

# BRISBANE CITY COUNCIL BRISBANE WATER OPERATION AND MAINTENANCE MANUAL 

## VOLUME 3

## PART 5: APPENDICES APPENDIX (2-20)

for
REDIRECTION OF HEROES AVE SEWAGE PUMP STATION MECHANICAL \& ELECTRICAL FITOUT \& COMMISSIONING

CONTRACT NO. BW.30079-02/03


## Principal Contractor

HVAC Queensland Pty Ltd
101 Cobalt Street, Carole Park QLD 4300
Phone: 073712 3400, Fax: 0737123444
Website: www.hvacald.com
HVAC Job No 3251Q
To

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Supplier/Manufacturer:
ABB Instrumentation - MagMaster Electromagnetic Flowmeters
ABB Kent - Taylor - MagMaster Electromagnetic Flowmeters - Keypad Version
ABB Instrumentation - MagMaster Electromagnetic Flowmeters - Instruction Manual
ABB Instrumentation - Material Data Sheet
Model: . MF/F351241104005ER1301111
Type: MagMaster, Electromagnetic
Sensor S/N: P/26949/3/5
Transmitter S/N: vkh06125
Tag No:
5428814
Meter Size:
350 mm
Set Up Parameters: Refer to Flowmeter Calibration Verification Certificate in Section 8:
Completed Precommissioning and Commissioning.
Manufacturer Contact Detail:
8136 Tennyson Memorial Ave, Yeerongpilly,
QLD - 4105
(07) 38486123


MagMaster ${ }^{\text {TM }}$ Electromagnetic Flowmeters

Keypad Version

CONTROLS AND DISPLAY


Upper display gives continual update of flow rate in selected units.

By pressing the key. the lower display steps itrough the following sequence:
> Forward flow total value

- Reverse flow total val sequenialy in more than one alarm is presen.
'Alm Clr' is displayed when no alarms are present.
${ }_{*}$ Vel Flow Velocity.
Pressing the key resets the flow total displayed on the upper display, if parameter 'Tol CIr En' is enabled
Pressing the [a] key accesses the Login Paramete where it is necessary to enter a security code before any
other parameters can be accessed - see SECURITY ACCESS

IM/MM-QRG Iss 1 5/96

Oidends Lane, Stonehouse, Gloucestershire, En Telephone: 01453826661 . Facsimile: 0145382635

MENU LAYOUT
.MENU LAYOUT
Return to Flow Rng' Page $\longleftarrow$


## CONTROLS AND DISPLAY

| A - Advancing to Next Page |  |  |
| :---: | :---: | :---: |
| Page 1 | Advance to next page | Page 2 |
| Parameter 1 | [1] | Parameter 1 |
| Parameter 2 |  | Parameter 2 |
| Parameter 3 |  |  |
| Parameter 4 | $\square$ |  |
| Parameter 5 |  |  |
| Parameter 6 |  |  |

C-Adjusting and Storing a Parameter Value $\left.\begin{array}{c|c}\text { Parameter Value } & \Delta \\ \text { or unit } & \square \\ \hline\end{array}\right\}$ Adjust
(1] New value is automatically stored
D-Selecting and Storing a Parameter Choice

automatically stored

Engineer Code Level 2 detault number is 56360 .

## SECURITY ACCESS

wo security code levels, 1 and 2 , are available, and are each accessed with a live digit number.

User Code Level 1 default number is 10760 .

Parameters accessible by the two levels are shown
above.
At the llashing cursor on the first digit of the Login code number, press either $\square$ or membrane switches to each the required digit.

To set this digit and pass to the next digit, depress the [t] switch. Continue until all digits have been set, and eopress the [m] 5 witch to enter the complete code.

If an incorrect value is entered. access to subsequent to ine Operating Page.

| PROGRAMMING | ANALOG OUTPUT |  |
| :---: | :---: | :---: |
| The correct security level MUST be selected - see SECURITY ACCESS | PARAMETER Anlg Fsd | DESCRIPTION <br> Enter output current in mA for $100 \%$ flow ( $0 \leq$ FSD $\leq 21$ ) |
| Select the parameter to read the value. or to change it as necessary. All 'live' data displayed is updated each second. | Anlg Zero | Enter output current in mA for 0\% How ( $0 \leq Z E R O \leq 21$ ) <br> Full scale flow range tor 2nd analog range. as \% of main How range. |
| Use the [[]] key to move between pages. | 1 ma | Present output current (mA) |
| Use the $\square$ key to move between parameters | Dir | Output responds to lorward flow il set to ' 1 '. § |
| The $\square$ and $\square$ keys change displayed values and units. <br> The key will accept the chosen value or unit. | Dir Rev | Output responds to reverse flow if set to ' 1 '. § |


| TEST MODE |  |
| :---: | :---: |
| parameter | description |
| Test Mode | Set to ' 1 'to enable. |
| Test Fiow | Displays present llowrate. <br> If in 'Test Mode', any value may be entered manually. $\ddagger$ |
| Test \% | Flowrate as a percentage |
| Test Hz | Output Frequency |
| Test mA | Output Current |
| Test Vel | Flow Velocity in sensor |
| Test Alm | Shows present active alarms sequentially. ('CIr' indicates no alarms are active). © |
| 4 Test Txv | Live flow velocity (uncorrected for sensor calibration). |


| DISPLAY RESOLUTION |  |
| :---: | :---: |
| parameter | description |
| Disp Res | Enter number of decimal places required on llow display (0 0 5). |
| Disp Mode | Serial Communication display |
|  | mode (Read Only) - attempts to |
|  | edit this parameter result in display |
|  | of 'Keypad Version No.' with |
|  | eventual return to normal |
|  | operation. |

SECURITY PASSWORD


| Login Key 1 | Set Level 1 security password. |
| :--- | :--- |
| Login Key 2 | Set Level 2 security password. |

\#The maximum which can be entered must nol exceed
21000 The value entered may pe displayed with a small 21000. The value entered may be displayed with a small
error in the decimal digits e.9. 1.900 may be displayed as error in the decimal igigis e.g. 1.900 may . This is a display characteristic and the value 1.900 will be used by the MagMaster.
$\$$ Select both parameters for bidirectional operation (e.g. is always $0 \%$.
$\ddagger$ On performing a Rapia Resevescape 10 return to
Operation' level. 'Test Mode' is automaticaly cancelled.
Operation' level. 'Test Mode' is automaticaly cancelled. - It the sensor is empty or disconnected. the ala
'MISnsr' and 'Coil' will pe displayed as appropriate.

## INTRODUCTION

ABB Instrumentation's MagMaster ${ }^{\text {rum }}$ provides high precision electromagnetic flowmeters for conductive
fuids of $>5 \mu \mathrm{~s} / \mathrm{cm}$, in sizes of 2.5 to $2200 \mathrm{~mm}(0.1$ to $86^{\prime \prime}$ ). It has state of the art accuracy, repeatability and rangeability.
The MagMaster offers a choice of liners and electrodes, flange or wafer tubes, integral or remote electronics, and an optional keypad display.
Standard outputs include fully programmable analog output ( $(0-21 \mathrm{~mA})$, dual pulse (forward and reverse).
dual alarm (now rate, fault conditions, etc.) and a RS. ual alarm (llow rate, fault conditions, etc.) and a RSand RS-422/423.
The MagMaster has been designed to eliminate traditional noisy signals in slurry applications. It has multiple self-monitoring and diagnostic functions, and comprehensive test mode to test the system without interrupting the process or power.

SIMPLE READ AND RESET


Top line of display indicates flow totals, velocity. \% of range and alarm status.

Applying wand to the leff icon steps the top line display through this sequence:

Forward flow total
Reverse flow total
Reverse flow total
Net
Alm Alarms in sequence ('Alm Clr' when no
alarms are activated)
\% Flow rate as \% of full scale range
Applying wand to right icon resets the flow total displayed on the top line if parameter 73 (Tot Cl Eisplayed on the
En) is enabled
En) is enabled

CONFIGURATION


RELATIONSHIP OF MENUS
Main Menu


## SECURITY ACCESS

Any of three security levels may be selected. In Levels 0 and 1 , operator is restricted to certain menus as misted below. In Level 2, operator has
menus and can change passwords.


## A舟親

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Qecause ABB instrumentation constantly seeks so imporve produc
quality, all specilications are subject to to change without nolice.
,
Iss


MagMast
Electromagn
Flowme



## ABB

## The Company

ABB is an established wortd force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory (No. 0255) is just one of ten flow calibration plants operated by the Company, and is indicative of ABB's dedication to quality and accuracy.

BS EN ISO 9001


St Neots, U.K. - Cert. No. Q5907 Stonehouse, U.K. - Cert. No. FM 21106

EN 29001 (ISO 9001)


Lenno, Italy - Cert. No. 9/90A


Stonehouse, U.K.

Note.
Clarification of an instruction or additional information.

Information.
Further reference for more detailed information or technical details.

Although Warning hazards are related to personal injury, and Caution hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all Warning and Caution notices.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Marketing Communications Department, ABB.

## Health and Safety

To ensure that our products are sate and without risk to heatth, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal sate handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

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## 1 INTRODUCTION

MagMaster ${ }^{T M}$ is a range of high performance electromagnetic flowmeters for the measurement of electrically conductive fluids and slurries, and is normally supplied as a calibrated system, with the transmitter, factory configured, to a supplied full-bore or insertion probe sensor.

A wide range of options is available to suit most applications, including:

Integral or remote transmitter.
Glass loaded polypropylene transmitter housing.
Flanged or wafer style sensors.
Insertion Probes.
Approved Versions, including:
Hazardous area operation.
Hygienic.
HART ${ }^{T M}$ communication protocol.

## Warning

For MagMaster Approved/Hazardous Versions see the full installation manual.

