes: ${ }^{1}$ ) Line side interpole barriers or terminal covers must be installed with MCCBs.
${ }^{2}$ ) Interpole Barriers are supplied with MCCBs as standard; 2 barriers with 3 pole MCCBs, and 3 barriers with 4 pole MCCBs.

## Accessories for 1250-1600A MCCBs

External accessories
Cat. No.
Price \$

| Toggle locks | Non Captive: Fits up to 3 padlocks or a multiple lock device |  |  |
| :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & \text { Suits MCCB types } \\ & 1250 \mathrm{~A}, 1600 \mathrm{~A} \end{aligned}$ |  |  |
|  | Lock with three 8 mm holes | T2HLX6A | 77.00 |
| HL | Captive: Allows a single padlock or multiple padlock device |  |  |
|  | 1250 A, 1600 A |  |  |
|  | Lock with two 8 mm holes | T2HLX6CAP | 165.00 |
| Motor operators | 1250 A, 1600 A |  |  |
|  | 110 V AC | T2MCX6A10NA | 3150.00 |
| MC | 240 V AC | T2MCX6A24NA | 3150.00 |
|  | 24 VDC | T2MCX6D02NA | 3150.00 |
| Rear connect $1250 \mathrm{~A}, 1600 \mathrm{~A}$ (factory fit only) |  |  |  |
| term | 3 pole kit, set of 6 studs (1250 A) | T2RPX335B | 1350.00 |
| RP | 4 pole kit, set of 8 studs (1250 A) | T2RPX345B | 1940.00 |
|  | 3 pole kit, set of 6 studs (1600 A) | T2RPX635B | 1730.00 |
|  | 4 pole kit, set of 8 studs (1600 A) | T2RPX645B | 2250.00 |



T2RP rear connect studs


Rear connect terminal studs fitted


T2HLX6A


Motor operator fitted to MCCB

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## TemBreak 1 series Electronic XS2000NE

## 85 kA

Current rating: 1000-2000 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)
3

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415^{1}$ ) | 85 | 64 |



Trip unit:
Adjustable long, short and instantaneous trip
LTD adjustment: $\quad I_{1}: 0.8-1 \quad$ t: $5-30 \mathrm{~s}$
STD adjustment: $\quad I_{2}: 2-10 \quad \mathrm{t}: 0.1-0.3 \mathrm{~s}$
Instantaneous Adj: I I : 3-12 NRC

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{2}\right)$ | 450 | 450 |
| W | 320 | 429 |
| D (less toggle) | 185 | 185 |
| Weight $(\mathrm{kg})$ | 55.0 | 67 |


| Amp rating <br> NRC | Min. | Max. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | :--- |
| 3 Pole |  |  |  |  |
| 2000 | 1000 | 2000 | XS2000NE 20003 RC | $\mathbf{1 7 4 0 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| 2000 | 1000 | 2000 | XS2000NE 20004 RC | $\mathbf{2 3 3 1 0 . 0 0}$ |
| Ground Fault Trip MCCBs ${ }^{3}$ ) |  |  |  |  |
| 3 Pole |  |  |  |  |
| 2000 | 1000 | 2000 | XS2000NE 20003L | $\mathbf{1 8 2 5 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| 2000 | 1000 | 2000 | XS2000NE 20004L | $\mathbf{2 4 1 6 0 . 0 0}$ |

Notes: ${ }^{1)} 415$ V Icu rating to IEC 60947-2.
${ }^{2}$ ) H excludes attached busbar.
${ }^{3}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutral is present) Refer accessories.
NRC: Nominal rated current

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## TemBreak 1 series Electronic XS2500NE

## 85 kA

Current rating: 1250-2500 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $\left.400 / 415^{1}\right)$ | 85 | 64 |

Trip unit: Adjustable long, short and instantaneous settings

| LTD adjustment: | 1 $1: 0.8-1$ <br>  t: $5-30 \mathrm{~s}$ <br> STD adjustment: $1: 2-10$ <br> Instantaneous Adj: $I_{3}: 3-12$ | t: $0.1-0.3 \mathrm{~s}$ |
| :--- | :--- | :--- |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{2}\right)$ | 450 | 450 |
| W | 320 | 429 |
| D (less toggle) | 185 | 185 |
| Weight $(\mathrm{kg})$ | 66.0 | 78 |

Amp rating

| NRC | Min. | Max. | Cat. No. | Price \$ |
| :--- | :---: | :---: | :--- | ---: |
| 3 Pole |  |  |  |  |
| 2500 | 1250 | 2500 |  | XS2500NE 2500 RC3 |
| 4 Pole |  |  |  |  |
| 2500 | 1250 | 2500 |  | XS2500NE 2500 RC4 |
| Ground Fault Trip MCCBs $\left.{ }^{2}\right)^{3}$ ) |  |  |  |  |
| 3 Pole |  |  |  | 25880.00 |
| 2500 | 1250 | 2500 |  | XS2500SE 25003L |
| 4 Pole |  | 2500 | XS2500SE 25004L | $\mathbf{2 6 7 5 0 . 0 0}$ |
| 2500 | 1250 |  |  |  |

[^29]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 1 series Electronic XS3200NE

## 85 kA

Current rating: 1600-3200 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)
Voltage IcukA Ics kA


Trip unit: Adjustable long, short and instantaneous settings
LTD adjustment: $\quad \mathrm{I}_{1}: 0.8-1 \quad \mathrm{t}: 5-30 \mathrm{~s}$
STD adjustment: $1_{2}: 2-10 \quad$ t: $0.1-0.3 \mathrm{~s}$
Instantaneous Adj: $\mathrm{I}_{3}$ : 3-12 NRC

OCR options: Pre-trip alarm, fault indication with relay contact
Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 450 |
| $W$ | 320 |
| $D$ (less toggle) | 185 |
| Weight (kg) | 66.0 |

3 Pole

| Amp <br> rating <br> NRC | Min. | Max. | Cat. No. | 3 pole <br> Price |
| :--- | :--- | :--- | :--- | ---: |
| 3200 | 1600 | 3200 | XS3200NE32003 RC | 23810.00 |

[^30]
## Accessories to suit 2000-3200 AF

| Internal accessories - factory fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Shunt trips | 110 V AC/DC (110-115 V) | 2H1526BAA | 560.00 |
|  | $240 \mathrm{~V} \mathrm{AC} \mathrm{(200-480} \mathrm{V)}$ | 2H1527BAA | 560.00 |
|  | 12 VDC | 2H1528BAA | 560.00 |
|  | 24 VDC | 2H1529BAA | 560.00 |
|  | 48 VDC | 2H1530BAA | 560.00 |
|  | 200 V DC (200-230 V) | 2H1531BAA | 560.00 |
|  | 415 V AC | 2H1541BAB | 560.00 |
|  | 24 VAC | 2H1532BAA | 560.00 |
|  | 48 VAC | 2H1533BAA | 560.00 |
| Undervoltage trips | AC coil ${ }^{1}$ ) | 2H1509BAA | 455.00 |
|  | 100-230 V DC coil ${ }^{2}$ ) | 2H1510BAA | 465.00 |
|  | $\underline{24 V D C}$ coil $^{2}$ ) | 2H1511BAA | 465.00 |
|  | 48 VDC coil $^{2}$ ) | 2H1512BAA | 465.00 |
|  | $60 \mathrm{~V} \mathrm{DC} \mathrm{coil}{ }^{2}$ ) | 2H1513BAA | 465.00 |
|  | 110 V AC instantaneous controller | UXUB0013B | 113.00 |
|  | 240 V AC instantaneous controller | UXUB0014B | 113.00 |
|  | 440 V AC instantaneous controller | UXUB0015B | 113.00 |
|  | 110 V AC time delay controller | UXUB0016B | 220.00 |
|  | 240 V AC time delay controller | UXUB0017B | 220.00 |
|  | 440 V AC time delay controller | UXUB0018B | 215.00 |
|  | 200-230 V DC controller | UXUB0038B | 113.00 |
| Auxiliary switches | AUX SW right hand 1C | UXXB0013C | 350.00 |
|  | AUX SW right hand 2 C | UXXB0014C | 400.00 |
|  | AUX SW right hand 3C | UXXB0015C | 465.00 |
|  | AUX SW right hand 4C | UXXB0016C | 540.00 |
|  | AUX SW right hand 5C | UXXB0017C | 590.00 |
|  | AUX SW right hand 6C | UXXB0018C | 640.00 |
| Alarm switch | ALT SW right hand | UXLB0012C | 445.00 |
| Alarm \& auxiliary switch | ALT/AUX right hand 1C | UXLB0019D | 510.00 |
|  | ATL/AUX right hand 2 C | UXLB0020C | 580.00 |
|  | ATL/AUX right hand $3 C$ | UXLB0021C | 670.00 |
|  | ATL/AUX right hand 5C | UXLB0023C | 790.00 |

Notes: ${ }^{1)}$ An AC UVT controller is required for $100-440 \mathrm{~V} \mathrm{AC}$.
${ }^{2}$ ) A DC UVT controller is needed for 200-230 V DC operation. None required for $24-110 \mathrm{~V}$ DC.

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Accessories to suit 2000-3200 AF

| Internal acc | fit | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Ground fault trip (GFT) Optional ext. 4th CTs | An option for all 2000-2500 A types Add | LSIG | 870.00 |
|  | 2000 A 4th CT | UXOY0006A | 720.00 |
|  | 2500 A 4th CT | UXOY0007A | 880.00 |
| Fault indication with contacts | An option for all 2000-3200 A types <br> Add FI then voltage | FI | 730.00 |
| Fault indication | LED's mounted at top of OCR | FILED | 2050.00 |
| Pre-trip alarm | An option for all 2000-3200 A types | LSIP | 700.00 |


| External accessories - most user fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Front connect | $\begin{aligned} & \text { 3 P attached busbars XS2000 } \\ & \text { (t } \left.(6 \text { in kit })^{1}\right) \end{aligned}$ | TXRD0003A | 2030.00 |
| busbar (factory fit) | 4 P attached busbars XS2000 (8 in kit) ${ }^{1}$ ) | TXRD0004A | 2810.00 |
|  | Mounting bolts ${ }^{1}$ ) | TXRD0005A | 210.00 |
| Motor operators | 110 V AC motor | UXMB0006B | 3820.00 |
|  | 240 V AC motor | UXMB0008B | 3820.00 |
|  | 110 V DC motor | UXMB0009B | 3820.00 |
| Mechanical interlocks (factory fit) | 3 P rear mechanical interlock | UXKC0012A | 2090.00 |
|  | 4 P rear mechanical interlock | UXKC0013A | 3120.00 |
|  | Interlock wire (cable style interlock) | UXKC0020A | 83.00 |
|  | Interlock mechanism - cable type ${ }^{2}$ ) | UXKC0025B | 650.00 |
| Handle operator | Direct mount handle mechanism 3) | XFE10 | 1690.00 |
|  | Handle extension | UXHB0001B | 195.00 |
| Toggle locks factory fit | Blocks toggle activation (non captive) | UXKB0001A | 79.00 |
| Accessory lead terminal | Accessory lead block (factory fit) | UXYD0001A | 26.80 |
|  | Terminal bolt (6 in kit) | UXYD0002A | 2.20 |
| OCR sealing kit | Tamperproof cover for OCR adjustment dials | XS20000CRSK | 60.50 |

Notes: ${ }^{1}$ ) When an XS2000NE MCCB is configured for "front connection", the Front Connect busbar kits TXRD0003A \& 4A already include mounting screws for the FC terminals.
The TXRD0005A mounting bolts, which also include spacers, are required to mount the MCCB itself. TXRD0005A is always required for FC 2000A MCCBs, but not RC.
${ }^{2}$ ) Order one interlock mechanism per breaker.
${ }^{3}$ ) Extension shaft handle not available.

# SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI 

## Integral Earth Leakage

## Moulded Case Circuit Breakers

## ZS Earth Leakage Circuit Breakers 125 A and 250 A

The ZS earth leakage MCCB from Terasaki offers machine or personnel protection within a standard 125 A, 160 / 250 A MCCB frame size. The ZS earth leakage MCCB also maintains the full functionality of a standard thermal-magnetic overload / short circuit protection device.

## Features

- Thermal/ magnetic MCCBStandard 125 A or 250 A frameThermal magnetic trip unit ratings:
12 A - 125 A (125AF), 100-250 A (250 AF)
- Fixed magnetic characteristic
- 65 kA fault interruption rating @ $400 / 415 \mathrm{~V}$ as standard



## Earth Leakage features

- Switching utilisation voltage up to 550 V AC ( $160 \mathrm{~V} \mathrm{AC} \mathrm{minimum)}$
- Suitable for use at $40 / 50 / 60 \mathrm{~Hz}$ (except for the 3 A setting @ 40 Hz )
- 3 or 4 pole types
- Yellow earth leakage TRIP indication flag
- Grey TEST button
- Green 'Power ON' LEDAdjustable thermal characteristic dial setting from 63-100 \% of $I_{R}$
- Adjustable earth leakage ranges: $30 \mathrm{~mA}, 100 \mathrm{~mA}, 300 \mathrm{~mA}, 500 \mathrm{~mA}, 1 \mathrm{~A}, 3 \mathrm{~A}$
- Trip time selection: $0,60,200,400,700 \mathrm{mS}$ or NT (No Trip)
- 30 mA trip time defaults to a less than 300 mS trip time as per AS/NZS standard requirements
- Built-in dielectric test disconnection test plug
- Remove trip function (standard)
- Harmonics inhibition (standard)
- Pre trip alarm unit (TCU) with cause of trip output


## Options and accessory fitting

- Accepts auxiliaries and alarm switchesWill not accept shunts and under voltage trips
$\square$
Accepts all external accessories, except mechanical interlocks
- ZS 125/250 A MCCBs can be installed on standard XA, XB, XC chassis
- ZS 250 can be fitted to HC Chassis
- Seal label available for sealing the residual current dial setting area for use at 30 mA (Catalogue number of label sheet T12CAPLAB)
- Captive padlock attachment that includes a dial sealing feature
- ZS ELCBs with unswitched or switched neutral poles are available

[^31]

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## Earth Leakage Circuit Breaker ZS125GJ/ ZS250GJ

## 65 kA

Current rating: $20-250 \mathrm{~A}$
Approvals and Tests: AS/NZS 3947-2, IEC 60947-2, Annex B, EN/IEC 60755

Operating voltage: $200-580 \mathrm{~V} 50 / 60 \mathrm{~Hz}$
Interrupting capacity:
Voltage Icu kA Ics kA

| AC use | $380 / 415$ | 65 | 36 |
| :--- | :--- | :--- | :--- |
| DC use | 250 V | 40 | 40 |



Trip unit: Adjustable thermal ( $0.63 \mathrm{I}_{\mathrm{r}}$ to $100 \% \mathrm{I}_{\mathrm{r}}$ ) and fixed magnetic
Earth leakage characteristic: Type 'A' - suitable for AC and residual pulsating DC currents.
Earth leakage adjustments: - $30 \mathrm{~mA}, 100 \mathrm{~mA}, 300 \mathrm{~mA}, 500 \mathrm{~mA}, 1 \mathrm{~A}, 3 \mathrm{~A}$.

- NT ${ }^{\prime}$, 0, 60, 200, 400, 700 mS
- 30 mA time setting non adjustable for instant trip


## Neutral pole option:

ZS ELCBs are available with switched or unswitched (or 'solid neutral') neutral poles. Many general distribution applications can use switched neutral types, whereas for UPS and some other uses, an unswitched neutral pole is preferred.

## Earth Leakage Circuit Breaker

ZS125GJ

## Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 155 | 155 |
| W | 90 | 120 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

## 3 Pole

| Amp rating NRC | Adj. $I_{r}{ }^{1}$ ) <br> Min. - Max. | Fixed $\mathrm{Im}_{\mathrm{m}}{ }^{1}$ ) <br> (Amps) | Cat. No. ${ }^{2}$ ) | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12-20 | 240 | ZS125 GJ 320 | 2000.00 |
| 32 | 20-32 | 384 | ZS125 GJ 332 | 2000.00 |
| 50 | 32-50 | 600 | ZS125 GJ 350 | 2000.00 |
| 63 | 40-63 | 756 | ZS125 GJ 363 | 2000.00 |
| 100 | 63-100 | 1200 | ZS125 GJ 3100 | 2230.00 |
| 125 | 80-125 | 1250 | ZS125 GJ 3125 | 2380.00 |

4 Pole - fixed neutral type

| Amp rating NRC | Adj. $I_{r}{ }^{1}$ ) <br> Min. - Max. | Fixed $\mathrm{I}_{\mathrm{m}}{ }^{1}$ ) <br> (Amps) | Cat. No. ${ }^{2}$ ) | 4 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 20 | 12-20 | 240 | ZS125 GJ $420^{\text {² }}$ ) | 2200.00 |
| 32 | 20-32 | 384 | ZS125 GJ $432^{2}$ ) | 2200.00 |
| 50 | 32-50 | 600 | ZS125GJ $4560^{\text {² }}$ ) | 2200.00 |
| 63 | 40-63 | 756 | ZS125GJ $463{ }^{\text {2 }}$ ) | 2200.00 |
| 100 | 63-100 | 1200 | ZS125GJ4 $10{ }^{2}$ ) | 2560.00 |
| 125 | 80-125 | 1250 | ZS125GJ4 $125^{\text {²) }}$ | 2750.00 |

4 Pole - solid neutral type

| Amp <br> rating <br> NRC | Adj. $\mathbf{I}_{\mathbf{r}}{ }^{1}$ ) <br> Min. - Max. | Fixed $\mathbf{I}_{\mathbf{m}}{ }^{1}$ ) <br> (Amps) | Cat. No. ${ }^{2}$ ) | 4 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 20 | $12-20$ | 240 | ZS125GJ 420 SN | $\mathbf{2 2 0 0 . 0 0}$ |
| 32 | $20-32$ | 384 | ZS125GJ 432 SN | $\mathbf{2 2 0 0 . 0 0}$ |
| 50 | $32-50$ | 600 | ZS125GJ 450 SN | $\mathbf{2 2 0 0 . 0 0}$ |
| 63 | $40-63$ | 756 | ZS125GJ 463 SN | $\mathbf{2 2 0 0 . 0 0}$ |
| 100 | $63-100$ | 1200 | ZS125GJ 4100 SN | $\mathbf{2 5 6 0 . 0 0}$ |
| 125 | $80-125$ | 1250 | ZS125GJ 4125 SN | $\mathbf{2 7 5 0 . 0 0}$ |

[^32]
## Earth Leakage Circuit Breaker

 ZS250GJDimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| H | 165 | 165 |
| W | 105 | 140 |
| D (less toggle) | 68 | 68 |
| Toggle cut-out | 104 | 104 |

## 3 Pole

| Amp rating <br> NRC | Adj. Ir ${ }^{1}$ ) <br> Min. - Max. | Fixed Im $^{1}$ ) <br> $($ Amps $)$ | Cat. No. ${ }^{2}$ ) | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 160 | $100-160$ | 1760 | ZS250 GJ 3 160 | $\mathbf{2 4 9 0 . 0 0}$ |
| 250 | $160-250$ | 2750 | ZS250 GJ 3 250 | $\mathbf{2 7 8 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| 160 | $100-160$ | 1760 | ZS250 GJ 4 160 ${ }^{\mathbf{2}}$ ) | $\mathbf{2 8 9 0 . 0 0}$ |
|  |  |  | ZS250 GJ4 160 SN ${ }^{2}$ ) | $\mathbf{2 8 9 0 . 0 0}$ |
| 250 | $160-250$ | 2750 | ZS250 GJ 4 250 ${ }^{\mathbf{2}}$ ) | $\mathbf{3 1 1 0 . 0 0}$ |
|  |  |  | ZS250 GJ4 250 SN ${ }^{2}$ ) | $\mathbf{3 1 1 0 . 0 0}$ |

Notes: ${ }^{1}$ ) Unswitched (solid neutral) type.
${ }^{2}$ ) Use list prices above for unswitched versions.

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## Integral Earth Leakage Circuit Breaker ZS 400 A-800 A

The ZS 400 - 800A Earth Leakage Circuit Breaker from Terasaki offers machine protection within a standard 400 A, 630 / 800 A MCCB frame size.
The full functionality of a standard thermal-magnetic overload / short circuit protection MCCB is maintained.

## Standard Features

- AS/NZS 60947.6, JIS Standards compliance
- Thermal/magnetic MCCB
- 3 or 4 pole $400 \mathrm{~A}, 630 / 800 \mathrm{~A} 3$ pole only
- Switching utilisation up to 110 to 440 V AC
- Suitable for use at $40 / 50 / 60 \mathrm{~Hz}$
- Trip unit ratings: 250 A - 400 A ( 400 AF ), 500 A - 800 A (800AF)
■ Fixed thermal setting, adjustable magnetic setting
■ 70 kA / 50kA fault interruption rating 400 AF / 800 AF
- Harmonics inhibition
- Megger / Dielectric test voltage: 500 V DC Maximum

Earth Leakage features


- Yellow ground fault TRIP indication flag

- Grey TEST button
- Green 'Power ON'LED
- Adjustable thermal characteristic dial setting from 63-100\% of IR
- Adjustable earth leakage ranges: $100 \mathrm{~mA}, 200 \mathrm{~mA}, 500 \mathrm{~mA}$,
- Trip time selection: Fixed
- Type "AC" earth leakage device suitable for AC currents

Options, Internal and external accessories

- Accessories are a customer fit.
- Auxiliaries \& Alarms can be used. The quantities refer to standard MCCB quantity configurations
- Cannot fit Shunt \& UVTs
- Standard MCCB external accessories can be installed, except for T2ML link and T2MW wire interlocks.T2MS slide interlocks can be installed
- Will fit to XC and HC chassis


## Integral Earth Leakage Circuit Breaker ZS 400 A-800 A

Settings \& Features:


Rated breaking capacities (Ics kA):
ZS ELCB model \& kA Rating (Ics)

| Voltage range | ZS400GF | ZS630NF | ZS800NF |
| :--- | :--- | :--- | :--- |
| AC440 V | 70 | 50 | 50 |
| AC100/240 V | 100 | 85 | 85 |

Overcurrent relay ratings and adjustment:

| Trip mechanism type | Thermal magnetic all types |  |  |
| :---: | :---: | :---: | :---: |
| ZS400NF/GF | trip unit ampere ratings: | $\begin{aligned} & 250,300, \\ & 350,400 \mathrm{~A} \\ & 500 \mathrm{~A}, 600 \mathrm{~A}, \\ & 630 \mathrm{~A}, 700, \\ & 800 \mathrm{~A} \end{aligned}$ | fixed thermal / Adj mag 6-12 $\mathrm{l}_{\mathrm{i}}$ |
| ZS630NF |  |  | fixed thermal / Adj mag 5-10 $\mathrm{ll}_{\mathrm{i}}$ |
| ZS800NF |  |  | fixed thermal / Adj mag 5-10 $\mathrm{xl}_{\mathrm{i}}$ |

## Integral Earth Leakage Circuit Breaker ZS 400 A-800 A



Dimensions

| Outline <br> Dimensions (mm) | ZS400GF | ZS630NF | ZS800NF |
| :--- | :--- | :--- | :--- |
| H | 260 | 273 | 273 |
| W | $1403 P / 1854 P$ | $2103 P$ | $2103 P$ |
| D | 103 | 103 | 103 |

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# Integral Earth Leakage Circuit Breaker ZS 400GF 

## 70 kA

Current rating: 250-400 A
Approvals and Tests: AS/NZS 3947-2, IEC 60947-2, AS/NZS 2081: 2011, JIS C 8201

Operating voltage: $110-440 \mathrm{~V} 50 / 60 \mathrm{~Hz}$
Interrupting capacity:

| AC use | Voltage Icu | Icu |
| :--- | :--- | :--- |
| $380 / 415$ | 70 |  |$\quad$| New 400AF |
| :--- |
|  |



Trip unit: Fixed thermal, adjustble magnetic $6 \times 12$ li
Earth leakage characteristic: Type " $A C$ " - suitable for $A C$ currents.
Earth leakage adjustments: $100 \mathrm{~mA}, 200 \mathrm{~mA}, 500 \mathrm{~mA}$
Fixed operating time: 0.1 second maximum
Options:
TemBreak 2, 400 A internal and external accessories can be installed, except for shunts, UVTs, Trip Control Units, T2ML / MW Interlocks.

## Neutral Pole

ZS ELCBs are available with switched neutral poles.
Dimensions

| Poles | $\mathbf{3}$ | 4 |
| :--- | :--- | :--- |
| H (less attached busbars) | 260 | 260 |
| W | 140 | 185 |
| D (less toggle) | 103 | 103 |



| Ampere Rating NRC | Fixed Ir ${ }^{1}$ ) Amps | Adj. Ii ${ }^{1}$ Amps | Cat. No. | 3 Pole Price $\$$ | 4 Pole Price $\$$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 250 | 250 | 1500-3000 | ZS400 GF 3250 | 3900.00 |  |
|  |  |  | ZS400 GF 4250 |  | 4600.00 |
| 300 | 300 | 1800-3600 | ZS400 GF 3300 | 3900.00 |  |
|  |  |  | ZS400 GF 4300 |  | 4600.00 |
| 350 | 350 | 2100-4200 | ZS400 GF 3350 | 4150.00 |  |
|  |  |  | ZS400 GF 4350 |  | 4800.00 |
| 400 | 400 | 2400-4800 | ZS400 GF 3400 | 4300.00 |  |
|  |  |  | ZS400 GF 4400 |  | 4950.00 |

[^33]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

# Integral Earth Leakage Circuit Breaker ZS630NF and ZS800NF 

## 50 kA

Current rating: 500-800 A
Approvals and Tests: AS/NZS 3947-2, IEC 60947-2, AS/NZS 2081: 2011, JIS C8201

Operating voltage: $110-440 \mathrm{~V} 50 / 60 \mathrm{~Hz}$
Interrupting capacity:

AC use | Voltage Icu | Icu |
| :--- | :--- |
| $380 / 415$ | 50 |



Trip unit: Fixed thermal, adjustble magnetic $6 \times 10$ li Earth leakage characteristic: Type " $A C$ " - suitable for $A C$ currents.
Earth leakage adjustments: $100 \mathrm{~mA}, 200 \mathrm{~mA}, 500 \mathrm{~mA}$
Fixed operating time: 0.1 second maximum
Options:
TemBreak 2, 630-800 A internal and external accessories can be installed, except for shunts, UVTs, Trip Control Units, T2ML / MW Interlocks

## Neutral Pole

ZS ELCBs are available with switched neutral poles.

Dimensions


| Poles | $\mathbf{3}$ | 4 |
| :--- | :--- | :--- |
| H (less attached busbars) | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |


| Ampere <br> Rating NRC | Fixed I ${ }^{1}$ ) <br> Amps | Adj. II ${ }^{1}$ ) <br> Amps | Cat. No. |  |
| :--- | :--- | :--- | :--- | ---: |
| 500 | 500 | $2500-5000$ | ZS630 NF 3 500 | $\mathbf{4 9 2 0 . 0 0}$ |
| 600 | 600 | $3000-6000$ | ZS630 NF 3 600 | $\mathbf{5 2 0 0 . 0 0}$ |
| 630 | 630 | $3150-6300$ | ZS630 NF 3 630 | $\mathbf{5 2 0 0 . 0 0}$ |
| 700 | 700 | $3500-7000$ | ZS800 NF 3 700 | $\mathbf{5 9 0 0 . 0 0}$ |
| 800 | 800 | $4000-8000$ | ZS800 NF 3 800 | $\mathbf{6 2 0 0 . 0 0}$ |

[^34]
## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 MCCB Switch Disconnectors

## (non-auto MCCBs)

Current rating: 125-2500 A
Approvals: Standards AS/NZS 3947-2 and IEC 60947-2

- Accepts MCCB internal and external accessories
- No overcurrent protection (isolator only)
- Suitable for use as a panelboard or switchboard isolator switch
AC 23 and DC 22 rated to IEC 60947-3
Rated impulse withstand voltage Uimp $=8 \mathrm{kV}$


3 Pole

| Amp <br> rating <br> NRC | Short time <br> rating kA for <br> 0.3 sec (lcw) | Rated short- <br> circuit making <br> capacity <br> $(\mathbf{l c m})($ kA $)$ | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 125 | 2 | 3.6 | S125NN3 | $\mathbf{4 3 0 . 0 0}$ |
| 160 | 3 | 6 | S160NN3 | $\mathbf{5 0 0 . 0 0}$ |
| 250 | 3 | 6 | S250NN3 | $\mathbf{5 0 0 . 0 0}$ |
| 400 | 5 | 9 | S400NN3 | $\mathbf{1 6 5 0 . 0 0}$ |
| 630 | 5 | 9 | S630NN3 | $\mathbf{2 4 9 0 . 0 0}$ |
| 800 | 10 | 15 | S800NN3 | $\mathbf{3 1 5 0 . 0 0}$ |
| 1250 | 15 | 32 | S1250NN3 | $\mathbf{7 6 0 0 . 0 0}$ |
| 1600 | 20 | 45 | S1600NN3 | $\mathbf{8 7 0 0 . 0 0}$ |
| 2000 | 35 | 90 | XS2000NN3RC | $\mathbf{1 5 6 1 0 . 0 0}$ |
| 2500 | 35 | 90 | XS2500NN3RC | $\mathbf{1 5 9 9 0 . 0 0}$ |

4 Pole

| Amp <br> rating <br> NRC | Short time <br> rating kA for <br> $\mathbf{0 . 3} \mathbf{~ s e c}(\mathbf{I c w})$ | Rated short- <br> circuit making <br> capacity <br> $(\mathbf{I c m})($ kA $)$ | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 125 | 2 | 3.6 | S125NN4 | $\mathbf{5 7 0 . 0 0}$ |
| 160 | 3 | 6 | S160NN4 | $\mathbf{6 7 0 . 0 0}$ |
| 250 | 3 | 6 | S250NN4 | $\mathbf{6 7 0 . 0 0}$ |
| 400 | 5 | 9 | S400NN4 | $\mathbf{2 2 0 0 . 0 0}$ |
| 630 | 5 | 9 | S630NN4 | $\mathbf{3 3 2 0 . 0 0}$ |
| 800 | 10 | 15 | S800NN4 | $\mathbf{3 9 9 0 . 0 0}$ |
| 1250 | 15 | 32 | S1250NN4 | $\mathbf{8 9 5 0 . 0 0}$ |
| 1600 | 20 | 45 | S1600NN4 | $\mathbf{9 9 0 0 . 0 0}$ |
| $\left.2000^{1}\right)$ | 35 | 90 | XS2000NN4RC | $\mathbf{2 0 8 2 0 . 0 0}$ |
| $\left.2500^{1}\right)$ | 35 | 90 | XS2500NN4FC | $\mathbf{2 3 6 6 0 . 0 0}$ |

Notes: ${ }^{1}$ ) TemBreak 1 MCCBs
Refer Part C catalogue for additional technical details and dimensions. UVTs and shunts are operated by the MCCBs trip lever which remains fitted in MCCB Switch disconnectors (Non Auto MCCBs)

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## Moulded Case Circuit Breakers

## TemBreak DC rated MCCBs

- Special "ND" models for 350 V to 600 V DC use ${ }^{1}$ )
- Thermal magnetic and Magnetic only types
- 3 and 4 pole types
- $125 \mathrm{~A}-2500 \mathrm{~A}$
- Will accept standard accessories on sizes to 630 A

Will accept standard external accessories for sizes 800-2500 A


- Refer NHP for internal accessory fitting for types XS800 - XS2500


## DC MCCBs to 800 A

| $\begin{array}{llll}\text { Ampere } \\ \text { frame }\end{array}$ | $\begin{array}{l}\text { Trip unit / OCR } \\ \text { Sensor ratings (Amps) }\end{array}$ | $\begin{array}{l}\text { Poles } \\ \text { 2 }\end{array}$ |  | $\begin{array}{l}\text { OCR type }\end{array}$ | Cat. No. |
| :--- | :--- | :--- | :--- | :--- | :--- |$]$ Price \$



Notes: ${ }^{1)}$ All standard thermal magnetic MCCBs are rated to switch DC currents up to 250 V DC.
${ }^{2}$ ) Connect poles in series for 350 V DC and above.
The time constant (L/R) of the circuit should be less than 2 ms at or below rated current, less than 7 ms for short circuit equal and below 10 kA , less than 15 ms for short circuits over 10 kA , the connections should be as shown in the diagrams on following page.

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## Moulded Case Circuit Breakers

Ratings

| DC Breaking capacity (kA) |  |  | Poles ${ }^{1}$ ) | Current OCR type adjust. |  | Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 350 V | 500 V | 600 V |  |  |  |  |
| 10 | - | - | 3 | Therm Ma | 63-100 | S125ND |
| 10 | 7.5 | 5 | 4 | Therm Mag | 63-100 \% | S125ND |
| 10 | - | - | 3 | Therm Ma | 63-100 | S160ND |
| 10 | 7.5 | 5 | 4 | Therm Mag | 63-100 | S160ND |
| 10 | - | - | 3 | Therm Mag | 63-100 | S250ND |
| 10 | 7.5 | 5 | 4 | Therm Ma | 63-100 | S250ND |
| 20 | 15 | 15 | 3 | Therm Ma | 63-100 \% | S400ND |
| 30 | 20 | 20 | 3 | Therm Mag | 50-100 \% | S800ND |


| Ampere <br> rating | Device type | Part Prefix | DC Utilisation <br> voltage |
| :--- | :--- | :--- | :--- |
| $20-2500$ | MCCB | S125-2500 ND | 600 V |
| $250-800$ | MCCB | PVS 400-800 NDL | 750 V |
| $250-800$ | MCCB | PVS 400-800 NDH | 1000 V |
| $160-800$ | Isolator | PVS 160-800 NNL | 800 V |
| $160-800$ | Isolator | PVS 400-800 NNH | 1000 V |

3 and 4 pole series connection
The following wiring connection diagrams should be followed to obtain the $k A$ switching rating levels indicated in the table above.

3 pole in series


## 4 pole in series



Notes: ${ }^{1}$ ) Connect poles in series for 350 V DC and above.
The time constant (L/R) of the circuit should be less than 2 ms at or below rated current, less than 7 ms for short circuit equal and below 10 kA , less than 15 ms for short circuits over 10 kA , the connections should be as shown in the diagrams on following page.

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## DC magnetic types 630 A - 2500 A

- Ampere range 630-2500 A3 poleSpecial shunt and UVT available for sizes 1250 A to 1600 A
- Magnetic adjustment range $4-8 \times \mathrm{I}_{\mathrm{m}}$


3 pole

| Amp rating NRC | Trip Unit Type | 3 Pole <br> (at. No. $^{2}$ ) ${ }^{3}$ ) | 3 pole <br> Price \$ |
| :--- | :--- | :--- | ---: |
| $1000{ }^{4}$ ) | Thermal Magnetic | XS1000ND10003FC | $\mathbf{9 6 3 0 . 0 0}$ |
| 1250 | Magnetic only | XS1250ND12503FC $\left.{ }^{2}\right)^{3}$ ) | $\mathbf{1 0 1 6 0 . 0 0}$ |
| 1600 | Magnetic only | XS1600ND16003FC $\left.{ }^{1}\right)^{3}$ ) | $\mathbf{1 6 7 5 0 . 0 0}$ |
| 2000 | Magnetic only | XS2000ND20003RC | $\mathbf{1 8 4 6 0 . 0 0}$ |
| 2500 | Magnetic only | XS2500ND25003RC | $\mathbf{2 0 7 1 0 . 0 0}$ |

Notes: ${ }^{1)} 3$ pole sizes stocked.
${ }^{2}$ ) Mounting details for DC Applications series are identical to those for the same frame size Standard series (i.e. for XS1000ND refer to XS800NJ, XS1250ND and XS1600ND refer to XS1600NE, XS2000ND and XS2500ND refer to XS2500NE).
${ }^{3}$ ) For 1250 A and 1600 A DC MCCBs some internal accessories may differ from standard AC types. Information is as follows. Internal accessories are a FACTORY fit.
a) Auxiliaries and alarms - Same as standard AC MCCB type
b) Shunt trips are type: $2 \mathrm{H} 2438 \mathrm{BAA}-110 \mathrm{~V}$ DC or $2 \mathrm{H} 2439 \mathrm{BDA}-220 \mathrm{~V}$ DC
c) Under voltage trips are type: $2 \mathrm{H} 3776 \mathrm{CBB}-110 \mathrm{~V}$ DC or 2 H 3776 CCB -

220 V DC + barrier 2H3748EBA
${ }^{4}$ ) Thermal/magnetic adjustment down to 630 amps .
NRC: Nominal rated current.
All TemBreak thermal magnetic MCCBs can be used for DC applications

## Plug in MCCBs: 125-630 AF TemBreak 2

## External accessories

Plug-in MCCBs ${ }^{4}$ )
A range of MCCBs are stocked with a rear mounted pre-fitted plug-in section that plugs into the panel mounted base section. The panel mounted base section is ordered separately. The TemBreak 2 plug-in bases include a safety interlock system where the MCCB must be switched OFF to allow MCCB removal. The plug-in base allows for the fitting of up to 4 terminal blocks when auxiliaries, alarms, shunts or UVTs are used. Rear connect terminal covers can be used on the front of the MCCB for IP 20 ingress protection. Standard MCCB conversion to plug-in - NHP can convert standard MCCB to plug-in use.

MCCBs complete with base plug ( 3 pole types below are stocked) ${ }^{1}$ )

|  | MCCB Ampere <br> Rating NRC |  |  |  | kA rating | 3 pole <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: | :---: | :---: | :---: | :---: |

Notes: ${ }^{1}$ ) Other MCCBs not listed can be supplied on request or converted to plug-in, refer next page.
2) S 630 MCCBs when used with a plug-in base must be derated to 530 A .
${ }^{3}$ ) Up to 4 control wiring plug and socket sets can be used in a base.
${ }^{4}$ ) Control wiring kits include pin lugs for internal accessories.
${ }^{5}$ ) Internal accessories must be ordered seperately.
${ }^{6}$ ) TemBreak 2 MCCBs types E/S/H/L can be converted for plug-in use.

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## Accessories to suit 125-630 AF TemBreak 2

FC connection bars $\llcorner$ 'L' shaped terminal

| bar set | Cat. No. | Price $\$$ |
| :--- | :--- | ---: |
| $\mathbf{S 1 2 5}$ |  |  |
| 3 pole kit of 3 bars | T2PF123BA | $\mathbf{3 4 . 0 0}$ |
| 4 pole kit of 4 bars | T2PF124BA | $\mathbf{4 6 . 0 0}$ |
| $\mathbf{S 1 6 0 , \mathbf { S 2 5 0 }}$ |  | $\mathbf{7 1 . 0 0}$ |
| 3 pole kit of 3 bars | T2PF253BA | $\mathbf{9 4 . 0 0}$ |
| 4 pole kit of 4 bars | T2PF254BA |  |
| $\mathbf{S 4 0 0 , \text { S630 }}$ |  | $\mathbf{2 1 5 . 0 0}$ |
| 3 pole kit of 3 bars | T2PF403BA | $\mathbf{2 8 0 . 0 0}$ |
| 4 pole kit of 4 bars | T2PF404BA |  |

Plug in MCCB kits Suits MCCB types Cat. No. Price \$
Kit parts to convert
a standard MCCB to
a plug in type
(T2PM base to be
ordered seperately)

| E125, S125 |  |  |
| :--- | :--- | :--- |
| 3 pole kit (base not <br> included) | 2H6843CAB | 105.00 |
| 4pole kit (base not <br> included) | $2 H 6844$ CAB | 127.00 |

S160, E/S 250
"S.....PM"
MCCB with plugs fitted

| 3pole kit (base not <br> included | 2H6845CAA | 132.00 |
| :--- | :--- | :--- |
| 4pole kit (base not <br> included) | 2H6846CAA | 167.00 |

H/L 125-160-250 (not S250PE/H250NE)

| 3 pole kit (base not <br> included | 2H6940CAB | 220.00 |
| :--- | :--- | :--- |
| 4pole kit (base not <br> included) | 2H6941CAB | $\mathbf{2 7 5 . 0 0}$ |

S250PE, H250NE

| 3 pole kit (base not <br> included) | 2H6940CBA | $\mathbf{2 5 0 . 0 0}$ |
| :--- | :--- | :--- |
| 4 pole kit (base not <br> included) | 2H6941CBA | $\mathbf{3 0 5 . 0 0}$ |

E400, S400 (not for H/L400)

| 3 pole kit (base not <br> included) | 2H6847CAAK | $\mathbf{3 0 5 . 0 0}$ |
| :--- | :--- | :--- |
| 4pole kit (base not <br> included) | 2H6848CAAK | $\mathbf{3 9 5 . 0 0}$ |

MCCB

| $\mathbf{S 6 3 0}$ |  |  |
| :--- | :--- | :---: |
| 3 pole kit (base not <br> included) | 2H7234CAAK | $\mathbf{5 0 0 . 0 0}$ |
| 4 pole kit (base not <br> included) | 2H7235CAAK | $\mathbf{6 4 0 . 0 0}$ |



T2PM base


Plug in MCCBs

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## TemBreak 2 \& TemBreak 1 MCCB cross reference

TemBreak 2 MCCB



Notes: The above equivalents are approximate only. Physical sizes may vary slightly as well as kA ratings.

## SP464 James St Lowood SPS - Electrical Installation OM Manual TERASAKI

## TemBreak 2 \& TemBreak 1 MCCB cross reference



To obtain stocked TemBreak 1 MCCBs 125-400 A Refer Section 6 or refer NHP

| TemBreak 1 - approximate equivalent Primary equivalent 1, secondary 2, third 3, / \& 415 V kA rating 1 1 2 2 3 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| XS125CJ | 18 kA | XS125NJ | 25 kA | X $=225 \mathrm{NC}$ | 18 kA |
| XS125CS | 14 kA | XS125NS | 25 kA | - |  |
| XH125NJ | 50 kA | - |  | - |  |
| XS125NJ | 25 kA | XS125CJ | 18 kA | X $=225 \mathrm{NC}$ | 18 kA |
| XH125NJ | 50 kA | TL100NJ | 85 kA | XH125PJ | 50 kA |
| TL30F | 120 kA | TL100F | 120 kA | TL100NJ | 85 kA |
| TL225B | 180 kA | - |  | - |  |
| - |  | - |  | - |  |
| XS250NJ | 25 kA | XH160PJ | 50 kA | X $=225 \mathrm{NC}$ | 18 kA |
| XH250NJ | 50 kA | XH250PJ | 85 kA | XH160PJ | 50 kA |
| TL250NJ | 85 kA | TL225F | 120 kA | TL100F | 120 kA |
| TL225B | 180 kA | TL100C | 180 kA | - |  |
| XS250NJ | 25 kA | X | 18 kA | - |  |
| XS250NJ | 25 kA | - |  | - |  |
| XH250NJ | 50 kA | TL.250NJ | 85 kA | - |  |
| XH400SE | 65 kA | XS400SE | 50 kA | - |  |
| TL250NJ | 85 kA | XH250PJ | 65 kA | - |  |
| TL400NE | 85 kA | TL225F | 120 kA | - |  |
| TL225B | 180 kA | - |  | - |  |
| XS400CJ | 35 kA | - |  | - |  |
| XS400CJ | 35 kA | - |  | - |  |
| XS400NJ | 50 kA | - |  | - |  |
| XS400SE | 50 kA | XH400SE | 65 kA | XH400PE | 65 kA |
| XH400PJ | 65 kA | - |  | - |  |
| XH400SE | 65 kA | XH400PE | 65 kA | TL400NE | 85 kA |
| TL400NE | 85 kA | - |  | - |  |
| TL400NE | 85 kA | TL630NE | 125 kA | - |  |
| - |  | - |  | - |  |
| XS630CJ | 42 kA | XS630NJ | 50 kA | - |  |
| XS630SE | 50 kA | XS630NJ | 50 kA | - |  |
| XH630SE | 65 kA | XH630PE | 65 kA | XS630PJ | 85 kA |

Notes: MCCBs with the same colours have the same outline dimensions, though in the case of $400 \mathrm{AF} \& 630 \mathrm{AF}$, main terminal heights vary.

## TemBreak 2 \& TemBreak 1 MCCB cross reference

TemBreak 2 MCCB


Isolators - Short time rating for 0.3 seconds Icw (kA)

| Ampere <br> Range | TemBreak 2 415 V kA <br> Ics | Thermal- <br> Mag Adjust- Electronic <br> able | TemBreak 2 <br> Adjustment |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Catalogue |  |  |  |  |  |
| 125 | 2 | - | - | - | Sumber |

TemBreak 1 MCCB


TemBreak 1 - approximate equivalent
Primary equivalent 1 , secondary 2 , third $3, /$ \& 415 V kA rating

| $\mathbf{1}$ | $\mathbf{2}$ |  |  |  |  | $\mathbf{3}$ |
| :--- | :--- | :--- | :--- | :---: | :---: | :---: |
| XS125NN | 1.8 kA | - | - |  |  |  |
| XS250NN | 4 kA | XE250NNC | 3 kA |  |  |  |
| XS250NN | 4 kA | - | - |  |  |  |
| XS400NN | 5 kA | - |  |  |  |  |
| XS630NN | 10 kA |  |  |  |  |  |

Notes: The above equivalents are approximate only. Physical sizes may vary slightly as well as
kA ratings.

Chassis assemblies for the TemBreak range

|  | Page |
| :--- | ---: |
| Chassis assemblies overview | $4-2$ |
| XA / XB, PXB series | $4-3$ |
| XB SS series | $4-7$ |
| XC series | $4-9$ |
| Chassis to suit 125-250 AF MCCBs | $4-11$ |
| Terminal covers | $4-12$ |
| HC High-current chassis <br> - to suit TemBreak 2 125 - 630 AF MCCBs <br> - to suit TemBreak 1 630 - 1250 AF MCCBs | $4-15$ |



## SP4( Japmesust Lowood SPS - Electrical Installatiem QMastanual

## Moulded Case Circuit Breaker

## Chassis Systems

General features of TemWay XA, XB, PXB, XC chassis

- 36 and 40 kA ratings on standard TemWay XA, XB, PXB chassis
- 50 and 65 kA ratings on TemWay XC chassis
- XC 1000 A chassis are now stocked with 400 A and 250 A tee off combinations
- A range of TemWay 4 pole XA and XB chassis, suitable for earth leakage MCCBs
- A simplified range of single sided chassis for 250 AF MCCBs, $20-250$ A
- Suitable for 690 V AC applications

General features of heavy current "HC" chassis

- For MCCBs, 20-1250 A
- Compact single sided version

Common configurations of HC chassis now stocked - fully assembled for quick delivery

- 11 box sizes - more economical sizing to suit applications and save cost
- Suitable for 690 V AC applications

Testing
Both TemWay and HC Chassis have been unconditionally type tested (no MCCBs fitted) in Australia, at the short time withstand ratings shown in the table below.

Chassis ratings

| Chassis Type | Description | Main bar rating (A) | Fault current level Icw rating | MCCB frame size | MCCB type |
| :---: | :---: | :---: | :---: | :---: | :---: |
| XA | Double sided | 630,800 A ${ }^{1}$ ) | 36 kA 1 sec. / 40 kA 0.5 sec . | 125 AF | $\begin{aligned} & \text { E/S/ZS125 } \\ & \text { 12A-125A } \end{aligned}$ |
| XB | Double sided | $800 \mathrm{~A}^{1}$ ) | 36 kA $1 \mathrm{sec} . /$ 40 kA 0.5 sec . | 250 AF | $\begin{aligned} & \mathrm{E} / \mathrm{S} / \mathrm{ZS} 250 \mathrm{NJ} / \mathrm{GJ} \\ & 12 \mathrm{~A}-250 \mathrm{~A} \\ & \hline \end{aligned}$ |
| XBSS | Single sided Left or right sided | $800 \mathrm{~A}^{1}$ ) | 36 kA 1 sec. / 40 kA 0.5 sec . | 250 AF | $\begin{aligned} & \text { E/S/ZS250 NJ/GJ } \\ & 12 \mathrm{~A}-250 \mathrm{~A} \end{aligned}$ |
| PXB | Double sided | 800 A | 36 kA $1 \mathrm{sec} . /$ 40 kA 0.5 sec | 250 AF | S250PE, or a mix of 250 AF sizes |
| XC | Double sided | 1000 A ${ }^{1}$ ) | 50 kA $1 \mathrm{sec} . /$ 65 kA 0.5 sec . | $\begin{aligned} & 250 \mathrm{AF}, \\ & 400 \mathrm{AF} \end{aligned}$ | $\begin{aligned} & E / S / Z S 160-250 \\ & \text { up to E/S400 } \end{aligned}$ |
| HC | Double sided or single sided left or right | $\begin{aligned} & 1250 \mathrm{~A}, \\ & 1600 \mathrm{~A}, \\ & 2200 \mathrm{~A} \end{aligned}$ | 65 kA 1 Sec . | $\begin{aligned} & 250 \mathrm{AF} \\ & \text { to } \\ & 1250 \mathrm{AF} \\ & \hline \end{aligned}$ | E/S160 <br> up to XS1250SE |

Notes: ${ }^{1)}$ XB and PXB Chassis main bars are rated at 800 A. Optional for XA chassis. To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, $X A, X B, ~ P X B$ and $X C$ chassis should be only used in switchboards having operational currents less than 800 A. For chassis that include integral separation and for currents equal to, and exceeding 800 A , a HC high current chassis must be used.

## XA / XB Chassis for 125-250 AF MCCBs

## 3 pole, double sided

## Features

Complies with AS/NZS 3439, AS/NZS 3000-2007

- Suits TemBreak MCCBs 125-250 A
- Top and bottom fed
- Busbars fully insulated

Side mounting rail now standard for quicker mounting on all chassis

- XA and XB chassis now rated up to : 36 kA for 1 second

40 kA for 0.5 seconds

## XA 630 and XA 800

## Suits E125, S125, ZS125 MCCBs

| No. <br> Poles | Cutout $\left.{ }^{1}\right)$ <br> Height <br> $(\mathbf{m m})$ | Pan <br> Height <br> $(\mathbf{m m})$ | Cat. No. | $\mathbf{6 3 0} \mathbf{A}$ <br> Price <br> $\mathbf{\$}$ | Cat. No. | $\mathbf{8 0 0}$ A <br> Price $\left.\mathbf{\$}^{2}\right)$ |
| :--- | :--- | :--- | :--- | ---: | :--- | ---: |
| 6 | 92 | 90 | XA6306U | $\mathbf{2 7 5 . 0 0}$ | XA8006U | $\mathbf{2 8 5 . 0 0}$ | A,

## XB 800

Suits S160, S250NJ, S250GJ, ZS250 MCCBs (not S250PE)

| No. <br> Poles | Cutout $\left.{ }^{1}\right)$ <br> Height $(\mathrm{mm})$ | Pan <br> Height $(\mathrm{mm})$ | Cat. No. | $\mathbf{8 0 0} \mathbf{A}$ <br> Price $\left.\${ }^{2}\right)$ |
| :--- | :--- | :--- | :--- | ---: |
| 6 | 107 | 105 | XB8006U | $\mathbf{4 5 5 . 0 0}$ |
| 12 | 212 | 210 | XB80012U | $\mathbf{4 0 0 . 0 0}$ |
| 18 | 317 | 315 | XB80018U | $\mathbf{7 4 0 . 0 0}$ |
| 24 | 422 | 420 | XB80024U | $\mathbf{6 7 0 . 0 0}$ |
| 30 | 527 | 525 | XB80030U | $\mathbf{1 1 2 0 . 0 0}$ |
| 36 | 632 | 630 | XB80036U | $\mathbf{1 3 3 0 . 0 0}$ |
| 42 | 737 | 735 | XB80042U | $\mathbf{1 5 4 0 . 0 0}$ |
| 48 | 842 | 840 | XB80048U | $\mathbf{1 7 6 0 . 0 0}$ |
| 60 | 1052 | 1050 | XB80060U | $\mathbf{2 1 3 0 . 0 0}$ |
| 72 | 1262 | 1260 | XB80072U | $\mathbf{2 7 1 0 . 0 0}$ |

Notes: ${ }^{1)}$ The length of the escutcheon cut-out
${ }^{2}$ ) $X B$ Chassis main bars are rated at 800 A , while for XA chassis it is an option. To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, XA, XB chassis should be used in switchboards having operational currents less than 800 A . For chassis that include integral separation and for currents equal to, and exceeding 800 A , a HC high current chassis must be used.
For XB chassis with Form 3bih separation, refer NHP.

# PXB Chassis for 250AF electronic / thermal magnetic MCCBs <br> 3 pole, double sided 

## Features

Complies with AS/NZS 3439, AS/NZS 3000-2007
Suitable for MCCBs 12 A - 250 A
Suits either all electronic or a mix of electronic and thermal magnetic MCCBs

- Top and bottom fed
- Busbars fully insulated
- PXB chassis rated: 36 kA for 1 second 40 kA for 0.5 seconds

PXB 800


Suits S250PE electronic, S160, E250, S250, ZS250 thermal mag. MCCBs

|  | Cutout Height $\left.{ }^{1}\right)$ <br> No. of Poles <br> $(\mathbf{m m})$ | Pan Height $\left.{ }^{2}\right)(\mathbf{m m})$ | $\mathbf{8 0 0} \mathbf{A}$ <br> Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 6 | 107 | 105 | PXB8006U | $\mathbf{5 1 0 . 0 0}$ |
| 12 | 212 | 210 | PXB80012U | $\mathbf{5 9 0 . 0 0}$ |
| 18 | 317 | 315 | PXB80018U | $\mathbf{8 1 0 . 0 0}$ |
| 24 | 422 | 420 | PXB80024U | $\mathbf{1 0 4 0 . 0 0}$ |
| 30 | 527 | 525 | PXB80030U | $\mathbf{1 2 3 0 . 0 0}$ |
| 36 | 632 | 630 | PXB80036U | $\mathbf{1 6 0 0 . 0 0}$ |
| 42 | 737 | 735 | PXB80042U | $\mathbf{1 8 5 0 . 0 0}$ |
| 48 | 842 | 840 | PXB80048U | $\mathbf{2 1 2 0 . 0 0}$ |
| 60 | 1052 | 1050 | PXB80060U | $\mathbf{2 5 4 0 . 0 0}$ |
| 72 | 1262 | 1260 | PXB80072U | $\mathbf{3 2 5 0 . 0 0}$ |

PXB Chassis showing add-on brackets for mounting thermal magnetic MCCBs
PXB chassis details

## Fitting S250PE Electronic MCCBs

The PXB chassis has extra long tee offs to accommodate 103 mm deep S250PE electronic MCCBs. An S250PE MCCB will not mount onto a standard XB chassis.

Fitting S250PE electronic, S160, E250 and S250 thermal magnetic MCCBs
The PXB chassis caters for a mix of 103 mm deep S250PE and 68mm deep thermal magnetic S160, E250, S250 MCCBs. The chassis comes as standard with add-on metal brackets \& screws, to allow shallower 68 mm deep MCCBs to be installed in any position on the chassis. The total quantity of 3 pole brackets supplied equals the number of 3 pole tee off sets.
Notes: ${ }^{1}$ ) The length of the escutcheon cut-out.
${ }^{2}$ ) Busbars extend 50 mm beyond the pan length at the top and bottom on $X A, X B, X C$ chassis.
PXB Chassis main bars are rated at 800 A . In order for adhere to the new Australian New Zealand AS/NZS 3000-2007 standard regarding separation, XB chassis should be used in switchboards having operational currents less than 800 A . For chassis that includes integral separation and for utilisation currents equal to, and exceeding 800 A , a HC high current chassis must be used.

## XA / XB Chassis for 125-250AF MCCBs

4 pole, double sided

## Features

- Complies with AS/NZS 3439, AS/NZS 3000-2007
- Suits TemBreak MCCBs 125-250 A
- Top and bottom fed
- Busbars fully insulated
- Side mounting rail now standard for quicker mounting on all chassis
- XA and XB chassis now rated up to : 36 kA for 1 second 40 kA for 0.5 seconds


## XA 630 and XA 800

Suits E125, S125, ZS125 MCCBs

| No. Poles | Cutout ${ }^{1}$ <br> Height (mm) | Pan <br> Height (mm) | Cat. No. | $630 \mathrm{~A}$ <br> Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 8 | 122 | 150 | XA6308U4POLE | 760.00 |
| 16 | 242 | 270 | XA63016U4POLE | 910.00 |
| 24 | 362 | 390 | XA63024U4POLE | 1320.00 |
| 32 | 482 | 510 | XA63032U4POLE | 1680.00 |
| 40 | 602 | 630 | XA63040U4POLE | 2010.00 |
| 48 | 722 | 750 | XA63048U4POLE | 2360.00 |
| 56 | 842 | 850 | XA63056U4POLE | 2920.00 |
| 64 | 962 | 990 | XA63064U4POLE | 3110.00 |
| No. Poles | Cutout ${ }^{1)}$ <br> Height (mm) | Pan <br> Height (mm) | Cat. No. ${ }^{2}$ ) | 800 A <br> Price $\$$ |
| 8 | 122 | 150 | XA8008U4POLE | 840.00 |
| 16 | 242 | 270 | XA80016U4POLE | 940.00 |
| 24 | 362 | 390 | XA80024U4POLE | 1380.00 |
| 32 | 482 | 510 | XA80032U4POLE | 1780.00 |
| 40 | 602 | 630 | XA80040U4POLE | 2170.00 |
| 48 | 722 | 750 | XA80048U4POLE | 2600.00 |
| 56 | 842 | 850 | XA80056U4POLE | 3020.00 |
| 64 | 962 | 990 | XA80064U4POLE | 3370.00 |

Notes: ${ }^{1}$ ) The length of the escutcheon cut-out.
${ }^{2}$ ) XB Chassis main bars are rated at 800 A , while for XA chassis it is an option.
To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, XA, XB chassis should be only used in switchboards having operational currents less than 800 A . For chassis that include integral separation and for currents equal to, and exceeding $800 \mathrm{~A}, \mathrm{a} \mathrm{HC}$ high current chassis must be used.
$\left.{ }^{3}\right)$ XA and XB 4 pole chassis have a common pan width. 630A chassis use 4 main bars while 800 A have 5 main bars ( 2 neutral bars).

# XA / XB Chassis for 125-250AF MCCBs <br> 4 pole, double sided 

XB 800
Suits S160, S250NJ, S250GJ, ZS250 MCCBs (not S250PE)

| No. <br> Poles | Cutout $\left.{ }^{1}\right)$ <br> Height $(\mathrm{mm})$ | Pan <br> Height $(\mathrm{mm})$ | Cat. No. ${ }^{2}$ ) | $\mathbf{8 0 0} \mathbf{A}$ <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 8 | 142 | 175 | XB8008U4POLE | $\mathbf{9 3 0 . 0 0}$ |
| 16 | 282 | 315 | XB80016U4POLE | $\mathbf{1 1 7 0 . 0 0}$ |
| 24 | 422 | 455 | XB80024U4POLE | $\mathbf{1 6 3 0 . 0 0}$ |
| 32 | 562 | 595 | XB80032U4POLE | $\mathbf{2 1 0 0 . 0 0}$ |
| 40 | 702 | 735 | XB80040U4POLE | $\mathbf{2 5 4 0 . 0 0}$ |
| 48 | 842 | 875 | XB80048U4POLE | $\mathbf{3 0 6 0 . 0 0}$ |

Notes: ${ }^{1}$ ) The length of the escutcheon cut-out.
${ }^{2}$ ) XB Chassis main bars are rated at 800 A , while for XA chassis it is an option.
To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, XA, XB chassis should be only used in switchboards having operational currents less than 800 A . For chassis that include integral separation and for currents equal to, and exceeding $800 \mathrm{~A}, \mathrm{a} \mathrm{HC}$ high current chassis must be used.

## XB SS Chassis for 125-250 AF MCCBs

3 pole, single sided

## Features

- Single sided MCCB mounting
- Different chassis for left or right side MCCB mounting
- Complies with AS/NZS 3439, AS/NZS 3000-2007
- Suits TemBreak, 160 / 250 A Frame MCCBs

Current ratings of MCCBs range 12 A to 250 A

- Top and bottom fed
- Busbars fully insulated
- Side mounting rail now standard for quicker mounting on
 all chassis
- XA and XB chassis now rated up to : 36 kA for 1 second 40 kA for 0.5 seconds


## Single Sided Chassis <br> Suits S160NJ, E250NJ, S250NJ, S160GJ, S250GJ, ZS250 MCCBs (not S250PE)

XB SSL 800
LEFT hand single sided 3 pole (MCCB loadside connections at LEFT)

| No. <br> Poles | Cutout ${ }^{1}$ ) <br> Height $(\mathrm{mm})$ | Pan <br> Height <br> $(\mathrm{mm})$ | Cat. No. $\left.{ }^{2}\right)$ | 800 A <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 3 | 107 | 105 | XBSSL 800 3U | $\mathbf{3 7 0 . 0 0}$ |
| 6 | 212 | 210 | XBSSL 800 6U | $\mathbf{4 4 0 . 0 0}$ |
| 9 | 317 | 315 | XBSSL 800 9U | $\mathbf{5 9 0 . 0 0}$ |
| 12 | 422 | 420 | XBSSL 800 12U | $\mathbf{7 5 0 . 0 0}$ |
| 15 | 527 | 525 | XBSSL 800 15U | $\mathbf{8 9 0 . 0 0}$ |
| 18 | 632 | 630 | XBSSL 800 18U | $\mathbf{1 0 8 0 . 0 0}$ |
| 21 | 737 | 735 | XBSSL 800 21U | $\mathbf{1 2 2 0 . 0 0}$ |
| 24 | 842 | 840 | XBSSL 800 24U | $\mathbf{1 7 6 0 . 0 0}$ |
| 30 | 1052 | 1050 | XBSSL 800 30U | $\mathbf{2 1 3 0 . 0 0}$ |
| 36 | 1262 | 1260 | XBSSL 800 36U | $\mathbf{2 7 1 0 . 0 0}$ |

Notes: ${ }^{1}$ The length of the escutcheon cut-out.
${ }^{2}$ ) Busbars extend 50 mm beyond the pan length at the top and bottom on $\mathrm{XA}, \mathrm{XB}, \mathrm{XC}$ chassis.
PXB Chassis main bars are rated at 800 A . In order for adhere to the new Australian New Zealand AS/NZS 3000-2007 standard regarding separation, XB chassis should be used in switchboards having operational currents less than 800 A. For chassis that includes integral separation and for utilisation currents equal to, and exceeding 800 A , a HC high current chassis must be used.

## XB SS Chassis for 125-250 AF MCCBs

3 pole, single sided

XB SSR 800
RIGHT hand single sided $\mathbf{3}$ pole (MCCB loadside connections at RIGHT)

| No. <br> Poles | Cutout $\left.{ }^{1}\right)$ <br> Height (mm) | Pan <br> Height <br> $(\mathrm{mm})$ | Cat. No. $\left.{ }^{2}\right)$ | $\mathbf{8 0 0}$ A <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 3 | 107 | 105 | XBSSR 800 3U | $\mathbf{3 7 0 . 0 0}$ |
| 6 | 212 | 210 | XBSSR 800 6U | $\mathbf{4 4 0 . 0 0}$ |
| 9 | 317 | 315 | XBSSR 800 9U | $\mathbf{5 9 0 . 0 0}$ |
| 12 | 422 | 420 | XBSSR 800 12U | $\mathbf{7 5 0 . 0 0}$ |
| 15 | 527 | 525 | XBSSR 800 15U | $\mathbf{8 9 0 . 0 0}$ |
| 18 | 632 | 630 | XBSSR 800 18U | $\mathbf{1 0 8 0 . 0 0}$ |
| 21 | 737 | 735 | XBSSR 800 21U | $\mathbf{1 2 2 0 . 0 0}$ |
| 24 | 842 | 840 | XBSSR 800 24U | $\mathbf{1 7 6 0 . 0 0}$ |
| 30 | 1052 | 1050 | XBSSR 800 30U | $\mathbf{2 1 3 0 . 0 0}$ |
| 36 | 1262 | 1260 | XBSSR 800 36U | $\mathbf{2 7 1 0 . 0 0}$ |

Notes: 1) The length of the escutcheon cut-out.
${ }^{2}$ ) Busbars extend 50 mm beyond the pan length at the top and bottom on $X A, X B, X C$ chassis.
PXB Chassis main bars are rated at 800 A . In order for adhere to the new Australian New Zealand AS/NZS 3000-2007 standard regarding separation, XB chassis should be used in switchboards having operational currents less than 800 A . For chassis that includes integral separation and for utilisation currents equal to, and exceeding 800 A , a HC high current chassis must be used.

## XC Chassis for 160 / 250 A - 400 A MCCBs

3 pole, double sided

## Features

- Complies with AS/NZS 3439, AS/NZS 3000-2007
$\square$
Suits TemBreak MCCB amp ratings 20 A - 400 A
- Top and bottom fed
- Busbars fully insulated
- Side mounting rail now standard for quicker mounting on all chassis
■ XC chassis now rated up to : 50 kA for 1 second

$$
65 \mathrm{kA} \text { for } 0.5 \text { second }
$$



- Now stocked with combinations of 250 A and 400 A tee offs 40 kA for 0.5 seconds


## XC 1000

Suits S160, E250, S250NJ, S250GJ, ZS250 MCCBs ${ }^{3}$ ) (not S250PE)

| No. <br> Poles | Cutout ${ }^{1}$ ) <br> Height $(\mathrm{mm})$ | Pan <br> Height $(\mathrm{mm})$ | Cat. No. $\left.{ }^{2}\right)$ | $\mathbf{1 0 0 0}$ A <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 6 | 107 | 170 | XC10006U | $\mathbf{7 1 0 . 0 0}$ |
| 12 | 212 | 275 | XC100012U | $\mathbf{8 0 0 . 0 0}$ |
| 18 | 317 | 380 | XC100018U | $\mathbf{1 1 1 0 . 0 0}$ |
| 24 | 422 | 485 | XC100024U | $\mathbf{1 4 3 0 . 0 0}$ |
| 30 | 527 | 590 | XC100030U | $\mathbf{1 6 6 0 . 0 0}$ |
| 36 | 632 | 695 | XC100036U | $\mathbf{1 9 8 0 . 0 0}$ |
| 42 | 737 | 800 | XC100042U | $\mathbf{2 3 4 0 . 0 0}$ |
| 48 | 842 | 905 | XC100048U | $\mathbf{2 5 8 0 . 0 0}$ |

Notes: ${ }^{1)}$ The length of the escutcheon cut-out
${ }^{2}$ ) XC Chassis main bars are rated at 1000 A . To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, XC chassis should be only used in switchboards having operational currents less than 800 A . For chassis that include integral separation and for currents equal to, and exceeding $800 \mathrm{~A}, \mathrm{HC}$ high current chassis must be used.
${ }^{3}$ ) XC chassis can be custom built for alternate combinations of 250 A MCCBs, and up to $2 \times 400$ AF MCCBs, and ZS125 (125 AF) ELCBs. 630 A MCCB mounting is not possible.

## XC Chassis for 160 / 250 A - 400 A MCCBs

3 pole, double sided

## XC 1000 Chassis

## Suits $\mathbf{2 5 0}$ A and 400 A MCCBs ${ }^{2}$ ) (not S250PE)

As an alternative to a larger high current chassis, where only up to $2 \times 400 \mathrm{~A}$ and up to $12 \times 68 \mathrm{~mm}$ deep 250 A MCCBs need to be installed, the configurations of stocked XC chassis below can be used.

| Pan <br> Height $(\mathrm{mm})$ | Chassis configured <br> for MCCBs below $\left.\left.{ }^{2}\right)^{\mathbf{3}}\right)$ | Cat. No. ${ }^{1}$ ) | 1000 A <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | ---: |
| 415 | $1 \times 400 \mathrm{~A}$ and $4 \times 250 \mathrm{~A}$ | XC10001X4R12U | $\mathbf{1 4 9 0 . 0 0}$ |
| 625 | $1 \times 400 \mathrm{~A}$ and $8 \times 250 \mathrm{~A}$ | XC10001X4R24U | $\mathbf{2 1 0 0 . 0 0}$ |
| 835 | $1 \times 400 \mathrm{~A}$ and $12 \times 250 \mathrm{~A}$ | XC10001X4R36U | $\mathbf{2 8 0 0 . 0 0}$ |
| 555 | $2 \times 400 \mathrm{~A}$ and $4 \times 250 \mathrm{~A}$ | XC10002X4R12U | $\mathbf{2 3 2 0 . 0 0}$ |
| 765 | $2 \times 400 \mathrm{~A}$ and $8 \times 250 \mathrm{~A}$ | XC10002X4R24U | $\mathbf{2 9 3 0 . 0 0}$ |
| 975 | $2 \times 400 \mathrm{~A}$ and $12 \times 250 \mathrm{~A}$ | XC10002X4R36U | $\mathbf{3 6 3 0 . 0 0}$ |



Notes: ${ }^{1}$ ) XC Chassis main bars are rated at 1000 A. To comply to the new Australian New Zealand AS/NSZ 3000-2007 standard regarding separation, XC chassis should be only used in switchboards having operational currents less than 800 A .
For chassis that include integral separation and for currents equal to, and exceeding $800 \mathrm{~A}, \mathrm{aHC}$ high current chassis must be used.
$\left.{ }^{2}\right)$ XC chassis can be custom built for alternate combinations of 250 A MCCBs, and up to $2 \times 400$ AF MCCBs, and ZS125 (125 AF) ELCBs. 630 A MCCB mounting is not possible.
${ }^{3}$ ) 400 A MCCB right side mounted as standard. LH mounting optional to special order.

## Chassis

## to suit 125-250 AF MCCBs

TemWay chassis ratings and cut-out detail

| Chassis Type | Amps | (Icw) kA short time withstand | Standard <br> Chassis suits MCCBs ${ }^{1}$ ) |
| :---: | :---: | :---: | :---: |
| XA | 630 | 36 kA for 1 sec | -E125, S125NJ, S125GJ, ZS125 |
|  | 630 | 40 kA for 0.5 sec |  |
|  | 800 | 36 kA for 1 sec |  |
|  | 800 | 40 kA for 0.5 sec |  |
| XB / XBSS | 800 | 36 kA for 1 sec | $\begin{aligned} & \text { S160NJ, E250NJ, S250NJ, ZS250 } \\ & \text { S160GJ, S250GJ } \end{aligned}$ |
|  | 800 | 40 kA for 0.5 sec |  |
| PXB | 800 | 36 kA for 1 sec | S250PE or a mix of 250 AF sizes. |
|  | 800 | 40 kA for 0.5 sec |  |
| XC | 800 | 50 kA for 1 sec | S160NJ/GJ, E250NJ |
|  | 800 | 65 kA for 0.5 sec | $\begin{aligned} & \text { (400 A MCCBs 2)) } \\ & \text { S250NJ/GJ, ZS250 } \end{aligned}$ |

## Testing

TemWay chassis have been unconditionally type tested (without MCCBs fitted) at the above short time kA ratings (Icw).

| MCCB dimensions (mm) |  |  |  |
| :---: | :---: | :---: | :---: |
|  | H | W | D |
| E125, S125NJ/GJ, ZS125 |  |  |  |
| 1 pole | 155 | 30 | 68 |
| 3 pole | 155 | 90 | 68 |
| S160, S250NJ/GJ, ZS250 |  |  |  |
| 1 pole | 165 | 40 | 68 |
| 3 pole | 165 | 105 | 68 |


| MCCB dimensions (mm) |  |  |  |
| :--- | :--- | :--- | :--- |
| $\mathbf{H}$ |  |  | W |

## Escutcheon cut-out dimensions (mm)

Applicable to:
TemBreak 2 MCCBs: E/S 125/160/250 AF/400 AF
TemBreak 1 MCCBs: XS/XH 125/250 AF


Notes: ${ }^{1}$ ) TemBreak 1, XS/XH MCCBs can be fitted to the above chassis.
${ }^{2}$ ) Refer XC chassis ordering page in this section for special XC chassis that accept 400 A MCCBs.
${ }^{3}$ ) For height dimensions for MCCB cut-out refer to " H " in the charts above.

## SP4( Japmesust Lowood SPS - Electrical Installatiem QMastanual

Terminal cover options for TemWay XA, XB, XBSS and XC Chassis

Installation considerations

- MCCBs on the chassis are to be reverse connected, that is, connect the 'bottom' of breaker to the chassis tee offs
- Terminal or interpole barriers or "other adequate insulation material" must be fitted at MCCB load side, (top of MCCB) which is the gas venting end of the MCCB

Load Side


# Terminal cover selection 

20 A-1250 A MCCBs

|  | Suit MCCB types | Cover length | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| Flush IP 20 covers (FC) | E125, S125 |  |  |  |
|  | 1 pole cover - set of 2 | - | T2CS121SG | 10.60 |
|  | 2 pole cover - set of 2 | - | T2CS122SG | 12.00 |
|  | 3 pole cover - set of 2 | - | T2CS123SG | 44.00 |
|  | 4 pole cover - set of 2 | - | T2CS124SG | 55.00 |
|  | H125, S160, H160, E250, S250, H250 |  |  |  |
|  | 1 pole cover - set of 2 | - | T2CS251SG | 10.00 |
|  | 3 pole cover - set of 2 | - | T2CS253SG | 54.00 |
|  | 4 pole cover - set of 2 | - | T2CS254SG | 60.50 |
|  | E400, S400, H400, E630, S630 |  |  |  |
|  | 3 pole cover set <br> - RC cov c/w cut-outs |  | T2CR403SG | 93.50 |
|  | 4 pole cover set <br> - RC cov c/w cut-outs |  | T2CR404SG | 111.00 |
| Start terminal covers (FC) | E125, S125 |  |  |  |
|  | 3 pole cover set of 2 | 22 mm | T2CF123SSNBA | 60.50 |
|  | 4 pole cover set of 2 | 22 mm | T2CF124SSNBA | 71.00 |
|  | S160, E250, S250 - except S250PE |  |  |  |
|  | 3 pole cover set of 2 | 30 mm | T2CF253SSNBA | 67.00 |
|  | 4 pole cover set of 2 | 30 mm | T2CF254SSNBA | 77.50 |
| ExtendedE125, S125 |  |  |  |  |
| covers | 1 pole cover - set of 2 | 40 mm | T2CF121SLNG | 35.00 |
| (FC) | 3 pole cover - set of 2 | 40 mm | T2CF123SLNG | 64.50 |
|  | 4 pole cover - set of 2 | 40 mm | T2CF124SLNG | 73.00 |
|  | S160, E250NJ, S250NJ, S250GJ (not S250PE) |  |  |  |
| 46) | 1 pole cover - set of 2 | 55 mm | T2CF161SLNG | 40.00 |
|  | 3 pole cover - set of 2 | 55 mm | T2CF253SLNG | 67.00 |
|  | 4 pole cover - set of 2 | 55 mm | T2CF254SLNG | 77.50 |
|  | H125, H160, S250PE, H250 |  |  |  |
|  | 3 pole cover - set of 2 | 55 mm | T2CF253LLNG | 71.00 |
| E | 4 pole cover - set of 2 | 55 mm | T2CF254LLNG | 77.50 |
| teto | E400, S400, H400, E630, S630 |  |  |  |
|  | 3 pole cover - narrow set of 2 | $80 \text { mm }$ | T2CF403SLNG | 190.00 |
|  | 3 pole cover - wide set of 2 | 110 mm | T2CF403SWNG | 190.00 |
|  | XS630, XH630, XS800, XH800 |  |  |  |
|  | 3 pole cover - set of 2 | 130 mm | 2H1417DAB | 215.00 |
| 400/630 IP20 pole insert - order 1 per. A narrow terminal and wide $\overline{X S 1250}$ terminal $\square$ |  |  | 2A1787DBA | 6.20 |
| cover 3 | 3 pole cover - set of 2 | 130 mm | 2H1419DAB | 235.00 |
| options shown | IP20 pole insert - order 1 per. terminal |  | 2A1787DBA | 6.20 |

## Terminal cover selection

|  | Suit MCCB types | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Rear Connect terminal covers (RC) | E125, S125 |  |  |
|  | 3 pole cover - set of 2 | T2CR123SG | 44.00 |
|  | 4 pole cover - set of 2 | T2CR124SG | 55.00 |
|  | H125, S160, H160, E250, S250, H250 |  |  |
|  | 3 pole cover - set of 2 | T2CR253SG | 54.00 |
|  | 4 pole cover - set of 2 | T2CR254SG | 60.50 |
|  | E400, S400, H400, E630, S630 |  |  |
|  | 3 pole cover - set of 2 | T2CR403SG | 93.50 |
|  | XS630, XH630, XS800, XH800 |  |  |
|  | 3 pole cover - set of 2 | UXPD0013C | 220.00 |
|  | XS630, XH630, XS800, XH800 |  |  |
| Terminal cover locking clip | A clip that provides terminal cover locking, and allows a seal device to be fitted. | T2CF00L | 9.10 |
| Interpole Barriers | E125, S125 |  |  |
|  | Interpole barrier - set of 2 | T2BA123SHA | 17.40 |
|  | S160, E250NJ, S250NJ, S250GJ (not S250PE) |  |  |
|  | Interpole barrier - set of 2 | T2BA253SHA | 20.00 |
|  | H125, H160, S250PE, H250 |  |  |
|  | Interpole barrier - set of 2 | T2BA253LHA | 20.00 |
|  | E400, S400, E630, S630 |  |  |
|  | Interpole barrier - set of 2 | T2BA403SHA | 21.60 |
|  | XS630, XH630, XS800, XH800, XS1250 |  |  |
|  | Interpole barrier - 1 only | UXQH0004B | 10.40 |

## HC High Current chassis for

## 250 AF to 1250 AF MCCBs

## Features

- Double sided 3 pole MCCB chassis
- Compact single sided chassis 3 or 4 pole
- $1250 \mathrm{~A}, 1600 \mathrm{~A}$ or 2200 A rated main bars
- 11 enclosure sizes for economical chassis sizing
- Front connect tags supplied as standard
- Complies with AS/NZS 3439, AS/NZS 3000-2007
- Form of separation 4bih. AS/NZS 3439.1: 2000 (Annex ZF)
- Circuit breakers are reverse fed as standard
- 4th pole neutral bars $100 \%$ rated

- Accepts MCCBs rated 12 A to 1250 A
- Ordering: choose from pre-assembled types, or custom assembly

Stocked assembled chassis selection - Suit MCCB amp frames shown below:

| Main bar rating (A) | Chassi <br> Size | 800 A 6 units | 630 A <br> 5 units | 400 A <br> 4 units | $\begin{aligned} & 250 \mathrm{~A} \\ & 3 \text { units } \end{aligned}$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1600 A | DS | - | $2 \times 630$ | $2 \times 400$ | $4 \times 250$ | HCSTD1DS16153 | 3990.00 |
| 1600 A | DS | - | $4 \times 630$ | - | $8 \times 250$ | HCSTD2DS16243 | 5680.00 |
| 1600 A | SS left | - | $1 \times 630$ | $1 \times 400$ | $2 \times 250$ | HCSTD3SSL16153 | 3990.00 |
| 1600 A | SS righ | t- | $1 \times 630$ | $1 \times 400$ | $2 \times 250$ | HCSTD4SSR16153 | 3990.00 |
| 1600 A | SS left | - | $1 \times 630$ | $1 \times 400$ | $4 \times 250$ | HCSTD5SSL16213 | 5460.00 |
| 1600 A | SS right |  | $1 \times 630$ | $1 \times 400$ | $4 \times 250$ | HCSTD6SSR16213 | 5460.00 |
| 2200 A | SS left | $1 \times 800$ | $1 \times 630$ | $1 \times 400$ | $3 \times 250$ | HCSTD7SSL22243 | 7000.00 |
| 2200 A | SS right | t $1 \times 800$ | $1 \times 630$ | $1 \times 400$ | $3 \times 250$ | HCSTD8SSR22243 | 7000.00 |



## HC High Current chassis

for $\mathbf{2 5 0}$ AF to 1250 AF MCCBs

| Chassis Size | Main bar rating (A) | Icw kA rating (1 sec) | MCCB unitspac | Overall height $\left.(\mathrm{mm})^{1}\right)$ | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | $\begin{aligned} & 1250 \mathrm{~A} \\ &-(2 \times 10 \\ & \times 20 \\ & \mathrm{~mm} \\ &- \text { bars }) \end{aligned}$ | 65 | 15 U | 610 | HC12153 | 1140.00 |
| 2 |  |  | 18 U | 718 | HC12183 | 1510.00 |
| 3 |  |  | 21 U | 826 | HC12213 | 1840.00 |
| 4 |  |  | 24 U | 934 | HC12243 | 1930.00 |
| 5 |  |  | 27 U | 1042 | HC12273 | 2090.00 |
| 6 |  |  | 30 U | 1150 | HC12303 | 2300.00 |
| 7 |  |  | 33 U | 1258 | HC12333 | 2430.00 |
| 8 |  |  | 36 U | 1366 | HC12363 | 2620.00 |
| 9 |  |  | 39 U | 1474 | HC12393 | 2710.00 |
| 10 |  |  | 42 U | 1582 | HC12423 | 3000.00 |
| 11 |  |  | 45 U | 1690 | HC12453 | 3240.00 |
| 1 | $\begin{aligned} & 1600 \mathrm{~A} \\ & -(2 \times 10 \\ & \times \times 30 \\ & \mathrm{~mm} \\ & - \text { bars }) \end{aligned}$ | 65 | 15 U | 610 | HC16153 | 1710.00 |
| 2 |  |  | 18 U | 718 | HC16183 | 2050.00 |
| 3 |  |  | 21 U | 826 | HC16213 | 2360.00 |
| 4 |  |  | 24 U | 934 | HC16243 | 2570.00 |
| 5 |  |  | 27 U | 1042 | HC16273 | 2850.00 |
| 6 |  |  | 30 U | 1150 | HC16303 | 3240.00 |
| 7 |  |  | 33 U | 1258 | HC16333 | 3360.00 |
| 8 |  |  | 36 U | 1366 | HC16363 | 3620.00 |
| 9 |  |  | 39 U | 1474 | HC16393 | 3800.00 |
| 10 |  |  | 42 U | 1582 | HC16423 | 3930.00 |
| 11 |  |  | 45 U | 1690 | HC16453 | 4200.00 |
| 1 | $\begin{aligned} & 2200 \mathrm{~A} \\ &-(2 \times 10 \\ & \times 50 \\ & \times 50 \\ & \mathrm{~mm} \\ &- \text { bars }) \end{aligned}$ | 65 | 15 U | 610 | HC22153 | 2640.00 |
| 2 |  |  | 18 U | 718 | HC22183 | 2840.00 |
| 3 |  |  | 21 U | 826 | HC22213 | 3140.00 |
| 4 |  |  | 24 U | 934 | HC22243 | 3430.00 |
| 5 |  |  | 27 U | 1042 | HC22273 | 3710.00 |
| 6 |  |  | 30 U | 1150 | HC22303 | 3980.00 |
| 7 |  |  | 33 U | 1258 | HC22333 | 4210.00 |
| 8 |  |  | 36 U | 1366 | HC22363 | 4350.00 |
| 9 |  |  | 39 U | 1474 | HC22393 | 4490.00 |
| 10 |  |  | 42 U | 1582 | HC22423 | 4680.00 |
| 11 |  |  | 45 U | 1690 | HC22453 | 4910.00 |

Notes: 1) Height excludes extended and attached busbar

- Overall chassis depth when MCCBs are fitted is 269 mm
- Refer next page for chassis Tee Off details
- For detailed dimensions, refer to the chassis technical catalogue
- For an ordering form, refer to the chassis technical catalogue
- HC chassis' are not compatible with TemBreak 1, 125 A - 400 A MCCBs


## HC High current MCCB chassis MCCB

| HC Chassis TEE OFFs ${ }^{1}$ ) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Frame | MCCB Amp Frame (A) | MCCB width | Single sided Cat. No. Right load | Single sided Cat. No. Left load | Double sided Cat. No. | Price \$ |
| S160/250 | 250 | 3 U | HCR250 | HCL250 | HCD250 | 355.00 |
| H125 / S250PE | 250 | 3 U | HCR250P | HCL250P | HCD250P | 355.00 |
| $\begin{aligned} & \text { E/S400-630 } \\ & \text { Narrow } \\ & \hline \end{aligned}$ | 400-630 | 4 U | HCRN630 | HCLN630 | HCDN630 | 510.00 |
| $\begin{aligned} & \text { E/S400-630 } \\ & \text { Wide } \end{aligned}$ | 400-630 | 5 U | HCRW630 | HCLW630 | HCDW630 | 510.00 |
| XS/XH630-800 | 630-800 | 6 U | HCR800 | HCL800 | HCD800 | 740.00 |
| XS1250 Right hand load | 1250 | 6 U | HCR1250 | - | HCR1250 | 770.00 |
| XS1250 Left hand load | 1250 | 6 U | - | HCL1250 | HCL1250 | 770.00 |

Ordering notes
${ }^{1}$ ) Add tee offs as required to the chassis enclosure to complete the chassis components list.
${ }^{2}$ ) Note: If MCCB below 32 A and a kA rating above 30 kA are required, use H125NJ320 and H125NJ332 with 250 A Tee Off Catalogue Number above.
$\left.{ }^{3}\right) 400 \mathrm{~A}$ MCCBs fitted with a same width narrow cover are 4 units in width.
$\left.{ }^{4}\right) 630$ A MCCBs fitted with a 'wide' width cover are 5 units in width.
${ }^{5}$ ) For ordering, use order from chassis catalogue or contact NHP.
${ }^{6}$ ) All MCCBs to be reverse fitted on chassis.


## Testing

The HC chassis has been unconditionally type tested (no MCCBs fitted) in Australia, at a short time rating of 65 kA for 1 second.

[^35]
## Chassis to suit:

TemBreak 2125 A-630 AF, TemBreak 1 630 A - 1250 A

## 400 / 630 A terminal covers

Terminal covers for 400 A and 630 AF MCCBs can be supplied as wide or narrow types, depending on the size of conductors to be connected to the MCCB. Generally for 400 A rated MCCBs, a narrow cover can be used for its smaller conductors, while a wide cover is used for the 630 A size.

A 630 A MCCB using a T2CF403SWNG wide cover is
5 units of width
(Narrow cover optional)

A 400 A MCCB using a T2CF403SLNG narrow (same width as MCCB) cover is 4 units wide (Wide cover optional)


5 Units wide: MCCB + wide cover

4 Units wide: MCCB + narrow cover

HC Chassis MCCB mounting brackets
Metal extension brackets are attached to the side of HC chassis to cover rear of fitted MCCBs and terminal covers


HC Chassis configuration types - $\mathbf{2}$ examples


HC Chassis with 250 A Frame MCCBs Double sided, 3 pole, 1250 A main bars


HC Chassis with 250 A - 800 A MCCBs Double sided, 3 pole, 2200 A main bars

## MCCB transfer switches and controllers

Page

| Terasaki |  |
| :--- | ---: |
| Transfer switch types | $5-2$ |
| Transfer switch selection | $5-7$ |
| Transfer switch component ordering | $5-12$ |
| Logic panel selection | $5-28$ |
| Transfer switch options | $5-34$ |
| Accessories to suit 125-630 AF MCCB | $5-36$ |



## TemBreak <br> Transfer Switches

TemBreak 2 transfer switches are available from 20 A to 630 A, and consist of mechanically interlocked circuit breakers, with or without a motor fitted. The transfer switches can be either 'link' interlocked, or cable interlocked. Link types are pictured below.
Transfer switches can be ordered as pre-assembled and wired units, or in broken down component form, for user assembly. A common loadside busbar kit is an option.

## Basic types

MTS



## TemBreak

The standard arrangement of MCCBs
ATS


Changeover logic panel / Controller
$+$


OR


MTS $=$ Manual transfer switch: no motors and no logic panel
BTS = Basic transfer switch: MCCBs have motors, but no logic panel
ATS $=$ BTS and logic panel

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## TemBreak

## TemBreak 1 transfer switches

TemBreak 1 transfer switches are factory assembled, and range from 400 A to 2500 A. The switches are interlocked via rear mounted walking beam interlock, or are available with a rod or cable interlock in sizes 400 A to 2500 A . Common loadside busbars (CLSBB) are an option.
A basic transfer switch fitted with motors, can be coupled with a TemLogic control panel TL101 electronic controller or TLP1 relay controller that will automatically changeover to a standby power supply in the event of power failure. The transfer switches are fitted with a mechanical interlock so as to prevent both breakers from being switched to the ON position at the same time.

Basic types
MTS



## TemBreak <br> The standard arrangement of MCCBs:



Logic panel


Electronic controller plus interface panel (TL101CIP)


## OR



Relay/timer logic panel type controller Cat. No. TLP1


An Interconnection wire loom is also required to connect between the TL101 interface panel and terminals on the transfer switch. Cat. No. TLP2L1CABLE

MTS $=$ Manual transfer switch: no motors and no logic panel
BTS = Basic transfer switch: MCCBs have motors mounted on them, no logic panel
ATS $=$ BTS and logic panel

## TemBreak 1 and 2 transfer

switch ordering

Type definition
MTS $=$ Manual Transfer Switch
BTS $=$ Basic Transfer Switch
ATS = Automatic Transfer Switch (consists of a BTS and controller)
TemBreak 2, MCCB transfer switches can be ordered in a number of ways:

## 1. Pre-Assembled

Pre-assembled BTS transfer switches using a link interlock, up to 630 A .

## 2. Components

Components for complete user assembly. This is applicable to TemBreak 2 transfer switches to 630 A, using either link or cable interlocks, in manual or basic transfer switch configuration.

## 3. Manual Transfer Switches to 630 A

TemBreak 2, manual transfer switches to 630 A are not assembled by NHP. The user orders the components.

## 4. 630 A - 2500 A Transfer Switches

Larger TemBreak 1, 630 A - 2500 A transfer switches, both automatic and manual types are pre-assembled to customer order by NHP.

## 5. Change-Over Controllers

Transfer switch change-over controllers, either electronic or relay logic, are ordered separately by the user for all above types, except where a completely enclosed transfer switch is being assembled by NHP.

## Standards conformity

## Product: TemBreak MCCB based automatic Transfer Switches

Terasaki confirm that the TemBreak MCCB based automatic Transfer Switches have been designed and comply with the international standard IEC 60947.6.1, and the Australian New Zealand standards AS/NZS 3947.6.1 and AS/NZS 3000-2007, for a utilisation class of AC31B for the following MCCB types:

E125, S125, H125, L125, S160, H160, L160, E250, S250, H250, L250, E400, S400, H400, L400, E630, S630, XS630, XH630, XS800, XH800, XS1250, XS1600, XS2000, XS2500

Class CB means: ATSE (Automatic Transfer Switching Equipment) provided with over-current releases and the main contacts of which are capable of making and are intended for breaking short-circuit currents.

# TemBreak <br> Basic Transfer Switches (BTS) <br> 3 or 4 pole 

Features / options:

- Motor driven MCCBs
- 3 or 4 pole types
- Front mounting link interlock used
- Pre-assembled and wired on a mounting plate
- Automatic changeover controller option
- A choice of Relay-Logic, or electronic controllers
- Common load side busbar option
- Conforms to AS/NZS 60947.6.1


BTS selection chart and catalogue numbers

| MCCBs used | Amp range | 3 or 4 Pole outline dimensions (mm) |  |  | 3 pole BTS Cat. No. | 4 pole BTS Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Icu H | W | D |  |  |
| S125NJ | 40-63 | $36^{1}$ ) |  |  | BTSS1NJ6333 | BTSS1GJ6344 |
| S125NJ | 63-100 | $\left.36^{1}\right)$ |  |  | BTSS1NJ10033 | BTSS1GJ10044 |
| S125NJ | 80-125 | $\left.36^{1}\right)$ |  |  | BTSS1NJ12533 | BTSS1GJ12544 |
| S125GJ | 40-63 | 65 |  |  | BTSS1GJ6333 | BTSS1GJ6344 |
| S125GJ | 63-100 | 65 |  |  | BTSS1GJ10033 | BTSS1GJ10044 |
| S125GJ | 80-125 | 65 |  |  | BTSS1GJ12533 | BTSS1GJ12544 |
| S160NJ | 40-63 | $36^{1}$ ) |  |  | BTSS16NJ6333 | BTSS16GJ6344 |
| S160NJ | 63-100 | $\left.36^{1}\right)$ |  |  | BTSS16NJ10033 | BTSS16GJ10044 |
| S160NJ | 100-160 |  |  |  | BTSS16NJ16033 | BTSS16GJ16044 |
| S250NJ | 160-250 |  |  |  | BTSS2NJ25033 | BTSS2GJ25044 |
| S160GJ | 100-160 |  |  |  | BTSS16GJ16033 | BTSS16GJ16044 |
| S250GJ | 160-250 |  |  |  | BTSS2GJ25033 | BTSS2GJ25044 |
| S250PE | 50-125 | 70 |  | 215 | BTSS2PE12533 | BTSS2PE12544 |
| S250PE | 100-250 |  |  |  | BTSS2PE25033 | BTSS2PE25044 |
| S400NJ | 160-250 |  |  |  | BTSS4NJ25033 | BTSS4NJ25044 |
| S400NJ | 250-400 |  |  |  | BTSS4NJ40033 | BTSS4NJ40044 |
| S400GJ | 160-250 |  |  |  | BTSS4GJ25033 | BTSS4GJ25044 |
| S400GJ | 250-400 |  |  |  | BTSS4GJ40033 | BTSS4GJ40044 |
| S400NE | 100-250 |  |  |  | BTSS4NE25033 | BTSS4NE25044 |
| S400NE | 160-400 |  |  |  | BTSS4NE40033 | BTSS4NE40044 |
| S400GE | 100-250 |  |  |  | BTSS4GE25033 | BTSS4GE25044 |
| S400GE | 160-400 |  |  |  | BTSS4GE40033 | BTSS4GE40044 |
| S630CE | 315-630 |  |  |  | BTSS6CE63033 | BTSS6CE63044 |
| S630GE | 315-630 |  |  |  | BTSS6GE63033 | BTSS6GE63044 |

Notes: Transfer switches are stocked off the shelf in sizes 125 A to 630 A in some sizes, while others are made to order. Contact NHP for availability. Refer following pages for information on TLP2 logic and TL101 electronic changeover controllers.
Wire interlocks must be used for transfer switches combining MCCBs of different frame size (different heights).
${ }^{\text {1) }} 4$ Pole types are 65 kA rated.

# TemBreak <br> Basic Transfer Switches (BTS) <br> 3 or 4 pole combination types 

## Features / options:

- Motor driven MCCBs
- 3 or 4 pole MCCB combinations
- Front mounting link interlock used
- Pre-assembled and wired on a mounting plate
- Automatic changeover controller option
- A choice of Relay-Logic, or electronic controllers
- Common load side busbar option
- Conforms to AS/NZS 60947.6.1

BTS selection chart and catalogue numbers

| MCCBs <br> used | Amp range | $\begin{aligned} & 400 \\ & \text { V } \\ & \text { kA } \\ & \text { Icu } \\ & \hline \end{aligned}$ | 3 or 4 Pole outline dimensions (mm) |  |  | 3:4 pole BTS Cat. No. | 4:3 pole BTS Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | H |  | D |  |  |
| S125GJ | 40-63 | 65 | 260305180 |  |  | BTSS1GJ6334 | BTSS1GJ6343 |
| S125GJ | 63-100 | 65 |  |  |  | BTSS1GJ10034 | BTSS1GJ10043 |
| S125GJ | 80-125 | 65 |  |  |  | BTSS1GJ12534 | BTSS1GJ12543 |
| S160GJ | 40-63 | 65 | 279340180 |  |  | BTSS16GJ6334 | BTSS16GJ6343 |
| S160GJ | 63-100 | 65 |  |  |  | BTSS16GJ10034 | BTSS16GJ10043 |
| S160GJ | 100-160 |  |  |  |  | BTSS16GJ16034 | BTSS16GJ16043 |
| S250GJ | 160-250 |  |  |  |  | BTSS2GJ25034 | BTSS2GJ25043 |
| S250PE | 50-125 | 70 | 279340215 |  |  | BTSS2PE12534 | BTSS2PE12543 |
| S250PE | 100-250 |  |  |  |  | BTSS2PE25034 | BTSS2PE25043 |
| S400NJ | 160-250 |  | 360415244 |  |  | BTSS4NJ25034 | BTSS4NJ25043 |
| S400NJ | 250-400 |  |  |  |  | BTSS4NJ40034 | BTSS4NJ40043 |
| S400GJ | 160-250 |  |  |  |  | BTSS4GJ25034 | BTSS4GJ25043 |
| S400GJ | 250-400 |  |  |  |  | BTSS4GJ40034 | BTSS4GJ40043 |
| S400NE | 100-250 |  |  |  |  | BTSS4NE25034 | BTSS4NE25043 |
| S400NE | 160-400 |  |  |  |  | BTSS4NE40034 | BTSS4NE40043 |
| S400GE | 100-250 |  |  |  |  | BTSS4GE25034 | BTSS4GE25043 |
| S400GE | 160-400 |  |  |  |  | BTSS4GE40034 | BTSS4GE40043 |
| S630CE | 315-630 |  |  |  |  | BTSS6CE63034 | BTSS6CE63043 |
| S630GE | 315-630 | 70 |  |  |  | BTSS6GE63034 | BTSS6GE63043 |

Notes: Transfer switches are stocked off the shelf in sizes 125 A to 630 A in some sizes, while others are made to order. Contact NHP for availability.
Refer following pages for information on TLP2 logic and TL101 electronic changeover controllers.
Transfer switch 'kits' are also available for quick on-site assembly of the above transfer switches. Refer following pages.
Wire interlocks must be used for transfer switches combining MCCBs of different frame size (different heights).

# TemBreak <br> Manual transfer switches <br> 3 and 4 pole 

Features / options:

- 3 or 4 pole types
- Rear walking beam interlock used
- Pre-assembled and wired on a mounting plate
- Will accept handles
- Common load side busbar option
- Conforms to AS/NZS 60947.6.1

MTS selection chart and catalogue numbers

| MCCBs used | Ampere range | $\begin{aligned} & \text { Inter- } \\ & \text { rupting } \\ & \text { capac- } \\ & \text { ity } \\ & (400 \mathrm{~V}) \\ & \hline \text { Icu Ics } \end{aligned}$ |  | 3 pole MTS Cat. No. ${ }^{3}$ ) | 4 pole <br> MTS <br> Cat. No. ${ }^{3}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| XS630NJ | 250-400 | $50 \quad 25$ | 550433182 | MS6N433 | MS6N444 |
| XS630NJ | 400-630 | $50 \quad 25$ | 550433182 | MS6N633 | MS6N644 |
| XS630SE | 315-630 | $\begin{array}{ll}50 & 25\end{array}$ | 550433182 | MS6S633 | MS6S644 |
| XH630SE | 315-630 | $65 \quad 33$ | 550433182 | MH6S633 | MH6S644 |
| XS800NJ | 500-800 | $50 \quad 25$ | 550433182 | MS8N833 | MS8N844 |
| XS800SE | 400-800 | $50 \quad 25$ | 550433182 | MS8S833 | MS8S844 |
| XH800PE | 400-800 | $65 \quad 50$ | 550433182 | MH8P833 | MH8P844 |
| XS1250SE | 500-1000 | 8565 | 553570198 | MS12S1033 | MS12S1044 |
| XS1250SE | 625-1250 | 8565 | 553550198 | MS12S1233 | MS12S1244 |
| XS1600SE | 800-1600 | 10075 | 553570198 | MS16S1633 | MS16S1644 |
| XS2000SE | 1000-2000 | 8564 | 774450361 | MS20E2033 | MS20E2044 |
| XS2500SE | 1250-2500 | 8564 | 774450361 | MS25E2533 | MS25E2544 |

Optional features include: auxiliary contacts, trip alarm contact and twin handle operation available on request. Specify when ordering.

Notes: ${ }^{1}$ ) Height includes attached busbar on MCCBs 630 A and above.
${ }^{2}$ ) Detailed dimensions including 4 pole types refer catalogue Part $C$.
$\left.{ }^{3}\right)$ Ordering sheet refer catalogue Part C.
All units are POA.
Transfer switches using 125-400 A MCCB are TemBreak 2 types, and are sold in component form. Refer component selection pages in this section.

# TemBreak <br> Basic transfer switches (BTS) with motor <br> 3 and 4 pole 

## Features / options:

- Motor driven MCCBs
- 3 or 4 pole types
- Rear walking beam interlock used
- Pre-assembled and wired on a mounting plate
- Automatic changeover controller option
- A choice of Relay-Logic, or electronic controllers
- Common load side busbar option
- Conforms to AS/NZS 60947.6.1



## Application notes:

- When a TL101CIP electronic controller plus interface panel is used with a TemBreak 1 transfer switch, an interconnection wire loom consisting of 2 cables is also required. This wire loom connects between the interface panel and the standard terminals on the transfer switch. The Cat. No. of the interconnection cable is "TLP2L1CABLE". The cables are 0.5 m long. Longer cable lengths are an option up to 2 metres. Refer page 5-32.
- When TLP1 relay controllers are used, an interconnection cable is not required.
- TLP2 relay controllers for TemBreak 2 transfer switches cannot be used with Tembreak 1 transfer switches.

BTS selection chart and catalogue numbers

| MCCBs used | Ampere range | Interrupting capacity ( 400 V) Icu Ics |  | 3 pole <br> BTS <br> Cat. No. ${ }^{4}$ ) | 4 pole BTS Cat. No. ${ }^{4}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| XS630NJ | 250-400 | $50 \quad 25$ | 550433341 | BS6N433 | BS6N444 |
| XS630NJ | 400-630 | $50 \quad 25$ | 550433341 | BS6N633 | BS6N644 |
| XS630SE | 315-630 | $50 \quad 25$ | 550433341 | BS6S633 | BS6S644 |
| XH630SE | 315-630 | 6533 | 550433341 | BH6S633 | BH6S644 |
| XS800NJ | 500-800 | $50 \quad 25$ | 550433341 | BS8N833 | BS8N844 |
| XH800SE | 400-800 | 6533 | 550433341 | BH8S833 | BH8S844 |
| XS800SE | 400-800 | $50 \quad 25$ | 550433341 | BS8S833 | BS8S844 |
| XS1250SE | 500-1000 | 8565 | 553530300 | BS12S1033 | BS12S1044 |
| XS1250SE | 625-1250 | 8565 | 553530300 | BS12S1233 | BS12S1244 |
| XS1600SE | 800-1600 | 10075 | 553570320 | BS16S1633 | BS16S1644 |
| XS2000SE | 1000-2000 | $85 \quad 64$ | $\left.774490361^{2}\right)$ | BS20E2033 | BS20E2044 |
| XS2500SE | 1250-2500 | $85 \quad 64$ | $\left.774490361^{2}\right)$ | BS25E2533 | BS25E2544 |

Notes: ${ }^{1)}$ Height includes attached busbar on sizes 630 A and above.
${ }^{2}$ ) Depth does not include rear connect busbars.
${ }^{3}$ ) Detailed dimensions $3 / 4$ pole refer catalogue Part C.
${ }^{4}$ ) Ordering sheet refer catalogue Part C.
All units are POA.

## TL101 AUTOMATIC TRANSFER SWITCH SYSTEM

High level functionality and ease of use.


Terasaki TemLogic 2 TL101 automatic transfer switch controller

- Genuine $144 \times 144 \mathrm{~mm}$ controller solution
- User friendly display and menu selection
- Large selection of functions and options as standard

Terasaki TemLogic 2 to TemBreak interface panel

- The optional TemBreak interface panel provides a safe link between the Terasaki TemLogic 2TL101 controller and a temBreak 1 or 2 MCCB transfer switch.
- The TemBreak interface panel comes complete with'plug'n' play style connectors, eliminating the need for separate control and power wiring.

Terasaki TemBreak 1 or 2 transfer switch

- Large range of amp-frame sizes available
- Enclosed types and options
- Selection of mechanical interlocks
- Suitable for TemBreak 1 or 2 $125-2500 \mathrm{~A}$


# TemBreak <br> Basic transfer switches - 

Component ordering

125 A (E125, S125) MCCBs fitted with a LINK interlock $\left.\left.{ }^{1}\right)^{2}\right)^{3}$ )

| Item | Description | Comment |
| :--- | :--- | :--- |
| 1 | Left and right side MCCBs | MCCB depth 68 mm ${ }^{1}$ ) |
| 2 | Link mechanical Interlock | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB left side |
| 3 | Left \& right side 1 C/O alarm switches |  |

Notes: ${ }^{1}$ ) The left and right side MCCBs have to be the same depth for correct interlocking function.
${ }^{2}$ ) Where $\mathrm{E} / \mathrm{S}$ and $\mathrm{H} / \mathrm{L}$ MCCBs of a different height need to be interlocked, a Cable Interlock must be used. Refer following pages.
${ }^{3}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T25CAPLAB.
${ }^{4}$ ) One electrical interlock wiring loom is required between motors on motorised transfer switches.

## TemBreak Manual and basic transfer switches Component ordering

Component quantity

BTS $\quad$ Cat. No. |  |  |
| :--- | :--- |
| 2 | E125, S125NJ/GJ |
| 1 | T2ML12RA |
| 1 | T2ML12L3A |
| 1 | T2ML12L4A |
| 2 | T2AL00M3SWA |
| 4 | T2AX00M3SWA |
| 2 | T2MC12A24NB |
| 1 | T2MM25L05A |
| 1 | 231-612-019-000 |
| 1 | 231-642-019-000 |
| 1 | T2SB123334 |
| 1 | T2SB124344 |

| 2 | H125NJ, L125NJ |
| :--- | :--- |
| 1 | T2ML125RA |
| 1 | T2ML125L3A |
| 1 | T2ML125L4A |
| 2 | T2AL00M3SWA |
| 4 | T2AX00M3SWA |
| 2 | T2MC25A24NB |
| 1 | T2MM25L05A |
| 1 | 231-612-019-000 |
| 1 | 231-642-019-000 |
| 1 | T2SB2533344344 |



## TemBreak Basic transfer switches -

## Component ordering

## 160 A and 250 A MCCBs fitted with a LINK interlock $\left.\left.{ }^{1}\right)^{2}\right)^{3}$ )

Item Description (omment $\left.{ }^{2}\right)^{3}$ )
1 Left or right side MCCBs MCCB depth $68 \mathrm{~mm}^{1}$ )

MCCB depth $103 \mathrm{~mm}{ }^{1}$ )

| 2 | Link mechanical interlock | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB left side |
| :--- | :--- | :--- |
| 3 | Left \& right side 1 C/O alarm switches Wire type alarm |  |
| 4 | Left \& right side 2 C/O auxiliary <br> switches | Wire type auxiliary |
| 5 | 240 V AC Motor operator | Other voltages available |
| 6 | Interlock connection wire | For motor electrical interlocking ${ }^{4}$ ) |
| 7 | WAGO male connector - Left | For TLP2 / TL101 controllers only |
| 8 | WAGO male connector - Right | For TLP2 / TL101 controllers only |
| 9 | Optional 3 \& 4P mounting plate | With pre threaded mounting holes |

Notes: ${ }^{1}$ ) The left and right side MCCBs have to be the same depth for correct interlocking function.
${ }^{2}$ ) Where $\mathrm{E} / \mathrm{S}$ and $\mathrm{H} / \mathrm{L}$ MCCBs of a different height need to be interlocked, a Cable Interlock must be used. Refer following pages.
${ }^{3}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T25CAPLAB.
${ }^{4}$ ) One electrical interlock wiring loom is required between motors on motorised transfer switches.

## TemBreak Manual and basic transfer switches -

 Component orderingComponent quantity

BTS $\quad$\begin{tabular}{l}
Cat. No. <br>
\hline 2

 

S160NJ/GJ <br>
ES250NJ/GJ
\end{tabular}



# TemBreak Basic transfer switches - 

## Component ordering

## 400 A MCCBs fitted with a LINK interlock

Item Description
Comment $\left.{ }^{1}\right)^{2}$ )
1 Left and right side MCCBs

MCCB depth $140 \mathrm{~mm}{ }^{1}$ )

| 2 | Link mechanical interlock <br> (For motorised MCCBs) | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB left side |
| :--- | :--- | :--- |
| 3 | Link mechanical interlock <br> (for MCCBs with handles) | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB right side |
| 4 | Left \& right side 1 C/O alarm switches Wire type alarm |  |
| 5 | Left \& right side 2 C/O auxiliary <br> switches | Wire type auxiliary |
| 6 | 240 V AC Motor operator | Other voltages available |
| 7 | Interlock connection wire | For motor electrical interlocking |
| 8 | WAGO male connector - Left | For TLP2 / TL101 controllers only |
| 9 | WAGO male connector - Right | For TLP2 / TL101 controllers only |
| 10 | Optional 3P: 3P mounting plate | With pre threaded mounting holes |
| 11 | Optional 4P: 4P / 4P: 3P mounting <br> plate | With pre threaded mounting holes |



Notes: ${ }^{1}$ ) Where E/S and H / L MCCBs of a different height need to be interlocked, a Cable Interlock must be used. Refer following pages.
${ }^{2}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Refer to page 5-36.

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## TemBreak Manual and basic transfer switches -

 Component ordering| Component quantity |  |
| :--- | :--- |
| BTS | Cat. No. |
| 2 | E400NJ |
|  | S400CJ |
|  | S400NJ |
|  | S400NE |
|  | S400GJ |
|  | S400GE |
| 2 | H400NE |
|  | L400NE |
| 1 | T2ML40RB |
| 1 | T2ML40L3B |
| 1 | T2ML40L4B |
| - | T2MLH40RB |
| - | T2MLH40L3B |
| - | T2MLH40L4B |
| 2 | T2AL00M3SWA |
| 4 | T2AX00M3SWA |
| 2 | T2MC40A10NB |
| 1 | T2MM40L06A |
| 1 | 231-612-019-000 |
| 1 | 231-642-019-000 |
| 1 | T2TSB403334MP |
| 1 | T2TSB404344MP |

## TemBreak <br> Basic transfer switches -

## Component ordering

630 A MCCBs fitted with a LINK interlock $\left.{ }^{2}\right)^{3}$ )

| Item | Description | Comment |
| :--- | :--- | :--- |
| 1 | Left and right side MCCBs | MCCB depth 103 mm ${ }^{1}$ ) |
| 2 | Link mechanical interlock <br> (For motorised MCCBs)${ }^{6}$ ) | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB left side |
| 3 | Link mechanical interlock <br> (For MCCBs with handles) | For 3 or 4 pole MCCB right side <br> For 3 pole MCCB left side <br> For 4 pole MCCB right side |
| 3 | Left \& right side 1 C/O auxiliary <br> switches | Wire type alarm |
| 4 | Left \& right side 2 C/O auxiliary <br> switches | Wire type auxiliary |
| 5 | 240 V AC Motor operator | Other voltages available |
| 6 | Interlock connection wire | For motor electrical interlocking ${ }^{4}$ ) |
| 7 | WAGO male connector - Left | For TLP2 / TL101 controllers only |
| 8 | WAGO male connector - Right | For TLP2 / TL101 controllers only |
| 9 | Optional 3P: 3P mounting plate | With pre threaded mounting holes |
| 10 | Optional 4P: 4P / 4P: 3P mounting <br> plate | With pre threaded mounting holes |

Notes: ${ }^{\text {) }}$ The Left and Right side MCCBs have to be the same depth for correct interlocking function.
${ }^{2}$ ) Where $\mathrm{E} / \mathrm{S}$ and $\mathrm{H} / \mathrm{L}$ MCCBs of a different height need to be interlocked, a Cable Interlock must be used. Refer following pages.
${ }^{3}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T40CAPLAB.
${ }^{4}$ ) One electrical interlock wiring loom is required between motors on motorised transfer switches.
${ }^{\text {s }}$ ) $400 \mathrm{~A} / 630 \mathrm{~A}$ link interlocks must use handles for manual transfer switches.
${ }^{6}$ ) An alternative interlock type is the manual 'slide interlock', which does not require a handle to be fitted. Refer S630 Accessories in Section 3.

## TemBreak Manual and basic transfer switches -

 Component orderingComponent quantity
BTS Cat. No.


# TemBreak Manual and basic transfer switches - 

Component ordering
125 A (E125, S125) MCCBs fitted with a CABLE interlock $\left.{ }^{2}\right)^{3}$ )

| Item | Description | Comment |
| :--- | :--- | :--- |
| 1 | Left and right side MCCBs | MCCB depth 68 mm ) |

125 A (E125, S125) MCCBs fitted with a CABLE interlock $\left.{ }^{2}\right)^{3}$ )

| Item | Description | Comment |
| :---: | :---: | :---: |
| 1 | Left and right side MCCBs | MCCB depth 103 mm 1) |
| 2 | Cable mechanical interlock | For 3 or 4 pole MCCBs 1.0 m length of cable - option 1 1.5 m length of cable - option 2 |
| 3 | Left \& right side 1 C/O alarm switc | Wire type alarm |
| 4 | Left \& right side $2 \mathrm{C} / \mathrm{O}$ auxiliary switches | Wire type auxiliary |
| 5 | 240 V AC Motor operator | Other voltages available |
| 6 | Interlock connection wire | For motor electrical interlocking ${ }^{4}$ ) |
| 7 | WAGO male connector - Left | For TLP2 / TL101 controllers only |
| 8 | WAGO male connector - Right | For TLP2 / TL101 controllers only |
| 9 | Optional 3P:3P mounting plate | With pre threaded mounting holes |
| 10 | Optional 4P:4P / 4P:3P mounting plate | With pre threaded mounting holes |

Notes: ${ }^{1)}$ Where E / S and H / L MCCBs of a different height need to be interlocked, a Cable Interlock must be used.
${ }^{2}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T25CAPLAB.
${ }^{3}$ ) Using TemBreak 2 MCCBs and by using a cable interlock, any combination of frame size or poles can be interlocked.
${ }^{4}$ ) One electrical interlocking connection wire is required between motors on motorised transfer switches. Cat. No. T2MM.
Refer alternate lengths, 160/250 A motor accessories in Section 3.

## TemBreak Manual and basic transfer switches -

 Component ordering| Component quantity |  |  |
| :--- | :--- | :--- |
| MTS | BTS | Cat. No. |
| 2 | 2 | E125NJ, S125NJ/GJ |
|  |  |  |
| 1 | 1 | T2MW12CA |
| 1 | 1 | T2MW00SA |
| 1 | 1 | T2MW00LA |
| - | 2 | T2AL00M3SWA |
| - | 4 | T2AX00M3SWA |
| - | 2 | T2MC12A24NB |
| - | 1 | T2MM25L15A |
| - | 1 | 231-612-019-000 |
| - | 1 | 231-642-019-000 |
| 1 | 1 | T2SB123334 |
| 1 |  | T2SB124344 |


| Component quantity |  |  |
| :--- | :--- | :--- |
| MTS | BTS | Cat. No. |
| 2 | 2 | H125NJ, L125NJ |
| 1 | 1 | T2MW25CA |
| 1 | 1 | T2MW00SA |
| 1 | 1 | T2MW00LA |
| - | 2 | T2AL00M3SWA |
| - | 4 | T2AX00M3SWA |
| - | 2 | T2MC25A24NB |
| - | 1 | T2MM25L15A |
| - | 1 | 231-612-019-000 |
| - | 1 | 231-642-019-000 |
| 1 | 1 | T2SB253334 |
| 1 |  | T2SB254344 |



# TemBreak <br> Manual and basic transfer switches - 

Component ordering

160 A and 250 A MCCBs fitted with a CABLE interlock $\left.{ }^{2}\right)^{3}$ )

## Item Description

Comment
1 Left or right side MCCBs
MCCB depth $68 \mathrm{~mm}{ }^{1}$ )

## MCCB depth 103 mm ${ }^{1}$ )

| 2 | Cable mechanical interlock | For 3 or 4 pole MCCBs <br>  <br>  <br>  <br>  <br>  <br>  .5 m l length of cable - option 1 |
| :--- | :--- | :--- |
| 3 | Left \& right side $1 \mathrm{C} / \mathrm{O}$ alarm switch - option 2 |  |



Notes: ${ }^{1}$ ) Where E / S and H / L MCCBs of a different height need to be interlocked, a Cable Interlock must be used.
${ }^{2}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T25CAPLAB.
${ }^{3}$ ) Using TemBreak 2 MCCBs and by using a cable interlock, any combination of frame size or poles can be interlocked.
${ }^{4}$ ) One electrical interlocking connection wire is required between motors on motorised transfer switches. Cat. No. T2MM.

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## TemBreak Manual and basic transfer switches -

 Component ordering| MTS | Component quantity |  |
| :--- | :--- | :--- |
| BTS |  |  |$\quad$| Cat. No. |
| :--- |
| 2 |

# TemBreak Manual and basic transfer switches - 

 Component ordering
## 400 A MCCBs fitted with a CABLE interlock $\left.{ }^{2}\right)^{3}$ )

## Item Description

Comment
1 Left and right side MCCBs
MCCB depth $103 \mathrm{~mm}^{1}$ )

* 400/ 630 A interlocks must
use a motor or handle
operator

MCCB depth $140 \mathrm{~mm}{ }^{1}$ )

| 2 (able mechanical interlock $\left.\left.{ }^{5}\right)^{6}\right)$ | For 3 or 4 pole MCCBs with motors |
| :--- | :--- |
|  | For 3 or 4 pole MCCBs with handles |
|  | 1.0 m length of cable - option 1 |
|  | 1.5 m length of cable - option 2 |
|  |  |


| 3 | Left \& right side 1 C/O alarm switch | Wire type alarm |
| :--- | :--- | :--- |
| 4 | Left \& right side 2 C/O auxiliary <br> switches | Wire type auxiliary |
| 5 | 240 V AC Motor operator | Other voltages available |
| 6 | Interlock connection wire | For motor electrical interlocking ${ }^{4}$ ) |
| 7 | WAGO male connector - Left | For TLP2 / TL101 controllers only |
| 8 | WAGO male connector - Right | For TLP2 / TL101 controllers only |
| 9 | Optional 3P:3P mounting plate | With pre threaded mounting holes |
| 10 | Optional 4P:4P / 4P:3P mounting <br> plate | With pre threaded mounting holes |

Notes: ${ }^{1)}$ Where E/S and H / L MCCBs of a different height need to be interlocked, a Cable Interlock must be used. .
${ }^{2}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T40CAPLAB..
$\left.{ }^{3}\right)$ Using TemBreak 2 MCCBs and by using a cable interlock, any combination of frame size or poles can be interlocked.
${ }^{4}$ ) One electrical interlocking connection wire is required between motors on motorised transfer switches. Cat. No. T2MM.
Refer alternate lengths for 400/630 A motor accessories in Section 3.
${ }^{\text {s }}$ ) 400 A and 630 A interlocks must use handles for manual transfer switches.
${ }^{6}$ ) An alternative interlock type is a manual "slide interlock", which does not require a handle to be fitted. Slide interlocks will not allow handles or motors to be fitted. Refer 400/630 A accessories in Section 3 for further information.

## TemBreak Manual and basic transfer switches -

 Component ordering|  | Component quantity <br> BTS | Cat. No. |
| :--- | :--- | :--- |
| 2 | 2 | E400NJ <br> S400CJ <br> S400NJ |
|  |  | S400NE <br> S400GJ <br> S400GE |
|  |  |  |
|  |  | H400NJ/NE |
|  |  | L400NJ/NE |
| 2 | 1 | T2MW40CB |
|  | 1 | T2MWH40CB |
| - | 1 | T2MW00SA |
| 1 | 2 | T2MW00LA |
| 1 | 4 | T2AL00M3SWA |
| - | 2 | T2AX00M3SWA |
| - | 1 | T2MC40A10NB |
| - | 1 | T2MM40L21A |
| - | 1 | 231-612-019-000 |
| - | 1 | 231-642-019-000 |
| - |  | T2TSB403334MP |
| 1 |  |  |
| 1 |  |  |



# TemBreak Manual and basic transfer switches - 

 Component ordering
## 630 A MCCBs fitted with a CABLE interlock $\left.{ }^{2}\right)^{3}$ )

Item Description Comment
1 Left and right side MCCBs MCCB depth $103 \mathrm{~mm}^{1}$ )

|  |  | For 3 or 4 pole MCCBs with motors <br> For 3 or 4 pole MCCBs with handles <br> 1.0 <br> m length of cable - option 1 |
| :--- | :--- | :--- |
| 1.5 m length of cable - option 2 |  |  |$|$

Notes: ${ }^{1}$ ) Where E/S and H / L MCCBs of a different height need to be interlocked, a Cable Interlock must be used. .
${ }^{2}$ ) MCCB marker and capacity size labels can be ordered for mounting on motors etc. Use ratings label sheet Cat. No. T40CAPLAB..
$\left.{ }^{3}\right)$ Using TemBreak 2 MCCBs and by using a cable interlock, any combination of frame size or poles can be interlocked.
${ }^{4}$ ) One electrical interlocking connection wire is required between motors on motorised transfer switches. Cat. No. T2MM.
Refer alternate lengths for 400/630 A motor accessories in Section 3.
${ }^{\text {5 }}$ ) 400 A and 630 A interlocks must use handles for manual transfer switches.
${ }^{6}$ ) An alternative interlock type is a manual "slide interlock", which does not require a handle to be fitted. Slide interlocks will not allow handles or motors to be fitted. Refer 400/630 A accessories in Section 3 for further information.

## TemBreak <br> Manual and basic transfer switches -

 Component ordering| MTS | Component quantity <br> BTS | Cat. No. |
| :--- | :---: | :--- |
| 2 | 2 | E630NE <br> S630CE / GE |
| 1 | 1 | T2MW00CB <br> T2MWH40CB <br> T2MW00SA <br> T2MW00LA |
| 1 | 1 | T2AL00M3SWA |
| 1 | 1 | T2AX00M3SWA |
| - | 2 | T2MC40A10NB |
| - | 4 | T2MM40L21A |
| - | 2 | 231-612-019-000 |
| - | 1 | 231-642-019-000 |
| - | 1 | T2TSB403334MP |
| - | 1 | T2TSB404344MP |
| 1 | 1 |  |
| 1 |  |  |



# TemBreak Automatic transfer switches (ATS) 

Logic controller for Tembreak 2

## Timer / Relay logic controller

NHP offers a choice of electromagnetic (relay) logic panels with various options, or a PLC controller type. The basic timer/ relay logic controller includes the following standard features:

- Voltage and phase sequence sensing relay
- Time delay normal to emergency and back
- Common power supply relays
- Normal supply phase sequence relay
- Control wiring terminals
- A 4 position mode selector switch is provided loose (Manual / Automatic / Test / Off) - SSW5
- Optional PLC logic panel (TLPC2)

TLP logic controller and options
TLP2
Relay/timer Controller panel

| Description |  | Cat. No. ${ }^{1}$ ) | Price \$ |
| :---: | :---: | :---: | :---: |
| Logic Panel for Tembreak 2 ATS |  | TLP2 | 2250.00 |
| Option $\left.{ }^{1}\right)^{2}$ ) | Description | Cat. No. ${ }^{1}$ ) | Price \$ |
| 2 | Emergency supply phase sequence and voltage sensing relays | EPSR / EVSR | 310.00 |
| 3 | Emergency supply frequency relay | EFR | 560.00 |
| 4 | Engine run-on time delay | ERTD | 335.00 |
| 5 | Engine start time delay | ESTD | 305.00 |
| 6 | Inhibit return control (Prevents auto-return to normal from emergency) | IRC | 119.00 |
| 7 | Cranking limiter time delay | CLTD | 310.00 |
| 8 | Additional mode selection 'Normal supply' | SSW2 | 390.00 |
| 9 | Additional contacts for remote indication of mode switch position (includes option 8) | SSW3 | 405.00 |
| 10 | Alarm lock-out relay. (Prevents breaker closure after overload or short circuit trip) | ALR | 465.00 |
| 13 | Mains stability timer | MST | 210.00 |
| 14 | Surge protection - single phase | SPD1 | 210.00 |
| 15 | Surge protection - 3 phase | SPD3 | 280.00 |

Notes: ${ }^{1}$ ) NHP has limited the number of gear tray plates to three (3) standard sizes, which cover all optional features.
$\left.{ }^{2}\right)$ NHP stock basic TLP2 logic panels. All others are built to order. Standard and custom logic panel ordering sheet, refer Catalogue Part C. Due to component and wiring differences, TemBreak 1 logic panels are not configured to work with TemBreak 2 Transfer Switches and vice versa.

## Do not use TLP1 with TemBreak 2 Motor operators otherwise motor burnout will occur. Use TLP2 for TemBreak 2.

## SP4(4) Jamiesl|t Lowood SPS - Electrical Installation OM Manual

## TemBreak Automatic transfer switches (ATS)

## Logic controller for Tembreak 1

## Timer / Relay logic controller

NHP offers a choice of electromagnetic (relay) logic panels with various options, or a PLC controller type. The basic timer/ relay logic controller includes the following standard features:

- Voltage and phase sequence sensing relay
- Time delay normal to emergency and back
- Common power supply relays
- Normal supply phase sequence relay
- Control wiring terminals

- A 4 position mode selector switch is provided loose
(Manual / Automatic / Test / Off) - SSW1
- Optional PLC logic panel (TLPC1)

TLP logic controller and options


Notes: ${ }^{1}$ ) NHP has limited the number of gear tray plates to three (3) standard sizes, which cover all optional features.
${ }^{2}$ ) NHP stock basic TLP1 logic panels. All others are built to order. Standard and custom logic panel ordering sheet, refer catalogue Part C.
Do not use TLP1 with TemBreak 2 Motor operators otherwise motor burnout will occur. Use TLP2 for TemBreak 2.

# TemLogic <br> TL101 Transfer switch controller 

The Temlogic2 TL101 automatic transfer switch controller will control and supervise the primary and secondary power of an installation and initiate transferring of the mains to a back-up source in the event of main source interruption. The changeover from one power source to the other can be fully automatic or manually operated. The
 logic controller includes all necessary features to monitor energy distribution systems or generating sets, and transfer equipment, such as motorised circuit breakers.
The TL101 is simply programmed from the front panel with visual LED indication or can be pre-programmed by NHP. The circuit breakers can be manually controlled using the function keys on the front face of the controller.

## TL101 Provides:

Control of minimum voltage, maximum voltage, phase loss, asymmetry, minimum frequency, maximum frequency, with independent enable and delay.

Front panel operation and display
Refer Part C Section 8 or TL101 manual.


Technical features

- Flush mount $144 \mathrm{~mm}^{2}$ housing
- Plug-in removable connections
- Phase to phase voltage measure inputs: 80-800 V AC
- Voltage transformer programming
- True RMS voltage measure
- Frequency measurement $45-65 \mathrm{~Hz}$
- Control functions: phase sequence, phase loss, maximum/minimum voltage, asymmetry, maximum/minimum frequency
- Two displays for voltage/frequency viewing
- 8 digital programming inputs/ 7 relay programmable outputs
- RS 232 interface (refer NHP for RS 485)
- Modbus communication ${ }^{1}$ )

Notes: ${ }^{1}$ ) Modbus communications: A 24 V DC power supply is needed.

## TemLogic <br> TL101 Transfer switch controller

## Interface panel

The interface panel provides short circuit protection via fuses between the transfer switch and TL101 controller. The interface panel comes complete with pre-terminated cable looms, enabling fast 'plug 'n' play' electrical connection between system components.

Ordering details - controller and interface panel

| Heading | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| TemLogic2 TL101 controller only | TL101240V | $\mathbf{1 9 0 0 . 0 0}$ |
| TemLogic2 TL101 controller plus interface <br> panel ${ }^{2}$ ) | TL101CIP | $\mathbf{2 9 9 0 . 0 0}$ |
| TemBreak 1 Transfer switch inter-connection <br> cable <br> (0.5 m standard length or refer next page) | TLP2L1LCABLE ${ }^{1}$ ) | $\mathbf{1 1 4 . 0 0}$ |

[^36]
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## TemBreak Basic Transfer Switch (BTS)

## Inter-connection cable for Tembreak 1 transfer switches using

 TLP1 controllers
## TLP2L1LCABLE

For use with a TL101 CIP (electronic controller and interface panel) when used with a TemBreak 1 transfer switch.

The connector cable connects to the standard BTS control wiring terminals.


| Red and blue cable lengths | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 0.5 m (standard) | TLP2L1LCABLE | $\mathbf{1 1 4 . 0 0}$ |
| 1.0 m | TLP2L1CABLE10 | $\mathbf{1 2 5 . 0 0}$ |
| 1.5 m | TLP2L1CABLE15 | $\mathbf{1 4 0 . 0 0}$ |
| 2.0 m | TLP2L1CABLE20 | $\mathbf{1 5 6 . 0 0}$ |
| 2.5 m | TLP2L1CABLE25 | $\mathbf{1 7 6 . 0 0}$ |
| 3.0 m | TLP2L1CABLE30 | $\mathbf{1 9 7 . 0 0}$ |

[^37]
# TemLogic <br> Temlogic controller types 

## For Tembreak 1 and 2 transfer switches

This page is a cross reference of features and options. For more specific information on each controller type, refer to the previous pages.

CONTROLLER TYPES
Features and options cross reference ${ }^{1}$ )

| Standard and optional features | Cat. No. | TemBreak 1 MCCBs | TemBreak 2 MCCBs | TemBreak 1 or 2 MCCBs |
| :---: | :---: | :---: | :---: | :---: |
|  |  | TLP1 | TLP2 | TL101 |
| Normal voltage sensing phase failure relay | (NVSR) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| Time delay emergency to normal | (TDEN) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| Time delay normal to emergency | (TDNE) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| Common power supply relay | (CPSR) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 2 Emergency supply phase sequence relay | (EPSR) | 0 | 0 | $\checkmark$ |
| Emergency supply voltage sensing relay | (EVSR) | 0 | 0 | $\checkmark$ |
| $3 \begin{array}{l}\text { Emergency supply frequency (EFR) } \\ \text { relay }\end{array}$ |  | 0 | 0 | $\checkmark$ |
| 4 Engine run-on time delay | (ERTD) | 0 | 0 | $\checkmark$ |
| 5 Engine start time delay | (ESTD) | 0 | 0 | $\checkmark$ |
| 6 Inhibit return control | (IRC) | 0 | 0 | $\checkmark$ |
| 7 Cranking limiter time delay | (CLTD) | 0 | 0 | - |
| 8 Additional mode selection 'Normal supply' | (SSW2) | 0 | 0 | $\checkmark$ |
| 9 Additional contacts for remote indication of mode switch position | (SSW3) | 0 | 0 | $\checkmark$ |
| 10 Alarm lock-out relay | (ALR) | 0 | 0 | $\checkmark$ |
| 11 Changeover time delay | (COTD) | 0 | 0 | $\checkmark$ |
| 13 Mains stability timer | (MST) | 0 | 0 | $\checkmark$ |
| Interface with building management system |  | - ${ }^{1}$ | - ${ }^{1}$ | $\checkmark$ |
| Load shedding control |  | - | - | $\checkmark$ |
| 14 Surge protection single phase(SPD1) |  | 0 | 0 | 0 |
| 15 Surge protection 3 phase | (SPD3) | 0 | 0 | 0 |
| 16 Modbus communications |  | - | - | TL102 required (RS485) |

O = Optional

- = Not available

Notes: ${ }^{1}$ ) PLC logic panels: TLPC2 and TLPC1 are available as options. Refer NHP. NHP PLC logic panels are ideally suited to BMS applications due to the multiple I/O of the PLC providing status to the BMS.

## SP4(6) JEMSSARt Lowood SPS - Electrical Installation OM-Manual

> TemLogic
> Basic Transfer Switches (BTS) and Manual Transfer Switches (MTS)

Options and accessories
Common loadside busbars - for connection to BOTTOM of MCCBs ${ }^{2}$ )
Tembreak 2: 250-630 A, Tembreak 1: 630-1250 A
3 pole CLSBB
Dimensions (mm)

| Busbar Amp <br> Rating | H | W | D | 3 pole set <br> Cat. No. |
| :--- | :---: | :---: | :---: | :--- |
| $250 A^{\prime}$ ) | 349 | 340 | 176 | T2CLSBB25033 |
| $\left.400 A^{\prime}\right)$ | 505 | 415 | 244 | T2CLSBB40033 |
| $\left.630 A^{\prime}\right)$ | 505 | 415 | 244 | T2CLSBB63033 |
| $630 / 800 \mathrm{~A}$ | 633 | 550 | 341 | CLSBB63033 |
| $1000 / 1250$ | 950 | 553 | 301 | CLSBB125033 |

4 pole CLSBB
Dimensions (mm)

| Busbar Amp <br> Rating | H | W | D | 4 pole set <br> Cat. No. |
| :--- | :---: | :---: | :---: | :--- |
| $250 \mathrm{~A}^{\prime}$ ) | 349 | 340 | 176 | T2CLSBB25044 |
| $\left.400 \mathrm{~A}^{\prime}\right)$ | 505 | 415 | 244 | T2CLSBB40044 |
| $630 \mathrm{~A}^{\prime}$ ) | 505 | 415 | 244 | T2CLSBB63044 |
| $630 / 800 \mathrm{~A}$ | 633 | 690 | 341 | CLSBB63044 |
| $1000 / 1250$ | 950 | 693 | 301 | CLSBB125044 |

3 \& 4 pole combination CLSBB
Dimensions (mm)

| Busbar Amp <br> Rating | $\mathbf{H}$ | W | D | 4 P and 3 P set <br> Cat. No. |
| :--- | :---: | :---: | :---: | :--- |
| $250 A^{\prime}$ ) | 349 | 340 | 176 | T2CLSBB25043 |
| $\left.400 A^{\prime}\right)$ | 505 | 415 | 244 | T2CLSBB40043 |
| $\left.630 A^{\prime}\right)$ | 505 | 415 | 244 | T2CLSBB63043 |
| $630 / 800$ A | 633 | $550 / 690$ | 341 | - |
| $1000 / 1250$ | 950 | $553 / 693$ | 301 | - |



250 A Transfer switch
Common loadside bars (for MCCB loadside only)


400-630 A Transfer switch Common loadside bars (for MCCB loadside only)

Notes: ${ }^{1}$ ) Do not fit TemBreak 1 transfer switches.
${ }^{2}$ ) Bars not designed for MCCB top mounting. Refer NHP for options.

# Automatic transfer switches 

## Interlocked and enclosed types

Cable mechanical interlocked MCCBs
TemBreak 1 types
The cable wire is supplied. Please specify length.
TemBreak 2 types


Any combination of 125-630 A can be interlocked by a cable interlock.


125 A and 250 A MCCBs shown. (S125NJ / H250NJ)


Interlocked 3 pole types MCCB to MCCB: 2000 A and 400 A

Enclosed automatic transfer switches, free-standing or wall mounted
Enclosed automatic transfer switches are assembled to order from stock components on a fast-track delivery system. The basic transfer switch section and associated logic panel are housed inside a pre-specified enclosure. A mode selector is supplied as standard and optional indicator lights may be mounted externally on the cabinet door.

## Standard features include:

- IP 65 rated enclosure
- Common loadside busbars
- Standard 240 V control (other voltage on application)
- Neutral and earth bars

Optional features:

- Busbar flags for large cable termination

- Pushbuttons or other front controls


## TemBreak <br> Accessories

to suit 125-630 AF MCCBs External accessories

## MCCB rating labels

Can be used to identify the MCCBs ratings and type when a motor or interlock is fitted to an MCCB.

Accessory label sheets - stocked


A4 sheets with multiple small catalogue number and rating labels for
TemBreak2 MCCBs

| 125 AF |  | T12CAPLAB | 3.50 |
| :---: | :---: | :---: | :---: |
| 160/250 AF |  | T25CAPLAB | 3.50 |
| 400/630 AF |  | T40CAPLAB | 3.50 |
| MCCB types | Left side Marker label Cat. No. | Rights side Marker label Cat. No. | Per label Price $\$$ |
| E125NJ | 2H4322SAB | 2H4324SAA | 7.20 |
| S125NJ | 2H4223SAB | 2H4218SAA | 7.20 |
| S125GJ | 2H4223SAB | 2H4219SAA | 7.20 |
| H125NJ | 2H4299SAA | 2H4307SAA | 7.20 |
| L125NJ | 2H4300SAA | 2H4308SAA | 7.20 |
| S160NJ | 2H4227SAB | 2H4221SAB | 7.20 |
| S160GJ | 2H4227SAB | 2H4222SAB | 7.20 |
| H160NJ | 2H4299SAA | 2H4307SAA | 7.20 |
| L160NJ | 2H4300SAA | 2H4308SAA | 7.20 |
| E250NJ | 2H4224SAB | 2H4220SAA | 7.20 |
| S250NJ | 2H4227SAB | 2H4221SAB | 7.20 |
| S250GJ | 2H4227SAB | 2H4222SAB | 7.20 |
| S250PE | 2H4277SAB | 2H6972SAA | 7.20 |
| H250NJ | 2H4299SAA | 2H4307SAA | 7.20 |
| H250NE | 2H4299SAA | 2H6973SAA | 7.20 |
| L250NJ | 2H4300SAA | 2H4308SAA | 7.20 |
| E400NJ | 2H5161SAB | 2H5162SAA | 7.20 |
| E400CJ | 2H5153SAB | 2H5331SAA | 7.20 |
| S400NJ | 2H5153SAB | 2H5154SAA | 7.20 |
| S400GJ | 2H5153SAB | 2H5155SAA | 7.20 |
| S400GE | 2H5153SAB | 2H6198SAA | 7.20 |
| E630NE | 2H5161SAB | 2H6871SAA | 7.20 |
| S630CE | 2H5153SAB | 2H6872SAA | 7.20 |
| S630GE | 2H5153SAB | 2H6873SAA | 7.20 |
| Isolator switches |  |  |  |
| S125NN | 2H4645SAB | 2H4648SAB | 7.20 |
| S160NN | 2H4650SAC | 2H4653SAB | 7.20 |
| S250NN | 2H4650SAC | 2H4653SAB | 7.20 |
| S400NN | 2H5364SAC | 2H5365SAB | 7.20 |
| S630NN | 2H5364SAC | 2H5365SAB | 7.20 |

TemBreak 1, 630 A - 1600 A and 1000 V mining MCCBs

|  | Page |
| :--- | ---: |
| Selection and location guide for MCCBs | $\mathbf{6 - 2}$ |
| 2013 stocking guide for 125 A - 400 A TemBreak 1 MCCBs | $\mathbf{6 - 3}$ |
| MCCBs and accessories | $\mathbf{6 - 5}$ |
| VS125NJ 1000 V MCCB | $\mathbf{6 - 6}$ |
| VS250NJ 1000 V MCCB | $\mathbf{6 - 7}$ |
| TL100EM 1000 V MCCB | $\mathbf{6 - 9}$ |
| XV400NE 1000 V MCCB | $\mathbf{6 - 1 3}$ |
| XS/XH630/800 | $\mathbf{6 - 2 4}$ |
| XV630/800 1000 V MCCB | $\mathbf{6 - 2 8}$ |
| XS1250SE | $\mathbf{6 - 3 0}$ |
| XV1250NE 1000 V MCCB | $\mathbf{6 - 3 1}$ |
| XS1600SE | $\mathbf{6 - 3 2}$ |
| TL630NE | $\mathbf{6 - 3 3}$ |
| TL800NE | $\mathbf{6 - 3 4}$ |
| TL1250NE |  |

## TemBreak 1 - selection and location guide

| Amps | kA | OCR Type | Base current adj. | TemBreak Cat. No. | CPB Sect. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.7-12 | 85 | Hydraulic/magnetic | Fixed | XM30РB | 3 |
| 16-125 | 14 | Thermal magnetic | Fixed | XS125CS | - |
| 16-125 | 25 | Thermal magnetic | Fixed | XS125NS | - |
| 12.5-125 | 18 | Thermal magnetic | 63-100 \% | XS125CJ | - |
| 12.5-125 | 25 | Thermal magnetic | 63-100 \% | XS125NJ | - |
| 12.5-125 | 50 | Thermal magnetic | 63-100 \% | XH125NJ | - |
| 12.5-125 | 50 | Thermal magnetic | 63-100 \% | XH125PJ | - |
| 100-250 | 25 | Thermal magnetic | 63-100 \% | XS250NJ | - |
| 100-250 | 50 | Thermal magnetic | 63-100 \% | XH250NJ | - |
| 160-250 | 65 | Thermal magnetic | 63-100 \% | XH250PJ | - |
| 160-400 | 35 | Thermal magnetic | 63-100 \% | XS400CJ | - |
| 160-400 | 50 | Thermal magnetic | 63-100 \% | XS400NJ | - |
| 250-400 | 65 | Thermal magnetic | 63-100 \% | XH400PJ | - |
| 80-400 | 50 | Electronic | 50-100 \% | XS400SE | - |
| 80-400 | 65 | Electronic | 50-100 \% | XH400SE | - |
| 125-400 | 65 | Electronic | 50-100\% | XH400PE | - |
| 250-630 | 42 | Thermal magnetic | 63-100 \% | XS630CJ | - |
| 250-630 | 50 | Thermal magnetic | 63-100 \% | XS630NJ | 6 |
| 250-630 | 85 | Thermal magnetic | 63-100 \% | XH630PJ | 6 |
| 315-630 | 50 | Electronic | 50-100 \% | XS630SE | 6 |
| 315-630 | 65 | Electronic | 50-100\% | XH630SE | 6 |
| 315-630 | 65 | Electronic | 50-100\% | XH630PE | 6 |
| 500-800 | 50 | Thermal magnetic | 63-100 \% | XS800NJ | 6 |
| 500-800 | 85 | Thermal magnetic | 63-100 \% | XH800PJ | 6 |
| 400-800 | 50 | Electronic | 50-100\% | XS800SE | 6 |
| 400-800 | 65 | Electronic | 50-100\% | XH800SE | 6 |
| 400-800 | 65 | Electronic | 50-100 \% | XH800PE | 6 |
| 500-1250 | 85 | Electronic | 50-100 \% | XS1250SE | 6 |
| 800-1600 | 100 | Electronic | 50-100\% | XS1600SE | 6 |
| 1000-2000 | 85 | Electronic | 50-100 \% | XS2000NE | 3 |
| 1250-2500 | 85 | Electronic | 50-100\% | XS2500NE | 3 |
| 12.5-100 | 85 | Thermal magnetic | 63-100 \% | TL100NJ | - |
| 100-250 | 85 | Thermal magnetic | 63-100 \% | TL250NJ | - |
| 200-400 | 85 | Electronic | 50-100\% | TL400NE | - |
| 315-630 | 125 | Electronic | 50-100 \% | TL630NE | 6 |
| 400-800 | 125 | Electronic | 50-100\% | TL800NE | 6 |
| 500-1250 | 125 | Electronic | 50-100\% | TL1250NE | 6 |
| 630-2500 | 20-40 | Magnetic | 63-100 \% | XS-ND | 3 |
| 15-100 | 10 | Thermal magnetic | Fixed | TL100EM | 6 |
| 80-400 | 12.5 | Electronic | 50-100 \% | XV400NE | 6 |
| 200-630 | 18 | Electronic | 50-100 \% | XV630PE | 6 |
| 400-800 | 18 | Electronic | 50-100\% | XV800PE | 6 |
| 200-1250 | 20 | Electronic | 50-100\% | XV1250NE | 6 |

Notes: TemBreak 1 and 2 cross reference chart, refer section 3.

# 2013 stocking guide: 

## 125 A - 400 A TemBreak 1 MCCBs

This table can be used as a guide for situations where an older TemBreak 1 MCCB must be used. TemBreak 1 consists of the 'TemBreak' and 'TemBreak PLUS' series of MCCBs.

The breakers marked 'stocked' can be used to replace those others which are not stocked. The stocked types will typically have a higher kA rating. ${ }^{2}$ )

MCCBs contained in CPB section 6:
Standard MCCBs

| Amps | kA rating | OCR type | Base current adjustment | TB1 type stocked in 2012 | MCCB type Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 12.5 | 85 | Therm Mag | Fixed | stocked | XM30PB |
| 16-125 | 14 | Therm Mag | Fixed | use XS125NS | XS125CS |
| 16-125 | 25 | Therm Mag | Fixed | stocked | XS125NS |
| 12.5-125 | 18 | Therm Mag | 63-100\% | use XH125NJ | XS125CJ |
| 12.5-125 | 25 | Therm Mag | 63-100\% | use XH125NJ | XS125NJ |
| 12.5-125 | 50 | Therm Mag | 63-100 \% | stocked | XH125NJ |
| 12.5-125 | 50 | Therm Mag | 63-100\% | use XH125NJ ${ }^{2}$ ) | XH125PJ |
| 125-225 | 18 | Therm Mag | Fixed | use E250NJ ${ }^{\text {2 }}$ ) | XE225NC |
| 100-160 | 50 | Therm Mag | 63-100\% | use $\mathrm{XH} 250 \mathrm{NJ} / 160^{2}$ ) | XH160PJ |
| 100-250 | 25 | Therm Mag | 63-100\% | stocked | XS250NJ |
| 100-250 | 50 | Therm Mag | 63-100\% | stocked | XH250NJ |
| 100-250 | 65 | Therm Mag | 63-100\% | use S400GJ/250 ${ }^{\text {1 }}$ ) | XH250PJ |
| 160-400 | 35 | Therm Mag | 63-100 \% | use XS400NJ | XS400CJ |
| 160-400 | 50 | Therm Mag | 63-100 \% | stocked | XS400NJ |
| 160-400 | 65 | Therm Mag | 63-100\% | use XH400SE ${ }^{\text {) }}$ | XH400PJ |
| 125-400 | 50 | Electronic | 50-100\% | use XH400SE | XS400SE |
| 125-400 | 65 | Electronic | 50-100\% | stocked | XH400SE |
| 125-400 | 65 | Electronic | 50-100 \% | use XH400SE ${ }^{\text {) }}$ | XH400PE |
| 250-630 | 42 | Therm Mag | 63-100 \% | use XS630NJ | XS630CJ |
| 250-630 | 50 | Therm Mag | 63-100\% | stocked | XS630NJ |
| 250-630 | 85 | Therm Mag | 63-100\% | stocked | XH630PJ |
| 315-630 | 50 | Electronic | 50-100\% | stocked | XS630SE |
| 315-630 | 65 | Electronic | 50-100\% | stocked | XH630SE |
| 315-630 | 65 | Electronic | 50-100\% | stocked | XH630PE |
| 12.5-100 | 85 | Therm Mag | 50-100\% | use H125NJ | TL100NJ |
| 160-250 | 85 | Therm Mag | 50-100 \% | use $\mathrm{H} 250 \mathrm{NJ}{ }^{1}$ ) | TL250NJ |
| 200-400 | 85 | Electronic | 50-100\% | use S400PE | TL400NE |

Notes: ${ }^{1}$ ) TemBreak 2 MCCB. This is an electrical equivalent, though check the application as the physical size of the TemBreak 2 equivalent will be different.
${ }^{2}$ ) Ics ratings are lower on SE / NJ types compared to PE / PJ types.
TemBreak 1 and 2 cross reference chart refer section 3.

## 2012 stocking guide: <br> 125 A - 400 A TemBreak 1 MCCBs

Mining MCCBs

| Amps | kA rating | OCR type | Base current <br> adjustment | TB1 type stocked <br> in 2012 | MCCB type <br> Cat. No. |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{1 5 - 1 0 0}$ | 10 | Therm MagFixed | stocked | TL100EM |  |
| $80-400$ | 12.5 | Therm MagFixed | stocked | XV400NE |  |
| $200-630$ | 18 | Electronic | $50-100 \%$ | stocked | XV630PE |
| $400-800$ | 18 | Electronic | $50-100 \%$ | stocked | XV800PE |
| $200-1250$ | 20 | Electronic | $50-100 \%$ | stocked | XV1250NE |

Non auto / switch disconnectors

| Amps | kA rating | OCR type | Base current <br> adjustment | TB1 type stocked <br> in 2012 | MCCB type <br> Cat. No. |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 125 | - | Non Auto | Fixed | use S125NN ${ }^{\mathbf{1}}$ ) | XS125NN |
| 250 | - | Non Auto | Fixed | stocked | XS250NN |
| 400 | - | Non Auto | Fixed | use S400NN ${ }^{\mathbf{1}}$ ) | XS400NN |
| 630 | - | Non Auto | Fixed | use S630NN ${ }^{\mathbf{1}}$ ) | XS630NN |

[^38]
# 1000V AC Mining MCCBs 

VS125NJ

6 kA
Current rating: 12.5-125 A
Approvals and tests: Standards AS/NZS 3947-2, and IEC60947-2

Interrupting capacity:

|  | Voltage IcukA Ics kA |  |  | Types |
| :---: | :---: | :---: | :---: | :---: |
| AC | 1100 | 4 | 4 | $20 \mathrm{~A}, 32 \mathrm{~A}$ |
| use | 1100 | 6 | 4 | $50 \mathrm{~A}, 63 \mathrm{~A}, 100 \mathrm{~A}, 125 \mathrm{~A}$ |



Trip unit:
Adjustable thermal: $63 \%$ Ir to $100 \%$ Ir
Adjustable magnetic: $6 x \operatorname{lm}$ to $12 x \operatorname{lm}$ for $20-100$ A trip unit types $6 x \operatorname{lm}$ to $10 \mathrm{x} \operatorname{Im}$ for 125 A trip unit types

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 155 |
| W | 90 |
| D (less toggle) | 68 |


| Amp rating NRC | Min. | Adj. Ir | Adj. $\mathrm{Im}_{\text {m }}$ |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 20 | 12.5 | 20 | 120 | 240 | VS125NJ320 | 1250.00 |
| 32 | 20 | 32 | 192 | 384 | VS125NJ332 | 1250.00 |
| 50 | 32 | 50 | 300 | 600 | VS125NJ350 | 1250.00 |
| 63 | 40 | 63 | 378 | 756 | VS125NJ363 | 1250.00 |
| 100 | 63 | 100 | 600 | 1200 | VS125NJ3100 | 1250.00 |
| 125 | 80 | 125 | 750 | 1250 | VS125NJ3125 | 1450.00 |

Notes: The rear insulation barrier, terminal covers, and terminal screw caps supplied with the MCCB, must be used for MCCB installation.
For internal and external accessory selection refer TemBreak 2 standard 125/250 AF accessories, section 3.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
Replaces: TL100EM. Check exact ratings and dimensions to suit your application requirement.

# 1000V AC Mining MCCBs 

VS250NJ

6 kA
Current rating: 100-250A
Approvals and tests: Standards AS/NZS 3947-2, and IEC60947-2

Interrupting capacity:

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | 1100 | 6 | 4 |



Trip unit:
Adjustable thermal: $63 \% \mathrm{Ir}$ to $100 \% \mathrm{Ir}$
Adjustable magnetic: $6 \mathrm{x} \mathrm{Im}_{\mathrm{m}}$ to $13 \mathrm{x} \operatorname{lm}$ for 160 A trip unit types $6 \mathrm{x} \operatorname{Im}$ to $10 \mathrm{x} \operatorname{Im}$ for 250 A trip unit types

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 165 |
| W | 105 |
| D (less toggle) | 68 |


| Amp rating | Adj. Ir |  | Adj. Im |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | ---: |
| NRC | Min. | Max. | Min. | Max | Cat. No. | Price $\boldsymbol{\$}$ |
| 160 | 100 | 160 | 960 | 2080 | VS250NJ3160 | $\mathbf{1 7 5 0 . 0 0}$ |
| 250 | 160 | 250 | 1500 | 2500 | VS250NJ3250 | $\mathbf{1 8 5 0 . 0 0}$ |

Notes: The rear insulation barrier, terminal covers, and terminal screw caps supplied with the MCCB, must be used for MCCB installation.
For internal and external accessory selection refer TemBreak 2 standard 125/250 AF Accessories, section 3.
NRC: Nominal rated current
Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting

# TemBreak 1000 V mining circuit breakers TL100EM 

50 kA
Current rating: 15-100 A
Approvals and tests: Complies with AS 2184 /
AS/NZS 3947-2
Complies with IEC 60947-2
Interrupting capacity: 10 kA at $900 \mathrm{~V} \mathrm{AC} \mathrm{(sym)}$

$$
\left.6.5 \mathrm{kA} \text { at } 1100 \mathrm{~V} \text { AC (sym) }{ }^{\prime}\right)
$$

Trip unit: Fixed
Thermal setting: Fixed $40^{\circ} \mathrm{C}$ industrial $45^{\circ} \mathrm{C}$ and $50^{\circ} \mathrm{C}$ marine

Magnetic setting: Fixed


Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 165 |
| $W$ | 105 |
| D (less toggle) | 125 |
| Weight $(\mathrm{kg})$ | 3.2 |


| Ampere rating | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 15 | TL100EM 15 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 20 | TL100EM 20 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 30 | TL100EM 30 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 40 | TL100EM 40 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 50 | TL100EM 50 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 60 | TL100EM 60 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 75 | TL100EM 75 3K | $\mathbf{2 3 3 0 . 0 0}$ |
| 100 | TL100EM 100 3K | $\mathbf{2 3 3 0 . 0 0}$ |



Notes: ${ }^{\text {² }}$ ) Ratings based upon IEC 60947-2.
TL100EM must use line-side terminal cover supplied with MCCB.

## Accessories

## to suit TL100EM / F

Internal accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Shunt trips | 110 V AC sht (100-115 V) | 7VF 2M1 | 280.00 |
|  | 240 V AC sht (200-480 V) | 7VF 2M2-B | 280.00 |
|  | 48 V DC sht | 7VF 2M6 | 280.00 |
|  | 24 VDC sht | 7VF 2M7 | 280.00 |
| Undervoltage trips | 440 V AC | 7UF 2D5B | 360.00 |
|  | 110 V AC | 7UF 2D6B | 360.00 |
|  | 240 V AC | 7UF 2D7B | 360.00 |
|  | 110 V DC | 7UF 2FD1 | 360.00 |
|  | 24 V DC | 7UF 2FD2 | 360.00 |
| Auxiliary switches | AUX SW right hand 1C | 7XA 2D31B | 245.00 |
|  | AUX SW left hand 1C | 7XA 2D41B | 245.00 |
| Alarm switches | ALT SW right hand | 7AB 2D11B | 245.00 |

External accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Screw tunnel lugs | 3 P solderless term. (6) | 7T 2M1 | 110.00 |
| Rear connect studs | 3 P RC studs (6) | 7RC 2LE | 210.00 |
| Motor operators | 110 V AC motor | 7MB 3BA1 | 1910.00 |
| Handle operators | Door interlocking handle kit | TFH 22D | 335.00 |
|  | IP 55 handle kit (plastic) | TL100EMR5GM | 390.00 |
|  | IP 65 handle kit (plastic) | TL100EMR6BN ${ }^{1}$ ) | 280.00 |
|  | IP 65 handle kit (metal) | YASD22D | 445.00 |
|  | IP 55 direct mounting handle kit | TFJ 22LU | 355.00 |
| Toggle locks | Toggle lock | 7KB 3BA | 60.00 |
|  | Lock plate | UXKE0030A | 2.20 |
| Accessory lead terminal | Accessory lead terminal, black | 7YD3 | 55.00 |

Notes: ') 'HS' handle option Cat. No. TL100EMR5GM (IP 55).

## TemBreak 1000 V mining circuit breakers Electronic XV400NE

## 12.5 kA

Current rating: 80-400 A
Approvals and tests: Standards AS/NZS 3947-2
Complies with IEC 60947-2
Interrupting capacity: 12.5 kA at $1000 / 1100 \mathrm{~V} \mathrm{AC}$, (IEC 60947-2)
Trip unit:

| Trip unit: | Fixed |  |
| :--- | :--- | :--- |
| LTD adjustment: | $I_{1}: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $I_{2}: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| INST adjustment: | $I_{3}: 3-12$ |  |
| Instantaneous Adj: | $I_{p}: 0.7-1$ | t: fixed at 40 s (sep control <br> power req.) |

Dimensions (mm)


| Poles | $\mathbf{3}$ |
| :--- | :--- |
| H | 260 |
| W | 140 |
| D (Less toggle) | 103 |
| Weight $(\mathrm{kg})$ | 5.0 |


| Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 160 | 80 | 160 | XV400NE $1603 \mathrm{~K}^{2}$ ) | 3860.00 |
| 250 | 125 | 250 | XV400NE $2503 \mathrm{~K}^{2}$ ) | 3860.00 |
| 400 | 200 | 400 | XV400NE 400 3K ${ }^{\text {² }}$ | 4080.00 |
|  |  | XV400 MINING BREAKERS MUST USE LINE-SIDE TERMINAL COVERS, TERMINAL BOLT COVERS and REAR INSULATION PLATES. <br> All items supplied with breaker $\left.{ }^{1}\right)^{3}$ ) |  |  |

Notes: 1) Applicable for front connect MCCBs. Contact NHP for rear connect details.
${ }^{2}$ ) For FAULT INDICATION option add 'FI' and nominate control voltage.
${ }^{3}$ ) Installation and incoming connection information is supplied with each MCCB or can be requested from NHP.
NRC: Nominal rated current
ASR: Adjustable setting range
Overcurrent trip combinations: (specify combinations req.)
LSI - standard,
LS - optional,
LSIP - optional (pre-trip alarm).
Special current ratings available on indent, refer NHP.

## Accessories

to suit 400 AF

| Internal accessories |  |  |  |
| :---: | :---: | :---: | :---: |
| Shunt trips | $110 \mathrm{~V} \mathrm{AC/DC} \mathrm{(100-115} \mathrm{V)}$ | 2H1305BAA | 405.00 |
|  | 240 V AC ( $200-480 \mathrm{~V}$ ) | 2H1306BAA | 405.00 |
|  | 12 VDC | 2H1307BAA | 405.00 |
|  | 24 V DC | 2H1308BAA | 405.00 |
|  | 48 VDC | 2H1309BAA | 405.00 |
|  | 24 V AC | 2H1311BAA | 405.00 |
| Undervoltage trips | AC coil ${ }^{1}$ ) | 2H1492BAA | 315.00 |
|  | 100-230 V DC coil ${ }^{2}$ ) | 2H1493BAA | 315.00 |
|  | $\underline{24 ~ V ~ D C ~ c o i l ~}{ }^{2}$ ) | 2H1494BAA | 315.00 |
|  | 48 VDC coil $^{2}$ ) | 2H1495BAA | 315.00 |
|  | $60 \mathrm{~V} \mathrm{DC} \mathrm{coil}{ }^{2}$ ) | 2H1496BAA | 315.00 |
|  | 110 V AC instantaneous controller | UXUB0013B | 113.00 |
|  | 240 V AC instantaneous controller | UXUB0014B | 113.00 |
|  | 440 V AC instantaneous controller | UXUB0015B | 113.00 |
|  | 110 V AC time delay controller | UXUB0016B | 220.00 |
|  | 240 V AC time delay controller | UXUB0017B | 220.00 |
|  | 440 V AC time delay controller | UXUB0018B | 215.00 |
|  | 200-230 V DC controller | UXUB0038B | 113.00 |
| Auxiliary switches | AUX SW right hand 1C | UXXB0004D | 169.00 |
|  | AUX SW right hand 2C | UXXB0005D | 220.00 |
|  | AUX SW right hand 3 C | UXXB0006D | 255.00 |
| Alarm switch | ALT SW right hand | UXLB0009D | 178.00 |
|  | ALT/AUX SW right hand 1C | UXLB0013D | 189.00 |
| Alarm \& auxiliary switch | ALT/AUX SW right hand 2 C Add then voltage | UXLB0014D | 220.00 |
| Pre-trip alarm | For electronic OCR MCCBs only | Pre-trip alarm | 770.00 |
| Fault indication \& contacts | Side of breaker mounted module. Electronic MCCBs only | FI | 900.00 |
| Fault indication | LEDs mounted at top of OCR (electronic breakers only) | FILED | 2050.00 |

Notes: Footnotes, refer to page 6-12.

## Accessories

to suit 400 AF

External accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Attached busbars | 3 P attached busbars (6 in kit) | 2H1384DAA | 225.00 |
|  | 4 P attached busbars (8 in kit) | 2H1385DAA | 305.00 |
| Screw tunnel terminals | 3 P solderless terminals (6 in kit) | 2H2012DAB | 430.00 |
|  | 4 P solderless terminals (8 in kit) | 2H2012DBB | 540.00 |
| Rear connect studs | 3 P RC studs (6 in kit) | UXRC0006C | 810.00 |
|  | 4 P RC studs (8 in kit) | UXRC0007C | 1090.00 |
| Motor operators (XMC4) | 110 V AC motor ${ }^{11}$ ) | UXMC0001B | 2780.00 |
|  | 110 V DC motor ${ }^{11}$ ) | UXMC0003B | 2780.00 |
|  | 24 V DC motor ${ }^{11}$ ) | UXMC0004B | 2780.00 |
|  | 240 V AC motor ${ }^{11}$ ) | UXMC0005B | 2780.00 |
|  | Motor base support ${ }^{11}$ ) | UXMD0001B | 47.00 |
| Mechanical interlocks | 3 P mechanical interlock ${ }^{3}$ ) | UXKC0001B | 560.00 |
|  | 3/4 P mechanical interlock ${ }^{4}$ ) | UXKC0002B | 560.00 |
|  | 4 P mechanical interlock ${ }^{5}$ ) | UXKC0003B | 840.00 |
| Cable mechanical interlocks | Interlock cable (wire) | UXKC0020A | 83.00 |
|  | Cable interlock mechanism ${ }^{6}$ ) | UXKC0021B | 220.00 |
| Handle operators | IP 55 grey vari-depth handle + 320 mm shaft | T1HS40R5GM | 415.00 |
|  | T1HS escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 390 mm T pin shaft for T1HS no flexi coupling | T2HS400SHAFT | 47.00 |
|  | IP 65 grey vari-depth handle + shaft | T1HP40R6BNA4 | 355.00 |
|  | IP 65 vari-depth metal handle + shaft | YASD34 | 700.00 |
|  | Padlock attachment for T2HP/ HS mechanism | T1HP40PALK | 44.50 |
|  | IP 55 direct mount fixed depth handle ${ }^{7}$ ) | TFJ34XU | 415.00 |
|  | T1HS handle shaft cam for Prosafe and Fortress locks | 14997702 | 235.00 |
| Toggle locks | Toggle lock - non captive (Padlockable) | 2H1956BAA | 47.00 |
|  | Toggle -lock - captive (Padlockable) | XKA4 | 47.00 |
|  | Resin for XKA4 | LOCTITE 480 | 83.00 |

Notes: Footnotes, refer to page 6-12.

## Accessories

to suit 400 AF

External accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Terminal covers | 3 P front connecting terminal cover - busbar connect type | 2H1413DAB | 190.00 |
|  | 4 P front connecting terminal cover - busbar connect type | 2H1414DAB | 245.00 |
|  | $3 P$ front connecting terminal cover-cable connect type | 2H1415DAB | 190.00 |
|  | 4 P front connecting terminal cover - cable connect type | 2H1416DAB | 245.00 |
|  | IP 20 protective cover - busbar connect type ${ }^{8}$ ) | 2A1787DBA | 6.20 |
|  | IP 20 protective cover - cable connect type ${ }^{8}$ ) | 2A1788DAA | 6.20 |
|  | 3 P rear connecting terminal cover | UXPD0011B | 190.00 |
|  | 4 P rear connecting terminal cover | UXPD0012A | 245.00 |
| Accessory lead terminal | Accessory lead terminal | UXYD0001A | 26.80 |
|  | Terminal and bolt ${ }^{9}$ ) | UXYD0002A | 2.20 |
| TemPlugs ${ }^{13}$ ) | 3 P TemPlug $400 \mathrm{~A}^{12}$ ) | UPX3440 | 355.00 |
| Interpole barrier | Interpole barrier ${ }^{10}$ ) | UXQH0004B | 10.40 |
| OCR sealing kit | Tamperproof cover for OCR adjustment dials | XS4000CRSK | 54.00 |

Notes: ${ }^{1)}$ An AC UVT controller is required for $100-440 \mathrm{VAC}$.
$\left.{ }^{2}\right)$ A DC UVT controller is needed for 200-230 V DC operation. None required for 24-110 V DC.
${ }^{3}$ ) For 3 P circuit breakers without motors.
${ }^{4}$ ) For 4 P circuit breakers without motors or 3 P circuit breakers with motors.
${ }^{5}$ ) For 4 P circuit breakers with motors.
${ }^{6}$ ) Order one interlock mechanism for each circuit breaker.
${ }^{7}$ ) Flush plate included.
${ }^{8}$ ) 6 pieces required for $3 P / 8$ pieces required for $4 P$.
${ }^{9}$ ) Specify quantity required (up to 6 pieces).
${ }^{10}$ ) Order individually.
${ }^{11}$ ) Order a motor base support for each motor : UXMD0001B.
${ }^{12}$ ) Price Schedule T3 applies to TemPlug.
${ }^{13}$ ) Not to be used with 1000 V mining MCCB type XV400.

## MCCB isolating switch

## Non-auto MCCB, XS800NN

- Accepts MCCB accessories
- Standards AS/NZS 3947-2 and IEC 60947-2
- Motor or motorised circuit isolation - no overcurrent protection
- Will accept auxiliaries, UVTs \& shunt trips ${ }^{2}$ )

Ordering details

| Ampere <br> rating | Short time <br> rating (kA) | 3 pole <br> Cat. No. $\left.{ }^{1}\right)$ | Price \$ |
| :--- | :--- | :--- | ---: |
| $630 / 800$ | 10 kA for 0.3 sec | XS800NN3 | $\mathbf{3 4 5 0 . 0 0}$ |

Dimensions (mm)

| Ampere | Height |  | Width | Depth | Weight (kg) <br> rating |  |
| :--- | :--- | :--- | ---: | :--- | :--- | :--- |
| ${ }^{\mathbf{3}}$ ) |  |  |  |  |  |  |



Notes: ${ }^{1}$ ) Additional technical details, refer to Part C.
${ }^{2}$ ) UVTs \& shunts are operated by the MCCBs trip lever which is fitted in non-auto MCCBs.
${ }^{3}$ ) Height excludes attached busbar.

# TemBreak 1 series <br> Current limiting thermal magnetic type XS630NJ 

## 50 kA

Current rating: $250-630 \mathrm{~A}$
Approvals and Tests: Standards: AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics $\mathbf{k A}$ |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 50 | 25 |
| DC use | 250 | 40 | - |



Trip unit: Adjustable thermal adjustable magnetic
OCR options: Special calibrated or disabled thermal trip
Dimensions (mm)

| Poles | 3 |
| :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 |
| $W$ | 210 |
| D (less toggle) | 103 |
| Weight $(\mathrm{kg})$ | 9.6 |
| 4 pole |  |

3 Pole
Amp

| rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 400 | 250 | 400 | XS630NJ 400 3 | $\mathbf{2 9 9 0 . 0 0}$ |
| 630 | 400 | 630 | XS630NJ 630 3 | $\mathbf{2 9 9 0 . 0 0}$ |

Notes: ${ }^{1)} \mathrm{H}$ excludes attached busbar. Magnetic only available on application. NRC: Nominal rated current. ASR: Adjustable setting range. Specify for DC rating.

## TemBreak PLUS PowerBreaker Ics = 50 kA

## Thermal magnetic type <br> XH630PJ

## 85 kA

Current rating: 250-630 A
Approvals and Tests: Standards: AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage |  | Icu $\mathbf{k A}$ |
| :--- | :--- | :--- | :--- |
| Ics $\mathbf{k A}$ |  |  |  |
| AC use | 400 | 100 | 50 |
|  | 415 | 85 | 50 |
| DC use | 250 | 40 | - |



Trip unit: Adjustable thermal adjustable magnetic OCR options: Special calibrated or disabled thermal trip

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 |
| W | 210 |
| D (less toggle) | 103 |
| Weight $(\mathrm{kg})$ | 9.6 |
| 4 pole on indent |  |

3 Pole
Amp

| rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 400 | 250 | 400 | XH630PJ 400 3 | $\mathbf{4 3 5 0 . 0 0}$ |
| 630 | 400 | 630 | XH630PJ 630 3 | $\mathbf{4 8 1 0 . 0 0}$ |

Notes: ${ }^{1}$ ) H excludes attached busbar Magnetic only available on application. NRC: Nominal rated current. ASR: Adjustable setting range.

## TemBreak PLUS selectivity series

## Electronic type XS630SE

## 50 kA

Current rating: 315-630 A
Approvals and Tests: Standards: AS/NZS 3947-2 and
IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 50 | 25 |



Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip.

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $1: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}^{2}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.6 | 12.2 |


| 3 Pole <br> Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 630 | 315 | 630 | XS630SE 6303 | 3100.00 |
| 4 Pole <br> Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole Price \$ |
| 630 | 315 | 630 | XS630SE 6304 | 4130.00 |

## Ground Fault Trip MCCB ${ }^{2}$ )

3 Pole

| Amp rating |  |  |  | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| NRC | ASR Min. | ASR Max. | Cat. No. |  |
| 630 | 315 | 630 | XS630SE 6303LSIG | $\mathbf{3 9 6 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| Amp rating |  |  |  | 4 pole <br> Price \$ |
| NRC | ASR Min. | ASR Max. | Cat. No. | $\mathbf{6 2 8 0 . 0 0}$ |
| 630 | 315 | 630 | XS630SE 6304LSIG |  |

Notes: ${ }^{1)} \mathrm{H}$ excludes attached busbar.
${ }^{2}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutral is present) Refer accessories. NRC: Nominal rated current. ASR: Adjustable setting range.

## TemBreak PLUS selectivity series

## Electronic type <br> XH630SE

## 65 kA

Current rating: 315-630 A
Approvals and Tests: Standards: AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 65 | 33 |



Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip.

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $11: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | I. $2: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.6 | 12.2 |


| 3 Pole <br> Amp rating <br> NRC |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| 630 | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price \$ |
| 4 Pole | 315 | 630 | XH630SE 630 3 | $\mathbf{3 2 6 0 . 0 0}$ |
| Amp rating |  |  |  |  |
| NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole <br> Price $\$$ |
| 630 | 315 | 630 | XH630SE 6304 | 4350.00 |

Ground Fault Trip MCCB ${ }^{2}$ )
3 Pole

| Amp rating |  |  |  | 3 pole <br> Price $\mathbf{\$}$ |  |
| :--- | :--- | :--- | :--- | ---: | ---: |
| NRC | ASR Min. | ASR Max. | Cat. No. | CH630SE6303LSIG | $\mathbf{4 1 1 0 . 0 0}$ |
| 630 | 315 | 630 | X |  |  |


| 4 Pole |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| Amp rating |  |  |  |  |
| NRC |  |  |  |  |
| 630 | ASR Min. | ASR Max. | Cat. No. | 4 pole <br> Price $\$$ |

[^39]
## THERMAL/MAGNETIC CIRCUIT BREAKERS

Terasaki thermal/magnetic circuit breakers offer superior protection when harmonics exist in a network.


Terasaki thermal/magnetic circuit breakers:

- Respond directly to the heat produced by the true RMS value of the load current
- Ensure protection irrespective of the harmonic distortion any future loads may cause
- Protect up to the infinite harmonic
- Are suitable for DC applications


# TemBreak 1 series <br> Current limiting thermal magnetic type <br> XS800NJ 

50 kA
Current rating: 500-800 A
Approvals and Tests: Standards: AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $\left.400 / 415^{1}\right)$ | 50 | 25 |
| DC use | 250 | 40 |  |



Trip unit: Adjustable thermal adjustable magnetic OCR options: Special calibrated or disabled thermal trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.7 | 12.2 |


| 3 Pole <br> Amp <br> rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 800 | 500 | 800 | XS800NJ 8003 | 3850.00 |
| 4 Pole |  |  |  |  |
| Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole Price \$ |
| 800 | 500 | 800 | XS800NJ 8004 | 5130.00 |

[^40]
## TemBreak PLUS PowerBreaker Ics = 50 kA

Thermal magnetic type XH800PJ

## 85 kA

Current rating: 500-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2
Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | 400 | 100 | 50 |
|  | 415 | 85 | 50 |
| DC use | 250 | 40 | - |

Trip unit: Adjustable thermal adjustable magnetic OCR options: Special calibrated or disabled thermal trip

Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.7 | 12.2 |

3 Pole
Amp

| rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: | ---: |
| 800 | 500 | 800 | XH800PJ 800 3P | $\mathbf{4 8 1 0 . 0 0}$ |

4 Pole
Amp

| rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 800 | 500 | 800 | XH800PJ 800 4P | $\mathbf{6 7 5 0 . 0 0}$ |

Notes: ${ }^{1}$ ) H excludes attached busbar. Magnetic only available on application. NRC: Nominal rated current. ASR: Adjustable setting range.

## TemBreak PLUS selectivity series

## Electronic type XS800SE

## 50 kA

Current rating: 400-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)


|  | Voltage | Icu kA | Ics $\mathbf{k A}$ |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 50 | 25 |

Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip.
Trip unit: Fixed.

| LTD adjustment: | $I_{1}: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| :--- | :--- | :--- |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}^{2}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.7 | 12.2 |

3 Pole
Amp rating

NRC ASR Min. $\quad$ ASR Max. $\quad$ Cat. No. | 3 pole |
| ---: |
| Price \$ |

## Ground Fault Trip MCCB ${ }^{2}$ )

3 Pole

| Amp rating |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
|  | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price $\$$ |
| NRC | 400 | 800 | XS800SE8003LSIG | 4990.00 |
| 800 |  |  |  |  |
| 4 Pole |  |  |  | 4 pole <br> Amp rating |
|  |  | ASR Min. | ASR Max. | Cat. No. |

Notes: 1) H excludes attached busbar.
${ }^{2}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCBs. (If a neutral is present) Refer accessories.
NRC: Nominal rated current.
ASR: Adjustable setting range.

## TemBreak PLUS selectivity series

## Electronic type XH800SE

65 kA
Current rating: 400-800 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 65 | 33 |



## Trip unit:

Electronic trip unit: Adjustable long, short and instantaneous trip.

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $1: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| Weight $(\mathrm{kg})$ | 9.7 | 12.2 |

3 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 800 | 400 | 800 | XH800SE 800 3 | $\mathbf{4 3 6 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| Amp rating |  |  |  | 4 pole |
| NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| 800 | 400 | 800 | XH800SE 800 4 | $\mathbf{6 7 5 0 . 0 0}$ |

Ground Fault Trip MCCB ${ }^{2}$ )
3 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 800 | 400 | 800 | XH800SE8003LSIG | $\mathbf{5 0 8 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| Amp rating |  |  |  | 4 pole |
| NRC | ASR Min. | ASR Max. | Cat. No. | Price $\mathbf{\$}$ |
| 800 | 400 | 800 | XH800SE8004LSIG | $\mathbf{7 4 8 0 . 0 0}$ |

Notes: ${ }^{1)}$ H excludes attached busbar.
${ }^{2}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutral is present) Refer accessories.
NRC: Nominal rated current.
ASR: Adjustable setting range.

## TemBreak PLUS PowerBreaker Ics = 50 kA

## Electronic type XH800PE

## 65 kA

Current rating: $400-800 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)


Q

|  | Voltage | Icu $k A$ | Ics $\mathbf{k A}$ |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 65 | 50 |
| DC use | 250 V | 40 | - |

## Trip unit:

Electronic trip unit: Adjustable long, short and instantaneous trip.

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $1: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 273 | 273 |
| W | 210 | 280 |
| D (less toggle) | 103 | 103 |
| kg | 9.7 | 12.2 |


| 3 Pole <br> Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 800 | 400 | 800 | XH800PE 800 3 | $\mathbf{4 7 0 0 . 0 0}$ |
| 4 Pole |  |  |  |  |
| Amp rating <br> NRC |  |  |  |  |
| 800 | ASR Min. | ASR Max. | Cat. No. | Price \$ |

[^41]
## TemBreak 1000 V mining circuit breakers Electronic XV630PE, XV800PE

18 kA
Current rating: 200-800 A
Approvals and tests: Standards AS 2184, AS/NZS 3947-2
Complies with IEC 60947-2
Interrupting capacity: 18 kA at $1000 \mathrm{~V} \mathrm{AC}^{1}$ ) (IEC 60947-2) 12.5 kA at $1100 \mathrm{~V} \mathrm{AC}^{2}$ )

Trip unit:
Trip unit:
Fixed

| LTD adjustment: | $\mathrm{I}_{1}: 0.8-1$ | $\mathrm{t}: 5-30 \mathrm{~s}$ |
| :--- | :--- | :--- |
| STD adjustment: | $\mathrm{I}_{2}: 2-10$ | $\mathrm{t}: 0.1-0.3$ |
| INST adjustment: | $\mathrm{I}_{3}: 3-12$ |  |
| PTA adjustment: | $\mathrm{I}_{p}: 0.7-1$ | t: fixed at 40 s (sep. control <br> power req.) |
| or GFT adjustment: | $\mathrm{I}_{6}: 0.1-0.4$ | $\mathrm{t}: 0.1,02,0.3,0.4$ or 0.8 s |

Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $\left.\mathrm{H}^{3}\right)$ | 273 |
| $W$ | 210 |
| $D$ (Less toggle) | 103 |
| Weight (kg) | 11.00 |


| Amp <br> rating <br> NRC | ASR Min. | ASR Max. |  |  |
| :--- | :--- | :--- | :--- | ---: |
| 400 | 200 | 400 | Cat. No. | Price \$ |
| 630 | 315 | 630 | XV630PE 400 3K ${ }^{\text {4 }}$ ) | $\mathbf{4 2 7 0 . 0 0}$ |
| 800 | 400 | 800 | XV630PE 630 3K ${ }^{\text {4 }}$ ) | $\mathbf{5 4 4 0 . 0 0}$ |

XV630/800 MINING BREAKERS MUST USE
either line-side terminal covers
OR
interpole barriers, and a rear
insulation plate
(All supplied with breaker) ${ }^{5}$ )
Notes: ${ }^{1)}$ Actual test voltage 1105 V .
${ }^{2}$ ) Actual test voltage 1165 V .
${ }^{3}$ ) H excludes attached busbar.
${ }^{4}$ ) For FAULT INDICATION option add 'FI' and nominate control voltage.
${ }^{5}$ ) Installation and incoming connection information can be found with each new MCCB, or by contacting NHP.
NRC: Nominal rated current.
ASR: Adjustable setting range.
Overcurrent trip combinations: (specify combinations req.)
LSI - standard,
LS - optional,
LSIP - optional (pre-trip alarm).

## Accessories

## to suit 630-800 AF

Internal accessories

| Description |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Shunt trips | $110 \mathrm{~V} \mathrm{AC/DC}$ | 2H1515BAA | 430.00 |
|  | 240 V AC | 2H1516BAA | 430.00 |
|  | 12 VDC | 2H1517BAA | 430.00 |
|  | 24 VDC | 2H1518BAA | 430.00 |
|  | 48 V DC | 2H1519BAA | 430.00 |
|  | 200 V DC | 2H1520BAA | 430.00 |
|  | 24 V AC | 2H1521BAA | 430.00 |
|  | 48 V AC | 2H1522BAA | 430.00 |
| Undervoltage trips | AC coil ${ }^{1}$ ) | 2H1503BAA | 395.00 |
|  | 100-230 V DC coil ${ }^{2}$ ) | 2H1504BAA | 395.00 |
|  | $\underline{24 ~ V ~ D C ~ c o i l ~}{ }^{2}$ ) | 2H1505BAA | 395.00 |
|  | 48 VDC coil $^{2}$ ) | 2H1506BAA | 395.00 |
|  | 60 VDC coil $^{2}$ ) | 2H1507BAA | 395.00 |
|  | 110 V AC instantaneous controller | UXUB0013B | 113.00 |
|  | 240 V AC instantaneous controller | UXUB0014B | 113.00 |
|  | 440 V AC instantaneous controller | UXUB0015B | 113.00 |
|  | 110 V AC time delay controller | UXUB0016B | 220.00 |
|  | 240 V AC time delay controller | UXUB0017B | 220.00 |
|  | 440 V AC time delay controller | UXUB0018B | 215.00 |
|  | 200-230 V DC controller | UXUB0038B | 113.00 |
| Undervoltage trips | AUX SW right hand 1C | UXXB0007D | 169.00 |
|  | AUX SW right hand 2C | UXXB0008D | 200.00 |
|  | AUX SW right hand 3C | UXXB0009D | 240.00 |
| Alarm switch | ALT SW right hand | UXLB0010D | 181.00 |
| Alarm \& auxiliary switches | ALT/AUX SW right hand 1C | UXLB0015D | 195.00 |
|  | ALT/AUX SW right hand 2 C | UXLB0016D | 225.00 |
| Pre-trip alarm | For electronic OCR Add MCCBs only | LSIP | 700.00 |
| Fault indication \& contacts | Side of breaker mounted $\begin{array}{r}\text { Add } \\ \text { module. then } \\ \text { Ele }\end{array}$ Electronic MCCBs only voltage | FI | 900.00 |
| Earth fault, with optional 4th external CTs | Earth fault, electronic Add breakers only (4th CTs optional, add price below) | LSIG | 730.00 |
|  | 630 A 4 th CT | UXOY0001A | 425.00 |
|  | 800 A 4th CT | UXOY0002A | 425.00 |

Notes: Footnotes, refer to page 6-26.

## Accessories to suit 630-800 AF

| External accessories - user fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Screw tunnel terminals | $\begin{aligned} & 3 \mathrm{P} \text { solderless terminals for } 630 \\ & \text { AF (6 in kit) } \end{aligned}$ | TXLD0005A | 385.00 |
|  | $\begin{aligned} & \text { 4P solderless terminals for } 630 \\ & \text { AF (8 in kit) } \end{aligned}$ | TXLD0006A | 495.00 |
| Rear connect studs | 3P rear connect studs, 630/800 AF ( 6 in kit) | UXRC0008B | 1460.00 |
|  | $\begin{aligned} & \text { 4P rear connect studs, 630/800 } \\ & \text { AF ( } 8 \text { in kit) } \end{aligned}$ | UXRC0009B | 2040.00 |
| Motor operators (XMD6) ${ }^{2}$ ) | 110 V AC motor | 2H1299CAC | 2750.00 |
|  | 110 V DC motor | 2H1301CAC | 2750.00 |
|  | 24 V DC motor | 2H1302CAC | 2750.00 |
|  | 240 V AC motor | 2H1303CAC | 2750.00 |
| Motor operators (XMC6) ${ }^{2}$ ) | 110 V AC motor | UXMC0006B | 3550.00 |
|  | 110 V DC motor | UXMC0008B | 3550.00 |
|  | 24 V DC motor | UXMC0009B | 3550.00 |
|  | 240 V AC motor | UXMC0010B | 3550.00 |
|  | Motor base support | UXMD0002B | 47.00 |
| Mechanical interlocks (Factory fit) | 3 P mechanical interlock rear mounting | UXKC0004A | 360.00 |
|  | 4 P mechanical interlock rear mounting | UXKC0005A | 520.00 |
|  | Interlock cable (wire) | UXKC0020A | 83.00 |
|  | Cable interlock mechanism ${ }^{1}$ ) | UXKC0022B | 310.00 |
| Handle operators | IP 55 Grey variable depth handle +357 mm shaft | T1HS80R5GM | 490.00 |
|  | T1HS escutcheon plate option: $100 \mathrm{~mm}^{2}$ | T2HSESC100 | 18.20 |
|  | 390 mm T pin shaft for T2HS - no flexi coupling | T2HS400SHAFT | 47.00 |
|  | IP 65 Grey variable depth handle +420 mm shaft | T1HP80R6BNA4 | 480.00 |
|  | Padlock attachment for T1HP/HS mechanism | T1HP80PALK | 49.50 |
|  | IP 55 direct mount fixed depth handle | TFJ36XU | 510.00 |
| Handle extension | Extends length of toggle | UXKB0002A | 60.50 |
|  | Toggle lock - non captive (Padlockable) | UXKB0002A | 60.50 |
| Toggle \& handle locks | Toggle lock - captive (Padlockable) | XKA6 | 60.50 |
|  | Resin for XKA6 | LOCTITE 480 | 83.00 |

Notes: ${ }^{1)}$ Order one interlock mechanism for each circuit breaker.
${ }^{2}$ ) XMC6 motors are used on all transfer switches as standard, and require a motor base support along with the motor when ordered. XMD6 motors offer superior ON/OFF/TRIPPED status indication and can be fitted to transfer switches on request. XMD6 motors do not require a motor base support.
Yellow and red handles available.

## Accessories to suit 630-800 AF

| External accessories - user fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Terminal covers | 3 P front connecting terminal cover | 2H1417DAB | 215.00 |
|  | 4 P front connecting terminal cover | 2H1418DAB | 270.00 |
|  | IP 20 protective cover ${ }^{1}$ ) | 2A1787DBA | 6.20 |
|  | 3 P rear connecting terminal cover | UXPD0013C | 220.00 |
|  | 4 P rear connecting terminal cover | UXPD0014B | 270.00 |
| Accessory lead terminal | Accessory terminal block | UXYD0001A | 26.80 |
|  | Terminal and bolt | UXYD0002A | 2.20 |
| Plug-in breaker parts 3 pole | Aux. connection block (MCCB) side | UXYC0005A | 54.00 |
|  | Aux. connection block (panel) side | UXYB0004A | 54.00 |
|  | Mounting bolts | TXLD0016A | 26.80 |
|  | Tulip block (6) $630{ }^{2}$ ) | TXLD0012A | 340.00 |
|  | Tulip block (6) $800{ }^{2}$ ) | 2A3308DAA | 360.00 |
|  | Mounting base | XDM6-3 | 880.00 |
| Plug-in breaker parts 4 pole | Aux. connection block (MCCB) side | UXYC0005A | 54.00 |
|  | Aux. connection block (panel) side | UXYB0004A | 54.00 |
|  | Mounting bolts | TXLD0016A | 26.80 |
|  | Tulip block (8) $630{ }^{2}$ ) | TXLD0013A | 425.00 |
|  | Tulip block (8) $800{ }^{2}$ ) | 2A3308DBA | 445.00 |
|  | Mounting bolts | XDM6-4 | 980.00 |
| TemPlug | TemPlug 800 A rated ${ }^{3}$ ) | UPX3800 | 660.00 |
| Interpole barrier | Interpole barrier | UXQH0004B | 10.40 |
| OCR sealing kit | Tamperproof cover for OCR adjustment dials | XS6300CRSK | 54.00 |
| ProSafe shot bolt interlock | Prosafe shot bolt lock HS handles xx code | TKNHPXX | 520.00 |
|  | Prosafe standard key xx code for above | TKNNHPKEYX_ | 130.00 |
|  | Cam for T2HS handle shafts Key codes A to Z are available. Specify by changing the key code above. | 14997702 | 235.00 |

Notes: ${ }^{1)} 6$ pieces required for $3 \mathrm{P} / 8$ pieces required for 4 P .
${ }^{2}$ ) Specify quantity required (up to 6 pieces).
${ }^{3}$ ) Price Schedule T3 applies to TemPlug.

## TemBreak PLUS selectivity series

## Electronic type <br> XS1250SE

## 85 kA

Current rating: 500-1250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage |  | Icu kA |
| :--- | :--- | :--- | :--- |
| Ics kA |  |  |  |
| AC use | 400 V | 85 | 65 |
|  | 415 V | 65 | 49 |



Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip.

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $11: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | In: $2-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 370 | 370 |
| W | 210 | 280 |
| D (less toggle) | 120 | 120 |
| Weight (kg) | 22 | 28 |

Notes: ${ }^{1}$ ) Hexcludes attached busbar.

3 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 1000 | 500 | 1000 | XS1250SE 1000 FC3 | $\mathbf{7 0 1 0 . 0 0}$ |
| 1250 | 625 | 1250 | XS1250SE 1250 FC3 | $\mathbf{8 7 7 0 . 0 0}$ |

## 4 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole <br> Price $\$$ |
| :--- | :--- | :--- | :--- | ---: |
| 1000 | 500 | 1000 | XS1250SE 1000 FC4 | $\mathbf{9 2 2 0 . 0 0}$ |
| 1250 | 625 | 1250 | XS1250SE 1250 FC4 | 11680.00 |

Ground Fault Trip MCCBs ${ }^{1}$ )
3 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price $\boldsymbol{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 1000 | 500 | 1000 | XS1250SE 10003LG | $\mathbf{7 8 7 0 . 0 0}$ |
| 1250 | 625 | 1250 | XS1250SE 12503LG | $\mathbf{9 4 9 0 . 0 0}$ |

4 Pole

| Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole <br> Price $\mathbf{\$}$ |
| :--- | :--- | :--- | :--- | ---: |
| 1000 | 500 | 1000 | XS1250SE 10004LG | $\mathbf{8 9 4 0 . 0 0}$ |
| 1250 | 625 | 1250 | XS1250SE 12504LG | $\mathbf{1 2 2 3 0 . 0 0}$ |

Notes: ${ }^{1}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutrel is present) Refer accessories.
NRC: Nominal rated current.
ASR: Adjustable setting range.

## TemBreak 1000 V mining circuit breakers

Electronic XV1250NE

20 kA
Current rating: 200-1250 A
Approvals and tests: Standards AS/NZS 3947-2, IEC 60947-2

Interrupting capacity: 20 kA at 1000/1100 V AC (IEC 60947-2)

Trip unit:

| Trip unit: | Fixed |  |
| :--- | :--- | :--- |
| LTD adjustment: | $I_{1}: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $I_{2}: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| INST adjustment: | $I_{3}: 3-12$ |  |
| PTA adjustment: | $I_{p}: 0.7-1$ | t: fixed at 40 s (sep control power <br> req.) |
| or GFT adjustment: $I_{G}: 0.1-0.4$ | t: $0.1,0.2,0.3,0.4$ or 0.8 s |  |

Dimensions (mm)

| Poles | 3 |
| :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 370 |
| W | 210 |
| D (Less toggle) | 120 |
| Weight $(\mathrm{kg})$ | 22.0 |
| 4 pole | POA |


| Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 400 | 200 | 400 | XV1250NE 400 3 K ${ }^{\mathbf{2}}$ ) | $\mathbf{1 0 0 3 0 . 0 0}$ |
| 800 | 400 | 800 | XV1250NE 800 3 K ${ }^{\mathbf{2}}$ ) | $\mathbf{1 0 0 3 0 . 0 0}$ |
| 1000 | 500 | 1000 | XV1250NE1000 3 K ${ }^{\mathbf{2}}$ ) | $\mathbf{1 0 6 2 0 . 0 0}$ |
| 1250 | 630 | 1250 | XV1250NE1250 3 K $\left.{ }^{\mathbf{2}}\right)$ | $\mathbf{1 3 6 3 0 . 0 0}$ |

## XV1 250 MINING BREAKERS MUST USE either line-side terminal covers <br> OR <br> interpole barriers, and a rear insulation plate (All supplied with breaker) ${ }^{3}$ )

Notes: ${ }^{1}$ ) H excludes attached busbar.
${ }^{2}$ ) For FAULT INDICATION option add "FI" and nominate control voltage.
${ }^{3}$ ) Installation information is supplied with MCCBs or refer NHP prior to purchase.
NRC: Nominal rated current.
ASR: Adjustable setting range.
Overcurrent trip combinations: (specify combinations req.)
LSI - standard,
LS - optional,
LSIP - pre-trip alarm,
LSIG - trip indicators - optional.

## TemBreak PLUS selectivity series

## Electronic type <br> XS1600SE

## 100 kA

Current rating: 800-1600 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage |  | Icu kA |
| :--- | :--- | :--- | :--- |
| Ics kA |  |  |  |
| AC use | 400 V | 100 | 75 |
|  | 415 V | 85 | 64 |



## Trip unit:

Electronic trip unit: Adjustable long, short and instantaneous trip

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $11: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}^{2}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ | $\mathbf{4}$ |
| :--- | :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 370 | 370 |
| W | 210 | 280 |
| D (less toggle) | 140 | 140 |
| Weight (kg) | 27 | 35 |

3 Pole
Amp rating

| NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 1600 | 800 | 1600 | XS1600SE 1600 FC3 | 10050.00 |

4 Pole

| Amp rating |  |  |  | 4 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| NRC | ASR Min. | ASR Max. | Cat. No. | C |
| 1600 | 800 | 1600 | XS1600SE 1600 FC4 | 13390.00 |

## Ground Fault Trip MCCBs ${ }^{2}$ )

3 Pole

| Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| 1600 | 800 | 1600 | XS1600SE 16003LG | 10780.00 |
| 4 Pole <br> Amp rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 4 pole Price \$ |
| 1600 | 800 | 1600 | XS1600SE 16004LG | 14120.00 |

Notes: ${ }^{1)}$ H excludes attached busbar.
${ }^{2}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutrel is present) Refer accessories.
NRC: Nominal rated current. ASR: Adjustable setting range.