## Warning.

- Installation and maintenance must only be carried out by suitably trained personnel.
- All relevant sections of this manual must be read before selecting a location.
- Safety requirements of this equipment, any associated equipment and the local environment must be taken into consideration.
- The installation and use of this equipment must be in accordance with relevant national and local standards.


## 2 MECHANICAL INSTALLATION

### 2.1 Unpacking



Fig. 2.1 Unpacking

### 2.2 Installation Conditions




Fig. 2.5 Vibration


Fig. 2.7 Straight Plpe Requirements


2 MECHANICAL INSTALLATION...


Fig. 2.13 Above Ground

Fig. 2.10 Cable Routing


Fig. 2.14 Temperature Difference

Fig. 2.11 Within Environmental Rating


Fig. 2.15 Shade

Fig. 2.12 Underground

## .. 2 MECHANICAL INSTALLATION

### 2.3 Mechanical Installation

### 2.3.1 Transmitters



Fig. 2.16 Dimensions

### 2.3.2 Sensors

## Caution

- Do NOT exceed the maximum working pressure marked on the equipment.
- Use stainless steel (austenitic) bolts, studs and nuts for flanged sensors below 200 mm .


Fig 2.18 Wafer Type Sensors


Fig. 2.17 Gasket Fitting

### 3.1 Grounding (Fig. 3.1, 3.2)



Fig. 3.1 Pipelines


Fig. 3.2 Pipellnes with Cathodic Protection

## ... 3 ELECTRICAL INSTALLATION

### 3.2 Cables

### 3.2.1 Cable (Remote Versions only)



Flg. 3.3 Cable Identification


Fig. 3.4 Cable Preparation

## 3 ELECTRICAL INSTALLATION...

### 3.2.2 Cable (Alternative Type - North American Wiring Practice)



Fig. 3.5 Cable Identification (North American Wiring Practice)


Fig. 3.6 Cable Preparation (North American Wiring Practice)

### 3.2.3 Cable Glands (IEC Installation Practice)



Fig. 3.7 Cable Gland (IEC Installation Practice)

## Warning.

- Rigid conduit must not be fitted to the transmifter.
- Transmitter conduit adaptors must incorporate a face seal.


## -

### 3.2.4 Conduit Adapters and Cable Glands (North American - 0.5in)



Fig. 3.8 Conduit Adapters and Cable Glands


Fig. 3.9 Connection Requirements

### 3.3 Connection Requirements

The transmitter and sensor are supplied as a matched syetem. Check serial numbers to ensure thay are matohed.

### 3.3.1 Sensors

Remote sensors are usually supplied with an integral cable and potted connections. If the sensor has been supplied unpotted, connections must also be made to the sensor terminal box and then potted on completion with the supp potting material - See Appendix A.

## 3 ELECTRICAL INSTALLATION...

Caution. (Remote versions)

- Remove any exposed black conductive layer from under coaxial screens.
- Make connections only as shown.
- Sleeve all bare wiring.
- Twist RED and YELLOW cores lightly together.
- Twist WHITE and GREY coaxial cables lightly together.
- Maintain Environmental Protection at all times.
- Conduit connections must provide cable entry sealing.


Information. (Remote versions)

- Refer to ENVIRONMENTAL PROTECTION (Appendix A).
- Internal appearance of Terminal Box may vary from that shown.


Fig. 3.10 Sensor Terminal Box Connections (Remote version)

## North American Wiring Practice



### 3.3.2 Transmitters (All versions)



Fig. 3.12 Transmitter Connection Terminal access

## Caution.

- Remove any exposed black conductive layer from the inner insulation of both coaxial cables.
- Substitute sensor cable of any kind is not acceptable.
- Do not make connections except as shown.
- Twist cable pairs together as shown.
- Sleeve ALL bare wires.
- Sensor cable may only be joined using company supplied junction box available separately.


Fig. 3.13 Sensor Cable Connections at the Transmitter (Remote version)

North American Wiring Practice


Fig. 3.14 Sensor Cable Connections at the Transmitter (North American Wiring Practice)

### 3.3.3 MagMaster-CalMaster Adapter

When a MagMaster Transmitter is fitted with an adaptor board for use with a CalMaster Veritication Unit, wiring from the sensor to this adaptor board is shown in the following diagram.

To wire the adaptor plug, carefully pull off the plug from the adaptor board, connect the wires, using only a screwdriver with a 2.5 mm blade to tighten the terminal screws, and replace the plug.


Fig 3.15 Fitting the Sensor Wiring onto the Adaptor
ue İndooroopilly SPS Redirēction of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume

## 3 ELECTRICAL INSTALLATION

### 3.4 Input/Output Connections

## Caution.

- Refer to SPECIFICATION SHEET for Input/Output ratings.
- Inductive loads must be suppressed or clamped to limit voltage swings
- Capacitive loads must be inrush current limited.
- Hazardous area requirements are not considered in the following pages.

Note. The connection terminal markings in the metal housed transmitter are identical to those in the standard transmitter as shown in this section. However, the supply connection in the former is made using a non-reversible plug (provided).

### 3.4.1 Frequency Outputs - Fig. 3.16



Fig. 3.16 Frequency Output Connections

### 3.4.2 PLC Interface - Fig. 3.17



Fig. 3.17 Frequency Output Connections

### 3.4.3 Alarm Outputs - Fig. $\mathbf{3 . 1 8}$

iInformation.

- Inductive loads may be suppressed by diodes (D) - 1 N4004 or similar.
- Inrush currents are limited to 1 Amp by resistor $\mathrm{F}-\mathrm{e} .9 .27 \Omega 1 \mathrm{~W}$ tor 24 V systems.
- Operation of outputs is programmable - see Contiguration Manual for details.
- Frequency and Alarm outputs share a common return with contact input.
- External isolators not normally required, as the pulse, alarm and contact circuits are electrically separated from all other Magmaster connections.


Fig. 3.18 Alarm Output Connections

### 3.4.4 Contact Input - Fig 3.19



Fig. 3.19 Contact input Connections
e‘Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume

## . 3 ELECTRICAL INSTALLATION

### 3.4.5 Current Output - Fig. 3.20 and 3.21

## $i$

Information.

- Output is fully programmable - see Programming Guide.
- Output is electrically separated from all other MagMaster connections.
- External isolators are not normally required and may significantly limit accuracy if used.


Fig. 3.20 Current Output Connections: Standard


### 3.4.6 Computer Connection - Fig. 3.22 and 3.23



Information. RS422/423 option is electrically isolated from all other MagMaster connections.


Fig. 3.22 RS 422 Connections (Balanced)


Fig. 3.23 RS 423 Connections (Single Ended or RS 232)

## . 3 ELECTRICAL INSTALLATION

### 3.4.7 Power Supply Connections - Fig. 3.24 and 3.25

## Warning.

- DISCONNECT THE SUPPLY FROM ANY CABLES BEING TERMINATED ON THE TRANSMITTER.
- Electrical installation and earthing (grounding) must be in accordance with relevant national and local standards.
- Ensure that the cover of the metal housed transmitter is never cross threaded. The threads are greased (as supplied).
- Ensure that the grease is in good condition when fitting the cover, and replenish as required with a grease suitable for aluminium threads.


Fig. 3.24 Power Supply Connections (A.C. Version Transmitter)


## Warning.

- Ensure Plant Safety while configuring, at all times.
- The 9-way D-Type Serial Link is not isolated. Ensure that it is NOT connected to power earth (ground), with cathodically protected systems.


### 4.1 Startup

Switch on the power supply to the flowmeter, and if a transmitter with display has been ordered, the flow rate will be shown on the display as shown in Fig. 4.1 or 4.2.
uential application of the provided magnetic Wrand to the left hand icon in the transmitter display area, or by pressing the button on the keypad versions or the remote display, steps the display through the following sequence:
\% (Flow Rate \% of Range)
> (Forward flow total value)
< (Reverse flow total value)

- (Net flow total value)

Alm(Active alarms)
Vel (Flow Velocity in $\mathrm{m} / \mathrm{s}$ or $\mathrm{ft} / \mathrm{s}$ )
Any alarms are displayed sequentially if more than one alarm is present.

Application of the wand to the right hand icon, or pressing the keypad $\square$ button, resets the totaliser display, if this facility is enabled.

## Information.

- For the use of local or remote serial communication, and configuration, see the Quick Reference Programming Guide or the main MagMaster manual.
- For all versions supporting HART ${ }^{T M}$, see the main MagMaster manual.
je indooroopilly SPSं Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume


Fig. 4.2 Location of Controls (Keypad Versions)

## APPENDIX A - ENVIRONMENTAL PROTECTION

## Warning.

- Potting materials are toxic - use suitable safety precautions.
- Read the manufacturers instructions carefully before preparing the potting material.
- The remote sensor terminal box.connections must be potted immediately on completion to prevent the ingress of moisture.
- Check all connections before potting - see ELECTRICAL INSTALLATION.
- Do not overfill the terminal box or allow the potting material to come into contact with the ' O ' ring or groove.
- Do not let potting material enter conduit, if used.



## PRODUCTS \& CUSTOMER SUPPORT

## Products

## Automation Systems

- tor the folfowing industries:
- Chemical \& Pharmaceutical
- Food \& Beverage
- Manulacturing
- Metals and Minerals
- Oil, Gas \& Petrochemical
- Pulp and Paper


## Drives and Motors

- $A C$ and DC Drives, $A C$ and $D C$ Machines, $A C$ molors to 1 kV
- Drive systems
- Force Measurement
- Servo Drives


## Controllers \& Recorders

- Single and Muiti-loop Controllers
- Gircular Chart. Sirip Chart and Papertess Recorders
- Paperless Racorders
- Process indicalors

Flexible Automation

- Industrial Robots and Robot Systems


## Flow Measurement

- Electromagnetic Magnetic Flowmeters
- Mas.s Flow Meters
- Turbine Flowmeters
- Wedigo Flow Elements


## Marine Systems \& Turbochargers

- Electrical Systems
- Marine Equipment
- Olfshore Retrolit and Relerbishment


## Process Analytics

- Process Gas Analysis
- Systems integration


## Transmitters

- Pressure
- Tamperatura
- Level
- Interface Modules


## Valves, Actuators and Positioners

- Control Valves
- Actuators
- Positioners

Water, Gas \& Industrial Analytics
Instrumentation

- $\mathrm{\rho H}$, conductivily, and dissolved oxygen transmitlers and sensors
- ammonia, nitrate, phosphate, sifica, sodium, chioride, fluoride, dissolved oxygen and hydrazine analyzers.
- Zirconia oxygen analyzers, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.


## Customer Support

ABE provides a comprohensive atter sales service via our Worldwide Service Organization. Contact one of the tollowing offices for details on your nearest Service and Repair Centre.

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Fax: +44 (0)1480 470787
United States of America
ABE Aulomation Inc.
Instrumentation Division
Tel: +1 215-674-6000
Fax: +1 215-674-7183

## Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a lailure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged fauity unit.


The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

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Stonehouse.
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Fax: $+44(0) 1453.827856$

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125 E. County Line Road
Warminster, PA 18974

ABB has Sales \& Customer Support expertise in over 100 countries worldwide
www.abb.com

## Polyurethane <br> Resin/Hardener, Composition EL227C/NC

Material Safety Data Sheet
Part Number:
0218492, 0218498, 0218499, 0218902

## READ ALL PAGES

1. Identification of the substance

Product: Polyurethane Resin/Hardener Part No.: $0218492,0218498,0218499,0218902$ Use: Potting Compound
2. Composition / information on Ingrediants

Comprises of two components:
Component 1. Non Hazardous
Component 2. Contains Diphenylmethanediisocyanate isomers
and homologues
Content 60-100\%
CAS No. 9016-87-9
3. Hazards Identification

Component 2 is harmful by inhalation. Irritating to the eyes, respiratory system and skin. May cause sensitisation by inhalation.
4. First aid measures

Eyes: Splashes into the eyes have to be rinsed out immediately with water. Continue to rinse for at least 15 mins . Get medical attention.

Skin: Immediately remove contaminated clothing. Wash off skin thoroughly with water. Contact physiclan if irritation persists.

Inhalation: Move to fresh air at once. When breathing difficult, propenly trained personnel may assist affected person by administrating $100 \%$ oxygen. Keep the affected person warm and at rest. Get prompt medical attention.

Mouth: Gel medical atiention immediaiely. Drink pienty of water and, if possible, an active carbon suspension. DO NOT INDUCE VOMITING. NEVER MAKE AN UNCONSCIOUS.PERSON DRINK FLUIDS!
5. Flre-fighting measures

Suitable extinguishing media: Dry chemicals, sand, dolomite, alcohol resistant foam, carbon dioxide. DO NOT USE HIGH PRESSURE WATER JET!
Special Fire Fighting Procedures: Keep runoff water out of sewers and water courses. Dike for water control. Move container from fire area If possible. If risk of water pollution. inform appropriate authorities.
Hazardous combustion products: Toxic gases/vapours/Humes of: ammonia or amines. Carbon Monoxide (CO). Hydrogen Cyanide (HCN). Nitrous gases (NOX). Isocyanates, butadiene.
6. Accidental release measures

Extinguish all ignition sources. Avoid sparks, flames, heat and smoking. Ventilate.
Prevent runoff or release to sewers, waterways etc. Inform relevant authorities if large quantities are involved.
Clean-up personnel should wear respiratory and/or liquid contact protection. Contain spillage with sand or earth and transfer to labelled salvage containers.
7. Handling and Storage

Avoid spilling, skin and eye contact. Keep away from heat, sparks and open flame.
Ventilate well, avoid breathing vapours. Use approved respirator if contamination above accepted level.
Wear tully protective clothing for prolonged exposure and/or high concentrations of isocyanates.
Do not use contact lenses.
Avoid contact with water, alcohols, amines and other materials, which may react with Isocyanates.
Store between 15 and $25^{\circ} \mathrm{C}$ in locked, well ventilated room isolated

- from acids.

May attack some plastics, rubbers and coatings
8. Exposure controls / personal protection

Component 2: Harmful ingredlent: Diphenyimethanedisocyanate isomers

| CAS: | STD | LTEXP. 8hrs | ST EXP.15mins |
| :--- | :--- | :--- | :--- |
| $9016-87-9$ | MEL | 0.02 mg m | $0.08 \mathrm{mg} \mathrm{m}^{-3}$ |

Ventilation: Adequate general and local exhaust ventilation
Resplrator: no specific recommendation, but must be used if general levet exceeds the MEL.
Dust respirator must be used if cured product is to be machined. Gloves: Rubber or plastic protective gloves to be worn.
Eye Protectlon: Splash-proof eye protection to be worn. No contact lenses.
Other measures: Do not eat, smoke or drink when using this material.
Wash hands after using and before eating drinking or smoking. Promptly remove any clothing that becomes contaminated. Wam personnel of chemicals hazardous properties.
9. Physical and chemical propertles

Component 1.
Form: Low viscosity liquid
Colour: Clear
Odour/Taste: Odourless
Solubility in water: Low
Component 2
Form: Liquid
Colour: Amber
Odour/Taste: Odourless
Solubility in water: Low
10. Stabllity and Reactivity

Stability: Normally stable.
Conditions to avoid: Heat, flames and other sources of Ignition.
Matertals to avoid: Acids, (oxidising, non-oxidising and organic). Bases, alkalis, oxidising agents.
Volatility description: Both components can emit toxic gases in a fire.
11. Toxicology information

THE FOLLOWING ALL REFERS TO COMPONENT 2 WHICH CONTAINS ISOCYANATE ISOMERS.

## Health Hazards General:

THE HEALTH EFFECTS DESCRIBED IN THIS SECTION ARE THOSE THAT MAY BE EXPECTED IF THE MATERIALS ARE NOT HANDLED, USED OR STORED IN ACCORDANCE WITH GOOD industrial hygiene practice. If any of The effects DESCRIBED ARE EXPERIENCEDASARESULT OF EXPOSURE TO THIS MATERIAL, THEN THE USER SHOULD TAKE APPROPRIATE REMEDIAL ACTION.
PERSONS WHO HAVE PRE-EXISTING CONDITIONS LISTED UNDER "MEDICAL CONSIDERATIONS" SHOULD NOT USE NOR BE EXPOSED TO COMPONENT 2. THE FOLLOWING ALL REFERS TO THIS PRODUCT.

Inhalation: Occupational Asthma (of which isocyanates can be a cause) is a reportable disease listed in the RIDDOR regulations (UK).
Health Warnings: In case of hypersensittvity of the respiratory tract (e.g. asthmatics, those who suffer from bronchial complaints or those who develop respiratory sensitisation) it is INADVISABLE to work with this product.
The material can be hazardous when inhaled, and/or touched. It may cause skin/eye irritation and burns (corrosive).
Pulmonary Sensitiser.
Severe pulmonary intitant.
Recognised allergen.

Route of Entry: Inhalation, Ingestion Skin and/or eye contact.
Target Organs: Eyes, Respiratory System, Lungs, Skin.
Medical Symptoms
THE MEDICAL SYMPTOMS DESCRIBED ARE SUBJECTIVE AS SOME INDIVIDUALS WILL REACT TO EXPOSURE/OVER EXPOSURE IN A DIFFERENT MANNER. IF THE MATERIAL IS HANDLED AND STORED IN ACCORDANCE WITH GOOD INDUSTRIAL HYGIENE PRACTICE, EXPOSURE SHOULD NOT BE SUFFICIENT TO CAUSE MEDICAL SYMPTOMS.
Extreme irritation of eyes and mucous membranes, including buming and tearing.
Rhinitus (inflammation of the nasal mucous membranes).
Epistaxis (nose bleeding).
Pharyngitus (inflammation of the back of the mouth).
Severe pulmonary irritation.
General respiratory distress, unproductive cough.
Severe skin irrtation.
Nausea, vomiting.
Severe abdominal pain.

## Medical Conslderations

PERSONNEL WHO HAVE ANY OF THE PRE-EXISTING CONDITIONS LISTED UNDER THIS HEADING SHOULD NOT USE NOR BE EXPOSED TO THIS MATERIAL.

Skin disorders and allergles.
Asthma or any condition leading to impaired lung function.
If employees develop chronic respiratory irritation, unproductive cough or asthma-like symptoms, they should be removed from all work involving this and analogous products. Continuous medical attention is advised until a complete cure is confirmed. Resumption of duties should not be permitted without a doctor's permission. Employees who do not respond to medical treatment or have recurring respiratory problems should be transferred to other work.

If respiratory irritation occurs despite precautions, sensitisation may have developed. The employee should be removed from all further exposure to this and analogous products and not allowed to resume usual dutles without medical permission. It may be necessary to transfer the person to another job.
12. Ecological information

Do not allow to escape into waters, wastewaters or soil.
Component 2 reacts with water at the interface forming carbon dioxide and an insoluble product with a high melting point, i.e. polyurea. This reaction is accelerated by surfactants or by water-soluble solvents. Component 2 is not readily blodegradable.
13. Disposal considerations

Residues must be incinerated with provision for removal of effluent gases by scrubber. Disposal must therefore be in accordance with Local Authority requirements.