## TemBreak PLUS LimitorBreaker Ics = 70 kA

## Electronic type <br> TL630NE

## 125 kA

Current rating: 315-630 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | 400 V | 125 | 70 |



## Trip unit:

Electronic trip unit: Adjustable long, short and instantaneous trip

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | 1:0.8-1 | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $12:-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}^{2}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | 3 |
| :--- | :--- |
| $\mathrm{H}^{1}$ ) | 370 |
| W | 210 |
| D (less toggle) | 140 |
| Weight $(\mathrm{kg})$ | 25.8 |
| 4 pole |  |

3 Pole
Amp

| rating <br> NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 630 | 315 | 630 | TL630NE 630 3 | $\mathbf{4 2 8 0 . 0 0}$ |


| Ground Fault Trip MCCBs ${ }^{2}$ ) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Amp rating NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole Price \$ |
| 630 | 315 | 630 | TL630NE3LSIG | 5010.00 |

[^42]
## TemBreak PLUS LimitorBreaker Ics = 70 kA

## Electronic type <br> TL800NE

## 125 kA

Current rating: $400-800 \mathrm{~A}$
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 125 | 70 |

Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $11: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $12:-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $I_{3}^{2}: 3-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | $\mathbf{3}$ |
| :--- | :--- |
| $\left.\mathrm{H}^{1}\right)$ | 370 |
| W | 210 |
| D (less toggle) | 140 |
| Weight $(\mathrm{kg})$ | 25.8 |
| 4 pole |  |

3 Pole

## Amp

| rating <br> NRC | ASR Min. | ASR Max. ${ }^{2}$ ) | Cat. No. | 3 pole <br> Price \$ |
| :--- | :--- | :--- | :--- | ---: |
| 800 | 400 | 800 | TL800NE 800 3 | $\mathbf{8 8 5 0 . 0 0}$ |

Ground Fault Trip MCCBs ${ }^{2}$ )

| 3 Pole <br> Amp |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| rating |  |  |  |  |

[^43]
## TemBreak PLUS LimitorBreaker Ics = 65 kA

## Electronic type TL1250NE

## 125 kA

Current rating: 500-1250 A
Approvals and Tests: Standards AS/NZS 3947-2 and IEC 60947-2

Interrupting capacity: Symmetrical amps (kA RMS)

|  | Voltage | Icu kA | Ics kA |
| :--- | :--- | :--- | :--- |
| AC use | $400 / 415$ | 125 | 65 |



Trip unit:
Electronic trip unit: Adjustable long, short and instantaneous trip

| Trip unit: | Fixed. |  |
| :--- | :--- | :--- |
| LTD adjustment: | $1: 0.8-1$ | t: $5-30 \mathrm{~s}$ |
| STD adjustment: | $1: 2-10$ | t: $0.1-0.3 \mathrm{~s}$ |
| Instantaneous Adj: | $1: 2-12$ | NRC |

OCR options: Pre-trip alarm, fault indication and contacts, ground fault trip
Dimensions (mm)

| Poles | 3 |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $\mathrm{H}^{\text {1 }}$ ) | 370 |  |  |  |
| W | 210 |  |  |  |
| D (less toggle) | 140 |  |  |  |
| Weight (kg) | 26 |  |  |  |
| 4 pole |  |  |  |  |
| 3 Pole |  |  |  |  |
| Amp rating |  |  |  | 3 pole |
| NRC | ASR Min. | ASR Max. | Cat. No. | Price \$ |
| 1000 | 500 | 1000 | TL1250NE 10003 FC | 11690.00 |
| 1250 | 625 | 1250 | TL1250NE 12503 FC | 13080.00 |

Ground Fault Trip MCCBs ${ }^{2}$ )

| 3 Pole <br> Amp <br> rating |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| NRC | ASR Min. | ASR Max. | Cat. No. | 3 pole <br> Price |
| 1000 | 500 | 1000 | TL1250NE 1000 3 LG | $\mathbf{1 2 4 2 0 . 0 0}$ |
| 1250 | 625 | 1250 | TL1250NE 12503 LG | $\mathbf{1 3 8 1 0 . 0 0}$ |

Notes: ${ }^{1)}$ H excludes attached busbar.
2) GF MCCBs require a 4 th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutrel is present) Refer accessories.
NRC: Nominal rated current.
ASR: Adjustable setting range.
Accessories, refer to page 6-35.

## Accessories to suit 1250-1600 AF

| Internal accessories - factory fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Shunt trips | 110 V AC/DC (110-115 V) | 2H1197BAA | 520.00 |
|  | $240 \mathrm{~V} \mathrm{AC} \mathrm{(200-480} \mathrm{V)}$ | 2H1198BAA | 520.00 |
|  | 12 V DC | 2H1199BAA | 520.00 |
|  | 24 VDC | 2H1200BAA | 520.00 |
|  | 48 VDC | 2H1201BAA | 520.00 |
|  | 200 V DC ( $200-230 \mathrm{~V}$ ) | 2H1202BAA | 520.00 |
|  | 24 VAC | 2H1203BAB | 520.00 |
|  | 48 V AC | 2H1204BAA | 520.00 |
| Undervoltage trips | AC coil ${ }^{1}$ ) | 2H1208BAA | 425.00 |
|  | 100-230 V DC coil ${ }^{2}$ ) | 2H1209BAA | 425.00 |
|  | $\underline{24 ~ V ~ D C ~ c o i l ~}{ }^{2}$ ) | 2H1210BAA | 425.00 |
|  | $48 \mathrm{VDC}{ }^{2}$ ) | 2H1211BAA | 425.00 |
|  | $60 \mathrm{VDC}^{2}$ ) | 2H1212BAA | 425.00 |
|  | 110 V AC instantaneous controller | UXUB0013B | 113.00 |
|  | 240 V AC instantaneous controller | UXUB0014B | 113.00 |
|  | 440 V AC instantaneous controller | UXUB0015B | 113.00 |
|  | 110 V AC time delay controller | UXUB0016B | 220.00 |
|  | 240 V AC time delay controller | UXUB0017B | 220.00 |
|  | 440 V AC time delay controller | UXUB0018B | 215.00 |
|  | 200-230 V DC controller | UXUB0038B | 113.00 |
| Auxiliary switches | AUX SW right hand 1C / 3 P | UXXB0010D | 335.00 |
|  | AUX SW right hand $2 \mathrm{C} / 3 \mathrm{P}$ | UXXB0011D | 415.00 |
|  | AUX SW right hand 3C/3P | UXXB0012D | 490.00 |
|  | AUX SW right hand 1C/4P | UXXB0023D | 335.00 |
|  | AUX SW right hand 2C/4P | UXXB0024D | 415.00 |
|  | AUX SW right hand 3C / 4 P | UXXB0025D | 490.00 |
| Alarm switches | ALT SW right hand / 3 P | UXLB0011D | 315.00 |
|  | ALT SW right hand / 4 P | UXLB0024D | 315.00 |
| Alarm \& auxiliary switches | ALT/AUX right hand 1C/3P | UXLB0017D | 385.00 |
|  | ALT/AUX right hand 2C / 3 P | UXLB0018D | 460.00 |
|  | ALT/AUX right hand 2C/4 P | UXLB0025D | 385.00 |
|  | ALT/AUX right hand 1C / 4 P | UXLB0026D | 460.00 |

[^44]
## Accessories to suit 1250-1600 AF

| Internal accessories - factory fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Fault indication \& contacts | An option for all Add 1250-1600 A types then voltage | FI | 900.00 |
| Fault indication | LED's mounted at top of OCR | FILED | 2050.00 |
| Pre-Trip alarm | An option for all 1250-1600 A types <br> Add | LSIP | 700.00 |
| Ground fault trip (GFT) Optional ext. 4th CT's | An option for all 1250-1600 A types | LSIG | 730.00 |
|  | 1000 A 4th CT | UXOY0003A | 445.00 |
|  | 1250 A 4th CT | UXOY0004A | 445.00 |
|  | 1600 A 4th CT | UXOY0005A | 445.00 |


| External accessories - factory fit |  | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: |
| Rear connect tags | 3 Prear connect studs (6 in kit) 1250 A | 2H1959DAB | 1750.00 |
|  | $\begin{aligned} & 4 \text { Prear connect studs (8 in kit) } \\ & 1250 \mathrm{~A} \end{aligned}$ | 2H1959DBB | 2330.00 |
|  | $\begin{aligned} & 3 \text { P rear connect studs (6 in kit) } \\ & 1600 \mathrm{~A} \end{aligned}$ | 2H1960DAA | 2310.00 |
|  | $\begin{aligned} & \text { 4P rear connect studs (8 in kit) } \\ & 1600 \mathrm{~A} \end{aligned}$ | 2H1960DBA | 3080.00 |
| Motor operators (XMD9) | 110 V AC motor - user fit | 2H1191CAB | 3670.00 |
|  | 110 V DC motor - user fit | 2H1193CAB | 3670.00 |
|  | 24 V DC motor - user fit | 2H1194CAB | 3670.00 |
|  | 240 V AC motor - user fit | 2H1195CAB | 3670.00 |
| Mechanical interlocks | 3 P mech I/lock / 1250 A rear connect | UXKC0006D | 880.00 |
|  | 4 P mech I/lock / 1250 A rear connect | UXKC0007D | 1170.00 |
|  | 3 P mech I/lock / 1600 A rear connect | UXKC0026C | 880.00 |
|  | 4 P mech I/lock / 1600 A rear connect | UXKC0027C | 1170.00 |
|  | Interlock cable (wire) | UXKC0020A | 83.00 |
|  | Interlock mechanism 1250 A Cable type ${ }^{1}$ ) | UXKC0023B | 460.00 |
|  | Interlock mechanism 1600 A Cable type ${ }^{1}$ ) | UXKC0024B | 460.00 |

Notes: ') Order one interlock mechanism for each breaker.

## Accessories to suit 1250-1600 AF



[^45]
## APPLICATION, INSTALLATION AND INSTRUCTION GUIDES

教


For Terasaki TemBreak 2 MCCBs and accessories
Installation sheets
Accessories listed below can be found in NHP Price List Catalogue Part C.

## Internal accessories

- Auxiliary switches
- Alarm switches


## External accessories

- Operating handles
- Motor operators
- Mechanical interlocks
- Interpole barriers
- Terminal covers
- Flush plates
- Shunt trips
- Undervoltage trips
- TemPlug
- Plug-in MCCB bases
- Toggle locks and locking devices
- Rear connection terminal studs
- Tunnel clamp terminals
- Attached flat bar


## SP4(6x) Jnmesist Lowood SPS - Electrical InstallatiogceMA,Manual

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## SP4(6) JEnCsist Lowood SPS - Electrical InstallationoPM|Manual

## TemPower Introduction

Meeting the requirements of contemporary switchboard manufacturers, consultants and end users, the TemPower 2 ACB boasts an attractive range of features including fast fault clearing times, advanced digital Overcurrent Relay (OCR) options and a small, compact design that maintains high Ampere Interrupting Capacities (AIC).


Maximum power from minimum volume


| Standard <br> series | $800-2000$ A $2500-3200 \mathrm{~A}$ | 4000 A | $5000-6300 \mathrm{~A}$ |  |
| :--- | :--- | :--- | :--- | :--- |
| High fault <br> series | $1600-$ $1600-3200 \mathrm{~A}$   | 2000 A Size AR2 | Size AR3 | Size AR4 |

Notes: Measurements on 3 pole model show in mm .

## TemPower Standards and certifications

Based Standards

| AS 3947-2 | Australian Standard |
| :--- | :--- |
| IEC 60947-2 | International Electrotechnical Commission |
| EN60947-2 | European Standard |
| JIS C8372 | Japanese Industrial Standard |
| NEMA PUB NO.SG3 | National Electrical Manufacturers Association |
| ANSI C37.13 | American National Standard Institute |
| Certification and Authorisation |  |
| ASTA, UK | ASTA Certification Services |
| NK, Japan | Nippon Kaiji Kyokai |
| LR, UK | Lloyd's Register of Shipping |
| ABS, USA | American Bureau of Shipping |
| GL, Germany | Germanischer Lloyd |
| BV, France | Bureau Veritas |



## SP4(6) JEnSSARt Lowood SPS - Electrical InstallationoPM|Manual

## TemPower <br> Stocked ACBs

Stocked ACBs are kept on the shelf in a standard pre-built configuration providing fast customer delivery. ACB bodies (withdrawable part) and carriages (fixed part) are ordered separately according to the required carriage terminal configuration.

## Stocked ACB specification

- Approvals and test: IEC 60947, A.S.T.A. certified
- AR-S type ACB body, 3 pole
- TemPro PLUS overcurrent release (type AGR21BL-PG) (240 V AC control voltage)
- Adjustable ‘LSI'+GF protection standard (GF comes set enabled as default) ${ }^{2}$ )
- Single trip indicator contact for 'LSI+GF' standard
- MODBUS communications facility (data monitoring as standard)
- Ground fault ready (external 4th CT required, see below) ${ }^{1}$ )
- 240 V AC continuous rated shunt trip
- 7 C/O auxiliary switch
- IP 41 door flange
- ON/OFF push button covers are padlockable as standard
- Position padlock facility (locks ACB inside carriage in 'connected' or 'test' position)

| Description | Current <br> rating (A) | 400/415 V interrupting capacity (kA) | ACB body Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| AR-S ACB body | 1250 | 65 | ARB2123STD | 11180.00 |
|  | 1600 | 65 | ARB2163STD | 11290.00 |
|  | 2000 | 65 | ARB2203STD | 13380.00 |
|  | 2500 | 85 | ARB3253STD | 14090.00 |
|  | 3200 | 85 | ARB3323STD | 15920.00 |
|  | 4000 | 100 | ARB4403STD | 22650.00 |



Notes: The above specification is fixed. If different accessories are required (e.g. UVT, OCR, different shunt voltage) please contact NHP sales to place a fully manufactured order.
'LSI+GF': long time delayed trip, short time delayed trip, instantaneous trip, ground fault trip
${ }^{1}$ ) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
${ }^{2}$ ) The ground fault protection setting is set to enabled as default. If GF is not required GF must be set to OFF by the user before ACB energisation.

## TemPower <br> Stocked ACBs

Stocked ACB carriage specification ${ }^{1)}$

- 3 pole carriage to suit standard ACB body

| Description | Suits ACB Body Cat. No. | Terminal Top | rrangement <br> Bottom | ACB carriage Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| AR-S ACB Carriage | ARB2123STD | Horizontal | Horizontal | ARC2123HHSTD | 4480.00 |
|  |  | Vertical | Vertical | ARC2123VVSTD | 4480.00 |
|  |  | Horizontal | Vertical | ARC2123HVSTD | 4480.00 |
|  |  | Vertical | Horizontal | ARC2123VHSTD | 4480.00 |
|  | $\begin{aligned} & \text { ARB2163STD } \\ & \text { ARB2203STD } \end{aligned}$ | Horizontal | Horizontal | ARC2203HHSTD | 4950.00 |
|  |  | Vertical | Vertical | ARC2203VVSTD | 4950.00 |
|  |  | Horizontal | Vertical | ARC2203HVSTD | 4950.00 |
|  |  | Vertical | Horizontal | ARC2203VHSTD | 4950.00 |
|  | ARB3253STDARB3323STD | Horizontal | Horizontal | ARC3323HHSTD | 7470.00 |
|  |  | Vertical | Vertical | ARC3323VVSTD | 7470.00 |
|  |  | Horizontal | Vertical | ARC3323HVSTD | 7470.00 |
|  |  | Vertical | Horizontal | ARC3323VHSTD | 7470.00 |
|  | ARB4403STD | Vertical | Vertical | ARC4403VVSTD | 11120.00 |

Notes: ${ }^{1}$ ) The stock carriages are suitable for use with the NHP 'stock body' shown on the previous page. If you require a different ACB specification to that listed on the previous page please contact NHP sales to place a fully manufactured order.

## TemPower Standard accessories

Ground fault 4th CT
The external ground fault 4th CT is required to be fitted to the switchboard neutral bar when the ground fault protection function used.


Rated Pri.

| Description | current | Suits ACB type | 4th CT Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| Ground fault 4th CT | 1250 A | ARB2123STD | XCW0840LS13 | 330.00 |
|  | 1600 A | ARB2163STD | XCW0840LS16 | 330.00 |
|  | 2000 A | ARB2203STD | XEC1640LS20 | 330.00 |
|  | 2500 A | ARB3253STD | XEC1640LS25 | 650.00 |
|  | 3200 A | ARB3323STD | XEC1640LS32 | 650.00 |
|  | 4000 A | ARB4403STD | XEC1640LS40 | 1240.00 |

Stocked ACB instruction manual

- Customer to specify required quanity at time of order (not suppied as standard)

| Description | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| TemPro Plus (AGR21B) Installation manual | ARAGR21BMANUAL | $\mathbf{1 0 . 4 0}$ |
| TemPro Premier (AGR31B) Installation manual | ARAGR31BMANUAL | $\mathbf{1 0 . 4 0}$ |

## TemPower Standard accessories

These items are factory fit / NHP service:

| Item | Description | Price \$ |
| :---: | :---: | :---: |
| Motor operator | A motor is used to remotely charge / close the ACB (specify voltage) | POA |
| Shunt trip (continuously rated) | Allows remote opening of the ACB (specify voltage) | POA |
| Under voltage trip (UVT) | Trips the ACB during an undervoltage (specify voltage) (single phase) | POA |
| Trapped key I/lock | Rockwell or Fortress type Prosafe | POA |
| Mech. Interlock 2 way | Cable interlock. /per ACB | POA |
| Mech. Interlock - 3 | Cable interlock. /per ACB | POA |
| Door interlock | Prevents enclosure door being opened unless ACB is isolated | POA |
| Fixing bolts for ACB | Holds the breaker firmly inside the carriage. | POA |
| Off position padlock facility | Allows the ACB to be padlocked in the OFF position | POA |
| Cycle counter | A 5 digit counter of the ACBs ON-OFF cycles | POA |
| Auxiliary contacts | 10C changeover contacts. | POA |
| Position switch | A contact set that switches to indicate the ACB status in a carriage | POA |
| Storage draw-out handle | Draw-out handle that is stored inside the ACB body | POA |

[^46] required specification.

## TemPower Standard accessories

These items can be fitted by the customer:

| Item | Description | Cat. No. | Price \$ |
| :--- | :--- | :--- | ---: |
| Interpole barrier | Suits 3P 800 A - 2000 A <br> AR ACB | 1H1894BAA | $\mathbf{2 5 0 . 0 0}$ |
| Interpole barrier | Suits 3P 2500 A, 3200 A <br> AR ACB | 1H1895BAA | $\mathbf{2 5 0 . 0 0}$ |
| Interpole barrier | Suits 3P 4000 A AR ACB | 1H1896BAA | $\mathbf{2 5 0 . 0 0}$ |
| Standard door <br> flange | IP41 front surround for ACB | 1H2243BAA | $\mathbf{1 5 6 . 0 0}$ |
| IP 55 door cover | A clear plastic hinged door <br> Cover | 1H2300CAB | $\mathbf{1 2 2 0 . 0 0}$ |
| Padlock main <br> safety shutters | Suits 3/4P 800 A-3200 A <br> AR ACB | 1H1627CAA | $\mathbf{3 4 0 . 0 0}$ |
| Padlock main <br> safety shutters | Suits 3/4P 4000 A AR ACB | 1H2022CAA | $\mathbf{1 1 4 . 0 0}$ |
| Lifting lugs | Attachable lifting brackets <br> for ACB bodies only | 1A3430BAB | $\mathbf{4 1 . 5 0}$ |
| Lifting truck | Available for lifting an ACB | ARACBTRUCK | $\mathbf{1 7 6 1 0 . 0 0}$ |
| OCR checker | Hand held secondary <br> injection test unit | ANU1AC200 | $\mathbf{5 5 1 0 . 0 0}$ |
| Test jumper | 5 m lead for maintenance <br> purpose | 1H1615BAA | $\mathbf{9 9 0 . 0 0}$ |





Notes: TEMPro PREMIER pricing is POA. Please contact NHP estimating with required specification.

## TemPower ACB ordering information

ACBs can be manufactured to suit specific customer requirements. About TEMPOWER 2 AR ACB Ordering: TemPower 2 AR ACBs are locally assembled by NHP along with many variations and options available to suit specific end user applications. The listing below represents typical specifications to be considered at the time of ordering:

1. ACB type and current rating (AR, 1250 A )
2. Number of poles (3P or $4 P$ )
3. Main circuit and control circuit voltage and frequency ( 415 or 690 V AC )
4. Operating temperatures ( 40 degree $C$ ambient)
5. Type of mounting. (Draw out type $A C B$ is available, fixed type is not available)
6. Terminal arrangements. For example rear connect vertical or horizontal main terminals. Front connect terminals are also an option.
7. Type of charging. Manual lever (standard) or motor operated. If a motor is chosen then the operating voltage has to be specified.
8. The OCR (overcurrent relay or 'release').

The OCR type needs to be chosen depending on the
 requirements of the installation. NHP / Terasaki have as standard "LSI" OCRs fitted with LCDs, MODBUS communications facilities in all ACBs. The control voltage must be specified at the time of order.
9. Electrical tripping devices: Other options such as Shunt trips, Under voltage releases, or capacitor trips need to be considered.
10. Other accessories, some of which are:

ON-OFF cycle counter
Auxiliary switch type (7 C is standard)
Key lock devices - standard or Trap key interlock etc.
Mechanical interlocks
IP 55 Cover
OFF padlock
Door flange
11. Contact your NHP sales office for any other special requirements such as service or repair, retrofitting, spare parts, test reports etc.
12. Prices: Contact your NHP sales office for a pricing of non standard equipment.

An AR ordering sheet is available covering the above ordering process.
Refer NHP.

## TemPower <br> Specifications

Rated from 200 A to 6300 A NHP can provide a withdrawable Terasaki Air Circuit Breaker (ACB) designed to meet the stringent demands of the industrial and marine market.

The AR series is available in four frame sizes:

- frame size 1 which ranges from 200 to 2000 A (AR2)
- frame size 2 which ranges from 2500 to 3200 A (AR3)
- frame size 3 which is rated at 4000 A (AR4)
- frame size 4 which is rated at 5000 to 6300 A (AR6)



# TemPower <br> Main power circuit terminals specifications 

Main circuit configuration is available in either horizontal or vertical form, a combination of both, or front connected. Refer to the table below, which indicates which terminal types are available for different ACB types. Specification of the desired terminal configuration should be made at the time of ordering the ACB or carriage. A cross ' $x$ ' below, indicates a configuration that is unavailable.

AR-S standard series

| Ampere <br> rating (A) | ACB type | ACB <br> mounting <br> method | Horizontal <br> terminals | Vertical <br> terminals | Front <br> connect <br> terminals |
| :--- | :--- | :--- | :--- | :---: | :---: |
| 800 A | AR208S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 1250 A | AR212S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 1600 A | AR216S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 2000 A | AR220S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 2500 A | AR325S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 3200 A | AR332S | Draw-out | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| 4000 A | AR440S | Draw-out | $x$ | $\checkmark$ | $x$ |

## AR-H high kA series

| Ampere <br> rating $(\mathbf{A})$ | ACB type | ACB <br> mounting <br> method | Horizontal <br> terminals | Vertical <br> terminals | Front <br> connect <br> terminals |
| :--- | :--- | :--- | :---: | :---: | :---: |
| 1600 A | AR216H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |
| 2000 A | AR220H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |
| 1600 A | AR316H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |
| 2000 A | AR320H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |
| 2500 A | AR325H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |
| 3200 A | AR332H | Draw-out | $\checkmark$ | $\checkmark$ | $X$ |

AR650 / AR663

| Ampere <br> rating $($ A $)$ | ACB type | ACB <br> mounting <br> method | Horizontal <br> terminals | Vertical <br> terminals | Front <br> connect <br> terminals |
| :--- | :--- | :--- | :---: | :---: | :---: |
| 5000 A | AR650 | Draw-out | $X$ | $\checkmark$ | $X$ |
| 6300 A | AR663 | Draw-out | $X$ | $\checkmark$ | $X$ |

## TemPower <br> Performance specification of the AR ACB

| AR-S TemPower 2 -STANDA |  | AR208S | AR212S | AR216S |
| :---: | :---: | :---: | :---: | :---: |
| Rated current ( In$\left.)^{1}\right)^{2}$ ) | (A) | 800 | 1250 | 1600 |
| Number of poles $\left.{ }^{3}\right)^{4}$ ) |  | 3 \& 4 | 3 \& 4 | 3 \& 4 |
| Current transformer ratings (Ict) | (A) | $\begin{aligned} & 200 \\ & 400 \\ & 800 \end{aligned}$ | $\begin{aligned} & 200 \\ & 400 \\ & 800 \\ & 1250 \end{aligned}$ | $\begin{aligned} & \hline 200 \\ & 400 \\ & 800 \\ & 1250 \\ & 1600 \end{aligned}$ |
| $\begin{aligned} & \text { Insulation voltage (Ui) } \\ & \text { (V } 50 / 60 \mathrm{~Hz} \text { ) } \end{aligned}$ | (V AC) | 1000 | 1000 | 1000 |
| $\begin{aligned} & \text { Operational voltage (Ue) } \\ & \text { (V } 50 / 60 \mathrm{~Hz} \text { ) } \end{aligned}$ | (V AC) | 690 | 690 | 690 |
| Impulse voltage (Uimp) | (kV) | 12 | 12 | 12 |
| Breaking capacity kA IEC, $\left.\mathrm{AS}^{5}\right)^{7}$ | 690 V | 50 | 50 | 50 |
| $(\mathrm{lcs}=\mathrm{lcu})[\mathrm{kA} \text { sym rms] }$ | 440 V | $65{ }^{6}$ ) | $65{ }^{6}$ ) | $65{ }^{6}$ ) |
| Making capacity (kA peak) | 690 V | 105 | 105 | 105 |
| (kA peak) <br> IEC, AS | 440 V | 143 | 143 | 143 |
| Rated short time | 1 Sec | 65 | 65 | 65 |
| withstand (lcw) | 3 Sec | 50 | 50 | 50 |
| Total breaking time | Sec | 0.03 | 0.03 | 0.03 |
| Motor charging time (max) | Sec | 10 | 10 | 10 |
| Closing time (max) | Sec | 0.08 | 0.08 | 0.08 |
| Latching current | (kA) | 65 | 65 | 65 |

Notes: ${ }^{1}$ ) Values in open air at $40^{\circ} \mathrm{C}\left(45^{\circ} \mathrm{C}\right.$ for marine applications).
${ }^{2}$ ) Values of AR208S, AR212S, AR216S for draw-out type with horizontal terminals, values of the other ACBs for draw-out type with vertical terminals.
${ }^{3}$ ) For 2 pole $A C B s$ use outside poles of 3 pole $A C B$.
$\left.{ }^{4}\right) 4$ Pole ACBs without Neutral phases protection can not apply IT earthing system.
${ }^{5}$ ) Contact NHP for the details.
6) For 500 VAC .
${ }^{7}$ ) Please contact NHP for DC applications.
When the INST trip function is set to NON, the MCR function should be enabled, otherwise, the rated breaking capacity is reduced to the rated latching current.

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## TemPower

| AR220S | AR325S | AR332S | AR440S | AR650S | AR663S |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 2000 | 2500 | 3200 | 4000 | 5000 | 6300 |
| $3 \& 4$ | $3 \& 4$ | $3 \& 4$ | $3 \& 4$ | $3 \& 4$ | $3 \& 4$ |
| 200 | 200 | 200 | 4000 | 5000 | 6300 |
| 400 | 400 | 400 |  |  |  |
| 800 | 800 | 800 | 1250 |  |  |
| 1250 | 1250 | 1600 | 2000 | 2500 | 3200 |

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## TemPower Performance specification of the AR-H ACB

A 'High Fault' series of AR ACB is available (the AR-H) on INDENT. For applications that require a larger breaking capacity than the standard series.

| AR-H TemPower 2-HIGH |  | AR216H | AR220H |
| :---: | :---: | :---: | :---: |
| Rated current (In) | (A) | 1600 | 2000 |
| Number of poles |  | 3 \& 4 | 3 \& 4 |
| Current transformer ratings (Ict) | (A) | $\begin{aligned} & 200 \\ & 400 \\ & 800 \\ & 1250 \\ & 1600 \end{aligned}$ | $\begin{aligned} & \hline 200 \\ & 400 \\ & 800 \\ & 1250 \\ & 1600 \\ & 2000 \end{aligned}$ |
| AC Insulation voltage (Ui) | (V AC) | 1000 | 1000 |
| Operational voltage | (VAC) | 690 | 690 |
| Impulse voltage (Uimp) | (kV) | 12 | 12 |
| Breaking capacity $\left.{ }^{1}\right)^{2}$ ) kA IEC, AS | 690 V | 55 | 55 |
| (ICS = ICU) <br> [kA sym rms] | 440 V | 80 | 80 |
| Making capacity | 690 V | 121 | 121 |
| (kA peak) <br> IEC, AS | 440 V | 176 | 176 |
| Rated short time | 1 Sec | 80 | 80 |
| withstand (Icw) | 3 Sec | 55 | 55 |
| Total breaking time | Sec | 0.03 | 0.03 |
| Motor charging time | Sec | 10 | 10 |
| Closing time (max) | Sec | 0.08 | 0.08 |
| Latching current | (kA) | 65 | 65 |

Notes: ${ }^{1}$ ) Contact NHP for the details.
${ }^{2}$ ) Please contact NHP for DC applications.

## 

## TemPower

| AR316H | AR320H | AR325H | AR332H |
| :---: | :---: | :---: | :---: |
| 1600 | 2000 | 2500 | 3200 |
| 3 \& 4 | 3 \& 4 | 3 \& 4 | 3 \& 4 |
| 200 | 200 | 200 | 200 |
| 400 | 400 | 400 | 400 |
| 800 | 800 | 800 | 800 |
| 1250 | 1250 | 1250 | 1250 |
| 1600 | 1600 | 1600 | 1600 |
|  | 2000 | 2000 | 2000 |
|  |  | 2500 | 2500 |
|  |  |  | 3200 |
| 1000 | 1000 | 1000 | 1000 |
| 690 | 690 | 690 | 690 |
| 12 | 12 | 12 | 12 |
| 85 | 85 | 85 | 85 |
| 100 | 100 | 100 | 100 |
| 187 | 187 | 187 | 187 |
| 220 | 220 | 220 | 220 |
| 100 | 100 | 100 | 100 |
| 75 | 75 | 75 | 75 |
| 0.03 | 0.03 | 0.03 | 0.03 |
| 10 | 10 | 10 | 10 |
| 0.08 | 0.08 | 0.08 | 0.08 |
| 85 | 85 | 85 | 85 |

## TemPower <br> Overcurrent Release (OCR) specification

Boasting an impressive range of standard features and specialised options, the Terasaki overcurrent release range is suitable for commercial, industrial and marine applications. The Terasaki OCR is divided into two performance ranges; the TEMPro PLUS and TEMPro PREMIER.

## TEMPro PLUS (Type AGR-21B)

Featuring a backlit liquid crystal display (LCD) for easy visual identification and a soft rubber key activated scrolling menu system the TEMPro PLUS can display ${ }^{1}$ ):

- Phase currents $I_{1}, I_{2}, I_{3}$ (accuracy $+2.5 \%$ )Fault current value
- Tripping delay time
- The maximum phase current
- Cause of fault (LTD, STD, INST, GF ${ }^{2}$ ))

Providing adjustable LSI and GF ${ }^{3}$ ) protection featuring
 MODBUS communications plus a built-in current meter as standard, the TEMPro PLUS is perfect for basic and mid range applications.

Notes: ${ }^{1}$ ) Trip variables can be viewed after an event via the LCD providing control power is constantly available.
${ }^{2}$ ) LTD-Long time delay trip, STD-Short time delay trip, INST-Instantaneous trip, GF-Unrestricted ground fault (not available for ' S ' curve model OCR).
${ }^{3}$ ) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.

## TemPower <br> Overcurrent Release (OCR) specification

## TEMPro PREMIER (Type AGR-31B)

The TEMPro PREMIER is an advanced OCR that offers the same LCD appearance and protective functions as the TEMPro PLUS. In addition to the current meter measurements listed above the TEMPro PREMIER has an inbuilt energy analyser which indicates:

- Phase currents $I_{1}, I_{2}, I_{3}$ (accuracy $+1.5 \%$ )
- Line voltages (V) $\mathrm{V}_{12}, \mathrm{~V}_{23}, \mathrm{~V}_{31}{ }^{1}$ )
- Phase voltage ( V ) $\mathrm{V}_{1 \mathrm{~N}}, \mathrm{~V}_{2 \mathrm{~N}}, \mathrm{~V}_{3 \mathrm{~N}}$ (accuracy + $1.0 \%$ )
- Active power (kW) (accuracy + 2.5 \%)
- Demanded active power (kW)
- Electric energy (kWh) (accuracy + 3.0 \%)
- Power factor ( $\cos \varnothing$ ) (accuracy + 2.5 \%)
- Frequency (Hz) (accuracy +0.5 Hz )
- Fault current value
- Tripping delay time
- The maximum phase current
- Cause of fault (LTD, STD, INST, GF ${ }^{2}$ ))

Furthermore the TEMPro PREMIER is available with a range of optional features that make it ideal for use in specialised applications.

## Field test facility

Type AGR-21B/31B OCRs are equipped with a field test function to verify the long time delay, short time delay, instantaneous and ground fault trip features without the need for tripping of the ACB.


# TemPower TEMPro PLUS and PREMIER appearance 



Notes: Indicative picture only

## TemPower TEMPro application protection curves

The TEMPro PLUS and TEMPro PREMIER OCR range is available in three model variations:

- Standard protection curve, or 'L' type - designed for general feeder applications and will achieve most selectivity and protection requirements.
- High selectivity curve or 'R' type - offers 3 curve characteristics to IEC60255 and is used when selectivity can not be achieved with other system protective devices (i.e. fuses or other relays).
■ Generator protection curve or 'S' type. - Specifically designed for generator and marine applications.
It is recommended that all general feeder circuits be protected by the 'L' type unless the results of a selectivity study indicate that an ' $R$ ' type is required to discriminate with another system protective device. The application curve type must be specified at the time of order.


L type is designed for General Feeder installations.


R type is used for high selectivity applications and offers 3 curve characteristics to IEC 60255.


Stype is best utilised for generator and marine power protection.

# TemPower TEMPo PLUS and TEMPro PREMIER 

## Standard protection features

TEMPro PLUS and TEMPro PREMIER have adjustable LSI - long time delay, short time delay, INSTANTANEOUS and GF as standard. This provides an adjustable time delay on overload and also the $I^{2} \mathrm{t}$ ramp characteristic which is essential to provide selectivity when grading with other protective devices such as downstream fuses and upstream relays. The standard 'LSI' curve provides more than five million combinations of unique time current characteristics.

| Standard feature | Description | Application curve |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | L | R | S |
| LTD trip | Adjustable overload protection area trip | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| STD trip | Adjustable short circuit protection area trip (with intentional delay) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| INST trip | Adjustable short circuit protection area trip <br> (with NO intentional delay) | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| GF trip ${ }^{1}$ ) | Adjustable unrestricted earth fault protection (GF) (requires external 4th CT for 3 pole model) | $\checkmark$ | $\checkmark$ | $x$ |
| Single Alarm contact indicato | As standard the single contact alarm indicator is available that indicates when the LTD trip, STD trip, INST/MCR trip or the GF trip function is activated. | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| MODBUS I/F | MODBUS communication interface allows monitoring of available data variables. <br> ACB control is non standard, refer to communications page. | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| Backlit LCD with current meter TEMPro PLUS | Displays phase currents $I_{1}, I_{2}, I_{3}$ and $I_{G F}$, fault current values, tripping time delay, the maximum phase current and the cause of fault <br> (LTD, STD, INST, GF) TEMPro PLUS ONLY | $\checkmark$ | $\checkmark$ | $\checkmark$ |
| Backlit LCD with energy analyser TEMPro | Displays phase currents $I_{1}, I_{2}, I_{3}$ and $I_{G F}$, Line voltages (V) $\mathrm{V}_{12}, \mathrm{~V}_{23}, \mathrm{~V}_{31}$, Phase voltage ( V ) $\mathrm{V}_{1 N}, \mathrm{~V}_{2 N}, V_{3 N}$, Active power (kW), Demanded active power (kW), Electric energy (kWh), Power factor (cos Ø), Frequency (Hz) <br> TEMPro PREMIER ONLY | $\checkmark$ | $\checkmark$ | $\checkmark$ |

Notes: ${ }^{1}$ ) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
$\checkmark=\operatorname{standard} X=$ not available

## TemPower TEMPro PLUS and TEMPro PREMIER

## Specialised optional features

TEMPro OCRs can be 'optioned up' with specialised application functions to suit customer requirements.

Please indicate what special application functions are required at the time of order as all are factory installed.

| Standard | Appli- |
| :--- | :--- | :--- |
| feature | Description |
| System Alarm | Activates if an internal fault exists within the OCR. <br> System alarm can be monitored remotely via the MODBUS <br> communications interface. |
| curve |  |$\quad$ L R S S

Notes: All special application functions are available on an indent basis.
For further information on special application functions please contact NHP.
$\boldsymbol{\checkmark}=\operatorname{standard} \boldsymbol{X}=$ not available

# TemPower TEMPro PLUS and TEMPro PREMIER 

 Specialised optional features| Standard feature | Description | Application curve |
| :---: | :---: | :---: |
| Undervoltage alarm function (TemPro Premier only) | This function monitors the main circuit voltage, and gives |  |
|  | an alarm on the LCD and an output signal via an alarm |  |
|  | contact when the voltage drops below the setting voltage. |  |
|  | The alarm is activated when the main circuit voltage |  |
|  | drops below the setting voltage (selectable from $40 \%$, |  |
|  | $60 \%$ or $80 \%$ of the rated main circuit voltage [Vn]), and |  |
|  |  |  |
|  | recovery setting voltage (selectable from $80 \%, 85 \%, 90 \%$ or $95 \%$ of the rated main circuit voltage [Vn]). | , 6 |
|  | Note 1: The undervoltage alarm function is disabled unless the main circuit voltage has once risen to the recovery |  |
|  | setting voltage or higher. |  |
|  | Note 2: If the undervoltage alarm function is used in conjunction with the undervoltage trip device, an alarm may occur after the ACB trips open depending on the alarm setting voltage. |  |
| Reverse power trip function RPT | (TemPro Premier AGR-31BS only.) |  |
|  | The RPT function protects 3-phase generators running |  |
|  | in parallel against reverse power. The RPT pickup current | $\checkmark \checkmark \checkmark$ |
|  | can be set in seven levels: $4 \%$ thru $10 \%$ of the generator rated power. |  |

Notes: All special application functions are available on an indent basis.
For further information on special application functions please contact NHP.
$\boldsymbol{J}=\operatorname{standard} \boldsymbol{X}=$ not available

## THINK MAJOR PROJECTS. THINK NHP.

When it comes to Major Projects, our staff involvement is always driven by long term results, actively seeking to support you with the right product and technical solutions before, during and after project completion.

## Major Projects Team

No matter what the project, from the initial stages of concept design, through to post-commissioning and future upgrades, NHP's Major Projects Team is there to see the project through together with you - our customer.
Our quality people have a diverse reach across Australia and New Zealand and their vast industry experience is sure to be there for you when you need it.

Think Major Projects. Think NHP.

# TemPower <br> TEMPro PLUS and TEMPro PREMIER Specifications 

Standard features

| OCR type | Cat. No. | Application protection curve ${ }^{1}$ ) | LCD monitoring | $\begin{gathered} \text { Basic } \\ \text { protection }{ }^{2} \text { ) } \\ \text { LTD STD INST } \\ \hline \end{gathered}$ | GF ${ }^{5}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| TEMPro PLUS | AGR-21B-L-PG | 'L' | Current meter (A) | $\checkmark$ | $\checkmark$ |
|  | AGR-21B-R-PG | 'R' | Current meter <br> (A) | $\checkmark$ | $\checkmark$ |
|  | AGR-21B-S-PS | 'S' | Current meter <br> (A) | $\checkmark$ | $x$ |
| TEMPro PREMIER | AGR-31B-L-PG | 'L' | Energy analyser | $\checkmark$ | $\checkmark$ |
|  | AGR-31B-R-PG | 'R' | Energy analyser | $\checkmark$ | $\checkmark$ |
|  | AGR-31B-S-PS | 'S' | Energy analyser | $\checkmark$ | $x$ |

## OCR control power

If the control power is not supplied or is lost, each function operates as follows:
Function when no power
LT, ST, INST, RPT
GF

MCR
PTA
1-channel PTA
Alarm contact output from OCR
LCD/ COMMUNICATIONS
Field test facility \& MODBUS

Notes: ${ }^{1}$ ) L/R/S refers to the application protection curve, please specify at time of ordering.
${ }^{2}$ ) LTD-Long time delay trip, STD-Short time delay trip, INST-Instantaneous trip, GF-Unrestricted ground fault, (load side GF).
${ }^{3}$ ) Trip variables can be viewed after an event via the LCD providing control power is constantly available.
The OCR does not require control power to operate as a protective device, however it is recommended.
Refer to the table above to see how absence or loss of control power affects the operation of the OCR.
${ }^{4}$ ) RPT- Reverse power trip. AGR-31BS-PS becomes AGR-31BS-PR with RPT.
${ }^{5}$ ) This function provides ground fault protection to TN-C or TN-S power distribution systems on the load side.
$\boldsymbol{\checkmark}=$ Standard, $\boldsymbol{x}=$ Not available, OPT = Optional

## TemPower

| Single contact <br> indicator (LTD) <br> STD/INST, GF | Modbus Facility <br> (data monitoring <br> only) | RPT $^{4}$ ) | Control power ${ }^{3}$ ) |
| :---: | :---: | :---: | :--- |
| $\checkmark$ | $\checkmark$ | $x$ | Required |
| $\checkmark$ | $\checkmark$ | $x$ | Required |
| $\checkmark$ | $\checkmark$ | $x$ | Required |
| $\checkmark$ | $\checkmark$ | $x$ | Required |
| $\checkmark$ | $\checkmark$ | $X$ | Required |
| $\checkmark$ | $\checkmark$ | $x$ | Required |

## Operation

Operates normally.
Operates normally.
When the CT rated primary current (ICT) is less than 800 A and the GF pick-up current is set to $10 \%$, the GF becomes inoperative.
Operates as INST.
Is inoperative. (Has a 40 ms operation)
Is inoperative.
No display when no other power source is available. Communications is disabled.
Is inoperative.

## TemPower <br> Tripping options - Shunt trip coil

The TEMPOWER 2 AR ACB has two methods of remote tripping of the main contacts:

- Shunt trip coil
- Undervoltage Trip (UVT) Device


## Shunt trip coil

The shunt trip coil is available in three varieties;

- single shunt - short time rated (STR) and should be wired in series with a N/C auxiliary contact.
- single shunt - which is continuously rated (CR)
 be wired in series with a N/C auxiliary contact.
Shunt coils are available in different voltages and are factory fit accessories / NHP service site visit. Below is a basic list of shunt coils, for voltages not shown on this list please contact your NHP representative.

Single shunt coil

| Rated Voltage | (CR) | Double shunt coil | Single shunt (STR) |
| :---: | :---: | :---: | :---: |
| AC 110 V | $\checkmark$ | $x$ | 1 |
| AC 220 V | - | $x$ | i |
| AC 240 V | $\checkmark$ | - | - |
| DC 24 V | $\checkmark$ | - | i |
| DC 48 V | $\checkmark$ | $x$ | i |
| DC 100 V | $\checkmark$ | $x$ | i |
| DC 110 V | i | $x$ | i |

Continuously rated shunt trip and undervoltage trip can not be fitted to the same ACB. However, the STR shunt trip can be used together with an undervoltage trip.

Notes: Double shunts require a special wiring loom to be fitted during manufacture. UVT cannot be fitted with a double shunt.
$\checkmark$-Stocked $X$-Not available
i) Available on indent only.

## TemPower Tripping options

Continuously-rated shunt trip device (CR)

| Type | Rated voltage (V) | Operational voltage (V) | Max. excitation current (A) | Opening time (max.) (ms) |
| :---: | :---: | :---: | :---: | :---: |
| AVR-1C | AC 100 | AC 70-110 | 0.48 | ( |
|  | AC 110 | AC 77-121 | 0.39 |  |
|  | AC 120 | AC 84-132 | 0.37 |  |
|  | AC 200 | AC 140-220 | 0.24 |  |
|  | AC 220 | AC 154-242 | 0.19 |  |
|  | AC 240 | AC 168-264 | 0.18 |  |
|  | DC 24 | DC 16.8-26.4 | 1.65 |  |
|  | DC 30 | DC 21-33 | 1.33 |  |
|  | DC 48 | DC 33.6-52.8 | 0.86 |  |
|  | DC 100 | DC 70-110 | 0.39 |  |
|  | DC 110 | DC 77-121 | 0.37 |  |
|  | DC 125 | DC 87.5-137.5 | 0.31 |  |
|  | DC 200 | DC 140-220 | 0.19 |  |
|  | DC 220 | DC 154-242 | 0.18 |  |

## Tripping options - Undervoltage Trip (UVT) Device

## Can be used to shunt trip the ACB

The Undervoltage Trip Device (UVT) monitors a single phase and trips the ACB when the control voltage drops below the opening voltage. When the control voltage is restored to the pick-up voltage, the ACB can be closed. The pick-up voltage is fixed to $85 \%$ of the rated voltage. The UVT device is available in an instantaneous or a 500 ms time delay version. Please refer to NHP for available monitoring voltages.
When a shunt facility is required to remotely open the ACB, a N/O push button or relay contact can be wired between control terminals 24 and 30 to remotely open the ACB main contacts. This is the recommended method of remotely opening the ACB because it uses the UVTs fail safe coil to 'trip' the main contacts. Alternatively a single shunt (STR) can be fitted together with the UVT coil. The UVT is a separate controller and coil that is not the same as the UV alarm.

## Single Phase Monitoring

Undervoltage trip control circuit (for AC)


Notes: --- Customer wiring
$\left.{ }^{1}\right) 1 \mathrm{~PB}$ and wiring to be supplied by user. Tripping signal PB contact must be rated for $48 \mathrm{~V} D C / 5 \mathrm{~mA}$. Apply tripping signal for at least 80 ms .
If a separate shunt trip facility is required (i.e. not using UVT trip terminals 24 and 30 as described above), a short time rated (STR) device can be provided.

## TemPower Tripping options

| Type of UVT Control Device | Rated voltage $50 / 60 \mathrm{~Hz}$ (V) | Operation- Pick-up al voltage Voltage (V) (V) |  | Coil <br> Excitation <br> Current <br> (A) | Power Consumption(VA) |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Normal | Reset |
| AUR-1CS | AC 100 | 35-70 | 85 |  |  |  |  |
| AUR-1CD | AC 110 | 38.5-77 | 93.5 |  |  |  |
|  | AC 120 | 42-84 | 102 |  |  |  |
|  | AC 200 | 70-140 | 170 |  |  |  |
|  | AC 220 | 77-154 | 187 |  |  |  |
|  | AC 240 | 84-168 | 204 |  |  |  |
|  | AC 380 | 133-266 | 323 |  |  |  |
|  | AC 415 | 133-266 | 352 |  |  |  |
|  | AC 440 | 154-308 | 374 |  |  |  |
|  | DC $24{ }^{1}$ ) | 8.4-16.8 | 20.4 |  |  |  |
|  | DC $48{ }^{1}$ ) | 16.8-33.6 | 40.8 |  |  |  |
|  | DC $100{ }^{1}$ ) | 35-70 | 85 |  |  |  |

Notes: ${ }^{1}$ ) Special specification. If a separate shunt trip facility is required (i.e. not using UVT trip terminals 24 and 30 as described above), a short time rated (STR) device can be provided.

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## TemPower Communications facility

As standard the TEMPro PLUS and TEMPro PREMIER are equipped with a MODBUS communications facility conforming to the following network interface I/O specifications:

TEMPro OCR

| Protocol | MODBUS |
| :--- | :--- |
| Transmission standard | RS-485 |
| Transmission method | Two wire (half duplex) |
| Topology | Multi drop bus |
| Transmission rate | 19.2 kbps maximum |
| Transmission distance | 1.2 km max. (at 19.2 kbps) |
| Data format | Modbus-RTU |
| Maximum number of data nodes | 32 |

The standard MODBUS communications facility enables variable monitoring only. ACB control (OPEN / CLOSE) over the MODBUS link requires an additional communications interface.

## Communications options

NHP offers additional external communications interfaces for other protocols such as Profibus ${ }^{\ominus}$, DeviceNet ${ }^{\text {TM }}$ and Ethernet. Furthermore ACBs fitted with the TEMPro range of OCRs can be remotely monitored and controlled via the TemVision Pro touch screen ${ }^{1}$ ).

| Description (required per ACB) ${ }^{\text {1 }}$ ) | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | ---: |
| Profibus ${ }^{\circledR}$ monitor \& control Interface | ARCOMMSMODPRO | $\mathbf{4 2 1 0 . 0 0}$ |
| DeviceNet $^{\top \mathrm{m}}$ monitor \& control Interface | ARCOMMSMODDEV | $\mathbf{4 2 1 0 . 0 0}$ |
| Ethernet monitor \& control Interface | ARCOMMSMOD2ETH | $\mathbf{4 2 1 0 . 0 0}$ |



Modbus Network

## Notes: ${ }^{1}$ ) ACBs must be fitted with a remote tripping device and charging motor.

 For TemVision Pro information, refer to NHP.
# TemPower <br> Monitored and communicated variables 

| Data variable | Description | TEMPro PLUS | TEMPro PREMIER |
| :---: | :---: | :---: | :---: |
| max./min. reset | Recorded max./min. variable | $\checkmark$ | $\checkmark$ |
| open/close status | Indicates the state of the main contacts | $\checkmark$ | $\checkmark$ |
| diagnosis - system alarm status Is the system alarm active? |  | $\checkmark$ | $\checkmark$ |
| OL pickup status | Is the overload status true? | $\checkmark$ | $\checkmark$ |
| STD pickup status | Is the short time delay status true? | $\checkmark$ | $\checkmark$ |
| INST pickup status | Is the Instant status true? | $\checkmark$ | $\checkmark$ |
| GFT pickup status | Is the UREF status true? | $\checkmark$ | $\checkmark$ |
| Line side earth fault status ${ }^{1}$ ) | Is the status true? | $x$ | $\checkmark$ |
| current - la | Phase current A (A) | $\checkmark$ | $\checkmark$ |
| current - lb | Phase current B (A) | $\checkmark$ | $\checkmark$ |
| current - Ic | Phase current C (A) | $\checkmark$ | $\checkmark$ |
| current - IN | (A) (4P ACB as a special spec.) | $\checkmark$ | $\checkmark$ |
| current - Ig | Phase current GF (A) | $\checkmark$ | $\checkmark$ |
| line voltage - Vab | - | $x$ | $\checkmark$ |
| line voltage - Vbc | - | $x$ | $\checkmark$ |
| line voltage - Vca | - | $x$ | $\checkmark$ |
| power factor - Pf | - | $x$ | $\checkmark$ |
| frequency - $F$ | Supply frequency | $x$ | $\checkmark$ |
| fault trip time | Speed of trip | $\checkmark$ | $\checkmark$ |
| diagnosis - MHT disconnect status | Is tripping coil connected? | $\checkmark$ | $\checkmark$ |
| active power - P | (kW) | $x$ | $\checkmark$ |
| total real energy - EP (HighHigh) | (kWh) | $x$ | $\checkmark$ |
| maximum current - I | Maximum phase current recorded | $\checkmark$ | $\checkmark$ |
| maximum current - linst | Maximum inst. current recorded | $\checkmark$ | $\checkmark$ |
| maximum active power - Pmax (kW) |  | $x$ | $\checkmark$ |
| fault current value | (A) | $\checkmark$ | $\checkmark$ |
| maximum voltage | Maximum voltage recorded | $x$ | $\checkmark$ |

All communications cabling should conform to the MODBUS standard. At a minimum the cabling should be shielded, of twisted pair construction and be AWG 24.

Typical MODBUS communication network


Notes: ${ }^{1}$ ) Restricted earth fault model only, not standard.

# TemPower <br> TemRelay external alarm module 

The TemRelay external alarm module provides individual trip/alarm indication from the OCR as well as monitoring basic variables. The TemRelay connects to ACBs via the RS485 interface.


## TemVision remote monitoring and control

The TemVision Pro series of touch screens is for remote monitoring and control of Terasaki ACBs on a 2-wire half-duplex RS485 network via the MODBUS protocol.

## Features

- Monitoring of variables from the OCR such as:
- On/off and trip status
- Phase currents
- Line voltages ${ }^{1}$ )
- Active power (kW) ${ }^{1}$ )
- Reactive power (kVar) ')
- Power factor ${ }^{1)}$
- Power consumption (kWh ${ }^{1}$ )
- On/off control of ACBs
- Trip indication and history of trip events
- Maintenance mode
- View and change protection settings
- Password protection


TemVision Pro 6" screen Maximum 6 ACBs


TemVision Max 10" screen Maximum 15 ACBs

| Description | Cat. No. | Price $\$$ |
| :--- | :--- | :---: |
| TemRelay | TEMRELAY | POA |
| TemVision Pro | TEMVISIONPRO | POA |
| TemVision Max | TEMVISIONMAX | POA |

Notes: ${ }^{1)}$ TEMPro Premier only.

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## TemPower TemPower Rack remote racking device for AR ACBs

NHP have developed a remote racking device for Terasaki AR ACBs to help improve operator safety in switchrooms.

## Features

- Racks ACBs between connected, test and isolated positions
- Remote operation of ACB on/off controls
- Controlled by a pendant attached to a 10 metre lead
- Integrated lifting trolley for ACB bodies
- Rechargeable battery power supply
- Requires no modification to ACBs - can be used on existing installations


Scan the QR code
to view the
TemPower
Rack video.

Description
Cat. No.
Price \$
TemPower Rack unit
ARTEMPOWERRACK
POA

## TemPower <br> TemPower 2 AR ACB service life and maintenance



## NHP ACB servicing

NHP offers a wide range of ACB preventative maintenance and servicing programs to keep your ACB fully operational. Offered services include:

- Trip unit calibration and secondary injection testing.
- ACB scheduled maintenance and servicing including contact restoration / replacement, parts lubrication, arc chute restoration, mechanical and electrical functional testing.
- On site commissioning and application support (field service).
$\square$ Full service reports are provided.
For further information on the available services and pricing please contact the NHP service department.


Notes: ${ }^{1}$ ) Expected service life based on endurance test. The service life of $A C B$ depends on the working and environmental conditions. Refer to NHP for the AR ACB "Maintenance, Inspection and Parts Replacement" guide for further information.

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## TemPower Retrofitting kits and installation kits

When replacing an obsolete air circuit breaker it is almost always necessary to modify the existing busbar alignment, mounting position and door cut-out. Retrofit kits and installation kits provide a cost effective third party solution that allows you to install a completely new Terasaki AR Air Circuit Breaker into many of the popular older brands cubicle with minor re-work and down time.
Retrofit kit: this is the remaking of connections etc. within the existing carriage to suit the new ACB. Typically the existing carriage remains in an altered form.
Installation kit: duplicates the connection and fixing points of the original ACB. The existing carriage is fully removed. Switchboard isolation is required.
Retrofit and installation kits can be purchased from NHP subject to our limitations of liability statement. For further details please contact NHP.
The table below shows the existing / obsolete ACB details (column 1), the Terasaki AR ACB body and carriage replacement (column 2), and either retrofit or installation kit type (column 3). Before selecting a retrofit or installation kit it is important to fully understand the specification of the existing/obsolete ACB .

| Existing / Obsolete air circuit breaker | Terasaki AR ACB equivalent frame size ${ }^{1}$ ) | Kit type | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT12,3P, V/V } \end{aligned}$ | AR212S, 3P | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT12, } 3 \mathrm{P}, \mathrm{H} / \mathrm{H} \end{aligned}$ | $\begin{aligned} & \text { AR212S,3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT16, 3P, V/V } \end{aligned}$ | AR216S, 3P (VV T\&B) | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT16, 3P, H/H } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT20, 3P, V/V } \end{aligned}$ | $\begin{aligned} & \text { AR220S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT } 25,3 \mathrm{P}, \mathrm{~V} / \mathrm{V} \end{aligned}$ | $\begin{aligned} & \text { AR325S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Installation | CONTACT NHP | POA |
| $\begin{aligned} & \text { Terasaki } \\ & \text { AT32, 3P, V/V } \end{aligned}$ | $\begin{aligned} & \text { AR332S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Installation | CONTACT NHP | POA |
| Nilsen NAB1 D8 3P | $\begin{aligned} & \text { AR208S, 3P } \\ & \text { (HV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Nilsen <br> NAB1 D12 3P | $\begin{aligned} & \text { AR212S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Nilsen <br> NAB1 D16 3P | AR216S, 3P (HH T\&B) | Retrofit | CONTACT NHP | POA |
| $\begin{aligned} & \text { Nilsen } \\ & \text { NAB1 D20 3P } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { AR220S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |

Notes: ${ }^{1}$ ) $\mathrm{VV}=$ vertical; $\mathrm{HH}=$ horizontal, $\mathrm{T} \& \mathrm{~B}=$ top terminal and bottom terminal.

## TemPower <br> Retrofitting kits and installation kits

| Existing / Obsolete Air circuit breaker | Terasaki AR ACB equivalent frame size ${ }^{1}$ ) | Kit type | Cat. No. | Price \$ |
| :---: | :---: | :---: | :---: | :---: |
| Nilsen NAB1 D25 3P | $\begin{aligned} & \text { AR325S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Nilsen <br> NAB1 D31 3P | $\begin{aligned} & \text { AR332S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Nilsen NAB1 D40 3P | $\begin{aligned} & \text { AR440S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Nilsen <br> NAB2 CBM 3P | AR212S, 3P (VV T\&B) | Retrofit | CONTACT NHP | POA |
| NAB2 3P Jig Set | Required for use for Nilsen NAB2 Kit | Retrofit | CONTACT NHP | POA |
| $\begin{aligned} & \text { Nilsen } \\ & \text { AB5/AB7 3P } \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { AR208S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| $\begin{aligned} & \text { Nilsen } \\ & \text { AB5/AB7 3P } \end{aligned}$ | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| $\begin{aligned} & \text { Nilsen } \\ & \text { AB5/AB7 3P } \end{aligned}$ | $\begin{aligned} & \text { AR332S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Unelec C9/8W 3 P | $\begin{aligned} & \text { AR208S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Unelec C9/12W 3P | AR212S, 3P (VVT\&B) | Retrofit | CONTACT NHP | POA |
| Unelec C9/16W 3P | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Unelec C9/20W 3P | $\begin{aligned} & \text { AR220S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Unelec C9/31W 3P | $\begin{aligned} & \text { AR332S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| $\begin{aligned} & \text { AEG } \\ & 1600 \mathrm{~A} 3 \mathrm{P} \end{aligned}$ | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Hundtwebr LH16 3P | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Hundtwebr LH2O 3P | $\begin{aligned} & \text { AR220S, 3P } \\ & \text { (VV T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Hawker CNP/16W 3P | $\begin{aligned} & \text { AR216S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |
| Hawker CNP/20W 3P | $\begin{aligned} & \text { AR220S, 3P } \\ & \text { (HH T\&B) } \end{aligned}$ | Retrofit | CONTACT NHP | POA |

Notes: ${ }^{1}$ ) $\mathrm{VV}=$ vertical; $\mathrm{HH}=$ horizontal, $\mathrm{T} \& \mathrm{~B}=$ top terminal and bottom terminal. As highlighted in the table above not all kit types are available ex-stock. All INDENT kits have a 4-6 week lead time from the receipt of a customer purchase order.

## TemPower Outline dimensions



TemPower 2 draw-out type - 3 and 4 pole outline dimensions (mm)

| Cat. No. | AR212SAR216S |  | $\begin{aligned} & \text { AR220S/ } \\ & \text { AR220H } \end{aligned}$ | AR332S/ <br> AR320H/ <br> AR316H |  | AR440SAR650 |  | AR663 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. of Poles | 3 P 4 P | 3 P 4 P | 3 P 4 P | 3 P 4 P | 3 P 4 P | 3 P 4 P | 3 P 4 P | 3 P 4 P |
| Drawout type | 354439 | 354439 | 354439 | 460580 | 460580 | 631801 | 7991035 | 7991034 |
|  | 460 | 460 | 460 | 460 | 460 | 460 | 460460 | 460460 |
|  | 345 | 345 | 345 | 345 | 345 | 375 | 380380 | 380380 |
|  | 40 | 40 | 40 | 40 | 40 | 53 | 6060 | 6060 |
| Approx. Body \& Weights carriage (kg) | 7386 | 7690 | 7994 | 105125 | 105125 | 139176 | 200260 | 220285 |
| Front Body \& rear only connect | $45 \quad 51$ | 4652 | 4652 | 5668 | 5668 | 7192 | 125160 | 140180 |
| with- draw- able ${ }^{1}$ ) | 2835 | $30 \quad 38$ | 3342 | 4957 | 4957 | 6884 | $75 \quad 100$ | $80 \quad 105$ |

Notes: ${ }^{1}$ ) Weights are based on normal specifications with the OCR and standard accessories.

## TemPower Our customers' needs

## Providing solutions



Switchboard builder
$\square$ Compact size for high packing density

- Zero arc space required for clearance
- Low temperature dissipation

Built in trip supervision circuit

- Fully rated neutral as standard
- Vertical, horizontal and front terminal connections are available
- Uniform panel cut out size

E Easy access to control, auxilary and position switch terminals

- Detailed product training available by NHP application engineers
- Manufactured in Australia, allowing for fast delivery and local technical support



## Consultant

Approvals and test: IEC 60947, AS3947-2 and A.S.T.A. certified

- Time Current Characteristics to IEC 60255-3 (SI, VI, EI curves)

Restricted and Unrestricted ground fault protection in one relay

- LSI characteristic curves as standard
- True r.m.s. protection up to 19th harmonic
- Sophisticated undervoltage/phase failure protection
- Integral reverse power protection and load shedding relay
- Only Terasaki can offer $\mathrm{I}_{\mathrm{cw}}=100 \mathrm{kA} / 1$ second in a small 3200 A frame size
- TemPower 2 ACB suffers no loss in performance when tripped through an external protection relay
- Super fast clearance times under fault



## End user

- System alarms that indicate tripping coil health
- Built in relay tester - can check on line without tripping ACB
- Contact temperature monitoring options

Fault diagnosis - type of fault, magnitude, tripping time \& trip history

- High making capacity for operator safety
- Communication to B.M.S. or S.C.A.D.A. system
- Main contacts can be changed within 15 minutes per pole
- Full technical support and ACB commissioning available via NHP
- Product servicing available from Australia's only Terasaki trained and certified ACB technicians


# Arc D-Tect <br> D1000 Arc Fault Protection system 




#### Abstract

Efficient protection of high, medium and low voltage switchgear A continuous supply of power is important in modern energy infrastructure and most production facilities. Wherever electrical energy is generated and distributed, arc flash faults and accidents are likely to occur. An arc protection system is an efficient way to maximise the safety and minimise the damages.


SELCO's D1000 arc protection system is designed to dramatically reduce the effects of arc flash faults in high, medium and low voltage switchgear.

## Fast protection is essential

An arc-fault in a switchboard or control gear develops within milliseconds and leads to the discharge of enormous amounts of energy. An arc fault is the result of a rapid release of energy due to an arcing fault between phase bus bars. If the arc flash is allowed to develop the result is that the massive energy discharge burns the bus bars, vaporising the copper and thus causing an explosion. Finally this may cause extensive material damage and jeopardise the safety of operational personnel.
An arc protection system operates much faster than conventional protection relays and thus damages caused by an arc flash fault can be kept at a minimum level. As a general guideline, an arc will not cause any damage if it is eliminated within 35 ms . If the arc is allowed to continue and last 100 ms some damage will occur. An arc fault lasting 500 ms may cause severe damage to the installation and will require extensive repair.
A short arc time is critical in order to avoid damage to personnel and material. It is therefore of vital importance that the source leading to the arc flash time is minimised and the power is disconnected as fast as possible SELCO's D1000 arc protection system is the solution to this problem.

# Arc D-Tect <br> Arc detecting relay system 

## D1000 Functionality

The D1000 arc protection system is an advanced and fast arc protection system, offering the following features and functionality:

- Compact unit - arc fault and overcurrent protection
- High speed arc fault detection less than 1 ms
- Over-current protection with detection within 1 ms
- Combines optical fibre and point sensors
- Real-time event loggingSelf-supervision of sensors and protection unit
- Easy installation and configuration via USB


## D1000 Arc flash protection unit

The D1000 is a stand-alone and high speed arc protection unit for electrical power distribution systems. D1000 supports both point and fibre sensor technologies for arc flash detection and supports up to six sensors. The sensors can be combined in any combination, depending on the application and requirements.

## Easy configuration

The D1000 is easy to install and set-up and in case any changes are needed this is easily done via the USB interface accessible from the front. The built-in user-friendly menu system is embedded in the D1000 unit and activates automatically when the unit is connected to a PC.
The built-in light sensor on the front makes it easy to adjust and verify that all sensors are correctly installed and equally sensitive. With the TRIP LEVEL adjustment on the front plate the sensitivity to light can be adjusted. The light range is 10-25,000 lux enabling use of sensors under different light conditions, indoor light, sunlight etc.


In small installations, the calibration TEST sensor can be used as a single arc detecting sensor, providing additional protection without added cost. Setup of the overcurrent detection, is easily done through the USB interface.

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Arc D-Tect<br>Arc detecting relay system

## Easy installation

The D1000 system is easy to install and made to implement in new switchgear installations as well as retrofit projects. Both the D1000 unit and sensors are quick and easy to install. A general guideline is to mount 1-2 sensors per cubicle or chamber. It is important to cover all horizontal/vertical busbars (1) as well as breaker compartments (2) and drawers. Example is shown below: D1000 relays can be linked (up to 4 relays) to provide expanded installation and sensing requirements.


## Flexible and efficient sensors

## A1000 point sensor

The point sensor is a light-sensitive element based on phototransistor technology. It detects visible light radiation which is captured at the cylindrical top. The A1000 point sensor has a detection area of up to 2 m with a characteristic of $180^{\circ} \times 360^{\circ}$. The A1000 supports self supervision, and a clear blinking built-in LED indicates that the sensor is active. If the sensor reaches the trigger level the LED will light up constantly. The A1000 sensor is supplied with a 10 m shielded cable. 6 sensors maximum.


## A2000 fibre sensor

The A2000 fibre sensor is a light sensitive element based on optical fibre technology. The A2000 fibre sensor is a fully flexible fibre with a detection angle of $360^{\circ}$ throughout the length of the fibre. The detection radius is up 2 meters. The fibre sensor is ideal to install in electrical cabinets with drawer sections. Allows the same coverage as approximately $6 \times$ A1000 point sensors. The fibre optic cable is available in 5 m or 8 m lengths. There is also another 10 m of wire cable attached to each end. The wire cable can be extended up to 50 m at each end.


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## Arc D-Tect <br> Arc detecting relay system

D1000 - wiring and installation

| 24 V battery <br> Back up | Internal or external <br> Supply |
| :--- | :--- |
| trip voltage |  |

 w. cable check A1000


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## Arc D-Tect <br> Arc detecting relay system

| D1000 Arc Protection Unit | D1000.0010 |
| :---: | :---: |
| Voltage Supply | $\begin{aligned} & 85-240 \mathrm{~V} \mathrm{AC} \\ & 100-250 \mathrm{~V} \text { DC } \\ & 24 \mathrm{~V} \text { Battery - Lead acid gel cell } \end{aligned}$ |
| Trip coil output | IGBT switch, $200 \mu$ s on-time, 2 s pulsed (configurable) |
| Trip coil voltage range | $\begin{aligned} & 24-600 \mathrm{VDC} \\ & 24-440 \mathrm{VDC} \\ & \hline \end{aligned}$ |
| Signal contacts | Online, Service, Tripped |
| Sensitivity | 10-25000 lux, Trip level adj. 1-9 |
| Current inputs | 3 -phase 5 A (75 A/1 sec) |
| Burden | $<0.25 \mathrm{VA} /$ inputs at 5 A |
| Current range | 1.5-3.0 $\times \ln$ ( $7.5-15 \mathrm{~A}$ ) |
| Response time | Less than 1 ms (arc fault) Less than 1 ms (overcurrent) |
| Number of detectors | Up to 6 |
| System expansion | Up to $4 \times$ D1000 units via Link connection |
| Interface | USB |
| Power consumption | $<3 \mathrm{~W}$ |
| Ambient temperature | -25 to $+70^{\circ} \mathrm{C}$ |
| Dimensions (WxHxD) | $200 \times 130 \times 52 \mathrm{~mm}$ |
| Mounting | 35 mm DIN Rail or screw-in |
| A1000 Sensor | A1000.0010 |
| Type | Point sensor |
| Detection area | $180^{\circ} \times 360^{\circ}-2 \mathrm{~m}$ |
| Length | 10 m shielded cable |
| Circuit check | Built-in - LED for visual feedback |
| Dimensions (WxHxD) | $32 \times 52 \times 21 \mathrm{~mm}$ |
| A2000 Sensor | A2000.0020 |
| Type | Fibre optical sensor |
| Detection area | $360^{\circ}$ |
| Length | 5 m flexible fibre optic cable (plus 10 m of wiring cable) |
| Circuit check | Built-in - LED for visual feedback |
| Dimensions (WxHxD) | $32 \times 52 \times 21 \mathrm{~mm}$ |
| A2000 Sensor | A2000.0010 |
| Type | Fibre optical sensor |
| Detection area | $360^{\circ}$ |
| Length | 8 m flexible fibre optic cable (plus 10 m of wiring cable) |
| Circuit check | Built-in - LED for visual feedback |
| Dimensions (WxHxD) | $32 \times 52 \times 21 \mathrm{~mm}$ |

## Approvals/standards

| EMC standards | EN60255-26 |
| :--- | :--- |
| Enclosure | IP 20 |

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## Arc D-Tect

D1000 Arc-fault protection system

Catalogue Numbers and ordering

|  | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| D1000 Arc protection unit | D1000 0010 | $\mathbf{5 6 1 0 . 0 0}$ |
| A1000 Arc point sensor 10 m | A1000 0010 | $\mathbf{5 5 0 . 0 0}$ |
| A2000 Arc fibre cable sensor 5 m | A2000 0020 | $\mathbf{2 0 0 0 . 0 0}$ |
| A2000 Arc fibre cable sensor 8 m | A2000 0010 | $\mathbf{3 0 3 0 . 0 0}$ |
| D1000 DIN rail mounting clips | D1000DINCLIPS | $\mathbf{1 1 . 4 0}$ |



Built-in overcurrent protection


Extended coverage with links input


Efficent self-supervision

Notes: Old sensor types ADR/ A0200/ A0300 can be used with the new D1000 relay. Refer NHP for connection details.

Earth Leakage Relays

|  | Page |
| :--- | ---: |
| Earth leakage relays | $8-2$ |
| Surface mounting type TZS series | $8-4$ |
| DIN Rail mounting type RD3A series | $8-5$ |
| DIN Rail mounting type RD1B series | $8-6$ |
| Panel mounting type RD1DF series | $8-7$ |
| Panel mounting type RD1EP series | $8-8$ |
| Panel mounting type RD3E2 series | $8-10$ |
| Panel mounting type RD1G2 series | $8-12$ |
| Mining earth leakage relay | $8-14$ |
| Panel mount mining relays, DSRM72 and DSR48T Series | $8-15$ |
| Remote current transformer (toroid) TD and DSR Series |  |
| Accessories |  |




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## TZS series

## Features

- Adjustable time range 0.3-2 s
$\square$ Sensitivity (adj.) $30 \mathrm{~mA}-1 \mathrm{amp}$.
- Immune to false tripping via harmonics
- High vibration withstand
- Output C/O contact
- Indication - LED
- Reset function - electrical


TZS relay

| Mounting | Voltage | Adj. <br> sensitivity range | Adj. time <br> rat. No. | Price \$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Surface | $120 / 240$ <br> V AC | 30 mA a-1 <br> amp | $0.3-2 \mathrm{~s}$ | TZS AD120240V | $\mathbf{6 8 0 . 0 0}$ |
| Surface | $400 / 440$ <br> V AC | $30 \mathrm{~mA} A-1$ <br> amp | $0.3-2 \mathrm{~s}$ | TZS AD415440V | $\mathbf{6 8 0 . 0 0}$ |
| Surface | 24 VAC | $30 \mathrm{~mA} A-1$ <br> amp | $0.3-2 \mathrm{~s}$ | TZS AD24VAC | $\mathbf{6 8 0 . 0 0}$ |
| Flush <br> (collar only) | - | - | - | TPD OSZ | $\mathbf{1 0 2 . 0 0}$ |

Tripping times

| Rated operating time <br> (sec) | Operating time range <br> $(\mathbf{s e c})$ | Non-operating time range <br> $(\mathbf{s e c})$ |
| :--- | :--- | :--- |
| 0.3 | $0.2-0.36$ | 0.15 |
| 0.5 | $0.4-0.6$ | 0.38 |
| 1 | $0.8-1.2$ | $0.7-1.25$ |
| 2 | $1.3-2.0$ | $0.7-1.25$ |

## Standard features

| Earth leakage detection | current operated type |
| :--- | :--- |
| Internally mounted contact | $1 \mathrm{C} / \mathrm{O}$ |
| Earth leakage indication | LED |
| Reset function (electrical) | Yes |
| Test button | Yes |
| Remote reset (power source) | 1 VA |
| Dimensions (mm) W/H/D | $60 / 104 / 78$ |
| Weight (kg) (relay only) | 0.22 |


| Toroidal CT - ZCT only (remote, add to relay) <br> Max. cable <br> $\mathbf{2}$ wire |  |  |  |  |
| :--- | :--- | :--- | :--- | ---: |
| Max. cable <br> 4 wire | Internal <br> diameter | Cat. No. | Price \$ |  |
| $8 \mathrm{~mm}^{2}$ | $5.5 \mathrm{~mm}^{2}$ | 15 mm | TZS-15 | $\mathbf{1 1 3 . 0 0}$ |
| $30 \mathrm{~mm}^{2}$ | $22 \mathrm{~mm}^{2}$ | 24 mm | TZS-24 | $\mathbf{3 4 0 . 0 0}$ |
| $100 \mathrm{~mm}^{2}$ | $80 \mathrm{~mm}^{2}$ | 40 mm | TZS-40 | $\mathbf{6 3 0 . 0 0}$ |
| $325 \mathrm{~mm}^{2}$ | $250 \mathrm{~mm}^{2}$ | 68 mm | TZS-68 | $\mathbf{1 0 5 0 . 0 0}$ |
| $850 \mathrm{~mm}^{2}$ | $600 \mathrm{~mm}^{2}$ | 100 mm | TZS-100 | $\mathbf{1 6 1 0 . 0 0}$ |

Notes: Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

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## TZS series

Outline dimensions (mm)


Rating of output contact

|  | Resistance load <br> cos $\varnothing=\mathbf{1}$ | Inductive load cos <br> $\boldsymbol{\varnothing = \mathbf { 0 . 4 } ( \mathbf { L } / \mathbf { R } = \mathbf { 7 } \mathbf { ~ m s } )}$ | Min. load |
| :--- | :--- | :--- | :--- |
| $120 / 230 \mathrm{~V} \mathrm{AC}$ | 6 A | 3.5 A | 10 mA at 5 V DC |
| 30 V DC | 6 A | 3 A | 10 mA at 5 V DC |

Connection diagram - Residual current relay


Notes: For 415 V AC or 440 V AC contact NHP for availability.
The output contacts remain until the RESET button is operated.
Should the control power supply fail the contacts automatically reset.

## DIN rail mount RD series RD3A

Standard AS 60947-2 (Annex M)
Core balance earth leakage relay
Adjustable $I \Delta \mathrm{n}$ up to 30 amps
Adjustable trip time up to 5 s
Harmonic filter
2 wire toroid connection
Field selectable negative/positive security
Instantaneous display as percentage $I \Delta \mathrm{n}$
DIN rail mounting (2 module)

RD relays in conjunction with a ring current transformer (toroid) provide earth leakage protection of electrical distribution systems and electrical equipment.

## Features

- Adjustable: $0,0.15,0.25,0.5,1,2.5,5 \mathrm{sec}$
- Adjustable trip current: . $03, .05, .075,0.1,0.15,0.2,0.3 \mathrm{~A}$ in 3 ranges $\mathrm{x} 1, \mathrm{x}$ $10, \times 100$
- Automatic reset option
- Trip: one changeover contact (5 A - 250 V AC $\cos 1.0,5 \mathrm{~A}-30 \mathrm{~V}$ DC)
- Local reset/test and remote reset/test ${ }^{1}$ )

LED indication: green (healthy), red (tripped), yellow (\%| $\mathrm{nn} 20 \%, 40 \%, 60 \%$ )

- IP 50 Front cover, IP 20 terminals
- Test buttons checks relay function and toroid connections

| Auxiliary Voltage | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 24 V AC | RD3AF1N (24 V AC) | $\mathbf{9 1 0 . 0 0}$ |
| 110 V AC | RD3AF12 (110 V AC) | $\mathbf{9 1 0 . 0 0}$ |
| 240 V AC | RD3AF14 (240 V AC) | $\mathbf{9 1 0 . 0 0}$ |
| 415 V AC | RD3AF15 (415 V AC) | $\mathbf{9 1 0 . 0 0}$ |
| $24-150$ V DC | RD3AF1H (24-150 V DC) | $\mathbf{9 1 0 . 0 0}$ |

Wiring diagram - RD3A


[^47]
## DIN rail mount RD series RD1B

- Standard AS 60947-2 (Annex M)
- Core balance earth leakage relay
- Adjustable $1 \Delta \mathrm{n}$ up to 30 amps
- Adjustable trip time up to 5 s
- Harmonic filter
- 2 wire toroid connection
- Field selectable negative/positive security
- Instantaneous display as percentage $I \Delta n$
- DIN rail mounting (4 module)


RD1B

RD relays in conjunction with a ring current transformer (toroid) provide earth leakage protection of electrical distribution systems and electrical equipment.

## Features

- Adjustable: $0,0.15,0.25,0.5,1,2.5,5 \mathrm{sec}$
- Adjustable trip current: . $03, .05, .075,0.1,0.15,0.2,0.3 \mathrm{~A}$ in 3 ranges $x 1, x$ $10, \times 100$
- Automatic reset option
- Trip: one changeover contact (5 A - 250 V AC $\cos 1.0,5 \mathrm{~A}-30 \mathrm{~V}$ DC)
- Local reset/test and remote reset/test ${ }^{1}$ )
- Changeover contact - selectable between alarm preset $50 \% \mathrm{I} \Delta \mathrm{n}$ and second trip contact
- Field selectable - high or low harmonic filter circuit

LED indication: green (healthy), red (tripped), yellow
(\%| n n $20 \%, 30 \%, 40 \%, 50 \%$ )

- IP 40 Front cover, IP 20 terminals
- Test buttons checks relay function and toroid connections

| Auxiliary Voltage | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 110 V AC | RD1B212 | $\mathbf{1 0 8 0 . 0 0}$ |
| 240 V AC | RD1B214 | $\mathbf{1 0 8 0 . 0 0}$ |
| 415 V AC | RD1B215 | $\mathbf{1 0 8 0 . 0 0}$ |
| $24-150$ V DC | RD1B21H | $\mathbf{1 0 8 0 . 0 0}$ |

## Wiring diagram - RD1B



Notes: ${ }^{1}$ ) Remote test on AC versions only. Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

## SP4(2) JEBAesist Lowood SPS - Electrical Enstallationgema|Manual

## Panel mount RD series

RD1DF

- Standard AS 60947-2 (Annex M)
- Core balance earth leakage relay
- Adjustable $I \Delta$ n up to 30 amps
- Adjustable trip time up to 5 sec
- Harmonic filter
- 2 wire toroid connection
. Field selectable negative/positive security


RD1D

## Features

- Panel mounting 48 mm
- Adjustable: $0,0.15,0.25,0.5,1.0,2.5,5 \mathrm{sec}$
- Adjustable trip current: . $03, .05, .075,0.1,0.15,0.2,0.3 \mathrm{~A}$, in 3 ranges $\mathrm{x} 1, \mathrm{x}$ $10, \times 100$
- Automatic reset option

Trip - one changeover contact (5 A - 250 V AC cos 1.0, 5 A - 30 V DC)

- Local and remote reset/test
- LED indication: green (healthy), red (tripped)
- IP 40 Front cover, IP 20 terminals
- Test buttons checks relay function and toroid connections

| Auxiliary Voltage | Cat. No. | Price \$ |
| :--- | :--- | :---: |
| 110 V AC | RD1DF12 | $\mathbf{5 2 0 . 0 0}$ |
| 240 V AC | RD1DF14 | $\mathbf{5 2 0 . 0 0}$ |
| 415 V AC | RD1DF15 | $\mathbf{5 2 0 . 0 0}$ |

## Wiring diagram




## SP4(2) JEhnesISt Lowood SPS - Electrical AnstallationgQM|Manual

## Panel mount RD series

RD1EP

Standard AS 60947-2 (Annex M)

- Core balance earth leakage relay
- Adjustable I n up to 30 amps
- Adjustable trip time up to 5 sec
- Harmonic filter
- 2 wire toroid connection

Field selectable negative/positive security


## Features

- Panel mounting 72 mm
$\square$ Adjustable: $0,0.15,0.25,0.5,1.0,2.5,5 \mathrm{sec}$
- Adjustable trip current: . $03, .05, .075,0.1,0.15,0.2,0.3 \mathrm{~A}$ in 3 ranges $\times 1$, x 10, x 100
- Changeover contact-selectable between alarm pre-set $50 \% \mathrm{I} \mathrm{n}$ and extra trip contact (5 A - 250 V AC $\cos 1.0,5 \mathrm{~A}-30 \mathrm{~V}$ DC)
- Trip - one changeover contact (5 A - $250 \mathrm{~V} \mathrm{AC}, \cos 1.0,5 \mathrm{~A}-30 \mathrm{~V}$ DC)
- Local and remote reset/test ${ }^{1}$ )

LED indication: green (healthy), red (tripped), yellow (\%I $\Delta \mathrm{n} 20 \%, 30 \%, 40 \%, 50 \%$ )

- IP 40 Front cover, IP 20 terminals
- Test buttons checks relay function and toroid connections

| Auxiliary Voltage | Cat. No. | Price $\mathbf{\$}$ |
| :--- | :--- | :---: |
| 110 V AC | RD1EP212 | $\mathbf{9 1 0 . 0 0}$ |
| 240 V AC | RD1EP214 | $\mathbf{9 1 0 . 0 0}$ |
| 415 V AC | RD1EP215 | $\mathbf{9 1 0 . 0 0}$ |
| $24-150$ V DC | RD1EP21H | $\mathbf{9 1 0 . 0 0}$ |

## Wiring diagram



## Notes: ${ }^{1}$ ) Remote test on AC versions only.

Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

# Panel mount RD series 

RD3E2
Standard AS 60947-2 (Annex M)
Core balance earth leakage relay
Adjustable I $\Delta$ n up to 30 amps
Adjustable trip time up to 5 sec
Field selectable negative/positive security
Instantaneous digital display
2 wire toroid connection
Monitor function ${ }^{\text {') }}$


RD3E2

Technical data

| Aux. voltage | $110,240 \& 415 \mathrm{~V} \mathrm{AC} \quad 50 / 60 \mathrm{HZ}$ or $24-150 \mathrm{~V} \mathrm{DC}$ |
| :--- | :--- |
| Contact rating | $5 \mathrm{~A}-250 \mathrm{~V} \mathrm{AC} \cos 1.0 ; 3 \mathrm{~A}-250 \mathrm{~V} \mathrm{AC} \cos 0.4 ; 5 \mathrm{~A}-30 \mathrm{~V} \mathrm{DC}$ |
| Pre trip alarm | $50 \% \mathrm{I} \mathrm{n}$ |
| Indication | Digital display -3 digits |
| Test | Tests relay function and toroid connections |
| IP rating | IP 40 front frame; IP 20 terminals |
| Operating temperature $-25^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$ |  |

## Features

- Panel mounting 72 mm
- Adjustable time: $0,0.15,0.25,0.5,1.0,2.5,5$, sec

Adjustable trip current-. $03, .05, .075,0.1,0.15,0.2,0.3 \mathrm{~A}$, in 3 ranges $\mathrm{x} 1, \mathrm{x}$ $10 \times 100$

- Digital indication of residual current-3 digits
- N/O contact-selectable between alarm pre-set $50 \% \mathrm{I} \Delta \mathrm{n}$ and extra trip contact
- Trip - one changeover contact
- Local and remote reset/test ${ }^{2}$ )

| Auxiliary Voltage | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 110 V | RD3E212B | $\mathbf{1 5 1 0 . 0 0}$ |
| 240 V | RD3E217B | $\mathbf{1 5 1 0 . 0 0}$ |
| 415 V | RD3E218B | $\mathbf{1 5 1 0 . 0 0}$ |
| $24-150 \mathrm{~V} \mathrm{DC}$ | RD3E21HB | $\mathbf{1 5 1 0 . 0 0}$ |

Notes: ${ }^{1)}$ Relay can operate as an earth leakage relay or as a digital meter with trip contacts and current setting disabled. This monitor function is ideal when first selecting the current settings and monitoring the installation.
${ }^{2}$ ) Remote test on AC version only.
Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

Wiring diagram - RD3E2
S 291/107


Dimensions (mm)


Rear view RD3E21

## Panel mount RD series

RD1G2
Standard AS 60947-2 (Annex M)
Core balance earth leakage relay
Adjustable sensitivity 30 mA to 30 A
Adjustable trip time up to 5 sec
Field selectable negative/positive security
Reduced depth housing
2 wire toroid connection
Continuous permanent test toroid connections
Harmonic filter
Pre trip alarm


Technical data

| Aux. voltage | $110 \mathrm{~V} \mathrm{AC}, 240 \mathrm{~V} \mathrm{AC}$ or 415 V AC $50 / 60 \mathrm{~Hz}$ |
| :--- | :--- |
| Contact rating | 5 A-250 V AC $\cos 1.0 ; 3 \mathrm{~A}-250 \mathrm{~V} \mathrm{AC} \cos 0.4 ; 5 \mathrm{~A}-30 \mathrm{~V} \mathrm{DC}$ |
| Indication | Supply healthy - green LED <br> Relay tripped - red LED |
| \%IAn- LEDS 20, 30, 40 and $50 \%$ |  |
| Test | Test button: Tests integrity of relay internal trip circuit <br> Permanent test: Continuously monitors toroid connections <br> and trip circuit |
| IP rating | IP 40 front frame; IP 20 terminals |

Operating temperature $-5^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$

## Features

- Panel mounting 96 mm
- Adjustable time delay - $0,0.15,0.25,0.5,1.0,2.5,5 \mathrm{sec}$
- Adjustable trip current - $0.03,0.05,0.75,0.1,0.15,0.2,0.3 \mathrm{~A}$ in range $\mathrm{x} 1, \mathrm{x}$ $10, \times 100$
- Field selectable negative/positive security
- Trip - 1 changeover contact
- Local and remote reset/test
- Changeover contact selectable between alarm preset $50 \% \mathrm{I} \mathrm{n}$ and extra trip contact

| Auxiliary Voltage | Cat. No. | Price \$ |
| :--- | :--- | ---: |
| 110 V AC | RD1G212 | $\mathbf{1 0 0 0 . 0 0}$ |
| 240 V AC | RD1G214 | $\mathbf{1 0 0 0 . 0 0}$ |
| 415 V AC | RD1G215 | $\mathbf{1 0 0 0 . 0 0}$ |

Notes: Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

## Panel mount RD series

RD1G2

Dimensions (mm) RD1G2


Wiring diagram - RD1G2


## Panel mount mining relay series

DSRM72 and DSR48TStandard AS/NZS 2081:2011
Core balance earth leakage relay
Adjustable sensitivity $0.03 \mathrm{~A}-0.5 \mathrm{~A}$

- Adjustable trip time $0.05 \mathrm{sec}-0.5 \mathrm{sec}$
- Separate test unit for circuit integrity testing
- Four wire toroid connection
- Field selectable negative/positive security

Field selectable function of outputs


Technical data (DSRM72)

| Aux. voltage | 240 V or $110 \mathrm{~V} \mathrm{AC} 50 / 60 \mathrm{~Hz}, 24 \mathrm{~V}$ DC |
| :---: | :---: |
| Contact rating | $5 \mathrm{~A}-250 \mathrm{~V} \mathrm{AC} \cos 1$; $3 \mathrm{~A} 250 \mathrm{~V} \mathrm{AC} \cos 0.4$; 5 A 30 V DC |
| Indication | Supply healthy - green LED |
|  | Power fail - Changeover contact |
|  | Relay tripped - red LED |
|  | Toroid fault - flashing red LED |
|  | \% I 4 n - LEDs 20, 30, 40 and $50 \%$ |
| Test | Internal relay test button on unit. |
|  | Circuit integrity test using external DSR48T. |
| IP rating | IP 40 front frame; IP 20 terminals |
| Operating temperature | $-10^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$ |

## Features

■ Units supplied complete with separate test device DSR48T

- Panel mounting 72 mm
- Adjustable trip current -7 steps: $0.03,0.06,0.1,0.2,0.3,0.4 \& 0.5$
- Adjustable trip time -7 steps: $0.05,0.1,0.15,0.2,0.3,0.4$ \& 0.5
- Choice of output contacts $2 \times$ AL or $1 \times$ AL $+1 \times$ Power Fail
- Negative/Positive security
- Complies with standard AS/NZS 2081:2011
- Latching contact

| Auxiliary Voltage |  | Cat. No. | Price ${ }^{\mathbf{\$}}$ |
| :--- | :--- | :--- | ---: |
| 110 V AC | Kit $^{1}$ ) | DSRM110V ${ }^{1}$ ) | $\mathbf{1 2 0 0 . 0 0}$ |
| 240 V AC | Kit $^{1}$ ) | DSRM240V ${ }^{1}$ ) | $\mathbf{1 2 0 0 . 0 0}$ |
| 24 V DC | Relay only | DSRM7224 ${ }^{2}$ ) | $\mathbf{9 8 0 . 0 0}$ |
| 110 V AC | Relay only | DSRM72110 | $\mathbf{9 8 0 . 0 0}$ |
| 240 V AC | Relay only | DSRM72240 | $\mathbf{9 8 0 . 0 0}$ |
| 110 V AC | Test unit | DSR48TD110 | $\mathbf{3 9 0 . 0 0}$ |
| 240 V AC | Test unit | DSR48TD240 | $\mathbf{3 9 0 . 0 0}$ |

Notes: ${ }^{1)}$ Part number is made up of 1 x relay \& 1 x test unit.
${ }^{2}$ ) Can be used with AC test unit.

## SP4(2) JEMASA1St Lowood SPS - Electrical Enstallationg OMA MAanual

## Panel mount mining relay series <br> DSRM72 and DSR48T

## Al. 2

A1. 2


A1.aux
Al.aux


For correct working according to AS/NZS 2081:2011 the device shall be set as positive security Ne.
DSR48TD - Test device


DSRM72-Relay


## Remote toroids

Type TD Series

## TD series

Only TD type toroids are to be used in conjunction with the NHP range of RD residual current relays. Care should be taken to select a toroid size closest to the diameter of the cables being protected. Also ensure the minimum possible distance between the toroid and relay to ensure maximum
 accuracy.

Closed core toroids (2 wire)

| Min. <br> $\mid \Delta n$ <br> (A) ${ }^{1}$ ) | Nom$\ln (A)$ | Max. <br> In <br> $\left.(A)^{2}\right)$ | Internal diameter (mm) | Overall dimensions (mm) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | A | B | C | Cat. No. | Price \$ |
| 0.03 | 65 | 390 | 28 | 59 | 59 | 47 | TDGA2 | 225.00 |
| 0.03 | 70 | 420 | 35 | 113 | 92 | 56 | TDGB2 | 300.00 |
| 0.03 | 90 | 540 | 60 | 112 | 105 | 56 | TDGH2 | 325.00 |
| 0.03 | 170 | 1020 | 80 | 160 | 125 | 56 | TDGC2 | 375.00 |
| 0.1 | 250 | 1500 | 110 | 198 | 165 | 56 | TDGD2 | 570.00 |
| 0.3 | 250 | 1500 | 140 | 234 | 200 | 56 | TDGE2 | 790.00 |
| 0.3 | 400 | 2400 | 210 | 323 | 290 | 64 | TDGF2 | 950.00 |

Open (split) core toroids (2 wire)

| Min. $1 \Delta n$ <br> (A) ${ }^{1}$ ) | Nom.$\ln (A)$ | Max. In <br> $\left.(A)^{2}\right)$ | Internal diameter (mm) | Overall dimensions (mm) |  |  |  | Price \$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | H | W | D | Cat. No. |  |
| 0.5 | 250 | 1500 | 110 | 214 | 235 | 79 | TDAA2 | 1000.00 |
| 0.5 | 250 | 1500 | 150 | 259 | 275 | 79 | TDAB2 | 1310.00 |
| 1.0 | 630 | 3780 | 310 | 386 | 400 | 30 | TDAC2 | 2130.00 |



Notes: ${ }^{1)}$ Lowest value of $I \Delta n$ to be set on relay with this toroid connected.
${ }^{2}$ ) Values shown are valid only for conductors passing exactly in the middle of the toroid.

## SP4 Thandedist Lowood SPS - Electricalenstallationg OMAManual

## Remote toroids

## Type DSR Series

## DSR series

Only the DSR type toroids are to be used in conjunction with the NHP range of DSRM mining relays. The four wire toroid is vital for compliance to AS/ NZS 2081:2011.

Closed core toroids (4 wire)

| Min. <br> $\mid \Delta n$ <br> (A) ${ }^{1}$ ) | Nom.$\ln (A)$ | Max. <br> In <br> $\left.(A)^{2}\right)$ | Internal diameter (mm) | Overall dimensions (mm) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | A | B | C | Cat. No. | Price \$ |
| 0.03 | 70 | 420 | 35 | 113 | 92 | 56 | DSR35DEL | 305.00 |
| 0.03 | 170 | 1020 | 80 | 160 | 125 | 56 | DSR80DEL | 375.00 |
| 0.1 | 250 | 1500 | 110 | 198 | 165 | 56 | DSR110DEL | 580.00 |
| 0.3 | 250 | 1500 | 140 | 234 | 200 | 56 | DSR140DEL | 800.00 |
| 0.3 | 400 | 2400 | 210 | 323 | 290 | 64 | DSR210DEL | 960.00 |

## Accessories

|  | Cat. No. | Price $\$$ |
| :--- | :--- | ---: |
| IP 65 - Front cover to suit $48 \times 48$ panel mount relay | RD4848C | $\mathbf{2 0 0 . 0 0}$ |
| IP65 - Front cover to suit $72 \times 72$ panel mount relay | RD7272C | $\mathbf{2 0 0 . 0 0}$ |
| IP 65 - Front cover to suit $96 \times 96$ panel mount relay | RD9696C | $\mathbf{2 5 5 . 0 0}$ |
| $72 \times 72$ mm to $96 \times 96$ mm adapter plate | RD7296A | $\mathbf{8 8 . 0 0}$ |



Notes: ${ }^{1}$ ) Lowest value of $I \Delta n$ to be set on relay with this toroid connected.
${ }^{2}$ ) Values shown are valid only for conductors passing exactly in the middle of the toroid.

## TL101 TRANSFER SWITCH CONTROLLER

## NHer

The soft touch TL101 controller automatically or manually switches a load from a main line to an emergency supply in the event of a power failure.


- Genuine $144 \times 144$ mm controller solution
- User friendly display and menu selection
- Large selection of functions and options as standard


## TemLogic (f) TERASAKI

## SP4(63) jamesist Losiscegheps - Electrical Installation EAMManual

Technical reference data

|  | Page |
| :--- | ---: |
| Din-T MCB: Ratings table | $9-2$ |
| Din-T MCB: Effects of frequency | $9-3$ |
| Din-T MCB: Time current curves | $9-4$ |
| Din-T MCB: B, C and D curve definitions | $9-7$ |
| Din-T MCB: Temperature compensation curves | $9-8$ |
| DC current circuit breaker selection table | $9-9$ |
| MCB Fuse-fault current limiting | $9-10$ |
| Selectivity/Cascade: MCB \& MCCB | $9-11$ |
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| Short circuit current calculator | $9-22$ |
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| MCCB Cross reference | $9-67$ |
| RCD/Earth Leakage applications and AS/NZS Standards | $9-68$ |
| IP Ratings chart | $9-70$ |
| NHP Technical News publications | $9-71$ |



## Din-T MCB

Features

| Decription | $\begin{aligned} & \text { Din-T } 6 \\ & 2 \text { to } 63 \text { A } \end{aligned}$ |  |  | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \text { to } 63 \mathrm{~A} \end{aligned}$ |  |  |  | $\begin{aligned} & \text { Din-T } 15 \\ & 6 \text { to } 63 \text { A } \end{aligned}$ |  |  |  | $\begin{aligned} & \text { Din-T } 10 \mathrm{H} \\ & 80 \text { to } 125 \mathrm{~A} \end{aligned}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| No. of poles | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Protected poles | 1 | 2 | 3 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Width (mm) | 18 | 36 | 54 | 18 | 36 | 54 | 72 | 18 | 36 | 54 | 72 | 27 | 54 | 81 | 108 |
| Depth (mm) ${ }^{\text {4 }}$ ) | 68 |  |  | 68 |  |  |  | 68 |  |  |  | 70 |  |  |  |
| Rated voltage | 240/415 V AC |  |  | 240/415 V AC |  |  |  | 240/415 V AC |  |  |  | 240/415 V AC |  |  |  |
| Max. current In | 63 A |  |  | 63 A |  |  |  | 63 A |  |  |  | 125 A |  |  |  |
| Calibration temp. ${ }^{\circ} \mathrm{C}$ | 30 |  |  | 30 |  |  |  | 40 |  |  |  | 40 |  |  |  |
| No. of operations |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{aligned} & 220 \mathrm{~V} \ln \\ & C O S=0.9 \end{aligned}$ | 10000 |  |  | 10000 |  |  |  | 4000 |  |  |  | 4000 |  |  |  |
| $\begin{aligned} & 415 \mathrm{~V} \ln \\ & C O S=0.9 \end{aligned}$ | 10000 |  |  | 10000 |  |  |  | 4000 |  |  |  | 4000 |  |  |  |
| Insulation resistance | >10 Mohm |  |  | >10 Mohm |  |  |  | >10 Mohm |  |  |  | >10 Mohm |  |  |  |
| Dielectric rigidity | $>2.5 \mathrm{kV}$ |  |  | $>2.5 \mathrm{kV}$ |  |  |  | $>2.5 \mathrm{kV}$ |  |  |  | $>2.5 \mathrm{kV}$ |  |  |  |
| Terminal capacity |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| line mm² | 35 |  |  | 35 |  |  |  | 35 |  |  |  | 70 |  |  |  |
| load mm ${ }^{2}$ | 35 |  |  | 35 |  |  |  | 35 |  |  |  | 70 |  |  |  |

DC application ${ }^{3}$ )

| Decription | $\begin{aligned} & \text { Din-T } 6 \\ & 2 \text { to } 63 \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \text { to } 63 \mathrm{~A} \\ & \hline \end{aligned}$ | Din-T 15 <br> 6 to 63 A | $\begin{aligned} & \text { Din-T 10H } \\ & 80 \text { to } 125 \text { A } \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
| Max. voltage | $48110{ }^{1}$ )-- | $48110^{1}$ )-- | $48110{ }^{1}$ )-- | $125^{1}$ ) $250^{\text {2 }}$ )-- |
| No. operations at $\mathrm{T} \leq 15 \mathrm{~ms}$ | 10000 | 10000 | 10000 | 40000 |
| Short circuit kA at $\mathrm{T} \leq 15 \mathrm{~ms}$ | 2025 - | 2530 - | 2530 - | 10-10- |

Notes: DC magnetic trip current is approximately $40 \%$ higher than $50 / 60 \mathrm{~Hz}$.
${ }^{1}$ ) Series connection 2 pole MCB.
${ }^{2}$ ) Series connection 4 pole MCB.
${ }^{3}$ ) For DC switching at 250 V and 500 V DC refer latest edition of Part C catalogue for ratings information.
${ }^{4}$ ) Depth measurement, excluding toggle.

## Effects of frequency on the tripping characteristic

Din-T 6, 10, 10H, 15

All the MCBs are designed to work at frequencies of $50-60 \mathrm{~Hz}$, therefore to work at different values, consideration must be given to the variation of tripping characteristics. The thermal tripping does not change with variation of the frequency but the magnetic tripping values can be up to $50 \%$ higher than the ones at $50-60 \mathrm{~Hz}$.

Tripping characteristics according to IEC 60898

| $\mathbf{6 0 ~ H z}$ | $\mathbf{1 0 0 ~ H z}$ | $\mathbf{2 0 0 ~ H z}$ | $\mathbf{3 0 0 ~ H z}$ | $\mathbf{4 0 0 ~ H z}$ |
| :--- | :--- | :--- | :--- | :--- |
| 1 | 1.1 | 1.2 | 1.4 | 1.5 |

Power losses Din-T 6, 10, 10H, 15
The power losses are calculated by measuring the voltage drop between the incoming and the outgoing terminals of the device at rated current.

Power loss per pole

| In $(\mathbf{A})$ | Voltage drop (V) | Energy Loss (W) | Resistance (Mohm) |
| :--- | :--- | :--- | :--- |
| 0.5 | 2.230 | 1.115 | 4458.00 |
| 1 | 1.270 | 1.272 | 1272.00 |
| 2 | 0.620 | 1.240 | 310.00 |
| 3 | 0.520 | 1.557 | 173.00 |
| 4 | 0.370 | 1.488 | 93.00 |
| 6 | 0.260 | 1.570 | 43.60 |
| 8 | 0.160 | 1.242 | 19.40 |
| 10 | 0.160 | 1.560 | 15.60 |
| 13 | 0.155 | 2.011 | 11.90 |
| 16 | 0.162 | 2.586 | 10.10 |
| 20 | 0.138 | 2.760 | 6.90 |
| 25 | 0.128 | 3.188 | 5.10 |
| 32 | 0.096 | 3.072 | 3.00 |
| 40 | 0.100 | 4.000 | 2.50 |
| 50 | 0.090 | 4.500 | 1.80 |
| 63 | 0.082 | 5.160 | 1.30 |
| 80 | 0.075 | 6.000 | 0.90 |
| 100 | 0.075 | 7.500 | 0.75 |
| 125 | 0.076 | 9.500 | 0.60 |

Din-T time current curves Din-T 6 and 10

Tripping characteristics according to IEC 60898
Din-T 10 B Curve devices
Curve B (3-5xIn)


Din-T time current curves Din-T 6 and 10

Tripping characteristics according to IEC 60898
Din-T 6, 10, 10H, 15, DC
Curve C (5-10 x In)


Din-T time current curves Din-T 6 and 10

Tripping characteristics according to IEC 60898
Din-T 6, 10, 10H, 15
Curve D ( 10 - $20 \times \ln$ )


## Characteristics according to EN 60898

Miniature circuit breakers are intended for the protection of wiring installations against both overloads and short-circuits in domestic or commercial wiring installations, where operation is possible by uninstructed people.

## Magnetic release

An electromagnet with plunger ensures instantaneous tripping in the event of short-circuit. The NHP Din-T range has 3 different types, following the current for instantaneous release: types B, C and D curve.

| Icn (A) | Test current | Tripping time | Applications |
| :---: | :---: | :---: | :---: |
| B | $\begin{aligned} & 3 \times \ln \\ & 5 \times \ln \end{aligned}$ | $\begin{aligned} & 0.1<\mathrm{t}<45 \mathrm{~s}(\ln \leq 32 \mathrm{~A}) \\ & 0.1<\mathrm{t}<90 \mathrm{~s}(\ln >32 \mathrm{~A}) \\ & \mathrm{t}<0.1 \mathrm{~s} \end{aligned}$ | Only for resistive loads such as: <br> - electrical heating <br> - water heater <br> - stoves |
| $\bar{C}$ | $\begin{aligned} & 5 \times \ln \\ & 10 x \ln \end{aligned}$ | $\begin{aligned} & 0.1<\mathrm{t}<15 \mathrm{~s}(\mathrm{In} \leq 32 \mathrm{~A}) \\ & 0.1<\mathrm{t}<30 \mathrm{~s}(\ln >32 \mathrm{~A}) \\ & \mathrm{t}<0.1 \mathrm{~s} \end{aligned}$ | Usual loads such as: - lighting <br> - socket outlets <br> - small motors |
| D | $\begin{aligned} & 10 \times \ln \\ & 20 \times \ln \end{aligned}$ | $\begin{aligned} & 0.1<\mathrm{t}<4 \mathrm{~s}(\ln \leq 32 \mathrm{~A}) \\ & 0.1<\mathrm{t}<8 \mathrm{~s}(\ln >32 \mathrm{~A}) \\ & \mathrm{t}<0.1 \mathrm{~s} \end{aligned}$ | Control and protection of circuits having important transient inrush currents (large motors) |

## Thermal release

The release is initiated by a bimetal strip in the event of overload. The standard defines the range of releases for specific overload values. Reference ambient temperature is $30^{\circ} \mathrm{C}$.

| Test current | Tripping time |
| :--- | :--- |
| $1.13 \times \ln$ | $\mathrm{t} \geq 1 \mathrm{~h}(\ln \leq 63 \mathrm{~A})$ |
|  | $\mathrm{t} \geq 2 \mathrm{~h}(\ln >63 \mathrm{~A})$ |
| $1.45 \mathrm{x} \ln$ | $\mathrm{t}<1 \mathrm{~h}(\ln \leq 63 \mathrm{~A})$ |
|  | $\mathrm{t}<2 \mathrm{~h}(\ln >63 \mathrm{~A})$ |
| $2.55 \mathrm{x} \ln$ | $1 \mathrm{~s}<\mathrm{t}<60 \mathrm{~s}(\ln \leq 32 \mathrm{~A})$ |
|  | $1 \mathrm{~s}<\mathrm{t}<120 \mathrm{~s}(\ln >32 \mathrm{~A})$ |

## 

## Temperature compensation curves

Din-T 6, 10, 10H and 15

## Influence of ambient temperature

The thermal calibration of the MCBs was carried out at an ambient temperature of $30^{\circ} \mathrm{C}$. Ambient temperatures different from the calibrated temperature influence the bimetal and this results in earlier or later thermal tripping (see curves).
0.5-6 A


16-40 A


10 A


50-63 A


## DC current circuit breaker

 selection table| Circuit Breaker Type | Rated Current (A) | 48 V 1 pole Icu (kA) | 110 V <br> 2 poles <br> in series <br> Icu (kA) | $250 \mathrm{~V}$ <br> 1 pole <br> Icu (kA) | $\begin{aligned} & 500 \mathrm{~V} \\ & 2 \text { poles } \\ & \text { in series } \\ & \text { Icu (kA) } \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Din-T 6 | 0.5..... 63 A | 20 | 25 | - | - |
| Din-T 10 | 0.5..... 63 A | 25 | 30 | - | - |
| Din-T DC | 0.5..... 63 A | - | - | 6 | 6 |
| Din-T 15 | 6........ 25 A | 25 | 30 | - | - |
| Din-T 10H | 80.... 125 A | 10 | 10 | - | - |
| Safe-T | 6...... 100 A | - | 5 | - | - |


| MCCB <br> type $\left.{ }^{2}\right)^{3}$ ) | $\begin{aligned} & 24 / 48 / \\ & 60 \mathrm{~V} \\ & \hline \end{aligned}$ | 125 V | 250 V | kA Rating below |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | 350 V | 500 V | 600 V |
| S160NF 1 pole | 15 | 15 | - |  |  |  |
| ES125/NJ | 25 | 25 | 25 |  |  |  |
| SHL125NJ/GJ | 50 | 40 | 40 |  | Refer to se |  |
| E250NJ | 25 | 25 | 25 |  | for 'ND' |  |
| SHL160/250 ${ }^{2}$ ) | 50 | 40 | 40 |  | $\text { to } 600 \mathrm{~V}$ |  |
| E400NJ | 25 | 25 | 25 |  | 20 A-800 |  |
| SHL400NJ/GJ ${ }^{3}$ ) | 50 | 40 | 40 |  |  |  |
| XS630NJ | 50 | 40 | 40 | 30 | 20 | 20 |
| S/XS800NJ/RJ | 50 | 40 | 40 | 30 | 20 | 20 |
| XS1000ND ${ }^{1}$ ) | - | 40 | 40 | 30 | 20 | 20 |
| XS1250ND | - | 40 | 40 | 30 | 20 | 20 |
| XS1600ND | - | 40 | 40 | 30 | 20 | 20 |
| XS2000ND ${ }^{1}$ ) | - | 40 | 40 | 30 | 20 | 20 |
| XS2500ND ${ }^{1}$ ) | - | 40 | 40 | 30 | 20 | 20 |

THE FOLLOWING CONNECTION
DIAGRAM SHOULD BE APPLIED.


## Notes for MCCB only:

For voltage levels up to and including 250 V DC standard MCCBs may be used, with two poles connected in series. For voltage levels greater than 250 V DC, three poles are to be connected in series as shown.

The time constant (L/R) of the circuit should be:
less than 2 ms at rated current
less than 2.5 ms for overload ( 2.5 x In )
less than 7 ms for short circuit $\leq 10 \mathrm{kA}$
less than 15 ms for short circuit $>10 \mathrm{kA}$
Notes: ${ }^{1}$ ) Magnetic trip only, without overload protection. Available on indent only.
${ }^{2}$ ) Thermal Magnetic types only can be used on DC.
${ }^{3}$ ) MCCBs not suitable for 12 V DC.

## Miniature circuit breakers and fuse-fault current limiters co-ordination chart

| Circuit breaker Type | kA | Minimum <br> Rating fuse amps amps ${ }^{1}$ ) |  | $\begin{aligned} & \quad \text { Maximum fuse - Amps } \\ & 50 \mathrm{kA} \end{aligned}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | BS 88 | DIN | BS 88 | DIN |
| Safe-T | 6 | 6-10 | 50 | $160^{2}$ ) | 160 | $125^{2}$ ) | 125 |
|  | 6 | 16-25 | 63 | $200^{2}$ ) | 200 | $160^{2}$ ) | 160 |
|  | 6 | 32 | 80 | $200{ }^{2}$ ) | 200 | $160^{2}$ ) | 160 |
|  | 6 | 40-50 | 100 | $200{ }^{2}$ ) | 200 | $160^{2}$ ) | 160 |
|  | 6 | 63-100 | 160 | $200{ }^{2}$ ) | 200 | $160{ }^{2}$ ) | 160 |
| SRCB | 6 | 10 | 50 | 160 | 160 | 125 | 125 |
|  | 6 | 16-20 | 63 | 200 | 200 | 160 | 160 |
| Din-T | 6 | 2-25 | 20-63 | 200 | 200 | 160 | 160 |
| DTCB6 | 6 | 32-63 | 100 | 200 | 200 | 160 | 160 |
| DTCB10 \& DTCB15 ${ }^{3}$ ) | 10,15 | 0.5-6 | 20 | 250 | 250 | 200 | 200 |
|  | 10,25 | 10 | 25 | 250 | 250 | 200 | 200 |
|  | 10,25 | 16 | 35 | 250 | 250 | 200 | 200 |
|  | 10, 20-25 | 20-32 | 63 | 250 | 250 | 200 | 200 |
|  | 10, 20-15 | 40-63 | 100 | 250 | 250 | 200 | 200 |
| DSRCB \& DSRCBH (RCBO) | 10 | 10 | 25 | 250 | 250 | 200 | 200 |
|  | 10 | 16 | 35 | 250 | 250 | 200 | 200 |
|  | 10 | 20-32 | 63 | 250 | 250 | 200 | 200 |
| Din-T10H | 10 | 80 | 160 | 200 | 200 | 160 | 160 |
|  | 10 | 100 | 200 | 200 | 200 | 160 | 160 |
|  | 10 | 125 | 250 | 250 | 250 | - | - |
| E125, S125 | 18/30 | 16-125 | 250 | 400 | 400 | 355 | 355 |

Notes: ${ }^{1}$ ) Minimum fuse size is based on grading under overload of one MCB with oneset of fuses. Where a single set of fuses protects more than one MCB, the minimum fuse size shall be increased to allow for load biasing effects.
${ }^{2}$ ) Maximum fuse size based on testing to AS 3439.1 clause 8.2.3.
${ }^{3}$ ) For specific kA ratings applicable to MCBs , refer page 1-23 ratings chart. Tables based on the following maximum pre-arcing I2t for both BS 88 and DIN fuses:
125 A - $0.4 \times 105,160$ A $-0.62 \times 105,200 \mathrm{~A}-1.2 \times 105,250 \mathrm{~A}-2.1 \times 105$. Suitable fuses include NHP, GEC, Siemens and Bovara-Crady.
Fuses with higher current ratings may be used provided $12 t$ values are equal to, or less than the levels above. Semi-conductor fuses have very low 12 t values and may suit some applications.
Attention is also drawn to AS 3000 clause 7.10.4.4 regarding the use of fault current limiters in installations containing fire and smoke control equipment, evacuation equipment and lifts.

## Selectivity (discrimination) and cascade

## Selectivity

The principle of Selectivity (Discrimination) is based upon an analysis of several circuit breaker characteristics. These include time-current (tripping) curves, peak-let-through current (lpeak) and energy let-through (I2t).
The figures stated give the maximum selectivity level with the two nominated breakers in series under short-circuit conditions. For an indication on selectivity under overloads refer to the circuit breaker tripping/characteristic curves, or use the NHP TemCurve selectivity analysis software package.
Selectivity can be enhanced beyond the breaking capacity of the downstream breaker provided it is backed up by an appropriately selected upstream breaker, which should not trip (unlatch) under the stated short circuit current.

## Cascade

Cascading is achieved by using an upstream device to assist (back-up) a downstream device in clearing a fault current. This principal is necessary should the downstream device be required to clear a prospective short circuit current greater than the devices' breaking capacity.
In most cascading applications it is generally necessary for the upstream breaker to trip (unlatch), as well as the downstream breaker to give adequate back-up protection. As such, cascade is commonly used in feeding and protecting non-essential loads, such as basic lighting.
For more information on selectivity and cascading please refer to the latest NHP Part C catalogue.

Cascade / back-up applications
Upstream: MCB
Downstream: MCB
Voltage 400/415 V, Icc max. in kA

| Downstream: MCBs |  | Upstream: MCBs |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Series | $\ln (\mathrm{A})$ | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \ldots 63 \text { A } \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & <40 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 50 \ldots 63 \mathrm{~A} \\ & \hline \end{aligned}$ |
| Din-T 6 | 0.5 ... 63 | 10 | 20 | 15 |
| Din-T 10 | 0.5 ... 63 | - | 20 | 15 |

Voltage 220/440 V, Icc max. in kA
Downstream: MCBs Upstream: MCBs

| Series | $\ln (\mathrm{A})$ | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \ldots 63 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 0.5 \ldots 63 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 80 \ldots 125 \mathrm{~A} \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
| Din-T 6 | 0.5 ... 63 | 30 | 30 | - |
| Din-T 10 | 0.5 ... 63 | - | 30 | - |
| Din-T 10 | 0.5 ... 63 | - | 35 | - |

## Selectivity MCB to MCB:

Thermal Magnetic

| MCBs | MCBs | Upstream C curve $10 \mathrm{~A} 16 \mathrm{~A}$ | $20 \mathrm{~A}$ | Din-T 6, 25 A | 6,10, 32 A | 15 | 50 A | 63 A |  | $\begin{aligned} & \text { Pin-T } 1 \\ & 100 \\ & \text { A } \\ & \hline \end{aligned}$ | OH <br> 125 <br> A |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Downstream B curve Din-T 10 | $\ln (\mathrm{A})$ | (kA below) |  |  |  |  |  |  | C Curve |  |  |
|  | 6 | 0.070 .10 | 0.15 | 0.18 | 0.23 | 0.27 | 0.35 | 0.45 | 1.5 | 1.6 | 1.7 |
|  | 10 | - - | 0.15 | 0.18 | 0.23 | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 16 | - - | - | - | 0.23 | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 20 | - - | - | - | 0.23 | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 25 | - | - | - | - | 0.27 | 0.35 | 0.45 | 0.9 | 1.1 | 1.1 |
|  | 32 | - | - | - | - | 0.27 | 0.35 | 0.45 | 0.9 | 1 | 1 |
|  | 40 | - - | - | - | - | - | - | - | - | 0.9 | 0.9 |
|  | 50 | - - | - | - | - | - | - | - | - | - | - |
|  | 63 | - - | - | - | - | - | - | - | - | - | - |


| MCBs | MCBs | Ups C cu 10 A | tream rve <br> 16 A | $20 \mathrm{~A}$ | Din-T 6, | 6,10, 32 A | 15 | 50 A | 63 A | 80 A | $\begin{aligned} & \text { in-T } \\ & 100 \\ & \text { A } \end{aligned}$ | OH <br> 125 <br> A |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Downstream C curve Din-T 6 Din-T 10 Din-T 15 | $\ln (\mathrm{A})$ | (kA below) |  |  |  |  |  |  |  | C Curve |  |  |
|  | 6 | 0.07 | 0.10 | 0.15 | 0.18 | 0.23 | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 10 | - | - | 0.15 | 0.18 | 0.23 | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 16 | - | - | - | - | - | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.2 |
|  | 20 | - | - | - | - | - | 0.27 | 0.35 | 0.45 | 1 | 1.1 | 1.1 |
|  | 25 | - | - | - | - | - | 0.27 | 0.35 | 0.45 | 0.9 | 1 | 1.1 |
|  | 32 | - | - | - | - | - | - | 0.35 | 0.45 | 0.9 | 0.9 | 1 |
|  | 40 | - | - | - | - | - | - | - | 0.45 | - | - | 0.9 |
|  | 50 | - | - | - | - | - | - | - | - | - | - | - |
|  | 63 | - | - | - | - | - | - | - | - | - | - | - |

Notes: $\mathrm{T}=$ Total selectivity

# Cascade / back-up applications - 

Upstream: MCB
Downstream: MCB
Voltage 400/415 V, Icc max. in kA

| Downstream: MCBs |  | Upstream: MCBs |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Series | $\ln (\mathrm{A})$ | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \ldots 63 \text { A } \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & <40 \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 50 \ldots 63 \mathrm{~A} \\ & \hline \end{aligned}$ |
| Din-T 6 | 0.5... 63 | 10 | 20 | 15 |
| Din-T 10 | 0.5... 63 | - | 20 | 15 |

Voltage 400/415 V, Icc max. in kA

| Downstream: MCBs |  | Upstream: MCBs |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Series | In (A) | $\begin{aligned} & \text { Din-T } 10 \\ & 0.5 \ldots 63 \text { A } \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 0.5 \ldots 63 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & \text { Din-T } 15 \\ & 80 \ldots 125 \text { A } \end{aligned}$ |
| Din-T 6 | 0.5... 63 | 20 | 22 | 16 |
| Din-T 10 | $\leq 32$ | - | 50 | - |
| Din-T 15 | $\geq 40$ | - | 35 | - |

Back-up protection with MCBs (DSRCD)

|  |  | Din-T 6 | Din-T 10 | Din-T 15 | Din-T 10H |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | (A) | (kA) | (kA) | (kA) | (kA) |
|  | 16 | 20 | 20 | 20 | 10 |
|  | 25 | 20 | 20 | 20 | 10 |
| 2 Poles | 40 | 20 | 20 | 20 | 10 |
| 240 V | 63 | 20 | 20 | 20 | 10 |
| (DSRCD) | 80 | - | - | - | 10 |
|  | 100 | - | - | - | 10 |
|  | 25 | 10 | 10 | 10 | 10 |
| RCCB 4 Poles | 40 | 10 | 10 | 10 | 10 |
| 415 V | 63 | 10 | 10 | 10 | 10 |
| (DSRCD) | 80 | - | - | - | 10 |
|  | 100 | - | - | - | 10 |

Back-up protection with fuses gG (DSRCD)

|  |  | 16 A | 25 A | 32 A | 40 A | 50 A | 63 A | 80 A | 100 A |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | (A) | (kA) | (kA) | (kA) | (kA) | (kA) | (kA) | (kA) | (kA) |
| RCCB 2 Poles 240 V (DSRCD) | 16 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | $\underline{25}$ | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 40 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 63 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 80 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 100 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 25 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 40 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 63 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 80 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |
|  | 100 | 100 | 100 | 80 | 50 | 40 | 25 | 16 | 10 |

## SP4(

## Selectivity and Cascade tables @ 400/415 V MCCBs and MCBs

| Downstream MCB |  |  | Upstream MCCBs |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { Current } \\ & \text { Range kA } \\ & \text { (A) } \quad \text { (RMS) } \end{aligned}$ |  |  | $\begin{array}{r} 25 \mathrm{kA} \\ \text { E125NJ } \\ \hline \end{array}$ |  |  |  | $\begin{gathered} 36 \mathrm{kA} \\ \text { S125NJ } \\ \hline \end{gathered}$ |  |  |  | $\begin{gathered} 65 \mathrm{kA} \\ \text { S125G } \\ \text { SS125G1 } \end{gathered}$ |
|  |  |  | 63 | 80 | 100 | 125 | 63 | 80 | 100 | 125 | 63 |
| DTCB6 | $\leq 20$ | 6 | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $35 \quad 135$ |
|  | 25 \& 32 |  | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 / 25$ | $20 \quad 125$ |
|  | 40 |  | - 125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | - 125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | 125 |
|  | 50\&63 |  | - 125 | - 125 | $20 / 25$ | $20 / 25$ | - 125 | - 2/5 | $20 / 25$ | $20 / 25$ | 125 |
| DINT10, DSRCBH \& DSRCB | $\leq 32$ | 10 | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $30 \quad 150$ |
|  | 40 |  | 2125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | - 125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | 125 |
|  | 50 \& 63 |  | 2125 | - 125 | $20 / 25$ | $20 / 25$ | 25 | - 125 | $20 / 25$ | $20 / 25$ | 125 |
| DIN-T10H | 80 | 10 |  |  | $4 / 25$ | 4/25 |  |  | $4 / 25$ | 4/25 |  |
|  | + 100 |  |  |  |  | $4 / 25$ |  |  |  | $4 / 25$ |  |
|  | 125 |  |  |  |  |  |  |  |  |  |  |
| DIN-T15 | $\leq 32$ | 15 | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $30 \quad 150$ |
|  | 40 |  | - 125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | - 125 | $20 / 25$ | $20 / 25$ | $20 / 25$ | - 125 |
|  | 50 \& 63 |  | - 125 | - 125 | $20 / 25$ | $20 / 25$ | - 125 | - 125 | $20 / 25$ | $20 / 25$ | 125 |
|  <br> SRCB | $\leq 63$ | 6 | - /10 | $3 / 10$ | $3 / 10$ | $3 / 10$ | - /10 | $3 / 10$ | $3 / 10$ | $3 / 10$ | /10 |


| Downstream MCB |  |  | Upstream MCCBs |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Current RangekA <br> (A) (RMS) |  | $\begin{gathered} 25 \mathrm{kA} \\ \text { E250NJ } \end{gathered}$ |  |  |  |  |  | $\begin{gathered} 36 \mathrm{kA} \\ \text { S250NJ } \end{gathered}$ |  |  | $\begin{aligned} & \text { 65 kA } \\ & \text { S250GJ- } \\ & \text { ZS250GJ } \end{aligned}$ |  |  |  |
|  |  |  | 63 | 80 | 100 | 160 | 200 | 250 | 160 | 200 | 250 | 160 | 200 | 250 | 63 |
| DTCB6 | $\leq 20$ | 6 | 25/25 | 25/25 | 25/25 | 25/25 | 25/25 | 25/25 | 36/36 | 36/36 | 36/36 | 36/36 | 36/36 | 36/36 | 36/36 |
|  | $\begin{gathered} 25 \& \\ 32 \end{gathered}$ |  | 25/25 | 25/25 | 25/25 | 25/25 | 25/25 | 25/25 | 30/30 | $30 / 30$ | $30 / 30$ | 30/30 | $30 / 30$ | $30 / 30$ | - 130 |
|  | 40 |  | - 125 | $20 / 25$ | 25/25 | 25/25 | 25/25 | 25/25 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | 30/30 |
|  | $\begin{gathered} 50 \& \\ 63 \\ \hline \end{gathered}$ |  | - 125 | - 125 | $252 / 5$ | 25/25 | 25/25 | 25/25 | 30/30 | $30 / 30$ | $30 / 30$ | 30/30 | $30 / 30$ | 30/30 | - 130 |
| DINT10H, DSRCBH \&DSRCB | $\leq 32$ | 10 | 25/25 | $25 / 25$ | 25/25 | 25/25 | 25/25 | 25/25 | 36/36 | 36/36 | 36/36 | 40/65 | 40/65 | 40/65 | 40/65 |
|  | 40 |  | - 125 | $20 / 25$ | 25/25 | 25/25 | 25/25 | 25/25 | 30/30 | $30 / 3$ | $30 / 30$ | 30/30 | $30 / 30$ | $30 / 3$ | - 130 |
|  | $\begin{gathered} \hline 50 \& \\ 63 \\ \hline \end{gathered}$ |  | - 125 | - 125 | 25/25 | 2525 | 20/25 | 25/25 | 30/30 | $30 / 30$ | $30 / 30$ | 30/30 | $30 / 30$ | 30/30 | - 130 |
| DIN-T10H | 80 | 10 |  |  | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 |  |
|  | 100 |  |  |  |  | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 | 15/25 |  |
|  | 125 |  |  |  |  | - 125 | 15/25 | 15/25 | -125 | 15/25 | 15/25 | - 125 | 15/25 | 15/25 |  |
| DIN-T15 | $\leq 32$ | 15 | $25 / 25$ | 25/25 | 25/25 | 25/25 | 25/25 | 25/25 | $36 / 36$ | 36/36 | 36/36 | 40/65 | 40/65 | 40/65 | 40/65 |
|  | 40 |  | - 125 | 25/25 | 25/25 | $25 / 25$ | 25/25 | $25 / 25$ | 30/30 | $30 / 30$ | $30 / 30$ | 30/30 | $30 / 30$ | 30/30 | - 130 |
|  | $\begin{gathered} 50 \& \\ 63 \end{gathered}$ |  | - 125 | - 125 | 25/25 | 25 | 25/25 | 25/25 | 30/30 | 30/30 | $30 / 30$ | 30/30 | $30 / 30$ | $30 / 30$ | - 130 |

Notes: XX Selectivity YY Cascade

| \& | $\begin{array}{r} 125 \mathrm{kA} \\ \mathrm{H} 125 \mathrm{NJ} \\ \hline \end{array}$ |  | $\begin{gathered} 36 \mathrm{kA} \\ \text { S160NJ } \end{gathered}$ |  |  |  |  | $\begin{gathered} 65 \mathrm{kA} \\ \text { S160GJ } \\ \hline \end{gathered}$ |  | \& | $\begin{aligned} & 125 \mathrm{kA} \\ & \mathrm{H} 160 \mathrm{NJ} \\ & \hline \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 80 | 100 | 125 | 63 | 80 | 100 | 125 | 160 | 63 | 80 | 100 | 125 | 160 |
| $35 / 35$ | $35 / 35$ | $35 / 35$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ |
| $20 / 25$ | $20 / 25$ | $20 / 25$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| $20 / 25$ | $20 / 25$ | $20 / 25$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| - 125 | $20 / 25$ | $20 / 25$ | - 130 | - /30 | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | - /30 | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| $30 / 50$ | $30 / 50$ | $30 / 50$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $40 / 65$ | $40 / 65$ | $40 / 65$ | $40 / 65$ | $40 / 65$ |
| $25 / 25$ | $25 / 25$ | $25 / 25$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| - 125 | $25 / 25$ | $25 / 25$ | - 130 | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ |
|  | $4 / 25$ | $4 / 25$ |  |  | $15 / 15$ | $15 / 15$ | $15 / 15$ |  |  | $15 / 15$ | $15 / 15$ | $15 / 15$ |
|  |  | $4 / 25$ |  |  |  | $15 / 15$ | 15/15 |  |  |  | $15 / 15$ | $15 / 15$ |
|  |  |  |  |  |  |  | $15 / 15$ |  |  |  |  | 15/15 |
| $30 / 50$ | $30 / 50$ | $30 / 50$ | $36 / 36$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $30 / 36$ | $40 / 65$ | $40 / 65$ | $40 / 65$ | $40 / 65$ | $40 / 65$ |
| $20 / 25$ | $25 / 25$ | $25 / 25$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| - 125 | $25 / 25$ | $25 / 25$ | - 130 | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ | - 130 | - 130 | $30 / 30$ | $30 / 30$ | $30 / 30$ |
| $3 / 10$ | $3 / 10$ | $3 / 10$ |  |  |  |  |  |  |  |  |  |  |


| $\begin{aligned} & 70 \mathrm{kA} \\ & \text { S250PE } \end{aligned}$ |  |  | $\begin{aligned} & 125 \mathrm{kA} \\ & \text { H250NJ- } \\ & \text { H250NE } \end{aligned}$ |  |  | $\begin{gathered} 36 \mathrm{kA} \\ \text { S400CJ } \end{gathered}$ |  |  |  | $\begin{gathered} 50 \mathrm{kA} \\ \text { S400NJ-S400NE } \\ \hline \end{gathered}$ |  |  |  | $\begin{gathered} 70 \mathrm{kA} \\ \text { S400GE } \\ \hline \end{gathered}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 80 | 100 | 125 | 160 | 200 | 250 | 100 | 200 | 250 | 400 | 100 | 200 | 250 | 400 | 100 | 200 | 250 | 400 |
| 36/36 | 36/36 | 36/36 | 36/36 | 36/36 | 36/36 |  |  |  |  |  |  |  |  |  |  |  |  |
| 30/30 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 30/30 | 30/30 | 30/30 | 30/30 | 30/30 | 30/30 |  |  |  |  |  |  |  |  |  |  |  |  |
| - 130 | 30/30 | 30/30 | $30 / 30$ | 30/30 | 30/30 |  |  |  |  |  |  |  |  |  |  |  |  |

40/65 $40 / 65$ 40/65 $40 / 6540 / 6540 / 65$ 36/36 $36 / 3636 / 3636 / 3640 / 5040 / 5040 / 5040 / 50 \mid 40 / 6540 / 6540 / 6540 / 65$ $30 / 3030 / 3030 / 3030 / 3030 / 3030 / 30$ 30/30 $30 / 3030 / 3030 / 30$ 30/30 $30 / 3030 / 30 / 30 / 3030 / 3030 / 3030 / 3030 / 30$ - /30 $30 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 30$ 30/30 $30 / 3030 / 3030 / 30$ 30/30 $30 / 3030 / 3030 / 30$

 - /10 $10 / 10$ 10/10 $10 / 10$ - $/ 1010 / 10$ 10/10 $10 / 10$ - $/ 10$ 10/10 $10 / 10$ 10/10 $40 / 6540 / 6540 / 6540 / 6540 / 6540 / 65$ 36/36 $36 / 36$ 36/36 $36 / 36$ | $40 / 50$ 40/50 $40 / 50$ 40/50 $40 / 6540 / 65$ 40/65 $40 / 65$ $-/ 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 30$ 30/30 $30 / 3030 / 3030 / 30 / 30 / 30 / 30 / 3030 / 3030 / 30$ - /30 30/30 $30 / 3030 / 3030 / 3030 / 3030 / 3030 / 3030 / 30$ 30/30 $30 / 30$ 30/30 $30 / 30$ 30/30 $30 / 30$ 30/30 $30 / 30$ 30/30

## 

## Selectivity \& Cascade Tables

@ 400 / 415 V

## Upstream MCCBs ${ }^{1}$ )



Notes: XX Selectivity YY Cascade
9-16 ※.

# Selectivity \＆Cascade Tables 

＠ 400 ／ 415 V

| $\begin{aligned} & 山 \\ & \tilde{\sim} \\ & \text { M } \\ & 0 \\ & \end{aligned}$ | $\begin{aligned} & \text { 山 } \\ & \text { M } \\ & \text { N } \\ & \frac{1}{x} \end{aligned}$ |  |  | $\begin{aligned} & 山 \\ & 0 \\ & 0 \\ & 0 \\ & \underset{x}{0} \end{aligned}$ | $\begin{aligned} & \text { 山 } \\ & \text { O } \\ & \text { 员 } \\ & \frac{T}{X} \end{aligned}$ | w Z O © 1 |  |  | $\begin{aligned} & \text { u } \\ & 0 \\ & 0 \\ & \frac{0}{n} \\ & x \end{aligned}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 65 | 70 | 125 | 50 | 65 | 125 | 85 | 125 | 100 | 85 |
| $25 / 36$ | $25 / 50$ | $25 / 50$ | $25 / 25$ | $25 / 36$ | $25 / 36$ | $25 / 36$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ |
| $36 / 50$ | $36 / 65$ | 36 ／ 65 | 36 ／ 36 | $36 / 50$ | 36 ／ 36 | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ |
| $50 / 50$ | $65 / 65$ | $65 / 70$ | 65 ／ 65 | $50 / 50$ | 65 ／ 65 | 65 ／ 65 | 65／65 | $65 / 65$ | $65 / 65$ | $65 / 65$ |
| $50 / 50$ | $50 / 65$ | $70 / 70$ | $70 / 125$ | $50 / 50$ | 65 ／ 65 | $65 / 125$ | 85 ／ 85 | $85 / 125$ | 100／100 | $85 / 85$ |
| $36 / 50$ | $36 / 50$ | $36 / 50$ | 36 ／ 36 | $36 / 50$ | $36 / 65$ | $36 / 36$ | $36 / 36$ | 36／36 | $36 / 36$ | $36 / 36$ |
| $50 / 50$ | $50 / 65$ | $65 / 70$ | 65 ／ 65 | $50 / 50$ | $50 / 65$ | $50 / 65$ | 65／ 65 | 65／ 65 | 65 ／ 65 | 65／65 |
| $50 / 50$ | $50 / 65$ | 70 ／ 70 | $70 / 125$ | $50 / 50$ | $50 / 65$ | $50 / 125$ | $85 / 85$ | $85 / 125$ | 100／100 | $85 / 85$ |
| $25 / 36$ | $25 / 50$ | $25 / 50$ | 25 ／ 25 | $25 / 36$ | $25 / 50$ | $25 / 50$ | $25 / 25$ | $25 / 25$ | $25 / 25$ | $25 / 25$ |
| $36 / 50$ | $36 / 65$ | $36 / 65$ | 36 ／ 36 | 36 ／ 50 | $36 / 65$ | $36 / 65$ | $36 / 36$ | $36 / 36$ | 36 ／ 36 | $36 / 36$ |
| $50 / 50$ | $50 / 65$ | $65 / 70$ | 65 ／ 65 | $50 / 50$ | $50 / 65$ | $50 / 65$ | $65 / 65$ | 65 ／ 65 | $65 / 65$ | 65／65 |
| $50 / 50$ | $50 / 65$ | $70 / 70$ | 70 ／ 70 | $50 / 50$ | $65 / 65$ | $50 / 70$ | $70 / 70$ | $70 / 70$ | 70 ／ 70 | 70／70 |
| $50 / 50$ | $50 / 65$ | $70 / 70$ | 70／125 | $50 / 50$ | $50 / 65$ | $50 / 125$ | $85 / 85$ | $85 / 125$ | 100／100 | $85 / 85$ |
| $50 / 50$ | $50 / 65$ | $70 / 70$ | $70 / 125$ | $50 / 50$ | $65 / 65$ | $50 / 125$ | 85 ／ 85 | $85 / 125$ | 100／100 | $85 / 85$ |
| 10 ／ 36 | $10 / 50$ | $10 / 50$ | 10 ／ 36 | $25 / 36$ | $25 / 50$ | $25 / 36$ | $25 / 36$ | $25 / 36$ | 25 ／ 36 | $25 / 25$ |
| $10 / 50$ | $10 / 65$ | $10 / 65$ | $10 / 50$ | $25 / 50$ | $25 / 65$ | $25 / 50$ | $36 / 50$ | $36 / 50$ | $36 / 50$ | $36 / 36$ |
| $10 / 50$ | $10 / 50$ | 10／50 | $10 / 50$ | $25 / 50$ | $25 / 50$ | $25 / 50$ | 50／50 | $50 / 50$ | $50 / 50$ | $50 / 50$ |
| $10 / 50$ | $10 / 65$ | $10 / 70$ | 10 ／ 65 | $25 / 50$ | $25 / 65$ | $25 / 65$ | $50 / 65$ | $50 / 65$ | $50 / 65$ | $50 / 50$ |
| $10 / 50$ | $10 / 65$ | $10 / 70$ | $10 / 70$ | $25 / 50$ | $25 / 65$ | $25 / 70$ | $70 / 70$ | $70 / 70$ | 70 ／ 85 | 70／70 |
| $10 / 50$ | $10 / 65$ | $10 / 70$ | 10 ／ 85 | $25 / 50$ | $25 / 65$ | $25 / 85$ | $70 / 85$ | $85 / 85$ | 85 ／ 85 | $85 / 85$ |
| 10／50 | $10 / 65$ | 10 ／ 70 | $10 / 125$ | $25 / 50$ | 25／65 | $25 / 125$ | $85 / 85$ | $85 / 125$ | $85 / 100$ | $85 / 85$ |
|  |  |  |  | $25 / 36$ | 25／36 | $25 / 36$ | $36 / 36$ | $36 / 36$ | $36 / 36$ | 36／36 |
|  |  |  |  | $25 / 50$ | 25／50 | $25 / 50$ | $50 / 50$ | $50 / 50$ | $50 / 50$ | 50／50 |
|  |  |  |  |  |  |  | $70 / 70$ | $70 / 70$ | $70 / 70$ | 70／70 |
|  |  |  |  |  |  |  | $30 / 42$ | $30 / 42$ | $30 / 42$ | $35 / 42$ |
|  |  |  |  |  |  |  | $30 / 65$ | $30 / 65$ | $30 / 65$ | $35 / 65$ |
|  |  |  |  |  |  |  | $30 / 85$ | $30 / 85$ | $30 / 85$ | $35 / 85$ |
|  |  |  |  |  |  |  | $30 / 65$ | $30 / 65$ | $30 / 85$ | $30 / 85$ |
|  |  |  |  |  |  |  | $30 / 65$ | $30 / 65$ | $30 / 85$ | $30 / 85$ |
|  |  |  |  |  |  |  | $30 / 65$ | $30 / 65$ | $30 / 85$ | $30 / 85$ |
|  |  |  |  |  |  |  | 15 ／ 65 | 15／65 | $20 / 65$ | $35 / 65$ |
|  |  |  |  |  |  |  | 15 ／ 50 | 15／50 | $20 / 50$ | $35 / 50$ |
|  |  |  |  |  |  |  | 15 ／ 85 | 15／85 | $20 / 85$ | $35 / 85$ |
|  |  |  |  |  |  |  | 15 ／ 65 | 15／65 | $20 / 65$ | $35 / 65$ |
|  |  |  |  |  |  |  | 15 ／ 65 | 15／65 | $20 / 65$ | $35 / 65$ |
|  |  |  |  |  |  |  |  |  | $20 / 65$ | $35 / 65$ |
|  |  |  |  |  |  |  |  |  |  | 35／85 |

Notes：${ }^{1}$ ）Refer NHP for TemBreak 2 MCCB combinations not included above．

Cascade table
Upstream-Downstream MCCBs (Thermal magnetic upstream)

Cascade @ 380-415 V AC ${ }^{1}$ )

| Upstream | CCBs | $\begin{aligned} & \underset{Z}{\lambda} \\ & \underset{\sim}{N} \\ & \underset{\sim}{4} \end{aligned}$ | $\begin{aligned} & 7 \\ & i n \\ & \stackrel{N}{n} \\ & i \end{aligned}$ |  | $\begin{aligned} & \underset{i}{\lambda} \\ & \stackrel{N}{\mathrm{~N}} \\ & \frac{1}{1} \end{aligned}$ | $\begin{aligned} & \underset{\sim}{\mathrm{N}} \\ & \underset{y}{\mathrm{~N}} \end{aligned}$ | $\begin{aligned} & 2 \\ & \lambda_{0} \\ & \frac{0}{n} \end{aligned}$ | $\begin{aligned} & \text { Эু } \\ & \text { O } \\ & \text { n } \end{aligned}$ | $\begin{aligned} & \text { 긍 } \\ & \text { O } \\ & \frac{0}{1} \end{aligned}$ | $\begin{aligned} & 7 \\ & \hline 0 \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Downstr MCCBs | kA (RMS) | 25 | 36 | 65 | 125 | 200 | 36 | 65 | 125 | 200 |
| E125NJ | 25 | 25 | 36 | 50 | 65 | 85 | 36 | 50 | 65 | 85 |
| S125NJ | 36 | - | 36 | 65 | 85 | 125 | 36 | 65 | 85 | 125 |
| S125GJ | 65 | - | - | 65 | 125 | 150 | 36 | 65 | 125 | 150 |
| H125NJ | 125 | - | - | 65 | 125 | 200 | 36 | 65 | 125 | 200 |
| S160NJ | 36 | - | - | 65 | 36 | 36 | 36 | 65 | 85 | 125 |
| S160GJ | 65 | - | - | - | - | - | - | 65 | 125 | 150 |
| H160NJ | 125 | - | - | - | - | - | - | 65 | 125 | 200 |
| E250NJ | 25 | - | - | - | - | - | - | 25 | 25 | 25 |
| S250NJ | 36 | - | - | - | - | - | - | 65 | 36 | 36 |
| S250GJ | 65 | - | - | - | - | - | - | - | - | - |
| S250PE | 70 | - | - | - | - | - | - | - | - | - |
| H250NJ | 125 | - | - | - | - | - | - | - | - | - |
| E400NJ | 25 | - | - | - | - | - | - | - | - | - |
| S400CJ | 36 | - | - | - | - | - | - | - | - | - |
| S400NJ | 50 | - | - | - | - | - | - | - | - | - |
| S400GJ | 70 | - | - | - | - | - | - | - | - | - |
| H400NJ | 125 | - | - | - | - | - | - | - | - | - | MCCBs.


|  | $\begin{aligned} & \text { Z } \\ & \text { ㅇ } \\ & \text { N } \\ & \text { N } \end{aligned}$ |  | 7 <br> Z <br> N <br>  | $Z$ <br> 융 <br>  |  | $\begin{aligned} & 7 \\ & \vdots \\ & 0 \\ & \vdots \\ & i \end{aligned}$ | $\begin{aligned} & \text { ত} \\ & 0 \\ & \hline \\ & \dot{U} \end{aligned}$ | 7 <br> 8 <br> 8 | $\begin{aligned} & \text { Z } \\ & \text { O } \\ & \text { S } \end{aligned}$ | ज |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 25 | 36 | 65 | 125 | 200 | 36 | 50 | 70 | 125 | 200 | 65 |
| 25 | 36 | 50 | 65 | 85 | 36 | 36 | 50 | 65 | 85 | 36 |
| 25 | 36 | 65 | 85 | 125 | 36 | 50 | 65 | 85 | 125 | 50 |
| 25 | 36 | 65 | 125 | 150 | 36 | 50 | 70 | 125 | 150 | 65 |
| 25 | 36 | 65 | 125 | 200 | 36 | 50 | 70 | 125 | 200 | 65 |
| 25 | 36 | 65 | 85 | 125 | 36 | 50 | 65 | 85 | 125 | 65 |
| 25 | 36 | 65 | 125 | 150 | 36 | 50 | 70 | 125 | 150 | 65 |
| 25 | 36 | 65 | 125 | 200 | 36 | 50 | 70 | 125 | 200 | 65 |
| 25 | 25 | 50 | 65 | 85 | 36 | 36 | 50 | 65 | 85 | 36 |
| 25 | 36 | 65 | 85 | 125 | 36 | 50 | 65 | 85 | 125 | 65 |
| - | - | 65 | 125 | 150 | 36 | 50 | 70 | 125 | 150 | 65 |
| - | - | 65 | 125 | 150 | 36 | 50 | 70 | 125 | 150 | 65 |
| - | - | 65 | 125 | 200 | 36 | 50 | 70 | 125 | 200 | 65 |
| - | - | 25 | 65 | 25 | 36 | 36 | 50 | 65 | 85 | 50 |
| - | - | 36 | 70 | 36 | 36 | 50 | 65 | 70 | 100 | 65 |
| - | - | 50 | 85 | 50 | 36 | 50 | 70 | 85 | 125 | 50 |
| - | - | 50 | 125 | 70 | 36 | 50 | 70 | 125 | 150 | 65 |
| - | - | - | - | - | - | - | - | - | 200 | 65 |

# Application data Load-break / MCCB 

## Socomec load-break switch and TemBreak MCCB co-ordination chart

TemBreak MCCB

|  | MCCB | $\begin{aligned} & \text { (kA) } \\ & \text { rms } \end{aligned}$ | MCCB | (kA) rms | MCCB | (kA) rms | MCCB | (kA) rms |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| SLB63 | E125NJ | 6.5 | S125NJ | 6.5 | S125GJ ${ }^{1}$ ) | 6.5 | H125NJ | 7.5 |
| SLB125 | E125NJ | 22 | S125NJ | 22 | S125GJ ${ }^{1}$ ) | 22 | H125NJ | 30 |
|  | - | - | S160NJ | 15 | S160GJ | 15 | H160NJ | 27 |
|  | E250NJ | 15 | S250NJ | 15 | S250GJ ${ }^{1}$ ) | 15 | H250NJ | 26 |
| SLB200 | E125NJ | 25 | S125NJ | 36 | S125GJ ${ }^{1}$ ) | 65 | H125NJ | 80 |
|  | - | - | S160NJ | 30 | S160GJ | 30 | H160NJ | 80 |
|  | E250NJ | 25 | S250NJ | 30 | S250GJ ${ }^{1}$ ) | 30 | H250NJ | 80 |
| SLB250 | E250NJ | 25 | S250NJ | 30 | S250GJ ${ }^{1}$ ) | 30 | H250NJ | 50 |
|  | E400NJ | 25 | S400NJ | 25 | S400GJ | 25 | H400NJ | 35 |
| SLB315 | E250NJ | 25 | S250NJ | 36 | S250GJ ${ }^{1}$ ) | 65 | H250NJ | 100 |
|  | E400NJ | 25 | S400NJ | 50 | S400GJ | 65 | H400NJ | 100 |
| SLB400 | E400NJ | 25 | S400NJ | 50 | S400GJ | 65 | H400NJ | 100 |

TemBreak MCCB

| Socomec <br> Load- <br> break <br> switch | MCCB | (kA) <br> rms | MCCB | (kA) <br> rms | MCCB | (kA) <br> rms |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| SLB630 | E630NE | 35 | S630CE | 35 | TL630NE | 24 |
| SLB800 | XS800NJ | 40 | XH800PJ | 40 | TL800NE | 28 |
| SLB1000 | XS1250SE | 45 | XS1600SE | 45 | TL1250NE45 |  |
| SLB1250 | XS1250SE | 65 | XS1600SE | 75 | TL1250NE70 |  |
| SLB1600 | XS1600SE | 75 | XS2000NE | 60 | - | - |
| SLB2000 | XS2000NE | 60 | XS2500NE | 60 | - | - |
| SLB2500 | XS2500NE | 60 | - | - | - | - |

Notes: ') Ratings also apply for ZS125GJ and ZS250GJ.
Figures based on / valid for $-400 / 415$ V AC
Application example:
All Socomec load-break switches can be used in higher prospective fault current level applications, due to the upstream Terasaki TemBreak MCCB reducing the peak let-through current.
Example: SLB250 can be used in a 30 kA application if there is an upstream S250NJ MCCB.
For other combinations please refer to NHP.

## Watts loss for Terasaki MCCBs ${ }^{\mathbf{1}}$ )

| C/B rating <br> MCCBs | Amps | AC Watts | DC Watts |
| :--- | :--- | :--- | :--- |
| TemBreak 2 MCCBs |  |  |  |
| E/S125 NJ - GJ, VS125NJ | 125 | 38 | 34 |
| S160 NJ - GJ, VS250NJ (160 A) | 160 | 40 | 36 |
| E/S250 NJ - GJ, VS250NJ | 250 | 55 | 49 |
| S250PE | 250 | 82 | 73 |
| E/S400 CJ - NJ - GJ | 400 | 75 | 67 |
| E/S400 NE - GE | 400 | 70 | 62 |
| E/S630 NE - CE - GE-PE | 630 | 133 | 119 |


| TemBreak 1 MCCBs |  |  |  |
| :---: | :---: | :---: | :---: |
| XS/XH400SE, XV400NE | 400 | 69 | 62 |
| XS/XH630SE, XV630PE | 630 | 109 | 97 |
| XS800NJ | 800 | 150 | 134 |
| XS/XH800SE, XV800PE | 800 | 151 | 134 |
| XS1250SE, XV1250NE | 1250 | 194 | 173 |
| XS1600SE | 1600 | 189 | 169 |
| XS2000NE | 2000 | 228 | 204 |
| XS2500NE | 2500 | 357 | 319 |
| XS3200NE | 3200 | 585 | 522 |

Notes: ${ }^{1}$ ) Values are valid for the maximum ampere trip units per breaker type. (E.g. S125GJ : 125 A) The above watts losses are for 3 poles combined.

## 

## Downstream short-circuit current calculator

Calculation of a downstream short-circuit current is a function of the uptream short-circuit current (Isco), cross-section and length of the conductor. The following table provides information to calculate approximately the short-circuit current at a relevant point of the installation.
Line protection - copper conductor
$\mathbf{m m}^{2}$ Length of the line in metres
1.5
2.5

| 4 |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  | 0.8 |
| 6 |  |  |  |  |  |  |  |  |  |  |  | 1.2 |
| 10 |  |  |  |  |  |  |  |  |  | 0.8 | 1.1 | 2.1 |
| 16 |  |  |  |  |  |  |  | 0.8 | 1.0 | 1.3 | 1.7 | 3.3 |
| 25 |  |  |  |  |  |  | 1.1 | 1.3 | 1.6 | 2.1 | 2.6 | 5.1 |
| 35 |  |  |  |  |  |  | 1.5 | 1.8 | 2.2 | 3.0 | 3.7 | 7.2 |
| 50 |  |  |  |  |  | 1.0 | 2.2 | 2.6 | 3.1 | 4.2 | 5.3 | 10 |
| 70 |  |  |  |  |  | 1.4 | 3.0 | 3.6 | 4.4 | 5.9 | 7.4 | 14 |
| 95 |  |  | 0.8 | 0.9 | 1.0 | 2.0 | 4.1 | 4.9 | 6.0 | 8.0 | 10 | 20 |
| 120 |  | 0.9 | 1.0 | 1.2 | 1.3 | 2.5 | 5.2 | 6.2 | 7.5 | 10 | 13 | 25 |
| 150 | 0.8 | 1.0 | 1.1 | 1.3 | 1.4 | 2.7 | 5.6 | 6.8 | 8.2 | 11 | 14 | 27 |
| 185 | 1.0 | 1.2 | 1.3 | 1.5 | 1.7 | 3.2 | 6.7 | 8.0 | 9.7 | 13 | 16 | 32 |
| 240 | 1.2 | 1.5 | 1.7 | 1.9 | 2.1 | 3.9 | 8.3 | 10 | 12 | 16 | 20 | 39 |
| 300 | 1.4 | 1.7 | 2.0 | 2.2 | 2.5 | 4.7 | 10 | 12 | 14 | 19 | 24 | 47 |
| 400 | 1.6 | 1.9 | 2.2 | 2.4 | 2.7 | 5.1 | 11 | 13 | 16 | 21 | 26 | 51 |
| 500 | 1.7 | 2.1 | 2.4 | 2.7 | 3.0 | 5.7 | 12 | 14 | 17 | 23 | 29 | 57 |
| 625 | 1.8 | 2.1 | 2.5 | 2.8 | 3.1 | 5.8 | 12 | 15 | 18 | 24 | 30 | 58 |
| 2x95 | 1.2 | 1.4 | 1.6 | 1.8 | 2.1 | 3.9 | 8.2 | 9.9 | 12 | 16 | 20 | 39 |
| 2x120 | 1.5 | 1.8 | 2.1 | 2.3 | 2.6 | 4.9 | 10 | 12 | 15 | 20 | 25 | 49 |
| 2x150 | 1.6 | 2.0 | 2.3 | 2.5 | 2.8 | 5.4 | 11 | 14 | 16 | 22 | 28 | 54 |
| 2x185 | 1.9 | 2.3 | 2.7 | 3.0 | 3.3 | 6.3 | 13 | 16 | 19 | 26 | 33 | 63 |
| 2x240 | 2.4 | 2.9 | 3.3 | 3.7 | 4.2 | 7.9 | 17 | 20 | 24 | 32 | 41 | 79 |
| $3 \times 95$ | 1.8 | 2.2 | 2.5 | 2.8 | 3.1 | 5.9 | 12 | 15 | 18 | 24 | 30 | 59 |
| $3 \times 120$ | 2.3 | 2.7 | 3.1 | 3.5 | 3.9 | 7.4 | 16 | 19 | 23 | 30 | 38 | 74 |
| $3 \times 150$ | 2.5 | 3.0 | 3.4 | 3.8 | 4.2 | 8.0 | 17 | 20 | 25 | 33 | 41 | 80 |
| $3 \times 185$ | 2.9 | 3.5 | 4.0 | 4.5 | 5.0 | 9.5 | 20 | 24 | 29 | 39 | 49 | 95 |
| $3 \times 240$ | 3.6 | 4.4 | 5.0 | 5.6 | 6.2 | 12 | 25 | 30 | 36 | 49 | 61 | 18 |

lsc $_{0} \mathbf{k A}$
Short-circuit current at the end of the cable

| 100 | 94 | 93 | 92 | 91 | 90 | 83 | 70 | 66 | 62 | 55 | 49 | 33 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 90 | 85 | 84 | 84 | 83 | 82 | 76 | 65 | 62 | 58 | 52 | 47 | 32 |
| 80 | 76 | 76 | 75 | 74 | 74 | 69 | 60 | 57 | 54 | 48 | 44 | 31 |
| 70 | 67 | 67 | 66 | 66 | 65 | 61 | 54 | 52 | 49 | 44 | 41 | 29 |
| \% 60 | 58 | 57 | 57 | 57 | 56 | 54 | 48 | 46 | 44 | 40 | 37 | 27 |
| ¢ 50 | 49 | 48 | 48 | 48 | 47 | 45 | 41 | 40 | 38 | 35 | 33 | 25 |
| $\pm 40$ | 39 | 39 | 39 | 39 | 38 | 37 | 34 | 33 | 32 | 30 | 28 | 22 |
| $\pm 35$ | 34 | 34 | 34 | 34 | 34 | 33 | 30 | 30 | 29 | 27 | 26 | 21 |
| 잉 | 29 | 29 | 29 | 29 | 29 | 28 | 27 | 26 | 25 | 24 | 23 | 19 |
| - 25 | 25 | 25 | 24 | 24 | 24 | 24 | 23 | 22 | 22 | 21 | 20 | 17 |
| \% 20 | 20 | 20 | 20 | 20 | 20 | 19 | 18 | 18 | 18 | 17 | 17 | 14 |
| - 15 | 15 | 15 | 15 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 12 |
| $\pm 10$ | 9.9 | 9.9 | 9.9 | 9.9 | 9.9 | 9.8 | 9.6 | 9.5 | 9.4 | 9.2 | 9.1 | 8.3 |
| \% 7 | 7.0 | 7.0 | 7.0 | 7.0 | 6.9 | 6.9 | 6.8 | 6.8 | 6.7 | 6.6 | 6.5 | 6.1 |
| ¢ 5 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 4.9 | 4.9 | 4.9 | 4.8 | 4.8 | 4.5 |
| $-4$ | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.9 | 3.9 | 3.9 | 3.9 | 3.8 | 3.7 |
| 3 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.9 | 2.9 | 2.9 | 2.8 |
| 2 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 1.9 |
| 1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

## Example

Cable with cross-section $95 \mathrm{~mm}^{2} \mathrm{Cu}, 45 \mathrm{~m}$ length, and short-circuit current at the
transformer terminals of 30 kA . Estimated short-circuit current of $\mathbf{1 2} \mathbf{~ k A}$ at the end of the cable.

## 

|  |  | 0.9 | 1.3 | 1.6 | 3.1 | 6.2 | 7.8 | 9.4 | 13 | 16 | 31 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1.0 | 1.3 | 1.6 | 2.1 | 2.6 | 5.1 | 10 | 13 | 16 | 21 | 26 | 51 |
| 1.6 | 2.1 | 2.5 | 3.4 | 4.2 | 8.2 | 16 | 21 | 25 | 34 | 42 | 82 |
| 2.5 | 3.1 | 3.8 | 5.1 | 6.4 | 12 | 25 | 31 | 38 | 51 | 64 | 123 |
| 4.1 | 5.2 | 6.3 | 8.4 | 11 | 21 | 41 | 52 | 63 | 84 | 106 | 205 |
| 6.6 | 8.3 | 10 | 13 | 17 | 33 | 66 | 83 | 100 | 135 | 170 | 329 |
| 10 | 13 | 16 | 21 | 26 | 51 | 103 | 130 | 157 | 211 | 265 | 514 |
| 14 | 18 | 22 | 30 | 37 | 72 | 144 | 182 | 219 | 295 | 371 | 719 |
| 21 | 26 | 31 | 42 | 53 | 103 | 205 | 259 | 314 | 422 | 530 |  |
| 29 | 36 | 44 | 59 | 74 | 144 | 288 | 363 | 439 | 590 | 742 |  |
| 39 | 49 | 60 | 80 | 101 | 195 | 390 | 493 | 596 | 801 |  |  |
| 49 | 62 | 75 | 101 | 127 | 246 | 493 | 623 | 752 |  |  |  |
| 54 | 68 | 82 | 110 | 138 | 268 | 536 | 677 | 818 |  |  |  |
| 63 | 80 | 97 | 130 | 163 | 317 | 633 | 800 | 967 |  |  |  |
| 79 | 100 | 120 | 162 | 203 | 394 | 789 | 996 |  |  |  |  |
| 95 | 120 | 145 | 195 | 244 | 474 | 948 |  |  |  |  |  |
| 103 | 130 | 157 | 211 | 265 | 514 |  |  |  |  |  |  |
| 114 | 144 | 174 | 234 | 294 | 571 |  |  |  |  |  |  |
| 117 | 147 | 178 | 240 | 301 | 584 |  |  |  |  |  |  |
| 78 | 99 | 119 | 160 | 201 | 390 | 781 | 986 |  |  |  |  |
| 99 | 125 | 150 | 202 | 254 | 493 | 986 |  |  |  |  |  |
| 107 | 135 | 164 | 220 | 276 | 536 |  |  |  |  |  |  |
| 127 | 160 | 193 | 260 | 327 | 633 |  |  |  |  |  |  |
| 158 | 199 | 241 | 324 | 407 | 789 |  |  |  |  |  |  |
| 117 | 148 | 179 | 240 | 302 | 585 |  |  |  |  |  |  |
| 188 | 187 | 226 | 304 | 381 | 739 |  | 315 | 804 |  |  |  |
| 161 | 203 | 245 | 330 | 415 | 39 |  |  |  |  |  |  |
| 190 | 240 | 290 | 390 | 490 | 950 |  |  |  |  |  |  |
| 237 | 299 | 361 | 486 | 610 |  |  |  |  |  |  |  |


| 20 | 16 | 14 | 11 | 8.8 | 4.7 | 2.4 | 1.9 | 1.6 | 1.2 | 1.0 | 0.5 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 19 | 16 | 14 | 11 | 8.7 | 4.7 | 2.4 | 1.9 | 1.6 | 1.2 | 1.0 | 0.5 |
| 19 | 16 | 14 | 11 | 8.6 | 4.7 | 2.4 | 1.9 | 1.6 | 1.2 | 1.0 | 0.5 |
| 18 | 15 | 13 | 10 | 8.5 | 4.6 | 2.4 | 1.9 | 1.6 | 1.2 | 1.0 | 0.5 |
| 18 | 15 | 13 | 10 | 8.3 | 4.6 | 2.4 | 1.9 | 1.6 | 1.2 | 0.9 | 0.5 |
| 17 | 14 | 12 | 9.8 | 8.1 | 4.5 | 2.4 | 1.9 | 1.6 | 1.2 | 0.9 | 0.5 |
| 15 | 13 | 12 | 9.3 | 7.8 | 4.4 | 2.3 | 1.9 | 1.6 | 1.2 | 0.9 | 0.5 |
| 15 | 13 | 11 | 9.0 | 7.6 | 4.4 | 2.3 | 1.9 | 1.6 | 1.2 | 0.9 | 0.5 |
| 14 | 12 | 11 | 8.6 | 7.3 | 4.3 | 2.3 | 1.8 | 1.5 | 1.2 | 0.9 | 0.5 |
| 12 | 11 | 9.9 | 8.2 | 7.0 | 4.2 | 2.3 | 1.8 | 1.5 | 1.2 | 0.9 | 0.5 |
| 11 | 10 | 9.0 | 7.5 | 6.5 | 4.0 | 2.2 | 1.8 | 1.5 | 1.1 | 0.9 | 0.5 |
| 9.4 | 9.0 | 7.8 | 6.7 | 5.9 | 3.7 | 2.1 | 1.7 | 1.5 | 1.1 | 0.9 | 0.5 |
| 7.1 | 7.0 | 6.2 | 5.5 | 4.9 | 3.3 | 2.0 | 1.6 | 1.4 | 1.1 | 0.9 | 0.5 |
| 5.5 | 5.0 | 4.9 | 4.4 | 4.1 | 2.9 | 1.8 | 1.5 | 1.3 | 1.0 | 0.8 | 0.5 |
| 4.2 | 4.0 | 3.8 | 3.5 | 3.3 | 2.5 | 1.7 | 1.4 | 1.2 | 1.0 | 0.8 | 0.5 |
| 3.4 | 3.0 | 3.2 | 3.0 | 2.8 | 2.2 | 1.5 | 1.3 | 1.2 | 0.9 | 0.8 | 0.4 |
| 2.7 | 3.0 | 2.5 | 2.4 | 2.3 | 1.9 | 1.4 | 1.2 | 1.1 | 0.9 | 0.7 | 0.4 |
| 1.9 | 2.0 | 1.8 | 1.7 | 1.7 | 1.4 | 1.1 | 1.0 | 0.9 | 0.8 | 0.7 | 0.4 |
| 1.0 | 1.0 | 0.9 | 0.9 | 0.9 | 0.8 | 0.7 | 0.7 | 0.6 | 0.5 | 0.5 | 0.3 |


| Correction coefficient |  |
| :--- | :--- |
| Voltage | $\mathbf{K}$ |
| 230 V | 0.58 |
| 660 V | 1.65 |

- Values shorter than 0.8 m or longer than 1 km are not considered. 1.65 - All values are for voltage 400 V .


#  

## Short circuit co-ordination

## What is co-ordination?

The motor starter consists of a combination of contactor, overload relay and short circuit protective device (SCPD) being either fuses or circuit breakers.
During motor starting and at normal loading, the overload relay protects both the motor and cables by tripping the contactor in a time inversely proportional to the current. However, under short circuit conditions, the response time would be too long and the fuses or circuit breaker must take over to interrupt the fault current therefore limiting energy passed through the starter components. When this is successfully achieved, the combination is said to be co-ordinated.

The primary function of co-ordination is to ensure that the selected components result in safe interruption of fault currents while minimising damage to the starter components themselves.

Why is co-ordination important?
Contactors are designed to switch loads frequently. They can carry the high starting currents of motors, but at short circuit levels, the extremely high current can force the contacts open due to electro- dynamic effects (it is this effect that is needed at normal operating currents to extinguish the arc quickly). Large short circuit currents can therefore lift the contacts possibly resulting in contact welding or further damage to the starter components.

The importance of selecting the correct SCPD is to minimise the effects of short circuits, provide safe interruption and a level of performance to meet the criteria for Type ' 2 '
co-ordination.

## Precise contactor control

While the correct selection of SCPD is of prime importance to ensure reliable operation under short circuit conditions, there are other malfunctions which can occur in a control circuit that can create contact welding due to uncontrolled and repetitive switching of the coil circuit (this is referred to as 'contact chatter'). This is particularly important with high current contactors where the switching currents of the respective motors are particularly high.
The electronically controlled mechanism 'ECM' of the CA 6 contactors prevent uncontrolled switching under all voltage conditions by providing precise control over the magnet system, thus preventing contact chatter and minimising contact bounce. Contactors of the
CA 5 series are provided with a delayed release mechanism to prevent contact chatter under low voltage conditions.

## High performance contactors

Under normal operating conditions all Sprecher + Schuh contactors offer high mechanical life (up to 10 million operations) with a contact life (electrical) up to 1.3 million under AC 3 conditions. Optimal performance is assured even under adverse conditions due to the design and selection of contactor components. This performance is evident in the design of the CA 6 contactor range which has enabled them to reach their full kilowatt potential under Type ' 2 ' conditions with both fuses and circuit breakers (refer co-ordination charts).


Terasaki 'TemBreak' tested with Sprecher + Schuh contactors to IEC 60947


The KTA 7 with CA 7 contactors.


Excellent design enables the CA 6 series contactors to reach their full potential under Type ' 2 ' conditions with both fuses and circuit breakers.

- 250A - 1600A MCCBs
- New 1000 A MCCB in a smaller 800 A Frame
- Ground Fault, Neutral pole, Phase Rotation, Pre Trip Alarm Protection
- Premium OCR -LSIAdjustable
- Back-lit LCD display
- Metering: I, U, P, W, $\operatorname{Cos} \varphi$, F
- Modbus communications
- Intelligent fault analysis
- Basic 2 dial OCR types
- Thermal magnetic to 800 A
- Common internal accessories for 125 A to 1600 A MCCBs


TemBreak

## 

## Type 2 Short Circuit Coordination

Terasaki/Sprecher + Schuh
TYPE 2 50/65 KA
For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1 415 V TemBreak MCCB circuit breakers
Sprecher + Schuh Thermal magnetic and Electronic overload relays.
Component Selection Table C64.0

|  | Motor | Circuit Breaker | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor <br> Kw | Motor Amp Ratings @ 400/415 V | Moulded Case Circuit Breaker | Contactor Type | Overload <br> Relay Thermal Type | Ampere Setting Range |
| 0.18 | 0.6 | XM30PB / 0.7A | CA7-9 | CT7N 23 A80 | 0.55-0.8 |
| 0.25 | 0.8 | XM30РB / 1.4A | CA7-9 | CT7N 23 B10 | 0.75-1.0 |
| 0.37 | 1.1 | XM30РB / 1.4A | CA7-9 | CT7N 23 B13 | 0.9-1.3 |
| 0.55 | 1.5 | XM30PB / 2.0 A | CA7-9 | CT7N 23 B20 | 1.4-2.0 |
| 0.75 | 1.8 | XM30PB / 2.6A | CA7-9 | CT7N 23 B25 | 1.8-2.5 |
| 1.1 | 2.6 | XM30РB / 4A | CA7-16 | CT7N 23 B32 | 2.3-3.2 |
| 1.5 | 3.4 | XM30РB / 5A | CA7-16 | CT7N 23 B40 | 2.9-4.0 |
| 2.2 | 4.8 | XM30PB / 8A | CA7-16 | CT7N 23 B63 | 4.5-6.3 |
| 3 | 6.5 | XM30PB / 10A | CA7-23 | CT7N 23 B75 | 5.5-7.5 |
| 4 | 8.2 | XM30PB / 12A | CA7-23 | CT7N 23 C 10 | 7.2-10 |
| 5.5 | 11 | S125GJ/20A | CA7-30 | CEP7 EEED | 5.4-27 |
| 7.5 | 14 | S125GJ/20A | CA7-30 | CT7N 37 C20 | 15-20 |
| 10 | 17 | S125GJ/20A | CA7-30 | CT7N 37 C20 | 15-20 |
| 11 | 21 | S125GJ/32A | CA7-30 | CT7N 37 C25 | 21-25 |
| 15 | 28 | S125GJ/50A | CA7-30 | CT7N 37 C30 | 24.5-30 |
| 18.5 | 34 | S125GJ/50A | CA7-37 | CT7N 37 C38 | 33-38 |
| 22 | 40 | S125GJ/63A | CA7-43 | CT7N 43 C47 | 35-47 |
| 30 | 55 | S125GJ/100A | CA7-72 | CT7N 85 C 60 | 45-60 |
| 37 | 66 | S125GJ/100A | CA7-72 | CT7N 85 C75 | 58-75 |
| 45 | 80 | S125GJ/125A | CA7-85 | CT7N 85 C 90 | 72-90 |
| 55 | 100 | S125GJ/125A | CA6-115 | CEP 7 EEHF | 30-150 |
| 75 | 130 | S160GJ/160A | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 90 | 155 | S250GJ / 250A | CA6-140-EI | CEP 7 EEJF | 40-200 |
| 110 | 200 | S250GJ/250A | CA6-180-EI | CEP 7 EEKG | 60-300 |
| 132 | 225 | S400GJ/400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 150 | 250 | S400GJ/400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 160 | 270 | S400GJ/400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 185 | 325 | S400GJ/400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 200 | 361 | S400GJ/400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 220 | 383 | S400GJ/400A | CA6-630-EI | CEP 7 EEMH | 120-600 |
| 250 | 425 | S630GE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 320 | 538 | S630GE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 400 | 700 | XH800SE / 800A | CA6-860-EI | CEP 7 EENH | 160-800 |

Notes: - Thermal or electronic overload relays may be used.

- XM30PB can be replaced with S125GJ/20 and CA7-23/ CA7-30
- Combinations based on the overload tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- Thermal magnetic MCCBs may be charged to electronic types if required.
- Same 'look' handles can be used on XM30PB and S125-630 A MCCBs
- S125GJ and S250GJ MCCBs can be changed to ZS125GJ and ZS250GJ earth leakage relay MCCBs if required.
- Refer to NHP for other device combinations
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## 

## Type 2 Short Circuit Coordination

## Terasaki/Sprecher + Schuh

For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1 TemBreak MCCB circuit breakers
Sprecher + Schuh Electronic overload relays.

## Component Selection Table C64.2

| Motor |  | Circuit Breaker | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor <br> Kw | Motor Amp Ratings @ $400 / 415$ V | Moulded Case Circuit Breaker | Contactor Type | Overload Relay (Electronic) | Ampere <br> Setting <br> Range |
| 0.18 | 0.6 | XM30РB / 0.7A | CA7-9 | CEP 7 EEBB | 0.2-1.0 |
| 0.25 | 0.8 | XM30РB / 1.4A | CA7-9 | CEP 7 EEBB | $0.2-1.0$ |
| 0.37 | 1.1 | XM30PB / 1.4A | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 0.55 | 1.5 | XM30PB / 2.0 A | CA7-9 | CEP 7 EECB | $1.0-5.0$ |
| 0.75 | 1.8 | XM30РB / 2.6A | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 1.1 | 2.6 | XM30PB / 4A | CA7-16 | CEP 7 EECB | 1.0-5.0 |
| 1.5 | 3.4 | XM30PB / 5A | CA7-16 | CEP 7 EECB | 1.0-5.0 |
| 2.2 | 4.8 | XM30РB / 8A | CA7-16 | CEP 7 EEEB | 5.4-27 |
| 3 | 6.5 | XM30РB / 10A | CA7-23 | CEP 7 EEEB | 5.4-27 |
| 4 | 8.2 | XM30PB / 12A | CA7-23 | CEP 7 EEEB | 5.4-27 |
| 5.5 | 11 | S125GJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 7.5 | 14 | S125GJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 10 | 17 | S125GJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 11 | 21 | S125GJ/32A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 15 | 28 | S125GJ / 50A | CA7-30 | CEP 7 EEFD | 9.0-45 |
| 18.5 | 34 | S125GJ/50A | CA7-37 | CEP 7 EEFD | 9.0-45 |
| 22 | 40 | S125GJ/63A | CA7-43 | CEP 7 EEFD | 9.0-45 |
| 30 | 55 | S125GJ/100A | CA7-72 | CEP 7 EEGE | 18-90 |
| 37 | 66 | S125GJ/100A | CA7-72 | CEP 7 EEGE | 18-90 |
| 45 | 80 | S125GJ/125A | CA7-85 | CEP 7 EEGE | 18-90 |
| 55 | 100 | S125GJ/125A | CA6-115 | CEP 7 EEHF | 30-150 |
| 75 | 130 | S160GJ/160A | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 90 | 155 | S250GJ/250A | CA6-140-EI | CEP 7 EEJF | 40-200 |
| 110 | 200 | S250GJ/250A | CA6-180-EI | CEP 7 EEKG | 60-300 |
| 132 | 225 | S400GJ/400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 150 | 250 | S400GJ/400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 160 | 270 | S400GJ / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 185 | 325 | S400GJ / 400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 200 | 361 | S400GJ/400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 220 | 383 | S400GJ/400A | CA6-630-EI | CEP 7 EEMH | 120-600 |
| 250 | 425 | S630GE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 320 | 538 | S630GE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 400 | 700 | XH800SE / 800A | CA6-860-EI | CEP 7 EENH | 160-800 |

Notes: . Thermal or electronic overload relays may be used.

- XM30PB can be replaced with S125GJ/20 and CA7-23/ CA7-30
- Combinations based on the overload tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- Electronic MCCBs may be changed to thermal magnetic types if required.
- Same 'look' handles can be used on XM30PB and S125-630 A MCCBs.
- S125GJ and S250GJ MCCBs can be changed to ZS125GJ and ZS250GJ earth leakage relay MCCBs if required.
- Refer to NHP for other device combinations.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## 

## Type 2 Short Circuit Coordination

Terasaki/Sprecher + Schuh
TYPE 2 50/65 KA
For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1 TemBreak MCCB circuit breakers
Sprecher + Schuh Electronic overload relays with communications and earth leakage.

Component Selection Table C64.11

| Motor |  | Circuit Breaker Contactor |  | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor Kw | Motor Amp <br> Ratings @ <br> 400/415 V | Moulded Case Circuit Breaker | Contactor Type | Overload Relay (Electronic) | Ampere <br> Setting <br> Range |
| 0.18 | 0.6 | S125GJ / 20A | CA7-23 | CEP7 C3-23-2 | 0.4-2.0 |
| 0.25 | 0.8 | S125GJ/20A | CA7-23 | CEP7 C3-23-2 | 0.4-2.0 |
| 0.37 | 1.1 | S125GJ/20A | CA7-23 | CEP7 C3-23-2 | 0.4-2.0 |
| 0.55 | 1.5 | S125GJ / 20A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 0.75 | 1.8 | S125GJ/20A | CA7-23 | CEP7 $73-23-5$ | 1.0-5.0 |
| 1.1 | 2.6 | S125GJ / 20A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 1.5 | 3.4 | S125GJ / 20A | CA7-23 | CEP7 $73-23-5$ | 1.0-5.0 |
| 2.2 | 4.8 | S125GJ/20A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 3 | 6.5 | S125GJ/20A | CA7-23 | CEP7 C3 23-25 | 5.0-25 |
| 4 | 8.2 | S125GJ/20A | CA7-23 | CEP7 C3 23-25 | 5.0-25 |
| 5.5 | 11 | S125GJ/20A | CA7-30 | CEP7 C3 43-25 | 5.0-25 |
| 7.5 | 14 | S125GJ/20A | CA7-30 | CEP7 C3 43-25 | 5.0-25 |
| 10 | 17 | S125GJ/20A | CA7-30 | CEP7 ${ }^{\text {C3 43-25 }}$ | 5.0-25 |
| 11 | 21 | S125GJ/32A | CA7-30 | CEP7 C3 43-25 | 5.0-25 |
| 15 | 28 | S125GJ/50A | CA7-30 | CEP7 C3 43-45 | 9.0-45 |
| 18.5 | 34 | S125GJ/50A | CA7-37 | CEP7 C3 43-45 | 9.0-45 |
| 22 | 40 | S125GJ/63A | CA7-43 | CEP7 C3 43-45 | 9.0-45 |
| 30 | 55 | S125GJ/100A | CA7-72 | CEP7 C3 85-90 | 18-90 |
| 37 | 66 | S125GJ/100A | CA7-72 | CEP7 C3 85-90 | 18-90 |
| 45 | 80 | S125GJ/125A | CA7-85 | CEP7 C3 85-90 | 18-90 |
| 55 | 100 | S125GJ/125A | CA6-115 | CEP7 C3 180140 | 28-140 |
| 75 | 130 | S160GJ/160A | CA6-140-EI | CEP7 C3 180140 | 28-140 |
| 90 | 155 | S250GJ/250A | CA6-140-EI | CEP7 C3 180210 | 42-210 |
| 110 | 200 | S250GJ/250A | CA6-180-EI | CEP7 C3 420302 | 60-302 |
| 132 | 225 | S400GJ/400A | CA6-420-EI | CEP7 C3 420302 | 60-302 |
| 150 | 250 | S400GJ/400A | CA6-420-EI | CEP7 C3 420302 | 60-302 |
| 160 | 270 | S400GJ/400A | CA6-420-EI | CEP7 C3 420302 | 60-302 |
| 185 | 325 | S400GJ/ 400A | CA6-420-EI | CEP7 C3 420420 | 84-420 |
| 200 | 361 | S400GJ/ 400A | CA6-420-EI | CEP7 C3 420420 | 84-420 |
| 220 | 383 | S400GJ/400A | CA6-630-EI | CEP7 C3 860630 | 125-630 |
| 250 | 425 | S630GE / 630A | CA6-860-EI | CEP7 C3 860630 | 125-630 |
| 320 | 538 | S630GE / 630A | CA6-860-EI | CEP7 C3 860630 | 125-630 |
| 400 | 700 | XH800SE / 800A | CA6-860-EI | CEP7 C3 860860 | 172-860 |

Notes: - Thermal or electronic overload relays may be used.

- S125GJ combinations can be replaced with XM30PB and smaller contactors if required.
- Combinations based on the thermal overload realy tripping before the circuit breaker at overload currents up the motor locked rotor current.
- Thermal magnetic MCCBs may be changed to electronic types if required.
- Same look handles can be used on XM30PB and S125-630 A MCCBs.
- Refer to NHP for other device combinations.
- The aove combinations are designed for motors with an inrush of $7 \times$ FLC for 5 seconds.
The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## 

## Type 2 Short Circuit Coordination

| Terasaki/Sprecher + Schuh | TYPE 2 |
| :--- | :---: |
| For DOL motor starting, $50 / 60 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS/NZS 60947.4.1 | 415 V | TemBreak MCCB circuit breakers

Sprecher + Schuh Thermal magnetic and electronic overload relays.
Component Selection Table C84.0

| Motor |  | Circuit Breaker <br> Moulded Case Circuit Breaker | Contactor <br> Contactor Type | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor <br> Kw | Motor Amp Ratings @ 400/415 V |  |  | Overload Relay | Ampere Setting Range |
| 0.18 | 0.6 | XM30PB / 0.7A | CA7-9 | CT7N 23 A80 | 0.55-0.8 |
| 0.25 | 0.8 | XM30PB / 1.4A | CA7-9 | CT7N 23 B10 | 0.75-1.0 |
| 0.37 | 1.1 | XM30PB / 1.4A | CA7-9 | CT7N 23 B13 | 0.9-1.3 |
| 0.55 | 1.5 | XM30PB / 2.0 A | CA7-9 | CT7N 23 B20 | 1.4-2.0 |
| 0.75 | 1.8 | XM30PB / 2.6A | CA7-9 | CT7N 23 B25 | 1.8-2.5 |
| 1.1 | 2.6 | XM30PB / 4A | CA7-16 | CT7N 23 B32 | 2.3-3.2 |
| 1.5 | 3.4 | XM30РB / 5A | CA7-16 | CT7N 23 B40 | 2.9-4.0 |
| 2.2 | 4.8 | XM30PB / 8A | CA7-16 | CT7N 23 B63 | 4.5-6.3 |
| 3 | 6.5 | XM30PB / 10A | CA7-23 | CT7N 23 B75 | 5.5-7.5 |
| 4 | 8.2 | XM30PB / 12A | CA7-23 | CT7N 23 C10 | 7.2-10 |
| 5.5 | 11 | H125NJ/20A | CA7-30 | CEP7 EEED | 5.4-27 |
| 7.5 | 14 | H125NJ/20A | CA7-30 | CT7N 37 C20 | 15-20 |
| 10 | 17 | H125NJ/20A | CA7-30 | CT7N 37 C20 | 15-20 |
| 11 | 21 | H125NJ/32A | CA7-30 | CT7N 37 C25 | 21-25 |
| 15 | 28 | H125NJ/50A | CA7-30 | CT7N 37 C30 | 24.5-30 |
| 18.5 | 34 | H125NJ/50A | CA7-37 | CT7N 37 C38 | 33-38 |
| 22 | 40 | H125NJ/63A | CA7-43 | CT7N 43 C47 | 35-47 |
| 30 | 55 | H125NJ/ 100A | CA7-72 | CT7N 85 C 60 | 45-60 |
| 37 | 66 | H125NJ/ 100A | CA7-72 | CT7N 85 C75 | 58-75 |
| 45 | 80 | H125NJ/125A | CA7-85 | CT7N 85 C 90 | 72-90 |
| 55 | 100 | H125NJ/125A | CA6-115 | CEP 7 EEHF | 30-150 |
| 75 | 130 | H160NJ / 160A | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 90 | 155 | H250NJ/250A | CA6-140-EI | CEP 7 EEJF | 40-200 |
| 110 | 200 | H250NJ/250A | CA6-180-EI | CEP 7 EEKG | 60-300 |
| 132 | 225 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 150 | 250 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 160 | 270 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 185 | 325 | H400NE / 400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 200 | 361 | H400NE / 400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 220 | 383 | H400NE / 400A | CA6-630-EI | CEP 7 EEMH | 120-600 |
| 250 | 425 | XH630PJ/630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 320 | 538 | XH630PJ/630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 400 | 700 | XH800PJ/800A | CA6-860-EI | CEP 7 EENH | 160-800 |

Notes: - Thermal or electronic overload relays may be used.

- XM30PB can be replaced with H125GJ and CA7-30 if required.
- Combinations based on the thermal overloads relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- Thermal magnetic MCCBs may be changed to electronic types if required.
- Same look handles can be used on XM30PB and S125-630 A MCCBs
- Refer to NHP for other device combinations.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## SP4/ JEnhesil Lisingegheps - Electrical testallletipreenentanual

## Type 2 Short Circuit Coordination

Terasaki/Sprecher + Schuh
For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1

> TYPE 2
> 100 KA
> 415 V

TemBreak MCCB circuit breakers
Sprecher + Schuh Electronic overload relays.
Component Selection Table C14.3

| Motor |  | Circuit Breaker | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor <br> Kw | Motor Amp Ratings @ 400/415 V | Moulded Case Circuit Breaker | Contactor Type | Overload Relay | Ampere Setting Range |
| 0.18 | 0.6 | H125NJ / 20A | CA7-23 | CEP 7 EEBB | 0.2-1.0 |
| 0.25 | 0.8 | H125NJ/20A | CA7-23 | CEP 7 EEBB | 0.2-1.0 |
| 0.37 | 1.1 | H125NJ/20A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 0.55 | 1.5 | H125NJ/20A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 0.75 | 1.8 | H125NJ/20A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 1.1 | 2.6 | H125NJ/20A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 1.5 | 3.4 | H125NJ/20A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 2.2 | 4.8 | H125NJ/20A | CA7-23 | CEP 7 EEDB | 3.2-16 |
| 3 | 6.5 | H125NJ/20A | CA7-23 | CEP 7 EEDB | 3.2-16 |
| 4 | 8.2 | H125NJ/20A | CA7-23 | CEP 7 EEDB | 3.2-16 |
| 5.5 | 11 | H125NJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 7.5 | 14 | H125NJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 10 | 17 | H125NJ/20A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 11 | 21 | H125NJ/32A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 15 | 28 | H125NJ/50A | CA7-30 | CEP 7 EEFD | 9.0-45 |
| 18.5 | 34 | H125NJ/50A | CA7-37 | CEP 7 EEFD | 9.0-45 |
| 22 | 40 | H125NJ/63A | CA7-43 | CEP 7 EEFD | 9.0-45 |
| 30 | 55 | H125NJ/ 100A | CA7-72 | CEP 7 EEGE | 18-90 |
| 37 | 66 | H125NJ/100A | CA7-72 | CEP 7 EEGE | 18-90 |
| 45 | 80 | H125NJ/ 100A | CA7-85 | CEP 7 EEGE | 18-90 |
| 55 | 100 | H125NJ/125A | CA6-115 | CEP 7 EEHF | 30-150 |
| 75 | 130 | H125NJ/125A | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 90 | 155 | H250NJ/250A | CA6-140-EI | CEP 7 EEJF | 40-200 |
| 110 | 200 | H250NJ/250A | CA6-180-EI | CEP 7 EEKG | 60-300 |
| 132 | 225 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 150 | 250 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 160 | 270 | H400NE / 400A | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 185 | 325 | H400NE / 400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 200 | 361 | H400NE / 400A | CA6-420-EI | CEP 7 EELG | 100-500 |
| 220 | 383 | H400NE / 400A | CA6-630-EI | CEP 7 EEMH | 120-600 |
| 250 | 425 | TL630NE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 320 | 538 | TL630NE / 630A | CA6-860-EI | CEP 7 EEMH | 120-600 |
| 400 | 700 | TL800NE / 800A | CA6-860-EI | CEP 7 EENH | 160-800 |

Notes: - Thermal or electronic overload relays may be used.

- Combinations based on the overloads relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- Thermal magnetic MCCBs may be changed to electronic types if required.
- Same 'look' handles can be used on all MCCBs.
- Refer to NHP for other device combinations.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## 

## Type 2 Short Circuit Coordination

Terasaki ZS ELCB/Sprecher + Schuh
TYPE 2 50/65 KA
For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1
415 V TemBreak MCCB circuit breakers
Sprecher + Schuh Electronic overload relays.
Component Selection Table EC64.3

| Motor |  | Circuit Breaker |  | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Motor Amp |  |  |  |  |  |
| Mo <br> tor <br> Kw | Ratings @ 400/ 415 V | Moulded Case Circuit Breaker | Earth Fault Sensing Range |  | Overload Relay | Ampere <br> Setting <br> Range |
| 0.18 | 0.6 | ZS125GJ/20A | 30mA - 3A | CA7-23 | CEP 7 EEBB | 0.2-1.0 |
| 0.25 | 0.8 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP 7 EEBB | 0.2-1.0 |
| 0.37 | 1.1 | ZS125GJ/20A | 30mA-3A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 0.55 | 1.5 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 0.75 | 1.8 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 1.1 | 2.6 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 1.5 | 3.4 | ZS125GJ/20A | 30 mA - 3 A | CA7-23 | CEP 7 EECB | 1.0-5.0 |
| 2.2 | 4.8 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EEDB | 3.4-16 |
| 3 | 6.5 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EEDB | 3.4-16 |
| 4 | 8.2 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP 7 EEDB | 3.4-16 |
| 5.5 | 11 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-30 | CEP 7 EEED | 5.4-27 |
| 7.5 | 14 | ZS125GJ/20A | 30mA - 3A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 10 | 17 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-30 | CEP 7 EEED | 5.4-27 |
| 11 | 21 | ZS125GJ/32A | 30mA-3A | CA7-30 | CEP 7 EEED | 5.4-27 |
| 15 | 28 | ZS125GJ/50A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-30 | CEP 7 EEFD | 9.0-45 |
| 18.5 | 34 | ZS125GJ/50A | 30 mA - 3A | CA7-37 | CEP 7 EEFD | 9.0-45 |
| 22 | 40 | ZS125GJ / 63A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-43 | CEP 7 EEFD | 9.0-45 |
| 30 | 55 | ZS125GJ/ 100A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-72 | CEP 7 EEGE | 18-90 |
| 37 | 66 | ZS125GJ/100A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-72 | CEP 7 EEGE | 18-90 |
| 45 | 80 | ZS125GJ/125A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-85 | CEP 7 EEGE | 18-90 |
| 55 | 100 | ZS125GJ/125A | 30mA-3A | CA6-115 | CEP 7 EEHF | 30-150 |
| 75 | 130 | ZS250GJ / 160A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 90 | 155 | ZS250GJ/250A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-140-EI | CEP 7 EEJF | 40-200 |
| 110 | 200 | ZS250GJ / 250A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-180-EI | CEP 7 EEKG | 60-300 |
| 132 | 225 | S400GE_AG/400A | $\mathrm{lg}=0.2 \times \ln \mathrm{min}$. | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 150 | 250 | S400GE_AG/400A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{min}$. | CA6-420-EI | CEP 7 EEKG | 60-300 |
| 160 | 270 | S400GE AG / 400A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{min}$. | CA6-420- | CEP 7 EEKG | 60-300 |
| 185 | 325 | S400GE_AG/ 400A | $\mathrm{lg}=0.2 \times \ln \mathrm{min}$. | CA6-420-EI | CEP 7 EELG | 100-500 |
| 200 | 361 | S400GE_AG/400A | $\lg =0.2 \times \ln \mathrm{min}$. | CA6-420-EI | CEP 7 EELG | 100-500 |
| 220 | 383 | S400GE_AG/ 400A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{min}$. | CA6-630-EI | CEP 7 EEMH | 120-600 |
| 250 | 425 | S630GE_AG/630A | $\mathrm{lq}=0.2 \times \mathrm{ln} \mathrm{min}$. | CA6-860 | CEP 7 EEMH | 120-600 |
| 320 | 538 | S630GE_AG/630A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{min}$. | CA6-860 | CEP 7 EEMH | 120-600 |
| 400 | 700 | XH800SE 800_LSIG | $\lg =0.2 \times \ln \mathrm{min}$. | CA6-860 | CEP7EENH | 160-800 |

Notes: - Thermal or electronic overload relays may be used.