## 14. Transport Information

General:
Not classified as hazardous under transport regulations. Keep separated from foodstuffs.

| UN-No: | $n l a$ | IMDG class: | $n / r$ |
| :--- | :--- | :--- | :--- |
| IMO: | $n / r$ | Packaging group: | $n / r$ |
| IATA: | $n / r$ | Packaging group: | $n / r$ |

## 15. Regulatory information

Labelling according to EEC directives
Symbol:

R-phrases: $\quad$ R-20 Harmful by inhalation
R-36/37/38 Irritating to eyes, respiratory system and skin
R-42 May cause sensitisation by inhalation
S-phrases: S-23 Do not breathe gas fumes/vapour/spray S-26 in case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S-51 use only in well ventilated areas
S-24/25 Avoid contact with skin and eyes
$\mathrm{P}-4$ Contains isocyanates. see information provided by manufacturer

## UK Regulatory References:

Health \& Safety at Work Act 1974
Control of Substances Hazardous to Health
Regulations 1999
Chemicals (Hazard Information \& Packaging)
Regulations 1993
EU Directlves:
Diphenylmethanediisocyanate is a substance covered by EC Directive 8215011EEC of 24/6/82 including subsequent amendments, concerning the risks of major accidents in industrial activities Dangerous Preparations Directive 881379
Systems of specific information relating to Dangerous Preparations 911155
Statutory Instruments:
Chemicals (Hazard Information and Packa!
Regulations
Control of Substances Hazardous to Healh
Approved Code of Practice:
Safety Data Sheets for Substances and Preparations L37
Classification and Labelling of Substances and
Preparations Dangerous for Supply
Guidance Notes:
Occupational Exposure Limits EH40
Isocyanates toxic hazards and precautions EH16 Introduction to Local Exhaust Ventilation HS(G)37 CHIP for everyone HSG(108)
16. Other Information

THE ABOVE INFORMATION IS BELIEVED TO BE CORRECT TO ENSURE SAFE HANDLING, USE AND DISPOSAL OF THE PRODUCT. HOWEVER, IT IS NOT TO BE CONSIDERED AS ALL. INCLUSIVE AND SHOULD BE USED ONLY AS A GUIDE.

[^0]AB8 Automation Lid
Stonehouse, Glos.
England. GL 10 3TA
Tel: 44 (0) 1453826561
Fax: 44 (0) 1453 B27856

## Appendix 3: Operating Instructions Indicating \& Adjustment Module PLICSCOM

$\begin{array}{ll}\text { Supplier/Manufacturer: } & \text { Vega } \\ \text { Model Number: } & \text { PLICSCOM.X }\end{array}$
Manufacturer Contact Detail:
398 The Boulevarde,
Kirrawee,
NSW - 2232
(02) 95426662


OrderNo: 1212305_1

## Operating Instructions Indicating and adjustment module PLICSCOM



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## 1 About this document

### 1.1 Function

This operating instructions manual has all the information you need for quick setup and safe operation of PLICSCOM. Please read this manual before you start setup.

### 1.2 Target group

This operating instructions manual is directed to trained personnel. The contents of this manual should be made available to these personnel and put into practice by them.

### 1.3 Symbolism used

## Information, tip, note

This symbol indicates helpful additional information.

## Caution, warning, danger

This symbol informs you of a dangerous situation that could occur. Ignoring this cautionary note can impair the person and/or the instrument.

## Ex applications



This symbol indicates special instructions for Ex al plications.

- List

The dot set in front indicates a list with no implied sequence.

## $\rightarrow$ Action

This arrow indicates a single action.

## 1 Sequence <br> Numbers set in front indicate successive steps in a procedure.

## 2 For your safety

## 2．1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained and specialist personnel authorised by the operator．For safety and warranty reasons，any internal work on the instruments must be carried out only by personnel authorised by the manufacturer．

## 2．2 Appropriate use

PLICSCOM is a pluggable indicating and adjustrment module for VEGA level and pressure sensors．

## 2．3 Warning about misuse

Inappropriate or incorrect use of the instrurnent can give rise to application－specific hazards，e．g．vessel overtill or damage to system components through incorrect mounting or adjustment．

## 2．4 General safety instructions

PLICSCOM is a high－tech instrument requiring the strict observance of standard regulations and guidelines．The user must take note of the safety instructions in this operating instructions manual，the country－specific installation standards（e．g．the VDE regulations in Germany）as well as all prevailing safety regulations and accident prevention rules．

## 2．5 CE conformity

The indicating and adjustment module is in CE conformity to EMC（89／336／EWG）and NSR（73／23／ EWG）．

Conformity has been judged acc. to the following standards:

- EMC:
- Emission EN 61326: 1997
- Susceptibility EN 61326: 1997 + A1:1998
- NSR: EN 61010-1: 2001


### 2.6 Compatibility acc. to NAMUR NE 53

PLICSCOM meets NAMUR recommendation NE 53.
The parameter adjustment of the basic sensor functions is independent of the software version. The available functions depend on the appropriate software version of the single components.

On our website www.vega.com you will find all software histories. Use the possibility and get registered for update information via e-mail.

### 2.7 Safety information for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

## 3 Product description

## 3．1 Configuration

Scope of delivery

## Configuration

The scope of delivery encompasses：
－Indicating and adjustment module PLICSCOM
－Documentation
－this operating instructions manual

PLICSCOM is provided with a display with full dot m＿．．．．： as well as four keys for adjustment．


Fig．1：Indicating and adjustment module PLICSCOM
1 Display
2 Keys


Fig. 2: Rear of the indicating and adjustment module PLICSCOM
1 integrated seal ring
2 gold-plated contact path

### 3.2 Principle of operation

The indicating and adjustment module PLICSCOM is used for measured value indication, adjustment and diagnosis for the following VEGA plics sensors:

- VEGAPULS series 60
- VEGAFLEX series 60
- VEGASON series 60
- VEGABAR series 50 and 60
- VEGACAL series 60.

PLICSCOM is mounted into the respective sensor housing or the extemal indicating and adjustment unit VEGADIS 61. After mounting, sensor and PLICSCOM are splash-proof also without housing cover.

The operation of two PLICSCOM parallel in the sensor and in VEGADIS 61 is not supported.

Power supply

## Area of application



1

### 3.3 Adjustment

Adjustment is carried out via the integrated keys. The entered parameters are generally saved in the respective sensor. With a copy function, parameters can be loaded into the indicating and adjustment module.

### 3.4 Storage and transport

## Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test acc. to DIN EN 24180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

## Storage and transport temperature

- Storage and transport temperature see "Supplement - Technical data - Ambient conditions"
- Relative humidity 20 ... $85 \%$


## 4 Mounting

### 4.1 Mounting procedure

Insert/remove PLICSCOM

PLICSCOM can be mounted or dismounted at any time. An interruption of the power supply is not necessary.
Proceed as follows:
1 Unscrew the housing cover
2 Place PLICSCOM in the required position to the electronics

## Information:

Four different positions are possible, each displaced by $90^{\circ}$.


Fig. 3: Installation of PLICSCOM
3 Press PLICSCOM lightly onto the electronics and turn it to the right until it snaps in
4 Screw housing cover with inspection window tightly back on

## Note:

If you intend to retrofit PLICSCOM with PLICSCOM for continuous measured value indication, a higher cover with an inspection glass is required.

Dismounting is carried out in reverse order.

Set up

## 5 Set up

### 5.1 Adjustment system



Fig. 4: Indicating and adjustment elements
1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions

- [OK] key:
- move to the menu overview
- confirm selected menu
- edit parameter
- save value
- $[->]$ key to select:
- menu change
- list entry
- editing position
- [+] key:
- modify value of a parameter
- [ESC] key:
- interrupt input
- jump to the next higher menu

The sensor is adjusted via the four keys of the indicating and adjustment module. The LC display indicates the individual menu items. The functions
keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with [OK] will not be saved.

### 5.2 General functions

Introduction
Continuously measuring sensors for level and pressure have various functions. Therefore they can be adapted perfectly to the respective application. These functi are structured in menu form. Some of the functions arw sensor-specific. These are described in the operating instructions manual of the respective sensor. Other functions, however, have general character, i.e. they are available in sensors with different measuring principles.

The general functions are described in this paragraph. The functions of PLICSCOM are determined by the sensor and correspond to the respective software version of the sensor.

## Information:

The respective menu item number differs depending on the sensor type and signal output.

Measured value indication The following presentations are available in the measured value display:

- Level as digital value, sensor TAG
- Level as digital value and bar graph, sensor TAG With $[->]$ you select the different presentations of $t$ measured value. From all presentations you reach the menu overview with [OK]. With [ESC] you return from the menu overview to the measured value display.

In the menu overview you select the respective menu with [ $->$ ] and finally reach it with [OK]. Then the individual menu items are available.


## Damping

Li rization curve

Edit senor TAG

Peak values

To damp process-dependent measured value fluctuations, you have to set an integration time of $0 \ldots 999 \mathrm{~s}$ in this menu item.


In this menu item you select the linearization curve:

- linear
- Cylindrical tank
- Spherical tank
- User programmable

User programmable means: Switching on a linearization curve programmed via PC and PACTware ${ }^{\text {TM }}$

The linearization curve relates height and volume. It takes the vessel geometry for the measured value display and the current output into account.


In the menu item "Sensor TAG" you edit a 12 -digit measurement loop character. The character set comprises:

- Letters from A... Z
- Numbers from 0 ... 9
- Special characters +, -, /, -


Min. and max. measured values are saved in the sensor. The values are displayed in the menu item "Peak values".

- Min. and max. distance in m(d): radar, ultrasonic, guided microwave sensors
- Min. and max. pressure: pressure transmitter ${ }^{1)}$
- Min. and max. temperature: ultrasonic sensors, pressure transmitters


When using sensors working acc. to the non-contact measuring principle, the measurement can be influenced by the respective process conditions. In this $m$ item, the reliability of the level echo is displayed in ab. The reliability is signal strength minus noise. The higher the value, the more reliable the measurement.

Indication "OK" or flashing error message, e.g. "E013". In addition, the error appears in clear text in the measured value display.


The following curves are available for radar, guided microwave and ultrasonic sensors:

- Echo curve
- False echo curve ${ }^{2)}$
- Trend curve.