- Combinations based on the thermal overloads relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- MCCBs 400-800 A have a Ground Fault option fitted. This will not sense small earth leakage (residual currents)
- Refer to NHP for other device combinations.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## SP4/ JEnhesil Lisingegheps - Electrical testallletipreenentanual

## Type 2 Short Circuit Coordination

Terasaki ZS ELCB/Sprecher + Schuh
TYPE 2 50/65 KA
For DOL motor starting, 50/60 kA @ 400/415 V to AS/NZS 60947.4.1 415 V TemBreak MCCB circuit breakers
Sprecher + Schuh Electronic overload relays with communications and earth leakage.

| ComponentMotor |  | Selection Table EC64.11 Circuit Breaker |  | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Motor Amp |  |  |  |  |  |
| M | Rating |  |  |  |  |  |
|  |  |  |  |  |  |  |
| Kw | 415 V | Circuit Breaker | Range | Type | Relay |  |
| 0.18 | 0.6 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP7 $73-23-2$ | 0.4-2.0 |
| 0.25 | 0.8 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP7 $73-23-2$ | 0.4-2.0 |
| 0.37 | 1.1 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP7 ${ }^{\text {C3-23-2 }}$ | 0.4-2.0 |
| 0.55 | 1.5 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP7 $73-23-5$ | 1.0-5.0 |
| 0.75 | 1.8 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 1.1 | 2.6 | ZS125GJ / 20A | 30 mA - 3 A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 1.5 | 3.4 | ZS125GJ/20A | 30 mA - 3 A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
|  | 4.8 | ZS125GJ/20A | 30mA - 3 A | CA7-23 | CEP7 C3-23-5 | 1.0-5.0 |
| 3 | 6.5 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP7 ${ }^{\text {C3 }} 23$-25 | 5.0-25 |
| 4 | 8.2 | ZS125GJ/20A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-23 | CEP7 C3 23-25 | 5.0-25 |
| 5.5 | 11 | ZS125GJ/20A | 30mA - 3 A | CA7-30 | CEP7 C3 43-25 | 5.0-25 |
| 7.5 | 14 | ZS125GJ/20A | 30mA - 3A | CA7-30 | CEP7 C3 43-25 | 5.0-25 |
| 10 | 17 | ZS125GJ/20A | 30mA - 3 A | CA7-30 | CEP7 C3 43-2 | 25 |
| 11 | 21 | ZS125GJ/32A | 30mA - 3 A | CA7-30 | CEP7 C3 43-2 | 5-25 |
| 15 | 28 | ZS125GJ/50A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-30 | CEP7 C3 43-45 | 9.0-45 |
| 18.5 | 34 | ZS125GJ/50A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-37 | CEP7 C3 43-45 | 9.0-45 |
| 22 | 40 | ZS125GJ/63A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA7-43 | CEP7 C3 43-45 | 9.0-45 |
| 30 | 55 | ZS125GJ / 100A | 30mA - 3 A | CA7-72 | CEP7 C3 85-90 | 18-90 |
| 37 | 66 | ZS125GJ/100A | 30mA-3A | CA7-72 | CEP7 C3 85-90 | 18-90 |
| 45 | 80 | ZS125GJ/125A | 30mA-3A | CA7-85 | CEP7 C3 85-9 | 18-90 |
| 55 | 100 | ZS125GJ/125A | 30mA-3A | CA6-115 | CEP7 C3 180140 | 28-140 |
| 75 | 130 | ZS250GJ / 160A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-140-EI | CEP7 C3 180140 | 42-140 |
| 90 | 155* | ZS250GJ / 250A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-140-EI | CEP7 C3 180210 | 42-210 |
| 110 | 200 | ZS250GJ/250A | $30 \mathrm{~mA}-3 \mathrm{~A}$ | CA6-180-EI | CEP7 C3 420302 | 60-302 |
| 132 | 225 | S400GE_AG/400 | $\lg =0.2 \times \ln \mathrm{m}$ | CA6-420 | CEP7 C3 420302 | 60-302 |
| 150 | 250 | S400GE_AG/400 | $\mathrm{g}=0.2 \times \ln$ | CA6-420 | CEP7 C3 4203 | 0-302 |
| 160 | 270 | S400GE AG/400 | $\mathrm{g}=0.2 \times \mathrm{ln}$ | CA6-420- | CEP7 C34203 | 60-302 |
| 185 | 325 | S400GE_AG/400 | $\lg =0.2 \times \ln \mathrm{m}$ | CA6-420- | CEP7 C34204 | 84-420 |
| 200 | 361 | S400GE AG/400A | $\mathrm{lq}=0.2 \times \mathrm{ln} \mathrm{mi}$ | CA6-420-EI | CEP7 C3420420 | 84-420 |
| 220 | 383 | S400GE_AG/400A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{mi}$ | CA6-630-EI | CEP7 C3 860630 | 125-630 |
| 250 | 425 | S630GE_AG/630A | $\lg =0.2 \times \ln \mathrm{mi}$ | CA6-860-EI | CEP7 C3 860630 | 125-630 |
| 320 | 538 | S630GE_AG/630A | $\mathrm{lg}=0.2 \times \mathrm{ln} \mathrm{mi}$ | CA6-860-EI | CEP7 C3860630 | 125-630 |
| 400 | 700 | XH800SE800_LSI | $=0.2 \times \ln \mathrm{m}$ | CA6-860-E | CEP7 C38608 | 172-860 |

Notes: - CEP7 C3 overloads include DeviceNet comms, earth fault relay, and thermistor relay.

- The CEP7 C3 inbuilt earth fault relay senses currents from 20 mA to 5 A . An external CT is required.
- MCCBs 400-800 A have a Ground Fault option fitted. This will not sense small earth leakage (residual currents)
- Combinations based on the thermal overloads relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds. The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## Type 2 Short Circuit Coordination

## Sprecher + Schuh

For DOL motor starting, 50/60 kA @ 690 V to AS/NZS 60947.4.1
Sprecher + Schuh KTA7 motor circuit breakers/ CEP 7 electronic overload relays
Component Selection Table C56.0

| Motor |  | Circuit Breaker Contactor |  | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Motor |  |  |  |  |
|  | Amp |  |  | KT7 overload or | Ampere |
| Motor | Ratings @ | MPCB/ M |  | separate Overload | Setting |
| Kw | 690 V AC | Circuit Break | Type | Relay | Range |
| 0.37 | 0.63 | KTA 7-25S-1A | CA7-9 | KT7 has adjustable O/L | 0.63-1.0 |
| 0.55 | 0.86 | KTA 7-25S-1A | CA7-9 | KT7 has adjustable O/L | 0.63-1.0 |
| 0.75 | 1.1 | KTA 7-25S-1.6A | CA7-9 | KT7 has adjustable O/L | 1.0-1.6 |
| 1.1 | 1.5 | KTA 7-25S-1.6A | CA7-9 | KT7 has adjustable O/L | 1.0-1.6 |
| 1.5 | 2.1 | KTA 7-25H-2.5A | CA7-9 | KT7 has adjustable O/L | 1.6-2.5 |
| 2.2 | 2.9 | KTA 7-25H-4A | CA7-9 | KT7 has adjustable O/L | 2.5-4 |
| 3 | 3.8 | KTA 7-25H-4A | CA7-12 | KT7 has adjustable O/L | 2.5-4 |
| 4 | 4.9 | KTA 7-25H-6.3A | CA7-12 | KT7 has adjustable O/L | 4.0-6.3 |
| 5.5 | 6.6 | KTA 7-25H-10A | CA7-16 | KT7 has adjustable O/L | 6.3-10 |
| 7.5 | 8.9 | KTA 7-25H-10A | CA7-23 | KT7 has adjustable O/L | 6.3-10 |
| 10 | 12 | KTA 7-25H-16A | CA7-23 | KT7 has adjustable O/L | 10-16 |
| 11 | 13 | KTA 7-25H-16A | CA7-30 | KT7 has adjustable O/L | 10-16 |
| 15 | 17 | KTA 7-45H-20A | CA7-30 | KT7 has adjustable O/L | 14.5-20 |
| 18.5 | 21 | KTA 7-45H-25A | CA7-43 | KT7 has adjustable O/L | 18-25 |
| $\underline{22}$ | 24 | KTA 7-45H-32A | CA7-60 | KT7 has adjustable O/L | 23-32 |

Notes: - The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds.

## 

## Type 2 Short Circuit Coordination

TYPE 2 50/65 KA 690 V
Socomec switch fuses/Sprecher + Schuh
For DOL motor starting, 50/60 kA @ 690 V to AS/NZS 60947.4.1
DIN Fuse links, SOCOMEC Switch Fuses
Sprecher + Schuh KTA7 Electronic overload relays
Component Selection Table F66D. 1

| Motor |  | Circuit Breaker |  | Contactor | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Motor |  |  |  |  |  |
| Motor Kw | Amp <br> Ratings @ <br> 690 V AC | DIN <br> gG Fuse <br> Amps/Size | SwitchFuse |  | Overload <br> Relay (Elec- <br> tronic) | Ampere <br> Setting <br> Range |
| 0.18 | 0.35 | 2/00C | SSFDN 63 | CA7-9 | CEP 7 EEBB | 0.2-1.0 |
| 0.25 | 0.46 | 2/00C | SSFDN 63 | CA7-9 | CEP 7 EEBB | 0.2-1.0 |
| 0.37 | 0.63 | 4/00C | SSFDN 63 | CA7-9 | CEP 7 EEBB | 0.2-1.0 |
| 0.55 | 0.86 | 4/00C | SSFDN 63 | CA7-9 | CEP 7 EEBB | 0.2-1.0 |
| 0.75 | 1.1 | 4/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 1.1 | 1.5 | 6/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 1.5 | 2.1 | 6/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 2.2 | 2.9 | 10/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 3 | 3.8 | 10/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 4 | 4.9 | 16/00C | SSFDN 63 | CA7-9 | CEP 7 EECB | 1.0-5.0 |
| 5.5 | 6.6 | 20/00C | SSFDN 63 | CA7-12 | CEP 7 EEEB | 5.4-27 |
| 7.5 | 8.9 | 25/00C | SSFDN 63 | CA7-16 | CEP 7 EEEB | 5.4-27 |
| 10 | 12 | 32/00C | SSFDN 63 | CA7-23 | CEP 7 EEEB | 5.4-27 |
| 11 | 13 | 35/00C | SSFDN 63 | CA7-30 | CEP 7 EEED | 5.4-27 |
| 15 | 17 | 50/00C | SSFDN 63 | CA7-30 | CEP 7 EEED | 5.4-27 |
| 18.5 | 21 | 50/00C | SSFDN 63 | CA7-37 | CEP 7 EEED | 5.4-27 |
| 22 | 24 | 63/00C | SSFDN 63 | CA7-43 | CEP 7 EEED | 5.4-27 |
| 30 | 32 | 80/00 | SSFDN 125 | CA7-60 | CEP 7 EEGE | 18-90 |
| 37 | 39 | 100/00 | SSFDN 125 | CA7-72 | CEP 7 EEGE | 18-90 |
| 45 | 47 | 125/00 | SSFDN 125 | CA7-85 | CEP 7 EEGE | 18-90 |
| 55 | 57 | 125/00 | SSFDN 125 | CA6-95 | CEP 7 EEHF | 30-150 |
| 75 | 78 | 160/00 | SSFDN 160 | CA6-115 | CEP 7 EEHF | 30-150 |
| 90 | 94 | 200/1 | SSFDN 250 | CA6-110-EI | CEP 7 EEHF | 30-150 |
| 110 | 114 | 224/1 | SSFDN 250 | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 132 | 135 | 250/1 | SSFDN 250 | CA6-140-EI | CEP 7 EEHF | 30-150 |
| 160 | 163 | $300 / 2$ | SSFDN 400 | CA6-180-EI | CEP 7 EEJF | 40-200 |
| 200 | 203 | 400/2 | SSFDN 400 | CA6-210-EI | CEP 7 EEKG | 60-300 |
| 220 | 220 | 400/2 | SSFDN 400 | CA6-300-EI | CEP 7 EEKG | 60-300 |
| 250 | 252 | 425/3 | SSFDN 630 | CA6-300-EI | CEP 7 EEKG | 60-300 |
| 315 | 312 | 500/3 | SSFDN 630 | CA6-420-EI | CEP 7 EELG | 100-500 |
| 355 | 354 | 630/3 | SSFDN 630 | CA6-420-EI | CEP 7 EELG | 100-500 |
| 400 | 397 | 630/3 | SSFDN 630 | CA6-420-EI | CEP 7 EELG | 100-500 |

Notes: - Thermal or electronic overload relays may be used.

- Refer to NHP for other device combinations.
- The above combinations are designed for motors with an inrush of 7 x FLC for 5 seconds.
- The fuse maximum inrush current must be considered when used with high inrush, high efficiency motors.


## 

## Type 2 Short Circuit Coordination

Terasaki/Sprecher + Schuh
For DOL motor starting, $6.5-20 \mathrm{kA} @ 1000 \mathrm{~V}$ to AS/NZS 60947.4.1
TemBreak 1 Moulded Case Circuit Breakers
Sprecher + Schuh Electronic overload relays
Component Selection Table C21.0

| Motor |  | Circuit Breaker Contactor |  | Overload Relay |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Motor Kw | Motor Amp Ratings @ 690 V AC | MPCB/ MCCB Circuit Breaker | Type | KT7 overload or separate Overload Relay | Ampere Setting Range |
| 25 | 20 | TL100EM403K | CA6 115 El | CEF1-11 | 20-180 |
| 30 | 25 | TL100EM503K | CA6 115 El | CEF1-11 | 20-180 |
| 45 | 33 | TL100EM603K | CA6 115 El | CEP7 EE HF | 30-150 |
| 55 | 40 | TL100EM753K | CA6 105 El | CEP7 EE HF | 30-150 |
| 75 | 55 | TL100EM1003K | CA6 140 El | CEP7 EE HF | 30-150 |
| 90 | 65 | TL100EM1003K | CA6 170 El | CEP7 EE HF | 30-150 |
| 111 | 80 | XV400NE2503K | CA6 210 EI | CEP7 EE HF | 30-150 |
| 133 | 95 | XV400NE2503K | CA6 250 EI | CEP7 EE HF | 30-150 |
| 163 | 115 | XV400NE2503K | CA6 300 El | CEP7 EE HF | 30-150 |
| 206 | 145 | XV400NE2503K | CA6 420 El | CEP7 EE JF | 40-200 |
| 280 | 200 | XV400NE4003K | CA5 450 | CEP7 EE KG | 60-300 |
| 355 | 250 | XV400NE4003K | CA5 550 | CEP7 EE KG | 60-300 |
| 500 | 340 | XV400NE4003K | CA5 700 | CEP7 EE LG | 100-500 |
| 550 | 380 | XV630PE6303K | CA5 860 | CEP7 EE LG | 100-500 |

Notes: - CEP7 overload add-on modules are available for Profibus, DeviceNet, Ethernet, Ground Fault, remote reset, jam protection, and a thermister protection relay. A CEP7 overload will accept one only add-on module.

- CEF 1 CT overloads can replace CEP7 overloads if required.
- For CEP7 C3 overload use, 1000 V rated CTs must be used.
- Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.
- Same 'look' handles can be used on MCCBs. Refer NHP for other device combinations.
- The above combinations are designed for motors with an inrush of $7 \times$ FLC for 5 seconds.
The instant trip point of MCCBs must be considered when used with high inrush, high efficiency motors.


## TEMCURVE 6 - CIRCUIT BREAKER SELECTIVITY APPLICATION SOFTWARE

The latest version of TemCurve 6 includes advanced new features making it a versatile application tool for use with Terasaki MCBs, MCCBs, ACBs, NHP fuses as well as generic IEC protection relay curves.


- TemCurve file sharing
- Distribution schematic
- Supply fault calculations
- Supply voltage options
- Catalogue data prints
- Time current curves
- Device photos
- User defined curves
- Motor start applications
- Internet update capability
- Energy let through curves
- Supply device type options
- Exports to AutoCad
- Circuit breaker setting detail
- Calculator

Motor circuit application table for DOL starting
Breaker type and current rating (A)

| Motor Rating (kW) | Approx. FLC (Amps) | $\begin{aligned} & \text { Din-T } \\ & \text { C \& D curve } \end{aligned}$ | Safe-T | $\begin{aligned} & \text { ZS125 } \\ & \text { E125 } \\ & \text { S125 } \\ & \text { H125 } \\ & \text { L125 } \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 |  |
| 0.55 | 1.5 | 4 | 6 | 20 |
| 0.75 | 1.8 | 6 | 6 | 20 |
| 1.1 | 2.6 | 10 | 6 | 20 |
| 1.5 | 3.4 | 10 | 10 | 20 |
| 2.2 | 4.8 | 16 | 16 | 20 |
| 3.0 | 6.5 | 20 | 16 | 20 |
| 4 | 8.2 | 25 | 20 | 20 |
| 4.5 | 9 | 32 | 25 | 20 |
| 5.5 | 11 | 32 | 32 | 32 |
| 7.5 | 14 | 40 | 40 | 32 |
| 10 | 19 | 50 | 50 | 50 |
| 11 | 21 | 50 | 50 | 50 |
| 15 | 28 | 63 | 63 | 63 |
| 18.5 | 34 | $100{ }^{1}$ ) | 80 | 100 |
| $\underline{22}$ | 40 | $125^{1}$ ) | 100 | 100 |
| 25 | 46 | $125^{1}$ ) | 100 | 100 |
| 30 | 55 |  |  | 125 |
| 37 | 66 |  |  | 125 |
| 45 | 80 |  |  | 125 |
| 55 | 100 |  |  |  |
| 75 | 135 |  |  |  |
| 90 | 160 |  |  |  |
| 110 | 200 |  |  |  |
| 132 | 230 |  |  |  |
| 160 | 270 |  |  |  |
| 185 | 320 |  |  |  |
| 200 | 361 |  |  |  |
| 220 | 380 |  |  |  |
| 250 | 430 |  |  |  |
| 280 | 480 |  |  |  |
| 300 | 510 |  |  |  |
| 375 | 650 |  |  |  |
| 450 | 750 |  |  |  |

Notes: ${ }^{\left.{ }^{2}\right)} 80,100$ and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Electronic TemBreak MCCB only.

## Motor circuit application table for DOL starting

Breaker type and current rating (A)

|  |  |  | ZS800 <br> S800CJ |  |
| :--- | :--- | :--- | :--- | :--- |
| ZS250 |  |  | S800NJ |  |
| S160 |  | S800 (630 A) | S800RJ | S800NE |


| 160 |  |  |
| :--- | :--- | :--- |
| 160 |  |  |
| 160 | 250 |  |
| 160 | 250 |  |
| 250 | 250 | 400 |
|  | 400 | 400 |
|  | 400 | 400 |
|  | 400 | 630 |
|  | $\left.400^{2}\right)$ | 630 |
|  | $\left.400^{2}\right)$ | 630 |
|  |  | $\left.630^{2}\right)$ |
|  |  | $\left.630^{2}\right)$ |
|  |  | $\left.800^{2}\right)$ |
|  |  | 800 |
|  |  | 800 |
|  |  |  |

1000
Notes: - The DOL table is based on holding 125 \% FLC continuously and $600 \%$ FLC for 10 seconds. For non-standard drives consult NHP.

- Lower circuit breaker ratings are possible in most applications. Refer to Type '2'co-ordination tables for specific circuit breaker/overload combinations.
- Adjustable magnetic trips set to high. Thermal magnetic TemBreak adjustable $63 \%-100 \%$ of NRC (nominal rated current).
- Din-T MCBs are calibrated to IEC 60898 Curve 'C' \& 'D'. Selected sizes of ' D ' Curve are available from stock, refer NHP.

General motor circuit application table for reduced voltage starting

Breaker type and current rating, star-delta, auto-transformer resistor or reactance starting

| Motor rating (kW) | Approx. FLC (Amps) | Din-T <br> C \& D curve | Safe-T | $\begin{aligned} & \text { ZS125 } \\ & \text { E125 } \\ & \text { S125 } \\ & \text { H125 } \\ & \text { L125 } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 |  |
| 0.55 | 1.5 | 4 | 6 | 20 |
| 0.75 | 1.8 | 4 | 6 | 20 |
| 1.1 | 2.6 | 6 | 6 | 20 |
| 1.5 | 3.4 | 10 | 6 | 20 |
| 2.2 | 4.8 | 10 | 10 | 20 |
| 3.0 | 6.5 | 16 | 16 | 20 |
| 4 | 8.2 | 20 | 16 | 20 |
| 4.5 | 9 | 20 | 16 | 20 |
| 5.5 | 11 | 25 | 20 | 20 |
| 7.5 | 14 | 32 | 25 | 20 |
| 10 | 19 | 40 | 40 | 32 |
| 11 | 21 | 50 | 40 | 32 |
| 15 | 28 | 50 | 50 | 50 |
| 18.5 | 34 | 63 | 63 | 50 |
| 22 | 40 | $80^{1}$ ) | 63 | 63 |
| 25 | 46 | $100{ }^{\text {1 }}$ ) | 80 | 100 |
| 30 | 55 | $125{ }^{\text { }}$ ) | 100 | 100 |
| 37 | 66 | $125{ }^{\text { }}$ ) |  | 100 |
| 45 | 80 |  |  | 125 |
| 55 | 100 |  |  |  |
| 75 | 135 |  |  |  |
| 90 | 160 |  |  |  |
| 110 | 200 |  |  |  |
| 132 | 230 |  |  |  |
| 160 | 270 |  |  |  |
| 185 | 320 |  |  |  |
| 200 | 361 |  |  |  |
| 220 | 380 |  |  |  |
| 250 | 430 |  |  |  |
| 280 | 480 |  |  |  |
| 300 | 510 |  |  |  |
| 375 | 650 |  |  |  |
| 450 | 750 |  |  |  |

Notes: ${ }^{1)} 80,100$ and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Electronic TemBreak MCCB only.
If co-ordination to IEC 60947-4-1 is required refer to co-ordination tables.
Reduced voltage table is based on holding 120 \% FLC continuously and $350 \%$ FLC for 20 seconds.
Din-T MCBs are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are available from stock refer NHP.

## 

## General motor circuit application table

 for reduced voltage starting$\left.\begin{array}{lllll} & & & \begin{array}{l}\text { ZS800 } \\ \text { S800CJ }\end{array} & \\ \text { ZS250 } & & & \begin{array}{l}\text { S800NJ }\end{array} & \\ \text { S160 } & & \text { S800 (630 A) } & \text { S800RJ } & \text { S800NE }\end{array}\right]$

| 160 |  |  |  |
| :--- | :--- | :--- | :--- |
| 160 | 250 |  |  |
| 160 | 250 |  |  |
| 160 | 250 |  |  |
| 250 | 250 | 400 | $\left.800^{2}\right)$ |
| 250 | 250 | 400 | $\left.800^{2}\right)$ |
|  | 400 | 400 | 800 |
|  | 400 | 630 | 800 |
|  | 400 | 630 | 800 |
|  |  | 630 | 800 |
|  |  | 630 | $\left.800^{2}\right)$ |
|  |  |  | 1000 |

Motor circuit application table for DOL fire pump starting duty

Breaker type and current rating (A)

| Motor rating (kW) | Approx. FLC (Amps) | Din-T <br> C \& D curve | Safe-T | XM30PB | $\begin{aligned} & \text { ZS125 } \\ & \text { E125 } \\ & \text { S125 } \\ & \text { H125 } \\ & \text { L125 } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | 4 | 6 | 3.6 |  |
| 0.55 | 1.5 | 6 | 6 | 3.6 |  |
| 0.75 | 1.8 | 6 | 6 | 5 | 20 |
| 1.1 | 2.6 | 10 | 6 | 7.4 | 20 |
| 1.5 | 3.4 | 16 | 10 | 10 | 20 |
| 2.2 | 4.8 | 20 | 16 | 12 | 20 |
| 3 | 6.5 | 25 | 20 |  | 20 |
| 4 | 8.2 | 32 | 25 |  | 32 |
| 4.5 | 9 | 32 | 32 |  | 32 |
| 5.5 | 11 | 40 | 40 |  | 32 |
| 7.5 | 14 | 50 | 50 |  | 50 |
| 10 | 19 | 63 | 50 |  | 50 |
| 11 | 21 | 63 | 63 |  | 63 |
| 15 | 28 | $100{ }^{1}$ ) | 80 |  | 100 |
| 18.5 | 34 | $125^{1}$ ) | 100 |  | 100 |
| 22 | 40 |  |  |  | 125 |
| 25 | 46 |  |  |  | 125 |
| 30 | 55 |  |  |  |  |
| 37 | 66 |  |  |  |  |
| 45 | 80 |  |  |  |  |
| 55 | 100 |  |  |  |  |
| 75 | 130 |  |  |  |  |
| 90 | 155 |  |  |  |  |
| 110 | 200 |  |  |  |  |
| 132 | 225 |  |  |  |  |
| 160 | 270 |  |  |  |  |
| 185 | 320 |  |  |  |  |
| 200 | 361 |  |  |  |  |
| 220 | 380 |  |  |  |  |
| 250 | 430 |  |  |  |  |
| 280 | 480 |  |  |  |  |
| 300 | 510 |  |  |  |  |
| 375 | 650 |  |  |  |  |
| 450 | 750 |  |  |  |  |

Notes: $\left.{ }^{1}\right) 80,100$ and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Electronic TemBreak MCCB only.
DOL table is based on holding 125 \% FLC continuously and $600 \%$ FLC for at least 20 seconds.
Din-T MCBs are calibrated to IEC 60898 Curve 'C' \& 'D'. Selected sizes of 'D' Curve are available from stock refer NHP.

## 

## Motor circuit application table for DOL fire pump starting duty

|  |  | S800CJ <br> S800NJ |  |  |
| :--- | :--- | :--- | :--- | :--- |
| ZS250 |  |  | S800RJ |  |
| S160 |  | S800NE |  |  |
| H160 |  | S800RE |  |  |
| L160 | ZS400 | ZS630 | H800NE |  |
| S250 | E400 | E630 | ZS800 | S1000NE |
| E250 | S400 | S630 | XS800NJ | S1250NE/1250 |
| H250 | H400 | XH630 | XH800SE | XS1250SE |
| L250 | L400 | XS630 | XS800SE | $/ 1000$ |

# Motor starting table for DOL starting at 1000 V AC 50 Hz 

|  | Full Load <br> Current <br> Amperes (A) | MCCB | Voltage (V) |
| :--- | :--- | :--- | :--- |
| Motor Size (kW) | $0.4-7.5$ | VS125NJ 20 | 1000 |
| $0.37-10$ | 9.0 | VS125NJ 20 | 1000 |
| 11.0 | $12-14.5$ | VS125NJ 32 | 1000 |
| $15-18.5$ | $17-23$ | VS125NJ 50 | 1000 |
| $22-33$ | $28-38$ | VS125NJ 50 | 1000 |
| $37-50$ | $40-57$ | VS125NJ 63 | 1000 |
| $55-80$ | $65-78$ | VS125NJ 100 | 1000 |
| $90-110$ | 102 | VS125NJ 160 | 1000 |
| 150 | $138-160$ | VS125NJ 250 | 1000 |
| $185-220$ | $160-350$ | XV400NE/400K | 1000 |
| $220-500$ |  |  |  |

 1000 V Type 2 co-ordination chart available. Refer NHP.

## 

## Rated outputs and standard values

for rated operational currents of standard squirrel-cage motors

3 phase 4 pole $50 / 60 \mathrm{~Hz}$ motors $\left.{ }^{1}\right)^{2}$ )

| kW ${ }^{1}$ ) | hp | $230 \text { V }$ | $\begin{aligned} & 400-415 \mathrm{~V} \\ & \text { A } \end{aligned}$ | $\begin{aligned} & 690 \mathrm{~V} \\ & \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1000 \mathrm{~V} \\ & \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & 1100 \mathrm{~V} \\ & \mathrm{~A} \\ & \hline \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.18 | 0.3 | 1.2 | 0.6 | 0.4 | 0.3 | 0.24 |
| 0.37 | 0.5 | 1.95 | 1.1 | 0.6 | 0.4 | 0.4 |
| 0.55 | 0.75 | 2.7 | 1.5 | 0.9 | 0.6 | 0.56 |
| 0.75 | 1 | 3.2 | 1.8 | 1.2 | 1.0 | 0.7 |
| 1.1 | 1.5 | 4.6 | 2.6 | 1.6 | 1.1 | 0.92 |
| 1.5 | 2 | 6.3 | 3.4 | 2.1 | 1.5 | 1.3 |
| 2.2 | 3 | 9 | 4.8 | 2.9 | 2 | 1.85 |
| 3 | 4 | 12 | 6.5 | 4 | 2.7 | 2.5 |
| 4 | 5.5 | 15.5 | 8.2 | 5 | 3.4 | 3.2 |
| 4.5 | 6 | 17 | 9 | 5.7 | 4.4 | 3.5 |
| 5.5 | 7.5 | 20 | 11 | 6.6 | 6 | 4.3 |
| 7.5 | 10 | 27 | 14 | 9 | 7 | 5.6 |
| 10 | 13.5 | 36 | 19 | 12 | 7.6 | 7.5 |
| 11 | 15 | 39 | 21 | 13 | 9 | 8 |
| 15 | 20 | 52 | 28 | 17 | 12.1 | 10.5 |
| 18.5 | 25 | 63 | 34 | 22 | 15 | 13 |
| 22 | 30 | 75 | 40 | 25 | 18 | 15.5 |
| 25 | 35 | 83 | 46 | 28 | 22 | 18 |
| 30 | 40 | 100 | 55 | 35 | 23 | 21 |
| 37 | 50 | 122 | 65 | 40 | 27 | 25 |
| 45 | 60 | 147 | 80 | 49 | 34 | 30 |
| 55 | 75 | 180 | 100 | 59 | 42 | 37 |
| 75 | 100 | 240 | 130 | 79 | 54 | 50 |
| 90 | 125 | 290 | 155 | 95 | 66 | 60 |
| 110 | 150 | 350 | 200 | 114 | 80 | 73 |
| 132 | 180 | 410 | 225 | 135 | 90 | 85 |
| 160 | 220 | 500 | 270 | 160 | 117 | 105 |
| 185 | 250 | 570 | 325 | 185 | 135 | 120 |
| 200 | 270 | 625 | 361 | 200 | 150 | 130 |
| 220 | 300 | 675 | 380 | 220 | 160 | 142 |
| 250 | 340 | 775 | 430 | 250 | 200 | 160 |
| 280 | 380 | 830 | 480 | 280 | 225 | 180 |
| 300 | 410 | 920 | 505 | 300 | 235 | 195 |
| 315 | 430 | 980 | 535 | 315 | 240 | 200 |
| 375 | 500 | 1150 | 650 | 375 | 270 | 240 |
| 400 | 545 | 1225 | 665 | 400 | 290 | 255 |
| 475 | 645 | 1450 | 780 | 465 | 335 | 300 |
| 500 | 680 | - | 820 | 495 | 360 | 320 |
| 560 | 750 | - | 920 | 570 | 390 | 350 |
| 600 | 800 | - | 1000 | 610 | 420 | 390 |
| 670 | 900 | - | 1100 | 680 | 470 | 430 |
| 750 | 1000 | - | 1250 | 770 | 530 | 490 |
| 900 | 1200 | - | 1470 | 930 | 650 | 600 |

Notes: Refer to 9-46 for footnotes

## Rated outputs and standard values

 for rated operational currents of standard squirrel-cage motorsSingle phase motors

|  |  | 230 V |
| :---: | :---: | :---: |
| kW ${ }^{1}$ ) | hp | A |
| 0.37 | 0.5 | 4 |
| 0.55 | 0.75 | 5 |
| 0.75 | 1 | 6.3 |
| 1.1 | 1.5 | 9 |
| 1.5 | 2 | 12 |
| 1.8 | 2.5 | 15 |
| 2.2 | 3 | 18 |
| 3 | 4 | 23 |
| 4 | 5 | 28 |
| 5.5 | 7.5 | 41 |
| 6 | 8 | 42 |
| 7.5 | 10 | 52 |

[^48]
## TemBreak MCCB clearance requirements at 380/415 V

Clearance requirements for MCCBs (phase to phase and earth).
When MCCBs are called upon to interrupt large short-circuits, ionised gas and arcing material is expelled from the vents, usually at the top of the MCCB.
This ionised gas is highly conductive and is also at an elevated temperature when it exits the MCCB via the arc vents. Care must be taken to avoid an arcing fault occurring due to the presence of the ionised gas.

Therefore, incoming conductors must be insulated right up to the terminal opening of the MCCB. This also applies to the attached busbars supplied as a proprietory part with the MCCB.
Proprietary type interpole barriers may be used to achieve creepage and clearance requirements.
Conductors must not impede the flow of ionised gas.

## Insulating distance from Line-End for 380/415 V

When earth metal is installed within proximity of the breakers the correct insulating distance must be maintained. This distance is necessary to allow the exhausted arc gases to disperse.


## WARNING:

EXPOSED CONDUCTORS INCLUDING TERMINALS AT ATTACHED BUSBARS MUST BE INSULATED TO AVOID POSSIBLE SHORT-CIRCUITING OR EARTHING DUE TO FOREIGN MATTER COMING INTO CONTACT WITH THE CONDUCTORS.

Notes: When using the terminal bar (optional), the specified insulating distance must be maintained.
All dimensions in mm .
When earthed metal is installed within proximity of the breakers the correct insulating distance must be maintained (refer to Table 1 over the page).
This distance is necessary to allow the exhausted arc gases to disperse.

## 

## TemBreak MCCB clearance requirements at 380/415 V

## Insulation distance in mm (at 440 V AC Maximum) ${ }^{1}$ )

TemBreak 2 MCCBs
Table 1 below illustrates the minimum clearance that must be maintained
A Distance from lower breaker to open charging part of terminal on upper breaker (front connection) or the distance from lower breaker to upper breaker end (rear connection and plug-in type)
B1 Distance from breaker end to ceiling (earthed metal)
B2Distance from breaker end to insulator
C Clearance between breakers
D Distance from breaker side to side plate (earthed metal)

| Cat. No. | Type | A | B1 | B2 | C | D |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E125 | NJ | 50 | 10 | 10 | 0 | 25 |
| S125 | NF | 50 | 10 | 10 | 0 | 25 |
| S125 | NJ | 50 | 10 | 10 | 0 | 25 |
| S125 | GJ | 75 | 45 | 25 | 0 | 25 |
| ZS125 | GJ | 75 | 45 | 25 | 0 | 25 |
| H125 | NJ | 100 | 80 | 60 | 0 | 50 |
| L125 | NJ | 100 | 80 | 60 | 0 | 50 |
| S160 | NF | 50 | 40 | 30 | 0 | 25 |
| S160 | NJ | 50 | 40 | 30 | 0 | 25 |
| S160 | GJ | 100 | 80 | 60 | 0 | 25 |
| H160 | NJ | 100 | 80 | 60 | 0 | 50 |
| L160 | NJ | 100 | 80 | 60 | 0 | 50 |
| E250 | NJ | 50 | 40 | 30 | 0 | 25 |
| S250 | NJ | 50 | 40 | 30 | 0 | 25 |
| S250 | GJ | 100 | 80 | 30 | 0 | 25 |
| ZS250 | GJ | 100 | 80 | 30 | 0 | 25 |
| S250 | PE | 100 | 80 | 60 | 0 | 50 |
| H250 | NJ | 100 | 80 | 60 | 0 | 50 |
| H250 | NE | 100 | 80 | 60 | 0 | 50 |
| L250 | NJ | 100 | 80 | 60 | 0 | 50 |
| E400 | NJ | 100 | 80 | 40 | 0 | 30 |
| S400 | CJ | 100 | 80 | 40 | 0 | 30 |
| S400 | NJ | 100 | 80 | 40 | 0 | 30 |
| S400 | GJ | 100 | 80 | 40 | 0 | 30 |
| S400 | GE/PE | 100 | 80 | 40 | 0 | 30 |
| H400 | NJ | 120 | 120 | 80 | 0 | 80 |
| H400 | NE | 120 | 120 | 80 | 0 | 80 |
| L400 | NJ | 120 | 120 | 80 | 0 | 80 |
| $\underline{L 400}$ | NE | 120 | 120 | 80 | 0 | 80 |
| E630 | NE | 120 | 100 | 80 | 0 | 80 |
| S630 | CE | 120 | 100 | 80 | 0 | 80 |
| S630 | GE | 120 | 100 | 80 | 0 | 80 |

Notes: ${ }^{1}$ ) Insulate the exposed conductor until it overlaps the moulded case at the terminal, or the terminal cover. All dimensions in mm .

#  <br> TemBreak MCCB clearance requirements at 380/415 V 

## Insulation distance in mm (at 440 V AC Maximum) ${ }^{1}$ )

This table is valid for $\mathbf{3 8 0 / 4 1 5} \mathbf{V}$ - TemBreak 1 MCCBs
Table below illustrates the minimum clearance that must be maintained
A Distance from lower breaker to open charging part of terminal on upper breaker (front connection) or the distance from lower breaker to upper breaker end (rear connection and plug-in type)
B1Distance from breaker end to ceiling (earthed metal)
B2Distance from breaker end to insulator
C Clearance between breakers
D Distance from breaker side to side plate (earthed metal)

| MCCB type | A | B1 | B2 | C | D |
| :--- | :--- | :--- | :--- | :--- | :--- |
| XM30PB | 30 | 10 | 10 | 0 | 25 |
| XH125NJ | 75 | 45 | 25 | 0 | 25 |
| XS250NJ | 80 | 60 | 30 | 0 | 25 |
| XH250NJ | 100 | 60 | 30 | 0 | 25 |
| XS400NJ <br> XH400SE | 100 | 70 | 40 | 0 | 30 |


| XS630NJ |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| XS630SE | 120 | 70 | 40 | 0 | 30 |

XS800SE

| XH630SE <br> XH800SE <br> XH800PE | 150 | 80 | 50 | 0 | 40 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| XS1250SE 150 70 40 0 30 <br> XH630PJ <br> XH800PJ <br> XS1600SE <br> XS2000NE 150 150 100 0 100 <br> XS2500NE      |  |  |  |  |  |

Notes: ${ }^{1}$ ) Insulate the exposed conductor until it overlaps the moulded case at the terminal, or the terminal cover. All dimensions in mm .

## Electrical formulae

- For obtaining kW, kVA, HP, and Amperes

| Wanted | Single-phase | Alternating Current Two-phase Four-wire | Three-phase | Direct current |
| :---: | :---: | :---: | :---: | :---: |
| Kilowatts | IxExPF | $\underline{1 \times E \times 2 \times P F}$ | $\underline{1 \times E \times 1.73 \times P F}$ | 1×E |
|  | 1000 | 1000 | 1000 | 1000 |
| kVA | $\underline{1 \times E}$ | $\underline{1 \times E \times 2}$ | $\underline{1 \times E \times 1.73}$ | $\underline{1 \times E}$ |
|  | 1000 | 1000 | 1000 | 1000 |
| Horsepower | $\underline{1 \times E \times \% \mathrm{Eff}}$. | $1 \times \mathrm{E} \times 2 \times \mathrm{F}$ Eff. $\times$ PF | $\underline{1 \times E \times 1.73 \times \% \mathrm{Eff}}$. | $1 \times \mathrm{E}$ \% Eff |
|  | $\frac{x P F}{746}$ | $\frac{746}{746}$ | $\frac{\times P F}{746}$ | $\frac{1 \times E \times \% \text { Eff }}{746}$ |
| Amperes from kVA | kVA $\times 1000$ | kVA $\times 1000$ | kVA $\times 1000$ | kVA $\times 1000$ |
|  | E | $2 \times \mathrm{E}$ | $1.73 \times \mathrm{E}$ | E |

# TemBreak <br> Electronic OCR adjustment setting 

## Configuring the STANDARD Over current relay

The standard TemBreak 2 OCR can be configured allowing the user to adjust the rated current $\left(I_{\text {Rated }}\right)$ of the MCCB and select a predetermined tripping curve. This allows the user to tailor the MCCBs tripping characteristics to suit the requirements of the electrical load.

## Setting the rated current

The TemBreak 2 MCCB OCR rated current is adjustable from $40 \%-100 \%$ of the nominal rated current $\left(I_{n}\right)$. The dial is adjustable in increments. It is not infinitely adjustable between setting indicators. This is a desirable feature where the demand of the protected electrical load increases over time. As the load demand increases, the rating of the breaker can be adjusted accordingly to meet the system requirements. For example, an S250PE TemBreak 2 MCCB can be configured to operate with an expected load of 125 A . The OCR can be set by rotating the rated current $I_{R}(A)$ selector switch to ' 0.5 '. This has the effect of setting the rated current of the S250PE to $I_{\text {Rated }}=I_{n}(250 \mathrm{~A}) \times I_{R}(0.5)=125 \mathrm{~A}$.


Notes: Additional setting and options information can be found in the 2010-2011 Part C catalogue.

## 

## TemBreak Electronic OCR adjustment setting

## Curve selection

The predetermined curve characteristic dial on TemBreak 2 MCCBs simplifies the OCR tripping settings by reducing the number of often misunderstood variables that need to be specified. This enables users of various technical abilities to set the OCR to match the required electrical load and service application. For example if an electrical contractor was required to configure a S400 A TemBreak 2 MCCB for use in a three phase Squirrel-cage motor application, curve 5 would be the correct setting as for most applications it provides class 10 general purpose motor protection.

Curve types provided as standard on TemBreak 2 electronic MCCBs: 250 A and 400 A MCCBs: 7 selectable curves $16 \mathrm{~A}-400 \mathrm{~A}$
630 A: $\quad 6$ selectable curves $252 \mathrm{~A}-630 \mathrm{~A}$ (Curve type 7 not available)
800-1600 A $\quad 7$ selectable curves 630 A-1600 A.
Although each of the curves can be said to be targeted towards particular applications, the use of the curves can be extended to any other use where that curve suits. For example, curve 1 is ideal for many generator applications, though curve 1 can also be used for any other application that suits the curve.

General applications by curve type:
Short circuit

|  | Primary <br> Application | (SC)/ motor <br> start type | Application 2 | Application 3 |
| :--- | :--- | :--- | :--- | :--- |
| Curve 1 | Generator <br> protection | Low level SC | Heating, resistive <br> loads | Long cable runs |
| Curve 2 | Generator <br> protection | Low level SC | General, heating, <br> resistive | Long cable runs |


| Curve 3 | General <br> distribution | Med. level SC Long cable runs | Lighting |  |
| :--- | :--- | :--- | :--- | :--- |
| Curve 4 | General <br> distribution | Std. level SC Various motor starting Lighting |  |  |
| Curve 5 | Motor start - <br> standard run up <br> time | Class 10 | Transformers | Lighting |
| Curve 6 | Motor start - <br> longer run up time | Class 20 | Capacitor switching | Lighting |
| Curve 7 | Motor start - <br> extra run up time | Class 30 | Capacitor switching | - |



Notes: Curve 4 is the MCCB factory default setting for new MCCBs out of the box.

## TemBreak <br> Electronic OCR adjustment setting

## Curve comparison

The predetermined curve characteristic dial on TemBreak 2 MCCBs enables easy OCR configuration to match the electrical characteristics of the load.


Tabular representation
Curve selection dial ONLY

| Characteristic curve selection dial position | LTD (sec) |  | STD Characteristics |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 200 \% overload | 600 \% overload | In $<630 \mathrm{~A}$ | $\mathrm{In} \geq 630 \mathrm{~A}$ | Delay (sec) |
| 1 | 11 | - | $2.5 \times I_{\text {R }}$ | $2.5 \times I_{R}$ | 0.1 |
| 2 | 21 | - | $2.5 \times I_{R}$ | $2.5 \times I_{R}$ | 0.1 |
| 3 | 21 | - | $5 \times 1 \mathrm{I}$ | $5 \times 1$ R | 0.1 |
| 4 | 53 | 5 | $10 \times 1{ }^{\text {R }}$ | $8 \times 1$ R | 0.1 |
| 5 | 108 | 10 | $10 \times 1{ }^{\text {R }}$ | $8 \times 1$ R | 0.2 |
| 6 | 200 | 19 | $10 \times 1{ }^{\text {P }}$ | $8 \times 1$ B | 0.2 |
| 7 | 308 | 29 <br> (Not <br> applicable <br> for 630 A) | $10 \times 1{ }_{\text {R }}$ | $8 \times I_{R}$ | 0.2 |


| $I_{\mathrm{R}}$ Selection dial position | $\begin{aligned} & \text { IAR Selection dial ONLY }_{\text {INST }} \\ & \text { IN } \end{aligned}$ |  | Optional features |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $I_{n}<630 \mathrm{~A}$ | $I_{\text {n }}>630 \mathrm{~A}$ |  |  |  |
| 0.40 | $14 \times I_{\text {R }}$ | $14 \times 1{ }^{\text {B }}$ | PTA <br> Pre Trip Alarm | $I_{n} \times I_{\text {R }}$ | 0.8 |
| 0.50 | $14 \times I_{R}$ | $14 \times 1{ }_{\text {R }}$ |  | $t_{p}(\mathrm{sec})$ | 40 |
| 0.63 | $14 \times I_{\text {R }}$ | $14 \times 1{ }_{\text {R }}$ | GFT <br> Ground <br> Fault Trip | $I_{g} \times I_{n}$ | 0.2 |
| 0.80 | $14 \times I_{\text {R }}$ | $10 \times 1{ }_{\text {R }}$ |  | $t_{\mathrm{g}}(\mathrm{sec})$ | 0.2 |
| 0.85 | $14 \times I_{\text {R }}$ | $10 \times 1{ }_{\text {R }}$ | NP Neutral rotection | $I_{N} \times I_{n}$ | 1 |
| 0.90 | $14 \times I_{R}$ | $10 \times 1$ R |  | $t_{\text {N }}(\mathrm{sec})$ | $\left.\left.t_{\mathrm{N}}=t_{\text {R }}\right)_{2}\right)$ |
| 0.95 | $13 \times I_{R}$ | $10 \times 1{ }^{1}$ |  |  |  |
| 1.00 | $13 \times 1$ R | $10 \times 1$ B |  |  |  |

Notes: ${ }^{1}$ ) The standard setting of $I_{n}$ is $100 \%$ of $I_{n}$. For any other setting, specify when ordering.
${ }^{2}$ ) When neutral pole protection is installed the breaker must be set at 100 $\%$ of its $I_{n}$ rating for the neutral protection to function. For other settings contact NHP.

## TemBreak Optional Functions

| CurveApplication | Description | LTD | STD |
| :---: | :---: | :---: | :---: |
| 1 Generator / heating / resistive loads (LOW short cct level) | The characteristic curve features faster tripping times during overload situations \& low level short circuit faults. | Fastest tripping time during an overload | Fastest tripping time during a low level short circuit |
| 2 General distribution (LOW short cct level) | Sharing the same short circuit tripping time characteristics as curve 1, curve 2 has greater tolerance to allow for overloads caused by small inrush currents. | Intermediate tripping time during an overload | Fastest tripping time during a low level short circuit |
| 3 General distribution (MEDIUM short cct level) | Featuring a shallower overload time trip curve and higher short circuit current protection characteristics than curve 2, curve 3 allows greater tolerance during overload and short circuit conditions. | Intermediate tripping time during an overload | Intermediate tripping time during a low level short circuit |
| $4 \quad$ General distribution (HIGH short cct level) | Featuring a shallower overload time trip curve and a higher short circuit current protection characteristic than curve 3. | Slow tripping time during an overload | Slow tripping (high tolerance) time during a low level short circuit |
| 5 Motor Protection Class 10 | Class 10 protection requires the overload detection element to trip the breaker in 10 seconds or less when a current of $600 \%$ of its rated current is experienced. Use - general purpose motor applications, hermetic motors and submersible pumps. | Slow tripping time during an overload | Slow tripping time (high tolerance) during a low level short circuit |
| $6 \quad$Motor Protection <br> Class 20 | Class 20 protection requires the overload detection element to trip the breaker in 20 seconds or less when a current of $600 \%$ of its rated current is experienced. Use motors with difficult starting conditions. | Slow tripping time during an overload | Slow tripping time (high tolerance) during a low level short circuit |
| 7 Motor Protection Class 30 | Class 30 protection requires the overload detection element to trip the breaker in 30 seconds or less when a current of $600 \%$ of its rated current is experienced. Usemotors with difficult starting conditions that are driving high inertia loads. | Slowest tripping time during an overload | Slowest tripping time (high tolerance) during a low level short circuit |

## TemBreak Optional functions

## Pre-Trip Alarm (PTA)

An LED and volt-free output contact are activated after a time delay, $t_{p}$, if the load current exceeds the preset threshold, $I_{\mathrm{p}}$. The default time delay, $t_{\mathrm{p}}$ is set to 40 seconds and the load current threshold, $I_{\mathrm{p}}$, is $80 \%$ of the rated current.
For example a S250PE TemBreak 2 MCCB with a $I_{\text {Rated }}$ setting of 125 A would have a pre-trip alarm threshold of $I_{\mathrm{p}}(0.8) \times I_{\text {Rated }}(125)=100 \mathrm{~A}$.

## Ground Fault Trip (GF)

This function trips the MCCB after a time delay, $t_{\mathrm{g}}$, if the ground fault current exceeds the preset threshold, $I_{g}$. Ground fault protection can be enabled and disabled by operating a DIP switch on the OCR. The default time delay, $t_{\mathrm{g}}$ is set to 0.2 seconds and the load current threshold, $I_{g}$, is $20 \%$ of the nominal current.

For example, an S400GE TemBreak 2 MCCB with a nominal current $\left(I_{n}\right) 400 \mathrm{~A}$ would have a ground fault trip threshold of $I_{g}(0.2) \times I_{n}(400 \mathrm{~A})=80 \mathrm{~A}$.
When 3 pole GF MCCBs are used, a 4th neutral pole CT will be required. Refer MCCB accessories. 4 pole GF MCCBs do not require a 4th CT as the neutral pole protection CT is used. As a general note, 4 wire systems are used in Australia and New Zealand, and this is why a 4th CT is required for 3 and 4 pole applications.
The MCCB OCR facia showing GFT option below. A DIP switch allows the GFT to be switched OFF or ON, while a'pick up' LED indicates that the $20 \%$ of rated current activation point for GFT has been reached.


## Neutral Protection (NP)

Neutral protection trips the MCCB after a time delay, $t_{N}$, if the current in the neutral conductor exceeds the nominal current rating, $I_{n}$, of the MCCB. The time delay characteristic is identical to that of the overload time delay characteristic, therefore $t_{\mathrm{N}}=t_{\mathrm{R}}$. The load current threshold, $I_{\mathrm{N}}$, is $100 \%$ of the nominal current.
For example a S250PE A TemBreak 2 MCCB with a nominal current, $I_{n}$, of 250 A would have neutral protection threshold of $I_{N}(1.0) \times I_{n}(250)=250 \mathrm{~A}$.

## 

## TemBreak Optional functions

## Option ordering

Optional functions must be specified at the time of order. Options can be selected by identifying the appropriate 'code' from the table below and appending this code after the MCCB type designation. For example, to select a 4 pole, 400 AF MCCB, front connect, with a nominal current (In) of 250 A, featuring a Pre-Trip Alarm (P) option the correct description would be: Cat. No. example: S400GE3 AP 4003 Pole: with the pre-trip alarm option

Optional Functions

| $I_{\text {n }}$ | Poles | Code | Ground Fault (GF) | Neutral Protection (NP) | Pre-Trip Alarm (PTA) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 250 A | 3 | AP | - | - | Yes |
|  | 4 | AP | - | - | Yes |
|  | 4 | AN | - | Yes | - |
|  | 4 | APN | - | Yes | Yes |
| 400 A | 3 | AP | - | - | Yes |
|  | 3 | AG | Yes | - | - |
|  | 3 | APG | Yes | - | Yes |
|  | 4 | AP | - | - | Yes |
|  | 4 | AN | - | Yes | - |
|  | 4 | APN | - | Yes | Yes |
|  | 4 | AGN | Yes | Yes | - |
| 630-1600 A | 3 | AP | - | - | Yes |
|  | 3 | AG | Yes | - | - |
|  | 3 | APG | Yes | - | Yes |
|  | 4 | AP | - | - | Yes |
|  | 4 | AN | - | Yes | - |
|  | 4 | APN | - | Yes | Yes |
|  | 4 | AGN | Yes | Yes | - |

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## TemBreak <br> Example 1: Generator Protection, Curve 1

Compared to a transformer, a generator has a limited short circuit capacity (say 4 times the full load rating). Therefore to avoid possible damage to the generator it is desirable to select a tripping characteristic curve that accommodates a generator's limitations.
When configured for use in a generator application the characteristic curve features faster tripping times during overload situations and low level short circuit faults.
From the curve below, an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200$ A features:

- Approximate trip time of 11 seconds during a $200 \%$ of rated current (400 A) overload
■ Approximate trip time of 0.1 seconds during a $250 \%$ of rated current (500 A) low level short circuit
■ Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


Generator Protection


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

## TemBreak <br> Example 2: General Feeder LOW SCP, Curve 2

Sharing the same short circuit tripping time characteristics as the generator protection curve, the General Feeder LOW SCP curve 2 has greater tolerance to allow for overloads caused by small inrush currents.
From the curve below, an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{N}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200 \mathrm{~A}$ features:

- Approximate trip time of 21 seconds during a $200 \%$ of rated current (400 A) overload
■ Approximate trip time of 0.1 seconds during a $250 \%$ of rated current (500 A) low level short circuit
- Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


General Feeder LOW SCP (SCP = Short circuit protection)


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

## TemBreak <br> Example 3: General Feeder MEDIUM SCP, Curve 3

Featuring a shallower overload time trip curve and higher short circuit current protection characteristics than curve 2, curve 3 allows greater tolerance during overload and short circuit conditions.
From the curve below, an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200$ A features:

- Approximate trip time of 21 seconds during a $200 \%$ of rated current (400 A) overload
- Approximate trip time of 0.1 seconds during a $500 \%$ of rated current (1000 A) low level short circuit
- Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).



Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## SP4(

## TemBreak <br> Example 4: General Feeder HIGH SCP, Curve 4

This curve contains a shallower overload time trip curve and a higher short circuit current protection characteristic compared to the previous curve 3.

From the curve below an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200$ A features:

- Approximate trip time of 58 seconds during a $200 \%$ of rated current (400 A) overload
- Approximate trip time of 5 seconds during a $600 \%$ of rated current (1200 A) overload
- Approximate trip time of 0.1 seconds during a $1000 \%$ of rated current (2000 A) low level short ciruit
- Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


General Feeder HIGH SCP


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

## TemBreak <br> Example 5: Motor Protection Class 10, Curve 5

Class 10 protection requires the overload detection element to trip the breaker in 10 seconds or less when a current of $600 \%$ of its rated current is experienced. Class 10 protection is commonly used for general purpose motor applications, hermetic motors and submersible pumps.
From the curve below an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I I_{\mathrm{R}}(0.8)=200 \mathrm{~A}$ features:

- Approximate trip time of 116 seconds during a $200 \%$ of rated current ( 400 A ) overload
- Approximate trip time of 10 seconds during a $600 \%$ of rated current (1200 A) overload
- Approximate trip time of 6.8 seconds during a $720 \%$ of rated current (1440 A) overload
- Approximate trip time of 0.2 seconds during a $1000 \%$ of rated current (2000 A) low level short circuit
■ Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


Motor Protection Class 10


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

## TemBreak <br> Example 6: Motor Protection Class 20, Curve 6

Class 20 protection requires the overload detection element to trip the breaker in 20 seconds or less when a current of $600 \%$ of its rated current is experienced. Class 20 protection is typically reserved for motors with difficult starting conditions.
From the curve below an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200$ A features:

- Approximate trip time of 221 seconds during a $200 \%$ of rated current ( 400 A ) overload
- Approximate trip time of 19 seconds during a $600 \%$ of rated current (1200 A) overload
- Approximate trip time of 13 seconds during a $720 \%$ of rated current (1440 A) overload
- Approximate trip time of 0.2 seconds during a $1000 \%$ of rated current (2000 A) low level short circuit
■ Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

# TemBreak <br> Example 7: Motor Protection Class 30, Curve 7 

Class 30 protection requires the overload detection element to trip the breaker in 30 seconds or less when a current of $600 \%$ of its rated current is experienced. Class 30 protection is typically reserved for motors with difficult starting conditions that are driving high inertia loads.
From the curve below an S250 TemBreak 2 MCCB with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200$ A features:

- Approximate trip time of 338 seconds during a $200 \%$ of rated current ( 400 A ) overload
- Approximate trip time of 29 seconds during a $600 \%$ of rated current (1200 A) overload
- Approximate trip time of 19.9 seconds during a $720 \%$ of rated current (1440 A) overload
- Approximate trip time of 0.2 seconds during a $1000 \%$ of rated current (2000 A) low level short circuit
■ Instantaneous (no intentional delay) threshold of $1400 \%$ of rated current (2800 A).


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

## 

## TemBreak <br> Example 8: Setting the Rated Current IR (A) Adjustment

The rated current value of the breaker can be adjusted from $40 \%$ to $100 \%$ of its nominal value. In this example an S250 TemBreak 2 MCCB OCR is initially set with a rated current of $I_{\mathrm{n}}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.8)=200 \mathrm{~A}$.



Notes: See also example next page.
The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

# TemBreak <br> Example 9: Setting the Rated Current IR (A) Adjustment 

The next example shows the OCR being set at ' 0.5 ' of $I_{R}(A)$. This has the effect of changing the rated current of the breaker to $I_{n}(250 \mathrm{~A}) \times I_{\mathrm{R}}(0.5)=125 \mathrm{~A}$. This change can be clearly seen in the curve movement.


Rated Current


Notes: The above curves are worked examples for an electronic MCCB with a 250 A rated overcurrent relay (OCR). The same curve and setting data will also apply to TemBreak 2 MCCBs with other ampere ratings.

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## INTEGRAL EARTH LEAKAGE MCCBs

 personnel protection within a standard 125 A or 250 A MCCB frame size.

The ZS earth leakage MCCB offers the following features and options:

- Thermal magnetic MCCB
- 125 A or 250 A frame
- 65 kA as standard
- 3 or 4 pole types
- Adjustable thermal-curve dial
- Trip unit ratings: $12 \mathrm{~A}-250 \mathrm{~A}$
- 30, 100, 300, $500 \mathrm{~mA}, 1$ A, 3 A settings
- 30 mA setting is non-adjustable, for near instant trip
- 0 sec to 700 ms selectable ( $100 \mathrm{~mA}-3 \mathrm{~A}$ )
- Will fit existing $X A, X B, X C$ Chassis
- Complies with AS2081:20
- Yellow TEST button
- Green'Power ON'LED
- 'No Trip' dial setting
- Remote trip function standard
- Harmonic inhibition standard

REFER TO NHP FOR NEW 400 A-800 A ZS SIZES

Terasaki MCCB Old Vs New cross reference

| Amps | kA | TO/TG/TT MCCB | OCR type | Base current adj. | TemBreak Cat.No. | TemBreak <br> Plus <br> Cat.No. | 2009/10 <br> Tem- <br> Break 2 <br> \& Tem- <br> Break 1 <br> com- <br> bined <br> range | 400 <br> V AC <br> rat- <br> ings <br> kA |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 12.5-125 | 18 | TO100BA | Adj. therm. fixed mag. | 63-100\% | XS125CJ | - | E125NJ | 25 |
| 12.5-125 | 30 | TO100BH | Adj. therm. fixed mag. | 63-100\% | XS125NJ | - | S125NJ | 36 |
| 12.5-125 | 50 | TG100B | Adj. therm. fixed mag. | 63-100\% | XH125NJ ${ }^{1}$ ) | - | S125GJ | 65 |
| 125-225 | 18 | TO225CB | Fixed therm. fixed mag. | Fixed | XE225NS | - | E250NJ | 25 |
| $\begin{aligned} & \hline 100-160 \\ & 160-250 \\ & \hline \end{aligned}$ | 35 | TO225BA | Adj. therm. fixed mag. | 63-100\% | XS250NJ ${ }^{1}$ ) | - | $\begin{aligned} & \text { S160NJ } \\ & \text { S250NJ } \end{aligned}$ | 36 |
| $\begin{aligned} & \hline 100-160 \\ & 160-250 \end{aligned}$ | 50 | TG225B | Adj. therm. fixed mag. | 63-100 \% | XH250NJ ${ }^{1}$ ) | - | $\begin{aligned} & \text { S160GJ } \\ & \text { S250GJ } \end{aligned}$ | 65 |
| $\begin{aligned} & 160-250 \\ & 250-400 \end{aligned}$ | 35 | TO400BA | Adj. therm. fixed mag. | 63-100\% | XS400CJ | - | S400CJ | 36 |
| $\begin{aligned} & 160-250 \\ & 250-400 \end{aligned}$ | 50 | TG400B | Adj. therm. adj. mag. | 63-100 \% | XS400NJ ${ }^{1}$ ) | - | S400NJ | 50 |
| $\begin{aligned} & 125-250 \\ & 200-400 \\ & \hline \end{aligned}$ | 50 | TTE400 | Electronic LSI | 50-100 \% | XS400NE | XS400SE | S400SE | 50 |
| $\begin{aligned} & 125-250 \\ & 200-400 \end{aligned}$ | 65 | TTE400 | Electronic LSI | 50-100 \% | XH400NE | $\begin{aligned} & \text { XH400SE } \\ & \text { 1) } \end{aligned}$ | S400GE | 70 |
| $\begin{aligned} & \hline 250-400 \\ & 400-630 \\ & \hline \end{aligned}$ | 45 | TO600BA | Adj. therm. adj. mag. | 63-100\% | XS630CJ | - | XS630NJ | 50 |
| $\begin{aligned} & \hline 250-400 \\ & 400-630 \\ & \hline \end{aligned}$ | 65 | TG600B | Adj. therm. adj. mag. | 63-100 \% | XS630NJ ${ }^{1}$ ) | - | XS630NJ | 50 |
| 315-630 | 50 | TTE630 | Electronic | 50-100\% | XS630NE | XS630SE ${ }^{1}$ ) | S630CE | 50 |
| 315-630 | 65 | TTE630 | Electronic | 50-100\% | XH630NE | $\begin{aligned} & \text { XH630SE } \\ & \text { 1) } \end{aligned}$ | S630GE | 70 |
| 500-800 | 65 | TO800BA | Adj. therm. adj. mag. | 63-100\% | XS800NJ ${ }^{1}$ ) | - | XS800NJ | 50 |
| 500-800 | 85 | TG800B | Adj. therm. adj. mag. | 63-100 \% | XS1250NE | $\begin{array}{\|l\|} \hline \text { XS1250SE } \\ \text { 1) } \end{array}$ | XS1250SE | 85 |
| 400-800 | 50 | TTE800 | Electronic | 50-100\% | XS800NE | XS800SE ${ }^{1}$ ) | )XS800SE | 50 |
| 400-800 | 65 | TTE800 | Electronic | 50-100 \% | XH800NE | $\begin{aligned} & \text { XH800SE } \\ & \text { (1) } \end{aligned}$ | XH800SE | 65 |
| $\begin{aligned} & 630- \\ & 1250 \\ & \hline \end{aligned}$ | 85 | $\begin{array}{\|l\|} \hline \text { TO1000B } \\ \text { TO1200B } \\ \hline \end{array}$ | Electronic | 50-100\% | XS1250NE | $\begin{array}{\|l\|} \hline \text { XS1250SE } \\ \text { 1) } \end{array}$ | XS1250SE | 85 |
| $\begin{aligned} & 800- \\ & 1600 \end{aligned}$ | 100 | TO1600B | Electronic | 50-100\% | XS1600NE | $\begin{aligned} & \text { XS1600SE } \\ & 1 \text { 1) } \end{aligned}$ | XS1600SE | 100 |
| $\begin{aligned} & 1000- \\ & 2000 \end{aligned}$ | 100 | $\begin{aligned} & \text { TTE2000 } \\ & \text { TO2000 } \end{aligned}$ | Electronic | $\begin{aligned} & 50-100 \\ & \% \end{aligned}$ | XS2000NE | - ${ }^{1}$ ) | XS2000NE | 85 |
| $\begin{aligned} & 1250- \\ & 2500 \\ & \hline \end{aligned}$ | 100 | TO2500 | Electronic | $\begin{aligned} & 50-100 \\ & \% \end{aligned}$ | XS2500NE | - ${ }^{1}$ ) | XS2500NE | 85 |
| $\begin{aligned} & 1600- \\ & 3200 \end{aligned}$ | 100 | TO3200 | Electronic | $\begin{aligned} & 50-100 \\ & \% \end{aligned}$ |  | 2009 | XS3200NE | 85 |
| Introduc date: |  | 1982 | - | - | 1990 | 2000 | 2006/07 |  |

Notes: ') Stocked

## Earth Leakage Relay and Circuit Breaker based RCD device applications

Amongst the users of various earth leakage devices, there is sometimes confusion between the correct application of the more sophisticated adjustable earth leakage relays and circuit breaker RCCB or RCBO devices. It is necessary therefore to define the correct use of earth leakage devices covering the areas of general industrial equipment protection, personnel protection and their use in applications, such as in mining.

Din-Safe Relays, TZS Relays, and the new RD Series Relay

RD3A relay



## 1. Equipment Protection

Terasaki Earth Leakage relays are suitable for earth fault protection of equipment and limitation of touch voltages where automatic disconnection of supply is required.
Typically this is achieved by shunt tripping another protective device such as an upstream circuit breaker.
Earth leakage relays are used in particular where ground (earth) fault detection is required
or the Fault Loop Impedance is of such a level that the over-current device (circuit breaker) does not achieve automatic disconnection within the times prescribed in the Wiring Rules.

## 2. Personnel Protection

Earth leakage relays are NOT suitable for personnel protection against direct contact as specified in the Wiring Rules, e.g. for socket outlets and lighting circuits. For these applications an RCD ( 10 mA or 30 mA ) must comply with the relevant standards (AS 3190, AS/NZS 61008 or AS/NZS 61009) and be approved by the relevant authorities. Terasaki earth leakage relays are not designed to meet the requirements of this approval.
For personnel protection Safe-T and Din-T devices such as the ELR relay, SRCB, SAFETRCB6, DSRCD, DSRCB, DSRCM \& DSRCBH are all suitable. These are approved devices and meet the relevant standards.

Circuit breaker based RCD devices


## Earth Leakage Relay and Circuit Breaker based RCD device applications

## 3. Mining Protection

Terasaki Earth Leakage Relays are suitable for mining applications, with the exception of coal and shale mine applications as governed by AS 2081:2011 - Electrical Equipment for coal and shale mines: "Earth Leakage protection for use on earth-fault current limited systems (IT systems)".

This is because Terasaki Earth Leakage Relays are not designed to comply with certain technical requirements of the above mining standard.

Terasaki Earth Leakage Relays that DO comply with AS 2081.3 and the DSRM72 relay.

Circuit breaker based 10 mA and 30 mA RCD devices do not need to comply with AS 2081.3, as this standard accepts devices that meet the personnel protection standards: AS 3190, AS/NZS 61008 or AS/NZS 61009. As such the following Safe-T and Din-T devices are suitable: ELR relay, SRCB, SAFETRCB6, DSRCD, DSRCB, DSRCM \& DSRCBH.
ZS earth leakage MCCBs also comply with the standard AS 2081:2011.

# Protection grades against contact and foreign bodies - Ingress Protection (IP) 

| First Number <br> Protection against solid objects |  |  | First Number <br> Protection against solid objects |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| IPTests |  |  | IPTests |  |  |
| 0 | - | No protection. | 0 | $\because$ | No protection. |
| 1 |  | Protected against solid objects up to 50 mm . (e.g. accidental touch by hands). | 1 |  | Protected against vertical falling drops of water. |
| 2 |  | Protected against solid objects up to 12 mm (e.g. fingers). | 2 |  | Protected against direct sprays of water up to $15^{\circ}$ from the vertical. |
| 3 |  | Protected against solid objects over 2.5 mm (tools + small wires). | 3 |  | Protected against spray of water up to $60^{\circ}$ from the vertical. |
| 4 |  | Protected against solid objects over 1 mm (tools + small wires). <br> Protected against | 4 |  | Protected against water sprayed from all directions limited ingress permissable. |
| 5 |  | dust-limited ingress permitted (no harmful deposit). | 5 |  | Protected against low pressure jets of water from all directions limited ingress permissable. |
| 6 |  | Totally protected against dust. | 6 |  | Protected against strong jets of water e.g. for use on shipdecks limited ingress permissable. |
|  |  |  | 7 |  | Protected against the effects of immersion between 15 cm and 1 m . |
|  |  |  | 8 |  | Protected against long periods of immersion under pressure. |

## 

A quarterly NHP publication, the NHP technical news features a wide range of application and design criteria for the motor control, power distribution and numerous other product fields. Copies can be issued on request. NHP Technical news ranges from 4 to 8 pages.

## Issue Technical subject



1. Contactor control circuits, latches etc.
2. Contactors: Parallel/series connection, non standard frequencies
3. Contactors: Failure to open or close, flashover, coil burnout
4. Soft starters: Motor starting, loads, electronic soft starters
5. MCCB overcurrent relay types and applications
6. Contactors: AC and DC control
7. Fault Levels: At the point of supply and reducing factors - bars, cables etc.
8. IP ratings: Definition and applications
9. $\mathrm{AC}-1$ to $\mathrm{AC}-23$ (AC types only)
10. VSDs: Loads, Dynamic resistor and DC injection braking
11. Thermal and electronic overloads
12. Contactors: Operating curves and contact inspection
13. Slip ring motors, liquid resistance types and applications
14. DC contactor arc design, arcing and connection options
15. Selecting the right kind of motor starter for an application
16. AC, DC lamps, types and applications
17. Surge causes and diverters
18. PLCs: Control, mathematics, inputs and outputs
19. Conventional types and contactors with electronic coils
20. Enclosures and temperature rise
21. Electro-magnetic interference (EMI)
22. The need for safety, sensors, E stops and other devices
23. Torque and motor starters
24. Power Factor: Electricity supply degradation and solutions
25. Safety, RCD operating speed, and applications
26. Terminations: Control circuit Temp. rise, vibration, corrosion, developments
27. Switchboards: Design, venting, earthing, fault containment, control equipment
28. Electrical Equip: Ambient temp, current, voltage, impulse, ins ratings
29. Electro-magnetic compatibility, cabling and EMC sources
30. Current limiting circuit breakers: Electric arcs, applications and device types
31. MCBs, characteristic curves, fault calculation, RCD's
32. Cable ratings, overloads, faults, circuit breakers, AS standards
33. RCDs, how they work, wiring, nuisance tripping, testing.

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| 35. | Star-delta starters and wiring, different versions, SC protection |
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|  | Flexible copper busbar - application |
| 38. | New standard Australian voltages: 230/400 V |
| 39. | Motor protection and the wiring rules |
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|  | 392.00001 | 2-57 | NT40143 | 46.50 |
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A BTSS2NJ25033
I A BTSS2PE12533
A BTSS2PE25033
I A BTSS2PE25044
I A BTSS4GE25033
I A BTSS4GE40033
I A BTSS4GE40044
I A BTSS4GJ25033
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A BTSS4GJ40033
I A BTSS4GJ40034
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I A BTSS4NE25033 BTSS4NE25044
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CPD 72SS2
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CPD 84M250G
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CPG 36M160G
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A CPG 36M25002
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A CPG 48M160G2
CPG 48M1600
A CPG 48M16002
I A CPG 48M250G
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A CPG 48M25002
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|  | H400 NE 3400 | 3-81 | NT20138 | 3240.00 |
| I | H400 NE 3400 X1L | 3-82 | NT20138 | 5350.00 |
| I | H400 NE $3400 \times 15$ | 3-82 | NT20138 | 7150.00 |
| I | H400 NE 3 AG 400 | 3-81 | NT20138 | 187.00 |
| I | H400 NE 3 AP + | 3-81 | NT20138 | 187.00 |
| I | H400 NE 3 APG 400 | 3-81 | NT20138 | 375.00 |
| I | H400 NE 4250 | 3-81 | NT20138 | 4320.00 |
| I | H400 NE 4250 X1L | 3-82 | NT20138 | 6540.00 |
| I | H400 NE 4250 X1S | 3-82 | NT20138 | 8250.00 |
| I | H400 NE 4400 | 3-81 | NT20138 | 4320.00 |
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| I | H400 NE 4 AGN 400 | 3-81 | NT20138 | 375.00 |
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|  | H800 NE 3630 | 3-109 | NT20138 | 4230.00 |
|  | H800 NE 3800 | 3-109 | NT20138 | 4590.00 |
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|  | ICLEC23 | 1-43 | NT40143 | 4.00 |
|  | ICLEC4 | 1-43 | NT40143 | 4.00 |
|  | ICLTOC | 1-50 | NT40143 | 4.60 |
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| L | L125 NJ 3100 | 3-31 | NT20138 | 1170.00 |
| 1 | L125 NJ 3125 | 3-31 | NT20138 | 1170.00 |
| 1 | L125 NJ 320 | 3-31 | NT20138 | 1090.00 |
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| 1 | L400 NE 3400 | 3-84 | NT20138 | 3370.00 |
| I | L400 NE 3 AG 400 | 3-84 | NT20138 | 187.00 |
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| A | M22IVS | 1-42 | NT40143 | 23.40 | (1) |
|  | MCEPCN5MFM | 2-7 | NB20054 | 88.00 | $\stackrel{\text { ®}}{ }$. |
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| 1 A | MS85844 | 5-9 | NZ00150 | 12510.00 |  |
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|  | S1000 NE 31000 X1L | 3-114 | NT20138 | 7750.00 |
|  | S1000 NE $31000 \times 15$ | 3-114 | NT20138 | 9450.00 |
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| I | S1000 NE 3 AP \# | 3-113 | NT20138 | 180.00 |
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|  | S1250 GE 41250 | 3-121 | NT20138 | 10250.00 |
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|  | S125 GJ 420 | 3-28 | NT20138 | 990.00 |  |
|  | S125 GJ 432 | 3-28 | NT20138 | 990.00 | $\bigcirc$ |
|  | S125 GJ 450 | 3-28 | NT20138 | 990.00 | D |
|  | S125 GJ 463 | 3-28 | NT20138 | 990.00 | $\times$ |
| 1 | S125ND3 | 3-143 | NT20138 | POA |  |
| 1 | S125ND4 | 3-143 | NT20138 | POA |  |
|  | S125 NF 1100 | 3-25 | NT20138 | 310.00 |  |
|  | S125 NF 1125 | 3-25 | NT20138 | 310.00 |  |
|  | S125 NF 116 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 120 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 125 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 132 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 140 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 150 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 163 | 3-25 | NT20138 | 165.00 |  |
|  | S125 NF 180 | 3-25 | NT20138 | 235.00 |  |
|  | S125 NJ 3100 | 3-27 | NT20138 | 680.00 |  |
|  | S125 NJ 3125 | 3-27 | NT20138 | 810.00 |  |
|  | S125 NJ 320 | 3-27 | NT20138 | 480.00 |  |
|  | S125 NJ 3 20PM | 3-146 | NT20138 | 850.00 |  |
|  | S125 NJ 332 | 3-27 | NT20138 | 480.00 |  |
|  | S125 NJ 3 32PM | 3-146 | NT20138 | 850.00 |  |
|  | S125 NJ 350 | 3-27 | NT20138 | 480.00 |  |
|  | S125 NJ 363 | 3-27 | NT20138 | 480.00 |  |
|  | S125NN3 | 3-142 | NT20138 | 430.00 |  |
| 1 | S125NN4 | 3-142 | NT20138 | 570.00 |  |
|  | S1600 NE 31250 | 3-122 | NT20138 | 9820.00 |  |
| 1 | S1600 NE 3 AG \# | 3-122 | NT20138 | 180.00 |  |
| 1 | S1600 NE 3 AP \# | 3-122 | NT20138 | 180.00 |  |
| 1 | S1600 NE 3 APG \# | 3-122 | NT20138 | 180.00 |  |
|  | S1600 NE 41250 | 3-122 | NT20138 | 11500.00 |  |
| 1 | S1600 NE 4 AGN \# | 3-122 | NT20138 | 360.00 |  |
| 1 | S1600 NE 4 AN \# | 3-122 | NT20138 | 180.00 |  |
| 1 | S1600 NE 4 AP \# | 3-122 | NT20138 | 180.00 |  |
| 1 | S1600 NE 4 APN \# | 3-122 | NT20138 | 360.00 |  |
|  | S1600NN3 | 3-142 | NT20138 | 8700.00 |  |
|  | S1600NN4 | 3-142 | NT20138 | 9900.00 |  |
|  | S160 GJ 3100 | 3-44 | NT20138 | 900.00 |  |
|  | S160 GJ 3125 | 3-44 | NT20138 | 1000.00 |  |
|  | S160 GJ 3160 | 3-44 | NT20138 | 1210.00 |  |
|  | S160 GJ 3 160PM | 3-146 | NT20138 | 1440.00 |  |

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|  | S160 GJ 350 | 3-44 | NT20138 | 750.00 |
|  | S160 GJ 363 | 3-44 | NT20138 | 750.00 |
| 1 | S160 GJ 4100 | 3-44 | NT20138 | 1210.00 |
|  | S160 GJ 4125 | 3-44 | NT20138 | 1330.00 |
|  | S160 GJ 4160 | 3-44 | NT20138 | 1620.00 |
| 1 | S160 GJ 450 | 3-44 | NT20138 | 950.00 |
| 1 | S160 GJ 463 | 3-44 | NT20138 | 990.00 |
| 1 | S160ND3 | 3-143 | NT20138 | POA |
| 1 | S160ND4 | 3-143 | NT20138 | POA |
|  | S160 NF 1100 | 3-42 | NT20138 | 310.00 |
|  | S160 NF 1125 | 3-42 | NT20138 | 310.00 |
|  | S160 NF 116 | 3-42 | NT20138 | 165.00 |
|  | S160 NF 1160 | 3-42 | NT20138 | 340.00 |
|  | S160 NF 120 | 3-42 | NT20138 | 165.00 |
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|  | S160 NF 132 | 3-42 | NT20138 | 165.00 |
|  | S160 NF 140 | 3-42 | NT20138 | 165.00 |
|  | S160 NF 150 | 3-42 | NT20138 | 165.00 |
|  | S160 NF 163 | 3-42 | NT20138 | 165.00 |
|  | S160 NF 180 | 3-42 | NT20138 | 220.00 |
|  | S160 NJ 3100 | 3-43 | NT20138 | 680.00 |
|  | S160 NJ 3125 | 3-43 | NT20138 | 810.00 |
|  | S160 NJ 3160 | 2-31 | NT20138 | 1080.00 |
|  | S160 NJ 3160 | 3-43 | NT20138 | 1080.00 |
|  | S160 NJ 320 | 3-43 | NT20138 | 480.00 |
|  | S160 NJ 332 | 3-43 | NT20138 | 480.00 |
|  | S160 NJ 350 | 3-43 | NT20138 | 480.00 |
|  | S160 NJ 363 | 3-43 | NT20138 | 480.00 |
|  | S160 NJ 4100 | 3-43 | NT20138 | 900.00 |
|  | S160 NJ 4125 | 3-43 | NT20138 | 1090.00 |
|  | S160 NJ 4160 | 3-43 | NT20138 | 1425.00 |
|  | S160 NJ 420 | 3-43 | NT20138 | 630.00 |
| I | S160 NJ 432 | 3-43 | NT20138 | 630.00 |
|  | S160 NJ 450 | 3-43 | NT20138 | 630.00 |
|  | S160 NJ 463 | 3-43 | NT20138 | 630.00 |
|  | S160NN3 | 3-142 | NT20138 | 500.00 |
|  | S160NN4 | 3-142 | NT20138 | 670.00 |
|  | S250 GJ 3250 | 3-49 | NT20138 | 1680.00 |
| 1 | S250 GJ 3 250M1000 | 3-49 | NT20138 | 1870.00 |
| 1 A | S250 GJ 3 250MAG | 3-49 | NT20138 | 1910.00 |
|  | S250 GJ 3 250PM | 3-146 | NT20138 | 1780.00 |
|  | S250 GJ 3 SO23160 | 3-49 | NT20138 | 1780.00 |
|  | S250 GJ 4250 | 3-49 | NT20138 | 2240.00 |
| 1 | S250ND3 | 3-143 | NT20138 | POA |
| 1 | S250ND4 | 3-143 | NT20138 | POA |
|  | S250NJ | 2-31 | NT20138 | 1480.00 |
|  | S250 NJ 3250 | 3-48 | NT20138 | 1480.00 |
|  | S250 NJ 4250 | 3-48 | NT20138 | 1860.00 |
|  | S250NN3 | 2-31 | NT20138 | 500.00 |


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|  | S250NN3 | 3-142 | NT20138 | 500.00 |
|  | S250NN4 | 3-142 | NT20138 | 670.00 |
|  | S250 PE 3125 | 3-52 | NT20138 | 1730.00 |
|  | S250 PE 3125 AC | 3-54 | NT20138 | 3760.00 |
|  | S250 PE 3250 | 3-52 | NT20138 | 2100.00 |
|  | S250 PE 3250 AC | 3-54 | NT20138 | 3970.00 |
|  | S250 PE 340 AC | 3-54 | NT20138 | 3560.00 |
| 1 | S250 PE 3 AP 3 | 3-52 | NT20138 | 187.00 |
| 1 | S250 PE 4125 | 3-52 | NT20138 | 2430.00 |
| 1 | S250 PE 4125 AC | 3-54 | NT20138 | 4500.00 |
|  | S250 PE 4250 | 3-52 | NT20138 | 2790.00 |
| 1 | S250 PE 4250 AC | 3-54 | NT20138 | 4760.00 |
| I | S250 PE 440 AC | 3-54 | NT20138 | 4270.00 |
| 1 | S250 PE 4 AN 4 | 3-52 | NT20138 | 187.00 |
| 1 | S250 PE 4 AP 4 | 3-52 | NT20138 | 187.00 |
| I | S250 PE 4 APN 4 | 3-52 | NT20138 | 365.00 |
|  | S400 CJ 3250 | 3-70 | NT20138 | 1930.00 |
|  | S400 CJ 3400 | 3-70 | NT20138 | 1970.00 |
|  | S400 GE 3250 | 3-75 | NT20138 | 2550.00 |
|  | S400 GE 3250 X1L | 3-76 | NT20138 | 4650.00 |
|  | S400 GE $3250 \times 15$ | 3-76 | NT20138 | 6550.00 |
|  | S400 GE 3400 | 3-75 | NT20138 | 2550.00 |
|  | S400 GE 3 400PM | 3-146 | NT20138 | 3010.00 |
|  | S400 GE 3400 X1L | 3-76 | NT20138 | 4900.00 |
|  | S400 GE $3400 \times 15$ | 3-76 | NT20138 | 6800.00 |
|  | S400 GE 3 AG 400 | 3-75 | NT20138 | 2720.00 |
| 1 | S400 GE 3 AP 400 | 3-75 | NT20138 | 2750.00 |
| 1 | S400 GE 3 APG 400 | 3-75 | NT20138 | 2930.00 |
| 1 | S400 GE 4250 | 3-75 | NT20138 | 3380.00 |
|  | S400 GE 4250 X1L | 3-76 | NT20138 | 5690.00 |
|  | S400 GE $4250 \times 15$ | 3-76 | NT20138 | 7750.00 |
|  | S400 GE 4400 | 3-75 | NT20138 | 3400.00 |
| 1 | S400 GE 4400 X1L | 3-76 | NT20138 | 5880.00 |
| 1 | S400 GE 4400 X1S | 3-76 | NT20138 | 8160.00 |
|  | S400 GE 4 AGN 400 | 3-75 | NT20138 | 3780.00 |
| 1 | S400 GE 4 AN 400 | 3-75 | NT20138 | 3590.00 |
| I | S 400 GE 4 AP 400 | 3-75 | NT20138 | 3590.00 |
| I | S400 GE 4 APN 400 | 3-75 | NT20138 | 3780.00 |
|  | S400 GJ 3250 | 3-73 | NT20138 | 2310.00 |
|  | S400 GJ 3400 | 3-73 | NT20138 | 2310.00 |
| 1 | S400 GJ 4250 | 3-73 | NT20138 | 3080.00 |
|  | S400 GJ 4400 | 3-73 | NT20138 | 3080.00 |
| 1 | S400ND3 | 3-143 | NT20138 | POA |
|  | S400 NE 3250 | 3-72 | NT20138 | 2180.00 |
|  | S400 NE 3400 | 3-72 | NT20138 | 2180.00 |
|  | S400 NE 4250 | 3-72 | NT20138 | 2180.00 |
|  | S400 NE 4400 | 3-72 | NT20138 | 2890.00 |
|  | S400 NJ 3250 | 3-71 | NT20138 | 2020.00 |
|  | S400 NJ 3400 | 3-71 | NT20138 | 2020.00 |

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|  | S400 NJ 4250 | 3-71 | NT20138 | 2700.00 |
|  | S400 NJ 4400 | 3-71 | NT20138 | 2700.00 |
|  | S400NN3 | 2-31 | NT20138 | 1650.00 |
|  | S400NN3 | 3-142 | NT20138 | 1650.00 |
|  | S400NN4 | 3-142 | NT20138 | 2200.00 |
| I | S400 PE 3250 | 3-79 | NT20138 | 2780.00 |
|  | S400 PE 3400 | 3-79 | NT20138 | 2780.00 |
| I | S400 PE 3 AG 400 | 3-79 | NT20138 | 187.00 |
| I | S400 PE 3 AP + | 3-79 | NT20138 | 187.00 |
| 1 | S400 PE 3 APG 400 | 3-79 | NT20138 | 375.00 |
| I | S400 PE 4250 | 3-79 | NT20138 | 3480.00 |
| 1 | S400 PE 4400 | 3-79 | NT20138 | 3480.00 |
| I | S400 PE 4 AGN 400 | 3-79 | NT20138 | 375.00 |
| 1 | S400 PE 4 AN + | 3-79 | NT20138 | 187.00 |
| I | S400 PE 4 AP + | 3-79 | NT20138 | 187.00 |
| 1 | S400 PE 4 APN + | 3-79 | NT20138 | 375.00 |
|  | S630 CE 3630 | 3-87 | NT20138 | 2920.00 |
|  | S630 CE 4630 | 3-87 | NT20138 | 3880.00 |
|  | S630 GE 3630 | 3-90 | NT20138 | 3130.00 |
|  | S630 GE 3 630PM | 3-146 | NT20138 | 3600.00 |
|  | S630 GE 3630 X1L | 3-91 | NT20138 | 5500.00 |
|  | S630 GE $3630 \times 15$ | 3-91 | NT20138 | 7340.00 |
|  | S630 GE 3 AG 630 | 3-90 | NT20138 | 3330.00 |
| I | S630 GE 3 AP 630 | 3-90 | NT20138 | 3330.00 |
| I | S630 GE 3 APG 630 | 3-90 | NT20138 | 3530.00 |
|  | S630 GE 4630 | 3-90 | NT20138 | 4180.00 |
| I | S630 GE 4630 X1L | 3-91 | NT20138 | 6600.00 |
| 1 | S630 GE $4630 \times 15$ | 3-91 | NT20138 | 8800.00 |
|  | S630 GE 4 AGN 630 | 3-90 | NT20138 | 4570.00 |
| I | S630 GE 4 AN 630 | 3-90 | NT20138 | 4370.00 |
| I | S630 GE 4 AP 630 | 3-90 | NT20138 | 4370.00 |
| 1 | S630 GE 4 APN 630 | 3-90 | NT20138 | 4570.00 |
|  | S630NN3 | 3-142 | NT20138 | 2490.00 |
|  | S630NN4 | 3-142 | NT20138 | 3320.00 |
|  | S800 CJ 3630 | 3-103 | NT20138 | 2500.00 |
|  | S800 CJ 3800 | 3-103 | NT20138 | 2550.00 |
| I | S800ND4 | 3-143 | NT20138 | POA |
|  | S800 NE 3630 | 3-106 | NT20138 | 3250.00 |
|  | S800 NE 3800 | 3-106 | NT20138 | 3990.00 |
|  | S800 NE 4630 | 3-106 | NT20138 | 3740.00 |
|  | S800 NE 4800 | 3-106 | NT20138 | 4560.00 |
|  | S800 NJ 3630 | 3-104 | NT20138 | 2900.00 |
|  | S800 NJ 3800 | 3-104 | NT20138 | 3150.00 |
|  | S800NN3 | 3-142 | NT20138 | 3150.00 |
|  | S800NN4 | 3-142 | NT20138 | 3990.00 |
|  | S800 RE 3630 | 3-107 | NT20138 | 3150.00 |
|  | S800 RE 3800 | 3-107 | NT20138 | 4200.00 |
|  | S800 RE 3800 X1L | 3-108 | NT20138 | 6450.00 |
|  | S800 RE 3800 X1S | 3-108 | NT20138 | 7900.00 |


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| I | S800 RE 3 AG \# | 3-107 | NT20138 | 180.00 |
| 1 | S800 RE 3 AP \# | 3-107 | NT20138 | 180.00 |
| 1 | S800 RE 3 APG \# | 3-107 | NT20138 | 360.00 |
|  | S800 RE 4630 | 3-107 | NT20138 | 3810.00 |
|  | S800 RE 4800 | 3-107 | NT20138 | 4850.00 |
| 1 | S800 RE 4800 X1L | 3-108 | NT20138 | 7740.00 |
| 1 | S800 RE $4800 \times 15$ | 3-108 | NT20138 | 9480.00 |
| 1 | S800 RE 4 AGN \# | 3-107 | NT20138 | 360.00 |
| 1 | S800 RE 4 AN \# | 3-107 | NT20138 | 180.00 |
| 1 | S800 RE 4 AP \# | 3-107 | NT20138 | 180.00 |
| I | S800 RE 4 APN \# | 3-107 | NT20138 | 360.00 |
|  | S800 RJ 3630 | 3-105 | NT20138 | 3910.00 |
|  | S800 RJ 3800 | 3-105 | NT20138 | 4500.00 |
|  | S800 RJ 4630 | 3-105 | NT20138 | 4350.00 |
|  | S800 RJ 4800 | 3-105 | NT20138 | 4950.00 |
|  | SAFET6106 | 1-7 | NT10136 | 61.50 |
| I | SAFET6106SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6110 | 1-7 | NT10136 | 61.50 |
|  | SAFET61100 | 1-7 | NT10136 | 138.00 |
|  | SAFET61100NA | 1-7 | NT10136 | 103.00 |
| I | SAFET61100NASHT | 1-8 | NT10136 | 225.00 |
| 1 | SAFET61100SHT | 1-8 | NT10136 | 270.00 |
| 1 | SAFET6110SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6116 | 1-7 | NT10136 | 61.50 |
|  | SAFET6116SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6120 | 1-7 | NT10136 | 61.50 |
|  | SAFET6120SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6125 | 1-7 | NT10136 | 61.50 |
|  | SAFET6125SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6132 | 1-7 | NT10136 | 61.50 |
|  | SAFET6132SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6140 | 1-7 | NT10136 | 61.50 |
| 1 | SAFET6140SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6150 | 1-7 | NT10136 | 61.50 |
| 1 | SAFET6150SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6163 | 1-7 | NT10136 | 61.50 |
|  | SAFET6163NA | 1-7 | NT10136 | 65.50 |
| I | SAFET6163NASHT | 1-8 | NT10136 | 184.00 |
| I | SAFET6163SHT | 1-8 | NT10136 | 190.00 |
|  | SAFET6180 | 1-7 | NT10136 | 138.00 |
| I | SAFET6180SHT | 1-8 | NT10136 | 270.00 |
|  | SAFET6206 | 1-7 | NT10136 | 190.00 |
| 1 | SAFET6206SHT | 1-8 | NT10136 | 325.00 |
|  | SAFET6210 | 1-7 | NT10136 | 190.00 |
| 1 | SAFET62100 | 1-7 | NT10136 | 355.00 |
| I | SAFET62100NA | 1-7 | NT10136 | 220.00 |
| I | SAFET62100NASHT | 1-8 | NT10136 | 350.00 |
| I | SAFET62100SHT | 1-8 | NT10136 | 475.00 |
| I | SAFET6210SHT | 1-8 | NT10136 | 325.00 |

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SAFET6216

SAFET6220

SAFET6225
SAFET6225SHT SAFET6232

SAFET6240

## SAFET6240SH

SAFET6250SHT
SAFET6263
SAFET6263NA
SAFET6263NASHT
SAFET6280 1-7
1-8

| $1-7$ | NT10136 | 225.00 |
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$\begin{array}{lll}1-8 & \text { NT10136 } & 350.00\end{array}$
$\begin{array}{lll}1-7 & \text { NT10136 } & 225.00\end{array}$
$\begin{array}{lll}1-7 & \text { NT10136 } & 405.00 \\ 1-7 & \text { NT10136 } & 285.00\end{array}$
2-30 NT10136 285.00

| $1-8$ | NT10136 | 425.00 |
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|  | SAFET63100SHT | 1-8 | NT10136 | 540.00 |
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|  | SAFET6310SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6316 | 1-7 | NT10136 | 225.00 |
|  | SAFET6316SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6320 | 1-7 | NT10136 | 225.00 |
|  | SAFET6320SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6325 | 1-7 | NT10136 | 225.00 |
|  | SAFET6325SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6332 | 1-7 | NT10136 | 225.00 |
|  | SAFET6332SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6340 | 1-7 | NT10136 | 225.00 |
|  | SAFET6340SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6350 | 1-7 | NT10136 | 225.00 |
|  | SAFET6350SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6363 | 1-7 | NT10136 | 225.00 |
|  | SAFET6363NA | 1-7 | NT10136 | 200.00 |
|  | SAFET6363NASHT | 1-8 | NT10136 | 335.00 |
|  | SAFET6363SHT | 1-8 | NT10136 | 350.00 |
|  | SAFET6380 | 1-7 | NT10136 | 405.00 |
|  | SAFET6380SHT | 1-8 | NT10136 | 540.00 |
| I | SAFET6406 | 1-7 | NT10136 | 315.00 |
| I | SAFET6406SHT | 1-8 | NT10136 | 440.00 |
| I | SAFET6410 | 1-7 | NT10136 | 315.00 |
| I | SAFET64100 | 1-7 | NT10136 | 495.00 |



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| 1 | SAFET64100NA | 1-7 | NT10136 | 440.00 |  |
| 1 | SAFET64100NASHT | 1-8 | NT10136 | 560.00 | $\overline{\text { V }}$ |
| 1 | SAFET64100SHT | 1-8 | NT10136 | 630.00 | $\bigcirc$ |
| 1 | SAFET6410SHT | 1-8 | NT10136 | 440.00 | 〕 |
| 1 | SAFET6416 | 1-7 | NT10136 | 315.00 | $\subsetneq$ |
| 1 | SAFET6416SHT | 1-8 | NT10136 | 440.00 | 3 |
|  | SAFET6420 | 1-7 | NT10136 | 315.00 | D |
| 1 | SAFET6420SHT | 1-8 | NT10136 | 440.00 | $\stackrel{\text { ®}}{ }$. |
| 1 | SAFET6425 | 1-7 | NT10136 | 315.00 |  |
| 1 | SAFET6425SHT | 1-8 | NT10136 | 440.00 | $\bigcirc$ |
|  | SAFET6432 | 1-7 | NT10136 | 315.00 | $\stackrel{\square}{\text { D }}$ |
| 1 | SAFET6432SHT | 1-8 | NT10136 | 440.00 | $\times$ |
| 1 | SAFET6440 | 1-7 | NT10136 | 315.00 |  |
| 1 | SAFET6440SHT | 1-8 | NT10136 | 440.00 |  |
|  | SAFET6450 | 1-7 | NT10136 | 315.00 |  |
|  | SAFET6450SHT | 1-8 | NT10136 | 440.00 |  |
|  | SAFET6463 | 1-7 | NT10136 | 315.00 |  |
| 1 | SAFET6463NA | 1-7 | NT10136 | 285.00 |  |
| 1 | SAFET6463NASHT | 1-8 | NT10136 | 425.00 |  |
| 1 | SAFET6463SHT | 1-8 | NT10136 | 440.00 |  |
|  | SAFET6480 | 1-7 | NT10136 | 495.00 |  |
| 1 | SAFET6480SHT | 1-8 | NT10136 | 630.00 |  |
|  | SAFETLCK 12 | 1-9 | NT10136 | 159.00 |  |
|  | SAFETLCK 24 | 1-9 | NT10136 | 210.00 |  |
|  | SAFE-TPC1 | 2-2 | NT10136 | 18.20 |  |
|  | SAFE-TPC23 | 2-2 | NT10136 | 32.50 |  |
|  | SAFETPF | 1-9 | NT10136 | 1.80 |  |
|  | SAFETPF | 2-10 | NT10136 | 1.80 |  |
|  | SAFETPF | 2-31 | NT10136 | 1.80 |  |
|  | SAFETPF | 2-51 | NT10136 | 1.80 |  |
|  | SPD1 | 5-28 | NT30141 | 210.00 |  |
|  | SPD1 | 5-29 | NT30141 | 210.00 |  |
|  | SPD3 | 5-28 | NT30141 | 280.00 |  |
|  | SPD3 | 5-29 | NT30141 | 280.00 |  |
| 1 | SRCB 1010 | 1-10 | NT10136 | 360.00 |  |
|  | SRCB 1030 | 1-10 | NT10136 | 325.00 |  |
|  | SRCB 1610 | 1-10 | NT10136 | 360.00 |  |
|  | SRCB 1630 | 1-10 | NT10136 | 325.00 |  |
|  | SRCB 2010 | 1-10 | NT10136 | 360.00 |  |
|  | SRCB 2030 | 1-10 | NT10136 | 325.00 |  |
|  | SRCBHA | 1-10 | NT10136 | 26.40 |  |
|  | SRCBLCK 12 | 1-10 | NT10136 | 275.00 |  |
|  | SRCBLCK 24 | 1-10 | NT10136 | 450.00 |  |
|  | SRCBWA | 1-10 | NT10136 | 26.40 |  |
|  | SSW2 | 5-28 | NB20052 | 390.00 |  |
|  | SSW2 | 5-29 | NB20052 | 390.00 |  |
|  | SSW3 | 5-28 | NB20052 | 405.00 |  |
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|  | STK250ND/TH | 2-31 | NT40143 | 119.00 |  |

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|  | T2AL00M3RTA | 3-123 | NT20138 | 187.00 |
|  | T2AL00M3STA | 3-32 | NT20138 | 134.00 |
|  | T2AL00M3STA | 3-59 | NT20138 | 134.00 |
|  | T2ALOOM3STA | 3-92 | NT20138 | 134.00 |
|  | T2AL00M3SWA | 3-32 | NT20138 | 146.00 |
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|  | T2AL00M3SWA | 3-92 | NT20138 | 146.00 |
|  | T2AL00M4STA | 3-115 | NT20138 | 129.00 |
|  | T2AL00M4STA | 3-123 | NT20138 | 129.00 |
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|  | T2AX00B2STA | 3-32 | NT20138 | 146.00 |
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|  | T2AX00M3SWA | 3-115 | NT20138 | 146.00 |
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| 1 | T2AX00M5SWA | 3-115 | NT20138 | 146.00 |
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|  | T2BA123SHA | 3-38 | NT20138 | 17.40 |
|  | T2BA123SHA | 4-14 | NT20138 | 17.40 |
|  | T2BA253LHA | 3-38 | NT20138 | 20.00 |
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| 1 | T2BA403LHA | 3-98 | NT20138 | POA |
|  | T2BA403SHA | 3-98 | NT20138 | 21.60 |

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|  | T2BA803SHA | 3-118 | NT20138 | 10.00 |
|  | T2BAX63LHA | 3-126 | NT20138 | 10.00 |
|  | T2CB803GHNA | 3-118 | NT20138 | 170.00 |
|  | T2CB804GHNA | 3-118 | NT20138 | 210.00 |
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|  | T2CF00LA | 3-126 | NT20138 | 8.80 |
|  | T2CF121SLNG | 3-37 | NT20138 | 35.00 |
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|  | T2CF122SLNG | 3-37 | NT20138 | 49.50 |
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| I | T2CF123SSNBA | 3-37 | NT20138 | 60.50 |
| I | T2CF123SSNBA | 4-13 | NT20138 | 60.50 |
|  | T2CF124SLNG | 3-37 | NT30141 | 73.00 |
|  | T2CF124SLNG | 4-13 | NT30141 | 73.00 |
| I | T2CF124SSNBA | 3-37 | NT20138 | 71.00 |
| I | T2CF124SSNBA | 4-13 | NT20138 | 71.00 |
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|  | T2CF253SLNG | 3-64 | NT20138 | 67.00 |
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|  | T2CF253SSNBA | 4-13 | NT20138 | 67.00 |
|  | T2CF254LLNG | 3-37 | NT20138 | 77.50 |
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|  | T2CF254LLNG | 4-13 | NT20138 | 77.50 |
|  | T2CF254SLNG | 3-64 | NT20138 | 77.50 |
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|  | T2CF804SLHGA | 3-118 | NT20138 | 260.00 |
|  | T2CFX33SLHGA | 3-126 | NT20138 | 225.00 |
|  | T2CFX34SLHGA | 3-126 | NT20138 | 280.00 |


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| I | T2CLSBB25043 | 5-34 | NT30141 | 760.00 |
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|  | T2CLSBB40033 | 5-34 | NT30141 | 650.00 |
| 1 | T2CLSBB40043 | 5-34 | NT30141 | 740.00 |
|  | T2CLSBB40044 | 5-34 | NT30141 | 880.00 |
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|  | T2CS121SG | 3-37 | NT20138 | 10.60 |
|  | T2CS121SG | 4-13 | NT20138 | 10.60 |
|  | T2CS122SG | 4-13 | NT40143 | 12.00 |
|  | T2CS123SG | 3-37 | NT20138 | 44.00 |
|  | T2CS123SG | 4-13 | NT20138 | 44.00 |
|  | T2CS124SG | 3-37 | NT20138 | 55.00 |
|  | T2CS124SG | 4-13 | NT20138 | 55.00 |
|  | T2CS251SG | 3-64 | NT20138 | 10.00 |
|  | T2CS251SG | 4-13 | NT40143 | 10.00 |
|  | T2CS253SG | 3-37 | NT20138 | 54.00 |
|  | T2CS253SG | 3-64 | NT20138 | 54.00 |
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| I | T2DF25A | 3-41 | NT20138 | 127.00 |
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T2FB254BA
T2FB463BA
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I T2FP125S3A
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I T2FP40S4A
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T2GBX6N12A
T2GBX6N16A
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T2HB12UR5BN
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T2HB40UR5BN
T2HB40UR5RN
T2HB80UR5BN
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A T2HL12CAP
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T2PF803HA
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| $3-120$ | 235.00 |
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3-40 NT20138 26.80
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3-32 NT20138 255.00

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|  | T2SH00A10TA | 3-59 | NT20138 | 255.00 | $\geq$ |
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|  | T2SH00A10TA | 3-123 | NT20138 | 255.00 | $\xrightarrow{2}$ |
|  | T2SH00A20TA | 3-32 | NT20138 | 255.00 | $\stackrel{\square}{¢}$ |
|  | T2SH00A20TA | 3-59 | NT20138 | 255.00 | 3 |
|  | T2SH00A20TA | 3-92 | NT20138 | 255.00 | (1) |
|  | T2SH00A20TA | 3-115 | NT20138 | 255.00 | $\stackrel{\sim}{\wedge}$ |
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|  | T2SH00A40TA | 3-59 | NT20138 | 255.00 | $\stackrel{\text { D }}{ }$ |
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| 1 A | T2SW4P125TC | 3-20 | NT20138 | 66.50 |
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- Product repairs and service
- On-site emergency breakdown service
- Preventative maintenance, and
- Commissioning


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Our National Service Headquarters is based in Melbourne. For over 40 years, we have supported all NHP products, from motor starters to circuit breakers. Traditionally, products are returned to our National service centre for maintenance and repair. When this is not possible, we deploy our field service technicians to complete the tasks at customer sites.
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In the case of commercial installations, continuity of service is equally important. In either case, disruption can result in costly losses and consequential damages. You want action, and you want it fast! NHP service offers $24 / 7$ protection to ensure that your plant and equipment continues to work for you. Our service technicians are on call and are equipped to minimise downtime.

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Normal business hours:
8.00am - 5.00 pm , Monday to Friday

All site work is subject to minimum four hours (includes travel and organisation time).

- Minimum charge normal business hours
$=4$ hours ( $\$ 5000$, thereafter $=\$ 125 / \mathrm{hr}$
- Minimum charge after hours

$$
=4 \text { hours }(\$ 750) \text {, thereafter }=\$ 187.50 / \mathrm{hr}
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- Minimum charge public holidays
$=4$ hours ( $\$ 1000$ ), thereafter $=\$ 250 / \mathrm{hr}$
Return to base: Standard hourly rate $=\$ 95 / \mathrm{hr}$
All return to base work incurs a minimum evaluation charge starting from $\$ 150$, and thereafter a quote is issued for the repair/service work to be completed on the item. This quote will cover both labour and parts.


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- Hourly rate after hours $=\$ 125 / \mathrm{hr}$
- Hourly rate for public holidays $=\$ 250 / \mathrm{hr}$


## Special service quotes:

The service sales team can also create special service quotes for scheduled work or maintenance contracts.

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Customers that do not have an account with NHP can use NHP's secure VISA and MasterCard credit card facilities.
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## Contacts

Normal business hours: contact your local NHP branch. After hours: phone 1300 NHP NHP, where your after hours service request will be answered by technically trained NHP customer service staff, who will assess the level of service support required and arrange for the work to be completed.

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NHP Electrical Engineering Products Pty Ltd
A.B.N. 84004304812

## TECHNICAL DATA SHEET

Equipment Type:Phase Failure Relay
Location:Power Distribution
Model Numbers: DPB 01CM48W4
Manufacturer: Carlo Gavazzi
Supplier:
NHP Pty Ltd
16 Riverview Place
Murarrie(07) 39094999


## Product Description

3 -phase or 3-phase+neutral line voltage monitoring relay for phase sequence, phase loss, over and under voltage (separately adjustable set
points) with built-in time delay function.
Supply ranges from 208 to 480 VAC covered by two multivoltage relays.

- TRMS 3-phase over and under voltage, phase sequence and phase loss monitoring relays
- Detect when all 3 phases are present and have the correct phase sequence (except for N versions)
- Available versions (W4) supplied between phase and neutral
- Detect if all the 3-phase-phase or phase-neutral voltages are within the set limits
- Upper and lower limits separately adjustable
- Measure on own power supply
- Selection of measuring range by DIP-switches
- Adjustable voltage on relative scale
- Adjustable delay function ( 0.1 to 30 s )
- Output: 8 A SPDT relay N.E.
- For mounting on DIN-rail in accordance with DIN/EN 50022 (DPB01) or plug-in module (PPB01)
- 22.5 mm Euronorm housing (DPB01) or 36 mm plug-in module (PPB01)
- LED indication for relay, alarm and power supply ON


## Ordering Key

DPB 01 C M23

## Housing <br> Function

Type
Item number
Output
Power supply

## Type Selection

| Mounting | Phase sequence detection | Output | $\begin{aligned} & \text { Supply: } \\ & 208 \text { to } 240 \text { VAC } \end{aligned}$ | $\begin{aligned} & \text { Supply: } \\ & 380 \text { to } 415 \text { VAC } \end{aligned}$ | $\begin{aligned} & \text { Supply: } \\ & 380 \text { to } 480 \text { VAC } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DIN-rail | yes | SPDT | DPB 01 C M23 | DPB 01 C M48 W4 | DPB 01 C M48 |
| Plug-in | yes | SPDT | PPB 01 C M23 | PPB 01 C M48 W4 |  |
| Plug-in | yes | SPDT |  | PPB 01 C M48 |  |
| DIN-rail | no | SPDT | DPB 01 C M23 N | DPB 01 C M48 N W4 | DPB 01 C M 48 N |
| Plug-in | no | SPDT | PPB 01 C M23 N | PPB 01 C M48 N W4 |  |
| Plug-in | no | SPDT |  | PPB 01 C M48 N |  |

## Input Specifications

$\left.\begin{array}{ll}\begin{array}{l}\text { Input } \\ \text { L1, L2, L3, } N\end{array} & \begin{array}{l}\text { DPB01: Terminals L1, L2, L3, N }\end{array} \\ & \text { PPB01: Terminals 5, 6, 7, 11 } \\ \text { Measure on own supply }\end{array}\right]$

| Ranges |
| :--- |
| Upper level |
| Lower level |

Note: The input voltage must not exceed the maximum rated voltage or drop below the minumum rated voltage reported above.

## Hysteresis

Set points from 2 to $5 \% \quad 1 \%$

Set points from 5 to $22 \%$
set points from 5 to $22 \%$

$$
\begin{aligned}
& +2 \text { to }+22 \% \\
& \text { of the nominal voltage } \\
& -22 \text { to }-2 \% \\
& \text { of the nominal voltage }
\end{aligned}
$$

## Output Specifications

| Output <br> Rated insulation voltage | SPDT relay 250 VAC |
| :---: | :---: |
| Contact ratings ( $\mathrm{AgSnO}_{2}$ ) | $\mu$ |
| Resistive loads AC 1 | 8 A @ 250 VAC |
| DC 12 | 5 A @ 24 VDC |
| Small inductive loads AC 15 | 2.5 A @ 250 VAC |
| DC 13 | 2.5 A @ 24 VDC |
| Mechanical life | $\geq 30 \times 10^{6}$ operations |
| Electrical life | $\geq 10^{5}$ operations <br> (at $8 \mathrm{~A}, 250 \mathrm{~V}, \cos \varphi=1$ ) |
| Operating frequency | $\leq 7200$ operations/h |
| Dielectric strength |  |
| Dielectric voltage | 2 kVAC (rms) |
| Rated impulse withstand volt. | $4 \mathrm{kV}(1.2 / 50 \mu \mathrm{~s})$ |

## Supply Specifications

Power supply
Rated operational voltage through terminals:
L1, L2, L3, N
(DPB01)

5, 6, 7, 11
(PPB01)
D/P PB01CM23,
D/P PB01CM23N
D/P PB01CM48W4,
D/P PB01CM48NW4,
PPB01CM 48, PPB01CM 48N
DPB01CM48, DPB01CM48N

Rated operational power
DPB01CM 23x, PPB01CM 23x
DPB01CM 48x, PPB01CM 48x
DPB01CM 48xW4
DPB01CM 48xW4

Overvoltage cat. III
(IEC 60664, IEC 60038)

208 to $240 \mathrm{~V}_{\text {L-L }}$ AC $\pm 15 \%$ 45 to 65 Hz

380 to $415 \mathrm{~V}_{\mathrm{L}-\mathrm{L}} \mathrm{AC} \pm 15 \%$ ( 220 to $240 \mathrm{~V}_{\mathrm{L}-\mathrm{N}} \mathrm{AC} \pm 15 \%$ ) 45 to 65 Hz

380 to $480 \mathrm{~V}_{\text {L-L }} \mathrm{AC} \pm 15 \%$ ( 220 to $277 \mathrm{~V}_{\mathrm{L}-\mathrm{N}} \mathrm{AC} \pm 15 \%$ ) 45 to 65 Hz

13 VA @ $230 \Delta V A C, 50 \mathrm{~Hz}$ 13 VA @ $400 \Delta V A C, 50 \mathrm{~Hz}$ Supplied by L1 and L2

13 VA @ 400 $\mathrm{DVAC}, 50 \mathrm{~Hz}$ Supplied by L1 and N

## General Specifications

| Power ON delay | $1 \mathrm{~s} \pm 0.5 \mathrm{~s}$ or $6 \mathrm{~s} \pm 0.5 \mathrm{~s}$ |
| :---: | :---: |
| Reaction time |  |
| Incorrect phase sequence or |  |
| total phase loss Voltage level | <200 ms |
| Voltage level | (input signal variatio |
|  | $+20 \%$ to $-20 \%$ of set value) |
| Alarm ON delay | $<200 \mathrm{~ms}$ (delay <0.1 s) |
| Alarm OFF delay | $<200 \mathrm{~ms}$ (delay <0.1 s) |
| Accuracy | (15 min warm-up time) |
| Temperature drift | $\pm 1000 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ |
| Delay ON alarm | $\pm 10 \%$ on set value $\pm 50 \mathrm{~ms}$ |
| Repeatability | $\pm 0.5 \%$ on full-scale |
| Indication for |  |
| Power supply ON | LED, green |
| Alarm ON | LED, red (flashing 2 Hz |
| put relay ON | during delay time) LED, yellow |
| Environment |  |
| Degree of protection | IP 20 |
| Pollution degree | 3 (DPB01), 2 (PPB01) |
| Operating temperature |  |
| @ Max. voltage, 50 Hz | -20 to $60^{\circ} \mathrm{C}$, R.H. $<95 \%$ |
| @ Max. voltage, 60 Hz | -20 to $50^{\circ} \mathrm{C}$, R.H. $<95 \%$ |
| Storage temperature | -30 to $80^{\circ} \mathrm{C}$, R.H. $<95 \%$ |
| Housing |  |
| $\begin{array}{ll}\text { Dimensions } & \text { DPB01 } \\ & \text { PPB01 }\end{array}$ | $\begin{aligned} & 22.5 \times 80 \times 99.5 \mathrm{~mm} \\ & 36 \times 80 \times 94 \mathrm{~mm} \end{aligned}$ |
| Weight | Approx. 120 g |
| Screw terminals |  |
| Tightening torque | Max. 0.5 Nm according to IEC 60947 |
| Approvals | $\begin{aligned} & \text { UL, CSA } \\ & \text { (except for W4 versions) } \end{aligned}$ |
| CE Marking | Yes |
| EMC | Eectromagnetic Compatibility |
| Immunity | According to EN 61000-6-2 |
| Emissions | According to EN 61000-6-3 |

## Mode of Operation

Connected to the 3 phases (and neutral) DPBO1 and PPBO1 operate when all 3 phases are present at the same time, the phase sequence is correct (not N versions) and the phasephase (or phase-neutral) voltage levels are within set limits.

If one or more phase-phase or phase-neutral voltages exceeds the upper set level or drops below the lower set level, the red LED starts
flashing 2 Hz and the output relay releases after the set time period. In any case if phase-neutral measurement is selected both phasephase and phase-neutral voltages are monitored. If the phase sequence is wrong or one phase is lost, the output relay releases immediately.
Only 200 ms delay occurs. The failure is indicated by the red LED flashing 5 Hz during the alarm condition.

## Example 2

(load monitoring)
The relay releases in case of interruption of one or more phases, when one or more voltages drop below the lower set level or exceed the upper set level.

## Example 1

(mains network monitoring)
The relay monitors over and under voltage, phase loss and correct phase sequence.
In case of $N$ versions, the relay monitors over and under voltage.

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## Function/ Range/ Level and Time Delay Setting

Adjust the input range setting the DIP switches 3 and 4 as shown below.

Select the desired function setting the DIP switches 1 and 2 as shown below.

To access the DIP swiches open the grey plastic cover as shown below

## Selection of level and time delay:

## Upper knob:

Setting of lower level on relative scale.

## Centre knob:

Setting of upper level on relative scale.

## Lower knob:

Setting of delay on alarm time on absolute scale (0.1 to 30 s ).


## Operation Diagrams



## Operation Diagrams (cont.)

L2
${ }^{(*)} \mathrm{N}$ versions don't detect incorrect phase sequence.

## Wiring Diagrams

## Example 1



## Example 2



DPB01

## Example 1



## Example 2



PPB01

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## Note

When DPB01 or PPB01 is used with phase indicator lamps (see examples in the following diagrams), the lamp H1 or H2 might be dimly lit when there is a phase loss in L1 or L2. This might happen if the lamps used are the typical low power indicator lamps, and there are no other loads present.
This fact can be avoided by using W4 models. Note that the neutral must be always connected to the device.


## PPB01



## Dimensions



Plug-in


## TECHNICAL DATA SHEET

Equipment Type:<br>Location:<br>Model Numbers:<br>Manufacturer:<br>Supplier:<br>Soft Starter<br>Motor Starter Section<br>MCD 500<br>Danfoss<br>Queensland<br>Unit 26/67 Depot Street<br>Banyo, QLD 4014<br>Tel: +61 732923600<br>Fax: +61 732664571



# Operating Instructions 

VLT ${ }^{\circledR}$ Soft Starter - MCD 500

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MCD 500 Operating Instruction

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Safety
MCD 500 Operating Instruction

## 1 Safety

### 1.1 Safety

When reading this manual you will come across different symbols that require special attention. The symbols used are the following:

## NOTE

Indicates something to be noted by the reader

## ACAUTION

Indicates a general warning

## AWARNING

Indicates a high voltage warning

The examples and diagrams in this manual are included solely for illustrative purposes. The information contained in this manual is subject to change at any time and without prior notice. In no event will responsibility or liability be accepted for direct, indirect or consequential damages resulting from the use or application of this equipment.

## NOTE

Before changing any parameter settings, ensure that the current parameter set is saved to an internal file. Refer to MCD 500 Operating Instructions, MG.17.KX.YY, for more information.

## AWARNING

WARNING - ELECTRICAL SHOCK HAZARD
MCD 500 soft starters contain dangerous voltages when connected to mains voltage. Only a competent electrician should carry out the electrical installation. Improper installation of the motor or the soft starter may cause equipment failure, serious injury or death. Follow this manual and local electrical safety codes.
Models MCD5-0360C - MCD5-1600C: The bus bar and heatsink are live while the unit is operating (starting, running or stopping). If the starter is installed without a main contactor, the bus bar and heatsink are live whenever mains voltage is connected (including when the starter is ready or tripped).

## AWARNING

Disconnect the soft starter from mains voltage before carrying out repair work.
It is the responsibility of the user or person installing the soft starter to provide proper grounding and branch circuit protection according to local electrical safety codes. Do not connect power factor correction capacitors to the output of MCD 500 soft starters. If static power factor correction is employed, it must be connected to the supply side of the soft starter.
MCD5-0021B - MCD5-0105B: After transportation, mechanical shock or rough handling there is possibility that the bypass contactor may have latched into the on state. To prevent the possibility of the motor starting immediately, on first commissioning or operation after transportation, always ensure that the control supply is applied before the power, so that the contactor state is initialised.

## AWARNING

## Safety of Personnel

The soft starter is not a safety device and does not provide electrical isolation or disconnection from the supply.

- If isolation is required, the soft starter must be installed with a main contactor
- The start and stop functions of the soft starter must not be relied upon for personnel safety. A motor may start or stop unexpectedly if faults occur in the mains supply, the motor connection, or the electronics of the soft starter.

To provide machine or personnel safety, the isolation device must be controlled through an external safety system.

In Auto On mode, the motor can be stopped using digital or bus commands while the soft starter is connected to mains.

## ACAUTION

These stop functions are not sufficient to avoid unintended start.
A motor that has been stopped may start if faults occur in the electronics of the soft starter, or a temporary fault in the supply mains or the motor connection ceases.

## CAUTION

Use the auto-start feature with caution. Read all the notes related to auto-start before operation.

Safety
MCD 500 Operating Instruction


Table 1.1

## 2 Introduction

The MCD 500 is an advanced digital soft start solution for motors from 7 kW to 800 kW . MCD 500 soft starters provide a complete range of motor and system protection features and have been designed for reliable performance in the most demanding installation situations.

### 2.1.1 Feature List

## Models for all connection requirements

- 21 A to 1600 A (in-line connection)
- In-line or inside delta connection
- Internally bypassed up to 215 A
- Mains voltage: 200-525 VAC or 380-690 VAC
- Control voltage: 24 VAC/VDC, 110-120 VAC or 220-240 VAC
User-friendly LCP
- Loggings
- Real-time graphs
- SCR conduction bar graph


## Tools

- Application setups
- Date and time stamped event log with 99 entries
- 8 most recent trips
- Counters
- Protection simulation
- Output signal simulation


## Inputs and Outputs

- Local or remote control input options ( $3 \times$ fixed $1 \times$ programmable)
- Relay outputs ( $3 \times$ programmable)
- Analog programmable output
- 24 VDC 200 mA supply output


## Start and run modes

- AAC - Adaptive Acceleration Control
- Constant current
- Current ramp
- Kickstart
- Jog
- Emergency run operation


## Stop modes

- AAC - Adaptive Acceleration Control
- Timed voltage ramp soft stop
- DC brake
- Soft brake
- Emergency stop


## Other features

- Auto start/stop timer
- Second order thermal model
- Battery backup of clock and thermal model
- Optional DeviceNet, Modbus or Profibus communication modules


## Comprehensive protection

- Wiring/Connection/Supply
- Motor connection
- Phase sequence
- Power loss
- Individual phase loss
- Mains frequency
- Current
- Excess start time
- Current imbalance
- Undercurrent
- Instantaneous overcurrent
- Thermal
- Motor thermistor
- Motor overload
- Bypass relay overload
- Heatsink temperature
- Communication
- Network comms
- Starter comms
- External
- Input trip
- Starter
- Individual shorted SCR
- Battery/Clock


### 2.1.2 Type Code



Installation
MCD 500 Operating Instruction

## 3 Installation

3.1 Mechanical Installation


Illustration 3.1

| $\mathbf{1}$ | MCD5-0021B - MCD5-0245C: Allow 100 mm (3.94 inches) between soft starters. <br> MCD5-0360C - MCD5-1600C: Allow 200 mm (7.88 inches) between soft starters. |
| :---: | :--- |
| $\mathbf{2}$ | MCD5-0021B - MCD5-0215B: Allow 50 mm (1.97 inches) between the soft starter and solid surfaces. <br> MCD5-0245C: Allow 100 mm (3.94 inches) between the soft starter and solid surfaces. <br> MCD5-0360C - MCD5-1600C: Allow 200 mm (7.88 inches) between the soft starter and solid surfaces. |
| $\mathbf{3}$ | The soft starter may be mounted on its side. Derate the soft starter's rated current by 15\%. |
| $\mathbf{4}$ | Soft starters may be mounted side by side with clearance of 50 mm (1.97 inches) on both sides. |

Table 3.1

Installation
MCD 500 Operating Instruction

### 3.2 Dimensions and Weights



Illustration 3.2


Table 3.2

## 4 Electrical Installation

### 4.1 Electrical Installation

### 4.1.1 Control Wiring

The soft starter can be controlled in three ways

- using the buttons on the LCP
- via remote inputs
- via a serial communication link

The MCD 500 will always respond to a local start or stop command (via the [Hand On] and [Off] buttons on the LCP). Pressing the [Auto On] button selects remote control (the MCD 500 will accept commands from the remote inputs). In remote mode, the Auto On LED will be on. In local mode, the Hand On LED will be on if the MCD 500 is starting or running and the Off LED will be on if the MCD 500 is stopped or stopping.

### 4.1.2 Control Terminals

Control terminations use $2.5 \mathrm{~mm}^{2}$ plug-in terminal blocks. Different models require control voltage to different terminals:

To maintain SELV, all connections made to the control terminals must be PELV (eg. thermistor must be reinforced/ double insulated from motor).

## NOTE

SELV offers protection by way of extra low voltage. Protection against electric shock is ensured when the electrical supply is of the SELV type and the installation is made as described in local/national regulations on SELV supplies.

## NOTE

Galvanic (ensured) isolation is obtained by fulfilling requirements for higher isolation and by providing the relevant creepages/clearance distances. These requirements are described in the IEC61140 standard.
The components that make up the electrical isolation also comply with the requirements for higher isolation and the relevant test as described in IEC61140.

### 4.1.3 Remote Inputs

The MCD 500 has three fixed inputs for remote control. These inputs should be controlled by contacts rated for low voltage, low current operation (gold flash or similar).


Illustration 4.2

| 1 | Two-wire control |
| :--- | :--- |
| 2 | Three-wire control |
| 3 | Four-wire control |

Table 4.1
The reset input can be normally open or normally closed. Use 3-8 Remote Reset Logic to select the configuration.

## ACAUTION

Do not apply voltage to the control input terminals. These are active 24 VDC inputs and must be controlled with potential free contacts.
Cables to the control inputs must be segregated from mains voltage and motor cabling


Illustration 4.1

## NOTE

Do not short terminals 05,06 without using a thermistor.
All control terminals and relay terminals comply with SELV (Protective Extra Low Voltage). This protection does not apply to grounded Delta leg above 400 V .

### 4.1.4 Serial Communication

Serial communication is always enabled in local control mode, and can be enabled or disabled in remote control mode (see 3-2 Comms in Remote).

### 4.1.5 Earth Terminal

Earth terminals are located at the back of the soft starter.

- MCD5-0021B - MCD5-0105B have one terminal, on the input side.
- MCD5-0131B - MCD5-1600C have two terminals, one on the input side and one on the output side.


### 4.1.6 Power Terminations

Use only copper stranded or solid conductors, rated for $75^{\circ} \mathrm{C}$.

## NOTE

Some units are aluminium bus bars. When connecting power terminations, we recommend cleaning the surface contact area thoroughly (using an emery or stainless steel brush) and using an appropriate jointing compound to prevent corrosion.


Table 4.2


Table 4.3

Electrical Installation
MCD 500 Operating Instruction

The bus bars on models MCD5-0360C - MCD5-1600C can be adjusted for top or bottom input and output as required. For step-by-step instructions on adjusting the bus bars, refer to the supplied insert.


| I/O | Input/Output |
| :--- | :--- |
| I | Input |
| O | Output |

Table 4.4

### 4.2 Motor Connection

MCD 500 soft starters can be connected to the motor inline or inside delta (also called three-wire and six-wire connection). The MCD 500 will automatically detect the motor connection and perform the necessary calculations internally, so it is only necessary to program the motor full load current (1-1 Motor FLC).

## NOTE

For personnel safety, the power terminals on models up to MCD5-0105B are protected by snap-off tabs. When using large cables, it may be necessary to break off these tabs. Models which are internally bypassed do not require an external bypass contactor.

### 4.2.1 Testing the Installation

The MCD 500 can be connected to a small motor for testing. During this test, the soft starter's control input and relay output protection settings can be tested. This test mode is not suitable for testing soft starting or soft stopping performance.

The minimum motor FLC for test purposes is $2 \%$ of the soft starter's minimum FLC (see 4.4 Minimum and Maximum Current Settings).

## NOTE

When testing the soft starter with a small motor, set 1-1 Motor FLC to the minimum allowable value.

### 4.2.2 In-line Installation

4.2.2.1 In-line Installation, Internally Bypassed


Illustration 4.4

| KM1 | Main contactor (optional) |
| :--- | :--- |
| F1 | Fuses (optional) |

Table 4.5

### 4.2.2.2 In-line Installation, Non-bypassed



Illustration 4.5

| KM1 | Main contactor (optional) |
| :--- | :--- |
| F1 | Fuses (optional) |

Table 4.6

### 4.2.2.3 In-line Installation, Externally Bypassed

Non-bypassed models have dedicated bypass terminals, which allow the soft starter to continue providing protection and monitoring functions even when bypassed via external contactor. The bypass contactor must be connected to the bypass terminals and controlled by a
programmable output configured to Run (see parameters 4.1 thorugh 4.9).

## NOTE

The bypass terminals on MCD5-0245C are T1B, T2B, T3B. The bypass terminals on MCD5-0360C ~MCD5-1600C are L1B, L2B, L3B.

## NOTE

The fuses can be installed on the input side if required.


Illustration 4.6 MCD5-0245C

| KM1 | Main contactor |
| :--- | :--- |
| KM2 | Bypass contactor (external) |
| F1 | Semiconductor fuses (optional) |

Table 4.7


Illustration 4.7 MCD5-0360C ~ MCD5-1600C

| KM1 | Main contactor |
| :--- | :--- |
| KM2 | Bypass contactor (external) |
| F1 | Semiconductor fuses (optional) |

Table 4.8

### 4.2.3 Inside Delta Installation

## CAUTION

When connecting the MCD 500 in inside delta configuration, always install a main contactor or shunt trip circuit breaker.

## NOTE

When connecting in inside delta, enter the motor full load current (FLC) for 1-1 Motor FLC. MCD 500 software calculates inside delta currents from this. 15-7 Motor Connection is set to Auto detect as default and can be set to force the soft starter inside delta or in-line.

### 4.2.3.1 Inside Delta Installation, Internally Bypassed



Illustration 4.8

| KM1 | Main contactor |
| :--- | :--- |
| F1 | Fuses (optional) |

Table 4.9

### 4.2.3.2 Inside Delta Installation, Nonbypassed



Illustration 4.9

| KM1 | Main contactor |
| :--- | :--- |
| F1 | Fuses (optional) |

Table 4.10

### 4.2.3.3 Inside Delta Installation, Externally Bypassed

Non-bypassed models have dedicated bypass terminals, which allow the MCD 500 to continue providing protection and monitoring functions even when bypassed via an external bypass contactor. The bypass relay must be connected to the bypass terminals and controlled by a programmable output configured to Run (see parameters 4-1 through 4-9).

## NOTE

The bypass terminals on MCD5-0245C are T1B, T2B, T3B.
The bypass terminals on MCD5-0360C - MCD5-1600C are L1B, L2B, L3B.
The fuses can be installed on the input side if required.


Illustration 4.10 MCD5-0245C

| KM1 | Main contactor |
| :--- | :--- |
| KM2 | Bypass contactor (external) |
| F1 | Semicondutcor fuses (optional) |

Table 4.11


Illustration 4.11 MCD5-0360C ~ MCD5-1600C

| KM1 | Main contactor |
| :--- | :--- |
| KM2 | Bypass contactor (external) |
| F1 | Semiconductor fuses (optional) |

Table 4.12

### 4.3 Current Ratings

Contact your local supplier for ratings under operating conditions not covered by these ratings charts.

All ratings are calculated at altitude of 1000 metres and ambient temperature of $40^{\circ} \mathrm{C}$.

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MCD 500 Operating Instruction

### 4.3.1 In-line Connection (Bypassed)

## NOTE

Models MCD5-0021B - MCD5-0215B are internally bypassed. Models MCD5-0245C - MCD5-1600C require an external bypass contactor.

|  | $\begin{gathered} \mathrm{AC}-53 \mathrm{~b} \\ 3-30: 330 \end{gathered}$ | $\begin{aligned} & \text { AC-53b } \\ & 4-20: 340 \end{aligned}$ | $\begin{gathered} \text { AC-53b } \\ 4.5-30: 330 \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| MCD5-0021B | 21 A | 17 A | 15 A |
| MCD5-0037B | 37 A | 31 A | 26 A |
| MCD5-0043B | 43 A | 37 A | 30 A |
| MCD5-0053B | 53 A | 46 A | 37 A |
|  | $\begin{gathered} \text { AC-53b } \\ 3-30: 570 \end{gathered}$ | $\begin{aligned} & \text { AC-53b } \\ & 4-20: 580 \end{aligned}$ | $\begin{gathered} \text { AC-53b } \\ 4.5-30: 570 \end{gathered}$ |
| MCD5-0068B | 68 A | 55 A | 47 A |
| MCD5-0084B | 84 A | 69 A | 58 A |
| MCD5-0089B | 89 A | 74 A | 61 A |
| MCD5-0105B | 105 A | 95 A | 78 A |
| MCD5-0131B | 131 A | 106 A | 90 A |
| MCD5-0141B | 141 A | 121 A | 97 A |
| MCD5-0195B | 195 A | 160 A | 134 A |
| MCD5-0215B | 215 A | 178 A | 148 A |
| MCD5-0245C | 255 A | 201 A | 176 A |
| MCD5-0360C | 360 A | 310 A | 263 A |
| MCD5-0380C | 380 A | 359 A | 299 A |
| MCD5-0428C | 430 A | 368 A | 309 A |
| MCD5-0595C | 620 A | 540 A | 434 A |
| MCD5-0619C | 650 A | 561 A | 455 A |
| MCD5-0790C | 790 A | 714 A | 579 A |
| MCD5-0927C | 930 A | 829 A | 661 A |
| MCD5-1200C | 1200 A | 1200 A | 1071 A |
| MCD5-1410C | 1410 A | 1319 A | 1114 A |
| MCD5-1600C | 1600 A | 1600 A | 1353 A |

Table 4.13

### 4.3.2 AC-53 Rating for Bypassed Operation

141 A: $A C-53 b: \frac{4.5-30}{T}: \frac{570}{1}$


## Illustration 4.12

All ratings are calculated at altitude of 1000 metres and ambient temperature of $40^{\circ} \mathrm{C}$.

### 4.3.3 In-line Connection (Non-bypassed/Continuous)

|  | AC-53a <br> $3-30: 50-6$ | AC-53a <br> $4-20: 50-6$ | AC-53a <br> $4.5-30: 50-6 ~$ |
| :---: | :---: | :---: | :---: |
| MCD5-0245C | 245 A | 195 A | 171 A |
| MCD5-0360C | 360 A | 303 A | 259 A |
| MCD5-0380C | 380 A | 348 A | 292 A |
| MCD5-0428C | 428 A | 355 A | 300 A |
| MCD5-0595C | 595 A | 515 A | 419 A |
| MCD5-0619C | 619 A | 532 A | 437 A |
| MCD5-0790C | 790 A | 694 A | 567 A |
| MCD5-0927C | 927 A | 800 A | 644 A |
| MCD5-1200C | 1200 A | 1135 A | 983 A |
| MCD5-1410C | 1410 A | 1187 A | 1023 A |
| MCD5-1600C | 1600 A | 1433 A | 1227 A |

Table 4.14

### 4.3.4 AC-53 Rating for Continuous Operation



## Illustration 4.13

All ratings are calculated at altitude of 1000 metres and ambient temperature of $40^{\circ} \mathrm{C}$.

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### 4.3.5 Inside Delta Connection (Bypassed)

## NOTE

Models MCD5-0021B ~ MCD5-0215B are internally bypassed. Models MCD5-0245C ~ MCD5-1600C require an external bypass contactor.

|  | $\begin{gathered} \text { AC-53b } \\ 3-30: 330 \end{gathered}$ | $\begin{gathered} \hline \text { AC-53b } \\ 4.20-: 340 \end{gathered}$ | $\begin{gathered} \text { AC-53b } \\ 4.5-30: 330 \end{gathered}$ |
| :---: | :---: | :---: | :---: |
| MCD5-0021B | 32 A | 26 A | 22 A |
| MCD5-0037B | 56 A | 47 A | 39 A |
| MCD5-0043B | 65 A | 56 A | 45 A |
| MCD5-0053B | 80 A | 69 A | 55 A |
|  | $\begin{aligned} & \text { AC-53b } \\ & 3-30: 570 \end{aligned}$ | $\begin{aligned} & \text { AC-53b } \\ & 4-20: 580 \end{aligned}$ | $\begin{gathered} \text { AC-53b } \\ 4.5-30: 570 \end{gathered}$ |
| MCD5-0068B | 102 A | 83 A | 71 A |
| MCD5-0084B | 126 A | 104 A | 87 A |
| MCD5-0089B | 134 A | 112 A | 92 A |
| MCD5-0105B | 158 A | 143 A | 117 A |
| MCD5-0131B | 197 A | 159 A | 136 A |
| MCD5-0141B | 212 A | 181 A | 146 A |
| MCD5-0195B | 293 A | 241 A | 201 A |
| MCD5-0215B | 323 A | 268 A | 223 A |
| MCD5-0245C | 383 A | 302 A | 264 A |
| MCD5-0360C | 540 A | 465 A | 395 A |
| MCD5-0380C | 570 A | 539 A | 449 A |
| MCD5-0428C | 645 A | 552 A | 463 A |
| MCD5-0595C | 930 A | 810 A | 651 A |
| MCD5-0619C | 975 A | 842 A | 683 A |
| MCD5-0790C | 1185 A | 1072 A | 869 A |
| MCD5-0927C | 1395 A | 1244 A | 992 A |
| MCD5-1200C | 1800 A | 1800 A | 1607 A |
| MCD5-1410C | 2115 A | 1979 A | 1671 A |
| MCD5-1600C | 2400 A | 2400 A | 2030 A |

Table 4.15

### 4.3.6 AC-53 Rating for Bypassed Operation

$141 \mathrm{~A}: \mathrm{AC}-53 \mathrm{~b}: \frac{4.5-30}{T}: \frac{570}{T}$


177HA281.11

## Illustration 4.14

All ratings are calculated at altitude of 1000 metres and ambient temperature of $40^{\circ} \mathrm{C}$.

### 4.3.7 Inside Delta Connection (Non-bypassed/Continuous)

|  | AC-53a <br> $3-30: 50-6$ | AC-53a <br> $4-20: 50-6$ | AC-53a |
| :---: | :---: | :---: | :---: |
|  | 368 A | 293 A | 257 A |
| MCD5-0245C | 540 A | 455 A | 389 A |
| MCD5-0360C | 570 A | 522 A | 438 A |
| MCD5-0380C | 643 A | 533 A | 451 A |
| MCD5-0428C | 893 A | 773 A | 629 A |
| MCD5-0595C | 929 A | 798 A | 656 A |
| MCD5-0619C | 1185 A | 1042 A | 851 A |
| MCD5-0790C | 1391 A | 1200 A | 966 A |
| MCD5-0927C | 1800 A | 1702 A | 1474 A |
| MCD5-1200C | 2115 A | 1780 A | 1535 A |
| MCD5-1410C | 2400 A | 2149 A | 1841 A |
| MCD5-1600C |  |  |  |

Table 4.16

### 4.3.8 AC-53 Rating for Continuous Operation



Illustration 4.15

All ratings are calculated at altitude of 1000 metres and ambient temperature of $40^{\circ} \mathrm{C}$.

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### 4.4 Minimum and Maximum Current Settings

The MCD 500's minimum and maximum full load current settings depend on the model:

|  | In-line Connection |  | Inside Delta Connection |  |
| :---: | :---: | :---: | :---: | :---: |
| Model | Minimum | Maximum | Minimum | Maximum |
| MCD5-0021B | 5 A | 23 A | 7 A | 34 A |
| MCD5-0037B | 9 A | 43 A | 13 A | 64 A |
| MCD5-0043B | 10 A | 50 A | 15 A | 75 A |
| MCD5-0053B | 11 A | 53 A | 16 A | 79 A |
| MCD5-0068B | 15 A | 76 A | 23 A | 114 A |
| MCD5-0084B | 19 A | 97 A | 29 A | 145 A |
| MCD5-0089B | 20 A | 100 A | 30 A | 150 A |
| MCD5-0105B | 21 A | 105 A | 32 A | 157 A |
| MCD5-0131B | 29 A | 145 A | 44 A | 217 A |
| MCD5-0141B | 34 A | 170 A | 51 A | 255 A |
| MCD5-0195B | 40 A | 200 A | 60 A | 300 A |
| MCD5-0215B | 44 A | 220 A | 66 A | 330 A |
| MCD5-0245C | 51 A | 255 A | 77 A | 382 A |
| MCD5-0360C | 72 A | 360 A | 108 A | 540 A |
| MCD5-0380C | 76 A | 380 A | 114 A | 570 A |
| MCD5-0428C | 86 A | 430 A | 129 A | 645 A |
| MCD5-0595C | 124 A | 620 A | 186 A | 930 A |
| MCD5-0619C | 130 A | 650 A | 195 A | 975 A |
| MCD5-0790C | 158 A | 790 A | 237 A | 1185 A |
| MCD5-0927C | 186 A | 930 A | 279 A | 1395 A |
| MCD5-1200C | 240 A | 1200 A | 360 A | 1800 A |
| MCD5-1410C | 282 A | 1410 A | 423 A | 2115 A |
| MCD5-1600C | 320 A | 1600 A | 480 A | 2400 A |

Table 4.17

### 4.5 Bypass Contactor

MCD 500 soft starters with model numbers MCD5-0021B - MCD5-0215B are internally bypassed and do not require an external bypass contactor.

MCD 500 soft starters with model numbers MCD5-0245C - MCD5-1600C are not internally bypassed and may be installed with an external bypass contactor. Select a contactor with an AC1 rating greater than or equal to the full load current rating of the connected motor.

### 4.6 Main Contactor

A main contactor must be installed if the MCD 500 is connected to the motor in inside delta format and is optional for inline connection. Select a contactor with an AC3 rating greater than or equal to the full load current rating of the connected motor.

### 4.7 Circuit Breaker

A shunt trip circuit breaker may be used instead of a main contactor to isolate the motor circuit in the event of a soft starter trip. The shunt trip mechanism must be powered from the supply side of the circuit breaker or from a separate control supply.

### 4.8 Power Factor Correction

If power factor correction is used, a dedicated contactor should be used to switch in the capacitors. Power factor correction capacitors must be connected to the input side of the soft starter.

## CAUTION

Power factor correction capacitors must be connected to the input side of the soft starter. Connecting power factor correction capacitors to the output side will damage the soft starter.

### 4.9 Fuses

### 4.9.1 Power Supply Fuses

Semiconductor fuses can be used for Type 2 coordination (according to IEC 60947-4-2 standard) and to reduce the risk of damage to SCRs from transient overload currents.

HRC fuses (such as Ferraz AJT fuses) can be used for Type 1 coordination according to IEC 60947-4-2 standard.

## NOTE

Adaptive Acceleration Control (AAC) controls the motor's speed profile, within the programmed time limit. This may result in a higher level of current than traditional control methods.

For applications using Adaptive Acceleration Control to soft stop the motor with stop times greater than 30
seconds, motor branch protection should be selected as follows:

- Standard HRC line fuses: Minimum $150 \%$ motor full load current
- Motor rated line fuses: Minimum rating 100/150\% motor full load current
- Motor control circuit breaker minimum long time setting: $150 \%$ motor full load current
- Motor control circuit breaker minimum short time setting: 400\% motor full load current for 30 seconds

Fuses recommendations are calculated for $40^{\circ} \mathrm{C}$, up to 1000 m .

## NOTE

Fuse selection is based on a $400 \%$ FLC start for 20 seconds in conjunction with standard published starts per hour, duty cycle, $40^{\circ} \mathrm{C}$ ambient temperature and up to 1000 m altitude. For installations operating outside these conditions, consult your local supplier.

## NOTE

These fuse tables contain recommendations only, always consult your local supplier to confirm the selection for your particular application.

For models marked - there is no suitable fuse.

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### 4.9.2 Bussman Fuses - Square Body (170M)

| Model | SCR $\mathrm{I}^{2} \mathrm{t}\left(\mathrm{A}^{2} \mathrm{~s}\right)$ | Supply Voltage ( $\leq 440$ VAC) | Supply Voltage ( $\leq 575$ VAC) | Supply Voltage ( $\leq 690$ VAC) |
| :---: | :---: | :---: | :---: | :---: |
| MCD5-0021B | 1150 | 170M1314 | 170M1314 | 170M1314 |
| MCD5-0037B | 8000 | 170 M 1316 | 170M1316 | 170 M 1316 |
| MCD5-0043B | 10500 | 170 M 1318 | 170M1318 | 170 M 1318 |
| MCD5-0053B | 15000 | 170M1318 | 170M1318 | 170 M 1318 |
| MCD5-0068B | 15000 | 170M1319 | 170M1319 | 170M1318 |
| MCD5-0084B | 512000 | 170M1321 | 170M1321 | 170M1319 |
| MCD5-0089B | 80000 | 170M1321 | 170M1321 | 170M1321 |
| MCD5-0105B | 125000 | 170M1321 | 170M1321 | 170M1321 |
| MCD5-0131B | 125000 | 170M1321 | 170M1321 | 170M1321 |
| MCD5-0141B | 320000 | 170M2621 | 170M2621 | 170M2621 |
| MCD5-0195B | 320000 | 170M2621 | 170M2621 | 170M2621 |
| MCD5-0215B | 320000 | 170M2621 | 170M2621 | 170M2621 |
| MCD5-0245C | 320000 | 170M2621 | 170M2621 | 170M2621 |
| MCD5-0360C | 320000 | 170 M 6010 | 170 M 6010 | 170 M 6010 |
| MCD5-0380C | 320000 | 170M6011 | 170M6011 | - |
| MCD5-0428C | 320000 | 170 M 6011 | 170M6011 | - |
| MCD5-0595C | 1200000 | 170 M 6015 | 170M6015 | 170 M 6014 |
| MCD5-0619C | 1200000 | 170 M 6015 | 170M6015 | 170 M 6014 |
| MCD5-0790C | 2530000 | 170 M 6017 | 170 M 6017 | 170 M 6016 |
| MCD5-0927C | 4500000 | 170 M 6019 | 170M6019 | 170M6019 |
| MCD5-1200C | 4500000 | 170M6021 | - | - |
| MCD5-1410C | 6480000 | - | - | - |
| MCD5-1600C | 12500000 | 170M6019* | - | - |

## Table 4.18

* Two parallel connected fuses required per phase.


### 4.9.3 Bussman Fuses - British Style (BS88)

| Model | SCR $\mathrm{I}^{2} \mathrm{t}\left(\mathrm{A}^{2} \mathrm{~s}\right)$ | Supply Voltage $\text { (< } 440 \text { VAC) }$ | Supply Voltage (< 575 VAC) | Supply Voltage $\text { (< } 690 \text { VAC) }$ |
| :---: | :---: | :---: | :---: | :---: |
| MCD5-0021B | 1150 | 63FE | 63FE | 63FE |
| MCD5-0037B | 8000 | 120FEE | 120FEE | 120FEE |
| MCD5-0043B | 10500 | 120FEE | 120FEE | 120FEE |
| MCD5-0053B | 15000 | 200FEE | 200FEE | 200FEE |
| MCD5-0068B | 15000 | 200FEE | 200FEE | 200FEE |
| MCD5-0084B | 512000 | 200FEE | 200FEE | 200FEE |
| MCD5-0089B | 80000 | 280FM | 280FM | 280FM |
| MCD5-0105B | 125000 | 280FM | 280FM | 280FM |
| MCD5-0131B | 125000 | 280FM | 280FM | 280FM |
| MCD5-0141B | 320000 | 450FMM | 450FMM | 450FMM |
| MCD5-0195B | 320000 | 450FMM | 450FMM | 450FMM |
| MCD5-0215B | 320000 | 450FMM | 450FMM | 450FMM |
| MCD5-0245C | 320000 | 450FMM | 450FMM | 450FMM |
| MCD5-0360C | 320000 | - | - | - |
| MCD5-0380C | 320000 | 400FMM* | 400FMM | 400FMM* |
| MCD5-0428C | 320000 | - | - | - |
| MCD5-0595C | 1200000 | 630FMM* | 630FMM* | - |
| MCD5-0619C | 1200000 | 630FMM* | 630FMM* | - |
| MCD5-0790C | 2530000 | - | - | - |
| MCD5-0927C | 4500000 | - | - | - |
| MCD5-1200C | 4500000 | - | - | - |
| MCD5-1410C | 6480000 | - | - | - |
| MCD5-1600C | 12500000 | - | - | - |

## Table 4.19

* Two parallel connected fuses required per phase.

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### 4.9.4 Ferraz Fuses - HSJ

| Model | SCR $\mathrm{I}^{2} \mathrm{t}\left(\mathrm{A}^{2} \mathrm{~s}\right)$ | Supply Voltage $\text { (< } 440 \text { VAC) }$ | Supply Voltage $\text { (< } 575 \text { VAC) }$ | Supply Voltage $\text { (< } 690 \text { VAC) }$ |
| :---: | :---: | :---: | :---: | :---: |
| MCD5-0021B | 1150 | HSJ40** | HSJ40** | Not suitable |
| MCD5-0037B | 8000 | HSJ80** | HSJ80** |  |
| MCD5-0043B | 10500 | HSJ90** | HSJ90** |  |
| MCD5-0053B | 15000 | HSJ110** | HSJ110** |  |
| MCD5-0068B | 15000 | HSJ125** | HSJ125** |  |
| MCD5-0084B | 51200 | HSJ175 | HSJ175** |  |
| MCD5-0089B | 80000 | HSJ175 | HSJ175 |  |
| MCD5-0105B | 125000 | HSJ225 | HSJ225 |  |
| MCD5-0131B | 125000 | HSJ250 | HSJ250** |  |
| MCD5-0141B | 320000 | HSJ300 | HSJ300 |  |
| MCD5-0195B | 320000 | HSJ350 | HSJ350 |  |
| MCD5-0215B | 320000 | HSJ400** | HSJ400** |  |
| MCD5-0245C | 320000 | HSJ450** | HSJ450** |  |
| MCD5-0360C | 320000 | Not suitable | Not suitable |  |
| MCD5-0380C | 320000 |  |  |  |
| MCD5-0428C | 320000 |  |  |  |
| MCD5-0595C | 1200000 |  |  |  |
| MCD5-0619C | 1200000 |  |  |  |
| MCD5-0790C | 2530000 |  |  |  |
| MCD5-0927C | 4500000 |  |  |  |
| MCD5-1200C | 4500000 |  |  |  |
| MCD5-1410C | 6480000 |  |  |  |
| MCD5-1600C | 12500000 |  |  |  |

Table 4.20
** Two series connected fuses required per phase

### 4.9.5 Ferraz Fuses - North American Style (PSC 690)

| Model | SCR $\mathrm{I}^{2} \mathrm{t}\left(\mathrm{A}^{2} \mathrm{~s}\right)$ | Supply Voltage $<440 \text { VAC }$ | Supply Voltage $<575 \text { VAC }$ | Supply Voltage $<690 \text { VAC }$ |
| :---: | :---: | :---: | :---: | :---: |
| MCD5-0021B | 1150 | A070URD30XXX0063 | A070URD30XXX0063 | - |
| MCD5-0037B | 8000 | A070URD30XXX0125 | A070URD30XXX0125 | A070URD30XXX0125 |
| MCD5-0043B | 10500 | A070URD30XXX0125 | A070URD30XXX0125 | A070URD30XXX0125 |
| MCD5-0053B | 15000 | A070URD30XXX0125 | A070URD30XXX0125 | A070URD30XXX0125 |
| MCD5-0068B | 15000 | A070URD30XXX0160 | A070URD30XXX0160 | A070URD30XXX0160 |
| MCD5-0084B | 51200 | A070URD30XXX0200 | A070URD30XXX0200 | A070URD30XXX0200 |
| MCD5-0089B | 80000 | A070URD30XXX0200 | A070URD30XXX0200 | A070URD30XXX0200 |
| MCD5-0105B | 125000 | A070URD30XXX0315 | A070URD30XXX0315 | A070URD30XXX0315 |
| MCD5-0131B | 125000 | A070URD30XXX0315 | A070URD30XXX0315 | A070URD30XXX0315 |
| MCD5-0141B | 320000 | A070URD30XXX0315 | A070URD30XXX0315 | A070URD30XXX0315 |
| MCD5-0195B | 320000 | A070URD30XXX0450 | A070URD30XXX0450 | A070URD30XXX0450 |
| MCD5-0215B | 320000 | A070URD30XXX0450 | A070URD30XXX0450 | A070URD30XXX0450 |
| MCD5-0245C | 320000 | A070URD30XXX0450 | A070URD30XXX0450 | A070URD30XXX0450 |
| MCD5-0360C | 320000 | A070URD33XXX0630 | A070URD33XXX0630 | A070URD33XXX0630 |
| MCD5-0380C | 320000 | A070URD33XXX0700 | A070URD33XXX0700 | - |
| MCD5-0428C | 320000 | A070URD33XXX0700 | A070URD33XXX0700 | - |
| MCD5-0595C | 1200000 | A070URD33XXX1000 | A070URD33XXX1000 | A070URD33XXX1000 |
| MCD5-0619C | 1200000 | A070URD33XXX1000 | A070URD33XXX1000 | A070URD33XXX1000 |
| MCD5-0790C | 2530000 | A070URD33XXX1400 | A070URD33XXX1400 | A070URD33XXX1400 |
| MCD5-0927C | 4500000 | A070URD33XXX1400 | A070URD33XXX1400 | A070URD33XXX1400 |
| MCD5-1200C | 4500000 | A055URD33XXX2250 | - | - |
| MCD5-1410C | 6480000 | A055URD33XXX2250 | - | - |
| MCD5-1600C | 12500000 | - | - | - |

Table 4.21
$X X X=$ blade type. Refer to Ferraz catalog for details.

### 4.9.6 UL Tested Fuses - Short Circuit Ratings

| Model | Nominal Rating (A) | Short Circuit Rating 480V AC (kA) | Short Circuit Rating 600V AC (kA) | Fuse Ferraz |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MCD5-0021B | 23 | 65 | 10 | AJT50 | A070URD30XXX0063 |
| MCD5-0037B | 43 | 65 | 10 | AJT50 | A070URD30XXX0125 |
| MCD5-0043B | 50 | 65 | 10 | AJT50 | A070URD30XXX0125 |
| MCD5-0053B | 53 | 65 | 10 | AJT60 | A070URD30XXX0125 |
| MCD5-0068B | 76 | 65 | 10 | AJT80 | A070URD30XXX0200 |
| MCD5-0084B | 97 | 65 | 10 | AJT100 | A070URD30XXX0200 |
| MCD5-0089B | 100 | 65 | 10 | AJT100 | A070URD30XXX0200 |
| MCD5-0105B | 105 | 65 | 10 | AJT125 | A070URD30XXX0315 |
| MCD5-0131B | 145 | 65 | 18 | AJT150 | A070URD30XXX0315 |
| MCD5-0141B | 170 | 65 | 18 | AJT175 | A070URD30XXX0315 |
| MCD5-0195B | 200 | 65 | 18 | AJT200 | A070URD30XXX0450 |
| MCD5-0215B | 220 | 65 | 18 | AJT250 | A070URD30XXX0450 |
| MCD5-0245C | 255 | 85 | 85 | AJT300 | A070URD30XXX0450 |
| MCD5-0360C | 360 | 85 | 85 | AJT400 | A070URD33XXX0630 |
| MCD5-0380C | 380 | 85 | 85 | AJT450 | A070URD33XXX0700 |
| MCD5-0425B | 430 | 85 | 85 | AJT450 | A070URD33XXX0700 |
| MCD5-0595C | 620 | 85 | 85 | A4BQ800 | A070URD33XXX1000 |
| MCD5-0619C | 650 | 85 | 85 | A4BQ800 | A070URD33XXX1000 |
| MCD5-0790C | 790 | 85 | 85 | A4BQ1200 | 070URD33XXX1400 |
| MCD5-0927C | 930 | 85 | 85 | A4BQ1200 | A070URD33XXX1400 |
| MCD5-1200C | 1200 | 100 | 100 | A4BQ1600 | A065URD33XXX1800 |
| MCD5-1410C | 1410 | 100 | 100 | A4BQ2000 | A055URD33XXX2250 |
| MCD5-1600C | 1600 | 100 | 100 | A4BQ2500 | A055URD33XXX2250 |

Table 4.22

### 4.10 Schematic Diagrams

### 4.10.1 Internally Bypassed Models



Illustration 4.16

| 1 | Control supply (model dependent) |
| :--- | :--- |
| 2 | Outputs |
| 07,08 | Programmable analog output |
| 16,08 | 24 VDC output |
| 3 | Remote control inputs |
| 11,16 | Programmable input |
| 15,16 | Start |
| 17,18 | Stop |
| 25,18 | Reset |
| 4 | Motor thermistor input (PTC only) |
| 5 | Relay outputs |
| 13,14 | Relay output A |
| $21,22,24$ | Relay output B |
| 33,34 | Relay output C |

Table 4.23

### 4.10.2 Non-bypassed Models



Illustration 4.17

| 1 | Control supply (model dependent) |
| :--- | :--- |
| 2 | Outputs |
| 07,08 | Programmable analog output |
| 16,08 | 24 VDC output |
| 3 | Remote control inputs |
| 11,16 | Programmable input |
| 15,16 | Start |
| 17,18 | Stop |
| 25,18 | Reset |
| 4 | Motor thermistor input (PTC only) |
| 5 | Relay outputs |
| 13,14 | Relay output A |
| $21,22,24$ | Relay output B |
| 33,34 | Relay output C |

Table 4.24
NOTE

* MCD5-0245C current transformers are located on the output. Bypass terminals are labelled T1B, T2B and T3B.


## 5 Application Examples

### 5.1 Motor Overload Protection

The thermal model used for motor overload in the MCD 500 has two components:

- Motor windings: These have a low thermal capacity and affects the short term thermal behaviour of the motor. This is where the heat is generated by the current.
- Motor Body: This has a large thermal capacity and affects the long term behaviour of the motor. The thermal model includes considerations for the following:
- Motor current, iron losses, winding resistance losses, motor body and winding thermal capacities, cooling during run and cooling at standstill.
- The percentage of the rated capacity of the motor. This sets the displayed value for the winding model and is affected by the motor FLC setting amongst others.


## NOTE

1-1 Motor FLC should be set to the motor's rated FLC. Do not add the overload rating as this is computed by the MCD500.

The thermal overload protection used in MCD500 has a number of advantages over the thermal relays.

- The effect of fan cooling is accounted for when the motor is running
- The actual full load current and locked rotor time can be used to more accurately tune the model. The thermal characteristics of the windings are treated separately from the rest of the motor (ie. the model recognises that the windings have low thermal mass and high thermal resistance).
- The winding portion of the thermal model responds very rapidly compared with the body portion, meaning the motor can be run closer to its safe maximum operating temperature while still being protected from thermal damage.
- The percentage of motor thermal capacity used during each start is stored in memory. The starter can be configured to automatically determine whether or not the motor has sufficient thermal capacity remaining to successfully complete another start.
- The memory function of the model means that the motor is fully protected in "warm start" situations. The model uses data from the real time clock to account for elapsed cooling time, even if control power has been removed.

The overload protection function provided by this model is compliant with a NEMA 10 curve, but will provide superior protection at low levels of overload due to the separation of the winding thermal model.


Current (\%motor full load current)
Illustration 5.1

1. $\mathrm{MSTC}^{1}=5$
2. $\mathrm{MSTC}^{1}=10$
3. $\mathrm{MSTC}^{1}=20$
${ }^{1}$ MSTC is the Motor Start Time Constant and is defined as the Locked Rotor Time (in 1-2 Locked Rotor Time) when the Locked Rotor Current is $600 \%$ of FLC.

### 5.2 AAC Adaptive Acceleration Control

AAC Adaptive Acceleration Control is a new form of motor control based on the motor's own performance characteristics. With AAC, the user selects the starting or stopping profile that best matches the load type and the starter automatically controls the motor to match the profile. The MCD 500 offers three profiles - early, constant and late acceleration and deceleration.

AAC uses two algorithms, one to measure the motor's characteristics and one to control the motor. The MCD 500 uses the first start to determine the motor's characteristics at zero speed and at maximum speed. During each subsequent start and stop, the starter dynamically adjusts its control to ensure the motor's actual performance matches the selected profile throughout the start. The starter increases power to the motor if the actual speed is too low for the profile, or decreases power if the speed is too high.

### 5.3 Starting Modes

### 5.3.1 Constant Current

Constant current is the traditional form of soft starting, which raises the current from zero to a specified level and keeps the current stable at that level until the motor has accelerated.

Constant current starting is ideal for applications where the start current must be kept below a particular level.


Illustration 5.2


Table 5.1

### 5.3.2 Current Ramp

Current ramp soft starting raises the current from a specified starting level (1) to a maximum limit (3), over an extended period of time (2).

Current ramp starting can be useful for applications where:

- the load can vary between starts (for example a conveyor which may start loaded or unloaded).

Set 1-5 Initial Current to a level that will start the motor with a light load, and 1-4 Current Limit to a level that will start the motor with a heavy load.

- the load breaks away easily, but starting time needs to be extended (for example a centrifugal pump where pipeline pressure needs to build up slowly).
- the electricity supply is limited (for example a generator set), and a slower application of load will allow greater time for the supply to respond.


Illustration 5.3

### 5.3.3 AAC Adaptive Acceleration Control

To use AAC Adaptive Acceleration Control to control starting performance:

1. Select Adaptive Control in 1-3 Start Mode.
2. Set 1-6 Start Ramp Time.
3. Select the desired profile in 1-13 Adaptive Start Profile.
4. Set 1-4 Current Limit sufficiently high to allow a successful start. The first AAC start will be a Constant Current start. This allows the MCD 500 to learn the characteristics of the connected motor. This motor data is used by the MCD 500 during subsequent AAC Adaptive Acceleration Control starts.


Illustration 5.4

| 1. Early acceleration |
| :--- |
| 2. Constant acceleration |
| 3. Late acceleration |
| 4. 1-16 Start Ramp Time |

Table 5.2 1-13 Adaptive Start Profile

## NOTE

AAC Adaptive Acceleration Control will control the load according to the programmed profile. Start current will vary according to the selected acceleration profile and the programmed start time.
If replacing a motor connected to an MCD 500 programmed for AAC Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The MCD 500 will automatically re-learn the motor's characteristics if 1-1 Motor Full Load Current or 1-12 Adaptive Control Gain is changed.

### 5.3.4 Kickstart

Kickstart provides a short boost of extra torque at the beginning of a start, and can be used in conjunction with current ramp or constant current starting.

Kickstart can be useful to help start loads that require high breakaway torque but then accelerate easily (for example flywheel loads such as presses).


Illustration 5.5

| 1: 1-7 Kickstart Level |
| :--- |
| 2: 1-8 Kickstart Time |
| 3: 1-5 Initial Current |
| 4: 1-6 Start Ramp Time |
| 5: 1-4 Current Limit |
| 6: Full voltage current |

Table 5.3

### 5.4 Stopping Modes

### 5.4.1 Coast to Stop

Coast to stop lets the motor slow at its natural rate, with no control from the soft starter. The time required to stop will depend on the type of load.

### 5.4.2 TVR Soft Stop

Timed voltage ramp reduces the voltage to the motor gradually over a defined time. The load may continue to run after the stop ramp is complete.

Timed voltage ramp stopping can be useful for applications where the stop time needs to be extended, or to avoid transients on generator set supplies.


Illustration 5.6

## 1: 1-11 Stop Time

Table 5.4

### 5.4.3 AAC Adaptive Acceleration Control

To use AAC Adaptive Acceleration Control to control stopping performance:

1. Select Adaptive Control in 1-10 Stop Mode.
2. Set 1-11 Stop Time.
3. Select the required profile in 1-14 Adaptive Stop Profile.


Illustration 5.7

| 1. Early deceleration |
| :--- |
| 2. Constant deceleration |
| 3. Late deceleration |
| 4. 1-10 Stop Time |

Table 5.5 1-14 AAC Adaptive Stop Profile

## NOTE

Adaptive control does not actively slow the motor down and will not stop the motor faster than a coast to stop. To shorten the stopping time of high inertia loads, use brake.

The first AAC Adaptive Deceleration Control stop will be a normal soft stop. This allows the MCD 500 to learn the characteristics of the connected motor. This motor data is used by the MCD 500 during subsequent Adaptive Control stops.

## NOTE

Adaptive Control will control the load according to the programmed profile. Stopping current will vary according to the selected deceleration profile and stop time. If replacing a motor connected to an MCD 500 programmed for AAC Adaptive Control starting or stopping, or if the starter has been tested on a different motor prior to actual installation, the starter will need to learn the characteristics of the new motor. The MCD 500 will automatically re-learn the motor's characteristics if 1-1 Motor Full Load Current or 1-12 Adaptive Control Gain is changed.

### 5.4.4 Brake

Brake reduces the time the motor requires to stop.

During braking an increased noise level from the motor may be audible. This is a normal part of motor braking.

## CAUTION

If the brake torque is set too high, the motor will stop before the end of the brake time and the motor will suffer unnecessary heating which could result in damage. Careful configuration is required to ensure safe operation of the starter and motor.

## CAUTION

A high brake torque setting can result in peak currents up to motor DOL being drawn while the motor is stopping. Ensure protection fuses installed in the motor branch circuit are selected appropriately.

## NOTE

Brake operation causes the motor to heat faster than the rate calculated by the motor thermal model. If you are using brake, install a motor thermistor or allow sufficient restart delay (2-11 Restart Delay).

When brake is selected, the MCD 500 uses DC injection to slow the motor.

Application Examples
MCD 500 Operating Instruction

## MCD 500 braking

- Does not require the use of a DC brake contactor
- Controls all three phases so that the braking currents and associated heating are evenly distributed through the motor


## Braking has two stages

1. Pre-brake: provides an intermediate level of braking to slow motor speed to a point where full brake can be operated successfully (approximately $70 \%$ speed).
2. Full brake: brake provides maximum braking torque but is ineffective at speeds greater than approximately $70 \%$.

To configure the MCD 500 for brake operation

1. Set 1-11 Stop Time for the desired stopping time duration (1). This is the total braking time and must be set sufficiently longer than the brake time (1-16 Brake Time) to allow the pre-braking stage to reduce motor speed to approximately $70 \%$. If the stop time is too short, braking will not be successful and the motor will coast to stop.
2. Set 1-16 Brake Time to approximately one quarter of the programmed Stop Time. This sets the time for the Full Brake stage (2).
3. Adjust 1-15 Brake Torque so that the desired stopping performance is achieved. If set too low, the motor will not stop completely and will coast to stop by the end of the braking period.


Illustration 5.8

## NOTE

When using DC brake, the mains supply must be connected to the soft starter (input terminals L1, L2, L3) in positive phase sequence and 2-1 Phase Sequence must be set to Positive only.

## NOTE

For loads which may vary between braking cycles, install a zero speed sensor to ensure that the soft starter ends DC braking when the motor stops. This avoids unnecessary heating of the motor.

For more information on using the MCD 500 with an external speed sensor, see 5.12 DC Brake with External Zero Speed Sensor.

### 5.5 Jog Operation

Jog runs the motor at reduced speed, to allow alignment of the load or to assist servicing. The motor can be jogged in either forward or reverse direction.

The maximum available torque for jog is approximately $50 \%-75 \%$ of motor full load torque (FLT) depending on the motor. Available jog torque in reverse is approximately $50 \%-75 \%$ of the jog torque in forward direction. To set the jog torque level, use 15-8 Jog Torque.

## NOTE

Setting 15-8 Jog Torque above 50\% may cause increased shaft vibration.


Table 5.6


Illustration 5.9

| 1. Jog Forward |
| :--- |
| 2. Jog Reverse |
| 3. Normal Operation |

Table 5.7

To activate jog operation, use a programmable input (3-3 Input A Function).

To stop a jog operation, perform either of the following:

- Remove the jog command
- Press the OFF button on the LCP
- Activate Emergency Stop using the LCP programmable inputs

Jog will recommence at the end of a restart delay if the jog command is still present. All other commands except the above will be ignored during jog operation.

## NOTE

Jog will operate in 2-wire mode regardless of the state of the remote Start, Stop and Reset inputs.

## NOTE

Jog is only available for the primary motor (for more information on primary and secondary sets, see Secondary motor set. Soft start and soft stop are not available during jog operation.

## CAUTION

Slow speed running is not intended for continuous operation due to reduced motor cooling. Jog changes the motor's heating profile and reduced the accuracy of the motor thermal model. Do not rely on motor overload protection to protection to protect the motor during jog operation.

### 5.6 Inside Delta Operation

AAC, Jog and Brake functions are not supported in inside delta (six-wire) operation. If these functions are programmed when the starter is connected inside delta the behaviour is as given below:

| AAC Start | The starter performs a Constant Current Start. |
| :--- | :--- |
| AAC Stop | The starter performs a TVR Soft Stop if Stop Time is <br> $>0$ secs. If Stop Time is set to 9 secs the starter <br> performs a Coast to Stop. |
| Jog | The starter issues a warning with the error message <br> Unsupported Option. |
| Brake | The starter performs a Coast to Stop. |

Table 5.8

## NOTE

When connected in inside delta, current imbalance is the only phase loss protection that is active during run. Do not disable current imbalance protection during inside delta operation.

## NOTE

Inside delta operation is only possible with mains voltage $\leq 600$ VAC.

### 5.7 Typical Start Currents

Use this information to determine the appropriate start current for your application.

## NOTE

These start current requirements are appropriate and typical in most circumstances, However, the performance and start torque requirements of motors and machines do vary. For further assistance, contact your local supplier.

| Application | Typical Start Current |
| :---: | :---: |
| General \& Water |  |
| Agitator | $4.0 \times$ FLC |
| Centrifugal pump | $3.5 \times$ FLC |
| Compressor (Screw, unloaded) | $3.0 \times$ FLC |
| Compressor (Reciprocating, unloaded) | $4.0 \times$ FLC |
| Conveyor | $4.0 \times$ FLC |
| Fan (damped) | $3.5 \times$ FLC |
| Fan (undamped) | $4.5 \times$ FLC |
| Mixer | $4.5 \times$ FLC |
| Positive displacement pump | $4.0 \times$ FLC |
| Submersible pump | $3.0 \times$ FLC |
| Metals \& Mining |  |
| Belt conveyor | $4.5 \times$ FLC |
| Dust collector | $3.5 \times$ FLC |
| Grinder | $3.0 \times$ FLC |
| Hammer mill | $4.5 \times$ FLC |
| Rock crusher | $4.0 \times$ FLC |
| Roller conveyor | $3.5 \times$ FLC |
| Roller mill | $4.5 \times$ FLC |
| Tumbler | $4.0 \times$ FLC |
| Wire draw machine | $5.0 \times$ FLC |
| Food Processing |  |
| Bottle washer | $3.0 \times$ FLC |
| Centrifuge | $4.0 \times$ FLC |
| Dryer | $4.5 \times$ FLC |
| Mill | $4.5 \times$ FLC |
| Palletiser | $4.5 \times$ FLC |
| Separator | $4.5 \times$ FLC |
| Slicer | $3.0 \times$ FLC |
| Pulp and Paper |  |
| Dryer | $4.5 \times$ FLC |
| Re-pulper | $4.5 \times$ FLC |
| Shredder | $4.5 \times$ FLC |
| Petrochemical |  |
| Ball mill | $4.5 \times$ FLC |
| Centrifuge | $4.0 \times$ FLC |
| Extruder | $5.0 \times$ FLC |
| Screw conveyor | $4.0 \times$ FLC |
| Transport \& Machine Tool |  |
| Ball mill | $4.5 \times$ FLC |
| Grinder | $3.5 \times$ FLC |
| Material conveyor | $4.0 \times$ FLC |
| Palletiser | $4.5 \times$ FLC |
| Press | $3.5 \times$ FLC |
| Roller mill | $4.5 \times$ FLC |
| Rotary table | $4.0 \times$ FLC |

Table 5.9

Application Examples
MCD 500 Operating Instruction

| Application | Typical Start Current |
| :--- | :--- |
| Lumber \& Wood products |  |
| Bandsaw | $4.5 \times$ FLC |
| Chipper | $4.5 \times$ FLC |
| Circular saw | $3.5 \times$ FLC |
| Debarker | $3.5 \times$ FLC |
| Edger | $3.5 \times$ FLC |
| Hydraulic power pack | $3.5 \times$ FLC |
| Planer | $3.5 \times$ FLC |
| Sander | $4.0 \times$ FLC |

Table 5.10

Application Examples
MCD 500 Operating Instruction

### 5.8 Installation with Main Contactor

The MCD 500 is installed with a main contactor (AC3 rated). Control voltage must be supplied from the input side of the contactor.

The main contactor is controlled by the MCD 500 Main Contactor output, which by default is assigned to Output Relay A (terminals 13, 14).


Illustration 5.10

| 1 | Control voltage (model dependent) | KM1 | Main contactor |
| :--- | :--- | :--- | :--- |
| 2 | 24 VDC output | F1 | Semiconductor fuses (optional) |
| 3 | Remote control inputs | S1 | Start /stop |
| 4 | Motor thermistor input (PTC only) | S2 | Reset contact |
| 5 | Relay outputs | 13,14 | Relay output A |
| 6 | 3-phase supply | $21,22,24$ | Relay output B |
| 7 | Motor terminals | 33,34 | Relay output C |

Table 5.11

## Parameter settings:

- 4-1 Relay A Function
- Select Main Contactor - assigns the Main Contactor function to Relay Output A (default value).

Application Examples
MCD 500 Operating Instruction

### 5.9 Installation with Bypass Contactor

The MCD 500 is installed with a bypass contactor (AC1 rated). The bypass contactor is controlled by the MCD 500 Run Output which by default is assigned to Output Relay B (terminals 21, 22, 24).


Illustration 5.11

| $\mathbf{1}$ | Control voltage (model dependent) | KM1 | Bypass contactor |
| :--- | :--- | :--- | :--- |
| 2 | 24 VDC output | F1 | Semiconductor fuses (optional) |
| 3 | Remote control inputs | S1 | Start contact |
| 4 | Motor thermistor input (PTC only) | S2 | Stop contact |
| 5 | Relay outputs | S3 | Reset contact |
| 6 | 3 -phase supply | 13,14 | Relay output A |
| 7 | Motor terminals | $21,22,24$ | Relay output B |
|  |  | 33,34 | Relay output C |

Table 5.12

## Parameter settings:

- 4-4 Relay B Function
- Select Run - assigns the run output function to Relay Output B (default value).

Application Examples
MCD 500 Operating Instruction

### 5.10 Emergency Run Operation

In normal operation the MCD 500 is controlled via a remote two wire signal (terminals 17, 18).

Emergency Run is controlled by a two wire circuit connected to Input A (terminals 11, 16). Closing Input A causes the MCD 500 to run the motor and ignore all trip conditions.


Illustration 5.12

| $\mathbf{1}$ | Control voltage (model dependent) | S1 | Start/stop contact |
| :--- | :--- | :--- | :--- |
| $\mathbf{2}$ | 24 VDC output | S2 | Reset contact |
| $\mathbf{3}$ | Remote control inputs | S3 | Emergency Run contact |
| $\mathbf{4}$ | Motor thermistor input (PTC only) | 13,14 | Relay output A |
| $\mathbf{5}$ | Relay outputs | $21,22,24$ | Relay output B |
| 6 | 3-phase supply | 33,34 | Relay output C |
| 7 | Motor terminals |  |  |

Table 5.13

## Parameter settings:

- 3-3 Input A Function
- Select Emergency Run - assigns Input A to Emergency Run Function
- 15-3 Emergency Run
- Select Enable - Enables the Emergency Run mode


### 5.11 Auxiliary Trip Circuit

In normal operation the MCD 500 is controlled via a remote two wire signal (terminals 17, 18).

Input A (terminals 11, 16) is connected to an external trip circuit (such as a low pressure alarm switch for a pumping system). When the external circuit activates, the soft starter trips, which stops the motor.


Illustration 5.13

| $\mathbf{1}$ | Control voltage (model dependent) | S1 | Start/stop contact |
| :--- | :--- | :--- | :--- |
| $\mathbf{2}$ | 24 VDC output | S2 | Reset contact |
| $\mathbf{3}$ | Remote control inputs | S3 | Auxiliary trip contact |
| 4 | Motor thermistor input (PTC only) | 13,14 | Relay output A |
| $\mathbf{5}$ | Relay outputs | $21,22,24$ | Relay output B |
| 6 | 3-phase supply | 33,34 | Relay output C |
| 7 | Motor terminals |  |  |

Table 5.14

## Parameter settings:

- 3-3 Input A Function
- Select Input Trip (N/O) assigns the Input A to Auxiliary Trip (N/O) function
- 3-4 Input A Name
- Select a name e.g. Low Pressure - assigns a name to Input A.
- 3-8 Remote Reset Logic
- Select as required e.g. Normally Closed - the input behaves like a normally closed contact.

Application Examples
MCD 500 Operating Instruction

### 5.12 DC Brake with External Zero Speed Sensor

For loads which may vary between braking cycles, there are benefits in using an external zero-speed sensor to interface with the MCD 500 for brake shut-off. This control method ensures that the MCD 500 braking will always shut off when the motor has reached a standstill, thus avoiding unnecessary motor heating.

The following schematic diagram shows how you can use a zero-speed sensor with the MCD 500 to turn the brake function off at motor standstill. The zero-speed sensor (A2) is often referred to as an under-speed detector. Its internal contact is open at zero-speed and closed at any speed above zero-speed. Once the motor has reached a standstill, the MCD 500 will go into Emergency Stop mode and remain in this state until the next start command is given (i.e. next application of -KA1).

The MCD 500 must be operated in remote mode and 3-3 Input A Function must be set to emergency stop.


Illustration 5.14

| 1 | Soft starter | 4 | Emergency stop mode (shown <br> on starter display) |
| :--- | :--- | :--- | :--- |
| 2 | Control voltage | A | Off (ready) |
| 15, <br> 16 | Start | B | Start |
| 17, <br> 18 | Stop | C | Run |
| 25, <br> 18 | Reset | D | Stop |
| 2 | Motor | E | Zero speed |
| 3 | Three-phase supply | 5 | Start signal (2, 3, or 4-wire) |
|  |  | 6 | Zero speed detect |
|  |  | 7 | Zero speed sensor |

Table 5.15

For details on configuring DC Brake, see 5.4.4 Brake.

## NOTE

When using DC brake, the mains supply must be connected to the soft starter (input terminals L1, L2, L3) in positive phase sequence and 2-1 Phase Sequence must be set to Positive only.

### 5.13 Soft Braking

For high inertia loads the MCD 500 can be configured for soft braking.

In this application the MCD 500 is employed with forward run and braking contactors. When MCD 500 receives a start signal (button S1), it closes the forward run contactor (KM1) and controls the motor according to the programmed primary motor settings.

When the MCD 500 receives a stop signal (button S2), it opens the forward run contactor (KM1) and closes the braking contactor (KM2) after a delay of approximately 2-3 seconds (KT1). KA3 is also closed to activate the secondary motor settings, which should be user programmed for the desired stopping performance characteristics.

When motor speed approaches zero, the external shaft rotation sensor (A2) stops the soft starter and opens the braking contactor (KM2).

Some shaft rotation sensors perform a self-test upon power-up and momentarily close the output relay. In these cases, also install a delay timer (KT3).


Illustration 5.15

| $\mathbf{1}$ | Control voltage (model dependent) | KA1 | Run relay |
| :--- | :--- | :--- | :--- |
| $\mathbf{2}$ | Remote control inputs | KA2 | Start relay |
| $\mathbf{3}$ | Motor thermistor input (PTC only) | KA3 | Brake relay |
| $\mathbf{4}$ | Relay outputs | KA4 | Rotation sensing relay |
| $\mathbf{5}$ | 3-phase supply | KM1 | Line contactor (Run) |
| $\mathbf{6}$ | Motor terminals | KM2 | Line contactor (Brake) |
| A2 | Shaft rotation sensor | KT1 | Run delay timer |
| S1 | Start contact | KT2 | Brake delay timer |
| S2 | Stop contact | KT3 | Shaft rotation sensor delay timer |
| S3 | Reset contact |  |  |

Table 5.16

## Parameter settings:

- 3-3 Input A Function
- Select Motor Set Select - assigns Input A for Motor set selection
- Set starting performance characteristics using the primary motor set (parameter group 1)
- Set braking performance characteristics using the secondary motor settings (parameter group 7)
- 4-7 Relay C Function
- $\quad$ Select Trip - assigns Trip function to Relay Output C


## NOTE

If the MCD-500 trips on supply frequency (16-5 Frequency) when the braking contactor KM2 opens, modify the setting of Parameters 2-8 through 2-10.

### 5.14 Two Speed Motor

The MCD 500 can be configured for control of dual speed Dahlander type motors, using a high speed contactor (KM1), low speed contactor (KM2) and a star contactor (KM3).

## NOTE

Pole Amplitude Modulated (PAM) motors alter the speed by effectively changing the stator frequency using external winding configuration. Soft starters are not suitable for use with this type of two-speed motor.

When the soft starter receives a high speed start signal, it closes the high speed contactor (KM1) and star contactor (KM3), then controls the motor according to the primary motor settings (parameters 1-1 through 1-16.)

When the soft starter receives a low speed start signal, it closes the low speed contactor (KM2). This closes Input A and the MCD 500 controls the motor according to the secondary motor settings (parameters 7-1 through 7-16).

## NOTE

If the MCD 500 trips on supply frequency (16-5 Frequency) when the high-speed start signal (7) is removed, modify the setting of parameters 2-8 through 2-10.

Application Examples
MCD 500 Operating Instruction


Illustration 5.16

| $\mathbf{1}$ | Control voltage | 6 | Remote low-speed start input | KM2 | Line contactor (low speed) |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\mathbf{2}$ | Remote control <br> inputs | 7 | Remote high-speed start input | KM3 | Star contactor (high speed) |
| $\mathbf{3}$ | Relay outputs | KA1 | Remote start relay (low speed) | S1 | Reset contact |
| $\mathbf{4}$ | 3-phase supply | KA2 | Remote start relay (high speed) | 21, <br> 22,24 | Relay output B |
| $\mathbf{5}$ | Motor terminals | KM1 | Line contactor (high speed) |  |  |

Table 5.17

## NOTE

Contactors KM2 and KM3 must be mechanically interlocked.

## Parameter settings:

- 3-3 Input A Function
- Select Motor Set Select - assigns Input A for Motor set selection
- Set high speed performance characteristics using parameters 1-1-2-9
- Set low speed performance characteristics using parameters 7-1-7-16.
- 4-4 Relay B Function
- Select Trip - assigns Trip function to Relay Output B


## 6 Operation

### 6.1.2 The LCP



Illustration 6.1

| $\mathbf{1}$ | Four-line display for status and programming details. |
| :--- | :--- |
| $\mathbf{2}$ | Display control buttons:Status: Return to the status displays Menu: Open the Quick Menu <br> Main Menu: Open the Main Menu <br> Alarm Log: Open the Alarm Log |
| $\mathbf{3}$ | Menu navigation buttons: <br> [Back]: Exit the menu or parameter, or cancel a <br> parameter change <br> [OK]: Enter a menu or parameter, or save a parameter <br> change <br> [4] [マ]: Scroll to the next or previous menu or <br> parameter, change the setting of the current <br> parameter or scroll through the status screens. |
|  | Soft starter local control buttons: |
| $\mathbf{4 H a n d ~ O n ] : ~ S t a r t ~ t h e ~ m o t o r ~ a n d ~ e n t e r ~ l o c a l ~ c o n t r o l ~}$ |  |
| mode. |  |
| [Off]: Stop the motor (only active in Hand On mode). |  |
| [Auto On]: Set the starter to Auto On mode. |  |
| [Reset]: Reset a trip (Hand On mode only). |  |

Table 6.1

### 6.2 Remote Mounted LCP

A remote mounted LCP can be installed with the MCD 500. The Control Panel LCP501 can be mounted up to 3 metres away from the starter, for control and monitoring.

Operation
MCD 500 Operating Instruction

The starter can be controlled and programmed from either the remote LCP or the LCP on the starter. Both displays show the same information.

### 6.2.1 Synchronising the LCP and the Starter

The DB9 cable can be connected/disconnected from the LCP while the starter is running.

The first time a LCP is plugged into a starter, the starter will copy its parameter settings to the LCP.


Table 6.2
If the LCP has previously been used with a MCD 500, the operator can select whether to copy the parameters to the starter, or to copy the MCD 500's parameter settings into the LCP.

Select the required option using the [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ buttons. The selected option is surrounded by a dotted line. Press OK to proceed with the selection. Copy Parameters Display to Starter Starter to Display

| Copy parameters |
| :--- | :--- |
| Display to starter <br> Starter to display |

Table 6.3

## NOTE

If the parameter software version in the LCP is different from the software version of the starter, only Starter to Display will be available.

## NOTE

While the LCP is synchronising, only the [ $\mathbf{\Delta}],[\mathbf{\nabla}],[\mathrm{OK}]$, and [Off] buttons are enabled.

### 6.3 Welcome Screen

When control power is applied, the starter will display the welcome screen

| Ready | Welcome |
| :---: | :---: |
|  | S1 |
|  | MCD5-0053-T5-G1-CV2 |
|  |  |

Table 6.4
3rd display line: Software versions for Remote LCP, Control software, Model software
4th display line: Product model number

## NOTE

The LCP version is only displayed if a Remote LCP 501 is connected when control power is applied. If no remote LCP is present, only the control software and model software versions will be displayed.

### 6.4 Control Methods

The MCD 500 can be controlled via the control buttons on the LCP (local control), via the remote inputs (remote control) or via the serial communication network.

- Local control is only available in Hand On mode.
- Remote control is only available in Auto On mode.
- Control via the serial communication network is always disabled in Hand On mode, and Start/Stop commands via the serial network may be enabled or disabled in Auto On mode by changing the setting of 3-2 Comms in Remote.

The MCD 500 can also be configured to auto-start or autostop. Auto-start/stop operation is only available in Auto On mode, and must be configured using parameters 5-1-5-4. In Hand On mode, the starter will ignore any auto-start/ stop setting.

To switch between Hand On and Auto On modes, use the local control buttons on the LCP.
[Hand On]: Start the motor and enter Hand On mode.
[Off]: Stop the motor and enter Hand On mode.
[Auto On]: Set the starter to Auto On mode.
[Reset]: Reset a trip (Hand On mode only).

The MCD 500 can also be set to allow local control only or remote control only, using 3-1 Local/Remote.

If 3-1 Local/Remote is set to Remote Control Only, the [Off] button is disabled and the motor must be stopped by remote control or via the serial communication network.

Operation
MCD 500 Operating Instruction

|  | Hand On mode | Auto On mode |
| :--- | :--- | :--- |
| To soft start the motor | press [Hand On] on the LCP | activate the Start remote input |
| To stop the motor | press [Off] on the LCP | activate the Stop remote input |
| To reset a trip on the starter | press [Reset] on the LCP | activate the Reset remote input |
| Auto start/stop operation | Disabled | Enabled |

Table 6.5

To emergency stop the motor, press the local [Off] and [Reset] buttons at the same time. The soft starter will remove power from the motor and open the main contactor, and the motor will coast to stop. Emergency stop can also be controlled via a programmable input.

## NOTE

Brake and Jog functions operate only with in-line connected motors (see 5.6 Inside Delta Operation)

### 6.5 Local Control Buttons

If 3-1 Local/Remote is set to LCL/RMT Anytime or LCL/RMT When OFF, the [Hand On] and [Auto On] buttons are always active. If the MCD 500 is in Auto On mode, pressing [Hand On] will enter Hand On mode and start the motor.

If 3-1 Local/Remote is set to Remote Control Only, the [Off] button is disabled and the motor must be stopped by remote control or via the serial communication network.

### 6.6 Displays

The LCP displays a wide range of performance information about the soft starter. Press [Status] to access the status display screens, then use [ $\mathbf{\Delta}$ ] and [ $\mathbf{v}$ ] to select the information to display. To return to the status screens from within a menu, press [Back] repeatedly or press [Status].

- Temperature monitoring
- Programmable screen (see parameters 8-2-8-5)
- Current
- Frequency
- Motor power
- Last start information
- Date and time
- SCR Conduction bar-graph
- Performance graphs


## NOTE

Screens shown here are with the default settings.

### 6.6.1 Temperature Monitoring Screen (S1)

The temperature screen shows the temperature of the motor as a percentage of total thermal capacity, and also shows which motor data set is in use.

The temperature monitoring screen is the default status screen.

| Ready | S1 |  |
| :--- | :---: | ---: |
| MS1 | 000.0A | 000.0 kW |
|  | Primary Motor Set |  |
| M1 000\% |  |  |

Table 6.6

### 6.6.2 Programmable Screen (S2)

The MCD 500's user-programmable screen can be configured to show the most important information for the particular application. Use parameters 8-2 to 8-5 to select which information to display.

| Ready |  | S2 |
| :--- | :---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
|  | .--pf |  |
| 00000 hrs |  |  |

Table 6.7

### 6.6.3 Average Current (S3)

The average current screen shows the average current of all three phases.

| Ready |  | S3 |
| :--- | :---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
|  | 0.0 A |  |

Table 6.8

### 6.6.4 Current Monitoring Screen (S4)

The current screen shows real-time line current on each phase.

| Ready |  | S4 |
| :--- | :---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
|  | Phase currents |  |
| 000.0 A | 000.0 A | 000.0 A |

Table 6.9

### 6.6.5 Frequency Monitoring Screen (S5)

The frequency screen shows the mains frequency as measured by the soft starter.

| Ready |  | S5 |
| :--- | :--- | ---: |
| MS1 | 000.0 A | 000.0 kW |
|  | 00.0 Hz |  |

Table 6.10

### 6.6.6 Motor Power Screen (S6)

The motor power screen shows motor power (kW, HP and kVA) and power factor.

| Ready | S6 |  |
| :--- | ---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
| 000.0kW |  | 0000 HP |
| 0000kVA | .---pf |  |

Table 6.11

### 6.6.7 Last Start Information (S7)

The last start information screen shows details of the most recent successful start:

- start duration (seconds)
- maximum start current drawn (as a percentage of motor full load current)
- calculated rise in motor temperature

| Ready | S7 |  |
| :--- | ---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
| Last start |  | 000 s |
| $000 \%$ FLC | $\Delta$ Temp 0\% |  |

### 6.6.8 Date and Time (S8)

The date/time screen shows the current system date and time ( 24 hour format). For details on setting the date and time, see 8.1 Set Date and Time.

| Ready |  | S8 |
| :--- | :---: | ---: |
| MS1 | 000.0 A | 000.0 kW |
|  | YYYY MMM DD |  |
|  | HH:MM:SS |  |

Table 6.13

### 6.6.9 SCR Conduction Bargraph

The SCR conduction bargraph shows the level of conduction on each phase.


Illustration 6.2

### 6.6.10 Performance Graphs

The MCD 500 can display real-time performance information for:

- Current
- Motor temperature
- Motor kW
- Motor kVA
- Motor power factor

The newest information is displayed at the right hand edge of the screen. Older data is not stored. The graph can also be paused, to allow past performance to be analysed. To pause or unpause the graph, press and hold [OK] for more than 0.5 seconds.

## NOTE

The MCD 500 will not collect data while the graph is paused. When graphing resumes, a small gap will be shown between the old data and the new data.

Table 6.12

## 7 Programming

It is possible to access the programming menus at any time, including while the soft starter is running. All changes take effect immediately.

### 7.1 Access Control

Critical parameters (parameter group 15 and higher) are protected by a four-digit security access code, preventing unauthorised users from viewing or modifying parameter settings.

When a user attempts to enter a restricted parameter group, the LCP prompts for an access code. The access code is requested once for the programming session, and authorisation continues until the user closes the menu.

To enter the access code, press [Back] and [OK] to select a digit, and $[\mathbf{4}]$ and $[\mathbf{v}]$ to change the value. When all four digits match the access code, press [OK]. The LCP will display an acknowledgement message before continuing.

To change the access code, use 15-1 Access Code.

| Enter Access Code <br> $\# \# \# \# ~$ |  |  |
| :---: | :--- | :---: |
| OK |  |  |
| Access Allowed |  |  |
| SUPERVISOR |  |  |

Table 7.1

## NOTE

The protection simulation and output simulation are also protected by the security access code. The counters and thermal model reset can be viewed without entering an access code, but an access code must be entered in order to reset.
The default access code is 0000 .

Lock the menus to prevent users from altering parameter settings. The adjustment lock can be set to allow Read \& Write, Read Only or No Access in 15-2 Adjustment Lock.

If a user attempts to change a parameter value or access the Main Menu when the adjustment lock is active, an error message is displayed:

| Access Denied <br> Adj Lock is On |
| :--- |

Table 7.2

### 7.2 Quick Menu

### 7.2.1 Quick Setup

Quick setup provides access to commonly used parameters, allowing the user to configure the MCD 500 as required for the application. For details of individual parameters, see Parameter Descriptions.

| 1 | Primary Mtr Set |
| :--- | :--- |
| $1-1$ | Motor FLC |
| $1-3$ | Start Mode |
| $1-4$ | Current Limit |
| $1-5$ | Initia Current |
| $1-6$ | Start Ramp Time |
| $1-9$ | Excess Start Time |
| $1-10$ | Stop Mode |
| $1-11$ | Stop Time |
| 2 | Protection |
| $2-1$ | Phase Sequence |
| $2-4$ | Undercurrent |
| $2-5$ | Undercurrent Dly |
| $2-6$ | Inst Overcurrent |
| $2-7$ | Inst Overcurrent Dly |
| 3 | Inputs |
| $3-3$ | Input A Function |
| $3-4$ | Input A Name |
| $3-5$ | Input A Trip |
| $3-6$ | Input A Trip Dly |
| $3-7$ | Input A Initial Dly |
| 4 | Outputs |
| $4-1$ | Relay A Function |
| $4-2$ | Relay A On Delay |
| $4-3$ | Relay A Off Delay |
| $4-4$ | Relay B Function |
| $4-5$ | Relay B On Delay |
| $4-6$ | User |
| $4-7$ | Relay B Off Delay |
| $4-8$ | Relay C Function |
| $4-9$ | Relay C On Delay |
| $4-10$ | Relay C Off Delay |
| $4-11$ | Low Current Flag Top L |
| $4-12$ | High Current FLag |
| 5 | Motor Temp Flag |
| $5-1$ | Start/Stop Timers |
| $5-2$ | Auto-Start Type |
| $5-3$ | Auto-Start Time |
| $5-4$ | $8-3$ |
| $8-1$ | User |
|  |  |

[^49]
### 7.2.2 Application Setups

The application setups menu makes it easy to configure the MCD 500 for common applications. The MCD 500 selects the parameters relevant to the application and suggests a typical setting, and you can adjust each parameter to suit your exact requirements.

On the display the highlighted values are suggested values and the values indicated by a are the loaded values.

Always set 1-1 Motor FLC to match the motor's nameplate full load current. The suggested value for motor FLC is the starter's minimum FLC.

| Pump Centrifugal | Suggested Value | Compressor Recip | Suggested Value |
| :---: | :---: | :---: | :---: |
| Motor Full Load Current Start Mode <br> Adaptive Start Profile <br> Start Ramp Time <br> Stop Mode <br> Adaptive Stop Profile <br> Stop Time | Adaptive Control <br> Early Acceleration <br> 10 seconds <br> Adaptive Control <br> Late Deceleration <br> 15 seconds | Motor Full Load Current Start Mode Start Ramp Time Current Limit | Constant Current 10 seconds 450\% |
| Pump Submersible |  | Conveyor |  |
| Motor Full Load Current Start Mode <br> Adaptive Start Profile Start Ramp Time Stop Mode Adaptive Stop Profile Stop Time | Adaptive Control <br> Early Acceleration <br> 5 seconds <br> Adaptive Control <br> Late Deceleration <br> 5 seconds | Motor Full Load Current Start Mode Start Ramp Time Current Limit Stop Mode Adaptive Stop Profile Stop Time | Constant Current 5 seconds 400\% <br> Adaptive Control Constant Deceleration 10 seconds |
| Fan Damped |  | Crusher Rotary |  |
| Motor Full Load Current Start Mode Current Limit | Constant Current \|350\% | Motor Full Load Current Start Mode Start Ramp Time Current Limit Excess Start Time Locked Rotor Time | Constant Current <br> 10 seconds <br> 400\% <br> 30 seconds <br> 20 seconds |
| Fan Undamped |  | Crusher Jaw |  |
| Motor Full Load Current Start Mode <br> Adaptive Start Profile <br> Start Ramp Time <br> Excess Start Time <br> Locked Rotor Time | Adaptive Control <br> Constant Acceleration <br> 20 seconds <br> 30 seconds <br> 20 seconds | Motor Full Load Current Start Mode Start Ramp Time Current Limit Excess Start Time Locked Rotor Time | Constant Current 10 seconds 450\% <br> 40 seconds <br> 30 seconds |
| Compressor Screw |  |  |  |
| Motor Full Load Current Start Mode Start Ramp Time Current Limit | Constant Current $5 \text { seconds }$ 400\% |  |  |

Table 7.4

### 7.2.3 Loggings

The Loggings menu allows the user to view performance information in real-time graphs.

- Current (\%FLC)
- Motor Temp (\%)
- Motor kW (\%)
- Motor kVA (\%)
- Motor pf

The newest information is displayed at the right hand edge of the screen. The graph can be paused to analyse data by pressing and holding the [OK] button. To re-start the graph, press and hold [OK].

### 7.3 Main Menu

The Main Menu button provides access to menus for setting up the MCD 500 for complex applications and for monitoring its performance.

### 7.3.1 Parameters

Parameters allows viewing and changing all programmable parameters that control how the MCD 500 operates.

To open Parameters, press [Main Menu] then select Parameters.

To navigate through Parameters:

- to scroll through parameter groups, press [ $\mathbf{\Delta}$ ] or [ v ].
- to view the parameters in a group, press [OK].
- to return to the previous level, press [Back].
- to close Parameters, press the [Back].

To change a parameter value:

- scroll to the appropriate parameter and press [OK] to enter edit mode.
- to alter the parameter setting, use the [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ buttons.
- to save changes, press [OK]. The setting shown on the display will be saved and the LCP will return to the parameter list.
- to cancel changes, press [Back]. The LCP will return to the parameter list without saving changes.


### 7.3.2 Parameter Shortcut

The MCD 500 also includes a parameter shortcut, which allows you to directly access a parameter within the Parameters menu.

- To access the parameter shortcut, press [Main Menu] for three seconds
- Use [ $\mathbf{\Delta}]$ or [ $\mathbf{v}]$ to select the parameter group.
- Press [OK] or [Back] to move the cursor.
- Use [ $\mathbf{\Delta}]$ or [ $\mathbf{v}]$ to select the parameter number.

| Parameter shortcut |  |
| :---: | :---: |
|  | Please enter a |
|  | Parameter number |
|  | $01-01$ |

Table 7.5

### 7.3.3 Parameter List

| 1 | Primary Mtr Set | 4 | Outputs | 7-12 | Adaptv Ctrl Gain-2 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1-1 | Motor FLC | 4-1 | Relay A Function | 7-13 | Adaptv Start Prof-2 |
| 1-2 | Locked Rotor Time | 4-2 | Relay A On Delay | 7-14 | Adaptv Stop Prof-2 |
| 1-3 | Start Mode | 4-3 | Relay A Off Delay | 7-15 | Brake Torque-2 |
| 1-4 | Current Limit | 4-4 | Relay B Function | 7-16 | Brake Time-2 |
| 1-5 | Initial Current | 4-5 | Relay B On Delay | 8 | Display |
| 1-6 | Start Ramp Time | 4-6 | Relay B Off Delay | 8-1 | Language |
| 1-7 | Kickstart Level | 4-7 | Relay C Function | 8-2 | User Scrn Top L |
| 1-8 | Kickstart Time | 4-8 | Relay C On Delay | 8-3 | User Scrn Top R |
| 1-9 | Excess Start Time | 4-9 | Relay C Off Delay | 8-4 | User Scrn Btm L |
| 1-10 | Stop Mode | 4-10 | Low Current Flag | 8-5 | User Scrn Btm R |
| 1-11 | Stop Time | 4-11 | High Current FLag | 8-6 | Graph Timebase |
| 1-12 | Adaptv Control Gain | 4-12 | Motor Temp Flag | 8-7 | Graph Max Adj |
| 1-13 | Adaptv Start Profile | 4-13 | Analog Output A | 8-8 | Graph Min Adj |
| 1-14 | Adaptv Stop Profile | 4-14 | Analog A Scale | 8-9 | Mains Ref Volt |
| 1-15 | Brake Torque | 4-15 | Analog A Max Adj | 15 | Restrict Paramtr |
| 1-16 | Brake Time | 4-16 | Analog A Min Adj | 15-1 | Access Code |
| 2 | Protection | 5 | Start/Stop Timers | 15-2 | Adjustment Lock |
| 2-1 | Phase Sequence | 5-1 | Auto-Start Type | 15-3 | Emergency Run |
| 2-2 | Current Imbalance | 5-2 | Auto-Start Time | 15-4 | Current Calibrat |
| 2-3 | Current Imbal Dly | 5-3 | Auto-Stop Type | 15-5 | Main Cont Time |
| 2-4 | Undercurrent | 5-4 | Auto-Stop Time | 15-6 | Bypass Cont Time |
| 2-5 | Undercurrent Dly | 6 | Auto-Reset | 15-7 | Motor Connection |
| 2-6 | Inst Overcurrent | 6-1 | Auto-Reset Action | 15-8 | Jog Torque |
| 2-7 | Inst Ocrnt Dly | 6-2 | Maximum Resets | 16 | Protection Action |
| 2-8 | Frequency Check | 6-3 | Reset Dly Grp A \& B | 16-1 | Motor Overload |
| 2-9 | Freq Variation | 6-4 | Reset Delay Grp C | 16-2 | Current Imbalance |
| 2-10 | Frequency Delay | 7 | Secondary Mtr Set | 16-3 | Undercurrent |
| 2-11 | Restart Delay | 7-1 | Motor FLC-2 | 16-4 | Inst Overcurrent |
| 2-12 | Motor Temp Check | 7-2 | Lock Rotor Time-2 | 16-5 | Frequency |
| 3 | Inputs | 7-3 | Start Mode-2 | 16-6 | Heatsink Overtemp |
| 3-1 | Local/Remote | 7-4 | Current Limit-2 | 16-7 | Excess Start Time |
| 3-2 | Comms in Remote | 7-5 | Initial Crnt-2 | 16-8 | Input A Trip |
| 3-3 | Input A Function | 7-6 | Start Ramp-2 | 16-9 | Motor Thermistor |
| 3-4 | Input A Name | 7-7 | Kickstart Lvl-2 | 16-10 | Starter Comms |
| 3-5 | Input A Trip | 7-8 | Kickstart Time-2 | 16-11 | Network Comms |
| 3-6 | Input A Trip Dly | 7-9 | Excess Strt Time-2 | 16-12 | Battery/Clock |
| 3-7 | Input A Initial Dly | 7-10 | Stop Mode-2 | 16-13 | Low Control Volts |
| 3-8 | Remote Reset Logic | 7-11 | Stop Time-2 |  |  |

Table 7.6

### 7.4 Primary Motor Settings

## NOTE

Default settings are marked with *.

The parameters in Primary Motors Settings configure the soft starter to match the connected motor. These parameters describe the motor's operating characteristics and allow the soft starter to model the motor's
temperature.
1-1 Motor FLC

| Option: | Function: |
| :--- | :--- |
| Model <br> dependent Matches the starter to the connected motor's <br> full load current. Set to the full load current <br> (FLC) rating shown on the motor nameplate. |  |$.$

1-2 Locked Rotor Time
Range:

| 10 secs* $^{*}$ | $[0: 01-2: 00$ <br> $($ min:sec)] | Sets the maximum length of the time <br> the motor can run at locked rotor <br> current from cold before reaching its <br> maximum temperature. Set according <br> to the motor datasheet. <br> If this information is not available, we <br> recommend the value should be less <br> than 20 seconds. |
| :--- | :--- | :--- |


| 1-3 Start Mode |  |  |
| :---: | :---: | :---: |
| Option: |  | Function: |
|  |  | Selects the soft start mode. See 5.3 Starting Modes for more details. |
| Constant Current* |  |  |
| Adaptive Control |  |  |
| 1-4 Current Limit |  |  |
| Range: |  | Function: |
| 350\%* | $\begin{gathered} \hline[100 \%- \\ 600 \% \text { FLC] } \end{gathered}$ | Sets the current limit for constant current and current ramp soft starting, as a percentage of motor full load current. See 5.3 Starting Modes for more details. |
| 1-5 Initial Current |  |  |
| Range: |  | Function: |
| 350\%* | $\begin{gathered} \hline[100 \%- \\ 600 \% \text { FLC] } \end{gathered}$ | Sets the initial start current level for current ramp starting, as a percentage of motor full load current. Set so that the motor begins to accelerate immediately after a start is initiated. <br> If current ramp starting is not required, set the initial current equal to the current limit. See 5.3 Starting Modes for more details. |

1-6 Start Ramp Time
Range:

| 10 secs* | $[1-180$ <br> secs $]$ | Sets the total start time for an AAC <br> Adaptive Control start or the ramp time <br> for current ramp starting (from the initial <br> current to the current limit). See <br> 5.3 Starting Modes for more details. |
| :--- | :--- | :--- |


| 1-7 Kickstart Level |
| :--- |
| Range: |
| $500 \%^{*}$ $[100 \%-$ <br> $700 \% \mathrm{FLC}]$ Sets the level of the kickstart current. <br> CAUT\|ON <br> Kickstart subjects the mechanical   <br> equipment to increased torque levels.   <br> Ensure the motor, load and couplings   <br> can handle the additional torque   <br> before using this feature.   |

1-8 Kickstart Time

| Range: | Function: |
| :--- | :--- | :--- |
| O000 <br> msecs* $[0-2000$ <br> msecs $]$ Sets the kickstart duration. A setting of 0 <br> disables kickstart. See 5.3 Starting Modes <br> for more details. <br> CAUT\|ON <br> Kickstart subjects the mechanical   <br> equipment to increased torque   <br> levels. Ensure the motor, load and   <br> couplings can handle the additional   <br> torque before using this feature.   |  |

## 1-9 Excess Start Time

## Range: Function:

|  |  | Excess start time is the maximum time <br> the MCD 500 will attempt to start the <br> motor. If the motor does not reach full <br> speed within the programmed limit, the <br> starter will trip. Set for a period slightly <br> longer than required for a normal <br> healthy start. A setting of 0 disables <br> excess start time protection. |
| :--- | :--- | :--- |
| 20 <br> secs $^{*}$ | $[0: 00-4: 00$ <br> $($ min:secs $)]$ | Set as required. |

## 1-10 Stop Mode

Option:
Function:

|  | Selects the stop mode. See 5.4 Stopping <br> Modes for more details. |  |
| :--- | :--- | :--- |
|  | Coast to Stop* |  |
|  | TVR Soft Stop |  |

## 1-10 Stop Mode

Option:
Function:

| Adaptive Control |  |
| :--- | :--- |
| Brake |  |

1-11 Stop Time
Range:

| 0 secs* | [0:00-4:00 <br> (min:secs)] | Sets the time for soft stopping the motor <br> using timed voltage ramp or Adaptive <br> Control (AAC). If a main contactor is <br> installed, the contactor must remain <br> closed until the end of the stop time. Use <br> a programmable output configured to <br> Run to control the main contactor. Sets <br> the toal stopping time when using brake. <br> See 5.4 Stopping Modes for more details. |
| :--- | :--- | :--- |

## 1-12 Adaptive Control Gain

Range:

| $75 \% \%^{*}$ | $[1 \%-$ <br> $200 \%]$ | Adjusts the performance of AAC adaptive <br> acceleration control. This setting affects both <br> starting and stopping control. |
| :---: | :---: | :--- |

## NOTE

We recommend leaving the gain setting at the default level unless AAC performance is not satisfactory. If the motor accelerates or decelerates quickly at the end of a start or stop, increase the gain setting by $5 \% \sim 10 \%$. If the motor speed fluctuates during starting or stopping, decrease the gain setting slightly.

## 1-13 Adaptive Start Profile

Option:
Function:

|  | Selects which profile the MCD 500 will <br> use for an AAC adaptive acceleration <br> control soft start. See 5.4 Stopping <br> Modes for more details. |
| :--- | :--- |
| Early Acceleration |  |
| Constant Acceleration |  |
| Late Acceleration |  |

## 1-14 Adaptive Stop Profile

## Option:

## Function:

|  | Selects which profile the MCD 500 will <br> use for an AAC adaptive acceleration <br> control soft stop. See 5.4 Stopping <br> Modes for more details. |
| :--- | :--- |
| Early Deceleration |  |
| Constant Deceleration |  |

### 7.4.1 Brake

Brake uses DC injection to actively slow the motor. See 5.4 Stopping Modes for more details.

| Rang | Function: |  |
| :---: | :---: | :---: |
| 20\%* | [20-100\%] | Sets the amount of brake torque the MCD 500 will use to slow the motor. |
| 1-16 Brake Time |  |  |
| Range: |  | Function: |
| 1 sec* | [1-30 secs] | Sets the duration for DC injection during a braking stop. <br> NOTE <br> This parameter is used in conjunction with 1-11 Stop Time. See for details. |

### 7.5 Protection

## 2-1 Phase Sequence

| Option: |
| :--- |
|  Function:Selects which phase sequences the soft starter <br> will allow at a start. During its pre-start checks, <br> the starter examines the sequence of the <br> phases at its input terminals and trips of the <br> actual sequence does not match the selected <br> option. <br> Any sequence  |
| Positive only |

### 7.5.1 Current Imbalance

The MCD 500 can be configured to trip if the currents on the three phases vary from each other by more than a specified amount. The imbalance is calculated as the difference between the highest and lowest currents on all three phases, as a percentage of the highest current.

Current imbalance detection is desensitised by $50 \%$ during starting and soft stopping.
2-2 Current Imbalance
Range:

| $30 \% *$ | $[10 \%-50 \%]$ | Sets the trip point for current imbalance <br> protection. |
| :--- | :--- | :--- |

2-3 Current Imbalance Delay

| Range: |
| :--- |
| 3 secs* Function: <br> $($ (min:secs) $)$  |
| Slows the MCD 500's response to <br> current imbalance, avoiding trips <br> due to momentary fluctuations. |

### 7.5.2 Undercurrent

The MCD 500 can be configured to trip if the average current of all three phases drops below a specified level while the motor is running.

## 2-4 Undercurrent

Range:

| $20 \% 0^{*}$ | Function: |
| :--- | ---: | :--- |
| $100 \%]$ | Sets the trip point for undercurrent protection, <br> as a percentage of motor full load current. Set <br> to a level between the motor's normal working <br> range and the motor's magnetising (no load) <br> current (typically 25\% to 35\% of full load <br> current). A setting of 0\% disables undercurrent <br> protection. |

2-5 Undercurrent Delay
Range:

| 5 secs* | Function: |
| :--- | :--- | :--- |
| (min:secs)] $-4: 00$ | Slows the MCD 500 's response to <br> undercurrent, avoiding trips due to <br> momentary fluctuations. |

### 7.5.3 Instantaneous Overcurrent

The MCD 500 can be configured to trip if the average current of all three phases exceeds a specified level while the motor is running.

| 2-6 Instantaneous Overcurrent |  |  |
| :---: | :---: | :---: |
| Range: |  | Function: |
| 400\%* | $\begin{aligned} & \text { [80\%-600\% } \\ & \text { FLC] } \end{aligned}$ | Sets the trip point for instantaneous overcurrent protection, as a percentage of motor full load current. |
| 2-7 Instantaneous Overcurrent Delay |  |  |
| Range: |  | Function: |
| 0 secs* | $\begin{array}{\|l\|} \hline \text { [0:00-1:00 } \\ \text { (min:secs)] } \end{array}$ | Slows the MCD 500's response to overcurrent, avoiding trips due to momentary overcurrent events. |

### 7.5.4 Frequency Trip

The MCD 500 monitors mains frequency throughout operation, and can be configured to trip is the frequency varies beyond a specified tolerance.

| 2-8 Frequency Check |
| :--- |
| Option: |
|  Do not Check |
| Start Only |
| Start/Run* |
| Run Only |

## 2-9 Frequency Variation

Option: Function:

|  | Selects the soft starter's tolerance for frequency <br> variation. <br> Running a motor outside its specified frequency for <br> long periods can cause damage and premature <br> failure. |  |
| :--- | :--- | :--- |
| $\pm 2 \mathrm{~Hz}$ |  |  |
| $\pm 5 \mathrm{~Hz}$ |  |  |
|  | $\pm 10 \mathrm{~Hz}$ |  |
|  | $\pm 15 \mathrm{~Hz}$ |  |

## 2-10 Frequency Delay

## Range:

| 1 sec* $^{*}$[0:01-4:00 <br> (min:sec)] | Slows the MCD 500 's response to <br> frequency disturbances, avoiding trips <br> due to momentary fluctuations. <br> NOTE |
| :--- | :--- | :--- |
| If the mains frequency drops below |  |
| 35 Hz or rises above 75 Hz the |  |
| starter will trip immediately. |  |

## 2-11 Restart Delay

Range:

| 10 | Function: |  |
| :--- | :--- | :--- |
| secs* | 60:01-01- <br> (min:secs)] | The MCD 500 can be configured to force <br> a delay between the end of a stop and <br> the beginning of the next start. During <br> the restart delay, the display shows the <br> time remaining before another start can <br> be attempted. <br> NOTE <br> The restart delay is measured from <br> the end of each stop. Changes to <br> the restart delay setting take effect <br> immediately. |

## 2-12 Motor Temperature Check

## Option: Function:

|  | Selects whether the MCD 500 will verify the <br> motor has sufficient thermal capacity for a <br> successful start. The soft starter compares the <br> motor's calculated temperature with the <br> temperature rise from the last motor start and <br> only operates if the motor is cool enough to start <br> successfully. |
| :--- | :--- |
| Do not <br> Check* |  |
| Check |  |

### 7.6 Inputs

## 3-1 Local/Remote

## Option:

Function:

|  | Selects when the [Auto On] and [Hand On] <br> buttons can be used to switch to Hand On or <br> Auto On modes. |
| :--- | :--- |
| Lcl/Rmt <br> anytime* | The user can change between local and <br> remote control at any time. |
| Local Control <br> Only | All remote inputs are disabled. |
| Remote Control <br> Only | Selects whether the starter can be used in <br> Hand On or Auto On modes. |

## 3-2 Comms in Remote

Option: Function

|  | Selects whether the starter will accept Start <br> and Stop commands from the serial <br> communication network when in Remote <br> mode. The Force Comms Trip, Local/Remote <br> Control and Test Start and Reset commands <br> are always enabled. |
| :--- | :--- |
| Disable Ctrl in <br> RMT |  |
| Enable Ctrl in <br> RMT |  |

3-3 Input A Function

| Option: | Function: |
| :--- | :--- | :--- |
| Motor Set <br> Select* | The MCD 500 can be configured with two <br> separate sets of motor data. The primary motor <br> data is programmed using Parameters 1-1 to <br> $1-16$. The secondary motor data is programmed <br> using Parameters 7-1 to 7-16. <br> To use the secondary motor data, this parameter <br> must be set to Motor Set Select and 11, 16 must <br> be closed when a start command is given. The <br> MCD 500 checks which motor data to use at a <br> start, and will use that motor data for the entire <br> start/stop cycle. |
|  | Input A can be used to trip the soft starter. <br> When this parameter is set to Input Trip (N/O), a <br> closed circuit across 11, 16 trips the soft starter <br> (Parameters 3-5, 3-6, 3-7). |
| Input Trip <br> (N/O) | When this parameter is set to Input Trip (N/C), an <br> open circuit across 11, 16 trips the soft starter <br> (Parameters 3-5, 3-6, 3-7). |
| Input Trip <br> (N/C) | Input A can be used to select between local and <br> remote control, instead of using the buttons on <br> theLCP. When the input is open, the starter is in <br> local mode and can be controlled via the LCP. <br> When the input is closed, the starter is in <br> remote mode. The [Hand On] and [Auto On] <br> buttons are disabled, and the soft starter will |
| Local/Remote |  |
| Select |  |

(N/O)
(N/C)

Local/Remote Select
remote control, instead of using the buttons on theLCP. When the input is open, the starter is in local mode and can be controlled via the LCP. When the input is closed, the starter is in Hand On] and [Auto On] buttons are disabled, and the soft starter will

## 3-3 Input A Function

## Option:

|  | ignore any Local/Remote select command from <br> the serial communications network. <br> To use Input A to select between local and <br> remote control, 3-1 Local/Remote must be set to <br> LCL/RMT Anytime. |
| :--- | :--- |
| Emergency <br> Run | In emergency run the soft starter continues to <br> run until stopped, ignoring all trips and <br> warnings (see 15-3 Emergency Run for details). <br> Closing the circuit across 11, 16 activates <br> emergency run. <br> Opening the circuit ends emergency run and the <br> MCD 500 stops the motor. |
| Emergency | The MCD 500 can be commanded to emergency <br> stop the motor, ignoring the soft stop mode set <br> in 1-10 Stop Mode. <br> When the circuit across 11, 16 is opened, the <br> soft starter allows the motor to coast to stop. |
| Jog Forward | Activates jog operation in a forward direction <br> (will operate only in Remote mode). |
| Jog Reverse | Activates jog operation in reverse direction (will <br> operate only in Remote mode). |

## 3-4 Input A Name

Option:

|  |  |
| :--- | :--- |
|  | Selects a message for the LCP to display <br> when Input A is active. |
| Input Trip* |  |
|  | Low Pressure |
|  |  |
| High Pressure |  |
| Pump Fault |  |
|  | Low Level |
| High Level |  |
| No Flow |  |
| Emergency Stop |  |
|  | Controller |
| PLC |  |
|  | Vibration Alarm |

## 3-5 Input A Trip

| Option: |  |
| :--- | :--- |
|  |  |
|  | Sunction: |
| Always Active* | A trip can occur at any time when the soft <br> starter is receiving power. |
| Operating Only | A trip can occur while the soft starter is <br> running, stopping or starting. |
| Run Only | A trip can only occur while the soft starter is <br> running. |

3-6 Input A Trip Delay
Range:

| 0 secs* | $[0: 00-4: 00$ (min:secs)] | Sets delay between the input <br> activating and soft starter <br> tripping. |
| :--- | :--- | :--- |

## 3-7 Input A Initial Delay

Range:

| 0 secs* $^{*}$$[00: 00-30: 00$ <br> (min:secs)] <br> Sets a delay before an input trip can <br> occur. The initial delay is counted <br> from the time a start signal is <br> received. The state of the input is <br> ignored until the initial delay has <br> elapsed. |
| :--- | :--- | :--- |

## 3-8 Remote Reset Logic

Option:
Function:

|  | Selects whether the MCD 500's remote reset <br> input (terminals 25, 18) is normally open or <br> normally closed. |
| :--- | :--- | :--- |
| Normally Closed* |  |
| Normally Open |  |

### 7.7 Outputs

4-1 Relay A Function
Option:

|  | Function: |  |
| :--- | :--- | :--- |
| Off | Selects the function of Relay A (normally <br> open). |  |
| Main Contactor* | Relay A is not used <br> The relay closes when the MCD 500 receives <br> a start command, and remains closed as long <br> as the motor is receiving voltage. |  |
|  | Run | The relay closes when the starter changes to <br> run state. |
| Trip | The relay closes when the starter trips. |  |
| Warning | The relay closes when the starter issues a <br> warning. |  |
|  | Low Current <br> Flag | The relay closes when the low current flag <br> activates (4-10 Low Current Flag). |
| High Current <br> Flag | The relay closes when the high current flag <br> activates (4-11 High Current Flag). |  |
| Motor Temp <br> Flag | The relay closes when the motor temperature <br> flag activates (4-12 Motor Temperature Flag). |  |

### 7.7.1 Relay A Delays

The MCD 500 can be configured to wait before opening or closing Relay A.

| 4-2 Relay A On Delay |  |  |
| :---: | :---: | :---: |
| Range: |  | Function: |
| 0 secs* | [0:00-5:00 (min:secs)] | Sets the delay for closing Relay <br> A. |
| 4-3 Relay A Off Delay |  |  |
| Range: |  | Function: |
| 0 secs* | [0:00-5:00 (min:secs)] | Sets the delay for re-opening Relay A . |

### 7.7.2 Relays B and C

Parameters 4-4 to 4-9 configure the operation of Relays B and $C$ in the same way as parameters 4-1 to 4-3 configure Relay A .

| 4-4 Relay B Function |
| :--- |
| Option: |
|  Function: |
| Off | Selects the function of Relay B (changeover). $\mid$ Relay B is not used

4-5 Relay B On Delay
Range:

| 0 secs* | $[0: 00-5: 00$ (min:secs)] | Sets the delay for closing Relay <br> B. |
| :--- | :--- | :--- | | 4-6 Relay B Off Delay | Function: |
| :--- | :--- |
| Range: | Sects |$\quad[0: 00-5: 00$ (min:secs)

Relay B.

## 4-7 Relay C Function

Option: Function:

|  |  | Selects the function of Relay C (normally <br> open). |
| :--- | :--- | :--- |
|  | Off | Relay C is not used |
| Main Contactor | The relay closes when the MCD 500 receives a <br> start command, and remains closed as long as <br> the motor is receiving voltage. |  |
| Run | The relay closes when the starter changes to <br> run state. |  |
| Trip* | The relay closes when the starter trips. |  |
| Warning | The relay closes when the starter issues a <br> warning. |  |
| Low Current <br> Flag | The relay closes when the low current flag <br> activates (4-10 Low Current Flag). |  |
| High Current <br> Flag | The relay closes when the high current flag <br> activates (4-11 High Current Flag). |  |
| Motor Temp <br> Flag | The relay closes when the motor temperature <br> flag activates (4-12 Motor Temperature Flag). |  |


| 4-8 Relay C On Delay |
| :--- |
| Range: |
| 0 secs* $[0: 00-5: 00$ (min:secs) $]$ Sets the delay for closing Relay <br> C. |
| 4-9 Relay C Off Delay |
| Range: |
| 0 secs* $[0: 00-5: 00$ (min:secs) $]$ Sets the delay for re-opening <br> Relay C. |

### 7.7.3 Low Current Flag and High Current Flag

The MCD 500 has low and high current flags to give early warning of abnormal operation. The current flags can be configured to indicate an abnormal current level during operation, between the normal operating level and the undercurrent or instantaneous overcurrent trip levels. The flags can signal the situation to external equipment via one of the programmable outputs. The flags clear when the current returns within the normal operating range by $10 \%$ of the programmed motor full load current.
4-10 Low Current Flag
Range:

| $50 \%{ }^{*}$ | $[1 \%-100 \%$ | Function: |
| :--- | :--- | :--- |
| FLC $]$ | Sets the level at which the low current <br> flag operates, as a percentage of motor <br> full load current. |  |


| 4-11 High Current Flag |
| :--- |
| Range: |
| $100 \%^{*}$ $[50 \%-600 \%$ Function: <br> FLC $]$   |
| Sets the level at which the high <br> current flag operates, as a percentage <br> of motor full load current. |

### 7.7.4 Motor Temperature Flag

The MCD 500 has a motor temperature flag to give early warning of abnormal operation. The flag can indicate that the motor is operating above its normal operating temperature, but lower than the overload limit. The flag can signal the situation to external equipment via one fo the programmable outputs.
4-12 Motor Temperature Flag
Range:

| $80 \% \%^{*}$ | $[0 \%-160 \%]$ | Sets the level at which the motor <br> temperature flag operates, as a percentage <br> of the motor's thermal capacity. |
| :---: | :---: | :--- |

### 7.7.5 Analog Output A

The MCD 500 has an analog output, which can be connected to associated equipment to monitor motor performance.

| 4-13 Analog Output A |  |
| :---: | :---: |
| Option: | Function: |
|  | Selects which information will be reported via analog output A. |
| Current (\% FLC)* | Current as a percentage of motor full load current. |
| Motor Temp <br> (\%) | Motor temperature as a percentage of the motor service factor (calculated by the soft starter's thermal model). |
| Motor kW <br> (\%) | Motor kilowatts. $100 \%$ is motor FLC (1-1 Motor FLC) multiplied by mains reference voltage (8-9 Mains Reference Voltage). Power factor is assumed to be 1.0. $\frac{\sqrt{3} \times v \times I_{F L C} \times p f}{1000}$ |
| Motor kVA <br> (\%) | Motor kilovolt amperes. 100\% is motor FLC (1-1 Motor FLC) multiplied by mains reference voltage (8-9 Mains Reference Voltage). $\frac{\sqrt{3} \times V \times I_{F L C}}{1000}$ |
| Motor pf | Motor power factor, measured by the soft starter. |

## 4-14 Analog A Scale

Option: Function:

|  |  | Selects the range of the output. |
| :--- | :--- | :--- |
|  | $0-20 \mathrm{~mA}$ |  |
|  | $4-20 \mathrm{~mA}$ |  |

## 4-15 Analog A Maximum Adjustment

Range:

| $100 \%^{*}$ | $[0 \%-600 \%]$ | Calibrates the upper limit of the analog <br> output to match the signal measured on <br> an external current measuring device. |
| :--- | :--- | :--- |

4-16 Analog A Minimum Adjustment
Range:

| $0 \% \%^{*}$ | $[0 \%-600 \%]$ | Canction: <br> outputes the lower limit of the analog <br> external current measuring device. |
| :---: | :---: | :---: |

### 7.8 Start/Stop Timers

## $\triangle$ CAUTION

The auto-start timer overrides any other form of control. The motor may start without warning.

## 5-1 Auto-Start Type

## Option: Function:

|  |  | Selects whether the soft starter will auto-start after a <br> specified delay, or at a time of day. |
| :--- | :--- | :--- |
|  | Off* | The soft starter will not auto-start. |
| Timer | The soft starter will auto-start after a delay from the <br> next stop, as specified in 5-2 Auto-start Time. |  |
| Clock | The soft starter will auto-start at the time programmed <br> in 5-2 Auto-start Time. |  |

5-2 Auto-Start Time
Range:

| $1 \mathrm{~min}^{*}$ | $[00: 01-24: 00$ <br> (hrs:min)] | Sets the time for the soft starter to <br> auto-start, in 24 hour clock format. |
| :---: | :---: | :--- |

## 5-3 Auto-Stop Type

Option: Function:

|  |  | Selects whether the soft starter will auto-stop after a <br> specified delay, or at a time of day. |
| :--- | :--- | :--- |
|  | Off $^{*}$ | The soft starter will not auto-stop. |
| Time | The soft starter will auto-stop after a delay from the <br> next start, as specified in 5-4 Auto-stop Time. |  |
| Clock | The soft starter will auto-stop at the time programmed <br> in 5-4 Auto-stop Time. |  |

5-4 Auto-Stop Time

Range:

| $1 \mathrm{~min} *$ | [00:01- <br> $24: 00$ <br> (hrs:min)] | Sets the time for the soft starter to auto- <br> stop, in 24 hour clock format. <br> CAUTION |
| :---: | :--- | :--- |
| This function should not be used in |  |  |
| conjunction with remote two-wire |  |  |
| control. The soft starter will still |  |  |
| accept start and stop commands from |  |  |
| the remote inputs or serial communi- |  |  |
| cation network. To disable local or |  |  |
| remote control, use 3-1 Local/Remote. |  |  |
| If auto-start is enabled and the user is |  |  |
| in the menu system, auto-start will |  |  |
| become active if the menu times out |  |  |
| (if no LCP activity is detected for five |  |  |
| minutes). |  |  |

### 7.9 Auto-Reset

The MCD 500 can be programmed to automatically reset certain trips, which can help minimise operating downtime. Trips are divided into three categories for autoreset, depending on the risk to the soft starter:

| Group |  |
| :--- | :--- |
| A | Current Imbalance |
|  | Phase Loss |
|  | Power Loss |
|  | Mains Frequency |
| B | Undercurrent |
|  | Instantaneous Overcurrent |
|  | Input A Trip |
| C | Motor Overload |
|  | Motor Thermistor |
|  | Starter Overtemperature |

Other trips cannot be automatically reset.

This function is ideal for remote installations using 2-wire control in Auto On mode. If the 2 -wire start signal is present after an auto-reset, the MCD 500 will restart.

## 6-1 Auto-Reset Action

Option: Function:

|  |  | Selects which trips can be auto-reset. |
| :--- | :--- | :--- |
|  | Do not Auto-Reset* |  |
|  | Reset Group A |  |
|  | Reset Group A \& B |  |
|  | Reset Group A, B \& C |  |

6-2 Maximum Resets
Range: Function:

| $1^{*}$ | $[1-5]$ | Sets how many times the soft starter will auto-reset, <br> if it continues to trip. The reset counter increases by <br> one each time the soft starter auto-resets, and <br> decreases by one after each successful start/stop <br> cycle. |
| :--- | :--- | :--- | :--- |

## NOTE

The reset counter will return to 0 if the starter is manually reset.

### 7.9.1 Auto-Reset Delay

The MCD 500 can be configured to wait before autoresetting a trip. Separate delays can be set for trips in Groups A and B, or in Group C.

## 6-3 Reset Delay Groups A \& B

| Range: |
| :--- |
| 5 secs* $[00: 05-15: 00$ <br> (min:secs)] Sets the auto-reset delay for <br> Group A and Group B trips.$6-4$ Reset Delay Group C  <br> Range: Function: <br> 5 min $^{*}$ $[5-60$ (minutes)]Sets the auto-reset delay for Group C <br> trips. |

### 7.10 Secondary Motor Set

## 7-1 Motor FLC-2

Range:

| [Motor <br> dependent $]$ | Matches the starter to the second motor's <br> full load current. Set to the full load <br> current (FLC) rating shown on the motor <br> nameplate. |
| :--- | :--- |

Table 7.7

## Programming

MCD 500 Operating Instruction
7-2 Locked Rotor Time-2
Range:

| 10 secs* | [0:01-2:00 <br> (min:secs)] | Sets the maximum length of the time <br> the motor can run at locked rotor <br> current from cold before reaching its <br> maximum temperature. Set according <br> to the motor datasheet. <br> If this information is not available, we <br> recommend the value should be less <br> than 20 seconds. |
| :--- | :--- | :--- |

## 7-3 Start Mode-2

## Option: Function:

|  Selects the start mode for the secondary <br> motor. <br> Constant Current ${ }^{*}$  |
| :--- |
| Adaptive Control |

## 7-5 Initial Current-2

Range:
Function:

| $350 \%^{*}$ | $[100 \%$ - | Sets the initial start current level for current <br> $600 \%$ FLC $]$ <br> ramp starting, as a percentage of motor full <br> load current. Set so that the motor begins to <br> accelerate immediately after a start is <br> initiated. <br> If current ramp starting is not required, set <br> the initial current equal to the current limit. |
| :---: | :---: | :--- |


| 7-6 Start Ramp Time-2 |  |  |  |
| :---: | :---: | :---: | :---: |
| Range: |  |  | Function: |
| 10 secs* | $\begin{gathered} {[1-} \\ \text { secs }] \end{gathered}$ | -180 Sets the <br> Adaptiv <br> for curr <br> current | total start time for an AAC <br> Control start or the ramp time ent ramp starting (from the initial to the current limit). |
| 7-7 Kickstart Level-2 |  |  |  |
| Range: |  |  | Function: |
| 500\%* | [100\% - 700\% FLC] |  | Sets the level of the kickstart current. |
| 7-8 Kickstart Time-2 |  |  |  |
| Range: |  |  | Function: |
| 0000 msecs* |  | [0-2000 msecs] | Sets the kickstart duration. A setting of 0 disables kickstart. |

## 7-9 Excess Start Time-2

| Range: | Function: |
| :--- | :--- | :--- |
|   Excess start time is the maximum time <br> the MCD 500 will attempt to start the <br> motor. If the motor does not reach full <br> speed within the programmed limit, the <br> starter will trip. Set for a period slightly <br> longer than required for a normal <br> healthy start. A setting of 0 disables <br> excess start time protection. <br> 20 <br> secs* $[0: 00-4: 00$ <br> (min:secs)] Set the excess time for the secondary <br> motor. |  |

## 7-10 Stop Mode-2

Option: Function:

|  | Selects the stop mode for the secondary <br> motor. |
| :--- | :--- |
| Coast to Stop* |  |
| TVR Soft Stop |  |
| Adaptive Control |  |
| Brake |  |

## 7-11 Stop Time-2

Range:

| 0 secs** $^{*}$ | [0:00-4:00 <br> (min:secs)] | Sets the time for soft stopping the motor <br> using timed voltage ramp or Adaptive <br> Control (AAC). If a main contactor is <br> installed, the contactor must remain <br> closed until the end of the stop time. <br> Use a programmable output configured <br> to Run to control the main contactor. <br> Sets the toal stopping time when using <br> brake. |
| :---: | :---: | :--- |

7-12 Adaptive Control Gain-2

| Range: |
| :--- |
| $75 \%^{*}$ Function: <br> $1 \%-$ Adjusts the performance of AAC adaptive <br> acceleration control. <br> NOTE <br> We recommend leaving the gain setting  <br> at the default level unless AAC  <br> performance is not satisfactory.  <br> If the motor accelerates or decelerates  <br> quickly at the end of a start or stop,  <br> increase the gain by setting by 5\% -  <br> 10\%. If the motor speed fluctuates  <br> during starting or stopping, decrease the  <br> gain setting slightly.  |

Programming
MCD 500 Operating Instruction

## 7-13 Adaptive Start Profile-2

## Option: <br> Function:

|  | Selects which profile the MCD 500 will <br> use for an AAC adaptive acceleration <br> control soft start. |
| :--- | :--- |
| Early Acceleration |  |
| Constant Acceleration |  |
| Late Acceleration |  |

7-14 Adaptive Stop Profile-2
Option:

## Function:

$\left.$|  |  |
| :--- | :--- | | Selects which profile the MCD 500 will |
| :--- |
| use for an AAC adaptive acceleration |
| control soft stop. | \right\rvert\,

7-15 Brake Torque-2
Function:
Range:

| $20 \% *$ | $[20-100 \%]$ | Function: <br> Sets the amount of brake torque the MCD <br> 500 will use to slow the motor. |
| :--- | :--- | :--- |

## 7-16 Brake Time-2

Range:
Function:
$\left.\begin{array}{|l|l|l|}\hline 1 \text { sec* }^{*} & {[1-30 \text { secs }]} & \begin{array}{l}\text { Sets the duration for DC injection during a } \\ \text { braking stop. } \\ \text { NOTE }\end{array} \\ \text { This parameter is used in conjunction } \\ \text { with 7-11 Stop Time-2. }\end{array}\right]$

### 7.11 Display

8-1 Language
Option:

|  | Function: |
| :--- | :--- |
|  | Selects which language the LCP will <br> use to display messages and feedback. |
| English* |  |
| Chinese (中丈) |  |
| Spanish (Español) |  |
|  | German (Deutsch) |
|  |  |
| Portuguese (Português) |  |
| French (Français) |  |
|  | Italian (Italiano) |
| Russian (Русский) |  |

### 7.11.1 User Programmable Screen

Selects which four items will be displayed on the programmable monitoring screen.

| 8-2 User Screen - Top Left |
| :--- |
| Option: | Function:

Option: Function:

|  | Selects the item displayed in the top right <br> part of the screen. |
| :--- | :--- | :--- |
| Blank* | Displays no data in the selected area, <br> allowing long messages to be shown without <br> overlapping. |
| Starter State | The starter's operating state (starting, <br> running, stopping or tripped). Only available <br> for "Top L" and "Btm L". |
| Motor Current | The average current measured on three <br> phases. |
| Motor pf | The motor's power factor, measured by the <br> soft starter. |
| Mains Frequency | The average frequency measured on three <br> phases. |
| Motor kW | The motor's running power in kilowatts. |
| Motor HP | The motor's running power in horsepower. |
| Motor Temp | The motor's temperature, calculated by the <br> thermal model. |
| kWh | The number of kilowatt hours the motor has <br> run via the soft starter. |
| Hours Run | The number of hours the motor has run via <br> the soft starter. |


| 8-4 User Screen - Bottom Left |
| :--- |
| Option: |
|  Function: |
| Blank |
| Selects the item displayed in the bottom left <br> part of the screen. |
| Starter State |
| Displays no data in the selected area, <br> allowing long messages to be shown without <br> overlapping. |
| Motor Current |
| The starter's operating state (starting, <br> running, stopping or tripped). Only available <br> for "Top L" and "Btm L". |
| The average current measured on three |
| phases. |

$\left.\left.\begin{array}{l}\text { 8-5 User Screen - Bottom Right } \\ \text { Option: } \\ \begin{array}{|l|l|l|}\hline & \text { Function: }\end{array} \\ \hline \text { Blank" } \\ \hline\end{array} \begin{array}{l}\text { Selects the item displayed in the bottom } \\ \text { right part of the screen. }\end{array}\right] \begin{array}{l}\text { Displays no data in the selected area, } \\ \text { allowing long messages to be shown without } \\ \text { overlapping. }\end{array}\right]$

### 7.11.2 Performance Graphs

The loggings menu allows the user to view performance information in real-time graphs.

The newest information is displayed at the right hand edge of the screen. The graph can be paused to analyse data by pressing and holding the OK button. To re-start the graph, press and hold OK.

## 8-6 Graph Timebase

Option:

|  | Sets the graph time scale. The graph will progres- <br> sively replace the old data with new data. |
| :--- | :--- | :--- |
| 10 secs $^{*}$ |  |
| 30 secs |  |
| 1 min |  |
| 5 minutes |  |
| 10 minutes |  |
| 30 minutes |  |
| 1 hour |  |
| 8-7 Graph Maximum Adjustment |  |
| Range: |  |
| 400\% [0\% - $600 \%]$ Adjusts the upper limit of the performance <br> graph |  | | Gunction: |
| :--- |

## 8-8 Graph Minimum Adjustment

| Range: |  | Function: |
| :---: | :---: | :---: |
| 0\%* | [0\%-600\%] | Adjusts the lower limit of the performance graph. |
| 8-9 Mains Reference Voltage |  |  |
| Range: |  | Function: |
| 400 V* | $\begin{aligned} & {[100-690} \\ & \mathrm{V}] \end{aligned}$ | Sets the nominal voltage for the LCP's monitoring functions. This is used to calculate motor kilowatts and kilovolt amperes (kVA), but does not affect the MCD 500's motor control protection. <br> Enter the measured mains voltage. |

### 7.12 Restricted Parameters

15-1 Access Code

Range: $\quad$\begin{tabular}{|l|l|l|}
\hline $0000^{*}$ \& {$[0000-$} \& Function: <br>

$9999]$ \& | Sets the access code to enter the simulation |
| :--- |
| tools and counter resets or the restricted |
| section of the Programming Menu (parameter |
| group 15 and higher). |
| Use [Back] and [OK] to select which digit to |
| alter and use [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ to change the value. |
| NOTE |
| In the event of a lost access code, contact |
| your supplier for master access code that |
| allows you to re-program a new access |
| code. | <br>

\hline
\end{tabular}

15-2 Adjustment Lock
Option:

|  | Function: |
| :--- | :--- |
|  | Selects whether the LCP will allow parameters to <br> be changed via the Programming Menu. |
|  <br> Write* | Allows users to alter parameter values in the <br> Programming Menu |
| Read Only | Prevents users altering parameter values in the <br> Programming Menu. Parameter values can still be <br> viewed. |
| No Access | Prevents users adjusting parameters in the <br> Programming Menu unless an access code is <br> entered. |
|  | NOTE <br> Changes to the Adjustment Lock setting take <br> effect only after the Programming Menu has <br> been closed. |

## 15-3 Emergency Run

Option: Function:

|  | Selects whether the soft starter will permit emergency <br> run operation. In emergency run, the soft starter will <br> start (if not already running) and continue to operate <br> until emergency run ends, ignoring stop commands and <br> trips. <br> Emergency run is controlled using a programmable <br> input. <br> When Emergency Run is activated in internally bypassed <br> models which are not running, the starter will attempt a <br> normal start while ignoring all trips. If a normal start is <br> not possible, a DOL start via the internal bypass relays <br> will be attempted. For non-bypassed models, an <br> external emergency run bypass contactor may be used. |
| :--- | :--- |


| 15-4 Current Calibration |
| :--- |
| Range: $\quad$Function: <br> $100 \% \%^{*}$ <br> $[85 \%$ <br> - <br> $115 \%]$Motor Current Calibration calibrates the soft <br> starter's current monitoring circuits to match an <br> external current metering device. <br> Use the following formula to determine the <br> necessary adjustment: <br> Calibration (\%) $=\frac{\text { Current shown on } M C D \text { 500 display }}{\text { Current measured by external device }}$ |
| e.g. $102 \%=\frac{66 \mathrm{~A}}{65 \mathrm{~A}}$ <br> NOTE <br> This adjustment affects all current-based <br> functions. |

## 15-5 Main Contactor Time

| Range: |
| :--- |
| 400 $[100-$ <br> msecs* 2000 msecs $]$Sets the delay period between the <br> starter switching the main contactor <br> output (terminals 13, 14) and <br> beginning the pre-start checks (before <br> start) or entering the not ready state <br> (after a stop). Set according to the <br> specifications of the main contactor <br> used. |

15-6 Bypass Contactor Time
Range:

| 150 msecs* | Function: |
| :--- | :--- | :--- | :--- |
| msecs] $]$ | Sets the starter to match the bypass <br> contactor closing time. Set according <br> to the specifications of the bypass <br> contactor used. If the time is too <br> short, the starter will trip. |

## 15-7 Motor Connection

Option: Function:

|  | Selects the soft starter will automatically detect <br> the format of the connection to the motor. |
| :--- | :--- |
| Auto-Detect* |  |
| In-line |  |
| Inside Delta |  |

## 15-8 Jog Torque

Range: Function:

| $50 \% *$ | $[20 \%-100 \%]$ | Sets the torque level for jog operation. <br> See the section Jog Operation for more <br> details. |
| :--- | :--- | :--- |

## NOTE

Setting this parameter above 50\% may cause increased shaft vibration.

### 7.13 Protection Action

16-1-16-12 Protection Action
Option: Function:

|  | Selects the soft starter's response to each protection. <br> - 16-1 Motor Overload <br> - 16-2 Current Imbalance <br> - 16-3 Undercurrent <br> - 16-4 Inst Overcurrent <br> - 16-5 Frequency <br> - 16-6 Heatsink Overtemp <br> - 16-7 Excess Start Time <br> - 16-8 Input A Trip <br> - 16-9 Motor Thermistor <br> - 16-10 Starter/Comms <br> - 16-11 Network/Comms <br> - 16-12 Battery/Clock <br> - 16-13 Low Control Volts |
| :---: | :---: |
| Trip Starter* |  |
| Warn and Log |  |
| Log Only |  |

### 7.14 Factory Parameters

These parameters are restricted for Factory use and are not available to the user.

Tools
MCD 500 Operating Instruction

## 8 Tools

To access Tools, open the Main Menu, scroll to Tools and press [OK].

### 8.1 Set Date and Time

To set the date and time:

1. Open the Tools Menu.
2. Scroll to Set Date \& Time.
3. Press [OK] to enter edit mode.
4. Press $[\mathrm{OK}]$ to select which part of the date or time to edit.
5. Use [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ to change the value.

To save changes, press [OK] repeatedly. The MCD 500 will confirm the changes. To cancel changes, press [Back] repeatedly.

### 8.2 Load/Save Settings

The MCD 500 includes options to:

- Load defaults: Load the MCD 500's parameters with default values
- Load User Set 1: Reload previously saved parameter settings from an internal file
- Save User Set 1: Save the current parameter settings to an internal file

In addition to the factory default values file, the MCD 500 can store a user-defined parameter file. This file contains default values until a user file is saved.

To load or save parameter settings:

1. Open the Tools Menu.
2. Use [ $\mathbf{v}]$ to select the required function, then press [OK].
3. At the confirmation prompt, select YES to confirm or NO to cancel and then [OK] to load/save the selection or exit the screen.

| Tools |  |
| :--- | :--- |
|  | Load Defaults |
|  | Load User Set 1 |
|  | Save User Set 1 |

Table 8.1

| Load Defaults |
| :---: |
| No |
| Yes |

Table 8.2

When the action has been completed, the screen will briefly display a confirmation message, then return to the status screens.

### 8.3 Reset Thermal Model

## NOTE

This function is protected by the security access code.

The MCD 500's advanced thermal modelling software constantly monitors the motor's performance. This allows the MCD 500 to calculate the motor's temperature and ability to start successfully at any time.

The thermal model can be reset if required.

1. Open Tools.
2. Scroll to Reset Thermal Model and press [OK].
3. At the confirmation prompt, press [OK] to confirm then enter the access code, or press [Back] to cancel the action.
4. Select Reset or Do Not Reset, then press [OK]. When the thermal model has been reset, the MCD 500 will return to the previous screen.

| Reset Thermal Model |
| :---: |
| $\mathrm{M1} \mathrm{X} \mathrm{\%}$ |
| OK to Reset |

Table 8.3

| Reset Thermal Model |
| :---: |
| Do Not Reset |
| Reset |

Table 8.4

## CAUTION

Adjusting the motor thermal model may compromise motor life and should only be done in the case of emergency.

### 8.4 Protection Simulation

## NOTE

This function is protected by the security access code.

Software simulation functions let you test the soft starter's operation and control circuits without connecting the soft starter to mains voltage.

The MCD 500 can simulate each different protection, in order to confirm that the soft starter is responding correctly and reporting the situation on the display and across the communication network.

To use the protection simulation:

1. Open the Main Menu.
2. Scroll to Protection Sim and press [OK].
3. Use [ $\mathbf{\Delta}]$ and $[\mathbf{v}]$ to select the protection you want to simulate.
4. Press $[\mathrm{OK}]$ to simulate the selected protection.
5. The protection message is displayed while [OK] is pressed. The soft starter's response depends on the Protection Action setting (parameter group 16).
6. Press [Back] to return to the simulation list.
7. Use [ $\mathbf{\Delta}$ ] or [ $\mathbf{v}$ ] to select another simulation, or press [Back] to return to the Main Menu.

| MS1 | 000.0 A | 0000.0 kW |
| :--- | ---: | ---: |
| Tripped |  |  |
| Selected Protection |  |  |

Table 8.5

## NOTE

If the protection trips the soft starter, reset before simulating another protection. If the protection action is set to Warn or Log, no reset is required. If the protection is set to Warn \& Log, the warning message can be viewed only while [OK] is pressed. If the protection is set to Log only, nothing appears on the screen but an entry will appear in the log.

### 8.5 Output Signal Simulation

## NOTE

This function is protected by the security access code.

The LCP allows the user to simulate output signalling in order to confirm that the output relays are operating correctly.

## NOTE

To test operation of the flags (motor temperature and low/ high current), set an output relay to the appropriate function and monitor the relay's behaviour.

To use the output signal simulation:

1. Open the Main Menu.
2. Scroll to Output Signal Sim and press [OK], then enter the access code.
3. Use [ $\mathbf{\Delta}$ ] and [ $\mathbf{v}$ ] to select a simulation, then press [OK].
4. Use [4] and [v] to turn the signal on and off. To confirm correct operation, monitor the state of the output.
5. Press [Back] to return to the simulation list.

| Prog Relay A |
| :--- |
| Off |
| On |

Table 8.6

### 8.6 Digital I/O State

This screen shows the current status of the Digital I/O in order.

The top line of the screen shows the start, stop, reset and programmable input.

The bottom line of the screen shows programmable outputs A, B and C.

The screen shot shows the stop input (17) as closed (1) and the start, reset and Input $A$ inputs $(15,25,11)$ as open $(0)$. Relay $A(13,14)$ is closed and relays $B$ and $C(21,22,24$ and 33,34 ) are open.

| Digital I/O State |  |
| :--- | :--- |
| Inputs: 0100 |  |
| Outputs: 100 |  |

Table 8.7

### 8.7 Temp Sensors State

This screen shows the state of the motor thermistor. The screen shot shows the thermistor state as O (open).

| Temp Sensors State |
| :--- |
| Thermistor: O |
| S = shrt $\mathrm{H}=$ hot $\mathrm{C}=$ cld $\mathrm{O}=$ opn |

Table 8.8

### 8.8 Alarm Log

The [Alarm Log] button opens the Alarm Logs, which contains a Trip Log, Event Log, and Counters which store information on the MCD 500's operating history.

### 8.8.1 Trip Log

The Trip Log stores details of the eight most recent trips, including the date and time the trip happened. Trip 1 is the most recent and trip 8 is the oldest stored trip.

## To open the Trip Log:

1. Open the Alarm Logs.
2. Scroll to Trip Log and press [OK].
3. Use [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ to select a trip to view, and press [OK] to display details.

To close the log and return to the main display, press [Back].

The resettable counters (hours run, starts and motor kWh) can only be reset if the correct access code is entered.

To view the counters:

1. Open the Alarm Logs.
2. Scroll to Counters and press [OK].
3. Use [ $\mathbf{\Delta}]$ and $[\mathbf{v}]$ buttons to scroll through the counters. Press [OK] to view details.
4. To reset a counter, press [OK] then enter the access code. Select Reset, then press [OK] to confirm.

To close the counter and return to the Alarm Logs, press [Back].

### 8.8.2 Event Log

The Event Log stores time-stamped details of the starter's 99 most recent events (actions, warnings and trips), including the date and time of the event. Event 1 is the most recent and event 99 is the oldest stored event.

## To open the Event Log:

1. Open the Alarm Logs.
2. Scroll to Event Log and press [OK].
3. Use [ $\mathbf{\Delta}]$ and [ $\mathbf{v}]$ to select an event to view, and press [OK] to display details.

To close the log and return to the main display, press [Back].

### 8.8.3 Counters

## NOTE

This function is protected by the security access code.

The performance counters store statistics on the starter's operation:

- Hours run (lifetime and since counter last reset)
- Number of starts (lifetime and since counter last reset)
- Motor kWh (lifetime and since counter last reset)
- Number of times the thermal model has been reset


## 9 Troubleshooting

When a protection condition is detected, the MCD 500 will write this to the event log and may also trip or issue a warning. The soft starter's response to some protections may depend on the Protection Action settings (parameter group 16).

If the MCD 500 trips you will need to reset the soft starter before restarting. If the MCD 500 has issued a warning, the soft starter will reset itself once the cause of the warning has been resolved.
mechanisms are designed to protect the soft starter, or can be caused by a fault within the soft starter.

### 9.1 Trip Messages

This table lists soft starter's protection mechanisms and the probable cause of the trip. Some of these can be adjusted using parameter group 2 Protection and parameter group 16 Protection Action, other settings are built-in system protections and cannot be set or adjusted.

Some protections cause a fatal trip. This response is predefined and cannot be overridden. These protection

| Display | Possible cause/Suggested solution |
| :---: | :---: |
| Battery/Clock | A verification error has occurred on the real time clock, or the backup battery voltage is low. If the battery is low and the power is off, date/time settings will be lost. Reprogram the date and time. Related Parameter: 16-12 Battery Clock |
| Current Imbalance | Current imbalance can be caused by problems with the motor, the environment or the installation, such as: <br> - An imbalance in the incoming mains voltage <br> - A problem with the motor windings <br> - A light load on the motor <br> Current imbalance can also be caused by incorrect cabling between the external bypass contactor and the soft starter or an internal problem with the soft starter, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. <br> Related Parameters: 2-3-2-3 and 16-2 |
| Excess Start Time | Excess start time trip can occur in the following conditions: <br> - 1-1 Motor Full Load Current is not appropriate for the motor <br> - 1-4 Current Limit <br> - 1-6 Start Ramp Time has been set greater than the setting for 1-9 Excess Start Time Setting <br> - 1-6 Start Ramp Time is set too short for a high inertia load when using Adaptive Acceleration Control <br> Related Parameters: 1-1, 1-6, 1-4, 1-9, 7-9, 7-1, 7-6, 7-4, and 16-7 |
| FLC Too High | The MCD 500 can support higher motor FLC values when connected to the motor using inside delta configuration rather than in-line connection. If the soft starter is connected in-line but the programmed setting for 1-1 Motor Full Load Current is above the in-line maximum, the soft starter will trip at start. <br> Related Parameters: 1-1 Motor FLC, 7-1 Motor FLC-2 |
| Frequency | The mains frequency has gone beyond the specified range. <br> Check for other equipment in the area that could be affecting the mains supply (particularly variable speed drives). <br> If the MCD 500 is connected to a generator set supply, the generator may be too small or could have a speed regulation problem. <br> Related Parameters: 2-8, 2-9, 2-10, and 16-5 |

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| Display | Possible cause/Suggested solution |
| :---: | :---: |
| Heatsink Overtemp | Check if cooling fans are operating. If mounted in an enclosure, check if ventilation is adequate. Fans operate during Start, Run and for 10 minutes after the starter exits the Stop state. NOTE <br> Models MCD5-0021B to MCD4-0053B and MCD5-0141B do not have a cooling fan. Models with fans will operate the cooling fans from a Start until 10 minutes after a Stop. <br> Related Parameters: 16-6 Heatsink Overtemp |
| Input A Trip | Identify and resolve the condition which caused Input A to activate. Related Parameters: 3-3, 3-4, 3-5, 3-6, 3-7, and 16-8 |
| Inst Overcurrent | The motor has experienced a sharp rise in motor current, probably caused by a locked rotor condition (shearpin) while running. This may indicate a jammed load. <br> Related Parameters: 2-6, 2-7, and 16-4 |
| Internal Fault X | The MCD 500 has tripped on an internal fault. Contact your local supplier with the fault code (X). Related Parameters.: None |
| L1 Phase Loss <br> L2 Phase Loss <br> L3 Phase Loss | During prestart checks the starter has detected a phase loss as indicated. In run state, the starter has detected that the current on the affected phase has dropped below $3.3 \%$ of the programmed motor FLC for more than 1 second, indicating that either the incoming phase or connection to the motor has been lost. <br> Check the supply and the input and output connections at the starter and at the motor end. Phase loss can also be caused by a failed SCR, particularly an SCR that has failed open circuit. A failed SCR can only be definitely diagnosed by replacing the SCR and checking the starter's performance. <br> Related Parameters: None |
| L1-T1 Shorted L2-T2 Shorted L3-T3 Shorted | During prestart checks the starter has detected a shorted SCR or a short within the bypass contactor as indicated. <br> Related Parameters: none |
| Low Control Volts | The MCD 500 has detected a drop in the control voltage. <br> - Check the external control supply (terminals A4, A5, A6) and reset the starter. <br> If the external control supply is stable: <br> - the 24 V supply on the main control PCB may be faulty; or <br> - the bypass driver PCB may be faulty (internally bypassed models only). <br> This protection is not active in Ready state. <br> Related Parameters: 16-13 Low Control Volts |
| Motor Overload/ <br> Motor 2 Overlaod | The motor has reached its maximum thermal capacity. Overload can be caused by: <br> - The soft starter protection settings not matching the motor thermal capacity. <br> - Excessive starts per hour <br> - Excessive throughput <br> - Damage to the motor windings. <br> Resolve the cause of the overload and allow the motor to cool. <br> Related Parameters: 1-1, 1-2, 1-3, 1-4, 7-1, 7-2, 7-3, 7-4, and 16-1 |
| Motor Connection | The motor is not connected correctly to the soft starter for inline or inside delta use. <br> - Check individual motor connections to the soft starter for power circuit continuity. <br> - Check connections at the motor terminal box. <br> Related Parameters: 15-7 Motor Connection |

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| Display | Possible cause/Suggested solution |
| :---: | :---: |
| Motor Thermistor | The motor thermistor input has been enabled and: <br> - The resistance at the thermistor input has exceeded $3.6 \mathrm{k} \Omega$ for more than one second. <br> - The motor winding has overheated. Identify the cause of the overheating and allow the motor to cool before restarting. <br> - The motor thermistor input has been open. <br> NOTE <br> If a valid motor thermistor is no longer used, a $1.2 \mathrm{k} \Omega$ resistor must be fitted across terminals 05, 06. <br> Related Parameters: 16-9 Motor Thermistor |
| Network Comms | The network master has sent a trip command to the starter, or there may be a network communication problem. <br> Check the network for causes of communication inactivity. <br> Related Parameters: 16-11 Network/Comms |
| Parameter out of Range | - A parameter value is outside the valid range. <br> The starter will load the default value for all affected parameters. Press [Main Menu] to go to the first invalid parameter and adjust the setting. <br> Related Parameters: None |
| Phase Sequence | The phase sequence on the soft starter's input terminals (L1, L2, L3) is not valid. Check the phase sequence on L1, L2, L3 and ensure the setting in 2-1 Phase Sequence is suitable for the installation. <br> Related Parameters: 2-1 Phase Sequence |
| Power Loss | The starter is not receiving mains supply on one or more phases when a Start Command is given. Check that the main contactor closes when a start command is given, and remains closed until the end of a soft stop. <br> If testing the soft starter with a small motor, it must draw at least $2 \%$ of its minimum FLC setting on each phase. <br> Related Parameters: None |
| Starter/Comms | - There is a problem with the connection between the soft starter and the optional communications module. Remove and reinstall the module. If the problem persists, contact your local distributor. <br> - There is an internal communications error within the soft starter. Contact your local distributor. <br> Related Parameters: 16-10 Starter/Comms |
| Thermistor Cct | The thermistor input has been enabled and: <br> - The resistance at the input has fallen below $20 \Omega$ (the cold resistance of most thermistors will be over this value) or <br> - A short circuit has occurred. Check and resolve this condition. <br> Check that a PT100 (RTD) is not connected to 05, 06. <br> Related Parameters: None. |
| Time - Overcurrent | The MCD 500 is internally bypassed and has drawn high current during running. (The 10 A protection curve trip has been reached or the motor current has risen to $600 \%$ of the motor FLC setting.) <br> Related Parameters: None |
| Undercurrent | The motor has experienced a sharp drop in current, caused by loss of load. Causes can include broken components (shafts, belts or couplings), or a pump running dry. <br> Related Parameters: 2-4, 2-5, and 16-3 |
| Unsupported Option | The selected function is not available (e.g. jog is not supported in inside delta configuration). Related Parameters: None |

Table 9.1

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### 9.2 General Faults

This table describes situations where the soft starter does not operate as expected but does not trip or give a warning.

| Symptom | Probable Cause |
| :---: | :---: |
| Soft starter does not respond to commands. | - If the soft starter does not respond to the [Reset] button on the LCP: <br> The soft starter may be in Auto On mode and will only accept commands from the remote control inputs. In Auto On mode, the Auto On LED on the LCP is illuminated. Press the [Hand On] or [Off] button to enable control via the LCP (this will also send a start or stop command to the MCD 500). <br> - If the soft starter does not respond to commands from the control inputs: <br> The soft starter may be in Hand On mode and will only accept commands from the LCP. When the soft starter is in Hand On control mode, the Off or Hand On LED on the LCP is active. To change to Auto On mode, press the [Auto On] button once. <br> The control wiring may be incorrect. Check that the remote start, stop and reset inputs are configured correctly (see Control Wiring for details). <br> The signals to the remote inputs may be incorrect. Test the signalling by activating each input signal in turn. The appropriate remote control input LED should activate on the LCP. <br> The soft starter will only execute a start command from the remote inputs if the remote stop input is inactive and the remote reset input is activated (the Reset LED on the starter will be on). <br> - If the soft starter does not respond to a start command from either the local or remote controls: <br> The soft starter may be waiting for the restart delay to elapse. The length of the restart delay is controlled by Par. 2-11 Restart Delay. <br> The motor may be too hot to permit a start. If Par. 2-12 Motor Temperature Check is set to Check, the soft starter will only permit a start when it calculates that the motor has sufficient thermal capacity to complete the start successfully. Wait for the motor to cool before attempting another start. <br> The emergency stop function may be active. If Par. 3-3 is set to Emergency Stop and there is an open circuit on the corresponding input, the MCD 500 will not start. If the emergency stop situation has been resolved, close the circuit on the input. |
| The soft starter does not control the motor correctly during starting. | - Start performance may be unstable when using a low Motor Full Load Current setting Par. 1-1). This can affect use on a small test motor with full load current between 5 A and 50 A . <br> - Power factor correction (PFC) capacitors must be installed on the supply side of the soft starter. To control a dedicated PFC capacitor contactor, connect the contactor to run relay terminals. |
| Motor does not reach full speed. | - If the start current is too low, the motor will not produce enough torque to accelerate to full speed. The soft starter may trip on excess start time. <br> NOTE <br> Make sure the motor starting parameters are appropriate for the application and that you are using the intended motor starting profile. If Par. 3-3 is set to Motor Set Select, check that the corresponding input is in the expected state. <br> - The load may be jammed. Check the load for severe overloading or a locked rotor situation. |
| Erratic motor operation. | - The SCRs in the MCD 500 require at least 5 A of current to latch. If you are testing the soft starter on a motor with full load current less than 5 A, the SCRs may not latch correctly. |

Troubleshooting
MCD 500 Operating Instruction

| Symptom | Probable Cause |
| :---: | :---: |
| Soft stop ends too quickly. | - The soft stop settings may not be appropriate for the motor and load. Review the settings of Pars. 1-10, 1-11, 7-10 and 7-11. <br> - If the motor is very lightly loaded, soft stop will have limited effect. |
| AAC adaptive acceleration control, DC brake and Jog functions not working | - These features are only available with in-line installation. If the MCD 500 is installed inside delta, these features will not operate. |
| A reset does not occur after an Auto-Reset, when using a remote 2 -wire control. | - The remote 2 -wire start signal must be removed and reapplied for a re-start. |
| Remote start/stop command is overriding Auto Start/Stop settings when using remote 2-wire control. | - Auto Start/Stop function should only be used in HAND ON mode or in tandem with HAND OFF mode, 3 and 4 -wire control. |
| After selecting AAC the motor used an ordinary start and/or the second start was different to the first. | - The first AAC start is current limit so that the starter can learn from the motor characteristics. Subsequent starts use AAC. |
| Non-resettable THERMISTOR CCT trip, when there is a link between Thermistor input 05, 06 or when the motor thermistor connected between 05,06 is permanently removed. | - The thermistor input is enabled once a link is fitted and short circuit protection has activated. <br> Remove the link then load the default parameter set. This will disable the thermistor input and clear the trip. <br> Place a $1 \mathrm{k} 2 \Omega$ resistor across the thermistor input. <br> Turn thermistor protection to 'Log only' (Par. 16-9). |
| Parameter settings cannot be stored. | - Make sure you are saving the new value by pressing the [OK] button after adjusting a parameter setting. If you press [BACK], the change will not be saved. <br> - Check that the adjustment lock (Par. 15-2) is set to Read/Write. If the adjustment lock is on, settings can be viewed but not changed. You need to know the security access code to change the adjustment lock setting. <br> - The EEPROM may be faulty on the Main Control PCB. A faulty EEPROM will also trip the soft starter, and the LCP will display the message Par. Out of Range. Contact your local supplier for advice. |

Table 9.2

Specifications
MCD 500 Operating Instruction

## 10 Specifications

Supply
Mains voltage (L1, L2, L3)
MCD5-xxxx-T5
MCD5-xxx-T7
MCD5-xxxx-T7
Control voltage (A4, A5, A6)
CV1 (A5, A6)
CV2 (A5, A6)
CV2 (A4, A6)
Current consumption (maximum)
CV1
CV2 (110-120 VAC)
CV2 (220 - 240 VAC)
Mains frequency
Rated insulation voltage to earth
Rated impulse withstand voltage
Form designation
Short circuit capability
Coordination with semiconductor fuses
Coordination with HRC fuses
MCD5-0021B to MCD5-0215B
MCD5-0245C to MCD5-0927B
MCD5-1200C to MCD5-1600C

## Environmental

Protection
$-10^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}$, above $40^{\circ} \mathrm{C}$ with derating

Specifications
MCD 500 Operating Instruction

| Storage temperature |
| :--- |
| Operating Altitude |
| Humidity |
| Pollution degree |
| Heat Dissipation |
| During start |
| During run |
| MCD5-0021B - MCD5-0053B |
| MCD5-0068B - MCD5-0105B |
| MCD5-0131B - MCD5-0215B |
| MCD5-0245C - MCD5-0927C | | $-25^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$ |
| :--- |
| MCD5-1200C - MCD5-1600C |
| Certification |
| C |
| UL/ C-UL |
| CE |
| CCC |
| Marine |
| (MCD5-0021B - MCD5-0215B only) |
| RoHS |

### 10.1 Accessories

### 10.1.1 LCP Remote Mounting Kit

The MCD 500 LCP can be mounted up to 3 metres away from the soft starter, allowing remote control and monitoring. The remote LCP also allows parameter settings to be copied between soft starters.

- 175G0096 Control Panel LCP501


### 10.1.2 Communication Modules

MCD 500 soft starters support network communication using the Profibus, DeviceNet and Modbus RTU protocols, via an easy-to-install communications module. The communications module plugs directly onto the side of the starter.

- 175G9000 Modbus Module
- 175G9001 Profibus Module
- 175G9002 DeviceNet Module
- 175G9009 MCD USB Module

Specifications
MCD 500 Operating Instruction

### 10.1.3 PC Software

MCD PC Software can be used in conjunction with a communications module to provide the following functionality for networks of up to 99 soft starters.

| Feature | MCD-201 | MCD-202 | MCD500 |
| :--- | :---: | :---: | :---: |
| Operational control (Start, Stop, <br> Reset, Quick Stop) | $\bullet$ | $\bullet$ | $\bullet$ |
| Starter status monitoring (Ready, <br> Starting, Running, Stopping, <br> Tripped) | $\bullet$ | $\bullet$ | $\bullet$ |
| Performance monitoring (motor <br> current, motor temperature) |  |  | $\bullet$ |
| Upload parameter settings |  |  | $\bullet$ |
| Download parameter settings |  |  | $\bullet$ |

Table 10.1

The PC software available from Danfoss's website is:

- WinMaster: VLT ${ }^{\circ}$ Soft Starter software for control, configuration and management
- $\quad$ :VLT ${ }^{\circ}$ software for configuration and management.


### 10.1.4 Finger Guard Kit

Finger guards may be specified for personnel safety and can be used on MCD 500 soft starter models 0131B - 1600C. Finger guards fit over the soft starter terminals to prevent accidental contact with live terminals. Finger guards provide IP20 protection.

- MCD5-0131B ~MCD5-0215B: 175G5662
- MCD5-245C: 175G5663
- MCD5-0360C ~MCD5-0927C: 175G5664
- MCD5-1200C ~MCD5-1600C: 175G5665


### 10.1.5 Surge Protection Kit (Lightning Protection)

As standard, MCD 500 rated impulse withstand voltage is limited to 4 kV . The surge protection kits protect the system and make the soft starter immune to high voltage impulses.

6kV

- 175G0100 SPD Surge protection kit for G1
- 175G0101 SPD Surge protection kit, G2-G5

12kV

- 175G0102 SPD Surge protection kit for G1
- 175 G 0103 SPD Surge protection kit, G1-G5


Illustration 10.1

## 11 Bus Bar Adjustment Procedure (MCD5-0360C - MCD5-1600C)

## NOTE

Many electronic components are sensitive to static electricity. Voltages so low that they cannot be felt, seen or heard, can reduce the life, affect performance, or completely destroy sensitive electronic components. When performing service, proper ESD equipment should be used to prevent possible damage from occurring.

All units are manufactured with input and output bus bars at the bottom of the unit as standard. The input and/or output bus bars can be moved tot he top of the unit if required.


## NOTE

Remove the main plastic slowly to avoid damaging the keypad wiring loom which runs between the main plastic and the backplane PCB.


1. Unscrew and remove the magnetic bypass plates (models MCD5-0620C to MCD5-1600c ONLY).
2. Remove the CT assembly (three screws).
3. Identify which bus bars are to be moved. Remove the bolts holding these bus bars in place then slide the bus bars out through the bottom of the starter (four bolts per bus bar).

## Table 11.1

## NOTE

If moving the input bars, the CTs must also be reconfigured.

1. Label the CTs L1, L2 and L3 (L1 is leftmost when working from the front of the starter). Remove the cable ties and unscrew the CTs from the bracket.
2. Move the CT bracket to the top of the starter. Position the CTs for the correct phases, then screw the CTs to the bracket. For models MCD5-0360C - MCD5-0930, the CTs must be placed on an angle (the left hand legs of each CT will be on the top row of holes and the right hand legs will be on the bottom tabs).

www.danfoss.com/drives

## TECHNICAL DATA SHEET

Equipment Type:Power Supply
Location:Power Distribution
Model Numbers:
CP M SNT 120W 24V 5A
Manufacturer: Weidmuller
Supplier:Ramelec2/5 Breene PlaceMorningsideQld 4170
Ph: 0738991322


PRO-M = Power-Reliable-Optimized
The perfectly reliable power supply for automation technology.
The ten different versions for the 24V-DC power supply all feature a solid but thin metal housing which enables them to be installed without any side gaps. This results in less space required on the mounting rail. Wide range of $A C / D C$ inputs and a wide temperature range enable them to be used anywhere. Because of its high efficiency, resistance to overloads and high power reserves, the PRO$M$ is a trusted power supply for use in any application. The three-phase PRO-M power supply modules continue to function reliably when one phase fails (i.e., in twophase mode).

General ordering data

|  |  |
| :--- | :--- |
| Type | CP M SNT 120W 24V 5A |
| Order No. | 8951340000 |
| Version | Power supply, switch-mode power supply unit |
| GTIN (EAN) | 4032248742554 |
| Qty. | $1 \mathrm{pc}(\mathrm{s})$. |

[^50]
## Dimensions and weights

| Width | 40 mm | Height | 130 mm |
| :---: | :---: | :---: | :---: |
| Depth | 125 mm | Weight | 0.7 kg |
| Net weight | 724.3 g |  |  |

Temperatures

| Operating temperature | $-25^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$ | Storage temperature | $-40^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$ |
| :--- | :--- | :--- | :--- |

## Input

| AC current consumption | $\begin{aligned} & 1.1 \mathrm{~A} @ 230 \mathrm{VAC} / 2.0 \mathrm{~A} \\ & @ 115 \mathrm{~V} \text { AC } \end{aligned}$ | DC current consumption | 0.4 A @ 370 V DC / 1.2 A <br> @ 120 V DC |
| :---: | :---: | :---: | :---: |
| $\overline{\mathrm{DC}}$ input voltage range | $\begin{aligned} & 80 . . .370 \text { V DC (Derating @ } \\ & 120 \text { V DC) } \end{aligned}$ | Frequency range AC | $47 . . .63 \mathrm{~Hz}$ |
| Input fuse | Yes | Input fuse (internal) | Yes |
| Input voltage range AC | $\begin{aligned} & 85 . . .264 \text { V AC (Derating @ } \\ & 100 \text { V AC) } \end{aligned}$ | Inrush current | max. 40 A |
| Recommended back-up fuse | 4 A / DI, safety fuse <br> 6 A, Char. B, circuit breaker <br> 3... 5 A, Char. C, circuit <br> breaker | Wire connection method | Screw connection |
| rated input voltage | 100... 240 V AC (widerange input) |  |  |
| output |  |  |  |
|  |  |  |  |
| Output current | 5 A | Output power | 120 W |
| Output voltage type | DC | Output voltage, max. | 29.5 V |
| Output voltage, min. | 22.5 V | Output voltage, note | (adjustable via potentiometer on front) |
| Overload protection | Yes | Parallel connection option | yes, max. 5 |
| Powerboost @ 24 V DC, $60{ }^{\circ} \mathrm{C}$ | 6 A for 1 min, $\mathrm{ED}=5 \%$ | Rated (nominal) output current @ U $\mathrm{U}_{\text {Nom }}$ | $5 \mathrm{~A} @ 60^{\circ} \mathrm{C}$ |
| Wire connection method | Screw connection | continous output current @ 24 V DC | 6.0 A @ $45^{\circ} \mathrm{C}, 5.3 \mathrm{~A} @ 55$ <br> ${ }^{\circ} \mathrm{C}, 3.8 \mathrm{~A} @ 70^{\circ} \mathrm{C}$ |
| rated output voltage | 24 V DC $\pm 1$ \% | residual ripple, breaking spikes | $<50 \mathrm{mV}$ Ss @ $24 \mathrm{VDC}, \mathrm{I}_{\mathrm{N}}$ |

## General data

| AC failure bridging time @ $\mathrm{I}_{\text {Nom }}$ | $\begin{aligned} & >100 \mathrm{~ms} @ 230 \mathrm{~V} \text { AC / > } \\ & 20 \mathrm{~ms} @ 115 \mathrm{~V} \mathrm{AC} \end{aligned}$ | Current limiting | $>120 \% \mathrm{I}_{\mathrm{N}}$ |
| :---: | :---: | :---: | :---: |
| Degree of efficiency | $90 \text { \% @ } 230 \text { V AC / } 88 \text { \% }$ $\text { @ } 115 \text { V AC }$ | Housing version | Metal, corrosion resistant |
| Indication | Operation, green LED | MTBF | $\begin{aligned} & >500,000 \mathrm{~h} \text { acc. to IEC } \\ & 1709 \text { (SN29500 } \end{aligned}$ |
| Mounting position, installation notice | Horizontal on TS35 mounting rail, with 50 mm of clearance at top and bottom for air circulation. Can be mounted side by side with no space in between. | Operating temperature | $-25^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$ |
| Power factor (approx.) | $\begin{aligned} & >0.5 @ 230 \mathrm{~V} \text { AC / > } 0.6 \\ & @ 115 \mathrm{~V} \text { AC } \end{aligned}$ | Protection against over-heating | Yes |
| Protection against reverse voltages from the load | 30... 35 V DC | Short-circuit protection | Yes |
| Weight | 0.7 kg |  |  |

## EMC / shock / vibration

| Limiting of mains voltage harmonic currents | in accordance with EN 61000-3-2 | Noise emission acc. to EN55022 | Class B |
| :---: | :---: | :---: | :---: |
| Interference immunity test acc. to | EN 61000-4-2 (ESD)\| <br> EN 61000-4-3 and EN <br> 61000-4-8 (fields)\|EN <br> 61000-4-4 (burst)\|EN <br> 61000-4-5 (surge)\|EN <br> 61000-4-6 (conducted)। <br> EN 61000-4-11 (dips) | Shock resistance IEC 60068-2-27 | 30 g in all directions |
| Insulation coordination |  |  |  |
| Class of protection | I, with PE connection | Insulation voltage | 3 kV input/ouput; 2 kV input/earth; 0.5 kV output/earth |
| Pollution severity | 2 | electrical isolation, input-earth | 2 kV |
| electrical isolation, input-output | 3 kV | electrical isolation, output-earth | 0.5 kV |
| Electrical safety (applied standards) |  |  |  |
| Electrical machine equipment | Acc. to EN60204 | For use with electronic equipment | Acc. to EN50178 / VDE0160 |
| Protection against dangerous shock currents | Acc. to VDE0106-101 | Protective separation protection against electrical shock | VDE0100-410 / acc. to DIN57100-410 |
| Safety extra-low voltage | SELV acc. to EN60950, PELV acc. to EN60204 | Safety transformers for switch-mode power supplies | Acc. to EN 61558-2-17 |
| Connection data (input) |  |  |  |
| Conductor cross-section, AWGcmil, max. | 12 | Conductor cross-section, AWGcmil , min | $26$ |
| Conductor cross-section, flexible , min. | $0.5 \mathrm{~mm}^{2}$ | Conductor cross-section, rigid , max. | $6 \mathrm{~mm}^{2}$ |
| Conductor cross-section, rigid , min. | $0.5 \mathrm{~mm}^{2}$ | Number of terminals [Input] | 3 for L/N/PE |
| Tightening torque, max. | 0.6 Nm | Tightening torque, min. | 0.5 Nm |
| Wire connection cross section, flexible (input), max. | 2.5 mm ${ }^{2}$ |  |  |

## Connection data (output)

Conductor cross-section, AWGcmil ,
max. 12

Conductor cross-section, flexible , max. $2.5 \mathrm{~mm}^{2}$
Conductor cross-section, rigid, max. $6 \mathrm{~mm}^{2}$
Number of terminals [Output] 5 (++/-)
Tightening torque, min. 0.5 Nm

Conductor cross-section, AWGcmil, min.
Conductor cross-section, flexible , min. $0.5 \mathrm{~mm}^{2}$
Conductor cross-section, rigid , min. $0.5 \mathrm{~mm}^{2}$
Tightening torque, max.

CP M SNT 120W 24V 5A

Technical data

Weidmüller Interface GmbH \& Co. KG
Klingenbergstraße 16
D-32758 Detmold
Germany
Fon: +49 5231 14-0
Fax: +49 5231 14-292083
www.weidmueller.com

Approvals

| Institute (GERMLLOYD) | Certificate No. (GERMLLOYD) | 94767-10 |
| :--- | :--- | :--- |
| Institute (cULus) | Certificate no. (cULus) | E258476VOL1SEC22 |
| Institute (cURus) | Certificate No. (cURus) | E255651VOLX3A13 |

Classifications

| ETIM 3.0 | ECOO1039 |  | $27-04-90-02$ |
| :--- | :--- | :--- | :--- |
| eClass 6.2 | $27-04-90-04$ | eClass 5.1 | $27-04-90-04$ |

## Approvals

Approvals

## $\frac{\Delta}{\text { TÜV }}$

Type
Approved

| ROHS | Conform |
| :--- | :--- |
| Downloads |  |
|  | Operating instructions |
| Package insert | K469_12 11.pdf |
| Declaration of Conformity | $\underline{\text { Warranty information }}$ |
| PDF |  |
| EPLAN |  |
| 3-D model |  |

[^51]CP M SNT 120W 24V 5A
Weidmüller Interface GmbH \& Co. KG Klingenbergstraße 16
D-32758 Detmold
Germany
Fon: +49 5231 14-0
Drawings
Fax: +49 5231 14-292083
www.weidmueller.com

## Electric symbol


win DC comecton, note polerty

## TECHNICAL DATA SHEET

Equipment Type:
Location:
Model Numbers:DAR-275V
Manufacturer:
Supplier:Energy Correction OptionsPO Box 431Kelvin Grove, QLD 4059
Ph: 0733560577Fax: 0733561432Web: www.ecoptions.com.au

## INSTALLATION INSTRUCTIONS



## 1. PREPARATION



DANGER: Electrical shock or burn hazard. Installation of this device should only be made by qualified personnel. Failure to lockout electrical power during installation or maintenance can result in fatal electrocution or severe burns. Before making any connections be sure that power has been removed from all associated wiring, electrical panels, and other electrical equipment.

## CAUTION NOTES:

1. The installation of this device should follow all applicable electrical codes, such as the National Electrical Code.
2. Check to make sure line voltage does not exceed DAR275V voltage ratings.
3. Follow all instructions to ensure correct and safe operation.
4. Do not attempt to open or tamper with the DAR in any way as this may compromise performance and will void warranty. No user serviceable parts are contained.

## 2. INTRODUCTION

Selected DSD, TDS \& TDF DINLINE Surge Protection Devices include status monitoring circuits which provide visual status display of device capacity. They may also provide a low voltage opto-coupler alarm output circuit that can be connect to the DAR to provide potential free (Form C) change-over contacts. The DAR alarm contacts may be used to provide output to external alarm systems or remote monitoring circuits.

One DAR can be used per DSD/TDS/TDF opto-coupler alarm or up to 16 DSD opto-coupler alarms can be connected in series to the one DAR to provide a common output. It is recommended that the DAR be powered from the same power circuit that feeds the device(s) being monitored, however the DAR can be powered from other circuits. This allows for example, one DAR unit to be connected to separate SPDs that are protecting a three phase circuit.

Note. Depending upon the usage of the DAR output contacts, failure of power to the DAR may be interpreted as a failure of one or more of the SPDs being monitored. Visual inspection of the DAR and SPDs status displays would determine this.

## 3. MOUNTING

The DAR is designed to clip to 35 mm (top hat) DIN rails (standard EN50022). Unless otherwise mechanically restrained, use horizontal DIN rails with the DAR module spring clips to the bottom and the label text the correct way up.

NOTE: The DAR must be installed in an enclosure or panel that:

- prevents the DAR temperature from exceeding

$$
131^{\circ} \mathrm{F}\left(55^{\circ} \mathrm{C}\right)
$$

- provides adequate electrical and safety protection
- prevents the ingress of moisture and water
- allows DAR status indicators to be inspected


## 4. ELECTRICAL CONNECTION

The interconnecting wiring should:

- be of size \#10 to \#14 AWG ( $2.5 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}$ ) solid or stranded conductor.
- The wire insulation should be stripped back $5 / 16^{\prime \prime}(8 \mathrm{~mm})$.
- NOTE: Do not use greater than 9inlbs (1Nm) of torque when tightening the terminals.


## CONNECTION TO TELECOMMUNICATIONS NETWORKS

The DAR is approved for use in Australia where the alarm contacts may be connected to private lines or building cabling associated with the telecommunications network. NO direct connection to the public switched network should be made.

## INSTALLATION INSTRUCTIONS

## 5. INTERCONNECTION

When connecting the DAR to a single opto-coupler output the + terminal of the SPD should connect to the + terminal on the DAR. The - terminal should connect to the -- terminal.

+/- terminal connections are polarity sensitive. Do not reverse.

When connecting the DAR to multiple opto-couplers the optocouplers should be connected in series with + terminal of one connected to the - terminal of the next. The DAR + terminal should connect to + SPD terminal at one end of the series connection and the - DAR terminal connect to the - SPD terminal at the other end of the series connection.


## 5. STATUS INDICATION

\begin{tabular}{|c|c|c|c|}
\hline \& $$
\sqrt{ }
$$ \& 1 \& $X$ <br>
\hline STATUS \& Protection Operational \& Protection Alarm \& Fault Mode <br>
\hline DISPLAY \& Normal Fault (8)

(6) \& Normal \& \begin{tabular}{l}
Normal
<br>
Fault

\end{tabular} <br>

\hline EXPLANATION \& | Normal operation |
| :--- |
| Normal (green) indicator ON |
| Red indicator OFF |
| Relay is energised |
| Power is supplied | \& | DSD in alarm mode or power to DSD has been removed |
| :--- |
| Normal (green) indicator OFF |
| Red indicator ON |
| Relay is de-energised |
| Power is supplied | \& | Power to DAR removed |
| :--- |
| Protection status unknown |
| Normal (green) indicatorOFF |
| Red indicator OFF |
| Relay is de-energised |
| Power is OFF | <br>

\hline
\end{tabular}

## 6. FUSING AND ISOLATION

Overcurrent protection must be installed in the upstream circuit of the power supply to the DAR to provide protection to the unit itself and the wiring in case of fault conditions.
The fuse rating should be based on the wiring size used to connect to the DAR Ph \& N terminals. Australian regulations AS3000-1991, Table B2 specifies the following upstream protection for single phase circuits, unenclosed in air.

| Cable Size | HRC Fuse or | CB Rewirable Fuse |
| :--- | :---: | :---: |
| $1.5 \mathrm{~mm}^{2}$ | 16 A | 12 A |
| $2.5 \mathrm{~mm}^{2}$ | 20 A | 16 A |
| $4 \mathrm{~mm}^{2}$ | 25 A | 20 A |
| $6 \mathrm{~mm}^{2}$ | 32 A | 25 A |

Where overcurrent protection of the appropriate rating or smaller is already fitted in the upstream circuit, overcurrent protection at the DAR will not be required

## 6. MAINTENANCE \& TESTING

Before removing a DAR unit from service, ensure that the power has been removed. Maintenance, testing and replacement should only be undertaken by qualified personnel.

Testing of a DAR unit which is connected to a fully functional DSD unit can be accomplished by removing power to the DSD only. The DAR Status indication and output contacts should alter from the Normal to Fault condition.

Testing of the DAR unit alone may be accomplished by disconnecting the + / -connections to the unit. When power is applied the DAR "Fault" Status Indicator should be illuminated. By connecting the + / - terminals together, the "Normal" Status Indicator should be illuminated. The output contacts should alter to the appropriate state.

## 7. USE OF OTHER INTERFACES

Only DAR units are recommended for the interfacing of equipment to the DSD, TDS \& TDF opto-coupler alarm output circuit(s). The direct connection of other equipment to these opto-coupler alarm outputs may not provide sufficient isolation or exceed the opto-coupler specifications. This may damage the SPD and/or the connected equipment. Warranty may be voided under such circumstances.

NOTE: In connecting to the SPD opto-coupler alarm output(s), do not reverse the +/- connections as damage may occur.

## TECHNICAL DATA SHEET

Equipment Type:Surge Filter Alarm Relay
Location:Power Distribution
Model Numbers:TDF-10A-240V
Manufacturer:
Critec
Supplier:Energy Correction OptionsPO Box 431Kelvin Grove, QLD 4059
Ph: 0733560577
Fax: 0733561432
Web: www.ecoptions.com.au

## Features

- CRITEC ${ }^{\circledR}$ Transient Discriminating (TD) Technology provides increased service life
- In-line series protection
- High efficiency low pass sine wave filtering - ideal for the protection of switched mode power supplies
- Three modes of protection: L-N, L-PE \& N-PE
- 35 mm DIN rail mount - simple installation
- LED status indication and opto-isolated output - for remote status monitoring
- CE, UL® 1449

Ed. 3 Listed

## CRITEC ${ }^{\circledR}$ Transient Discriminating Filter

The TDF series has been specifically designed for process control applications to protect the switched mode power supply units on devices such as PLC controllers, SCADA systems and motor controllers. Units are UL ${ }^{\circledR}$ Recognized and available for 3A, 10A and 20A loads and suitable for $110-120 \mathrm{~V}$ ac/dc and 220-240Vac circuits.
The TDF is a series connected, single phase surge filter providing an aggregate surge capacity of 50kA ( $8 / 20 \mu \mathrm{~s}$ ) across L-N, L-PE,
 and $N-P E$. The low pass filter provides up to 65 dB of attenuation to voltage transients. Not only does this reduce the residual let-through voltage, but it also helps further reduce the steep voltage rate-of-rise providing superior protection for sensitive electronic equipment.


| Model | TDF3A120V | TDF3A240V | TDF10A120V | TTDF10A240V | TDF20A120V | TDF20A240V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Item Number for Europe | 700001 | 700002 | 700003 | 700004 | 700005 | 700006 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | $110-120 \mathrm{~V}$ | 220-240 V | 110-120 V | 220-240 V | 110-120 V | 220-240 V |
| Distribution System | TN-C-S, TN-S |  |  |  |  |  |
| Max Cont. Operating Voltage, Uc | 170VAC | 340VAC | 170VAC | 340VAC | 170VAC | 340VAC |
| Stand-off Voltage | 240 V | 400 V | 240 V | 400V | 240V | 400V |
| Frequency | $0-60 \mathrm{~Hz}$ | 50/60Hz | $0-60 \mathrm{~Hz}$ |  |  | 50/60Hz |
| Max Line Current, $\mathrm{L}_{\mathrm{L}}$ | 3 A |  | 10 A |  | 20 A |  |
| Operating Current @ Un | 135 mA | 250 mA | 240 mA | 480 mA | 240 mA | 480 mA |
| Max Discharge Current, $I_{\text {max }}$ | 10kA $8 / 20 \mu \mathrm{~S}$ N-PE 20kA $8 / 20 \mu \mathrm{~s}$ L-N 20kA 8/20us L-PE |  |  |  |  |  |
| Protection Modes | All modes protected |  |  |  |  |  |
| Technology | In-line series low pass sine wave filter TD Technology |  |  |  |  |  |
| Voltage Protection Level, $U_{p}$ | $\begin{aligned} & 500 \mathrm{~V} @ \text { 500A } \\ & 250 \mathrm{~V} \text { @ 3kA } \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} @ \text { 500A } \\ & 600 \mathrm{~V} \text { @ 3kA } \end{aligned}$ | $\begin{aligned} & 500 \mathrm{~V} @ 500 \mathrm{~A} \\ & 250 \mathrm{~V} @ 3 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} @ \text { 500A } \\ & 600 \mathrm{~V} @ 3 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & \text { 500V @ 500A } \\ & \text { 250V @ 3kA } \end{aligned}$ | $\begin{aligned} & \text { 700V @ 500A } \\ & 600 \mathrm{~V} @ 3 \mathrm{kA} \end{aligned}$ |
| Filtering | -62dB @ 100kH |  | -65dB @ 100k |  | -53dB @ 100kHz |  |
| Status | Green LED. On=Ok. Isolated opto-coupler output |  |  |  |  |  |
| $\begin{aligned} & \text { Dimensions H x D x W: } \\ & \mathrm{mm} \text { (in) } \end{aligned}$ | $90 \times 68 \times 72$ $90 \times 68 \times 144$ <br> $(3.54 \times 2.68 \times 2.83)$ $(3.54 \times 2.68 \times 5.67)$ |  |  |  |  |  |
| Module Width | 4 M |  | 8 M |  |  |  |
| Weight: kg (lbs) | 0.7 (1.54) |  | 1.48 (3.25) |  | 1.57 (3.46) |  |
| Enclosure | DIN 43880, UL94V-0 thermoplastic, IP 20 ( NEMA $^{\oplus}-1$ ) |  |  |  |  |  |
| Connection | $1 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}$ (\#18AWG to \#10) |  |  |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |  |  |
| Back-up Overcurrent | 3A |  | 10A |  | 20A |  |
| Protection | $-35^{\circ} \mathrm{C}$ to $55^{\circ} \mathrm{C}\left(-31^{\circ} \mathrm{F}\right.$ to $\left.131^{\circ} \mathrm{F}\right)$ |  |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |  |  |
| Approvals | C-Tick, CE (NOM 3A, 120V), CSA 22.2, UL® 1283, UL® 1449 Ed 3 Recognized Component Type 2 |  |  |  |  |  |
| Surge Rated to Meet | ANS ${ }^{\text {®/IEEE }}{ }^{\text {® }}$ C62.41.2 Cat A, Cat B, Cat C |  |  |  |  |  |

(1) Opto-coupler output can be connected to DINLINE Alarm Relay (DAR275V) to provide Form C dry contacts.

[^52]
## Features

- In-line series protection
- EMI/RFI noise filtering - protects against industrial electrical noise
- Compact design - fits into motor control and equipment panels
- Three modes of protection: L-N, L-PE \& N-PE
- 35 mm DIN rail mount - simple installation
- LED power indicator


## CRITEC ${ }^{\circledR}$ Dinline Surge Filter

The "two port" DSF series has been specifically designed for process control applications to protect the switched mode power supply units on devices such as PLC controllers, SCADA systems and motor controllers. The 30 V unit is suitable for 12 V and $24 \mathrm{Vac} / \mathrm{dc}$ signaling and control systems.
The 6A DSF series incorporates a space efficient, low pass, series filter which provides attenuation to high frequency interference. The larger 20A model provides status indication and a higher surge rating, making this ideal for the protection of higher risk equipment.



| Model | DSF6A30V | DSF6A150V | DSF6A275V | DSF20A275V |
| :---: | :---: | :---: | :---: | :---: |
| Item Number for Europe | 702090 | 701000 | 701030 | 701020 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | 24 | 110-120 V | 220-240 V |  |
| Distribution System | 1Ph 2W+G |  |  |  |
| System Compatibility | TN-S, TN-C-S |  |  |  |
| Max Cont. Operating Voltage, Uc | 30VAC, 38VDC | 150VAC | 275VAC |  |
| Frequency | 0-60Hz | 50/60Hz |  |  |
| Max Line Current, $\mathrm{I}_{1}$ | 6A |  |  | 20 A |
| Operating Current @ U ${ }_{\text {n }}$ | 7 mA |  |  |  |
| Max Discharge Current, $\mathrm{I}_{\text {max }}$ | 4kA 8/20رs | $16 \mathrm{kA} 8 / 20 \mu \mathrm{~s}$ |  | $\begin{aligned} & \text { 15kA 8/20 } \mathrm{LS} \text { L-N } \\ & \text { 15kA 8/20 L-PE } \\ & \text { 25kA } 8 / 20 \mu \mathrm{~s} \text { N-PE } \end{aligned}$ |
| Protection Modes | All modes protected |  |  |  |
| Technology | In-line series filter MOV |  |  |  |
| Voltage Protection Level, $U_{p}$ | 110 V @ 3kA | 400V @ 3kA | 750V @ 3kA | 710 V @ 3kA |
| Filtering | -3dB @ 300kHz |  |  | -3dB @ 62kHz |
| Status | LED power indicator |  |  | Status indicator |
| Dimensions H x D x W: mm (in) | $\begin{aligned} & 90 \times 68 \times 36 \\ & (3.54 \times 2.68 \times 1.42) \end{aligned}$ |  |  | $\begin{aligned} & 90 \times 68 \times 72 \\ & (3.54 \times 2.68 \times 2.83) \end{aligned}$ |
| Module Width | 2 M |  |  | 4M |
| Weight: kg (lb) | 0.2 (0.441) |  |  | 0.7 (1.543) |
| Enclosure | DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1) |  |  |  |
| Connection | $1 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}$ (\#18AWG to \#10AWG) |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |
| Back-up Overcurrent Protection | 6A |  |  | 20A |
| Temperature | $-35^{\circ} \mathrm{C}$ to $55^{\circ} \mathrm{C}\left(-31^{\circ} \mathrm{F}\right.$ to $\left.131^{\circ} \mathrm{F}\right)$ |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |
| Approvals | C-Tick, CE, NOM, UL® 1449 Ed 3 Recognized Component Type 2 | C-Tick, CE |  |  |
| Surge Rated to Meet | ANSI®/EEE ${ }^{\text {C }}$ C2.41.2 Cat A, Cat B |  |  |  |

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## WARNING

ERICO products shall be installed and used only as indicated in ERICO's product instruction sheets and training materials. Instruction sheets are available at www.erico.com and from your ERICO customer service representative. Improper installation, misuse, misapplication or other failure to completely follow ERICO's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death.

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## TECHNICAL DATA SHEET

Equipment Type:
Location:
Model Numbers:
Manufacturer:
Supplier:TDS1100-2SR-277

Surge Diverter

Power Distribution

TDS1100-2SR-277

Critec

Energy Correction Options PO Box 431
Kelvin Grove, QLD 4059
Ph: 0733560577
Fax: 0733561432
Web: www.ecoptions.com.au

## CRITEC ${ }^{\circledR}$ Transient Discriminating Surge Diverters



## Surge Protection And Surge Ratings

The stress, which an SPD will experience under surge conditions, is a function of many complex and interrelated parameters. These include:

- Location of the SPD(s) within the structure - are they located at the main distribution board or within the facility at secondary board, or even in front of the end-user equipment?
- Method of coupling the lightning strike to the facility for example, is this via a direct strike to the structures LPS, or via induction onto building wiring due to a nearby strike?
- Distribution of lightning currents within the structure for example, what portion of the lightning current enters the earthing system and what remaining portion seeks a path to remote grounds via the power distribution system and equipotential bonding SPDs?
- Type of power distribution system - the distribution of lightning current on a power distribution system is strongly influenced by the grounding practice for the neutral conductor. For example, in the TN-C system with its multiple earthed neutral, a more direct and lower impedance path to ground is provided for lightning currents than in a TT system.
- Additional conductive services connected to the facility - these will carry a portion of the direct lightning current and therefore reduce the portion which flows through the power distribution system via the lightning equipotential bonding SPD.
- Type of waveshape - it is not possible to simply consider the peak current which the SPD will have to conduct, one also has to consider the waveshape of this surge. It is also not possible to simply equate the areas under the current-time curves (also referred to as the action integral) for SPDs under different waveshapes.

Many attempts have been made to quantify the electrical environment and "threat level" which an SPD will experience at different locations within a facility. The new IEC ${ }^{\text {sM }}$ standard on lightning protection, IEC 62305-4 "Protection against lightning - Part 4: Electrical and electronic systems within structures" has sought to address this issue by considering the highest surge magnitude which may be presented to an SPD based on the lightning protection level (LPL) being considered. For example, this standard postulates that under a LPL I the magnitude of a direct strike to the structure's LPS may be as high as 200kA $10 / 350$. While this level is possible, its statistical probability of occurrence is approximately $1 \%$. In other words, $99 \%$ of discharges will be less than this postulated 200 kA peak current level.

An assumption is made that $50 \%$ of this current is conducted via the building's earthing system, and 50\% returns via the equipotential bonding SPDs connected to
a three wire plus neutral power distribution system. It is also assumed that no additional conductive service exists. This implies that the portion of the initial 200 kA discharge experienced by each SPD is 25 kA .

Simplified assumptions of current dispersion are useful in considering the possible threat level, which the SPD(s) may experience, but it is important to keep in context the assumptions being made. In the example above, a lightning discharge of 200kA has been considered. It follows that the threat level to the equipotential bonding SPDs will be less than 25kA for 99\% of the time. In addition, it has been assumed that the waveshape of this current component through the SPD(s) will be of the same waveshape as the initial discharge, namely 10/350, while in reality the waveshape have been altered by the impedance of building wiring, etc.

Many standards have sought to base their considerations on field experience collected overtime. For example, the IEEE® guide to the environment C62.41.1 and the recommended practice C62.41.2 present two scenarios of lightning discharge and different exposure levels under each of these depending on the location where the SPD is installed. In this standard, Scenario II depicts a direct strike to the structure, while Scenario I depicts a nearby strike and the subsequent conducted current into a structure via power and data lines. The highest surge exposure considered feasible to an SPD installed at the service entrance to a facility under Scenario I is $10 \mathrm{kA} 8 / 20$, while under Scenario II it is considered to be 10kA 10/350 (exposure Level 3).

From the above, it is apparent that the selection of the appropriate surge rating for an SPD depends on many complex and interconnected parameters. When addressing such complexities, one needs to keep in mind that one of the more important parameters in selecting an SPD is its limiting voltage performance during the expected surge event, and not the energy withstand which it can handle.


Protection zones defined by specific product application.

## Advanced Technologies - The ERICO ${ }^{\circ}$ Advantage

## Transient Discriminating Technology

To meet the fundamental requirements of performance, longer service life and greater safety under real world conditions, ERICO has developed Transient Discriminating (TD) Technology.

This quantum leap in technology adds a level of "intelligence" to the Surge Protection Device enabling it to discriminate between sustained abnormal over-voltage conditions and true transient or surge events. Not only does this help ensure safe operation under practical application, but it also prolongs the life of the protector since permanent disconnects are not required as a means of achieving internal over-voltage protection.

## Traditional Technologies

Conventional SPD technologies utilize metal oxide varistors and/ or silicon avalanche diodes to clamp or limit transient events. However, these devices are susceptible to sustained $50 / 60 \mathrm{~Hz}$ mains over-voltage conditions which often occur during faults to the utility system. Such occurrences present a significant safety hazard when the suppression device attempts to clamp the peak of each half cycle on the mains over-voltage. This condition can cause the device to rapidly accumulate heat and in turn fail with the possibility of inducing a fire hazard.

## The Core of TD Technology

The secret to ERICO's Transient Discriminating Technology is its active frequency discrimination circuit. This patented device can discriminate between a temporary over-voltage (TOV) condition

and a very fast transient, which is associated with lightning or switching-induced surges. When the transient frequencies are detected, the patented Quick-Switch within TD activates to allow the robust protection to limit the incoming transient. The frequency discriminating circuit that controls the Quick-Switch helps ensure that the SPD device is immune to the effects of a sustained 50 or 60 Hz TOV. This allows the device to keep operating, in order to help provide safe and reliable transient protection, even after an abnormal over-voltage condition has occurred.

## Meeting \& Exceeding UL ${ }^{\circledR}$ Standards

The CRITEC ${ }^{\oplus}$ range of surge protection devices from ERICO® employing TD Technology has been specifically designed to meet and exceed the new safety requirements of UL 1449 Edition 3. To meet the abnormal over-voltage testing of UL 1449 Edition 3, many manufacturers of SPD devices have incorporated fuse or thermal disconnect devices which permanently disconnect all protection from the circuit during an over-voltage event. Transient Discriminating Technology on the other hand will allow the SPD device to experience an abnormal overvoltage up to twice its nominal operating voltage and still remain operational even after this event! This allows the device to help provide safe, reliable and continuous protection to your sensitive electronic equipment. TD Technology is especially recommended for any site where sustained over-voltages are known to occur, and where failure of traditional SPD technologies cannot be tolerated.

The UL 1449 testing standard addresses the safety of an SPD device under temporary and abnormal overvoltage conditions, but does not specifically mandate a design that will give a reliable, long length of service in the real world. Specifically, UL 1449 tests that the SPD remains operational at $10 \%$ above nominal supply voltage, allowing SPD manufacturers to design products that permanently disconnect just above that. Most reputable manufacturer's designs allow for up to a $25 \%$ overvoltage, while ERICO's TD Technology gives even greater overhead.


## Features

- CRITEC TD Technology with thermal disconnect protection
- Compact package, modular DIN rail mounting for limited space requirements
- Three modes of protection: L-N, L-PE \& N-PE
- Indication flags and voltage-free contacts provide remote status monitoring
- Separate plug and base design facilitates replacement of a failed surge module
- 15kA $8 / 20 \mu s$ surge rating per mode
- CE, UL ${ }^{\circledR} 1449$

Edition 3 Listed

## CRITEC ${ }^{\circledR}$ TDS Surge Diverter - TDS 130 Series

Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.
The TDS130 series of surge suppressors provide economical and reliable protection from voltage transients on power distribution systems. The TDS130 is specifically designed for the protection of single phase power supplies within instrumentation and control applications. They are conveniently packaged for easy installation on 35 mm DIN rail within control
 panels.
CRITEC ${ }^{\circledR}$ TD technology helps ensure reliable and continued operation during sustained and abnormal over-voltage events. Internal thermal disconnect devices help ensure safe behavior at end-of life. A visual indicator flag provides user-feedback in the event of such operation. The TDS130 provides a set of optional voltagefree contacts for remote signaling that maintenance is required.
The convenient plug-in module
 and separate base design facilitates replacement of a failed surge module without needing to undo installation wiring.


## Features

- CRITEC® TD Technology with thermal disconnect protection
- Compact design fits into DIN distribution panel boards and motor control centers
- 35 mm DIN rail mount - DIN 43880 profile matches common circuit breakers
- Indication flags and voltage-free contacts provide remote status monitoring
- Separate plug and base design facilitates replacement of a failed surge module
- 50kA $8 / 20 \mu \mathrm{~s}$ maximum surge rating provides protection suitable for sub-distribution panels and a long operational life
- Available in various operating voltages to suit most common power distribution systems
- CE, UL® 1449

Edition 3 Listed

## CRITEC ${ }^{\circledR}$ TDS Surge Diverter - TDS 150 Series

Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.
The TDS150 series of surge suppressors provide economical and reliable protection from voltage transients on power distribution systems. They are conveniently packaged for easy installation on 35 mm DIN rail within main distribution panelboards.
CRITEC ${ }^{\circledR}$ TD technology helps ensure reliable and continued operation during sustained and abnormal
 over-voltage events. Internal thermal disconnect devices help ensure safe behavior at end-of-life. A visual indicator flag provides userfeedback in the event of such operation. As standard, the TDS150 provides a set of voltage-free contacts for remote signaling that maintenance is required.
The convenient plug-in module and separate base design facilitates replacement of a failed surge module without needing to undo installation wiring.


| Model | TDS1501SR150 | TDS1501SR240 | TDS1501SR277 | TDS1501SR560 |
| :---: | :---: | :---: | :---: | :---: |
| Item Number for Europe | 702404 | 702406 | 702407 | 702408 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | 120-150 VAC | 220-240 VAC | 240-277 VAC | 480-560 VAC |
| Max Cont. Operating Voltage, $\mathbf{U}_{\text {c }}$ | 170VAC | 275VAC | 320VAC | 610VAC |
| Stand-off Voltage | 240VAC | 440VAC | 480VAC | 700VAC |
| Frequency | 0-100Hz |  |  |  |
| Short Circuit Current Rating, $\mathrm{Isc}_{\text {c }}$ | 200kAIC |  |  |  |
| Back-up Overcurrent Protection | 125 AgL , if supply > 100A |  |  |  |
| Technology | TD with thermal disconnect |  |  |  |
| Max Discharge Current, $\mathrm{I}_{\text {max }}$ | 50kA $8 / 20 \mu \mathrm{~s}$ |  |  |  |
| Nominal Discharge Current, $\mathrm{I}_{\mathrm{n}}$ | 25kA 8/20 ${ }^{\text {s }}$ / 20kA 8/20 |  |  |  |
| Protection Modes | Single mode (L-G, L-N or N-G) |  |  |  |
| Voltage Protection Level $\mathrm{U}_{\mathrm{p}}$ |  | $\begin{aligned} & 700 \mathrm{~V} @ 3 \mathrm{kA} \\ & 1.2 \mathrm{kV} @ \mathrm{In} \end{aligned}$ | $\begin{aligned} & 800 \mathrm{~V} @ 3 \mathrm{kA} \\ & 1.6 \mathrm{kV} @ \text { In } \end{aligned}$ | $\begin{aligned} & 1.8 \mathrm{kV} @ 3 \mathrm{kA} \\ & 2.4 \mathrm{kV} @ \mathrm{In} \\ & \hline \end{aligned}$ |
| Status | N/O, N/C Change-over contact, 250V~/0.5A, max $1.5 \mathrm{~mm}^{2}$ (\#14AWG) terminals <br> Mechanical flag / remote contacts ( R model only) |  |  |  |
| Dimensions H x D x W: mm (in) | $90 \times 68 \times 18(3.54 \times 2.68 \times 0.69)$ |  |  |  |
| Module Width | 1 M |  |  |  |
| Weight: kg (lbs) | 0.12 (0.26) |  |  |  |
| Enclosure | DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1) |  |  |  |
| Connection | $\begin{aligned} & \leq 25 \mathrm{~mm}^{2} \text { (\#4AWG) stranded } \\ & \leq 35 \mathrm{~mm}^{2} \text { (\#2AWG) solid } \end{aligned}$ |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |
| Temperature | $-40^{\circ} \mathrm{C}$ to $80^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.176^{\circ} \mathrm{F}\right)$ |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |
| Approvals | CE, IEC ${ }^{\text {® }}$ 61643-1, UL® 1449 Ed 3 Recognized Component Type 2 |  |  |  |
| Surge Rated to Meet | ANSI® $/$ IEEE $^{\oplus}$ C62.41.2 Cat A, Cat B, Cat C <br> ANSI®/IEEE ${ }^{\oplus}$ C62.41.2 Scenario II, Exposure 2, 50kA 8/20 <br> IEC 61643-1 Class II <br> UL® 1449 Ed3 In 20kA mode |  |  |  |
| Replacement Module | TDS150M150 | TDS150M240 | TDS150M277 | TDS150M560 |

## CRITEC ${ }^{\circledR}$ TDS Surge Diverter - TDS 1100 Series

Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.

The TDS1100 series of surge suppressors provide economical and reliable protection from voltage transients on power distribution systems. They are conveniently packaged for easy installation on 35 mm DIN rail within main distribution panelboards.
CRITEC ${ }^{\circledR}$ TD technology helps ensure reliable and continued operation during sustained and abnormal over-voltage events. Internal thermal disconnect devices help ensure safe behavior
 at end-of-life. A visual indicator flag provides user-feedback in the event of such operation. As standard, the TDS1100 provides a set of voltage-free contacts for remote signaling that maintenance is due.
The convenient plug-in module and separate base design facilitates replacement of a failed surge module without needing to undo installation wiring.


| Model | TDS11002SR150 | TDS11002SR240 | TDS11002SR277 | TDS11002SR560 |
| :---: | :---: | :---: | :---: | :---: |
| Item Number for Europe | 702409 | 702411 | 702412 | 702413 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | 120-150 VAC | $220-240$ VAC | 240-277 VAC | $480-560$ VAC |
| Max Cont. Operating Voltage, $\mathrm{U}_{\text {c }}$ | 170VAC | 275VAC | 320VAC | 610VAC |
| Stand-off Voltage | 240VAC | 440VAC | 480VAC | 700VAC |
| Frequency | 0-100Hz |  |  |  |
| Short Circuit Current Rating, $\mathrm{I}_{\text {sc }}$ | 200kAIC |  |  |  |
| Back-up Overcurrent Protection | 125AgL, if supply > 100A |  |  |  |
| Technology | TD with thermal disconnect |  |  |  |
| Max Discharge Current, $\mathrm{I}_{\text {max }}$ | 100kA 8/20 ${ }^{\text {s }}$ |  |  |  |
| Impulse Current, $\mathrm{l}_{\text {imp }}$ | 12.5kA 10/350 ${ }^{\text {s }}$ |  |  |  |
| Nominal Discharge Current, $I_{n}$ | $50 \mathrm{kA} 8 / 20 \mu \mathrm{~s}$, 40kA 8/20 $\mathrm{s}^{2}$ |  |  |  |
| Protection Modes | Single mode (L-G, L-N or N-G) |  |  |  |
| Voltage Protection Level, $\mathrm{U}_{\mathrm{p}}$ | $\begin{aligned} & 400 \mathrm{~V} @ 3 \mathrm{kA} \\ & 1.0 \mathrm{kV} @ 2 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} @ 3 \mathrm{kA} \\ & 1.2 \mathrm{kV} @ 20 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 800 \mathrm{~V} @ 3 \mathrm{kA} \\ & 1.6 \mathrm{kV} @ 20 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 1.8 \mathrm{kV} @ 3 \mathrm{kA} \\ & \text { 2.4kV @ 20kA } \\ & \hline \end{aligned}$ |
| Status | N/O, N/C Change-over contact, 250V~/0.5A, max $1.5 \mathrm{~mm}^{2}$ (\#14AWG) terminals Mechanical flag / remote contacts (R model only) |  |  |  |
| Dimensions H x x W: mm (in) | $90 \times 68 \times 35(3.54 \times 2.68 \times 1.38)$ |  |  |  |
| Module Width | 2 M |  |  |  |
| Weight: kg (lbs) | 0.24 (0.53) |  |  |  |
| Enclosure | DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1) |  |  |  |
| Connection | $\leq 25 \mathrm{~mm}^{2}$ (\#4AWG) stranded $\leq 35 \mathrm{~mm}^{2}$ (\#2AWG) solid |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |
| Temperature | $-40^{\circ} \mathrm{C}$ to $80^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.176^{\circ} \mathrm{F}\right)$ |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |
| Approvals | CE, IEC® 61643-1, UL® 1449 Ed 3 Recognized Component Type 2 |  |  |  |
| Surge Rated to Meet | ANSI®/IEEE ${ }^{\oplus}$ C62.41.2 Cat A, Cat B, Cat C <br> ANSI®/IEEE ${ }^{\oplus}$ C62.41.2 Scenario II, Exposure 3, 100kA 8/20 s , 10kA 10/350 $\mathrm{\mu}$ <br> IEC 61643-1 Class I and Class II <br> UL® 1449 Ed3 In 20kA mode |  |  |  |
| Replacement MOV Module | TDS150M150 | TDS150M240 | \|TDS150M277 | \|TDS150M560 |

## Features

- CRITEC ${ }^{\oplus}$ TD

Technology with thermal disconnect protection

- Compact design fits into DIN distribution panel boards and motor control centers
- 35 mm DIN rail mount - DIN 43880 profile matches common circuit breakers
- Indication flags and voltage-free contacts provide remote status monitoring
- Separate plug and base design facilitates replacement of a failed surge module
- 50kA $8 / 20 \mu \mathrm{~s}$ maximum surge rating provides protection suitable for sub-distribution panels and a long operational life
- Available in various operating voltages to suit most common power distribution systems
- CE, UL® 1449 Edition 3 Listed


## CRITEC ${ }^{\circledR}$ TDS Surge Diverter - TDS350 Series

Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.
CRITEC ${ }^{\oplus}$ TD technology helps ensure reliable and continued operation during sustained and abnormal over-voltage events. Internal thermal disconnect devices help ensure safe behavior at end-of-life. A visual indicator flag provides user-feedback in the event of such operation. As standard, the TDS provides a set of voltage-free contacts for remote signaling that maintenance is due.
The convenient plug-in module and separate base design facilitates replacement of a failed surge module without needing to undo installation wiring.


68 mm


68 mm




53 mm (2.07")

| Model | TDS350TNC150 | TDS50120240 | TDS350TNC277 | TDS350TT150 | TDS350TT277 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Item Number for Europe | 702414 | 702419 | 702417 | 702416 | 702418 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | 120-150 VAC |  | 240-277 VAC | 120-150 VAC | 240-277 VAC |
| Max Cont. Operating Voltage, $\mathrm{U}_{\text {c }}$ | 170/295VAC | 240/480VAC | 320/536VAC | 170/295VAC | 320/536VAC |
| Stand-off Voltage | 240/415VAC | 240/480VAC | 480/813VAC | 240/415VAC | 480/813VAC |
| Frequency | $0-100 \mathrm{~Hz}$ |  |  |  |  |
| Short Circuit Current Rating, $\mathrm{Isc}_{\text {sc }}$ | 200kAIC |  |  |  |  |
| Back-up Overcurrent Protection | 125AgL, if supply > 100A |  |  |  |  |
| Technology | TD with thermal disconnect |  |  |  |  |
| Max Discharge Current, $\mathrm{I}_{\text {max }}$ | 50kA 8/20 $/ \mathrm{s}$ |  |  | $\begin{aligned} & \text { 12.5kA } 10 / 350 \mu \mathrm{~s} \text { N-PE } \\ & \text { 50kA } 8 / 20 \mu \mathrm{~s} \end{aligned}$ |  |
| Nominal Discharge Current, $\mathrm{I}_{\mathrm{n}}$ | 25kA 8/20رs |  | 20kA 8/20 | 25kA 8/20 ${ }^{\text {us }}$ | 20kA 8/20 |
| Protection Modes | L-N | L-N, N-PE | L-N | L-N, N-PE |  |
| Voltage Protection Level, $\mathrm{U}_{\mathrm{p}}$ | $\begin{aligned} & \text { 400V @ 3kA } \\ & 1.0 \mathrm{kV} @ \ln \end{aligned}$ |  | $\begin{aligned} & \text { 800V @ 3kA } \\ & 1.6 \mathrm{kV} \text { @ In } \end{aligned}$ | $\begin{aligned} & \text { 400V @ 3kA } \\ & 1.0 \mathrm{kV} @ \text { In } \end{aligned}$ | $\begin{aligned} & \text { 800V @ 3kA } \\ & 1.6 \mathrm{kV} @ \text { In } \end{aligned}$ |
| Status | N/O, N/C Change-over contact, 250V~/0.5A, max $1.5 \mathrm{~mm}^{2}$ (\#14AWG) terminals Mechanical flag / remote contacts |  |  |  |  |
| Dimensions H x D x W: mm (in) | $90 \times 68 \times 53$ ( $3.54 \times 2.68 \times 2.07$ ) |  |  | $90 \times 68 \times 70$ (3.54 $\times 2.68 \times 2.76)$ |  |
| Module Width | 3 M |  |  | 4 M |  |
| Weight: kg (lbs) | 0.36 (0.79) |  |  | 0.5 (1.10) |  |
| Enclosure | DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1) |  |  |  |  |
| Connection | $\leq 25 \mathrm{~mm}^{2}$ (\#4AWG) stranded <br> $\leq 35 \mathrm{~mm}^{2}$ (\#2AWG) solid |  |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |  |
| Temperature | $-40^{\circ} \mathrm{C}$ to $80^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.176^{\circ} \mathrm{F}\right)$ |  |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |  |
| Approvals | CE, IEC ${ }^{\circledR} 61643-1$, UL® $^{\oplus} 1449$ Ed 3 Recognized Component Type 2 |  |  |  |  |
| Surge Rated to Meet | ANSI® $/$ IEEE ${ }^{\oplus}$ C62.41.2 Cat A, Cat B, Cat C <br> ANSI®/IEEE ${ }^{\oplus}$ C62.41.2 Scenario II, Exposure 2, 50kA 8/20 ${ }^{\text {s }}$ IEC 61643-1 Class II <br> UL® 1449 Ed3 In 20kA mode |  |  |  |  |
| Replacement MOV Module | TDS150M150 |  | TDS150M277 | TDS150M150 | TDS150M277 |
| Replacement GDT Module | - |  |  | SGD112M |  |
| Replacement GDT Module (Europe) | - |  |  | 702403 |  |


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## WARNING

ERICO products shall be installed and used only as indicated in ERICO's product instruction sheets and training materials. Instruction sheets are available at www.erico.com and from your ERICO customer service representative. Improper installation, misuse, misapplication or other failure to completely follow ERICO's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death.

## TECHNICAL DATA SHEET

Equipment Type: ..... Radio
Location: RTU Section
Model Numbers: ..... RD2006
Manufacturer: ..... Radtel
Supplier: RadtelUnit 127 Birubi StreetCoorparoo QD 4151

DIGITAL INPUTS - 16
Two input voltage ranges are available:

- 10-35VAC/DC RD2006x-Lx-xx
- 70-130VAC/DC RD2006x-Hx-xx


## PULSE COUNTERS

The first two digital inputs can be configured as pulse counters to 5 KHz . All digital inputs can count to 5 Hz

## DIGITAL OUTPUTS - 4

The digital outputs are configurable as either isolated relays or transistor outputs.

- Isolated relays - 2 form A + 2 form C
- 2A @ 30VDC/240VAC
- Transistors - 100mA sinking - 35V max


## ANALOG INPUTS - 8

There are 8 analog input channels, 4 of which may be used as analog outputs with the plug-in 4 channel analog output option. Channel 8 can also be configured internally to monitor the DC supply to the module. All input channels are configurable as either:

- $4-20 \mathrm{~mA} / 1-5 \mathrm{~V}$ Resolution - 12 bits
- 0-20mA / 0-5V Accuracy - 0.1\%
- 0-1V Linearity - 0.1\%


## ANALOG OUTPUTS - 4

The last four analog channels can be configured as outputs by installing the plug-in 4 channel analog output option.

- Output format $4-20 \mathrm{~mA}$
- Resolution - 16 bits
- Accuracy - 0.1\%
- Linearity - 0.1\%


## I/O EXPANSION MODULES

The field I/O of the RD2006 can be expanded up to 512 points by means of the range of I/O expansion modules available. These are DIN rail mounting units and up to 32 modules can be driven from the RS485 port of the RD2006. This means that they can be remote from the RD2006 module within normal limits of RS485 communications.

## Modules available:

- M16-LN 16 Digital Inputs 10-35VAC/DC
- M16-HN 16 Digital Inputs 70-130VAC/DC
- M16-TR 16 Relay Outputs 2A@ 30VDC/240VAC
- M8-AD 8 Analog Inputs $4-20 \mathrm{~mA} / 1-5 \mathrm{~V}, 0-1 \mathrm{~V}$
- 0-20mA/0-5V

PLC CONTROL LOGIC
IEC61131.3 Ladder Diagram

## COMMUNICATIONS PORTS - 5

The RD2006 has five serial communications ports which support a number of communications formats and industrial standard protocols. Port 1 is normally used by the internal data radio, or connected to an external radio or modem.

- Port 1 - Internal or external connection via either FFSK to 4800 baud or RS232 to 115 kB
- Port 2 - RS232 to 115kB
- Port 3 - RS485 to 115kB
- Port 4 - USB 2.0 Programming Port
- Port 5 - Ethernet $10 / 100 \mathrm{Mb} / \mathrm{s}$ or RS232 to 115 kB


## RADIO and MODEM OPTIONS

There is an extensive range of data radios and modems available for the RD2006 modules. These include VHF, UHF, Spread Spectrum and Ethernet. See the radio specifications sheet for further details.

## COMMUNICATIONS PROTOCOLS

RD2006 supports a number of industrial standard protocols including:

- Allen Bradley DF1
- DNP3.0
- GE-Fanuc/Koyo CCM
- Modbus RTU/ASCII
- Modbus TCP
- OPC Server
- Rad-tel Data Communications Protocol (RDCMP)
- Drivers for other third party devices are also available


## DATALOGGING

1Mbyte Flash on-board memory. Logging may be scheduled or event driven up to 100,000 time-stamped readings.

## OPERATING TEMPERATURE

-20 to $+70^{\circ} \mathrm{C}$

## POWER SUPPLY

12 or 24VDC versions available. Power consumption - typical:

- Without on-board radio - 1W
- With on-board radio - Receive only - 2.5W
- Transmit - 20W max


## WEIGHT

- With internal data radio or modem -960 g
- With no internal radio - 650g


## DIMENSIONS

$202 \times 178 \times 60$ mounting plate supplied

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# Radtel 

RAD-TEL SYSTEMS PTY LTD RD2000 IO EXPANSION MODULES
Engineering

## RD2000 10 EXPANSION MODULES

## PART NUMBERS



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RAD-TEL SYSTEMS PTY LTD RD2006 QUICKSTART MANUAL


# RD2006 TELEMETRY MODULE QUICKSTART MANUAL 

This manual is intended to provide sufficient information for the correct installation of your RD2006 telemetry module. In most cases, your RD2006 module will be delivered pre-configured to your project requirements.

For programming information please refer to the MiriMap 2000+ Software on-line help.

PLEASE ENSURE THAT YOU HAVE THE CORRECT POWER SUPPLY VOLTAGE BEFORE POWERING UP THE MODULE

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Frix

RAD-TEL SYSTEMS PTY LTD RD2006 ORDERING INORMATION

There are many variations of the RD2006 telemetry modules available. The following shows the ordering code and details for modules with and without internal data radios. For other radio or modem options please contact Rad-tel Systems directly.

The following options are not fitted as factory standard and need to be requested when ordering:

- 4 Channel Analog Ouput option
- Ethernet Port option

If you are ordering a module to add to an existing system, please be sure to specify the project when ordering the new module.

## ORDERING

Add 'T' for Ethernet Option Otherwise leave blank

Part No. RD2006Tx-aaabb-xx-xx


The RD2006 part number is displayed on the rear of each unit together with other relevant information.

## RD2006R-M5125-LN-12

Hardware version - Rev. 4
Tx frequency - 450.650 MHz
Rx frequency $=450.650 \mathrm{MHz}$
serial no
10462

Brockman Return Water Pumps
Miri Technologies - Perth, West Australia. tel. 461894098998 fax. +61894099229

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## DISPLAY PANEL



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RAD-TEL SYSTEMS PTY LTD
DIGITAL I/O

## DIGITAL INPUTS

There are two different versions of the RD2006 module with respect to Digital Inputs. There is a low voltage version for nominally 12 or 24 volt inputs, and a high voltage version specifically for 110 volt inputs.

$$
\begin{array}{lll}
\text { RD2006L - Lo Voltage } & 10-35 V D C / A C & 4 k 7 \text { Impedance } \\
\text { RD2006H - Hi Voltage } & 70-130 V A C / D C & 27 k \text { Impedance }
\end{array}
$$

This is not an on-board selectable option so please ensure that you have the correct version of hardware for your application. The digital input voltage is marked on the terminal strip label with the Lo voltage inputs being highlighted in blue and the Hi voltage inputs being highlighted in orange.
The digital inputs are supplied in two blocks of 8 inputs each with a separate common terminal. The inputs will accept an AC input voltage or a DC voltage of either polarity.

## PULSE COUNTERS

Each Digital Input may be used as a pulse counter up to 5 Hz . The first two inputs can be configured as high speed pulse counters up to 5 KHz equal (mark space ratio). Where the inputs are used as slow counters (to 5 Hz .) the inputs are usually referred to the digital input common. Where the fast pulse counters are used, the inputs are referred to the module OV supply (ground). They will then accept inputs from common emitter transistors, FETs or reed switches etc as shown below.
The factory default setting is for all inputs to be configured as digital inputs/slow counters. The following jumper settings apply where inputs 1 and 2 are required to be fast counters.

|  | 127 J 30 |
| :---: | :---: |
| All inputs DINs (factory default) |  |
|  | J28 329 |
| DIN1 - Fast Pulse | J27 330 |
|  |  |
|  |  |
|  | J28 J29 |
| DIN2 - Fast Pulse | $J 27 \mathrm{~J} 30$ |
|  | Fan A |
|  |  |



## DIGITAL OUTPUTS

Each Digital Output may be individually configured as an isolated relay or common emitter transistor.

With all jumpers J12-J15 in position A the module is configured for 2 form A and 2 form C relay outputs. (factory default)


With all jumpers J12 - J15 in position B, all outputs are common


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RAD-TEL SYSTEMS PTY LTD
ANALOG OPTIONS

## ANALOG INPUTS

The RD2006 module has 8 analog input channels as standard. These are configured from the factory as $4-20 \mathrm{~mA} / 1-5 \mathrm{~V}$. The following options are available by jumper selection:

## A. 0 -20mA/0-5V <br> B. 4-20mA/1-5V <br> C. 0-1V

Whichever option is selected determines the configuration of ALL analog input channels. Channels 1 to 8 are configured for current or voltage inputs via jumpers J 35 to J 42 respectively. If a jumper is installed in the appropriate location then that channel will operate as a current input. If no jumper is installed, it will operate as a voltage input.

FACTORY DEFAULTS - All channels set to $4-20 \mathrm{~mA}$



## OTHER OPTIONS


POWER SUPPLY MONITOR - Analog Input channel 8 is set by factory default to monitor the supply voltage to the telemetry module. This is particularly useful in solar powered installations. If channel 8 is required as a normal analog input channel then J 24 is moved from position A to position B .

VOLTAGE SOURCE FOR FIELD SENSORS - Analog input channel 8 can be configured as a 5V source to power field sensors to a maximum current supply of 20 mA . To select this option, install jumpers in J16 position B and J22 position A.

ANALOG OUTPUT OPTION - An analog output board must be installed to utilise this option. This is a factory fitted option. When the analog output option is installed, any of the last four channels can be configured as $4-20 \mathrm{~mA}$ outputs.

ANALOG OUTPUTS - Channels 5-8 configured as outputs


Channels 5 to 8 are selected as $4-20 \mathrm{~mA}$ outputs by way of locating jumpers in position A as follows:

Ch. 5 J4
Ch. 6 J5
Ch. 7 J20
Ch. 8 J22 and J16
Note - If channel 8 is configured as an analog output, analog input 8 will still operate as a supply voltage monitor, provided that J 24 is selected in position A.

Note - J9, J10 and J11 are not relevant to the analog channel options.

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## RadCtel

PORT 1 - EXTERNAL RADIO - FFSK or RS232
Port 1 is intended for connection to an external data radio and provides either FFSK or RS232 options. The FFSK is configurable to 4800 baud.
The RS232 option can operate up to 115,200 baud. The on-board selectable options are detailed on the following page of this manual.

PORT 2 \& PORT 5 - RS232
Port 2 and Port 5 can both be used for connection to third party devices via RS232.
Each port can operate up to 115,200 baud.
The on-board selectable options are detailed in the following page of this manual.
Note - Port 5 cannot be used as an RS232 port if the Ethernet connection is being used.

PORT 3 - RS485
Port 3 is an RS485 port intended for use as a multidrop serial connection for I/O expansion modules or third party devices.
It can run either Miri protocol or Modbus.
PORT 4 - USB-B
This port is intended for use as a programming port.
PORT 5 - Ethernet Option
The Ethernet port is a factory fitted 10/100T option which can run either Modbus TCP or Miri protocols. Note that where the Ethernet port is used, Port 5 cannot be used as an RS232 port.

External Radio Port Pin assignment

| 1. | $n / c$ |
| :--- | :--- |
| 2. | RTS |
| 3. | TX data |
| 4. | PTT |
| 5. | GND |
| 6. | RX data |
| 7. | CTS |
| 8. | CD |

View looking into ext. radio port.

8 PIN 1


View looking into RS232 ports.

8 PIN 1


External RS485 port Pin assignment

View looking into RS485 port.
1.
2.

DATA B DATA A GND


123

## RAD-TEL SYSTEMS PTY LTD RADIO COMMUNICATIONS OPTIONS

FACTORY DEFAULTS - INTERNAL RADIO - 2400 baud


There are a number of radio options available for the RD2006 modules. Some of these use audio (FFSK) modulation, whereas others have an RS232 interface. The above jumper configuration is applicable to both VHF and UHF internal radios. If an audio (FFSK) external radio is to be used with the module, this is implemented using Port1. Ports 2 and 5 are available for RS232 connections.

There is a PTT push button located under the bottom right hand corner of the module. This is intended to be used to check the SWR of antenna installations during commissioning.

FFSK BAUD RATE OPTIONS - The jumper arrangement shown is the factory default configuration for an internal radio operating at 2400 baud.
Other options are achieved by implementing the following changes to J18, J33, J34.


FFSK EXTERNAL RADIO - To configure the module for an external audio radio, make the following changes to J1, J3, J7, J8, and J9, J10, J11.


RS232 EXTERNAL RADIO CONNECTION - To configure the module for an external RS232 radio port, jumpers J1, J9, J10, J11 should be set up as follows:


NOTE - The above configuration is the factory default configuration and so it may not be necessary to move any jumpers to implement this mode.

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## RadCtel

The RD2006 module is installed by means of the clip in stainless steel mounting bracket supplied with the unit. Please ensure when mounting the telemetry module that sufficient clearance is left for wiring to and from the unit. Recommended minimum clearances are shown here.

The module is removed by depressing the small tongue at the bottom of the mounting bracket and sliding the unit upwards.
The terminal blocks are removable such that the I/O wiring need not be disturbed when replacing a module in the field.


RAD-TEL SYSTEMS PTY LTD WIRING DIAGRAM

The digital outputs are configurable for relay or solid state format as described in this manual. The relay format is shown here. The relays are

Internal DC-DC converter

There are 8 Analog input channels which share a common ground. Channels 5-8 may be configured as $4-20 \mathrm{~mA}$ analog outputs by way of a factory installed analog output option.


NEGATIVE SUPPLY \& COAXIAL CONNECTION MUST BE GROUNDED

## miriad $_{\text {AD }}$ <br> 合 Introduction

This manual is intended to give suffic ient information for the comect installation and wing of the miriAD 2000 telemetry module. For programming information please refer to the MiriMap 2000 software on-line help.

The miniiAD 2000 will normally be delivered physic ally pre-configured to your requirements. Please check that the telemetry module you have is the corect model for your application.

There are many possible configurations for the physical I/O and communications options of the miriAD 2000. The following information provides for situations where it is necessary to reconfigure the unit or to set up the configuration from scratch.

## Display Panel



## miriad <br> Communications

## RS232 Port

The RS232 port provides the facility for a serial data link to third party devices. It is also used as the programming port for the miriAD 2000. The function of the RS 232 port is selected by means of the slide switch located on the bottom right hand side of the unit. The switch has two positions, "prog "and "run ".
The slide switch should be in the "prog" position when programming ormonitoring the telemetry module. The slide switch should then be moved to the "run" position for nomal operation. The pin assignment of the RS232 port is as shown below.

RS232 Port Pin assignment


View looking into RS232 port.

| 1. | DTR |
| :--- | :--- |
| 2. | RTS |
| 3. | TX data |
| 4. | CD |
| 5. | GND |
| 6. | RX data |
| 7. | CTS |
| 8. | DSR |

## PCMCIA Port

The PCMCIA port provides the facility forthe telemetry module to be connected to the PSTN via a dial up modem. It also provides the facility for the use of other PCMCIA format senial cards. The PCMCIA socket is located under the right hand side of the telemetry module.

## Internal Data Radio

The intemal data radio will nomally come programmed to the corect system frequency.
The only connection required to the intemal radio is a coaxial tail. The connectoron the AD2000 is an SMA jack and therefore the coaxial tail should be teminated in an SMA plug. The coaxial tail is nomally RG58 which is a readily available cable. The radio will normally be programmed foran output power of 1 Watt however a range of 0.1-5 Watts is available. The intemal radio configuration is downloaded via the MiriMap 2000 software.

## miriad

## 2000 <br> Communications

## External Radio Port

The extemal radio port provides the facility to connect the miriAD 2000 to an extemal radio orfor connection to landlines or fibre-optics. The selection between intemal radio and the extemal port is made by configuring jumpers J 203, J204, J 205 as shown below. In the audio format both 2 wire and 4 wire options are available. The ext radio port is configured for RS232 or audio operation by installing links on jumpers J 206, J 207, J 208 as shown.

|  | J 203 | J204 | J205 |  | J 206 | J207 | J 208 |  | J209 | J 210 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| EXIERNAL | A | B | A | RS232 | A | A | A | 2 MRE | A | A |
| INTERNAL | B | A | B | AUDIO | B | B | B | 4 MRE | B | B |
|  |  |  |  |  |  |  |  |  | J 201 | J 202 |
|  | J 211 | J212 | J213 |  |  |  |  | 1200 baud | 0 | 0 |
| EXIERNAL | B | A | A |  |  |  |  | 2400 baud | 0 | 1 |
| INTIERNAL | A | A | A |  |  |  |  | 4800 baud | 1 | 1 |



View looking into ext radio port


Where the telemetry module is to be connected to an extemal radio requiring audio modulation then the 4 wire configuration must be selected.

The baud rate is selected by the configuration of jumpers J 201 and J 202. This baud rate selection applies whether the telemetry module is to be used with an intemal data radio or with an extemal device.

When using an extemal audio modulated radio, it is prefered if possible to retain the preset levels of modulation within the AD2000 and to adjust the levels in the extemal radio to match these preset levels.
The preset audio output level from pin 3 is 600 mv peak to peak. This is adjusted in the AD2000 using VR201 if necessary.
The received data audio level into the AD2000 should be 500mv peak to peak. The received audio level to the modem is monitored at test point "Rx.SIG.IN" and is adjusted using VR202 if necessary.

## miriad $_{A D}$ <br> 응 Digital Outputs

There are 4 digital outputs which can be configured as:-
Isolated Relays
or Isolated Transistors
or Common Ground Transistors
The outputs may be configured individually to provide a combination of the above. The factory preset configuration is for all outputs to be isolated relays.


Relay Outputs

## Isolated Relay Outputs Maximum Current <br> at <br> 2 form $A+2$ form $C$ 5 Amps 30 VDC or 240VAC

To configure all outputs as isolated relays install all links J 501 - J 508 to position A .

## Isolated Transistors

Current - 100 mA
Vcc max - 35 VDC
Isolation - 2.5 kV
To configure all outputs as isolated transistors install all links in position B.


## Common Transistors



To select common ground transistor outputs install the links in the following positions :-

A J 501,J 502,J 503,J 504
B J505,J506,J 507,J 508


## miríad $^{A D}$ <br> 荷 Digital Inputs

There are two different versions of the miriAD 2000 with respect to Digital inputs. There is a low voltage version made for nominally 12 or 24 volt inputs and a high voltage version made specific ally for 110 volt inputs.

$$
\begin{array}{lll}
\text { AD 2000L - م } \text { Voltage }: ~ 10-48 \text { VDC/AC } & \text { 10k impedance } \\
\text { AD 2000H - Hi Voltage } & : & 48-130 V D C / A C
\end{array} \text { 47k impedance }
$$

This is not an on-board selectable option so please ensure that you have the corect version of hardware for your application. The input voltage is printed on the terminal strip. The ما voltage input labelling is blue and the Hi voltage input labelling is red.

In each version of hardware there are two groups of 8 inputs each with a separate common teminal. The inputs will accept DC inputs of either polarity orAC inputs.

## Pulse Counters

Each Digital Input to the miriAD 2000 can act as a pulse counterfor DC inputs. Input number 1 can also be configured as a fast pulse counter to 5 KHz To configure input number 1 as a normal input link jumpers J 601 and J 602 in position $B$. In this configuration input number 1 acts as a nomal input refered to common C1. In this mode all inputs can count pulses up to 5 hz . To configure input number 1 as a fast pulse counterjumpers J 601 and J 602 should be linked in position A. In this mode input number 1 is refered to the supply ground and requires a sinking input


## miríad $^{\text {I }}$ <br> 空Analog Channels

4-20mA/1-5 Volts Resolution-12bits
$0-20 \mathrm{~mA} / 0-5$ Volts Accuracy - $0.1 \%$ $0-1$ Volt

Linearity - 0.1\%
There are several options available forthe 8 analog channels. All channels can be used as inputs or any of the last 4 channels can be used as $4-20 \mathrm{~mA}$ outputs if the analog output option is fitted. The factory preset is for all channels to be configured as inputs and for all input channels to be configured as current inputs ( links installed ). With channels 5-8 configured as inputs, jumpers J 401, 402, 403, 404 are installed in position B. To select any of these channels as an output the links should be moved to position A. Please note that regardless of the input range selection the output channels will always be $4-20 \mathrm{~mA}$.

Input Range - $4-20 \mathrm{~mA} / 1-5 \mathrm{~V}$ or $0-20 \mathrm{~mA} / 0-5 \mathrm{~V}$ or $0-1 \mathrm{~V}$


In addition to the above options, input channel 8 can be configured to monitor the supply voltage to the telemetry module. This is partic ularly useful where solar supplies and batteries are used. J umperJ 406 is linked in position A when channel 8 is used as a nomal input To use this channel as a supply monitormove the link to position B. The input level in this mode is adjusted by VR403. The input voltage is set to equal one tenth of the actual voltage. Fora supply of $12-15$ volts the input will range from 1.2 to 1.5 volts. This input will then in tum be conditioned by the selection of analog input range.

## miriad $_{A D}$ <br> 음 <br> Shaft Encoder Interface

The SEl-100 shaft encoder interface provides the means to interface a Unidata 6509B Water Level Instrument to the AD2000 telemetry module.
The shaft encoderinterface provides a regulated 6 volt DC supply to the instrument from the 12 volt DC supply to the AD2000. It also utilises two digital outputs from the AD2000 which should be configured as common ground transistors, and one digital input to the AD2000 which is used in normal input mode ( not fast pulse mode ). In this scenario the DIN common is wired to 0 volts. The AD2000 software may be configured to use any combination of $I / O$ for the shaft encoder interface. The wiring diagram below shows the wiring a rangement using DOTS $1 \& 2$ and DIN 1.

## Output configuration

Outputs 1 and 2 are configured as common grounded transistors.


To Water Level
Instrument

## miríad $^{A}$ <br> Mounting Detail



The miriAD 2000 is installed by means of the stainless steel mounting bracket supplied with the unit. Please ensure when fixing the mounting bracket to your equipment panel that sufficient space is left to install the unit from the top as shown in the above diagram. All wiring to the unit enters from below. If a PCMCIA dial up modem is to be installed, leave a 50 mm gap to the night of the AD2000 for the modem cable.

The AD2000 is removed from the mounting bracket by depressing the small tongue at the bottom of the mounting bracket and sliding the unit upwards.

There are 8 Analog input channels.
Any of the last 4 channels may be
$\begin{aligned} & \text { configured as outputs. } \\ & \text { Configuration details are included }\end{aligned}$
$\begin{aligned} & \text { Configuration details are included } \\ & \text { in this manual. }\end{aligned}$
in this manual.
The analog input channels are
configurable as $4-20 \mathrm{ma} / 1-5 \mathrm{~V}$,
$\begin{aligned} & 0-20 \mathrm{~mA} / 0-5 \mathrm{~V} \text { or } 0-1 \mathrm{~V} \text {. } \\ & \text { The analog outputs are }\end{aligned}$
$\begin{array}{ll}\text { VOLTAGE BEFORE CONNECTION ! } & 0-20 \mathrm{~mA} / 0-5 \mathrm{~V} \text { or } 0-\mathrm{TV} . \\ \text { VOL } & \text { The analog outputs are } 4-20 \mathrm{~mA} .\end{array}$
The digital outputs are configurable for
$\begin{array}{ll}\text { converter. } \quad \text { in this manual. The relay format is shown here. } \\ \text { The relays are isolated - } 2 \text { form } A, 2 \text { form } C \text {. }\end{array}$
(ל)
he digital inputs are optically isolated to 2.5 KV .
with a separate common. These will both have
with a separate common. These will both have
AC or DC source voltages
$\begin{array}{lll}\text { INPUTS : } & \text { LO.V : } 10-48 \mathrm{VDC/AC} & \text { AD2000 L } \\ & 110 \mathrm{~V}: 48-130 \mathrm{VDC} / \mathrm{AC} & \text { AD2000 H }\end{array}$

$$
\begin{aligned}
& \stackrel{\square}{\square} \\
& \text { The digit } \\
& \begin{array}{l}
\text { The digital outputs are configurable for } \\
\text { relay or solid state format as described }
\end{array}
\end{aligned}
$$

$$
\begin{aligned}
& \text { MUST BE GROUNDED }
\end{aligned}
$$

AD2000x-xx-xx<br>12-for 12VDC supply.<br>24-for 24 VDC supply.<br>N - forno analog output option.<br>A - for analog output option fitted.<br>L - forlow voltage inputs 10 - 50 V<br>H - for high voltage inputs $50-130 \mathrm{~V}$<br>R - with inbuilt radio<br>E - without radio<br>B- expansion base only (no PCMCIA, no FFSK modem on Int/Ext port but with RS232 on Int/Ext and RS232 ports)

The AD2000 part number is displayed on the rear of each unit together with other relevant information.

## AD2000R-LN-12

Hardware version - Rev. 0
Tx frequency - 472.0250 MHz
Rxfrequency- 472.0250 MHz

## Kintore RTU 3 - Community Tank

Miri Engineering - Perth, West Australia. tel - 61893782388 fax- 61893782468

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## miri technologies

P.O. Box 1116, Wangara, Western Australia, 6947

30 Buckingham Drive, Wangara, Western Australia, 6065
Email : miri@miri.com.au
Web: http://www.miri.com.au
Tel : (61 8) 94098998 Fax : (61 8) 94099229


## TECHNICAL DATA SHEET

Equipment Type: 3 Phase inlet
Location: ..... External
Model Numbers: ..... 3658 and 40787
Manufacturer: Mennekes
Supplier: ..... DKSH
039554666

# $\square$ MENNEKES ${ }^{\circledR}$ 

Plugs for the world

## Industrial plugs and receptacles



## Global focus



MENNEKES plugs and receptacles are well known all over the world - and comply with the relevant national and international standards.
More than half of our products are destined for international markets. This is why MENNEKES also has a global presence, with subsidiaries and agencies in more than 90 countries. When plugs and receptacles are being tested by independent testing authorities, such as the VDE Testing and Certification Institute, the test reports are compiled according to CCA or CB-II procedures. They then serve as the basis for approvals in other countries, such as those whose national test marks are shown below. For plugs and receptacles for USA and Canada please contact us.


# MENNEKES ${ }^{\circledR}$ 

Plugs for the world

## Family business

MENNEKES is a family-run business - like most of our customers' companies.

Perhaps this is also the reason behind our legendary customer focus. At MENNEKES, an 800-strong global workforce produces plugs and receptacles for international markets. From its headquarters in Kirchhundem, Germany and its Neudorf plant in the Erzgebirge. In addition, a production plant in Nanjing supplies the Chinese market exclusively.

The North American market is serviced by MENNEKES Electrical Products headquartered in Fairfield, NJ.


Neudorf plant


Kirchhundem headquarters

When a MENNEKES product leaves our factory, it has already survived the harshest testing. In our test lab it is exposed to cold, heat, dust and water over and over again. Only the products that withstand these tests are worthy of the name MENNEKES. Our products are of course certified to national and international standards by renowned institutions.


Only the combination of first-class raw materials and advanced manufacturing processes guarantees a premium product. This is why we use only first-grade granules which are processed by a highly skilled workforce in state-of-the-art production facilities to create certified


## CEE receptacles 16 A up to 125 A

63A: SoftCONTACT, 125A: TorsionSpringCONTACT
Other voltages and frequencies available on request.


Panel mounted receptacles

|  | straight | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 |  | 63 | 3 | 1260 | 1261 | 1262 |
| 7in |  | 63 | 4 | 1246 | 1247 | 1248 |
|  |  | 63 | 5 | 1250 | 1251 | 1252 |
|  |  | 125 | 3 | - | - | - |
|  |  | 125 | 4 | - | - | - |
|  | $\triangle 1 P 44$ | 125 | 5 | - | - | - |

Panel mounted receptacles

angled $20^{\circ}$

| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| ---: | ---: | ---: | ---: | ---: |
| 63 | 3 | 1146 | $\mathbf{1 1 4 7}$ | 1148 |
| 63 | 4 | 1149 | 1150 | $\mathbf{1 1 5 1}$ |
| 63 | 5 | 1153 | 1154 | $\mathbf{1 1 5 5}$ |
| 125 | 3 | - | - | - |
| 125 | 4 | - | - | - |
| 125 | 5 | - | - | - |

Panel mounted receptacles with standard flange dimensions

| $\mathbf{A}$ | $\mathbf{P}$ |
| :--- | :--- |
| 16 | 3 |
| 16 | 4 |
| 16 | 5 |
| 32 | 3 |
| 32 | 4 |
| 32 | 5 |

angled $20^{\circ}$,
flange:
$85 \times 85 \mathrm{~mm}$,
fixing hole spacing:
$70 \times 70 \mathrm{~mm}$

Q-Pulse Id: TMS4412
angled $20^{\circ}$,
lange.
fixing hole spacing:
$70 \times 70 \mathrm{~mm}$


Panel mounted receptacles


Panel mounted receptacles


Panel mounted receptacles

| $\square$ straight | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 63 | 3 | 1263 | 1264 | 1265 |
|  | 63 | 4 | 1122 | 1123 | 1124 |
|  | 63 | 5 | 1126 | 1127 | 1128 |
|  | 125 | 3 | - | 3380 | - |
| . | 125 | 4 | 1455 | 1456 | 1457 |
| - ${ }_{\text {dP }} 67$ | 125 | 5 | 1459 | 1460 | 1461 |
| Panel mounted receptacles |  |  |  |  |  |
| angled $20^{\circ}$ | A | P | 110V | 230V | 400V |
|  | 63 | 3 | 2179 | 2180 | 2181 |
|  | 63 | 4 | 203 | 204 | 205 |
|  | 63 | 5 | 207 | 208 | 209 |
|  | 125 | 3 | - | 3575 | - |
|  | 125 | 4 | 210 | 211 | 212 |
| \d IP 67 | 125 | 5 | 214 | 215 | 216 |

Panel mounted receptacles with standard flange dimensions

|  | angled $20^{\circ}$, | A | P | 110V | 230 V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | flange: | 16 | 3 | 903 | 905 |  |
|  | $85 \times 85 \mathrm{~mm}$, | 16 | 4 | - | - | 1081 |
|  | fixing hole spacing: | 16 | 5 | - | - | 1103 |
|  | $70 \times 70 \mathrm{~mm}$ | 32 | 3 | 3197 | 3200 | - |
|  |  | 32 | 4 | - | - | 3254 |
| /2015 | d ${ }_{\text {IP }} 67$ | 32 |  | ge - | of 13 | 3524 |

Wall mounted receptacles with TwinCONTACT

screwless spring

| $\mathbf{A}$ | $\mathbf{P}$ |
| :---: | :---: |
| 16 | 3 |
| 16 | 4 |
| 16 | 5 |
| 32 | 3 |
| 32 | 4 |
| 32 | 5 |


| $\mathbf{1 1 0 V}$ | 230 V | 400 V |
| ---: | ---: | ---: |
| 1340 | 1341 | - |
| - | 1342 | $\mathbf{1 3 4 3}$ |
| - | - | 31 |
| 1345 | 1346 | - |
| - | 1347 | $\mathbf{1 3 4 8}$ |
| - | - | 32 |

Wall mounted receptacles with TwinCONTACT


Panel mounted receptacles with TwinCONTACT

|  | screwless spring | $\mathbf{A}$ | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | terminals, | 16 | 3 | 1667 | $\mathbf{1 6 6 8}$ | 1669 |
|  | straight | 16 | 4 | 1672 | 1673 | $\mathbf{1 6 7 4}$ |
|  |  | 16 | 5 | 1678 | 1679 | $\mathbf{3 3 8 5}$ |
|  |  | 32 | 3 | 1786 | $\mathbf{1 7 8 7}$ | 1788 |
|  |  | 32 | 4 | 1789 | 1790 | $\mathbf{1 7 9 1}$ |

Panel mounted receptacles with TwinCONTACT

|  | screwless spring terminals, angled $20^{\circ}$ | A | P | 110V | 230 V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16 | 3 | 1631 | 1632 | 1633 |
|  |  | 16 | 4 | 1636 | 1637 | 1638 |
| , |  | 16 | 5 | 1642 | 1643 | 3473 |
|  |  | 32 | 3 | 1733 | 1734 | 1735 |
|  |  | 32 | 4 | 1738 | 1739 | 1740 |
|  | $\triangle$ IP 44 | 32 | 5 | 1744 | 1745 | 1746 |

Panel mounted receptacles RAPIDO with TwinCONTACT

screwless spring

| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 3 | 1132 | $\mathbf{9 9 7}$ | - |
| 16 | 4 | - | - | - |
| 16 | 5 | - | - | - |
| 32 | 3 | - | - | - |
| 32 | 4 | - | - | - |
| 32 | 5 | - | - | - |

$\triangle I P 44$
terminals, central fixing,
61 mm Ø
mounting hole

## TwinCONTACT

Screw less connection technique
without screws, double terminal with split spring for throughwiring.


Wall mounted receptacles with TwinCONTACT


Panel mounted receptacles with TwinCONTACT

|  | screwless spring terminals, straight | A | P | 110V | 230 V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16 | 3 | 1707 | 1708 | 1709 |
|  |  | 16 | 4 | 1710 | 1711 | 1712 |
|  |  | 16 | 5 | 1716 | 1717 | 1131 |
|  |  | 32 | 3 | 1809 | 1810 | 1811 |
|  |  | 32 | 4 | 1812 | 1813 | 1814 |
|  | \d IP 67 | 32 | 5 | 1818 | 1819 | 1820 |

Panel mounted receptacles with TwinCONTACT

|  | screwless spring terminals, angled $20^{\circ}$ | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16 | 3 | 1700 | 1701 | 1702 |
|  |  | 16 | 4 | - | 1703 | 1704 |
|  |  | 16 | 5 | - | - | 3485 |
|  |  | 32 | 3 | 1801 | 1802 | 1803 |
|  |  | 32 | 4 | - | 1804 | 1805 |
|  | ds IP 67 | 32 | 5 | - | - | 1808 |

Panel mounted receptacles RAPIDO with TwinCONTACT

| screwless spring | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: |
| terminals, | 16 | 3 | - | - | - |
| central fixing, | 16 | 4 | - | 1133 | 998 |
| $70 \mathrm{~mm} \varnothing$ | 16 | 5 | - | - | 907 |
| mounting hole | 32 | 3 | 1135 | 987 | - |
|  | 32 | 4 | - | 1166 | 988 |
| $\triangle \mathrm{IP} 44$ | 32 | 5 | - | - | 989 |

## RAPIDO

RAPIDO receptacles are available with screw terminals or with screwless TwinCONTACT.
16A, 3p:
for mounting holes 61 mm diam. and wall thickness from 2 up to 5 mm .
$16 A, 4 p+5 p$ and $32 A$ :
for mounting holes 70 mm diam. and wall thickness from 2 up to 9 mm .


CEE plugs and inlets 16A up to 125A
Other voltages and frequencies available on request.

| Plugs AM-TOP |  |  |  |  |  | Plugs Protop |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| single part | A | P | 110 V | 230 V | 400 V |  | split body, | A | P | 110 V | 230 V | 400 V |
| body, screw | 16 | 3 | 247 | 248 | 249 |  | screw | 16 | 3 | 147 | 148 | 149 |
| terminals | 16 | 4 | 250 | 251 | 252 |  | terminals | 16 | 4 | - | 151 | 152 |
|  | 16 | 5 | 256 | 257 | 3 |  |  | 16 | 5 | - | - | 13 |
|  | 32 | 3 | 259 | 260 | 261 |  |  | 32 | 3 | 159 | 160 | - |
|  | 32 | 4 | 262 | 263 | 264 |  |  | 32 | 4 | - | 163 | 164 |
| $\triangle 1 P 44$ | 32 | 5 | 268 | 269 | 4 |  | $\triangle 1 P 44$ | 32 | 5 | - | - | 14 |
| Plugs StarTOP with SafeCONTACT |  |  |  |  |  | Plugs PowerTOP Xtra |  |  |  |  |  |  |
| screwless with | A | P | 110 V | 230 V | 400 V |  | with rubberized | A | P | 110 V | 230 V | 400 V |
| - insulation | 16 | 3 | 947 | 948 |  |  | grip area, | 63 | 3 | 13101 | 13102 | - |
| displacement | 16 | 4 | - | 951 | 952 |  | for toughest | 63 | 4 | - | 13105 | 13106 |
| technique | 16 | 5 | - |  | 33 |  | conditions | 63 | 5 | - | 13111 | 13112 |
|  | 32 | 3 | 711 | 712 | - |  |  | 125 | 3 | - | - | - |
|  | 32 | 4 | - | 717 | 719 |  |  | 125 | 4 | - | - | - |
| $\triangle$ IP 44 | 32 | 5 | - | - | 34 |  | $\triangle 1 P 44$ | 125 | 5 | - | - | - |
| Plugs AM-TOP |  |  |  |  |  | Plugs PowerTOP |  |  |  |  |  |  |
| single part | A | P | 110 V | 230 V | 400 V |  | with external | A | P | 110 V | 230 V | 400 V |
| body, screw | 16 | 3 | 277 | 278 | 279 |  | strain relief | 16 | 3 | 3794 | 3796 | 3799 |
| - terminals | 16 | 4 | 280 | 281 | 282 |  |  | 16 | 4 | 3807 | 3811 | 3809 |
|  | 16 | 5 | 286 | 287 | 288 |  |  | 16 | 5 | 3819 | 3823 | 3821 |
|  | 32 | 3 | 289 | 290 | 291 |  |  | 32 | 3 | 3829 | 3830 | 3832 |
|  | 32 | 4 | 292 | 293 | 294 |  |  | 32 | 4 | 3839 | 3844 | 3841 |
| ds IP 67 | 32 | 5 | 298 | 299 | 300 |  | ds IP 67 | 32 | 5 | 3851 | 3855 | 3853 |
| Plugs PowerTOP Xtra |  |  |  |  |  | Angled plugs |  |  |  |  |  |  |
| with rubberized | A | P | 110 V | 230 V | 400 V |  |  | A | P | 110 V | 230 V | 400 V |
| 3 grip area, | 63 | 3 | 13201 | 13202 | 13203 |  |  | 16 | 3 | 1410 | 1411 | - |
| for toughest | 63 | 4 | 13204 | 13205 | 13206 |  |  | 16 | 4 | - | 891 | 315 |
| conditions | 63 | 5 | 13210 | 13211 | 13212 |  | VarioTOP | 16 | 5 | 3312 | 3981* | 3980* |
|  | 125 | 3 | 13215 | 13216 | - |  |  | 32 | 3 | - | 3306 | - |
|  | 125 | 4 | 13217 | 13218 | 13219 |  |  | 32 | 4 | - | 3646 | 3987 |
| ds IP 67 | 125 | 5 | 13223 | 13224 | 13225 |  | $\triangle 1 P 44$ | 32 | 5 | - | 3424 | 3266 |
| Panel mounted inlets RAPIDO |  |  |  |  |  | Panel mounted inlets RAPIDO |  |  |  |  |  |  |
| with screw | A | P | 110V | 230 V | 400 V | with screw terminals, central fixing, $70 \mathrm{~mm} \varnothing$ mounting hole $\triangle$ IP 44 |  | A | P | 110V | 230 V | 400 V |
| - terminals, | 16 | 3 | 919 | 924 | - |  |  | 16 | 3 | - | - | - |
| central fixing, | 16 | 4 | - | - | 931 |  |  | 16 | 5 | - | 932 | 933 |
| ) $61 \mathrm{~mm} \varnothing$ | 16 | 5 | - | - | 949 |  |  | 16 |  | - | - | 972 |
| mounting hole | 32 | 3 | - | - | - |  |  | 32 | 3 | 935 | 938 | 942 |
| $\triangle 1 P 44$ | 32 | 5 | - | - | - |  |  | 32 | 5 | - | - | 945 |
| Wall mounted appliance inlets |  |  |  |  |  | Wall mounted appliance inlets |  |  |  |  |  |  |
| $\triangle$ IP 44 <br> Panel mounted appliance inlets | A | P | 110 V | 230 V | 400 V |  |  | A | P | 110 V | 230 V | 400 V |
|  | 16 | 3 | 843 | 844 | - |  |  | 16 | 3 | 331 | 332 | 333 |
|  | 16 | 4 | - | - | 800 |  |  | 16 | 4 | 334 | 335 | 336 |
|  | 16 | 5 | - | - | 801 |  |  | 16 | 5 | 340 | 341 | 342 |
|  | 32 | 3 | - | 802 | - |  |  | 32 | 3 | 343 | 344 | 345 |
|  | 32 | 4 | - | - | 803 |  |  | 32 | 4 | 346 | 347 | 348 |
|  | 32 | 5 | - | - | 804 |  | $\triangle 1 P 44$ | 32 | 5 | 352 | 353 | 354 |
|  | Panel mounted appliance inlets |  |  |  |  | Wall mounted appliance inlets |  |  |  |  |  |  |
| Win with hinged lid | A | P | 110 V | 230 V | 400 V | -4 IP 67 |  | A | P | 110 V | 230 V | 400 V |
|  | 16 | 3 | - | - | - |  |  | 63 | 3 | 1216 | 1107 | 1217 |
|  | 16 | 4 | 392 | 393 | 394 |  |  | 63 | 4 | 355 | 356 | 357 |
|  | 16 | 5 | 398 | 399 | 400 |  |  | 63 | 5 | 359 | 360 | 361 |
|  | 32 | 3 | 401 | 402 | 403 |  |  | 125 | 3 | - | - | - |
|  | 32 | 4 | 404 | 405 | 406 |  |  | 125 | 4 | 362 | 363 | 364 |
| $\triangle 1 P 44$ | 32 | 5 | 410 | 411 | 412 |  |  | 125 | 5 | 366 | 367 | 368 |
| Panel mounted inlets |  |  |  |  |  | Panel mounted inlets |  |  |  |  |  |  |
|  | A | P | 110 V | 230 V | 400 V |  |  | A | P | 110 V | 230 V | 400 V |
|  | 16 | 3 | 810 | 812 | - |  |  | 63 | 3 | 822 | 1981 | - |
|  | 16 | 4 | - | 837 | 813 |  |  | 63 | 4 | - | 1984 | 1982 |
|  | 16 | 5 | - | - | 815 |  |  | 63 |  | - | - | 1688 |
|  | 32 | 3 | 816 | 817 | - |  |  | 125 | 3 | - | - | - |
|  | 32 | 4 | - | 838 | 819 |  |  | 125 | , | - | - | - |
|  | 32 | 5 | - | - | 821 |  | $\triangle \mathrm{PP} 44$ | 125 | 5 | - | - | - |
| Panel mounted inlets |  |  |  |  |  | Panel mounted inlets |  |  |  |  |  |  |
| Q-Pulse Id: TAASP14712 | A | P | 110 V | 230 V | 400 V |  |  | A | P | 110 V | 230 V | 400V |
|  | 16 | 3 | 825 | 826 | - |  |  | 63 | 3 | 835 | 836 | - |
|  | 16 | 4 | - | 839 | 827 |  |  | 63 | 4 | - | 3704 | 3656 |
|  | 16 | 5 | - | - | 829 |  |  | 63 | 5 | - | - | 3658 |
|  | 32 | 3 | 830 | 831 | - |  |  | 125 | 3 | - | 3665 | - |
|  | 32 | 4 | - | 840 | 832 |  |  | 125 | 4 | - | 3413 | 3583 |
|  | 32 | 5 |  |  | Acti83 |  |  | 125 |  | age-77 | of 1382 | 1983 |

Connectors AM-TOP

| single part | A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :--- | ---: | ---: | ---: | ---: | ---: |
|  | 16 | 3 | 509 | $\mathbf{5 1 0}$ | 511 |
| body, screw | 16 | 4 | 512 | 513 | $\mathbf{5 1 4}$ |
| terminals | 16 | 5 | 518 | 519 | $\mathbf{5}$ |
|  | 32 | 3 | 521 | $\mathbf{5 2 2}$ | 523 |
|  | 32 | 4 | 524 | 525 | $\mathbf{5 2 6}$ |
|  | 32 | 5 | 530 | 531 | $\mathbf{6}$ |

Connectors StarTOP with SafeCONTACT

| screwless with | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: |
| insulation | 16 | 3 | 979 | 980 | - |
| displacement | 16 | 4 | - | 993 | 994 |
| technique | 16 | 5 | - | - | 35 |
|  | 32 | 3 | 725 | 731 | - |
|  | 32 | 4 | - | 761 | 763 |
| $\triangle 1 P 44$ | 32 | 5 | - | - | 36 |

Connectors AM-TOP

| single partbody, screwterminals | A | P | 110V | 230 V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 16 | 3 | 539 | 540 | 541 |
|  | 16 | 4 | 542 | 543 | 544 |
|  | 16 | 5 | 548 | 549 | 550 |
|  | 32 | 3 | 551 | 552 | 553 |
|  | 32 | 4 | 554 | 555 | 556 |
| \1 IP 67 | 32 | 5 | 560 | 561 | 562 |
| Connectors PowerTOP Xtra |  |  |  |  |  |
| with rubberized | A | P | 110V | 230V | 400V |
| \# grip area, | 63 | 3 | 14201 | 14202 | 14203 |
| - for toughest | 63 | 4 | 14204 | 14205 | 14206 |
| conditions | 63 | 5 | 14210 | 14211 | 14212 |
|  | 125 | 3 | 14215 | 14216 | - |
|  | 125 | 4 | 14217 | 14218 | 14219 |
| ds IP 67 | 125 | 5 | 14223 | 14224 | 14225 |


| Connectors ProTOP |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| - split body, | A | P | 110V | 230V | 400V |
| screw | 16 | 3 | 179 | 180 | 181 |
| terminals | 16 | 4 | - | 193 | 194 |
|  | 16 | 5 | - | - | 15 |
|  | 32 | 3 | 121 | 122 | - |
|  | 32 | 4 | - | 125 | 126 |
| $\triangle 1 P 44$ | 32 | 5 | - | - | 16 |
| Connectors PowerTOP Xtra |  |  |  |  |  |
| with rubberized | A | P | 110V | 230V | 400V |
| 1 grip area, | 63 | 3 | 14101 | 14102 | - |
| for toughest | 63 | 4 | - | 14105 | 14106 |
| conditions | 63 | 5 | - | 14111 | 14112 |
|  | 125 | 3 | - | - | - |
|  | 125 | 4 | - | - | - |
| $\triangle$ ¢ $\triangle 44$ | 125 | 5 | - | - | - |
| Connectors PowerTOP |  |  |  |  |  |
| $\triangle$ with external | A | P | 110V | 230 V | 400V |
| 5train relief | 16 | 3 | 3859 | 3860 | 3862 |
|  | 16 | 4 | 3869 | 3873 | 3871 |
|  | 16 | 5 | 3879 | 3883 | 3881 |
|  | 32 | 3 | 3887 | 3888 | 3891 |
|  | 32 | 4 | 3896 | 3899 | 3897 |
| ds IP 67 | 32 | 5 | 3905 | 3909 | 3907 |
| Angled connector |  |  |  |  |  |
| A. | A | P | 110V | 230V | 400V |
|  | 16 | 3 | - | 1438 | - |
|  | 16 | 4 | - | - | - |
| 02 | 16 | 5 | - | - | - |
|  | 32 | 3 | - | - | - |
|  | 32 | 4 | - | - | - |
| $\triangle I P 44$ | 32 | 5 | - | - | - |

## PowerTOP Xtra



PowerTOP Xtra is rubberized for the best grip. Improved impact resistance even under humid conditions. Highly heat-resistant contact carrier, frame terminals, cable gland and sealing, strain relief and protection against kinking. Enclosure with thread lock, two safety slides and plugs with nickelplated contacts. Connectors 63A with SoftCONTACT and 125A with TorsionSpringCONTACT.

## StarTOP


with SafeCONTACT, screwless with insulation displacement technique, cable gland with sealing,


## SoftCONTACT



TorsionSpringCONTACT

 <br> \section*{SP464 James St Lowood SPS - Electrical Installation OM Manual <br> \section*{SP464 James St Lowood SPS - Electrical Installation OM Manual <br> CEE receptacles switched, interlocked, 16A up to 125A}

63A: SoftCONTACT, 125A: TorsionSpringCONTACT. CEE receptacles with DUO-interlock can be padlocked.
Other voltages and frequencies available on request.
Wall mounted receptacles with mechanical DUO-interlock

$\triangle$ IP 44
Wall mounted receptacles with mechanical DUO-interlock

| + - W |  | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 63 | 3 | 6569 | 6571 | - |
| $\leftrightarrow$ |  | 63 | 4 | - | 5955 | 5956 |
|  |  | 63 | 5 | - | - | 5959 |
|  |  | 125 | 3 | - | - | - |
|  |  | 125 | 4 | - | - | - |
|  | $\triangle 1 P 44$ | 125 | 5 | - | - | - |

Wall mounted receptacles with mechanical DUO-interlock

$\triangle$ IP 44

| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| ---: | ---: | ---: | ---: | ---: |
| 16 | 3 | 7602 | $\mathbf{7 6 0 3}$ | - |
| 16 | 4 | - | 7604 | $\mathbf{7 6 0 5}$ |
| 16 | 5 | - | - | $\mathbf{7 6 0 7}$ |
| 32 | 3 | 7611 | $\mathbf{7 6 1 2}$ | - |
| 32 | 4 | - | 7613 | $\mathbf{7 6 1 4}$ |
| 32 | 5 | - | - | $\mathbf{7 6 1 6}$ |

Panel mounted receptacles with mechanical DUO-interlock

|  | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | 16 | 3 | 7502 | 7503 | - |
|  | 16 | 4 | - | 7504 | 7505 |
|  | 16 | 5 | - | - | 7507 |
|  | 32 | 3 | 7511 | 7512 | - |
|  | 32 | 4 | - | 7513 | 7514 |
| $\triangle 1 P 44$ | 32 | 5 | - | - | 7516 |

Wall mounted receptacles with mechanical DUO-interlock

| fused, | A | P | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :--- | :--- | :--- | :--- | :--- | ---: |
| DIN-rail | 16 | 3 | - | 7213 | - |
|  | 16 | 4 | - | - | $\mathbf{5 6 1 0}$ |
|  | 16 | 5 | - | - | 5613 |
|  | 32 | 4 | - | - | 5615 |
|  | 32 | 5 | - | - | 5618 |
|  | 63 | 4 | - | - | 6059 |
|  | 63 | 5 | - | - | 6062 |

Wall mounted receptacles with mechanical DUO-interlock

|  | fused, | A | P | 110V | 230V | 400V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | MCB | 16 | 3 | - | 7216 | - |
|  |  | 16 | 4 | - | - | 7217 |
|  |  | 16 | 5 | - | - | 7218 |
| $\pm$ |  | 32 | 4 | - | - | 7219 |
|  |  | 32 | 5 | - | - | 7220 |
|  |  | 63 | 4 | - | - | 7221 |
|  | $\triangle \mathrm{IP} 44$ | 63 | 5 | - | - | 7222 |

## M echanical DUO-interlock



After insertion and switching on, the plug is interlocked in the ON-position.
After switching off and withdrawing, the switch is locked in the OFF-position.


```
Phase inverter plugs AM-TOP
\begin{tabular}{l|l|l|l|l|}
\hline single part & A & \(\mathbf{P}\) & \(\mathbf{1 1 0 V}\) & \(\mathbf{2 3 0 V}\) \\
body, screw \\
terminals & 16 & 3 & - & - \\
\hline
\end{tabular}
```

Wall mounted phase inverter inlets

$\triangle$ IP 44

| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :---: | :---: | :---: | ---: | ---: |
| 16 | 3 | - | - | - |
| 16 | 4 | - | - | - |
| 16 | 5 | - | - | $\mathbf{3 5 1 7}$ |
| 32 | 3 | - | - | - |
| 32 | 4 | - | - | - |
| 32 | 5 | - | - | $\mathbf{3 5 2 3}$ |

Panel mounted phase inverter inlets

© IP 44

| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| :---: | :---: | :---: | ---: | ---: |
| 16 | 3 | - | - | - |
| 16 | 4 | - | 3348 | $\mathbf{3 3 5 0}$ |
| 16 | 5 | - | - | $\mathbf{2 0 9 7 0}$ |
| 32 | 3 | - | - | - |
| 32 | 4 | - | 3355 | $\mathbf{3 3 5 6}$ |
| 32 | 5 | - | 3717 | $\mathbf{2 1 2 4 1}$ |

Panel mounted phase inverter inlet

Wall mounted receptacles for low voltage

| A | $\mathbf{P}$ | $20-25 V$ <br> 50 a .60 Hz |
| :---: | :---: | :---: |
| 16 | 2 | $\mathbf{1 8 2 5}$ |
| 16 | 3 | $\mathbf{1 8 3 2}$ |
| 32 | 2 | $\mathbf{1 8 3 8}$ |
| 32 | 3 | $\mathbf{1 8 4 5}$ |


| $40-50 \mathrm{~V}$ |  |
| :---: | :---: |
| 50 a .60 Hz | $20-25 \mathrm{~V} /$ <br> $40-50 \mathrm{~V}$ <br> $100-200 \mathrm{~Hz}$ |
| 1831 | - |
| 1837 | 1835 |
| 1844 | - |
| 1850 | 1848 |

Panel mounted receptacles for low voltage

$\triangle$ IP 44

| A | P | $20-25 V$ <br> 50 a .60 Hz | $40-50 \mathrm{~V}$ <br> 50 a .60 Hz | $20-25 \mathrm{~V} /$ <br> $\mathbf{4 0 - 5 0 \mathrm { V }}$ <br> $\mathbf{1 0 0 - 2 0 0 \mathrm { Hz }}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | 603 | 604 | - |
| 16 | 3 | 610 | 611 | 612 |
| 32 | 2 | 616 | 617 | - |
| 32 | 3 | 623 | 624 | 625 |

Plugs for low voltage

| A | P | $20-25 \mathrm{~V}$ <br> 50 a .60 Hz | $40-50 \mathrm{~V}$ <br> 50 a .60 Hz | $20-25 \mathrm{~V} /$ <br> $40-50 \mathrm{~V}$ <br> $100-200 \mathrm{~Hz}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | 629 | 630 | - |
| 16 | 3 | 636 | 637 | 638 |
| 32 | 2 | 642 | 643 | - |
| 32 | 3 | 649 | 650 | 651 |

Connectors for low voltage

| A | P | $\begin{gathered} 20-25 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{gathered} 40-50 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{gathered} 20-25 \mathrm{~V} / \\ 40-50 \mathrm{~V} \\ 100-200 \mathrm{~Hz} \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | 681 | 682 | - |
| 16 | 3 | 688 | 689 | 690 |
| 32 | 2 | 694 | 695 | - |
| 32 | 3 | 701 | 702 | ACtiv |


| A | P | $\begin{gathered} 20-25 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{gathered} 40-50 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{aligned} & 20-25 \mathrm{~V} / \\ & 40-50 \mathrm{~V} \\ & 100-200 \mathrm{~Hz} \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | 681 | 682 | - |
| 16 | 3 | 688 | 689 | 690 |
| 32 | 2 | 694 | 695 | - |
| 32 | 3 | 701 | 702 | ACtiv |

$\triangle$ IP 44
Panel mounted receptacles for low voltage

| A | $\mathbf{P}$ | $20-25 \mathrm{~V}$ <br> 50 a .60 Hz | $40-50 \mathrm{~V}$ <br> 50 a .60 Hz | $20-25 \mathrm{~V} /$ <br> $\mathbf{4 0 - 5 0 V}$ <br> $100-200 \mathrm{~Hz}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | $\mathbf{1 2 7 0}$ | 2855 | - |
| 16 | 3 | 2845 | 1272 | 2860 |
| 32 | 2 | 1271 | 2864 | - |
| 32 | 3 | 2870 | 1273 | 2852 |

Wall mounted appliance inlets for low voltage

| A | $\mathbf{P}$ | $\mathbf{2 0 - 2 5 V}$ <br> 50 a .60 Hz |
| :---: | :---: | :---: |
| 16 | 2 | $\mathbf{1 9 5 5}$ |
| 16 | 3 | $\mathbf{1 9 6 2}$ |
| 32 | 2 | 1968 |
| 32 | 3 | $\mathbf{1 9 7 5}$ |

Wall mounted receptacles for low voltage

| A | P | $\begin{gathered} 20-25 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{gathered} 40-50 \mathrm{~V} \\ 50 \mathrm{a} .60 \mathrm{~Hz} \end{gathered}$ | $\begin{gathered} 20-25 \mathrm{~V} / \\ 40-50 \mathrm{~V} \\ 100-200 \mathrm{~Hz} \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 2 | 577 | 578 | - |
| 16 | 3 | 584 | 585 | 586 |
| 32 | 2 | 590 | 591 | - |
| 32 | 3 | 597 | 598 | 599 |





| $40-50 \mathrm{~V}$ | $20-25 \mathrm{~V} /$ |
| :---: | :---: |
| 50 a .60 Hz | $40-50 \mathrm{~V}$ |
| $100-200 \mathrm{~Hz}$ |  |
| 1961 | - |
| 1967 | 1965 |
| 1974 | - |
| 1980 | 1978 |




Phase inverter plug VarioTOP


Plugs for the world

Wall mounted phase inverter inlets


| A | $\mathbf{P}$ | $\mathbf{1 1 0 V}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ |
| ---: | ---: | ---: | ---: | ---: |
| 16 | 3 | - | - | - |
| 16 | 4 | - | 3342 | $\mathbf{3 3 4 3}$ |
| 16 | 5 | - | - | $\mathbf{2 5 1 1}$ |
| 32 | 3 | - | - | - |
| 32 | 4 | - | 3345 | $\mathbf{3 3 4 6}$ |
| 32 | 5 | - | 3347 | $\mathbf{2 4 7 8}$ |



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## Plugs and receptacles 7 pole

Other voltages and frequencies available on request.


Panel mounted receptacles

angled $20^{\circ}$
$\triangle$ IP 44
Plugs AM-TOP

| single part | A | $\mathbf{P}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ | $\mathbf{5 0 0 V}$ |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | 16 | 7 | 741 | $\mathbf{7 4 2}$ | 1055 |  |
| body, screw |  |  |  |  |  |  |
| terminals | 32 | 7 | 743 | $\mathbf{7 4 4}$ | 1060 |  |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Wall mounted inlets

|  | A | P | 230V | 400V |
| :--- | :--- | :--- | :--- | :--- |
| 1 | 16 | 7 | $\mathbf{5 0 0 V}$ |  |
|  | 32 | 7 | - | 2166 |

Connectors AM-TOP
 single part
body, screw
terminals
$\triangle$ IP 44

| A | $\mathbf{P}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ | $\mathbf{5 0 0 V}$ |
| ---: | ---: | ---: | ---: | ---: |
| 16 | 7 | 745 | $\mathbf{7 4 6}$ | 1065 |
| 32 | 7 | 747 | $\mathbf{7 4 8}$ | 1070 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Wall mounted receptacles with mechanical DUO-interlock


3 pole switch,
can be
padlocked
$\triangle \operatorname{IP} 44$

| A | $\mathbf{P}$ | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ | $\mathbf{5 0 0 V}$ |
| :---: | :---: | :---: | :---: | :---: |
| 16 | 7 | - | 5536 | - |
| 32 | 7 | - | $\mathbf{7 0 6 1}$ | - |
|  |  |  |  |  |
|  |  |  |  |  |

Wall mounted receptacles


Panel mounted receptacles

|  | angled $20^{\circ}$ | A | P | $\mathbf{2 3 0 V}$ | $\mathbf{4 0 0 V}$ | $\mathbf{5 0 0 V}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16 | 7 | 2883 | $\mathbf{2 4 5 9}$ | 2296 |
|  |  | 32 | 7 | - | $\mathbf{2 3 1 7}$ | 2212 |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

Plugs AM-TOP


Panel mounted inlets

|  |  | A | P | 230V | 400V | 500V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 16 | 7 | 749 | 750 | 1075 |
|  |  | 32 | 7 | 751 | 752 | 1080 |
|  | $\triangle 1 P 44$ |  |  |  |  |  |

Connectors AM-TOP

| single part | A | P | 230V | 400V | 500V |
| :---: | :---: | :---: | :---: | :---: | :---: |
| body, screw | 16 | 7 | 3783 | 3916 | 3784 |
| terminals | 32 | 7 | 2406 | 2255 | 2460 |
|  |  |  |  |  |  |

Wall mounted receptacles with mechanical DUO-interlock

| A | P | 230 V | $\mathbf{4 0 0 V}$ | $\mathbf{5 0 0 V}$ |
| :---: | :---: | ---: | ---: | ---: |
| 16 | 7 | - | 5785 | - |
| 32 | 7 | - | 6106 | - |
|  |  |  |  |  |
|  |  |  |  |  |

## Plugs and receptacles 7 pole for multi functional applications

These plugs and receptacles provide solutions where there are multi functional requirements in industry, farming and commerce.

This number of poles provides solutions in the following fields:

- Star-delta start-up
- Closed loop control
- Open loop control
- Monitoring
- Detection and alarms
- Clearing alarms
- Electrical interlocking




## Perfect in every detail - one fits another

## Anything goes.

Covers, current rating and colors may be optionally combined: neutral cover, with labeling field, with labeling field and lock, 3 pole, 5 pole and SCHUKO.


SP464 James St Lowood SPS - Electrical Installation OM Manual

## Plugs and receptacles 200 A up to 400 A

Plugs and receptacles are available in seawater resistant design on request.
Other voltages and frequencies available on request.

| Receptacles |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| with cable | A | P | 230 V | 400V | 500V | 690V | 1000V | weight |
| gland | 200 | 4 | 75220 | 75221 | 75222 | 75223 | 75224 | 5580 |
|  | 200 | 5 | 75225 | 75226 | 75227 | 75228 | 75229 | 5780 |
|  | 250 | 4 | 75020 | 75021 | 75022 | 75023 | 75024 | 10510 |
| $\sim$ | 250 | 5 | 75110 | 75111 | 75112 | 75113 | 75114 | 11020 |
|  | 400 | 4 | 75025 | 75026 | 75027 | 75028 | 75029 | 10510 |
| - ${ }^{\text {d } 1 P 67}$ | 400 | 5 | 75115 | 75116 | 75117 | 75118 | 75119 | 11020 |
| Panel mounted receptacles |  |  |  |  |  |  |  |  |
|  | A | P | 230V | 400V | 500V | 690V | 1000V | weight |
|  | 200 | 4 | 75240 | 75241 | 75242 | 75243 | 75244 | 3200 |
|  | 200 | 5 | 75245 | 75246 | 75247 | 75248 | 75249 | 3450 |
|  | 250 | 4 | 75040 | 75041 | 75042 | 75043 | 75044 | 6800 |
|  | 250 | 5 | 75130 | 75131 | 75132 | 75133 | 75134 | 7300 |
|  | 400 | 4 | 75045 | 75046 | 75047 | 75048 | 75049 | 6800 |
| ds IP 67 | 400 | 5 | 75135 | 75136 | 75137 | 75138 | 75139 | 7300 |
| Receptacles, switched and interlocked |  |  |  |  |  |  |  |  |
| - | A | P | 230V | 400V | 500V | 690V | 1000V | weight |
|  | 200 | 4 | 75230 | 75231 | 75232 | 75233 | 75234 | 25100 |
|  | 200 | 5 | 75235 | 75236 | 75237 | 75238 | 75279 | 25300 |
|  | 250 | 4 | 75030 | 75031 | 75032 | 75033 | 75034 | 45000 |
| d | 250 | 5 | 75120 | 75121 | 75122 | 75123 | 75124 | 46500 |
|  | 400 | 4 | 75035 | 75036 | 75037 | 75038 | 75039 | 43900 |
| It IP 55 | 400 | 5 | 75125 | 75126 | 75127 | 75128 | 75129 | 45400 |
| Plugs |  |  |  |  |  |  |  |  |
| with cable | A | P | 230V | 400V | 500V | 690V | 1000V | weight |
| mgland | 200 | 4 | 75200 | 75201 | 75202 | 75203 | 75204 | 3000 |
| = | 200 | 5 | 75205 | 75206 | 75207 | 75208 | 75274 | 3200 |
|  | 250 | 4 | 75000 | 75001 | 75002 | 75003 | 75004 | 8290 |
| Hians | 250 | 5 | 75090 | 75091 | 75092 | 75093 | 75094 | 8610 |
| - | 400 | 4 | 75005 | 75006 | 75007 | 75008 | 75009 | 8290 |
| \1 IP 67 | 400 | 5 | 75095 | 75096 | 75097 | 75098 | 75099 | 8610 |
| Connectors |  |  |  |  |  |  |  |  |
| with cable | A | P | 230V | 400 V | 500V | 690V | 1000V | weight |
| gland | 200 | 4 | 75210 | 75211 | 75212 | 75213 | 75214 | 3730 |
|  | 200 | 5 | 75215 | 75216 | 75217 | 75218 | 75219 | 3980 |
| 5 | 250 | 4 | 75010 | 75011 | 75012 | 75013 | 75014 | 9160 |
| 8 | 250 | 5 | 75100 | 75101 | 75102 | 75103 | 75104 | 9670 |
|  | 400 | 4 | 75015 | 75016 | 75017 | 75018 | 75019 | 9160 |
| d IP 67 | 400 | 5 | 75105 | 75106 | 75107 | 75108 | 75109 | 9670 |

## Heavy duty versions for industry



Mechanical interlocking. For mobile consumers of rated current > 125A we have included a heavy duty range with 200A, 250A and 400A in our program. This can be supplied for rated voltages of 230 V to 1000 V and in seawater resistant version.

The heavy duty range is suitable for use in very harsh conditions, e.g. building sites:

- drilling rigs
- tunnel constructions
- gravel pits
- strip mining
- container terminals and crane connections in harbours
- for versatile power supply at large-scale indoor and outdoor events
- power supply to market places
- airports
- quarries


## SCHUKO and grounding-type receptacles

SCHUKO and French/Belgian standard 16A, 230V, $2 p+$ E. British standard 13A, 230V, $2 p+E$. Other variations on request.

## SCHUKO panel mounted receptacles


with plug-in terminals or screw-terminals,
without shutter
$\triangle I P 54$
Grounding-type panel mounted receptacles French/Belgian standard

with plug-in terminals, without shutter
$\triangle$ IP 44

| SCHUKO wall mounted receptacles |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | with plug-in terminals, | Color | plug-in terminals | screw terminals |
|  | without shutter | grey | 10081 | - |
|  |  | blue | 10082 | - |
|  |  | black | 10083 | - |
|  | $\triangle 1 P 44$ | red | - | - |

Base for wall mounted receptacles

|  | with cable entry and screws |  |
| :--- | :--- | :--- |
|  |  |  |
|  | Part no. | grey |
| Part no. | blue | 10714 |
| Part no. | black | 10715 |
|  |  | 10716 |

SCHUKO panel mounted receptacles

|  | with plug-in terminals or screw-terminals, without shutter | Color | plug-in terminals | screw terminals |
| :---: | :---: | :---: | :---: | :---: |
|  |  | grey | - | - |
|  |  | blue | 11511 | 11531 |
|  |  | black | 11512 | 11532 |
|  | IP 20 | red | - | - |

Grounding-type panel mounted receptacle British standard


SCHUKO panel mounted receptacles

|  | with plug-in terminals or | Color | plug-in terminals | screw terminals |
| :---: | :---: | :---: | :---: | :---: |
|  | screw-terminals, | grey | 11060 | - |
| 0106 | with shutter | blue | 11061 | 11081 |
|  |  | black | - | - |
|  | $\triangle$ IP 54 | red | - | - |

Grounding-type panel mounted receptacles French/Belgian standard

with plug-in
terminals or
screw-terminals,
with shutter

| Color | plug-in <br> terminals | screw <br> terminals |
| :--- | ---: | ---: |
| grey | 11160 | 11180 |
| blue | 11161 | 11181 |
| black | 11162 | 11182 |
| red | 11163 | 11183 |

Grounding-type wall mounted receptacle French/Belgian standard

with plug-in terminals, with
shutter

| Color | plug-in <br> terminals | screw <br> terminals |
| :--- | ---: | ---: |
| grey | - | - |
| blue | $\mathbf{1 0 0 9 2}$ | - |
| black | - | - |
| red | - | - |

Modular system for wall mounted receptacle
The combination of the base with one of the panel mounted receptacles shown above, gives a wall mounted receptacle.


Grounding-type panel mounted receptacles French/Belgian standard
 with plug-in

| Color | plug-in <br> terminals | screw <br> terminals |
| :--- | ---: | ---: |
| grey | - | - |
| blue | $\mathbf{1 1 6 1 1}$ | 11631 |
| black | - | - |
| red | - | - |

Grounding-type panel mounted receptacle British standard
 with screwterminals, with shutter and seal
© IP 44

| Color | plug-in <br> terminals | screw <br> terminals |
| :--- | ---: | ---: |
| grey | - | - |
| blue | - | $\mathbf{1 0 7 1 8}$ |
| black | - | - |
| red | - | - |

SCHUKO connectors with grommet



## AMAXX ${ }^{\circledR}$ receptacle combinations

## Success in series

Extensively configurable receptacle combinations in six different sizes - the AMAXX ${ }^{\circledR}$ range by MENNEKES. With an appealing and unique design in many variations for almost all applications. With our extended program, you now have three good extra reasons to opt for $\mathrm{AMAXX}{ }^{\circledR}$ receptacle combinations.


$650 \times 225 \mathrm{~mm}$ (HxW)

$650 \times 112.5 \mathrm{~mm}$ (HxW)


- Protection types: IP 44 and IP 67.
- Enclosure materials: AMAPLAST and especially chemical-resistant AMELAN.
- Colors: bottom part black, top part grey, silver (IP 44), yellow or red.
- Equipped with: CEE receptacles from 16A, 3-poles up to 63A, 5-poles, grounding-type receptacles in accordance with many national standards, DUO receptacles switched and interlocked from 16A, 3p to 32A, $5 p$ as well as fuse elements.


## International



## AMAXX ${ }^{\circledR}$ receptacle combinations

# MENNEKES ${ }^{\circledR}$ 

Plugs for the world

## Features and benefits



## 1 Liftable DIN Rails

Liftable DIN rails and a large, smooth wiring space significantly ease the insertion as well as connection of large cables.

2 One-man installation
Shorter installation times with the new, user-friendly external fixing.

## 3 Hinged cover

The hinged cover which opens to one side, eases connection work.

## Ready for application

All combinations are pre-wired for installation and tested for electric safety and quality.


Generally angled insertion direction.


Both hands free because inspection windows fold dow nwards. WindonQ $\in$ Rnlbe ldckadsithla padlock, enclosure can be seale


Especially fast opening and closing of the enclosure due to captive double-threaded cover screws.


Standard pre-punched cable entries at the top and at the bottom Of09/2016 up to M 40.

## EverGUM receptacle combinations with solid rubber enclosures



With the EverGUM range MENNEKES provides a solid rubber alternative to enclosures in AMAPLAST, AMELAN and sheet steel. This is an alternative which is suitable for the most diverse environments, especially when there is likely to be exposure to rough handling or aggressive cleaning agents. These products can also be supplied to conform to the standards of other European countries.

## AirKRAFT and 3KRAFT

AirKRAFT
for energy, data, compressed air. Also available with feeder cable.

Enclosure
$400 \times 229 \times 220 \mathrm{~mm}$ (size without receptacles)


3KRAFT
for energy, data, compressed air.

Enclosure
diam. 240-264 x H 152 mm
(depending what receptacles are used)

For ceilings, walls and floors.
Three colors: Signal yellow, red or silver.
AirKRAFT. Up to four receptacles, or data, or light, plus compressed air, plus fusing. Ready for connection or with supply cable and plug.
3KRAFT. Equipped to suit your requirements: Up to three receptacles, or data, plus compressed air. Ready for QrPqustion:OTmish $4 \psi$ !ply cable and plug.