The echo curve represents the echoes with signal strength in "dB" (radar) or in "V" (guided microwav". over the distance. This allows a first rough evaluation of the measurement.

The false echo curve shows the saved false echoes (see menu "Service") of the empty vessel with signal strength in "dB" over the measuring range.

[^1]
## Curve presentation

With a comparison of echo and false echo curve a more detailed statement of the reliability can be made. The selected curve is updated permanently. With the [OK] key, a submenu with zoom functions is opened.

Available with the echo and false echo curve:

- "X-Zoom": Zoom function for the meas. distance
- "Y-Zoom": 2, 5 and 10-times magnification of the signal in "dB"
- "Unzoom": Resetting the presentation to the nominal measuring range with single magnification
Available with the trend curve:
- "X-Zoom": Splitting in minutes, hours or days
- "Stop/Start": Interruption of a recording or start of a new recording
- "Unzoom": Resetting the splitting to minutes


Simulation of measured values

In this menu item you simulate individual level and pressure values via the current output. Then the signal
 path can be tested, e.g. via connected indicating instruments or the input card of the processing system.

The following simulation factors are available:

- Percent
- Current
- Pressure (with pressure transmitters)
- Distance (with radar and guided microwave).

With Profibus PA sensors, the selection of the simulated value is made via the "Channel" in the menu "Basic adjustments".
How to start the simulation:
1 Push [OK]

2 Select the requested simulation factor with [ $->$ ] and confirm with [OK]
3 Set the requested value with $[+]$ and $[->]$.

## 4 Push [OK]

The simulation is now running, with $4 \ldots 20$ mA HART a current is outputted and with Profibus PA or Foundation Fieldbus a digital value.
How to interrupt the simulation:
$\rightarrow$ Push [ESC]

## Information:

The simulation is interrupted automatically 10 minutes after the last key has been pushed.

## Reset



With the reset function, modified values are reset. Three subfunctions are available:

- Basic adjustment
- Reset of the values modified with the indicating and adjustment module to the sensor-specific basic setting (see chart)
- Factory setting
- Like basic setting, but also reset of special parameters modified with PACTware ${ }^{\text {TM }}$ to de very status
- Peak values measured value and temperature ${ }^{31}$
- Reset of the min./max. values of pressure, level and temperature to the current values

3) Temperature only with pressure transmitters and ultrasonic sensors.

Reset values basic setting

| Menu | Menu Item | Radar, ultrasonic | Guided microwave | Pressure |
| :---: | :---: | :---: | :---: | :---: |
| Basic adjustment | Units of measurement | deleted | deleted | Density unit $\mathrm{kg} / \mathrm{dm}^{3}$ |
|  |  | deleted | deleted | Density $1,0000 \mathrm{~kg}{ }^{\prime}$ $\mathrm{dm}^{3}$ |
|  | zero, min. adjustment | upper dead zone depending on instrument | $50,150,300 \mathrm{~mm}$ (upper dead zone depending on the instrument) | Begin nominal measuring range |
|  | span, max. adjustment | end nominal measuring range | $30 \mathrm{~m}(\mathrm{~d})$ | end nominal measuring range |
|  | Linearization curve | linear | linear | linear |
|  | Sensor-TAG | Sensor | Sensor | Sensor |
| Display | Displayed value 1 | Distance | Height | depending on the adjustment unit pressure or height |
|  | Scaling | $\begin{aligned} & 0 \%=0.0,100 \%= \\ & 100.0 \end{aligned}$ | $\begin{aligned} & 0 \%=0.0,100 \%= \\ & 100.0 \end{aligned}$ | $\begin{aligned} & 0 \%=0.0,100 \%= \\ & 100.0 \end{aligned}$ |
| Service | Current output | Output mode: <br> 4...20mA <br> Failure mode: $<3.6 \mathrm{~mA}$ <br> min. current: 3.8 mA | Output mode: <br> 4... 20 mA <br> Failure mode: <br> $<3.6 \mathrm{~mA}$ <br> min. current: 3.8 mA | Output mode: <br> 4... 20 mA <br> Failure mode: <br> $<3.6 \mathrm{~mA}$ <br> min. current: 3.8 mA |



Units of measurement

In this menu item you select the internal arithmetic unit of the sensor.

With radar, guided microwave and ultrasonic sensors this is $\mathrm{m}(\mathrm{d})$ or $\mathrm{ft}(\mathrm{d})$.

For pressure transmitters more comprehensive units are available. They are described in the operating instructions manual of the respective sensor in the menu "Basic adjustments".

## Language

Copy sensor data


The sensor is already set to the ordered national language. In this menu item you can change the language. The following languages are available:

- Deutsch
- English
- Français
- Espanōl
- Pycckuu.


With this function

- data are read from the sensor
- data are written into the sensor.

The data are permanently saved in an EEPROM memory in PLICSCOM and remain there even in case of voltage failure. From PLICSCOM they can be written in one or several sensors and kept as a backup for a possible sensor exchange. When writing the data into the sensor, the instrument type from which the data originate as well as the TAG no. of that sensor are displayed.

## Information:

Before writing the data into the sensor, it is checked if the data sets fit to the measuring principle of the sensor. Loading of useless data is hence prevented.


## PIN

## Info

In this menu item, the PIN is activated/deactivated permanently. Entering a 4-digit PIN protects the sensor data against unauthorized access and unintentional modifications. If the PIN is activated permanently, it can be deactivated temporarily (i.e. for approx. 60 min .) in any menu item. The instrument is delivered with the PIN set to 0000 .


Only the following functions are permitted with activated PIN:

- Select menu items and show data
- Read data from the sensor into the indicating/ adjustment module.

In this menu item the most important sensor information can be displayed:

- Sensor type
- Serial number: 8-digit number, e.g. 12345678
- Date of manufacture: Date of the factory calibration, e.g. 26. September 2004
- Software version: Edition of the sensor software, e.g. 3.22 .00
- Date of last change using PC: Date of the last change of sensor parameters via PC, e.g. 26. September 2004
- Sensor details, e.g. approval, process fitting, seal, meas. cell, meas. range, electronics, housing, cable entry, plug, cable length etc.



```
Serisor
details
```


### 5.3 Special functions - $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$

The $4 \ldots 20 \mathrm{~mA}$... 2 ART special functions are briefly described in this paragraph. The respective range of functions of the indicating and adjustment module is determined by the sensor and the sensor software revision.

Display
In the menu item "Display" you can define how the measured value should be presented on the display.

The foltowing indication values are available:

- Height
- Pressure (only with pressure transmitters)
- Distance (only with radar, guided microwave, ultrasonics)
- Current
- scaled
- Percent
- Lin. percent
- Temperature (only with pressure transmitters).

The selection "scaled" opens the menu items "Display unit" and "Scaling". In "Display unit" there are the following options:

- Height
- Mass
- Flow
- Volume
- Without unit.

Depending on the selection, the different units will be available.

In the menu item "Scaling", the requested numerical value with decimal point is entered for $0 \%$ and $100 \%$ of the measured value.

There is the following relation between the indication value in the menu "Display" and the adjustment unit in the menu "Basic adjustment":

- With radar, guided microwave and ultrasonics, displayed value "Distance" means: presentation of the measured value in the selected adjustment unit, e.g. $\mathrm{m}(\mathrm{d})$
- With pressure, displayed value "Pressure" or "Height" means: presentation of the measured value in the selected adjustment unit, e.g. bar or m.



## Current output

In the menu item "Current output" you determine the behaviour of the current output during operation and in case of failure. The following options are available:

## Current output

| Output mode | $\begin{aligned} & 4 \ldots 20 \mathrm{~mA} \\ & 20 \ldots 4 \mathrm{~mA} \end{aligned}$ |
| :---: | :---: |
| Failure mode ${ }^{\text {a }}$ | $\begin{aligned} & \hline \text { Hold value } \\ & 20.5 \mathrm{~mA} \\ & 22.0 \mathrm{~mA} \\ & <3.6 \mathrm{~mA} \end{aligned}$ |
| Min．current ${ }^{\text {s }}$ | $\begin{aligned} & 3.8 \mathrm{~mA} \\ & 4 \mathrm{~mA} \end{aligned}$ |

The values in bolt font represent the data of the factory setting．

In HART multidrop mode，the current is constantly 4 mA ． This value does not change even in case of failure．

## HART mode

HART offers standard and multidrop mode ${ }^{66}$ ．In multi－ drop mode up to 15 sensors can be operated on one two－wire cable．

In this menu item you determine the HART mode and enter the address with multidrop．


4）Value of the current output in case of failure，e．g．if no valid measured value is delivered．
5）The current never falls below this value during operation．
6）In multidrop mode，the $4 \ldots 20 \mathrm{~mA}$ signal of the HART sensor is switched off．The sensor consumes a constant current of 4 mA ． The meas．signal is only transmitted as digital HART signal．

### 5.4 Special functions - Profibus PA

Introduction

## Sensor address

## Channel

## Display

The Profibus PA special functions are briefly described in this paragraph. The respective range of functions of the indicating and adjustment module is determined by the sensor and the sensor software revision.

Level and pressure sensors operate as slaves on the Profibus PA. To be identified as a bus participant, each sensor must have a unique address. Each instrument is delivered with address 126. With this address, it can at first be connected to an existing bus. However, the address must be changed. This can be done in this menu item.