## Stainless steel surface and flush mounted

receptacle combinations


Safe.
Practical.
Timelessly elegant.

- Protection type IP 43 or IP 44 with closed door, even when plugs are inserted.
- The cable guard aperture is sufficiently dimensioned for leading through cables.
- Safety lock protects against unauthorized access.


## Power posts

Rugged. Vandalism-proof.
Steel power posts provide a safe means of energy supply, protection against car-crossing. Hot-dip galvanized and powder coated. Available in various sizes.

## CombiTOWER

Power. Compressed air. Water. Outdoors and indoors.
The solution: CombiTOWER. Short routes to your energy source for industry, workshops, assembly shops, loading platforms, etc.



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| 14 | 2776 | $555 \quad 7$ | 907 | 1341 | 1711 | 2782 | 10 | 3981 | 6 | 5887 | 8 | 11081 | 13 | 75043 | 12 |
| 24 | 2786 | 5567 | 919 | 1342 | 1712 | 2818 | 10 | 3987 | 6 | 5888 | 8 | 11110 | 13 | 75044 | 12 |
| 36 | 2796 | 5607 | 9246 | 13435 | 1716 | 2845 | 9 | 4101 | 11 | 5911 | 8 | 11111 | 13 | 75045 | 12 |
| 46 | 2806 | 5617 | 9316 | 1345 5 | 1717 | 2852 | 9 | 4102 | 11 | 5924 | 8 | 11160 | 13 | 75046 | 12 |
| 57 | 2816 | 5627 | 9326 | 13465 | 1719 | 2855 | 9 | 4103 | 11 | 5925 | 8 | 11161 | 13 | 75047 | 12 |
| 67 | 2826 | 577 9 | 933 | 1347 | 1720 | 2860 | 9 | 4105 | 11 | 5955 | 8 | 11162 | 13 | 75048 | 12 |
| 136 | 2866 | 5789 | 935 | 13485 | 1721 | 2864 | 9 | 4106 | 11 | 5956 | 8 | 11163 | 13 | 75049 | 12 |
| 146 | 2876 | 5849 | 938 | 13654 | 1723 | 2870 | 9 | 4107 | 11 | 5959 | 8 | 11180 | 13 | 75090 | 12 |
| 157 | 2886 | 5859 | 9396 | 1366 4 | 17245 | 2883 | 10 | 4108 | 11 | 6059 | 8 | 11181 | 13 | 75091 | 12 |
| 167 | 2896 | 5869 | 942 | 13674 | 1730 | 3030 | 4 | 4110 | 11 | 6062 | 8 | 11182 | 13 | 75092 | 12 |
| 315 | 2906 | 5909 | 945 | 1368 4 | 1733 | 3031 | 4 | 4111 | 11 | 6106 | 10 | 11183 | 13 | 75093 | 12 |
| 325 | 2916 | 5919 | 9476 | 1369 4 | 1734 | 3034 | 4 | 4112 | 11 | 6569 | 8 | 11511 | 13 | 75094 | 12 |
| 336 | 2926 | 5979 | 948 | 13714 | 1735 | 3036 | 4 | 4113 | 11 | 6571 | 8 | 11512 | 13 | 75095 | 12 |
| 346 | 2936 | 5989 | 9496 | 1372 4 | 1738 | 3041 | 4 | 4115 | 11 | 7000 | 8 | 11531 | 13 | 75096 | 12 |
| 357 | 2946 | 5999 | 9516 | 1373 4 | 1739 | 3045 | 4 | 4116 | 11 | 7002 | 8 | 11532 | 13 | 75097 | 12 |
| 367 | 2986 | 6039 | 952 | 1384 | 1740 | 3072 | 4 | 4117 | 11 | 7010 | 8 | 11611 | 13 | 75098 | 12 |
| 1004 | 2996 | 6049 | 9726 | 13854 | 1744 | 3074 | 4 | 4118 | 11 | 7011 | 8 | 11631 | 13 | 75099 | 12 |
| 1014 | 3006 | 6109 | 9797 | 13864 | 1745 | 3093 | 4 | 4120 | 11 | 7012 | 8 | 13101 | , | 75100 | 12 |
| 1024 | 3156 | 6119 | 9807 | 13884 | 1746 | 3110 | 4 | 4122 | 11 | 7050 | 8 | 13102 | 6 | 75101 | 12 |
| 1034 | 3189 | 6129 | 9875 | 1389 4 | 1750 | 3112 | 4 | 4125 | 11 | 7060 | 8 | 13105 | 6 | 75102 | 12 |
| 1044 | 3199 | 6169 | 9885 | 13904 | 1751 | 3136 | 4 | 4127 | 11 | 7061 | 10 | 13106 | 6 | 75103 | 12 |
| 1054 | 3219 | 6179 | 9895 | 13944 | 1755 | 3153 | 4 | 4130 | 11 | 7213 | 8 | 13111 | 6 | 75104 | 12 |
| 1094 | 3229 | 6239 | 9937 | 13954 | 1756 | 3197 | 4 | 4132 | 11 | 7216 | 8 | 13112 | 6 | 75105 | 12 |
| 1104 | 3259 | 6249 | 9947 | 13964 | 1786 | 3200 | 4 | 4133 | 11 | 7217 | 8 | 13201 | 6 | 75106 | 12 |
| 1114 | 327 9 | 6259 | 9975 | 13974 | 1787 | 3240 | 10 | 4135 | 11 | 7218 | 8 | 13202 | 6 | 75107 | 12 |
| 1217 | 3289 | 629 9 | 9985 | 13984 | 1788 | 3254 | 4 | 4137 | 11 | 7219 | 8 | 13203 | 6 | 75108 | 12 |
| 1227 | 3316 | 6309 | 103510 | 13994 | 1789 | 3262 | 10 | 4138 | 11 | 7220 | 8 | 13204 | 6 | 75109 | 12 |
| 1257 | 3326 | 6369 | 104010 | 14106 | 1790 | 3266 | 6 | 4140 | 11 | 7221 | 8 | 13205 | 6 | 75110 | 12 |
| 1267 | 3336 | 6379 | 104510 | 1411 6 | 17915 | 3306 | 6 | 4141 | 11 | 7222 | 8 | 13206 | 6 | 75111 | 12 |
| 1284 | 3346 | 6389 | 105010 | 1418 4 | 1795 | 3312 | 6 | 4142 | 11 | 7238 | 8 | 13210 | 6 | 75112 | 12 |
| 1294 | 3356 | 6429 | 105510 | 14194 | 1796 | 3319 | 9 | 4143 | 11 | 7239 | 8 | 13211 | 6 | 75113 | 12 |
| 1304 | 3366 | 6439 | 106010 | 14204 | 1797 | 3322 | 9 | 4145 | 11 | 7240 | 8 | 13212 | 6 | 75114 | 12 |
| 1314 | 3389 | 6499 | 106510 | 14214 | 1801 | 3331 | 5 | 4146 | 11 | 7241 | 8 | 13215 | 6 | 75115 | 12 |
| 1324 | 3399 | 6509 | 107010 | 14224 | 1802 | 3338 | 9 | 4147 | 11 | 7242 | 8 | 13216 | 6 | 75116 | 12 |
| 1344 | 3406 | 6519 | 107510 | 1423 4 | 1803 | 3339 | 9 | 4148 | 11 | 7243 | 8 | 13217 | 6 | 75117 | 12 |
| 1354 | 3416 | 681 9 | 108010 | 1424 4 | 18045 | 3340 | 9 | 4150 | 11 | 7244 | 8 | 13218 | 6 | 75118 | 12 |
| 1364 | 3426 | 6829 | 10814 | 14254 | 1805 | 3341 | 9 | 4162 | 11 | 7502 | 8 | 13219 | 6 | 75119 | 12 |
| 1374 | 3436 | 688 9 | 11034 | 14387 | 1808 | 3342 | 9 | 4163 | 11 | 7503 | 8 | 13223 | 6 | 75120 | 12 |
| 1384 | 3446 | 689 9 | 11076 | 14554 | 1809 | 3343 | 9 | 4165 | 11 | 7504 | 8 | 13224 | 6 | 75121 | 12 |
| 1394 | 3456 | 6909 | 11224 | 14564 | 18105 | 3345 | 9 | 4167 | 11 | 7505 | 8 | 13225 | 6 | 75122 | 12 |
| 1414 | 3466 | 6949 | 1123 4 | 14574 | 18115 | 3346 | 9 | 4168 | 11 | 7507 | 8 | 14101 | 7 | 75123 | 12 |
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| 1434 | 3486 | 7019 | 11264 | 1460 4 | 1813 | 3348 | 9 | 4171 | 11 | 7512 | 8 | 14105 | 7 | 75125 | 12 |
| 1476 | 3526 | 7029 | 11274 | 14614 | 1814 | 3350 | 9 | 4172 | 11 | 7513 | 8 | 14106 | 7 | 75126 | 12 |
| 1486 | 3536 | 7039 | 11284 | 14624 | 1818 | 3355 | 9 | 4173 | 11 | 7514 | 8 | 14111 | 7 | 75127 | 12 |
| 1496 | 3546 | 7116 | 11315 | 1463 4 | 1819 | 3356 | 9 | 4175 | 11 | 7516 | 8 | 14112 | 7 | 75128 | 12 |
| 1516 | 3556 | 7126 | 1132 | 1464 4 | 1820 5 | 3380 | 4 | 4177 | 11 | 7520 | 8 | 14201 | 7 | 75129 | 12 |
| 1526 | 3566 | 7176 | 11335 | 14654 | 18259 | 3385 | 5 | 4178 | 11 | 7521 | 8 | 14202 | 7 | 75130 | 12 |
| 1596 | 3576 | 7196 | 11355 | 14664 | 18319 | 3413 | 6 | 4180 | 11 | 7523 | 8 | 14203 | 7 | 75131 | 12 |
| 1606 | 3596 | 7257 | 11364 | 1467 4 | 18329 | 3424 | 6 | 4233 | 11 | 7524 | 8 | 14204 | 7 | 75132 | 12 |
| 1636 | 3606 | 7317 | 11374 | 1471 | 18359 | 3449 | 4 | 4237 | 11 | 7526 | 8 | 14205 | 7 | 75133 | 12 |
| 1646 | 3616 | 73310 | 11384 | 14724 | 18379 | 3451 | 4 | 4238 | 11 | 7530 | 8 | 14206 | 7 | 75134 | 12 |
| 1797 | 3626 | 73410 | 11394 | 1473 4 | 1838 9 | 3454 | 4 | 4247 | 11 | 7531 | 8 | 14210 | 7 | 75135 | 12 |
| 1807 | 3636 | 73510 | 11404 | 1474 | 18449 | 3473 | 5 | 4254 | 11 | 7533 | 8 | 14211 | 7 | 75136 | 12 |
| 1817 | 3646 | 73610 | 11414 | 1475 4 | 18459 | 3485 | 5 | 4262 | 11 | 7534 | 8 | 14212 | 7 | 75137 | 12 |
| 1937 | 3666 | 73710 | 11434 | 14764 | 18489 | 3517 | 9 | 4263 | 11 | 7536 | 8 | 14215 | 7 | 75138 | 12 |
| 1947 | 3676 | 73810 | 1144 | 1477 | 1850 | 3523 | 9 | 4273 | 11 | 7602 | 8 | 14216 | 7 | 75139 | 12 |
| 2005 | 3686 | 73910 | 11454 | 1478 | 1851 | 3524 | 4 | 4274 | 11 | 7603 | 8 | 14217 | 7 | 75200 | 12 |
| 2034 | 3926 | 74010 | 1146 | 1479 4 | 1852 | 3575 | 4 | 4275 | 11 | 7604 | 8 | 14218 | 7 | 75201 | 12 |
| 204 4 | 3936 | 74110 | 11474 | 14834 | 1855 | 3583 | 6 | 4970 | 11 | 7605 | 8 | 14219 | 7 | 75202 | 12 |
| 2054 | 3946 | 74210 | 11484 | 1484 | 1856 | 3646 | 6 | 4971 | 11 | 7607 | 8 | 14223 | 7 | 75203 | 12 |
| 2074 | 3969 | 74310 | 1149 | 1485 | 1860 | 3656 | 6 | 4972 | 11 | 7611 | 8 | 14224 | 7 | 75204 | 12 |
| 2084 | 3979 | 74410 | 11504 | 1489 4 | 1861 | 3658 | 6 | 4973 | 11 | 7612 | 8 | 14225 | 7 | 75205 | 12 |
| 2094 | 3986 | 74510 | 11514 | 1490 | 1867 | 3665 | 6 | 4974 | 11 | 7613 | 8 | 20970 | 9 | 75206 | 12 |
| 2104 | 3996 | 74610 | 11534 | 1491 | 1868 | 3704 | 6 | 4976 | 11 | 7614 | 8 | 21241 | 9 | 75207 | 12 |
| 2114 | 4006 | 74710 | 1154 | 14924 | 1870 | 3717 | 9 | 4977 | 11 | 7616 | 8 | 41404 | 11 | 75208 | 12 |
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| $214 \quad 4$ | 4026 | 74910 | 11665 | 1494 | 1875 | 3777 | 10 | 4980 | 11 | 7621 | 8 | 75001 | 12 | 75211 | 12 |
| 215 4 | 4036 | 75010 | 11774 | 14954 | 18765 | 3783 | 10 | 5099 | 8 | 7623 | 8 | 75002 | 12 | 75212 | 12 |
| 2164 | 4046 | 751 | 11784 | 14964 | 1877 5 | 3784 | 10 | 5100 | 8 | 7624 | 8 | 75003 | 12 | 75213 | 12 |
| 2174 | 4056 | 75210 | 11924 | 14984 | 1878 | 3794 | 6 | 5102 | 8 | 7626 | 8 | 75004 | 12 | 75214 | 12 |
| 2184 | 4066 | 7617 | 11934 | 14994 | 18795 | 3796 | 6 | 5103 | 8 | 7628 | 8 | 75005 | 12 | 75215 | 12 |
| 2194 | 4106 | 7637 | 1194 | 15004 | 1880 | 3799 | 6 | 5104 | 8 | 7629 | 8 | 75006 | 12 | 75216 | 12 |
| $220 \quad 4$ | 4116 | 8006 | 11954 | 1501 4 | 1884 | 3807 | 6 | 5105 | 8 | 7633 | 8 | 75007 | 12 | 75217 | 12 |
| 2214 | 4126 | 8016 | 11964 | 15024 | 1885 | 3809 | 6 | 5107 | 8 | 7634 | 8 | 75008 | 12 | 75218 | 12 |
| 2224 | 4185 | 8026 | 11984 | 15034 | 1955 | 3811 | 6 | 5108 | 8 | 7636 | 8 | 75009 | 12 | 75219 | 12 |
| 2264 | 4195 | 8036 | 11994 | 1504 4 | 19619 | 3819 | 6 | 5109 | 8 | 10081 | 13 | 75010 | 12 | 75220 | 12 |
| 2274 | 4205 | 8046 | 12004 | 15054 | 19629 | 3821 | 6 | 5110 | 8 | 10082 | 13 | 75011 | 12 | 75221 | 12 |
| 228 4 | 4215 | 8106 | 12014 | 15064 | 19659 | 3823 | 6 | 5112 | 8 | 10083 | 13 | 75012 | 12 | 75222 | 12 |
| 2294 | 4225 | 8126 | 12024 | 15514 | 1967 9 | 3829 | 6 | 5113 | 8 | 10092 | 13 | 75013 | 12 | 75223 | 12 |
| 2304 | 5097 | 8136 | 12034 | 15554 | 1968 9 | 3830 | 6 | 5457 | 8 | 10713 | 13 | 75014 | 12 | 75224 | 12 |
| 2314 | 5107 | 8156 | 12044 | 15564 | 19749 | 3832 | 6 | 5459 | 8 | 10714 | 13 | 75015 | 12 | 75225 | 12 |
| 2324 | 5117 | 8166 | 12054 | 15574 | 19759 | 3839 | 6 | 5460 | 8 | 10715 | 13 | 75016 | 12 | 75226 | 12 |
| 2334 | 5127 | 8176 | 12064 | 16315 | 1978 | 3841 | 6 | 5462 | 8 | 10716 | 13 | 75017 | 12 | 75227 | 12 |
| 2344 | 5137 | 8196 | 12084 | 1632 | 19809 | 3844 | 6 | 5536 | 10 | 10718 | 13 | 75018 | 12 | 75228 | 12 |
| 2384 | 5147 | 8216 | 12094 | 1633 5 | 1981 6 | 3851 | 6 | 5599 | 8 | 10749 | 13 | 75019 | 12 | 75229 | 12 |
| 2394 | 5187 | 8226 | 1210 4 | 16365 | 19826 | 3853 | 6 | 5600 | 8 | 10751 | 13 | 75020 | 12 | 75230 | 12 |
| $240 \quad 4$ | 5197 | 8256 | 12114 | 16375 | 19836 | 3855 | 6 | 5602 | 8 | 10754 | 13 | 75021 | 12 | 75231 | 12 |
| 2415 | 5217 | 826 | 12166 | 1638 5 | 19846 | 3859 | 7 | 5603 | 8 | 10755 | 13 | 75022 | 12 | 75232 | 12 |
| 2425 | 5227 | 8276 | 12176 | 16425 | 21624 | 3860 | 7 | 5604 | 8 | 10837 | 13 | 75023 | 12 | 75233 | 12 |
| 2435 | 5237 | 8296 | 12464 | 1643 | 216610 | 3862 | 7 | 5605 | 8 | 10838 | 13 | 75024 | 12 | 75234 | 12 |
| 2445 | 5247 | 8306 | 1247 4 | 16675 | 216710 | 3869 | 7 | 5607 | 8 | 10839 | 13 | 75025 | 12 | 75235 | 12 |
| 2455 | 5257 | 8316 | 12484 | 1668 | 2179 4 | 3871 | 7 | 5608 | 8 | 10840 | 13 | 75026 | 12 | 75236 | 12 |
| 2476 | 5267 | 8326 | 12504 | 1669 5 | $2180 \quad 4$ | 3873 | 7 | 5610 | 8 | 10841 | 13 | 75027 | 12 | 75237 | 12 |
| 2486 | 5307 | 8346 | 12514 | 16725 | 2181 | 3879 | 7 | 5613 | 8 | 10842 | 13 | 75028 | 12 | 75238 | 12 |
| 2496 | 5317 | 8356 | 12524 | 1673 | 221210 | 3881 | 7 | 5615 | 8 | 10843 | 13 | 75029 | 12 | 75240 | 12 |
| 2506 | 5397 | 8366 | 1260 4 | 1674 | 221310 | 3883 | 7 | 5618 | 8 | 10844 | 13 | 75030 | 12 | 75241 | 12 |
| 2516 | 5407 | 837 | 1261 4 | 1678 | 225510 | 3887 | 7 | 5630 | 8 | 10845 | 13 | 75031 | 12 | 75242 | 12 |
| 2526 | 5417 | 8386 | 12624 | 1679 | 229610 | 3888 | 7 | 5633 | 8 | 10846 | 13 | 75032 | 12 | 75243 | 12 |
| 2566 | 5427 | 8396 | 1263 4 | 1688 | 231710 | 3891 | 7 | 5635 | 8 | 11010 | 13 | 75033 | 12 | 75244 | 12 |
| 2576 | 5437 | 8406 | 1264 4 | 17005 | 232410 | 3896 | 7 | 5638 | 8 | 11011 | 13 | 75034 | 12 | 75245 | 12 |
| 2596 | 5447 | 8436 | 12654 | 1701 | 240510 | 3897 | 7 | 5640 | 8 | 11012 | 13 | 75035 | 12 | 75246 | 12 |
| 2606 | 5487 | $844{ }^{6}$ | 12674 | 1702 | 240610 | 3899 | 7 | 5643 | 8 | 11013 | 13 | 75036 | 12 | 75247 | 12 |
| 2616 | 5497 | 8549 | 12684 | 1703 | 245910 | 3905 | 7 | 5691 | 8 | 11030 | 13 | 75037 | 12 | 75248 | 12 |
| 2626 | 5507 | 856 | 12709 | 17045 | 246010 | 3907 | 7 | 5692 | 8 | 11031 | 13 | 75038 | 12 | 75249 | 12 |
| 2636 | 5517 | 859 9 | 12719 | 17075 | 24789 | 3909 | 7 | 5696 | 8 | 11032 | 13 | 75039 | 12 | 75274 | 12 |
| 2646 | 5527 | 8916 | 1272 | 17085 | 25119 | 3913 | 10 | 5743 | 8 | 11033 | 13 | 75040 | 12 | 75279 | 12 |
| 2686 | 5537 | 9034 | 1273 9 | 17095 | 264810 | 3916 | 10 | 5785 | 10 | 11060 | 13 | 75041 | 12 |  |  |
| 29-Pufise | Id: 5 ¢MS1412 | 29054 | 13405 | 1710 Aētiv | ve: 30\%09/2015 | 53980 | 6 | 5793 | 8 | 11061 | 13 | Pageatz8 | 1®f | 1382 |  |

## References

Plugs for the world



BM W motorcycle plant, Berlin - Germany


Formula 1 circuit, M anama - Bahrain



AIDAbella, Jos. L. M eyer Werft, Papenburg - Germany


Constitution, Heerema M arine Contractors - Netherland


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The right combination for every application.


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Non-M etallic Interlocked Receptacles.


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## (973) 882-8333

Request brochures by E-Mail to:
info@MENNEKES.com

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## TECHNICAL DATA SHEET

Equipment Type:Impulse Suppressor
Location:

RTU Section

Model Numbers:IS-50NX-C2
Manufacturer: Polyphaser
Supplier:
RFI Industries
30 Raubers RoadBanyo, QLD 4010Ph: 0736219400Fax: 0736215505
Web: www.rfi.com.au


## MAXIMUM CHARACTERISTICS

## SURGE:

50kA IEC 1000-4-5 8/20 1 s WAVEFORM 500 JOULES TURN ON:
$600 \mathrm{Vdc} \pm 20 \%$
TURN ON TIME:
2.5ns FOR $2 \mathrm{kV} / \mathrm{ns}$

FREQUENCY RANGE:
125 MHz TO 1 GHz
vSWR:
S1.1:1 OVER FREQUENCY RANGE
INSERTION LOSS:
$\leq 0.1 \mathrm{~dB}$ OVER FREQUENCY RANGE
TEMPERATURE:
$-45^{\circ} \mathrm{C}$ TO $+85^{\circ} \mathrm{C}$ STORAGE/OPERATING $+50^{\circ} \mathrm{C}$

CUSTOMER APPROVAL: $\qquad$ DATE:
all dimensions shown above are for reference only.

| DRAFTER <br> J. CALLISTER | $\begin{gathered} \text { DATE } \\ 09 / 21 / 93 \end{gathered}$ | rolyphoser <br> P.O. BOX 9000, MINDEN, NV 89423-9000 (775) 782-2511 |  |  | FAX (775) 782-4476 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| MECH ENGINEER | DATE |  |  |  |  |
| - - - - | - - - | DWG No/PART NO/DESCRIPTION |  |  |  |
| $\begin{aligned} & \text { ELEC ENGINEER } \\ & \text { J. JONES } \end{aligned}$ | $\begin{aligned} & \text { DATE } \\ & 04 / 12 / 95 \end{aligned}$ | IS-50NX-C2 |  |  |  |
| MARKETING | date | CUSTOMER PRINT |  |  |  |
| QUALITY DEPT | DATE | CAGE CODE | FILE NAME | SCALE | SHEET |
| R. MATHEUS | 04/12/95 | 61114 | $-\mathrm{C} 1$ | 1/1 | 1 OF |

## TECHNICAL DATA SHEET

Equipment Type:
Location:
Model Numbers:
PB251
Manufacturer:
Powerbox
Supplier:
Powerbox Australia Pty Ltd433 Logan RoadStones Corner, QLD 4120

Ph: 0733948372
Fax: 0733948373
Web: www.powerbox.com.au

## 220-330 WATTS DC UPS

## Features

- Ultra-low noise output
- Independent battery charging output
- DC output OK \& battery OK alarms \& LEDs
- Battery-LVD and alarm
- Over-temperature protection
- Battery fuse fail LED


## Specifications

InPuT

| Voltage: | 190 to 264 vac, or 190 to 400VDC |
| :--- | :--- |
| Line regulation: | $0.2 \%$ typical |
| Current: | 1.4 A maximum |
| Inrush current: | 10 A maximum |
| Frequency: | 45 to 65 Hz |

OUTPUT

| Voltage | See table |
| :--- | :--- |
| Current | See table |
| Load regulation | $0.5 \%$ typical |
| Current limit type - load cct | Constant current |
| Current limit type - batt. cct | Constant current |
| Short circuit protection | Indefi nite, auto-resetting |
| Over-voltage protection | 17.5 to 20V latching (13.8Vdc output) |
|  | 31.5 to 39V latching (27.6Vdc output) |
| Ripple \& noise | $28 \mathrm{mVp}-\mathrm{p} \mathrm{(13.8Vdc} \mathrm{output)}$ |
| 100 MHz bandwidth | $55 \mathrm{mVp}-\mathrm{p}(27.6 \mathrm{Vdc}$ output) |

ENVIRONMENTAL

| Operating temperature | 0 to $70^{\circ} \mathrm{C}$ ambient with derating, 5...90\% <br> relative humidity <br> (non-condensing) |
| :--- | :--- |
| Over-temperature protection | Automatic \& auto-resetting |
| Cooling requirement | Natural convection |
| Efficiency | $80 \%$ minimum |

## Selection Table



## STANDARDS \& APPROVALS

| Safety | Complies with AS/NZS 60950, class 1, |
| :--- | :--- |
|  | NSW Office of Fair Trading Approval N20602 |
| EMC | Emissions comply with AS/NZS CISPR11, |
|  | Group 1, Class B. Complies with ACA EMC <br>  <br>  <br>  <br>  <br>  <br>  <br>  <br> Scheme, Safety \& EMC Regulatory Compliance <br> Isolation i/p-o/p <br> i/p-ground <br> o/p-ground |

## ALARMS \& BATTERY FUNCTIONS

| Converter ON/OK alarm | Indicated by voltage-free changeover relay <br>  |
| :--- | :--- |
| green LED | ON=PSU OK |
| Battery low (\& fuse) alarm | 10.2 to 12.6 V for 12V battery, adjustable 20.4 <br> to 25.2 V for 24V battery, adjustable Indicated <br>  <br> green LED: ON=BATT OK |
| Low voltage disconnect | 9.6 to 12V for 12V battery, adjustable <br> 19.2 to 24V2 for 4V battery, adjustable |
| Charger over-load protection | Auto-resetting electronic circuit breaker |
| Reverse polarity protection | Internal battery fuse |
| Battery to load voltage drop | 0.2 to. 0.25 V typical |
| MECHANICAL |  |
| Case size | $264 \mathrm{~L} \times 172 \mathrm{~W} \times 67 \mathrm{H} \mathrm{mm}$ |
| Case size with heatsink | $264 \mathrm{~L} \mathrm{x} \mathrm{186} \mathrm{W} \mathrm{x} \mathrm{67H} \mathrm{~mm}$ |
| Rack size | $232 \mathrm{D} \mathrm{x} \mathrm{19"} \mathrm{~W} \mathrm{x} \mathrm{2RU} \mathrm{H}$ |
| Weight | 1.9 kg |
| Weight with heatsink | 2.1 kg |
| Weight (rack mounted version) | 5.5 kg |


| MODEL | OUTPUT |  |  | OUTPUT | Note: Non standard battery charging current available on request. ie PB251-12CM-H-10 for 10A. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| NUMBER | VDC | ILoad | $\mathrm{I}_{\text {BATt }}$ | POWER |  |
| PB251-12CM | 13.8 V | 16A | 2A | 220W |  |
| PB251-12CM-H | 13.8 V | 20A | 2A | 275W |  |
| PB251-24CM | 27.6 V | 11A | 2A | 300W |  |
| PB251-24CM-H | 27.6 V | 12A | 2A | 330 W |  |
| PB251-12RML | 13.8 V | 20A | 4A | 275W |  |
| PB251-12B | 13.8 V | 20A | 4A | 275W |  |
| PB251-24RML | 27.6 V | 12A | 2A | 330W |  |

Technical Illustrations


## TECHNICAL DATA SHEET

## Equipment Type:

Location:

Model Numbers:

## Manufacturer:

Supplier:

020130FSP
Level Probe

Common Control

Multitrode

Brisbane Technology Park
Unit 1, 18 Brandl Street
P.O. Box 4633

Eight Mile Plains
Queensland 4113
Australia
733407000

## The MultiTrode Probe


#### Abstract

MultiTrode probes are unsurpassed for rugged reliability, cost effectiveness and simplicity. Designed for the tough, turbulent conditions found in water, sewage and industrial tanks and sumps, the probes can be found in the simplest and the most complex water and wastewater management systems around the world.


- Low maintenance
- Simple installation
- Excellent in turbulence
- Short \& long term cost savings
- Environmentally friendly
- Safe, low sensing voltage
- Unaffected by fat, grease, debris and foam
- Positive pump cut-out
- Safe - MTISB Barrier


## Reliable in all conditions

Operation is unaffected by build up of fat, grease debris and foam, which causes other systems such as floats, bubblers, pressure and ultrasonic transducers to fail. Turbulence does not affect the probe operation. The rugged, streamlined design eliminates tangling and is ideal for confined spaces.

## Positive pump cut-out

Operational consistency is important to longevity, low maintenance and cost control. The positive pump cut-out ensures pumps are turned off at the same level every time. This avoids damage due to pump over run and the cost of additional control equipment.

## Safe for people and environment

The extra low sensing voltage ensures operators and maintenance staff are protected. All MultiTrode products are environmentally safe, containing no mercury or other harmful contaminants.

## Cost savings

The low cost of equipment, installation and maintenance makes MultiTrode one of the most efficient level control systems available. Plus robust construction and longevity ensures continued cost savings when compared to other systems on the market.

## Standard and custom probes

MultiTrode manufactures a wide range of standard probes, from a single sensor $(200 \mathrm{~mm})$ to a ten-sensor probe ( 1000 mm increasing to a maximum of nine metres). Custom probes can be manufactured to suit your requirements.

## Installation

Installation is straightforward. Probes are easy to install without entering the wet area. The probe is simply lowered in from the top and suspended by its own cable, using the mounting kit supplied.

## MTAK-1 Mounting Kit (Supplied)

The mounting bracket is a standard accessory supplied with all multi-sensor probes (not standard with 0.2/1-xx single sensor probe).
The MTAK-1 mounting bracket has an integral cleaning device. All metal components are stainless steel.


## MTAK-2 Mounting Kit (Optional extra)

This extended bracket provides up to 300 mm extra wall clearance. This bracket is not included as standard with probes.


Ordering Examples and Information

| Model <br> Code | Probe <br> Length <br> $(\mathbf{m} / \mathbf{i n})$ | Sensor <br> Separation <br> $(\mathbf{m m} / \mathbf{i n})$ | Cable <br> Length* <br> $(\mathbf{m} / \mathbf{f t})$ | Number of <br> Sensors |
| :---: | :---: | :---: | :---: | :---: |
| $0.2 / 1-10$ | $0.2 / 8$ | $\mathrm{~N} / \mathrm{A}$ | $10 / 33$ | 1 |
| $0.5 / 3-10$ | $0.5 / 16$ | $150 / 6$ | $10 / 33$ | 3 |
| $1.0 / 10-10$ | $1 / 40$ | $100 / 4$ | $10 / 33$ | 10 |
| $1.5 / 10-30$ | $1.5 / 60$ | $150 / 6$ | $30 / 100$ | 10 |
| $2.0 / 10-30$ | $2 / 80$ | $200 / 8$ | $30 / 100$ | 10 |
| $2.5 / 10-30$ | $2.5 / 96$ | $250 / 10$ | $30 / 100$ | 10 |
| $3.0 / 10-30$ | $3 / 115$ | $300 / 12$ | $30 / 100$ | 10 |
| $6.0 / 10-30$ | $6 / 224$ | $600 / 24$ | $30 / 100$ | 10 |
| $9.0 / 10-30$ | $9 / 368$ | $900 / 40$ | $30 / 100$ | 10 |

*Cable Length $10 \mathrm{~m} / 33 \mathrm{ft}$ or $30 \mathrm{~m} / 100 \mathrm{ft}$

| Probe Length <br> (meters) | Sensor <br> Points | Cable Length <br> (meters) |
| :---: | :---: | :---: |
| 2.5 | 10 | 10 |

MultiTrode Pty Ltd • Australia Brisbane Technology Park 18 Brandl Street PO Box 4633 Eight Mile Plains QId 4113 Tel: +61 733407000 Fax: +61733407077

## TECHNICAL DATA SHEET

Equipment Type:Pressure Measurementinstrument
Location:
Model Numbers:
VEGABAR 52
Vega
Supplier:
Vega398 The BoulevardKerrawee, NSW 2232Ph: 0295426662Fax: 0295426665Web: www.vega.com/au

## VEGABAR 52

## Profibus PA

## Pressure transmitter with CERTEC $^{\circledR}$ measuring cell



## Area of application

The VEGABAR 52 pressure transmitter can be used universally for measurement of gases, vapours and liquids. Also substances such as sand are not problem for the abrasion-resistant ceramic measuring cell. The VEGABAR 52 is an economical solution for a multitude of applications in all areas of industry.

## Advantages

- High plant availability through maximum overload and vacuum resistance of the ceramic measuring cell
- Measurement down to the last drop through extremely small measuring ranges with high accuracy.
- Low costs for maintenance thanks to wear-free ceramic measuring cell


## Function

The heart of the pressure transmitter is the pressure measuring cell that transforms pressure into an electrical signal. This pressure-dependent signal is converted into a standard output signal by the integrated electronics.
The sensor element is the CERTEC ${ }^{\circledR}$ measuring cell with excellent longterm stability and high overload resistance. The CERTEC ${ }^{\circledR}$ measuring cell is also equipped with a temperature sensor. The temperature value can be displayed via the indicating and adjustment module or processed via the signal output.

| Technical data |  |
| :---: | :---: |
| Measuring ranges | $\begin{aligned} & -1 \ldots+72 \mathrm{bar} /-100 \mathrm{kPa} \ldots+7200 \mathrm{kPa} \\ & (-14.5 \ldots+1044 \mathrm{psig}) \end{aligned}$ |
| Smallest measuring range | +0.1 bar/+10 kPa (+1.45 psig) |
| Deviation | $<0.075 \%$, optionally up to < $0.05 \%$ |
| Process fitting | Thread G1⁄2 (EN 837), thread from G1½ (DIN 3852-A), flanges from DN 25 or ANSI 1", fittings for the food processing and paper industry |
| Process temperature | $-40 \ldots+150{ }^{\circ} \mathrm{C}\left(-40 \ldots+302{ }^{\circ} \mathrm{F}\right)$ |
| Ambient, storage and transport temperature | $-40 \ldots+80^{\circ} \mathrm{C}\left(-40 \ldots+176^{\circ} \mathrm{F}\right)$ |
| Betriebsspannung | $9 \ldots 32 \mathrm{~V}$ DC |

## Materials

The wetted parts of the instrument are made of 316L, PVDF, Hastelloy, C4-plated or Sapphire-ceramic ${ }^{\circledR}$. The process seal is available in FKM, FFKM as well as EPDM.
You will find a complete overview of the available materials and seals in the "configurator" on our homepage under www.vega.com/configurator.

## Housing versions

The housings are available as single chamber or double chamber version in plastic, stainless steel or aluminium.
They are available in protection ratings up to IP 68 (25 bar) with external electronics.

## Electronics versions

The instruments are available in different electronics versions. Apart from the two-wire electronics with $4 \ldots 20 \mathrm{~mA}$ or $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$, two purely digital versions with Profibus PA and Foundation Fieldbus are available.

## Approvals

The instruments are suitable for use in hazardous areas and are approved e.g. according to ATEX and IEC. The instruments have also different ship approvals such as e.g. GL, LRS or ABS.
You can find detailed information on the existing approvals in the "configurator" on our homepage under www.vega.com/configurator.

## Bedienung

Die Bedienung des Gerätes erfolgt über das optional einsetzbare Anzeige- und Bedienmodul PLICSCOM oder über einen PC mit der Bediensoftware PACTware und entsprechendem DTM. Eine alternative Bedienmöglichkeit ist das herstellerspezifische Bedienprogramm PDM.


Elektrischer Anschluss


Elektronik- und Anschlussraum Einkammergehäuse
1 Steckverbinder für VEGACONNECT ( $I^{2} C$-Schnittstelle)
2 Federkraftklemmen zum Anschluss der externen Anzeige VEGADIS 61
3 Erdungsklemme zum Anschluss des Kabelschirms
4 Federkraftklemmen für Spannungsversorgung und Signalausgang
Details zum elektrischen Anschluss finden Sie in der Betriebsanleitung des Gerätes auf unserer Homepage unter www.vega.com/downloads.

## Dimensions


(1)

Dimensions VEGABAR 52
1 Threaded version $G 1 ⁄ 2$ A (manometer connection EN 837)

2 Threaded version G1½ A
3 Flange version DN 50

## Information

You can find further information about the VEGA product line on our homepage www.vega.com.
In the download section under www.vega.com/downloads you'll find free operating instructions, product information, brochures, approval documents, instrument drawings and much, much more.
There, you will also find GSD and EDD files for Profibus PA systems as well as DD and CFF files for Foundation Fieldbus systems.

## Instrument selection

With the "finder" you can select the most suitable measuring principle for your application: www.vega.com/finder.
You can find detailed information on the instrument versions in the "configurator" on our homepage under www.vega.com/configurator.

## Contact

You can find the VEGA agency serving your area on our homepage www.vega.com.

## TECHNICAL DATA SHEET

Equipment Type:Valve Measurement instrument
Location:
Model Numbers:
VEGADIS 62
Manufacturer: Vega
Supplier:
Vega398 The BoulevardKerrawee, NSW 2232Ph: 0295426662Fax: 0295426665Web: www.vega.com/au

## VEGADIS 62

## External indicating and adjustment unit without external energy



## Application area

VEGADIS 62 is suitable for measured value indication and adjustment of sensors with HART protocol. The instrument is looped directly into the signal line at any location.
VEGADIS 62 can be also used as indicator for bus participants in a HART multidrop system.
VEGADIS 62 operates also as a pure indicating instrument in a $4 \ldots 20 \mathrm{~mA}$ current loop.

## Advantages

- Digital and quasianalogue indication of the measured value
- Digital LC display with 4-key adjustment
- Detachable indicating and adjustment module
- Protection rating IP 65


## Function

VEGADIS 62 measures the current in the current loop and indicates the measured value in digital and quasianalogue format.
The instrument operates in two modes: in HART mode the instrument listens continuously to the HART communication of the processing system with the sensor. Modifications of units and/or measuring range are adapted automatically. In the basic mode, all settings of VEGADIS 62 are carried out with the keys on the front.

## Technical data

## General data

Materials

- Housing
- Inspection window in hous-
plastic PBT, Alu die-casting, 316L
Polycarbonate (UL-746-C listed) ing cover for indicating and adjustment module
- Ground terminal 316Ti/316L

Weight approx.
0.35 kg ( 0.772 lbs )

## Supply circuit

Voltage supply and data trans- via the signal circuit mission
Current range
$3.5 \ldots 22.5 \mathrm{~mA}$

## Indicating and adjustment module

Display

- Principle LCD
- Measured value presenta- 7 segments, 5 -digit, height of digits 9 mm tion (0.354 in), indication range -99999 ... 99999
- Bar graph 20 segments
- Info line

14 segments, 6-digit, height of digits 5.5 mm ( 0.217 in )

4 keys
Adjustment elements
Materials

- Housing
- Inspection window


## Ambient conditions

Ambient temperature $\quad-20 \ldots+70^{\circ} \mathrm{C}\left(-4 \ldots+158^{\circ} \mathrm{F}\right)$
Storage and transport temper- $-40 \ldots+80^{\circ} \mathrm{C}\left(-40 \ldots+176{ }^{\circ} \mathrm{F}\right)$
ature
Electromechanical data
Cable gland $2 \times$ cable entry M20 x 1.5 (cable:
$\quad \varnothing 5 \ldots 9 \mathrm{~mm}$ )
Spring-loaded terminals for wire cross-section

| - Massive wire, cord | $0.2 \ldots 2.5 \mathrm{~mm}^{2}$ (AWG $24 \ldots 14$ ) |
| :--- | :--- | :--- |
| - Cord with cable end sleeve | $0.2 \ldots 1.5 \mathrm{~mm}^{2}$ (AWG $24 \ldots 16$ ) |

## Electrical protective measures

Protection rating
$\begin{array}{ll}\text { - Housing plastic } & \text { IP 66/IP } 67 \\ \text { - } \begin{array}{l}\text { Housing Aluminium, stain- } \\ \\ \\ \text { less steel }\end{array} & \text { IP 66/IP } 68 \text { (0.2 bar) } \\ & \end{array}$

## Approvals

You can find detailed information on the existing approvals in the "configurator" on our homepage under www.vega.com/configurator.

## Operation

The adjustment of VEGADIS 62 is menu-controlled via four keys on the front and one LC display.


## Indicating and adjustment elements

1 Status information (HART mode, unit lock, warning or error information)
2 Unit and information line
3 Digital measured value indication
3 Bar graph for quasianalogue measured value indication
3 Adjustment keys

## Electrical connection



## Wiring plan VEGADIS 62

1 To the sensor
2 For power supply
3 For connection cable to indicating and adjustment module


Installation example VEGADIS 62 in conjunction with an individual sensor
1 Sensor
2 VEGADIS 62
3 HART resistance $250 \Omega$ (required depending on the processing)
4 Voltage supply/Processing
You can find details on the electrical connection in the operating instructions of the instruments on our homepage under www.vega.com/downloads.

## Dimensions



## TECHNICAL DATA SHEET

Equipment Type: ..... Hydrostatic
Location:
Model Numbers: VEGADIS 62
Manufacturer: Vega
Supplier:
Vega398 The BoulevardKerrawee, NSW 2232
Ph: 0295426662Fax: 0295426665
Web: www.vega.com/au

## VEGAWELL 52



## Product Information

## Contents

1 Description of the measuring principle ..... 3
2 Type overview ..... 4
3 Mounting instructions. ..... 5
4 Electrical connection
4.1 General requirements ..... 7
4.2 Power supply ..... 7
4.3 Connection cable. ..... 7
4.4 Cable screening and grounding ..... 7
4.5 Wiring plan VEGAWELL 52-4 ... 20 mA ..... 7
4.6 Wiring plan VEGAWELL 52-4 ... $20 \mathrm{~mA} / H A R T$ - Pt 100 ..... 8
5 Operation
5.1 Overview. ..... 9
5.2 Adjustment with PACTware ..... 9
6 Technical data ..... 10
7 Dimensions. ..... 14
8 Product code ..... 15

## Take note of safety instructions for Ex applications

Please note the Ex specific safety information which you can find on our homepage www.vega.comlservicesldownloads and which comes with every instrument. In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units. The sensors must only be operated on intrinsically safe circuits. The permissible electrical values are stated in the certificate.

## 1 Description of the measuring principle

## Measuring principle

VEGAWELL 52 pressure transmitters work according to the hydrostatic measuring principle, which functions independently of the dielectric properties of the product and is not influenced by foam generation.

The sensor element of VEGAWELL 52 is the dry ceramic-capacitive CERTEC ${ }^{\circledR}$ measuring cell in two sizes. Base element and diaphragm consist of high purity sapphire-ceramic ${ }^{\circledR}$.

The hydrostatic pressure of the product causes via the diaphragm a capacitance change in the measuring cell. This capacitance change is converted into an appropriate output signal.


Fig. 1: Configuration of the CERTEC ${ }^{\circledR}$ measuring cell with VEGAWELL 52
1 Diaphragm
2 Soldered glass bond
3 Base element
The advantages of the CERTEC ${ }^{\circledR}$ measuring cell are:

- Very high overload resistance
- No hysteresis
- Excellent long-term stability
- Completely front flush installation
- Good corrosion resistance
- Very high abrasion resistance


## Wide application range

VEGAWELL 52 is suitable for level measurement in deep wells and ballast tanks as well as for gauge measurement in open flumes. Typical media are drinking water and waste water as well as water containing abrasive substances. All signal outputs are available in $4 \ldots 20 \mathrm{~mA}$ and $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100.
In the $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100 version, a temperature sensor Pt 100 in four-wire technology is integrated in the transducer. Power supply or processing are carried out via an external temperature transducer.

## 2 Type overview

VEGAWELL 52


Measuring cell:
Media:
Process fitting:
CERTEC ${ }^{\circledR}$
drinking water and waste water
Straining clamp, screw connection, thread
Material process fitting:
316L
Material, suspension cable: PE, PUR, FEP
Material transmitter:
316L, 1.4462 (Duplex), each also with PE coating, PVDF, Titanium
Diameter transmitter:
depending on material and version at least 22 mm
Measuring range: $\quad 0 \ldots 0.1$ bar up to $0 \ldots 25$ bar
Process temperature: $\quad-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176{ }^{\circ} \mathrm{F}\right)$
Deviation:
Signal output:
Operation: $<0.2 \%,<0.1 \%$

4 ... $20 \mathrm{~mA}, 4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$
depending on the version via PACTware/PC

## 3 Mounting instructions

## Mounting position

The following illustration shows a mounting example for VEGAWELL 52. The VEGA price list contains suitable mounting brackets under the section Accessories. With these parts, standard mounting arrangements can be realised quickly and reliably.


Fig. 3: VEGAWELL 52 in a pump shaft with VEGABOX 02
VEGAWELL 52 must be mounted in a calm area or in a suitable protective tube. This avoids lateral movements of the transmitter and the resulting corruption of measurement data.


## Note:

As an alternative to fixing the transmitter, the use of a measuring instrument holder from VEGA's line of mounting accessories is recommended.

Beside the connection and suspension cables, the suspension cable also contains a capillary for atmospheric pressure compensation. All versions can be shortened on site.

With VEGAWELL 52, the electronics is completely integrated in the transmitter. The cable end can be lead directly to a dry connection compartment. Pressure compensation is then carried out via the filter element of the capillaries.

1

## Note:

The pressure compensation housing VEGABOX 02 is recommended for connecting VEGAWELL 52.

It contains a high-quality ventilation filter and terminals. A protective cover is optionally available for use outdoors.

## Mounting versions

The following illustrations show the different mounting versions depending on the instrument type.

Mounting with straining clamp

Fig. 6: Screw connection
1 Suspension cable
2 Seal screw
3 Cone bushing
4 Seal cone
5 Screw connection
6 Seal

Fig. 5: Straining clamp
1 Suspension cable
2 Suspension opening
3 Clamping jaws

Mounting with screw connection


Mounting with housing and thread


Fig. 7: Housing with thread G1½ A
1 Housing
2 Seal
3 Thread

4 Electrical connection

### 4.1 General requirements

The supply voltage range can differ depending on the instrument version. You can find exact specifications in chapter "Technical data".

The national installation standards as well as the valid safety regulations and accident prevention rules must be observed.

In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units.

### 4.2 Power supply

Supply voltage and current signal are carried on the same twowire cable. The requirements on the power supply are specified in chapter "Technical data".

The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as VEGAMET signal conditioning instruments are suitable for power supply. When one of these instruments is used, a reliable separation of the supply circuits from the mains circuits according to DIN VDE 0106 part 101 is ensured.

### 4.3 Connection cable

In general
An outer diameter of $5 \ldots 9 \mathrm{~mm}$ ensures the seal effect of the cable entry. If electromagnetic interference is expected, screened cable should be used for the signal lines.

The sensors are connected with standard two-wire cable without screen.


In Ex applications, the corresponding installation regulations must be noted for the connection cable.

### 4.4 Cable screening and grounding

If screened cable is necessary, the cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. $1 \mathrm{nF}, 1500 \mathrm{~V}$ ).

### 4.5 Wiring plan VEGAWELL 52-4 ... 20 mA

## Direct connection



Fig. 8: Wire assignment, suspension cable
1 blue (-): to power supply or to the processing system
2 brown (+): to power supply or to the processing system
3 Shielding
4 Breather capillaries with filter element

## Connection via VEGABOX 02



Fig. 9: Terminal assignment VEGABOX 02
1 To power supply or the processing system
2 Shielding ${ }^{1)}$

## Connection via housing



Fig. 10: Terminal assignment of the housing
1 To power supply or the processing system
2 Shielding ${ }^{2}$ )

[^53]
### 4.6 Wiring plan VEGAWELL 52-4... 20 mA/ HART - Pt 100

## Direct connection



Fig. 11: Wire assignment, connection cable
1 blue (-): to power supply or to the processing system
2 Brown (+): to power supply or to the processing system
3 White: for processing of the integrated Pt 100 (power supply)
4 Yellow: for processing of the integrated Pt 100 (measurement)
5 Red: for processing of the integrated Pt 100 (measurement)
6 Black: for processing of the integrated Pt 100 (power supply)
7 Shielding
8 Breather capillaries with filter element

## Connection via VEGABOX 02



Fig. 12: Terminal assignment VEGABOX 02
1 To power supply or the processing system (signal pressure transmitter)
2 To power supply or the processing system (connection cables resistance thermometer Pt 100)
3 Shielding ${ }^{3}$

Connection via VEGABOX 02 with integrated temperature sensor


Fig. 13: Terminal assignment VEGABOX 02
1 To power supply or the processing system (signal pressure transmitter)
2 For voltage supply or to processing system (resistance thermometer Pt 100)
3 Shielding ${ }^{4)}$

## Connection via housing



Fig. 14: Terminal assignment of the housing
1 To power supply or the processing system (signal pressure transmitter)
2 For voltage supply or to processing system (resistance thermometer Pt 100)
3 Shielding ${ }^{5}$
${ }^{3)}$ Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
4) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
5) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

## 5 Operation

### 5.1 Overview

VEGAWELL 524 ... 20 mA
VEGAWELL 52-4... 20 mA has no adjustment options.
VEGAWELL 524 ... 20 mA/HART - Pt 100

- Adjustment software according to FDT/DTM standard, e.g. PACTware and PC
- HART handheld


### 5.2 Adjustment with PACTware

## Connecting the PC to the signal cable



Fig. 15: Connection of the PC to VEGABOX 02 or communication resistor
1 PC with PACTware
2 RS232 interface (with VEGACONNECT 3), USB interface (with VEGACONNECT 4)
3 VEGACONNECT 3 or 4
4 Communication resistor $250 \Omega$
5 Power supply unit

Necessary components:

- VEGAWELL 52
- PC with PACTware and suitable VEGA DTM
- VEGACONNECT with HART adapter cable
- HART resistor approx. $250 \Omega$
- Power supply unit Note:
With power supply units with integrated HART resistance (internal resistance approx. $250 \Omega$ ), an additional external resistance is not necessary (e.g. VEGATRENN 149A, VEGAMET 381/624/625, VEGASCAN 693). In such cases, VEGACONNECT can be connected parallel to the $4 \ldots 20 \mathrm{~mA}$ cable.


## 6 Technical data

## Materials and weights

Materials, wetted parts

- Transmitter

316L, 316L with PE coating, 1.4462 (Duplex), 1.4462 with PE coating,

- Diaphragm
- Measuring cell seal
- Suspension cable
- Cable gland on the transmitter PVDF, Titanium
sapphire ceramic ${ }^{\circledR}$ (99.9 \% oxide ceramic)
FKM (VP2/A) - FDA and KTW approved, FFKM (Perlast G75S), EPDM (A+P 75.5/KW75F)
PE (FDA and KTW-approved), FEP, PUR
- Process fitting

316L

- Straining clamp

316L

- Unassembled screw connection
1.4301
- Threaded connection on the housing

316L, PVDF
Materials, non-wetted parts

- Housing

Weight approx.

- Basic weight 316L
- Suspension cable
plastic PBT (Polyester), 316L
- Straining clamp
0.8 kg (1.764 lbs)
$0.1 \mathrm{~kg} / \mathrm{m}(0.07 \mathrm{lbs} / \mathrm{ft})$
- Screw connection
$0.2 \mathrm{~kg}(0.441 \mathrm{lbs})$
- Plastic housing $0.4 \mathrm{~kg}(0.882 \mathrm{lbs})$
- Stainless steel housing $0.8 \mathrm{~kg}(1.764 \mathrm{lbs})$ 1.6 kg (3.528 lbs)


## Input variable

| Measured value | Level |
| :--- | :--- |
| Measuring range | see product code |
| Recommended max. turn down | $10: 1$ |

## Output variable

4 ... 20 mA
Output signal
Signal resolution
Failure signal
4 ... 20 mA
$2 \mu \mathrm{~A}$
Max. output current
$<3.6 \mathrm{~mA}$
Run-up time
Step response time
Fulfilled NAMUR recommendations
mA
100 ms (ti: $0 \mathrm{~s}, 0 \ldots 63 \%$ )

4 ... 20 mA/HART - Pt 100
Output signal
Signal resolution
Failure signal
Max. output current
NE 43

Run-up time
Step response time
$4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$

Fulfilled NAMUR recommendations
$2 \mu \mathrm{~A}$
< $3.6 \mathrm{~mA} ; 20.5 \mathrm{~mA}$; 22 mA ; unchanged (adjustable via PACTware)
22 mA
15 s
200 ms (ti: $0 \mathrm{~s}, 0 \ldots 63 \%$ )
NE 43

## Additional output parameter - temperature

| integrated resistance thermometer | Pt 100 according to DIN EN 60751 |
| :--- | :--- |
| Range | $-50 \ldots+100^{\circ} \mathrm{C}\left(-58 \ldots+212^{\circ} \mathrm{F}\right)$ |
| Resolution | $1^{\circ} \mathrm{K}$ |

## Deviation for 4 ... 20 mA version ${ }^{6}$

Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.
Deviation with version < 0.2 \%

- Turn down 1: 1 up to $5: 1$
< 0.2 \%
- Turn down > 10 : 1

$$
<0.04 \% \times \text { TD }
$$

${ }^{6)}$ Determined according to the limit point method according to IEC 60770, incl. non-linearity, hysteresis and non-repeatability.

Deviation with version < 0.1 \%

- Turn down 1: 1 up to $5: 1$

$$
\begin{aligned}
& <0.1 \% \\
& <0.02 \% \text { x TD }
\end{aligned}
$$

## Deviation for version $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100 ${ }^{\text {7 }}$

Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

Deviation with version < 0.2 \%

- Turn down 1:1 up to $5: 1$

$$
\begin{aligned}
& <0.2 \% \\
& <0.04 \% \text { x TD } \\
& <0.1 \% \\
& <0.02 \% \times \text { TD }
\end{aligned}
$$

- Turn down > 10:1

Deviation with version $<0.1 \%$

- Turn down 1:1 up to $5: 1$
- Turn down > 10 : 1


## Influence of the product or ambient temperature

Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

## Average temperature coefficient of the zero signal

In the compensated temperature range of $0 \ldots+80^{\circ} \mathrm{C}\left(+32 \ldots+176^{\circ} \mathrm{F}\right)$, reference temperature $20^{\circ} \mathrm{C}\left(68^{\circ} \mathrm{F}\right)$.
Average temperature coefficient of the zero signal

- Turn down 1:1
- Turn down 1: 1 up to 5 : 1
- Turn down > 10:1

Outside the compensated temperature range
Average temperature coefficient of the zero signal

- Turn down 1:1 typ. $<0.05 \% / 10 \mathrm{~K}$


## Long-term stability (similar to DIN 16086, DINV 19259-1 and IEC 60770-1)

Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.
Long-term drift of the zero signal

```
                                    < (0.1 % x TD)/year
```


## Ambient conditions

Ambient temperature

- Connection cable PE
$-40 \ldots+60^{\circ} \mathrm{C}\left(-40 \ldots+140^{\circ} \mathrm{F}\right)$
- Connection cable PUR, FEP
$-40 \ldots+85^{\circ} \mathrm{C}\left(-40 \ldots+185^{\circ} \mathrm{F}\right)$
Storage and transport temperature
$-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176^{\circ} \mathrm{F}\right)$


## Process conditions

## Process pressure

Max. process pressure, transmitter ${ }^{8)}$

- Measuring range 0.1 bar (1.45 psig) 15 bar (218 psig)
- Measuring range 0.2 bar (2.9 psig)

20 bar (290 psig)

- Measuring range $\leq 0.4$ bar ( 5.8 psig )

25 bar (363 psig)
Pressure stage, process fitting

- Unassembled screw connection

316L: PN 3, PVDF: unpressurized

- Thread on the housing

PN 3
Product temperature, depending on the version

[^54]| Suspension cable | Transmitter | Product temperature |
| :--- | :--- | :--- |
| PE | All | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |
| PUR | All | $-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| PUR | PE coating | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |
| FEP | All | $-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| FEP | PE coating | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |

Vibration resistance mechanical vibrations with 4 g and $5 \ldots 100 \mathrm{~Hz}^{9)}$

## Electromechanical data

Suspension cable

- Configuration
six wires, one suspension cable, one breather capillary, screen braiding,
- Tensile strength
foil, mantle
$\geq 1200 \mathrm{~N}$ (270 pound force)
- Max. length

1000 m ( 3280 ft )

- Min. bending radius

25 mm (with $25^{\circ} \mathrm{C} / 77^{\circ} \mathrm{F}$ )

- Diameter approx

8 mm ( 0.315 in )

- colour (non-Ex/Ex) - PE
black/blue
- colour (non-Ex/Ex) - PUR, FEP
blue/blue
Cable entry housing or VEGABOX 02
$1 \times$ cable gland $\mathrm{M} 20 \times 1.5$ (cable: $\varnothing 5 \ldots 9 \mathrm{~mm}$ ), $1 \times$ blind stopper $\mathrm{M} 20 \times 1.5$
Screw terminals


## Supply voltage - $4 \ldots 20 \mathrm{~mA}$

Operating voltage
Permissible residual ripple
$-<100 \mathrm{~Hz}$
$-100 \mathrm{~Hz} \ldots 10 \mathrm{kHz}$
Load

8 ... 36 V DC
$\mathrm{U}_{\mathrm{ss}}<1 \mathrm{~V}$
$\mathrm{U}_{\mathrm{ss}}<10 \mathrm{mV}$
see diagram


Fig. 16: Voltage diagram
1 Voltage limit
2 Operating voltage

## Supply voltage - $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100

Operating voltage
Permissible residual ripple

| $-<100 \mathrm{~Hz}$ | $\mathrm{U}_{\mathrm{ss}}<1 \mathrm{~V}$ |
| :--- | :--- |
| $-100 \mathrm{~Hz} \ldots 10 \mathrm{kHz}$ | $\mathrm{U}_{\mathrm{ss}}<10 \mathrm{mV}$ |
| Load | see diagram |

Load
see diagram
$\mathrm{U}_{\mathrm{ss}}<1 \mathrm{~V}$
9) Tested according to the regulations of German Lloyd, GL directive 2.


Fig. 17: Voltage diagram
HART load
Voltage limit
Operating voltage

## Electrical protective measures

## Protection

| - Transmitter | IP 68 (30 bar) |
| :--- | :--- |
| - Housing | IP 66/IP 67 |
| - VEGABOX 02 | IP 65 |
| Overvoltage category | III |
| Protection class | III |

## Existing approvals or approvals applied for

| Gas explosion protection | e.g. according to ATEX and IEC |
| :--- | :--- |
| Fire-damp protection | e.g. according to ATEX |
| Overfill protection | e.g. according to WHG |
| Ship approval | e.g. according to GL, LRS, ABS, RINA |

The available approvals can be selected via the configurator on www.vega.com.

Depending on the version, instruments with approvals can have different technical data. For these instruments, please note the corresponding approval documents. They can be downloaded in the download section on www.vega.com.

## CE conformity

| EMC (2004/108/EG) | EN 61326-1: 2006 |
| :--- | :--- |
| LVD $(2006 / 95 / E G)$ | EN 61010-1: 2001 |

## Environmental instructions

VEGA environment management system
certified according to DIN EN ISO 14001
You can find detailed information under www.vega.com.

## 7 Dimensions

VEGAWELL 52 - suspension cable 1


Fig. 18: VEGAWELL 52 - suspension cable
1 Transmitter Duplex, with straining clamp
2 Transmitter Duplex for deep wells, with unassembled screw connection G1½ A (11/2 NPT) and closing cap
3 Transmitter Duplex, with PE coating
4 Transmitter with screwed connection of PVDF
5 Transmitter Titanium/Titanium with glass leadthrough, with thread G1 A (1 NPT) and plastic housing

VEGAWELL 52 - suspension cable 2


Fig. 20: VEGAWELL 52 - suspension cable
1 Transmitter 316L, with straining clamp
2 Transmitter Titanium, with unassembled screw connection G1 A (1 NPT)

VEGAWELL 52 - threaded fitting


Fig. 22: VEGAWELL 52 - thread
1 Threaded fitting G½ inner G1⁄4
2 Threaded fitting G1

## 8 Product code

## VEGAWELL 52




$B(\in\langle x\rangle=0$

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Phone +49 7836 50-0
Fax +49 7836 50-201
E-Mail: info@de.vega.com
www.vega.com

You can find at www.vega.com
downloads of the following

- operating instructions manuals
- menu schematics
- software
- certificates
- approvals
and much, much more


# TECHNICAL DATA SHEET 

Equipment Type:Control Relays
Location:
RTU Section
Model Numbers: Various
Manufacturer:
Specher \& Schuh
Supplier:
NHP Pty Ltd
16 Riverview Place
Murarrie
(07) 39094999

## Control \& Timing Relays

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Relpol Ice Cube Relays
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Technical Information. ..... G51
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Technical Information ..... G60
RUC Plug-in Power Relays. ..... G64
Technical Information. ..... G67
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## CS7

Industrial

Reliable, general purpose relays for heavy duty applications

CS7 Industrial Control Relays share the same design as our modern CA7 contactor range. They are compact and designed for heavy duty industrial control applications where reliability and versatility are essential.

## Introducing Three CS7 Models for any Control Application

The standard CS7 relay utilizes $x$ stamped contact technology that reliably switches typical control circuits up to 10A (AC-15). For master relay circuits requiring higher amp capacity, the CS7-M Master Relay is designed for control circuits up to 15A (AC15).

For applications requiring low energy switching such as PLC's or other electronic circuits, the CS7-B relay with bifurcated contacts is designed for 20 million operations down to a signal level of 5 V @ 3 mA .

The bifurcated H-bridge design divides each movable gold contact into two sections at the tip of the spanner which provides a higher degree of reliability for low signal applications.

## Auxiliary components provide a range of options

CS7 auxiliary components convert the basic four pole relay into a:

- $5,6,7,8,9,10,11$ or 12 pole relay
- 4, 5, 6, 7 or 8 pole latched relay
- 4, 5, 6, 7 or 8 pole relay with two pneumatic time delay contacts
- Mechanically latched 4, 5, 6, 7 or 8 pole relay
- Also available are top mounted bifurcated auxiliary contacts which operate down to $5 \mathrm{~V} @ 3 \mathrm{~mA}$.

Since the CS7 uses the same auxiliary components as our CA7 contactors, inventory is reduced.


## Mechanically linked contacts for safety

CS7 control relays are perfect for fail-safe control circuits. An interlock contact design, which maintains minimum 0.3 mm clearance, prevents the NC contact from reclosing if the NO contact is welded when in operation. This feature not only includes the base contact poles, but extends to the front and/or side mounted auxiliary contacts. This is a requirement in safety circuits and is backed by SUVA-PRO certification.

## Maximum convenience and safety

CS7 relays are designed for fast and trouble free installation and maintenance. All components are modular and snap-on without the use of tools. The relays are DIN-rail mountable so they can be installed, moved or replaced quickly. All terminals are "captive" and are shipped in the open position, saving you an operation. The entire line is UL Listed, CSA Certified and CE marked and offers finger and back of hand protection to the strictest international standards.

## Effortless installation

CS7 relays are DIN-rail mountable for instant installation and modification. Fittings are also included for base mounting. All terminals are clearly marked and ready for installation with either manual or power screwdrivers. A complete identification system is also available using self-adhesive labels, paper tags or plastic clip-on tags.

Series CS7 Standard Control Relays - 4 Pole 14

| CS7 Relay | Contact Arrangement and Numbering | Contacts 1 |  | AC Operation |  | Electronic DC © |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | NO | NC | Catalog Number | Price | Catalog Number | Price |
|  |  | 2 | 2 | CS7-22E-* | 92 | CS7E-22E-* | 127 |
|  | $\left.\left.\left.\left.\left.\right\|_{\text {A2 }} ^{\mathrm{A} 1}\right\|_{14} ^{13}\right\|_{22} ^{21}\right\|_{34} ^{23}\right\|_{44} ^{33}$ | 3 | 1 | CS7-31E-* |  | CS7E-31E-* |  |
|  | $\left.\left.\left.\left.\left.\left.\right\|_{\text {A2 }} ^{\text {A1 }}\right\|_{14} ^{13}\right\|_{24} ^{13}\right\|_{34} ^{23}\right\|_{44} ^{33}\right\|_{43} ^{43}$ | 4 | 0 | CS7-40E-* |  | CS7E-40E-* |  |
|  |  | 0 | 4 | CS7-04E-* |  | CS7E-04E-* |  |

Contact Ratings (Per UL508/NEMA A600 \& P600)

| Standard | Circuit <br> Voltage | Make <br> (Amps/VA) | Break <br> (Amps/VA) | Continuous <br> Amps |
| :---: | :---: | :---: | :---: | :---: |
|  | 120 AC | $60 \mathrm{~A} / 7200 \mathrm{VA}$ | $6 \mathrm{~A} / 720 \mathrm{VA}$ |  |
| A600 | 240 AC | $30 \mathrm{~A} / 7200 \mathrm{VA}$ | $3 \mathrm{~A} / 720 \mathrm{VA}$ | 10 |
|  | 480AC | $15 \mathrm{~A} / 7200 \mathrm{VA}$ | $1.5 \mathrm{~A} / 720 \mathrm{VA}$ |  |
|  | 600 AC | $12 \mathrm{~A} / 7200 \mathrm{VA}$ | $1.2 \mathrm{~A} / 720 \mathrm{VA}$ |  |
| P600 | 125 DC ( 3 | $1.1 \mathrm{~A} / 138 \mathrm{VA}$ | $1.1 \mathrm{~A} / 138 \mathrm{VA}$ |  |
|  | 250 DC (2 | $0.55 \mathrm{~A} / 138 \mathrm{VA}$ | $0.55 \mathrm{~A} / 138 \mathrm{VA}$ | 5 |
|  | $301-600 \mathrm{DC}$ ( $)$ | $0.2 \mathrm{~A} / 138 \mathrm{VA}$ | $0.2 \mathrm{~A} / 138 \mathrm{VA}$ |  |

Other UL Ratings
Maximum Voltage $\quad 600$ volts AC or DC General Purpose Amps CS7
Auxiliaries (@40 ${ }^{\circ}$ )
Auxiliaries (@ $60^{\circ} \mathrm{C}$ )

25 amps
10 amps
6 amps

## AC Coil Codes 3

| AC <br> Coil Code | Voltage Range |  |
| :---: | :---: | :---: |
|  | 50 Hz | 60 Hz |
| 24 Z | 24 V | 24 V |
| $\mathbf{1 2 0}$ | $\mathbf{1 1 0 \mathrm { V }}$ | $\mathbf{1 2 0 \mathrm { V }}$ |
| 208 | $\sim$ | 208 V |
| 220 W | $\mathbf{2 0 0 V}-220 \mathrm{~V}$ | $\mathbf{2 0 8 V}-240 \mathrm{~V}$ |
| 240 | 220 V | 240 V |
| 277 | 240 V | 277 V |
| 380 | $380 \mathrm{~V}-400 \mathrm{~V}$ | 440 V |
| 480 | 440 V | 480 V |
| $\mathbf{6 0 0}$ | 550 V | 600 V |

## Ordering Instructions

| Specify Catalog Number |  |
| :--- | :--- |
| Replace $(\boldsymbol{*})$ with Coil Code | See Coil Codes <br> on this page |

on this page

DC Coil Codes 5

| DC Coil Codes | Voltage |
| :---: | :---: |
| 12 E | 12 V |
| 24 E | 24 V |
| $48 \mathrm{E} \cdot 6$ | $48-72 \mathrm{~V}$ |
| $110 \mathrm{E} \cdot 6$ | $110-125 \mathrm{~V}$ |
| $220 \mathrm{E} \cdot \odot$ | $220-250 \mathrm{~V}$ |

(1) Side mounted and/or top auxiliaries may be field installed to increase the number of available poles, limitations apply. Refer to page G12 for ordering and restriction details. Please note that side mount auxiliary terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
DC rating for CS7 base control relay.
(3) Other voltages available, see page G13. Non-standard coil voltages not listed here must be ordered and installed separately as renewal parts.
(4) Positively-Guided/Mechanically-Linked Contacts per IEC 947-5-1 Annex L on 4 main poles.
(5) CS7E electronic coils are not interchangeable with non-electronic DC or AC coils.
© Not applicable with Electronic Timer accessories (CRZ_7).

Series CS7-B Control Relays - 4 Pole, Bifurcated Contacts for Lower Level Signals 14

| CS7-B Relay | Contact Arrangement and Numbering | Contacts 1 |  | AC Operation |  | Electronic DC 5 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | NO | NC | Catalog Number | Price | Catalog Number | Price |
|  |  | 2 | 2 | CS7-B22E-* | 117 | CS7E-B22E-* | 190 |
|  |  | 3 | 1 | CS7-B31E-* |  | CS7E-B31E-* |  |
|  |  | 4 | 0 | CS7-B40E-* |  | CS7E-B40E-* |  |
|  |  | 0 | 4 | CS7-B04E-* |  | CS7E-B04E-* |  |

Contact Ratings (Per UL508/NEMA A600 \& Q600)

| Standard | Circuit Voltage | Make (Amps/VA) | Break (Amps/VA) | Continuous Amps |
| :---: | :---: | :---: | :---: | :---: |
| A600 | 120AC | 60A/7200VA | 6A/720VA | 10 |
|  | 240AC | 30A/7200VA | 3A/720VA |  |
|  | 480AC | 15A/7200VA | 1.5A/720VA |  |
|  | 600AC | 12A/7200VA | 1.2A/720VA |  |
| 0600 | 125DC ${ }^{(2)}$ | 0.55A/69VA | 0.55A/69VA | 2.5 |
|  | 250DC © | 0.27A/69VA | 0.27A/69VA |  |
|  | 301-600DC (2) | 0.1A/69VA | 0.1A/69VA |  |

## CS7-B Bifurcated Control Relay

- Gold plated bifurcated contacts for low level switching application, min 5V, 3mA
- Maximum voltage 600V AC or DC
- General purpose amps - 10 amps
- Positively guided/mechanically-linked main contacts

Principle moving contact designs:

AC Coil Codes 3

| AC <br> Coil Code | Voltage Range |  |
| :---: | :---: | :---: |
|  | 50 Hz | 60 Hz |
| $\mathbf{1 2 0}$ | 110 V | 120 V |

## DC Coil Codes 5

| DC Coil Codes | Voltage |
| :---: | :---: |
| 12 E | 12 V |
| 24 E | 24 V |
| 48 E 6 | $48-72 \mathrm{~V}$ |
| 110 E 6 | $110-125 \mathrm{~V}$ |
| 220 E 6 | $220-250 \mathrm{~V}$ |

## Ordering Instructions

| Specify Catalog Number |  |
| :--- | :--- |
| Replace $(*)$ with Coil Code | See Coil Codes <br> on this page |

(1) Side mounted and/or top auxiliaries may be field installed to increase the number of available poles, limitations apply. Refer to page G12 for ordering and restriction details. Please note that side mount auxiliary terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
(2) DC rating for CS7-B base control relay.
(3) Other AC voltages available, see page G13. Non-standard coil voltages not listed here must be ordered and installed separately as renewal parts.
(4) Positively-Guided/Mechanically-Linked Contacts per IEC 947-5-1 Annex L on 4 main poles.
(5) CS7E electronic coils are not interchangeable with non-electronic DC or AC coils.
© Not applicable with Electronic Timer accessories (CRZ_7).

## Series CS7 Master Control Relays - 4 Pole 14

| CS7-M Relay | Contact Arrangement and Numbering | Contacts 1 |  | AC Operation |  | Electronic DC 6 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | NO | NC | Catalog Number | Price | Catalog Number | Price |
|  |  | 2 | 2 | CS7-M22E-* | 168 | CS7E-M22E-* | 239 |
|  |  | 3 | 1 | CS7-M31E-* |  | CS7E-M31E-* |  |
|  |  | 4 | 0 | CS7-M40E-* |  | CS7E-M40E-* |  |
|  |  | 0 | 4 | CS7-M04E-* |  | CS7E-M04E-* |  |

Contact Ratings (Per UL508/NEMA A600 \& P600)

| Standard | Circuit <br> Voltage | Make <br> (Amps/VA) | Break <br> (Amps/VA) | Continuous <br> Amps |
| :---: | :---: | :---: | :---: | :---: |
| A600 | 120 AC | $60 \mathrm{~A} / 7200 \mathrm{VA}$ | $6 \mathrm{~A} / 720 \mathrm{VA}$ |  |
|  | 240 AC | $30 \mathrm{~A} / 7200 \mathrm{VA}$ | $3 \mathrm{~A} / 720 \mathrm{VA}$ | 20 |
|  | 480AC | $15 \mathrm{~A} / 7200 \mathrm{VA}$ | $1.5 \mathrm{~A} / 720 \mathrm{VA}$ | 20 |
|  | 600AC | $12 \mathrm{~A} / 7200 \mathrm{VA}$ | $1.2 \mathrm{~A} / 720 \mathrm{VA}$ |  |
|  | 125DC © | $1.1 \mathrm{~A} / 138 \mathrm{VA}$ | $1.1 \mathrm{~A} / 138 \mathrm{VA}$ |  |
|  | 250 DC ( | $0.55 \mathrm{~A} / 138 \mathrm{VA}$ | $0.55 \mathrm{~A} / 138 \mathrm{VA}$ | 5 |

## CS7-M Master Control Relays

- Excellent replacement for heavy duty NEMA master relay users.
- Maximum voltage 600V AC or DC
- General purpose rating 30 amps (2X A600 for CS7-M Base Relay)

Principle moving contact designs:


## AC Coil Codes 3

| AC | Voltage Range |  |
| :---: | :---: | :---: |
|  | 50 Hz | 60 Hz |
| $\mathbf{1 2 0}$ | 110 V | 120 V |

DC Coil Codes 9

| DC Coil Codes | Voltage |
| :---: | :---: |
| $\mathbf{1 2 E}$ | 12 V |
| $\mathbf{2 4 E}$ | 24 V |
| $\mathbf{4 8 E} \boldsymbol{\theta}$ | $48-72 \mathrm{~V}$ |
| $\mathbf{1 1 0 E} \boldsymbol{\theta}$ | $110-125 \mathrm{~V}$ |
| $220 \mathrm{E} \boldsymbol{\theta}$ | $220-250 \mathrm{~V}$ |

## Ordering Instructions

| Specify Catalog Number |  |
| :--- | :--- |
| Replace (*) with Coil Code | See Coil Codes <br> on this page |

(1) Side mounted and/or top auxiliaries may be field installed to increase the number of available poles, limitations apply. Refer to page G12 for ordering and restriction details. Please note that side mount auxiliary terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
(2) DC rating for CS7-M base control relay.
(3) Other AC voltages available, see page G13. Non-standard coil voltages not listed here must be ordered and installed separately as renewal parts.
(4) Positively-Guided/Mechanically-Linked Contacts per IEC 947-5-1 Annex L on 4 main poles.
(5) CS7E electronic coils are not interchangeable with non-electronic DC or AC coils.
(7) Not applicable with Electronic Timer accessories (CRZ_7).

## CS7 Complete Assemblies - 6 Pole, AC Control 11 ©

| CS7 Relay | Contact Arrangement and Numbering | Contacts 1 |  | AC Operation |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | N0 | NC | Catalog Number | Price |
|  | $\left.\left.\left.\left.\left.\left.\left.A_{\mathrm{A} 2}\right\|_{14} ^{\mathrm{A} 1}\right\|_{22} ^{13}\right\|_{32} ^{21}\right\|_{44} ^{31}\right\|_{54} ^{43}\right\|_{62} ^{53}\right\|_{61} ^{61}$ | 3 | 3 | CS7-33Y-* |  |
|  | $\left.\left.\left.\left.\left.\left.\nabla_{\mathrm{A} 2}^{\mathrm{A} 1}\right\|_{14} ^{13}\right\|_{24} ^{13}\right\|_{34} ^{23}\right\|_{44} ^{33}\right\|_{52} ^{43}\right\|_{62} ^{51}$ | 4 | 2 | CS7-42E-* |  |
|  | $\left.\left.\left.\left.\left.\left.\left.\left.\right\|_{\mathrm{A} 2} ^{\mathrm{A} 1}\right\|_{14} ^{\mathrm{I}^{13}}\right\|_{22} ^{21}\right\|_{34} ^{21}\right\|_{44} ^{33}\right\|_{54} ^{43}\right\|_{62} ^{53}\right\|^{51}$ | 4 | 2 | CS7-42Y-* | 122 |
|  | $\left.\left.\left.\left.\left.\left.\left.\left.\right\|_{\mathrm{A} 2}\right\|_{14} ^{\mathrm{A} 1}\right\|_{24} ^{13}\right\|_{34} ^{13}\right\|_{44} ^{23}\right\|_{54} ^{33}\right\|_{62} ^{43}\right\|_{62} ^{53}$ | 5 | 1 | CS7-51E-* |  |
|  |  | 6 | 0 | CS7-60E-* |  |

## AC Coil Codes 4

| AC <br> Coil Code | Voltage Range |  |
| :---: | :---: | :---: |
|  | 50 Hz | 60 Hz |
| 24 Z | 24 V | 24 V |
| $\mathbf{1 2 0}$ | $\mathbf{1 1 0 \mathrm { V }}$ | $\mathbf{1 2 0 V}$ |
| 208 | $\sim$ | 208 V |
| 220 W | $\mathbf{2 0 0 V}-220 \mathrm{~V}$ | $\mathbf{2 0 8 \mathrm { V } - 2 4 0 \mathrm { V }}$ |
| 240 | 220 V | 240 V |
| 277 | 240 V | 277 V |
| 380 | $380 \mathrm{~V}-400 \mathrm{~V}$ | 440 V |
| $\mathbf{4 8 0}$ | 440 V | 480 V |
| $\mathbf{6 0 0}$ | 550 V | 600 V |

Contact Ratings (Per UL508/NEMA A600, P600 \& Q600)

| Standard | Circuit <br> Voltage | Make (Amps/VA) | Break (Amps/VA) | Continuous Amps |
| :---: | :---: | :---: | :---: | :---: |
| A600 | $\begin{aligned} & \hline 120 \mathrm{AC} \\ & 240 \mathrm{AC} \\ & 480 \mathrm{AC} \\ & 600 \mathrm{AC} \end{aligned}$ | $\begin{aligned} & \hline 60 \mathrm{~A} / 7200 \mathrm{VA} \\ & \text { 30A/7200VA } \\ & \text { 15A/7200VA } \\ & \text { 12A/7200VA } \end{aligned}$ | $\begin{gathered} \hline \text { 6A/720VA } \\ \text { 3A/720VA } \\ \text { 1.5A/720VA } \\ \text { 1.2A/720VA } \end{gathered}$ | 10 |
| P600 | $\begin{gathered} \text { 125DC (2 } \\ 250 D C \text { 2 } \\ 301-600 \mathrm{DC} \text { (2 } \end{gathered}$ | $\begin{gathered} 1.1 \mathrm{~A} / 138 \mathrm{VA} \\ 0.55 \mathrm{~A} / 138 \mathrm{VA} \\ 0.2 \mathrm{~A} / 138 \mathrm{VA} \end{gathered}$ | $\begin{gathered} \text { 1.1A/138VA } \\ 0.55 \mathrm{~A} / 138 \mathrm{VA} \\ 0.2 \mathrm{~A} / 138 \mathrm{VA} \end{gathered}$ | 5 |
| Q600 | $\begin{gathered} 125 D C \times 3 \\ 250 D C \text { 3 } \\ 301-600 \mathrm{DC} 3 \end{gathered}$ | $\begin{gathered} 0.55 \mathrm{~A} / 69 \mathrm{VA} \\ 0.27 \mathrm{~A} / 69 \mathrm{VA} \\ 0.1 \mathrm{~A} / 69 \mathrm{VA} \end{gathered}$ | $\begin{gathered} 0.55 \mathrm{~A} / 69 \mathrm{VA} \\ 0.27 \mathrm{~A} / 69 \mathrm{VA} \\ 0.1 \mathrm{~A} / 69 \mathrm{VA} \end{gathered}$ | 2.5 |

Other UL Ratings
Maximum Voltage 600 volts AC or DC

General Purpose Amps
CS7
25 A
Aux. (@40 $\left.{ }^{\circ} \mathrm{C}\right) 10 \mathrm{~A}$
Aux. (@60 ${ }^{\circ} \mathrm{C}$ ) A

## Ordering Instructions

Specify Catalog Number Replace (*) with Coil Code

See Coil Codes on this page
(1) Side mounted and/or top auxiliaries may be field installed to increase the number of available poles, limitations apply. Refer to page G12 for ordering and restriction details. Please note that side mount auxiliary terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
(2) DC rating for CS7 base control relay.
(3 DC rating for CS7 auxiliary blocks.
(4) Other voltages available, see page G13. Non-standard coil voltages not listed here must be ordered and installed separately as renewal parts.
© Positively-Guided/Mechanically-Linked Contacts per IEC 947-5-1 Annex L on 4 main poles and auxiliaries.

## CS7 Complete Assemblies - 8 Pole, AC Control 116

| CS7 Relay | Contact Arrangement and Numbering | Contacts 1 |  | AC Operation |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | NO | NC | Catalog Number | Price |
|  |  | 4 | 4 | CS7-44E-* | 150 |
|  |  | 4 | 4 | CS7-44Y-* |  |
|  |  | 5 | 3 | CS7-53E-* |  |
|  |  | 5 | 3 | CS7-53Y-* |  |
|  |  | 6 | 2 | CS7-62E-* |  |
|  |  | 7 | 1 | CS7-71E-* |  |
|  |  | 8 | 0 | CS7-80E-* |  |

AC Coil Codes 4

| AC <br> Coil Code | Voltage Range |  |
| :---: | :---: | :---: |
|  | 50 Hz | 60 Hz |
| 24 Z | 24 V | 24 V |
| 120 | 110 V | 120 V |
| 208 | $\sim$ | 208 V |
| 220 W | $200 \mathrm{~V}-220 \mathrm{~V}$ | $208 \mathrm{~V}-240 \mathrm{~V}$ |
| 240 | 220 V | 240 V |
| 277 | 240 V | 277 V |
| 380 | $380 \mathrm{~V}-400 \mathrm{~V}$ | 440 V |
| 480 | 440 V | 480 V |
| 600 | 550 V | 600 V |

Contact Ratings (Per UL508/NEMA A600, P600 \& Q600)

| Standard | Circuit Voltage | Make (Amps/VA) | Break (Amps/VA) | Continuous Amps |
| :---: | :---: | :---: | :---: | :---: |
| A600 | $\begin{aligned} & \hline 120 \mathrm{AC} \\ & 240 \mathrm{AC} \\ & 480 \mathrm{AC} \\ & 600 \mathrm{AC} \end{aligned}$ | 60A/7200VA <br> 30A/7200VA <br> 15A/7200VA <br> 12A/7200VA | $\begin{gathered} \hline 6 \mathrm{~A} / 720 \mathrm{VA} \\ \text { 3A/720VA } \\ 1.5 \mathrm{~A} / 720 \mathrm{VA} \\ 1.2 \mathrm{~A} / 720 \mathrm{VA} \end{gathered}$ | 10 |
| P600 | $\begin{gathered} \text { 125DC (2 } \\ 250 D C \text { (2 } \\ 301-600 D C \text { (2) } \end{gathered}$ | $\begin{gathered} \hline 1.1 \mathrm{~A} / 138 \mathrm{VA} \\ 0.55 \mathrm{~A} / 138 \mathrm{VA} \\ 0.2 \mathrm{~A} / 138 \mathrm{VA} \end{gathered}$ | $\begin{gathered} \hline \text { 1.1A/138VA } \\ 0.55 \mathrm{~A} / 138 \mathrm{VA} \\ 0.2 \mathrm{~A} / 138 \mathrm{VA} \end{gathered}$ | 5 |
| Q600 | $\begin{gathered} 125 D C \text { 3 } \\ 250 \mathrm{DC} \text { 3 } \\ 301-600 \mathrm{DC} 3 \end{gathered}$ | $\begin{gathered} \hline 0.55 \mathrm{~A} / 69 \mathrm{VA} \\ 0.27 \mathrm{~A} / 69 \mathrm{VA} \\ 0.1 \mathrm{~A} / 69 \mathrm{VA} \end{gathered}$ | $\begin{gathered} 0.55 \mathrm{~A} / 69 \mathrm{VA} \\ 0.27 \mathrm{~A} / 69 \mathrm{VA} \\ 0.1 \mathrm{~A} / 69 \mathrm{VA} \end{gathered}$ | 2.5 |

Other UL Ratings
Maximum Voltage 600 volts AC or DC

General Purpose Amps
CS7 25 A
Aux. (@40 $\left.{ }^{\circ} \mathrm{C}\right) \quad 10 \mathrm{~A}$
Aux. (@60 ${ }^{\circ}$ ) 6A

## Ordering Instructions

| Specify Catalog Number |  |
| :--- | :--- |
| Replace $(\boldsymbol{*})$ with Coil Code | See Coil Codes <br> on this page |

(1) Side mounted and/or top auxiliaries may be field installed to increase the number of available poles, limitations apply. Refer to page G12 for ordering and restriction details. Please note that side mount auxiliary terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
(2) DC rating for CS7 base control relay.
(3) DC rating for CS7 auxiliary blocks.
(4) Other voltages available, see page G13. Non-standard coil voltages not listed here must be ordered and installed separately as renewal parts.
(5 Positively-Guided/Mechanically-Linked Contacts per IEC 947-5-1 Annex L on 4 main poles and auxiliaries. Industrial Control Relays

Series CS7

## Side Mount Auxiliary Contact Blocks (1 \& 2 Pole) (12

| Contact Block | Description | N0 | NC | Contact <br> Arrangement | For use with... | Standard Contacts Catalog Number | Price |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Auxiliary Contact Blocks for Side <br> Mounting 23 <br> - 1 and 2-pole <br> - Two way numbering for right or left mounting on the contactor <br> - Snap-on design - mounts without tools <br> - Electronic compatible contacts $17 \mathrm{~V}, 10 \mathrm{~mA}$ <br> - Late break / early make (L) available <br> - Mirror contact performance to control relay poles | 0 | 1 | $\psi^{\frac{21}{2 \varepsilon}}$ | CS7 all | CA7-PA-01 | 17 |
|  |  | 1 | 0 | $\left.\right\|_{\mid} ^{\left\lvert\, \frac{13}{7 t}\right.}$ | CS7 all | CA7-PA-10 | 17 |
|  |  | 0 | 2 | $4_{\frac{11}{2 \dagger}}^{\frac{12}{1 \hbar}} 4_{\frac{21}{2 \varepsilon}}^{\frac{22}{1 \varepsilon}}$ | CS7 all | CA7-PA-02 | 27 |
|  |  | 1 | 1 | $\left.\left.\right\|_{\frac{13}{\varepsilon \hbar}} ^{\frac{13}{z D}}\right\|_{\frac{21}{2 \varepsilon}} ^{\frac{22}{1 \varepsilon}}$ | CS7 all | CA7-PA-11 | 27 |
|  |  | 2 | 0 |  | CS7 all | CA7-PA-20 | 27 |
|  |  | 1L | 1L | $\left\{\begin{array}{l\|l} \frac{17}{8 t} & 4^{\frac{25}{9 \varepsilon}} \\ \frac{18}{L t} & \frac{26}{9 \varepsilon} \end{array}\right.$ | CS7 all | CA7-PA-L11 | 37 |

## Top Mount Auxiliary Contact Blocks (2 \& 4 Pole) (2)

| Contact Block | Description | NO | NC | Contact <br> Arrangement | For use with... | Standard Contacts Catalog Number | Price | Bifurcated Contacts Catalog Number | Price |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Auxiliary Contact Blocks for Top Mounting (2) <br> - 2 and 4 pole <br> - Snap-on design - mounts without tools <br> - Electronic compatible standard contacts down to $17 \mathrm{~V}, 5 \mathrm{~mA}$, bifurcated version $5 \mathrm{~V}, 3 \mathrm{~mA}$ <br> - Mechanically linked between N.O. and N.C. poles and to the control relay poles (excluding L types). <br> - Several terminal numbering choices even for models with equal function <br> - Late break / early make (L) available | 0 | 2 |  | CS7 all | CS7-PV-02 | 27 | CS7-PVB-02 | 42 |
|  |  | 1 | 1 | $\left.\left.\right\|_{54} ^{\mid 53}\right\|_{62} ^{61}$ | CS7 all | CS7-PV-11 | 27 | CS7-PVB-11 | 42 |
|  |  | 2 | 0 |  | CS7 all | CS7-PV-20 | 27 | CS7-PVB-20 | 42 |
|  |  | 2 | 2 | $\left.\left.\left.\left.\right\|_{54} ^{53}\right\|_{62} ^{61}\right\|_{72} ^{71}\right\|_{84} ^{83}$ | CS7 all | CS7-PV-22 | 53 | CS7-PVB-22 | 80 |
|  |  | 3 | 1 | $\left.\left.\left.\left.\right\|_{54} ^{\left.\right\|^{53}}\right\|_{62} ^{61}\right\|_{74} ^{73}\right\|_{84} ^{73}$ | CS7 all | CS7-PV-31 | 53 | CS7-PVB-31 | 80 |
|  |  | 1 | 3 | $\left.\left.\left.\left.\right\|_{54} ^{53}\right\|_{62} ^{61}\right\|_{72} ^{71}\right\|_{82} ^{81}$ | CS7 all | CS7-PV-13 | 53 | CS7-PVB-13 | 80 |
|  |  | 4 | 0 | $\left.\left.\left.\left.\left.\right\|_{54} ^{53}\right\|_{64} ^{63}\right\|_{74}\right\|_{84} ^{73}\right\|_{83} ^{83}$ | CS7 all | CS7-PV-40 | 53 | CS7-PVB-40 | 80 |
|  |  | 0 | 4 | $t_{52}^{51} \underbrace{61}_{62} \underbrace{71}_{72} \underbrace{81}_{82}$ | CS7 all | CS7-PV-04 | 53 | CS7-PVB-04 | 80 |
|  |  | 1+1L | 1+1L | $\left.\left.\left.\left.\right\|_{54} ^{53}\right\|_{62} ^{61}\right\|_{76} ^{75}\right\|_{88} ^{87}$ | CS7 all | CS7-PV-L22 | 74 | Not Available | $\sim$ |

(1) Side mounted auxiliaries may be field installed to increase the number of available poles. Please note that terminal markings may conflict with base relay and/or top mount auxiliary terminal markings.
(2) Max. number or auxiliary contacts that may be mounted:

AC and Electronic DC Coil relays -max. 4 N.O. contacts on the front of the relay, 2-N.O. contacts on the side, 4-N.C. front or side: 6 total

Industrial Control Relays

Control Modules

| Module | Description | For use with... | Connection Diagrams | Catalog Number | Price |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Mechanical Latch <br> Following relay latching, the relay coil is immediately de-energized by the NC auxiliary contact (65-66). <br> - Electrical or manual release <br> - 1 NO + 1 NC auxiliary switch <br> - Suitable for all CS7 relays | CS7 all |  | CV7-11-* <br> Replace $\boldsymbol{*}$ with coil code below (See Application Note) | 94 |

## CV7 Mechanical Latch Coil Codes 1228

| Coil <br> Code | Application Range |  |  | Latch \& Contactor Coil Rating |
| :---: | :---: | :---: | :---: | :---: |
|  | 50 Hz | 60 Hz | VDC |  |
| $24 Z$ | 24 VAC | 24 VAC | 12 VDC | 24V 50/60 Hz |
| 482 | 48 VAC | 48 VAC | 24 VDC | $48 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ |
| 110 | 100 VAC | 110 VAC | 48 or 60VDC | 110V50/110V60 |
| 120 | 110 VAC | 120 VAC | ~ | 110V50/120V60 |
| 220W | ~ | 208... 240 VAC | ~ | 208...240V60 |
| $230 Z$ | 230 VAC | 230 VAC | 110 VDC | $230 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ |
| 240Z | 240 VAC | 240 VAC | 125 VDC | $240 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ |
| 277 | 240 VAC | 277 VAC | ~ | 240V50/277V60 |
| 380 | 380...400 VAC | 440 VAC | ~ | 380...400V50/440V60 |
| 4002 | 400 VAC | 400 VAC | 220 VDC | $400 \mathrm{~V} 50 / 60 \mathrm{~Hz}$ |
| 415 | 400...415 VAC | ~ | ~ | 400...415 V50 Hz |
| 480 | 440 VAC | 480 VAC | $\sim$ | 440V50/480V60 |
| 600 | 550 VAC | 600 VAC | $\sim$ | 550V50/600V60 |

## APPLICATION NOTE:

The CV7 Mechanical Latch for CS7 Control Relay may be used for both AC and DC applications; however when using DC control circuit the user must apply the following rules for coil selection of the control relay and latch combination:

- When DC control circuits are required use CS7 control relay with AC coil and latch with AC coil. From column "VDC" in the table on the left, identify the required application DC control voltage and then select its specific Coil Code. Enter this Coil Code to complete the catalog numbers for both the control relay and latch (i.e.: 125 V DC control circuit should use a $240 Z$ coil code in both the CS7 and CV7). This works because both coils are only momentary energized and coil clearing contacts breaks the circuit after closing or opening.
- The CS7E control relay uses an electronic DC coil and the CV7 latch coil code should be chosen from the table on the left. (i.e.: 24 V DC control circuit select CS7E with code 24E and CV7 latch uses a $48 Z$ AC coil code).
(1) Other voltages available. Contact your Sprecher + Schuh representative.
(2) CV7 must be wired for momentary impulse operation only.
(3) Command duration $0.03 \ldots 15$ seconds.
(4) Use 600 V AC when 575 V is required.


## Control Modules

| Module | Description | For use with... | Connection Diagrams | Function | Catalog Number | Price |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Pneumatic Timing Module The contacts in the Pneumatic Timing Element switch after the delay time. The contacts on the relay continue to operate without delay. <br> - Continuous adjustment range | CS7 all |  | $\begin{aligned} & \text { ON-Delay } \\ & .3 \ldots 30 \mathrm{~s} \\ & 1.8 \ldots 180 \mathrm{~s} \end{aligned}$ | $\begin{aligned} & \text { CZE7-30 } \\ & \text { CZE7-180 } \end{aligned}$ | 160 |
|  |  |  |  | OFF-Delay <br> 0.3...30s <br> 1.8... 180 s | $\begin{aligned} & \text { CZA7-30 } \\ & \text { CZA7-180 } \end{aligned}$ | 160 |
|  | Electronic Timing Module - ON-Delay © The relay is energized at the end of the delay time. | CS7 all |  | $\begin{aligned} & 110 \ldots 240 \mathrm{~V} 50 / 60 \mathrm{~Hz} \\ & 110 \ldots 250 \mathrm{VDCO} . \\ & 0.1 \ldots 3 \mathrm{~s} \\ & 1 \ldots 30 \mathrm{~s} \\ & 10 \ldots . .180 \mathrm{~s} \end{aligned}$ | CRZE7-3-110/240 <br> CRZE7-30-110/240 <br> CRZE7-180-110/240 | 98 |
|  |  |  |  | $\begin{aligned} & 24 \ldots 48 \mathrm{VDC} \\ & 0.1 \ldots 3 \mathrm{~s} \\ & 1 \ldots 30 \mathrm{~s} \\ & 10 \ldots . .180 \mathrm{~s} \end{aligned}$ | CRZE7-3-24/48VDC CRZE7-30-24/48VDC CRZE7-180-24/48VDC | 104 |
|  | Electronic Timing Module - OFF-Delay © After interruption of the control signal, the relay is de-energized at the end of the delay time. | CS7 all |  | $\begin{aligned} & 110 \ldots . .240 \mathrm{~V} 50 / 60 \mathrm{~Hz} \\ & 0.3 \ldots 3 \mathrm{~s} \\ & 1 \ldots 30 \mathrm{~s} \\ & 10 \ldots 180 \mathrm{~s} \end{aligned}$ | $\begin{aligned} & \text { CRZA7-3-110/240 } \\ & \text { CRZA7-30-110/240 } \\ & \text { CRZA7-180-110/240 } \end{aligned}$ | 112 |
|  |  |  |  | $\begin{aligned} & 24 \mathrm{VAC} 50 / 60 \mathrm{~Hz} \\ & 0.3 \ldots 3 \mathrm{~s} \\ & 1 \ldots 30 \mathrm{~s} \\ & 10 \ldots 180 \mathrm{~s} \end{aligned}$ | CRZA7-3-24VAC <br> CRZA7-30-24VAC <br> CRZA7-180-24VAC | 112 |

Industrial Control Relays

Control Modules (continued)

| Module | Description | For use with... | Connection Diagrams | Function |  | Catalog Number |  | Price |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Electronic Interface - <br> Interface between the DC control signal from a PLC and the AC operating mechanism of the relay. <br> - Requires no additional surge suppression for the coils <br> - Switching capacity 200VA <br> - Suitable for all CS7 relays | CS7 all (with AC control) |  | Input | Output | CRI7E-24 <br> CRI7E-12 <br> CRI7E-48 <br> Indicates special order |  | $\begin{aligned} & 72 \\ & 72 \\ & 72 \end{aligned}$ |
|  |  |  |  | 24 V DC <br> 18...30V DC <br> 48V DC | $\begin{gathered} 110 \ldots \\ 240 \mathrm{VAC} \end{gathered}$ |  |  |  |
|  | Surge Suppressors Limits coil switching transients. <br> - Plug-in, coil mounted <br> - Suitable for all CS7 contactors | CS7 all | $\left[\begin{array}{c} -\mathrm{N}_{1}^{--} \\ \square \\ \square-1 \end{array}\right]$ | RC Module - <br> AC Control ( $50 / 60 \mathrm{~Hz}$ ) <br> 24...48V <br> 110...280V <br> 380...480V |  | CRC7-48 CRC7-280 CRC7-480 |  | 34 |
|  |  |  |  | Diode Module DC Control <br> 12-250VDC |  | CRD7-250 | (2) | 34 |
|  |  |  |  | Varistor Module - <br> AC/DC Control <br> 12...55VAC/ <br> 12...77VDC <br> 56...136VAC/ <br> 78...180VDC <br> 137...277VAC/ <br> 181...350VDC <br> 278...575VAC |  | CRV7-55 <br> CRV7-136 <br> CRV7-277 <br> CRV7-575 | (2) <br> (2) <br> (2) <br> (2) | 34 |

## Assembly Components

| Component | Description | For Use With... | Pkg. <br> Qty. | Catalog Number | Price <br> Each |
| :--- | :--- | :--- | :---: | :--- | :---: |
|  | Protective Covers - <br> Protects against unintended manual <br> operation. | CS7 all | 1 | CA7-SCC | See page |
| A54 |  |  |  |  |  |
|  | Protective Covers - <br> For front mounted auxiliary contacts, <br> preumatic timers and latches. | CS7-PV, CA7-PV, <br> CZE7, CZA7, CV7 | 1 | CA7-SCF |  |

(1) Minimum order quantity is one package of 10 . Price each $\times 10=$ total price.
(2) Electronic DC Control Relays (CS7E) include internal surge protection and do not require additional external surge protection.

## Marking Systems

| Component | Description | Pkg. Qty. | Catalog Number | Price <br> Each |
| :---: | :---: | :---: | :---: | :---: |
| 132 | Label Sheet - <br> 1 sheet with 105 self-adhesive paper labels each, $6 \times 17 \mathrm{~mm}$ | 1 | CA7-FMS | $\begin{aligned} & \text { See } \\ & \text { page } \\ & \text { A54 } \end{aligned}$ |
|  | Marking Tag Sheet - <br> 1 sheet with 160 perforated paper labels each, <br> $6 \times 17 \mathrm{~mm}$. To be used with transparent cover. | 1 | CA7-FMP |  |
|  | Transparent Cover To be used with Marking Tag Sheets. | $\begin{gathered} 100 \\ 0 \end{gathered}$ | CA7-FMC |  |
|  | Tag Carrier - <br> For marking with Series V7 Terminal Clip-on Tags. | $\begin{gathered} 100 \\ 0 \end{gathered}$ | CA7-FMA2 |  |

Mounting Accessories

| Accessory | Description | Catalog Number | Price |
| :--- | :--- | :--- | :--- |
|  |  |  |  |
|  | DIN-rail -2 meter lengths (6' 6") |  |  |
|  | Top Hat, low profile (price per rail) | See |  |
|  | Top Hat, high profile (price per rail) | 3F | page |

Renewal Coils - AC 1 (2)

| AC Control Voltages |  |  | AC Coil $\Downarrow$ Codes $\Downarrow$ (2) | Catalog No. |
| :---: | :---: | :---: | :---: | :---: |
| 50 Hz | 60 Hz | $50 / 60 \mathrm{~Hz}$ |  |  |
|  | 12V |  | 12B | TA006 |
| 12V |  |  | 12A | TA404 |
|  | 24V |  | 24B | TA013 |
| 24V |  |  | 24A | TA407 |
|  |  | 24V | $24 Z$ | TA855 |
| 32V | 36V |  | 36 | TA481 |
| 36V |  |  | 36A | TA410 |
| 42 V | 48V |  | 48 | TA482 |
| 48 V |  |  | 48A | TA414 |
|  |  | 48 V | 482 | TA860 |
| 100 V | 100...110V |  | 110 | TA861 |
| 110V | 120 V |  | 120 | TA473 |
|  |  | 110V | 1102 | TA856 |
| 120 V |  |  | 120A | TA425 |
| 127 V |  |  | 127A | TA428 |
| 200V | 200...220V | 200 V | 220 | TA862 |
|  | 208V |  | 208 | TA049 |
|  | 208V...240V |  | 220W | TA296 |
| 220 V | 240 V |  | 240 | TA474 |
| 220V...230V | 260 V |  | 230A | TA441 |
|  |  | 200...230V | 230 W | TA864 |
|  |  | 230 V | 2302 | TA851 |
| 230V...240V |  |  | 240A | TA440 |
| 240 V | 277V |  | 277 | TA480 |
|  |  | 240V | 2402 | TA858 |
|  | 347V |  | 347 | TA065 |
|  | 380 V |  | 380B | TA067 |
| 380V...400V | 440 V |  | 380 | TA071 |
|  |  | 400V | 4002 | TA863 |
| 400V...415V |  |  | 415 | TA457 |
| 440 V | 480V |  | 480 | TA475 |
|  |  | 440 V | 4402 | TA859 |
| 500V |  |  | 500A | TA479 |
| 550 V | 600 V |  | 600 | TA476 |
| Price |  |  |  | 59 |

Renewal Coils - DC 1026

|  | $\begin{gathered} \text { DC Coil } \\ \Downarrow \text { Codes } \Downarrow \\ \mathbf{2} \end{gathered}$ | Electronic DC Coils 6 | True DC Coils | Two Winding DC Coils 5 |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Cat. No. | Cat. No. | Cat. No. |
| 9 V 3 | 9D | $\sim$ | TA766 | TA766Y |
| 12 V | 12E | TC708E | $\sim$ | $\sim$ |
| 12 V | 12D | ~ | TA708 | TA708Y |
| 24 V | 24E | TC714E | $\sim$ | $\sim$ |
| 24 V 4 | 24D | $\sim$ | TA714 | TA714Y |
| 24 V Diode 4 | 24DD | $\sim$ | TA714M | TA714Y |
| 36V | 36D | $\sim$ | TA719 | TA719Y |
| 48-72V | 48 E | TC724E | $\sim$ | $\sim$ |
| 48 V | 48D | ~ | TA724 | TA724Y |
| 60V | 60D | $\sim$ | TA774 | TA774Y |
| 64 V | 64D | $\sim$ | TA727 | TA727Y |
| 72 V | 72D | $\sim$ | TA728 | TA728Y |
| 80V | 80D | $\sim$ | TA729 | TA729Y |
| 110-150V | 110E | TC733E | $\sim$ | $\sim$ |
| 110 V | 110D | $\sim$ | TA733 | TA733Y |
| 115 V | 115D | $\sim$ | TA734 | TA734Y |
| 125V | 125D | $\sim$ | TA737 | TA737Y |
| 220-250V | 220E | TC747E | ~ | ~ |
| 220 V | 220D | ~ | TA747 | TA747Y |
| 230 V | 230D | $\sim$ | TA749 | TA749Y |
| 250V | 250D | $\sim$ | TA751 | TA751Y |
| Price (no diode) |  | ~ | 138 | ~ |
| Price (with diode) |  | 202 | 202 | 134 |

48V, 110V \& 220V Electronic DC coil with Back Pack $\boldsymbol{6}$



Two Winding DC coil (typical) ©

CS7 AC coil (typical)


12V \& 24V Electronic DC coil 6


Other coil voltages available. Contact your Sprecher + Schuh representative for information.
(2) Coil Codes in bold letters indicate coils that are standard stocked items.
(3) Voltage operating range: $0.65 \ldots 1.3 \times U_{s}$.
(4) Voltage operating range: $0.7 \ldots 1.25 \times U_{s}$.
© CS7-...YY(EY) two winding coils are sold for renewal parts only and are not interchangeable with standard CS7-Y(E) AC coil relays or CS7C...Y(E) true DC coil relays. CS7-...YY(EY) relays should be tested following a coil swap to insure functionality of the timed auxiliary.
© Electronic DC Coils are not interchangeable with non-electronic DC or AC coils.

Technical Information

|  | Mounted <br> Standard <br> Auxiliary | Standard Control Relay CS7 | Front Mounted Standard Auxiliary Contacts | Bifurcated Control Relay CS7-B | Front Mounted <br> Bifurcated <br> Auxiliary Contacts | Master Relay CS7-M | Side <br> Mounted Contacts |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Electrical Contact Ratings - NEMA |  | A600, P600 | A600, Q600 |  |  | $\begin{gathered} \hline 2 \times \mathrm{A} 600, \\ \text { P600 } \\ \hline \end{gathered}$ | A600, Q600 |
| Min. Contact Rating |  | 17V, 10 mA | 17V, 5 mA | $5 \mathrm{~V}, 3 \mathrm{~mA}$ |  |  | 17V, 10 mA |
| Contact Ratings - IEC AC-15 (solenoids, contactors) rated voltage IEC 60947-5-1 | 24 V | 10 A | 6 A | 3 A | 3 A | 15A | 6 A |
|  | 48 V | 10 A | 6 A | 3 A | 3 A | 15 A | 6 A |
|  | 120 V | 10 A | 6 A | 3 A | 3 A | 15 A | 6 A |
|  | 240 V | 10 A | 5 A | 3 A | 3 A | 15 A | 5 A |
|  | 400V | 6 A | 3 A | 2 A | 2 A | 7.5 A | 3 A |
|  | 480V/500V | 2.5 A | 1.6 A | 1.2 A | 1.2 A | 5 A | 1.6 A |
|  | 600 V | 1 A | 1 A | 0.7 A | 0.7 A | 2 A | 1 A |
|  | 690 V | 1 A | 1 A | 0.7 A | 0.7 A | 2 A | 1 A |
| AC-12 (Control of resistive loads) IEC 60947-5-1 | $1{ }_{\text {th }}$ | 20 A | 10 A | 10 A | 10 A | 20 A | 10 A |
|  | 230 V | 8 kW |  |  |  |  |  |
|  | 400 V | 14 kW |  |  |  |  |  |
|  | 690 V | 24 kW |  |  |  |  |  |
|  | $I_{\text {th }}$ | 20 A | 6 A | 6 A | 6 A | 20 A | 6 A |
|  | 230 V | 8 kW |  |  |  |  |  |
|  | 400 V | 14 kW |  |  |  |  |  |
|  | 690 V | 24 kW |  |  |  |  |  |
| DC-12 Switching DC Loads L/R $<1 \mathrm{~ms}$, Resistive Loads IEC 60947-5-1 | 24 V | 15 A | 10 A | 6 A | 6 A | 20 A | 6 A |
|  | 48 V | 10 A | 9 A | 3.2 A | 3.2 A | 20 A | 3.2 A |
|  | 110 V | 6 A | 3.5 A | 1.0 A | 1.0 A | 8 A | 1.0 A |
|  | 220 V | 1.0 A | 0.7 A | 0.5 A | 0.5 A | 1.5 A | 0.5 A |
|  | 440 V | 0.4 A | 0.2 A | 0.2 A | 0.2 A | 0.4 A | 0.2 A |
| DC-13 IEC 60947-5-1, Solenoids and contactors | 24 V | 5 A | 5 A | 2.5 A | 2.5 A | 5 A | 5 A |
|  | 48 V | 3 A | 3 A | 1.5 A | 1.5 A | 3 A | 2.5 A |
|  | 110 V | 1.2 A | 1.2 A | 0.6 A | 0.6 A | 1.2 A | 0.68 A |
|  | 220 V | 0.6 A | 0.6 A | 0.3 A | 0.3 A | 0.6 A | 0.32 A |
|  | 440 V | 0.3 A | 0.15 A | 0.15 A | 0.15 A | 0.3 A | 0.15 A |

## Mechanically Linked Contacts (2)

| Location of welded NO contacts | State of NC contacts if NO contact welds |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | Main | Front mount auxiliary | Left side auxiliary | Right side auxiliary |
| Main | Open | Open ${ }^{\text {¢ }}$ | Open 3 | Open 3 |
| Front auxiliary | Open | Open $\boldsymbol{\square}$ | Open 3 | Open 3 |
| Left side aux. | Open | Open © | Open 3 | Open 3 |
| Right side aux. | Open | Open $\boldsymbol{1}$ | Open 3 | Open 3 |


| DC Switching Ratings for CS7 Main Poles in Series (Resistive Load at $60^{\circ} \mathrm{C}$ ) |  |  |  |
| :---: | :---: | :---: | :---: |
|  | 1 pole | 2 poles | 3 poles |
| 24/48 V | 25/20 A | 25 A | 25 A |
| 125 V | 6 A | 25 A | 25 A |
| 220 V | 1.5 A | 8 A | 25 A |
| 440 V | 0.4 A | 1 A | 3 A |

## Standards Compliance

UL 508
CSA C22.2 NO. 14
EN/EC 60947-1, -5-1
Meets the material restrictions for European Directive 2002/95/EC - EU-RoHS.

|  |  | $\begin{gathered} \text { CS7 } \\ \text { Relays } \end{gathered}$ | Front Mount Auxiliaries <br> \& Pneumatic <br> Timer Contacts |
| :---: | :---: | :---: | :---: |
| Mechanical |  |  |  |
| Mechanical Life | [Mil] | 15 | 5 |
| Electrical Life |  |  |  |
| AC-15 (240V, 3A) AC Operations [Mil] | 1.5 | 1.5 | 1.5 |
| Weight | [g] | 390 | - |

Terminal Cross-Sections Terminal Type

Terminal Size per IEC 947-1
\& =


Flexible with Wire 1 Cond. $\quad\left[\mathrm{mm}^{2]}\right.$
$\stackrel{\text { 号 }}{\stackrel{4}{4}}$
榌
$2 \times \mathrm{A} 4$
$0.5 \ldots 2.5$
$0.75 \ldots 2.5$
$0.5 \ldots 2.5$
$0.75 \ldots 2.5$
Max. Wire Size

| per UL/CSA | $[$ AWG $]$ | $16 \ldots 10$ | $18 \ldots 14$ |
| :--- | :---: | :---: | :---: |
| Tightening Torque | $[\mathrm{Nm}]$ | $1.5 \ldots 2.5$ | $1 \ldots .1 .5$ |
|  | $[\mathrm{lb}-\mathrm{in}]$ | $13 \ldots 22$ | $8.9 \ldots 13$ |

## Certifications

cULus Listed (File No. E33916, Guide NKCR/NKCR7)
CE Marked
(1) If the accessory is a Pneumatic Timer or latch, there is no positive guidance; the accessory contacts are independent.
(2) Defined in IEC 947-5-1 annex L. Mechanically linked is a relationship between contacts of opposite types (i.e., NO and NC).
(3) Side mounted auxiliary contacts provide "mirror contact" performance with main poles only.

Technical Information

## Technical Information

|  |  |  | CS7 Relays |
| :---: | :---: | :---: | :---: |
| Control Circuit Operating Voltage |  |  |  |
| AC 50/60 Hz | Pickup | [ $\mathrm{X} \mathrm{U}_{\mathrm{s}}$ ] | 0.85...1.1 |
|  | Dropout | [ $\mathrm{X} \mathrm{U}_{\mathrm{s}}$ ] | 0.3...0.6 |
| Electronic DC | Pickup | [ $\mathrm{XUS}_{\mathrm{s}}$ ] | 0.7...1.25 |
|  | Dropout | [ $\mathrm{X} \mathrm{U}_{\mathrm{s}}$ ] | 0.1...0.6 |
| Coil Consumption |  |  |  |
| AC $50 / 60 \mathrm{~Hz}$ | Inrush | [VA/W] | 70 / 50 |
|  | Seal | [VA/W] | $8 / 2.6$ |
| Electronic DC | Inrush | [W] | $10 / 17$ |
|  | Seal | [W] | 1.7 |
| Operating Times |  |  |  |
| AC- $50 / 60 \mathrm{~Hz}$ | Pickup Time | [ms] | 15... 30 |
|  | Dropout Time | [ms] | 10... 60 |
| Electronic DC | Pickup Time | [ms] | 25... 50 |
|  | Dropout Time | [ms] | 25... 50 |
| Latch Attachment Release, CV7-11 |  |  |  |
| Coil Consumption | AC | [VA/W] | $45 / 40$ |
|  | DC | [W] | 25 |
| Contact Signal Duration |  | [min/max] | 0.03...15s |
| Timing Attachment, CRZE7, CRZA7 Reset Time |  |  |  |
|  |  |  |  |
| at min. time setting |  | [ms] | 10 |
| at max. time setting |  | [ms] | 70 |
| Repeat Accuracy |  |  | $\pm 10 \%$ |


|  | CS7 Relays |
| :---: | :---: |
| General |  |
| Rated Insulation Voltage $\boldsymbol{U}_{\mathbf{i}}$ |  |
| IEC | 690 V |
| UL; CSA | 600 V |
| Rated Impulse Strength Uimp | 6 kV |
| High Test Voltage |  |
| 1 minute (per IEC 947-4) | 2500V |
| Rated Voltage $\mathbf{U}_{\text {e }}$ |  |
| AC | 115, 230, 400, 500, 690V |
| DC | 24, 48, 110, 220, 440V |
| Rated Frequency | $50 / 60 \mathrm{~Hz}$, DC |
| Ambient Temperature |  |
| Storage | $-55 \ldots+80^{\circ} \mathrm{C}\left(-67 \ldots 176^{\circ} \mathrm{F}\right)$ |
| Operation at nominal current | $-25 \ldots+60^{\circ} \mathrm{C}\left(-13 \ldots 140^{\circ} \mathrm{F}\right)$ |
| Conditioned $15 \%$ current reduction after $\mathrm{AC}-1$ at $>60^{\circ} \mathrm{C}$ | $-25 \ldots+70^{\circ} \mathrm{C}\left(-13 \ldots 158^{\circ} \mathrm{F}\right)$ |
| Corrosion Resistance | humid-alternating climate, cyclic, per IEC 68-2-30 and DIN 50 016, 56 cycles |
| Altitude | 2000m above main sea level, per IEC 947-4 |
| Type of Protection <br> IP 2 X (IEC 60529 and DIN 40050) | in connected state |
| Finger Protection | safe from touch by fingers and back of hand per VDE 0106, Part 100 |
| Shock Protection |  |
| IEC 68-2: Half Sinusoidal shock 11ms | 30G (in 3 directions) |
| Vibration Resistance |  |
| IEC 68-2: static >2G in normal position | no malfunction $<5 \mathrm{G}$ |

## Utilization Category Table from EN 947-5-1

| Verification of Making and Breaking Capacities of Switching Elements Under Normal Conditions Corresponding to the Utilization Categories © |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Normal Condition of Use |  |  |  |  |  |  |  |  |
|  | Make (3) |  |  | Break (2) |  |  | Number \& Rate of Making \& Breaking Operations |  |  |
| Utilization <br> Category | $1 /{ }_{\text {e }}$ | $\mathrm{U} / \mathrm{U}_{\mathrm{e}}$ | $\operatorname{COS} \Psi$ | 1/I | $\mathrm{U} / \mathrm{U}_{\mathrm{e}}$ | $\operatorname{Cos} \Psi$ | No. of operating cycles 3 | Operating cycles per minute | ON time(s) $\oplus$ |
| AC-12 © | 1 | 1 | 0.9 | 1 | 1 | 0.9 | 6050 | 6 | 0.05 |
| AC-13 © | 2 | 1 | 0.65 | 1 | 1 | 0.65 | 6050 | 6 | 0.05 |
| AC-14 © | 6 | 1 | 0.3 | 1 | 1 | 0.3 | 6050 | 6 | 0.05 |
| AC-15 © | 10 | 1 | 0.3 | 1 | 1 | 0.3 | 6050 | 6 | 0.05 |
| DC |  |  | $T_{0.95}$ |  |  | $T_{0.95}$ |  |  |  |
| DC-12 | 1 | 1 | 1 ms | 1 | 1 | 1 ms | 6050 | 6 | 0.05 © |
| DC-13 | 1 | 1 | $6 \times P$ (4) | 1 | 1 | $6 \times P$ (4) | 6050 | 6 | 0.05 © |
| DC-14 © | 10 | 1 | 15 ms | 1 | 1 | 15 ms | 6050 | 6 | 0.05 © |

$\mathrm{I}_{\mathrm{e}} \quad$ Rated operational current $\mathrm{P}=U_{e} l_{\mathrm{e}}$ steady-state power consumption (W)
$U_{e} \quad$ Rated operational voltage. Current to be made or broken.
$T_{0.95}$ Time to reach $95 \%$ of the steady-state current (ms) UVoltage before make
(1) See sub-clause 8.3.3.5.2
(2) For tolerances on test quantities, see sub-clause 8.3.2.2
(8) The first 50 operating cycles shall be run at $U / U_{e}=1.1$ with the loads set at $U_{e}$
(4) The value " $6 \times P$ " results from an empirical relationship which is found to represent most DC magnetic loads to an upper limit of $P=50 \mathrm{~W}$, i.e. $6 \times P=300 \mathrm{~ms}$.
© The ON time shall be at least equal to $T_{0.95}$
© Where the break current differs from the make current value, the ON time refers to the make current value after which the current is reduced to break current value for a suitable period e.g., 0.05 s .

## NEMA Ratings and Test Values for AC (50 and 60Hz) and DC Control Circuits Contacts

| $\begin{aligned} & \text { Designation } \\ & \text { © } \end{aligned}$ | Utilization <br> Category | Therm. Continuous Test Current (A) | Maximum Current |  |  |  |  |  |  |  | VA |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 120V |  | 240V |  | 480V |  | 600V |  |  |  |
|  |  |  | Make | Break | Make | Break | Make | Break | Make | Break | Make | Break |
| A150 | AC-15 | 10 | 60 | 6.00 | ~ | ~ | ~ | $\sim$ | ~ | ~ | 7200 | 720 |
| A300 | AC-15 | 10 | 60 | 6.00 | 30 | 3.00 | ~ | ~ | ~ | ~ | 7200 | 720 |
| A600 | AC-15 | 10 | 60 | 6.00 | 30 | 3.00 | 15 | 1.50 | 12 | 1.20 | 7200 | 720 |
| B150 | AC-15 | 5 | 30 | 3.00 | $\sim$ | $\sim$ | $\sim$ | $\sim$ | ~ | ~ | 3600 | 360 |
| B300 | AC-15 | 5 | 30 | 3.00 | 15 | 1.50 | ~ | ~ | ~ | ~ | 3600 | 360 |
| B600 | AC-15 | 5 | 30 | 3.00 | 15 | $1 . .50$ | 7.5 | 0.75 | 6 | 0.60 | 3600 | 360 |
| C150 | AC-15 | 2.5 | 15 | 1.50 | ~ | ~ | $\sim$ | ~ | $\sim$ | ~ | 1800 | 180 |
| C300 | AC-15 | 2.5 | 15 | 1.50 | 7.5 | 0.75 | $\sim$ | $\sim$ | ~ | ~ | 1800 | 180 |
| C600 | AC-15 | 2.5 | 15 | 1.50 | 7.5 | 0.75 | 3.75 | 0.375 | 3 | 0.30 | 1800 | 180 |
| D150 | AC-14 | 1.0 | 3.60 | 0.60 | $\sim$ | $\sim$ | ~ | ~ | ~ | ~ | 432 | 72 |
| D300 | AC-14 | 1.0 | 3.60 | 0.60 | 1.8 | 0.30 | ~ | $\sim$ | ~ | ~ | 432 | 72 |
| E150 | AC-14 | 0.5 | 1.80 | 0.30 | $\sim$ | $\sim$ | $\sim$ | ~ | $\sim$ | $\sim$ | 216 | 36 |
| $2 \times$ A300 | AC-15 | 20 | 120 | 12 | 60 | 6.00 | $\sim$ | $\sim$ | ~ | $\sim$ | 14400 | 1440 |
| $2 \times$ A600 | AC-15 | 20 | 120 | 12 | 60 | 6.00 | 30 | 3.00 | 24 | 2.40 | 14400 | 1440 |
| DC |  |  | 5...28V |  | 125 V |  | 250 V |  | 301...600V |  | Make or Break at 300V or less [VA] |  |
| N150 | DC-13 | 10 | 10 |  | 2.2 |  | $\sim$ |  | $\sim$ |  | 275 |  |
| N300 | DC-13 | 10 | 10 |  | 2.2 |  | 1.1 |  | $\sim$ |  | 275 |  |
| N600 | DC-13 | 10 | 10 |  | 2.2 |  | 1.1 |  | 0.40 |  | 275 |  |
| P150 | DC-13 | 5.0 | 5.0 |  | 1.1 |  | $\sim$ |  | $\sim$ |  | 138 |  |
| P300 | DC-13 | 5.0 | 5.0 |  | 1.1 |  | 0.55 |  | $\sim$ |  | 138 |  |
| P600 | DC-13 | 5.0 | 5.0 |  | 1.1 |  | 0.55 |  | 0.20 |  | 138 |  |
| Q300 | DC-13 | 2.5 | 2.5 |  | 0.55 |  | 0.27 |  | 0.11 |  | 69 |  |
| Q600 | DC-13 | 2.5 | 2.5 |  | 0.55 |  | 0.27 |  | 0.11 |  | 69 |  |
| $2 \times$ P600 | DC-13 | 10 | 102.2 |  | 2.2 |  | 1.1 |  | 0.40 |  | 275 |  | that follows is the rated insulation voltage.

## Series CS7 Industrial Control Relays (AC and Electronic DC)

## Dimensions are in millimeters (inches). Dimensions not intended for manufacturing purposes.



| Catalog Number | Coil Code | a | b | b1 | C | c1 | c2 | $\varnothing$ d | d1 | d2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CS7 (AC) |  | $\begin{gathered} \hline 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ |  | $\begin{gathered} 80.5 \\ (3-11 / 64) \end{gathered}$ | $\begin{gathered} 75.5 \\ (3-3 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ (1 / 4) \\ \hline \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-25 / 64) \\ \hline \end{gathered}$ |
| CA7-9E...CA7-23E, CAN7-12E...CAN7-16E | 12E | $\begin{gathered} 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ | $\underset{\sim}{\sim}$ | $\begin{gathered} 80.5 \\ (3-11 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 75.5 \\ (2-31 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ (15 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-3 / 8) \\ \hline \end{gathered}$ |
|  | 24E | $\begin{gathered} 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ |  | $\begin{gathered} 80.5 \\ (3-11 / 64) \end{gathered}$ | $\begin{gathered} 75.5 \\ (2-31 / 32) \end{gathered}$ | $\begin{gathered} 6 \\ (15 / 64) \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-3 / 8) \end{gathered}$ |
|  | 48E | $\begin{gathered} 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 24 \\ (15 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 80.5 \\ (3-11 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 75.5 \\ (2-31 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ (15 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-3 / 8) \\ \hline \end{gathered}$ |
|  | 110E | $\begin{gathered} 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 24 \\ (15 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 80.5 \\ (3-11 / 64) \end{gathered}$ | $\begin{gathered} 75.5 \\ (2-31 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ (15 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-3 / 8) \\ \hline \end{gathered}$ |
|  | 220E | $\begin{gathered} 45 \\ (1-25 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 81 \\ (3-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 24 \\ (15 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 80.5 \\ (3-11 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 75.5 \\ (2-31 / 32) \\ \hline \end{gathered}$ | $\begin{gathered} 6 \\ (15 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 2-4.5 \\ (2-3 / 16) \\ \hline \end{gathered}$ | $\begin{gathered} 60 \\ (2-23 / 64) \\ \hline \end{gathered}$ | $\begin{gathered} 35 \\ (1-3 / 8) \\ \hline \end{gathered}$ |

Relays \& Accessories (+...)

| Relays with... |  | Dim. $[\mathrm{mm}]$ | Dim. [inches] |
| :--- | :--- | :--- | :--- |
| auxiliary contact block for front mounting | 2-, or 4-pole | $\mathrm{c} / \mathrm{c} 1+39$ | $\mathrm{c} / \mathrm{c} 1+1-37 / 64$ |
| auxiliary contact block for side mounting | 1-, or 2-pole | $\mathrm{a}+9$ | $\mathrm{a}+23 / 64$ |
| pneumatic timing module |  | $\mathrm{c} / \mathrm{c} 1+58$ | $\mathrm{c} / \mathrm{c} 1+2-23 / 64$ |
| electronic timing module | on coil terminal side | $\mathrm{b}+24$ | $\mathrm{~b}+15 / 16$ |
| mechanical latch |  | $\mathrm{c} / \mathrm{c} 1+61$ | $\mathrm{c} / \mathrm{c} 1+2-31 / 64$ |
| interface module | on coil terminal side | $\mathrm{b}+9$ | $\mathrm{~b}+23 / 64$ |
| surge suppressor | on coil terminal side | $\mathrm{b}+3$ | $\mathrm{~b}+1 / 8$ |
| $\boldsymbol{\text { © Labeling with... }}$ | label sheet | +0 | +0 |
|  | marking tag sheet with clear cover | +0 | +0 |
|  | marking tag adapter for V7 Terminals | +5.5 | $+7 / 32$ |

## Mounting Position



AC \& Electronic DC control relays

## TECHNICAL DATA SHEET

Equipment Type:Push Buttons
Location:
RTU Section
Model Numbers: Various
Manufacturer: Specher \& Schuh
Supplier: NHP Pty Ltd
16 Riverview Place
Murarrie(07) 39094999


INDUSTRIAL SWITCHGEAR \& AUTOMATION SPECIALISTS


## Experience a Touch of Quality



New D7...

## Experience a Touch of Quality



Introducing the all new D7 range from Sprecher + Schuh. The D7 range is the latest in a long line of quality 22.5 mm control and signalling equipment from a company with a long built reputation for combining high quality manufacturing skills and attention to detail to produce only the finest quality products.

Available in both thermoplastic and metal variations, the D7 range incorporates all the features that you have come to expect from Sprecher + Schuh and raises the bar one step further with a functional low profile design and all new stylish appearance.

Once you get past the new appearance you will find the D7 range has some unique features incorporated, such as improved operational feel on the pushbuttons for a positive "tactile" response and a new positive detent on selector switches. In addition optional time saving cage style termination on contact blocks, improved LED illumination on pilot lights and hard wearing laser engraving have also been included.

Utilising state of the art modelling technologies and finite element analysis, you can be sure every component used in the D7 range has been optimised for durability and reliability with the aim of providing the ultimate in control and indication.

Designed and manufactured to meet the most exacting performance, the new D7 range is the pushbutton to use in today's demanding environments.


## D7 at a glance...



## "Auto Break" Safety contacts

Separation of the contact block assembly from the front operator or mounting latch can prevent an Emergency Stop from shutting down the controlled process in an emergency. Correct contact block installation is critical to ensure that the normally closed contacts will open when the emergency stop operator is active. The exclusive Sprecher + Schuh "Auto Break" contact block monitors itself to ensure it is always correctly installed.
A normally open "Auto Break" contact is physically moulded and wired in series with a standard set of normally closed contacts. When correctly installed the operator creates a maintained pressure on the normally open "Auto Break" contact and automatically closes the contact. In this state the normally closed contact operates as normal.
If the contact block assembly should separate from the front operator, the pressure releases and the "Auto Break" contact will automatically open. Because the "Auto Break" contact is wired in series with the normally closed, the opening of either set of contacts will open the circuit controlled by the emergency stop operator.

## Goupling plates and contact blocks

- Choice of metal or plastic coupling plates
- Rotating collar with "snap secure" system ensures fast one-hand removal
- Contact blocks snap-fit and are hinged at one end for easy installation
- Colour coded contact block plungers for easy identification
- H-bridge contact design and the option of gold contacts provides cleaner current flow for maximum reliability at lower voltages
- Bifurcated contacts provide excellent wiping and optimal switching reliability
- Option of Cage style wire termination or Screw clamp
- Live components are shrouded and touch safe to IP 20



## Inscription caps and diffusers

- Durable abrasion-proof press plates
- 6 colour choices
- Ergonomically contoured design
- Diffusers constructed in two colour moulded assembly

- Durable wear resistant laser printing available

- Metal and plastic enclosures
- In choices to accommodate up to $6 \times 22.5 \mathrm{~mm}$ operators
- Yellow thermoplastic pendant style enclosure available for up to 2 operators
- 20 mm metric cable entry
- Suitable for base or panel mount contact blocks


## Illumination



- Modern and compact integrated LED lamp modules
- Superior illumination qualities
- 5 colour choices
- 11 year lamp life (100,000 hrs)
- Maintenance free
- Vibration and shock resistant
- 24 V AC/DC, 110 V AC and 240 V AC
- Accepts two piece snap-in legend


## Complete Standard Units

Pushbuttons 7
Illuminated pushbuttons 8
Pilot Lights 8
Emergency Stop Stations 9
Enclosed Emergency Stop Stations 9
Multi Function Operators 10
Rotary Switches 10
Rotary Key Switches $\quad 10$

| Potentiometer Dial | 10 |
| :--- | :--- |

Panel mounted subassemblies
Front elements and back of panel sub assemblies to your requirements
Illuminated and Non Illuminated Pushbuttons $\quad 11-13$
Illuminated and Non Illuminated Mushroom Pushbuttons 14
Multifunction Operators $\quad 15$
Emergency Stop Operators 16
Reset Operators 17
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Selector Jog Switches and Joystick operators $\quad 19-20$
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Individual components for custom requirements
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Panel and base mount contact elements 28
Panel and base mount lamp elements 29
Coloured inserts, lens caps, lens diffusers 30
Spare incandescent, neon and LED lamps 31

| Mounting tools, guards and sealing boots | 32 |
| :--- | :--- |

Hole plug, potentiometer legends, resistive elements 33
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Legend Plates and labeling
Operator text/symbols configurator form 36
Standard pushbutton inserts and diffusers with text 37
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Press plates with text for multifunction operator 38
$\begin{array}{ll}\text { Legend carriers, legend plates } & \text { 39-42 }\end{array}$

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46-53

## Design

- Functional low profile appearance
- Ergonomic easy to operate handles
- Reduced depth contact blocks
- Improved positive "tactile" operation on pushbuttons
- Improved "positive detent" on rotary selector switches
- Durable two colour plastic caps and laser engraving



## Improved safety

- Unique "Auto break" self-monitoring emergency contact system
- IP 20 touch protection
- Tamperproof rear fixing nut



## Time saving

- New design snap-lock, twist-to-reset rotating collar on coupling plates for easier mounting and assembly
- Snap-on components
- Redesigned anti-rotation tab


## Flexibility

- Thermoplastic or metal operators
- Latching or impulse operators
- Five different colour choices
- Maximum of six contact blocks
- Full voltage and transformer lamp blocks



## Improved reliability

- IP 65/66 sealing across the range for reliability in dusty and wet conditions
- Improved vibration resistance
- Continuous wiping contact for improved reliability
- Tested to IEC 947
- Positive detent on rotary switches which ensures operation will not "hang up" between positions


## Contact blocks

- Improved mounting from "Snapsecure" snap fit mounting system
- Colour coded plungers for easy identification
- Optional Quadfurcated Gold contacts for improved low voltage switching
- Optional spring clamp termination on contact blocks for reduced wiring time


## Non-Illuminated Momentary Pushbuttons



Dimensions in (mm)

- Metal or plastic options
- Improved momentary action for fast response
- Low mounting depth from panel



| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| :---: | :---: | :---: | :---: |
| Flush Pushbutton with Green insert with Red insert with Blue insert |  | $\begin{aligned} & \text { D7P-F3-PX10 }{ }^{1} \text { ) } \\ & \text { D7P-F4-PX01 }{ }^{1} \text { ) } \\ & \text { D7P-F6-PX10 }{ }^{1} \text { ) } \end{aligned}$ | D7M-F3-MX10 ${ }^{\text {² }}$ ) <br> D7M-F4-MX01 ${ }^{1}$ ) <br> D7M-F6-MX10 ${ }^{1}$ ) |
|  <br> Dimensions in (mm) |  | D7P-E4-PX01 | D7M-E4-MX0 |
| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| Extended Pushbutton with Red insert | $\square$ | D7P-E4-PX01 ${ }^{1}$ ) | D7M-E4-MX01 ${ }^{\text { }}$ ) |

Non-Illuminated Momentary Pushbuttons with labelled Press Plates


| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| :---: | :---: | :---: | :---: |
| Flush Pushbutton <br> with Green insert labelled "Start" <br> with Red insert labelled "Stop" <br> with Blue insert labelled "Reset" <br> with extended Red press plate labelled "Stop" |  | $\begin{aligned} & \text { D7P-F301-PX10 ¹) } \\ & \text { D7P-F402-PX01 }{ }^{1} \text { ) } \\ & \text { D7P-F607-PX10 }{ }^{\prime} \text { ) } \\ & \text { D7P-E402-PX01 }{ }^{1} \text { ) } \end{aligned}$ | D7M-F301-MX10 ${ }^{1}$ ) <br> D7M-F402-MX01 ${ }^{1}$ ) <br> D7M-F607-MX10 ${ }^{1}$ ) <br> D7M-E402-MX01 ${ }^{1}$ ) |

Illuminated Momentary Flush Pushbuttons with integrated LED Lamp Block


Dimensions in (mm)

- Long life integrated LED illumination
- 24 V and 240 V versions
- Supplied complete with contact blocks

| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| :---: | :---: | :---: | :---: |
| 24 V AC/DC |  |  |  |
| Green pushbutton with Green LED | $\cdots-\frac{\pi}{4}$ | D7P-LF3-PN3G-X10 ${ }^{\text {² }}$ ) | D7M-LF3-MN3G-X10 ${ }^{\text {² }}$ ) |
| Red pushbutton with Red LED | $-4$ | D7P-LF4-PN3R-X01 ${ }^{1}$ ) | D7M-LF4-MN3R-X01 ${ }^{1}$ ) |
| Blue pushbutton with Blue LED | $-1 \pi$ | D7P-LF6-PN3B-X10 ${ }^{\text {² }}$ ) | D7M-LF6-MN3B-X10 ${ }^{1}$ ) |
| Yellow pushbutton with Yellow LED | - - $\mathrm{CN}^{\text {N }}$ | D7P-LF5-PN3Y-X10 ${ }^{\text {² }}$ ) | D7M-LF5-MN3Y-X10 ${ }^{1}$ ) |
| 240 V AC |  |  |  |
| Green pushbutton with Green LED | $\stackrel{A 1}{4}$ | D7P-LF3-PN7G-X10 ${ }^{\text {² }}$ ) | D7M-LF3-MN7G-X10 ${ }^{\text {² }}$ ) |
| Red pushbutton with Red LED | $-\mathbb{N}_{1}^{\pi}$ | D7P-LF4-PN7R-X01 ${ }^{\text {² }}$ ) | D7M-LF4-MN7R-X01 ${ }^{1}$ ) |
| Blue pushbutton with Blue LED | - | D7P-LF6-PN7B-X10 ${ }^{\text {² }}$ ) | D7M-LF6-MN7B-X10 ${ }^{1}$ ) |
| Yellow pushbutton with Yellow LED | - | D7P-LF5-PN7Y-X10 ${ }^{\text {² }}$ ) | D7M-LF5-MN7Y-X10 ${ }^{1}$ ) |

Pilot Light with integrated LED Lamp Block


Dimensions in (mm)

- Superior LED illumination qualities
- Scratch resistant lenses
- Modern low profile bodies



| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| :---: | :---: | :---: | :---: |
| 24 V AC/DC |  |  |  |
| Green pilot light with Green LED | $-\frac{1}{1}$ | D7P-P3-PN3G ${ }^{1}$ ) | D7M-P3-MN3G ${ }^{1}$ ) |
| Red pilot light with Red LED | - | D7P-P4-PN3R ${ }^{1}$ ) | D7M-P4-MN3R ${ }^{1}$ ) |
| Blue pilot light with Blue LED | - $\square^{\prime \prime}$ | D7P-P6-PN3B ${ }^{1}$ ) | D7M-P6-MN3B ${ }^{1}$ ) |
| Yellow pilot light with Yellow LED | - ${ }^{1 / 4}$ | D7P-P5-PN3Y ${ }^{1}$ ) | D7M-P5-MN3Y ${ }^{1}$ ) |
| Translucent pilot light with White LED | - | D7P-P7-PN3W ${ }^{1}$ ) | D7M-P7-MN3W ${ }^{1}$ ) |
| 240 V AC |  |  |  |
| Green pilot light with Green LED | $-\frac{11}{4}$ | D7P-P3-PN7G ${ }^{1}$ ) | D7M-P3-MN7G ${ }^{1}$ ) |
| Red pilot light with Red LED | $\cdots$ | D7P-P4-PN7R ${ }^{1}$ ) | D7M-P4-MN7R ${ }^{1}$ ) |
| Blue pilot light with Blue LED | - | D7P-P6-PN7B ${ }^{1}$ ) | D7M-P6-MN7B ${ }^{\text {² }}$ ) |
| Yellow pilot light with Yellow LED | $\cdots$ | D7P-P5-PN7Y ${ }^{1}$ ) | D7M-P5-MN7Y ${ }^{\text {² }}$ ) |
| Translucent pilot light with White LED | $\xrightarrow{* 1}$ | D7P-P7-PN7W ${ }^{\text {² }}$ ) | D7M-P7-MN7W ${ }^{1}$ ) |

## Emergency Stop Operators

- Choice of "Auto Break" or Standard normally closed contacts
- 30, 40 or 60 mm Mushroom head
- Extra security key release
Dimensions in (mm)



D7M-MK44-MX01S

| Description Contact | Plastic Body Cat. No. | Metal Body <br> Cat. No. |
| :---: | :---: | :---: |
| Twist To Reset with Standard Contact Blocks |  |  |
| 30 mm Operator | D7P-MT34-PX01 ${ }^{1}$ ) | D7M-MT34-MX01 ${ }^{1}$ ) |
| 40 mm Operator | D7P-MT44-PX01 ${ }^{1}$ ) | D7M-MT44-MX01 ${ }^{1}$ ) |
| 60 mm Operator | D7P-MT64-PX01 ${ }^{1}$ ) | D7M-MT64-MX01 ${ }^{1}$ ) |
| Key To Reset with Standard Contact Blocks |  |  |
| 40 mm Operator | D7P-MK44-PX01 ${ }^{\text {² }}$ ) | D7M-MK44-MX01 ${ }^{1}$ ) |
| Twist To Reset with "Auto Break" Safety Contact Blocks |  |  |
| 30 mm Operator | D7P-MT34-PX01S ${ }^{1}$ ) | D7M-MT34-MX01S ${ }^{1}$ ) |
| 40 mm Operator | D7P-MT44-PX01S ${ }^{1}$ ) | D7M-MT44-MX01S ${ }^{1}$ ) |
| 60 mm Operator | D7P-MT64-PX01S ${ }^{1}$ ) | D7M-MT64-MX01S ${ }^{1}$ ) |
| Key To Reset with "Auto Break" Safety Contact Blocks |  |  |
| 40 mm Operator | D7P-MK44-PX01S ${ }^{\text {² }}$ ) | D7M-MK44-MX01S ${ }^{1}$ ) |

## Enclosed Emergency Stop Operators



- Modern low profile enclosures
- Supplied complete
- 20 mm metric cable entry
- Plastic or Metal enclosures


Dimensions in (mm)

## Description

Contact
Cat. No.
Plastic Enclosures with Emergency Stop "Twist To Reset" Operator
Yellow enclosure 40 mm plastic operator
$\square$
D71YM1
Plastic Enclosures with Emergency Stop "Twist Key To Reset" Operator
Yellow enclosure 40 mm plastic operator
$\square$
D71Y4

## Metal Enclosures with Emergency Stop "Twist To Reset" Operator

Grey enclosure 40 mm metal operator
$\square$
D71MM1

## Metal Enclosures with Emergency Stop "Twist Key To Reset" Operator

Grey enclosure 40 mm metal operator
$\square$
D71MM4

Multi Function Operators

## Time saving



- Central nut fixing
- Snap fitting of components

Space efficient

- 2 or 3 functions in a minimum of space
- Single 22.5 mm hole mounting


## Economical

- Negates the need for 3 separate devices
- Less mounting time

Flexible

- Uses standard D7 rear elements
- 2 contact levels possible
- Choice of plastic or metal body

Dimensions in (mm)

$$
\text { - IP } 66 \text { protection }
$$

| Description | Contact | Plastic Body | Metal Body |
| :--- | :--- | :--- | :--- |
|  |  | Cat. No. | Cat. No. |

Maintained Operation
Blank press plates (Red / Green) O-I (Red "Stop" / Green "Start")
$\qquad$ D7P-U2E4F3-PX11 ${ }^{1}$ )
D7P-U2EFFE-PX11 ${ }^{1}$ )
D7M-U2E4F3-MX11 ${ }^{1}$ )
D7M-U2EFFEMX11 ${ }^{1}$ )

Short lever Rotary Switches and Key Operated Rotary Switches
Description
Maintained Operation
2 pos Rotary SW $90^{\circ}$
3 pos Rotary SW $2 \times 60^{\circ}$
2 pos Key SW $90^{\circ}$
3 pos Key SW $2 \times 60^{\circ}$

| Description | Contact | Plastic Body Cat. No. | Metal Body Cat. No. |
| :---: | :---: | :---: | :---: |
|  |  | D7P-SM22-PX10 ${ }^{1}$ ) <br> D7P-SM32-PX20 ${ }^{1}$ ) <br> D7P-KM21-PX10 ${ }^{1}$ ) <br> D7P-KM31-PX20 ${ }^{1}$ ) | D7M-SM22-MX10 ${ }^{1}$ ) <br> D7M-SM32-MX20 ${ }^{\text {¹ }}$ <br> D7M-KM21-MX10 ${ }^{\text {² }}$ <br> D7M-KM31-MX20 ${ }^{1}$ ) |
|  | Potentiometer <br> - Supplied complete with resistive elements <br> - Thermoplastic body | D7P-POT |  |
| Description | Contact | Plastic Body Cat. No. |  |
| Operator without resistive element Operator with $1000 \Omega$ resistive Operator with $5000 \Omega$ resistive Operator with $10000 \Omega$ resistive |  | D7P-POT <br> D7P-POT3 <br> D7P-POT5 <br> D7P-POT6 |  |



- Improved sealing
- Raised detent for improved switching capabilities
- Ergonomic handles
- Key release at off position


D7P-SM22-PX10

Maintained Operation

2 pos Key SW $90^{\circ}$ -
$\qquad$
-


Contact Cat. No.


D7P-U2E4F3-PX11


D7M-U2E4F3-MX11

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PF Flush frame, non-illuminated plastic pushbutton operators
D7PLF Flush frame, illuminated plastic pushbutton operators
D7MF Flush frame, non-illuminated metal pushbutton operators
D7MLF Flush frame, illuminated metal pushbutton operators

- Protection class IP 66
- Individually packaged
- 2 part ordering 2


1


Dimensions in (mm)

Non Illuminated Plasti

## Ca

D7P-F9

| D7P-F1 | D7M-F1 | D7PL-F1 | D7M |
| :--- | :--- | :--- | :--- |
| D7P-F2 | D7M-F2 | - | - |


| Operator with Black insert |
| :--- | :--- |
| Operator with Green insert |

Operator with Red insert

| Operator with Yellow insert |
| :--- | :--- |
| Operator with Blue insert |

Operator with Green "Start" insert
Operator with Green "I" insert
Operator with Red "STOP" insert D7

| Operator with Red "O" insert | D7P-F405 | D7M-F405 | - | - |
| :--- | :--- | :--- | :--- | :--- |
| Operator with Black " $\rightarrow$ " insert | D7P-F208 | D7M-F208 | - | - |

D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

| Description | Screw Cat. No. | Spring Clamp Cat. No. | Metal Screw Cat. No. | Metal Spring Clamp Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| 1 N/O contact block | D7PX10 | D7PQ10 | D7MX10 | D7MQ10 |
| $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX01 | D7PQ01 | D7MX01 | D7MQ01 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX11 | D7PQ11 | D7MX11 | D7MQ11 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block and incandescent lamp block | D7PD ${ }^{1}$ CX11 | D7PD ${ }^{1}$ CQ11 | D7MD ${ }^{1}$ ) ${ }^{\text {CX11 }}$ | D7MD ${ }^{1}$ )CQ11 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block and integrated LED lamp block | D7PN $\left.{ }^{1}{ }^{2}\right) \mathrm{X} 11$ | D7PQ ${ }^{1}{ }^{2}{ }^{\text {)Q11 }}$ | D7MN $\left.{ }^{1}\right)^{2}$ ) ${ }^{\text {(11 }}$ | D7MQ') ${ }^{2}$ ) X 11 |

[^55]
## D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

- Protection class IP 66
- Individually packaged


D7PE Extended frame, non-illuminated plastic pushbutton operators
D7PLE
D7ME
D7MLE

Extended frame, illuminated plastic pushbutton operators
Extended frame, non-illuminated metal pushbutton operators
Extended frame, illuminated metal pushbutton operators

| 1 Dimensions in (mm) | D7P-E1 | D7M-E402 | D7PL-E4 | D7ML-E4 |
| :---: | :---: | :---: | :---: | :---: |
| Description | Non Illuminated Plastic Cat. No. | Non Illuminated <br> Metal <br> Cat. No. | Illuminated <br> Plastic <br> Cat. No. ${ }^{3}$ ) | Illuminated <br> Metal <br> Cat. No. ${ }^{3}$ ) |
| Operator only - no insert | D7P-E9 | D7M-E9 | D7PL-E9 | D7ML-E9 |
| Operator with White / Clear insert | D7P-E1 | D7M-E1 | D7PL-E1 | D7ML-E1 |
| Operator with Black insert | D7P-E2 | D7M-E2 | - | - |
| Operator with Green insert | D7P-E3 | D7M-E3 | D7PL-E3 | D7ML-E3 |
| Operator with Red insert | D7P-E4 | D7M-E4 | D7PL-E4 | D7ML-E4 |
| Operator with Yellow insert | D7P-E5 | D7M-E5 | D7PL-E5 | D7ML-E5 |
| Operator with Blue insert | D7P-E6 | D7M-E6 | D7PL-E6 | D7ML-E6 |
| Operator with Green "Start" insert | D7P-E301 | D7M-E301 | - | - |
| Operator with Green "l" insert | D7P-E306 | D7M-E306 | - | - |
| Operator with Red "STOP" insert | D7P-E402 | D7M-E402 | - | - |
| Operator with Red "O" insert | D7P-E405 | D7M-E405 | - | - |
| Operator with Black " $\rightarrow$ " insert | D7P-E208 | D7M-E208 | - | - |

D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  | Screw | Metal | Metal | Spring Clamp |
| :--- | :--- | :--- | :--- | :--- |
| Sescription | Cat. No. | Cat. No. | Crew |  |
| Cat. No. | Cat. No. |  |  |  |

[^56]D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PG Guarded frame, non-illuminated plastic pushbutton operators
D7PLG Guarded frame, illuminated plastic pushbutton operators
D7MG Guarded frame, non-illuminated metal pushbutton operators
D7MLG Guarded frame, illuminated metal pushbutton operators

- Protection class IP 66
- Individually packaged
- 2 part ordering


1
Dimensions in (mm)
-

|  | Non Illuminated <br> Plastic <br> Cat. No. | Non Illuminated <br> Metal <br> Cat. No. | Illuminated <br> Plastic <br> Cat. No. $\left.{ }^{3}\right)$ | Illuminated <br> Metal <br> Cat. No. ${ }^{3}$ ) |
| :--- | :--- | :--- | :--- | :--- |
| Description | D7P-G9 | D7M-G9 | D7PL-G9 | D7ML-G9 |
| Operator only - no insert | D7P-G1 | D7M-G1 | D7PL-G1 | D7ML-G1 |
| Operator with White / Clear insert | D7P | D7M-G2 | - | - |
| Operator with Black insert | D7P-G2 | D7M-G3 | D7PL-G3 | D7ML-G3 |
| Operator with Green insert | D7P-G3 | D7M-G4 | D7PL-G4 | D7ML-G4 |
| Operator with Red insert | D7P-G4 | D7M-G5 | D7PL-G5 | D7ML-G5 |
| Operator with Yellow insert | D7P-G5 | D7M-G6 | D7PL-G6 | D7ML-G6 |
| Operator with Blue insert | D7P-G6 | D7M-G301 |  |  |
| Operator with Green "Start" insert | D7P-G301 | D7M-G306 |  |  |
| Operator with Green "l" insert | D7P-G306 | D7M-G402 |  |  |
| Operator with Red "STOP" insert | D7P-G402 | D7M-G405 |  |  |
| Operator with Red "O" insert | D7P-G405 | D7M-G208 |  |  |
| Operator with Black " $\rightarrow$ " insert | D7P-G208 |  |  |  |



D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate
$\left.\begin{array}{lllll} & \text { Screw } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Spring Clamp } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Metal } \\ \text { Screw } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Metal } \\ \text { Spring Clamp } \\ \text { Cat. No. }\end{array}\right]$

[^57]- Protection class IP 66


D7PMM 40 mm and 60 mm , non-illuminated momentary plastic mushroom operators D7PLMM 40 mm and 60 mm , illuminated momentary plastic mushroom operators D7MMM 40 mm and 60 mm , non-illuminated momentary metal mushroom operators D7MLMM 40 mm and 60 mm , illuminated momentary metal mushroom operators

<br>D7P-MM62

## Non Illuminated Plastic <br> Cat. No.



D7M-MM44


D7P-LMM43


D7M-LMM46

| Illuminated | Illuminated |
| :--- | :--- |
| Plastic | Metal |
| Cat. No. | Cat. No. |

D7P-LMM42
D7M-LMM42
40 mm operator with Clear insert
40 mm operator with Green insert
40 mm operator with Yellow insert

40 mm operator with Blue insert
40 mm operator with Blue insert

| 60 mm operator with Clear insert | - | - | D7P-LMM62 | D7M-LMM62 |
| :--- | :--- | :--- | :--- | :--- |
| 60 mm operator with Black insert | D7P-MM62 | D7M-MM62 | - | - |
| 60 mm operator with Green insert | D7P-MM63 | D7M-MM63 | D7P-LMM63 | D7M-LMM63 |
| 60 mm operator with Red insert | D7P-MM64 | D7M-MM64 | D7P-LMM64 | D7M-LMM64 |
| 60 mm operator with Yellow insert | D7P-MM65 | D7M-MM65 | D7P-LMM65 | D7M-LMM65 |
| 60 mm operator with Blue insert | D7P-MM66 | D7M-MM66 | D7P-LMM66 | D7M-LMM66 |

D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  | Screw | Spring Clamp | Metal <br> Screw <br> Cat. No. | Metal <br> Spring Clamp |
| :--- | :--- | :--- | :--- | :--- |
| Description | Cat. No. | Cat. No. No. |  |  |

[^58]| D7PU2 / D7PLU2 | 2 Position plastic illuminated and non-illuminated multifunction operators |
| :--- | :--- |
| D7MU2 / D7MLU2 | 2 Position metal illuminated and non-illuminated multifunction operators |
| D7PU3 | 3 Position plastic non-illuminated multifunction operators |
| D7MU3 | 3 Position metal non-illuminated multifunction operators |

- Protection class IP 66
- Individually packaged


1


Non-illuminated operator without
Illuminated operator without

Two Position
Plastic Operator
Cat. No.

Two Position Metal Operator Cat. No.
D7P-U2X

D7P-LU2X insert

2 Blank inserts for top or bottom cap To suit 2 or 3 position operators

| White Blank |  |
| :--- | :--- |
| Black Blank |  |
| Green Blank |  |
| Red Blank |  |
| Yellow Blank |  |
| Blue Blank |  |


| Engraved inserts <br> To suit 2 or 3 position operators | Flush plate for <br> top cap | Flush plate for <br> bottom cap | Extended plate for <br> bottom cap |
| :--- | :--- | :--- | :--- |
| Green I | D7-AFCU3CU909 | D7-AFAU3CU909 | - |
| Green II | D7-AFCU3CU230 | D7-AFAU3CU230 | - |
| Green O | - | D7-AFAU3CU910 | - |
| Green Start | D7-AFCU3CU208 | - | - |
| Red Stop | - | - | D7-AEAU4CU910 |
| Red O | - | - | D7-AEAU4CU212 |

[^59]
## D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

- Protection class IP 66
- Individually packaged
- 2 part ordering

D7PMT Plastic twist to release emergency stop operators
D7MMT Metal twist to release emergency stop operators
D7PLMT Plastic twist to release illuminated emergency stop operators
D7MLMT Metal twist to release illuminated emergency stop operators


Dimensions in (mm)


D7P-MT44


D7M-MT64


D7P-LMT44


D7M-LMT64

|  | Non Illuminated | Non Illuminated | Illuminated | Illuminated |
| :--- | :--- | :--- | :--- | :--- |
|  | Plastic | Metal | Plastic | Metal |
| Description | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 30 mm Red operator | D7P-MT34 | D7M-MT34 | N/A | N/A |
| 40 mm Red operator | D7P-MT44 | D7M-MT44 | D7P-LMT44 | D7M-LMT44 |
| 60 mm Red operator | D7P-MT64 | D7M-MT64 | D7P-LMT64 | D7M-LMT64 |

D7PMK Plastic key-release emergency stop operators


Dimensions in (mm) D7MMK Metal key-release emergency stop operators


D7P-MK44


D7M-MK44

40 mm Red operator
D7P-MK44
D7M-MK44


D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

| Description | Screw Cat. No. | Spring Clamp Cat. No. | Metal Screw Cat. No. | Metal <br> Spring Clamp Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| $1 \mathrm{~N} / \mathrm{O}$ contact block | D7PX10 | D7PQ10 | D7MX10 | D7MQ10 |
| $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX01 | D7PQ01 | D7MX01 | D7MQ01 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX11 | D7PQ11 | D7MX11 | D7MQ11 |
| 1 N/O and 1 N/C contact block and incandescent lamp block | D7PD')CX11 | D7PD')CQ11 | D7MD')CX11 | D7MD')CQ11 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block and integrated LED lamp block | D7PN $\left.{ }^{11}{ }^{2}\right) \mathrm{X} 11$ | D7PQ') ${ }^{2}$ )Q11 | D7MN $\left.\left.{ }^{1}\right)^{2}\right) \mathrm{X} 11$ | D7MN $\left.{ }^{\text { }}{ }^{2}\right)$ Q11 |

[^60]D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7P-R /D7M-R Flush frame reset rod operators - Mechanical and/or electrical reset, momentary operation


1
Dimensions in (mm)


D7P-R611


D7MM-R607
Metal ${ }^{1}$ )
Cat. No.
D7M-R611
D7M-R607
D7M-R6

D7-ATR Adjustable threaded reset rod

D7-ATR06

| Rod Length ${ }^{2}$ ) | Rod length adjustability | Cat. No. |
| :--- | :--- | :--- |
| 40 mm | $34 \ldots . .52 \mathrm{~mm}$ | D7-ATR01 |
| 55 mm | $50 \ldots 67 \mathrm{~mm}$ | D7-ATR02 |
| 85 mm | $80 \ldots 98 \mathrm{~mm}$ | D7-ATR04 |
| 115 mm | $110 \ldots . .128 \mathrm{~mm}$ | D7-ATR06 |
| 145 mm | $141 \ldots 195 \mathrm{~mm}$ | D7-ATR08 |
| 315 mm | $157 \ldots 326 \mathrm{~mm}$ | D7-ATR19 $\left.{ }^{3}\right)$ |

Notes: ${ }^{1}$ ) For electrical operation, operator will accept coupling plate and up to four circuit contact blocks or two dual level contact blocks. (Refer to page 28 for contact blocks). ${ }^{2}$ ) If contact blocks are used, they must have a minimum rod length of 55 mm for one level of contact blocks and 85 mm for two levels of contact blocks.
${ }^{3}$ ) Rod is threaded along its entire length. Fully threaded rod can be provided after cutting.

- Protection class IP 66
- Individually packaged
- 2 part ordering


Dimensions in (mm)


D7P-P3


D7M-M4

|  | Plastic | Metal |
| :--- | :--- | :--- |
| Description | Cat. No. | Cat. No. |
| Pilot light with Clear lens | D7P-P7 | D7M-P7 |
| Pilot light with Green lens | D7P-P3 | D7M-P3 |
| Pilot light with Red lens | D7P-P4 | D7M-P4 |
| Pilot light with Yellow lens | D7P-P5 | D7M-P5 |
| Pilot light with Blue lens | D7P-P6 | D7M-P6 |



D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

| Description | Plastic Screw Cat. No. | Plastic <br> Spring Clamp <br> Cat. No. | Metal Screw Cat. No. | Metal <br> Spring Clamp Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| Integrated LED lamp block White | D7PN ${ }^{1}$ ) ${ }^{\text {d }}$ | D7PQ ${ }^{1}$ ) ${ }^{\text {d }}$ | D7MN ${ }^{1}$ ) ${ }^{\text {W }}$ | D7MQ ${ }^{1}$ W |
| Integrated LED lamp block Green | D7PN ${ }^{1}$ )G | D7PQ ${ }^{\prime}$ )G | D7MN ${ }^{1}$ )G | D7MQ ${ }^{1}$ ) |
| Integrated LED lamp block Red | D7PN ${ }^{1}$ ) | D7PQ ${ }^{1}$ R | D7MN ${ }^{1}$ ) | D7MQ ${ }^{1}$ R |
| Integrated LED lamp block Yellow | D7PN ${ }^{1}$ ) ${ }^{\text {( }}$ | D7PQ ${ }^{1}$ ) ${ }^{\text {d }}$ | D7MN ${ }^{1}$ ) Y | D7MQ ${ }^{1}$ ) |
| Integrated LED lamp block Blue | D7PN ${ }^{1}$ ) ${ }^{\text {( }}$ | D7PQ ${ }^{1}$ ) ${ }^{\text {d }}$ | D7MN ${ }^{1}$ )B | D7MQ ${ }^{1}$ ) |
| Ba9s incandescent lamp block <br> - lamp supplied separately ${ }^{2}$ ) | D7PDOC | - | D7MDOC | - |

Notes: ${ }^{1}$ ) Enter voltage $24 \mathrm{~V} \mathrm{AC/DC}=\mathbf{3}, 110 \mathrm{~V}$ AC/DC $=\mathbf{5}, 240 \mathrm{~V} \mathrm{AC/DC} \mathrm{=} \mathbf{7}$
${ }^{2}$ ) Refer page 31 for full lamp selections.

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PSJ Plastic, selector jog operators 2 or 3 position
D7MSJ Metal, selector jog operators 2 or 3 position

- Protection class IP 66
- Individually packaged
- 2 part ordering


D7M-SJ23

1


Dimensions in (mm)

|  | Plastic operator | Metal operator |
| :--- | :--- | :--- |
| Description | Cat. No. | Cat. No. |
| Black 2 position | D7P-SJ22 | D7M-SJ22 |
| Green 2 position | D7P-SJ23 | D7M-SJ23 |
| Black 3 position | D7P-SJ32 | D7M-SJ32 |
| Green 3 position | D7P-SJ33 | D7M-SJ33 |


| Target Table and Operator Position (2-Position) ${ }^{1}$ ) |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Contact <br> Type | Position On <br> Mounting Latch | Selector Left <br> Free | Selector Left <br> Depressed | Selector Right <br> Free | Selector Right <br> Depressed |
| N/O | Left | O | X | O | O |
| N/O | Right | O | O | O | X |
| N/O | Centre | O | X | O | X |
| N/C | Left | X | O | X | X |
| N/C | Right | X | X | X | O |
| N/C | Centre | X | O | X | O |


| Target Table and Operator Position (3-Position) ${ }^{1}$ ) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | $0$ |  | $4$ |  | $\bigcirc$ |  |
| Contact Type | Position On Mounting Latch | Selector Left Free | Selector Left Depressed | Selector Right Free | Selector Right Depressed | Selector Right Free | Selector Right Depressed |
| N/O | Left | 0 | X | 0 | X | 0 | 0 |
| N/O | Right | 0 | 0 | 0 | X | 0 | X |
| N/O | Centre | 0 | X | 0 | X | 0 | X |
| N/C | Left | X | 0 | X | 0 | X | X |
| N/C | Right | X | X | X | 0 | X | 0 |
| N/C | Centre | X | 0 | X | 0 | X | 0 |

Note: ${ }^{1}$ ) $\mathrm{X}=$ Closed $0=$ Open


- Protection class IP 66
- Individually packaged
- 2 part ordering


## 

D7MJM / JR2 Metal, 2 position joystick operator
D7MJM / JR4 Metal, 4 position joystick operator

Description
Metal 2 position Maintained
Metal 2 position Spring Retu

| Cat. No. |  | Cat. No. |
| :--- | :--- | :--- |
| D7M-JM2 | Metal 4 position Maintained | D7M-JM4 |
| D7M-JR2 | Metal 4 position Spring Return | D7M-JR4 |


| Target Table and Operator Position (2-Position) ${ }^{\text {1 }}$ ) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Contact Type | Position on <br> Mounting Latch | Toggle Left | Centre | Ooggle Right |
| N/O | Left | O | O | X |
| N/O | Right | X | O | O |
| N/O | Centre | X | O | X |
| N/O | Left | X | X | O |
| N/O | Right | O | X | X |
| N/O | Centre | O | X | O |

Note: ${ }^{1}$ ) $\mathrm{X}=$ Closed $0=$ Open


D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  |  |  | Metal | Metal <br> Sprew |
| :--- | :--- | :--- | :--- | :--- |
|  | Scamp |  |  |  |
| Description | Cat. No. | Spring Clamp | Screw | Cat. No. |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PS / D7MS Non illuminated short handle 2 position selector switch operators
D7PLS / D7MLS Illuminated short handle 2 position selector switch operators

- Protection class IP 66
- Individually packaged
- 2 part ordering $\mathbf{2}$



Note: ${ }^{1}$ ) Illuminated operators available in a choice of six different knob colours.
Green $=3$, Red $=4$, Yellow $=5$, Blue. $=6$, Clear $=7$
Example D7P-LSM24 = Red Knob

2


D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate
$\left.\begin{array}{lllll} & \text { Screw } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Spring Clamp } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Metal } \\ \text { Screw } \\ \text { Cat. No. }\end{array} \quad \begin{array}{l}\text { Metal } \\ \text { Spring Clamp } \\ \text { Cat. No. }\end{array}\right]$

[^61]- Protection class IP 66


D7PH / D7MH Non-illuminated long lever 2 position selector switch operators

|  |  |
| :--- | :--- |
| Dimensions in (mm) | Non Illuminated <br> Plastic <br> Cat. No. |
| D7P-HM22 Non Illuminated <br> Metal <br> Cat. No. <br> Stayput $60^{\circ}$ D7M-HM22 |  |
| S7P-HN22 | D7M-HN22 |
| Spring return from Left $60^{\circ}$ | D7P-HL22 |



D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  |  |  | Metal | Metal |
| :--- | :--- | :--- | :--- | :--- |
|  | Screw | Spring Clamp | Screw | Spring Clamp <br> Description |
|  | Cat. No. | Cat. No. | Cat. No. | Cat. No. |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PS / D7MS Non-illuminated short lever 3 position selector switch operators
D7PLS / D7MLS Illuminated short lever 3 position selector switch operators

- Protection class IP 66
- Individually packaged
- 2 part ordering

|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| 1 Dimensions in (mm) | D7P-SM32 | D7M-SL32 | D7P-LSM36 | D7M-LSM35 |
| Description | Non Illuminated Plastic Cat. No. | Non Illuminated Metal Cat. No. | Illuminated <br> Plastic <br> Cat. No. | Illuminated <br> Metal <br> Cat. No. |
| Stayput $60^{\circ}$ | D7P-SM32 | D7M-SM32 | D7P-LSM3_ ${ }^{\text {') }}$ | D7M-LSM3 - ${ }^{1}$ ) |
| Spring return from Left $60^{\circ}$ | D7P-SL32 | D7M-SL32 | D7P-LSL3 - ') | D7M-LSL3 - ${ }^{\text {) }}$ |
| Spring return from Right $60^{\circ}$ | D7P-SR32 | D7M-SR32 | D7P-LSR3 - ${ }^{1}$ ) | D7M-LSR3 - ${ }^{\text {) }}$ |
| Spring return from Left and Right $60^{\circ}$ | D7P-SB32 | D7M-SB32 | D7P-LSB3- ${ }^{\text {) }}$ | D7M-LSB3- ${ }^{\text {) }}$ |

Note: ${ }^{1}$ ) Illuminated operators available in a choice of six different knob colours.
Green = 3, Red = 4, Yellow = 5, Blue. =6, Clear = 7
Example D7P-LSM34 = Red Knob


D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

| Description | Screw Cat. No. | Spring Clamp Cat. No. | Metal Screw Cat. No. | Metal <br> Spring Clamp Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| $1 \mathrm{~N} / \mathrm{O}$ contact block | D7PX10 | D7PQ10 | D7MX10 | D7MQ10 |
| $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX01 | D7PQ01 | D7MX01 | D7MQ01 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block | D7PX11 | D7PQ11 | D7MX11 | D7MQ11 |
| $1 \mathrm{~N} / \mathrm{O}$ and $1 \mathrm{~N} / \mathrm{C}$ contact block and incandescent lamp block | D7PD ${ }^{2}$ ) ${ }^{\text {(11 }}$ | D7PD ${ }^{2}$ ) ${ }^{\text {CQ11 }}$ | D7MD ${ }^{2}$ CX11 | D7MD²)CQ11 |
| 1 N/O and 1 N/C contact block and integrated LED lamp block | D7PN $\left.{ }^{2}\right)^{3}$ ) ${ }^{\text {1 }}$ (1 | D7PQ $\left.{ }^{2}\right)^{3}$ )Q11 | D7MN $\left.{ }^{2}\right)^{3}$ ) ${ }^{\text {11 }}$ | D7MQ $\left.{ }^{2}\right)^{3}$ ) ${ }^{\text {(11 }}$ |

[^62]D7PH / D7MH Non illuminated long lever 3 position selector switch operators

- Individually packaged


D7M-HM32
D7P-HM32

## Non Illuminated

|  | Non Illuminated <br> Plastic <br> Cat. No. | Non Illuminated <br> Metal <br> Cat. No. |
| :--- | :--- | :--- |
| Description | D7P-HM32 | D7M-HM32 |
| Stayput $60^{\circ}$ | D7P-HL32 | D7M-HL32 |
| Spring return from Left $60^{\circ}$ | D7P-HR32 | D7M-HR32 |
| Spring return from Right $60^{\circ}$ | D7M-HB32 |  |
| Spring return from Left and Right $60^{\circ}$ | D7P-HB32 |  |



D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  |  |  | Metal | Metal |
| :--- | :--- | :--- | :--- | :--- |
|  | Screw | Spring Clamp | Screw | Spring Clamp |
| Description | Cat. No. | Cat. No. | Cat. No. | Cat. No. |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7PK / D7MK
Key operated 2 position selector switch operators

- Protection class IP 66
- Individually packaged
- 2 part ordering



Dimensions in (mm)

|  |  | Illuminated <br> Plastic <br> Cat. No. | Illuminated <br> Metal <br> Cat. No. |
| :--- | :--- | :--- | :--- |
| Description | Key Removable | D7P-KM21 | D7M-KM21 |



D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  |  |  | Metal | Metal |
| :--- | :--- | :--- | :--- | :--- |
| Description | Screw | Spring Clamp | Screw | Spring Clamp |
| 1 N/O contact block | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 1 N/C contact block | D7PX10 | D7PQ10 | D7MX10 | D7MQ10 |
| 1 N/O and 1 N/C contact block | D7PX01 | D7PQ01 | D7MX01 | D7MQ01 |

- Protection class IP 66
- Individually packaged


1
Dimensions in (mm)

|  |  | Illuminated <br> Plastic <br> Cat. No. | Illuminated <br> Metal <br> Cat. No. |
| :--- | :--- | :--- | :--- |
| Description | Key Removable | D7P-KM31 | D7M-KM31 |
| Stayput $60^{\circ}$ | Key removable Left | D7P-KM33 | D7M-KM33 |
|  | Key removable Both | D7P-KM34 | D7M-KM34 |
|  | Key removable Centre | D7P-KM35 | D7M-KM35 |
| Spring return from Left $60^{\circ}$ | Key removable Left and Centre | D7P-KL34 | D7M-KL22 |
| Spring return from Right $60^{\circ}$ | Key removable Centre | D7P-KR31 | D7M-KR31 |
|  | Key removable Left | D7P-KR34 | D7M-KR34 |
| Spring return from Left and right $60^{\circ}$ | Key removable Left and Centre | D7P-KR35 | D7M-KR35 |

2


D7PX / D7PQ Pre-assembled clip-on rear elements with plastic coupling plate D7MX / D7MQ Pre-assembled clip-on rear elements with metal coupling plate

|  |  |  | Metal | Metal |
| :--- | :--- | :--- | :--- | :--- |
|  | Screw | Spring Clamp | Screw | Spring Clamp |
| Description | Cat. No. | Cat. No. | Cat. No. | Cat. No. |
| 1 N/O contact block | D7PX10 | D7PQ10 | D7MX10 | D7MQ10 |
| 1 N/C contact block | D7PX01 | D7PQ01 | D7MX01 | D7MQ01 |
| 1 N/O and 1 N/C contact block | D7PX11 | D7PQ11 | D7MX11 | D7MQ11 |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Enclosures
Enclosures with 22.5 mm cut-outs

- Individually packaged


Dimensions in (mm)

| No. of Units (Holes) | A | B |
| :---: | :---: | :---: |
| 1 | 85 | 89 |
| 2 | 124 | 79 |
| 3 | 155 | 79 |
| $4 / 5$ | 186 | 79 |
| 6 | 248 | 87 |

## Enclosures

Grey plastic enclosures ${ }^{1}$ )
Degree of protection IP 65 to IEC 529
Water jet protected to SEV 3047
Empty, with $22.5 \mathrm{~mm} \varnothing$ holes and 2 cable entries $21.5 \mathrm{~mm} \varnothing$, top with knock-out, bottom with cable sleeve


Dimensions in (mm)

No. of Cut-Outs

| 1 | D7-1PM | D7-1MM |
| :--- | :--- | :--- |
| 2 | D7-2PM | D7-2MM |
| 3 | D7-3PM | D7-3MM |
| 4 | D7-4PM | - |
| 5 | - | D7-5MM |
| 6 | D7-6MP | - |
| 1 | D7-1YM | $\left.-{ }^{3}\right)$ |

Pendant Enclosures - Yellow Plastic ${ }^{2}$ )
No. of Cut-Outs
Cat. No.
1 Hole in Face
2 Holes in Face
1
D7-P15
D7-P25

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7-ALP / D7-ALM Contact block coupling plates

- Time saving snap-on twist to release operation
- Suitable for 3 contacts in one level
- Available in metal or plastic


| Description | Cat. No. |
| :--- | :--- |
| Plastic coupling plate | D7-ALP |
| Metal coupling plate | D7-ALM |



D7-X / D7-Q Panel mount contact blocks
D7-BX / D7-BQ Base mount contact blocks

- Option of screw or spring clamp termination
- Self-cleaning operation for long life
- Colour coded operators for easy identification
- Small dimensions
- Panel mount can be mounted to metal or plastic coupling plate


Dimensions in (mm)

D7-X01S


D7-X10V


D7-BX01V

| Description | Operator Colour | Panel Mount <br> Cat. No. | Base Mount <br> Cat. No. |
| :--- | :--- | :--- | :--- |
| Normally open contact block | Green | D7-X10 | D7-B10 |
| Normally closed contact block | Red | D7-X01 | D7-B01 |
| Normally open contact block with spring <br> clamp terminals | Green | D7-Q10 | D7-BQ10 |
| Normally closed contact block with <br> spring clamp terminals | Red | D7-Q01 | D7-BQ01 |
| Normally open early make | Green | D7-X10E | D7-BX10E |
| Normally closed late brake | Red | D7-X01L | D7-BX01L |
| Normally open low voltage <br> (Quadfurcated gold contacts | Blue | D7-X10V | D7-BX10V |
| Normally closed low voltage <br> (Quadfurcated gold contacts | Blue | D7-X01V | D7-BX01V |
| Dual circuit 2 normally open | Green | D7-X20D | N/A |
| Dual circuit 2 normally closed | Red | D7-X02D | N/A |
| Autobreak safety contact block for <br> emergency stop operators | Yellow | D7-X01S | N/A |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

D7-DOC / BDOC Incandescent lamp module for panel and base mount applications
D7-N / D7-BN
Integrated LED lamp module for panel and base mount
applications

- Supplied less coupling plate
- Option of screw or spring clamp termination ${ }^{3}$ )
- Self cleaning operation for long life
- Small dimensions
- High illumination qualities


| Description | Colour | Panel Mount Cat. No. | Base Mount Cat. No. |
| :---: | :---: | :---: | :---: |
| Incandescent lamp module (without Ba9s lamp) |  | D7-DOC ${ }^{1}$ ) | - |
| Integrated LED module 24 V AC/DC ${ }^{2}$ ) | Yellow | D7-N3Y | D7-BN3Y |
|  | Green | D7-N3G | D7-BN3G |
|  | Red | D7-N3R | D7-BN3R |
|  | Blue | D7-N3B | D7-BN3B |
|  | White | D7-N3W | D7-BN3W |
| Integrated LED module 120 V AC/DC ${ }^{2}$ ) | Yellow | D7-N5Y | D7-BN5Y |
|  | Green | D7-N5G | D7-BN5G |
|  | Red | D7-N5R | D7-BN5R |
|  | Blue | D7-N5B | D7-BN5B |
|  | White | D7-N5W | D7-BN5W |
| Integrated LED module $240 \mathrm{~V} \mathrm{AC/DC}{ }^{2}$ ) | Yellow | D7-N7Y | D7-BN7Y |
|  | Green | D7-N7G | D7-BN7G |
|  | Red | D7-N7R | D7-BN7R |
|  | Blue | D7-N7B | D7-BN7B |
|  | White | D7-N7W | D7-BN7W |

Spring - clamp termination is available for the integrated LED lamp block upon request.
Substitute $\mathbf{N}$ for $\mathbf{Q}$ in the catalogue number.
Example D7-Q3R

Notes: $\left.\quad{ }^{1}\right)$ Ba9s lamps supplied separately. Refer page 31.
${ }^{2}$ ) For best results LED should match lens colour.
${ }^{3}$ ) Spring clamp terminations only available on integrated LED lamp block.

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Replacement Len's and colour caps pushbutton operators and pilot lights

- Each component supplied separately



|  | To suit | To suit Flush and |
| :--- | :--- | :--- |
| Description | Extended operator | Guarded operator <br> Cat. No. |

Non-illuminated inserts

| White | D7-AE1 | D7-AF1 |
| :--- | :--- | :--- |
| Black | D7-AE2 | D7-AF2 |
| Green | D7-AE3 | D7-AF3 |
| Red | D7-AE4 | D7-AF4 |
| Yellow | D7-AE5 | D7-AF5 |
| Blue | D7-AE6 | D7-AF6 |



Lens caps

| Description | To suit Flush operator Cat. No. | To suit Extended Guarded operator Cat. No. | To suit Pilot Light operato Cat. No. |
| :---: | :---: | :---: | :---: |

Illuminated lens cap and pilot light lenses

| Green | D7-ALF3 | D7-ALE1 | D7-AP3 |
| :--- | :--- | :--- | :--- |
| Red | D7-ALF4 | D7-ALE2 | D7-AP4 |
| Yellow | D7-ALF5 | D7-ALE3 | D7-AP5 |
| Blue | D7-ALF6 | D7-ALE4 | D7-AP6 |
| Clear | D7-ALF7 | D7-ALE5 | D7-AP7 |

Diffuser for illuminated pushbuttons and pilot lights


D7-AD4


|  | To suit | To suit Extended |  |
| :--- | :--- | :--- | :--- |
| Flush operator | Guarded operator <br> Cat. No. | To suit Pilot <br> Light operator <br> Cat. No. |  |
| Description | Cat. No. | D7-AD4 | D7-AD3 |
| Spare lens diffuser | D7-AD2 |  |  |

## Spare lamps

Incandescent lamps for pilot lights
Ba9s style for full voltage lamp block D7-DOC

- Incandescent, multi-cluster LED and neon lamps
- Each component supplied separately


| Voltage | Typical Current | 1.2 Watt Cat. No. | 2 Watt Cat. No. |
| :--- | :--- | :--- | :--- |
| 6 V | 150 mA | BA9S-I3-6V-1.2W | BA9S-I3-6V-2W |
| 12 V | 80 mA | BA9S-I3-12V-1.2W | BA9S-I3-12V-2W |
| 24 V | 70 mA | BA9S-I3-24V-1.2W | BA9S-I3-24V-2W |
| 36 V | 60 mA | BA9S-I3-36V-1.2W | BA9S-I3-36V-2W |
| 48 V | 50 mA | BA9S-I3-48V-1.2W | BA9S-I3-48V-2W |
| 60 V | 22 mA | BA9S-I3-60V-1.2W | BA9S-I3-60V-2W |

## Neon lamps

Ba9s style for full voltage lamp block D7-DOC


| Voltage | Typical Current | Cat. No. |
| :--- | :--- | :--- |
| 110 V...127 V Clear | 22 mA | BA9S-CN3-110V |
| 220 V...240 V Clear | 22 mA | BA9S-CN3-240V |

Multi-Cluster LED lamp Ba9s style
Ultra bright extended life (typical 50,000 + hours) multi-cluster Ba9s style.
Available in White (WL), Red (RL), Green (GL), Yellow (YL), Blue (BL)
eg: Ba9s-WL-8VACDCM


|  |  |  | Ultra Bright Style <br> Coltage |
| :--- | :--- | :--- | :--- |
| $8 \mathrm{~V} \mathrm{AC/DC}$ | 72 mA | Cat. No. ${ }^{1}$ ) | Cal $^{1}$ ) |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

## General accessories

## Description <br> Cat. No.

## Adaptor

Allows a 22.5 mm pushbutton operator to be installed into a panel with existing 30.5 mm mounting hole

|  | Shiny metal IP 66 | D7-AHA1 |
| :--- | :--- | :--- |

Lock nuts

| For fixing front elements | Plastic | D7-ARP |
| :--- | :--- | :--- |
|  | Metal | D7-ARM |
| Mounting ring tool | Plastic | D7-AW2 |

## Lens / lamp removal tool

To remove incandescent lamps or neon
lamps and for fixing the lens

|  | Plastic | D7-ALR1 |
| :--- | :--- | :--- |

## Anti-rotation washer

| Metal | D7-ALC1 |
| :--- | :--- |

## Snap-in contact marker (Blank)

For circuit identification of back of panel components (card 100) V7-SM5X9 (Marking available).

## 85 mm Protective guard yellow

Suit $40+60 \mathrm{~mm}$ illuminated and non-illuminated Emergency Stop

D7-A6PR5

## Emergency stop rings

| - | Blank 60 mm diameter | D7-15Y |
| :--- | :--- | :--- |
| - | Blank 90 mm diameter | D7-16Y |
| Printed "Emergency Stop" | 60 mm diameter | D7-15YE112 |
| Printed "Emergency Stop" | 90 mm diameter | D7-16YE112 |

## Sealing caps

| For flush pushbuttons | IP 66 | D7-AB7 |
| :--- | :--- | :--- |
| For multi-function operators | Flush IP 66 | D7-AB3 |
|  | Pos. A extended IP 66 | D7-AB2 |
|  | Pos. B extended IP 66 | D7-AB1 |

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

## General accessories



| Description |  | Cat. No. |
| :--- | :--- | :--- |
| Replacement Boot for Joystick operator | Silicone | D7-ABJS |

Hole Plug used to plug 22.5 mm holes $\quad$ Black plastic $\quad$ D7-N2


D7-30WN


D7-30WG


D7-AC3

Potentiometer Legend Plate scale 1-10
D7-30WN
Note: Sold in multiples of 10.
Order (quantity of) 10 to receive one packet of 10 pieces

Potentiometer Legend Plate
D7-30WG
Graphical scale
Note: Sold in multiples of 10.
Order (quantity of) 10 to receive one packet
of 10 pieces

|  | Resistance | Cat. No. |
| :--- | :--- | :--- |
| Replacement Resistive Elements | $150 \Omega$ | D7-AC1 |
| for the 800FP Potentiometer operator | $500 \Omega$ | D7-AC2 |
|  | $1000 \Omega$ | D7-AC3 |
|  | $2500 \Omega$ | D7-AC4 |
|  | $5000 \Omega$ | D7-AC5 |
|  | $10000 \Omega$ | D7-AC6 |

Padlocking attachments

## Description <br> Cat. No.

Padlocking attachments for pushbutton operators
Flush standard padlocking attachment ${ }^{1}$ ) D7-AFL1

Extended standard padlocking attachment ${ }^{1}$ )
D7-AEL1

Mushroom padlocking attachments ${ }^{1}$ )
For 40 mm Mushroom operators D7-AML1
For 40 mm Emergency Stop operators D7-AML2

Locking cover
D7-AL01
For use on flush, extended, guarded and latched pushbuttons,
short knob selector switches and potentiometer operators

40 mm protective ring
D7-AMRG
For use on 2 position push-pull operators only

## Selector switch padlocking attachment

| Left lock position | D7-ASL2L |
| :--- | :--- |
| Centre lock position | D7-ASL3C |

Note: ${ }^{1}$ ) When the operator is activated -N/C contacts are held open

- N/O contacts may or may not be held open.
- N/C.L.B. contacts may or may not be held closed.
- N/O.E.M. contacts are held closed.


## General accessories

| Cat. No. |  |
| :--- | :--- | :--- |
| Description | D7-ALP |
| Plastic Coupling Plate |  |
| Note: Sold only in multiples of 10. Order (quantity of) 10 to receive |  |
| one package of 10 pieces. |  |$\quad$| Metal Coupling Plate |
| :--- |
| These are zinc-plate, metal die cast coupling plates. |
| Note: Sold only in multiples of 10. Order (quantity of) 10 to receive |
| one package of 10 pieces. |
| Ground Screws |
| These are self-tapping \#6-32 (M3.5) ground screws for metal |
| coupling plates. |
| Note: Sold only in multiples of 10. Order (quantity of) 10 to receive |
| one package of 10 pieces. |

## Replacement Base Mount Adaptor

This accessory comes standard with all metal enclosures. It is
required when using metal enclosures with base-mounted contact
blocks or base-mounted power modules.

| Description | Ronis Key | Cat. No. |
| :--- | :--- | :--- |
| Replacement Ronis Key <br> Standard replacement key is <br> Cat. No. D7-AKR3825 | 3825 | D7-AKR3825 |
|  | 455 | D7-AKR455 |
| NOTE: These are spare keys <br> supplied in set of two to suit key <br> operated devices with same <br> lock number | 3801 | D7-AKR3801 |
|  | 3802 | D7-AKR3802 |
|  | 3803 | D7-AKR3803 |
|  | 3804 | D7-AKR3804 |
|  | 4006 | D7-AKR3805 |
| 4002 | D7-AKR3806 |  |
| 4003 | D7-AKR4001 |  |
| 4004 | D7-AKR4003 |  |
|  | 4005 | D7-AKR4004 |
| 4006 | D7-AKR4005 |  |
|  |  | D7-AKR4006 |

## Laser-Engraved Caps and Diffusers

Standard Text / Symbols Configurator 1, 2, 3

| D7-A | F |  | 3 |  | E 166 |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Type |  |  | Colour | Suffix No. |
|  | Code |  | Code |  | See pages 37 for laser engraved text/ symbol options. Insert suffix code Exx / Uxx as shown. |
|  | E | Pushbutton extended cap | 1 | White |  |
|  | F | Pushbutton flush cap | 2 | Black |  |
|  | FAU | Multi-function flush cap (for bottom cap) | 3 | Green |  |
|  | EAU | Multi-function extended cap (for bottom cap) | 4 | Red |  |
|  | FCU | Multi-function flush cap (for top cap) | 5 | Yellow |  |
|  | ECU | Multi-function extended cap (for top cap) | 6 | Blue |  |
|  | D | Pilot light diffuser | 3 | Default code for pilot light diffusers |  |
|  | D | Illuminated pushbutton diffuser, flush | 2 | Default code for flush diffusers |  |
|  | D | Illuminated pushbutton diffuser, extended | 4 | Default code for extended diffusers |  |

## Ordering Information for Standard Text / Symbols

1. Select the Cat. No. for the appropriate product type and colour from the Configurator Table on this page.
2. Complete the Cat. No. by adding the appropriate suffix no. selected from pages per letter.
3. List price for non-standard text / symbols, laser engraved caps and diffusers, per letter.

Example: Cat. No. D7-AF3CE166 identifies a pushbutton flush cap, green cap with laser engraved text "ON".


Multi-Function Cap Positions

Customer laser-Engraved Caps and Diffusers Form 2 / 3


Notes: 1. Package quantity of one for all standard laser-engraved caps and diffusers.
2. Standard font is Arial Narrow.
3. Font size is automatically determined by the number of characters. Seven characters maximum allowable.

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Standard Engraved
Pushbutton inserts and diffusers with text

| Description | Cat. No. <br> Flush <br> Non Illuminated | Cat. No. Extended Non Illuminated | Cat. No. <br> Diffuser for Flush Illum. Pushbutton | Cat. No. Diffuser for Extended Illum. Pushbutton | Cat. No. Diffuser for Pilot Light |
| :---: | :---: | :---: | :---: | :---: | :---: |
| START | D7-AF_CE208 | D7-AF_CE208 | D7-AD2CE208 | D7-AD4CE208 | D7-AD3CE208 |
| STOP | D7-AF_CE212 | D7-AF_CE212 | D7-AD2CE212 | D7-AD4CE212 | D7-AD3CE212 |
| ON | D7-AF_CE166 | D7-AF_CE166 | D7-AD2CE166 | D7-AD4CE166 | D7-AD3CE166 |
| OFF | D7-AF_CE163 | D7-AF_CE163 | D7-AD2CE163 | D7-AD4CE163 | D7-AD3CE163 |
| 1 | D7-AF_CU229 | D7-AF_CU229 | D7-AD2CE229 | D7-AD4CE229 | D7-AD3CE229 |
| 0 | D7-AF_CU228 | D7-AF_CU228 | D7-AD2CE228 | D7-AD4CE228 | D7-AD3CE228 |
| RESET | D7-AF_CE186 | D7-AF_CE186 | D7-AD2CE186 | D7-AD4CE186 | D7-AD3CE186 |
| R | D7-AF_CU924 | D7-AF_CU924 | D7-AD2CE924 | D7-AD4CE924 | D7-AD3CE924 |
| UP | D7-AF_CE223 | D7-AF_CE223 | D7-AD2CE223 | D7-AD4CE223 | D7-AD3CE223 |
| DOWN | D7-AF_CE110 | D7-AF_CE110 | D7-AD2CE110 | D7-AD4CE110 | D7-AD3CE110 |
| OPEN | D7-AF_CE110 | D7-AF_CE110 | D7-AD2CE170 | D7-AD4CE170 | D7-AD3CE170 |
| CLOSE | D7-AF_CE107 | D7-AF_CE107 | D7-AD2CE107 | D7-AD4CE107 | D7-AD3CE107 |
| RAISE | D7-AF_CE182 | D7-AF_CE182 | D7-AD2CE182 | D7-AD4CE182 | D7-AD3CE182 |
| LOWER | D7-AF_CE152 | D7-AF_CE152 | D7-AD2CE152 | D7-AD4CE152 | D7-AD3CE152 |
| RIGHT | D7-AF_CE191 | D7-AF_CE191 | D7-AD2CE191 | D7-AD4CE191 | D7-AD3CE191 |
| LEFT | D7-AF_CE145 | D7-AF_CE145 | D7-AD2CE145 | D7-AD4CE145 | D7-AD3CE145 |
| FORWARD | D7-AF_CE120 | D7-AF_CE120 | D7-AD2CE120 | D7-AD4CE120 | D7-AD3CE120 |
| REVERSE | D7-AF_CE188 | D7-AF_CE188 | D7-AD2CE188 | D7-AD4CE188 | D7-AD3CE188 |
| FAST | D7-AF_CE114 | D7-AF_CE114 | D7-AD2CE114 | D7-AD4CE114 | D7-AD3CE114 |
| SLOW | D7-AF_CE210 | D7-AF_CE210 | D7-AD2CE201 | D7-AD4CE201 | D7-AD3CE201 |
| RUN | D7-AF_CE193 | D7-AF_CE193 | D7-AD2CE193 | D7-AD4CE193 | D7-AD3CE193 |
| TEST | D7-AF_CE219 | D7-AF_CE219 | D7-AD2CE219 | D7-AD4CE219 | D7-AD3CE219 |
| AUTO | D7-AF_CE219 | D7-AF_CE219 | D7-AD2CE101 | D7-AD4CE101 | D7-AD3CE101 |

Spare Blank diffusers for pilot lights and illuminated pushbuttons

|  |  | Diffuser for |  |
| :--- | :--- | :--- | :--- |
|  | Diffuser for Flush <br> Illum. Pushbutton | Extended <br> Illum. Pushbutton | Diffuser for <br> Description <br> Cat. No. |
| Cat. No. | Cat. No. |  |  |
| Blank | D7-AD2 | D7-AD4 | D7-AD3 |

[^63]Engraving / Legend plates and colour caps

For standard multi-function operators ${ }^{1}$ )

| Description | Pos. C <br> Green symbol white text Cat. No. | Pos. A <br> Green symbol white text Cat. No. | Pos. A Red symbol white text Cat. No. | Pos. A Red symbol white text Cat. No. |
| :---: | :---: | :---: | :---: | :---: |
| $\rightarrow$ | D7-AFAU3CU700 |  |  |  |
| $\leftarrow$ |  | D7-AFAU3CU700 |  |  |
| + | D7-AFAU3CU730 | D7-AFAU3CU730 |  |  |
| - | D7-AFAU3CU731 | D7-AFAU3CU731 |  |  |
| I | D7-AFAU3CU909 | D7-AFAU3CU909 |  |  |
| II | D7-AFAU3CU602 | D7-AFAU3CU602 |  |  |
| 4 | D7-AFAU3CU712 |  |  |  |
| $\downarrow$ |  | D7-AFAU3CU713 |  |  |
| 0 |  |  | D7-AEAU4CU910 | D7-AEAU4CU910 |
| UP | D7-AFAU3CU223 |  |  |  |
| DOWN |  | D7-AFAU3CU110 |  |  |
| RIGHT | D7-AFAU3CU191 |  |  |  |
| LEFT |  | D7-AFAU3CU145 |  |  |
| FORWARD | D7-AFAU3CU120 |  |  |  |
| REVERSE |  | D7-AFAU3CU188 |  |  |
| START | D7-AFAU3CU208 |  |  |  |
| STOP |  |  | D7-AEAU4CU212 | D7-AEAU4CU212 |

Legend plates with symbol

| Description |  |  |  | Plastic black, inscription white, for legend plate carrier D7-110 $30 \times 40 \mathrm{~mm}^{2}$ ) Cat. No. | Plastic black, inscription white, for legend plate carrier $\begin{aligned} & \text { D7-RO } \\ & 30 \times 50 \mathrm{~mm}^{3} \text { ) } \\ & \text { Cat. No. } \end{aligned}$ | Aluminium, inscription black, for legend plate carrier D7-120 \& D7-200 $30 \times 50 \mathrm{~mm}{ }^{4}$ ) Cat. No. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0 | . | I | D7-17BU231 |  | D7-18BU231 | D7-18AU231 |
| I |  | II | D7-17BU229 |  | D7-18BU229 | D7-18AU229 |
| I | 0 | II |  | D7-17BU234 | D7-18BU234 | D7-18AU234 |
| 0 |  | I |  | D7-17BU255 | D7-18BU255 | D7-18AU255 |
| $\leftarrow$ | 0 | I |  | D7-17BU252 | D7-18BU252 | D7-18AU252 |
| $\leftarrow$ | 0 | $\rightarrow$ |  | D7-17BU253 | D7-18BU253 | D7-18AU253 |
|  | 0 | $\rightarrow$ |  | D7-17BU256 | D7-18BU256 | D7-18AU256 |

Lescription

[^64]
## D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Custom legend plates

D7 Custom Legend Plate ordering Form (for text/symbols not found on other pages)



D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Engraving / legend plates with text

| Description |  | Plastic black, inscription white, for legend plate carrier D7-110 $30 \times 40 \mathrm{~mm}{ }^{1}$ ) | Plastic black, inscription white, for legend plate carrier D7-120 $30 \times 50 \mathrm{~mm}{ }^{2}$ ) | Aluminium, inscription black, for legend plate carrier D7-150 \& D7-200 $30 \times 50 \mathrm{~mm}{ }^{3}$ ) |
| :---: | :---: | :---: | :---: | :---: |
| AUTO |  | D7-17BE101 | D7-18BE101 | - |
| CLOSE |  | D7-17BE107 | D7-18BE107 | - |
| DOWN |  | D7-17BE110 | D7-18BE110 | - |
| EMERGENCY STOP |  | D7-17BE112 | D7-18BE112 | - |
| FAULT |  | D7-17BE113 | D7-18BE113 | - |
| FAST |  | D7-17BE114 | D7-18BE114 | - |
| FORWARD |  | D7-17BE120 | D7-18BE120 | - |
| HAND |  | D7-17BE126 | D7-18BE126 | - |
| HIGH |  | D7-17BE129 | D7-18BE129 | - |
| IN |  | D7-17BE132 | D7-18BE132 | - |
| INCH |  | D7-17BE134 | D7-18BE134 | - |
| JOG |  | D7-17BE138 | D7-18BE138 | - |
| LEFT |  | D7-17BE145 | D7-18BE145 | - |
| LOW |  | D7-17BE148 | D7-18BE148 | - |
| LOWER |  | D7-17BE152 | D7-18BE152 | - |
| OFF |  | D7-17BE163 | D7-18BE163 | - |
| ON |  | D7-17BE166 | D7-18BE166 | - |
| OPEN |  | D7-17BE170 | D7-18BE170 | - |
| OUT |  | D7-17BE173 | D7-18BE173 | - |
| RAISE |  | D7-17BE182 | D7-18BE182 | - |
| REVERSE |  | D7-17BE188 | D7-18BE188 | - |
| RIGHT |  | D7-17BE191 | D7-18BE191 | - |
| SLOW |  | D7-17BE201 | D7-18BE201 | - |
| START |  | D7-17BE208 | D7-18BE208 | - |
| STOP |  | D7-17BE212 | D7-18BE212 | - |
| UP |  | D7-17BE223 | D7-18BE223 | - |
| 0 | AUTO | D7-17BU250 | D7-18BU250 | D7-30AU250 |
| HAND O | AUTO | D7-17BU251 | D7-18BU251 | D7-30AU251 |
| MAN O | AUTO | D7-17BE238 | D7-18BE238 | D7-30AE238 |
| ON OFF | AUTO | D7-17BE300 | D7-18BE300 | D7-30AE300 |
| MAN | AUTO | D7-17BE301 | D7-18BE301 | D7-30AE301 |
| HAND | AUTO | D7-17BE127 | D7-18BE127 | D7-30AE127 |
| FROW. OFF | REV. | D7-17BE261 | D7-18BE261 | D7-30AE261 |
| SET-UP | RUN | D7-17BE302 | D7-18BE302 | D7-30AE302 |
| FROW. | REV. | D7-17BE303 | D7-18BE303 | D7-30AE303 |
| UP | DOWN | D7-17BE224 | D7-18BE224 | D7-30AE224 |
| OFF | ON | D7-17BE165 | D7-18BE165 | D7-30AE165 |
| STOP | START | D7-17BE305 | D7-18BE305 | D7-30AE305 |
| BLANK LEGEND | PLATE | D7-17BE100 | D7-18BE100 | D7-30AE100 |

Notes: $\left.\quad{ }^{1}\right)$ Legend plate size $27 \times 6 \mathrm{~mm}$.
${ }^{2}$ ) Legend plate size $27 \times 16 \mathrm{~mm}$.
${ }^{3}$ ) Legend plate size $26 \times 15 \mathrm{~mm}$

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

Engraving / legend plates with text

| Description |  |  | Plastic black, inscription white, for legend plate carrier D7-110 $30 \times 40 \mathrm{~mm}^{1}$ ) | Plastic black, inscription white, for legend plate carrier D7-120 $30 \times 50 \mathrm{~mm}{ }^{2}$ ) |
| :---: | :---: | :---: | :---: | :---: |
| HIGH |  | LOW | D7-17BE130 | D718BE130 |
| INCH |  | REVERSE | D7-17BE135 | D7-18BE135 |
| JOG |  | FORWARD | D7-17BE255 | D7-18BE255 |
| JOG |  | REVERSE | D7-17BE256 | D7-18BE256 |
| JOG |  | RUN | D7-17BE142 | D7-18BE142 |
| LEFT |  | RIGHT | D7-17BE146 | D7-18BE146 |
| OFF |  | ON | D7-17BE165 | D7-18BE165 |
| OPEN |  | CLOSE | D7-17BE171 | D7-18BE171 |
| RAISE |  | LOWER | D7-17BE183 | D7-18BE183 |
| SLOW |  | FAST | D7-17BE204 | D7-18BE204 |
| UP |  | DOWN | D7-17BE224 | D7-18BE224 |
| FORWARD | STOP | REVERSE | D7-17BE254 | D7-18BE254 |
| HAND | OFF | AUTO | D7-17BE128 | D7-18BE128 |
| JOB | STOP | RUN | D7-17BE144 | D7-18BE144 |
| FORWARD | OFF | REVERSE | D7-17BE261 | D7-18BE261 |
| LOW | OFF | HIGH | D7-17BE150 | D7-18BE150 |
| RAISE | OFF | LOWER | D7-17BE184 | D7-18BE184 |
| SLOW | OFF | FAST | D7-17BE205 | D7-18BE205 |
| SLOW | OFF | START | D7-17BE207 | D7-18BE207 |

Notes: $\quad{ }^{1}$ ) Legend plate size $27 \times 6 \mathrm{~mm}$.
${ }^{2}$ ) Legend plate size $27 \times 16 \mathrm{~mm}$.

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

## Front-of-Panel (Operators) (1)



## Back-of-Panel Components ${ }^{1}$ )



Notes: ${ }^{1}$ ) Performance data given in this publication is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.
${ }^{2}$ ) Momentary mushroom operators are IP 65, multi-function operators have no Type 13 rating. Plastic operators with keys have no Type 4X rating.
${ }^{3}$ ) Operating temperatures below $0{ }^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right)$ are based on the absence of freezing moisture and liquids.
${ }^{4}$ ) Low voltage contacts are recommended for applications below $17 \mathrm{~V}, 5 \mathrm{~mA}$.

Back-of-Panel Components ${ }^{1}$ ), continued

| Illumination |  |  | Plastic (D7P) |
| :---: | :---: | :---: | :---: |
| LED dominant wavelength | Green | (nm) | 525 nm |
|  | Red |  | 629 nm |
|  | Yellow |  | 590 nm |
|  | Blue |  | 470 nm |
|  | White |  |  |
| LED luminous intensity | Green | (mcd) | 890 mcd |
|  | Red |  | 890 mcd |
|  | Yellow |  | 690 mcd |
|  | Blue |  | 193 mcd |
|  | White |  | 412 mcd |
| Incandescent maximum wattage |  | (W) | 1 W |
| Environmental |  |  |  |
| Temperature range (operating) ${ }^{2}$ ) |  | $\left({ }^{\circ} \mathrm{C}\right)$ | $-25 \ldots+70^{\circ} \mathrm{C}\left(-13 \ldots+158{ }^{\circ} \mathrm{F}\right)$ |
| Temperature range (short-term storage) |  | $\left({ }^{\circ} \mathrm{C}\right)$ | $-25 \ldots+85^{\circ} \mathrm{C}\left(-13 \ldots+185^{\circ} \mathrm{F}\right)$ |
| Humidity |  | (\%) | tested at $50 \ldots 95 \%$ relative humidity from $25 \ldots 60^{\circ} \mathrm{C}\left(77 \ldots 140^{\circ} \mathrm{F}\right)$ per: procedure IV of MIL-STD-810C, Method 507.1 cycling test |
| Materials |  |  |  |
| Springs |  |  | Stainless steel and zinc coated music wire |
| Electrical contacts | Standard |  | Silver-nickel |
|  | Low voltage |  | Gold-plated over silver |
| Terminals | Screw |  | Brass |
|  | Screwless |  | Silver-plated copper |

Environmental Approval Note: Front elements UL Recognised; Complete assemblies UL Approved.
See Table A2 (below) for your application.
This table is extracted from Sprecher + Schuh's UL 508A file and can be used to determine which D7 Pilot Device is approved for a particular enclosure type.

|  | TABLE A2 - Openings in Enclosure |
| :---: | :--- |
| Enclosure Type | Openings May Be Closed By Equipment Marked... |
| 2 | $2,3,3 \mathrm{R}, 3 \mathrm{~S}, 4,4 \mathrm{X}, 6,6 \mathrm{P}, 11,12,12 \mathrm{~K}, 13$ |
| 3 | $3,3 \mathrm{R}, 3 \mathrm{~S}, 4,4 \mathrm{X}, 6,6 \mathrm{P}$ |
| 3 R | $3,3 \mathrm{R}, 3 \mathrm{~S}, 4,4 \mathrm{X}, 6,6 \mathrm{P}$ |
| 3 S | $3,3 \mathrm{R}, 3 \mathrm{~S}, 4,4 \mathrm{X}, 6,6 \mathrm{P}$ |
| 4 | $4,4 \mathrm{X}, 6,6 \mathrm{P}$ |
| 4 X | 4 X |
| 6 | $6,6 \mathrm{P}$ |
| 6 P | 6 P |
| 11 | 11 |
| $12,12 \mathrm{~K}$ | $12,12 \mathrm{~K}, 13$ |
| 13 | 13 |

## Product Certification

| Certifications | UL. UR, CSA, CCC, CE |
| :--- | :---: |
| Standards | NEME ICS-5; UL 508, EN 418, EN 60947-1, EN 60947-5-1, EN 60947-5-5 |
| Terminal Identification | IEC 60947-1 |
| Shipping Approvals | RINA, LR, ABS |

Notes: ${ }^{1}$ ) Performance data given in this publication is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements. ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.
${ }^{2}$ ) Operating temperatures below $0^{\circ} \mathrm{C}\left(32^{\circ} \mathrm{F}\right)$ are based on the absence of freezing moisture and liquids.

D7 22.5 mm CONTROL \& SIGNALLING PRODUCTS

## Material Listing

| Component | For Use With | Material Used |
| :---: | :---: | :---: |
| Panel gasket | All operators | Nitrile |
| Diaphragm seal | Illuminated pushbutton, non-illuminated pushbutton | Automotive acceptable silicone |
| K-seal | Selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom | Niltrile |
| Diaphragm retainer, return spring I | Illuminated pushbutton, non-illuminated pushbutton, momentary mushroom, push/twist-to-release E-stop, key E-stop, push/pull mushroom | Stainless steel |
| Return spring II | Reset, selector switch, key selector switch | Zinc coated music wire |
| Button cap/mushroom head | Non-illuminated pushbutton, momentary mushroom, reset, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function | PBT/polycarbonate blend |
| 2-colour moulded button insert | Non-illuminated pushbutton | PBT/polycarbonate blend |
| Lens | Multi-function | Acetal |
| Lens, knob | Illuminated pushbutton, illuminated momentary mushroom, illuminated selector switch | Polyamide |
| Plastic bezel/bushing I | Non-illuminated pushbutton, illuminated pushbutton, momentary mushroom, selector switch, key selector switch, push/twist-to-release E-stop, key E-stop, push/pull mushroom, multi-function | Glass-filled polyamide |
| Plastic bezel/bushing II, jam nut, knob | Reset, non-illuminated selector switch, pilot light | Glass-filled polyamide |
| Metal bezel/bushing | All metal operators | Zinc |
| Diffuser | Illuminated pushbutton, pilot light | Polycarbonate |
| Legend frames | - | Glass-filled nylon |
| Plastic mounting ring | All plastic operators | Glass-filled polyamide |
| Metal mounting ring | All metal operators | Chromated zinc |
| Plastic coupling plate | - | Glass-filled nylon |
| Metal coupling plate | - | Chromated zinc + stainless steel |
| Plastic enclosures | - | PBT/polycarbonate blend |
| Metal enclosure | - | Aluminium |
| Terminal screws | LED module, incandescent module, contact blocks | Zinc-plated steel with chromate |
| Terminals | LED module, incandescent module, contact blocks | Brass with silver-nickel contacts |
| Screwless | LED module, incandescent module, contact blocks | Stainless steel |
| Lamp socket | Incandescent module | Brass |
| Housing | Incandescent module, LED module | Glass-filled nylon |
| Low voltage terminals | Contact blocks | Gold-plated brass with silver-nickel contacts |
| Low voltage spanner | Contact blocks | Gold-plated brass with silver-nickel contacts |
| Spanner | Contact blocks | Brass with silver-nickel contacts |

Dimensions (mm) and panel hole spacing


Non-Illuminated and Illuminated Momentary Flush pushbutton Operators


Illuminated and Non-Illuminated Momentary Extended pushbutton Operators

Illuminated Momentary Guarded pushbutton Operators


Non-Illuminated Guarded, Illuminated and Non-Illuminated Alternate Action pushbutton Operators


## Dimensions (mm)

Reset Operators with Reset Rod


Illuminated and Non-Illuminated 2-Position Multi-Function Operators


Non-Illuminated
3-Position Multi-Function Operators


Pilot Light Operators


Illuminated and Non-Illuminated Knob Selector Switch and Potentiometer Operators


Illuminated and Non-Illuminated Push-Pull Mushroom Operators $30 \mathrm{~mm}, 40 \mathrm{~mm}$ and 60 mm


| Operator | A |
| :---: | :---: |
| 30 mm | 30.0 |
| 40 mm | 40.0 |
| 60 mm | 60.0 |

Active: 30/09/2015

Illuminated and Non-Illuminated Momentary Mushroom Operators 40 mm and 60 mm


Non-Illuminated Knob Lever Selector Switch Operators


Illuminated and Non-Illuminated Twist-to-Release Operators $30 \mathrm{~mm}, 40 \mathrm{~mm}$ and 60 mm


| Operator | A |
| :---: | :---: |
| 30 mm | 30.0 |
| 40 mm | 40.0 |
| 60 mm | 60.0 |

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## Dimensions (mm)

Mushroom Key Release Operator 40 mm


Joystick Operators

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Back-of-Panel Components Incandescent Module with coupling plate


Key Selector Switch and Key Ejected SensEject Operators


Selector Jog Operators


Back-of-Panel Components LED Module with coupling plate


## Dimensions (mm)

Back-of-Panel Components Contact Cartridges with coupling plate


Potentiometer with Resistive Element


Protective Ring


Back-of-Panel Components -
Dual Circuit Contact Block or SMBC Contact Block (Max. of 1 Deep)

$30 \times 40 \mathrm{~mm}$ Snap-In Legend Plate

$30 \times 50 \mathrm{~mm}$ Snap-In Legend Plate


## Dimensions (mm)

Plastic Guard



60 mm Round Legend


Potentiometer Legend Plate

$30 \times 60 \mathrm{~mm}$ Snap-In Legend Plate


90 mm Round legend


Special Multi-Function Snap-In Legend Plate


## Dimensions (mm)

$30 \times 40 \mathrm{~mm}$ One-Piece Legend Plate


30 to 22.5 mm Hole Adaptor


Hole Plug



Maintained Mushroom Locking Attachment


Extended Non-Illuminated locking Attachment


Momentary Mushroom Locking Attachment


Locking Cover



## Dimensions (mm)

Selector Switch Locking Cover (Same for all Lock Positions)


Pendant Stations


Plastic Enclosures


| Cat. No. | No. of Units (Holes) | $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ |
| :---: | :---: | :---: | :---: | :---: |
| D7F-1PM | 1 | 85 | 89 | 58 |
| D7F-2PM | 2 | 124 | 79 | 58 |
| D7F-3PM | 3 | 155 | 79 | 58 |
| D7F-4PM | 4 | 186 | 79 | 58 |
| D7F-6PM | 6 | 248 | 87 | 64 |

Metal Enclosures


| Cat. No. | No. of Units (Holes) | A | B |
| :---: | :---: | :---: | :---: |
| D7F-1MM | 1 | 85 | 89 |
| D7F-2MM | 2 | 124 | 79 |
| D7F-3MM | 3 | 155 | 79 |
| D7F-5MM | 5 | 186 | 79 |

## Product selection made easy

Until now, NHP has been easily recognisable by its logo $\mathbf{N P}$. However, we realise that, as a customer you need to locate the products and information most relevant to you quickly and easily. That's why we're phasing in our new product icons, to help you differentiate the product information you need amongst the clutter that is business today.

You may have already come across these icons, prominent on the front of our literature as new catalogues and flyers become available. These brightly coloured icons in an obvious location mean no longer will you have to worry about searching for product information amongst the mounds of promotional literature. No more flicking through pages of catalogues, wondering where the things you need might be. We've done the searching for you. Just look for the icon that suits your product needs.......your guide to save yourself time $\qquad$ so that you can get back to your business.


When it comes to motor control, our product package is by far the most technically advanced and comprehensive.
This includes the leading Sprecher+Schuh motor starting and protection products, well known for their reliability in service.


NHP offers an extensive range of power quality products to maintain and protect your power distribution network. All our products, from Terasaki circuit protection devices through to our load-break and switch-fuses, offer high levels of security and reliability.


Automation and communication systems are central to your productivity and efficiency. Our range consists of the world's best and proven products, from Hitachi drives to the technically advanced Adroit SCADA system.

Our control and switching range keeps the risk of human error to a minimum with pushbuttons, cam switches, pendant controllers, foot switches, relays and timers.


We are specialists in safety products and our vast range reflects that. From Schmersal safety switches through to Sunx light curtains, our safety and protection products enable you to provide and maintain 'Safety in the Workplace'. Our range also includes sirens, sounders and bells.


Our power quality range helps you to condition your power supply through power factor correction, surge protection and filtering, reducing your power consumption costs and saving you money while also protecting valuable equipment.


The NHP Ex Hazardous area equipment range helps you protect people and property in areas such as petro-chemical and grain handling. Products include Exde control equipment and Ex Lighting products.


If it's there, our sensing and detection products will see it, touch it, or find it. From beam sensors and magnetic reed switches to limit switches, we offer numerous variations of each sensor type.


When you need to know how high or low a level is, how much you have used or how long there is to go, NHP offers a vast series of measuring and display instruments, for panel, base or DIN rail mounting.


Our enclosures and termination products answer all your housing and cabling needs. The range includes insulated, weatherproof and stainless steel enclosures, slotted and solid cable duct and DIN rail mounting terminals.


These products are sold exclusively through electrical wholesaling outlets, and include such items as the BelMate conduit bell tool and the TestPro range of voltage and continuity testers.


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Fax +64 33774405
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## TECHNICAL DATA SHEET

Equipment Type:Switches
Location:
RTU Section
Model Numbers: Various
Manufacturer: Kraus \& Naimer
Supplier:
Kraus \& Naimer
22 Brookes St Bowen Hills QLD ..... 4006(07) 32528344


BLUE LINE switchgear
2013


# FOR COMPLETE PRODUCT RANGE VISIT www.krausnaimer.com.au 



## Kraus \& Naimer

## BLUE LINE switchgear

The development of the Blue Line rotary switch, load break switch disconnector, cont actor and motor starter product ranges is based on
One Hundred years experience by Kraus \& Naimer.
In the Design and manufacture of electrical switchgear,
Kraus and Naimer have pioneered the introduction of the cam operated rotary switch, and continues to be recognised as the world leader in that product field.

## BLUE LINE

Blue Line products are protected by numerous patents throughout the industrial world. They are built to national and international standards and designed to withstand adverse temperatures and climates.

Blue Line products are accepted and universally recognised for their quality and workmanship. They are supported by the world-wide sales and service organisation.

The Kraus \& Naimer Registered Trademark


WORLDWIDE SYMBOL FOR QUALITY SWITCHGEAR

Page
Rotary Cam Switches 10A-2400A
4-12


- Control, Instrument, Motor Switches
- Infinite number of switch programmes
- $\quad$ CA / CG / CH Switches with fingerproof terminals
- CA / CG / CH Switches with captive plus-minus terminal screws
- CAD Switches having self-cleaning "H" Bridge with 'cross wire' contacts
- CHR Switches with captive terminal screws for use with ring terminals
- $\quad$ Special Switches designed to any contact programme

UPS Maintenance Bypass Switches 13
$\begin{array}{ll}\text { Smart Switches (Available from wholesalers) } & \text { 14-15 }\end{array}$
Enclosed KG Main Switches 20A - 315A

- Padlockable maintenance and safety switches
- Enclosed IP 65 protection in Plastic or Stainless Steel
- $\quad 3,4,6$ and 8 pole models available
- Enclosure cable entries top, bottom, sides and rear, or blank

KG Main Switches 20A-315A 16-18

- Padlockable main and emergency switches
- Modular frame sizes
- $\quad 3,4,6$ and 8 pole models available
- Forced positive contact movement
- Cam operated auxilliary contacts

Application Guide AS/NZS 947-3 3F Lockout Isolators 19
Mains off Generator Switches Base Mount and Enclosed 20-21
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Disconnectors For Photovoltaic (PV) Power Systems 26
Fortress - Trapped Key Interlocking Systems 32
$\begin{array}{ll}\text { Operating - Handles } & 33\end{array}$
Push Buttons, Pilot Lights 30-31

- Control and indicating devices
- $\quad 22 \mathrm{~mm}$ IP65 / IP69K
- Fingerproof connections
- Pot drive unit

New Products

27-29

Dimensions 33 -35

Switch Ordering Chart \& Design Sheet
36

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Technical Data

| Rated Operational Current |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Multi cross point contacts |  | 1V | 6 V | 12 V | 24 V | 48 V | 110V | 240 V |
| $\begin{aligned} & \text { CA4/CG4 } \\ & \text { DC21 B } \end{aligned}$ | AC21A |  |  | 10 | $\begin{aligned} & 10 \\ & 6 \end{aligned}$ | $\begin{aligned} & 10 \\ & 0.7 \end{aligned}$ | $\begin{aligned} & 10 \\ & 0.2 \end{aligned}$ | 10 |
| H-Bridge cross wire contacts |  | 1.2 | $\begin{aligned} & 2 \\ & 0.7 \end{aligned}$ | $\begin{aligned} & 1.2 \\ & 0.4 \end{aligned}$ | $\begin{aligned} & 0.7 \\ & 0.25 \end{aligned}$ | $\begin{aligned} & 0.45 \\ & 0.13 \end{aligned}$ | $\begin{aligned} & 0.25 \\ & 0.08 \end{aligned}$ | 0.15 |
| $\begin{aligned} & \text { CGD4-1 } \\ & \text { DC21B } \end{aligned}$ | AC21A 3 |  |  |  |  |  |  |  |
| $\begin{gathered} \text { CAD11 } \\ \text { DC21B } \end{gathered}$ | AC21A | 5 2.5 | 1.5 | 0.8 | $0.3$ | $\begin{aligned} & 0.8 \\ & 0.2 \end{aligned}$ | 0.4 0.1 | 0.2 |
| CAD12 | $\begin{aligned} & \text { AC21A } \\ & \text { DC21B } \end{aligned}$ |  | 5 4 | 5 3 | $2.2$ | $\begin{aligned} & 4 \\ & 1.2 \end{aligned}$ | 3 0.6 | 2 0.3 |
| Special Contact Systems |  |  |  | liple crosspoint contacts, istance. Terminals on the minals on the CG series proof terminals.These are |  |  |  |  |
| CA4/CG4 (@1 $\mu$ gold plating) <br> A high contact reliability is achieved by the use of multiple crosspoint contacts, having a fourpoint contact face to minimise contact resistance. Terminals on the CA series are accessible from both sides, and the terminals on the CG series are accessible from the rear. Both switches have finger proof terminals.These are the smallest cam switch 30 mm sq. |  |  |  |  |  |  |  |  |  |  |  |  |
| CAD11/CAD12 / CGD4-1 <br> H-bridge cross wire contact system. The moving contact is made of spring type material to absorb possible contact bounce. These corrosive resistant contacts are capable of operating on systems voltages as low as 1 volt. CAD11 = Gold contacts. CAD12 $=$ Silver contacts. Both switches have screw driver guides, finger proof terminals and captive plus-minus terminal screws capable of accepting two variant cable sizes. |  |  |  |  |  |  |  |  |
| CICA <br> Switches C/CA have finger proof terminals and captive plus-minus terminal screws. Each stage contains two rigid, double-break silver alloy contacts. The terminals are accessible from both sides. Ranging from $20 \sim 315$ amperes these switches will accept a wide range of "optional extras". |  |  |  |  |  |  |  |  |
| KG/KH Switches: This durable switch line possesses high short circuit withstand capabilities, with positive movement during both making and breaking functions. The $\mathrm{K} \mathbf{G} / \mathrm{KH}$ range of isolators and changeover switches exhibit excellent $\mathrm{AC}-3$ and $\mathrm{AC}-23$ making and breaking capabilities. |  |  |  |  |  |  |  |  |
| This 'Short Form' catalogue illustrates only a small selection of the KRAUS \& NAIMER switches. Other switches available are:- A11, A14, A30, AD11, AD12, CH10 ~ CHR16B, D10 ~ D14R, DH, DHR, DK, DKR, L350 ~ L1251,X63 ~ X630. Additional information available on request. |  |  |  |  |  |  |  |  |
| G20 (S) DC SWITCHING WITH KNIFE CONTACTS |  |  |  |  |  |  | Refe |  |



Rotary Cam Switches - Panel Mounting



## Rotary Cam Switches - Panel Mounting



| Function | Front Plate | Code No. |  | No of Stages | Code No. |  | No. of Stages |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Changeover Switches with Centre "OFF" $60^{\circ}$ Switching |  | 1 Pole |  | 1 | 2 Pole |  |  |
|  | ${ }^{\Phi}{ }^{\text {off }}$ | CG4 A210-620 E <br> CA10 A210-620 E <br> CH10 A210-620 E <br> CA20 A210-620 E <br> CA25 A210-620 E <br> CA40/C26 A210-620 E <br> CA50/C32 A210-620 E <br> CA63/C42 A210-620 E <br> C80 A210-620 E <br> C125 A210-620 E <br> C200-4 A210-620 E <br> C315 A210-620 E |  |  | CG4 | A211-620 E | 2 |
|  |  |  |  | 1 | CA10 A | A211-620 E | 2 |
|  |  |  |  | 1 | CH10 A | A211-620 E | 2 |
|  | -620 |  |  | 1 | CA20 A | A211-620 E | 2 |
|  |  |  |  | 1 | CA25 A | A211-620 E | 2 |
|  |  |  |  | 1 | CA40/C26 | A211-620 E | 2 |
|  |  |  |  | 1 | CA50/C32 | A211-620 E | 2 |
|  |  |  |  | 1 | CA63/C42 | A211-620 E | 2 |
|  |  |  |  | 1 | C80 A | A211-620 E | 2 |
|  |  |  |  | 1 | C125 A | A211-620 E | 2 |
|  | -623 |  |  | 1 | C200-4 | A211-620 E | 2 |
|  |  |  |  | 1 | C315 A | A211-620 E | 2 |
|  |  | 3 Pole |  |  | 4 Pole(1) |  |  |
|  |  | CG4 | A212-620 E | 3 | CG4 | A213-620 E | 4 |
|  |  | CA10 | A212-620 E | 3 | CA10 A | A213-620 E | 4 |
|  |  | CH10 | A212-620 E | 3 | CH10 A | A213-620 E | 4 |
|  |  | CA20 | A212-620 E | 3 | CA20 A | A213-620 E | 4 |
|  |  | CA25 A212-620 E |  | 3 | CA25 A | A213-620 E | 4 |
|  |  | $\begin{aligned} & \text { CA40/C26 A212-620 E } \\ & \text { CA50/C32 A212-620 E } \end{aligned}$ |  | 3 | CA40/C26 | A213-620 E | 4 |
|  |  |  |  | 3 | CA50/C32 | A213-620 E | 4 |
|  |  | CA63/C42 A212-620 E <br> C80 A212-620 E |  | 3 | CA63/C42 | A213-620 E | 4 |
|  |  |  |  | 3 | C80 A | A213-620 E | 4 |
|  |  | C125 A212-620 E <br> C200-4 A212-620 E <br> C315 A212-620 E |  | 3 | C125 A | A213-620 E | 4 |
|  |  |  |  | 3 | C200-4 | A213-620 E | 4 |
|  |  |  |  | 3 | C315 A | A213-620 E | 4 |
|  |  | 6 Pole |  |  | 8 Pole |  |  |
|  |  | CA10 | A362-620 E | 6 | CA10 WA | AA364-620 E | 8 |

Gang Switches - Sequence Switching


## Special Application Switches:-

Ship To Shore Switches, UPS Bypass Switches*, Series Parallel Switches, Special Meters Switches, For further information, contact your nearest KRAUS \& NAIMER stockist.
*(see p13)
(1) If Preclosing 4th Pole Required Change A213 To A663

Rotary Cam Switches - Panel Mounting


(1) If Preclosing 4th Pole Required Change A223 To A673

Rotary Cam Switches - Panel Mounting



Rotary Cam Switches - Panel Mounting

|  |  | Selection Data <br> Rated Thermal Current <br> Rated Category | IEC 60947-3, EN 60947, VDE 0660 |  |  | CG 4 | $\begin{aligned} & \text { CG } 8 \\ & \text { CH } 10 \end{aligned}$ | CA20 | C26 |  | C32 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{I}_{\mathrm{u}}=\mathrm{I}_{\text {th }}$ | A | 10 | 20 | 25 | 32 | 40 | 50 |
|  |  | $3 \times 380 \mathrm{~V} / 440 \mathrm{~V}$ | AC-23A | kW | 3 | 7.5 | 11 | 15 | 18.5 | 22 |
|  |  |  |  |  |  | C 42 | C 80 | C125 | C200-4 | C315 | L400 |
|  |  | Rated Thermal Current |  | $I_{u}=I_{\text {th }}$ | A | $\begin{aligned} & \text { CA } 63 \\ & 63 \end{aligned}$ | 115 | 150 | 200 | 315 | 500 |
| CG4 A240 FS2 | CA10 A280 E |  | Rated Category | $3 \times 380 \mathrm{~V} / 440 \mathrm{~V}$ | AC-23A | kW | 30 | 45 | 75 | 75 | 132 | 132 |


| Function | Front Plate | Code No. | No. of Stages | Code No. | No. of Stages |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 Step Switches cont. <br> 3 Pole |  | 3 Pole <br> CA10 WAA273-600 E <br> CH10 WAA273-600 E <br> CA20 WAA273-600 E | $\begin{aligned} & 9 \\ & 9 \\ & 9 \end{aligned}$ | Refer to catalogue or details on additional | vitches |
| 2 Step Switches with "OFF" $60^{\circ}$ Switching |  | 1 Pole   <br> CG 4 A240-620 E <br> CA10 A240-620 E <br> CH10 A240-620 E <br> CA20 A240-620 E <br>    <br>    | $\begin{aligned} & 1 \\ & 1 \\ & 1 \\ & 1 \\ & \\ & 3 \\ & 3 \\ & 3 \\ & 3 \end{aligned}$ | 2 Pole <br> 4 Pole <br> CG 4 WAA480-620E CA10 WAA480-620E CH10 WAA480-620E CA20 WAA480-620E | $\begin{aligned} & 2 \\ & 2 \\ & 2 \\ & 2 \\ & \\ & 4 \\ & 4 \\ & 4 \\ & 4 \end{aligned}$ |
| 3 Step Switches with "OFF" $45^{\circ}$ Switching <br> 1- and 2 pole <br> 4 Pole Drawing on Request | $\Phi_{1}^{\Phi_{1}} \mathbf{2}^{2}$ | 1 Pole <br> 3 Pole | $\begin{aligned} & 2 \\ & 2 \\ & 2 \\ & 2 \\ & 2 \end{aligned}$ | 2 Pole <br> 4 Pole <br> CG 4 WAA481-620E <br> CA10 WAA481-620E CH10 WAA481-620E CA20 WAA481-620E | $\begin{aligned} & 3 \\ & 3 \\ & 3 \\ & 3 \end{aligned}$ |
| 4 Step Switches with "OFF" $30^{\circ}$ Switching |  | 1 Pole <br> 3 Pole <br> CG 4 WAA282-620E CA10 WAA $282-620 \mathrm{E}$ CH10 WAA $282-620$ E CA20 WAA $282-620 \mathrm{E}$ | $\begin{aligned} & 2 \\ & 2 \\ & 2 \\ & 2 \\ & \\ & \\ & 6 \\ & 6 \\ & 6 \\ & 6 \end{aligned}$ | 2 Pole <br> CG 4 WAA262-620E CA10 WAA262-620E CH10 WAA262-620E CA20 WAA262-620E <br> 4 Pole drawing on request <br> 4 Pole <br> CG 4 WAA482-620E CA10 WAA482-620E CH10 WAA 482-620E CA20 WAA482-620E | 4 4 4 4 <br> 8 8 8 8 |
|  |  | This catalogue lists some of the many common 'Standard Switches' available. For additional selection refer to catalogue 100 or enquire. |  |  |  |

## Rotary Cam Switches - Panel Mounting




Rotary Cam Switches - Panel Mounting

|  | Selection Data | IEC 60947-3, EN 60947, VDE 0660 |  |  | CG 4 | $\begin{aligned} & \text { CG } 8 \\ & 8 \end{aligned}$ | CA20 | C26 |  | C32 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | CA 4 | CA 10 | CA20B | CA25 | CA 40 | CA 50 |
|  | Rated Thermal Current |  | $I_{U}=I_{\text {th }}$ | A | 10 | 20 | 25 | 32 | 40 | 50 |
|  | Rated Category | $3 \times 380 \mathrm{~V} / 440 \mathrm{~V}$ | AC-23A | kW | 3 | 7.5 | 11 | 15 | 18.5 | 22 |
|  |  |  |  |  | $\begin{aligned} & \text { C } 42 \\ & \text { CA } 63 \end{aligned}$ | C 80 | C125 | C200-4 | C315 | L400 |
|  | Rated Thermal Current |  | $I_{U}=I_{\text {th }}$ | A |  | 115 | 150 | 200 | 315 | 500 |
| CA10 AU9Y96-600FT2 | Rated Category | $3 \times 380 \mathrm{~V} / 440 \mathrm{~V}$ | AC-23A | kW | 30 | 45 | 75 | 75 | 132 | 132 |



## UPS - Maintenance Bypass Switches

## Maintenance Bypass Switches

Kraus \& Naimer Maintenance Bypass Switches are an accepted industrial standard wherever emergency power equipment is installed and maintained.
The Maintenance Bypass Switch can be utilized as a simple method of isolating a UPS without interrupting the power source. This allows servicing of the UPS with complete safety to maintenance personnel. A wide range of models has been established, while a broad selection of designer specified options is available on request.

Options Include
Maintenance Bypass Switches are available as - Switch only, Enclosed or Enclosed wired to terminals.

1. Key interlock (V760) with auxiliaries for signal confirmation on locking/unlocking or to shut down the inverter of a UPS prior to switching to the bypass position.
2. Push button interlock with auxiliaries (V400). Switching only possible if push button is depressed, simultaneously closing or opening auxiliaries for signal confirmation to the UPS.
3. A solenoid interlock device (V140) that prevents the operation of the switch except under predetermined electrical conditions.
4. Automatic changeover switches also available.

| Current rating to AC22A - 240v | amps | max. cable size | KVA ratings to AC22A - 240v | KVA |
| :---: | :---: | :---: | :---: | :---: |
| CA10B | 16 | 2.5 mm | CA10B | 3.68 |
| C26 | 32 | 6 mm | C26 | 7.3 |
| C42 | 63 | 16 mm | C42 | 14 |
| Current rating to AC22A - 415V | amps | max. cable size | KVA ratings to AC22A-415v | KVA |
| CA10B | 16 | 2.5 mm | CA10B | 11.5 |
| C26 | 32 | 6 mm | C26 | 23 |
| C42 | 63 | 16 mm | C42 | 45 |
| C80 | 100 | 35 mm | C80 | 72 |
| C125 | 150 | 70 mm | C125 | 107 |
| C200-4 | 200 | M8 95 mm | C200-4 | 143 |
| C315 | 315 | M12 185mm | C315 | 225 |



Enclosed \& Wired to Terminals

## Be smart look for them NOW, at your nearest Wholesaler.

Get smart with Smart Switch

## The complete switch solutionFirst time everytime.



## SMART SWITCH STOCK LIST

| Product | Description | Barcode | Trade Price |
| :---: | :---: | :---: | :---: |
| KN11 | Smart Body - On Off 1 Pole | 9004257083664 |  |
| KN12 | Smart Body - On Off 2 Pole | 9004257083671 |  |
| KN13 | Smart Body - On Off 3 Pole | 9004257083688 |  |
| KN14 | Smart Key - For KN11, KN12,KN13 | 9004257083572 |  |
| KN15 | Smart Padlock Yellow - For KN11, KN12,KN13 | 9004257083596 |  |
| KN25 | Smart Padlock Black - For KN11. KN12,KN13 | 9004257091942 |  |
| KN27 | Smart Main Switch - 32A 3 Pole | 9004257092680 |  |
| KN16 | Smart Body - Auto Off Man 1 Pole | 9004257083626 |  |
| KN17 | Smart Body - Auto Off Man 3 Pole | 9004257083633 |  |
| KN18 | Smart Key - For KN16, KN17 | 9004257083589 | FOR PRICN NEARES |
| KN19 | Smart Body - C/O w/out Off 1 Pole | 9004257083640 | FOR YOUR |
| KN20 | Smart Body - C/O w/out Off 3 Pole | 9004257083657 | REFER |
| KN21 | Smart Key - For KN19, KN20 | 9004257083701 |  |
| KN26 | Smart Reverser - 1 \& 3 Phase | 9004257091959 |  |
| KN31 | Smart Contactor - 20A AC1, 4kW AC3 | 9004257092703 |  |
| KN22 | Smart Handle - Bezel Only | 9004257083602 |  |
| KN23 | Smart Handle - With Frame \& Plate | 9004257083619 |  |
| KN24 | Smart Box - IP65 Enclosure | 9004257091966 |  |
| KN28 | Smart Header Plate - For KN22 | 9004257092710 |  |
| KN29 | Smart Header Plate - For KN23 | 9004257092727 |  |
| KN30 | Smart DIN Mount | 9004257092697 |  |

Smart Switch
Match the label colours (blue to blue, yellow to yellow) to ensure the switch body and handle, key or padlock device are compatible.



## IEC 60947-3

## SWITCHES - DISCONNECTORS - SWITCH DISCONNECTORS

IEC 60947 is a safety and performance standard for low voltage switchgear (up to 1000V) which has universally replaced IEC 408 and combined specific requirements of many individual national standards. IEC 60947 is a uniform standard for most countries around the world and establishes a truly global marketplace. IEC 60947-3 is a section of the standard specific to switches. Importantly, it recognises that devices for the switching function and isolating function require very different performance criteria. Switching requires high performance of current carrying parts to make and break loads under normal and overload conditions, ie., motor reversing applications. Isolation requires high insulation, sufficient spacing of current carrying parts and mechanical integrity that the handle corresponds to actual contact position for the safety of maintenance personnel.

Practicality of real life applications calls for three definitions within IEC 60947-3; Switches, Disconnectors and Switch Disconnectors. A switch does not have to satisfy the isolation and mechanical strength tests, and a disconnector likewise the load tests. A Switch Disconnector must satisfy all tests and is suitable for safety switch applications. A switch disconnector must have a direct drive late make early break auxillary contact in series with a load breaking device to be suitable as a safety switch.

Kraus \& Naimer have developed complete products which satisfy all IEC 60947 criteria, some of which are listed overleaf. For further information, please contact our offices.

KG Main Switches - Padlockable Panel Mount, Enclosed Plastic or Stainless Steel


(1) 4 Pole changeover enclosed. Refer page 20.

For Panel and Base mount 4 Pole changeover Refer to page 20.
(2) Suitable for no load switching (AC-20A) above 690v.

KG Main Switches - Base Mounted Padlockable with Extension Shafts


(1) Suitable for no load switching (AC-20A) above 690v.

## Application Guide AS/NZS 947-3 3F Lockout Isolators

Get a Handle on Safety with your Eyes Closed

## Product Features

## M700 Door Interlock

- Padlockable in 'OFF' only - safety requirement according to AS/NZS 947-3
- In 'ON' the door interlock is engaged - the cabinet cannot be opened
- In 'ON' the door interlock can be defeated by using a tool - authorised entry only
- The door interlock re-engages when the door is closed after authorised defeat in 'ON'
- In 'OFF' and padlocked, the door interlock defeat is disabled - no access
- When the door is opened the handle position is locked - assured alignment
- Mechanical Position Indicator on the switch module - visible when the door is open
- Internal Padlock Device on switch module
- Robust, keyed, floating head on switch shaft


## KG Switch Disconnectors

-13/14mm contact gap. 690v-1000v insulation

- High AC3 and AC23 ratings
- Large, finger proof IP20 box type terminals
- Double break forced opening safety rated auxiliary contacts. Silver or Gold 1 to 6 N/O - N/C
- Positive drive make and break main contacts. 3 to 8 poles OFF ON, 3 or 4 pole C/O
- IEC 947-3 3F disconnector handle. Isolation is assured 'OFF' is 'OFF'


## General Features

- Custom colours and engraving for escutcheon plates and header labels
- Scratch-proof reverse engraving
- IP65 dust and water protection
- Robust, double insulated handle
- Asymmetric shaft and interlock profiles ensure the handle position matches the switch position
- Fixed length shaft ensures shaft must engage with the handle


## Telephone now for a demonstration

## IEC 947-1

## Equipment Suitable For Isolation - The Following Clauses Apply

Clause 7.1.6 Additional constructional requirements for equipment suitable for isolation
Clause 7.1.6.1 Additional constructional requirements
Equipment suitable for isolation shall provide, in the open position (see 2.4.21) an isolation distance in accordance with the requirements necessary to satisfy the isolation function (see 7.2.3.1 and 7.2.2) (dielectric test)
Indication of the position of the mains contacts shall be provided by one or more of the following means:
(1) The position of the actuator
(2) A separate mechanical indicator
(3) Visibility of the moving contacts

The effectiveness of each of the means of indication provided on the equipment and its mechanical strength shall be verified in accordance with clause 8.2.5
Clause 8.2.5 Verification of the effectiveness of indication of the main contact position of equipment suitable for isolation To verify the effectiveness of the indication of the main contact position, all means of indication of contact position shall continue to function correctly after the operational performance type tests, and special durability type tests (if performed).

## Switch Classifications

All low voltage switches installed in Australia and New Zealand shall meet AS/NZS 60947 and carry the appropriate easily identifiable symbol depending on the switch classification.

## Switch

$\qquad$
A mechanical switching device capable of making and breaking currents under normal conditions, which may include specified overload conditions according to the duty, and abnormal circuit conditions such as short-circuit. (motor reversing switches, control switches, start delta switches, etc)
Disconnector $\qquad$
A mechanical switching device which in the open position, complies with the requirements specified for the isolating function (Off load isolator)
Switch Disconnector $\qquad$
A 'Switch' which in the open position, complies with the requirements specified for the isolating function (On load isolator)

Changeover Switches Base Mount \& Enclosed


For Further Information Regarding The Range of Enclosed Isolators
Refer to the Kraus \& Naimer "Enclosed Switch Catalogue" on www.krausnaimer.com.au

Changeover Switches Base Mount \& Enclosed


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Optional Extras


Optional Extras


## Special Drive Options \& Enclosures

| Special Drives | Description | Optional Code No. | $\begin{array}{r} \text { CG } 4 \\ \text { - CA } 4 \end{array}$ | $\begin{array}{r} \text { CA10 } \\ -\mathrm{CA} 25 \end{array}$ | $\begin{array}{r} \text { CA10B } \\ -\mathrm{C} 42 \end{array}$ | $\begin{array}{r} \text { C } 43 \\ -\mathrm{C} 125 \end{array}$ | $\begin{array}{r} \text { C315 } \\ -\mathrm{L} 2000 \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Heavy Duty Drive <br> Create your own handle/drive unit and weld it onto the removable plate. Long rods, T-bars, etc. <br> E Panel Mount, PK Plastic Encl. <br> GK Aluminum Enclosure | G800/A | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Limit Switch <br> Heavy duty roller \& actuator for spring return or stepping applications. <br> E Panel Mount <br> PK Plastic Enclosure <br> GK Aluminum Enclosure <br> Also Available in 6CL 56 Plastic Enclosure. | G800/B | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Rope Operator <br> Heavy duty for GK / PK or 6CL 56 series enclosures. <br> Drive Only <br> Also Available in 6CL 56 Plastic Enclosure | G900/B | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Aluminium Enclosures for Drives <br> Switch length 4 stages. <br> Various sizes available on request. | GK | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Plastic Enclosures for Drives Switch length 4 stages. <br> Various sizes available on request. | PK | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | HAZARDOUS AREAS <br> Dust Ignition Proof <br> Flame Proof | $\begin{aligned} & \text { DIP } \\ & \text { Ex d } \end{aligned}$ | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Stainless Steel Enclosures Marine Grade 316 $\begin{aligned} & 208 \mathrm{H} \times 113 \mathrm{~W} \times 96 \mathrm{D} \\ & 240 \mathrm{H} \times 140 \mathrm{~W} \times 120 \mathrm{D} \\ & 350 \mathrm{H} \times 230 \mathrm{~W} \times 170 \mathrm{D} \\ & 500 \mathrm{H} \times 320 \mathrm{~W} \times 175 \mathrm{D} \\ & 710 \mathrm{H} \times 320 \mathrm{~W} \times 175 \mathrm{D} \text { c/W rain hood } \end{aligned}$ | $6 S$ | Options:- <br> Rain Hood. <br> Hinge Door. <br> Variations on request:- <br> Stop / Start Pushbuton. <br> Control \& Changeover Switches. <br> Selection of auxiallary contacts. |  |  |  |  |

## Standard Enclosures

## Enclosure Information

The following options can be included by substituting suffix code "E" for the optional code number.. PF, KS, KL, 6CL...

Note: KG enclosed isolators listed complete on page 17

Example: 3pole 20Amp Off/On Switch
Enclosed with Padlockabe handle

CA 10 A292-621 PF
V840G

| Enclosures | Description | Code No. | $\begin{array}{r} \text { CG } 4 \\ - \text { CA } 4 \end{array}$ | $\begin{array}{r} \text { CA10 } \\ - \text { CA20 } \end{array}$ | $\begin{gathered} \text { CA10B } \\ -\mathrm{C} 42 \end{gathered}$ | $\begin{array}{r} \text { C } 43 \\ - \text { C125 } \end{array}$ | $\begin{array}{r} \text { C315 } \\ -\mathrm{L} 2000 \end{array}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | CG 4 \& CA 4 Switches <br> Material - Very high UV resistance <br> - High chemical resistance <br> Dimensions mm <br> 1 stage $-90 \mathrm{~L} \times 70 \mathrm{~W} \times 60 \mathrm{H}$ <br> 2 stage $-90 \mathrm{~L} \times 70 \mathrm{~W} \times 72.5 \mathrm{H}$ | $\begin{aligned} & \text { KS } \\ & \text { KS } \end{aligned}$ | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Standard without Cover Interlock <br> Very high UV resistance Excellent chemical resistance | PF | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Industrial Enclosure IP66 <br> Dimensions mm <br> $-101 \mathrm{~L} \times 101 \mathrm{~W} \times 91 \mathrm{H} / 98$ series <br> $-198 \mathrm{~L} \times 101 \mathrm{~W} \times 91 \mathrm{H} / 195$ series <br> Chemical resistant orange available on request. (Nominate entries prefered). | 6 CL 56/98 <br> 6 CL 56/98-4 <br> 6 CL 56/195 | Flip Lid PRICES AVAILABLE ON REQUEST |  |  |  |  |
| 6 FE enclosure | General Purpose ABS Enclosures Excellent Chemical resistance IP67. <br> 6FE B85AG $-110 \mathrm{H} \times 80 \mathrm{~W} \times 85 \mathrm{D}$ <br> 6FE C65AG - $140 \mathrm{H} \times 80 \mathrm{~W} \times 65 \mathrm{D}$ <br> 6FE C85AG $-140 \mathrm{H} \times 80 \mathrm{~W} \times 85 \mathrm{D}$ <br> 6FE D85AG $-170 \mathrm{H} \times 60 \mathrm{~W} \times 85 \mathrm{D}$ <br> 6FE M95AG $-230 \mathrm{H} \times 140 \mathrm{~W} \times 95 \mathrm{D}$ | 6FE B85AG <br> 6FE C65AG <br> 6FE C85AG <br> 6FE D85AG <br> 6FE M95AG | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Polycarbonate Enclosures IP67 <br> 6 FEC $-190 \mathrm{H} \times 190 \mathrm{~W} \times 130 \mathrm{D}$ <br> 6 FEC $-190 \mathrm{H} \times 190 \mathrm{~W} \times 180 \mathrm{D}$ <br> 6 FEC $-280 \mathrm{H} \times 190 \mathrm{~W} \times 130 \mathrm{D}$ <br> 6 FEC $-280 \mathrm{H} \times 190 \mathrm{~W} \times 180 \mathrm{D}$ <br> 6 FEC $-280 \mathrm{H} \times 280 \mathrm{~W} \times 130 \mathrm{D}$ <br> 6 FEC $-380 \mathrm{H} \times 280 \mathrm{~W} \times 130 \mathrm{D}$ <br> 6 FEC $-380 \mathrm{H} \times 280 \mathrm{~W} \times 180 \mathrm{D}$ <br> 6 FEC $-560 \mathrm{H} \times 380 \mathrm{~W} \times 180 \mathrm{D}$ <br> 6 FEC $-560 \mathrm{H} \times 380 \mathrm{~W} \times 230 \mathrm{D}$ |  | PRICES AVAILABLE ON REQUEST |  |  |  |  |
|  | Metal Enclosures IP67 <br> Switches mounted to gear tray with door interlock. <br> 6AE $1033 / 300 \times 300 \times 210$ <br> 6AE $1385 / 380 \times 380 \times 250$ <br> 6AE $1338 / 600 \times 380 \times 350$ <br> Additional metal enclosures available | 6AE 1033 <br> 6AE 1385 <br> 6AE 1338 | PRICES AVAILABLE ON REQUEST |  |  |  |  |

SP464 James St Lowood SPS - Electrical Installation OM Manual

DC Disconnectors for Solar Photovoltaic (PV) Power Supply System
acc. to IEC 60364-7-712:2002
Disconnectors for


Contact development: 2 pole, 6 contacts per circuit ( $2 \times 3$ in series)


## G20 (S) - DC Switch With Knife Contacts

Kraus and Naimer have developed and designed a new DC Switch; the G20(S)
The 'Knife contacts' have been designed in a new way resulting in a switching capacity of 20 Amps at 690V DC (DC-22A) and high short circuit withstand capability.
Finger-proof terminals according to EN 50274 and protection degree IP20 offer maximum safety. With a standard latching mechanism, the G20 complies with all regulations required for main switches according to IEC/EN 60204.
In addition the G20 is also ideal for AC applications with high short circuit fault levels, as well as electronic circuitry with low current and voltages.

- Self-cleaning and vibration resistant knife contacts
- Compact design
- High DC switching capacity
- Highest contact reliability (better than any H-bridge contact system)
- High short circuit withstand capability
- Finger-proof terminals (IP20) even if jumper leads are used
- Terminal extensions (accessory item) for ring type cable lugs (max. width 6 mm ) and quick connect lugs available
- Heat resistant contact system according to standard EN 12101-3

G20 - with normal latching (in preparation)
G20S - with snap action latching

| Utilisation <br> Category | No. of Series Contacts G20S <br> Total Voltage in Volts |  |  |  |  | Rated Operational Current le/A |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
|  | 1 | 2 | 3 | 4 | 5 | 6 |  |
|  | 250 | 500 | 750 | 1000 | - | - | 20 |
|  | 440 | 880 | - | - | - | - | 13 |
| DC-22A | 250 | 500 | 750 | 1000 | - | - | 20 |
|  | 330 | 660 | 990 | - | - | - | 10 |
|  | 440 | 880 | - | - | - | - | 5 |
|  | 48 | 96 | 144 | 192 | 240 | 144 | 20 |
|  | 60 | 120 | 180 | 240 | 300 | 288 | 15 |
|  | 110 | 220 | 330 | 440 | 550 | 360 | 12 |
|  | 160 | 320 | 480 | 640 | - | - | 8 |
|  | 250 | 500 | 750 | 1000 | - | - | 5 |
|  | 330 | 660 | 990 | - | - | - | 3 |
|  | 440 | 880 | - | - | - | - | 1 |

## KF Switch Range 1 Pole per module (16-32A)

The innovative modular system is both simple and very safe while offering enormous flexibility.
The position of the various modules in relation to each other can be defined by the user.
Than assembled in the factory

Rotating contact movement (instead of the classical vertical lifting) allows

- Big contact gaps
- High mechanical life expectancy
- Very precise movement sequence
- Self cleaning contacts
- Forced opening and closing of contacts
- Compact (very shallow design)
- Up to 1000V insulation voltage according to IEC possible
- Lateral drive possible (latching module not in the centre but on left or right hand side)
- Coupling profile determines pre-closing function of switched 4th pole
- Visible contacts (windows) available on request
- Design allows a big variation of terminal markings


## Telephone now for a demonstration

## Kraus \& Naimer

```
BLUE LINE switchgear
```

Maintenance Switches for EMC-compliant connectión,


DOWNLOAD NOW FROM www.krausnaimer.com.au

# Kraus \& Naimer tat 

BLUE LINE switchgear


3 \& 4 POLE CONTACTORS $4 \mathrm{~kW}-160 \mathrm{~kW}$ DC CONTACTORS

MOTOR STARTERS—DOL, STAR -DELTA \& REVERSING
MODULAR CONTACTORS
EXTRAS INCLUDE-THERMAL OVERLOADS,CLIP ON AUX (TOP AND SIDE MOUNT), MECHANICAL INTERLOCKS, COIL SUPPRESSOR, MECHANICAL LATCH

AC \& DC COILS - SPECIAL COIL VOLTAGES AVAILABLE ON REQUEST


Control \& Signalling Units 22mm - Assembled Units


For further information refer to Catalogue 302
*NOTE ALSO AVAILABLE AS RESET BY PULLING OR
KEY OPERATION
Palm Push Buttons AC-15 230v 6A, IP66


## Potentionmeter Units Heavy Duty \& Standard 22mm Mounting

| Heavy Duty With K\&N Switch Front IP65 <br> Reienforced Stop. Optional Keyed or Stepping <br> 48mm Square Front Engraved With Swoop |  |  |  |  |  |
| :--- | :--- | :---: | :---: | :---: | :---: |
| 1 k | CA10NZQ172*02FT2 |  |  |  |  |
| 2.2 | CA10NZU606*01FT2 |  |  |  |  |
| 4.7 k | CA10NZU607*01FT2 |  |  |  |  |
| 10k | CA10NZV049*02FT2 |  |  |  |  |
| 64 mm Square Front Engraved With Swoop |  |  |  |  |  |
| 1k | CA10NZQ172*02FH3 |  |  |  |  |
| 2.2 k | CA10NZU606**1FH3 |  |  |  |  |
| 4.7 k | CA10NZQ607*01FH3 |  |  |  |  |
| 10 k | CA10NZQ049*02FH3 |  |  |  |  |


| Standard IP66 3 Screw Terminals |  |  |
| :--- | :--- | :--- |
| P max $=0.5$ watt |  |  |
| 1.0k Ohm | PSN/R1k |  |
| 4.7k Ohm | PSN/R4K7 |  |
| 10k Ohm | PSN/R10K |  |

## Heavy Duty Pot Units.

Developed by Kraus \& Naimer for use in industrial applications.
The $270^{\circ}$ single turn pot drive features a HEAVY DUTY drive, large operator handle and sealing to IP65. With easy mount 22 mm single hole mounting the drive has smooth stepless operation and comes complete with a header label. Options include keys and additional contacts

## Control \& Signalling Units 22mm - Loose Components



Double Push Buttons AC-15 230v 6A, IP66 Colour Cap Opaque


Pilot Lights IP67/69K


Castell \& Fortress Trapped Key Interlocking Systems

| Products | Applications |
| :---: | :---: |
| Panel Door Interlock Multiple Panel Door Interlock | As part of an interlock system, the locks are used to control access to areas, e.g. switchgear panels or machines where hazards may be present, until a safe condition has been achieved. |
| Key Operated Rotary Switches | As part of an interlock system, the switch units are used for the direct control or isolation of control or power circuits controlling the plant or machinery. |
| Solenoid Controlled Interlock Unit | As above with a solenoid facility to integrate with other electronic control processes within the system. |
| Key Operated Rotary Switch for Use in Hazardous Areas | A key operated rotary switch for use as part of an interlocked system, in areas where explosive/flammable gases or dust particles may be present. BASEEFA certified (EExdIIC T6 Zones 1 \& 2.) |
| H31 Basic Interlock and Keys | This form of basic interlock is normally used in the mechanical interlocking of electrical switchgear. Used in conjunction with other interlocking systems. |
| Door Interlock | Specifically designed for sliding doors. |
| Interlock Deadlock | Single or multi-keyed deadlocks, with either claw bolt or limit switch. |
| Mechanical Key Exchange Boxes | A range of mechanical key exchange units into which any sequence of trapped and freed keys can be incorporated. |
| Electronic Time Delay Rotation Sensing Unit Temperature Sensing | As part of an interlock system, the locks are used to control access to areas, e.g. switchgear panels or machines where hazards may be present, until a safe condition has been achieved. |
| Other Products | Fortress Amgard Modular Safety Systems. <br> Castell Products. <br> Smith Ellis - Valve Interlocks. <br> HF Securite Products. <br> Load banks |

Handles

| Type | Colour | Code | Size | Type | Colour | Code | Size |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |



## Dimensions mm

## Rotary Cam Switches - Panel Mounting



## E Panel Mounting

## Size 0 - Size 3

|  | CG4 | $\begin{aligned} & \text { CAD‘s } \\ & \text { CA10 } \end{aligned}$ | CA20 | CA25 | $\begin{aligned} & \text { CA63 } \\ & \text { CA50 } \\ & \text { CA40 } \\ & \text { C26 } \end{aligned}$ | C32 | C42 | C80 | C200-4 C125 | C315 L400 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A | 30 | 48 | 48 | 48 | 64 | 64 | 64 | 88 | 88 | 130 |
| B | 28 | 43 | 45 | 46 | 45/58 | 60 | 66 | 84 | 88 | 126 |
| C | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 5,5 | 5,5 | 7 |
| D1 | 3,2 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 6 | 7 |
| D2 | 8 | 8 | 8 | 10 | 10 | 10 | 10 | 13 | 13 | 16 |
| E | - | 36 | 36 | 36 | 48 | 48 | 48 | 68 | 68 | 104 |
| M | - | 4,5 | 4,5 | 5,5 | 6,5 | 7.5 | 7.5 | 9,4 | 9,4 | 11,9 |

## Length L



Dimensions mm
KG Main Switches
Panel Mounting

KG10A
KG20A, KG32A
KG20B, KG32B
KG41B, KG64B
KG80, KG100, KG105
KG126, KG161
KG251, KG316

| A | B | C | D1 | D2 | F | G | H | L | M1 | M2 | M3 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 48 | 36 | 4 | 11 | 5 | 48 | 48 | 50 | 48.2 |  |  |  |
| 48 | 36 | 4 | 10 | 5 | 48 | 42 | 54 | 53.8 |  |  |  |
| 64 | 48 | 4 | 10 | 5 | 64 | 42 | 54 | 53.8 | 13.5 | 9 | 2 |
| 64 | 48 | 4 | 10 | 5 | 64 | 50 | 64 | 60.5 | 16 | 12.5 | 16 |
| 64 | 48 | 4 | 10 | 5 | 70 | 70 | 80 | 70.6 | 22 | 10 | 25 |
| 88 | 68 | 5.5 | 13 | 6 | - | 112 | 108 | 96 | 38 | 21 | 22 |
| 88 | 68 | 5.5 | 13 | 6 | - | 145 | 126 | 103 | 52.5 | 21 | $24.5 \times 2$ |

M1 = Extra Length 4th Pole / Neutral Contact / Earth Block M2 = Extra Length Top Mounted Auxilliary Contacts

Base Mounted
3 and 4 Pole


Note : 6 Pole Width $=3$ Pole Width $\times 2$


## KG10

KG20A, KG32A
KG20B, KG32B
KG41B, KG64B
KG41B, KG64B
KG80, KG100, K
KG126, KG161
KG126, KG161

| $\mathbf{A}$ | $\mathbf{B}$ | $\mathbf{C}$ | D1 | D2 | $\mathbf{G}$ | $\mathbf{H}$ | $\mathbf{L}$ | $\mathbf{M 1}$ | M2 | M3 |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 48 | 36 | 12 | 8 | 5 | 48 | 50 | 49.2 |  |  |  |
| 48 | 36 | 12 | 8 | 5 | 42 | 54 | 50 |  |  |  |
| 64 | 48 | 13.5 | 10 | 5 | 42 | 54 | 50 | 13.5 | - | 20 |
| 64 | 48 | 13.5 | 10 | 5 | 50 | 64 | 61 | 16 | 10 | 16 |
| 64 | 48 | 13.5 | 10 | 5 | 70 | 80 | 68 | 22 | 10 | 25 |
| 88 | 68 | 16 | 13 | 6 | 112 | 108 | 91 | 38 | 0 | 22 |
| 88 | 68 | 16 | 13 | 6 | 145 | 126 | 98 | 52.5 | 0 | $24.5 \times 2$ |

M1 = Extra Length 4th Pole / Neutral Contact / Earth Block
M2 = Extra Length Top Mounted Auxilliary Contacts
M3 = Extra Length Terminal Cover

Padlock Device V840G
36 mm sq. Fixation
KG10, KG20, KG32


Door Interlock M280E 48mm sq.
36 mm sq. Fixation
KG10, KG20, KG32

Padlock Device V840G
48 mm sq. Fixation
KG10B, KG20B, KG32B, KG41B, KG64B, KG80, KG100, KG105


Door Interlock M280E 64mm sq.
48mm sq. Fixation
KG10, KG20, KG32, KG41, KG64, KG80, KG100, KG105

Padlock Device V845
68 mm sq. Fixation
KG126, KG161, KG251, KG316


88


Door Interlock M280E 88mm sq.
68mm sq. Fixation
KG126, KG161, KG251, KG316


Single Hole Mounting FS1/FS2
(Size 00)

To accomodate
16.2 in 22.3 Hole S00 T160-01


## SWITCH ORDERING CHART

## Mounting Requirements

E Panel Mount. (5 hole mount)VE Base mount suitable for door clutch etc.

E-V Panel Mount.(vertical access to terminals

E22 Panel mount. ( 3 hole, size 0)ER Combined panel square base plates.

T146 K DIN rail mounting plate. (size 0 and size 1)FT1 Single hole mtg. w/o esc. plate IP65. ( $\mathrm{S} 0=22.3 \mathrm{~mm}$ )
FT2 single hole mtg . wth square plate IP65. $(\mathrm{S} 0=22.3 \mathrm{~mm})$EF Panel seal IP65. (mounts between switch and panel).KD/KN
Heavy duty mounting plate and metal shaft.

L100 Various shaft lengths (metal)
M004 Adjustable shaft (advise length).
PF Enclosure ABS IP56

GK Enclosure aluninium IP54.

M280E Door clutch (specify depth required).

6 CL Enclosure 56 series.
6 SS Enclosure stainless steel.

KS/KL Enclosures IP65.

6S115 x 70 Wall plate stainless or Plastic

Other, nominate type of mounting required.

## Handle Operation

Normal/standard handle (G251) or $\qquad$$\square$ V840AI.Padlockable handle (S0 \& S1). V750D Key operator size $00 \sim 0$.V845 Padlock Handle. (c/w esc.plate)V755A or C Key operator (530 series) . $\square$ V840G Padlock device.
$\square$ V750/A9 Key operator size 0 switch.(Lockwood) $\square$ V850 Padlockable with handle device

6SOLW V750 Key operator (201 Lockwood etc.) $\square$ V400 Push-button interlock device.

V760 Seperate key and handle (programmable). $\square$ Other specify

## Essential Data

1. Switch/circuit requirement. .

Amp $\qquad$ Volts $\qquad$ kW $\qquad$
2. Cable size $\qquad$ or limiting dimensions $\qquad$
3. AC or DC (DC voltage required). $\qquad$ Duty:- AC21/AC22/AC23/AC11 or other.
4. PLC/Electronic circuit/dry circuit or standard switch.

## Ohm's Law

## SYMBOLS

$\mathrm{U}=$ Voltage in volts
I = Current in amperes
R = Resistance on ohms
$P=$ Power in watts

## Useful Formulae



| $\mathrm{kW}=\mathrm{kVA} \times \mathrm{pF}$ | Line Amps $=\frac{h p \times 746}{\text { Line volts } \times 1.732 \times \text { Eff } \times \text { pF }}$ |
| :---: | :---: |
| kW $=\frac{\mathrm{hp} \times 746}{1000 \times \text { Eff }} \quad \frac{\mathrm{hp} \times 746 \times 100}{1000 \times \text { Eff }}$ | $\begin{aligned} & \text { Horsepower }=\frac{\text { kVA } \times 1000 \times \text { Eff }}{746} \\ & \quad(\mathrm{hp}) \end{aligned}$ |
| $\mathrm{kW}=\frac{\text { Line amps } \times \text { Line volts } \times 1.732 \times \mathrm{pF}}{1000}$ | $\mathrm{hp}=\frac{\mathrm{kVA} \times 1000 \times \mathrm{Eff} \mathrm{pF}}{}$ |
| $\mathrm{kVA}=\frac{\mathrm{kW}}{\mathrm{pF}}$ | $\mathrm{hp}=\underline{\text { Line amps } \times \text { Line volts } \times 1.732 \times \text { Eff } \times p F}$ |
| $\mathrm{kVA}=\frac{\mathrm{hp} \times 756}{1000 \times \mathrm{Eff} \times \mathrm{pF}}$ | 1 Watt = 1 joule/second |
| $\mathrm{kVA}=\frac{\text { Line amps } \times \text { Line volts } \times 1.732}{1000}$ | $1 \mathrm{hp}=746$ Watts |
| $\text { Line Amps }=\frac{\mathrm{kVA} \times 1000}{\text { Line volts } \times 1.732}$ |  |
| $\text { Line Amps }=\frac{\mathrm{kW} \times 1000}{\text { Line volts } \times 1.732 \times \mathrm{pF}}$ | $1 \mathrm{hp}=746$ joules/second |

VOLT-DROP Single Phase
Service Voltage $=240 \mathrm{~V}$
Max Permissible Vd $=\frac{240 \times 2.5}{100} \quad(2.5 \%$ Service Voltage $)$

$$
=6 \mathrm{~V}
$$

Max Unit Vd $=\frac{\text { Max Vd x } 1000}{1 \times \text { distance }}$ (Length of cable run)

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## AC-1

Resistive or low inductive loads.
AC-3
Direct on line starting, star delta starting.

## AC-4

Direct on line starting, reversing, plugging and inching.

AC-21
Switching of resistive loads, including moderate overloads.

## AC-23A

Frequent switching of motors or other highly inductive loads (selection criteria for main switches)

## AC-22

Isolation of 6 Pole star delta motor circuits

| POWER <br> Motor Size |  | CURRENT <br> three phase $50-60 \mathrm{~Hz}$ |  |
| :---: | :---: | :---: | :---: |
| kW | h.p. | 415 V | 440V |
| 0.37 | 0.5 | 1.2 | 1 |
| 0.55 | 0.75 | 1.6 | 1.3 |
| 0.75 | 1 | 2 | 1.68 |
| 1.1 | 1.5 | 2.5 | 2.37 |
| 1.5 | 2 | 3.5 | 3.06 |
| 2.2 | 3 | 5 | 4.42 |
| 3 | 4 | 6.5 | 5.77 |
| 4 | 5.5 | 7.5 | 7 |
| 5.5 | 7.5 | 11 | 10.4 |
| 7.5 | 10 | 14 | 13.7 |
| 10 | 13.5 | 19 | 16.5 |
| 11 | 15 | 21 | 20.1 |
| 15 | 20 | 28 | 26.5 |
| 18.5 | 25 | 35 | 32.8 |
| 22 | 30 | 40 | 39 |
| 30 | 40 | 55 | 51.5 |
| 37 | 50 | 66 | 64 |
| 45 | 60 | 80 | 76.3 |
| 55 | 75 | 100 | 90 |
| 75 | 100 | 135 | 125 |
| 90 | 125 | 165 | 156 |
| 110 | 150 | 200 | 186 |
| 132 | 175 | 230 | 216 |
| 160 | 220 | 280 | 256 |
| 200 | 270 | 340 | 321 |
| 220 | 300 | 385 | 353 |
| 250 | 350 | 450 | 400 |
| 315 | 430 | 535 | 500 |

## IP Ratings

IP65 - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 5 means water projected by nozzle against the equipment from any direction shall have no harmful effect.

IP66 - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 6 means water projected by powerful jets against the enclosure from any direction shall have no harmful effect.

IP69K - where 6 means complete protection against accidental contact with live or internal moving parts. Protection against the ingress of dust (dust tight). Where 9K means where water directed against the enclosure under extremely high pressure from any direction must not have any harmful effect. Water pressure of 100 bar. Water temperature of 80 deg C.

## The Range of Blue Line Switchgear

Technical Catalogues for the following products are available from our website. www.krausnaimer.com.au
Main Switches and Main Switches with Emergency Function 16 A-315 A
Maintenance Switches 20 A-315 A
Switch Disconnectors 20 A-315 A
500
According to IEC 60947 - 3, EN 60947 - 3, VDE 0660 part 107, IEC 60204, EN 60204 and VDE 0113

## CL SWitches 10 A-20 A

C, CA and CAD Switches 10 A-315 A and L Switches 350 A- 2400 A
C, CA andCAD switches are designed for universal application. They are recommended for instument, isolator, double-throw and motor 100 control.
L switches are designed for load and off-load applications. They are used to switch resistive or low inductive loads.

## Optional Extras and Enclosures

The complete product line, a large number of oiptional extras is available, including door interlocks, push-pull devces, cylinder and padlock attachments, control and indicator devices, Ac motor drives, as well as enclosures, both inslated and metal.

## A and AD Switches 6 A-25 A

A and AD Switches have 4 contacts in each switching stage. These switches provide an extensive range of switch functions and require a 110 minimum mounting depth. Up to 36 switching postions are possible, with availability of 48 contacts per 12 stage column.

## CG, CH and CHR Switches 10 A-25 A

Ultra compact CG, CH and CHR switches are ideally suited for control and instumentation applications.
Switch terminals are 'finger-proof' and conveniently accessible for wiring and are delivered open. All CG4 ewiches offer specially designed
gold plated contacts or H -bridges with 'cross-wire' contact systems, which facilitates their use in electronic circuitry and chemically aggressive environments.

## DH, DHR, DK and DKR Switches 6 A-16 A

DH, DHR, DK, and DKR switches incorporate unique corrosion resistant contacts that permit operation on system voltage as low as 1 V. They have fully enclosed and protected contacts which can be operated either by rotary and/or lateral handle movement. D switches are used in calibration and semiconductor circuits. They are also used for relay and contactor control.

## X Switches 80 A-630 A

$X$ swiches can be applied for load, tap and gang duties. They incorporate 6 contacts in each switching stage. Their compact design provides
a minimum lengtgh dimension for mounting purpose.

KG Switches 20 A-315 A and KH and KHR Switches 16 A-80 A
KC, KG, KH anh KHR switches are excellent circuit interruptors. They have high through fault and fault making capacities and are especially designed for use as isolators and safety switches for machine tools, distribution panels and switchboards. KG ON/OFF switches offer unusually high dimensioned air and creepage distances between terminals which are designed for time saving 'straight-line' wiring. ON/OFF switches are available with up to 8 poles and double-throw switches are available with up to 4 poles.
KC switches offer spring cage terminals for greater termination security.

Push Buttons and Pilot Lights, $22.5 \mathrm{~mm} \varnothing$
A complete range of state-of-the-art push buttons and pilot lights represent an ideal combination of functional security economical efficiency in a modular design.

## Disconnectors for Photovoltaic

## Maintence Switches for EMC - Compliant Connection

Frequency regulated motors.

We reserve the right to make technical and dimensional changes without prior notice. Any errors or omissions are not binding.

# Kraus \& Naimer ${ }_{\text {rowes }}$ BLUE LINE switchgear 

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## Distributor:

The Cam Switch Creators and Innovators.

## TECHNICAL DATA SHEET

Equipment Type: ..... RTU
Location:RTU Section
Model Numbers: Multismart
Manufacturer:
Xylem
Supplier:
Brisbane Technology Park
Unit 1, 18 Brandl Street
P.O. Box 4633
Eight Mile Plains
Queensland 4113
Australia

# multitrode <br> WATER • WASTEWATER • PUMP STATION • TECHNOLOGY 

## MultiSmart Pump Station Manager \& RTU



# This Manual is the support documentation for the installation, commissioning and operation of the MultiTrode MultiSmart Pump Station Manager/RTU and Reservoir Monitor. 

Revision 20

15 May 2013
This manual is used for v3.1.0 of the MultiSmart Pump Station Manager

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## 1 Warnings \& Cautions

### 1.1 Information to User

Read through this manual to obtain a good working knowledge in order to get maximum performance from the MultiSmart for your application. After reading, place the manual in a safe place for future reference.

### 1.2 Documentation Standards



DANGER:
THIS SYMBOL IS USED WHERE NON-COMPLIANCE COULD RESULT IN INJURY OR DEATH.


WARNING:
THIS SYMBOL IS USED WHERE NON-COMPLIANCE COULD RESULT IN INCORRECT OPERATION, DAMAGE TO OR FAILURE OF THE EQUIPMENT.


NOTE:
THIS SYMBOL IS USED TO HIGHLIGHT AN ISSUE OR SPECIAL CASE WITHIN THE BODY OF THE MANUAL.

### 1.3 Installation Notes



## WARNING:

THE MULTISMART INSTALLATION AND WIRING MUST BE PERFORMED BY QUALIFIED PERSONNEL.


DANGER:
THE MULTISMART HAS NO USER SERVICEABLE PARTS. TO REDUCE THE RISK OF ELECTRIC SHOCK, LEAVE ALL SERVICING TO QUALIFIED MULTITRODE TECHNICAL STAFF.

## DANGER:

INSTALLATION OR USE OF THIS EQUIPMENT OTHER THAN IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS MAY RESULT IN EXPOSURE TO HARM, SERIOUS INJURY OR DEATH.

## 2 Glossary \& Symbols

## Terminology

| Activation Level | The point at which a pump or alarm is switched On. |
| :--- | :--- |
| Alternate Mode | The Pump Station Manager automatically switches the lead (duty) pump each cycle. |
| Deactivation Level | The point at which a pump or alarm is switched Off. |
| Decommissioned Pump | A pump that has been removed from duty or an installation, e.g. for maintenance <br> purposes. |
| Duty (Lead) Pump | The main pump or the first pump to start within a pumping cycle. |
| Empty (Discharge) Mode | When the Pump Station Manager is set to empty a tank or pit. |
| Fill (Charge) Mode | When the Pump Station Manager is set to fill a tank or pit. |
| Fixed Sequence | Pump 1 or pump 2 is fixed as the lead (duty) pump. |
| InterPump Start Delay | The delay between any two pumps starting. |
| InterPump Stop Delay | The delay between any two pumps stopping. |
| Probe | MultiTrode manufactures a range of conductive level sensors. They have many <br> advantages over traditional devices such as ball floats. Advantages include: <br> resistance to fatty deposit build-up, tangle-free and an adjustable sensitivity to liquid <br> to prevent false readings. |
| Standby (Lag) Pump | The secondary pump or the next pump to start within a pumping cycle. <br> ISaGRAFISaGRAF is a control software environment which supports all of the internationally <br> recognised IEC 61131-3 control languages and offers a combination of highly <br> portable and robust control engine. |

## Abbreviations, Symbols \& Units

| PSM | Pump Station Manager |
| :--- | :--- |
| $\Omega$ | Resistance Value (Ohm) |
| EMC | Electromagnetic Compatibility |
| Hz | Frequency (Hertz) |
| LED | Light Emitting Diode |
| MTU | Master Terminal Unit |
| N/C | Normally Closed |
| N/O | Remote Telemetry Unit |
| RTU | Alternating Current Voltage |
| VAC | Direct Current Voltage |
| VDC | Variable Frequency Drive |
| VFD |  |

## 3 Major New Features \& Enhancements in Recent Firmware Releases

### 3.1 Version 3.1.0

Version 3.1.0 includes a large number of enhancements and bug fixes. This section lists some of the major highlights of this release.

### 3.1.1 New Features

- Enhanced security features supporting different levels of security for accessing screens
- SMS Server functionality for sending SMS messages on alarm conditions
- Web-based monitoring services and web security for accessing web pages
- Well cleanout can now be controlled by watching current drawn
- Ability to calculate statistics whenever event triggers occur (e.g. average, minimum, and maximum current while the pump is running)
- Support for DNP Secure Authentication Version 5
- $\quad$ Support for WITS-DNP V2.0


### 3.1.2 Screen Changes

- Setup Wizard redesign - once completed, users are prompted to set up additional common features
- Device network information now displayed on a Network page under the Info group of pages
- Deactivating faults now show time until reset
- Faults in the fault screen are now shown in order of most recent fault first


## Part 1 - Operations

## 4 Introduction

Congratulations on your purchase of the MultiTrode MultiSmart Pump Station Manager.
Depending on the options you have purchased, the unit may be configured as either a Pump Station Manager or a Reservoir Monitor or as a Remote Telemetry Unit. The generic product description of MultiSmart Pump Station Manager is used throughout the manual and for convenience refers to any of the three configurations.

The pump station manager is an "out of the box" Pump Station Manager for water and sewerage pump stations. The large LCD screen with soft-keys eliminates the need for selector switches, push buttons, fault lights, meters, accumulators and other additional panel items. This simplifies panel wiring and reduces costs.

The product has a very low "whole of life" cost compared with a PLC due to the pump control functionality already developed in the product. Users simply configure the parameters, rather than program the unit. This reduces engineering cost and greatly increases reliability.

The MultiSmart pump station manager has the option of an IEC 61131-3 PLC programming language so that additional functionality can be added by the user if required.
The MultiSmart has fully open communications and can be supplied with Modbus and DNP3 protocols. A MultiSmart can also be shipped just as an RTU without any pump control functionality or user interface.

The Reservoir Monitor is a version of the product for monitoring reservoirs and communicating with remote pump stations.

MultiSmart is fully configurable from the LCD user interface. However, there is also a PC-based Configurator program with comprehensive functionality now available.

### 4.1 Range of Options

The functionality of the basic product can be enhanced with additional software modules, such as:

- DNP3 RTU with security
- Security key - based on the 'Dallas Key'
- VFD control - variable frequency/speed drive
- "Energy Monitoring and Motor protection" option which allows power, energy, power factor and pump efficiency monitoring as well as 3-phase currents, motor protection functions and insulation resistance tests (requires energy monitoring and motor protection I/O module)
- Logic engine (for custom logic additions)
- ISaGRAF (IEC 61131-3) PLC programming
- Well Mixer
- PumpView - a web-based monitoring and control system via the cellular/mobile network
- SMS Server - for sending SMS messages in the event of configured alarm conditions

The product can be shipped with these software modules enabled or they can be enabled in the field with the appropriate enable code. To the base unit, an additional I/O board can be installed in the factory to allow for either an expansion of I/O or motor protection options.

### 4.2 Intuitive Operator Interface

The MultiSmart has screens which have been designed for operators of pump stations. The operator can see at a glance:

- Level
- Pump mode
- Pump availability
- Detailed fault information
- Date/time of each fault occurring and clearing
- Single or 3-phase supply, DC supply
- Fault and event history (up to 50,000 records, or millions of records with SD card)
- Accumulators (starts, hours, faults, etc)
- Pump efficiency (requires energy monitoring, motor protection and flow enabled)
- Status of all I/O
- Status of a communications link
- Duration to Overflow


### 4.3 Intuitive Engineering Interface

The product has clear menu screens for altering:

- Pump set points
- Alarm set points
- Delays
- Alternation and grouping
- Level device and backup level device
- Number of pumps
- I/O and fault configuration
- Supply protection
- Energy Monitoring and Motor protection (where installed)
- Station optimization parameters (max run time, max off time, max starts per hour, plus many more)
- Data logging parameters
- Communications
- Profiles


## 4.4 "Out of the Box" Control of a Pump Station

When the unit is first powered up, it starts controlling a pump station using its default parameters. Although it's shipped with this basic configuration, the configuration can be easily modified to suit a wide range of applications by running through the Setup Wizard.
The Setup Wizard takes into account the MultiTrode probe or other level devices, fill or empty applications, number of pumps, number of wells, station power supply, type of pump sensors and DNP communication settings.
Even though the basic setup meets most of the normal pump station requirements, with a few button presses the MultiSmart can be setup to perform most of the complex pump station management requirements.

Changing between a reservoir and a pump station, the number of pumps, the number of wells, or empty (discharge) to fill (charge) is done through the Setup Wizard and takes only a few minutes, which is far less time than that required to implement the same functionality using a standard PLC.
Complete station setups can be saved and/or loaded via an SD card or USB.
If the extensive range of existing features do not cover a particular requirement, additional functionality can be added by writing new code using either Logic Engine (a simple Boolean language) or ISaGRAF (a suite of PLC languages).

## WARNING:

Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

## 5 Operator Interface

The MultiSmart pump station manager has an easy to use interface featuring a large graphical LCD. A large amount of critical information is displayed on the main screen, making it simple for an operator to determine the current status of the pump station at a glance.

The buttons (or soft-keys) around the edge of the screen are used to access features, depending on what is displayed at the time.


Figure 1 - MultiSmart Display

1. Fault Indication LED (Red)
2. Power Status LED (Green)
3. Home Button
4. Help Button
5. Increase Contrast
6. Decrease Contrast

### 5.1 LCD Panel

The large LCD gives the operator a clear view of how the pump station is operating. Water levels are shown graphically. A backlight turns on when any of the display buttons are pushed. The backlight turns off again after a set time of inactivity (this time is user configurable).

### 5.2 LED Indicators

### 5.2.1 Power

The Power LED is at the bottom left hand corner of the display and indicates that the DC supply is connected and turned on.

### 5.2.2 Faults

The fault LED is above the power LED. It flashes once a second when a fault is detected. This gives the operator a quick indication of whether a fault is present without having to access the LCD screen.

### 5.3 Buttons

### 5.3.1 Home/Help Button

The Home/Help button has two positions:

- Pressing the Home icon returns the user to the main status screen.
- Pressing the Help icon displays online help for the currently displayed screen.


### 5.3.2 Contrast Button

The contrast button is used to adjust the LCD screen's contrast. Press "+" or "-" as required to optimise the display for the light conditions.

### 5.3.3 Display Buttons

Eleven buttons are located around the edge of the LCD display. These are used to access menu items and other data on the display. For any screen, the display indicates what each button is used for.

### 5.3.4 Numerical Keypad

A numerical keypad is located at the right of the interface. This is used to enter alpha-numeric characters during configuration.

### 5.4 Using the Interface

### 5.4.1 Main Status Screen

Pressing the Home button turns on the LCD backlight and also returns the MultiSmart display to the main status screen. The following screen displays the current status of all pumps connected to the MultiSmart:


Figure 2 - Main Status Screen

### 5.4.1.1 Pump Mode

The buttons located next to each pump are used to switch the pump into Manual (Hand), Off, or Auto modes.

- Auto - In this mode a pump starts when the activation setpoint is reached. The pump automatically stops when the deactivation setpoint is reached.
- Off - This turns a pump off, so pump run commands are ignored by the off pump regardless of level. In order to meet security requirements, the Off mode can be disabled from the advanced menu. (If changed while the pump is already in the Off mode, it stays off until the mode changes).
- Manual (Hand) - is semi-automatic manual, as the mode returns automatically to Auto when the deactivation setpoint of the pump is reached. (This prevents pumps from being left on unintentionally).
A pump is placed into Full Manual mode as follows: when the pump is in Off mode, instead of just briefly pressing the Auto/Off/Manual button, press and hold it on. This puts the pump into Full Manual mode for as long as the button is pressed.


### 5.4.1.2 Running Status

The Running Status of each pump appears to the right of the Pump Name. The various states are:

- Stopped - Pump is stopped
- Starting in $x$ seconds - Pump is about to start and a delay is counting down
- Running - Pump is running
- Stopping in x seconds - Pump is about to stop and a delay is counting down
- Next to Run - Indicates the next pump to run. (Not applicable in multiple well configurations).
- Request to Run - The controller is waiting for the feedback from the contactor. (A contactor auxiliary is wired in and the command to run a pump has been sent).
- External Run - If the pump is started by an external control method (for example, via a manual override switch), the contactor will be closed but no run command would have been sent by the controller, hence External Run is displayed. The MultiSmart continues to update the pump run time statistics and other relevant historical data. As well, the relevant faults and warnings are generated.
- Reversing in $x$ seconds - The pump is about to reverse
- Reversing for x seconds - The pump is currently being reversed
- Decommissioned - The pump has been taken out of service


### 5.4.1.3 Availability Status

The Availability of each pump is displayed below the Running Status. The states are:

- Available - There are no current faults for this pump. The pump is available to run (this condition does not consider the mode of the pump, so if the pump is OFF, the pump will not run).
- Unavailable - A fault is present or a fault requires manual acknowledgment.
- Hold Out - The text," Hold Out" flashes indicating a fault is present and the pump is unavailable.
- Inhibit - Station or individual pump inhibited from SCADA


### 5.4.1.4 Fault Status

The Fault Status of each pump is displayed below the Availability Status. The states are:

- Fault Present
- Ack Required - A fault condition has cleared and is not holding out the pump, but requires acknowledgement.
- Reset Required - A fault condition has cleared and is holding out the pump, so requires reset (see Section 5.4.2).
- Reset in $\mathrm{x} \mathbf{s e c}$ - A fault condition has cleared and the pump will auto-reset when the countdown is complete.

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### 5.4.1.5 Level Indication and Setpoints Display

A bar graph is displayed next to the pumps and shows:

- Current liquid level
- Each pump's activation and deactivation levels
- Level alarms that have been enabled


Figure 3 - Level Indication

### 5.4.1.6 Soft-keys

The buttons at the bottom of the screen are used to access the following areas:

- Settings - used to configure the MultiSmart pump station manager
- Info: displays full station and pump information
- History: shows alarms and event history
- Faults: shows details of current fault conditions


## NOTE:

When the unit is controlling 5 or more pumps, a Next Pumps button also appears on the bottom line allowing access to pumps 5 and 6, etc. This button is also present when the unit is configured for more than 1 well.

### 5.4.2 Faults / History

When a fault occurs, a large FAULT box is displayed at the bottom of the screen. At the same time, the fault status changes to Fault Present.


Figure 4 - Fault Indication
The left Fault soft-key button flashes when a fault is present. Pushing this button (or the right Faults button) displays a screen which details the fault. (Appendix A contains a description of all faults displayed).


Figure 5 - Fault Reset Screen
Use the selector buttons to select each fault in turn.
From this screen the operator can reset the fault if the fault condition is no longer present. If the fault is still present, the Reset Fault button does not appear.

A Mute Fault button appears for faults that can be muted. It is used to stop sirens or flashing lights that may have been activated by the fault.
A Reboot Unit button appears for a Config Changed - Reboot Required fault. Pressing this button will save current values and then reboot the unit. Press the Yes button to confirm a restart of the controller. This process takes one to two minutes to complete.
By default, digital output 4 (DO4) is linked to the high-level alarm and can be muted. The digital output can be configured for Pulsed or Steady operation and is typically connected to an external warning light or alarm.

- The Mute button is only available for other faults if the user has configured them to be mutable.
- Pressing the History button displays the entire fault \& event history log.
- Pressing the Main button returns the operator to the main status screen.


Figure 6 - Fault History Screen
Section 19.4 explains more about Filters and section 19.7 explains the Add/Delete button.

### 5.4.3 Information Screen

The Information screens show:

- Hours run, starts and faults for each pump and the station
- The status of all I/O
- Flow data (when the optional flow module is installed)
- System log (identifies any application problems)
- Version and modules installed in the unit
- Power and Efficiency - kW, kVA, power factor, pump efficiency, energy accumulators (kWh and kVAh) for various periods: today/yesterday; this week/last week
- Communications statistics for DNP3/ Modbus slave and the current DNP3 Modbus tag values
- Option to browse MultiSmart internal tag database
- Option to view ISaGRAF 5 tags and values useful for PLC programming

To navigate to the Information screen, press the Info button on the main operator screen.


Figure 7 - Information Screen 1 of 2
Pressing More displays the second screen, which includes the Version button which gives details on the firmware version installed on the unit. (Free firmware upgrades are available from the MultiTrode website).


Figure 8 - Information Screen 2 of 2

### 5.4.3.1 Power \& Efficiency

This screen shows the power factor and efficiency of the pumps. Efficiency, energy and apparent energy of the present day, yesterday, this week, last week, this month, last month and totals are displayed on this screen. There is also a Benchmark Efficiency (further down the screen) which can be entered as a comparison value (see section 17.1).

Navigate to: $\operatorname{Info} \rightarrow$ Power \& Efficiency


Figure 9 - Power Efficiency Screen

### 5.4.3.2 I/O Information

Information about the System, DC Voltage, Top Board, Bottom Board and Probe can be seen in this screen. The I/O information screens are especially useful in troubleshooting input/output related issues. Insulation Resistance test (IRT) can be accessed from within the I/O information screen, (the test is only performed when the pumps are not running).

Navigate to: Info $\rightarrow$ I/O Information


Figure 10 - I/O Information Screen

To determine the configuration and current state of the digital inputs, navigate to the I/O Information: Digital Inputs screen.

$$
\text { Info } \rightarrow \text { I/O Information } \rightarrow \text { Top Board } \rightarrow \text { Digital Inputs }
$$

The current state of a digital input is displayed on the top line: Value.
Press the Advanced button to display configuration information on the digital inputs, for example Mode and Sensitivity.

The resistance as measured by the input is also displayed in Advanced mode. When the measured resistance is below the Sensitivity, then the input turns on (unless it is inverted, in which case the reverse is true).

## NOTE:

The Sensitivity used by the probe (default of 22k ohms, Section 14.8.3) is not the same Sensitivity found in the digital inputs advanced options.


Figure 11 - Digital Inputs Information Screen
High Density IO info page screens display the state of all digital inputs/outputs on one page for one unit/board at a time. The unit name and board name are displayed at the top. By pressing the Next/Prev button, the I/O for the next/previous unit/board can be viewed.

To determine the current state of all digital inputs/outputs, navigate to the I/O Information: High Density IO


### 5.4.3.3 Flow

The station inflow rate, pump outflow rate, volume pumped during a range of intervals, number of overflows, last overflow time, last overflow duration, duration to overflow, and total overflow volume can be seen in this screen.
Navigate to: Info $\rightarrow$ Flow


Figure 12 - Flow Screen - Part 1

Navigate to: $\operatorname{\text {Info}} \rightarrow$ Flow and scroll down.


Figure 13 - Flow Screen - Part 2


Figure 14 - Flow Screen - Part 3

### 5.4.3.4 Pump Information

Under this screen, the Runtime, Start, Reverse and Fault statistics as well as IRT information can be accessed. These options are illustrated in this section.
(a) Runtime Statistics

Navigate to: Info $\rightarrow$ Pump Information $\rightarrow$ Runtime Statistics


Figure 15 - Pump Run Time Statistics
Runtime is calculated based on when the pump is considered running via the contactor auxiliary status. This includes when the pump is externally run (determined via the contactor auxiliary status). If no contactor auxiliary is wired in, the runtime is calculated from when the pump is called for by MultiSmart, and external pump runs (e.g. via external switch) will not be included. This is also the case for Starts (below).

In the case of the runtime statistics, the station runtime may not equal the sum of the pump runtimes. For example, if Pump 1 is running for 1 hour by itself, followed by Pump 2 running for 1 hour by itself, then both pumps run for 1 hour together. The Pump 1 and Pump 2 runtimes will be 2 hours each whereas the Station runtime will be 3 hours since both the pumps were running together for an hour.

For the Generator Run Time statistics to be calculated, a digital input must be wired into the MultiSmart and configured as the Generator Running fault.
(b) Start Statistics

Navigate to: Info $\rightarrow$ Pump Information $\rightarrow$ Starts Statistics


Figure 16 - Pump Start Statistics
(c) Fault Statistics

Navigate to: Info $\rightarrow$ Pump Information $\rightarrow$ Faults Statistics


Figure 17 - Fault Statistics
This screen displays the total faults that occurred, today, yesterday, this week and last week for each pump and the station.
(d) Insulation Resistance


Figure 18 - Insulation Resistance
The insulation resistance test can be activated from this screen. The result of the test and related values are displayed in this screen. This test can only be performed when the pump is not running. (IRT can also be accessed from the I/O information screen).
(e) Reverse Statistics

Navigate to: Info $\rightarrow$ Pump Information $\rightarrow$ Reverse Statistics
Pump reverse information can be viewed here. Three different Reverse Statistics can be viewed.
(i) Total Reversals


Figure 19 - Pump Total Reversal Statistics
This gives the total reversal statistics for the pumps as well as the station.
(ii) Preventative Reversals


Figure 20 - Pump Preventative Reversal Statistics
This gives the preventative reversals statistics, which is reversals on start/stop.
(iii) Fault Reversals


Figure 21 - Pump Fault Reversal Statistics
This gives the blockage removal reversal statistics (reversals triggered by faults)

### 5.4.3.5 Communications

The DNP and Modbus master and slave status and values can be seen from this menu. Viewing the tag values in real-time helps with trouble shooting communication errors. If logging is enabled (via the Advanced menu) and the View Log button is pressed, then the related communications messages are displayed. (If both DNP and Modbus masters and slaves are present, a second screen is created to cover all stats and values).
Navigate to:


Figure 22 - Communications

### 5.4.3.6 Browse Database

The Browse Database menu option lists all nodes within the real-time database in the MultiSmart. The tags are categorized and grouped into nodes as illustrated below. Each node can contain a list of tags as well as a number of child nodes. This screen allows for the selection and display of the real-time value of a tag.
Navigate to: Info $\rightarrow$ Browse Database


Figure 23 - Browse Database

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### 5.4.3.7 Version Information

The hardware and software versions and the MultiSmart serial number are displayed in this screen. This information may be required if MultiSmart technical support is requested. (The MultiSmart firmware version is listed beside the Build Version).


Figure 24 - Version Information

### 5.4.3.8 ISaGRAF 5

This screen displays ISaGRAF resource information including compile date, download rate, mode, cycle time, cycle overflow, cycle count, and tags. Parameters and variables can be viewed through this screen. Also the value of parameters can be changed from this menu.

Navigate to:


Figure 25 - ISaGRAF Resource Summary Screen

Pressing Resource cycles to the next "application" and Disable allows the user to stop one or many ISaGRAF "Resources" from running.

### 5.4.3.9 System Log

System Log displays any system errors with a time stamp.
Navigate to:


Figure 26 - System Log

### 5.4.4 Settings Screen

Changes to the operation of the MultiSmart unit can be done by accessing this menu. Most of the general pump station requirements can be configured from the sub-sections under Settings. However a wide range of advanced configuration options are also available, and can be accessed and configured through the Advanced button in the Settings menu.


Figure 27 - Settings Screen

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Some of the settings require a reboot of the MultiSmart unit for it to come into effect after the change, whereas many others come into effect as soon as the changes are saved. If a restart is required, MultiSmart prompts the user with two options, Restart Now and Restart Later, as shown in the figure below.


Figure 28 - Reboot Screen
If Restart Now is selected, the unit saves the current values and reboots immediately before any further configuration changes can be performed. If further configuration changes are needed, choose Restart Later.

If Restart Later is selected, the MultiSmart resumes normal operation, however the new changes do not come into effect until after a reboot, and the restart prompt is no longer displayed. A fault is displayed on the main screen to remind the user that a reboot is required.

NOTE:
The restart option in some cases is not displayed. For example, for some major changes like adding a new DNP slave profile, the MultiSmart skips the restart option prompt and performs an automatic reboot to bring the new changes into effect immediately.

## Part 2 - Installation \& Commissioning



## WARNING:

Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

## 6 Mounting Instructions

The MultiSmart pump station manager is mounted on a standard DIN rail on a panel inside an enclosure. The operator interface is usually mounted on the (dead) front door of the enclosure. The two units are connected together with the cable supplied.

### 6.1 Mounting the Operator Interface Display

The operator interface (LCD) is mounted to the door with $8 \times \mathrm{M} 4$ hex head screws (supplied). A 25 mm (1") hole must be cut to accommodate the cable connecting the interface to the controller. Drilling dimensions are given below. Note, this drawing is not to scale. (See Appendix B for a mounting template).


Figure 29 - Mounting the Display

### 6.2 Mounting the Pump Station Manager

The pump station manager is designed to mount onto 35 mm DIN rail. Overall dimensions are given below.


Figure 30 - Mounting the Controller

### 6.3 Connecting the Operator Interface to the Pump Station Manager

The interface and pump station manager are connected together with a supplied cable. Connect one end into the RJ45 socket on the back of the interface. Connect the other end into the RJ45 socket marked DISPLAY on the MultiSmart CPU Board.

## Connect cable

 into here

Figure 31 - Connecting the display interface

## 7 MultiSmart Boards

## General Precautions

## Electrical Hazard:

- A certified electrician must supervise all electrical work. Comply with all local codes and regulations.
- Before starting work on the unit, make sure that the unit is isolated from the power supply and cannot be energized.
- Make sure that all unused conductors are insulated.
- There is a risk of electrical shock or explosion if the electrical connections are not correctly carried out or if there is fault or damage on the product.



## WARNING:

Do not use this unit in environments that may contain flammable/explosive or chemically aggressive gases or powders.

## Requirements

These general requirements apply for electrical installation:

- The mains voltage and frequency must agree with the specifications for the product.
- Circuit breakers must be installed between the main voltage line and this unit.
- All fuses and circuit breakers must have the proper rating, and comply with local regulations.
- The cables must be in accordance with the local rules and regulations.


## Cables

These are the requirements to follow when you install cables:

- The cables must be in good condition, not have any sharp bends, and not be pinched.
- The sheathing must not be damaged and must not have indentations or be embossed (with markings, etc.) at the cable entry.
- The minimum bending radius must not be below the accepted value.


## Earthing (Grounding)

## Electrical Hazard:

- You must earth (ground) all electrical equipment. This applies to the pump equipment, the driver, and any monitoring equipment. Test the earth (ground) lead to verify that it is connected correctly.
- If the power cable is jerked loose by mistake, the earth (ground) conductor should be the last conductor to come loose from its terminal. Make sure that the earth (ground) conductor is longer than the phase conductors. This applies to both ends of the power cable.

The MultiSmart pump station manager has up to four boards plugged into it depending on the application. The most common configuration is shown below.
Pump Control I/O Board (3PC) - The pump control board monitors the single or 3-phase supply and provides digital and analog I/O. Level sensing can be from a MultiTrode conductive probe or any 4-20mA device (e.g. pressure transducer, ultrasonic device). Pump faults can be contact closures or pump specific inputs such as seal, PTC thermistor or Flygt FLS and CLS. Digital outputs drive the pump contactors. (I/O = $20 \times$ DIN, $2 \times$ AIN, $7 \times$ DOUT, $1 \times$ AOUT)

CPU Board - Houses the microprocessor running the MultiSmart unit, provides two Ethernet ports, two RS232 ports, two RS485 ports, an iButton (security key) port, connects to the display, and has SD card and USB ports.

## WARNING:

THE DIGITAL INPUTS ARE VOLT-FREE INPUTS. DO NOT APPLY ANY SOURCING VOLTAGE TO THEM.

## DSP Board

This board handles the I/O and communicates between multiple I/O Module modules.

## Energy Monitoring and Motor Protection (3MP)

Monitors single or 3-phase motor currents direct from a CT, and provides motor protection and power monitoring. The board also carries out an automatic 1000VDC insulation resistance test of the motor windings (I/O = $9 \times \mathrm{IIN}, 3 \times \mathrm{IRT}, 3 \times$ AOUT, $5 \times \mathrm{DOUT}$ ).


Figure 32 - MultiSmart Boards

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### 7.1 Power Supply

The MultiSmart pump station manager runs from an external $12-24$ VDC (+/-5\%) power supply. This external DC supply is connected to the DSP board as shown below:

## $12-24 \mathrm{VDC}{ }^{+}$



Figure 33 - Power Supply

### 7.1.1 Power Consumption

The MultiSmart unit consumes up to 30W per unit during initial start-up, (inrush current) and 15 W per unit during continuous operation.

### 7.1.2 Power Supply Requirements

The MultiSmart must be used in conjunction with a power supply that meets or exceeds the specifications listed in Table 1 - Power Supply Specifications.

NOTE:
To maintain UL compliance of the product, the power supply must also be UL Listed.

| OUTPUT | DC Voltage | $12-24 \mathrm{VDC}$ |
| :--- | :--- | :--- |
|  | Power | $>30 \mathrm{~W}$ |
|  | Voltage Tolerance | $+-2.0 \%$ |
|  | Line Regulation | $+-0.5 \%$ |
|  | Load Regulation | $+-0.5 \%$ |
| INPUT | Voltage Range | $85 \sim 264 \mathrm{VAC}(120 \sim 370 \mathrm{VDC})$ |
| ENVIRONMENT | Wrequency Range | $47-63 \mathrm{~Hz}$ |
|  | Working Temp | $14{ }^{\circ} \mathrm{F} \sim 140^{\circ} \mathrm{F} /-10^{\circ} \mathrm{C} \sim+60^{\circ} \mathrm{C}$ |
|  | Working Humidity | $20-90 \%$ Relative Humidity non- <br> condensing |
|  | $-40^{\circ} \mathrm{F} \sim 185^{\circ} \mathrm{F} /-40^{\circ} \mathrm{C} \sim+85^{\circ} \mathrm{C}$, <br> $(10 \sim 95 \%$ Relative Humidity $)$ |  |

Table 1 - Power Supply Specifications

### 7.2 Default Wiring Setup for Pump Control Board

While many different configurations of the MultiSmart are possible, five common configurations are illustrated in this section. These default configurations can be applied by completing the Setup Wizard in the Settings menu. After a default configuration has been applied, changes can be made as required. Refer to Section 7.3 for a complete description of the Pump Control I/O Board.

### 7.2.1 Default 1 - 10 Sensor Probe and 2 Pumps



Figure 34 - Default 1
7.2.2 Default 2-10 Sensor Probe and 3 Pumps


Figure 35 - Default 2

### 7.2.3 Default 3 - Analog Level Device and 2 Pumps



Figure 36 - Default 3
7.2.4 Default 4 - Analog Level Device and 3 Pumps


Figure 37 - Default 4

### 7.2.5 Default 5 - DuoProbe and 3 Pumps



Figure 38 - Default 5

### 7.2.6 Contactor Auxiliary Fault

If the contactor auxiliary is wired in, the pump status is displayed differently for when a pump is called to run. The contactor auxiliary is used to provide feedback to the MultiSmart as to when the contactor is closed and the pump is actually running. As soon as the pump running command is sent, the MultiSmart displays the status of the pump as Request to Run, and when the contactor closes the status is updated to Running. If the contactor takes too long to close or fails to close at all, the preset delay will expire and a pump fault is displayed, but the pump is not faulted. As per all faults, this can be modified to fault the pump thereby calling the next pump to run.

### 7.3 Pump Control Board

The pump control I/O board monitors mains voltage and provides digital and analog I/O. Level sensing can be from a MultiTrode conductive probe, or any $4-20 \mathrm{~mA}$ device (e.g. pressure transducer or ultrasonic). Pump faults can be contact closures or pump specific inputs such as seal, PTC thermistor, or Flygt FLS and CLS. Digital outputs drive the pump contactors.

### 7.3.1 Mains Voltage Monitoring

For voltage monitoring to work, connect the main supply to the pump control I/O board. To configure voltage monitoring and protection see Section 18. MultiSmart also supports single phase AC power supplies.


Figure 39 - Connecting Mains Supply to MultiSmart for Monitoring and Protection Purposes.

### 7.3.2 Digital Inputs

There are 20 digital inputs on the Pump Control I/O (3PC) board. All inputs can be used as volt-free digital inputs, but also have additional functionality. An example of the digital input wiring follows.


Figure 40 - Digital Input Wiring Example


## WARNING:

the digital inputs are volt-free inputs. Do not apply any sourcing voliage to them.

### 7.3.2.1 Sensor Types

The digital inputs are configured through the interface to accept many types of inputs. For example:

- Flygt FLS (thermal \& seal)
- Thermal Switch
- Voltage Free Contact (switch or relay)
- Transistor (inc. opto-coupler)
- Conductive Probe
- Conductive Seal
- Thermistor (non-linear PTC)
- Counters

Certain DINs have added capability:

- DI 19-20 High speed inputs (up to 1 kHz ).

Used for high speed pulsed inputs such as Pulse Flow Meters.

- DI 16-18

These three inputs can be used with Flygt CLS (Capacitive Leakage Sensors)

- DI 1 Fail-Safe probe input.

Used to connect the failsafe sensor wire from a MultiTrode Failsafe probe.
All the above inputs can be used as general purpose digital inputs.

### 7.3.2.2 10 Sensor Probe (or Ball Floats)

An example on how to connect a 10 sensor MultiTrode probe utilizing a 12 core cable is shown below. Connect the 10 sensors from DI 2 to DI 11 (this matches the MultiSmart default configuration). To DI 1 connect the red wire. (While this input is reserved for the Failsafe function, if it is not required then DI 1 can be used like any other digital input). The $12^{\text {th }}$ core is black and is connected to DI 2 - thus forming a wire loop from DI 1 through the probe cable, through the probe itself and back to DI 2. Periodically the MultiSmart tests this loop for conductivity.


Figure 41-10 Sensor Probe Connections

For further Probe configuration information including DuoProbe connections, refer to Section 14.8.


NOTE:
The Fail Safe feature requires a compatible probe and firmware version 2.2.2 or later.


NOTE:
If more than one Fail Safe probe is installed, only one (1) Failsafe probe (the highest) is connected to the Fail Safe input.

### 7.3.2.3 Single Sensor Probe (or Ball Floats)

An example of wiring single sensor probes is shown below. Any input can be used as long as they have been configured to accept a single sensor probe using the interface. (See Section 14.8.4-Single Sensor Mode for more information).


Figure 42 - Single Sensor Inputs


Figure 43 - Ball Floats

### 7.3.3 Digital Volt-Free Outputs

The pump control I/O board has seven 240V, 5A, and digital volt-free outputs:


Figure 44 - Digital Volt-free Outputs

- DO 1-4 - Isolated voltage free contacts
- DO 5-7 - Common rail voltage free contacts
- Multiple sources can be assigned to a digital output with the option of AND, OR and XOR operations performed on the source

NOTE:
DO1-4 are configured by default if 3 pumps were selected during the Setup Wizard. For a system which has less than 3 pumps, only the relevant digital outputs are configured. (For 4 pumps or more, no digital outputs are configured).


NOTE:
MultiTrode recommends that snubbers are fitted to the contactor coils that the digital outputs are driving.

### 7.3.4 Analog Inputs

The pump control board has two isolated $4-20 \mathrm{~mA}$ analog inputs.

- Maximum Load (Input Impedance) - 120 ohms
- Resolution 0.2\%
- Isolated


Figure 45 - Analog Input External Excitation: 2-Wire


Figure 46 - Analog Input External Excitation: 3-Wire

### 7.3.5 Analog Output

The pump control I/O board has one analog output (non-isolated) which produces a $4-20 \mathrm{~mA}$ output signal. This output can be used to transmit the water level (or reflect the value in any AIN on the MultiSmart unit) or to control a Variable Frequency/Speed Drive, i.e. VFD. (VFD functionality is an optional feature which needs to be ordered if required. It can be enabled after purchase).

- Maximum Load (Impedance) - 800 ohms
- Resolution 0.2\%
- Non-isolated


| $1+$ | $2+$ | $1+$ |
| :---: | :---: | :---: |
| $1-$ | $2-$ | $1-$ |
| AIN | AOUT |  |

Figure 47 - Analog Output

### 7.4 CPU Board

The CPU Board is the core of the MultiSmart pump station manager and provides serial and Ethernet communications ports, controls the user interface and has SD card and USB interfaces.

### 7.4.1 Connecting the User Interface Display

Connect the display into the RJ45 socket on the MultiSmart unit CPU Board as shown below.
Connect the Display
Cable into Here


Figure 48 - Connecting the display cable
WARNING: DO NOT CONNECT THE DISPLAY INTO THE ETHERNET PORT

### 7.4.2 Ethernet Port

The CPU Board has two 10Mbit/s, RJ45, Ethernet ports for SCADA communications using one of the following protocols: Modbus or DNP3 over TCP/IP.

### 7.4.3 Serial Ports

There are two RS232 (DB-9 - male) serial ports on the CPU Board. Either of these ports can be assigned to a communications channel. All I/O lines are implemented.
The MultiSmart serial ports use the standard RS232 pin outs as tabled below. When connecting to say a laptop, a cross over cable is required - as a minimum RX, TX and GND are required.

| Pin | Name | Abbrev | Direction |
| :---: | :--- | :---: | :---: |
| 1 | Carrier Detect | CD | Input |
| 2 | Receive Data | RX | Input |
| 3 | Transmit Data | TX | Output |
| 4 | Data Terminal Ready | DTR | Output |
| 5 | System Ground | GND | - |
| 6 | Data Set Ready | DSR | Input |
| 7 | Request to Send | RTS | Output |
| 8 | Clear to Send | CTS | Input |
| 9 | Ring Indicator | RI | Input |

Table 2 - Serial Port Pin Outs

### 7.4.4 SD Memory Card

The SD memory card socket takes standard SD memory cards. The SD card can be used in a number of ways:

- As extra storage space for data logging.
- To install new firmware.
- Can be used to load or save configuration files from/to the MultiSmart unit.


### 7.4.5 USB

The USB port takes standard USB memory sticks. USB can be used in the same manner as for SD cards.

### 7.5 DSP Board

The Digital Signal Processor board handles the I/O, communicates between multiple I/O modules and is where the main power supply is connected.

### 7.5.1 Power Supply Connector

The $12-24 \mathrm{VDC}$ power supply is connected into the DSP board as shown below:


Figure 49 - Connecting the power supply

## NOTE:

Unless the MultiSmart is configured in a specific way, the Battery Level terminal will only measure the
battery charger voltage - not the actual battery voltage.

### 7.5.2 DSP Status LEDs

There are four DSP status LEDs labelled COP, Power, Offline and Fault.


Figure 50 - DSP Board Status LEDs
(a) COP (Computer Operating Properly) (Correct State: Slow Flash)

Off: This occurs when the DSP is waiting for the first communications on the bus.
This LED remains off until the Host processor starts running I/O. If the LED stays off, then most likely a fault is present with the bus and it is preventing the DSP from receiving initial communications from the Host processor.

Slow Flash: Flashes about once every 2 seconds when the main software is running.
Quick Flash: A faster flash rate (approx 2 Hz ) indicates that the bootloader is running and waiting for commands. This will be seen for about 5 seconds after the Host starts running the I/O and also during a DSP firmware upgrade.
(b) Power (Correct State: On)

This is a power indicator.
(c) Offline (Correct State: Off)

Off: The main software is running. This means that the I/O is running.
On: The bootloader is running. The main software is not running so no $\mathrm{I} / \mathrm{O}$ is running.
(d) Fault (Red) (Correct State: Off)

Off: Status OK
On: At least one of the I/O boards attached has I/O calibration data which the current firmware cannot handle and as a result, the I/O is not calibrated. Firstly upgrade the DSP firmware and if the Fault LED remains on, contact MultiTrode as the I/O is not calibrated.

Flashing: This indicates that at least one of the I/O boards found is incompatible with the firmware. It means that no I/O at all can operate on the unit. Upgrading the DSP firmware should solve the problem.

### 7.5.3 Add PSU \& Battery Backup

### 7.5.3.1 Connections to the Power Supply

The figure below illustrates the connections to the Mean Well power supply, model AD-155A, (Part No. PSU-BATT-02).


Figure 51 - Power Supply Terminal Block Connections

### 7.5.3.2 Setting the Correct Charge Voltage

To help maximize battery life, it is essential that the correct charge voltage from the power supply to the battery is set. The correct value is $13.7 \mathrm{VDC}+/-.1 \mathrm{VDC}$ *.

* This value applies to the current 12VDC, 28Ah batteries supplied (Yuasa and Panasonic brands - alternative brands may be supplied, however).

| To verify the charge voltage: | Measure the voltage between terminals B+ and B- |
| :--- | :--- |
| To alter the charge voltage: | Adjust the small potentiometer (labelled V1 ADJ) until the correct value is <br> displayed. |

### 7.5.3.3 Power Supply Reset

## NOTE:

If mains power is lost and the connections to the battery are removed and then reconnected, it will
 be necessary to reset the power supply in order to restore operation (unless mains power is also restored).

The reset connector is located on the right hand side of the terminal connections on the power supply (labelled "RESET"). Bridge the two terminals within the reset connector to reset the power supply.

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### 7.5.4 CAN Bus I/O Expansion

MultiSmart I/O expansion units are connected to the main MultiSmart unit using the CAN Bus network. The CAN Bus cannot be used for other external devices.

Third party external I/O modules are connected through the Ethernet port, RS232 ports, or RS485 ports (See Section 14.7). With custom engineering, any I/O module that supports DNP3 or Modbus communications can be interfaced to the MultiSmart.

The CAN Bus baud rate and the device ID are set using the dial switches shown below. The ID must be unique and non-zero for each device on the CAN Bus.
The baud rate should be set to the same speed on every device connected to the bus. Select a suitable speed for the length of cable between devices as shown in the table below.


Figure 52 - CAN Bus Settings

| $\#$ | Baud Rate | Max Cable Length |  |
| :---: | :---: | :---: | :---: |
|  | $(\mathrm{kb} / \mathrm{s})$ | $(\mathrm{m})$ | $(\mathrm{ft})$ |
| 0 | 125 (default) | 500 | 1640 |
| 1 | 10 | 1000 | 3280 |
| 2 | 20 | 1000 | 3280 |
| 3 | 50 | 1000 | 3280 |
| 4 | 100 | 500 | 1640 |
| 5 | 125 | 500 | 1640 |
| 6 | 250 | 250 | 820 |
| 7 | 500 | 100 | 328 |
| 8 | 800 | 50 | 164 |
| 9 | 1000 | 25 | 82 |

Table 3 - Max. Cable Length at Specific Baud Rates

If the CAN Bus baud rate is changed on the unit, the same change must be made in the Advanced menu. Navigate to:
Settings $\rightarrow$ Advanced $\rightarrow$ IOModule $\rightarrow$ CAN Bus Baud Rate

Then select the appropriate value.

### 7.5.4.1 CAN Bus Settings



Figure 53 - Connecting Expanded I/O


## NOTE:

The CAN Bus Termination is set to ON for standalone MultiSmart units. Termination is only set to ON when this device is the LAST device on the CAN Bus network.

| Hardware <br> Configuration | Master Unit |  | First Slave |  | Second Slave |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :--- |
|  | CAN Bus <br> Termination | CAN <br> ID | CAN Bus <br> Termination | CAN <br> ID | CAN Bus <br> Termination | CAN <br> ID | Comment |
| Master device only | ON | 1 | $\mathrm{n} / \mathrm{a}$ | $\mathrm{n} / \mathrm{a}$ | $\mathrm{n} / \mathrm{a}$ | $\mathrm{n} / \mathrm{a}$ | Default setting |
| Master + Slave | OFF | 1 | ON | 2 | $\mathrm{n} / \mathrm{a}$ | $\mathrm{n} / \mathrm{a}$ | Single slave device |
| Master + Slave(s) | OFF | 1 | OFF | 2 | ON | 3 | Multiple slave devices |

Table 4 - Can BUS and Can ID Settings


Figure 54 - CAN Bus Settings - Single unit only


Figure 56 - CAN Bus Settings - Intermediate Slave Unit


Figure 55 - CAN Bus Settings - Master Unit


Figure 57 - CAN Bus Settings - Last Slave Unit


Figure 58 - CAN Bus Cable Connection Wiring

### 7.5.4.2 CAN Status LEDs

Consists of 4 LEDs labelled: Offline, Error, TX and RX.


Figure 59 - CAN Bus Status LEDs
(a) Offline (Correct State: Off)

Off: The CAN Bus sub-system is in Operation mode.
This means that everything is up and running and the Slave (DSP) is completely configured and sending status data to the Master (Host processor).

On: The CAN Bus sub-system is not in Operational mode.
Slave (DSP) to Master (Host processor) communications have not been established.
This LED normally activates soon after power-up whilst it is waiting for and receiving configuration from the Master (Host processor). Once the Master has configured the Slave (DSP), then the Master will send a command to switch the CAN sub-system to Operational mode. The Slave will then start sending status data automatically to the Master.
(b) Error (Correct State: Off)

This LED indicates errors on the CAN Bus.
This can be due to either a connection or termination problem on the bus, or due to a Baud Rate mismatch between either the Master or one of the slaves. Bad connections or bit errors (due to poor wiring or too long a bus) can also cause bus errors.

The Slave and the Master both attempt to recover automatically from the errors, but unless the fault is rectified, the errors will continue.

Off: Status OK
On: The Slave has switched to "Error Passive" mode on the bus.
This means that the unit will receive but not transmit. This is due to the detection of packet errors on the bus. The unit will attempt to recover automatically.

Flashing (approx 5Hz): The Slave has switched to "Bus Off" mode.
This means that the unit has stopped communicating on the bus. The unit will attempt to recover automatically. The auto-recovery mechanism will mean that the total duration of the flashing period will be short.
(c) TX \& RX (Transmit and Receive) (Correct State: fast flash)

Indicates activity on the bus. These LEDs simply flash with the data on the bus.
At high baud rates, the LEDs are only illuminated briefly so they will appear fairly dim - this is normal.

### 7.6 Energy Monitoring \& Motor Protection Board

The Energy Monitoring and Motor Protection Board (3MP) is an optional board. It monitors single or 3-phase motor currents for up to 3 pumps, direct from CTs, and provides motor protection and power monitoring. The board also carries out an automatic 1000 V DC insulation resistance test on the motor windings. An additional 5 digital outputs and 3 analog outputs are on board.


NOTE: Power monitoring requires 3-phase supply monitoring located in the same MultiSmart unit. The 3PC board has 3-phase supply inputs. Therefore you must have a 3PC board and a 3MP board in the same unit to do power measurements. MultiSmart can monitor single phase supply as well.

### 7.6.1 Insulation Resistance Tester

The 1000 VDC Insulation Resistance Tester is connected to the motor windings and periodically tests them for insulation breakdown. See Section 17.2 for details on how to configure the tester.


Figure 60 - Connecting the IRT
Insulation resistance measurements are only performed when the motor is stopped. Therefore the motor windings must be connected in a star or delta configuration when it is stopped in order to ensure all windings are tested. The MultiSmart can be set with two thresholds for the Insulation Resistance Test, one for a warning message, the second for a fault message. The default setting of the IRT warning does not stop the pump whereas the IRT fault message does stop the pump.
Wire one winding from each motor controlled by the MultiSmart pump station manager.
Connect the Protective Conductor Terminal, to earth/ground.
NOTE: Follow the manufacturer's guidelines regarding motor insulation testing when using soft starters and VFDs. Functionality is included in the MultiSmart software so that a DOUT can drive isolation contactors while IRT is in progress - refer to Section 17.2.2.

### 7.6.2 Digital Volt-Free Outputs

The board has five isolated volt free outputs rated for 5 A at 240 V AC.


Figure 61 - Digital Volt-free Outputs

### 7.6.3 Current Inputs

The Energy Monitoring and Motor Protection Board has three sets of three-phase current inputs. These inputs measure between $0-5 A$ and are connected to the secondaries of external CTs to measure higher currents. The CTs must be wired with the correct polarity and ensure that the current phase corresponds to the voltage phase. Shielded twisted pair cable is recommended between the CTs and MultiSmart. The shield ground can be connected at either the MultiSmart end or at both, the MultiSmart and the CT, depending on the predominate interference - electrical or magnetic.


NOTE: If the CTs are wired such that the polarity is wrong, the current reading will be correct, however the power and energy calculations will be incorrect as the power factor will be zero.


NOTE: The CTs must not be grounded / earthed. Otherwise incorrect current readings will be measured.
When selecting CTs, consider the MultiSmart input resistance (around $40 \mathrm{~m} \Omega$ ) and the resistance of the copper wire used in the installation. To avoid losing accuracy of the current readings, do not burden the CTs.


Figure 62 - Current Inputs per Motor

### 7.6.4 Analog Output

The energy monitoring/motor protection board has 3 analog outputs which produce a $4-20 \mathrm{~mA}$ output signal.

- Maximum Load (Impedance) - 800 ohms
- Resolution 0.2\%
- Non-isolated


Figure 63 - Analog Output

## 8 PumpView Hardware Setup

PumpView is a web-based monitoring and control system. There is no software to install and no server or radios are required. All that is needed is a web browser (with internet access) and a cellular / mobile based connection at the site(s). While primarily aimed at the water and wastewater sector, it can be used in a variety of industries.

Once the hardware is installed and the MultiSmart configured, the site can be monitored and controlled via the web. Faults can be configured to generate alarm messages and users notified by email and/or SMS.


## CAUTION:

To avoid damaging the modem, always have the antenna connected before applying power to the modem. Failure to do so may result in damage to the modem.

NOTE:


The antenna must be installed outside the panel. A standard omni-directional antenna as supplied by MultiTrode (smooth cylinder or rod with no protrusions) should be mounted vertically, such that the cable exit point is directed towards the ground. This will ensure correct operation and prevention of water ingress into the antenna. Antennas are unlikely to function if they are directed horizontally. Ensure the cable is not kinked or bent tighter than a 25 mm (1") radius.

Using the RS232 cable provided, connect the modem to the MultiSmart unit on serial 3 (as shown in Figure 60).


Figure 64 - Connecting the PumpView modem to MultiSmart

### 8.1 Fault Finding

For the Sony Ericsson, Wavecom and SAM 3G modems (except for the SAM 3G Plus modem), an LED on the modem flashes when power is applied and the device is communicating (it may take a few minutes to establish communications).
If the LED is on but not flashing, this means it cannot connect to the cellular network. If you have previously determined that there is adequate signal strength for this site, it may indicate a temporary cell tower problem. However, it is more likely to indicate that there is a signal strength problem at this location. Possible solutions are:

- Using a higher gain antenna
- Installing the antenna at a higher point


### 8.2 Configuring PumpView for a Serial Cellular Modem

The following setup is typically completed prior to shipment but circumstances may arise when this procedure must be performed on-site. From the factory, a PumpView serial modem is configured to use Serial 3.
Navigate to: Settings $\rightarrow$ More $\rightarrow$ Communications $\rightarrow$ PumpView


Figure 65 - Modem Setup Screen for Serial Modem
This screen allows the user to configure a cellular modem for use with PumpView - MultiTrode's hosted Website - or for general DNP3/Modbus over a cellular network. A number of modems are supported. A username and password for access onto the cellular network is required by some of the communication carriers. PumpView setup procedure:

- Enable PumpView - tick the checkbox
- Enter the 4 digit Site ID (this is supplied by MultiTrode)
- Select the modem (based on the Telco and the modem brand)
- Depending on the Telco, a Username may be needed. The text "Username:" will appear on the left hand side if a username is required.
- The username has the format: pv[Site ID]@multitrode.com where [Site ID] is the same as the 4 digit number previously entered above, e.g. pv1009@multitrode.com
- Press the Edit button to change or to enter a Username, then press Save
- The Password should not be changed from the default (displayed as xxxxxxxxx)
- Press Save and then Restart Later

The serial port that the modem is connected to must be selected. This is done in the Advanced settings in the PPP2 Manager module. The PPPM (point to point protocol manager) is the module which handles cellular communications. Navigate to this module.


- Under Comms Channel select a serial port - for example Serial 3.
- Press Save and then Restart Now

The MultiSmart will reboot and cellular communications should be established within a few minutes.

NOTE: From firmware version 1.4 onwards the original pppm module was replaced by pppm2. If you purchased your MultiSmart prior to the v1.4 release, you can contact MultiTrode for a free enable code upgrade from pppm to pppm2 for improved modem and cellular handling.

### 8.3 Configuring PumpView for an Ethernet Cellular Router

The following setup is typically completed prior to shipment but circumstances may arise when this procedure must be performed on-site. A Cellular Router is connected to the Ethernet port on the MultiSmart via a crossover cable.

1. Select the Ethernet Modem

Navigate to:


More Communications PumpView


- Enable PumpView - tick the checkbox
- Enter the 4 digit Site ID (this is supplied by MultiTrode)
- Select Ethernet Modem
- Press Save and then Restart Later

Figure 66 - Modem Setup Screen for Ethernet Modem

## 2. Configure the DNP Slave

There may be more than one DNP3 slave present. The PumpView related DNP3 slave will have the channel TCP/IP3.

Navigate to:


More Communications Protocol Settings

- Highlight the correct DNP Slave \& press Select


Figure 67 - Selecting PumpView Protocol

NOTE: The Site ID can be found at the end of the URL. Visit the PumpView website, select the site of interest. The Site ID is the last 4 digits that appear at the end of the URL. (The URL or website address is located at the top of the web browser). Example: http://www.pumpview.com/t3000/...\&siteld=1234

## 3. Enter the TCP/IP Channel Information

- Press the Channel button \& enter the channel information and press Save

- Connection Type = UDP
- Dest IP Address = 166.212.251.240
- Local UDP Port $=20010$
- Dest UDP Port = 20010
- Keep-alive Timeout $=600$

Figure 68 - TCP/IP 1 Parameters
4. Enter the IP Address and Subnet Mask into the MultiSmart.
Settings $\rightarrow$ More $\rightarrow$ Communications $\rightarrow \mathbb{I P}$ Address

The subnet mask must allow for communications to the router. The MultiSmart must be on the same subnet as the router. If the router's IP address is A.B.C.D with a subnet mask of 255.255.255.0 then the MultiSmart must have an IP address of A.B.C.x where $x$ is unique on the subnet. For example, if the router's IP address is 192.168.1.230, then MultiSmart IP address should be 192.168.3.x.

## 5. Enter the Gateway and Netmask.

Settings $\rightarrow$ More $\rightarrow$ Communications $\rightarrow$ Routing

The router is the default gateway for the MultiSmart unit. Enter the routing information and press Add and Restart Now.


- Enter the IP address for the router in the New Gateway field
- Enter the subnet mask for the router in the New Netmask field
- Leave the New Target field empty

Figure 69 - IP Routing Table
If an incorrect Gateway is displayed in the Existing routing entries table, it can be deleted by highlighting it and then pressing Delete.

## 9 Quick Commissioning Guide

MultiSmart is fully configurable from the LCD user interface. However, there is also a PC-based configurator program with sophisticated functionality now available.

The MultiSmart is pre-programmed with a number of standard configurations for typical water/wastewater applications. These include:

- Pump station manager with local level
- Pump station manager with remote level (reservoir)
- Reservoir monitor communicating with remote pump station

The Setup Wizard in the Settings menu takes you through a number of questions to configure the product.

## Settings $\rightarrow$ Setup Wizard



NOTE: If the unit has already been setup by a previous user, then security may be enabled via a DIN or by a PIN number. Refer to Section 11 for more detail.


Figure 70 - Settings Screen
When a pump station manager is selected, this also establishes one of the standard I/O connection diagrams (see Section 7.2 to Section 7.2.4). The MultiSmart pump station manager establishes 1 of 4 standard connection diagrams, depending on whether the configuration is:

- 2 pumps with a MultiTrode Probe / Duo probe
- 3 pumps with a MultiTrode Probe / Duo probe
- 2 pumps with a $4-20 \mathrm{~mA}$ level device
- 3 pumps with a $4-20 \mathrm{~mA}$ level device

These connections diagrams have a complete set of pump faults wired in (contactor auxiliary input, C/B off trip, pump seal and thermal (or Flygt FLS), thermal overload).


NOTE: Disabling any faults not required is a very simple task - see Section 9.3 at the end of the Quick Commissioning Guide.

### 9.1 Setup Wizard Flow Diagrams

The following diagrams outline the steps taken to complete the Setup Wizard.

### 9.1.1 Wizard Start



Figure 71 - Setup Wizard - 1 of 4

### 9.1.2 Pump Station Setup



Figure 72 - Setup Wizard - 2 of 4

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### 9.1.3 Reservoir Setup



Figure 73 - Setup Wizard - 3 of 4

### 9.1.4 RTU Setup



Figure 74 - Setup Wizard - 4 of 4

### 9.1.5 Advanced Setup after setup wizard

Once Setup Wizard is complete, the unit reboots and the product is configured for basic operations. Users then have the option of configuring some additional options as part of the initial setup, and they are prompted as to whether they want to configure these additional settings. If the user selects "No", these additional settings can be configured at any time from settings menus (if required). If the user selects "Yes", the user is redirected to a few more settings screens where additional options such as Flow Settings, Motor Protection Settings, VFD Settings and Station Optimization Settings can be configured. Once these additional configurations are complete, the user is prompted for a reboot and after the reboot, the unit is ready for operation.
See Section 20 for more information about Flow Settings.
See Section 17 for more information about Motor Protection Settings.
See Section 23 for more information about VFD Settings.
See Section 16 for more information about Station Optimization Settings.

### 9.2 Setup Wizard Notes

### 9.2.1 Key Setup Wizard Parameters

While many of the parameters specified during the Setup Wizard can be modified (if necessary) at a later date through other menus, some key setup parameters can only be changed through the Setup Wizard, so it's important that these parameters are correct the first time.
The Setup Wizard can be run any number of times, but each time it clears the memory, such that any other configuration changes are lost and must be re-entered (if still required). The key setup parameters are listed below.

| Key Setup Parameter | Options |
| :--- | :--- |
| Station Type | Pump Station, Reservoir, RTU |
| Station Mode | Fill, Empty |
| Number of MultiSmart Units | $1-3$ |
| Board in Bottom Slot | $3 P C, 3 M P$, None |
| Number of Wells | $1-3$ |
| Number of Pumps | $1-9$ |

Table 5 - Key Setup Parameters (can only be modified through the Setup Wizard)

### 9.2.2 Activating New Modules

Each MultiSmart unit comes with certain modules enabled. New modules are activated with a new site key. New site keys can be entered at any time when new modules need to be activated.

### 9.2.3 Fill (Charge) or Empty (Discharge) Modes

A pump station can be configured to either Fill (Charge), or Empty (Discharge) the well.

### 9.2.4 Number of MultiSmart Units in Installation

Multiple MultiSmart units can be connected together using the CAN Bus interface. This allows additional I/O to be added to the station if required. A "unit" is defined as a separate DIN mounted housing containing one DSP Board and at least one other board (such as a 3PC Pump Control Board, for example).

### 9.2.5 Configuring the Type of Board Located in the Bottom Slot

There are four board slots in a MultiSmart unit. By setting what type of board is located in the bottom slot, the setup wizard can determine the correct I/O configuration for the unit.

### 9.2.6 Number of Wells in Station

A station can have up to three wells.

### 9.2.7 Level Devices

There is a choice of Probe (MultiTrode conductive probe), DuoProbe (MultiTrode conductive probe with pressure transducer, Analog (e.g. Pressure transducer or ultrasonic) or Remote Level. Remote level is typically used where the pump station is pumping to a reservoir.

NOTE: If later it becomes necessary to change the level device, there is no need to go back through the setup wizard, simply see Section 14.8.

### 9.2.8 Number of Pumps in each Well

If more than one well is configured, consecutive prompts are displayed requesting the number of pumps in each well.


NOTE: The number of pumps available for the system is limited to 3,6 or 9 depending on the software and hardware options purchased.


NOTE: If more than 3 pumps or more than 1 well are selected during the Setup Wizard, then no I/O defaults will be applied.

### 9.2.9 Select Fault Input Sensor Type

The digital inputs can be setup to handle either a Flygt FLS sensor, or a Thermal/Seal type sensor direct from the pumps.


NOTE: This specific pump fault input is identified because the FLS uses one input, whereas a typical thermistor/seal combination uses two inputs. The answer to this question establishes a default connection diagram

If the pumps have neither a Flygt FLS sensor nor a Thermal/Seal type sensor, choose None. (After the MultiSmart is configured, it may be necessary to unassign some of the default digital inputs or faults that are not used in the panel. Refer to Section 9.3 at the end of this Quick Commissioning Section).

### 9.2.10 Configure Phase to Phase Voltage

A phase to phase pump supply voltage is required in order for the voltage protection functionality to work correctly. Either select one of the options, or enter a custom voltage. The over-voltage, under-voltage and phase fail thresholds are then automatically configured.

To modify the threshold settings after the setup wizard is completed, go to:
Settings $\rightarrow$ More $\rightarrow$ Supply Protection and select the parameter to modify (see section 18).

### 9.2.11 Choose DNP3 Configuration (Reservoir Setup Only)

One of three standard DNP3 configurations must be chosen when setting up the MultiSmart as a Reservoir monitor. The selected configuration sets the method of communications between the reservoir and the remote pump station.

Configuration B is the preferred method. It sets up the DNP3 configuration for situations where a direct communications link between the pump station and reservoir station exists.
Configurations $A$ and $C$ are used where a direct communications link is not present. Instead, these configurations setup the MultiSmart to receive the level via a DNP Master (MTU).

See Section 21 for more information.

### 9.2.12 Accepting New Configuration \& Resetting Controller

The final commissioning screen displays a summary of the major settings entered. Check the configuration carefully and press the Yes button if it is correct. All current settings are replaced by the new configuration. The controller restarts with the new settings. This process takes a few minutes to complete.

### 9.3 Unassign Any Faults Not Used

To speed up the process of establishing a new station, four standard configurations are used. These include a number of useful pump faults, some of which may not be needed or not available in the station.

NOTE: Some of the standard configurations include a contactor auxiliary input for each pump. If no contactor auxiliary is connected to this input, a pump fault will be displayed but the pump will continue to run. If not used, this fault should be unassigned.

To unassign any fault inputs, go to:


This screen shows what DINs have been assigned:


Figure 75 - Digital Input assignments
Select the Faults option button: $\square$ This screen identifies all faults that have been pre-configured in the system, along with any that are currently linked to digital inputs.


Figure 76 - Pre-configured Faults
Select the required fault to be unassigned, and press the Unassign softkey. Repeat this process for any other faults to be unassigned, and then press the Save button.

For certain faults which are assigned or unassigned, the MultiSmart needs to be restarted. If a restart is necessary, the following prompt is displayed. Select the desired option, keeping in mind that a restart is required before those changes come into effect.


Figure 77 - Reboot Options

Choose Restart Now if all the faults have been configured. Choose Restart Later to continue making further changes without again being prompted for a restart. If Restart Later is selected, a fault appears in the fault list which can only be cleared with a MultiSmart restart. This is to ensure that the user doesn't forget to do the final restart.


Figure 78 - Restart Screen

### 9.4 Level Simulation Mode

### 9.4.1 Simulating Levels for Safety/Commissioning Purposes

The pump station manager can simulate levels for safety or commissioning purposes. This function allows the level to be increased or decreased in $1 \%$ steps from the keypad. Use this feature to test the control panel before it is installed at the pump station.

Navigate to the Level Simulation screen:


Figure 79 - Simulating Levels

- Press the Level Simulation button.
- The time remaining starts counting down. Simulation mode automatically turns off at zero.
- Press the Home key.
- Use the up and down arrows on the keypad to raise or lower the simulated level.
- When the tests on the station are complete, either let the level simulation time out, or go back to the level simulation page and press the Level Simulation button to turn it off.


Health and Safety Feature: This feature allows operators to test pump and alarm levels without having to open the pit cover to move the level sensing device.


WARNING: The pumps respond to the simulated level exactly as they would to a real level.
Therefore, it is possible to run the pumps with no actual liquid IN THE WELL, thereby running the pumps dry and damaging them.

### 9.5 Maintenance Mode

When a unit is placed into Maintenance Mode, all controls from SCADA via DNP3 and Modbus are disabled. This provides a level of isolation for operators, for example preventing remote control of pumps. (Local control is not affected).
Additionally, all of the tags sent to SCADA by DNP3 are be flagged as suspect (not by Modbus because Modbus tags do not have this capability). This means the SCADA system can be programmed not to create alarms from this station while in maintenance mode.

An event is generated for maintenance mode when activated (if it exists in the DNP3 points list) and the status will be received by the SCADA system.

There is an option to accept commands from SCADA and send data and alarms even during the maintenance mode. This can be set in the Advanced menu.


Setting this tag to true allows the MultiSmart to accept controls from the SCADA system while in maintenance mode.


Setting this tag to true will send data and alarms to SCADA while in maintenance mode.
Data sent from the MultiSmart while in maintenance mode is marked as 'out of service'. Based on this flag and the 2 tags described above, SCADA can decide what actions to take and what alarms to trigger.

The main operator screen (the home page) displays a flashing MAINTCE indication in the level bar graph while the unit is in maintenance mode.
Pressing the Configure button displays the Simulation/Maintenance Mode Config screen. In this screen, the duration of maintenance mode can be configured. The three options are:

- Mode (On) - remains in maintenance mode for the preset time
- Always? - remains in maintenance mode indefinitely
- Duration hh:mm - user entered duration (to access, press the down arrow key 3 times)


Figure 80 -Level Simulation / Maintenance Mode Screen
Use the up/down arrows on the soft-keys to navigate to the appropriate field. When a checkbox is highlighted, the right-hand soft-key changes to a Toggle option. When the Duration field is highlighted, a new duration in hours and minutes can be entered via the keypad. Pressing the Add button (right-hand softkey) adds the current preset time interval to the countdown.
If the Always box is checked, the unit will stay in maintenance mode until an operator manually changes the state via the Maintenance Mode button.

If the Always box is unchecked, the unit will count down using the value set in the Time Remaining field or until an operator turns off the feature using the Maintenance Mode button (in the previous screen).
The Maintenance Mode state is retained after a restart of the unit.

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## Part 3 - Advanced Settings

## 10 High Level Overview

### 10.1 MultiSmart Pump Station Manager Overview

The MultiSmart Pump Station Manager has a large range of features and functionalities built in, some of which are shown in the figure below. Functionality wise, MultiSmart can be considered as a Pump Station Manager and an RTU integrated together. MultiSmart can handle all the common water and sewage pump station applications, but its capabilities are not limited to that. MultiSmart has support from PLC functionality, thereby allowing further advanced requirements to be met.


Figure 81 - MultiSmart Pump Station Manager Overview

### 10.2 Pump Station Manager

The Pump Station Manager module provides all the logic to control and monitor water and sewer pump stations. In conjunction with the LCD module (and the LCD itself), it provides a complete operator interface for control, monitoring and commissioning.


Figure 82 - Pump Control Functionality Overview

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### 10.3 Reservoir Monitor

The MultiSmart can also be configured as a Reservoir Monitor. In this mode there are no pumps to control, so all functionality related to pumps and groups are unavailable. All remaining functionality is the same as for the Pump Station Manager Module.


Figure 83 - MultiSmart Reservoir Monitor Overview

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### 10.4 Pump Control Module

### 10.4.1 Pump Modes

Three pump modes exist for each pump controlled by the MultiSmart Pump Station Manager. They are Manual, Off and Auto.
If Manual (Hand) mode is selected, the pump turns on unless the pump is faulted or unavailable. It returns to Automatic mode when the deactivation setpoint is reached.

In Off mode, the pump does not start unless put into Manual or Automatic modes, even when the activation setpoint is reached.

In Automatic mode, the advanced pump control module takes over the duties of starting and stopping the pumps.


NOTE: The Off mode can be disabled (skipped), if desired, from the advanced settings menu. As a safety measure, when this feature is turned off while the pump is already in Off mode, it will remain in that state until the mode is change.

### 10.4.2 Fill / Empty \& Pump Setpoints, Alarm Setpoints, Delays

Emptying or filling a well is supported along with multiple wells, either independent or balanced (however all wells must be of the same type - empty or fill). Each mode has a default set of activation/deactivation points for pumps and alarms. Four level alarms are supported for each well (where more than one well exists), with the ability to disable/enable any alarm. Each level alarm has an activation and deactivation point. Activation and deactivation delays are supported for each pump, as well as inter-pump delays. (See Section 12 for more information).

### 10.4.3 Pumps \& Groups

A single MultiSmart unit can support up to 6 pumps (depending on the configuration), which can be assigned to more than one well if required. Multiple groups of pumps are supported. Typical applications for groups are jockey pumps and flood pumps. Within a group, pumps can alternate or be in fixed sequence, and maximum pumps running can be set. Groups of pumps can be alternated or in fixed sequence, and a maximum number of groups running can also be set.

Some configuration parameters for pumps relate to whether they are the lead (duty) pump or the lag (standby) pump. This capability is supported in the pump control module - parameters can relate to the pump position in the alternation sequence rather than the physical pump, e.g. activation and deactivation delays. See Section 13 for more information.

### 10.4.4 I/O, Faults \& Level Devices

Inputs and Outputs (I/O), Faults and Level Devices are closely related. They all work together to provide the functionality required to run a pump station.

- I/O

General purpose I/O can be used to interface to a wide range of devices. Digital outputs are used (via contactors or soft starters) to start and stop pumps, and to switch external hardware such as solenoids, mixers or beacons. Some digital inputs have extra capabilities for interfacing to devices such as Flygt CLS sensors.

- Faults

Faults can be assigned to both digital and analog I/O. Inputs are used to detect faults within the pump station, such as pump related faults.

- Level Sensors

The pump control module supports multiple level sensors, including 4-20mA analog sensors (e.g. pressure transducer, ultrasonic), MultiTrode conductive probe and ball floats. Support for redundant level sensing is built-in.
See Section 14 for more information.

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### 10.4.5 Profiles

The pump control module supports six (6) profiles. Each profile consists of pump activation/deactivation setpoints, as well as four station optimization functions (Max Off Time, Max Run Time, Station Max Pumps to Run \& Well Clean Out). Profiles can be switched via any of the following methods: (See Section 15 for more information).

- User interface
- SCADA
- A timer (e.g. time of day)
- Digital input (e.g. a switch on the panel) or any digital tag (e.g. an alarm condition)
- Logic engine script or ISaGRAF program


### 10.4.6 Station Optimization Functions

Many desirable functions are pre-defined, with the user simply enabling/disabling or choosing parameters for the functions. These functions include:

- Pump Reversal (to avoid blockages)
- Odor Reduction (via maximum off time)
- Maximum Run Time
- $\quad$ Station Maximum Pumps to Run (for electrical or hydraulic overload protection)
- Minimize Fat Buildup (via random duty start)
- Well Clean Out
- Minimize Excessive Starts
- High Inflow
- Well Washer
- Well Mixer
- Blocked Pump Detection
- Pump n Max Starts per Hour

See Section 16 for more information.

### 10.4.7 Watchdog

The pump control module includes a watchdog function which counts up while the pump control module is functioning. This value is available as a tag in DNP3 and Modbus so that a SCADA system can monitor the health of this module.

### 10.5 Energy Monitoring and Motor Protection

An optional Energy Monitoring Motor Protection module in conjunction with a Motor Protection card can be supplied with the MultiSmart pump station manager. The module monitors currents and provides protection from:

- Over and Under Current
- Over Current $I^{2} T$
- Current Phase Imbalance (or Phase Failure)
- Current Phase Rotation
- Ground (Earth) fault

This module also periodically tests the insulation resistance of the motor windings. Two user defined thresholds can be entered one for a warning message and a second for a fault message, neither or both can be configured to fault a pump if the IRT value falls below the thresholds.

A Pump Efficiency Warning is also available which displays a warning if efficiency (in say L/kWh) falls below a threshold.

### 10.6 Supply Protection

The Pump Control I/O Board monitors the three phase supply through the "Mains Voltage Monitoring" inputs. Single or 3 phase supplies can be monitored by the MultiSmart. The voltage is constantly measured and is used to detect the following conditions:

- Under \& Over Voltage
- Voltage Phase Imbalance (or Phase Failure)
- Voltage Phase Rotation


### 10.7 Data Logger

The MultiSmart unit has a datalogger. The logged data can be downloaded onto an SD card or USB and then transferred to a computer and viewed via Excel, Access, or any other reporting/database tool. The datalogger stores approximately 100,000 events and faults, but this can be significantly increased by logging data to an SD card instead. Each event or fault is date/time stamped. See Section 19 for more information.

### 10.8 Flow

The flow module is used to calculate inflow, pump flow rates and total station volume. This allows flow to be derived without needing a flow meter. See Section 20 for more information.

### 10.9 Fault Module

The fault module handles pump and station faults. Many pre-defined faults exist, e.g., thermal overload, contactor auxiliary and Flygt FLS. A fault only needs to be assigned to an I/O (within the configuration) to begin to function. New faults can also be defined. Any fault can be configured to lock out a pump, well or station until a manual (or SCADA) reset is performed. A fault can also be configured to allow the pump to become available when the fault clears, or after a deactivation delay.

### 10.10 Security

The MultiSmart can restrict access to the configuration menus and other screens. Each user is assigned a PIN which they enter before being allowed access. By enabling security, a user must log-in before making changes to the configuration and before accumulators can be cleared. Pump information (such as Runtime Statistics) can still be viewed without a PIN. An alternative method to log-in is via a digital input. A third method requires a Security or Dallas (iButton) key which is placed on a reader. User access rights are managed by an administrator. See Section 11 for more information.

### 10.11 PLC Extension (IEC 61131-3)

ISaGRAF, a control software environment which supports all of the internationally recognized IEC 61131 control languages and offering a combination of highly portable and robust control engine, is available in MultiSmart. MultiSmart currently only supports ISaGRAF version 5 and above. Earlier versions of ISaGRAF are not supported. See Section 24 for more details.

### 10.12 Logic Engine

A simple, Boolean, logic engine has been built into the MultiSmart to allow basic customization of control capabilities, thereby extending existing functionality or allowing new functionality to be added. It uses mathematical expressions which are evaluated at regular intervals to determine if they are true or false. The expressions are associated with a tag within the MultiSmart to create actions when an expression changes state. See Section 25 for more information.

### 10.13 RTU

The MultiSmart can be supplied with optional RTU capabilities. Supported communication protocols are Modbus and DNP3. The MultiSmart can also be shipped just as an RTU without any Pump Station Manager functionality or user interface. See Section 21 for more information.

The diagram below illustrates the extensive communication capabilities of the MultiSmart, even though in practice it is highly unlikely to use all of these in the same installation. MultiSmart can be interfaced with most industry standard equipment and SCADA networks.


Figure 84 - MultiSmart Communication Capability Overview

## 11 Security

The MultiSmart restricts access to the configuration menus and other screens by creating users. MultiSmart supports different levels of security for accessing the screens. Users gain access to the secure screens by either:

- Entering a PIN when prompted
- Activating a digital input (a key switch, for example)
- Placing a Security Key (Dallas iButton Key) on the reader

Each user is assigned a PIN or digital input access by an administrator.
The administrator user account is enabled and a password automatically generated by default at the factory before despatch. The administrator password can be changed from the Security Screen accessed from the Settings menus.

Security access for users is not activated until the first user has been configured. The administrator must go to the Security Screen in the settings menus and configure a user before security is enabled.


NOTE: The factory set security password can be found on the sleeve of the product manual CD.

NOTE: It is important the administrator password is kept in a secure location. If the password is lost, the unit may need to be returned to MultiTrode for re-configuration.

NOTE: The Admin user can use the admin password to enter secure screens. Press the admin button on the login page to use the Admin password.

The administrator is the only user allowed to add, delete or edit user accounts.
To access the security screen:

- Press Settings
- Go to page 3 of the settings screens and press Security
- Enter the administrator password and press Continue


Figure 85 - Security Screen

To edit, add or delete a user press Add/Remove Users
The following user settings can be edited:

- User ID
- PIN
- User Name
- User Group


Figure 86 - Edit User Security Details
In the user configuration screen, the user group can be chosen from the UserGroup drop down list, which contains all the groups defined in the system.

There is an encryption key defined in the MultiSmart for encrypting the security information before transferring to a remote location. This encryption key can be changed in Encryption Key screen.

To change the administrator password:

- Press Administrator Settings
- Enter a new password
- Press Save


Figure 87 - Change Administrator Password

To configure security to be activated by a digital input, press Security via Digital Input.

- Enable security via DIN by pressing the Toggle button
- Select a digital input tag. By default, this is set to DIN 20 on the top board. Any digital tag in the system can be selected, allowing greater flexibility than just using Digital Inputs. To choose another Digital Input, simply use the tag browser to find the appropriate DIN, and choose ValueDigital (see Figure 85 and Figure 86 in Section 11.1 below).
- Press Save


Figure 88 - Configure Security via DIN

### 11.1 Selecting any Digital Input Tag

The screens below show how to navigate to any digital input tag.
Find the IO Module in Advanced and using the $+\digamma$ button, expand out the tree view to get to the Digital Input you are looking for.


Figure 89 - Tag browser screen


Figure 90 - Tag browser screen -continued.
Once you have found the Digital Input (DIN) you are looking for, expand the selection using the $++/-$ button, and scroll down to ValueDigital and press OK.

NOTE: The tag browser gives you access to any tag in the MultiSmart unit, including tags generated by the logic engine.

### 11.2 Security Key Setup

The Security (or Dallas) key allows a quick and easy method of accessing the MultiSmart whilst maintaining a high level of security, as only those users with a Security key (in which the Administrator has registered the PIN) can gain access the MultiSmart menus.

The Security key module is a separate software module which can be enabled after purchase.

### 11.2.1 Initial Hardware Setup

To enable the Security key reader:

- If not purchased with the MultiSmart, enter the new Site Key provided by MultiTrode (See Section 9.2.1 for procedure).
- Connect the Security key reader to the iButton port.


### 11.2.2 Adding Security Key Users

The Administrator must now create a user that matches the PIN of the Security key. This procedure differs slightly compared to a PIN only user as PIN details are automatically entered.

- Navigate to the Security screen

- Enter the MultiSmart Administrator password
- Press the Add / Remove Users button
- With the Edit User Details screen displayed, place a security key on the reader until the PIN is displayed on the screen. Then add other user details including User ID, User Name and Group.
- Press Back and Save.


### 11.2.3 Accessing the MultiSmart with a Security Key

The Security key must already be registered by the Administrator (see Section 11.2.2).

- Try to access a secure screen to display the 'Login' screen
- Place the Security Key on the reader until the menus are accessed
- If an unregistered Security key is read, the screen does not change
- If an invalid PIN is manually entered, an Access Denied message is displayed



## NOTE:

It is recommended that the Administrator maintains a record of all Security Key PINs registered. In the event the Security Key reader fails, a PIN can be manually entered via the key pad.

## NOTE:

The Security Key must make firm contact with the outer ring of the reader before it can read the key.

### 11.3 Accessing MultiSmart Without a Security Key

With security enabled, it is possible for an on-site operator to log into the MultiSmart without a security key (iButton or card).

There is an Lcd Login Override tag which can be set from SCADA. When this tag is set to true from SCADA, an on-site operator is able to access the unit without prompting to login. This tag is cleared back to zero and login is restricted when:

- The user navigates back to the main screen or
- The screen saver kicks in or
- The Login Override tag is manually reset to zero from SCADA.


## 12 Fill / Empty \& Pump Setpoints, Alarm Setpoints, Delays

### 12.1 Fill / Empty (Charge / Discharge)

This parameter is selected during the Setup Wizard, as described in Section 9.

### 12.2 Default Pump and Alarm Setpoints

The MultiSmart pump station manager has an activation and deactivation setpoint for each pump, and four independent level alarm setpoints: high, high-high, low, low-low, each with their own activation and deactivation points. In the case of multi-well mode, the alarm setpoints are replicated for each well.

The MultiSmart unit applies different default setpoints depending on whether fill or empty (charge or discharge) is chosen during the Setup Wizard.
There can also be multiple profiles - each with their own setpoints (refer to Section 15). For most applications, the default level settings should be appropriate for correct operation of the installation.


Figure 91: Empty (Discharge) Mode—Default Normal Levels


Figure 92: Fill (Charge) Mode - Default Normal Levels

### 12.3 Changing Pump and Alarm Levels Setpoints

### 12.3.1 Limitations

The MultiSmart unit does not allow the user to set invalid activation and deactivation setpoints, for example:

- When in Empty (Discharge) mode the Lag (Standby) pump cannot be configured to activate or deactivate before the Lead (Duty) pump.
- When in Fill (Charge) mode the activation level for any particular pump cannot be higher than the level for the previous pump in the duty order. The deactivation level also cannot be higher than the previous pump in the duty order.


### 12.3.2 Setting Pump Setpoints

From the main screen navigate to the Level/Control Setpoints screen:


Figure 93 - Setting Pump Levels

- Use the arrows to select a pump
- Enter new values using the keypad
- Push the Save button to commit the changes
- If the settings are invalid, an error message is displayed

NOTE: If there are more than one well and if they are independent, the first set of Lead/Lag pump/s listed in this menu will correspond to the pumps in well 1 and the next set will correspond to the pump/s in the second well.

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### 12.3.3 Pump setpoints with two independent wells

The Setup Wizard allows the user to create a pump control configuration with more than one well. This section explains how to change pump setpoints when "independent wells" is selected (i.e. no hydraulic connection between the wells).

The standard pump setpoints screen is still used but certain rules are in place for normal operation which makes the setup for independent wells a little more difficult.
The following example is a 4-pump station with 2 pumps in well 1 and 2 pumps in well 2 .

- P1 and P2 are automatically assigned to well 1.
- The required start/stop points are $50 / 10$ for lead (duty) and $60 / 20$ for lag (standby) for both wells.
- $\quad$ The pump setpoint screen will be similar to Figure 89 - Setting Pump Levels (except with 4 pumps). Change the setpoints to 50/10, 50/10, 60/20, 60/20.
- Now go to the Alternation and Grouping screen (see Section 13.2), and while keeping the pumps in alternation mode, change the order of the pumps to P1, P3, P2, P4.
If the station operation is now tested, P 1 and P 2 are in well 1 and the start points are $50 \%$ for the lead pump, and $60 \%$ for the lag pump. Well 2 contains P3 and P4 and have identical start/stop points.

To enable or disable the Independent Wells options, navigate to:
Settings $\rightarrow$ Advanced $\rightarrow$ Pump Control $\rightarrow$ Independent Wells?

### 12.3.4 Setting Alarms Activation/Deactivation points

The Pump Station Manager provides four independent level alarms (per well if more than one well exists).

- High-High Level
- High Level
- Low Level
- Low-Low Level

The alarms operate the same for both Fill (Charge) mode and Empty (Discharge) modes. Any level alarm can be disabled using the Enable/Disable level alarms screen (see Section 12.3.5).

From the main screen navigate to the Alarm Levels screen:


Figure 94 - Setting Alarms

- Use the arrows to select an alarm
- Enter new values using the keypad
- Push the Save button to commit the changes
- If the settings are invalid an error message is displayed


NOTE: In the case of a configuration for more than one well, a well selector will appear in the upper left of the LCD screen.

### 12.3.5 Enable/Disable Alarms

From the main screen navigate to the Level Alarms screen:


Figure 95 - Enable/Disable Alarms

- Use the arrows to select an alarm
- Use the Enable/Disable button to select or unselect each alarm
- Push the Save button to commit the changes


### 12.4 Setting Pump \& Alarm Delays

Activation delays are used to prevent a pump or alarm from turning on when it reaches its activation level until the activation delay has expired. Deactivation delays do the same for turning off an alarm or pump. The unit also contains inter-pump delays to prevent two pumps starting or stopping within a predefined period of time. This can prevent water hammer and electrical overload. All pump and alarm activation and deactivation delays have a factory default setting. These may be adjusted as required.

Navigate to:
Settings $\rightarrow$ Set Points $\rightarrow$ Delays


Figure 96 - Pump and Level Alarm Delays

- Use the arrows to select an alarm.
- Enter new values, in seconds, using the keypad.
- Push the Save button to commit the changes.

This screen changes the delays for all profiles.

### 12.4.1 Inter-pump delays

There are four different delays that operate between one pump stopping or starting and a second pump starting or stopping.

- $\quad$ Start-Start (10s default)
- Stop-Stop (10s default)
- $\quad$ Start-Stop (5s default)
- $\quad$ Stop-Start (5s default)


### 12.4.2 Activation \& Deactivation delays for individual pumps

An activation and deactivation delay is present for each pump.

- $\quad$ Pump Activation Delay ( 0.5 s default)
- Pump Deactivation Delay ( 0.5 s default)


### 12.4.3 Activation \& Deactivation delays for level alarms

Each of the four level alarms have an activation delay ( 5 s default) and a deactivation delay (10s default).

- High-High Level
- High Level
- Low Level
- Low-Low Level


NOTE: Activation delays can be used to stagger equipment starts from a common level point.
Deactivation delays allow you to pump beyond the normal deactivation level for a set period of time.
NOTE: Activation delays can be used to prevent false alarm trips due to splashing or foam build-up, so an alarm will only be raised if the level is above the alarm level for a certain time period. Deactivation delays allow you to be sure the alarm condition has passed before clearing the alarm.

NOTE: The Pump Station Manager can be set up so that it periodically runs past the normal deactivation level for a configured time, to enable a full well clean-out. This is the well clean out mode in Station Optimization.

## 13 Pumps and Groups

The number of pumps is specified during the Setup Wizard. Depending on the hardware and software configuration purchased, the number of pumps is limited to 3 , 6 or 9 pumps.

Alternation of pumps is on and set to Alternation (std) by default. All pumps are placed into one group (and maximum groups to run is set to one).
The following eight alternation schemes are available for sequencing pumps within a group:

| Alternation (std) | The pumps alternate on each start. If a pump faults, the next pump in the cycle takes over. |
| :--- | :--- |
| Fixed (std) | The pumps do not alternate on each start. If a pump faults, the next pump in the cycle takes <br> over. |
| Alternation <br> Special | The pumps alternate on each start. If a pump faults, the next pump in the cycle does not <br> start until the activation point for that pump is reached. |
| Fixed Strict | The pumps do not alternate on each start. If a pump faults, the next pump in the cycle does <br> not take over until activation point for that pump is reached. |
| Pump Hours and <br> Pump Start | Options allow alternation based on hours and starts. This can be useful in special <br> circumstances. For example, a large 2-pump water station. Each day one pump runs for <br> about 4 hrs in the morning, and the other for around 1-2 hrs in the afternoon. So even <br> though they have alternation, P1 always runs in the morning and the hours run on P1 is <br> much higher than P2. |
| Efficiency | In this mode the pump alternation occurs with the most efficient pump being favoured. This <br> mode is especially useful where an old pump, scheduled for replacement, is coupled with a |
| new pump. The most efficient pump is run N times in a row before alternating the duty cycle |  |
| to the other pumps, this minimizing energy cost. The default of N is 10 and the most |  |
| efficient pump will be alternated once every 10 runs (this frequency can be changed in the |  |
| MultiSmart advanced mode). For the efficiency mode to be active, the pumps have to run at |  |
| least 10 cycles and the power efficiency data must be available for calculations. This mode |  |
| uses pump efficiency last week and this will not be active if the efficiency results are reset |  |
| or unavailable. See section 13.1.1. |  |

Table 6 - Alternation Schemes
Most installations use the first 2 options: Alternation or Fixed.
There are three alternation schemes available for sequencing between groups. They are Alternation (std), Fixed (std), and Alternation Special.

©
NOTE: The number of pumps is specified during the Setup Wizard and can only be modified by running the Setup Wizard again. Any configuration changes made must be re-entered.


NOTE: Efficiency alternation is based on the calculated efficiency for 'last week'.

To make changes to pump groups and alternation schemes, go into the Alternation and Grouping setup.


Figure 97 - Alternation \& Grouping Screen
This example screen shows that the 4 pumps are divided into 2 groups. Group 1 pumps are alternating. Group 2 pumps are fixed sequence, with pump 4 starting before pump 3. The Group Alternation is set to Fixed, which means that Group 1 always starts before Group 2.

### 13.1 Change Alternation \& Fixed Duty

Settings $\rightarrow$ Alternation \& Grouping $\rightarrow$ Pump Alternation

Choose the Pump Alternation option to change the alternation scheme. In the usual situation of only one group:


Figure 98 - Configuring Alternation Options
Simply select the new alternation scheme using the Alter arrows on the right and press Save. Some of the options produce additional options below the list. For example, if " $N$ to 1 " is selected, a box with: $\mathbf{N}$ to $\mathbf{1}$ ratio appears for user configuration.

If $\mathbf{N}$ to $\mathbf{M}$ is selected, the user saves this option then presses the Config button which appears on the right, and enters the values N and M in a new screen.

If there is more than one group, the screen has additional options:


Figure 99 -Changing Group Alternation \& Fixed Duty
Use the Group arrows on the left to select each group in turn, then the Alter arrows on the right to change the alternation scheme.

Press Save to apply changes and go back to the Alternation and Grouping screen. The summary now shows the changes made as the current settings.

### 13.1.1 Alternation by Efficiency

This feature can provide a valuable energy saving function, as the most efficiency pump will be run more often than the less efficient pump.
When Efficiency is highlighted two fields appear below the selection box:

- Efficiency Deadband
- $\quad N$ to 1 ratio

An arrow appears by the bottom left soft-key to move the selection between the main alternation options and these two parameters.

The Efficiency Deadband ensures that a marginally more efficient pump is not run in preference. When the efficiencies of the pumps are within the deadband, a secondary alternation scheme of Alternation (Std) is used instead. This ensures even wear between pumps with similar efficiencies.

Once outside of the efficiency deadband, the more efficient pump will be run as the duty pump N times for every one time the less efficient pump is run. N is defaulted to 10.

### 13.1.2 Alternation N to M

This feature allows the pumps to alternate based on the values of $N$ and $M$. For every $N+M$ calls of the duty pump, the lead pump will run $N$ times and the lag pump will run $M$ times. This can be extended to more than 2 pumps. Once $\mathbf{N}$ to $\mathbf{M}$ is selected and saved as the pump alternation mode, a Config button appears in the bottom right corner. When pressed, a new screen is displayed that allows the N to M ratio to be changed.
It can also be changed in the advanced screen:


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### 13.2 Moving Pumps Between Groups, or Changing the Order of Pumps

To move pumps between groups or to change the order of pumps (when they are in Fixed sequence), press the Assign Pumps button.


Figure 100 - Moving pumps between Groups and changing the order of pumps
Select a pump using the Select arrows and move it using the Move arrows. Press Save to apply changes.


NOTE: Moving pumps between groups requires a restart.

### 13.3 Adding or Deleting Groups \& Changing Group Alternation

To add or remove a group navigate to Group Settings.


Figure 101 - Add/Remove Groups Screen
To add a group, press the New Group button. To remove a group, press the Remove Group button.


NOTE: A particular group cannot be selected and deleted, rather the highest numbered group is always deleted. Adding or removing a group requires a restart of the unit.

### 13.3.1 Maximum Groups Running

Maximum Groups Running can be used to control the number of groups running when there is more than one group (default is 1 , i.e. only pumps in the same group can run).

For example, for an installation containing jockey pumps and flood pumps, it is usual to ensure the jockey pumps are never running at the same time as the flood pumps. To achieve this, go to Maximum Groups Running, enable Block running pumps and set the Quantity to 1.
These settings turns off group 1 (the jockey pumps) whenever group 2 starts (the flood pumps). This means the jockey pumps will never run at the same time as the flood pumps.

### 13.3.2 Pump Logic in Multi-well Mode

In the case of independent wells, the two wells simply operate as two independent entities with the pumps allocated to a particular well operating dependent on the level in that well.
In the case of hydraulically connected wells, the pump control module is more complex. If alternation is enabled (the default), each pump in turn will start regardless of which well it is in, based on the highest level in either well. Deactivation of a pump is dependent on the level in the well where the pump is located. This is to prevent problems with equalization between the two wells allowing a well to run dry while a pump is still operating.

### 13.4 Decommissioning Pumps

Individual pumps can be decommissioned. This prevents the pump from running under any circumstances, and also displays a "Decommissioned" notice under the pump on the main operator display. To decommission a pump, navigate to the Commission/Decommission Pumps screen:


Figure 102-Decommissioning Pumps

- Select the pump to be decommissioned using the arrow buttons.
- Press the Decommission button.

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## 14 Configuring I/O, Fault \& Level Devices

The MultiSmart unit can interface directly to a wide range of Input/Output, Fault and Level devices. Connection diagrams for these are described in Section 7.2. This section describes how to configure these devices on the pump station manager itself.

### 14.1 Digital Inputs

Various types of devices can be connected to DINs. Some inputs have special functions for particular purposes. These are summarized in Sections 7.3, 7.6 and 14.4. To view the current digital input configuration, navigate to the Digital Inputs screen:


Figure 103-Digital Input Assignments
To change the I/O configuration go to either the Faults or General screen:

- Faults - Used to assign/unassign a particular type of fault such as pump seal fault.
- General - Allows the description of the input (i.e. DIN 12) to be renamed.


### 14.2 Assigning Faults to Digital Inputs

Navigate to:


The predefined faults that can be linked to a digital input are listed below.

| Generator Running | Pump 1 Thermal Overload | Pump 1 Holdout |
| :--- | :--- | :--- |
| Generator Fault | Pump 1 Motor Over Temp | Pump 1 Not In Auto |
| Station Inhibit Override | Pump 1 CB Off/Trip | Pump 1 Inhibit Override |
| Station Manual Reset | Pump 1 Contactor Auxiliary | Pump 1 Manual Reset |
| Pump 1 CLS | Pump 1 Delay Fail | - etc, repeated for each pump |
| Pump 1 FLS | Pump 1 Critical | General faults 1-10 |
| Pump 1 Seal | Pump 1 Non Critical | Power Failure |

Table 7 - Digital Input Fault Sources


NOTE: For a full list of faults and their function, see Appendix A.


Figure 104 - Select a Fault

- Use the scroll buttons to highlight the type of fault input required
- Press the Assign button


Figure 105-Assign the Selected Fault to a Digital Input

- Use the scroll buttons to highlight a Digital Input.
- Press the Select button to assign this input to the selected fault.
- $\quad$ Select DIN Invert if the fault needs to be active when the input is Low (open circuit), else the fault will be active when the DIN is High (closed circuit).
- Press Back and repeat for each fault that needs to be assigned.
- Press Save at the end of the process.


NOTE: The Pump Holdout fault is hidden by default, so the "Fault" button does not flash when this fault is active. Instead, the text "Holdout" appears in the pump status section.

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NOTE: In order to make some changes, a reboot of the pump station manager may be necessary - a message will be displayed. It is recommended that all pumps are turned off prior to rebooting.

### 14.3 Unassigning Fault Inputs

Settings $\rightarrow$ I/O, Faults \& Level $\rightarrow$ Digital Inputs $\rightarrow$ Faults

Figure 106 - Fault Screen

- Use the scroll buttons to highlight the Fault to be unassigned.
- Press the Unassign button, (Cancel and Save buttons will appear).
- Press Back and repeat for each fault needs to be unassign.
- Press Save at the end of the process.


### 14.4 Configuring Digital Inputs

Navigate to the Digital Inputs screen and press the General button.


Figure 107 - Digital Input Configuration Screen

This screen only allows the description of the input (DIN 09) to be changed.

Advanced configuration options can be found in the Advanced menu. These options include changing the scaling, e.g. for a pulse accumulator such as a flow meter or rain gauge.

## Settings $\rightarrow$ Advanced

- From the tree select: IO Module $++/$ Unit ++-
- $\quad$ Select the correct unit (i.e. Unit 01) and press $+!-$
- Select which module the inputs are located (i.e.: TopBoard) then $+1-$
- Select Digital Input then $+1-$
- $\quad$ Select the digital input to configure (i.e. DIN 01) and press $+!-$


### 14.4.1 Advanced Digital Input Options

Navigating to the Advanced Digital Input options is shown in Section 14.4.
NOTE:
When faults are assigned to digital inputs, the digital input options are automatically set.

| Name | Description | Range/Type |
| :--- | :--- | :--- |
| Delay (ms) | The length of time the input must be present before it is considered <br> active. This can be used to add debounce and prevent spurious signals. | Integer |
| Description | Description of the input. This is the name shown in the Info / IO Module <br> screens. | Text |
| Edge Mode | Sets which edge of an input signal will trigger counting of the input. | Negative Edge <br> Positive Edge <br> Double Edge |
| Invert? | Changes the input between Normally Open or Normally Closed. <br> If False (unticked) the input is Normally Open. <br> If True (ticked) the input is Normally Closed. | True/False |
| Mode | Sets the input mode type. Various modes are available depending on the <br> capability of the input being configured. | See table <br> below |
| Probe (requires <br> 'Show More <br> Options' checked - <br> Section 31.1) | Sets whether this input is part of a multi-sensor conductive level sensor or <br> probe and which sensor it is connected to (for example sensor number 1 <br> in a 10 sensor probe). <br> Note: Go to the "Level Devices" screen to assign and configure the probe. | N/A |
| Scale Factor | Sets a scale factor for a pulsed counter such as a rain gauge or flow <br> meter. For example, one pulse might be equivalent to 5mm of water in a <br> rain gauge. |  |
| Sensitivity | Sets the input sensitivity in ohms. For example, a seal sensor sensitivity. <br> When a seal fault is assigned to a Digital Input, the sensitivity is <br> automatically set, but the value can be adjusted to meet specific <br> requirements. (Not applicable for High Speed and Digital Modes). <br> The sensitivity for the MultiTrode conductive probe is setup separately, <br> see Section 14.8.5 |  |
| Value Resistance | Used to set dead band parameters such as Type and Value. |  |

Table 8 - Advanced Digital Input Options

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NOTE: When a MultiTrode conductive probe is used, the sensitivity settings above for DINs are not used. Instead the overall setting for the probe is independently used. See Section 14.8.7 for more detail.

Digital Input configuration - for reference only:

| Type of Input | Mode | Typical Sensitivity or Range | Invert? |
| :--- | :--- | :--- | :--- |
| Conductive Probe | AC | $20,000 \Omega$ | No |
| Seal Sensor (conductive) | AC | $40,000 \Omega$ | No |
| Flygt CLS | CLS | Seal $>4 \mathrm{k} \Omega$, Thermal $<1 \mathrm{k} \Omega$ | No |
| PTC Thermistor | DC | $3,000 \Omega$ | Yes |
| Flygt FLS | DC | Seal $>4 \mathrm{k} \Omega$, Thermal $<545 \Omega$ | No |
| Normal Volt Free Contact Closure | Digital | 4 Hz | No (default) $/$ Yes (N/C) |
| Failsafe Probe Sensor | Fail Safe | $4,000 \Omega$ | No |
| High Speed Counter | High Speed | 1 kHz | No (default) $/$ Yes |

Table 9 - Digital Input Mode Examples

### 14.4.2 Digital Input Summary Table

This table summarizes the capabilities of the digital inputs on the Pump Station Manager (3PC) board:

| DIN\# | Volt Free Input | PTC Thermistor, Seal Sensor, Flygt FLS | Conductive Probe | Low Speed Counter ( 4 Hz ) | High Speed Counter ( 1 kHz ) | Flygt CLS | Fail Safe Probe |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Mode | Digital | DC | AC | Digital | High Speed | CLS | FailSafe |
| 1 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  | $\checkmark$ |
| 2 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 3 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 4 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 5 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 6 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 7 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 8 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 9 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 10 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 11 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 12 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 13 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 14 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 15 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |  |
| 16 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  | $\checkmark$ |  |
| 17 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  | $\checkmark$ |  |
| 18 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  | $\checkmark$ |  |
| 19 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |
| 20 | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ | $\checkmark$ |  |  |

Table 10 - Digital Input Capabilities

### 14.5 Configuring Analog Inputs

Navigate to the Analog Inputs screen, select an input and press the General button.


Figure 108-Analog Input Configuration

## Settings $\rightarrow$ I/O, Faults \& Level $\rightarrow$ Analog Inputs $\rightarrow$ General

This screen allows the AIN to be zeroed and spanned, as well as the description of the input to be changed. (This description appears in the Info screens, in Section 14 Configuring I/O, Fault \& Level Devices.) Advanced configuration options can be found in the advanced menu.

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NOTE: In most cases, the default settings will be suitable. Only make changes in the advanced menu if you have a good understanding of analog sensors and their configuration.

## Settings

 Advanced- From the tree structure select: IO Module $++I$ Unit ++-
- Select the correct unit (i.e. Unit 01) and press $+1-$
- Select which module the inputs are located, i.e. TopBoard then
- Select Analog Inputs then $+1-$
- Select the appropriate analog input (i.e. AIN 01) to configure and press $++1-$

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### 14.6 Advanced Analog Input Options

| Name | Description | Range/Type |
| :---: | :---: | :---: |
| Delay (ms) | This delay is used as a low pass filter. | 0-100000ms |
| Description | Description of the input. This is the same item as the one shown on the General IO Module Configuration Screen. | Text |
| Enable Over Range? | Sets whether the Over Range feature is enabled or disabled. | True / False |
| Enable Under Range? | Sets whether the Under Range feature is enabled or disabled. | True / False |
| Over Range Delay (sees) | The time to wait after the Over Range Set Point has been reached before an over range event is generated. | 0-120s |
| Over Range Set Point (\%) | This is the set point for over range detection. | 0-100\% |
| Under Range Delay (sec) | The time to wait after the Under Range Set Point has been reached before an under range event is generated. | 0-120s |
| Under Range Set Point (\%) | This is the set point for under range detection. | 0-100\% |
| Value | This sets advanced parameters affecting the value produced by the analog input. These include: <br> Deadband <br> Raw Max <br> Raw Min <br> Scaled Max <br> Scaled Min |  |

Table 11 - Advanced Analog Input Options

### 14.7 External Digital \& Analog Modules

If an I/O unit has Modbus or DNP3 capabilities, then a MultiSmart unit can be configured to communicate to the device. The configuration will usually require custom engineering, increasing the effort required for integration.

To speed up this process, certain I/O units have been selected as standard MultiSmart solutions. MultiSmart has wizard functionality which can be used to greatly simplify configuration. Once configured, these analog inputs, digital outputs and digital inputs are listed in the respective LCD screen menus wherever the corresponding MultiSmart I/Os are displayed. Hence they can be assigned to any faults or configured to use with other functionality in the unit using the same procedure as that for native MultiSmart I/O.

Currently, this wizard functionality supports the following units:

- ADAM-4017+ - RS485, $8 \times$ AIN
- ADAM-4051 - RS485, 16 DIN
- ADAM-6017 - Ethernet, $8 \times$ AIN, $2 \times$ DOT
- ADAM-6050 - Ethernet, $12 \times$ DIN, $6 \times$ DOT
- ADAM-6051 - Ethernet, $12 \times$ DIN, $2 \times$ DOT
- ACROMAG-961 - Ethernet, 6 DC Current Input Channels (6x AIN)
- ACROMAG-983 - Ethernet, 12 Discrete Input Output Channels


### 14.7.1 Point List Configuration

The first step to setting up communications to an external IO block is to create a new Modbus master. In order to do this, the MultiSmart unit must have Modbus Master enabled. The slave profile for the external IO unit that communicates over the Ethernet port must be created under this Master.

To check if the Modbus Master is enabled, browse to:


If Modbus Master is disabled, contact MultiTrode to find out how to enable it.
To create a new Modbus Master via the LCD, navigate to:

then click on Add Modbus Master
When the Modbus Master is created, a Modbus Slave under the master is also created by default. It is only necessary to reconfigure the points list for that slave to match the Modbus profile of the external IO unit. To do this, navigate to:


Select the desired Ethernet expansion module that MultiSmart supports. (If the module is not listed, custom engineering is required to interface it with MultiSmart.) Confirming the selection will require a restart of the unit. Once restarted the points list will be complete. Jump to Section 14.7.2 if you don't have more than one IO unit to be configured.
If more I/O expansion modules are to be added, simply create additional slave profiles under the same Modbus Master and configure the Modbus points list to that slave profile.
To create an additional slave via the LCD, navigate to:


Once the slave is created and after the MultiSmart has restarted, navigate to the following location:


The option "Next Slave" will appear at the bottom of the screen. This makes it possible to browse the points list settings of the next slave.
To regenerate the points list, select the appropriate slave, and select the Regenerate Points List option under that particular slave.

### 14.7.2 Configuring Communications

If an Ethernet port in the MultiSmart is available for interfacing and only one or two ADAM/ACROMAG units are required to be connected, then the connection can be established by using one or two shielded RJ45 cross over cables.
If more than two ADAM/ACROMAG units are to be interfaced and/or if MultiSmart is connected to an Ethernet network, then an Ethernet switch is required for establishing the connection. In this method, shielded RJ45 straight through cables are required to connect the MultiSmart and ADAM/ACROMAG units to the switch. The two different methods of interfacing the devices are shown in the figures below.


Figure 109 - MultiSmart + Ethernet Switch $=2 \times$ Adam Units

### 14.7.3 ADAM Ethernet Units

ADAM Ethernet units currently supported include:

- ADAM-6017
- ADAM-6050
- ADAM-6051

The ADAM units, if purchased from MultiTrode, are preconfigured to interface with the MultiSmart.
The ADAM units are packaged with a CD which includes a program called Adam.NET. This program can be installed on a Windows PC and used to configure the I/O device. It allows the IP address of the ADAM unit to be changed, in order to match a specific domain.
To establish communications to the device, first connect the device to a DC power supply (10-30V) via the (R) $+V s$ and (B) GND pins. Then connect the device to the network used by the Windows machine via an RJ-45 connection.

Run the Adam.NET program. From the displayed window, highlight ADAM5000TCP_6000, then click on the magnifying glass icon. This detects the connected device. Highlighting this device allows the IP Address to be reconfigured via the Network tab. Once the desired IP address has been set, click on Apply Change.

## NOTE:

If you are using an ADAM-6017 device which is not purchased through MultiTrode, you must configure the I/O to make it suitable for interfacing with the MultiSmart.

The default IP address of the ADAM unit is 10.0.0.1 unless it is specified and purchased from MultiTrode.
The MultiSmart now needs to be reconfigured to communicate to this device.

Check the IP address of the MultiSmart, modify if it does not match with that of the ADAM unit. To verify or to change the IP address of the MultiSmart, browse to:


If the ADAM unit is directly connected to the MultiSmart using a cross over cable, set the MultiSmart IP Address to 10.0.0.2. To configure the IP address of the ADAM units for advanced installations, refer to the unit manual (available for download from http://advantech.com.tw). Ensure that no more than one ADAM unit has the same IP address, otherwise an IP address conflict will occur. If advanced routing needs to be setup in the MultiSmart, refer to Section 22.4.

Navigate to:


Protocol Settings

1. Select the Modbus Master, which contains the slave profiles of the $\mathrm{I} / \mathrm{O}$ units, using the select arrow buttons and press Select.
2. Set the Comms Channel to TCP/IP 1, 2 or 3 whichever is available for use, Link Type to TCP and press Save. Choose Restart Later option if prompted.
3. Use the select arrow button and select the first slave and press Edit. Select the Enabled? option if it is not selected already, set the Slave Address to 1 and press Save.
4. Select the IP Address button, enter the ADAM unit's IP address in the Dest IP Address tab, set the TCP Port to 502 and press Save. Now press Back button twice to navigate to the Modbus Master settings. (If there is more than one slave, edit the settings for each additional slaves by following the above procedure)
5. Press the Channel button, set the Connection Type to Initiating end-point and press Save.
6. Once the changes are complete, press Save and restart the unit.

### 14.7.4 ACROMAG Ethernet Units

ACROMAG Ethernet units currently supported by MultiSmart include:

- ACROMAG-961
- ACROMAG-983

Each device includes a CD, which has full instructions on how to set up and use all devices within their product range. The following description presents a very quick discussion of how to configure the devices for communications to a MultiSmart. Refer to the full instructions from the manufacturer for more details.

In order to establish communications to the device, first connect the device to a DC power supply (15-36V, although ACROMAG claim that the units will operate at 11 V ) via the DC+ and DC- pins. Then connect the device to the network used by the Windows machine via the RJ-45 connection.

ACROMAG Ethernet I/O units are able to serve html pages. Therefore, to configure a unit, only a web browser is required. All ACROMAG Ethernet I/O devices have a pre-programmed IP address of: 128.1.1.100.
In order to set up communications to a device, the computer connected must be able to address the unit's IP range. The simplest way to achieve this is to use a laptop and change the IP address of the laptop to 128.1.1.101. Load a web browser and type the following http://128.1.1,100.

This loads the configuration page of the device. The user name is User and the password is passwordOO. By clicking on Network Configuration, the IP address of the device can be modified. Ensure that no more than one ACROMAG unit has the same IP address, otherwise it will result in an IP address conflict.

For the ACROMAG-961 analog input device, it is necessary to configure the range of the inputs. This can be done via the Test Page. Select the range to be $4-20 \mathrm{~mA}$, unless another range is desired. If another range is selected, the raw ranges of the analog tags in MultiSmart should also be modified to reflect this.

The MultiSmart now needs to be reconfigured to communicate to this device.
The default IP address of the ACROMAG unit is 128.1.1.100 unless it is specified and purchased from MultiTrode.
Check the IP address of the MultiSmart and modify it if it does not match with that of the ACROMAG unit. To verify or change the IP address of the MultiSmart, browse to:

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Settings $\rightarrow$ More $\rightarrow$ Communications $\rightarrow$ IP Address

If the ACROMAG unit is directly connected to the MultiSmart using a cross over cable, set the MultiSmart IP address to 128.1.1.101. To configure the IP address of the ACROMAG unit for advanced installations, refer to the unit manual (available for download from www.acromag.com). If advanced routing needs to be setup in MultiSmart, refer to Section 22.4.

Navigate to:


1. Select the Modbus Master, which contains the slave profiles of the I/O units, using the select arrow buttons and press Select.
2. Set the Comms Channel to TCP/IP 1, 2 or 3 whichever is available for use, Link Type to TCP and press Save. Choose Restart Later option if prompted.
3. Use the select arrow button and select the first slave and press Edit. Select the Enabled? option if it is not selected already, set the Slave Address to 1 and press Save.
4. Select the IP Address button, enter the ADAM unit's IP address in the Dest IP Address tab, set the TCP Port to 502 and press Save. Now press Back button twice to navigate to the Modbus Master settings. (If there is more than one slave, edit the settings for each additional slaves by following the above procedure)
5. Press the Channel button, set the Connection Type to Initiating end-point and press Save.
6. From the Advanced screen, navigate to :

7. Change the Comms Channel parameter to TCP/IP 1 (or TCP/IP 2 or 3 if channel 1 is already used by another application). Then change the Link Type parameter to TCP.
8. Next, from the Advanced screen, navigate to:

$$
\text { Telemetry } \rightarrow \text { Channel } \rightarrow \text { TCP/IP 1 } \rightarrow \text { TCP/IP Channel }
$$

9. Change the Connection Type parameter to Initiating end-point
10. Then navigate to: IP Address $\rightarrow$ IP Address 01
11. Set the IP Address parameter to the address selected for the ADAM IO device, and then set the TCP Port parameter to 502 (which is the default for Modbus communications).
12. Once the changes are complete, press Save and restart the unit.

### 14.7.5 Verifying Communications \& Values

Communications to an external I/O device can be verified by navigating to:


If communications have been successfully established then Online is True and Comms Fail is False.

- Online status indicates whether the last message sent was acknowledged by the receiving device. If no acknowledgment is received within a preset time, then Online is set to False. (Relevant parameter - Default Response Timeout, default is 20s).
- Comms Fail - if the channel remains offline for longer than a preset time, then Comms Fail is set to True. (Relevant parameter - Comms Fail Time, default is 2 mins).

The Transmitted and Received counts are incremented on each message received or transmitted. By default, scans are configured to occur every 2 seconds.
To view the values read by the MultiSmart, press the Back button, select the Modbus Master Values button, and then select one of the point classes. All the points values read from the I/O device are displayed and are dynamically updated as new values are read.
The full menu path is:


Highlight a point and pressing the Details button displays more detailed information for the selected point. For example, if an analog value (input register) is selected, then the raw and scaled values can be compared from this screen.

### 14.8 Configuring Level Devices

Navigate to the Level Devices screen. From this menu the primary and backup level devices can be assigned or unassigned.


Figure 110 - Level Devices Screen
From this screen the following can be configured:

- level units (in, ft, m, \% or custom)
- level at which the bar graph shows full
- range of the device (except \% which is always $0-100 \%$ )

To configure the primary level device scroll down, highlight Primary, and press the Config button.
The (Primary) Level Device Configuration screen loads:


Figure 111 - Selection of the Primary Level Device

- Scroll down to the appropriate device in the list
- For Probes, FailSafe can be enabled (requires a compatible probe \& firmware version 2.2.2 or later)
- Press Save, if a restart message is displayed, press Restart Later

Press Config to change additional settings for the level device. For Analog devices for example, the port it's connected to and the range (zero and span values) can be entered. For Probes and DuoProbes, the model number, units and depth of well can be entered.

The main operator screen (the home page) displays a flashing INVALID indication in the level bar if the primary level device is invalid and a backup level device is not configured.

### 14.8.1 Probe Selection

If you have selected a Probe and pressed Config, the next screen, Probe Model Configuration lists all of the standard models for you to select from.


Figure 112 - Probe Model Selection Screen
Select using the Model up and down arrows. If the units for the level display have not been changed from percentage ( $0-100 \%$ ), then another screen is displayed (Probe Model - Extra Details). This screen prompts the user to enter the depth of the well (and the units). Without this information, entering the probe model has no meaning. Also, if the custom probe model is selected, the user can press the Modify button displayed on the bottom right to display the Extra details screen, where details such as depth of well and probe length can be entered using the units selected. Once Save is pressed, another prompt is displayed asking if the setpoints should be rescaled. This rescaling (if answer "Yes") ensures that the physical activation and deactivation setpoints remain unchanged (strongly recommended). If the answer is "No", then the values of the existing setpoints remain unchanged but now represent depths in the well rather than points along the probe. For example, a setpoint of $100 \%$ previously represented $100 \%$ on the probe but now represents $100 \%$ of the well depth - i.e. a full well. An example follows.

## Example of Probe Selection

The units have not been changed from the default percentage and the setpoint for lead pump activation is $50 \%$, while lag pump activation is $60 \%$. This means that the lead pump will start when the level is halfway up the probe (not halfway up the well).

The user selects 1.0/10-xx (a $1 \mathrm{~m}, 10$-sensor probe) from the list and is now requested to enter the depth of well and units. The well depth of 4 m is entered. After the MultiSmart has reconfigured, the bar graph will only show a quarter full when the top sensor on the probe is covered. This is because the probe is only 1 m high in a 4 m well. The bar graph display can be changed by the parameter Show Full At in the first Level Device configuration screen (section 14.8).
If the user does not select "Yes" to the option to Recalculate the setpoints, the lead activation setpoint will be at $50 \%$ of the well - not $50 \%$ of the probe. If the user does select "Yes" - which is strongly recommended then the lead activation setpoint will be at $50 \%$ of the probe, or 0.5 m .

### 14.8.2 Three Sensor and Single Sensor Probes

Further down in the list of model numbers (not shown in the graphic above), there are also the options of selecting Single Sensor probe (0.2/1-xx) or 3-sensor probe ( $0.5 / 3-x x$ ).

To use a number of single sensor probes, the recommended approach is to select a 10-sensor probe from the list and follow section 14.8.4 for configuration. This is because typically at least three or four single sensor probes are needed to control a pump station, and the method above only allows a maximum of two probes to be selected.

### 14.8.3 Probe Configuration and Sensitivity

From the previous screen, when the Sensors button is pressed, the probe sensitivity and the digital inputs assigned to the probe are listed. Use the Input arrows to select the value to change. By pressing Config Sensor, these inputs can be assigned or unassigned as required to match the probe wiring. (The default is Din 2 to Din 11, with Din 2 being 100\%).

If necessary, more than one probe can be configured for a system, e.g. for 2 wells, or probe in primary and backup configuration.


Figure 113 - Probe configuration
In a typical system where only one probe is used, the $2^{\text {nd }}$ probe is not assigned.


NOTE:
When a $2^{\text {nd }}$ probe is defined, it is important to assign the Digital Inputs to which this $2^{\text {nd }}$ probe is connected.

Press the Config Sensor button to make changes to the Digital Input assigned or to the \% value that each sensor indicates. By default, each sensor represents 10\% level change. By selecting the model number, the length of the probe can also be defined.

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### 14.8.4 Single-Sensor Mode

The MultiSmart can be configured with less than 10 level sensors - this is called Single Sensor Mode. Single or three sensor MultiTrode probes or Ball floats may be used.

To configure the MultiSmart for Single Sensor Mode.

1. To Enable Single Sensor Mode go to:


Scroll down to Single Sensor Mode? and check the box. This prevents the "Probe 1 Failed Sensor" from occurring on the "missing" sensors.
2. To Assign the Sensors, go to:


Scroll down and highlight the Primary Probe and press Configure. Now select the probe and press Config. Unassign any sensors not required.
With one of the remaining sensors highlighted, press the Config Sensor button to modify the digital input or the level represented by that sensor (if necessary).

NOTE: To avoid an Invalid Input message, the highest level must be assigned to the lowest digital input used, e.g. for 3 sensors, 100\% = Din 2, 50\% = Din 3 and 10\% = Din 4.
3. To Verify Digital Input Mode, go to:

and press the Advanced button.
For Probes, the Mode must be "AC". For ball floats the Mode should be "Digital".
4. To Modify Digital Input Mode, go to:


Select the appropriate digital input, expand and scroll down to Mode. Select the correct mode and press Save.

### 14.8.5 Advanced Probe Configuration

The probe sensitivity, as of version 2.3 can be configured without going to the advanced screen (see section 14.8.3). Extra probe settings, including probe sensitivity can be accessed by navigating to:

| Settings $\rightarrow$ Advanced$\rightarrow$ IOModule $\rightarrow$ Unit $\rightarrow$ Unit 01 $\rightarrow$ Probe $\rightarrow$ Probe 01 |
| :--- |
| Name |
| Description |
| Delay (ms) |
| Sescription |
| Sets a delay before a probe sensor change is accepted. |
| Sensitivity (Ohms) |
| Sext description of the probe. |
| Sets the sensitivity of the entire probe in ohms. |
| Value |
| Settings for individual sensors in a probe. Normally no need to change these. |

Table 12 - Advanced Probe Settings

### 14.8.6 DuoProbe Level Sensor Configuration

Similar to the normal MultiTrode probe, a DuoProbe is comprised of ten (10) conductive sensors, with the addition of a pressure transducer located at the end of the probe. (As for the standard probe, more than one DuoProbe can be configured for a system, e.g. 2 wells, or a DuoProbe in primary and backup configuration).