The channel is the input selector switch for function block (FB) of the sensor. Within the function block, additional scalings (Out-Scale) are carried out. In this menu item, the value fir the function block is selected:

- SV1 (Secondary Value 1):
- Percent with radar, guided microwave and ultrasonic sensors
- Pressure or height with pressure transmitters
- SV2 (Secondary Value 2):
- Distance with radar, guided microwave and ultrasonic sensors
- Percent with pressure transmitters
- PV (Primary Value):
- Linearised percentage value


Radar, guided microwave and ultrasonic sensors deliver the following measured values:

- SV1 (Secondary Value 1): Percentage value after the adjustment
- SV2 (Secondary Value 2): Distance value before the adjustment
- PV (Primary Value): Linearised percentage value
- PA-Out (value after passing the function block): PA output
A pressure transmitter delivers the following measured values:
- SV1 (Secondary Value 1): Pressure or height vanc before the adjustment
- SV2 (Secondary Value 2): Percentage value after the adjustment
- PV (Primary Value): Linearised percentage value
- PA-Out (value after passing the function block): PA output
- Temperature.

In the menu item "Display" you can define which measured value should be presented on the display.


Profibus transmits two values cyclically. The first value is determined in the menu item "Channel". The selection of the additional cyclical value is made in the menu item "Additional PA value".

With radar, guided microwave and ultrasonic sensors the following values are available:

- SV1 (Secondary Value 1): Percentage value after the adjustment
- SV2 (Secondary Value 2): Distance value before the adjustment
- PV (Primary Value): Linearised percentage value.

With pressure transmitters the following values are available:

- SV1 (Secondary Value 1): Pressure and height value before the adjustment
- SV2 (Secondary Value 2): Percentage value after the adjustment
- PV (Primary Value): Linearised percentage value.


Here, you determine the unit and scaling for PA-Out. These settings also apply to the value displayed on PLICSCOM if in the menu item "Displayed value" PAOut was selected.

The following displayed values are available in "OutScale unit":

- Pressure (only with pressure transmitters)
- Height
- Mass
- Flow
- Volume
- Others (no unit, \%, mA).

In the menu item "PV-Out-Scale", the requested numerical value with decimal point is entered for $0 \%$ and $100 \%$ of the measured value.


27835-EN-050405

### 5.5 Menu schematic for a $4 \ldots 20 \mathrm{~mA}$... mART sensor (example: VEGAPULS 61)

## Basic adjustment



## Display



## Diagnostics



## Service



## Info



## 5．6 Menu schematic for a Profibus PA sensor （example：VEGAFLEX 61）

## Basic adjustment



## Display



## Diagnostics


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## VE區號

## Service



## Info



### 5.7 Menu schematic for a Foundation Fieldbus sensor (example: VEGABAR 52)

## Basic adjustment



## Display



## Diagnostics


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## Service



## Info



## 6 Maintenance and fault rectification

### 6.1 Maintenance

When used appropriately under normal condition, the indicating and adjustment module is maintenance-free.

### 6.2 Instrument repair

If it is necessary to repair PLICSCOM please proceed as follows:

You can download a return form ( 23 KB ) from our homepage www.vega.com under: "Services - Downloads - Forms and Certificates - Repair form".

By doing this you help us carry out the repair quickly and without having to call for additional information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument.
- Send the instrument to the respective address of your agency. In Germany to the VEGA headquarters in Schiltach.


## 7 Dismounting

### 7.1 Dismounting procedure



Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "Mounting" and "Connecting to power supply" and carry out the listed steps in reverse order.

### 7.2 Disposal

The indicating and adjustment module consists of materials which can be recycled by specialised recycling companies. We have purposely designed the components to be easily separable. Mark the instrument as scrap and dispose of it according to government regulations (electronic scrap ordinance, ...).

Materials: see "Technical data"
If you cannot dispose of the instrument properly, please contact us about disposal methods or return.


## 8 Supplement

### 8.1 Technical data

General data
Weight 150 g

## Ambient conditions

| Ambient temperature | $-20 \ldots+70^{\circ} \mathrm{C}$ |
| :--- | :--- |
| Storage and transpoit temperature | $-40 \ldots+80^{\circ} \mathrm{C}$ |

## Indicating and adjustment module

Power supply and data transmission
Indication
Adjustment elements
Protection

- unassembled
- mounted into the sensor without cover

Materials

- housing
- inspection window
through sensor via gold-plated sliding contacts ( ${ }^{2} \mathrm{C}$ bus)
LC display in dot matrix
4 keys
|P 20
IP 40

ABS
Polyester foil

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 $\qquad$

## -8:2-Dimensions

## PLICSCOM



Fig. 5: PLICSCOM
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## Q $C \in$

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

## Appendix 4: Operating Instructions VEGABAR 64 4....20mA/HART

| Supplier/Manufacturer: | Vega |
| :--- | :--- |
| Model/Part Number: | BR64 XXGG1RHTMAX |
| Manufacturer Contact Detail: |  |
|  |  |
|  |  |
|  |  |
|  | Kirrawee, |
|  |  |
|  | NSW -2232 |
|  |  |
|  |  |
|  | $(02) 95426662$ |



OrderNo: 1212305_1

Operating Instructions vegabar 64
4 ... $20 \mathrm{~mA} / \mathrm{HART}$


| 8 |
| :--- |
|  |

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## 1 About this document

## 1．1 Function

This operating instructions manual has all the informa－ tion you need for quick setup and safe operation of VEGABAR 64．Please read this manual before you start setup．

## 1．2 Target group

This operating instructions manual is directed to trained personnel．The contents of this manual should be made available to these personnel and put into practice by them．

## 1．3 Symbolism used

## －Information，tip，note

$i$
This symbol indicates helpful additional information．

## Caution，warning，danger

This symbol informs you of a dangerous situation that could occur．Ignoring this cautionary note can impair the person and／or the instrument．

## Ex applications

This symbol indicates special instructions for Ex ap－ plications．
－List
The dot set in front indicates a list with no implied sequence．

## $\rightarrow$ Action

This arrow indicates a single action．

## 1 Sequence

Numbers set in front indicate successive steps in a procedure.

## 2 For your safety

### 2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained, specialised personnel authorised by the operator. For safety and warranty reasons, any internal work on the instruments must be carried out only by personnel authorised by the manufacturer.

### 2.2 Appropriate use

VEGABAR 64 is a pressure transmitter for measurement of gauge pressure, absolute pressure and vacuum.

### 2.3 Warning about misuse

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overtill or damage to system components through incorrect mounting or adjustment.

### 2.4 General safety instructions

VEGABAR 64 is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

### 2.5 CE conformity

VEGABAR 64 is in CE conformity with EMC (89/336/ EWG), fulfils the Namur recommendation NE 21 and is in CE conformity with NSR (73/23/EWG).

Conformity has been judged acc. to the following standards:

## - EMC:

- Emission EN 61326: 2004 (class B)
- Susceptibility EN 61326: 2004 incl. supplement A
- NSR: EN 61010-1: 2001

VEGABAR 64 is not subject to the pressure device guideline. ${ }^{1)}$

### 2.6 Compatibility acc. to NAMUR NE 53

VEGABAR 64 meets NAMUR recommendation NE 53.
VEGA instruments are generally upward and downward compatible:

- sensor software for DTM VEGABAR 64 HART, PA or FF
- DTM VEGABAR 64 for adjustment software PACTware ${ }^{\text {rM }}$
- adjustment module PLICSCOM for sensor software

The parameter adjustment of the basic sensor functions is independent of the software version. The scope of available functions depends on the respective software version of the individual components.

The software version of VEGABAR 64 can be determined as follows:

- via PACTware ${ }^{\text {rm }}$
- on the type label of the electronics
- via the adjustment module PLICSCOM

On our website www.vega.com you will find all software histories. Make use of this convenience and get registered for update information via e-mail.

[^2]
### 2.7 Safety information for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

### 2.8 Environmental instructions

Protection of the environment is one of our most important duties. That is why we have introduced an environment management system with the goal of continuously improving company environmental protection. The environment management system is certified acc. to DIN EN ISO 14001.

Please help us fulfil this obligation by observing the environmental instructions in this manual:

- Chapter "Storage and transport"
- Chapter "Disposal"
$\qquad$


## 3 Product description

### 3.1 Configuration

Scope of delivery

## Components

The scope of delivery encompasses:

- VEGABAR 64 pressure transmitter
- Documentation
- this operating instructions manual
- test certificate
- Ex-specific safety instructions (with Ex versions) and, if necessary, further certificates

VEGABAR 64 consists of the following components:

- Process fitting with measuring cell
- Housing with electronics, optionally available with plug connector
- Housing cover, optionally available with indicating/ adjustment module PLICSCOM

The components are available in different versions.


Fig. 1: Example of a VEGABAR 64 with process fitting G11/2A and plastic housing
1 Housing cover with integrated PLICSCOM (optional)
2 Housing with electronics
3 Process fitting with measuring cell

### 3.2 Principle of operation

Area of application

Physical principle

Power supply

VEGABAR 64 is a pressure transmitter for use in the paper, food processing and pharmaceutical industries as well as in water/sewage water plants. Depending on the version, it is used for level, gauge, absolute pressure or vacuum measurement. Measured products are gases, vapours and liquids, also those containing abrasive substances.

The sensor element is the CERTEC ${ }^{\circledR}$ measuring cell with flush, abrasion resistant ceramic diaphragm. The hydrostatic pressure of the medium or the process pressure causes a capacitance change in the measuring cell via the diaphragm. This change is converted into an appropriate output signal and outputted as measured value.

The CERTEC ${ }^{\oplus}$ measuring cell is also equipped with a temperature sensor. The temperature value can be displayed via PLICSCOM or processed via the signal output.

Two-wire electronics $4 \ldots 20 \mathrm{~mA}$... HART for power supply and measured value transmission on the same cable.

The power supply range can differ depending on the instrument version. The exact range is stated in the "Technical data" in the "Supplement".