For calibration purposes, a second pressure transducer is present in the MultiSmart to sense ground level atmospheric pressure. The calibration process takes into account the pressure reading from the DuoProbe and the atmospheric pressure measured by the sensor in the MultiSmart. To maintain accuracy, a re-calibration can be triggered manually or by a timer. The recalibration process is inhibited when two or more sensors are uncovered faster than a preset time, e.g. if the probe is manually raised too fast. (The relevant parameter is the Level Change Time and has a default of 5 s ). The recalibration process is reenabled when two or more sensors are uncovered slower than the preset time.
There are hardware and firmware requirements which must be satisfied before the DuoProbe can be used as the level device on a MultiSmart.

- Build Version - firmware installed must be version 2.20 or higher
- HW Version - the processor board must be version PCB40001r01 or higher

To confirm the versions are correct, navigate to:
Info $\rightarrow$ More $\rightarrow$ Version Information and verify the Build and HW Versions.

### 14.8.6.1 DuoProbe Placement - IMPORTANT Considerations

While the DuoProbe is capable of measuring the full depth of the well, MultiTrode recommends that the probe is positioned such that the pumps operating range is within the probe range, i.e. the pump(s) activation setpoint is below the top most sensor of the probe. See Figure 111. This best utilises the redundancy feature of the DuoProbe should the analog pressure transducer fail.


Figure 114 - DuoProbe Positioned Within Operating Range of the Pump(s)

When the pressure transducer fails, a DuoProbe Error is triggered. If the DuoProbe is positioned such that the activation setpoint is above the highest probe sensor, then when a DuoProbe Error occurs, the activation setpoints are changed to the top most digital sensor level. This action is performed to ensure that the station can continue to operate (although most likely over a different operating range).

### 14.8.6.2 Configuring the DuoProbe

To configure the DuoProbe, navigate to:


A simple wiring diagram for the DuoProbe interfacing with the MultiSmart is shown below.

The negative terminal of the analog input (AIN 1-) is connected to a ground such as the GND on the DSP board, or the negative input on the analog output (AOUT 1-), as illustrated below. The black wire is connected to the positive terminal of the analog input (AIN $1+$ ). The red wire is connected the positive DC supply.


Figure 115 - DuoProbe Wiring to MultiSmart


WARNING:
If the polarity to the pressure sensor in the DuoProbe is incorrect, it may permanently damage the sensor or the MultiSmart or both.

If the well depth is represented as percentage, then the Display Full At and Negative Offset (Datum Point) options (with default values of 100 and 0 ) can be left unchanged. However if the well depth is specified as a linear measurement, then select the appropriate Units and configure the Display Full At, Negative Offset and the Depth of Well by highlighting the options and entering the new values. See the screen below.


Figure 116 - Well Parameters
Scroll down and select the Primary (or Backup) level device for which the DuoProbe requires configuration and press Config.

Select DuoProbe 1 (or DuoProbe 2 if the first one is already assigned) and press Config. Select Save changes \& continue to the unsaved data prompt and then select the Restart Later option.
Select the DuoProbe length based on the model number and press Save. (The first number represents the length of the probe in metres). The adjacent table below lists the various probe lengths in inches.


| Model Number | Inches* |
| :--- | ---: |
| Custom | - |
| $1.0 / 10-\mathrm{xx}$ | 39 |
| $1.5 / 10-\mathrm{xx}$ | 59 |
| $2.0 / 10-\mathrm{xx}$ | 79 |
| $2.5 / 10-\mathrm{xx}$ | 98 |
| $3.0 / 10-\mathrm{xx}$ | 118 |
| $6.0 / 10-\mathrm{xx}$ | 236 |
| $9.0 / 10-\mathrm{xx}$ | 354 |

*Approximate value
Table 13 - Probe
Length in Inches

Figure 117 - DuoProbe Model Selection
The Sensors button allows the digital inputs to be reconfigured - this is not necessary if the defaults are used on DuoProbe 1 (Dins 2 to 11).


NOTE: If the standard MultiSmart wiring diagram is followed for the DuoProbe interfacing, there is no need to change the default digital inputs (Din 2 to 11). However if a $2^{\text {nd }}$ DuoProbe is defined, it is essential that the correct digital inputs are assigned to the $2^{\text {nd }}$ DuoProbe.

Press the Pressure button to select the analog input to be used for the DuoProbe.
Scroll down to the appropriate analog input (e.g. TopBoard Ain 01) and press Select and Save.


Figure 118 - Analog Input Selection for DuoProbe


NOTE: The analog input for the pressure transducer is automatically assigned when selected through the Setup Wizard.

Perform a Restart (Settings / More / More / Restart Unit).
The DuoProbe is now configured. "NO CAL" flashes in the Well on the main screen until the first automatic calibration is performed.

The Min and Max pressures, ( 90 and 140 kPa respectively) that appear at the bottom of the DuoProbe Pressure Configuration screen represent the pressure range of the DuoProbe pressure sensor and hence should not need to be modified.

Follow the sensitivity settings for the normal probe to configure the DuoProbe advanced sensitivity parameters (Refer to Section 14.8.5). The sensitivity settings of Probe 1 are applicable to that of the DuoProbe 1 and the sensitivity settings of Probe 2 are applicable to that of the DuoProbe 2.

Refer to Section 14.8.4 for more information on configuring the mode of the digital inputs used for the DuoProbe and for details on configuring it to be able to operate with less than 10 digital inputs.

!
NOTE: DuoProbe requires at least 3 sensors wired to the digital inputs and hence in cannot be configured to work like a normal probe in single sensor mode.

There is an option to manually re-calibrate the DuoProbe. This is done in the DuoProbe Model Selection screen (Figure 114 - DuoProbe Model Selection above). It is highly recommended to clean the probe before triggering a recalibration, since this will result in more accurate calibrations.

Pressing the Calib button marks the DuoProbe for re-calibration and it will re-calibrate when normal calibration conditions are met.

In addition to manual re-calibration, a DuoProbe can be re-calibrated using a timer. The timer can be configured in the advanced screen at:


The DuoProbe Calibration timer has the following configuration settings:

| Name | Description |
| :--- | :--- |
| Enabled? | Enables or disables periodic DuoProbe re-calibration. |
| Period Type | Period Type defines the frequency of DuoProbe re-calibration. It can be re-calibrated <br> hourly, daily, weekly or monthly. |
| Period | Period defines the period of the timer. For e.g.: if the Period Type is weekly and <br> Period is 2, then the DuoProbe will be re-calibrated once in every 2 weeks. |
| Start Time | Start Time defines the time of the day at which re-calibration will start. |

Table 14 - DuoProbe Calibration Parameters
There is an option to define an additional level (default 10\%) to apply to activation setpoints during a calibration cycle. This is to avoid calibration at the normal lead pump activation setpoint, which is where most fat build-up is likely to occur. This tag is called Level Adjustment and can be changed at


During a manual or periodic re-calibration, the main operator screen (the home page) displays a flashing CALIB indication in the level bar graph to indicate that a DuoProbe calibration is pending and setpoints may be adjusted for the calibration. Once the calibration is complete and setpoints are reset to the original values, the level bar graph is set to its original state.

### 14.8.6.3 DuoProbe Faults

There are different faults associated with DuoProbe which will be triggered under various conditions.

- DuoProbe Error

When the analog signal becomes invalid (out of range or less than atmospheric pressure), then a DuoProbe fault will be raised.

- High Range Error

A high range error occurs when the DuoProbe level reads beneath the High Range Error Primary SP, whilst the Probe level reads above the High Range Error Backup SP. These set points can be configured at:
Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Level/Control Devices $\rightarrow$ Compare
This fault condition will only be cleared after a complete pump cycle for which no discrepancy was detected.

- Low Range Error

If the lowest sensor is uncovered, then Low Range Error will be triggered. This doesn't actually constitute a fault condition, but simply switches to use the probe level for controlling the pumps in order to protect the pumps from running dry.

Various limits for these faults can be changed at:


### 14.8.7 Analog Level Sensor Configuration

## Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Level Control/Devices

Select Analog then press the Config button. The available Analog Inputs are listed in the Inputs box. Use the Input arrows to highlight the correct input, then press Select.
You can also navigate, using the Input arrows, to the $4-20 \mathrm{~mA}$ values.

### 14.8.7.1 Zero and Span the Well

To zero and span the well, perform the following steps:

- Bring level of the well to the desired "Zero" level
- Press the Zero button. The current value is read from the Analog Input and entered into the Raw Min setting box.
- Bring the level of the well to the desired "Span" level
- Press the Span button. The current value is read from the Analog Input and entered into the Raw Max setting box.
- Press Save to confirm the changes.


NOTE: There is also a parameter under Advanced-Pump Control- Well which is the level that the pump control module assumes when both primary and backup (if configured) have failed. This parameter is Input invalid sensor.

### 14.8.7.2 Options Available for Special Applications

The MultiSmart supports a relative offset around a datum point, which can be set through the control panel. In the Level Devices section mentioned above, you can specify an offset around a particular datum point which is to be added to the MultiSmart level input. These scaled set points can be verified using the DNP or MODBUS points list.
The MultiSmart also supports inverted levels when an analog input is used as the level device. In order to configure this, in the Advanced menu navigate to:


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Toggle the parameter to: 100 - SourceX
This inverts the level. To invert the set points, navigate to:


### 14.8.8 Remote Level Sensor Configuration

The MultiSmart can receive levels from a remote level sensor such as a reservoir monitor.
Select Remote Level to assign a Remote Level Sensor to the level device chosen (Primary or Backup). Press Save to confirm the change.
To remove a Remote Level Sensor from the system, press the Unassign button.
Configuring the Remote Level during the setup wizard (rather than subsequently via this screen) has the advantage that the unit displays a number of questions related to DNP3 configuration and master/slave addresses. See Section 9.1. The disadvantage of going through the Setup Wizard is that any configuration already performed is overwritten.

### 14.8.9 Backup Level Devices \& Failover

The MultiSmart can accept two level devices monitoring the same well - a primary and a backup level device (section 14.8). Typically, the primary level device is an analog device ( $4-20 \mathrm{~mA}$ ) and the backup or secondary level device is a MultiTrode probe. The probe is commonly used as a backup as it is highly reliable, while the analog device has higher resolution and hence is commonly used as the primary level device.

The main operator screen (the home page) displays a flashing BACKUP indication in the level bar graph whilst the unit is operating on a backup level device.
The failover or switch-over to the backup level device is based on the comparison of the level returned from each device with predefined values or a window. There are two windows, a low and a high, and each has two values associated with it. When both of the levels returned fall outside the window, one of two possible faults is displayed.
The Primary Level High Range fault is displayed when the result of the comparison to the predefined high window fails. Similarly, the Primary Level Low Range fault is displayed when the result of the comparison to the predefined low window fails.

N

## NOTE:

These faults only detect a fault within the specified window. For a full range comparison, see the Analog Compare feature, 14.8.11.

How to setup the windows is explained in the following section. The faults associated with the backup probe are automatically enabled when a backup probe is assigned.

The primary level device is restored as the primary level source when the comparison of the current levels to the windows no longer fails.

### 14.8.9.1 Primary Level High Range Setup

The High Range Primary and High Range Backup values (and the associated delay) are located at:


## Definitions:

High Range Primary - the maximum level at which the primary must indicate in order to trigger a Primary Level High Range fault. (The default value is $80 \%$ ).

High Range Backup - the minimum level at which the backup must indicate in order to trigger a Primary Level High Range fault. (The default value is 95\%).


Figure 119 - Primary and Backup High Range Values
For example (with reference to the Figure above), the High Range Primary value $=80 \%$ and the High Range Backup value $=95 \%$. If the primary level device is reading less than $80 \%$ while the backup level device is reading greater than 95\%, a Well 1 Primary Level High Range fault is triggered (after the High Range Delay has expired). The MultiSmart switches over to the backup level device as the source of level information.

### 14.8.9.2 Primary Level Low Range Setup

Similarly the Low Range Primary and Low Range Backup values (and the associated delay) are set at the same location as for the High Range values (see Section above). Following is an example of the Well 1 Primary Level Low Range fault.

## Definitions:

Low Range Primary - the minimum level at which the primary must indicate in order to trigger a Primary Level Low Range fault. (The default value is $15 \%$ ).
Low Range Backup - the maximum level at which the backup must indicate in order to trigger a Primary Level Low Range fault. (The default value is 5\%).


Figure 120 - Primary and Backup Low Range Values
For example (with reference to the Figure above), the Low Range Primary value = 15\% and the Low Range Backup value $=5 \%$. If the primary level device is reading greater than $15 \%$ while the backup level device is reading less than $5 \%$, a Well 1 Primary Level Low Range fault is triggered (after the Low Range Delay has expired). The MultiSmart switches over to the backup level device as the source of level information.

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### 14.8.10 Configuring Remote and Local Level

MultiSmart can be configured to switch to the local level if the remote level times out. To set this up navigate to:
Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Level/Control Devices
Configure the primary device to use the remote level and configure the backup device to the appropriate source (e.g. probe, analog, or even another remote source).

The unit is already configured to use a remote and local level. However, by default, it will switch to use the local level if there is a high or low range error defined. A high range error will occur, for example, when the backup level is about a certain set point whilst the primary level (remote source) is below another level. If it is not desired to switch over when these conditions occur, then it is possible to disable these features. To do this, go the Advanced screen and locate:
Pump Control $\rightarrow$ Well $\rightarrow$ Well $01 \rightarrow$ Primary Level Input
Under this menu are two parameters called High range enabled and Low range enabled. It is possible to disable these features later on. The local level will then only be used if the remote level becomes invalid. If the remote level is being sourced via DNP, then when a communication fail alarm is raised to the remote site, the remote level is marked as invalid and the local level will be used. When communications are restored to the remote site, the remote level will be used again.
Note that if the Setup Wizard is used to configure and if a remote source is used, then DNP Master and Slave on the unit will be configured to use Connection Manager as their communications channel. If it is preferred to use separate channels for these applications, then the Use conmng parameter should be disabled via the Advanced screen, which can be accessed via:

$$
\text { Settings } \rightarrow \text { Advanced } \rightarrow \text { DNPMaster } \rightarrow \text { Master } \rightarrow \text { Master 01 } \rightarrow \text { Use Conmng }
$$

in the case of the DNP Master or:

in the case of DNP Slave.

### 14.8.11 Analog Level Compare

This feature is recommended for use when two analog level devices (a primary and a backup device) are used in the same well.

When the primary and backup level devices differ by more than a predefined threshold, a Well 1 Analog Compare fault is triggered. (The fault is disabled by default).
If the fault is triggered, the behaviour of the controller remains unchanged (i.e. the primary level device continues to be used as the primary source of level).

NOTE:
If the primary analog device fails such that no 4-20mA signal is generated, then in this situation the fault Well 1 Primary Level Ain Under Range is displayed and the backup analog level device becomes the source of level information.

To configure Analog Compare, navigate to the following screen:

## Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Level/Control Devices

- Press the Compare button
- With the Enabled check box highlighted, press the Toggle button to check the box
- Scroll to Threshold \% and enter the required threshold (5\% is the default)
- Press Save


### 14.8.12 Level Locked

The Level Locked alarm indicates that the level returned by the level device has not changed by more than a predefined amount in a specified period of time. The timed period can be a period of the day (e.g. 14:30 to $17: 00)$ or the entire day. Up to four different time periods can be set.

To configure, navigate to the following screen:

## Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Level/Control Devices

- Press the Locked button
- With one of the four periods highlighted, press the Configure button
- With Enabled highlighted, press the Toggle button to check the box
- Scroll down to Change Threshold (\%) and enter the minimum percentage by which the level should change during the set period.
- Scroll down to Duration and enter the period of time over which to monitor the minimum percentage change (e.g. with a threshold of $5 \%$ set, the level should change by at least $5 \%$ in 30 minutes).
- Press Save.

If only a period of the day is to be specified, rather than the whole day:

- Scroll down to Always and press Toggle to uncheck the box.
- Enter a start and finish time.

If a start and finish time is specified, any 'Locked' time immediately prior to the start time is taken into account when the period starts. For example, with a $5 \%$ threshold, a 30 minute duration and a start time of 06:00 set, and if the level changes by no more than $1 \%$ in 25 minutes prior to the start time and continues like this for another 5 minutes, a Level Locked alarm is generated at 06:05.

### 14.9 Configuring Faults

To configure the fault options, navigate to the Faults screen, select a fault type then press the Configure button. MultiSmart comes with a large number of pre-configured faults. Any fault can be assigned to a particular context as well (Refer to Section 14.9.5).


NOTE: Supply Protection and Motor Protection faults have screens specifically designed for them and are not found in this general fault screen.


Figure 121 - Select Fault Type


Figure 122-Configure Basic Fault Options

The following items can be configured for each fault:

| Name | Description | Range/Type |
| :--- | :--- | :--- |
| Description | Text description of the fault. | Text |
| Act Delay | Activation delay in seconds. The time period before the fault becomes <br> active. | Seconds |
| Deact Delay | Deactivation delay in seconds. The amount of time the fault must have <br> cleared before it is deactivated. | Seconds |
| Pump Unavailable | Check this box to make the pump unavailable when the fault is active. | True/False |
| Manual Reset <br> Req | Determines whether the pump station manager performs an auto-reset of <br> the fault or an operator is required to manually reset the fault. <br> (Note, even if auto-reset is selected, an operator must still manually <br> acknowledge the fault via the display (or via SCADA) before it is removed <br> from the screen). <br> The manual reset can be further configured so that a manual reset is <br> required only if a preset number of faults occur within a set period of time. <br> i.e. when the number of faults equals the preset value and they occurred <br> within the set period, the pump becomes unavailable (locked out) until an <br> operator resets the fault. This is configured as follows: <br> Enable Pump Unavailable <br> Enable Manual Reset Req (this also displays the extra settings) <br> Set the After [x] faults to the number of faults <br> Set the Within (hh:mm:ss) field to the length of time that the number of <br> faults must occur within to trigger a Manual Reset lockout (pump <br> unavailable). <br> Press Save to confirm. | True/False |
| Reset Count on <br> pump cycle | Determines whether to clear the manual reset required count on a <br> successful pump cycle. For example, if a manual reset was required after <br> 3 instances of the fault, then if the fault occurred for two consecutive pump <br> cycles, but then the pump ran successfully for the next pump cycle without <br> faulting, the fault count is reset back to zero. The "Reset Count On Pump <br> Cycle" option can be selected in the Fault Configuration screen only if <br> Manual Reset Required option is selected. | True/False |

Table 15 - Advanced Fault Parameters

### 14.9.1 Fault "Actions" including Pump Reversal

The Actions button provides some more advanced functionality, including Pump Reversal:


Figure 123 - Fault Actions Screen
Faults can be configured to automatically trigger pump reversals. For example, over-current may be triggered by a pump blockage. Reversing the pump for a short duration has the potential to clear the blockage.

To configure a fault to automatically trigger a pump reversal, set the Reverse Function to Call Pump Reverse. After the fault activates, the pump reversal will start after the Fault-Reverse delay defined in the Station Optimization - Pump Reversals screen. The reversal duration is also set in that screen (see Section 16.1.1), however more than one fault can occur within a short time frame and the reversal may not be desirable under some fault conditions. Therefore, those faults should have Reverse Function set to Block Pump Reverse.
The following items can be configured for this screen:

| Name | Description | Range/Type |
| :--- | :--- | :--- |
| Reverse Function | Described above, choice of No Action, Call Pump Reverse, Block Pump <br> Reverse | Selection |
| Reset Source? | Not usually required for most faults. Fault conditions like "Maximum Run <br> Time Exceeded" requires this feature so that after the fault has occurred it <br> can clear. <br> Faults like Thermal Overload, Under-current do not need this feature <br> enabled, because when the thermal overload cools down the input to <br> MultiSmart resets, and when the under-current trips the pump under- <br> current is no longer active. | True/False |
| Reset During | When this is enabled (default) - the fault can be reset from the user <br> interface or by SCADA while the deactivation delay is counting down. <br> Deactivation? <br> If this parameter is disabled, then even after the fault condition has cleared <br> and while the deactivation timer is counting down, no reset is possible. | True/False |
| Hidden Fault? | Disabled by default. If this is enabled, when the fault condition occurs it will <br> hold out the pump but will not be displayed as a fault on the Faults screen. | True/False |
| Auto <br> Acknowledge? | This allows a fault to be auto acknowledged when it is deactivated. When <br> deactivated, an auto acknowledged fault will disappear from Faults screen. | True/False |
| Mute Allowed? | This allows a fault to be "muted" from the faults screen. A muted fault still <br> continues to take any configured actions but is hidden on the faults screen <br> until the Mute Delay expires. | True/False |


| Mute Delay | The delay described in "Mute Allowed". | Time |
| :--- | :--- | :--- |

Table 16 - Fault Actions Parameters
Block Pump Reverse is the default pump reversal action for the (default) faults that make the pump unavailable. There are three faults which this action does not apply, they are:

- Under-current
- Over-current
- $\quad I^{2} T$ faults

The default pump reversal action for these faults is No Action.

### 14.9.2 Delay Fail (No Flow) Fault Setup

A predefined fault called Pump n Delay Fail fault is available that monitors a digital input and only faults if the input does not change state after preset time expires after a pump starts. It is typically used as a "No Flow" fault but can be used in many other applications that require the status of an input to be checked after a preset time expires after a pump starts running.
The procedure to configure the Delay Fail fault is listed below. The setup is very similar to any of the predefined faults except the delay period can only be adjusted in the Advanced menu.

1. Set the Delay Fail Source (Digital Input)


- Scroll down to Pump 1 Delay Fail
- Press Assign
- Scroll down to the required digital input and press Select
- Press Back and Save


## 2. Modify the Fault Description (Optional)



- Scroll down to Pump 1 Delay Fail
- Press Configure, modify the description as required.


NOTE: The Act Delay shown in this screen is not the timed delay, it only delays the displaying of the already triggered fault. To avoid confusion leave this set to 1 second.

## 3. Set the Delay Time

This is the period of time that expires before the state of the digital input is checked.

- Navigate to:

- Change this value to the required amount (the default setting is 10 seconds). Note that "Show More Options" must be enabled to view this setting (section 31.1)
- Press Save and press Back twice.
- Repeat the above steps for each pump that requires a Delay Fail fault.

NOTE: Use Delay fault 02 not 01 as this is already used for the Contactor Auxiliary Fault.

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If the input changes state before the timed period expires, no fault is displayed. The input is continually monitored while the pump is running, so that if the input reverts back to initial state, then a Pump n Delay Fail fault is displayed (after the delay period expires).

### 14.9.3 Low Flow Fault - Using Analog Signal

A 'Pump n Low Flow' fault can also be configured using the analog output of the flow meter. One flow meter on the outflow is sufficient. A Low Flow fault for a specific pump is displayed whenever the flow rate falls below a predefined value.

There are 3 main steps involved: enable flow, set flow rates and configure the flow faults.

## 1. Enable Flow

Navigate to:


- Enable Flow - tick the Flow Enabled check box
- For Mode, select Metered flow (der vol)
- Select the appropriate Units
- Press Save


## 2. Set Flow Rates

Navigate to:


- Scroll down to Nominal Flow Rate \& enter a nominal flow rate for Pump 1 (default is 100L/s)
- Scroll down and tick the Low Flow Fault Enabled for Pump 1
- Scroll down and enter a value for the Low Flow Fault Level. A percentage of the nominal flow (default is $50 \%$ which in this case equates to $50 \mathrm{~L} / \mathrm{s}$ )
- Repeat the first 3 steps above for Pump 2
- Press Save

3. Configure the Low Flow Faults

Navigate to:


- Scroll down and highlight Pump 1 Low Flow Fault and press Configure
- Set the Act Delay (Activation Delay) (typically 10 or more seconds)
- Set the Deact Delay (It's a good idea to set to at least 30s or more, that way if the second pump is faulted, the first pump is not continually starting and stopping if Manual Request Req (Required) is turned off.
- Tick the Pumps Unavailable check box (This option forces the pump to stop)
- If the Manual Reset Req (Required) is checked, an operator must acknowledge the fault on the display (or remotely via SCADA) before the pump can run again.
- Press Save

For this example, whenever a pump is running and the flow rate falls below $50 \mathrm{~L} / \mathrm{s}$ (after the activation delay expires), the pump is stopped and the standby pump is started. Note, any given flow rate from the Flow Meter is halved when both pumps are running.

### 14.9.4 Configuring General Faults

Up to ten (10) General purpose (or custom) faults can be created. A General fault is typically used when none of the predefined faults are a close match to the required functionality (based on the name of the fault). However, all of the predefined faults can be renamed.
Be aware that the predefined faults are always listed in the Advanced menu under the original name, so if the functionality is not similar it can become difficult to locate the renamed fault in the Advanced menu.

The same parameters are present for General faults as for the predefined faults. So a General fault can be created to stop one or more pumps, fault acknowledgement can be set to auto or manual and activation delay set, to name a few of the options. The source, description, activation and deactivation delays for a General fault can be modified in the low level menus.

To illustrate the configuration of a General fault, the following two examples will be implemented.

## Example 1:

A fault called Manual Mode is required to stops all pumps when a digital input (Din 16) becomes active. A manual reset is required before the pumps are free to run again. The setup for this fault follows.

## 1. Set the Source

Navigate to:


- Scroll down to General fault 1
- Press Assign
- Scroll down to Digital Input 16
- Press Select
- Press Back, Save and the Home key

2. Set the other Parameters

Navigate to:


- Scroll down to General fault 1
- Press Configure
- Enter the new fault description - Manual Mode
- Scroll down to Manual Reset Req and press Toggle to check the box
- Press Context
- Press Toggle to check the Station box (This will stop all pumps)
- Press Save and Restart Now

Whenever Din 16 becomes active, all the pumps will stop and the fault message Manual Mode is displayed.

## Example 2:

A low level fuel warning is required. A resistive fuel gauge is connected to digital input 16. A resistance of less than 500 ohms indicates low fuel remaining. A 10 second activation delay is required to prevent false triggering. Pump operation is not affected by the fault.

## 1. Set the Source

Navigate to: $\square$
Settings I/O, Faults \& Level Digital Inputs Faults

- Scroll down to General fault 1
- Press Assign
- Scroll down to Digital Input 16
- Press Select
- Press Back, Save and the Home key

2. Set the other Parameters

Navigate to: Settings $\rightarrow$ I/O, Faults \& Level $\rightarrow$ Faults

- Scroll down to General fault 1
- Press Configure
- Enter the new fault description - Low Fuel Warning
- Scroll down to Act Delay and enter 10
- Scroll down to Pumps Unavailable and press Toggle to uncheck the box
- Press Save and the Home key


## 3. Enter the Required Resistance Threshold

This value can only be set in the advance menu under the digital input assigned.
From the main screen go to:


Digital Input $\rightarrow$ DIN 16 $\rightarrow$ Sensitivity (Ohms)

- Enter 500
- Press Save and Restart Now

Now, whenever the resistance of the fuel gauge falls below 500 ohms (for more than 10s), the message Low Fuel Warning is displayed. A similar configuration would be used for a PTC sensor.

### 14.9.5 Assigning Faults to a Context

You can select single or multiple contexts from Station to Pump, Well and Group. If none are selected, the fault will still come up in the fault information screen, however no actions like 'stop pump until fault is cleared' will be executed when the fault is active. More advanced fault configuration can be configured from the Advanced screen.

Navigate to:

$$
\text { Settings } \rightarrow \text { Advanced } \rightarrow \text { Fault Module }
$$

### 14.9.6 Reset All Faults Trigger

A ResetAllFaults tag is present in the MultiSmart which can be assigned to a digital input, DNP or Modbus digital control point. It is used to reset faults that require a reset or an acknowledgement. The tag needs to be set to 1 to reset. The tag's location in the MultiSmart is 'PumpControl.FaultStatistics.ResetAllFaults'.

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### 14.10 Configuring Analog Outputs

The MultiSmart Pump Control I/O Board (3PC) has one analog output available. The optional Motor Protection Board (3MP) has three analog outputs available.
These analog outputs can be used for tasks such as re-transmitting an analog input or producing an analog output value that matches the level in a well measured by a non-analog sensor, such as a probe.
Analog outputs are configured in the Analog Output screen.
Settings $\rightarrow 1 / O$, Faults \& Level $\rightarrow$ Analog Outputs


Figure 124 - Analog Outputs Screen


Figure 125 - Select the source Analog Input and press "Select"

©
NOTE: By default, AOUT1 on the main 3PC board follows primary level

### 14.11 Configuring Digital Outputs

Digital outputs can be sourced from a wide variety of events occurring in the MultiSmart. They can be used to activate external alarms, control pumps, reverse pumps, send signals to SCADA systems and connect to other external logic (PLCs, relays, etc).


NOTE: Some digital outputs will already be in use as part of the initial configuration. D01 to D03 may already be configured to control pumps and DO4 will be configured as an alarm output. All outputs can be reconfigured.

Digital outputs are configured from the I/O, Faults \& Level screen.


Figure 126 - Digital Outputs Screen


Figure 127 - Configure Digital Outputs Screen
Multiple sources can be selected for a digital output. The operations, AND, OR \& XOR can be performed on the multiple sources before the digital output is set. Choose the first source, press Select and then select the second source; the operator selection box then appears.

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After the source is selected, press Back, and repeat the process for each digital output. The sources listed in this setup screen include:

| Any Fault | Probe 1 Sensor Fault | All Pumps Unavailable | DC Over Voltage |
| :--- | :--- | :--- | :--- |
| Remote Source | Probe 2 Sensor Fault | Any Pump Faulted | DC Under Voltage |
| High High Level Alarm | Pump 1 Call to Run | All Pumps Faulted | Battery Over Voltage |
| High Level Alarm | -etc to number of pumps | Pump 1 Off | Battery Under Voltage |
| Low Level Alarm | Pump 1 Reversing | -etc to number of pumps | Test Battery |
| Low Low Level Alarm | -etc to number of pumps | Pump 1 Off or Unavailable | Application Failure* |
| Any Level Alarm | Any Pumps Running | -etc to number of pumps | Modem Reboot |
| Any High Level Alarm | All Pumps Running | Any Pumps Off | AIN1 Over Range |
| Any Low Level Alarm | No Pumps Running | All Pumps Off | AIN1 Under Range |
| Primary Level Fault | Pump 1 Unavailable | Any Pumps Off or <br> Unavailable | AIN2 Over Range |
| Backup Level Fault | -etc to number of pumps | All Pumps Off or <br> Unavailable | AIN2 Under Range |
| Well Mixer Active | All Pumps Available | Over Voltage |  |
| Well Washer Active | Any Pumps Unavailable | Under Voltage |  |

Table 17 - Digital Output Sources
*Application failure is the internal watchdog functionality.
If the desired source cannot be found in this list, press the Advanced button, which then displays the Tag Browser and allows the selection of any digital tag within the system.

### 14.11.1 Advanced Digital Output Options

Advanced configuration options for Digital Outputs can be found in the Advanced menu. These options include inverting, enabling it to flash and delaying the activation or deactivation of the output.

A source (or multiple sources) and the Boolean operator can be assigned in the Digital Outputs screen.


Refer to the previous section for details.
To perform the advanced operations navigate to:

and select a digital output.

| Name | Description |  | Range/Type |
| :---: | :---: | :---: | :---: |
| Count | Sets the number of times to pulse the output but only applies if Mode is set to one of the pulsing modes. |  | Integer |
| Description | Description of the output. This is the name displayed in the Info screens. |  | Text |
| Invert? | Turns the Normally Open output into a Normally Closed output. |  | True/False |
| Mode (5 modes) | Normal/Latch | Output is on for the duration the source is active (default). |  |
|  | Flash | Output toggles according to the T Closed \& T Opened values. |  |
|  | Delay | The activation or deactivation of the output is delayed according to the T Closed \& T Opened values. |  |
|  | Pulse, Pos Trigger | Uses the 'Count' variable to pulse the output while T Closed \& T Opened sets the period. |  |
|  | Pulse, <br> Neg Trigger | Uses the 'Count' variable to pulse the output while T Closed \& T Opened sets the period. |  |
| Multiple Sources Logic | Allows a Boolean operation to be performed on the multiple sources. (The one operator is applied to all sources). |  | And, Or, Xor |
| Non Volatile? | If set to true, the state of the output will be restored after a restart. |  | True/False |
| Source | The primary source for the digital output. |  | Digital Tag |
| Sources 2,3,4 | Up to 3 more sources can be specified. |  | Digital Tag |
| T Closed | Number of milliseconds that the relay is to be closed (on) for when flashing or pulsing. |  | Integer |
| T Opened | Number of milliseconds that the relay is to be opened (off) for when flashing or pulsing. |  | Integer |

Table 18 - Advanced Digital Output Options

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### 14.11.2 Example: How To Make a Digital Output State Follow a Digital Input State

 In this example, Digital Output 5 is configured to follow Digital Input 1.- Select Advanced, select IO Module $++I-$ Unit ++
- $\quad$ Select the Unit (e.g. Unit 01) then $+I-$
- Select which board the digital output is located on (e.g. Top Board) then $+1-$
- Select Digital Output then $+1-$
- Select the free digital output that is to follow the digital input (e.g. DOUT 05) then +1-
- Select Source and press "Use this button to view or change value"
- Select IO $++I-+I-$
- Select the Unit (e.g. _1) then $+I-$
- Select which board the digital input is located on (e.g. Top Board) then + + +
- Select Din $+1-$
- Select the digital input that that the digital output is to follow (e.g. _1)
- Select ValueDigital (a digital tag) then press the Ok button
- Press the Save button


Figure 128 - Making a Digital Output Follow a Digital Input

## 15 Profiles

The MultiSmart can have multiple sets of fully programmable profiles. Each profile can have independent setpoints and a few specific pump control parameters (e.g. maximum pumps to run). These can be used by an operator to switch the pump station into another mode of operation simply by selecting one profile.

Profiles can be selected via the following methods:

- User interface
- A digital input or any digital tag (e.g. an alarm condition)
- A timer (e.g. time of day and multiple timers can be setup)
- SCADA
- Logic engine script or ISaGRAF program

Multiple profiles can be configured by the user. This flexibility allows efficient pump station control both locally and remotely. The MultiSmart is supplied with three profiles pre-configured:

- Default

Suitable for most sewerage applications as shipped from the factory. It is intended to be the standard mode of operation for the pump station.

- Spill Management

A set of peak levels for use in emergency spill management situations. The pump station can be switched to this profile rather than manually setting new levels.

- GenSet/Load Shedding

Uses a set of levels designed to limit how long pumps are run in order to minimize the load. This profile can be used in power outage situations where a generator set is being used temporarily.

There are also 3 generic profiles (profiles 4-6) that can be named and configured according to user requirements.

### 15.1 Profile Selection Methods

Three of the five different ways to select a profile are discussed in this section.

### 15.1.1 Select a Profile with the User Interface:

To change the current Profile, navigate to the Select Current Profile screen:
Settings $\rightarrow$ Station Optimization $\rightarrow$ Select Profile



Use the Help button for more information at any time.

Figure 129 -Profile Selection Screen

- Use the arrow buttons to select a Profile from the list.
- Press the Select Profile button.


### 15.1.2 Selecting Profiles Using a Digital Tag

A digital tag whether for a digital input or for some other source can be assigned to select a profile:

## Settings $\rightarrow$ Advanced

- From the tree select: Pump Control ++-+
- Select the desired profile from the list and press $+I-$
- From the tree select: DIN Activation $+1-$

Any digital tag (of type "DigitalTag") can be selected. In this example a digital input is the source. The following values should be set:

- Enabled? (check the box to enable, uncheck to disable)
- Source (contains the digital tag source), press "Use this button to see additional values".
- Scroll down to IO, press $+I-$, Unit, $+1-, 1,++-$, TopBoard, ++- , DIN, ++-
- Select the DIN to be use. Scroll down to ValueDigital, and Press Ok.


### 15.1.3 Selecting Profiles Using a Timer

A timer can be used to set a specific date/time for a profile to be selected. Timer settings for each profile are accessed through the advanced menu:

## Settings $\rightarrow$ Advanced

- From the tree select: Pump Control ++-+ Profile $+\square$
- Select the desired profile from the list and press $+1-$
- From the tree select: Timers $\square$
- Select the desired timer and press +

The following values can be set for each timer:

- Enabled? (check the box to enable, uncheck to disable)
- Period (Days) (The repeat period for the timer, 1-28 days)
- Start date (only the date is actually used on this screen, the time is not used). This start date only needs to be set if the timer is to be activated at some time in the future, or you want the timer to run on a specific day each week (in which case you would set Period $=7$ )
- Start time (this is the actual start time used by the timer)
- Stop time


### 15.2 Configuring the Setpoints of Profiles



To edit the setpoints of a profile, select that profile first by pressing the Switch Profile button in the Level/Control Setpoints screen. This button only switches to that profile for editing purposes. See Section 12.3.2 for changing setpoints.

To switch to a different profile that is used by the station see Section 15.1.1.

### 15.3 Configuring Other Profile Properties

### 15.3.1 Through Profile Config Screen

Profiles can be edited from the profile configuration screen under:

```
Settings }->\mathrm{ Station Optimization }->\mathrm{ Config Profile
```

The Profile Config screen lists all the profiles present. Any listed profile can be selected for editing, which displays current values for the selected profile parameters and allows modifying those values.
The following Lead/Lag pump parameters can be set for each profile:

- Activation Set Point
- Activation Delay
- Deactivation Set Point
- Deactivation Delay
- VFD $100 \%$ level

To use profile VFD 100\% level, "Use Profile Full Speed Level" should be set to true under:

## Pump Control $\rightarrow$ VFD Configuration

The following station optimization parameters can also be changed for each profile

- Maximum Pumps Running Mode
- Maximum Pumps Running Quantity
- Maximum (Pump) On Time Enabled?
- Maximum (Pump) On Time Duration
- Maximum Off Time Enabled?
- Maximum Off Time Duration
- Maximum Off Time Quantity

Also the following Well Cleanout parameters can be changed for each profile through this screen.

- Well CleanOut Mode
- Number of Cycles
- Delay Adjustment
- Level Adjustment

Profiles can be configured to holdout specific pumps. Profiles have a holdout enabled option for each pump present. Profile pump holdout can be enabled/disabled on this screen. If holdout enabled is true for a pump in a profile, then the corresponding pump is held out when this profile is selected as the current profile. To use these profile well cleanout parameters, "Use Profile Set Points" should be set to true under:

## Pump Control $\rightarrow$ Well Clean Out

If the profile that is modified is the current active profile, then the corresponding pump control parameters are also updated.

### 15.3.2 Through Advanced Menu

Profiles can be configured through the Advanced menu:

$$
\text { Settings } \rightarrow \text { Advanced }
$$

- From the tree select: Pump Control ++-
- Select the desired profile from the list and press $+1-$

The following values can be set for each profile:

- DIN Activation
- Lead/Lag pump parameters
- Timers
- Name
- Activation Delay
- Activation Set Point
- Deactivation Delay
- Deactivation Set Point

The setpoints and delays can also be set by switching to that profile using the Switch Profile button (under Settings -> Set Points -> Level/Control Setpoints) and edit as per the default profile.

- Maximum Off Time Duration
- Maximum Off Time Enabled?
- Maximum Off Time Quantity
- Maximum Pumps Running Mode
- Maximum Pumps Running Quantity
- Maximum (Pump) Run Time Duration
- Maximum (Pump) Run Time Enabled?

These maximum values can be set under Station Optimization.

NOTE: Currently, if the unit is operating with the profile you are editing, to activate the new parameters for this profile, the unit needs to be switched out of the profile and back in. See Section 15.1.1 for how to do this.

## 16 Station Optimization

The MultiSmart pump station manager includes a wide range of configurable parameters for optimizing a pump station, such as:

| Parameter | Description |
| :--- | :--- |
| Pump Reversal | Many wastewater utilities reverse pumps periodically to help avoid blockages. They also <br> reverse pumps on certain faults (where those faults are believed to be mainly caused by <br> blockages). Pump reversal can easily be configured to operate on a set numbers of <br> cycles and/or under certain fault conditions. <br> caUtION: Check with your pump manufacturer before using this feature. |
| Odor Reduction via | Sewer stations with both high and low-use periods often generate odours. During the low <br> use period (e.g. a weekend), the station may take a number of days to reach the <br> activation level for the pump. This allows the station to become septic. This feature <br> allows a maximum off time to be applied so the station is completely emptied in order to <br> reduce septic odours occurring. |
| maximum off time | Maximum run time is used to prevent any pump from running too long. It does this by <br> cycling the pumps when a maximum run time is reached. A fault notification can be <br> triggered when this happens, if desired. |
| Max Pumps to Run | This feature is used to limit the total number of pumps allowed to run at any one time. <br> This is usually done to prevent damage to equipment from either electric or hydraulic <br> overload. |
| Minimize Fat Build-up | This feature sets a random activation delay for a pump in order to stop fat building up at <br> the activation level in the well. |
| Well Clean Out | This feature allows the pumps to be run past the normal deactivation point for a set time <br> or to a set level in order to completely empty the well. This can be set to occur at regular <br> periods. |
| Well Washer | This feature helps keep the maximum starts per hour of a pump below the level <br> recommended by the manufacturer. It works by automatically adjusting the activation <br> level upwards to minimise starts whenever the settings are exceeded. There is an over- <br> ride level to ensure that the activation point does not move too high. |
| Migh Inflow | Enables detection of a high inflow rate and if present, a fault is displayed and/or the lead <br> pump is pulsed started. |
| Minimize Excessive Starts | A variety of parameters can be set to optimize use of a well-washer to clean the well. |
| Wamp Starts Per Hour | Individual pumps can be limited to a maximum number of starts per hour if required. <br> There is an over-ride level to ensure that an overflow is not risked. |
| Allows control over a well mixer. Two modes, Every Pump Cycle and Every x Hours. |  |
| it indicates a blocked pump. |  |

Table 19 - Station Optimization Parameters
The most common settings are found in the main station optimization screen. The Pump Station Manager functionality has a whole range of advanced pump station parameters and can support multiple wells, multiple groups of pumps and multiple profiles.

The Advanced button gives access to these complete settings which are listed under Pump Control in the Advanced screen. Some parameters are found under the heading "Wells", some under "Groups" etc., even when there is only one well or one group.

### 16.1 Station Optimization Menu

Station Optimization is accessed by:
Settings $\rightarrow$ Station Optimization $\rightarrow$ Optimize Station


Figure 130 - Station Optimization Screen
To configure, highlight the optimization feature of interest and press Configure. The configuration screens are mostly self-explanatory and five examples are covered in this section. The first example, pump reversals, is the most complex.

### 16.1.1 Pump Reversing

The concept behind pump reversing is to prevent blockages by frequent and short pump reversing cycles. There is also the option of reversing on specific faults. Manual reversing can be carried out from within this configuration screen.

There are a few elements to configuring pump reversal:

- Wiring a reversing contactor/starter for each pump and connecting each contactor input to a Digital Output on MultiSmart
- Configuring those Digital Outputs to activate from Pump Reversing (see section 14.11)
- Configuring the duration and delays for pump reversal (this section)
- Configuring automatic pump reversal on start or stop (this section)
- Configuring certain faults to trigger pump reversal (see section 14.9.1), note that the duration and delays are still set via the description in this section

With Pump Reversals highlighted in the Station Optimization screen, press Configure to setup the automatic pump reversal - the Pump Reversals screen is displayed. (See figure below).


Figure 131 - Pump Reversal Mode Screen
Mode by default is Disabled. There are two active modes:

- On Pump Start - reversal is triggered before the pump run command
- On Pump Stop - reversal is triggered after the pump stop command

To change the mode, press the Toggle button when Mode is highlighted. Once either of these active modes is enabled, the MultiSmart uses the Pump Cycles parameter to determine how often to invoke the feature.

For example, with Mode = On Pump Start, and Pump Cycles = 6, each pump will reverse before starting once every 6 pump starts for that pump.
These parameters just described apply to all pumps.
The next set of parameters - the duration and delays - are individually applied to each pump. To change the parameters scroll down using the Select arrows and once the timing row for a particular pump is highlighted, the Toggle button changes to Edit. Press Edit to enter the Duration/Delays screen:


Figure 132 - Pump Reversal Duration and Delays Screen

The explanation of each parameter is as follows:

| Name | Description |
| :--- | :--- |
| Reverse Duration (secs) | The length of time the pump will run in reverse. This value is used by all reversing <br> features regardless of the trigger. It is also the reversing time for manual triggering. |
| Reverse - Start Delay (secs) | Used when the mode is "On Pump Start" - the time delay between the reversal <br> finishing and when the pump starts running normally. |
| Stop - Reverse Delay (secs) | Used when the mode is "On Pump Stop" - the time delay between the pump <br> stopping and the reversal starting. |
| Fault - Reverse Delay (secs) | When a fault has activated a pump reversal this value defines the minimum delay <br> after the fault before the pump can be run in reverse. |

Table 20 - Pump Reversal Parameters
Once the parameters have been set to the desired value, press Save and return to the home screen. Pressing the "Apply to All Pumps" button sets the same duration and delay values for all pumps. Remember that each fault that is required to trigger a pump reversal must be set in the respective fault screen - see Section 14.9.1.

### 16.1.1.1 Manual Operation

The reversing function can be operated manually from the Pump n Reversal Duration/Delays screen (as shown above in Figure 129). Note that each pump has its own configuration screen - be sure you are in the correct screen before manually reversing.
Press the Reverse Now button to reverse the pump - the display returns to the home screen.
The pump will not reverse if it is currently running or any condition is in place (such as an active fault) which has been configured to block a reversal. If for some reason the pump cannot reverse, the screen still returns to the home screen but no pump reversal takes place.

### 16.1.2 Odor Reduction

Sewer stations with both high and low-use periods often generate odors. During the low use period (e.g. a weekend), the station may take a number of days to reach the activation level for the pump. This delay allows the station to become septic. The Odor Reduction feature allows a maximum off time to be applied so the station is regularly emptied in order to reduce odors occurring.


Figure 133-Odor Reduction Screen


Use the Help button for more information at any time.

## Odor Reduction Help Text

Check this box to enable Odor Reduction. Odor Reduction is usually used to reduce H2S build-up.

Odor Reduction defines the maximum time for which pumps within the station should remain off. If no pumps are activated within the time period defined by the Duration parameter, and Odor Reduction has been enabled, then Odor Reduction will attempt to start the number of pumps defined by the Num Pumps to Start parameter.

NOTE: If the level of the well is beneath a pump's deactivation set point, then that pump will not be activated (i.e. Pumps will not be forced on if the well is empty).

### 16.1.3 Maximum Run Time

Maximum Run Time is used to prevent any pump from running too long. It does this by cycling the pumps when a maximum run time is reached.


Figure 134-Max Run Time Screen


Use the Help button for more information at any time.

## Max. Runtime Help Text

Check this box to enable Maximum Run Time.
Maximum Run Time defines the maximum time for which pumps may run continuously. If this duration is exceeded, then a fault may be triggered, notifying operators of potential problems within the station.

### 16.1.4 Well Clean Out

This feature allows the pumps to be run past the normal deactivation point for a set time or to a set level, in order to completely empty the well. This can be made to occur at regular periods.


Figure 135 - Well Cleanout Screen
If "Use Profile Setpoints" is set to true, then the Well Clean Out setpoints defined in the profile are used instead of the values on this screen. If set to false, then standard setpoints defined on this screen are used. Check the box using the Toggle button to enable profile setpoints for Well Clean Out.


Use the Help button for more information at any time.

## Well Cleanout Help Text

The Mode defines the condition upon which a well cleanout will be activated. The following modes are available:

- Disabled
- Pump Cycles (activate well cleanout after a defined no. of pump cycles)
- Timers (activate well cleanout when a timer becomes active)
- Pump Cycles and Timers (activate well cleanout after a no. of pump cycles or when a timer becomes active)

If the user wants to use extra options for inhibiting well cleanout, press the Options button displayed on the bottom left of the screen.

The additional options for stopping well cleanout are:

- Pump under current
- Pump low power factor
- Low station outflow
- Digital alias

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Figure 136-Well Cleanout Inhibit Options
These inhibit options are disabled by default. The user can enable these options on this screen. These options make sure that pumps will be stopped before reaching the pump's snore point, thus protecting the pumps during well cleanout. If these options are enabled, then the Delay Adjustment and Level
Adjustment on the Well Cleanout screen are not used and a value of 0 is used for both Delay and Level Adjustments.

Digital Alias on this screen can be assigned to any digital tag to stop well cleanout when the tag is set.
Under Current Threshold defines the pump under current threshold for inhibiting well cleanout. If the pump current reaches less than this threshold, well cleanout is inhibited if it is active.

Low Power threshold defines the pump power factor threshold for inhibiting well cleanout. During a well cleanout, if pump power factor reaches less than this threshold, well cleanout is inhibited.
Low Flow threshold defines the pump station outflow rate threshold for inhibiting well cleanout. If the station outflow rate reaches less than this threshold during a well cleanout, the cleanout is inhibited.

A value of 0 for any of these thresholds indicates that the particular option is disabled for inhibiting well cleanout.

### 16.1.5 Well Washer

A well washer can be controlled by the MultiSmart in order to coordinate its use with the pumping cycles.

| Name | Description |
| :--- | :--- |
| Enabled? | Toggle this value to enable or disable the well-washer feature. |
| Activation Level | Sets the level at which the washer is activated. |
| Activation Delay | Sets a delay after the Activation Level is reached before the well washer is started. |
| Max On time | Maximum run time for the well-washer |
| Inter-Start Period | Ensures the well washer does not run too often |
| Maximum Off Time | Sets a maximum time the well-washer can be off. This ensures the washer is run at a <br> minimum interval even if the well level has not reached the activation level. |

Table 21 - Well Washer Parameters
NOTE: It will also be necessary to configure a digital output to activate the well washer. In particular, you will need to set the digital output source to the well washer "active" tag. See Section 14.11 for a description of how to configure digital outputs.

### 16.1.6 Well Mixer

The Well Mixer feature allows well mixers to be controlled in one of two ways:

- Every Pump Cycle
- Every x Hours

In addition to each mode, the pumps can be allowed or inhibited to run with the mixer.
For both modes, a digital output must be assigned to the source Well Mixer Active. (Not to be confused with the Well Washer Active source). (See Section 14.11)

This Well Mixer feature is part of a separate module which if not enabled at the time of purchase can be enabled later with a new Site Key (requires firmware version 2.2.0 or later).


Figure 137 - Well Mixer Screen

### 16.1.6.1 Every Pump Cycle

In this mode, the mixer starts when the lead pump run command is sent, however the actual pump start is delayed until the mixer stops (providing the Run Pumps With Mixer check box is unchecked). The mixer runs for the specified Run Duration or until the level reaches the Minimum Level.

### 16.1.6.2 Every $x$ Hours

In this mode, the mixer starts periodically based on the specified Frequency (e.g. once every 4 hours). If the Run Pumps With Mixer check box is unchecked then the pump and mixer do not run simultaneously. The mixer runs for the specified Run Duration or until the level reaches the Minimum Level.

If the Run Pumps With Mixer is unchecked and the pump happens to be running when the time period expires, the mixer runs for the full duration after the pump stops.

### 16.2 Additional Parameters

Pressing the Advanced button on the Optimization screen displays the advanced settings screen, where a large number of additional pump control settings may be found, including the following settings.

### 16.2.1 Max. Number Groups Running

This feature is used to control how many groups run at same time. This function is only required when more than one group has been configured. It can be used to restrict groups from running at the same time, for example, making sure jockey pumps do not run when flood pumps are running. The feature is on by default and set to 1 .

### 16.2.2 Group

When more than one group of pumps have been configured (see Section 13.3), different parameters can be set for each group. For example, Max Pumps Running can be set differently for group 1 and group 2.

### 16.2.3 Pulse Start \& Pulse Stop

A digital input can be assigned to the Pulse Start option through the advanced menu. The example below shows how to assign Digital Input 12 to Pulse Start:

Settings $\rightarrow$ Advanced (This is the direct path).

- From the tree select Pump Control $++I$ Pulse Start ++- Pulse Start $01+I-$
- Scroll down to Source and press "Use this button to view or change value."
- From within the Digital tag tree, scroll down to $\mathbf{I O}++I-$ Unit $+I-$
- Select the board that contains the Digital Input, in this case the Top Board ++- then Din ++-
- Scroll down to chosen digital input, (DIN. 12 shown here) $\_12++-$
- Scroll down to a DigitalTag, select ValueDigital, press Ok, then press Save
- Use the Back button to return to the main screen.

The pulse start function will normally only allow a pump to start if the level is above the pump's deactivation point. An additional configuration parameter allows the Pulse Start and Pulse Stop feature to ignore the level. This feature is configured by the parameter:
Settings $\rightarrow$ Advanced $\rightarrow$ Pump Control $\rightarrow$ Ignore Set Points?

Once this configuration parameter is activated the Setpoints will be hidden both on the main display and in the Settings menu option.
To activate the Digital Input a restart is required.

(Alternatively cycle the power).

### 16.2.4 Assigning a Name to Digital Inputs (Optional)

A descriptive name such as "Pulse Start Input" can be assigned to Digital Input 12 as shown below:

## Settings $\rightarrow$ Advanced

- Navigate through the tree:

IOModule ${ }^{+I-}$ Unit ${ }^{+I-}$ Unit $01+$ Top Board ${ }^{++-}$Digital Input ++- DIN. $12++-$

- Under Description enter a new name.
- Press Save and return to the main screen using the Back button.

The changes to the Digital Input name can be confirmed by going to:

## Settings $\rightarrow$ I/O, Faults \& Level $\rightarrow$ Digital Inputs

Scroll down to TopBoard Din 12 and the new name should appear in right column.

### 16.2.5 Well

Parameters can be set for how primary \& backup level devices function, and when backup devices take over.

## 17 Energy Monitoring and Motor Protection

Energy Monitoring and Motor protection is an optional module consisting of the Energy Monitoring and Motor Protection board (3MP board) and software.

WARNING:
IF THIS MODULE IS NOT CONFIGURED, YOUR PUMPS WILL NOT BE PROTECTED.

This module monitors currents and provides protection from:

- Over-current
- Under-current
- Phase fail (current)
- Phase rotation (current)
- $\quad I^{2} T$ Protection
- Ground (earth) fault

This module also monitors Insulation Resistance values with pump lockout or fault notification when IRT values fall below a user-defined threshold. Two separate areas must be configured:

- Current Transformer (CT) Values
- Motor Protection Values


### 17.1 Setting Motor Protection Values

Motor Protection configuration is accessed by navigating to:


Figure 138 - Motor Protection Settings Screen
This screen can be used to copy motor protection settings from one pump to another. This speeds up the configuration process if all the pumps in a well are the same. Simply configure the first pump and then copy the configuration to the others using the Copy to button.

To edit motor protection settings, select a pump in the left hand column and press the Config button.


Figure 139 - Motor Protection Settings for an Individual Pump.

### 17.1.1 Configuring CT Values

Current transformers (CTs) wired into the Energy Monitoring and Motor Protection board (3MP) are used to monitor motor currents. In order for the correct currents to be calculated, the ratio the CTs must be entered.
The default configuration is for a 50:5A CT for each current input.

| Name | Description |
| :--- | :--- |
| CT Primary | Enter the CT Primary current in Amps. |
| CT Secondary | Enter the CT Secondary current in Amps. <br> Note: 5A is the maximum CT Secondary current allowable. <br> Benchmark EfficiencyIf required, enter the value which ongoing efficiency measurements will be <br> compared against. This value is displayed in the Efficiency screen (see Section <br> 5.4.3.1). The default is -1.0 to indicate that nothing has been entered. |
| Full Load Current (Amps) | Sets the Full Load Current of the pump motor. This setting must be correctly <br> entered by the user for the threshold values to correctly work. |

Table 22 - CT \& FLC Parameters

### 17.1.2 Configuring Motor Protection Faults

| Name | Description |
| :--- | :--- |
| Amps Phase Imbalance | Detects a current imbalance between phases. The threshold value sets how <br> much imbalance is acceptable before a fault condition exists. |
| Amps Phase Rotation | Detects if the phase rotation is incorrect. |
| Ground (Earth) Fault | Detects a fault to ground. The threshold value sets what amount of phase to <br> ground current is required to be considered a fault. |
| Insulation Resistance | The energy monitoring and motor protection board has a built in insulation <br> tester. This parameter sets fault conditions. The threshold value sets the <br> insulation resistance level to raise a fault condition in Mohms. See Section 17.2 <br> for more detail on configuring the insulation resistance tester itself. |
| Insulation Resistance Warning | This option if enabled will give a warning and will not fault the pumps by default. <br> However we can set this to fault the pump if required. The main use for this is to <br> generate a warning at the first threshold set for the test. |
| Low Power Factor | Detects a Low Power condition. The threshold value sets the level of low power <br> factor required before a fault condition exists. |
| Over Current | Detects an Over Current condition. The threshold value sets the level of over <br> current required before a fault condition exists. |
| Over Current I ${ }^{2} \mathrm{~T}$ | Calculates the instantaneous I ${ }^{2} \mathrm{~T}$ and faults the pump if the calculated value <br> goes above the threshold. |
| Pump Efficiency | This functions as a fault. If the calculated efficiency is larger than a preset <br> amount, a Pump Efficiency fault is displayed. |
| Under Current | Detects an Under Current condition. The threshold value sets the level of under <br> current required before a fault condition exists. |

Table 23 - Motor Protection Faults
Most parameters use a \% of Full Load Current (FLC) as the threshold. Ensure that the FLC is correctly setup for each pump, and ensure that any motor protection threshold $\%$ is set, and the function is enabled.
On screen help is available for most parameters.
NOTE:
Motor Protection must be configured by the user. The defaults are designed to alert the panel builder, or contractor commissioning the station to the fact that values for full load current must be entered.

### 17.1.3 Configuring Faults

Each fault described above has the following configuration settings:

| Name | Description |
| :--- | :--- |
| Enabled? | Enables or disables the fault. |
| Threshold | Sets a threshold where it is relevant. When this is reached, a fault condition is <br> activated. |
| Act Delay (secs) | Activation delay in seconds. This sets how many seconds to wait after a fault has <br> been detected before an alarm condition is raised. |
| Deact Delay (secs) | Deactivation delay in seconds. Sets how many seconds to wait before deactivating an <br> alarm condition after the fault condition is no longer present. |
| Pump Unavailable? | Check this box to make the pump unavailable when the fault is active. |
| Man Reset Required? | Determines whether MultiSmart performs an auto-reset of the fault or an operator is <br> required to manually reset the fault. <br> (Note, even if auto-reset is selected, an operator must still manually acknowledge the <br> fault via the display or via SCADA before it is cleared from the screen). <br> The manual reset can be further configured so that a manual reset is required only if a |
| preset number of faults occur within a set period of time. |  |
| i.e. when the number of faults equals the preset value and they occurred within the set |  |
| period, the pump becomes unavailable (locked out) until an operator resets the fault. |  |
| This is configured as follows: |  |
| Enable Pump Unavailable |  |
| Enable Manual Reset Req (this also displays the extra settings) |  |
| Set the After [x] faults to the number of faults |  |
| Set the Within (hh:mm:ss) field to the length of time that the number of faults must |  |
| occur within to trigger a Manual Reset lockout (pump unavailable). |  |
| Set the 'Reset Count on pump cycle' to true to zero the manual reset required count |  |
| on a successful pump cycle. For example, if a manual reset was required after 3 |  |
| instances of the fault, then if the fault occurred for two consecutive pump cycles, but |  |
| then the pump ran successfully for the next pump cycle without faulting, the fault |  |
| count is reset back to zero. |  |
| Press Save to confirm. |  |

Table 24 - Basic Fault Options
To configure each of the motor protection faults, navigate to
Settings $\rightarrow$ More $\rightarrow$ Motor Prot \& Efficiency and select the pump and press Config. Scroll down to select the desired fault and press Configure. The left box contains the current value while the right box contains the last modified value. Remember to press Save after making the necessary changes.

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### 17.2 Insulation Resistance Tester

The energy monitoring and motor protection board has a built in insulation tester. It can be configured to conduct tests at regular intervals. A wiring diagram can be found in Section 7.6.1. Navigate to:

$$
\text { Settings } \rightarrow \text { More } \rightarrow \text { Motor Prot \& Efficiency and select the pump and press Config. }
$$

There are two options listed,

- Insulation Resistance Warning
- Insulation Resistance (Test)

Both can be set to fault the pump, however as the name suggests, the Insulation Resistance Warning fault is configured to generate an alarm and not to fault the pump. In order to configure the threshold, scroll down and select the appropriate option and press Configure. Save the settings after the changes are completed.
An Insulation Resistance test is only carried out when the pumps are not running. The MultiSmart checks if the pump is currently running and skips the test if it is still running. Insulation Resistance Test can be carried out automatically over a changeable time period. It can also be done manually from the information screen (Refer to Section 17.2.4).
Advanced configurations for the Insulation Resistance Test can be done from the Advanced menu.
Browse to Advanced menu:

## Settings $\rightarrow$ Advanced

Navigate to the Motor Protection section:

- From the tree select: Motor Protection $+1 /$ Pump $+I-$
- $\quad$ Select the correct pump (i.e. Pump 01) and press $+1-$
- Select Insulation Resistance Test (IRT) + + .
- And again select Insulation Resistance Test (IRT) + +

The following parameters can be set:

| Name | Description | Default |
| :--- | :--- | :---: |
| Clear To Run | If linked to a digital input, when true IRT is allowed to run, when false IRT is <br> blocked. If no tag is assigned, then IRT is allowed to run. | None |
| Cool Down Period <br> (sec) | The Cool Down Period gives the pump a set amount of time to cool down <br> before the insulation resistance test is run. | 10 s |
| Enabled? | Enables or disables the insulation resistance test. | Disabled |
| IRT Hardware Input | A pointer to the actual hardware performing the function. For pump 1 it is <br> usually IRT1. You don't usually need to change this parameter. |  |
| MOhms | Sets a measurement threshold in Mega Ohms. When this is reached, a fault <br> condition is activated. | $1.0 \mathrm{M} \Omega$ |
| MOhms | Sets the measurement threshold in Mega Ohms for the IRT warning to be <br> generated. Default setting will not fault the pump. | $5.0 \mathrm{M} \Omega$ |
| Test Duration | Sets how many seconds the insulation test will last. The recommended time <br> is 60 seconds. | 60 s |
| Test Interval | Time interval between tests in hours. Tests are only conducted when the <br> pump is stopped and the Cool Down Period has expired. | 4 h |
| Test Voltage | The insulation tester can operate at 250V, 500V or 1000V. | 1000 VDC |
| Warning Enabled | Insulation Resistance Test Warning Threshold is enabled | Disabled |

Table 25 - IRT Parameters

### 17.2.1 Enabling Insulation Resistance Testing (IRT)

During the Setup Wizard, the IRT terminals are automatically assigned, although for safety reasons the IRT functionality is not enabled. To enable IRT for each motor perform the following procedure.

Navigate to:


- Select the required pump with the arrow keys.
- Press Config
- Scroll down to Insulation Resistance and press Configure
- Press Toggle to check the enable box
- Change the default threshold resistance of 1.0 M ohms if necessary
- Press Save and Back and repeat for each pump

An Insulation Resistance Warning can also be configured in the same way - enable and enter a suitable warning threshold resistance.


NOTE:
By default IRT is not enabled.

Basic Insulation Resistance Test configurations can be done from the Settings menu.
Navigate to:

$$
\text { Settings } \rightarrow \text { More } \rightarrow \text { Motor Prot \& Efficiency }
$$

- Select the required pump with the arrow keys.
- Press Config
- Scroll down to Insulation Resistance and press Configure
- Press Settings button displayed on the bottom of the screen


Figure 140 - Insulation Resistance Test Configuration Screen

The following parameters can be set from the IRT Configuration screen:

| Name | Description | Default |
| :--- | :--- | :---: |
| Test Voltage | The insulation tester can operate at $250 \mathrm{~V}, 500 \mathrm{~V}$ or 1000 V. | 1000 VDC |
| Test Duration | Sets how many seconds the insulation test will last. The recommended time <br> is 60 seconds. | 60 s |
| Test Interval | Time interval between tests in hours. Tests are only conducted when the <br> pump is stopped and the Cool Down Period has expired. | 4 h |
| Cool Down Delay <br> (sec) | The Cool Down Period gives the pump a set amount of time to cool down <br> before the insulation resistance test is run. | 10 s |
| Max Resistance | Maximum resistance displayed by the test | $999.99 \mathrm{M} \Omega$ |

Table 26 - Basic IRT Parameters

### 17.2.2 Soft Starter and Pump Isolation for IRT

When a Soft Starter (or VFD) is used, it is essential (in most cases) to isolate it from the Insulation Resistance Test voltage (1000V DC). This can be accomplished using isolation contactors positioned after the Soft Starter. A digital output (one for each pump) is assigned to a pump isolation tag which becomes active whenever the Insulation Resistance Test is in progress.

### 17.2.2.1 Assigning the Pump Isolation Tag to a Digital Output

To isolate the IRT voltage from a Soft Starter, a digital output is used to activate the Isolation contactor.
The procedure to configure a digital output for this purpose follows.

- Firstly identify a free digital output for each pump
- Navigate to: Settings $\rightarrow$ I/O Faults \& Level $\rightarrow$ Digital Outputs
- Highlight the selected Dout
- Press Config and then press the Advanced button
- Now find the source (pump isolation tag)

Navigate to:


- Once Pumplsolation is highlighted, press Ok
- Press Ok, Back, Save and Restart Later
- Repeat this procedure for each pump - allocating the selected Dout to the appropriate pump isolation tag.
- When the last tag is assigned restart the unit.


### 17.2.2.2 Inverting IRT (Pump Isolation) Dout

As configured, the digital output is active whenever the IRT is active and the Isolation contactor must be open during this time (i.e. the Contactor will be normally closed), so typically it will be necessary to invert the digital output.
To invert a digital output:

- Navigate to:

- Press the bottom button on the left-hand side marked Invert?
- Press Save and Restart Now


### 17.2.3 IRT Inhibited

Case 1: Before performing a test, the IRT monitors the voltage on the IRT terminal. If it is above a threshold $(50 \mathrm{~V})$, the test is not performed.
Case 2: In addition, during the test, it monitors the load (current). If this is too high (as it will normally be if the mains voltage is present, rather than an isolated motor), then the test is aborted. (This is done in hardware, not in software).

In both of the above cases, the Last Test Status is updated, but the resistance is not (it retains the value of the last successful test).
This means that a test is not normally performed when there is power to the motor, but Case 2 can occur, which means that the high IRT voltage will attempt to drive, but the resistance won't be updated. If the IRT attempts to drive a running motor, Case 2 is sufficient to protect MultiSmart and the very limited current available means that driving the IRT will have no effect on the motor. The fact that the value is not updated in either of these cases means that trends of the IRT value should be unaffected.

### 17.2.4 Manual Activation of the Insulation Resistance Test

An Insulation Resistance Test (IRT) can be manually activated. To perform an IRT:-

- Press: Info $\rightarrow$ Pump Information $\rightarrow$ Insulation Resistance or
- Press:

- Press the left / right arrow keys at the bottom of the screen to highlight an IRT corresponding to a pump.


CAUTION: Once activated 1000 VDC will be present on the IRT terminals.

- Press the Test Now button. The test will last for the time specified under Duration (default 60s)


CAUTION: A test will be conducted for each press of the Test Now button.

### 17.2.5 IRT Wiring for 6-Star Delta Starter

Figure 136 below illustrates the wiring when the Insulation Resistance Test (IRT) is used with a 6 wire StarDelta Starter. The MultiSmart IRT outputs are connected to one phase of each pump as shown.


Figure 141-IRT Wiring for 6-Star Delta Starter

### 17.3 Reassigning (Motor) Current Inputs used in Motor Protection

If an Energy Monitoring and Motor Protection (3MP) board is installed and is selected during the Setup Wizard (as being in the bottom slot), then the motor Current Inputs (for each phase) for three motors are automatically assigned.
The following procedure only applies if it becomes necessary to modify the default motor Current Inputs. As an example, navigate to:

$$
\text { Settings } \rightarrow \text { Advanced } \rightarrow \text { Motor Protection } \rightarrow \text { Pump } \rightarrow \text { Pump 01 } \rightarrow \text { IIN }
$$

- Select Amps A
- Press the "Use this button to view or change value." button to reveal the node list. (The highlighted node that appears in this screen is the currently assigned Current Input.)
- Scroll down to:- ... IIN I _2 I Amps A, and press Ok
- Repeat for the other 2 phases and then press Save

This has reassigned Current Inputs "2" (i.e. current inputs 2A, 2B and 2C) to pump 1 (rather than pump 2).
Repeat this procedure for each pump that requires the default motor Input Currents to be modified from the default.

### 17.4 Calculating Efficiency

The MultiSmart has support for calculating the pump efficiency and displaying it on the LCD screen as well as sending it to SCADA. To be able to calculate the efficiency, energy monitoring, motor protection and flow must be enabled. Refer to Section 17 for more information on energy monitoring and motor protection and refer to Section 20 for more information on flow.
Efficiency is calculated as Volume/Energy AND as Volume/Energy/Head.

### 17.4.1 Efficiency

Efficiency can be displayed in Litres/kWh or kWh/Megalitre. This can be configured by navigating to:


Efficiency information for today, yesterday, this week, last week, this month \& last month and total efficiency can be observed at the following menu on the LCD screen.
Info $\rightarrow$ Power \& Efficiency
The efficiency can also be set to be displayed in the main screen. To set this:
Navigate to:


Select the desired efficiency data to be displayed.
The efficiency calculations are updated dynamically in all flow calculation modes except for calculated mode where the efficiency is updated at the end of the pump cycle.

When an overflow condition is detected, a constant flow rate which is the previous average of the pump outflow rate is used for the current pump cycle for efficiency calculations. As soon as the pumps catch up and the overflow is cleared, the MultiSmart will resume normal flow calculations.
There are occasions where manual override of power factor is desirable. For example, Modbus communications to a VFD may not include power factor, and energy and efficiency calculations may therefore be incalculable. In this scenario, the power factor can be measured manually and stored into the MultiSmart as a parameter which is then be used by the MultiSmart for energy and efficiency calculations.
To configure this navigate to:

and select the corresponding power (Power 01 etc) option with respect to the pump number, set the power factor value of Manual Power Factor option and Save the settings.
MultiSmart will now use the new power factor for the efficiency calculations.

### 17.4.2 Efficiency per Unit Head

To make use of this calculation, the parameter Head must be altered in the advanced screens:


This value is used to display the True Efficiency calculations in the Power \& Efficiency page in the Info screens.

## 18 Supply Protection

The Pump Control/General I/O Board monitors the single or three phase supply through the "Mains Voltage Monitoring" inputs. Single and 3 phase power supplies can be monitored by the MultiSmart. The voltage is constantly measured and is used to detect the following conditions:

- Under Voltage
- Over Voltage
- Phase Imbalance (or Phase Failure)
- Phase Rotation

Supply protection is usually automatically enabled when the setup wizard is completed.


NOTE:
The Under Voltage threshold is temporarily ignored during the starting of a pump.

To configure supply protection navigate to:

Settings $\rightarrow$ More $\rightarrow$ Supply Protection


Figure 142 - Configuring Supply Protection Faults


Use the Help button for more information at any time.

A range of parameters can be set:

| Name | Description |
| :--- | :--- |
| Over Voltage | Used to protect the station from over voltage conditions. The setup wizard automatically <br> configures an initial value to $15 \%$ above the nominal phase to phase voltage. |
| Under Voltage | Used to protect the station from under voltage conditions. While the pump is starting, <br> this fault is disabled for a short while. The setup wizard automatically configures an <br> initial value to $10 \%$ below the nominal phase to phase voltage. |
| Volts Phase Imbalance | Protects the station from a change in voltage in relation to the other phases. This can <br> also be used to detect phase failure. The setup wizard automatically configures an initial <br> value to 15\% of the nominal phase to phase voltage. |
| Volts Phase Rotation | Protects against a change in phase rotation. |
| DC Over Voltage | Used to protect the station from DC Over Voltage conditions. |
| DC Under Voltage | Used to protect the station from DC Under Voltage conditions which may occur when <br> the station has been running off the battery for a long period of time. |
| Battery Over Voltage | Used to protect the station from Battery Over Voltage conditions which may occur when <br> the battery is over voltage during the battery test. |
| Battery Under Voltage | Used to protect the station from Battery Under Voltage conditions which may occur <br> when the battery is under voltage during the battery test. |

Table 27 - Supply Protection Faults
Each Supply Protection fault described above has the following configuration settings:

| Name | Description |
| :--- | :--- |
| Enabled? | Enables or disables the fault. |
| Threshold | Sets a voltage threshold where it is relevant. When this is reached, a fault condition is <br> activated. |
| Act Delay (sec) | Activation delay in seconds. This sets how many seconds to wait after a fault has <br> been detected before an alarm condition is raised. |
| Deact Delay (sec) | Deactivation delay in seconds. Sets how many seconds to wait before deactivating an <br> alarm condition after the fault condition is no longer present. |
| Fault Station? | Sets whether to fault the station when a fault is detected |
| Manual Reset Required? | Sets whether a Manual Reset is required after a fault condition has been detected. |

Table 28 - Supply Protection Fault Parameters

### 18.1 Battery Test

MultiSmart Battery voltage can be monitored by performing Battery Tests in MultiSmart.
To configure Battery Test, navigate to:


Figure 143 - Configuring Battery Test
Battery Test has the following configuration settings:

| Name | Description |
| :--- | :--- |
| Enabled? | Enables or disables battery test. |
| Period Type | Period Type defines the frequency of battery test. It can be performed Daily, Weekly <br> or Monthly. |
| Start Time | Start Time defines the time of the day at which battery test will start. |
| Duration | Duration defines the duration of the battery test. |
| Day | In case of Weekly or Monthly battery tests, Day defines the day of the week or month <br> to perform the battery test. |

Table 29 - Battery Test Parameters
The Battery test is initiated at a specified time. It activates a digital output to switch to Battery only mode for the specified test duration. The DC voltages at the MultiSmart are checked during this period and the digital output turns off on completion, switching back to the DC voltage from the main power supply.
To isolate the MultiSmart from the DC voltage (from the power supply) during the battery test, 'Test Battery' in the Configure Digital Output screen is assigned to a digital output.

Make sure that Battery Under Voltage and Battery Over Voltage faults are enabled before starting the battery test. These faults represent the state of the Battery. If the battery test is completed without any of these faults being activated, it indicates that the battery is in a good state.

If the MultiSmart reboots as a result of the battery test, the 'Battery Test Failed' fault will be activated. If there is an unacknowledged fault as a result of the battery test, a new test cannot be started. Test details such as start time of test, end time of test and DC voltage during the test can be found in the History page.

## 19 Datalogger

The MultiSmart comes with a sophisticated datalogger. The results can be viewed by pressing the History button from the main screen. Also, the data can be downloaded onto a laptop and viewed via Excel, Access, or any other reporting/database tool.
The primary datalogger - called the Event Logger - stores faults and events and is fully configurable.
There are additional datalogging options (which are explained later in this section):

- Crisis Logging
- Interval Logging

The datalogger stores approximately 50,000 events and faults. Each event or fault is date/time stamped.
By default, the following are configured to be logged:

- All faults
- Level
- Pump starts/stops
- Pump mode changes
- Changes to analog inputs and level by more than $5 \%$
- Voltage changes of more than 10 V
- Flow values and overflow events - if the optional flow module is installed
- Profile changes
- Pump power factor
- SMS send/receive
- Level Simulation activates/deactivates
- Pump efficiency yesterday
- Energy accumulators per pump
- IRT changes
- Single or 3-phase current changes
- User logins, invalid logins, invalid administrator logins
- Unforced restarts (watchdog)
- Temperature changes of more than $10^{\circ} \mathrm{C}$


### 19.1 Configuring the Event Logger

Event Logger configuration is through the Settings menu:
Settings $\rightarrow$ More $\rightarrow$ Datalogger $\rightarrow$ Event Logging

Figure 144 - Event Logger Main Configuration Screen
To stop logging "tags" (as each fault or event is called), there are two options - Delete, which removes them from this list, or Disable which stops them logging but retains the setup in the Event Log Configuration screen.

Edit and New Event buttons displays the same screen but in the case of Edit, the configuration screen is already populated:


Figure 145 - Event Logger Parameter Configuration Screen
In the case of a new tag, if no Description is entered, the value defaults to the tag name. Tag names can appear cryptic to a lot of users. The value for the Description is what appears in the entry in the history screen (Section 5.4.2).

Once Source Tag is highlighted, the Toggle button changes to Select. Pressing this button brings up the Tag Browser where any tag can be selected. The most useful tags to log are usually found under Pump Control, IO and Flow. A full list of tags can be found in the Modbus and DNP3 manuals (available online at www.multitrode.com).

The parameters in this screen are described as follows:

| Name | Description |
| :---: | :---: |
| Description | Description of the event as it will appear in the history page. |
| Source Tag | The tag being monitored and logged. The value of this tag will be saved to the history log when it changes state, or in the case of an analog tag, when it changes by more than the Deadband. |
| Type | Event types can be used for changing how a value is displayed in the history page or for filtering purposes. Standard mode is the default. The setup wizard configures the datalogger as part of station configuration and will automatically select the appropriate value for Type. <br> Additional modes are: <br> - Pump Mode (displays Auto, Manual, Off) <br> - Config Log (for identifying changes in configuration) <br> - Start/Stop (displays "Started" and "Stopped" instead of True/False) <br> - Currents (Amps) <br> - Voltage |
| Enabled? | This checkbox allows logging to be disabled without deleting the tag and its configuration. This allows later re-enabling if required. |
| Deadband | The Deadband is an important parameter for analog values. Logging of events is based on change of state. In the case of analog values, it is based on a deadband. <br> The deadband is always an absolute value. For analog inputs however, the deadband is associated with the scaled value, which is $0-100$ by default. Therefore the deadband is actually a percentage in this case. However, for duo-probe, the scaled range is $90-140$ for an analog input. For volts and currents, every station is different, so the appropriate deadband needs to be set. |

Table 30 - Event Datalogger Parameters

## NOTE:



If the deadband is set with too small a value (e.g. zero), there will a huge amount of datalogging on this one tag. The correct value of deadband depends completely on the installation and the importance for the organization of capturing changes in each tag.

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### 19.2 Crisis Logger

The crisis logger is a very powerful datalogging feature which allows for higher resolution logging around particular faults and events - without filling up the datalogger memory.

For example, the organization might have chosen not to log motor currents because the datalogger memory fills up too quickly. However, when a motor over-temperature fault occurs, the currents immediately before this fault might be of great interest.
The crisis logger allows the user to:

- Select "triggers" that activate the crisis logger
- Define the time period before and after each trigger to log
- Define the time interval between each log
- Select multiple tags to log when the trigger event occurs


Figure 146 -Crisis Logger Main Configuration Screen
Navigation is similar to the Event Logger. Simply use the Select up and down arrows via the soft-keys on the right to select a trigger, then click Edit.
To add a new trigger, click New Crisis. Both of these actions lead to the same screen, but in the case of Edit, the screen is already populated with the existing information:


Figure 147 - Configuration of Crisis Log "Trigger" Parameters
This screen defines how the trigger tag is configured and the time periods and interval for logging. The Tags button at the bottom navigates into the list of tags that are logged when the trigger event occurs. In that screen (not shown), New Tag and Edit (of existing tags) both use the tag browser.
Parameters in this screen are explained below:

| Name | Description |
| :--- | :--- |
| Description | Description of the "trigger" or event as it will appear in the history page. |
| Trigger | The tag being monitored which will trigger intensive logging of other tags. This can <br> only be a digital tag (on or off), e.g. a fault, a digital input, a digital output, etc. |
| Enabled? | This checkbox allows logging to be disabled without deleting the tag and its <br> configuration. This allows later re-enabling if required. |
| On Value of | Selectable as "True" or "False" - if set to "False" then when the tag being monitored <br> changes from On to Off, the crisis logger will be triggered. |
| Samples (secs) | Time between each log of the tags associated with the trigger. |
| Before (secs) | Time before the trigger occurs to record data. |
| After (secs) | Time after the trigger has occurred to record data. |

Table 31 - Crisis Logger Configuration for "Trigger" Parameters
Example: With Samples $=1$, Before $=20$ and After $=10$, all of the tags associated with this trigger will be logged for 20 seconds before the trigger occurs and until 10 seconds afterwards at 1 second intervals.

### 19.3 Interval Logger

The best use of memory is to log on change of state. However, some organizations may wish to log specific tags on exact time intervals. Examples of where logging on an interval might be required are:

- Regulatory reporting requirements
- Hydraulic modeling software data input
- Internal requirements for values in reservoir levels at midday and midnight

The interval logger provides this functionality.


The configuration screens are similar to the event logger and crisis logger above. The parameters that can be set for interval logging for each tag are explained below:

| Name | Description |
| :--- | :--- |
| Description | Description of the event as it will appear in the history page. |
| Source Tag | The tag being monitored and logged. The value of this tag will be saved to the history log at a <br> frequency defined by the interval. |
| Type | Event types can be used for changing how a value is displayed in the history page or for filtering <br> purposes. Standard mode is the default. |
| Enabled? | This checkbox allows logging to be disabled without deleting, to allow later re-enabling if required |
| DNP Event? | DNP events are usually only triggered on change of state (a change outside deadband for an analog <br> tag). If enabled, a DNP event will also be triggered when the value is logged to history - allowing <br> these interval logs to be reported to SCADA. |
| Interval Type | Intervals can be set as hh:mm:ss for more frequently logged data. There are also options for days, <br> weeks and months. |
| Interval | This value, in conjunction with Interval Type, is what sets the logging frequency. For example, if <br> Interval Type = "Days" and Interval = 5, this parameter will be logged every 5 days. The exact time of <br> logging is set by the Offset parameter. |
| Offset | This defines the offset to each time period at which to trigger the event log. For example, if the interval <br> is set to 1 hour and the offset is 30 minutes, the value will be logged at 30 minutes past each hour. <br> If the interval is defined to be a multiple of one day, then the offset specifies the time of the day to <br> trigger an event. If the interval is defined to be a multiple of one week then there is also the option to <br> specify the day of the week. If interval is monthly there is the option to specify the day of the month. |

Table 32 - Interval Logger Configuration Parameters

### 19.4 Filtering the Data Viewed in the History Page

From the main operator screen, pressing the History button shows all events and faults logged. The History page has the option for filtering the data to make it easier to find specific events or faults.

While in the History page, press Filters. This brings up a screen with five filter options. The screen also shows if any filters are currently applied under each type.

By selecting each of the options on this screen, filters can be applied to a number of different areas as explained in the following sections. A filter does not start or stop any data being logged, it only affects viewing of that data in History.

NOTE: Any filters you apply remain in place for any future users of the History page, so if there are
many users of the system, it is best to remove the filters before leaving the station.

### 19.4.1 Log Type / Pump Filters

History $\rightarrow$ Filters $\rightarrow$ Log Type / Pump Filters

Within this filter, the first option is Log Type with a selection between different logging methods (described earlier in this chapter):

- Faults and Events
- Interval Logs
- Crisis Logs
- Config Logs

These different logs cannot be displayed together. Additional to Log Type there are check boxes for:

- Events
- Faults
- Pump 1
- Pump 2 etc

To only view faults, uncheck the Events box. To remove faults from the view, uncheck the Faults box. To view station data not relating to a pump, uncheck both (or all) the pump boxes.

Once changes are made, press Save, then Back -> Back and the History screen will now show the filtered data.

### 19.4.2 General Event Filters

History $\rightarrow$ Filters $\rightarrow$ General Event Filters

There are 17 useful filters:

| Analog Inputs | Device Restarts | Pump Energy | User Logins |
| :--- | :--- | :--- | :--- |
| Comments | Flow | Pump Mode | Voltages |
| Currents | Insulation Resistance | Pump Starts | All other events |
| Current Profile | Level | Pump Stops |  |
| DC Supply | Level Alarms | Temperature |  |

Table 33 - Predefined Filters Available in General Filters
By default, all of these filters are enabled (checked). To remove any from the history view simply uncheck the box.

### 19.4.3 Include Filters and Exclude Filters

History $\rightarrow$ Filters $\rightarrow$ Include Filters

This simply allows text strings to be filtered in or out.
For example, to find any "Energy" related information, go to the Include Filter, enter the text string "Energy" and press Add Filter. Then press Save, Back and Back, now the history page will only show logged data with the text "Energy",
e.g. Pump 1 Energy, Pump 2 Energy.

## History $\rightarrow$ Filters $\rightarrow$ Exclude Filters

The Exclude Filter does the opposite and both can be used together if necessary - even though this would be an unusual requirement.

### 19.4.4 Time Filter



To find data between specific dates and times, use the Time Filter. Dates and time of day can be entered. With a lot of data stored this is much quicker than using the PgDn button to move to older data.

### 19.5 Storing the Datalogger on the SD Card

There are two ways to save data onto an SD card:

- Use the Backup menu to save the datalogger file to an SD card (can also save to USB)
- Configure the MultiSmart unit to save directly onto an SD card

This latter option would normally be used when the on-board 50,000 event datalogger is not sufficient. Putting in a 4GB SD card, for example, gives storage of around 40,000,000 events.

### 19.5.1 Using Backup to Save the Datalogger onto an SD Card or USB Stick

To save datalogger files onto an SD card or USB, insert the SD card or USB into the MultiSmart and go to:
Settings $\rightarrow$ More $\rightarrow$ More $\rightarrow$ Backup Options $\rightarrow$ Backup Log Files

There are six options:

- Backup Fault \& Event - copies the fault \& events and time interval logs to the SD card / USB
- Backup Crisis Logs - copies the crisis log to the SD card / USB. This data is stored in a different format from the faults and events
- Backup Config Logs - copies configuration change log (i.e. details of user changes to the configuration)
- Backup Device Info - serial number, hardware and software version and IP address of the unit
- Backup System Logs - copies the system logs which contain advanced diagnostic information
- All Logs files - all of the above in one key press

For the first three options (and "All Logs files" option), the user will be prompted with the question "Do you want to save in native or in human-readable format?"
Generally, the Human Readable option should be chosen if the data will be read via Excel, Access or a textbased application.

### 19.5.2 File Names and Generations

| Name | Description and Data Structure | Filename when <br> copied to SD/USB |
| :--- | :--- | :--- |
|  <br> Interval Logger | Events and faults - the main "Event Logger" (Section 19.1) and the <br> time-based "Interval Logger" (Section 19.3) | history.log |
| Crisis Logger | High resolution datalogging around "trigger" events (Section 19.2) | crisis.log |
| Configuration Logger | Configuration changes to the MultiSmart are logged along with the <br> user ID (if security is setup). Fields: <br> Tag Name, Tag Type, New Value, Old Value, Time Stamp, User ID | config.log |
| System Log | Information which can be useful to MultiTrode engineers when <br> diagnosing serious problems | messages |
| Device Information | Stores data about a unit which is not evident from its configuration <br> files: MAC address, serial number, enable code, hardware and <br> software version, IP address | Device.inf |

Table 34 - Filenames for Each Type of Datalog file
To avoid log files becoming too large, MultiSmart has a file size limit defined (see below). Once this file size is reached, a new log file is started and the old log file has a name change to identify it.

This is easiest to see with an example of the history.log file.
Initially history.log is the only file. Once the file size limit is reached (usually around 50,000 records):

1. history.log becomes history. 0
2. A new history.log file is started

Once this second file reaches the size limit:
3. history. 0 becomes history. 1
4. history.log becomes history. 0
5. A new history.log file is started

This continues to the maximum number of file generations. Both maximum file size and maximum number of generations can be configured in the advanced menus.
This means that history. log is always the newest file, history. 0 is the next file and so on.
A configurable number of previous files (or file generations) can be retained.*

- For the Event Logger:- Settings / Advanced / FaultModule / Number of file generations, by default it is set to 3 .
- For the Crisis Log:- Settings / Advanced / Event Logger / Number of file generations, by default it is set to 2 .

NOTE: Show More Options must be enabled (see Section 31.1)

### 19.5.3 Viewing the Event Logger Files on a Computer

The following procedures allow the data from the Event Logger in MultiSmart (file: history.log) to be imported into Microsoft WordPad or Microsoft Office Excel.

## Importing the Event Logger File into Microsoft WordPad

1. With the Event Logger file copied to the USB, insert the USB into a PC
2. Copy the file history.log to a local directory
3. Open WordPad (Under Start / Programs / Accessories)
4. Click on File then Open
5. At the bottom of the file Open window is "Files of type", select "All Documents (*.*)"
6. Locate and highlight the history.log file
7. Click on Open
8. The faults (or events) listed in the file should now be displayed

## Importing the Data Logger Files into Microsoft Excel

1. With the Event Logger file copied to the USB, insert the USB into a PC
2. Copy the file history.log to a local directory
3. Start Excel
4. Click on File then Open
5. Located at the bottom of the file Open window is "Files of type", select "All Files (*.*)"
6. Locate and highlight the history.log file
7. Click on Open
8. Select Delimited then Next
9. Uncheck Tab and check the Comma check box, then click Finish
10. The faults (or events) listed in the file should now be displayed
11. Adjust column widths to view full text

### 19.6 Configuring the datalogger to write directly to an SD Card

When an SD card is installed in the unit, the Datalogger can be configured so that event or fault data is saved to the card as the event or fault occurs. If not all event or fault data are required, the unwanted tags can be removed before the data is saved. The following steps show how to setup the Datalogger to save data to the SD card.

### 19.6.1 Setting the Event Logger and Crisis Logger File Location

## Settings Advanced

- Scroll down to Event Logger then press $+I-$
- Scroll down to Log file name (Show More Options, section 31.1, must be enabled for this to be displayed)
- Press an arrow key located on the keypad (such as $\leftarrow$ ) and change the default path and filename (/var/log/events.log) to:
/media/sd/events.log
Where "events.log" is the filename.
If the Crisis Logger is also being used (section 19.2) it can also be logged directly to SD.
- Scroll up (from Log file name) to Fault file name
- Press an arrow key located on the keypad (such as $\leftarrow$ ) and change the default path and filename (/var/log/crisis.log) to:
/media/sd/crisis.log
When either or both of these tasks are done:
- Press Save, then Back, and Back again, and restart the unit using the menu option:
Settings $\rightarrow$ More $\rightarrow$ More $\rightarrow$ Restart Unit


NOTE: Data will be saved to the previous file name until the unit is restarted.


NOTE: An event is saved to the SD card as soon as it occurs, however if no card is present or an invalid file name has been entered, no data will be saved, not even to internal memory.


NOTE: New data is always appended to the file (if it exists), so if only new data is required, delete the file from the SD card before re-installing it. (The default event file size is $3 M B$ and the default fault file size is 300 kB ).

### 19.7 Adding Comments and Deleting Logs

From the History screen, press Add/Delete to navigate to the screen: "Add Comment / Delete History Logs".
This screen has two different functions:
Firstly, the user can add comments to the datalog. For example, "Serviced Pump 2". This text entry will appear in the history page along with the data/time it was entered.

Secondly, the user can delete logs from this screen.

NOTE: Deleted log files cannot be restored.

## 20 Flow

The flow module provides the ability to calculate flow without the use of a flow meter in most empty/discharge applications. The flow menu can be used to assign and make changes to the configuration of the flow input devices or to unassign the input device.
The Smart Outflow feature present in the flow module can detect a partially blocked pump from a large inflow. The Time to Spill feature calculates and displays the time period within which a spill may happen if the current conditions do not change.

The flow module also allows a flow meter to be used, either 4-20mA for instantaneous flow, a pulse counter for totalized flow, or both.

The advantage of using the flow module when a flow meter is installed is that the data appears on the Flow section of the Info screens. Accumulators such as Flow today, yesterday, this week, last week are calculated, and flow rates are also apportioned to individual pumps.

In addition, the flow module uses specific flow tags, and when SCADA is used, these tags are available at SCADA, providing a common tag structure across a network of pump stations.

The flow module also provides 2 low flow and 2 high flow alarms.


NOTE: After calculated flow is configured, one complete fill cycle and one complete empty cycle are needed before any flow calculations show up in the Info page.

### 20.1 Configure General Flow Setting

To configure Flow settings go to:
Settings $\rightarrow$ More $\rightarrow$ Flow $\rightarrow$ General Settings

The following parameters can be set:

| Name | Description | Range |
| :--- | :--- | :--- |
| Flow Enabled | Enables or disables flow calculations for the station. | Enabled/Disabled |
|  | Sets the flow measurement mode. <br> The flow mode specifies whether the station outflow should be <br> calculated or measured using one of the following flow metering <br> methods: <br> Metered F \& V uses an analog input for instantaneous flow (F) <br> and a pulse counter input for volume (V). <br> In Metered Flow mode, the flow module uses an analog input to <br> measure the flow, and derives the total volume, (if the flow rate <br> is <1 gal/sec or <1 litre/sec the total flow will not be <br> accumulated). This method supports more than one flow meter. <br> In Metered Volume mode, a digital input is used to count pulses <br> from a flow meter to measure the volume pumped, and <br> periodically it derives the flow rates. | Calculated <br> Metered F \& V <br> Metered Flow (der.vol) <br> Metered Volume (der.flow) |
| Units | Flow measurement units. | Litres/Second <br> Litres/Minute <br> Gallons/Minute |
| Volume Units | Allows selection of kl or Ml (instead of litres), and the same for <br> gallons. Takes the litres or gallons selection from Units | Normal, Kilo or Mega |
| Efficiency Units | Efficiency measurement units | Litres/kWh <br> kWh/Megalitre |
| Overflow <br> Enabled | Enables overflow detection. | Enabled/Disabled |
| \% Level for <br> Overflow | Sets the level at which an overflow condition is detected. | $0-100 \%$ |
| Averaging <br> Cycles | Sets how many pump cycles are used in the outflow averaging <br> (alculations. Only used for Calculated and Metered Volume <br> (der.flow) Modes. | $0-100$ |

Table 35 - General Flow Fault Parameters

NOTE: If the Units are changed, the existing flow statistics are not converted into the new units so a reset of the flow statistics is recommended. (Navigate to: Info $\rightarrow$ Flow $\rightarrow$ Reset).

### 20.2 Configuring Analog Inputs for Flow Measurement

An analog flow meter can be used to measure instantaneous flow. To select and configure an analog input for this purpose, go to:
Settings $\rightarrow$ More $\rightarrow$ Flow $\rightarrow$ Inflow/Outflow Meter

## Now select Outflow Meter and press Config

Use the Toggle button in the top left to select between Meter Mode = "Standard" or "Per Pump". Selecting "Per Pump" allows a different meter for each pump, a common configuration for large pump stations:


Figure 148-Selecting Analog Device for Flow Meter
If "Per Pump" is chosen, the left hand Select arrows and the pump selection box appear. Select each pump in turn and, using the Select arrows in the top right, choose from the available analog inputs.

Note: if "Standard" is chosen, then the Pumps box and select arrows will not appear.
Press the Configure button to make changes to the analog input selected. This allows span and zero for the flow meter. When finished, press the Save button.

Press the Unassign button if the analog input device needs to be deselected.

### 20.3 Configuring Analog Inputs for Inflow Measurement

An analog flow meter can be used to measure inflow. To select and configure an analog input for this purpose, go to:


Now select Inflow Meter and press Config


Figure 149 - Selecting Analog Device for Inflow Meter
Using the Select arrows on top right, choose from the available analog inputs.
Press the Configure button to make changes to the analog input selected. This allows span and zero for the flow meter. When finished, press the Save button.

Press the Unassign button if the analog input device needs to be deselected.

### 20.4 Configuring Digital Inputs for Flow Measurement

A digital input can be used to count pulses from a flow meter to measure totalized flows.
To select and configure a digital input to count pulses, go to:


Press the Config button and select a digital input from the list. Press Configure to make changes to the digital input setup if the flow meter has special interface requirements. If a high speed input is required $(1 \mathrm{kHz})$, then use Din 19 or 20 and select the Mode as High speed. When finished, press the Save button. Refer Section 14.4.1 for more information on the configuration options for the digital input.

Press the Unassign button if the pulse input device needs to be deselected.


NOTE: The Pump Control/General I/O Board (3PC) has two high-speed digital inputs designed specifically for use with pulse counters (DIN 19 and 20). It is recommended that one of these inputs is used where possible. It is important to use the Configure option to change the Mode to High Speed and the Scale Factor to the volume that each pulse represents.

Currently only one pump is supported for the totalized results to be displayed in the flow screen (Info Flow).
However, additional flow meter pulse counters can still be assigned to digital inputs. Although they won't appear in Info - Flow, they will still appear in the Info - I/O Information screens. See Section 14.4 for independently configuring digital inputs.

### 20.5 Configuring Calculated Flow Settings

When using the Calculated Flow method, it is necessary to tell the Flow Module how much liquid volume exists between a number of level values in the well (e.g. each $10 \%$, each 0.5 m , each 1 ft , etc). Once this has been entered, flows can be calculated across pumping cycles. To configure calculated volumes, go to:


NOTE: When using a flow meter (mode-"metered f\&v"), it is also possible to use the volumes in the well to calculate inflows. Volume can be in litres or gallons, depending on the unit setting selected in the general settings screen.


Figure 150 - Entering volumes for each level in well.
If it is desired to automatically calculate volume between sensors, the Calc button will take the user to a screen where the shape and dimensions of the well can be selected.


Figure 151 - Volume calculation based on well dimensions
The user has the option of selecting square, rectangle or cylinder as the well shape. Once the shape and dimensions of the well have been selected and saved, the volume between each sensor will be calculated automatically. Press Back and the calculated values will be displayed on Volumes for Calc Flow screen. The user then has the option of making any adjustments to these values. Press Save to save and use these values for flow calculations.

### 20.5.1 MultiTrode Probe

If using a MultiTrode probe as the primary level device, enter the volume of liquid between each sensor into each of the volume fields. Since there are 10 evenly spaced sensors, the percentages will range from $10-$ $100 \%$ in equal increments. If feet or metres has been set as the level units (see section 14.8), then the configuration display will change accordingly.

### 20.5.2 Analog Level Device

If using a $4-20 \mathrm{~mA}$ Level device, then the percentage values can be altered to reflect any volumes required to be entered.

For example, in a 5 m well, the lead/duty pump may be set to start at 1.5 m (from the bottom) and stop at 0.5 m . In this case, the activation point is $30 \%$ and the deactivation point is $10 \%$. Setpoints may change, and the level may rise above the activation point, therefore the volumes should ideally be set to $10 \%, 15 \%, 20 \%$, $25 \%, 30 \%, 35 \%, 40 \%, 60 \%, 80 \%$ and $100 \%$. The volumes for each step will then have to be calculated and entered.

### 20.6 Flow Alarms

Flow warnings and faults are used to indicate when flow rates fall outside acceptable limits. To select and configure alarms, navigate to:


Figure 152 - Configuring Flow Alarms
The first step is to enter a Nominal Flow Rate for the well. All the alarms are defined as percentages of this rate. The rate is expressed as litres/second, litres/minute or gallons/minute depending on the Unit configuration made in the General Settings screen.

In a similar manner, Low Flow alarms can also be configured for the station; enter the minimum Flow Rate. All the alarms are defined as percentages of this rate.

Select and enable an alarm by pressing the Toggle button. When finished, press the Save button.
The basic fault parameters such as activation delay, deactivation delay, pump context and fault reset method can be modified by navigating to:


Select the appropriate fault and then press Configure.

Additional fault parameters can be found in the Advanced menu:


- Select a pump and press $+1-$
- Select Flow $++\Omega$, then select a specific flow alarm, e.g. High Flow Fault ++- then Status ++-


### 20.7 Smart Outflow

This is a MultiSmart patent pending feature. The Smart Outflow feature allows the MultiSmart to recalculate the inflow by stopping pump(s) for a short period when pump runtime is excessive.
Flow calculations have an inherent uncertainty - when the pump is pumping, the inflow is unknown. In most cases, assuming the inflow from the last cycle and averaging pump flow rates over a number of cycles reduces or eliminates the inaccuracies arising from unknown inflow.
However, one case is common - during peak wet weather events, high inflows may cause the pump(s) to run for a long period. This scenario is not easily differentiated from a partially blocked pump. The Smart Outflow feature, if enabled, turns off the pump (but only if a spill is highly unlikely) and checks the increase in level to verify the current inflow. If the inflow is effectively unchanged from the previous calculated inflow, then the long pump runtime is most likely due to a partially blocked pump.

To be able to use this feature, the flow module must be enabled in the MultiSmart. (If not, refer to Section 28 for turning on this feature). Navigate to:


In the flow General Settings, select the Flow Enabled and set the Mode to Calculated. Enter the desired Averaging Cycles (the default is 10). This sets how many pump cycles are used in the outflow averaging calculations (Refer to Section 20.1). Remember to Save the changes.

The Smart Outflow must now be enabled, navigate to:


| Name | Description |
| :--- | :--- |
| Recheck Inflow after Pump Run Time | The continuous pump running time period after which the recalculation <br> of the inflow needs to be performed |
| Recheck Inflow Pump Stop Time | The time period after which the pumps are restarted and inflow is <br> calculated |
| Over-ride Level | Define the level above which the smart outflow feature is disabled |

Table 36 - Smart Outflow Parameters
The Smart Outflow feature only deactivates the pumps (in order to recalculate inflow) once in any one pump down cycle.

It is also recommended to set maximum pump running time to ensure that if a pump is blocked, the station will cycle to the next pump.

To do this navigate to Settings $\rightarrow$ Station Optimization $\rightarrow$ Optimize Station and configure the Max Run Time. Ensure that while using this feature, Max Run Time is set to a longer time than the value for Recheck Inflow after Pump Run Time. Otherwise the Smart Outflow calculation will never occur as the pumps will alternate after the max pump running time is reached.

### 20.8 Estimating Duration to Overflow

When the well level is rising (pumps on or not, the inflow may defeat the pumps), the MultiSmart can estimate the duration to overflow and display it until the level reaches the overflow level. This calculation is dynamic and based on the dynamic rate of level increase. This time estimation is available in the DNP and MODBUS points list so that it can be sent to SCADA.

To be able to use this feature, the flow module must be enabled in the MultiSmart. (If not enabled, refer to Section 20.1).

Navigate to:


Under the flow General Settings button, check the Flow Enabled and Overflow Enabled check boxes and set the \% Level for Overflow.

To display the Duration to Overflow in the main screen browse to:

```
Settings \(\rightarrow\) More \(\rightarrow\) Customize Display \(\rightarrow\) Bottom Section
```

Select the Line in which the data is to be displayed from the left column and then select Duration To Overflow from the right column and press Save. This value now appears in the bottom section of the main screen display.


NOTE: When a probe is selected as the level device, the setpoints need to be at least 20 percent wide so that the duration to overflow can be calculated.

## 21 Reservoir Monitor

The MultiSmart can be configured as a Reservoir Monitor when this module has been purchased. In this mode, there are no pumps to control, so all functionality related to pumps, groups and motor protection are unavailable.


Figure 153 - Typical Reservoir Monitor Main Screen

### 21.1 Communications Configuration

When configuring the MultiSmart as a Reservoir Monitor, the first question asked by the Setup Wizard is which DNP3 Communications configuration should be used. There are three options - A, B or C.

$\triangle$

## NOTE:

Configuration B is the recommended setup.
When running through the Setup Wizard for the corresponding pump station, if you select Remote Level and enter the corresponding DNP3 addresses, the two stations will be linked.

### 21.1.1 Configuration A

In this configuration, the Pump Station receives the level from the Reservoir Monitor via the DNP3 Master (MTU). This configuration is used when there is no direct communications link between the pump station and reservoir monitor or the communications network is complex.

MultiTrode recommends using a redundant MTU when using this configuration.


Figure 154-Communications Configuration B

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### 21.1.2 Configuration B (Recommended)

In this configuration, the Pump Station receives the level over a direct communications link with the Reservoir Monitor. This is the preferred configuration.
The Pump Station must be configured as a DNP Master (choosing remote level and configuration B for the pump station will ensure this is the case).


Figure 155-Communications Configuration B

### 21.1.3 Configuration C

This configuration is also used when there is no direct communications link between the Pump Station and the Reservoir Monitor. In this mode, the Pump Station will establish a second connection to the DNP3 Master (MTU) in order to retrieve levels from the Reservoir Monitor.

This configuration can be used instead of Configuration A when there is no redundant MTU available.
When using this configuration Connection Manager must be enabled on the Pump Station. The Pump Station must also be configured as a DNP Master (choosing remote level and configuration B for the pump station will ensure this is the case).


Figure 156-Configuration C

NOTE:


Connection manager is functionality which should be enabled as standard on the MultiSmart. Check the software modules screen to ensure this is the case.

### 21.2 User Interface

The Reservoir Monitor user interface mirrors the Pump Station Manager, with all the pump functionality and options removed. This ensures that menu options are always in the same place for both products to make training of operations staff more effective.

Settings Menu options still available on the Reservoir Monitor:

### 21.2.1 Set Points (but Level/Control Setpoints sub-menu item removed)

- I/O faults and Level
- $\quad$ Setup Wizard
- Station Optimization (only Profile selection remains)
- Supply Protection
- Customize Display
- Communications
- Flow
- Datalogger
- Backup Options
- Security
- Date/Time
- Software Modules
- Logic Engine
- Restart Unit


### 21.2.2 Settings Menu options removed from the Reservoir Monitor:

- Level/Control Setpoints (under the main Setpoints menu item)
- Alternation and Grouping
- Commission / De-commission pumps
- Energy Monitoring and Motor Protection


### 21.3 Connection Manager

### 21.3.1 Overview

The Connection Manager allows multiple DNP channels (slaves or masters) to communicate over one physical serial port.
The software module (Connection Mgr) must be enabled. To view the currently enabled modules, navigate to:


If the module is enabled, it will appear in the left column.
Either of the two serial ports can be assigned as the physical port.
The Connection Manager can only be configured for use on a Reservoir Monitor and the associated Pump Station Manager (with Remote Level). When the Connection Manager is enabled, ("Use conmng" is checked), the individual Comms Channel settings are ignored. This applies to both DNP Slaves and DNP Masters.

The following diagram illustrates the functionality of the Connection Manager.

MultiSmart - Pump Controller (Remote Level)


Figure 157 - Functionality of Connection Manager

### 21.3.2 Reservoir Monitor Setup

Whenever a Reservoir Monitor or an associated Pump Station Manager (with Remote Level) is configured using the Setup Wizard, the Connection Manager is configured by default. The 2 slaves within the Reservoir Monitor both communicate on Serial 2 by default. The associated pump station manager also uses Serial 2 for both the slave and the master.

If necessary, a different physical channel (other than Serial 2) can be assigned. Navigate to:


If separate physical communication ports are required, the following changes must be made.
(a) The software module (Connection Mgr) must be disabled - a new Site Key is required.

Navigate to:
 and enter the new Site Key).
(b) The Connection Manager must be disabled in both slaves in the case of a Reservoir Monitor. For a pump station manager with Remote Level, disable the Connection Manager in the master and both slaves. Navigate to:

and clear the check-box in both slaves. For a master, the Connection Manager enable is located at:

(c) Assign individual Comms Channels. Navigate to:

and


If Remote Level is assigned as the level device after the Pump Station Manager is configured (i.e. after running the Set Wizard), then the Connection Manager is not enabled.

## 22 RTU Module

The MultiSmart pump station manager can be supplied with a fully functional RTU. Modbus RTU/ASCII/TCP and/or DNP3 communications protocols are available. To check which protocols are installed, go to the Software Modules section (page 3 of the Settings menu).


NOTE: The MultiSmart can also be shipped just as an RTU without any Pump Station Manager functionality or user interface.


NOTE: The Integrator's Manual contains more detail and examples in some areas of communication, SCADA integration and communication troubleshooting.

### 22.1 Communications Screen

## Settings $\rightarrow$ More $\rightarrow$ Communications

The main communications screen allows access to view and configure the communication protocols and setup the points list, view and edit the communication port settings, view and edit the IP address and Routing table of the MultiSmart and also to configure the communications via cellular modem.


Figure 158 - MultiSmart Communications Settings Screen

### 22.2 Communication Protocols

The MultiSmart RTU can communicate using MODBUS (RTU/ASCII/TCP) and/or DNP3 protocols depending on which software modules have been purchased. If these modules are not enabled, contact MultiTrode for more information on how to enable them.
(Visit the MultiTrode website www.multitrode.com for the DNP3 and MODBUS manuals).


## NOTE:

If DNP3 and Modbus are both enabled, ensure that they are not pointing to the same channel. If they are, Modbus will be disabled and a fault will be displayed ("Comms Channel Conflict").

### 22.2.1 DNP3 Configuration

The entire list of DNP3 points can be accessed and configured by going to:


Multiple DNP Masters and DNP Slaves can be configured in MultiSmart. However considerations should be given to the number of physical communication ports available and the size of the points list which in turn affects the available free memory in the MultiSmart.
The MultiSmart has support for remote reconfiguration of DNP points list via DNP file transfer from the master station. Contact MultiTrode to find out more details about how to configure the DNP master station to support this.
MultiSmart has support for WITS-DNP, which is a standard being widely adopted throughout the UK water industry. For more information about setting up the MultiSmart for WITS-DNP communications, see Appendix E - Setting Up WITS-DNP Communications.

### 22.2.1.1 Add DNP Slave



A DNP slave is created by default in the MultiSmart when the default configuration is used or the setup wizard is being used to generate a standard configuration. Select this option if a new slave is to be added. This requires a reboot of the MultiSmart.
Once a slave is added, go to the DNP Slave option to configure the points list. You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons which are visible if more than one slave is configured.


Then select the Protocol Settings to configure the communication channel.


### 22.2.1.2 Add DNP Master



Select this option to create a DNP Master. When a master is created, a slave profile for that particular master is also created by default. To add another slave profile under the master, use the Add DNP Master Slave option. Multiple masters can be created by selecting this option again. A restart of the MultiSmart is required for each addition of a master.

Once a master is added, go to the DNP Master option to configure the points list. You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons which are visible if more than one slave is configured under the same master or if multiple masters are present.


Then select the Protocol Settings to configure the communication channel.


### 22.2.1.3 Add DNP Master Slave

A slave profile for the master is created by default when a DNP Master is created. When more than one slave is to be configured under that master, select this option. This feature requires a reboot of the MultiSmart. If multiple masters are configured, the wizard will prompt for which master the new slave profile needs to be created.

### 22.2.1.4 DNP Slave

This menu gives access to viewing and editing of the points list configurations of all the DNP Slaves present. To switch between the subsequent slaves (if more than one slave is present), press Next Slave or Prev Slave at the bottom of the LCD screen. The screen title in that menu shows the information about the currently selected slave. All binary inputs, binary outputs, analog inputs, analog outputs, counters, frozen counters and strings can be viewed under this menu. The properties of the points can be edited and new points can be added in their respective categories by accessing the corresponding sub-sections.


Select the appropriate slave settings from the list below:

- Binary Inputs
- Binary Outputs
- Analog Inputs
- Analog Outputs
- Counters
- Frozen Counters
- Strings

To add a new point, click Add New.
You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons, which are visible if more than one slave is configured.

### 22.2.1.5 DNP Master

This menu gives access to viewing and editing of the slave profiles of all the DNP slaves configured under all the DNP masters created in the MultiSmart unit. To switch between the different slave profiles (if there are more than one present), press Next Slave or Prev Slave at the bottom of the LCD screen. The screen title in that menu shows the information about the currently selected master slave pair. Similar to the DNP Slave menu, all binary inputs, binary outputs, analog inputs, analog outputs, counters, frozen counters and strings can be viewed under this menu. The properties of the points can be edited as well as new points can be added in their respective categories by accessing the corresponding sub sections.


Select the appropriate slave settings from the list below:

- Binary Inputs
- Binary Outputs
- Analog Inputs
- Analog Outputs
- Counters
- Frozen Counters
- Strings

To add a new point browse, click Add New.
You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons, which are visible if more than one slave is configured under the same master or if multiple masters are present.

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### 22.2.2 MODBUS Configuration

The entire list of MODBUS points can be accessed and configured by going to:


Multiple Modbus Masters and Modbus Slaves can be configured in MultiSmart. However, consideration should be given to the number of physical communication ports available and the size of the points list, which in turn affects the available free memory in the MultiSmart.

### 22.2.2.1 Add Modbus Slave



A Modbus slave is created by default in the MultiSmart when the default configuration is used or the setup wizard is being used to generate a standard configuration. Select this option if a new slave is to be added. This requires a reboot of the MultiSmart.
Once a slave is added, go to the Modbus Slave option to configure the points list.


Modbus Slave $\rightarrow$ Regenerate Points List
Then select the Protocol Settings to configure the communication channel.


### 22.2.2.2 Add Modbus Master

Select this option to create a Modbus Master. When a master is created, a slave profile for that particular master is also created by default. To add another slave profile under the master, use the Add Modbus Master Slave option. Multiple masters can be created by selecting this option again. A restart of the MultiSmart is required for each addition of a master.
Once a master is added, go to the Modbus Master option to configure the points list.


Then select the Protocol Settings to configure the communication channel.


### 22.2.2.3 Add Modbus Master Slave

A slave profile for the master is created by default when a Modbus Master is created. When more than one slave is to be configured under that master, select this option. This feature requires a reboot of the MultiSmart. If multiple masters are configured, the wizard will ask for which master the new slave profile needs to be created.

### 22.2.2.4 Modbus Slave

This menu gives access to viewing and editing of the points list configurations of all the Modbus Slaves present. To switch between the subsequent slaves (if more than one slave is present), press Next Slave or Prev Slave at the bottom of the LCD screen. The screen title in that menu shows the information about the currently selected slave. All discrete inputs, coils, input registers and holding registers can be viewed under this menu. The properties of the points can be edited as well as new points can be added in their respective categories by accessing the corresponding sub sections.

To add a new point browse to the corresponding section as shown below and select Add New.


Select the appropriate slave settings from the list below:

- Discrete Inputs
- Coils
- Input Registers
- Holding Registers

To add a new point, click Add New.
You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons, which are visible if more than one slave is configured.

## NOTE:

Modbus only supports 16-bit integers for Input Registers and Holding Registers, whereas MultiSmart tags are stored as 32-bit numbers. If a value greater than the 16 -bit range (maximum of 65,535 ) is represented as an Input Register or Holding Register, then the value will roll-over back to zero and be misrepresented. In order to prevent this from happening, appropriate scale factors need to be applied to ensure that values remain within range of 16-bit representations.

The potential for this problem is especially with floating point values. For example, the level of the well is represented as a value between 0 and 100, with four decimal places. This means that a value of 100 is represented in integer form as 1,000,000. A scale factor of 10,000 will limit the range to 0 and 100 with zero decimal places, and ensure that the level is always accurately represented.

### 22.2.2.5 Modbus Master

This menu gives access to viewing and editing of the slave profiles of all the Modbus slaves configured under all the Modbus masters created in the MultiSmart unit. To switch between the different slave profiles (if there are more than one present), press Next Slave or Prev Slave at the bottom of the LCD screen. The screen title in that menu shows the information about the currently selected master slave pair. Similar to the Modbus Slave menu, all discrete inputs, coils, input registers and holding registers can be viewed under this menu. The properties of the points can be edited as well as new points can be added in their respective categories by accessing the corresponding sub sections.

$$
\text { Settings } \rightarrow \text { More } \rightarrow \text { Communications } \rightarrow \text { Modbus Points Lists } \rightarrow \text { Modbus Master }
$$

Select the appropriate slave settings from the list below:

- Discrete Inputs
- Coils
- Input Registers
- Holding Registers

To add a new point browse, click Add New.
You may have to select the appropriate slave using "Next Slave" or "Previous Slave" buttons, which are visible if more than one slave is configured under the same master or if multiple masters are present.

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### 22.2.3 Points List Regeneration for DNP3 and Modbus Slaves


or


CAUTION: Do not perform a points list regeneration unless you fully understand the options and are aware of the implications.

Very occasionally, it may be necessary to regenerate a DNP3 or Modbus slave points list. For example, a newer version of the MultiSmart firmware may contain new points which are required in an existing installation. The firmware would be upgraded first and then based on the type of the points list already in use, one of the options described below would be selected. If the points list has been customised, these customised points will be lost and must be re-entered.
In the case of Fixed points list, the new points are located in reserved locations. For a Dynamic points list, the new points are located throughout the list. A firmware upgrade does not add these new points into the existing points list - the existing points list is preserved. This is done in case the points list has been customised.

Three different operations can be performed on the points lists.
(a) Fixed List - This generates a Fixed points list. The points list contains 'gaps' or reserved points amongst the valid points. These reserve points have no immediate function except to reserve a location for a potential future point. (This allows for the addition of new points to be grouped with points of similar functionality rather than simply attached to the end of the list).
A MultiSmart leaves the factory with a Fixed points list.
(b) Dynamic List - This generates a Dynamic points list. All points in the list are continuous - there are no 'gaps' or reserved points.
(c) Clear List - Clears the entire points list, i.e. the points list contains no points.


CAUTION: Performing any of the above options on an existing pump station overwrites the existing points list so any customised points will be lost and must be re-entered.

However, the points regeneration for the slaves configured under the Modbus master has a different set of choices as follows.
(a) Clear List - Clears the entire points list, i.e. the points list contains no points.
(b) ADAM-4017+ - Generates the points list for the ADAM 4017+ external IO unit.
(c) ADAM-4051 - Generates the points list for the ADAM 4051 external IO unit.
(d) ADAM-6017 - Generates the points list for the ADAM 6017 external IO unit.
(e) ADAM-6050 - Generates the points list for the ADAM 6050 external IO unit.
(f) ADAM-6051 - Generates the points list for the ADAM 6051 external IO unit.
(g) Acromag 961EN-4006 - Generates the points list for the Acromag 961EN-4006 external IO unit.
(h) Acromag 983EN-4012 - Generates the points list for the Acromag 983EN-4012 external IO unit.

The MultiSmart has support for remote reconfiguration of DNP points list via DNP file transfer from the master station. Contact MultiTrode to find out more details about how to configure the DNP master station to support this.

### 22.2.4 Exporting and Importing DNP3 / MODBUS Points List

MultiSmart can export DNP and MODBUS 'Slave' or 'Master Slave' points list to an SD card / USB or saved to the /tmp directory where it can be copied from the unit using FTP.


The DNP slave and MODBUS slave points list can be edited and imported back into the unit using the Import CSV option in MultiSmart. The corresponding options can be accessed by browsing through the following menu.


### 22.2.5 Protocol Settings



Figure 159 - Protocol Settings
In this menu, we can see the list of all DNP \& MODBUS, Master/s and Slave/s configured in the MultiSmart unit. The menu also shows the master/slave number, master/slave address, communication channel and the type of the communication link. Most of the common settings can be accessed from this menu. However, if further advanced settings are to be configured, you will need to navigate to the Advanced menu.
To edit the settings of a particular master or slave, select the item in the list and press Select.
Once you are in this menu, input the new values using the keypad or use the Toggle button to cycle through the options. When the changes have been applied, press the Save button for them to be written to the configuration files. Most of the communication settings changes need a restart of the unit in order to come into effect. Press the Channel button to view and edit the channel settings and press the IP Address wherever applicable while configuring the communication over TCP/IP to change the IP Address and the port used.

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22.2.5.1 Modbus / DNP Slave

Settings $\rightarrow$ More $\rightarrow$ Communications $\rightarrow$ Protocol Settings
Scroll down to the DNP or Modbus slave and press Select.
Enabled - Select this for the slave to be active.
Comms Channel - Select from Serial 1, Serial 2, RS485 A, RS485 B, TCP/IP 1, TCP/IP 2, TCP/IP 3, Modem 1 or PSTN.

Slave Address - DNP Slave address.

## DNP slave specific settings:

Master Address - Address of the DNP Master to which the slave is talking to.
Unsolicited - Select this if unsolicited communication needs to be enabled for the slave.

## Modbus slave specific settings:

Link Type - Select the link type out of TCP, RTU, ASCII and PLUS
Save the settings and press the Channel button to view or modify the communication channel settings. Refer Section 22.2.6 for the appropriate channel settings.

### 22.2.5.2 Modbus / DNP Master



Scroll down to the DNP or Modbus master and press Select.
Comms Channel - Select from Serial 1, Serial 2, RS485 A, RS485 B, TCP/IP 1, TCP/IP 2, TCP/IP 3, Modem 1 or PSTN.
DNP Master specific settings:
Master Address - Address of the DNP Master to which the slave is talking to.
Listener - Select this to accept unsolicited responses from the slaves.

## Modbus Master specific settings:

Link Type - Select the link type out of TCP, RTU, ASCII and PLUS
Save the settings and press the Channel button to view or modify the communication channel settings. Refer Section 22.2.6 for the appropriate channel settings.

The slave settings for the particular master are also shown in this menu. The details shown are the number of slaves under the master, the slave addresses and the IP address of the slave if TCP/IP channel is selected. To edit the slave settings, highlight the particular slave and press Edit.

DNP Master Slave specific settings:

- Enabled - Select this to make the slave active under the master.
- Slave Address - Enter the DNP slave address.
- Integrity Scan Pd (hhh:mm:ss) - Time period for the integrity scan in the specified time format.
- Class 1 Scan Pd (hhh:mm:ss) - Time period for the Class 1 points scan in the specified time format.
- Class 2 Scan Pd (hhh:mm:ss) - Time period for the Class 2 points scan in the specified time format.
- Class 3 Scan Pd (hhh:mm:ss) - Time period for the Class 3 points scan in the specified time format.
- Response Timeout (hhh:mm:ss) - Time period to wait for a response in the specified time format.


## Modbus Master Slave specific settings:

- Enabled - Select this to make the slave active under the master.
- Slave Address - Enter the Modbus slave address.
- Discrete Input Scan Pd (hhh:mm:ss) - Time period for the Discrete Input scan in the specified time format.
- Coil Scan Pd (hhh:mm:ss) - Time period for the Coil scan in the specified time format.
- Input Reg Scan Pd (hhh:mm:ss) - Time period for the Input Registers scan in the specified time format.
- Holding Reg Scan Pd (hhh:mm:ss) - Period for the Holding Registers scan in the specified time format.
- Response Timeout (hhh:mm:ss) - Time period to wait for a response in the specified time format.


### 22.2.6 Communication Channel Settings

The specific communication channel settings are described in the following subsections.

### 22.2.6.1 TCP/IP Channel Settings

- Connection Type - Choose from Initiating end point, Listening end point, Dual end point or UDP.
- Destination IP - Enter the destination IP address.
- TCP Port - Enter the TCP port number if TCP mode is used.
- Idle Timeout - Time period after which the connection is closed. Applicable only to TCP as UDP is a connectionless protocol. Setting this to zero will disable the idle timeout.
- Keep-alive Timeout - Time period after which a keep-alive message is sent when no response is being received from the remote host. Applicable only to TCP as UDP is a connectionless protocol.
- Dual end-point port - Enter the dual end point port number when Dual end point type is selected.
- Local UDP Port - Enter the local UDP port number when UDP mode is selected.
- Dest UDP Port - Enter the destination UDP port number when UDP mode is selected.
- UDP Port Mode - Choose from Use configured port, Use source port and None.

Save the settings. Select the Advanced button to configure advanced parameters.

## Example: Modbus over TCP

- Comms Channel = TCP/IP 1.
- $\quad$ Slave Address = 1
- Link Type = TCP

Channel Options

- Connection Type: Listening end-point (Default). Master I.P. Address. (Default). Cs to any master.Other I.P. Address options:
- (a)(b) TCP Port $=502$ (Default $=20$ 000)


### 22.2.6.2 Serial / Modem Channel Settings

- Baud Rate - Choose the appropriate baud rate.
- Data/Stop Bits/Parity - Select the number of data bits, stop bits and parity.
- First Char Timeout (ms) - Wait period before the message timing out.
- Inter Char Timeout (ms) - Wait period between successive characters in a message.
- RTS Control - Enable or Disable Request To Send control.
- Radio On Time (ms) - Time period to wait before the Radio is ON, ignored if RTS is disabled.
- Radio Off Time (ms) - Time period to wait after the Radio is OFF, ignored if RTS is disabled.

Further serial port parameters can be found in the Advanced menu, navigate to:


| Name | Description | Range/Type | Default |
| :--- | :--- | :--- | :--- |
| Baud Rate | Sets the baud rate for the channel. | $1200,2400,4800$, <br> $9600,19200,38400$, <br> 76800,115200 | 9600 |
| Communications Port | Selects which port this channel communicates <br> through. | Serial 1, Serial 2 | - |
| First Character Timeout <br> (ms) | Sets a timeout for the first character in <br> milliseconds. | $0-9999 \mathrm{~ms}$ | 1000 |
| Inter Character <br> Timeout (ms) | Sets a timeout between characters in <br> milliseconds. | $0-9999 \mathrm{~ms}$ | 20 |
| MultiTrode RTU? | Deprecated. | Enable/Disable | Disabled |
| Number of Wakeups | Sets the number of wakeups. | $0-120$ | 60 |
| Number of Data Bits | Sets the number of data bits. | 7 or 8 | 8 |
| Number of Stop Bits | Sets the number of stop bits. | 1 or 2 | 1 |
| Parity | Sets the type of parity. | Enable/Disable | Disabled |
| RTS Control | Sets whether RTS is controlled. | $0-9999$ ms | 0 |
| Radio Off Time (ms) | Creates delays for use with analog radios | $0-9999$ ms | 0 |
| Radio On Time (ms) | Creates delays for use with analog radios | None |  |

Table 37 - Advanced Serial Port Parameters

### 22.2.6.3 PSTN Channel Settings

The following parameters should only be modified by an experienced modem user. Only the DNP3 protocol can be used over PSTN.

- Navigate to:


## Settings

 $\rightarrow$ More Communications Protocol Settings

- Highlight a DNP Slave and press Select
- $\quad$ Set the Comms Channel to PSTN and press Save.
- Press Channel to modify the following modem related parameters;

Phone Number - Enter the destination phone number.
Baud Rate - Choose the appropriate baud rate Data/Stop Bits/Parity - Select the number of data bits, stop bits and parity Connect Timeout (sec) - Period to establish connection before dial up connection times out Retry Delay (sec) - Time period to wait after a failed connection before retrying Idle Timeout (sec) - Time period to wait after the last data transmission before hanging up Comms Port - Physical port used by this channel. In most cases this need not be changed

The default modem initialization string (Init String 2) can be found at:


The default initialisation string is: AT\&FE0Q1M0V1S0=2\&C1\&D2W2\&Y0

This string can be modified as required or another string variable, Init String $\mathbf{3}$ is available for additional commands, if required.

### 22.2.7 Communications Redundancy

MultiSmart supports DNP communications over two physical channels, for a single slave instance. For example, primary communications may be configured for radio using Serial 1 channel, whereas backup communications may be configured for using PSTN.
In order to define redundant channels, first set up the primary channel using the Protocol Settings page. Selection of the redundant channel can then be made from the Advanced screen. Navigate to:


When unsolicited responses are enabled, then only one of the channels will have control of unsolicited responses at a time. On startup, the primary channel will assume responsibility. However, in the event of a communications failure of the primary channel, the redundant channel will assume control of unsolicited messages. This functionality can be modified from the Advanced screen. Navigate to:


If this parameter is set to false, then the redundant channel will not automatically assume control of unsolicited responses in the event of a communications failure of the primary channel.

Unsolicited responses can also be controlled by the master station. If the master station sends a message on the redundant channel, then that channel will automatically assume control of unsolicited responses. If the master then sends a message on the primary channel, then control is switched back to the primary channel.

### 22.2.8 Redundant IP Addresses

There is an option in the MultiSmart to define redundant IP servers for DNP3 communications. When communications with the primary master fails, the device attempts to establish communications to the redundant master.
Redundant masters can be configured via the Advanced screen as described below.
Set Redundant Addresses to true in:


Then define the secondary IP address in:


Up to ten redundant IP addresses can be configured in this manner.

### 22.2.9 Redundant Phone Numbers

It is also possible to define redundant phone numbers for the PSTN channel. Unlike the TCP/IP redundancy feature, there is no Redundant Addresses parameter to configure in this case. Instead, if multiple numbers of defined, then it is assumed that redundancy is intended.

To define a secondary phone number, navigate to:


Up to ten redundant phone numbers can be configured in this manner.

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### 22.2.10 File transfer over DNP3

The MultiSmart supports file transfer over DNP3. This can be used for various operations such as changing the MultiSmart configuration, upgrading the firmware, changing the DNP3 point list, changing the ISaGRAF programs running on MultiSmart, retrieving log files, etc.

### 22.2.10.1 Bulk Configurations

A bulk configuration can be transferred to the MultiSmart using DNP File Transfer. Then, by sending an Activate Configuration Command with the same file name, the configuration can be activated.
The bulk configuration file name must be called bulkcfg.tgz. (The file can also be of the form WITSCFG $\backslash$ bulk_version. dat when WITS-DNP is enabled.) This file can be generated by either exporting to an SD card or USB via the LCD, or else via the MultiSmart Configurator.
DNP File Transfer can also be used to retrieve the existing MultiSmart configuration in bulk configuration format.

### 22.2.10.2 Upgrade Image

An upgrade image can be downloaded into the MultiSmart by using the DNP File Transfer command. Then an Activate Configuration Command will confirm the upgrade, and the unit will reboot with the upgraded firmware.

The file name must be multismart.img.
In order to do an upgrade via DNP, an SD card must be mounted in the MultiSmart. Because of the size of this file( $\sim 18 \mathrm{MB}$ ), the transfer process can be very time consuming, especially over slow communication links.

### 22.2.10.3 ISaGRAF programs

ISaGRAF programs can be transferred to the MultiSmart using DNP File Transfer command. Sending an Activate Configuration Command with the complete file name will activate the ISaGRAF programs transferred.

The file name must be isagraf.tgz. (The file can also be of the form WITSCFG $\operatorname{app}$. dat when WITSDNP is enabled.)

ISaGRAF programs running on a MultiSmart can be retrieved using DNP File Transfer command.

### 22.2.10.4 Point Lists

Using DNP File Transfer, a comma separated point list can be transferred to the MultiSmart. Then by sending an Activate Configuration Command with the file name, the point list can be activated.

The points list file must be called dnps.csv, or else dnps.csv.gz. Both of these files can be exported via MultiSmart Configurator. Using the .gz format will result in a much smaller file and faster transmission and activation of the points list.

A significant advantage of downloading and activating points lists is to change event classes or deadbands of points. This mechanism can also be used to add or delete points in the list.
DNP File Transfer can be used to retrieve point lists in a comma separated format from a MultiSmart.

### 22.2.10.5 Log files

Log files from MultiSmart can be retrieved over DNP3 using DNP File Transfer.
The file name used to retrieve log files must be logs. tgz.

### 22.3 Enabling and Viewing of DNP and MODBUS Logs

The MultiSmart RTU can display the DNP and MODBUS event logs in the LCD screen, which is helpful for troubleshooting communications. This is especially useful for system integrators.

If logging needs to be enabled, navigate to the corresponding DNP/MODBUS Master/Slave menu in the Advanced settings menu.
Settings $\rightarrow$ Advanced then using the Select arrows move up or down to select any of the following options:

- DNP Slave
- DNP Master
- Modbus Slave
- Modbus Master

Select the master or slave for which logging needs to be enabled. Select the parameter Enable Log File and press Save. The default log file location is /var/log/. You can change the name and location of the log file by editing the Log File Name parameter. However certain locations are not writable by the MultiSmart unit and hence /tmp/, /var/log/, /media/usb/ and/media/sd/ are the best locations for saving the log file. /media/usb/ refers to the USB and/media/sd/ refers to the SD card. By using these locations, logs can be saved to an external memory device if desired.

In order to view the log file from the MultiSmart LCD screen navigate to
 press the View Log button visible at the bottom of the screen.

Now you can see the following four options.

- DNP Slave
- DNP Master
- Modbus Slave
- Modbus Master

Select the appropriate option in order to view the log. In this menu, you can scroll up and down by pressing the PgUp and PgDn buttons. If the Auto button is pressed, new log messages are dynamically updated to the screen, which eliminates the need for scrolling. Once in Auto mode, you can switch back to manual mode by pressing the Manual button, which will prevent the new messages to be automatically displayed on the screen. This mode is useful when analyzing log messages in more detail.

### 22.4 IP Address \& Routing Settings

Navigate to:


Enter the IP Address and Subnet mask in this menu using the keypad. The subnet mask is usually 255.255.255.0 for standard networks.


The current routing table entries are visible in this screen. If the remote hosts to which the MultiSmart is talking are on the same network, we do not need to update the routing table. If the routing table is updated, a restart is required for the changes to come into effect.

If the MultiSmart is in a network which has a dedicated Gateway for all communications, enter the IP address of the Gateway as the New Gateway, add 0.0.0.0 as the New Netmask, and leave the New Target field blank. Select Add to update the routing table. This effectively means that all the IP traffic, after reboot, will go through the gateway.

If the MultiSmart needs to go through the Gateway for communicating to specific target networks, and ignore that Gateway for communications to other networks, enter the Gateway IP address in the New Gateway, add 255.255.255.0 as the New Netmask, and add the target IP address in the New Target with the last part of it as zero. For example if the target IP address is 192.168.3.54 enter the New Target as 192.168.3.0. Press Add to update the routing table and restart the MultiSmart.
If an existing routing table needs to be deleted, scroll down to highlight the routing entry and press Delete. A restart is again required for this change to come into effect.

## Example 1: Targeting a Private Subnet

You are using a cellular router with an IP address of 192.168.5.254 and a subnet mask of 255.255.255.0 and the MultiSmart is using an IP address of 192.168.5.1. The target is an entire subnet of 192.168.2.0.


Enter into the MultiSmart IP Routing Table:

- New Gateway: 192.168.5.254
- New Netmask: 255.255.255.0
- New Target: 192.168.2.0


## Example 2: Targeting a Specific IP Address

You are connected to a router with an IP address of 10.50.20.1 with a subnet of 255.255.255.192 and your target is a specific computer on the internet with an IP address of 166.135.20.152. The MultiSmart has an IP address of 10.50.20.2.


Enter into the MultiSmart IP Routing Table:

- New Gateway: 10.50.20.1
- New Netmask: 255.255.255.255
- New Target: 166.135.20.152


## 23 Variable Frequency Drive (VFD)

The MultiSmart can control VFD drives through an analog output. This is an optional feature that must be enabled on the MultiSmart before it can be used. (If not enabled at the time of purchase, it can be enabled later with a new Site Key).
The VFD feature coordinates and alternates drives so that the flow does not fluctuate as extra pumps are turned on and off. A single analog output is used as the control signal to all VFD drives. As new pumps are started, the overall VFD speed is reduced.
For example, if one pump is running at $100 \%$ and a second one is about to start at $30 \%$, the algorithm in the pump station manager adjusts the speed of both so that they run at $65 \%$. This ensures a smooth power curve with both pumps running at the same speed.

The VFD algorithm varies the speed of the pumps as the well level varies. It is likely that during steady inflows the system may equalise, and hence run continuously with the outflow matching the inflow. We highly recommend that you enable the Maximum Run Time function (Section 16.3) to ensure that the pumps alternate under this situation.
The following steps are required to configure VFD:

1) Enable and configure VFD functionality
2) Setup the individual pump control parameters
3) Configure the analog output as a source to drive the VFD

### 23.1 Enabling VFD

To enable and configure the VFD drive functionality:
Navigate to:


- Configure the settings listed in the screen and table below as required for the application
- Press the Save button when finished


Figure 160- VFD Settings Screen

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| Name | Description | Range/Value |
| :--- | :--- | :---: |
| VFD Enabled? | Activates the VFD functionality. This must be checked before VFD <br> will work. | Enabled / <br> Disabled |
| Compensation (\%) | The compensation factor is used to adjust how the algorithm <br> averages out the speeds of multiple pumps. <br> This might be necessary to account for losses in the system (e.g. <br> losses in the discharge pipe work). | -50 to 50 |
| Fixed Start Speed <br> Enabled? | This feature allows the pump to be started at a fixed speed for a <br> specified time period. <br> This is normally done to clear the pipes by running the pumps at a <br> higher speed for a short time. | True/False |
| Fixed Start Speed | Sets the starting speed when "Fixed Start Speed" is enabled. | $0-100 \%$ |
| Fixed Start Speed <br> Duration | Sets the length of time a pump is started at a fixed speed when <br> "Fixed Start Speed" is enabled. | seconds |
| Fixed Manual Speed <br> Enabled? | Allows the pump speed to be fixed when running in manual/hand <br> mode. (A common situation would be where operators want the <br> pump to operate at full speed when used in manual mode). | True/False |
| Fixed Manual Speed | Sets the pump speed when "Fixed Manual Speed" is enabled. $0-100 \%$ <br> Well Clean Out <br> Speed The fixed speed to run when "Well Clean Out" is active. | $0-100 \%$ |
| Use Prof FullSpeedLevel | Profile behaviour VFDFullSpeedLevel will be used when "Use Prof <br> FullSpeedLevel" is set to true. Else standard VFDFullSpeedLevel <br> will be used. | True/False |

Table 38 - VFD Parameters

### 23.2 Individual Pump Parameters

To set the start, minimum and maximum pump speeds:

- Press the Pumps button displayed in the VFD Settings screen (See Figure above)
- Set the speed at which to start the pump
- $\quad$ Set a minimum speed (the minimum speed setting of the actual VFD unit may override this value)
- Set a level at which the pump will be running at $100 \%$ speed
- Repeat for each pump and press the Save button when finished


Figure 161 - VFD Pump Speeds Settings Screen

### 23.3 Setup an Analog Output for use with a VFD Drive

Navigate to:

$$
\text { Settings } \rightarrow \text { I/O, Faults \& Level } \rightarrow \text { Analog Outputs }
$$

Press Config and assign VFD Current Speed to an analog output. For more information, see Section 14.10.

### 23.4 Controlling a VFD Drive Using MODBUS

A VFD can be controlled using Modbus communications rather than an analog output.
To do this, the VFD Modbus master needs to be configured to read Input Register point 2 from the MultiSmart. This Modbus point is assigned to the PumpControl.VFD.VFDCurrentSpeed tag. Refer to the MultiSmart Modbus protocol manual for further information.

### 23.4.1 ABB VFD Drive Support

The VFD points list can be automatically configured for two drives manufactured by ABB - models ACS 550 and ACS 800.

To configure the MultiSmart:

- Create a Modbus Master and Slave configuration. (If an existing one is to be used, the points list must be cleared first).
- Configure the protocol and communications channel for the Modbus Master/Slave configuration just created.
- A Config Modbus button now appears in the Motor Protection screen. This allows selection of the drive model and the configured Modbus Master/Slave. A points list is now created.
For a detailed procedure, a Knowledge Based Article is available ("Modbus Connection to ACS550 or ACS800 VFD for Motor Protection, MultiSmart Firmware 2.2.0") - contact MultiTrode.


NOTE:
Only selected points from Profile 3 of the ABB points list are supported.

### 23.5 Displaying VFD speed on Main Screen

See Section 26 Customizing the Display for information on how to display the VFD speed on the Main Screen.

### 23.6 Calculating Efficiency using VFD

For pumps with VFD, currents and power for each pump can be obtained via Modbus communications. Using this information, the MultiSmart is able to calculate pump power and efficiency and display it on the LCD screen, as well as sending it to SCADA, even when the Motor Protection board is not present. To be able to calculate the efficiency, energy monitoring, motor protection and flow modules must be enabled. Refer to Section 17 for more information on energy monitoring and motor protection and refer to Section 20 for more information on flow.

Efficiency is calculated as Volume/Energy AND as Volume/Energy/Head.

## 24 PLC Extension IEC 61131-3 (ISaGRAF)

ISaGRAF, a control software environment which supports all of the internationally recognised IEC 61131-3 control languages and offering a combination of highly portable and robust control engine, is available in MultiSmart. MultiSmart supports ISaGRAF versions 5 and 6. Earlier versions of ISaGRAF are not supported.
ISaGRAF allows system integrators and end-users to further enhance or adapt the capability of MultiSmart. The existing functionality set in the product is very high, but there are always customers or applications that push the envelope. The product has thousands of tags, and system integrators or end-users can now interface to these with the PLC engine. This means they can extend the capability without having to rewrite existing functions.

The ISaGRAF implementation of IEC 61131-3 is added because it is the most proven platform and version 6 is chosen as it offers a number of advantages over version 3 . One example is the ability in v6 to run different 'resources', or applications, at different rates to allow more critical applications to run more frequently.

!

## NOTE:

This is an optional feature that must be purchased with the MultiSmart, or enabled later on the MultiSmart before it can be used. To check if this feature is enabled refer to Section 28.1

ISaGRAF 6 (and patches if any, which are needed for the ISaGRAF logic development), can be downloaded from www.isagraf.com. The MultiSmart definition file required for the ISaGRAF programming can be downloaded from the Training and Support section of the MultiTrode website, www.multitrode.com. The logic, after building, should be downloaded into the MultiSmart for ISaGRAF to run.


Figure 162-ISaGRAF Workbench

### 24.1 Setting up the Workbench

Once the workbench has been installed and started, you can open a new project. Give the project a meaningful name and comment, and select the ISaFREE_TPL template. You will then need to import the MultiSmart PLC definition, which defines the I/O and pre-defined function blocks for the MultiSmart. To do this, right-click on the project name in the Solution Explorer, highlight Import, and select:

## Import Target Definitions

Select the file MultiSmart2.txt. This file is included with each release of the MultiSmart.
Once the MultiSmart definition has been imported, highlight the Resource symbol on the Deployment page and view the properties. The resource will currently be defined as ISAFREE_TGT, and a generic rackmounted PLC symbol will be displayed. This is shown below.


Figure 163 - Selecting Resource Target
In the Properties tab, select Target, and then select MultiSmart from the drop-down list. Once this is selected, the image for the Resource will change to a MultiSmart LCD.
In the Solution Explorer tab, navigate to the Resource, and then review the Properties for the resource. In particular, consider the Cycle Timing (ms), which defaults to 100 ms . In general, this timing can be reduced to 1000 ms or more, unless execution of the resource is particularly time critical.

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### 24.2 Setting up I/O

In order to be able to access I/O Points within ISaGRAF programs, the I/O devices must first be defined. Right-click on the Resource in Solution Explorer, and then select I/O Device. Then click on the Add Device icon. You will see the following devices:

| Device Name | Description |
| :--- | :--- |
| multismart: pc: MultiSmartPCboard(**) | Pump Control board |
| multismart: pc: MultiSmartMPboard (* *) | Energy Monitoring and Motor Protection board |
| multismart: pc: adam6017: ADAM6017(**) | ADAM-6017 Analog Input Unit |
| multismart: pc: adam6050: ADAM6050(**) | ADAM-6050 Digital Input Unit |
| multismart: pc: adam6051: ADAM6051(* *) | ADAM-6051 Digital Input Unit |
| multismart: pc: acromag961: ACROMAG961 (* *) | ACROMAG-961 Analog Input Unit |
| multismart: pc: acromag983: ACROMAG983(* *) | ACROMAG-983 Digital Input Unit |

Table 39 - ISaGRAF Device Names

You can select the desired device. For example, make the following selection:
multistmart : pc multiSmartPCboard(* *)
Then expand the new device and then expand Parameters. There are two parameters defined for this device:

1. Unit - The unit number (1 by default)
2. TopBoard - Whether this unit represents to top (1) or bottom (0) board (1 by default)

These parameters can be modified, for example, to define the pump control board to be the bottom board, or to define a board on unit 2. Additional devices of the same type can also be defined, with difference parameters.
Now make the following selection:
multismart : mp: MultiSmartMPboard(* *)
The same two parameters exist for this device. The only difference is that the topBoard parameter for this device defaults to 0 (which defined it to be the bottom board, by default).

### 24.3 MultiSmart Functions \& I/O Blocks

In order to support the greatest power and flexibility of a MultiSmart unit, a number of functions and function blocks have been defined.

MultiSmart function blocks can be categorized in one of two groups:

- High level - function blocks for controlling pumps, determining the current level of the well, etc.
- Low level - function blocks for interacting directly with the MultiSmart tag database.


### 24.3.1 High Level Functions \& Function Blocks

### 24.3.1.1 CurrentLevelPercent

This function returns the current level of well 1 as percentage.

### 24.3.1.2 CurrentLevelScaled

This function returns the scaled level of well 1.
With a MultiSmart unit, it is possible to redefine the scaling of the level of the well. For example, it is possible to express the level of the well in feet, with the depth of the well defined as 10 ft . It is also possible to define an offset, or datum point. The CurrentLevelScaled function takes all of these parameters into account for its calculations. If no scaling has been defined for a unit, then this function returns the same result as CurrentLevelPercent.

### 24.3.1.3 CurrentTime

This function returns the current time of the MultiSmart as seconds (UDINT) since 1/1/1970.

### 24.3.1.4 CurrentTimeOfDay

This function returns the current time of the day in ISaGRAF TIME format.

### 24.3.1.5 DailyTimer

This function receives a start time and duration as inputs, and returns a Boolean value as an output. The output is returned as true when the time reaches the start time, and remains true for the period defined by the duration.

### 24.3.1.6 DateTime

This function takes the number of seconds of the particular time since $1 / 1 / 1970$ as input (UDINT) and outputs the year, month, day, day of the week ( $0=$ Sun, up to $6=$ Sat), hour, minute and seconds. All outputs are Unsigned Integers. This function is especially useful when used with the CurrentTime function.

### 24.3.1.7 Exec

This block can be used for executing shell commands directly on the MultiSmart. It is a powerful feature, and should only be used by experienced developers. The response of the shell command is returned as an output, and this response can also be saved (and optionally appended) to file.

### 24.3.1.8 GetPumpMode

This block receives a pump number as an input and returns whether the pump is in auto, off, manual, or semi-auto mode, or whether the pump is decommissioned.

### 24.3.1.9 HourlyTimer

This function is like the DailyTimer function, except that it can be used to trigger an output at the same time each hour.

### 24.3.1.10 IsPumpAvailable

Pumps become unavailable due to critical faults. For example, a Motor Over-Temperature fault will cause the pump to be locked out by default, so that it cannot be run. Other faults (e.g. Contactor Auxiliary) do not cause the pump to be locked out. The IsPumpAvailable function block returns whether a specified pump is currently available to be run. It receives a pump number (1,2,3...) as an input, and returns a Boolean result specifying whether the selected pump is available.

### 24.3.1.11 IsPumpRunning

This function returns whether a pump has been called to run. This doesn't reflect pumps running in external mode, and doesn't reflect whether the pump contactor has been closed.

### 24.3.1.12 IsPumpStarting

This function returns whether a pump is currently starting. When a pump is called to run, and count-down start timer is activated, which takes into account various inter-pump delays. The pump is defined to be starting whilst this timer is active.

### 24.3.1.13 LogMessage

This function can be used for diagnostic purposes, and provides traceability of significant events. When the function is called, a message is written to the system log (/var/log/messages). This log can be retrieved by saving log files to a USB from the LCD, via Configurator, or via DNP file transfer (by requesting logs.tgz).

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### 24.3.1.14 MonthlyTimer

This function is like the DailyTimer function, except that it can be used to trigger an output at the same time each month.

### 24.3.1.15 NextPumpRunning

This function block returns whether a specified pump is currently running. It receives a pump number $(1,2,3 \ldots)$ as an input, and returns a Boolean result specifying whether the selected pump is running.

### 24.3.1.16 NextPumpToRun

This function returns the pump number ( $1,2,3 \ldots$ ) of the next pump which will be run. This takes into account any pump alternation scheme defined in the unit.

### 24.3.1.17 NumRunningPumps

This function returns the number of currently running pumps which are managed by the MultiSmart.

### 24.3.1.18 PumpAuto

This function block can be used to place a pump into AUTO mode. It receives a pump number as an input, as well as a Boolean variable which defines whether the function block should be activated. It returns a Boolean result, indicating whether the operation was successful.

### 24.3.1.19 PumpHoldout

As of MultiSmart version 2.0.0, a new Holdout fault has been defined. This fault can be used to hold out a pump without "faulting" it. (i.e. There is to fault indication on the unit). The PumpHoldout function block can be used to activate this condition. However, its operation depends upon the unit being configured appropriately. This function block actually writes to the source of the PumpHoldout fault. If the source is not defined, then this action will have no effect. As well, if the source is defined to be a digital input, then the value of the digital input will override any attempt made by this function block to modify the source. Therefore, if use of this function block is desired, then the source of the PumpHoldout fault should be set to a digital tag not defined by a physical input. The tags defined under Isagraf5. Values are most appropriate for this purpose. In order to do this, first go to the Advanced screen. Then navigate to:

FaultModule->Pump->Pump_n->Pump Holdout->Status
Highlight Source and press the middle left button. Then navigate to Isagraf5. Values and select one of the digital tags (e.g. Digital01). Then press OK.

The PumpHoldout function block can then be used to hold out the pump. The function block receives a pump number as an input, as well as Boolean variable which defines whether activate or clear the holdout condition. It returns a Boolean result, indicating whether the operation was successful.

### 24.3.1.20 PumpManual

This function block can be used to place a pump into MANUAL mode. It receives a pump number as an input, as well as a Boolean variable which defines whether the function block should be activated. It returns a Boolean result, indicating whether the operation was successful.

### 24.3.1.21 PumpOff

This function block can be used to place a pump into OFF mode. It receives a pump number as an input, as well as a Boolean variable which defines whether the function block should be activated. It returns a Boolean result, indicating whether the operation was successful.

### 24.3.1.22 Ramp

This function block can be used to generate a ramp output. It receives four values as inputs. They are the SVAL- Starting Value (DINT), EVAL - Ending Value (DINT), STIM - Starting Time (TIME) and ETIM Ending Time (TIME). It returns a Boolean result ACT, indicating whether the Ramp function is currently running and DINT output, RES which shows the current value of the ramp output.

### 24.3.1.23 WeeklyTimer

This function is like the DailyTimer function, except that it can be used to trigger an output at the same time each week.

### 24.3.2 Low Level Functions \& Function Blocks

Low level functions and function blocks give direct access to the MultiSmart tag database. As such, they offer great flexibility and power for ISaGRAF programs. However, their use requires a more detailed understanding of the tag database.
The MultiSmart tag database has three types of tags:

1. Status tags - these include Analog, Digital, Integer, Fixed-Point, Date, and String tags.
2. Command tags - these include Analog Control and Digital Control tags, and are used for sending commands to various processes.
3. Configuration tags - these include Boolean Attribute, Date Attribute, Integer Attribute, Fixed-Point Attribute, and String Attribute tags, and are used for configuration of various processes. As such, the values of these tags are stored in non-volatile memory, such that these values can be restored if the unit restarts.

### 24.3.2.1 CommitSetPoint

Command tags and configuration tags all consist of a set point and value. When you write to one of these tags, the set point is modified. This does not actually effect any change in the unit until the value is also updated.
The CommitSetPoint function block can be used to update the value of a command or configuration tag with its modified set point. It receives the full name of the tag as an input, together with a Boolean variable which defines whether the function block should be activated. It then returns a Boolean result, indicating whether the operation was successful.

### 24.3.2.2 GetNodeCount

This function returns the number of sub-nodes within a given node. It can be useful for determining the number of certain objects. For example, the number of pumps can be determined by passing in PumpControl. Pump as an input to this function.

### 24.3.2.3 GetTagCount

This function returns the number of tags within a given node.

### 24.3.2.4 RollbackSetPoint

This function block performs the reverse of the CommitSetPoint function block. It is used to reject set point changes.

### 24.3.2.5 IsSetPointPending

This function block is used to determine whether a set point change has been made to a command or configuration tag. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the set point is pending for the selected tag.

### 24.3.2.6 ReadAnalogRanges

This function block returns the raw and scaled ranges of an Analog tag.

### 24.3.2.7 ReadAnalogRaw

This function returns the raw value of an Analog tag. In order to read the scaled value, use the ReadFloat function block.

### 24.3.2.8 ReadBoolSetPoint

This function block can be used to read the value of Digital, Digital Control, and Boolean Attribute tags. It receives the full name of the tag as an input. It then returns a Boolean result indicating whether the operation was successful, together with the value of the selected tag.

### 24.3.2.9 ReadBoolValue

This function block can be used to read the value of Digital, Digital Control, and Boolean Attribute tags. It receives the full name of the tag as an input. It then returns a Boolean result indicating whether the operation was successful, together with the value of the selected tag.

### 24.3.2.10 ReadFlag

This function block returns the status flags of a tag. Flags are comprised of combinations of bits, with the following interpretations (values below are hexadecimal numbers):

| Flag | Value |
| :--- | :--- |
| Online | $0 \times 01$ |
| Restart | $0 \times 02$ |
| Comms Lost | $0 \times 04$ |
| Remote Forced | $0 \times 08$ |
| Local Forced | $0 \times 10$ |
| Chatter Filter | $0 \times 20$ |
| Rollover | $0 \times 40$ |
| Over-range | $0 \times 80$ |
| Discontinuity | $0 \times 100$ |
| Reference Error | $0 \times 200$ |
| Non-volatile | $0 \times 400$ |
| Needs Commit | $0 \times 800$ |
| Control Error | $0 \times 8000$ |
| Pending Flag | $0 \times 10000$ |
| Needs Saving | $0 \times 80000$ |

### 24.3.2.11 ReadFloatSetPoint

This function block can be used to read the set point of Analog Control and Fixed-Point Attribute tags. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the operation was successful, together with the set point of the selected tag.

### 24.3.2.12 ReadFloatValue

This function block can be used to read the value of Analog, Analog Control, Fixed-Point, and Fixed-Point Attribute tags. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the operation was successful, together with the value of the selected tag.

### 24.3.2.13 ReadIntegerSetPoint

This function block can be used to read the set point of Integer Attribute tags. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the operation was successful, together with the set point of the selected tag.

### 24.3.2.14 ReadIntergerValue

This function block can be used to read the value of Integer, Integer Attribute, and Digital tags. When selecting a Digital tag, the function block returns the number of time the tag has changed state. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the operation was successful, together with the value of the selected tag.

### 24.3.2.15 ReadTimeStamp

This function block can be used to read the Timestamp of a tag. It receives the full name of the tag as an input. It then returns a Boolean result, indicating whether the operation was successful, together with the timestamp in seconds (UDINT) of the selected tag.

### 24.3.2.16 ReadWITSInhibit

This function returns whether a WITS inhibit has been applied to a particular tag. WITS inhibits can be used for inhibiting generation of events of DNP points. When an inhibit is applied, no events will be generated for the point. This functionality was specifically designed in support of WITS-DNP, but can also be used for inhibiting event in native DNP applications.

### 24.3.2.17 SerialOpen

This function block opens the serial port.

### 24.3.2.18 SerialRead

This function block reads the serial port.

### 24.3.2.19 SerialWrite

This function block writes to the serial port.

### 24.3.2.20 SerialClose

This function block closes the serial port.

### 24.3.2.21 SerialFlush

This function block clears the serial port buffer.

### 24.3.2.22 TouchTimeStamp

This function block can be used to update the Timestamp of a tag with the current MultiSmart time. The function receives the full name of a tag and a Boolean input depending on which the write operation is being performed. The status of the operation is output as another Boolean value.

### 24.3.2.23 WriteBool

This function block can be used to write to the value of Digital tags, or to the set point of Digital Control and Boolean Attribute tags. It receives the full name of the tag as an input, together with a Boolean variable which defines whether the function block should be activated. It also receives the value which is to be written to the tag. It then returns a Boolean result, indicating whether the operation was successful.

### 24.3.2.24 WriteFlag

This function can be used to write the status flag for a given tag.

### 24.3.2.25 WriteFloat

This function block can be used to write to the value of Analog and Fixed-Point tags, or to the set point of Analog Control and Fixed-Point Attribute tags. It receives the full name of the tag as an input, together with a Boolean variable which defines whether the function block should be activated. It also receives the value which is to be written to the tag. It then returns a Boolean result, indicating whether the operation was successful.

### 24.3.2.26 Writelnteger

This function block can be used to write to the value of Integer tags, or to the set point of Integer Attribute tags. It receives the full name of the tag as an input, together with a Boolean variable which defines whether the function block should be activated. It also receives the value which is to be written to the tag. It then returns a Boolean result, indicating whether the operation was successful.

### 24.3.2.27 WriteString

This function block can be used to write to the value of String tags, or to the set point of String Attribute tags. It receives the full name of the tag as an input, together with a Boolean variable which defines whether the function block should be activated. It also receives the value which is to be written to the tag. It then returns a Boolean result, indicating whether the operation was successful.

### 24.3.2.28 WriteWITSInhibit

This function can be used to trigger and clear WITS inhibits on specified tags. As with the ReadWITSInhibit block, this functionality was designed in support of WITS-DNP, but can also be taken advantage of in native DNP applications.

### 24.4 Downloading ISaGRAF Resources to MultiSmart

Once ISaGRAF programs have been completed, it is time to download them to the MultiSmart unit. MultiSmart only supports downloading via Ethernet. To do this, first click on the Deployment page on workbench, and then highlight the vertical line which connects the configuration to the horizontal bar labelled DefNet. On the Properties tab, you will then see an entry for specifying an IP address. This needs to be the IP address of the MultiSmart unit.
Once the IP address has been specified, highlight the project and click on the Download icon. This may first compile the resources, if they have not been previously compiled. If this is the case, you will need to click on the Download icon again once this is completed.

It should be noted that ISaGRAF 5 must be enabled via the enable code on the MultiSmart unit. Otherwise, the download process will fail.

### 24.5 Compiling and Downloading Multiple Resources

ISaGRAF and MultiSmart support the concept of multiple resources. A new resource can be added by rightclicking on the Device in the Solution Explorer, and then selecting Add->New Resource. The second resource can be defined to run at a different frequency from the first resource. This is especially useful where there is a time-critical resource which needs to be run frequently, as well as a non-time-critical resource which can be run at a much slower frequency. It can also be useful as a means of dividing unrelated functionality. Each resource defines its own separate dictionary.
As explained in the following section, MultiSmart allows viewing of ISaGRAF variables from the LCD, and supports this in a multi-resource environment. However, in order for this to work, the symbol table for each resource must be downloaded to MultiSmart. This can be defined by displaying the properties of a resource. Ensure that Embed Symbol Table is checked.

### 24.6 Viewing the Status of ISaGRAF Variables

Once ISaGRAF resources have been compiled and downloaded to MultiSmart, it is possible to view the values of all ISaGRAF variables from the LCD. To do so, navigate to Info->More->ISaGRAF 5. From there, you will see the status information for the first resource. If multiple resources have been downloaded, then information for additional resources can be displayed by using the arrow keys at the bottom of the screen.

Of particular interest is the Variables button at the bottom-right of the screen. If you press this button, all ISaGRAF variables for the selected resource will be displayed, together with their values. The values of these variables are updated dynamically. This is an extremely valuable tool for confirming that a resource is behaving properly, and for debugging any problems. If you then highlight a variable and select the Details button, you will see additional information for that variable, such as whether it is retained (in non-volatile memory), and whether it has Read or Write access.

### 24.7 The Tags Button

On the Resource Information page is a Tags button. Selecting this button will display a list of general purpose tags defined under the Isagraf5.Values node in the database. The values of these tags are updated dynamically. New values for these tags can be assigned from this menu.
These tags are designed for use within ISaGRAF programs. They can be used for updating the status and controlling set points of algorithms. They can also be added to a DNP or Modbus points list, thereby allowing remote access to ISaGRAF functionality. The values of these tags can be read and controlled via the lowlevel functions blocks defined in a previous section.

### 24.8 The Params Button

On the Resource Information page is also a Params button. Selecting this button will display a list of configuration tags defined under the Isagraf5.Parameters node in the database. The values of these tags are updated dynamically. The values of these parameters can be changed from this menu itself.
These tags are designed to be used as configuration parameters within ISaGRAF programs. They can be modified via the Advanced screen by navigating to IsaGRAF5->Parameters, and will persist in nonvolatile memory. They can also be added to a DNP or Modbus points list, thereby allowing remote configuration of ISaGRAF functionality. For increased readability and ease in understanding during programming, ISaGRAF parameter descriptions can be renamed. These descriptions will be displayed in the information screen. The renaming can be done via the Information screen or via the Advanced menu.
They can also be added to a DNP or Modbus points list, thereby allowing remote access to ISaGRAF functionality.

### 24.9 Disabling ISaGRAF Resources

The user can disable ISaGRAF resources via the Info page. See section 5.4.3.8

### 24.10 Backing Up ISaGRAF Resources

All ISaGRAF resource and symbol information is downloaded to the/var/config/isagraf5 directory on the MultiSmart. These files are all backed up to an SD card or USB whenever a full backup of the MultiSmart configuration is performed. This is done by navigating to:


Restoring a saved configuration will also restore any ISaGRAF resource files.
It is also possible to restore only the ISaGRAF configuration files from an SD card or USB. This is especially useful for deploying new ISaGRAF resources to existing devices. For example, if resources are compiled and downloaded to one device, and then backup up onto USB, these files can then be transferred to other devices via this functionality. This is done by navigating to:


### 24.11 ISaGRAF Application Examples

A brief overview of some of the applications which are implemented with the help of ISaGRAF is mentioned in the subsections below.

### 24.11.1 Battery Testing

This application was written to perform a Battery Voltage test, which is to be performed at the specified time on a periodic basis. The application initiates at the specified time, activates a relay to switch to Battery mode for a very short duration, check the voltage status and switch back to the main power supply.

### 24.11.2 Redundant Communication over TCP/IP

This application switches the communication from the MultiSmart from the Primary Server to the Backup Server in case of a server failure. The Program checks if the communication channel is still alive periodically. If a communication failure occurs, the IP address of the Primary Server to which the MultiSmart is talking will be changed with the IP address of the Backup Server. This will enable communication from MultiSmart to the Backup Server.

## 25 Logic Engine

A simple, Boolean, engine has been built into the MultiSmart to allow basic customization of control capabilities.


NOTE: This is an optional feature that must be purchased with the MultiSmart, or enabled later on the MultiSmart before it can be used.

The logic engine uses mathematical expressions which are evaluated at regular intervals to determine if they are true or false. The expressions are associated with a tag within the MultiSmart to create actions when an expression changes state.

Expressions are written on a single line in a simple text file. Multiple expressions can be included in a text file, but only one expression is allowed per line. The text file can be created in any basic text editor and saved as a basic text file with an ".Ige" extension so the MultiSmart can identify it as a logic engine file.
Files are transferred to the MultiSmart using an FTP program or the configuration utility. From there, they must be activated from the Logic Engine settings screen on the MultiSmart.


NOTE: When creating a logic engine file, use a simple text editor such as Windows Notepad. Using MS Word may cause problems with formatting tags being added. Also ensure that the filename created is not of the form example.Ige.txt - i.e. be sure to remove any .txt or .doc from the end of the filename, otherwise Logic Engine will not recognize it.


NOTE: The logic engine is limited in its capability and should only be used in simple situations where existing functionality within the MultiSmart is insufficient to cover a particular scenario. Before using the logic engine, it is recommended that you first make sure the same functionality is not already provided by the MultiSmart.

### 25.1 MultiSmart Tags

The MultiSmart has a comprehensive tag database, which includes the full setup and status of all I/O, the setup and status of all pump control functionality and other station tags.

### 25.1.1 I/O Tags

Finding I/O values is straightforward. For example:

| Description | Tag |
| :--- | :--- |
| AIN1 on the top board of I/O unit 1 | IO.Unit._1.TopBoard.Ain._1.Value |
| AIN2 on the top board of I/O unit 1 | IO.Unit._1.TopBoard.Ain._2.Value |
| DIN15 on the top board of I/O unit 1 | IO.Unit._1.TopBoard.Din._15.ValueDigital |
| DOUT11 on the bottom board of I/O unit 2 | IO.Unit._2.BottomBoard.Dout._11.Value |

From these examples, you should be able to identify the tag for any I/O. There is also a complete list of I/O with the tag name in the DNP3 and Modbus manuals.

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### 25.1.2 Pump Control Tags

The pump station manager is a sophisticated pump control engine with advanced capabilities. A few examples of Pump Station Manager tags are shown in the table below:

| Description | Tag |
| :--- | :--- |
| Current Level (in well 1) | PumpControl.Well._1.CurrentLevel |
| Pump 1 Running? | PumpControl.Pump._1.Running |
| Pump 2 Running? | PumpControl.Pump._2.Running |
| Pump 1 Mode (0=auto, 1=full manual, 2=semi-auto manual, 3=off, <br> $4=$ decommissioned. Values $1 \& 4$ cannot be written) | PumpControl.Pump._1.PumpMode |
| Next pump to run | PumpControl.NextToRun |
| Current active profile number | PumpControl.ProfileNumber |
| VFD current speed (when VFD functionality is enabled) | PumpControl.VFD.VFDCurrentSpeed |
| Lead (duty) pump activation set point (for writing to a value) | PumpControl.Behaviour._1.ActSetPoint |
| Lag (standby) pump activation set point (for writing to a value) | PumpControl.Behaviour._2.ActSetPoint |
| Lag (standby) pump deactivation set point | PumpControl.Behaviour._2.DeactSetPoint |

Table 40 - Example of MultiSmart Tags
A comprehensive list of tags can be found in the DNP3 or Modbus manuals, where the tag names and descriptions, along with valid ranges, are listed.

### 25.2 Logic Engine Tags

Extra tags have been provided within the MultiSmart database for use with the logic engine. These are used to access digital and analog tags or as "scratchpad tags" (i.e. temporary values).
Logic engine tags available for use with the logic engine include:

- Digital Tags - Logic.Values.Digital01 up to Digital20
- Analog Tags - Logic.Values.Analog01 up to Analog20
- Fixed Point Tags - Logic.Values.Decimal01 up to Decimal20
- Integer Tags - Logic.Values.Integer01 up to Integer20


### 25.3 Mathematical Operators

The following mathematic operators can be used to create expressions:

| Operation | Description |
| :---: | :--- |
| and | Logical and |
| or | Logical or |
| Xor | Logical xor |
| $!$ | Logical Not |
| + | addition |
| - | subtraction |
| * | multiplication |
| $/$ | floating point division |
| $>=$ | greater than or equal to |
| $<=$ | less than or equal to |
| $!=$ | not equal t |
| $==$ | equal to |
| $>$ | greater than |
| $<$ | less than |
| $\wedge$ | raise $x$ to the power of $y$ |
| () | parenthesis |

Table 41 - Logic Engine Mathematic Operators

### 25.4 MultiSmart Logic Functions

The following table lists MultiSmart-specific logic functions which can be used to build expressions:

| Function | Description |
| :--- | :--- |
| valueof | Get the value of a MultiSmart tag: valueof("pump.1.running") |
| now | Get the current date/time using the local time |
| date | Convert a time broken into segments to seconds .e.g. Date (1, 1, 2005, 12, 0, 0) |
| hour | Returns the hour of the day in 24 hour localtime. |
| minute | Returns the minutes of the current hour. |
| second | Returns the seconds of the current minute. |
| day | Returns the day of the month in localtime. |
| month | Returns the month of the year in localtime. |
| year | Returns the year in localtime. |
| delay | Pause the running of this expression for the number of milliseconds as specified by the delay <br> parameter. |

Table 42 - Logic Engine Functions

### 25.5 Advanced Functions

| Function | Description |
| :---: | :---: |
| sin | Sine |
| cos | Cosine |
| tan | Tangent |
| asin | Arc sine |
| acos | Arc cosine |
| atan | Arc tangent |
| sinh | Hyperbolic sine |
| cosh | Hyperbolic cosine |
| tanh | Hyperbolic tangent |
| $\log 2$ | logarithm to the base 2 |
| $\log 10$ | logarithm to the base 10 |
| In | logarithm to the base e |
| $\log$ | logarithm to the base 10 |
| exp | e raised to the power of $x$ |
| sqrt | Square root |
| sign | -1 if $x<0 ; 1$ if $x>0$ |
| round | round to nearest integer |
| floor | Round down to nearest integer |
| ceil | Round up to nearest integer |
| mod | Modulus |
| abs | absolute value |
| min | minimum of an unlimited parameter list |
| max | maximum of an unlimited parameter list |
| sum | sum of an unlimited parameter list |
| avg | average of unlimited parameter list |
| if | if ... then ... else e.g. if ( $10>1,1,0$ ) if arg1, then arg2 else arg3 |

Table 43 - Logic Engine Advanced Functions

### 25.6 Logic Examples

Some examples of logic expressions are shown below:

### 25.6.1 Example 1: Changing the Lead (Duty) Pump Setpoint from an Analog Input

This example allows the Lead (Duty) pump to have its activation setpoint changed via an analog input.

- The left side of the expression above represents the activation setpoint for the lead pump.
- The right side of the expression is AIN1 on the top board multiplied by a factor of 4. So if AIN1 is 15 mA , the lead (duty) pump setpoint will be $60 \%$.

PumpControl.Behaviour._1.ActSetPoint = valueof("I0.Unit._1.TopBoard.Ain._1.Value")*4

NOTE: A "Behaviour" is the name used internally for lead/lag pumps. In alternation mode, the setpoints aren't assigned to physical pumps but rather to their position in the cycle.

### 25.6.2 Example 2: Start the Station if an Analog Input Falls below a Certain Value

The MultiSmart includes a station function called Pulse Start. This was originally designed so that a Digital Input, when closed or opened, could start one or more pumps. See Section 16.2.3 for a description of this feature.

In this example, a logic engine tag is set to trigger the pulse start instead of "ValueDigital". A logic file is then used to define when this feature is activated. Rather than just activating in response to the digital input, this example uses an analog input to trigger the digital input when it passes a set value.

```
Logic.Values.Digital01 = valueof("I0.Unit._1.TopBoard.Ain._2.Value") < 12
```

What this does is test if AIN2 in the top board of I/O unit 1 is less than 12 mA . This Boolean expression resolves to 0 if AIN2 $>=12 \mathrm{~mA}$, and resolves to 1 if AIN2 $<12 \mathrm{~mA}$. As a result, the virtual Digital Input01 gets set to 1 or 0 .

When it changes from 0 to 1 (i.e. when AIN2 falls below 12 mA each time), the station operates its pulse start functionality.

### 25.6.3 Example 3: Change Pump Mode if an Analog Input Falls Below a Set Value

```
PumpControl.Pump._1.PumpMode = 2 *
(valueof("IO.Unit._1.TopBoard.Ain._2.Value") < 7)
```

If AIN2 is below 7 mA , the value of the expression on the right $=2$. This value for pump mode puts the pump into semi-automatic manual (i.e., manual until the pump reaches its deactivation setpoint, at which time it reverts to auto mode).

If AIN2 is above 7 mA , the value of the expression on the right $=0$. This puts the pump into Auto mode. The above expression could also be achieved by the following:

```
PumpControl.Pump._1.PumpMode = if
(valueof("IO.Unit._1.TopBoard.Ain._2.Value") < 7, 2, 0)
```

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### 25.7 Uploading Logic Files Using FTP

The easiest way to transfer files into the MultiSmart unit is by using FTP. In order to do this you will need an Ethernet crossover cable, and have your PC's IP address on the same subnet as the MultiSmart. See Section 22.4 on how to change the Ethernet address of the MultiSmart.
If you have Windows XP on your PC, you can change the IP address from:

- Start-> Settings ->Network Connections and then right click the Local Area Network icon.


Figure 164 - Select TCP/IP and click Properties:


Figure 165 -Enter IP Address

Now check the "Use the following IP address" button and enter an IP address, for example, the one shown above.

The easiest way to ftp a file into the unit is using MS Internet Explorer. For example, if you had set the IP address of MultiSmart to 192.168.0.10, at the address (URL) field type the following:

## ftp://user@192.168.0.10

When prompted for the password you need to enter the administrator password for the unit.

$\triangle$
NOTE: Each unit is shipped with the administrator password is on the inside back cover of the Installation and Operation manual. See Section 11 for details.

Open the folder /var/config and copy your logic engine files into this directory.

### 25.8 Enabling Logic Files

Once a logic file has been uploaded it can be:

- Enabled
- Disabled
- Assigned an execution interval
- Have a description edited

The first time a logic engine file is enabled, the MultiSmart will require a restart. Subsequently, it can be disabled or re-enabled any number of times without a restart. Also, the file can be completely changed via FTP without a restart.

To access the Logic Engine screen, go to:


Figure 166 - Logic Engine Screen

## 26 SMS Server

MultiSmart has SMS Server functionality for sending SMS messages whenever configured alarm conditions are triggered. SMS server uses PPP Manager 2 to send the SMS.


NOTE: This is an optional feature that must be purchased with the MultiSmart, or enabled later on the MultiSmart before it can be used. PPP Manager 2 must also be enabled for this functionality to work.

Refer to section 29.2 for enabling the modules.
SMS Server configuration can be set up at:


Figure 167-SMS Server Settings

For general SMS Server settings, press General Settings.
The following details can be configured in general settings:

- Station Name
- Number of SMS retries
- Wait period for an SMS acknowledgement


Figure 168 - SMS Server General Settings Screen
To configure the phone numbers for sending the SMS, press Mobile Numbers on SMS Server Settings screen.


Figure 169 - SMS Server Mobile Numbers
To edit, add or delete a mobile number, press New Number/Delete/Edit
When a fault condition occurs or a configured digital input value changes, an SMS is sent to the first mobile number in the list and the SMS Server waits for an acknowledgement. A unique sequence number is associated with each SMS sent out by the SMS Server. On receiving an acknowledgement, SMS Server drops the message. The acknowledgement must be from a configured mobile and must contain the unique sequence number received as part of the message. If an acknowledgement is not received within the waitPeriod, the same SMS is sent to the next mobile number in the list. Once it is sent to all numbers in the list and an acknowledgement is not received, SMS Server starts again from the beginning of the mobile number list. In this way, SMS Server retries the message for the configured number of retries to all numbers configured. If there isn't any acknowledgement after all the retries, the message is dropped.

In order to configure the faults to be monitored by the SMS Server, press Faults on SMS Server Settings screen.


Figure 170 - SMS Server Faults
If all the faults in MultiSmart are to be monitored by SMS Server, then check the All Faults ? box. The faults selected and saved on this screen are monitored by SMS Server and an SMS is sent to the configured mobiles if any of these faults change their state to activated, deactivating or reset required.

For configuring the digital inputs to be monitored by the SMS Server, press Digital Inputs on SMS Server Settings screen.


Figure 171 - SMS Server Digital Values
To edit, add or delete a digital value, press New Value/Delete/Edit.
The following settings can be configured for a digital value:

- Source tag - Source digital tag which is to be monitored
- Message - The message to be sent as part of the SMS
- OnMessage - The message sent as part of the SMS for ON state of the tag
- OffMessage - The message sent as part of the SMS for OFF state of the tag

The digital values configured on this screen are also monitored by SMS Server. In the event that any of these digital values are set/cleared, an SMS will be sent to the configured mobiles.

## 27 Customizing the Display

Some elements of the main operator screen can be customized by the user.


Figure 172-Customize Display Screen

### 27.1 Naming Pumps

One or more pumps can be given a custom name, which is reflected through the Faults, History and Info screens, (except the Set Points screen). If you want to rename pumps and pump faults, be sure to rename the pump first. The most common naming conventions for the pump are Lead/Lag and Duty/Standby. The new pump names are shown in the main display, pump set point screen and in the pump delay screen.


## NOTE:

Some advanced settings screens do not contain the customized names.

### 27.2 Pump Data Display

This allows a number of different values to be shown at the bottom of each pump section.


Figure 173 - Choosing a new value to display

Values available include:

| Apparent Energy (kVAh) ${ }^{1}$ | Hours Run ${ }^{3}$ |
| :---: | :---: |
| Apparent Power (kVA) | Total Hours Run |
| Efficiency (L/kWh, Gal/kWh, kWh/ML or kWh/MGal) ${ }^{1 *}$ | Starts ${ }^{2,3}$ |
| Energy (kWh) ${ }^{1}$ | Total Starts |
| Flow Rate (L/sec, L/min or gpm) * | VFD Speed (\%) |
| Insulation Resistance (M) | Power (kW) |
| Last Minutes Run | Power Factor |
| Minutes Run ${ }^{2}$ | Three Phase Currents (A) (\%FLC) |

${ }^{1}$ Last Week, This Week, Today or Yesterday, ${ }^{2}$ Last Hour or This Hour
${ }^{3}$ Today or Yesterday, * Some units may require changes to Flow Settings (Section 20).
Table 44 - Customize Display - Pump Data

### 27.3 Bottom Section

The bottom 3 lines of the Pump Station display can also be customized. Options are:

| Date and Time* | DSP Firmware Version |
| :--- | :--- |
| Supply Volts* (3-Phase Supply) | Last Login ID, Name and Date/Time |
| Mode and Profile* | Invalid Login Count and Date/Time |
| Alternation Mode | Invalid Admin Login Count and Date/Time |
| Inflow and Volume | Topboard Ains |
| Duration To Overflow | Topboard Aouts |
| Station Run Time (hrs) and Starts | Topboard Dins $^{1}$ |
| Temperature | Topboard Douts $^{1}$ |
| Last Overflow Time | Well Mixer $^{\text {Site Name }}$ |

* Defaults, ${ }^{1}$ Maximum of 3 Dins or Douts displayed

Table 45 - Customize Display - Bottom 3 Lines
Example of a customized display:


Figure 174 - Customized Display Screen

## 28 Restarting the MultiSmart

A manual restart of the MultiSmart controller can be performed at any time by pressing the following buttons:
Settings $\rightarrow$ More $\rightarrow$ More $\rightarrow$ Restart Unit

Press the Yes button to confirm a restart of the controller. This process takes one or two minutes to complete.

NOTE: Accumulators and counters are saved every half an hour. In order to ensure that these values are saved, use this menu option to restart the MultiSmart.

The MultiSmart can also be restarted via a "tag" - which allows remote restart, or via ISaGRAF or the logic engine.

## 29 Site Keys and Enabling New Modules

The Site Key is entered before the MultiSmart leaves the factory. It enables those software modules that have been purchased with the unit. A new Site Key is only required if one or more modules have been purchased from MultiTrode, for example:

- VFD functionality
- More than 3-pump control (additional hardware may be required)
- DNP3 RTU (Master \& Slave)
- Security Key
- Well Mixer Control
- PumpView Protocol
- Logic Engine for customized logic
- ISaGRAF 5 - IEC 61131-3 PLC programming


### 29.1 Software Modules Available

To view what software modules are enabled and the optional modules, navigate to:


Figure 175 - Enabled \& Disabled Software Modules

### 29.2 Enabling Software Modules with a New Site Key

A new Site Key can be obtained from MultiTrode to enable one or more software modules that are currently disabled. The Site Key is entered via the keypad in a similar way to using a mobile phone, e.g. pressing the number 3 , steps the character displayed through $3, \mathrm{~d}, \mathrm{e}$ and f . (The Site Code is unique to each MultiSmart and cannot be changed).

Navigate to:


Figure 176 - Enabling Software Modules


NOTE: The Site Key is based on the serial number of the unit so a different Site Key is required for each MultiSmart.

## 30 Upgrading MultiSmart Firmware

### 30.1 Upgrading via PC Configuration Utility

To upgrade the firmware, insert the SD card or USB into the MultiSmart unit and restart (see Section 27). It is recommended to save your current configuration prior to commencing a firmware upgrade.

The MultiSmart displays a firmware update prompt with the version information of the current version and the update image present on the SD card or USB. If neither option is selected after a predefined time period, the MultiSmart resumes normal operation without performing a firmware upgrade.

The unit uses the file of upgrade image to upgrade to the latest version of firmware. The existing configuration is preserved. After the new firmware is installed, the MultiSmart automatically upgrades the existing configuration to the latest firmware version.


## NOTE:

This process takes approximately 6 minutes. This is a consequence of having forward and backwards compatibility. MultiSmart interrogates every tag in the existing configuration and checks for any new tags in the firmware. Any new tags found are set to the default status.


NOTE:
During the upgrade process, the MultiSmart does not control the pumps, so a backup method of level monitoring and pump control may be required.

## 31 Backing Up \& Restoring Configuration Settings

The MultiSmart automatically stores a copy of the previous settings anytime a change is made. It is also possible to backup the current configuration to internal memory or to a SD card or USB. Thus there are three options when restoring the configuration settings:

- Restore the previous settings
- Restore from the internal backup file
- Restore from an SD card or USB

If an SD card / USB is inserted into the port, then multiple configurations can be saved. If no SD card or USB is present, then only one backup can be saved.
Backing up and restoring configuration settings is done from the Backup Options screen:


Use the Help button for more information at any time.

Figure 177 - Configuration Backup Options

### 31.1 Resetting Defaults

Pressing the Reset Defaults button displays the Setup Wizard as described in Section 9.

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### 31.2 Restore a Backup

Navigate to:
 Configurations $\rightarrow$ Restore Backup

This allows an existing configuration to be loaded into the MultiSmart. There are three possibilities: restore the previous configuration (automatically saved to internal memory), restore a (manually saved) backup version (stored in internal memory), or restore from an SD card or USB.


Figure 178 - Restoring Saved Configurations

### 31.2.1 Restore from Previous Configuration

This option restores the previous automatically saved configuration. The configuration is automatically saved every time prior to a change taking effect. To restore the previous configuration, select RTU Previous and then press Restore. A confirmation message is then displayed.


NOTE: In the event that the current configuration becomes corrupt (displayed as an Application Failure), the MultiSmart loads the Previous Configuration and if this also fails, the Backup configuration is loaded.

### 31.2.2 Restore from Backup Configuration

This restores the last backup of the configuration that was saved by the user to internal memory. To restore the backup configuration, select RTU Backup and then press Restore. A confirmation message is then displayed.

### 31.2.3 Restore from External Memory (SD Card or USB)

A configuration can be restored from an SD card or USB. To restore a saved configuration, insert the SD card or USB, select the desired configuration from the list and then press Restore. A confirmation message is then displayed.

### 31.3 Back Up Current Configuration

Navigate to: $\square$ Backup Current

A backup of the configuration can be saved to internal memory or an SD card or USB.


Figure 179 - Backing up a current configuration

### 31.3.1 Save to External Memory (SD Card or USB)

A backup of the configuration can be saved to an SD card or USB. Either a new backup file can be created or an existing one over-written. To create a new backup:

- Press New - the default filename is the current date (in the format YYYYMMDD).
- Modify the filename if necessary using the keypad.
- Modify the location using the Location button on the bottom left. Location can be USB or SD
- Press Save

An SD card or USB can store multiple backups. (A configuration requires about 1.5 to 3 MB ).

### 31.3.2 Save to Backup Configuration

If no SD card or USB is present, the configuration can be saved to internal memory.

- Select the file Backup (stored on the "RTU")
- Press Overwrite and answer Yes.

The Backup filename can not be renamed or new filename added to internal memory.

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## 32 More Advanced Configuration

Part 3 has detailed many of the configuration settings beyond the Quick Commissioning Guide. The MultiSmart unit has a great deal of flexibility and therefore presents opportunity for advanced users to customize the product for a large variety of complex applications. Navigate to:


A Windows Explorer style screen is displayed which shows all of the main functional modules inside the MultiSmart.
Pressing the $+I-$ key by any of the modules expands out the options available for that module.


Figure 180-Advanced Screens


NOTE:
Refer to the Short Help in the top left corner for each setting.


Pressing the Help key will often provide additional information on the feature or setting.

### 32.1 Default Mode vs. Showing Less Options

There are two modes within the Advanced screens. As of v2.3.3 the default mode shows all parameters. The option (previously the default) is to hide some of the more complex / less-used features.

To hide these less-used parameters and features, navigate to:

## Settings $\rightarrow$ Advanced

- From the list of modules select: LCD ++-
- Highlight Show More Options?
- Press the Show More Option? button (bottom left corner) to uncheck the box
- Press Save
- Exit to the main settings screen via the Back button
- Again press Advanced

The reduced list of parameters are now displayed whenever the is pressed.

## 33 Web Server

MultiSmart has web server functionality, which is valuable for monitoring MultiSmart details on remote machines, or for where there is no local LCD. Most of the information which can be viewed by info screens on the MultiSmart are available in various web pages. As well, there are options to change pump modes, reset faults and configure basic communication settings via web pages.
To access the web pages on a MultiSmart, the MultiSmart should be connected to the internet using an ethernet cable and it should have an IP address configured. Refer to section 22.4 for configuring an IP address for MultiSmart. Open a web browser and type in the IP address of the MultiSmart to access the main page. Other pages can be navigated from the main page. Most of the pages are refreshed automatically to reflect the changes in MultiSmart.

### 33.1 Web Page Security

The MultiSmart restricts access to web pages by creating users. Although the concept is similar to the security feature for restricting access to MultiSmart menus, all security details are managed separately for web pages. MultiSmart supports different levels of security for accessing web pages. Users gain access to secure web pages by either:

- Entering a user password when prompted
- Placing a Security Key (Dallas iButton Key) on the reader

Each user is assigned a password by the MultiSmart administrator.
The administrator user account is enabled and a password automatically generated by default at the factory before despatch. The administrator password can be changed from the Security Screen accessed from Settings menus on the MultiSmart.
Security access for web pages is not activated until the first user has been configured. The administrator must go to the Security web page and configure a user before security is enabled.


NOTE: The factory set security password can be found on the sleeve of the product manual CD.


NOTE: It is important that the administrator password is kept in a secure location. If the password is lost, the unit may need to be returned to MultiTrode for re-configuration.


NOTE: The Admin user can use admin password to enter secure web pages.

The administrator is the only user allowed to add, delete or edit user accounts. There is a separate web page designed to add/edit/delete user details.

To access the security web page:

- Go to the main web page
- Press Security page link
- Enter the administrator password and press Submit

To edit, add or delete a user, press the relevant button.
The following user details can be edited:

- User Name
- User Group
- Password

User group can be chosen for the new user from UserGroup drop down list, which contains all the groups defined in the system.

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### 33.2 Security Key Setup

The Security (or Dallas) key allows a quick and easy method of accessing the MultiSmart web pages whilst maintaining a high level of security, as only those users with a Security key (in which the Administrator has registered the PIN) can gain access to the secure web pages.
The Security key module is a separate software module which can be enabled after purchase.

### 33.2.1 Initial Hardware Setup

To enable the Security key reader:

- If not purchased with the MultiSmart, enter the new Site Key provided by MultiTrode (See Section 9.2.1 for procedure).
- Connect the Security key reader to the iButton port.


### 33.2.2 Adding Security Key Users

The Administrator must now create a user that matches the ID of the Security key. This procedure differs slightly compared to a password-only user as the password is automatically entered.

- Navigate to the Security screen mainpage->Security
- Enter the MultiSmart Administrator password and submit
- Press the New User button
- With the User Configuration screen displayed, place a security key on the reader and add the user details including User ID, User Name and Group.
- The Password field won't be populated with the security key. Leave the password field blank.
- Press Save.


### 33.2.3 Accessing the MultiSmart with a Security Key

The Security key must already be registered by the Administrator (see Section 33.2.2).

- Try to access a secure page to display the 'Login' screen
- Place the Security Key on the reader and press Submit
- If an unregistered Security key is read, the screen does not change
- If an invalid password is manually entered, an Access Denied message is displayed


NOTE:
It is recommended that the Administrator maintains a record of all Security Key IDs registered. In the event the Security Key reader fails, an ID can be manually entered via the key pad.


NOTE:
The Security Key must make firm contact with the outer ring of the reader before it can read the key.

## 34 Troubleshooting

Common problems and their resolution:

### 34.1 There is no level displayed on my unit

First check the I/O module is reading the input(s) correctly. From the main operator screen, press Info, then I/O Information, then choose a board (typically Top Board), then select the relevant input type as described below.

### 34.1.1 Analog level device

If you are using a $4-20 \mathrm{~mA}$ level device, choose Analog Input. If the input is at 0 mA then one of the following maybe the cause:

- the level device is not properly connected
- the level device is not properly configured
- there is a problem with the MultiSmart I/O card. Problems with I/O cards can often be seen in the system log in Info, System Log.

If the input is reading between $4-20 \mathrm{~mA}$, then the pump control module is not configured to use this level device. From the main operator screen, press Settings, I/O faults \& level, Level devices. The primary level device will probably be showing a different analog input or a MultiTrode probe - i.e. it has not been correctly configured. It's possible to go back through the Setup Wizard at any time to generate a completely new configuration, however it is easier to configure the level device using the Level Devices screen (see Section 14.8).

### 34.1.2 Probe

If you are using a MultiTrode conductive probe, choose Digital Inputs. Check that some of the sensors are covered (the value should be showing as ON). If none of the probe sensors are reading ON, then one of the following is the problem:

- You have not connected the probe
- The probe is not covered with conductive liquid
- There is no ground (earth) return for the probe
- There is a problem with the MultiSmart I/O card. Problems with I/O cards can often be seen in the system log in Info, System Log.
If the DINs are showing an ON status, then the pump control module is not configured correctly. From the main operator screen, press Settings, I/O faults \& level, Level Devices. The primary level device needs to be changed to Probe - or the correct sensors need to be assigned. For example, when the probe is selected as the level device, by default, DIN 2-11 are configured for the 10 sensors. If the probe has been wired differently, either rewire the probe to the default connections or edit the sensor configuration (using the Level Devices screen - see Section 14.8). It is also possible to go back through the Setup Wizard, however this will create a completely new configuration.


### 34.2 Every time the pump starts I see a Contactor Auxiliary fault

The default wiring diagram for the pump station manager usually includes feedback from the contactor to indicate that the pump has started. If you have followed the wiring diagram correctly, then the MultiSmart unit is indicating one of the following

- That the contactor has failed (check contactor)
- The pump output relay is not wired to the contactor (check wiring)
- The output relay has been reconfigured (see Section 14)
- The output relay has a problem (check the System Log in the Info screen)

If you don't have a contactor auxiliary output, see Section 9.3 for how to unassign this fault.

### 34.3 My unit is showing a "Current Config Fail" fault

This fault indicates that a conflict exists with the current configuration due to either which modules have been enabled or some corruption with the configuration.

For example, if you copy a configuration file from a unit with energy monitoring and motor protection enabled, into a unit without energy monitoring and motor protection, you may get a Configuration Fail.
Solution - go through the Setup Wizard to re-create your configuration, or load a configuration file from your USB or SD card which is appropriate for the unit.

### 34.4 My unit has started with the message "Fail Safe Mode"

A conflict has occurred with either one or more of the enabled modules or with the specified bottom board (during the running of the Setup Wizard). The list of enabled and disabled software modules in the MultiSmart can be viewed in Fail Safe Mode. Follow the same steps as outline in the previous section.

### 34.5 PPP2 Manager Connection Error

To find out the cause of the problem enable Debug mode from the Advanced menu. To enable this, navigate to:

and select the type of modem in use, then select Debug
Restart the MultiSmart so that the debug information about the chat script initialisation can be captured.
Remember to turn debugging mode off after the fault finding.

### 34.6 My unit keeps restarting

To stop the restarting - hold down the 2 bottom left buttons and the Backspace button, (similar to "Ctrl, Alt, Delete" for a computer). This puts the unit into failsafe mode. See the highlighted buttons in Figure 168. You should now be able to follow the solution in Section 32.3.