### 3.3 Adjustment

VEGABAR 64 can be adjusted with three different adjustment media:

- the indicating and adjustment module PLICSCOM
- an adjustment software acc. to FDT/DTM standard, e.g. PACTware ${ }^{\text {TM }}$ and PC
- a HART handheld

The entered parameters are generally saved in VEGABAR 64, optionally also in PLICSCOM or in PACTware ${ }^{\text {™ }}$.
$\Rightarrow$

### 3.4 Storage and transport

Packaging

Storage and transport
temperature

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test acc. to DIN EN 24180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

- Storage and transport temperature see "Supplement - Technical data - Ambient conditions"
- Relative humidity $20 \ldots 85 \%$


## 4 Mounting

## 4．1 General instructions

Wetted materials

Installation position

## Moisture

Check if the wetted materials such as seal，process fitting etc．are suitable for the existing process condi－ tions，such as product，temperature etc．

Select an installation position you can easily reach for mounting and connecting as well as later retrofitting of an indicating and adjustment module．The housing can be rotated by $330^{\circ}$ without the use of any tools．You can also install the indicating and adjustment module in four different positions（each displaced by $90^{\circ}$ ）．

Use the recommended cable（see chapter＂Connecting to power supply＂）and tighten the cable entry．
You can give your VEGABAR 64 additional protection against moisture penetration by leading the connection cable downward in front of the cable entry．Rain and condensation water can thus drain off．This applies mainly to mounting outdoors，in areas where moisture is expected（e．g．by cleaning processes）or on cooled or heated vessels．


Fig．2：Measures against moisture penetration

Mounting

### 4.2 Mounting procedure

Welding the socket

Sealing/Screwing in threaded versions


Sealing/Screwing in flange versions

To mount VEGABAR 64, a welded socket is necessary. Use components from the line of VEGA mounting accessories:

- Welded socket G1A, article no. 2.27867
- dto. G11/2A, article no. 2.21993
- dto. Tri-Clamp 1", article no. 2.24711
- dto. Tri-Clamp 11/2", article no. 2.14140
- dto. Tri-Clamp 2", article no. 2.10974
- dto., hygienic fitting with slotted round nut F40, article no. 2.23898
- dto. DN 40 DIN 11851, article no. 2.10955
- dto. DN 50 DIN 11851, article no. 2.4177
- dto. DN 50 DIN 11864, article no. 2.25290
- dto. DRD, article no. 2.10500
- dto. M44×1.25, article no. 2.15986
- dto. cone 2.1, nut M64x2, article no. 2.9875
- dto. cone 2.1, nut M52x2, article no. 2.8760
$\rightarrow$ Note the applicable welding standards (segment welding procedure) when welding the socket.

Seal the thread with teflon, hemp or a similar resistant seal material on the process fitting thread $11 / 2$ NPT.
$\rightarrow$ Screw VEGABAR 64 into the welded socket. Tighten the hexagon screw on the process fitting. Wrench size see dimensional drawings.

## Warning:

The housing must not be screwed in! Tightening can damage the rotary mechanism of the housing.

Seal the flange connections acc. to DIN/ANSI with a suitable, resistant seal and mount VEGABAR 64 with suitable screws.

Use the appropriate seal. You will find the seal material and the VEGA article no. in the following list:

- Tri-Clamp1": EPDM, article no. 2.24710
- Tri-Clamp 1½": EPDM, article no. 2.14141
－Tri－Clamp 2＂：EPDM，article no． 2.10975
－hygienic fitting with slotted round nut：EPDM 40x5， article no． 2.28074
－Bolting DIN 11851 DN 40：NBR，article no． 2.10956
－dto．DIN 11851 DN 50：NBR，article no． 2.4178
－dto．DIN 11864 DN 50：EPDM，article no， 2.17682
－DRD PN 40：PTFE，article no． 2.10360
－Cone 2．1，nut 64x2；EDPM，article no．2．19094．


## 5 Connecting to power supply

### 5.1 Preparing the connection

Note safety instructions

Take note of safety instructions for Ex applications

Select power supply

Select connection cable

Always observe the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltages are expected, overvoltage arresters should be installed


## Tip:

We recommend VEGA overvoltage arresters ÜS-F-LB-I and ÜSB 62-36G. .

In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units.

Power supply and current signal are transmitted via the same two-wire connection cable. The power supply range can differ depending on the instrument version. The exact range is stated in the Technical data in the Supplement.
Provide a reliable separation between the supply circuit and the mains circuits acc. to DIN VDE 0106 part 101. The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as all VEGAMETs meet this requirement.

Bear in mind the following factors regarding supply voltage:

- the reduction of the output voltage of the power supply unit under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault signal)
- the influence of additional instruments in the circuit (see load values in Technical data)
VEGABAR 64 is connected with standard two-wire cable without screen. An outer cable diameter of 5 .. 9 mm ensures the seal effect of the cable entry. If electromagnetic interference is expected, we recommend the use of screened cable.



## Cable screening and grounding

Connect the cable screen on both ends to ground potential．In the sensor，the screen must be connected directly to the internal ground terminal．The ground terminal outside on the housing must be connected to the potential equalisation（low impedance）．
If potential equalisation currents are expected，the connection on the evaluation side must be made via a ceramic capacitor（e．g． $1 \mathrm{nF}, 1500 \mathrm{~V}$ ）．The low frequency potential equalisation currents are thus sup－ pressed，but the protective effect against high frequency interference signals remains．

Take note of the corresponding installation regulations for Ex applications．In particular，make sure that no potential equalisation currents flow over the cable screen．In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation．

## 5．2 Connection procedure

Proceed as follows：
1 Unscrew the housing cover
2 If a PLICSCOM indicating and adjustment module is installed，remove it by turning it slightly to the left．

3 Loosen compression nut of the cable entry
4 Remove approx． 10 cm of the cable mantle，strip approx． 1 cm insulation from the ends of the individual wires

5 Insert the cable into the sensor through the cable entry
6 Lift the opening levers of the terminals with a screwdriver（see following illustration）
7 Insert the wire ends into the open terminals according to the wiring plan

8 Press down the opening levers of the terminals, you will hear the terminal spring closing

9 Check the hold of the wires in the terminals by lightly pulling on them

10 Connect the screen to the intemal ground terminal and the extemal ground terminal to potential equalisation

11 Tighten the compression nut of the cable entry, the seal ring must completely encircle the cable
12 Screw the housing cover back on
The electrical connection is finished.


Fig. 3: Connection steps 6 and 7

IP 68 version

27525-EN-050421

Proceed as follows:
1 Loosen the screw in the cover of the plug connector and remove it

2 Open the cover and remove it
3 Press the plug insert downwards
4 Loosen the screws of the strain relief and cable entry


Fig. 4: Plug connector with opened cover
1 Plug insert
2 Strain relief
3 Cable entry
4 Housing
5 Insert the connection cable through the cable entry and into the plug housing ${ }^{2)}$
6 Connect the wire ends to the screw terminals acc. to the wiring plan


Fig. 5: Connection to the screw terminals
1 Plug insert
2 Housing
3 Cable entry
2) The connection cable is already preconfectioned. If necessary shorten to the requested length, cut the breather capillaries clean. Remove approx. 5 cm of the cable mantle, strip approx. 1 cm insulation from the ends of the individual wires. After shortening the cable, fasten the type plate with support back onto the cable.
$\qquad$

7 insert the plug insert into the plug housing

## \%

## Information:

Note correct alignment, see figure "Plug connector with open cover"!

8 Tighten the screws on the strain relief and cable entry

9 Hook in the cover and press it onto the plug connector

10 Attach the plug seal, tighten the plug connector with the screw

### 5.3 Wiring plans, single chamber housing

The following illustrations apply to the non-Ex as well as
 to the Ex ia version.


Fig. 6: Material versions, single chamber housing
1 Plastic
2 Aluminium
3 Stainless steel
4 Filter element for pressure compensation or blind stopper with version IP 66/IP 681 bar

Electronics and connec－ tion compartment


Fig．7：Electronics and connection compartment，single chamber housing
1 Plug connector for VEGACONNECT（ $I^{2} C$ interface）
2 Spring－loaded terminals for connection of the external indication VEGADIS 61
3 Ground terminal for connection of the cable screen
4 Spring－loaded terminals for power supply


Fig．8：Wiring plan，single chamber housing
1 Power supply／Signal output

## 5．4 Wiring plans，double chamber housing

The following illustrations apply to the non－Ex as well as to the Ex ia version．The Exd version is described in the next subchapter．


## Housing overview



Fig. 9: Double chamber housing
1 Housing cover, connection compartment
2 Blind stopper or plug M12x1 for VEGADIS 61 (option)
3 Housing cover, electronics compartment
4 Filter element for pressure compensation or blind stopper with version IP 66/IP 681 bars)
5 Cable entry or plug
Electronics compartment


Fig. 10: Electronics compartment, double chamber housing
1 Plug connector for VEGACONNECT (I2C interface)
2 Internal connection cable to the connection compartment
3 Terminals for VEGADIS 61
3) Version IP 66/IP 681 bar not with four-wire instruments
je｜Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Voluin Connecting to power supply V宣區

## Connection compartment



Fig．11：Connection compartment，double chamber housing
1 Plug connector for VEGACONNECT（ $I^{2} C$ interface）
2 Ground terminal for connection of the cable screen
3 Spring－loaded terminals for power supply

## Wiring plan



Fig．12：Wiring plan，double chamber housing
1 Power supply／Signal output

## 5．5 Wiring plans，double chamber housing Exd

Housing overview


Fig．13：Double chamber housing
1 Housing cover，connection compartment
2 Blind stopper or plug M12x1 for VEGADIS 61 （option）
3 Housing cover，electronics compartment
4 Filter element for pressure compensation or blind stopper with version IP 66／IP 681 bart
5 Cable entry or plug
Electronics compartment


Fig．14：Electronics compantment，double chamber housing
1 Plug connector for VEGACONNECT（ $1^{2} \mathrm{C}$ interface）
2 Internal connection cable to the connection compantment
3 Terminals for VEGADIS 61