Figure 181 - Forced Failsafe Mode

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## 35 Appendix A - Fault Message Glossary

Listed below are the predefined faults that may appear on the MultiSmart.
The faults shown are based on an empty (or discharge) pump station with 1 pump, 1 well, Motor Protection and Flow enabled

| Fault Name | Description | Default Setting | Default Status | Section Reference |
| :---: | :---: | :---: | :---: | :---: |
| Configuration Faults |  |  |  |  |
| Application Failure | A software module or application has failed | - | On | 14.11 |
| Config changed - reboot required | The current configuration has changed and it will come into effect after a reboot | - | On | - |
| Current config failure | The current configuration has failed | - | On | 32 |
| Fail Safe | The current config has failed or the config upgrade process has failed | - | On | 32 |
| Previous config failure | The previous configuration has failed | - | On | 32 |
| Communication Faults |  |  |  |  |
| Comms Channel Conflict-Modbus Slave disabled | A communication channel clash has occurred between DNP3 \& Modbus | - | On | - |
| Comms Channel Failure | The same communication channel has been selected for both DNP3 \& Modbus | - | On | - |
| IO Unit 1 DSP Comms Fault | Unit 1 can not communicate to all other units connected on the Can Bus | - | On | - |
| IO Unit 1 DSP Failed Init | A failure of the comms between the DSP board and the 3PC board initiated a reboot | - | On | - |
| Modem Connection Failure | Cellular / PumpView communications can not be established | - | On | - |
| DC Supply Faults |  |  |  |  |
| DC Over Voltage | DC supply is greater than the specified maximum | 100V | On | - |
| DC Under Voltage | DC supply is less than the specified minimum | OV | On | - |
| AC Supply Faults (The AC voltage is specified during the Setup Wizard) |  |  |  |  |
| Over Voltage | AC voltage is greater than the specified maximum | 115\% | On | 18 |
| Under Voltage | AC voltage is less than the specified minimum | 90\% | On | 18 |
| Volts Phase Imbalance | Phase-phase voltages differs by more than the specified minimum | 15\% | On | 18 |
| Volts Phase Rotation | The incorrect phase rotation (or phase sequence) is connected | - | On | 18 |
| Battery Faults |  |  |  |  |
| Battery Over Voltage | Battery Voltage is greater than the specified maximum during battery test. | 100V | Off | 18 |
| Battery Under Voltage | Battery Voltage is less than the specified minimum during battery test. | OV | Off | 18 |
| DuoProbe / Probe Faults |  |  |  |  |
| DuoProbe Calibration Warning | Discrepancy between analog and probe readings at each sensor position is greater than the configured CalWarningLimit (default = 5\%), for an entire pump cycle (one pump stop to next pump stop). | 5\% | On | 14.8.6.3 |
| DuoProbe Fat Build-up | Discrepancy between analog and probe readings is greater than the configured FatBuildUpLimit (default 10\%) and is detected consecutively at the same sensor for a configurable number of cycles (3 by default). | 10\% | On | 14.8.6.3 |
| Duo-probe 1 Error | Either the analog signal becomes invalid (out of range or less than atmospheric pressure) or if the discrepancy between analog and probe readings is greater than the configured FatBuildUpLimit (default 10\%) for 2 consecutive sensor positions. | 10\% | On | 14.8.6.3 |
| Duo-probe 1 Low Range Error ${ }^{1}$ | All pumps are held out if the pressure transducer level is above the low range limit and the probe is reading $0 \%$. Level source is switched to probe. | 12\% | On | 14.8.6.3 |

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| Fault Name | Description | Default Setting | Default Status | Section Reference |
| :---: | :---: | :---: | :---: | :---: |
| Probe 1 Failed Sensor n | Where ' n ' is the sensor that has failed to activate. (Not applicable to highest sensor,"1") | - | On | 14.8.4 |
| Probe 1 Fail Safe Error | The Fail Safe loop in the probe has become open circuit (i.e. $>4 \mathrm{k}$ ohms) | - | Off | 7.3.2.2, 14.8 |
| Pump - Standard Faults |  |  |  |  |
| Pump 1 CB Off/Trip ${ }^{2}$ | Circuit Breaker has tripped | - | On | - |
| Pump 1 Contactor Auxiliary | Contactor has failed to close (Active input (1) = no fault) | - | On | 9.3 |
| Pump 1 Critical | A user definable fault (A link or source required) | - | On | - |
| Pump 1 Delay Fail | Fault input timed out after pump started (Active input (1) = no fault) | - | On | 14.9.1 |
| Pump 1 Holdout | A user definable fault (It's a 'Hidden' fault so "Fault" does not flash only "Holdout") | - | Off | 24.3.1.11 |
| Pump 1 Low Power Factor | The Power Factor has fallen below a specified threshold | 0.5 | Off | - |
| Pump 1 Max Starts | Number of pump starts has exceeded the specified maximum within a 1 hour period | 0 | Off | 16 |
| Pump 1 Motor Over Temp | Motor Thermal switch (e.g. PTC Thermistor) has activated (Input inverted) | - | On | - |
| Pump 1 Non Critical | A user definable fault (A link or source required) | - | On | - |
| Pump 1 Not In Auto | Pump not in Auto mode | - | On | - |
| Pump 1 Pulse Start | A pump based Pulse Start has been initiated | - | Off | 16.2.3 |
| Pump 1 Pulse Stop | A pump based Pulse Stop has been initiated | - | Off | 16.2.3 |
| Pump 1 Seal ${ }^{2}$ | Conductive Seal sensor has activated (Sensitivity 40 k Ohms) | - | On | 9.2 .9 |
| Pump 1 Thermal Overload ${ }^{2}$ | In circuit Thermal Overload device has activated | - | On | 9.2.9 |
| Pump - CLS / FLS Faults |  |  |  |  |
| Pump 1 CLS (assigned input description) (2 faults, 1 digital input) (Threshold resistance values are fixed) |  |  |  |  |
| Displayed as Pump 1 CLS Flygt Thermal | CLS (Capacitive Leakage Sensor) Thermal fault (motor over temperature) | >4k $\square$ | Off | 7.3.2.1 |
| Displayed as Pump 1 CLS Flygt Seal | CLS (Capacitive Leakage Sensor) Seal fault (water in oil chamber) | <1k $\square$ | Off | 7.3.2.1 |
| Pump 1 FLS (assigned input description) (2 faults, 1 digital input) (Threshold resistance values are fixed) |  |  |  |  |
| Displayed as Pump 1 FLS Flygt Thermal ${ }^{3}$ | FLS (Flygt Leakage Sensor) Thermal fault (motor over temperature) | >4k $\square$ | On | 7.3.2.1 |
| Displayed as Pump 1 FLS Flygt Seal ${ }^{3}$ | FLS (Flygt Leakage Sensor) Seal fault (liquid in the stator housing ) | $<545 \square$ | On | 7.3.2.1 |
| Pump - Flow Faults (Default nominal flow rate of 100.0) |  |  |  |  |
| Pump 1 High Flow Fault | Flow rate is greater than the specified maximum | 150\% | Off | 20.5 |
| Pump 1 High Flow Warning | Flow rate is greater than the specified maximum | 150\% | Off | 20.5 |
| Pump 1 Low Flow Fault | Flow rate is less than the specified minimum | 150\% | Off | 20.5 |
| Pump 1 Low Flow Warning | Flow rate is less than the specified minimum | 150\% | Off | 20.5 |
| Pump 1 Low Efficiency | Pump efficiency has fallen below a nominal value by a specified amount | 85\% | Off | 10.5 |
| Pump - Motor Protection Faults (Default FLC = 5.0 A) |  |  |  |  |
| Pump 1 Amps Phase Imbalance | Phase-phase current differs by more than the specified maximum | 20\% | Off | 10.5 |
| Pump 1 Amps Phase Rotation | The incorrect phase rotation (or phase sequence) is connected | - | Off | 10.5 |
| Pump 1 Ground (Earth) Fault | The sum of the phase currents is greater than the specified maximum | 25\% FLC | Off | 10.5 |
| Pump 1 Inhibited ${ }^{5}$ | Activated via SCADA - Pump 1 become unavailable ('Inhibit' flashes on display) | - | On | - |
| Pump 1 Insulation Resistance | The insulation resistance measured is less than the specified maximum | $1.0 \mathrm{M} \square$ | Off | 17.2 |
| Pump 1 Insulation Res Warning | The insulation resistance measured is greater than the specified warning level | 5M $\square$ | Off | 17.2 |
| Pump 1 Over Current | The motor current is greater than the specified maximum | 110\% FLC | Off | 10.5 |
| Pump 1 Over Current I ${ }^{\text {T }}$ T | The $I^{2} \mathrm{~T}$ motor current is greater than the specified maximum | $3000 \mathrm{~A}^{2} \mathrm{~s}$ | Off | 10.5 |
| Pump 1 Under Current | The motor current is less than the specified minimum | 1\% FLC | Off | 10.5 |
| VFD - Variable Frequency Drive (Only applies if the ABB VFD Macro is selected) |  |  |  |  |

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| Fault Name | Description | Default Setting | Default Status | Section Reference |
| :---: | :---: | :---: | :---: | :---: |
| Pump 1 VFD Comms Fail | The MultiSmart is unable to communicate to the VFD | - | On | 23.4 |
| Pump 1 VFD Fault | The VFD has returned a fault | - | On | 23.4 |
| Pump 1 VFD Warning | The VFD has returned a warning | - | On | 23.4 |
| Groups |  |  |  |  |
| Group 1 Blocked Pump Detection | Number of Standby pump starts equals the specified maximum | 3 | Off | 16 |
| Group 1 Pulse Start | A group based Pulse Start has been initiated | - | Off | 16.2.3 |
| Group 1 Pulse Stop | A group based Pulse Stop has been initiated | - | Off | 16.2.3 |
| Well Faults |  |  |  |  |
| High Inflow | If level rises > a specified amount within a preset time, lead pump is pulse started | 10\%, 2min | Off | 16 |
| Overflow | The level is greater than the specified Overflow level (Flow module must be enabled) | 100\% | Off | 20.1 |
| Well 1 Analog Compare Fault | The difference in the level between the primary and the backup level devices is greater than the specified threshold. | 5\% | Off | 14.8.11 |
| Well 1 Level Locked | The level has changed by less than the specified amount in the specified time. (The timed period can be a fixed amount of time or a period of the day, e.g. 14:30 to 17:00). Up to four timed periods can be specified. | 5\%, 30min | Off | 14.8.12 |
| Well 1 High High Level | Level has reached the High High level | 96.0-98.0 | Off | 12.3.4 |
| Well 1 High Level | Level has reached the High level | 87.0-92.0 | On | 12.3 .40 |
| Well 1 Low Low Level | Level has reached the Low Low level | 4.0-6.0 | Off | 12.3 .4 |
| Well 1 Low Level | Level has reached the Low level | 10.0-15.0 | Off | 12.3.4 |
| Well 1 Backup Level Ain Over Range | The current of backup level device is greater than specified maximum | 20 mA | On | - |
| Well 1 Backup Level Ain Under Range | The current of backup level device is less than the specified minimum | 4 mA | On | - |
| Well 1 Backup Level Invalid | Communications to the backup remote level has failed | - | On | - |
| Well 1 Primary Level Ain Over Range | Primary level device current is greater than the specified maximum | 20 mA | On | 14.6 |
| Well 1 Primary Level Ain Under Range | Primary level device current is less than the specified minimum | 4 mA | On | 14.6 |
| Well 1 Primary Level High Range | Primary Level < HRP and Backup level > HRB <br> HRP = High Range Primary level, HRB = High Range Backup level | $\begin{gathered} \hline 80 \%, 95 \% \\ 5 \mathrm{~s} \\ \hline \end{gathered}$ | On | 14.8.9.1 |
| Well 1 Primary Level Invalid | Communications to the primary remote level has failed | - | On |  |
| Well 1 Primary Level Low Range | Primary Level > LRP and Backup level < LRB <br> LRP = Low Range Primary level, LRB = Low Range Backup level | $\begin{gathered} 15 \%, 5 \% \\ 5 \mathrm{~s} \\ \hline \end{gathered}$ | On | 14.8.9.2 |
| Well 1 Pulse Start | A well based Pulse Start has been initiated | - | Off | 16.2.3 |
| Well 1 Pulse Stop | A well based Pulse Stop has been initiated | - | Off | 16.2.3 |
| Station Faults |  |  |  |  |
| Max Off Time ${ }^{4}$ | Off time of any pump is greater than the specified maximum | 6h | Off | 16 |
| Max Run Time ${ }^{4}$ | The run time of any pump is greater than the specified maximum | 30min | Off | 16 |
| Power Failure | A user definable fault (A link or source required) | - | On | - |
| Station Inhibited ${ }^{5}$ | Activated via SCADA - all pumps in station become unavailable ('Inhibit' flashes) | - | On | - |
| Station Pulse Start | A station based Pulse Start has been initiated | - | Off | 16.2.3 |
| Station Pulse Stop | A station based Pulse Stop has been initiated | - | Off | 16.2.3 |
| Station Low Flow Fault | Station Flow rate is lower than the expected flow rate by an amount of preconfigured percentage of the expected flow | 100\% | Off | 20.5 |
| Station Low Flow Warning | Station Flow rate is lower than the expected flow rate by an amount of preconfigured | 120\% | Off | 20.5 |

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| Fault Name | Description | Default Setting | Default Status | Section Reference |
| :---: | :---: | :---: | :---: | :---: |
|  | percentage of the expected flow, to give a warning to the operator |  |  |  |
| IO Unit - Analog Inputs |  |  |  |  |
| 10 Unit 1 Ain 1 Over Range | Analog input current is greater than the specified maximum | 20 mA | On | - |
| IO Unit 1 Ain 1 Under Range | Analog input current is less than the specified minimum | 4 mA | On | - |
| 1 O Unit 1 Ain 2 Over Range | Analog input current is greater than the specified maximum | 20 mA | On | - |
| IO Unit 1 Ain 2 Under Range | Analog input current is less than the specified minimum | 4 mA | On | - |
| Generator faults (No default Sources are linked to these faults) |  |  |  |  |
| Generator Running | Generator supply is currently being used | - | Off | 5.4.3.4 |
| Generator Fault | Generator is faulty | - | Off | 5.4.3.4 |
| Rain Gauge Fault | A predefined fault for a rain gauge | - | Off | - |

## NOTES:

1. The Low Range Limit is found under: Advanced / IOModule / Unit / Unit 01 / Probe / Probe01 / Duo Probe / Low Range Limit.
2. These are the default inputs only when Thermal/Seal inputs are selected as part of the Setup Wizard.
3. These are the default inputs only when Flygt FLS inputs are selected as part of the Setup Wizard.
4. These faults are specific to each profile.
5. The Inhibit faults (Station \& Pump) can be overridden by a digital input (if configured) (e.g. Station Inhibit Override or Pump x Inhibit))

## 36 Appendix B - Display Mounting Template - Metric Units



## 37 Appendix C - Display Mounting Template - US / Imperial Units



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## 38 Appendix D - MultiSmart Security Explained

All security details are stored on a MultiSmart in/var/config/security/security.xml. User details can be managed via the LCD. However, it is also possible to reconfigure user groups and access levels for each group. These advanced changes require direct editing of this configuration file.
Different users within the MultiSmart can be given different levels of security. Users with the same access permissions are grouped into user groups. A user has his/her group details defined as part of the attributes.
Each user has the following configuration attributes:

| Name | Description |
| :--- | :--- |
| Userld | The unique id of the user. |
| UserName | Name of the user. |
| UserGroup | The group to which this user belongs. Each user group has a name and its own <br> access permissions for different screens. |
| Pin | PIN number to be entered to login. |

Each group has the following attributes:

| Name | Description |
| :--- | :--- |
| Name | Name of the user group. |
| Mask | Mask of screens for which this user group has access. |

Each screen in the MultiSmart can be assigned a unique level of security. This is achieved by assigning a unique mask to each screen requiring restricted access.
A screen which requires restricted access has the following attributes

| Name | Description |
| :--- | :--- |
| Name | Screen Name |
| Operation | Operation defines the specific operation for the screen for which access is restricted. <br> Operation can be either READ or WRITE. If operation is READ, then unauthorized <br> users are not able to access the screen, where as if is WRITE, then all users can <br> access the screen, but only authorized users can make any changes to the values on <br> the screen. |
| Mask | Unique mask controlling restricted access. |

There is no user present by default, which means security is disabled by default. Users are classified into four user groups - Operator, Electrician, Scada Engineer and Administrator. Each user group has different access levels.

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The screens for which access is restricted are listed below, together with the operation type and the user classes which are allowed to access these screens:

| Screen Name | Operation | User Classes with access |
| :---: | :---: | :---: |
| Main Screen | Write | Operator, Electrician, Administrator |
| Date/Time | Read | Electrician, Administrator |
| Customize Display | Read | Electrician, Administrator |
| Alternation \& Grouping | Read | Electrician, Administrator |
| Backup Options | Read | Electrician, Administrator |
| Station Optimization | Read | Electrician, Administrator |
| Set Points | Read | Electrician, Administrator |
| Configure Profile | Read | Electrician, Administrator |
| Motor Protection \& Efficiency | Read | Electrician, Administrator |
| Supply Protection | Read | Electrician, Administrator |
| Data Logger | Read | Electrician, Administrator |
| IO Configuration | Read | Electrician, Administrator |
| Flow Settings | Read | Electrician, Administrator |
| Logic Engine | Read | Electrician, Administrator |
| Faults Screen | Write | Electrician, Administrator |
| Pump Commision | Write | Electrician, Administrator |
| Communications | Read | Scada Engineer, Administrator |
| Modify Modules Key | Read | Administrator |
| Setup Wizard | Read | Administrator |
| Advanced Settings | Read | Administrator |
| All Information Screens | Write | Administrator |

## 39 Appendix D - MultiSmart Web Security Explained

Similar to the security for accessing MultiSmart menus, different users of the MultiSmart web pages can be given different levels of security for accessing the pages. Users with same access permissions are grouped into user groups. A user has his/her group details defined as part of the attributes.
All web page security details are stored on a MultiSmart in /var/www/htdocs/security.xmI. User details can be managed via the Security web page. However, it is also possible to reconfigure user groups and access levels for each group. These advanced changes require direct editing of this configuration file.
Each user has the following configuration attributes:

| Name | Description |
| :--- | :--- |
| Userld | The unique id of the user. |
| UserName | Name of the user. |
| UserGroup | The group to which this user belongs. Each user group has a name and its own <br> access permissions for different screens. |
| Password | Password to be entered to login. |

Each group has the following attributes:

| Name | Description |
| :--- | :--- |
| Name | Name of the user group. |
| Mask | Mask of screens for which this user group has access. |

Each web page can be assigned a unique level of security. This is achieved by assigning a unique mask to each page requiring restricted access.
Screens which require restricted access will have the following attributes

| Name | Description |
| :--- | :--- |
| Name | Screen Name |
| Operation | Operation defines the specific operation for the screen for which access is restricted. <br> Operation can be either READ or WRITE. If operation is READ, then unauthorized <br> users are not able to access the screen, where as if it is WRITE, then all users can <br> access the screen, but only authorized users can make any changes to the values on <br> the screen. |
| Mask | Unique mask controlling the restricted access. |

There aren't any users defined by default, which means that web page security is disabled by default. Users are classified into four user groups - Operator, Electrician, Scada Engineer and Administrator. Each user group has different access levels.

The web pages for which access is restricted are listed below, together with the operation type and the user classes which are allowed to access these screens:

| Screen Name | Operation | User Classes with access |
| :---: | :---: | :---: |
| Mainscreen | Write | Operator, Electrician, Administrator |
| Version Information | Write | Electrician, Administrator |
| Power Information | Write | Electrician, Administrator |
| Pump Information | Write | Electrician, Administrator |
| 10 Information | Write | Electrician, Administrator |
| Probe Information | Write | Electrician, Administrator |
| Flow Information | Write | Electrician, Administrator |
| Comms Information | Write | Electrician, Administrator |
| Isagraf Information | Write | Electrician, Administrator |
| History Page | Write | Electrician, Administrator |
| Faults View | Write | Electrician, Administrator |
| Setpoints | Write | Electrician, Administrator |
| Dnp Slave Settings | Write | Scada Engineer, Administrator |
| PPP Configuration | Write | Scada Engineer, Administrator |
| TCP/IP Configuration | Write | Scada Engineer, Administrator |
| PSTN Configuration | Write | Scada Engineer, Administrator |
| Rs485 Configuration | Write | Scada Engineer, Administrator |
| Serial Configuration | Write | Scada Engineer, Administrator |

## 40 Appendix E - Setting Up WITS-DNP Communications

Water Infrastructure Telemetry System - Distributed Network Protocol (WITS-DNP) is a system being widely adopted by the UK water industry. The intention of this section is not to describe this system in detail, but rather to describe how to set up a MultiSmart device for a WITS-DNP environment. Reference should be made to the WITS Application Notes for a full description of the features and benefits of WITSDNP.

### 40.1 Basic Configuration

There is one main parameter which controls whether or not DNP3 communications will use WITS. Under DnpSlave.Slave._1 is a parameter called Enable WITS? This parameter should be set to true.
WITS requires information to be saved within log files. Because of this, the format of log files changes when WITS is enabled. When a device first restarts after having WITS enabled, existing log files will be deleted. It is highly recommended that these log files be backed up first if they contain valuable information.
Another important parameter is the WITS Version under DnpSlave.Slave._1. MultiSmart currently supports up to incremental version 3. (Incremental version 3 equates with WITS 1.2. MultiSmart actually supports WITS 2.0, but no changes to incremental configurations were made from WITS 1.2 to WITS 2.0, and WITS 1.2 continues to describe the latest version for incremental configurations.)
When the WITS Version is set to Default, then the latest version is used. If a master station only supports earlier versions of WITS, then there will be interoperability issues when incremental configurations are returned to the master. In order to avoid these problems, the WITS Version should be configured to be at the same level as the master. At the time of writing, WITS 1.1 is commonly supported by most master stations with WITS functionality. To configure the MultiSmart for WITS 1.1, set the WITS Version parameter to Version 2.

### 40.2 Connection Details

WITS Connection Details define a number of channels which can be used for communications. The MultiSmart allows for up to ten details to be defined in this manner. However, only two physical ports are supported. Additional records must define alternate uses of these ports.

For example, the first record may identify a GPRS connection, using a TCP/IP channel. The second record may identify a PSTN connection. Any additional records must then define alternate IP addresses or phone numbers using these two channels.
When a device starts up with WITS enabled, these connection details are examined, and the Comms Channel and Redundant Comms Channel parameters under DnpSlave.Slave._1.Session are modified. As well, the details in these records are copied to the relevant channels under the Telemetry node. If any changes are detected during this process, then the device will be forced to restart in order for the changes to take effect.

The Port Number field in a Connection Detail record identifies which channel should be used. Port numbers have the following mappings:

| Port Number | Channel |
| :--- | :--- |
| $\mathbf{0}$ | Not Used |
| $\mathbf{1}$ | Serial 1 |
| $\mathbf{2}$ | Serial 2 |
| $\mathbf{3}$ | RS485A |
| $\mathbf{4}$ | RS485B |
| $\mathbf{5}$ | TCP/IP 1 |
| $\mathbf{6}$ | TCP/IP 2 |
| $\mathbf{7}$ | TCP/IP 3 |
| $\mathbf{8}$ | PSTN |

In order to establish communications to a MultiSmart with WITS enabled, at least one connection detail should be defined in this way.
Connection Details can optionally be handled outside of standard code. Under DnpSlave.Slave._1.Session is a parameter called Handle WITS Connection Detail Records, which is set to true by default. If this parameter is set to false, then no handling of connection details is performed by the standard software. The MultiSmart will continue to interpret any incremental downloads of connection detail records by updating the details in the Connection Detail configuration, but will take no further action. This allows these records to be handled in a different manner (i.e. via an ISaGRAF program), and for port numbers to have alternate meanings. It is then entirely the responsibility of the ISaGRAF program to respond to any changes to connection detail records.

### 40.3 Handling of Redundant Channels with Connection Details

The port number of the first Connection Detail record will identify the primary communications channel, and is saved to the Comms Channel parameter under DnpSlave.Slave._1.Session. If the channel is a TCP/IP channel, then the IP address, port number, and mode (UDP or TCP) are also updated for the relevant channel under the Telemetry node. If the channel is a PSTN channel, then the phone number is updated.
Any additional records which refer to the same port number must be limited to identifying alternate IP addresses or phone numbers. For example, if the second record refers to the same TCP/IP channel as the first record, then the IP address of the second record is updated as the second address under the Telemetry node. The port number and mode would be ignored for this second record, since there is no mechanism for defining alternate port numbers or modes for the same channel.

If there are any other Connection Detail records which define a different port number, then that record identifies the redundant communications channel, and is saved to the Redundant Comms Channel parameter under DnpSlave.Slave._1.Session.
When a Comms Fail alarm is triggered for the current channel, then the details defined by the next Connection Detail record are used in an attempt to re-establish communications. This may involve the use of an alternate IP address / phone number, or may make use of the redundant communications channel. This automatic switching can be turned off via the Switch Channel on Comms Fail parameter under DnpSlave.Slave._1.Session.

### 40.4 Device On/Off Scan

WITS incremental record type 0 defines whether a device is on or off scan. This controls the following MultiSmart configuration parameter under the DnpSlave.Slave._1.Session node:

Device On Scan?

### 40.5 Scheduled Connection

WITS incremental record type 2 defines configuration for scheduled connections. This controls configuration parameters under the following configuration node:
DnpSlave.Slave._1.WitsSchedConnect

### 40.6 Point On/Off Scan

WITS incremental record type 1,000 defines whether each point is on or off scan. This can be configured for the following point types:

- Binary inputs
- Binary outputs
- Counters
- Analogue inputs
- Analogue outputs

For each point, this controls the following configuration parameter:
Point On Scan?

### 40.7 Analogue Range/Scaling

WITS incremental record type 1,002 defines the range and scaling for analogue points. This can be configured for the following point types:

- Analogue inputs
- Analogue outputs

There are a number of different tag types which can be assigned to analogue inputs / outputs. Of these, only two tag types permit scaling:

- Analogue tags
- Analogue control tags

For these tag types, the scaling factors are saved to the following attributes of the tag:

- Raw Min
- Raw Max
- Scaled Min
- Scaled Max

For all other tag types, these attributes don't actually exist, and only a scale of $1: 1$ is supported.
The Range Minimum and Range Maximum fields are saved to the following attributes of the tag:

- minValue
- maxValue

The Units field is saved to a Units tag for each analogue input and output. Nothing is done with these units, except to save them so that they can be returned to the master when an incremental upload is requested.

### 40.8 Analogue Limits

WITS incremental record type 1,003 defines limits for analogue input and analogue output points.
Analogue Limits are implemented by the Analogue Watcher application in the MultiSmart. This application is responsible for determining when limits are transgressed. The configuration for these records is stored under AnalogWatcher.Analog Limits.

For most parameters, the Analogue Watcher configuration maps directly from the incremental configuration. There is one field for each point limit which deserves more attention. A Description field exists for each point limit, which is not identified by the incremental record. This description is an optional field, and is used when writing limit alarms to log files.

When the WITS action of a point limit is identified as 1 (log only), an analogue limit trigger will write an entry into the event logger's log file. This log file can then be viewed via the History page on the MultiSmart LCD. When the Description field for a point limit is unpopulated, the entry in the History page
will simply refer to the Analogue Limit index, and its meaning will not be very obvious. This limitation can be overcome by populating the Description field with a meaningful description for each point limit.

### 40.9 Counter Limits

WITS incremental record type 1,004 defines limits for counter points. These records are handled via the Analogue Water application in exactly the same way as for Analogue Limits.

### 40.10 Point Archives

WITS incremental record type 1,005 defines records for periodic logs of counters, analogue inputs, and analogue outputs. This functionality is managed by the Snapshot application and is saved under the Snapshot.Interval Tags node.

Log information is saved to the file defined by the Snapshot.Log File tag, which is set to /var/log/snapshot.log by default. The information in this log file can be viewed on the History page of the LCD by setting the Log Type in the Filters screen to Interval Logs.

Each Interval Tag entry has a Description field. This field is used in exactly the same manner as for Analogue Limits.

### 40.11 Binary States

WITS incremental record type 1,006 defines change of state actions for binary inputs. Binary States are managed by the Analogue Watcher application. The configuration for these records is stored under the AnalogWatcher.Binary States node.

### 40.12 Profiles

WITS incremental record type 1,007 defines WITS profiles. These should not be confused with traditional MultiSmart profiles. Because of this potential confusion, they are always referred to as WITS Profiles within the configuration.
WITS Profiles are implemented by the Analogue Watcher application. The configuration for these records is stored under the AnalogWatcher.WITS Profile node.

### 40.13 Rate of Change

WITS incremental record type 1,008 defines rates of change. This functionality is managed by the Analogue Watcher application. The configuration for these records is stored under AnalogWatcher.Rates Of Change.

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### 40.14 Object Flag Actions

WITS incremental record type 1,009 defines DNP3 object flag actions. This functionality is managed by the DNP Slave application. Each DNP point has a WITS Flag Actions tag, which defines what actions to take when flags change state.

The use of the WITS Flag Actions tag is not obvious. Although there are eight different actions defined by this incremental record, all actions are stored within a single tag for each point. The value of the tag has the following interpretation:

| Bits | Description |
| :---: | :--- |
| $\mathbf{0 - 1}$ | Action to be taken on the ONLINE flag changing |
| $\mathbf{2 - 3}$ | Action to be taken on the RESTART flag changing |
| $\mathbf{4 - 5}$ | Action to be taken on the COMM_LOST flag changing |
| $\mathbf{6 - 7}$ | Action to be taken on the REMOTE_FORCED flag changing |
| $\mathbf{8 - 9}$ | Action to be taken on the LOCAL_FORCED flag changing |
| $\mathbf{1 0 - 1 1}$ | Action to be taken on the CHATTER_FILTER or OVER_RANGE flag changing |
| $\mathbf{1 2 - 1 3}$ | Action to be taken on the DISCONTINUITY or REFERENCE_ERR flag changing |
| $\mathbf{1 4 - 1 5}$ | Reserved for future use |

In this manner, the flag action for each flag can be defined to be between 0 and 3 . By default, the flag action for every point is defined as 16,383 , which has the binary representation of:

## 0b0011111111111111

This value has bits $0-13$ all set to 1 , and bits $14-15$ set to 0 . The interpretation of this is that a flag action of 3 is defined for every flag in the list.

### 40.15 Minimum, Maximum, and Mean

WITS incremental record types $1,010,1,011$, and 1,012 define logging for minimum, maximum, and mean values of periodic logs. This is all implemented as part of the same functionality as Point Archives.

When a Point Archive is defined, the minimum, maximum, and mean values are automatically calculated and included in the log file. However, there is another flag entry within the log file which defines what should be returned when a WITS log file read is performed. For example, this flag entry may define that the point archive and the maximum should be returned. So even though the minimum and mean would also have been recorded, these would not be returned in the log file read.
The minimum, maximum, and mean values are stored under the Minimum, Maximum, and Average tags under each Interval Tag node. If any of these values are assigned to a virtual analogue input, then the analogue input will have its alias tag point to the relevant Interval Tag value.

### 40.16 Integral Values

WITS incremental record type 1,013 defines Integral calculations. Integral values are implemented by the Analogue Watcher application. The configuration for these records is stored under
AnalogWatcher.Integral Values.

### 40.17 State Counter

WITS incremental record type 1,014 defines State Counter calculations. State Counters are implemented by the Analogue Watcher application. The configuration for these records is stored under AnalogWatcher.State Counter.

When a State Counter is created by an incremental configuration, the Source Tag of the State Counter record points to either a Binary State or an Analogue Limit record. When the point type of the State Counter is defined to be a binary input or binary output, the list of binary states is searched in an attempt to find a Binary State which references this binary input or binary output. If a Binary State is found, then the Value tag for the Binary State is assigned as the source tag for the State Counter.

When the point type of the State Counter is defined to be an analogue input, analogue output, or counter, the list of Analogue Limits is searched in an attempt to find a record which references this analogue input/output or counter. If an Analogue Limit is found, then the ActiveLimitsMask tag for the Analogue limit is assigned as the source tag for the State Counter.

### 40.18 State Runtime

WITS incremental record type 1,015 defines State Runtime calculations. State Runtimes are implemented by the Analogue Watcher application. The configuration for these records is stored under AnalogWatcher.State Runtime.
The definition of source tags for State Runtime records follows exactly the same logic as for State Counters.

### 40.19 Profile Control Value

WITS incremental record type 1,016 defines Profile Control Values. As for WITS Profiles, these should not be confused with traditional MultiSmart profiles.
Profile Control Values are implemented by the Analogue Watcher application. The configuration for these records is stored under AnalogWatcher.Profile Control Value.

### 40.20 Bulk Configurations and Versions

There are a number of ways of retrieving a bulk configuration from a MultiSmart:

- By requesting WITSCFGlbulk.dat via the DNP channel.
- By backing up a bulk configuration to a USB via the LCD.
- By retrieving a configuration into MultiSmart Configurator and then exporting the configuration from Configurator as a bulk configuration.

Similarly, bulk configurations can be activated in the following ways:

- By sending and activating WITSCFGlbulk.dat via the DNP channel.
- By activating a bulk configuration stored on a USB via the LCD.
- By importing a bulk configuration into MultiSmart Configurator and then sending the configuration to the MultiSmart via Configurator.

When activating a bulk configuration via the DNP channel, the version of the bulk configuration can also be managed. The version is determined from the file name, which then takes the following form:

## WITSCFG\bulk_<version>.dat

For example, the following file name would set the version to $X 23$.

```
WITSCFG\bulk_X23.dat
```

The version number is saved under DnpSlave.Slave._1.Session.BulkCfgFile. This tag isn't actually a configuration tag, since it would be simply overwritten by the configuration if it was. Instead, the value of this version is remembered by the Snapshot application (stored under the list of Init tags).

It is possible to manage the version of the bulk configuration file using Configurator. This is a valuable mechanism when it is desired to set the version to some base number within this environment as part of the commissioning process. In order to define this version number, the ftp.properties file needs to be edited.

Each configuration within Configurator has an ftp.properties file, which is not actually part of the configuration, but defines various attributes used when communicating to the device (including the IP address and an optional password). The bulk configuration version can be managed by adding the following line to this file:

```
version=<version>
```

For example, if the base version of the bulk configuration is defined to be $M$, then the following line should be added to this file:

```
version=M
```


### 40.21 Event Logs

In conventional use, the Event Logger application is configured with a number of Event Log entries. For every analogue value, a log entry is saved when the value changes by more than its deadband. For every digital value, a log entry is saved whenever the value changes state.
When WITS is enabled, Event Logger operates in a different manner. Instead of sourcing log definitions in the Event Log records, event log entries are generated by Analogue Limits and Binary States. Event Logger watches all of these records, and whenever a change occurs with a WITS action of 1 (log only), an entry is added to the event log.
Despite having this new purpose, Event Logger continues to monitor any of its Event Log records, and actually operates in a dual mode. For this reason, it is generally recommended to delete all Event Log records from the Event Logger configuration when WITS is enabled. Otherwise, there is the possibility for duplicate log entries to be generated, or else WITS log entries to be generated which are not expected.

An exception to this rule is when there are tags not included in the DNP points list, which are desired to be logged. An example of this is the LCD. HistoryComment tag. If these tags do not exist in the DNP points lists, then they will be ignored whenever WITS log reads are performed. These entries will only be accessible via the History page on the LCD, or when native log files are retrieved from the MultiSmart.

There are three ways of retrieving native log files:

1. Save to a USB via the LCD.
2. Via the Retrieve Log Files option in Configurator.
3. By uploading logs.tgz via the DNP channel.

## 41 Technical Specifications

### 41.1 Processor Unit

Type
Speed
Flash Memory
RAM
Real-time Clock
Serial Ports
Ethernet Ports
USB Port
SD Port

Renesas SH-7724
566 MHz
64MByte
256MByte
Yes
RS232 x 2 (115kbit/s)
RS485 x 2 (115kbit/s)
$2 \times 10 \mathrm{Mbit} / \mathrm{s}$
Yes
Yes

### 41.2 RTU/Communications

Protocols Media

Datalogging

DNP3 level 2, Modbus
TCP, RS232, RS485
Change of state for digital, deadbanding for analog.
Date, time and quality stamped
50,000 events stored (more with SD card option)

### 41.3 Firmware/Application Upgrade Capability

## Local

### 41.4 I/O Standard Modules

Digital Inputs (DIN) 20

Digital Outputs (DOUT) 7
Analog Inputs (AIN) 2
Analog Outputs (AOUT) 1
Voltage Inputs (VIN)

Current Inputs (IIN)
Insulation Resistance Testing (IRT)
Digital Outputs (DOUT)
Analog Outputs (AOUT)

Via serial or Ethernet from PC Via SD or USB

### 41.5 I/O-3MP: Motor Protection I/O Board

9
$1000 \mathrm{~V} \times 3$
5
3

### 41.6 Power (per unit)

Start Up 30W

Continuous 15W

### 41.7 Power Supply \& Environmental

DC Supply (monitored to 5\% accuracy)
Ambient Temperature Storage Temperature Humidity IP Rating
$11-25 \mathrm{~V}$
$-10^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$
$-40^{\circ} \mathrm{C}$ to $+90^{\circ} \mathrm{C}$
$5 \%$ to $95 \%$ (non-condensing)

| Controller: | IP20 | (Nema 1 equivalent) |
| :--- | :--- | :--- |
| Display (Faceplate): | IP65 | (Nema 4 equivalent) |

### 41.8 Product Dimensions

Controller
Display (Faceplate)

$$
\begin{array}{ll}
\text { H } 173 \times \text { W } 217 \times \text { D } 159(\mathrm{~mm}) & \text { H }^{3 / 4} \times \text { W } 8^{1 / 2} \times \text { D }^{1 / 4} \text { (in) } \\
\text { H } 144 \times \text { W } 250 \times \text { D } 42(\mathrm{~mm}) & \text { H }^{5 / 8} \times \text { W } 9^{7 / 8} \times \text { D }^{5 / 8}(\mathrm{in})
\end{array}
$$

## 42 MultiTrode Terms \& Conditions of Sale

A full copy of the MultiTrode Standard Terms and Conditions of Sale is available for download from the website: www.multitrode.com in the training and support section.

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Visit www.multitrode.com for the latest information

MultiSmart Installation \& Operation Manual

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$\qquad$

## TECHNICAL DATA SHEET

Equipment Type: Batteries
Location:Battery Compartment
Model Numbers: ..... NP 712
Manufacturer: ..... Yuasa
Supplier:
Battery Specialties6/10 Argon StSumner Park(07) 32794375

## NP SERIES - NP7-12

## Reliability is your Security

## Utilizing the latest advance design Oxygen

 Recombination Technology, Yuasa have applied their 80 years of experience in the lead acid battery field to produce the optimum design of Sealed Lead Acid batteries.
## FEATURES

- Superb recovery from deep discharge.
- Electrolyte suspension system.
- Gas Recombination.
- Multipurpose: Float or Cyclic use.
- Usable in any orientation
- Superior energy density.
- Lead calcium grids for extended life.
- Manufactured World wide.
- Application specific designs.


## Technical Features

## Sealed Construction

Yuasa's unique construction and sealing technique ensures no electrolyte leakage from case or terminals.

## Electrolyte Suspension System

All NP batteries utilize Yuasa's unique electrolyte suspension system incorporating a microfine glass mat to retain the maximum amount of electrolyte in the cells. The electrolyte is retained in the separator material and there is no free electrolyte to escape from the cells. No gels or other contaminants are added.

## Control of Gas Generation

The design of Yuasa's NP batteries incorporates the very latest oxygen recombination technology to effectively control the generation of gas during normal use.

## Low Maintenance Operation

Due to the perfectly sealed construction and the recombination of gasses within the cell, the battery is almost maintenance free.

## Terminals



## Terminals

NP batteries are manufactured using a range of terminals which vary in size and type. Please refer to details as shown.

## Operation in any Orientation

The combination of sealed construction and Yuasa's unique electrolyte suspension system allows operation in any orientation, with no loss of performance or fear of electrolyte leakage.

## Valve Regulated Design

The batteries are equipped with a simple, safe low pressure venting system which releases excess gas and automatically reseals should there be a build up of gas within the battery due to severe overcharge. Note. On no account should the battery be charged in a sealed container.

General Specifications

## Layout



| Nominal Capacity (Ah) | NP7-12 |
| :--- | :--- |
| 20 hr to $1.75 \mathrm{vpc} 30^{\circ} \mathrm{C}$ | 7 |
| 1 Ohr to $1.75 \mathrm{vpc} 20^{\circ} \mathrm{C}$ | 6.4 |
| 5 hr to $1.70 \mathrm{vpc} 20^{\circ} \mathrm{C}$ | 5.9 |
| 1 hr to $1.60 \mathrm{vpc} 20^{\circ} \mathrm{C}$ | 4.2 |
| Voltage | 12 |
| Energy Density (Wh.L.20hr) | 91 |
| Specific Energy (Wh.kg.20hr) | 32 |
| Int. Resistance (m.Ohms) | 25 |
| Maximum discharge (A) | $40 / 75$ |
| Short Circuit current (A) | 210 |
| Dimensions (mm) |  |
| Length | 151 |
| Width | 65 |
| Height overall | 97.5 |
| Weight (Kg) | 2.65 |
| Terminal | $\mathrm{A} / \mathrm{D}$ |
| Layout | 4 |
| Terminal Torque Nm | - |

## NP SERIES - NP7-12

## Lead Calcium Grids

The heavy duty lead calcium alloy grids provide an extra margin of performance and life in both cyclic and float applications and give unparalleled recovery from deep discharge.

## Long Cycle Service Life

Depending upon the average depth of discharge, over a thousand discharge/charge cycles can be expected.

## Float Service Life

The expected service life is five years in float standby applications.

## Separators

The use of the special separator material provides a very efficient insulation between plates preventing inter-plate short circuits and prohibiting the shedding of active materials.


NP DISCHARGE CHARACTERISTICS
CURVES AT $25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$ CURVES AT $25^{\circ} \mathrm{C}\left(77^{\circ} \mathrm{F}\right)$


FLOAT SERVICE LIFE NP RANGE


## Long shelf Life

The extremely low self discharge rate allows the battery to be stored for extended periods up to one year at normal ambient temperatures with no permanent loss of capacity.

## Operating Temperature Range

The batteries can be used over a broad temperature range permitting considerable flexibility in system design and location.
Charge $\quad-15^{\circ} \mathrm{C}$ to $50^{\circ} \mathrm{C}$
Discharge $-20^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}$
Storage $\quad-20^{\circ} \mathrm{C}$ to $50^{\circ} \mathrm{C}$ (fully charged battery)


FLOAT CHARGE CHARACTERISTICS


## TYPICAL DISCHARGE CHARACTERISTICS NP RANGE

CYCLE SERVICE LIFE IN RELATION TO DEPTH OF DISCHARGE



# TECHNICAL DATA SHEET 

## Equipment Type:

## Location:

## Model Numbers:

Lumifa LF1B-N Series

Manufacturer:
IDEC

## Supplier:

IPD Australia Pty Ltd

$$
\text { Unit } 17
$$

104 Ferntree Gully Road
Oakleigh, Victoria 3166,
Ph: 0385235900
Fax: 0385235999
Web: www.idec.com

## LF1B series

LED Illumination Units $\mathbb{L} \mathbb{M} \mathbb{M} \mathbb{F}$


| Illumination Colors \& Application Examples |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Men |  |  |  |  |  |
| Illumination Color |  | Cool White | Warm White | Yellow | Red |
| Power Voltage |  | 24 V DC |  |  |  |
|  | Clear Cover |  | -a | $-3, \cdots+1$ | $\rightarrow, \quad 1$ |
|  | White Cover |  | $-8.3$ | - | -6 crimencomad |
| Spectrum |  |  |  |  |  |
| Fea | atures | Suppressing glare, the bright, clear cool white illumination color lights up a target object clearly. This illumination color gives off a color temperature of 5500 K . | Warm color similar to that of incandescent lamps. This illumination color gives off a color temperature of 2800 K . | Yellow illumination color gives off an emission spectrum with a dominant wavelength of 590 nm . | Red illumination color gives off an emission spectrum with a dominant wavelength of 625 nm . |
| App | plications | - Control panel <br> - Plant equipment <br> - Refrigerator/freezer <br> - Inspection/test equipment <br> - Advertising display/board <br> - Machine tool | - Food processing machines <br> - Cosmetic plants <br> - Chemical plants <br> - Showcases <br> - Food display cases | - Manufacturing equipment <br> - IC foundries | - Photosensitive materials <br> - Semiconductor manufacturing equipment |

## Features

- Brightness: 62.5 Lumens/Watt
- Low heat generation.
- Less energy usage, longer operation life, smaller mounting space, and no electrical noise.
- $71 \%$ reduction of power and $\mathrm{CO}_{2}$ emission when compared to 20 W fluorescent lamps (LF1B-C/D)
- Thin and slim style fits into compact spaces.
- Two cover colors: clear and white (diffused light)
- Cool white, warm white, yellow and red illumination colors available.
- UL Listed \& IP54 protection against dust and water splash (IEC 60529)


## Part No. Development

## LF1B- C 3 S -2 THWW4

LED Module Arrangement
A: 3 LEDs $\times 1$ row
B: 6 LEDs $\times 1$ row
C: 12 LEDs $\times 1$ row
D: 24 LEDs $\times 1$ row


## LED Optics Specifications

| Illumination Color | Cool White | Warm White | Yellow |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Luminous Intensity (typ.) (Single LED module) | 5000 mcd | 4500 mcd | 2300 mcd |  |  |
| Color Temperature (typ.)/Dominant Wavelength (typ.) | 5500 K | 2800 K | 590 nm |  |  |
| Reference Illuminance (typ.) at <br> 500 mm (clear cover) | 3 LEDs $\times 1$ row | 90 lx | 60 lx | 20 lx |  |
|  | 6 LEDs $\times 1$ row | 170 lx | 600 mcd |  |  |
|  | 12 LEDs $\times 1$ row | 330 lx | 20 lx |  |  |
|  | 24 LEDs $\times 1$ row | 560 lx | 200 lx | 40 lx | 75 lx |

Note: Illumination colors and illuminance may vary. Specifications shown in the above table are typical values and may vary depending upon actual environment.

## Performance Specifications



- Do not use the LF1B illumination units in environments subject to corrosive gases, otherwise illuminance may deteriorate.


## Dimensions



| Type No. | A | B | C |
| :---: | :---: | :---: | :---: |
| LF1B-A | 134 | 64 | 123 |
| LF1B-B | 210 | 140 | 199 |
| LF1B-C | 330 | 260 | 319 |
| LF1B-D | 580 | 510 | 569 |



All dimensions in mm.

## Internal Circuit



# TECHNICAL DATA SHEET 

| Equipment Type: | Thermostat |
| :--- | :--- |
| Location: | Motor Starter Section |
| Model Numbers: | FZK011 |
| Manufacturer: | Stego |
|  |  |
| Supplier: | NHP Pty Ltd |
|  | 16 Riverview Place <br> Murarrie <br> (07) 3909 4999 |

STEGO FZK 011 SERIES


## MECHANICAL THERMOSTAT SERIES FZK 011

The mechanical thermostat is used for controlling heating and cooling equipment， filter fans or signal devices．The thermostat registers the surrounding air and can switch both inductive and resistive loads via snap－ action contact．
－Adjustable temperature
－Small hysteresis
－Changeover contact

Dimensions（mm）


Load 1：
Enclosure heater
Load 2：
Filter fan，Cooling equipment，Signal device

Technical Data：
Operating voltage： 230 V AC
Switch temperature difference：

Sensor element：Thermostatic bimetal
Contact type：Changeover snap－
action contact
Contact
＜ 10 mOhm
resistance：
Service life：$\quad>100,000$ cycles
Max．Switching
250 V AC， 10 A
DC 30 W
250 V AC， 5 A DC 30 W

Acc．to EN 55014－1－2，
EN 61000－3－2，
EN 61000－3－3
4－pole terminal for $2.5 \mathrm{~mm}^{2}$ ，clamping torque 0.8 Nm

Clip for 35 mm DIN rail， EN50022

Plastic according to UL－94 V－0，light grey
$67 \times 50 \times 38 \mathrm{~mm}$
Approx． 0.10 kg
Operating／Storage -20 to $+80^{\circ} \mathrm{C}$
temperature：$\quad /-45$ to $+80^{\circ} \mathrm{C}$
Protection type：IP 20

## C

Note：${ }^{1}$ ）Connecting terminal＂ N ＂（RF heating resistor）causes the thermal feedback to work and so reduces the switch temperature difference to approx． 0.5 K ．

# TECHNICAL DATA SHEET 

Equipment Type: ..... MTR Relays
Location:
RTU Section
Model Numbers: ..... MTR
Manufacturer: ..... Xylem
Supplier:
Brisbane Technology Park
Unit 1, 18 Brandl Street
P.O. Box 4633Eight Mile PlainsQueensland 4113Australia

## MTR Level Relay



The MTR level relay has proven itself to be simple and extremely reliable in pump stations everywhere. The MTR controls one pump or one alarm. The MTRA controls one pump and one alarm.

- Safe

The extra low sensing voltage ensures maintenance staff and operators are protected at all times.

- Four sensitivities

Allows the relay to operate effectively in a wide range of conductive liquids.

- Activation delays

Each output can have a different time delay to overcome wave action and turbulence.

- LED indication

High intensity LED indicators ensure clear signals. Power On (green). Alarm On (red). Pump On (yellow).

- Dipswitch programmable

All settings are easily selectable from the front panel.

- Proven reliability

The proven design and performance of the relay ensures long-term reliability of the MultiTrode system.

- I.S application

Perfect for I.S application when used with an MTISB.

- Unique two-sensor operation (MTRA only)

Pump and alarm can be controlled using two or three sensors. Two-sensor operation is ideal for budget applications or where space is limited.

- DIN rail or screw mounting
- Low installed cost


## Specifications

## Mode of operation:

MTR Mode MTRA Mode

Charge/Discharge (Fill or Empty) Discharge ONLY

Probe Inputs: Sensor inputs Sensor voltage Sensor current Sensitivity

MTR : 2 / MTRA : 3 10/12VAC Nominal 0.8 mA max. (per sensor) 1k, 4k, 20k, 80k

Relay Outputs:

| MTR relay output | 2 contact sets :1 N/O \& $1 \mathrm{C} / \mathrm{O}$ |
| :--- | :--- |
| MTR Output delay | $0,2.5,5,10,20,40,80,160 \mathrm{sec}$ |
|  |  |
| MTRA relay output | 2 relays : both N/O |
| MTRA Output delay | Pump: 0.5,10; Alarm: $0.5,15 \mathrm{sec}$ |
|  |  |
| Relay contact rating | 250 VAC |
|  | 5 A Resistive, 2A Inductive |
| Relay contact life | $10^{5}$ Operations <br> Terminal size |

$2 \times 13$ AWG / $2.5 \mathrm{~mm}^{2}$

| Display |  |  |  |
| :--- | :--- | :--- | :--- |
| LEDs: | Power On | Pump | Alarm |
| MTR | Green | Red |  |
| MTRA | Green | Yellow | Red |

Physical Product:
Dimensions
Mounting
Enclosure
2.7/8H $\times 1.3 / 4 \mathrm{~W} \times 4.1 / 2 \mathrm{D}$ (Inches) $72 \mathrm{Hx} 45 \mathrm{~W} x 114 \mathrm{D}$ (mm)
DIN Rail or 2 x \#6 Screws / 2 x M4 Screws Makrolon (self-extinguishing)


Power Supply:

| Supply Voltage AC | $24,110,240,415 \mathrm{VAC}^{*}-50 / 60 \mathrm{~Hz}$ |
| :--- | :--- |
| Power Consumption | 3.5 Watts max |
| 年(MTR only) |  |
| Supply Voltage DC | 12 or 24 VDC, |
| Power Consumption | 3 Watts max |

Environmental Range:

| Centigrade | $-10^{\circ}$ to $+60^{\circ} \mathrm{C}$ |
| :--- | :--- |
| Fahrenheit | $+14^{\circ}$ to $+140^{\circ} \mathrm{F}$ |

N1653
LISTEN 2P27

Available Models \& Ordering Information

| 415VAC | MTR-1 | n/a |
| :--- | :--- | :--- |
| 240VAC | MTR-2 | MTRA-2 |
| 110VAC | MTR-3 | MTRA-3 |
| 24VAC | MTR-4 | MTRA-4 |
| 24VDC | MTR-5 | MTRA-5 |
| 12VDC | MTR-6 | MTRA-6 |

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# TECHNICAL DATA SHEET 

## Equipment Type:

Location:
Model Numbers:
Manufacturer:
Supplier:
Xylem

## SAFE FSP Relays

RTU Section

SAFE FSP
Brisbane Technology Park
Unit 1, 18 Brandl Street
P.O. Box 4633Eight Mile Plains
Queensland 4113
Australia

# multitrode <br> WATER • WASTEWATER • PIMM STATION • TECHNOLOGY 

## SAFESMART

## Backup Controller SAFE-FSP

## Installation \& Operation Manual



This Manual is the support documentation for the installation, commissioning and operation of the SafeSmart FSP Backup Controller

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## 1 Warnings \& Cautions

### 1.1 Information to User

Read this manual prior to installing or operating the SafeSmart-FSP Backup Controller. It contains all the information necessary to configure it for maximum performance for your application. After reading, place the manual in a safe place for future reference.

### 1.2 Documentation Standards



## DANGER:

This symbol is used where non-compliance could result in injury or death.


## WARNING:

This symbol is used where non-compliance could result in incorrect operation, damage to or failure of the equipment.


NOTE:
This symbol is used to highlight an issue or special case within the body of the manual.

### 1.3 Installation Notes



## WARNING:

The SafeSmart-FSP installation and wiring must be performed by qualified personnel.


## DANGER:

The SafeSmart-FSP has no user serviceable parts. To reduce the risk of electric shock leave all servicing to qualified Multitrode technical staff.

## 2 Introduction

The SAFE-FSP Backup Controller is a solid-state electronic level control module housed in a hi-impact plastic case with a DIN rail attachment on the back. It is used to control a pump (via a contactor or soft starter) in response to a liquid level sensor such as a MultiTrode probe.
The FSP Controller can be used as the primary source of control for a single pump or as a backup control device (for a single pump) when the primary control equipment fails. When using an FSP Controller as a backup controller, it only controls the pump in response to high or low level signals from dedicated level sensors.

A thermal sensor can be connected to the FSP Controller for pump protection. During operation, the LED indicators on the front panel display the current status including - Power, Pump On/Off, Level alarm, Thermal fault and Probe fault.

The FSP Backup Controller is designed to be easy to install and configure. All connections are clearly labelled on the side of the device and options are configured using a set of Dip switches on the front of the Controller.

## 3 Specifications

| Dimensions |  |
| :---: | :---: |
| Width | 22.5 mm (7/8") |
| Height | 101 mm (4") |
| Length (depth) | $120 \mathrm{~mm}\left(43 / 4{ }^{\prime \prime}\right)$ |
| Environmental |  |
| Ambient Temperature | -10 to $60^{\circ} \mathrm{C}\left(14\right.$ to $\left.140{ }^{\circ} \mathrm{F}\right)$ |
| Humidity | $5 \%$ to $90 \%$ non-condensing |
| AC Power Supply |  |
| Voltage Range | 85-265V AC |
| Frequency | $50 / 60 \mathrm{~Hz}$ |
| Power | 3.5W |
| DC Power Supply |  |
| Voltage Range | 12-30V DC |
| Current | 0.15A max |
| Relay Outputs |  |
| Type | Form A |
| Current (Resistive) | 5A |
| Current (Inductive) | 2A |
| Voltage Rating DC | 30V DC |
| Voltage Rating AC | 250V AC |
| Thresholds* |  |
| Thermal Fault Present | > 4k ohms |
| Thermal Fault Cleared | < 2k ohms |
| Thermal BU Input | 0.15V DC |

Table 1 - SAFE-FSP Specifications
*Where applicable, values include a 56 ohm series resistor on the thermal input.

## 4 Installation

The FSP Backup Controller is designed to be mounted onto a standard DIN rail. The power supply, input and output connections are located on the top of the Controller housing.

The features of the Controller are listed below and are discussed in the following sections.

- Power Supply Options
- Four Configurations
- Operation Modes \& Probe Inputs
- Empty (Discharge) Mode
- Fill (Charge) Mode
- Level Alarm Fault
- Level Alarm (AL Probe)
- Pump Faults
- Thermal Pump Fault
- Probe Faults
- Failsafe Probe Fault
- Assumed Probe Fault
- Digital Output and Pump Sensor Connection Options
- Local or Remote Monitoring of Pump Status \& Faults
- MultiSmart Connections - Conductive Thermal Sensor
- MultiSmart Connections - FLS Thermal Sensor
- Manual (Hand) Operation
- Alarm Activation and Deactivation Delays
- Probe Sensitivity
- LED Status Summary
- DIP Switch Settings


## 5 Power Supply Options

The FSP Controller can be supplied power in the following ways:

- $85-240 \mathrm{~V}$ AC Supply Only
- 12 - 30V DC Supply Only
- $85-240 \mathrm{~V}$ AC with $12-14 \mathrm{~V}$ DC as Backup
- $15^{*}-30 \mathrm{~V}$ DC with $85-240 \mathrm{~V}$ AC as Backup
* When the DC supply is 15 V or greater, the DC supply is the primary source.

A Power LED (steady green) indicates when the Controller is powered. If the LED flashes, supply voltage is too low.

## NOTE:

If the power supply is below 24 VDC , the voltage alarm threshold is automatically set to 11.5 V . If the supply is 24 VDC or above, the voltage alarm threshold is automatically set to 23 V .

A switch or circuit-breaker and an over-current protection device must be included in the installation. The protection device must be in close proximity to the equipment, within easy reach of the operator, and be marked as the protection device for the equipment.
The input wiring and the switch/circuit-breaker/over-current device must be rated to at least the nominal input voltage being used. The recommended current ratings are below.

| Unit Supply <br> Range | Recommended Switch/Circuit- <br> Breaker/Overcurrent <br> Protection Device Rating | Minimum Supply <br> Wiring Rating |
| :---: | :---: | :---: |
| $85-180 \mathrm{VAC}$ | 0.1 A | 0.1 A |
| $180-265 \mathrm{VAC}$ | 0.05 A | 0.05 A |
| $12-20 \mathrm{VDC}$ | 0.3 A | 0.3 A |
| $20-30 \mathrm{VDC}$ | 0.15 A | 0.15 A |

Table 2 - Current Ratings


NOTE:
The MultiTrode probe uses an earth/ground return path for the signal. Ensure that the GROUND (DC-) terminal on the FSP Controller is also grounded.

## 6 Operation Modes \& Probe Inputs

The SafeSmart-FSP Backup Controller can be configured to operate in either Empty (Discharge) or Fill (Charge) mode.

- Empty (Discharge) Mode - Dip Switch 1 = OFF
- Fill (Charge) Mode - Dip Switch $1=\mathrm{ON}$

The Controller has three (3) probe inputs, High, Low and Alarm. The Alarm probe input can be configured as a low or high level alarm.

- High Level Alarm - Dip Switch 2 = OFF
- Low Level Alarm - Dip Switch 2 = ON


### 6.1 Empty (Discharge) Mode

This mode is used to pump liquid out of a well once it reaches a preset level. (Figure 1) In this mode the Controller operates as follows:

- The pump activates when the liquid reaches the sensor in the high level probe.
- The pump continues to operate until the liquid level drops below the low level probe and the pump deactivation period expires.
- When a thermal fault occurs, the Pump Control output is deactivated regardless of the liquid level. The pump stops, the Pump Fault output (DO1) is deactivated and the Thermal LED flashes.


Figure 1 - Empty (Discharge) Mode

### 6.2 Fill (Charge) Mode

This mode is used to fill up a well with liquid when the level falls to a preset level. (Figure 2 ) In this mode the Controller operates as follows:

- The pump activates when the liquid falls just below the sensor in the low level probe.
- The pump continues to operate until the liquid level reaches the sensor in the high level probe and the pump deactivation period expires.
- When a thermal fault occurs the Pump Control output deactivates regardless of the liquid level. The pump stops, the Pump Fault output is deactivated and the Thermal LED flashes.


Figure 2 - Fill (Charge) Mode

## 7 Level Alarms (AL Probe)

A conductive level sensor is connected to the AL Probe input to detect when the liquid level has risen above or fallen below an acceptable level.

In Empty (Discharge) mode this is typically a high level alarm and is activated when the AL Probe input detects liquid and the activation delay has expired.
In Fill (Charge) mode this is typically a low level alarm and is activated when the AL Probe input is no longer detecting level (i.e. the level has dropped below the sensor) and the activation delay has expired.

When a level alarm is detected the Level Alarm output (DO1) changes state and the Level Alarm LED flashes at 1 Hz . The Level Alarm/Pump Fault output can be used to operate an alarm device such as a beacon.

The Level Alarm/Pump Fault output (DO1) can be configured as normally open or normally closed.

- $\quad$ Normally Closed Output - Dip Switch 6 = OFF
- Normally Open Output - Dip Switch $6=$ ON

NOTE:
Dip Sw6 also has the same effect on the Probe/Failsafe Alarm output (DO3).

## 8 Thermal Pump Fault

The FSP Controller can detect thermal and FLS thermal faults. The FSP Controller can not detect a Seal fault. Types of sensors that maybe connected are FLS (Flygt Leakage Sensor), FLS10 or a thermal only sensor such as non-linear PTC thermistor or bi-metallic switch.

A thermal sensor is connected as illustrated in Figure 3. No Dip Switch setting change is required.


Figure 3 - Thermal Sensor Connection (Flygt and Non-Flygt Pumps)

When a thermal fault is detected, the pump stops, (DO2 is deactivated), the Level Alarm / Pump Fault output (DO1) changes state and the Thermal Fault LED begins to flash.
A thermal fault is automatically reset when the pump returns to normal operating temperature (i.e. the fault is no longer present). The flashing Thermal LED becomes steady and the pump is free to run.

A manual acknowledgement is required to clear the Thermal LED. A manual acknowledgement is performed by momentarily connecting Ground/Earth to the Manual (Hand) terminal. See Figure 4 below. (Note, the pushbutton switch is not supplied).


Figure 4 - Manual Thermal Fault Reset \& Manual (Hand) Operation

The Level Alarm/Pump Fault output (DO1) can be configured as normally open or normally closed.

- Normally Closed Output - Dip Switch $6=$ OFF
- Normally Open Output - Dip Switch $6=$ ON

©
NOTE:
Dip Sw6 also has the same effect on the Probe/Failsafe Alarm output (DO3).

## 9 Probe Faults

The FSP Controller detects two types of probe faults, a Failsafe Probe fault and an Assumed Probe fault. When either fault is detected the Probe/Failsafe Alarm output (DO3) changes state. This output can be configured as normally open or normally closed.

- Normally Closed Output - Dip Switch 6 = OFF
- $\quad$ Normally Open Output - Dip Switch $6=$ ON

NOTE:
Dip Sw6 also has the same effect on the Level Alarm/Pump Fault output (DO1).

### 9.1 Failsafe Probe Fault

MultiTrode probes are available with a failsafe connection to the top-most sensor to enable detection of a sensor fault. If a broken cable is detected to the top-most sensor, the Probe/FailSafe fault output (DO3) changes state, the Probe Fault LED flashes and the pump stops.

A Failsafe probe is typically used in discharge (empty) applications only. By its very nature the probes used in a charge or fill application are covered, so for example if the low level alarm probe goes open circuit, a low level alarm would be present immediately.

## NOTE:

If a non-failsafe probe is used, then a jumper must be connected between the Alarm Probe and the Failsafe Probe inputs to suppress erroneous probe faults.

## NOTE:

When using single sensor probes, the Failsafe Probe input should be connected to the highest probe in the system.

### 9.2 Assumed Probe Fault

For an Empty (Discharge) application, if a High Level probe is activated and the Low Level probe is deactivated, then the Controller assumes the Low Level probe is faulty. This condition is called an "Assumed Probe Fault" and the Probe Fault LED illuminates.

The Controller changes its pumping behaviour to a timed method until the fault condition is no longer present. So the pump continues to run for 60 s after the High Level probe has deactivated and during this time the Pump LED flashes.

For a Fill (Charge) application, if a High Level probe is activated and the Low Level probe is deactivated, then the Controller assumes the Low Level probe is faulty. This condition is called an "Assumed Probe Fault" and the Probe Fault LED illuminates.

The Controller changes its pumping behaviour to a timed method until the fault condition is no longer present. So the Controller waits for 60 seconds after the High Level probe has deactivated then starts the pump, and during this time the Pump LED flashes.

When an Assumed Probe fault occurs, the Probe/FailSafe fault output (DO3) changes state.

## 10 Digital Output and Pump Sensor Connection Options

### 10.1 Local or Remote Monitoring of Pump Status \& Faults

The FSP Controller's digital outputs can be wired into the inputs of a wide range of devices (e.g. a PLC, RTU or Dialler etc.) and the state of the pump monitored. The valid states and what they signify are tabled below.

|  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DO1 | DO2 | DO3 | DO1 | DO2 | DO3 |
| 0 | 0 | 0 | - | Off | - |
| 0 | 0 | 1 | - | Off | Y |
| 1 | 0 | 0 | Y | Off | - |
| 1 | 0 | 1 | Y | Off | Y |
| 0 | 1 | 0 | - | On | - |
| 0 | 1 | 1 | - | On | Y |
| 1 | 1 | 0 | Y | On | - |
| 1 | 1 | 1 | Y | On | Y |

Table 3 - FSP Controller Output States

* Dip Sw 6 = On (Normally Open)


### 10.2 MultiSmart and FSP Controller Thermal Sensor Options

The FSP Controller can be used in conjunction with a MultiSmart Pump Station Manager.
The MultiSmart is indirectly connected to the thermal sensor via a relay within the FSP Controller. The Controller monitors this line and if it detects that the MultiSmart is no longer connected, the internal relay switches over and the FSP Controller drives the sensor.

The Controller monitors the voltage on the Thermal BU input to the MultiSmart. If the MultiSmart fails, the Controller takes over and controls the pump (but does not inhibit the MultiSmart pump control) and monitors for a thermal fault - thus providing backup control and thermal overload protection to the pump.

### 10.2.1 MultiSmart Connections - Conductive Thermal Sensor

The conductive thermal sensor is connected to the Thermal input. The Thermal BU (backup) is connected to a digital input on the MultiSmart (configured as a Motor OverTemp fault). See Figure 5 below.

The MultiSmart and FSP controller are both capable of responding to a thermal fault. When a thermal fault is detected, the pump stops, if running. A Motor OverTemp fault is displayed on the MultiSmart and a thermal fault is displayed on the Controller. The pump can not be restarted until the thermal fault clears. The FSP Controller automatically resets the fault when the fault condition is no longer present, this allows the pump to run again but only via the Controller The fault must be reset at the MultiSmart before the MultiSmart is able to run the pump again.


Figure 5 -Thermal Sensor Connections to a MultiSmart

### 10.2.2 MultiSmart Connections - FLS Thermal Sensor

The FLS sensor is connected to the Thermal input. The Thermal BU is connected to a digital input on the MultiSmart (configured as an FLS fault). (See Figure 6 below). The FSP Controller is not able to detect a seal fault however the MultiSmart can.

When an FLS thermal fault is detected, the pump stops, if running - shut down by the MultiSmart and/or the FSP Controller. An FLS Flygt Thermal fault is displayed on the MultiSmart and on the Controller. The pump can not be restarted until the thermal fault clears. The FSP Controller automatically resets the fault when the fault condition is no longer present, this allows the pump to run again but only via the Controller The fault must be reset at the MultiSmart before the MultiSmart is able to run the pump again.

When an FLS Seal fault occurs the FSP Controller is unable to detect it however the MultiSmart can and will display an FLS Flygt Seal fault. By default, the MultiSmart allows the pump to continue to run when a seal fault occurs.


Figure 6 - FLS Connections to a MultiSmart (Flygt Pump)

## 11 Manual (Hand) Operation

A momentary action pushbutton (not supplied) may be connected to the Manual (Hand) input and used to operate the pump directly. (See Figure 7). Once pressed the pump begins to operate immediately irrespective of the liquid level. A second momentary action pushbutton switch is required to switch the pump off. It is connected across the Off input and Ground/Earth.

## WARNING:



If operating the pump manually via the Manual (Hand) switch, the pump does NOT automatically turn off when the level falls below the low sensor. So ensure that the pump is switched off via the Pump Off switch before the level becomes critically low to avoid potential damage to the pump.


Figure 7 - Manual Pump Operation - On \& Off Switches

## 12 Pump Activation and Deactivation Delays

Activation delays are used to prevent spurious pump starts. The delay allows the level device to positively detect the liquid before operating the pump.

There are two delay periods for Pump Activation delay:

- $0.5 \mathrm{sec}-$ Dip Switch $3=$ OFF
- 30 sec - Dip Switch 3 = ON

There are two delay periods for Pump Deactivation delay:

- $0.5 \mathrm{sec}-$ Dip Switch $4=$ OFF
- 30 sec - Dip Switch $4=$ ON


## 13 Alarm Activation and Deactivation Delays

Activation and Deactivation delays are used to prevent spurious level alarms. The delay allows the level device to positively detect the liquid before triggering the alarm.

There are two delay periods:

- $0.5 \mathrm{sec}-$ Dip Switch $5=$ OFF
- 10 sec - Dip Switch $5=$ ON

This delay applies to both the alarm activation and deactivation delay.

## 14 Probe Sensitivity

The Controller is used in conjunction with a conductive level sensing device, such as the MultiTrode probe. Conductive probes rely on conductivity through the liquid to earth in order to detect level. Highly conductive liquids, such as saltwater, generally require the Controller be set to a lower sensitivity than for low conductivity liquids, such as distilled water.

For most applications, the default probe setting of 20 k ohms is satisfactory but the Controller allows the operator to adjust its sensitivity as needed for specific conditions. The sensitivity is set using Dip Switches 7 and 8.


| Dip Sw 7 | Dip Sw 8 | Sensitivity | Typical Application |
| :---: | :---: | :---: | :--- |
| OFF | OFF | 1 k ohm | Concentrates Acids, Minerals, Alkalis |
| ON | OFF | 4 k ohm | Acids, Alkalis, Diluted Brine, Sea Water |
| OFF | ON | 20 k ohm | Sullage, Sewage Effluent, Town Water |
| ON | ON | 80 k ohm | Industrial Effluent, Purified Water* |

Table 4 - Probe Sensitivity

* Not recommended for use with purified de-ionised water or pristine rain water.


## 15 LED Status Summary

Five LEDs on the front of the Controller indicate the power, level alarm, pump status, thermal and probe fault status of the Controller.

| LED | Status | Indication |
| :--- | :--- | :--- |
| Power | Power on | Steady |
|  | Low voltage | Flashing |
| Level | Level alarm | Flashing |
| Pump | Pump on | Steady |
|  | Activation delay period | Flashing |
| Thermal | Manual ack required | Steady |
|  | Thermal fault active | Flashing |
|  | Standalone locked mode* | Flashing - Double |
| Probe | Assumed probe fault | Steady |
|  | Failsafe probe fault ** | Flashing |

Table 5 - LED Summary Status

* In Standalone Locked mode the FSP Controller ignores the THERMAL BU input. Standalone Locked mode occurs if the voltage on the THERMAL BU input is unstable (i.e. voltage is $<0.15 \mathrm{~V}$ and $>6 \mathrm{~V}$ in less than 0.5 s for 30 seconds). To exit Standalone Locked mode, press the Manual (Hand) button.
** Failsafe probe fault has higher priority than Assumed probe fault.


## 16 DIP Switch Settings

The Controller is configured using the DIP switches located on the front of the enclosure.

| DIP \# | Setting | Mode Description | Section |
| :---: | :---: | :--- | :---: |
| $\mathbf{1}$ | OFF | Empty (Discharge) Mode | 6 |
|  | ON | Fill (Charge) Mode | 6 |
| $\mathbf{2}$ | OFF | High Level Alarm | 6 |
|  | ON | Low Level Alarm | 6 |
| $\mathbf{3}$ | OFF | O.5 sec Pump Activation Delay | 12 |
|  | ON | 30 sec Pump Activation Delay | 12 |
| $\mathbf{4}$ | OFF | 0.5 sec Pump Deactivation Delay | 12 |
|  | ON | 30 sec Pump Deactivation Delay | 12 |
| $\mathbf{5}$ | OFF | 0.5 sec Alarm Activation \& | 13 |
|  | ON | 10 sec Alarm Activation \& | 13 |
| $\mathbf{6}$ | OFF | N/C (Normally Closed) (DO3 \& DO1) | $7,8,9$ |
|  | ON | N/O (Normally Open) (DO3 \& DO1) | $7,8,9$ |
| $\mathbf{7}$ | $\mathbf{8}$ | Probe Sensitivity | 14 |
| OFF | OFF | 1k ohm |  |
| ON | OFF | 4k ohm |  |
| OFF | ON | 20 k ohm |  |
| ON | ON | 80 k ohm |  |

Table 6 - Dip Switch Settings

## 17 Example Applications

### 17.1 Backup Operation

Following is an example an empty (discharge) application using the FSP Controller as backup to a pump controller (the primary control device). In this configuration the FSP Controller does not control the pump until the High Level probe is covered which should only occur if the pump controller fails.
If the level continues to rise and it reaches the Alarm probe, a high level alarm is tripped. This indicates that the pump for whatever reason is unable to cope and the level has risen to an excessively high level (and overflow is possibly imminent).
The Alarm and High Level probes are positioned higher than the highest activation point used by the pump controller.

EMPTY (DISCHARGE) MODE


```
Dip Sw 1 = Off (Empty Mode )
Dip Sw 2 = Off ( High Level Alarm )
Dip Sw \(3=\) On ( Pump Activation Delay \(=30 \mathrm{~s}\) )
Dip Sw \(4=\) Off ( Pump Deactivation Delay \(=0.5 \mathrm{~s}\) )
Dip Sw \(5=\) Off (Alarm Delay \(=0.5 \mathrm{~s}\) )
Dip Sw 6 = Off (N/C Level \& Probe Alarms )
```

Figure 8 - Example of a Backup Application
If the pump controller is located at a site with no telemetry, a low level alarm could be configured (rather than a high level alarm). If the alarm trips, it indicates (by means of say a beacon) that the primary pump controller has most likely failed. However in this case no further alarm can be generated by the FSP Controller to indicate an excessively high level has been reached.


## NOTE:

The actual probe position is at the discretion of the end user, the only requirement for a discharge (empty) application is that the high probe must be positioned higher than the (highest*) activation setpoint. (* In some pump controllers, more then one activation setpoint may be defined).


### 17.2 Dual Thermal Fault Monitoring (with MultiSmart)

The following wiring diagram (Figure 9), illustrates an application where the FSP Controller and a MultiSmart pump controller operate in parallel.

The thermal sensor is connected to the FSP Controller and the Thermal Bu input is connected to the MultiSmart. This allows both devices to act on a thermal fault.

If a seal sensor is present it is connected to the MultiSmart.


Figure 9 - Dual Thermal Fault Monitoring

## SAFE-FSP Relay Manual

### 17.3 Simplex Pump Controller

In this example the FSP Controller is configured as the primary pump controller for a single pump. The FSP Controller takes no action until the High Level probe is covered. When it is covered, the Pump Control output (DO2) closes turning on the pump.

When the Alarm Level probe is covered, a high level alarm is generated and the Level Alarm/Pump Fault output (DO1) changes state.

The FSP Controller monitors the thermal sensor. If a seal sensor is present it is not connected to the FSP Controller.

The FSP Controller and associated probes can control a maximum of one pump. The wiring is illustrated in Figure 10 below.


Figure 10-Simplex Pump Controller


Figure 11 - SafeSmart SAFE-FSP Label.

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Visit www.multitrode.com for the latest information

## 3. Drawings

## Drawings - As Built

## (1) UurnsañUtilities

## SP464 JAMES STREET SEWAGE PUMPING STATION SITE COVER SHEET



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SP464 James St Lowood SPS - Electrical Installation OM Manual


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RTU ANALOG OUTPUTS

1 ALL WRES $~$ cable cores are


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## Sheet 08

FOR CONSTRUCTION

|  |  |  |  | Sente | P.haoue | mmaz |  | 234 | rume <br>  <br> (6) Ürbanutilities | Carcino Roglag the Fi .ive |  | SP464 <br> james street <br> SEWAGE PUMP STATION | COMMON RTU I/O SCHEMATIC DIAGRAM SCHEMATICDIAGRAM | metre . |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{4} 05.14$ | ISSUED FOR CON | P. H. | Aw. | gevtmaerex | A Withert | asoar | ARE |  |  |  |  |  |  |  |
| - 03.48 | For tender | 4. | A | aonle | 37-047500LA | Antwor | 3 | ${ }^{334}$ |  |  |  | 486/5/7-0475-008 |  | A |
| Home | mencoue | ${ }^{\circ}$ | No | eocrale |  | emaneax | Peone |  |  |  |  |  |  |  |  |
|  | Putiste Id: TMS141? |  |  |  |  |  |  |  | Active: 30/09/201 |  |  |  |  |  | 1240 of |  |




SP464 James St Lowood SPS - Electrical Installation OM Manual







[^65]Sheet 17
FOR CONSTRUCTION


SP464 James St Lowood SPS - Electrical Installation OM Manual



SP464 James St Lowopd SPS - Electricą Installation OM Manual




Itre fros splatite and groxand smooth where neeged

M6 Eeth thuts thee to the interior of al docers and hinged essuthenens and on sfiareent

Hor stay arms to te $5 /$ /steel and of suffisent strength to prevent being deformeo when swijectec to cessonable loase. Mrinum 3 jna sisteel
th-off covers and mounting paneis fued with Mas stusts steniess steel done sots

 able glands to be fitted with conpression sidd instaled within cobtcie loetal G Giland /nspection/ /access spatest to be titted dith
Giendthrspection/Accesss plates to nimitain 5 Somen cierance fron section dividers
ilanchinspection/Access ppates re NOT To be sp
inspection/Acesss plates are NoT to be earthed


fingece sesutheens fixed with Eekha $1 / 6$ tuen $1000-0$
 Al masutheons to open a minimun of 9 .
All switchbourc LED lights to be nounted on me horizontal plane
$\frac{\text { Leas Does } 1-236-7}{\text { SELECTRX }-5 \text { Sving Handie }}$
SELECTRXX - 3 ponnt lock rod set - Woop-


OPERATING PARAMETG
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Retet Operational Volts
Rated handition Voctigetil
Rated Autidar Yoltage
Rated Auctiary Yoitage
Sherer Cruereit Curent Ise

Messure ot Protetection by borriers
and exclosures
Service Conations
$\underset{ }{\text { Mass }}$ (arns of Segregation
Not axteobery 2000kg
Lexts poor:
Lexts poor:
*)
*)
NERCEX Pasacch, S/Stel Shackie, LSmm brass pon tunble%
NERCEX Pasacch, S/Stel Shackie, LSmm brass pon tunble%
Evegen Key No3S. (1\times2 2ey:
Evegen Key No3S. (1\times2 2ey:

 re-isudited crinp lugs or pins
Separate luss or pins shali be ussed for eech conductor: A proprietary double pin lug may be used

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 as detalis belox Wring between ATU termina
fextbe coperer conoctors
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= 2217上 苜

Covaricons

eantivg

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Spply OULUX ALPMAFECH 30000 powder Coat to nemulacture's recommencartions

 Minimum Dry fina Thichesess all wurfaces 50 nictrons

Latas

Idrring labels R/w engraved ABS PLASTCC To Iobel shedui

Proctataes
Cotantern mis
E/Stop inels
Karing tasts

89t thebls sectired by M3 chrone plated setal threats
Lemels obstructed by swithboard wring ze rellocited to asjacent duct lid and setured oy $M$ B ayion treesas. Lad to De sesures by a single cable tie ot one corpe Exxemal swithboard libels to be inen Hich 316 grade staniess steel seaved so
All hiteraza and external labels ree to hare bevelied edges

Andrew Burnvia LicNo 39850

6-11-2014
"III
AS INSTALLED


DETALL M2 xCostrention Aepakgergy

|  |  |  |  | Swne | P.hague |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ${ }^{1} 05.14$ | ISSUED FOR Construction | P. H. | aw. | cwnmeatea | A Withert |
| $0 \cdot 03.4$ | FOR TENDER | PH. | a.w. | aOnif | 57-0475nela |
|  | vencoer | ¢om | $\cdots$ | becruita |  |



ESCUTCHEON LAYOUT DETAAL R


THIS ESCUTCHEON LA YOUT DRAWING IS A GUDE ONLY THAT SHOWS THE PREFERRED OVERALL GENERAL EOUPMENT LAYOUT
II ISOO TO SCCLE ANO MUST NOT BE USED AS WORKSHOP DESION IT IS NOT TO SLALE ANO MUST NOT BE USED AS WORKSHOP DESION
THE SWTOHBARD MANUFACTURER MUST PROVIDE THER
 OWF SWITHBOARN WORS SHOP DSSINN FOR GUU APP

AS INSTALLED
Andreas Burnam
LICN 39850


Sheet 22 FOR CONSTRUCTION






Section A-A


GLAND PLATE CUTOUTS


AS INSTALLED

Anoseos Burnere WicNo 39850


Sheet 30
FOR CONSTRUCTION

|  |  |  |  | ¢arte | Pracue | Pmow |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ISSUED FOR CONSTRUCTION | P... | aw | wemed | Awithoft | ceen | R2E | वute |
| - 03.14 | for tender | P... | Aw. | cobnt | 57-04759et A | Aminom | m | 234 |
| bis mate | menownt | \%en | No | eccersio |  | 人sacrofa | ${ }_{\text {RPFo ite }}$ | bale |





## Drawings-Functional

# SP464 JAMES STREET SEWAGE PUMPING STATION SITE COVER SHEET 



| STANDARD DESIGN OPTIONS |  |  |
| :---: | :---: | :---: |
| OPTION | DESCRIPTION | FITED |
| A |  | We ${ }^{\text {No }}$ |
| B | INOIVIUAL PUMP MOTOR AUX PROTECTION SENSORS AND FAUIT TELAYS | N0 |
| $\checkmark$ | reflux valve lati swith | N ${ }^{1}$ |
| 0 | Station manhole surcharge imment | We ${ }^{\text {No }}$ |
| $\varepsilon$ | STATION DRY WELL SUMP PUMP ANO LEVEL WOICATION SENSORS AND RELAYS | No |
| F | PERMANENT GENERATOR MSTALLED | No |
| $G$ | STATION EMERGENCY STORAGG LEVEL SENSOR 8 OE WA TERING PUMP | Wa ${ }^{\text {Wo }}$ |
| H | STATION DELIVERY FLOWMETER | ［⿴囗 ${ }^{\text {No }}$ |
| 1 | backup communication－Gism | Yes cro |
| J | PUMP CONNECTION－（Via Direct Connection） | Yes Ext |
| K | CATHOOIC PROTECTION | ［区 № |
| L | MOTOR THERMISTORS－（Via Direct Connection） | Yes cese |
| M | ODOUR CONTROL | \％No |
| N | ORECT CONNECTED METERING | YES［8（ ${ }^{\text {c }}$ |
| 0 | PUMPS ELECTRILAL INTERLOCK | N0 |
| P | WET WELL WASHER | （1）No |
| 0 | AUX PIT SUMP PUMP AND LEVEL PROBE | N0 |
| R | TELEMETRY RADIO | Yes ${ }^{\text {cki }}$ |
| 5 | WET WELL SECONDARY LEVEL SENSOR | NO |
| T | WET WELL PRIMARY LEVEL SENSOR（Direti Connetted） | YES［8］ |
| U | DELIVERY PRESSURE TRANSMIT TER（Direct Connected） | YES ©xa |
| $v$ | CMEMICAL DOSING | ［2］No |
| w | PUMP START METHOO－SOET STARTER | YeS dm |
| x | 3＇d PUMP IWSTALLED | NO |
| Y | POWER MEIER | No |
|  |  |  |
|  |  |  |
|  |  |  |


| $686 / 5 / 7-0675-029$ | SWBD GENERAL ARRANGEMENT ELEVATIONS |
| :--- | :--- | :--- | 486／5／7－0475－030




Sheet 00

FOR CONSTRUCTION

| ． |  |  |  | Swit | praque | пMame |  | 234 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 105.14 | ISSUED FOR CONSTRUCTION | P．．． | aw． | osarminota | Alutmoet | semem | ＊Ram | one |  |
| 002.14 | For tenoer | Pr | aw． | amaz | 57－047588LA | namber | m | 34 | （）Mutuuro |
| － 10 cm | ниement | ceac | No |  | Sorsua | Eetancica | Repa，me | 201E | （ UrbanUtilities |

$\qquad$ SIE
SP4
SAMES
JAM Sp464
JAMES STREET
SEWAGE PUMP SEWAGE PUMP STATION


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Q-Pulse Id: TMS1412 ${ }^{2}$

SP464 James St Lowood SPS - Electrical Installation OM Manual



Superseded

| DAY 18 MH. 8 YEAR 14 |
| :---: |
| Name: Nick Small |
| Licenceno: 12988 |
| Signed. Sall |

NOTES

1. SUémersible pump noz cricut greaner shall be
Line side shroued 2. cracuit breaker ratngs to sut fallt level Comothay int
 4. FALLT LEVEL OF 20ha AT 45V For 02 sec









Q-Pulse Id: TMS1412








SP464 James St Lowood SPS - Electrical Installation OM Manual




## Drawings - Point to Point

| POINT TO POINT |
| :--- |
| DAY 15 MTH 8 YEAR IL |
| Name:.....Nick SMall 129881 |
| Licence no: 129. |
| Signed: .... |

## SP464 JAMES STREET SEWAGE PUMPING STATION <br> SITE COVER SHEET

| ELECTRICAL DRAWINGS INDEX |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DWG N: | TITLE | SHEET |  |  | IONS |  |
| 688/5/7-0475-000 | SITE COVER SHEET | 00 | 0 | A |  |  |
| 488/5/7-0475-001 | POWER DISTRIBUTION SCHEMATIC DIAGRAM | 01 | 0 | A |  |  |
| 488/5/7-0475-002 | PUMP O1 SCHEMATIC DIAGRAM | 02 | 0 | A |  |  |
| 486/5/7-0475-003 | PUMP 02 SCHEMATIL DIAGRAM | 03 | 0 | A |  |  |
| 486/5/7-0675-006 | RESERVEO orawma sheti | 04 |  |  |  |  |
| 488/5/7-0475-005 | Reserveo drawmg sheti | 05 |  |  |  |  |
| 488/5/7-0475-006 | MTS CONTROL WIRING DiAGfam | 06 | 0 | A |  |  |
| 486/5/7-0475-007 | COMMON CONTROL S SCHEMATIC OIAGRAM | 07 | 0 | A |  |  |
| 486/5/7-0475-008 | COMMON RTUIVO SCHEMATIC DIAGRAM | 08 | 0 | A |  |  |
| 486/5/7-0475-009 | RTU POWER OISTRIBUTION SCHEMATIC \& NETWORK OIAGRAM | 09 | 0 | A |  |  |
| 686/5/7-0475-010 | RTU DIGITAL INPUTS TERMINATION DIAGRAM - SHEET 10 O 3 | 10 | 0 | A |  |  |
| L86/5/7-0675-011 | RTU DIGITAL INPUTS TERMINA TION DIAGRAM - SHEET 2 OF 3 | 11 | $\bigcirc$ | A |  |  |
| 486/5/7-0475-012 | RESPRVED DRA WITG SHIET | 12 |  |  |  |  |
| 486/5/7-0475-013 | RTU DIGITAL OUTPUTS TERMINATION DIAGRAM - SHEET 10 O 2 | 13 | 0 | A |  |  |
| L86/5/7-0475-014 | RTU DIGITAL OUTPUTS TERMINATION DIAGRAM - SHEET 2 OF 2 | 14 | 0 | A |  |  |
| 486/5/7-0675-015 | RTU ANALOG INPUTS TERMMATIION DIAGRAM | 15 | 0 | A |  |  |
| 686/5/7-0475-016 | RTU ANALOG OUTPUTS TERMINATION OIAGRAM | 16 | 0 | A |  |  |
| 486/5/7-04725-017 | COMMON CONTROLS TERMINATION DIAGRAM | 17 | 0 | A |  |  |
| 686/5/7-0675-018 | EQUIPMENT LIST | 18 | 0 | A |  |  |
| 486/5/7-04775-019 | CABLE SCHEDULE | 19 | 0 | A |  |  |
| 686/5/7-0675-020 | SWITCHBOARD LABEL SCHEDULE | 20 | 0 | A |  |  |
| L86/5/7-0475-021 | SWITCHBOARD CONSTRUCTION DETALLS - SHEET 1 of 3 | 21 | 0 | A |  |  |
| 486/5/7-0475-022 | SWITCHBOARD CONSTRUCTION DETAALS - SHEET 2 of 3 | 22 | 0 | A |  |  |
| 486/5/7-0475-023 | SWITCHBOARD CONSTRUCTION DETALLS - SHEET 3 of 3 | 23 | $\bigcirc$ | $\cdots$ |  |  |
| 486/5/7-0675-026 | Fill in in trumentation - INSTALLATION DETALLS | 24 | 0 | A |  |  |
| 486/5/7-0675-025 | ReSERVEO (EATHOOIC PRotection unit | 25 |  |  |  |  |
| 486/5/7-0475-026 | RESERVED DRA WTHG SHEt? | 26 |  |  |  |  |
| 486/5/7-0675-027 | Reserved (f)LLODISCOnvettion box) | 27 |  |  |  |  |
| 4.86/5/7-0675-028 | Restrved opa wma Shet | 28 |  |  |  |  |
| 486/5/7-0675-029 | SWBD GENERAL ARRANGEMENT ELEVATIONS | 29 | 0 | A |  |  |
| 486/5/7-0475-030 | SWBD General arrangement sections. | 30 | 0 | A |  |  |
| 486/5/7-0675-031 |  | 31 |  |  |  |  |
| 486/5/7-0475-060 | LOCALITY \& STTE PLANS-SHEET $10+3$ | 40 | 0 | A |  |  |
| 486/5/7-0475-041 | SWITCHBOARO SLAB ANO CONDUT DETALS-SHEET 2 Of 3 | 4 | 0 | A |  |  |
| 486/5/7-0475-042 | SWITCHBOARD \& ELECTRICAL CONDUIT LAYOUT-SHEET 3 of 3 | 42 | 0 | A |  |  |


| STANDARD VARIABLES |  |
| :---: | :---: |
| DESCRIPTION | VALUES |
| CTMETERING ISOLA AOR | NOT APPLILABLE |
| NORMAL SUPPLY MAIN SWITCH | 0.51625015 5250PE/225 |
| GENERATOR SUPPLY MAIN SWITCH | $0.516254155850 P 6 / 125$ |
| PUMPI CIRCUIT BREAKER | $0.5311254)$ 51256/120 |
| PUMP2 CIRCUIT BREAKER | $063112541517256 / 720$ |
| PUMP SOFT STARIER SIZE | M005-00216. TA |
| pump rating | 2thw 5A |
| PUMP LINE CONTACTOR | (A7-30E |
| PUMP SOCKET OUTLET - WEZME SLEEVE | NOT APPLKABlit |
| PIMP MIET PLUG . hanole | AOT APPILCABLE |
| WET WELL LEVEL TRANSMITTER |  |
| DELIVERY PRESSURE TRANSMITER |  |
| RADIO | -08990-07A02-003. |
| EMERGENCY PUMPING TMME | tbasee |
| No of SINGLE POINT PROBES | 2 |
| INCOMING MANS SUPPLY CABLE | $16 \mathrm{na}{ }^{2}$ |
| MAIN EARTHINGG CABLE | $6 \mathrm{max}^{2}$ |
| SOFF STARTER 3 PHASE SUPPLY | $6 \mathrm{ma}^{2}$ |
| FLOWME TER RANGE | NOT APPLILABLE |
|  | - |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |


| STANDARD DESIGN OPTIONS |  |  |
| :---: | :---: | :---: |
| OPTION | DESCRIPTION | FITTED |
| A | INOIVIDUAL PUMP MOIS TURE IN OM (MMOI SENSOR AND FAULT TRELAY | [1a ${ }^{\text {N0 }}$ |
| B | TWOIVIUAL PUMP MOTOR AUX PROTECTION SENSORS AND FAULT RELAYS | N0 |
| $\tau$ | reflux valve lait switeh | N0 |
| 0 | Station manhole surcharge mminent | W N0 |
| E | STATION DRY WELL SUMP PUMP AND LEVEL INOICATION SENSORS AND RELAYS | N0 |
| F | Permanent generator installed | N0 |
| $\sigma$ | STATION EMERGENCY STORAGE LEVEL SENSOR \& DEWATERING PUMP | \%es No |
| H | STATION DELIVERY FLOWMETER | Wa |
| 1 | backup communication - GSM | YES $\times$ Ca |
| J | PUMP CONNECTION - (Via Direct Connection) | YES [xC |
| K | CATHOOL PROTECTION | No |
| L | MOTOR THERMISTORS - (Via Direct Connection) | YES $\mathrm{x} \times \mathrm{m}$ |
| M | Odour control | \% No |
| N | DIRECT CONNECTED METERING | YES Cx |
| 0 | PUMPS ELECTARAL INIERLOCK | [1] No |
| P | WET WELL WASHER | (1) ${ }^{\text {No }}$ |
| 0 | AUX PIT SUMP PUMP ANO LEVEL PROBE | [1] № |
| R | TELEMETRY RADIO | YES [ zac |
| 5 | WET WELL SECONDARY Level Sensor | $\square$ No |
| $\uparrow$ | WET WELL PRIMARY LEVEL SENSOR (Direct Connecteed | YES $\times$ cet |
| U | DELIVERY PRESSURE TRANSMITER (Direct Connected) | YES $\times$ cat |
| V | CHEMICAL DOSING | N N0 |
| W | PUMP START METHOD - SOFT STARTER | YES源 |
| $\times$ | 3rd PUMP INSTALLED | - No |
| Y | POWER METER | $\cdots \mathrm{NO}$ |
|  |  |  |
|  |  |  |
|  |  |  |






















SP464 James St Lowood SPS - Electrical Installation OM Manual




## 4. Inspection and Test Results

## RadCtel

## Integrated Water Management

## FAT/SAT Test Sheet

| Sales Order No: | So 212863 |  |  | Customer: | QUU VIA SJ |  |  |  | Site Name: | LOVOOD SPS 3 | Stn No: | 44 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Date: | Start Time: |  | 830 AM | Hardware | RTU: |  | Miri RD2006 |  | FileName: |  |  |  |
| $00 / 1114$ | Stop Time: |  | 319 |  | PLC: |  |  |  | FileName: |  |  |  |
| Software: | Mirimap |  |  |  | Touch Screen: |  |  |  | FileName: |  |  |  |
| Engineer: | Haneef Mustafa |  |  |  | Radio: |  | Internal Miri |  | FileName: |  |  |  |
| TASK |  | Action |  |  |  | Results (Pass/Fail) |  | Notes |  |  |  |  |
| Mains Run Test |  | RTU runs on Mains with battery disconnected |  |  |  | $\checkmark P$ |  |  |  |  |  |  |
| Battery Run Test |  | RTU runs on battery with mains disconnected |  |  |  | $\sim P$ |  |  |  |  |  |  |
| Battery Voltage |  | Mains OFF, Transmit for 20 seconds, ensure battery above 12.2 V |  |  |  | $P$ |  |  |  |  |  |  |
| Comms |  | Interrogate OK from test master station |  |  |  | , |  |  |  |  |  |  |
| Comms |  | Change of state answered first time |  |  |  | $P$ |  |  |  |  |  |  |
| Station Name and Number |  | Station added and online with correct name? |  |  |  | $P$ |  |  |  |  |  |  |
| 10 List Entered |  | Station Page IO Listed matches termination schedule? |  |  |  | $P$ |  |  |  |  |  |  |
| 10 Testing - Digital Input |  | From Terminal Strip in RTU (or inputs on RTU if no terminal strip) to SCADA Point Listing and Diagram, |  |  |  | P |  |  |  |  |  |  |

## RadCtel <br> Integrated Water Management

|  | Alarms to SMS | 7 |  |
| :---: | :---: | :---: | :---: |
| DI Point Phase | Normally Closed / Normally Open | $P$ |  |
| DI tv label descriptions | If used on diagrams | $\sim$ |  |
| DI Digital Loop Transfer parameters | Standard ? One way ? N/A ? |  |  |
| IO Testing - Digital Output | Correct Type (Pulse/Latch) and operates OK to terminal strip (check with multimeter) | - |  |
| 10 Testing - Analog Input | From Terminal Strip in RTU (or inputs on RTU if no terminal strip) to SCADA Point Listing and Diagram, Alarms to SMS | 1 |  |
| 10 Testing - Analog Output | Min, Max and Mid range OK and correct scaling to multi meter plugged into terminal strip |  |  |
| SCADA Configuration - input Parameters | Point Type (Alarm/Event) | $p$ |  |
| SCADA Configuration - input Parameters | Alarm Debounce |  |  |
| SCADA Configuration - input Parameters | SMS Numbers (If Alarm) |  |  |
| SCADA Configuration - input Parameters | Dialler Relay (If Alarm) |  |  |
| Setpoints from SCADA to site | All setpoint mappings sent from RTU to SCADA (3000/5000 not included) | - |  |



Integrated Water Management

| Setpoints from Site to SCADA | All setpoints mappings sent from RTU to SCADA (3000/5000 not included) | - |  | Contial vin |
| :---: | :---: | :---: | :---: | :---: |
| Control | Analog Control Loops Setup, enabled, tested Or N/A | - | 4 |  |
| Control | Digital \& Analog Transfers Setup, enabled, tested Or N/A | - | $k$ |  |
| Control | All peer to perr transfter tested (need to setup test peer RTUs for this) Or N/A | - | 4 |  |
| Control | Standard control sequences tested through range (bridge inputs, use analog generator and setup test peer RTUs as required) Or N/A | - | $\checkmark$ |  |
| Control | Backup control sequences tested (e.g. floats, manual) (bridge inputs, use analog generator and setup test peer RTUs as required) Or N/A | - | $V$ |  |
| Control | Exception cases tested and OK (e.g. 0\%, overscale, faults, etc) (bridge inputs, use analog generator and setup test peer RTUs as required) Or N/A | - | 11 |  |
| Nightly summary parameters | Rain Gauge and Flow Meter Pulse size. Flowmeters linked to Pulse. Or N/A |  |  |  |
| Reference numbers | Added for all pumps, valves and analogs | $\bigcirc$ |  |  |
| Poll pulse | Setup for all DI with REF number |  |  |  |
| apol | Priority Set |  |  |  |
| Nightly summary | All Pumps, Valves, Level indicators, Flow meters and |  |  |  |

## RadCtel <br> integrated Water Management

|  | Rain Gauges added |  |  |
| :---: | :---: | :---: | :---: |
| Diagrams | Setup and cross referenced |  |  |
| Events page | Working and showing events |  |  |
| Trends | Setup and working - scale correct |  |  |
| Site photo and map | Added in SCADA if required |  |  |
| Master has latest | All updates and source on Master including diagrams |  |  |
| Documentation | Termination schedule complete with any mark-ups and saved on server |  |  |
| Documentation | FAT as builts for site saved on server |  |  |
| Documentation | Photos taken and save in FAT folder of project doc on server |  |  |
|  | - Site name to identify photo | $?$ |  |
|  | - RTU with wiring details |  |  |
|  | . RTU cabinet from outside |  |  |
| Documentation | PLC, RTU, Touch screen and Radio programs saved on server and names with FAT on end |  |  |
| Documentation | All software backups and updates on saved on Radtel server |  |  |

integrated Water Management


## Factory Acceptance Test (SAT) (Regional Sites)

| Client | SJ ELECTRIC | End User | QVV |
| :--- | :--- | :--- | :--- |
| SP No - Site Name | SP 464 - JAMES ST | Date(s) | $6 / 11 / 2014$ |
| Xylem Project No. |  |  |  |

## 1 MultiSmart Information

| MS Serial No. | E 1427769 | User Password | $H B W 28 \mathrm{AS} 2$ |
| :--- | :--- | :--- | :--- |
| Firmware Ver. | 2.4 .12 | ISaGRAF Date |  |
| MAC Address | $00: 0 \mathrm{C}: 79: 00: 94: 2 \mathrm{~F}$ | ISaGRAF Version |  |

## 2 Pump Related Information



|  | Pump 1 | Pump 2 | Pump 3 |
| :--- | :---: | :---: | :---: |
| Pump Size (kW) | 2.4 kw | 2.4 kW | - |
| Full Load Current (A) | 5.6 | $\boxed{6} 6.2$ | - |
| CT Ratio | $1: 1$ | $1: 1$ | - |

## 3 Well Setpoints

Enter site specific pump setpoints (if available).

| Pump | Pump No. | Activation | Deactivation | Entered (Y/N) | Comment |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Duty | 1 | N/S | 3 | 7 |  |
| ASSIST | 2 | 17 | 5 | $y$ |  |
|  | 3 | - | - | - |  |

## 4 Alarm Setpoints

Enter the site specific alarm setpoints (if available).

| Alarm Name | Activation | Deactivation | Entered (Y/N) |  |
| :--- | :---: | :---: | :---: | :---: |
| Surcharge Imminent | 70 | 69 | $y$ |  |
| High Level Alarm | 20.4 | 19.4 | $\Varangle$ | 3.45 |
| Low Level Alarm | 1.0 | 2.0 | $y$ |  |

## 5 Secondary Controller Start Setpoint

The minimum well level that the SSCT will run at.

| SCCT Start Level* | Entered (Y/N) | Comment |
| :---: | :---: | :---: |
| $10 \%$ | $\Varangle$ |  |

* Approximately at the halfway point of the well operating range.

| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 6 Digital Inputs (Unit 1 - Top Board 3PC)

Trigger the following digital inputs via the field device if present and where possible.

| No. | Function | Pass / Fail |  |
| :---: | :--- | :--- | :--- |
| 1 | Pump 1 CtrI Power Available | PASS |  |
| 2 | Pump 1 Start Pushbutton | PASS |  |
| 3 | Pump 1 Stop Pushbutton | PASS |  |
| 4 | Pump 1 E-Stop Relay | PASS |  |
| 5 | Pump 1 Reset Pushbutton | PASS |  |
| 6 | Pump 1 Running Feedback | PASS |  |
| 7 | Pump 1 Starter Fault | PASS |  |
| 8 | Pump 1 Motor Protection | - |  |
| 9 | Spare | - |  |
| 10 | Pump 1 Reflux | - |  |
| 11 | Spare | - |  |
| 12 | Energex Mains Power | PASS |  |
| 13 | Spare* | PASS |  |
| 14 | Surge Diverter | PASS |  |
| 15 | Station Local/Remote Switch | PASS |  |
| 16 | Surcharge Imminent Level | - |  |
| 17 | Dry Well Sump Pump Running | - |  |
| 18 | Dry Well Sump Pump Healthy | - |  |
| 19 | Dry Well Flooded Alarm | - |  |
| 20 | Dry Well Flooded Trip | - |  |

* Allocated but not used for Station Mains Power


## 7 Digital Outputs (Unit 1 - Top Board 3PC \& Bottom Board 3MP)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass / Fail |  |
| :---: | :--- | :---: | :--- |
| 1 | Pump 1 Run | PASS |  |
| 2 | Pump 1 Starter Fault Reset | PASS |  |
| 3 | Pump 1 Emergency Mode Interrupt | PASS $^{\text {AS }}$ |  |
| 4 | Spare | - |  |
| 5 | Electrode Test Relay | PASS |  |
| 6 | Well Washer | - |  |
| 7 | Spare | - |  |
| 11 | Spare | - |  |
| 12 | Spare | - |  |
| 13 | Station Odour Control Run at Max | - |  |
| 14 | Spare | - |  |
| 15 | Spare | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 8 Digital Inputs (Unit 2 - Top Board 3PC)

Trigger the following digital inputs via the field device if present and where possible.

| No. | Function | Pass / Fail |  |
| :---: | :--- | :---: | :--- |
| 1 | Pump 2 CtrI Power Available | PASS |  |
| 2 | Pump 2 Start Pushbutton | PASS |  |
| 3 | Pump 2 Stop Pushbutton | PASS |  |
| 4 | Pump 2 E-Stop Relay Healthy | PASS |  |
| 5 | Pump 2 Reset Pushbutton | P-SS |  |
| 6 | Pump 2 Running Feedback | PASS |  |
| 7 | Pump 2 Starter Fault | PASS |  |
| 8 | Pump 2 Motor Protection | - |  |
| 9 | Spare | - |  |
| 10 | Pump 2 Reflux Valve | - |  |
| 11 | Surcharge Imminent Probe Fail | NoT T3TO) |  |
| 12 | RTU Battery OK | PASS |  |
| 13 | RTU Control Power | PASS |  |
| 14 | Emergency Pumping Mode | PASS |  |
| 15 | Wet Well High Level Probe | PASS |  |
| 16 | Door Security Status | PAS S |  |
| 17 | ATS / Normal Supply CB Closed | PASS |  |
| 18 | Valve Pit High Level | - |  |
| 19 | Cathodic Protection | - |  |
| 20 | Spare | - |  |

## 9 Digital Outputs (Unit 2 - Top Board 3PC)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass / Fail |  |
| :---: | :--- | :---: | :---: |
| 1 | Pump 2 Run | PASS |  |
| 2 | Pump 2 Starter Fault Reset | PASS |  |
| 3 | Pump 2 Emergency Mode Interrupt | PASS |  |
| 4 | Spare | - |  |
| 5 | Spare | - |  |
| 6 | Spare | - |  |
| 7 | Spare | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 10 Digital Inputs (Unit 2 - Bottom Board 3PC)

Trigger the following digital inputs via the field device if present and where possible.

| No. | Function | Pass/Fail |  |
| :---: | :---: | :---: | :---: |
| 1 |  |  | Comment |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |
| 13 |  |  |  |
| 14 |  |  |  |
| 15 |  |  |  |
| 16 |  |  |  |
| 17 |  |  |  |
| 18 |  |  |  |
| 19 |  |  |  |
| 20 |  |  |  |

## 11 Digital Outputs (Unit 2 - Bottom Board 3PC)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass/Fail |  |
| :---: | :---: | :---: | :---: |
| 1 |  |  | Comment |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 12 Supply Protection Faults

Adjust to the recommended threshold the following faults.

| Fault | Enabled <br> $(\mathrm{Y} / \mathrm{N})$ | Recommended <br> Threshold | Threshold | Comment |
| :--- | :---: | :---: | :---: | :--- |
| Over Voltage | Y | $115 \%$ | $1 / 5$ |  |
| Under Voltage | Y | $85 \%$ | 85 |  |
| Volts Phase Imbalance | Y | $25 \%$ | 25 |  |
| Volts Phase Rotation | Y | None | - |  |
| DC Over Voltage | Y | 29 V | 29 |  |
| DC Under Voltage | Y | 21 V | $2 /$ |  |
| Battery Over Voltage | Y | 29 V | 29 |  |
| Battery Under Voltage | Y | 21 V | $2 /$ |  |

## 13 Motor Protection Faults

Adjust to the recommended threshold the following faults.

| Fault | Enabled <br> (Y/N) | Recomm. <br> Threshold | Pump 1 <br> Threshold | Pump 2 <br> Threshold | Pump 3 <br> Threshold | Comment |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Amps Phase Imbalance | Y | $25 \%$ | 25 | 25 |  |  |
| Amps Phase Rotation | Y | None | - | - |  |  |
| Ground Fault | Y | $25 \%$ | 25 | 25 |  |  |
| Over Current | Y | $125 \%$ | 125 | 125 |  |  |
| Under Current | Y | $25 \%$ | 25 | 25 |  |  |

Note, other motor protection faults are disabled except for the Insulation Resistance tests (see Section 19.1)

## 14 Analog Inputs (Unit 1 \& Unit 2)

With the field device or current source connected, simulate a valid analog input signal for each.

| Unit | Board | Ain No. | Function | Raw Min | Raw Max | Scaled Min | Scaled Max | Pass / Fail |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unit $1-$ 3PC | Top | 1 | Level Transducer (Vega) | 4 mA | 20 mA | 0 | 100 | PASS |
|  |  | 2 | Spare | 4 mA | 20 mA | 0 | 100 | - |
| Unit 2 3PC | Top | 1 | Flow Meter PR ESSURE | 4 mA | 20 mA | 0 |  | PASS |
|  |  | 2 | Preseure Gauge Flow | 4 mA | 20 mA | 0 | 100 | - |
| Unit 2 3PC | Bottom | 1 | Pump 1 VSD Speed F/B | 4 mA | 20 mA | 0 | 100 | - |
|  |  | 2 | Pump 2 VSD Speed F/B | 4 mA | 20 mA | 0 | 100 | $\alpha$ |

## 15 Analog Outputs (Unit 1 \& Unit 2)

Configure each analog output to generate a valid output.

| Unit | Board | Aout No. | Function | Raw Min | Raw <br> Max | Scaled Min | Scaled Max | Pass / Fail |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unit 1-3PC | Top | 1 | Pump 1 VSD Speed Ref. | 4 mA | 20 mA | 0 | 100 | NotE I |
| Unit 1-3MP | Bottom | 11 | Spare | 4 mA | 20 mA | 0 | 100 |  |
|  |  | 12 | Spare | 4 mA | 20 mA | 0 | 100 |  |
|  |  | 13 | Spare | 4 mA | 20 mA | 0 | 100 |  |
| Unit 2-3PC-1 | Top | 1 | Pump 2 VSD Speed Ref. | 4 mA | 20 mA | 0 | 100 | Set Nãtl |
| Unit 2-3PC-2 | Bottom | 1 | Spare | 4 mA | 20 mA | 0 | 100 |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 16 Other Faults \& Features

Enable, configure and test the appropriate additional features.

| Feature | Threshold(s) | Pass / Fail | Comment |
| :--- | :--- | :---: | :---: |
| Well Washer |  | - |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## 17 Flow Calculations

Subject to the presence or absence of a flow meter, configure and test the flow rate. Record flow rate and volume as appropriate during after a pump cycle.

Tick the method in use for determining the flow.
ㅁ Metered Flow - see section 17.1
Calculated Flow - see section 17.2
ㅁ None

### 17.1 Meter Based Flow

| Mode | Metered F \& V | Metered Flow 口 | Metered Volume $\square$ | Calculated $\downarrow$ |
| :---: | :---: | :---: | :---: | :---: |

For 1 pump cycle simulate the flow or volume meter in operation.

| Option | Flow Rate | Volume | Pass / Fail | Comment |
| :---: | :---: | :---: | :---: | :---: |
| Metered Flow \& Volume |  |  |  |  |
| Option | Flow Rate | Calculated Volume | Pass / Fail | Comment |
| Metered Flow (der Vol) |  |  |  |  |
| Option | Calculated Flow Rate | Volume | Pass / Fail | Comment |
| Metered Volume |  |  |  |  |

### 17.2 Calculated Based Flow CACC FLOW O/SABLCD

With well volumes entered, simulate a rise and fall in level (1 minute each). Start a pump when level starts to fall.

| Inflow Rate | Outflow Rate | Volume | Comment |
| :---: | :---: | :---: | :---: |
|  |  |  |  |

## 18 FS Relay

Configure the SAFE-FS relay and test the probe input.

| Input | Pass / Fail | Comment |
| :---: | :--- | :--- |
| Alarm Probe | PASS |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 19 Scheduled Tests

### 19.1 Wet Well Calibration Test

Trigger a Wet Well Calibration test.

| Pump Run Time | \% Error Returned* | Pass / Fail | Comment |
| :--- | :--- | :--- | :--- |
|  |  |  | NOT TCJT2D |

* \% Error is contained in DNP Analog Input point 42 (ISaGRAF schedule to run tag $=116$ )


### 19.2 Electrode Test

Trigger an Electrode test for each sensor present. During the test trigger the sensor's input. (The number of sensor's present is site specific)..

| Sensor to Trigger | Pass / Fail |  |
| :--- | :---: | :--- |
| None - do not trigger any sensor | - |  |
| High Level probe | PASS |  |
| Manhole Surcharge Imminent | - |  |
| Valve Pit Flooded | - |  |
| Dry Well Flooded High | - |  |
| Dry Well Flooded Tripped | - |  |

(ISaGRAF schedule to run tag $=6$ )

### 19.3 High Level Pumping Mode

At the MultiSmart turn 'off' all pumps and let the level rise to the High Level probe. Re-enable pumps, one pump should run for the High Level Pumping time.

| High Level Pumping time | Pass / Fail | Comment |
| :---: | :--- | :--- |
| 66 S | PASS |  |

### 19.4 Emergency High Level Pumping Mode

At the MultiSmart turn 'off all pumps and let the level rise to the Surcharge Imminent Level probe. Reenable pumps, all pumps should run for the Emergency Pumping time.

| Emergency Pumping time | Pass / Fail | Comment |
| :---: | :--- | :--- |
| 606 S | Pass |  |

### 19.5 Secondary Controller Circuit Test

Trigger a Secondary Controller Circuit test. Adjust hardware timer to match the MultiSmart. Repeat if timers mismatch. For sites with 'Max Pumps to Run' $=1$, advance the clock by 1 day and repeat test.

| SCCT Run Time |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| HW Timer | MS Timer* | Pass / Fail | Comment |  |
| 10 MiNJ | 600 S | Asss |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

* Minimum recommended time is 120 s (ISaGRAF schedule to run tag $=20$ )


## 20 Soft Starter /-VFB Configuration

| VFD No. | Configured (YIN) | Configured By | Comment |
| :---: | :---: | :--- | :--- |
| 1 | $y$ | SJE |  |
| 2 | $y$ | SJE |  |
| 3 | - | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 21 Modbus Communications (MultiSmart to RD2006 Radtel Radio)

### 21.1 Hardwired

Test the following hardwired points. The value of the point should be displayed on SCADA.

| No. | Function | Logic '0' | Logic '1' | Pass / Fail | Comment |
| :---: | :--- | :---: | :---: | :--- | :---: |
| 1 | Wet Well Surcharge Imminent Din | Normal | Active | PASS |  |
| 2 | Wet Well Level | $4 \mathrm{~mA}=0 \mathrm{~m}$ | 20mA=depth | PASS |  |
| 3 | Modbus Communications Fault ${ }^{\top}$ | Active | Normal | PA-SS |  |

${ }^{\top}$ Generated Internally in the RD2006

### 21.2 Modbus Points - Discrete Inputs (10xxx)

Trigger the following events, faults \& alarms, and the corresponding point should be displayed on SCADA. (Points have been inverted where necessary within the MultiSmart to reflect the correct 'logic' state as expected by SCADA). Note, "Logic.Values.Digital01" is used to pad out the points to 64.

| No. | Address | Function | Logic '0' | Logic '1' | Pass/Fail | Comment |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1-10 | 10001-10 | Logic.Values.Digital01 | - | - | - |  |
| 11 | 10011 | Pump 1 Running | Off | On | PASS |  |
| 12 | 10012 | Pump 1 Healthy / Fault | Active | Normal | PASS |  |
| 13 | 10013 | Pump 1 Ctrl Power Circuit Fault | Active | Normal | PAES |  |
| 14 | 10014 | Pump 1 Starter Fault / Moisture in Oil | Active | Normal | PASS |  |
| 15 | 10015 | Pump 1 Reflux Valve Fail to Close Fault | Active | Normal | - |  |
| 16-20 | 10016-20 | Logic.Values. Digital01 | - | - | ${ }^{-}$ |  |
| 21 | 10021 | Pump 2 Running | Off | On | AASS |  |
| 22 | 10022 | Pump 2 Healthy / Fault | Active | Normal | PALS |  |
| 23 | 10023 | Pump 2 Ctrl Power Circuit Fault | Active | Normal | PASS |  |
| 24 | 10024 | Pump 2 Starter Fault / Moisture in Oil | Active | Normal | PASS |  |
| 25 | 10025 | Pump 2 Reflux Valve Fail to Close Fault | Active | Normal | - |  |
| 26-50 | 10026-50 | Logic. Values. Digital01 | - | - | - |  |
| 51 | 10051 | Battery System Fault | Active | Normal | Pass |  |
| 52 | 10052 | RTU Power Supply Fault | Active | Normal | Pass |  |
| 53 | 10053 | Station Surge Diverter Fault | Active | Normal | Pass |  |
| 54 | 10054 | Station Mains Power Fault | Active | Normal | Pass |  |
| 55 | 10055 | Station Security Alarm | Active | Normal | PASS |  |
| 56 | 10056 | ATS Position Normal Supply CB Closed | Active | Normal | Pass |  |
| 57 | 10057 | Pit Flooded | Active | Normal | - |  |
|  |  | Pump 1 Emergency Stop Pressed | Normal | Active | PASJ |  |
| 58 | 10058 | Pump 2 Emergency Stop Pressed | Normal | Active | PASS |  |
| 59 | 10059 | Emergency Pumping Mode (Backup on) | Normal | Active |  |  |
| 60 | 10060 | Station in Remote | Local | Remote | PASS |  |
| 61 | 10061 | Wet Well High Level Alarm (bothreeurees) | Normal | Active | PASS |  |
| 62-64 | 10062-64 | Logic. Values. Digiatl01 | - | - | - |  |

### 21.3 Modbus Points - Input Registers (30xxx)

Test the following analog points and the value of the point should be displayed on SCADA.

| No. | Function |  | Range | Pass / Fail | Comment |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 30011 | Pump 1 VSD Speed 0-100\% | 0-100\% |  | NOTE 1 |
| 2 | 30021 | Pump 2 VSD Speed 0-100\% | 0-100\% |  | NoTEI |
| 3 | 30031 | Reesure- |  | - |  |
| 4 | 30041 | Flow Aleler / RE3SUK |  | PASS |  |


| Date | No. of Alterations | Signature |
| :---: | :--- | :--- |
|  |  |  |

## 1. Due to Rain unabie to complent conazuenpor pak

 mutismat to soptsimer comms.
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| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 23 Sign Off of FAT Results

The following parties were either present, witnessed or participated in performing the Factory Acceptance tests on the MultiSmart.

Client: SJ ELECTRIC
SAT Location: JAMES ST, LO Woad
Date: $6 / 11 / 2014$
Time: $\qquad$

Parties Present:

1. $X Y C E M$
2. ST ELECTRIC
3. 

Qu V
4. RADTEL

## Participants / Authorised Witnesses:



| Site ID SP464 | Site Name - James Street | Date 18-8-14 | $11 / 08 / 2014$ |
| :--- | :--- | :--- | :--- |

## A. Electrical Installation Test Records

AS/NZS 3000:2007 requires that prior to placing an electrical installation or any part thereof in service following its construction, alteration, addition or repair, it shall be inspected and tested to verify that the installation is safe to energize and that it will operate correctly in accordance with the requirements of AS3000:2007.
This section is aimed to ensure that the switchboard manufacturer has carried out and documented all applicable AS3000:2007 tests considered as mandatory, prior to execution of the Factory Acceptance Test.
AS/NZS 3017 Electrical Installations - Verification Guidelines provides inspection, test methods and test acceptance parameters to verify AS3000:2007 safety requirements, however these methods are provided for guidance and other alternative methods are acceptable, AS3017:2007 may be applied through legislative requirements made in each State and Territory of Australia and in New Zealand.

| Item <br> No. Activity Description |
| :--- |
| A.1 |


| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |
|  |  |  |  |  |  | AS3000:2007 Section 8.3.7 |
|  |  |  |  |  |  | AS3017:2007 Sections 3.3 and 3.5 |
| A. 4 | Records for the verification of Correct Circuit connection tests records shall include: <br> a) Interconnection between conductors of different circuits <br> b) Socket-Outlet Sub-Circuits <br> c) Lighting Points <br> d) Equipment Sub-circuits | $\begin{aligned} & 1 \\ & 1 \\ & 1 \\ & 1 \end{aligned}$ |  |  |  | For acceptance criteria and test methods refer to: <br> AS3000:2007 Section 8.3.8 <br> AS3017:2007 Section 3.4 |
| A. 5 | Records for the verification of operation of RCD's shall include: <br> a) Circuits protected by an RCD | $1$ |  |  | $H$ | For acceptance criteria and test methods refer to: <br> AS3000:2007 Section 8.3.10 <br> AS3017:2007 Section 3.7 |

## Company Name: SJ Electric Group Qld

Contractor's Tester Name: Nick Small
QUU Electrical Inspector Name: John Clayton

Signature
signature......$C l a n$

Company Electrical Licence No: 129881

$$
\text { Date } 18-8-14
$$

Date 25-8-14

## B. Testing Area, Documentation and Test Set Up Arrangements

This section is aimed to ensure that all documentation and test set up arrangements have been provided to allow execution and readiness to carry out the FAT.

| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |
| B. 1 | Verify that a suitable test area has been provided, the test area shall be: <br> - Clearly identified and barricaded <br> - Test bench with enough space for testing equipment and documentation <br> - Well ventilated | $1$ |  |  |  |  |
| B. 2 | All testing equipment to simulate field inputs and outputs including field instruments and motors shall be pre-connected | $/$ |  |  |  |  |
| B. 3 | Progressive "As Built" drawings marked up available. | / |  |  |  |  |
| B. 4 | "Point to Point" test drawing and Function Test schematic mark-ups provided | $1$ |  |  |  | A set for each |

## Company Name: SJ Electric Group Qld

Contractor's Tester Name: Nick Small
QUU Electrical Inspector Name: John Clayton
DOCID: CHEI35

C-tusers\Anand.Kumar\Desktop \Oo QU Sewage Pump
File Path: $\quad$ Station $\times 7,43402231$ SP464 James Stree $\backslash$ Test Sheets \QUU FAT document_James St.docx

## C. Visual Inspections - Sheet Metal / Mechanical Construction Works

The following visual inspections shall take place previous to energising the switchboard circuits. All power supplies shall be disconnected, including the main power supply, generator power supplies and battery power supplies.

| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comment |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |  |  |
| C. 1 | Switchboard dimensions correct as per contract drawings | / |  |  |  |  |  |  |
| C. 2 | Panel layout as per drawings | 1 |  |  |  |  |  |  |
| C. 3 | All equipment is to be removable from switchboard via front access. | 1 |  |  |  |  |  |  |
| C. 4 | Power distribution chassis not to be installed too close to the left of the door aperture | $I$ |  |  |  |  |  |  |
| C. 5 | Check operation and orientation of doors and door handles | $/$ |  |  | $V$ |  |  |  |
| C. 6 | Switchboard mounting feet as per drawing | $/$ |  |  |  |  |  |  |
| C. 7 | Material finish as per specification | $l$ |  |  |  |  |  |  |
| C. 8 | IP Rating as per specifications. Fitting of sun shields shall maintain IP56 rating. | $/$ |  |  |  |  |  |  |
| C. 9 | All bolts fitted / tight | 1 |  |  |  |  |  |  |
| C. 10 | All sheet metal edging to be de-burred, special attention given to handle/lock |  |  |  |  |  |  |  |
| Docio: | CHEI35 | $\begin{aligned} & \text { Active Date: } 4 \text { Suly } 2013 \\ & \text { Dote: } 4 / 7 / 15 \end{aligned}$Date: 4/7/15 |  |  | Review Dote: $477 / 154$ July 2013 |  | Review | Printed at $3: 02$ PM on $8 / 108$, |
| fie Path: | C: Uusers Anand.Kumar\Desktop $\backslash 06$ QU Sewage Pump Station $\times$ 入 43402231 SP464 James Streef $\backslash$ Test Sheets $\backslash$ QUU FAT document_James St.docx |  |  |  |  |  |
| Q-Pulse Id: TMS1412 |  | Active: 30/09/2015 |  |  |  |  |  | Page 1328 of 1382 |




| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |
| C. 29 | A minimum clearance of 55 mm shall be provided around the Redlion HMI to other components mounted in common controls door. |  |  | $/$ |  |  |
| C. 30 | Check that selector switches are correctly engraved | $\sqrt{ }$ | / |  |  | Warting on 'on' off N.S |
| C. 31 | Check that Indicators are fitted with correct coloured bezels | $/$ |  |  |  |  |
| C. 32 | Verify that all external labels are fitted to the switchboard. |  | $1$ |  |  | warting Compliance labcl |
| c. 33 | Labelling is correct and complete wording, size, fixing, material, level. | $1$ |  |  |  |  |
| C. 34 | All internal and external labels are to have bevelled edges, sharp edges are not allowed. |  |  |  |  | $\cdots+\rho$ |
| C. 35 | Verify that 240VAC warning sign is fitted to the switchboard. | $/$ |  |  |  | please Fill N.G |

## Company Name: SJ Electric Group Qid

Contractor's Tester Name: Nick Small
QUU Electrical Inspector Name: John Clayton

Company Electrical Licence No: 129881
Date $18-8-14$
Date $27 / 8 / 14$

C: \Users \Anand.Kumar $\backslash$ Desktop $\backslash 06$ QU Sewage Pump
File Path: $\quad$ Station $\times 7 \backslash 43402231$ SP464 James Street $\backslash$ Test Sheets $\backslash Q U U$ FAT document_James St.docx
D. Visual Inspections- Neutral and Earthing

A visual inspection shall be made when work on an electrical installation has been completed in order to verify that the work complies with the requirements of AS/NZS 3000.

The visual inspection shall be carried out before, or in association with testing, and as far as possible it should be made before the electrical installation is placed in service.


## E. Visual Inspections - Electrical Components Mounting, Wiring and Labelling

As a minimum a visual inspection shall be made when work on an electrical installation has been completed in order to verify that the work complies with the requirements of AS/NZS 3000. This visual inspection section includes AS/NZS 3000 checks as well as several checks to verify that the electrical installation meets the specific design and quality requirements and scope of work.
The visual inspection shall be carried out before, or in association with testing, and as far as possible it should be made before the electrical installation is placed in service.




Pre Factory Inspection Tests

| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |
| E. 28 | Multicore cables shall be used for RTU harnesses to provide neat wiring installation. | $/$ |  |  |  |  |
| E. 29 | Verify that adequate access to RTU and communication plug is provided | $/$ |  |  |  |  |
| E. 30 | Modbus communication cables (RS 485) shall be 1200 hm impedance twisted pair's. | $/$ |  |  |  | Road Worx is a good cable to use |
| E. 31 | Aerial surge arrestor shall be mounted with a small section of DIN rail | $/$ |  |  |  | the earthed shall be run as directly as possible 6 mm |
| E. 32 |  |  |  |  |  |  |
| E. 33 |  |  |  |  |  |  |
| E. 34 |  |  |  |  |  |  |
| E. 35 |  |  |  |  |  |  |

Company Name: SJ Electric Group Qld
Contractor's Tester Name: Nick Small
QUU Electrical Inspector Name: John Clayton

Signature
Signature

Company Electrical Licence No: 129881
Date 18-8-14
Date $27 / 8 / 14$
F. Live Power and Operational Tests

The following tests shall be made with all switchboard electrical circuits energized in order to check that the switchboard meets all operational requirements.

| Item <br> No. | Activity Description |  |  | Contractor <br> Results |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| QUU |  |  |  |  |


| Item No. | Activity Description | Contractor Results |  |  | Signed QUU | Comments |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Pass | Fail | N/A |  |  |
| F. 10 | Record output of 24 VDC power supply when disconnected to 240 VAC main. | $/$ |  |  |  |  |
| F. 11 | RTU provided with corresponding firmware/ software |  |  | $l$ |  | Software Version: |
| F. 12 | Redlion HMI provided with corresponding software configuration |  |  | 1 |  | Software Version: |
| F. 13 | I/O tested to RTU terminals |  |  | / |  |  |
| F. 14 | Manual functions tested as per the below list | $1$ |  |  |  | Before the function test the RTU \& Redlion has been loaded with the correct code OK |

## "CONTRACTOR FUNCTION TEST ACTIVITIES"



| Task | Outcome |  |
| :---: | :---: | :---: |
| Using the schematic page I/O list check each individual physical I-O <br> Wired to the RTU from beginning to end. <br> ie press the actual button and watch the I-O change in the Redlion debug page <br> Output lights and relays activate <br> Inject 4-20mA into the Analog Inputs monitor the result on the Redlion debug page <br> The schematic page I/O should be highlighted and signed by the tester and attached to this FAT Test Document. Also confirm that the display panel is showing the correct information during each point to point check | $\begin{array}{ll} \text { OK } \\ \text { OK } \end{array}$ | $N / A$ |
| Run Both pumps (Check for Interlocking) <br> Turn the station to local and start pump 1. <br> Then simultainiuosly start pump 2 . <br> Stop both pumps and then start pump 2. and then start pump 1. Confirm test results match expected. Repeat this exersize via the emergency peump mode switches and in remote, inhect a wet well level signal above the duty " $B$ " start point. <br> (For Interlocked sites - also complete the next section) | 2 pumps r/an <br> Site is Interlocked $\square$ | No interloch |


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| For a generator only interlocked site |  |
| :--- | :--- |
| Ensure that 2 pumps can run simultaneously when the station is powered by Energex. | OK |
| (From the RTU. Emergency Pumping Circuit and the Emergecy Pumping Mode Switch) |  |
| Ensure that the 2 pumps can not run either from a RTU command, Emergency Pumping |  |
| Circuit or the Emergecy Pumping Mode Switch while the stations is powered from the |  |
| Generator |  |
| Pump Faulted Scenario |  |
| Ensure that if pump 1 is faulted, pump 2 can still start both via the RTU and the Emergency |  |
| Pumping Circuit. |  |
| Ensure that if pump 2 is faulted, pump 1 can still start both via the RTU and the Emergency |  |
| Pumping Circuit. | OK OK |




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## G. Non-Conformances and Unauthorised Modifications


G. 7 multismare Ami Does not Alow Now R To OPEN

Company Name SJ Electric Group Qld

## Contractor's Tester Name Nick Small

 QUU Electrical Inspector Name John Clayton

[^66]
## Inspection and Test Check List

| Project: James ST SPS SP4. | SP4 |  |  |
| :--- | :--- | :--- | :--- |
| Contractor/Order No. | Date: $18-8-14$ | Corresponding Job No. 43402231 |  |
| ITC No. 003 | No. 001 |  |  |

General Data

| Built By: Jerry. A Jimmy.W. Aaron.M | Test Equipment: Multi meter Megear |  |  |
| :--- | :--- | :--- | :--- |
| Location Tested: SJ Workshor | Type: | Mutie | Kyontsu |
| Drg Rev No. | Serial No. | 1342041 | 5149622 |

Check List (Tick () acceptable items only, note deviations under "REMARKS") (If not applicable mark as N/A)

| Switch Board and Control Panels Construction Cheek List |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| "This check list is to be used in conjunction with the correct construct schematic/wiring diagrams |  |  |  |  |
| Item | Activity Description | Hold Points | Checked | By (Initial) |
|  | Busbar |  | ( ) |  |
| 1 | Correct size busbar to rated current load to meet AS 2067 |  | (1) |  |
| 2 | Appearance is good i.e. Straight \& level |  | () |  |
| 3 | Correct phase identification |  | (.) |  |
| 4 | Correct hole sizes for joins and terminations |  | (\%) |  |
| 5 | All clearances have been meet |  | ( $)$ |  |
| 6 | Correct busbar support material has been used and edges sealed with varnish. |  | ( $)$ |  |
| 7 | Busbar supports are at the correct distances apart |  | $(\lambda)$ |  |
| 8 | Correct tensioning at all joins \& terminations and witnessed marked. |  | $(6$ |  |
| 9 | Correct hole format in joining cubicle |  | () |  |
| 10 | Sufficient clearances for terminating cable |  | ( 10 |  |
| 11 | All joins are dressed flat |  | ( 1 |  |
| 12 | Busbar is insulated at supports when required, |  | ( $)$ |  |
| Cabling |  |  |  |  |
| 13 | Correct size for demand of circuit |  | (\%) |  |
| 14 | Correct phase colouring |  | (6) |  |
| 15 | Correct termination \& insulated |  | ( $)$ |  |
| 16 | Correct numbering |  | ( 10 |  |
| 17 | Correctly formed and neat |  | ( 5 |  |
| 18 | Correctly supported |  | ( 7 |  |
| 19 | All cable entry holes are insulated |  | (5) |  |
| 20 | Check cable tray is mounted correctly \& all sharp surfaces are removed |  | $15$ |  |
| 21 | All cable ties are neatly trimmed |  | ( 8 |  |
| 22 | All cable clear from busbar's |  | ( |  |
| 23 | Check all analog inputs and outputs are shielded |  | ( 1 |  |
| 26 | All shielded cables have been earthed |  | ( 1 |  |
| Remarks/Remedial Action Required Hold Points: |  |  |  |  |

## Inspection and Test Check List



## Inspection and Test Check List

| Switch Board and Control Panels Construction Check List (SJQF 502) |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Item | Activity Description | Hold Points | Checked | By (Initial) |
| Fuses |  |  | 1 |  |
| 1 | Check that the cartridge is correct size |  | ( 1 ) |  |
| 2 | Correct mountings |  | ( 1 |  |
| 3 | Correct labelling |  | ( $)$ |  |
| 4 | Check that line side conductors are SDI |  | ( |  |
| Current Transformers |  |  |  |  |
| 5 | Correct ratio \& size |  | ( ) |  |
| 6 | Correct direction of feed |  | () |  |
| 7 | Correct earthing |  | (1) |  |
| 8 | Correct cabling |  | ( ) |  |
| Voltage / Current Monitoring Equipment |  |  |  |  |
| 9 | Correct voltage / current range on meter to the installation |  | ( ) |  |
| 10 | Correct Ct Ratio |  | ( ) |  |
| 11 | Voltmeter terminations are insulated |  | () |  |
| 12 | Check that all meters are preset to zero |  | ( |  |
| 13 | Correct indication labels applied |  | ( ) |  |
| Indication Equipment |  |  |  |  |
| 14 | Correct colour |  | (1) |  |
| 15 | Correct voltage size with matching lamp attached |  | ( |  |
| 16 | Correct operation eg. Push to test |  | ( 1 |  |
| 17 | Correct labelling |  | (1) |  |
| Terminal Blocks |  |  |  |  |
| 18 | Correct size to cable |  | $1 /$ |  |
| 19 | Correct colour coding |  | (\%) |  |
| 20 | Correct numbering |  | ( 1 ) |  |
| 21 | Correctly mounted with lock ends |  | ( |  |
| 22 | Correct labels |  | ( 1 |  |
| Neutral Links |  |  |  |  |
| 23 | Check that they are accessible |  | (1) |  |
| 24 | Correct labelling |  | ( 1 |  |
| 25 | Correct numbers stamped to match circuit identification |  | (1) |  |
| 26 | Correct cabling to circuit identification |  | (1) |  |
| 27 | Check that all neutral links \& bar are insulated from the switchboard frame |  | $(1)$ |  |
| Earthing |  |  |  |  |
| 28 | Check that all main earth bar is correct size |  | ( |  |
| 29 | Check that the main earth is continuous |  | ( 1 |  |
| 30 | Correctly labelled |  | ( 8 |  |
| 31 | Continuous for CT wiring |  | $($ |  |
| 32 | Check that all doors with equipment mount are electrically earth |  | $1 / y$ |  |
| 33 | Check all frames are earthed |  | $(5)$ |  |
| Remarks/Remedial Action Required: |  |  |  |  |

Inspection and Test Check List

| Switch Board and Control Panels Construction Check List (SJQF 50 |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| Item | Activity Description | Hold Points | Checked | By (Initial) |
| Earthing Resistance \& Continuity Test (Note all readings should be $<0.5 \Omega$ ) |  |  |  |  |
| 1 | Make sure the MEN connection is removed |  | ( $)$ |  |
| 2 | Attach lead to main earth connection point than test with other lead between |  | $1 y$ |  |
| 3 | The frame of each section |  | $(7)$ |  |
| 4 | The doors |  | (8) |  |
| 5 | All mounting bolts to all equipment |  | (5) |  |
| 6 | All brackets |  | ( 5 |  |
| 7 | All earth links |  | ( 5 |  |
| 8 | All bolts \& threads for the mounting of escutcheon |  | ( $)$ |  |
| 9 | All gland plates |  | ( 8 |  |
| 10 | All cable trays |  | ( 8 |  |
| 11 | All earth connection |  | (\%) |  |
| 12 | Earth secondary of transformers and power supplies where applicable |  | ( 5 |  |
| 13 | Earth surge diverters |  | ( $)$ |  |
| 14 | Current transformers |  | 5 |  |
| Insulation Test |  | Hold Points | Test Result | By (Initial) |
| 1 | Make sure all control fuses and earths are removed from all electronic equipment before this test is carried out |  | $15$ |  |
| 2 | Set insulation tester (meggar) to 500 volts before proceeding. Note reading to be $>1 \mathrm{M} \Omega$ |  | $(\gamma$ |  |
| 3 | Test between: <br> - Red - White |  | $/$ |  |
|  | - Red-Blue |  | $/$ |  |
|  | - Red - Earth |  | 7 |  |
|  | - Red - Neutral |  | 1 |  |
|  | - White - Blue |  | I |  |
|  | - White - Earth |  | 1 |  |
|  | - White - Neutral |  |  |  |
|  | - Blue - Earth |  | 7 |  |
|  | - Blue - Neutral |  | 7 |  |
| 4 | If all readings are clear the insulation tester is to be set at 1000 volts then proceed with the following Note reading to be $>1 \mathrm{M} \Omega$ |  | ( ) |  |
| 5 | Test between: <br> - Red - White |  | $/$ |  |
|  | - Red-Blue |  |  |  |
|  | - Red - Earth |  |  |  |
|  | - Red - Neutral |  |  |  |
|  | - White - Blue |  |  |  |
|  | - White - Earth |  |  |  |
|  | - White - Neutral |  |  |  |
|  | - Blue-Earth |  | $1 /$ |  |
|  | - Blue - Neutral |  |  |  |
| Remarks/Remedial Action Required: |  |  |  |  |

## Inspection and Test Check List

| Switch Board and Control Panels Construction Check List |  |  | (SJQF 502) |  |
| :---: | :---: | :---: | :---: | :---: |
| Item | Activity Description | Hold Points | Checked | By (Initial) |
| 2.5 KV TestThis test is used to prove all busbar construction |  |  |  |  |
| 1 | Make sure all costrol fuses and earths are removed from all electronic equipmentbefore this test is carried out |  | ( ) |  |
| 2 | All the following tests thst be set at a 1 minute time period |  | ( ) |  |
|  |  | Hold Points | Test Result | By (Initial) |
| 3 | Test between: <br> - Red - White |  |  |  |
|  | - Red - Blue |  |  |  |
|  | - Red - Earth |  |  |  |
|  | - Red - Neutral |  |  |  |
|  | - White - Blue |  |  |  |
|  | - White - Earth |  |  |  |
|  | - White - Neutral |  |  |  |
|  | - Blue-Earth |  |  |  |
|  | - Blue - Neutral |  |  |  |
| Supply Authority section |  |  |  |  |
| 1 | Check supply authority main isolator lockable in the on position |  | + |  |
| 2 | Check all doors before the Ct's. Or meters are lockable |  | $(-)$ |  |
| 3 | Check where the neutral link is located for the site connection if metres are remotely mounted |  | $1 y$ |  |
| 4 | Check where the earth link is located for the site connection if meters are remotely mounted |  | ( 7 |  |
| 5 | Check double insulated cable for POT fuses are less than 500 mm |  | $(-)$ |  |
| 6 | Check double insulated cable are taken on line side of Ct.s |  | $\rightarrow$ |  |
| 7 | Check meter wiring is in building wire and correct size |  | (1) |  |
| 8 | Check if Ct meter wiring is in steel conduit when closer than 100 mm to other conductors |  | $\rightarrow$ |  |
| 9 | Check there is no equipment connected before on the line side of meters or Ct.s (i.e., surge diverters) |  | ( y |  |
| 10 | Check list may vary if switch board is going interstate. Alter where applicable |  | $1$ |  |
| 11 | Provide black wrap when needed |  | (1) |  |
| Remarks/Remedial Action Required: |  |  |  |  |

## Inspection and Test Check List



All the above signatories certify that the Electrical switchboard work listed has been checked and tested in accordance with the prescribed procedure and that such work complies in every respect with the requirements of the Electricity Act 2002, AS3000 2007 and AS3008.1 1998

## Factory Acceptance Test (FAT)

| Client | SJ ELECTRIC | End User | QUU |
| :--- | :--- | :--- | :--- |
| SP No- Site Name | SP4 64 - JAMES ST | Date(s) | $25 / 08 / 14-28 / 08 / 14$ |

## 1 MultiSmart Information

| MS Serial No. | El427769 | User Password | $1+B w 28 \mathrm{ASZ}$ |
| :--- | :--- | :--- | :--- |
| Firmware Ver. | $2 \cdot 4 \cdot 12$ | ISaGRAF Date |  |
| MAC Address | $00: 0 \mathrm{C}: 79: 00: 94: 2 \mathrm{~F}$ | Part No. | MSM-QUU2 |

## 2 Pump Related Information

| Pump Control Mode | DOLD S/S VFD | Model | DANFOSS BMCDS0021B |
| :---: | :---: | :---: | :---: |
| Pump Count | 2 |  |  |
| Max Pumps to Run | 2 |  |  |
| Pump Alternation Mode | STD Alternation |  |  |


|  | Pump 1 | Pump 2 | Pump 3 |
| :--- | :---: | :---: | :---: |
| Pump Size (kW) | $2 \cdot 4$ | $2 \cdot 4$ |  |
| Full Load Current (A) | 5 | 5 |  |
| CT Ratio | NA $(1: 1)$ | NA (1:1) |  |

## 3 Well Setpoints

Enter site specific pump setpoints (if available).

| Pump | Pump No. | Activation | Deactivation | Entered (Yes/Test Setpoints) |
| :---: | :---: | :---: | :---: | :--- |
| Duty | 1 | 40 | 23 | TEST/NE SETPOINT |
| Assist | 2 | 50 | 23 | TESTML SETPONT |
| Standby | 3 | - | - |  |

## 4 Alarm Setpoints

Enter the site specific alarm setpoints (if available).

| Alarm Name | Activation | Deactivation | Entered (Yes/Test Setpoints) |
| :---: | :---: | :---: | :---: |
| Surcharge Imminent | 87-00 | 86-00 | TESDM SETPOMT |
| High Level Alarm | 65.00 | 66.00 | TESTING SETPOMT |
| Low Level Alarm | 18.00 | 19.00 | TESTNG SETPANT. |

## 5 Secondary Controller Start Setpoint

The minimum well level that the SSCT will run at.

| SCCT Start Level* | Entered (Yes/Test Setpoints) |
| :---: | :---: |
| 25 | $>^{*} \in 3$ |

*Approximately at the halfway point of the well operating range.

| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 6 Digital Inputs (Unit1-Top-Board 3PC)

Trigger the following digital inputs via the field device if present and where possible.


## 7 Digital Outputs (Unit 1 - Top Board 3PC \& Bottom Board 3MP)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass/Fail | Comment |
| :---: | :--- | :---: | :--- |
| 1 | Pump 1 Run | PASS |  |
| 2 | Pump 1 Starter Fault Reset | PASS |  |
| 3 | Pump 1 Emergency. Mode <br> Interrupt Relay |  | NoT TEJTeD - CONE C/FWGE REQ. |
| 4 | Pump 1 IRT Isolation Contactor | - | No MoRE |
| 5 | Pump 1 Reverse Run | - |  |
| 6 | Chemical Dosing Unit Run | - |  |
| 7 | RTU Battery System Test | - | NO MDRE |
| 11 | Electrode Test | PAS S |  |
| 12 | Generator Remote Start/Exercise | - |  |
| 13 | Station Odour Control Run at Max | - |  |
| 14 | Cathodic Rectifier Interrupt | - |  |
| 15 | Cathodic Protection Fault | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 8 Digital Inputs (Unil-2-Tep-Beard 3PC)

Trigger the following digital inputs via the field device if present and where possible.

|  |  | Trigger | No Fault |  |
| :---: | :---: | :---: | :---: | :---: |
| No. | Function | Pass / Fail | Pass / Fail | Comment |
| 1 | Generator Fault | - |  |  |
| 2 | Generator Warning | - |  |  |
| 3 | Generator Low Fuel | - |  |  |
| 4 | Generator Running | - |  |  |
| 5 | Generator Medium Fuel | - |  |  |
| 6 | Generator Canopy Door Open | - |  |  |
| 7 | Generator CBs Tripped | - |  |  |
| 8 | Generator Not in Auto | - |  |  |
| 9 | Generator On Site | - |  |  |
| 10 | Automatic Transfer Switch | PASS |  |  |
| \# | Station Security Alarm (Door switch) | PASS |  |  |
| 12 | Pump 2 Moisture in Oil | - |  |  |
| 13 | Pump 2 Motor Protection | $\checkmark$ |  |  |
| 14 | Pump 2 Reflux Valve | - |  |  |
| 18 | Pump 2 Running | PASS |  |  |
| 16 | Pump 2 Starter Fault | PASS |  |  |
| 17 | Pump 2 Ctrl Power Available | PASS |  |  |
| 18 | Powerbox Power Supply-Battery Ok ${ }^{*}$ | PASS |  |  |
| 19 | Powerbox Power Supply-Power On (Powerbox RTU Power Fault) | PASS |  |  |
| 20 | Spare | - |  |  |

*Appears after a'Failed Battery Fest'

## 9 Digital Outputs (Unit 2 - Top Board 3PC)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass / Fail | Comment |
| :---: | :--- | :---: | :---: |
| 1 | Pump 2 Run | PASS |  |
| 2 | Pump 2 Starter Fault Reset | PASS |  |
| 3 | Pump 2 Emergency Mode Interrupt <br> Relay |  | Nor TESTED - CODE CHAM6E RECR, |
| 4 | Pump 2 IRT Isolation Contactor | NA | NO MORE |
| 5 | Pump 2 Reverse Run | NA | NO MOLE |
| 6 | Station Power Available | NA | NO MORC |
| 7 | Spare | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 10 Digital Inputs (Unit 2-Bottom-Board 3PC)

Trigger the following digital inputs via the field device if present and where possible.


## 11 Digital Outputs (Unit 2 - Bottom Board 3PC)

Where possible during normal station operation, trigger the following digital outputs.

| No. | Function | Pass / Fail | Comment |
| :--- | :--- | :---: | :---: |
| 1 | Pump 3 Run | - |  |
| 2 | Pump 3 Starter Fault Reset | - |  |
| 3 | Pump 3 Emergency Mode Interrupt <br> Relay | - |  |
| 4 | Pump 3 IRT Isolation Contactor | - |  |
| 5 | Pump 3 Reverse Run | - |  |
| 6 | Dry Well Strobe Light | - |  |
| 7 | Well Washer | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 12 Supply Protection Faults

Adjust to the recommended threshold the following faults.

| Fault | Enabled <br> (Y/N) | Recommended <br> Threshold | Threshold | Comment |
| :--- | :---: | :---: | :--- | :--- |
| Over Voltage | Y | $115 \%$ | $1 / 5$ |  |
| Under Voltage | Y | $85 \%$ | 85 |  |
| Volts Phase Imbalance | Y | $25 \%$ | 25 |  |
| Volts Phase Rotation | Y | None | - |  |
| DC Over Voltage | Y | 29 V | 29 |  |
| DC Under Voltage | Y | 21 V | 21 |  |
| Battery Over Voltage | Y | 29 V | 29 |  |
| Battery Under Voltage | Y | 21 V | $2 /$ |  |

## 13 Motor Protection Faults

Adjust to the recommended threshold the following faults.

| Fault | Enabled <br> $(\mathrm{Y} / \mathrm{N})$ | Recomm. <br> Threshold | Pump 1 <br> Threshold | Pump 2 <br> Threshold | Pump 3 <br> Threshold | Comment |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| Amps Phase Imbalance | Y | $25 \%$ | 25 | 25 |  |  |
| Amps Phase Rotation | Y | None | - | - |  |  |
| Ground Fault | Y | $25 \%$ | 25 | 25 |  |  |
| Over Current | Y | $125 \%$ | 125 | 125 |  |  |
| Under Current | Y | $25 \%$ | 25 | 25 |  |  |

Note, other motor protection faults are disabled except for the Insulation Resistance tests (see Section 19.1)

## 14 Analog Inputs (Unit 1 \& Unit 2)

With the field device or current source connected, simulate a valid analog input signal for each.

| Unit | Board | Ain No. | Function | Raw Min | Raw Max | Scaled Min | Scaled Max | Pass / Fail |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Unit 1 3PC | Top | $1^{*}$ | Level Transducer (Vega) | 4 mA | 20 mA | 0 | 100 | PASS |
|  |  | 2 | Chemical Dosing | 4 mA | 20 mA | 0 | 100 | Pass |
| Unit 2 3PC | Top | 1 | Flow-Meter PRESSURE | 4 mA | 20 mA | 0 |  | PASI |
|  |  | 2 | Pressure Gauge | 4 mA | 20 mA | 0 |  | Pass |
| Unit 2 3PC | Bottom | 1 | Emergency Storage Level | 4 mA | 20 mA | 0 | 100 | PASS |
|  |  | 2 | Cathodic Protection Current | 4 mA | 20 mA | 0 | 100 | PASS |

*Default source for U1 TopBoard Ain is IsagrafValues.CDCFlowScaled

## 15 Analog Outputs (Unit 1 \& Unit 2)

Configure each analog output to generate a valid output.

| Unit | Board | Aout No. | Function | Raw <br> Min | Raw <br> Max | Scaled <br> Min | Scaled <br> Max | Pass / Fail |
| :--- | :--- | :---: | :--- | :---: | :---: | :---: | :---: | :---: |
| Unit 1-3PC | Top* | 1 | Chem. Dosing Speed | 4 mA | 20 mA | 0 | 100 | - |
| Unit 1-3MP | Bottom | $11,12,13$ | Spare | 4 mA | 20 mA | 0 | 100 | - |
| Unit 2-3PC-1 | Top | 1 | Spare | 4 mA | 20 mA | 0 | 100 | - |
| Unit 2-3PC-2 | Bottom | 1 | Spare | 4 mA | 20 mA | 0 | 100 | - |

*Default value is Isagraf5.Values.CDCFlowScaled

| Date | No, of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 16 Other Faults \& Features

Enable, configure and test the appropriate additional features.

| Feature | Threshold(s) | Pass / Fail | Comment |
| :--- | :--- | :---: | :---: |
| Well Washer |  | - |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

## 17 Flow Calculations

Subject to the presence or absence of a flow meter, configure and test the flow rate. Record flow rate and volume as appropriate during after a pump cycle.

### 17.1 Meter Based Flow

| Mode | Metered F \& V $\square$ | Metered Flow $\square$ | Metered Volume $\square$ | Calculated ${ }^{\text {d }}$ |
| :---: | :---: | :---: | :---: | :---: |

For 1 pump cycle simulate the flow or volume meter in operation.

| Option | Flow Rate | Volume | Pass / Fail | Comment |
| :---: | :---: | :---: | :---: | :---: |
| Metered Flow \& Volume |  |  |  |  |
| Option | Flow Rate | Calculated Volume | Pass / Fail | Comment |
| Metered Flow (der Vol) |  |  |  |  |
| Option | Calculated Flow Rate | Volume | Pass / Fail | Comment |
| Metered Volume |  |  |  |  |

### 17.2 Calculated Based Flow

With well volumes entered, simulate a rise and fall in level (1 minute each). Start a pump when level starts to fall.

| Inflow Rate | Outflow Rate | Volume | Comment |
| :--- | :--- | :---: | :---: |
| $47 \cdot 84 / 5$ | 206 | $17 / 05$ |  |

## 18 FSp Relay

Configure FSp relay and test probe inputgindividually.

| Input | Pass / Fail |  |
| :--- | :--- | :--- |
| tow probe |  |  |
| High prebe and baektup runs |  |  |
| Alarm probe and backup runs | PASS |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 19 Periodic or Manually Triggered Tests

### 19.1 Installation Resistance Test (IRT) - Thresholds

Adjust to the recommended threshold for the IRT faults.

| IRT | Recommended <br> Threshold | Threshold | Comments |  |
| :---: | :---: | :---: | :---: | :---: |
| Warning | 5.0 MOhms |  | NO MORE |  |
| Fault | 1.0 MOhms |  | NO MORE |  |

Ensure IRT is enabled for the relevant pump and the fuse is closed. For safety during installation, disable upon completion of these tests or open IRT fuse.

| Pump | Resistance <br> Returned | Pass / Fail | Disabled |  | Comment |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Fault |  |

### 19.2 Battery Tests

Record the battery test settings.

| Period | Time of Day | Duration (mins) | Week Day | Comment |
| :---: | :---: | :---: | :---: | :---: |
|  | DISABLED |  |  | No moRE |

Manually trigger a battery test. MultiSmart should run on battery only.

| Test | Pass / Fail | Comment |
| :--- | :---: | :---: | :---: |
| Battery Test - battery only | NA | NO MORC |

Turn off supply from battery. Manually trigger a battery test. MultiSmart should reboot (due to no power) and on boot up a 'Battery Test' fault should be displayed.

| Test | Pass/Fail | Comment |
| :--- | :---: | :---: |
| Battery Test - no power | NA | No MoRE |

### 19.3 Wet Well Calibration Test

Trigger a Wet Well Calibration test.

| Pump Run Time | \% Error Returned* | Pass / Fail | Comment |
| :---: | :--- | :---: | :---: |
| 60 s | -1.162 | PATS |  |

* \% Error is contained in DNP Analog Input point 42


### 19.4 Electrode Test

Trigger an Electrode test for each sensor present. During the test trigger the sensor's input. (The number of sensor's present is site specific).

| Sensor to Trigger | Pass / Fail | Comment |
| :--- | :---: | :---: |
| None - do not trigger any sensor | PASS |  |
| High Level probe | PASS |  |
| Manhole Surcharge Imminent | - |  |
| Valve Pit Flooded | - |  |
| Dry Well Flooded High | $\frown$ |  |
| Dry Well Flooded Tripped | - |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

### 19.5 Secondary Controller Circuit Test

Trigger a Secondary Controller Circuit test. Adjust hardware timer to match the MultiSmart. Repeat if timers mismatch. For sites with 'Max Pumps to Run' $=1$, advance the clock by 1 day and repeat test.


* Minimum recommended time is 120 s


### 19.6 High Level Pumping Mode

At the MultiSmart turn 'off' all pumps and let the level rise to the High Level probe. Re-enable pumps, one pump should run for the High Level Pumping time.

| High Level Pumping time | Pass / Fail | Comment |
| :---: | :--- | :--- |
| 60 | PASS |  |

### 19.7 Emergency High Level Pumping Mode

At the MultiSmart turn 'off' all pumps and let the level rise to the Surcharge Imminent Level probe. Reenable pumps, all pumps should run for the Emergency Pumping time.

| Emergency Pumping time | Pass / Fail | Comment |
| :---: | :--- | :--- |
| 120 s | PAS |  |

### 19.8 Generator

Trigger a generator test.

| Pass / Fail | Comment |
| :---: | :--- |
| $\sim$ |  |

## 20 Test Card Reader

Swipe a valid QUU swipe card.

| Pass / Fail | Comment |
| :---: | :--- |
| - |  |

## 21 VFD Configuration

| VFD No. | Configured (Y/N) | Configured By |
| :---: | :---: | :---: |
| 1 | - |  |
| 2 | - |  |
| 3 | - |  |

## 22 Additional Outputs - Radtel Sites - SEE ATMECtA

Configure additional outputs as determined by site requirements for sites using Radtel radios.

| Requirement | Configured (Y/N) |
| :---: | :---: |
| Level Signal |  |
| Pump 1 Run |  |
| Pump 2 Run |  |
| Pump 3 Run |  |
| Pump 1 Fault |  |
| Pump 2 Fault |  |
| Pump 3 Fault |  |
|  |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

Notes:

1. SHROVD AROUND 3 PIASS INPNT TO MRLTISMRT MISSING
2. MULTISMART I/O MODIPIOD TO SUIT NEW DRAWINGS.
3. ILO IN ISAGRAT CODE CHONGED TO MATZH NEW ITO LISN
4. LOCTL/REMOTE SWITLH (NOW FEATVE) ADDED
5. COMAS TO SOFT STARAR ARE NOT WOKAING. SJELEZMIC DAMPOSS TO INVEJTLGAE

6 ISAGRAF CODE THAT CONTROLLCD/MONITNLED THE SATE ER-RSA BACEUP COMTMOL NEZDS DO BE MCNIPICD TO MAFEH HUNDLT THE SAFE-FS THMT IS Now in PLACE: $X \subset L E X$ TO MODIFSer cose.
7. MULTISMO2T DISPLF HITS CABINET WHER DODN IS FULY OPENED

8 HARDWARE FOR HARDWIRED INPITS TO MIRI RADIO NOT YET INSTALLED.
9. NOT ALL MULTISMRT TO MIRI MONO MODBUS POINTS HAL BEEN tegten at tie multismat (hepen to atiache tasce). no POINTI HANE BEET TESTLD AT THE MIRI RAOIO.
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$\qquad$
$\qquad$

| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

## 23 Sign Off of FAT Results

The following parties were either present, witnessed or participated in performing the Factory Acceptance tests on the MultiSmart.

Client: SJ ELECTRIC
FAT Location: SJ ELCCRIC
Date: 28/08/14
Time: $10: 55 \mathrm{Am}$
MultiSmart Firmware: $2 \cdot 4 \cdot 12$
Parties Present:
xyLEM/mVLTITRODE
2. SJ ELECMIC
3. QUN
4. $\qquad$

## Participants / Authorised Witnesses:



## Variation 2

### 22.3 Hardwired

Test the following hardwired points. The value of the point should be displayed on SCADA.

| No. | Function | Logic '0' | Logic '1' | Pass / Fail | Comment |
| :---: | :--- | :---: | :---: | :---: | :---: |
| 1 | Wet Well Surcharge Imminent Din | Normal | Active |  |  |
| 2 | Wet Well Level | $4 \mathrm{~mA}=0 \mathrm{~m}$ | $20 \mathrm{~mA}=10 \mathrm{~m}$ |  |  |
| 3 | Modbus Communications Fault ${ }^{\top}$ | Active | Normal |  |  |

${ }^{\top}$ Generated Internally in the RD2006

### 22.4 Modbus Points - Discrete Inputs (10xxx) - Variation 2

Trigger the following events, faults \& alarms, and the corresponding point should be displayed on SCADA. (Points have been inverted where necessary within the MultiSmart to reflect the correct 'logic' state as expected by SCADA). Note, "Logic.Values.Digital03" is used to pad out the points to 64.

| No. | Address | Function | Logic '0' | Logic '1' | Pass / Fail | Comment |
| :---: | :---: | :--- | :---: | :---: | :---: | :---: |
| 1 | $10001-10$ | Logic.Values.Digital03 |  |  |  |  |
| 11 | 10011 | Pump 1 Running | Off | On |  |  |
| 12 | 10012 | Pump 1 Healthy / Fault | Active | Normal |  |  |
| 13 | 10013 | Pump 1 Control Circuit Fault | Active | Normal |  |  |
| 14 | 10014 | Pump 1 Moisture in Oil Fault | Active | Normal | - |  |
| 15 | 10015 | Pump 1 Reflux Valve Fail to Close Fault | Active | Normal | - |  |
| 16 | $10016-20$ | Logic.Values.Digital03 |  |  |  |  |
| 21 | 10021 | Pump 2 Running | Off | On |  |  |
| 22 | 10022 | Pump 2 Healthy / Fault | Active | Normal |  |  |
| 23 | 10023 | Pump 2 Control Circuit Fault | Active | Normal |  |  |
| 24 | 10024 | Pump 2 Moisture in Oil Fault | Active | Normal | - |  |
| 25 | 10025 | Pump 2 Reflux Valve Fail to Close Fault | Active | Normal | - |  |
| 26 | $10026-56$ | Logic.Values.Digital03 |  |  |  |  |
| 51 | 10051 | Battery System Fault | Active | Normal |  |  |
| 52 | 10052 | RTU Power Supply Fault | Active | Normal |  |  |
| 53 | 10053 | Station Surge Diverter Fault | Active | Normal |  |  |
| 54 | 10054 | Station Mains Power Fault | Active | Normal |  |  |
| 55 | 10055 | Station Security Alarm | Active | Normal |  |  |
| 56 | 10056 | ATS Position Normal Supply CB Closed | No | Yes |  |  |
| 57 | 10057 | Pit Flooded | Active | Normal | - |  |
| 58 | 10058 | Emergency Stop Pressed | Normal | Active | Ams, PASS |  |
| 59 | 10059 | Emergency Pumping Mode | Normal | Active |  |  |
| 60 | 10060 | Station in Remote | Mantual | R Auto | PASS |  |
| 61 | 10061 | Wet Well High Level Alarm | Normal | Active |  |  |
| 62 | $10062-64$ | Logic.Values.Digiatl03 |  |  |  |  |

### 22.5 Modbus Points - Input Registers (30xxx)

Test the following analog points by running each pump. The value of the point should be displayed on SCADA.

| No. | Function |  | Range | Pass / Fail | Comment |
| :---: | :---: | :--- | :---: | :---: | :---: |
| 1 | 30011 | Pump 1 VSD Speed 0-100\% | $0-100 \%$ |  |  |
| 2 | 30021 | Pump 2 VSD Speed 0-100\% | $0-100 \%$ |  |  |
| 3 | 30031 | Discharge Pressure | $0-5 \mathrm{bar}$ |  |  |


| Date | No. of Alterations | Signature |
| :--- | :--- | :--- |
|  |  |  |

5.) Electric Group (Otd) Pty Ltd

## SP464 JAMES STREET, LOWOOD SEWAGE PUMP STATION

## COMMISSIONING PLAN

## In Attendance



Electrical Contactor's Supervisor


Signature: $\qquad$


## 1 INTRODUCTION

## !! IMPORTANT !!

## This commissioning Procedure is not to replace the electrical contractors own internal quality control and statutory documentation.

At all times during the switchboard upgrade, the pump station must be capable of running at least 1 of the 2 pumps. To achieve this during the switchboard changeover, a temporary pumping system will be configured by installing a temporary distribution and starter panel. The temporary distribution and starter panel will be supplied by SJ Electric Group (Qld).
The sequence of works shall be:

1. Station Preliminary Works.
2. Install new switchboard
3. Install Probes
4. Install new consumer mains/earthing
5. Install temporary switchboard and RTU
6. Energise new switchboard
7. Connect pump 1 to new switchboard and test.
8. Connect pump 2 to new switchboard and test.
9. Confirm communications work
10. Post Changeover

### 1.1 MAINTENANCE CHECK OF EXISTING INSTALLATION

Before the works on site can commence, QUU staff to ensure that both pumps are fully operational shall perform a thorough maintenance inspection of the site.

### 1.2 PRE COMMISSIONING CHECKLIST

The following checklist is to be completed and signed by the electrical contractor.

### 1.2.1 Switchboard Factory Acceptance Test

| Contractor Task |  |
| :--- | :--- |
| FAT has been completed <br> identified have been rectified. | OK |



### 1.2.2 Pump Station preliminary operational checks

| QUU Task | Checked |
| :--- | :--- |
| These are checks will ensure the pump station is fully operational and that no |  |
| delays will be incurred due to any pump station problem out side of the contract. |  |
| These tasks are desirable to have completed before the SAT but are not essential. |  |
| The job can proceed if they are not done. |  |
| Commissioning Manager to request networks maintenance to inspect and rectify if |  |
| necessary |  |

## 2 STATION PRELIMINARY WORKS

### 2.1 SUPPLY AND INSTALL CONDUITS AND SLAB

| Contractor Task | Completed |
| :--- | :---: |
| Supply and install conduits as per plan, install new concrete slab <br> Arrange for core holes in to the wet well and valve pit | OK 司 |

### 2.2 INSTALL NEW SWITCHBOARD

| Contractor Task | Completed |
| :--- | :---: |
| After the switchboard FAT and all defects rectified deliver the switchboard to site <br> and fix to slab. <br> Install consumer mains cabling from the pole to the switchboard |  |
| Install new antenna cabling and antenna. | OK 岁 |



### 2.3 UPGRADE WET WELL LEVEL SENSORS

| Contractor Task | Completed |
| :--- | :---: |
| Install new Surge Imminent Probe |  |
| Install new High Level Probe | OK Q |
| Install new Hydrostatic level Probe |  |

### 2.4 UPGRADE DELIVERY PRESSURE TRANSMITTER

| Contractor Task | Completed |
| :--- | :---: |
| Install new pressure transmitter, cabling and associated fittings into existing <br> tapping point in header pipe adjacent new access platform. The contractor shall <br> supply and fit all fittings necessary to plumb the pressure transducer into the <br> existing isolation valve. Fit label to pressure transmitter. |  | Commissioing Manager initial:.

## 3 SWITCHBOARD CHANGEOVER PROCEDURE

## OVERVIEW

The following sequence of change over works is the order in which they must be followed. One pump must be operational at all times. After each phase has been completed, the commissioning manager will record the results and instruct the commissioning team to commence work on the next phase.

### 3.1 CHANGEOVER SWITCHBOARD

### 3.1.1 Register with Control Room

| Contractor and Commissioning Manager Task | Outcome |
| :--- | :--- |
| Call the QUU Control Room Operator (CRO) and inform him that you are on site. <br> Record the CRO's Name and Officer Code and record the time of the call. | Name: Jaser |
| Advise CRO that you are performing a switchboard changeover and that you will |  |
| initially be taking one pump off line. Give the operator your contact name and |  |
| number and advise the operator that communications will be lost to the pump |  |
| station until the job is finished |  |$\quad$ CRO: | Time: $\frac{6: 20}{}$ |
| :--- |

### 3.1.2 Existing Switchboard Parameters



Pump two $1+2$ THIERMAL


### 3.1.3 Set up Temporary Generator and Switchboard

| Contractor Task | Outcome |
| :--- | :--- |
| Position generator (to be supplied by Total Generators) in an appropriate <br> location. Locate away from the work site to <br> reduce noise and fumes. |  |
| Connect the temporary pump controller to the generator. | OK |
| Install Multitrode level sensors and set the Start and Stop levels to be equivalent <br> to the current Start and Stop levels of the existing switchboard parameters. | OK 日 |
| Install the backup audible and visual alarm system (powered by separate <br> battery). Test electrodes back to temporary pump controller to confirm operation. |  |
| Ensure that the generator fuel will be sufficient to enable the generator to run |  |
| loaded for 12 hours. (This may require extra fuel - arrange if required) | OK Q |

### 3.1.4 Shut down Pump 2

| Contractor Task | Outcome |
| :--- | :---: |
| OPEN, LOCK \& TAG PUMP 2 SWITCH | OK 口 |
| OPEN, LOCK \& TAG CIRCUIT BREAKER FOR PUMP 2 | OK |
| TEST FOR DEAD AT LOAD SIDE OF CIRCUIT BREAKER FOR PUMP 2 | OKAD |
| DISCONNECT PUMP 2 CABLING FROM SOCKET OUTLET | OK |
| REMOVE OLD PLUG FROM CABLE | OK |
| REDIRRECT PUMP 2 CABLING TO TEMPORARY SWITCHBOARD |  |
| CONNECT PUMP 2 TO TEMPORARY SWITCHBOARD | OK |

TEST PUMP 2 CONFIRM THAT THE PROBES WORK AND THAT THE PUMP WILL EMPTY THE WET WELL

### 3.1.5 Shut down Pump 1

| Contractor Task | Outcome |
| :--- | :---: |
| OPEN, LOCK \& TAG PUMP 1 SWITCH | OK |
| OPEN, LOCK \& TAG CIRCUIT BREAKER FOR PUMP 1 | OK |
| TEST FOR DEAD AT LOAD SIDE OF CIRCUIT BREAKER FOR PUMP 1 | DEAD |
| DISCONNECT PUMP 1 CABLING FROM SOCKET OUTLET | OK |
| REMOVE OLD PLUG FROM CABLE | OK |
| REDIRECT PUMP 1 CABLING TO THE NEW SWITCHBOARD | OK ם |
| CONNECT NEW MARECHAL PLUG AND PLUG INTO PUMP1 OUTLET | OK |

### 3.1.6 Shut down existing switchboard

| Contractor Task | Outcome |
| :--- | :---: |
| REMOVE ENERGEX PILLAR FUSES AND PLACE IN LOCK BOX | OK |
| DISCONNECT ANY BATTERIES FROM EXISTING EQUIPMENT | OK |
| DISCONNECT EXISTING CONSUMER MAINS AT PILLAR AND AT EXISTING <br> SWITCHBOARD | OK |



### 3.1.7 Energise new switchboard

| Contractor Task | Outcome |
| :--- | :---: |
| CONNECT NEW CONSUMER MAINS AT PILLAR PCOPLRRY |  |
| RELOCATE ENERGEX METER TO NEW SWITCHBOARD |  |
| INSTALL PILLAR FUSES AND TURN ON EXISTING MAIN SWITCH Q2 |  |
| THE NEW SWITCHBOARD WILL NOW BE ENERGISED |  |

### 3.1.8 Commission Pump 1

| Contractor Task | Outcome |
| :---: | :---: |
| CLOSE CIRCUIT BREAKER Q4 | OK母 |
| MANUAL TEST OF PUMP NO . 1 (CONFIRM PUMP DIRECTION) | OKロ |
| COMMISSION PUMP NO. 1 ON NEW SWITCHBOARD. CONFIRM AUTO CONTROL FROM LEVEL SIGNALS BEFORE PROCEEDING. | OK D |



## CUSTOMER NAME： <br> V゙ルにけいご <br> Jamis Striast <br> CUSTOMER ADDRESS：

### 3.1.9 Commission Pump 2

| Contractor Task | Outcome |
| :---: | :---: |
| SHUT DOWN THE TEMPORARY SWITCHBOARD CONTROLLING PUMP 2 SHUT DOWN THE GENERATOR. | OK |
| REDIRRECT CABLING FOR PUMP 2 TO THE NEW SWITCHBOARD | OK |
| CONNECT NEW MARECHAL PLUG AND PLUG INTO PUMP2 OUTLET A)RECT COMNEOA | OK $\square$ |
| CLOSE CIRCUIT BREAKER Q5 | OK |
| MANUAL TEST OF PUMP NO 2 (CONFIRM PUMP DIRECTION) | OK |
| COMMISSION PUMP NO. 2 ON NEW SWITCHBOARD. CONFIRM AUTO CONTROL FROM LEVEL SIGNALS BEFORE PROCEEDING. | OK $\square$ |

### 3.2 SUGGESTIONS FOR IMPROVEMENT

| Suggestion | Recommended By |
| :--- | :---: |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |


|  | SP464 James Street, Lowood - Soft Starter Settings |  |  |
| :---: | :--- | :---: | :---: |
|  |  | Pump 1 | Pump 2 |
| 1.10 | M otor FLC | 5.8 amps | 6.2 amps |
| 1.20 | Locked Rotor Time | 10 seconds | 10 seconds |
| 1.30 | Start M ode | 1 | 1 |
| 1.40 | Current Limit | 20 amps | 22 amps |
| 1.50 | Initial Current | 20 amps | 22 amps |
| 1.60 | Start Ramp Time | 10 seconds | 10 seconds |
| 1.70 | Kickstart Level | 29 amps | 31 amps |
| 1.80 | Kickstart Time | 0 | 0 |
| 1.90 | Excess Start Time | 20 seconds | 20 seconds |
| 1.10 | Stop M ode | 1 | 1 |
| 1.11 | Stop Time | 0 | 0 |
| 1.12 | Adaptv Control Gain | $75 \%$ | $75 \%$ |
| 1.13 | Adaptv Start Profile | 2 | 2 |
| 1.14 | Adaptv Stop Profile | 2 | 2 |
| 1.15 | Brake Torque | $20 \%$ | $20 \%$ |
| 1.16 | Brake Time | 1 second | 1 second |

## 5. Compliance Certificate

## CERTIFICATE OF:

(Please mark relevant check-box)

# X TESTING AND COMPLIANCE (Electrical Installations) <br> Issued in accordance with s227 of the Electrical Safety Regulation 2013 

## X TESTING AND SAFETY (Electrical Equipment)

Issued in accordance with s26 of the Electrical Safety Regulation 2013

## *Work performed for:

Customer: $\underset{\text { |Company Name) }}{\text { Queensland }}$ Urban Utilities
Address: Level 2, 15 Green Square Close (Street)
Fortitude Valley Qed 4006
(Suburb/nown)
(State)
(Postcode)
*Electrical installation / equipment tested (please include site address for electrical installation work if different from above): Work carried out at SP464 James Street, Lowood
Installation tested as per drawings 486/5/7-0475-000 to 486/5/7-0475-042

| *Date of test $6 \quad /$ November / 2014 | *Electrical contractor licence <br> number: | 73286 |
| :--- | :--- | :--- | :--- | :--- |
| Name on contractor licence: | SJ Electric Group (Old) Ply Ltd |  |

For electrical installations, this certifies that the electrical installation, to the extent it is affected by the electrical work, has been tested to ensure that it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying under the Electrical Safety Regulation 2013 to the electrical installation.
For electrical equipment, this certifies that the electrical equipment, to the extent it is affected by the electrical work, is electrically safe.

## Name: Andrew Burnell



Date:


111
12014
*Indicates a mandatory field

## 6. Photos

## Photos - Before





## Photos - After



photo 5


[^0]:    Notes: ${ }^{1}$ ) Neutral pole is switched but does not provide overcurrent or short circuit protection.
    ${ }^{2}$ ) NA - Non-Auto MCB without overcurrent or short circuit protection, suitable for main switch.
    Refer page 9-10 for back-up fuse data. Accessories refer page 1-9.

[^1]:    Notes: ${ }^{1}$ ) Screw-less cable clamping 'load-side' connection.
    ${ }^{2}$ ) Screw 'load-side' connection.
    Double pole and 'D' Curve available on request.

[^2]:    Power loss 3 VA

[^3]:    Notes: For a more complete listing of accessory details refer to accessory pages relating to individual panelboards.
    ${ }^{1}$ ) Dust seal option - IP52B.
    ${ }^{2}$ ) On large enclosures $\geq 1000 \mathrm{~mm}$.

[^4]:    Notes: ${ }^{1}$ ) Factory set 160 A. Adjustable down to 100 A.
    ${ }^{2}$ ) Factory set 200 A . Adjustable down to 160 A .
    For 250 A refer NHP.
    For orange door change " G " to " O " e.g. CDT24MCCB16002 made to order.

[^5]:    Notes: ') Transforms interior of board white without respray.
    ${ }^{2}$ ) Plinth is designed for bottom cable entry, if panelboard is freestanding additional support is required.

[^6]:    Notes: ${ }^{1)}$ For top fed chassis delete "U" and replace with "TF" e.g. NCTF212183TF
    ${ }^{2}$ ) Add 40 mm for flared busbar at top and 56 mm for bottom of chassis.
    For split chassis, order special chassis or order two top fed chassis and mount bottom chassis upside down and fit new label. See accessories for Cat. No.
    OFF (line) side of MCB connects to chassis tee-off.
    Combinations other than those listed above can be special ordered refer to NHP.

[^7]:    Notes: ${ }^{1)}$ For top fed chassis delete "U" and replace with "TF" e.g. NCTF212183TF
    ${ }^{2}$ ) Add 40 mm for flared busbar at top and 56 mm for bottom of chassis.
    For split chassis, order special chassis or order two top fed chassis and mount bottom chassis upside down and fit new label. See accessories for Cat. No.
    OFF (line) side of MCB connects to chassis tee-off.
    Combinations other than those listed above can be special ordered refer to NHP.

[^8]:    Notes: ${ }^{1}$ ) For top fed chassis delete "U" and replace with "TF" e.g. NC224184TF.
    ${ }^{2}$ ) Add 55 mm for flared busbar at top and bottom of chassis.
    4 pole and other special configurations available to special order refer NHP. OFF (line) side of MCB connects to chassis tee-off.
    Combinations other than those listed above can be special ordered refer to NHP.

[^9]:    Notes: ${ }^{1}$ ) For bottom feed replace TF with BF.
    ${ }^{2}$ ) Add 41 mm for busbar tags at top or bottom as applicable.
    Chassis cannot be split, use a top feed and bottom feed in lieu.

[^10]:    Notes: ${ }^{1}$ ) For bottom feed replace TF with BF.
    ${ }^{2}$ ) Add 41 mm for busbar tags at top or bottom as applicable.
    Chassis cannot be split, use a top feed and bottom feed in lieu.

[^11]:    Notes: ${ }^{1}$ ) Add 32.5 mm for flared busbar at top and bottom of chassis. 4 pole and other special configurations available to special order refer NHP.
    'OFF' (line) side of MCB connects to chassis tee-off.
    Use insulated tool provided to disengage DIN clip when removing MCB from chassis. DIN clip can be removed and discarded when mounting MCB on CD chassis.

[^12]:    Notes: ${ }^{1}$ ) Add 32.5 mm for flared busbar at top and bottom of chassis. 4 pole and other special configurations available to special order refer NHP.
    'OFF' (line) side of MCB connects to chassis tee-off.
    Use insulated tool provided to disengage DIN clip when removing MCB from chassis. DIN clip can be removed and discarded when mounting MCB on CD chassis.

[^13]:    Notes: ${ }^{1}$ ) Add 25 mm for flared busbar at top of chassis.
    ${ }^{2}$ ) Add 22 mm for straight busbar at bottom of chassis.
    4 pole and other special configurations available to special order refer NHP.

[^14]:    Notes: For Interpole Barriers, Terminal Covers and Padlock attachments refer to accessories pages.
    Ir: thermal rating
    Im: magnetic rating
    NRC: Nominal rated current
    S125NF will not accept rear connection studs. (S160NF types do)

[^15]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting

[^16]:    Notes: ${ }^{1}$ ) Not suitable for reverse connection either individually or on chassis. Suitable for general motor starting and power distribution applications. Refer to NHP for availability of 4 pole version.
    Adj. Ir: Adjustable thermal setting
    Adj. Im: Adjustable magnetic setting NRC: Nominal rated current

[^17]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting NRC: Nominal rated current

[^18]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting NRC: Nominal rated current

[^19]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting

[^20]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting

[^21]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting Adj. Im: Adjustable magnetic setting
    NRC: Nominal rated current Magnetic only MCCBs are available on request.

[^22]:    Notes: ${ }^{1}$ ) The STD and Instantaneous pickup currents $\left(I_{s d} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $I_{R}$ settings the values will vary. Curve $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve $3 I_{\text {sd }}=5 \times I_{R}$, curve $4-7 I_{s d}=10 \times I_{R}$. $I_{R}$ dial setting $0.4-0.9 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.95-1.0 \mathrm{I}_{\mathrm{i}}=13 \times \mathrm{I}_{\mathrm{R}}$. Refer curve examples \& setting data in section 9.
    ${ }^{2}$ ) To order a MCCB with the above options add the required amp rating to the end of the catalogue number to complete it. Eg: S250PE 4 AN 250 is a S250PE 4 Pole 250 A MCCB c/w Neutral Protection.
    NRC = Nominal rated current, $\quad I R=$ Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous
    For additional information on installation, options and applications refer Section 9, Part C

[^23]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting
    Adj. Im: Adjustable magnetic setting
    NRC: Nominal rated current
    Magnetic only MCCBs are available on request.

[^24]:    Notes: ${ }^{1}$ ) Adj. Ir: Adjustable thermal setting
    Adj. Im: Adjustable magnetic setting
    NRC: Nominal rated current
    Magnetic only MCCBs are available on request.

[^25]:    Notes: NRC = Nominal rated current, IR = Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous
    ${ }^{1}$ ) The STD and Instantaneous pickup currents ( $I_{\text {sd }} \& I_{\mathrm{i}}$ ) settings are not individually adjustable, however by selecting different curve types and different $I_{\mathrm{R}}$ settings the values will vary. Curves $1 \& 2 \mathrm{I}_{\mathrm{sd}}=2.5 \times \mathrm{I}_{\mathrm{R}}$, curve 3 Isd $=5 \times I_{R}$, curves $4-7 I_{s d}=10 \times I_{R}$.
    IR dial setting $0.4-0.9 I_{i}=14 \times I_{R}$ and $I_{R}$ dial setting $0.95-1.0 I_{i}=13 \times I_{R}$. Not suitable for reverse connection either individually or on a chassis. Suitable for general motor starting and power distribution applications. Refer NHP for 4 pole version availability.
    Refer NHP for additional information.

[^26]:    Notes: Magnetic only available on application.
    For additional information on applications refer section 9 or Part C catalogue.
    NRC: Nominal rated current
    Adj. Ir: Adjustable thermal setting
    Adj. Im: Adjustable magnetic setting
    Replaces: XS630NJ and XS800NJ. Note: check exact ratings or dimensions to suit your application requirement.

[^27]:    Notes: ${ }^{1}$ ) 1. The STD and Instantaneous pickup currents ( $\left.I_{\mathrm{sd}} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $I_{R}$ settings the values will vary. Curve $1 \& 2 I_{s d}=2.5 \times I_{R}$, curve $3 I_{\text {sd }}=5 \times I_{R}$, curve $4-6 I_{s d}=8 \times I_{R}$. $I_{R}$ dial setting $0.4-0.63 I_{i}=14 x$ $I_{R}$ and $I_{R}$ dial setting $0.8-1.0 \mathrm{li}=10 \times I_{R}$.
    ${ }^{2}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: S1000NE 4 AGN 800 is an S1000NE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
    For additional information on OCR settings, options and applications refer section 9 or part C catalogue.
    Replaces: XH800SE and XS1250SE 1000A. Note: check exact ratings or dimensions to suit your application requirement.

[^28]:    Notes: ${ }^{1}$ ) The STD and Instantaneous pickup currents $\left(l_{\text {sd }} \& I_{\mathrm{i}}\right)$ settings are not individually adjustable, however by selecting different curve types and different $I_{R}$ settings the values will vary. Curve $1 \& 2 I_{s d}=2.5 \times I_{R}$, curve $3 \mathrm{I}_{\mathrm{sd}}=5 \times \mathrm{I}_{\mathrm{R}}$, curve $4-6 \mathrm{I}_{\mathrm{sd}}=8 \mathrm{x} \mathrm{I}_{\mathrm{R}}$. $\mathrm{I}_{\mathrm{R}}$ dial setting $0.4-0.63 \mathrm{I}_{\mathrm{i}}=14 \mathrm{x}$ $I_{R}$ and $I_{R}$ dial setting $0.8-1.0 \mathrm{li}=10 \times I_{R}$.
    ${ }^{2}$ ) To order a MCCB with the above options insert the required amp rating after the option to make up the Cat. No. Eg: S1250GE 4 AGN 800 is an S1250GE 4 Pole 800 A MCCB c/w Neutral Protection and Ground Fault protection.
    For additional information on OCR settings, options and applications refer section 9 or part C catalogue.
    Replaces: XS1250SE. Note: check exact ratings or dimensions to suit your application requirement.

[^29]:    Notes: $\left.{ }^{1}\right) 415$ V Icu rating to IEC 60947-2.
    ${ }^{2}$ ) H excludes attached busbar.
    ${ }^{3}$ ) GF MCCBs require a 4 th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutral is present) Refer accessories.
    NRC: Nominal rated current.

[^30]:    Notes: ${ }^{1)} \mathrm{H}$ excludes attached busbar. NRC: Nominal rated current.

[^31]:    Notes: Fault interruption and other performance data for ZS125-250GJ ELCBs, is the same as the standard S125-250GJ MCCBs, except:

    - Rated to an operational voltage of 550 V AC maximum
    - Magnetic characteristic is fixed

[^32]:    Notes: ${ }^{1}$ ) NRC: Nominal rated current. Adj. $\mathrm{I}_{\mathrm{r}}$ : Adjustable thermal setting Fixed $I_{m}$ : Fixed magnetic setting NT: No Trip
    ${ }^{2}$ ) Use list prices above for unswitched versions.

[^33]:    Notes: ${ }^{1}$ ) NRC: Nominal rated current, Fixed Ir : Fixed thermal setting,
    Adj. Fixed li: Adjustable magnetic setting,

[^34]:    Notes: ${ }^{1}$ ) NRC: Nominal rated current, Fixed Ir : Fixed thermal setting,
    Adj. Fixed li: Adjustable magnetic setting,

[^35]:    Notes: ') Refer to NHP for HC chassis with new TemBreak 2800 A - 1250 A MCCBs. Bottom or top extended main bar are optional.
    For MCCB terminal cover selection use refer pages 4-13 and 4-14

[^36]:    Notes: ${ }^{1}$ ) This cable is used to connect between a TL101 electronic controller interface panel (LTLP2 or LTLP2S) and a standard TemBreak 1 transfer switch. Refer page 5-33 for a features comparison table between TLP1, TLP2 \& TL101.
    ${ }^{2}$ ) Modbus communications: A 24 V DC power supply is needed.

[^37]:    Notes: ${ }^{1}$ ) Alternate interconnecting cable lengths are available on application. Refer NHP catalogue numbers for the alternate lengths indicated above.

[^38]:    Notes: ${ }^{1)}$ TemBreak 2 MCCB. This is an electrical equivalent, though check the application as the physical size of the TemBreak 2 equivalent will be different.

[^39]:    Notes: ${ }^{1)}$ H excludes attached busbar.
    $\left.{ }^{2}\right)$ GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutral is present) Refer accessories. NRC: Nominal rated current. ASR: Adjustable setting range.

[^40]:    Notes: ${ }^{1}$ ) H excludes attached busbar.
    NRC: Nominal rated current.
    ASR: Adjustable setting range.
    Magnetic only available on application.
    Specify for DC rating.

[^41]:    Notes: ${ }^{1}$ ) H excludes attached busbar.
    NRC: Nominal rated current.
    ASR: Adjustable setting range.

[^42]:    Notes: ${ }^{1)}$ H excludes attached busbar.
    ${ }^{\text {2) }}$ ) GF MCCBs require a 4th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutrel is present) Refer accessories.
    NRC: Nominal rated current.
    ASR: Adjustable setting range.
    Accessories, refer to page 6-35.

[^43]:    Notes: ${ }^{1)}$ H excludes attached busbar.
    2) GF MCCBs require a 4 th Neutral CT to be ordered for 3 and 4 pole MCCB applications. (If a neutrel is present) Refer accessories.
    NRC: Nominal rated current.
    ASR: Adjustable setting range.
    Accessories, refer to page 6-35.

[^44]:    Notes: ') An AC UVT controller is required for 100-440 V AC.
    ${ }^{2}$ ) A DC UVT controller is needed for 200-230 V DC operation. None required for $24-110 \mathrm{~V}$ DC.

[^45]:    Notes: 1) Yellow and red handles available.
    ${ }^{2}$ ) 6 pieces required for $3 P / 8$ pieces required for $4 P$.
    ${ }^{3}$ ) Specify quantity required (up to 6 pieces).
    ${ }^{4}$ ) Individual barrier (not a set).
    ${ }^{5}$ ) Use interpole barriers for 1600 A MCCBs.

[^46]:    Notes: TEMPro PREMIER pricing is POA. Please contact NHP estimating with

[^47]:    Notes: ${ }^{1}$ ) Remote test on AC versions only. Refer page 9-68 for AS/NZS requirements when using earth leakage relays.

[^48]:    Notes: ') Standard values for standard squirrel-cage motors: Rated operational currents
    for motors with $\mathrm{n}=1500$ RPM (4 pole), possible deviation +_ $10 \%$ depending on type and manufacturer, +_ $50 \%$ for small motors. Deviation of rated operational currents for motors with other speeds (greater deviations for smaller motors):
    With $\mathrm{n}=3000 \mathrm{rpm}$
    (2 pole): $-2 \%$...-10 \%
    With $\mathrm{n}=1000 \mathrm{rpm}$
    ( 6 pole): $+2 \% \ldots+10 \%$
    With $\mathrm{n}=750 \mathrm{rpm}$
    ( 8 pole): $+5 \% \ldots+20 \%$
    ${ }^{2}$ ) The power factor is usually around 0.8 , but this varies with the size and speed of the motor.
    Efficiency ranges from $85 \%$ in small motors to $90 \%$ and over for large motors.

[^49]:    Table 7.3

[^50]:    Creation date August 5, 2013 3:10:33 AM CEST

[^51]:    Creation date August 5, 2013 3:10:33 AM CEST

[^52]:    ANSI is a registered trademark of the American National Standards Institute. IEEE is a registered trademark of the Institute of Electrical and Electronics Engineers, Incorporated. NEMA is a registered trademark of the National Electrical Manufacturers Association. UL is a registered trademark of Underwriters Laboratories, Inc.

    ## WARNING

    ERICO products shall be installed and used only as indicated in ERICO's product instruction sheets and training materials. Instruction sheets are available at www.erico.com and from your ERICO customer service representative. Improper installation, misuse, misapplication or other failure to completely follow ERICO's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death.

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[^53]:    ${ }^{1)}$ Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
    ${ }^{2)}$ Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

[^54]:    ${ }^{7)}$ Determined according to the limit point method according to IEC 60770, incl. non-linearity, hysteresis and non-repeatability.
    Limited by the overpressure resistance of the measuring cell.

[^55]:    Notes: ${ }^{1}$ ) Enter voltage $6 \mathrm{~V} \mathrm{AC} / D C=1,12 \mathrm{~V} \mathrm{AC} / D C=2,24 \mathrm{~V} \mathrm{AC} / D C=3,48 \mathrm{~V} \mathrm{AC} / D C=4,120 \mathrm{~V}$ AC/DC $=5,240 \mathrm{~V} \mathrm{AC} / \mathrm{DC}=\mathbf{7}$ Example D7PD3CX11 = 24 V AC/DC Incandescent lamp block, lamp ordered separately (24, 110, 240 available with LED).
    ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED,
    B = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block.
    ${ }^{3}$ ) A full range of labelled press plates available separately refer to page 37 .

[^56]:     Example D7PD3CX11 $=24 \mathrm{~V}$ AC/DC Incandescent lamp block, lamp ordered separately ( $24,110,240$ available with LED).
    ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED,
    B = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block.
    ${ }^{3}$ ) A full range of labelled press plates available separately refer to page 37 .

[^57]:     Example D7PD3CX11 $=24 \mathrm{~V}$ AC/DC Incandescent lamp block, lamp ordered separately ( $24,110,240$ available with LED).
    ${ }^{\text {2 }}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED,
    B = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block.
    ${ }^{3}$ ) A full range of labelled press plates available separately refer to page 37 .

[^58]:     Example D7PD3CX11 = 24 V AC/DC Incandescent lamp block, lamp ordered separately (24, 110, 240 available with LED) ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED, B = Blue LED - Example D7PN3RX11 $=24 \mathrm{~V}$ AC/DC RED integrated LED lamp block.

[^59]:     Example D7PD3CX11 $=24 \mathrm{~V}$ AC/DC Incandescent lamp block, lamp ordered separately ( $24,110,240$ available with LED)
    ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=\mathrm{Green}$ LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED, $\mathbf{B}=$ Blue LED, Example D7PN3RX11 $=24 \mathrm{~V}$ AC/DC RED integrated LED lamp block.
    Full list of labelled press plates refer to page 37 .
    $\left.{ }^{3}\right)$ Shown fitted with inserts.

[^60]:     Example D7PD3CX11 $=24 \mathrm{~V}$ AC/DC Incandescent lamp block, lamp ordered separately ( $24,110,240$ available with LED)
    ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED,
    B = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block
    Safety auto break contact available, refer to page 28.

[^61]:     Example D7PD3CX11 = 24 V AC/DC Incandescent lamp block, lamp ordered separately ( $24,110,240$ available with LED) ${ }^{2}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED, B = Blue LED - Example D7PN3RX11 = 24V AC/DC RED integrated LED lamp block.

[^62]:    Notes: ${ }^{2}$ ) Enter voltage $6 \mathrm{~V} \mathrm{AC} / D C=1,12 \mathrm{~V} \mathrm{AC} / D C=2,24 \mathrm{~V} \mathrm{AC} / D C=3,48 \mathrm{~V} \mathrm{AC} / D C=4,120 \mathrm{~V}$ AC/DC $=5,240 \mathrm{~V} \mathrm{AC} / \mathrm{DC}=7$ Example D7PD3CX11 = 24 V AC/DC Incandescent lamp block, lamp ordered separately (24, 110, 240 available with LED) ${ }^{3}$ ) Enter lamp colour $\mathbf{C}=$ clear (incandescent), $\mathbf{R}=$ Red LED, $\mathbf{G}=$ Green LED, $\mathbf{Y}=$ Yellow LED, $\mathbf{W}=$ White LED, B = Blue LED - Example D7PN3RX11 = 24V AC/DC RED integrated LED lamp block

[^63]:    Notes: 1. Not all combinations are held in stock. Indent items are engraved to order allow 1-2 days.
    2. Supplied with white engraving (black with white lettering). Add insert colour code as follows eg: D7-AF3CE208 is green.
    3. Diffusers are supplied clear with black lettering.

[^64]:    Note: ${ }^{1}$ ) Supplied blank refer to page 40-41 for available legends.
    ${ }^{2}$ ) Three snap-in legend plates are required for each D7-400 legend plate frame.

[^65]:    NOTES
     COMPATBLELABELING

[^66]:    DOC ID: CHE 135
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