4）Version IP 66／IP 681 bar not with four－wire instruments

## Connection compartment



Fig．15：Connection compartment，double chamber housing Exd
1 Spring－loaded terminals for power supply and cable screen
2 Ground terminal for connection of the cable screen

## Wiring plan



Fig．16：Wiring plan，double chamber housing Exd
1 Power supply／Signal output

## Overview

### 5.6 Wiring plans, remote electronics



Fig. 17: VEGABAR 64 in IP 68 version and direct cable outlet, remote electronics

Electronics and connection compartment


Fig. 18: Electronics and connection compartment
1 Plug connector for VEGACONNECT (I2C interface)
2 Plug connector to VEGABAR
3 Spring-loaded terminals for connection of the external indication VEGADIS 61
4 Ground terminal for connection of the cable screen
5 Spring-loaded terminals for power supply

Wiring plan plug connec－ tor，remote electronics


Fig．19：Wiring plan plug connector，remote electronics
1 brown
2 blue
3 yellow
4 Screen
5 Breather capillaries

Wiring plan，remote elect－ ronics

Switch on phase


Fig．20：Wiring plan，remote electronics
1 Power supply

## 5．7 Switch on phase

After VEGABAR 64 is connected to power supply，the instrument carries out a self－test for approx． 30 seconds． The following steps are carried out：
－internal check of the electronics
－indication of the instrument type，the firmware version as well as the sensor TAGs（sensor name）
－output signal jumps briefly（approx． 10 seconds）to the set fault current．
$\qquad$

Then the actual measured value is displayed and the corresponding current is transmitted to the cable. ${ }^{5)}$
5) The values correspond to the actual level as well as to the settings already carried out, egg. default setting.

## 6 Setup with the indicating and adjustment module PLICSCOM

### 6.1 Short description

Function/Configuration

Insert/remove PLICSCOM

The indicating and adjustment module PLICSCOM is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

- All sensors of the plics ${ }^{\left({ }^{(2)}\right.}$ instrument family, in the single as well as in the double chamber housing (optionally in the electronics or connection compartment)
- External indicating and adjustment unit VEGADIS 61.


## Note:

You will find detailed information on the adjustment in the operating instructions manual of the indicating and adjustment module PLICSCOM.

### 6.2 Installing the indicating and adjustment module PLICSCOM

PLICSCOM can be inserted or removed at any time. It is not necessary to interrupt the power supply.

Proceed as follows:
1 Unscrew the housing cover
2 Place PLICSCOM in the desired position on the electronics (you can choose any one of four different positions - each displaced by $90^{\circ}$ )
3 Press PLICSCOM lightly onto the electronics and turn it to the right until it snaps in.

4 Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

PLICSCOM is powered by the sensor, an additional connection is not necessary.


Fig. 21: Installation of PLICSCOM
Note:
If you intend to retrofit VEGABAR 64 with PLICSCOM for continuous measured value indication, a higher cover with an inspection glass is required.

## 6．3 Adjustment system



Fig．22：Indicating and adjustment elements
1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions
－［OK］key：
－move to the menu overview
－contirm selected menu
－edit parameter
－save value
－［ $->$ ］key to select：
－menu change
－list entry
－editing position
－［＋］key：
－modify value of a parameter
－［ESC］key：
－interrupt input
－jump to the next higher menu

## Adjustment system

The sensor is adjusted via the four keys of the indicating and adjustment module．The LC display indicates the individual menu items．The functions of the individual keys are shown in the above illustration．Approx． 10 minutes after the last pressing of a key，an automatic
reset to measured value indication is triggered. Any values not confirmed with [OK] will not be saved.

### 6.4 Setup procedure

Address setting HARTMultidrop

In HART-Multidrop mode (several sensors on one input) the address must be set before continuing with the parameter adjustment. You will find a detailed description in the operating instructions manual of PLICSCOM or in the online help of PACTware ${ }^{\text {TM }}$ or DTM.


Level or process pressure measurement

Optional settings

Parameter adjustment "Level measurement"

VEGABAR 64 can be used for level as well as for process pressure measurement. Default setting is level measurement. The mode can be changed in the adjustment menu.

Depending on your application, only the respective subchapter "Level measurement" or "Process pressure measurement" will apply. There you will find the individual adjustment steps.

Additional adjustment and diagnosis options such as e. g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual of the indicating and adjustment module PLICSCOM.

## Level measurement

Set up VEGABAR 64 in the following sequence:
1 Selecting adjustment unit/density unit
2 Carry out position correction
3 Carrying out min. adjustment
4 Carrying out max. adjustment

In the menu item＂Units of measurement＂you select the physical unit in which the adjustment should be carried out，e．g．mbar，bar，psi．．．

The position correction compensates the influence of the mounting position or static pressure on the measurement．It does not influence the adjustment values．

## Information：

These steps are not necessary for instruments which are already preset acc．to customer specifications！

You can find these data on the type label on the instrument and in the menu items of the min．／max． adjustment．

PLICSCOM enables the adjustment without filling or pressure．You can carry out the settings in the workshop without the instrument having to be installed．

In the menu items for min．／max．adjustment，the actual measured value is also displayed．

Selecting adjustment univ／ density unit

To switch over to another adjustment unit（in the example from bar to mbar），proceed as follows：6）

1 Push［OK］in the measured value display，the menu overview will be displayed．


2 Confirm the menu＂Basic adjustment＂with［OK］，the menu item＂Units of measurement＂will be displayed．


3 Activate the selection with［OK］and select the requested unit with［ $->$ ］（in the example mbar）．

8）Selection options：mbar，bar，psi， $\mathrm{Pa}, \mathrm{kPa}, \mathrm{MPa}, \mathrm{inHg}, \mathrm{mmHg}$ ， $\mathrm{inH}_{2} \mathrm{O}, \mathrm{mmH}_{2} \mathrm{O}, \mathrm{mm}, \mathrm{cm}, \mathrm{m}$ ，in， f ．

4 Confirm with [OK] and move to position correction with $[->]$.

The adjustment unit is now changed from bar to mbar.
Information:
When changing over to a height unit (in the example from bar to m ), also the density has to be entered.

Proceed as follows:
1 Push [OK] in the measured value display, the menu overview will be displayed.
2 Confirm the menu "Basic adjustment" with [OK], the menu item "Units of measurement" will be displayed.

3 Activate the selection with [OK] and select the requested unit with $[->]$ (in the example $m$ ).
4 Confirm with [OK], the submenu "Density unit" appears.


5 Select the requested unit, e.g. $\mathrm{kg} / \mathrm{dm}^{3}$ with $[->]$ and confirm with [OK], the submenu "Density" appears.


6 Enter the requested density value with [ $->$ ] and $[+]$, confirm with $[O K]$ and move to position correction with [ $->$ ].

The adjustment unit is now changed from bar to m .
Carry out position correction

Proceed as follows:
1 Edit the offset value in the menu item "Position correction" with [OK].


2 Set the requested offset value, e.g. the actual measured value with reciprocal sign with $[->]$ and [+].

3 Confirm with [OK] and move to min. (zero) adjustment with $[->]$.

Carrying out min. adjust- Proceed as follows: ment

Carrying out max. adjustment

1 Edit in the menu item "Min. adjustment" the \% value with [OK].


2 Set the requested \% value with [ + ] and $[->]$.
3 Edit the requested mbar value with [OK].
4 Set the requested mbar value with [ + ] and $[\rightarrow]$.
5 Confirm with [+] and move to max. adjustment with $[\rightarrow]$.

The min. adjustment is finished.

## Information:

To adjust with a filling, you simply enter the indicated actual measured value. If the adjustment ranges are exceeded, the message is displayed "Outside parameter limits". The editing procedure can be interrupted with [ESC] or the displayed limit value can be accepted with [OK].

Proceed as follows:
1 Edit the \% value in the menu item "Max. adjustment" with [OK].


Information:
The displayed pressure for $100 \%$ corresponds to the nominal measuring range of the sensor (in the above example $1.0 \mathrm{bar}=1000 \mathrm{mbar})$.

2 Set the requested \% value with [ $->$ ] and [OK].
3 Edit the requested mbar value with [OK].
4 Set the requested mbar value with [ + ] and $[->]$.
5 Confirm with [OK] and move to the menu overview with [ESC].

The max. adjustment is finished.
Information:
To adjust with a filling, you simply enter the indicated actual measured value. If the adjustment ranges are exceeded, the message is displayed "Outside parameter limits". The editing procedure can be interrupted with [ESC] or the displayed limit value can be accepted with [OK].

The setup of VEGABAR 64 is finished. All other menu items are described in the separate operating instructions manual of the indicating and adjustment module PLICSCOM.

## Process pressure measurement

Set up VEGABAR 64 in the following sequence:
1 Select application "Process pressure measurement"
2 Select the adjustment unit
3 Carry out position correction
4 Carry out zero adjustment
5 Carry out span adjustment

In the menu item "Units of measurement" you select the physical unit in which the adjustment should be carried out, e.g. mbar, bar, psi...

The position correction compensates the influence of the mounting position or static pressure on the measurement. It does not influence the adjustment values.

In the menu items "zero" and "span" you determine the span of the sensor, the span corresponds to the end value.

## Information:

These steps are not necessary for instruments which are already preset acc. to customer specifications!

You can find these data on the type label on the instrument and in the menu items of the zero/span adjustment.

PLICSCOM enables the adjustment without filling or pressure. You can carry out the settings in the workshop without the instrument having to be installed.

In the menu items for zero/span adjustment, the actual measured value is also displayed.

Select application "Process pressure,measurement"

VEGABAR 64 is preset to application "Level measurement". Proceed as follows when switching over to application "Process pressure measurement":

1 Push [OK] in the measured value display, the menu overview will be displayed.
2 Select the menu Service with " $[->]$ " and confirm with [OK].


3 Select the menu item "Appiication" with [ $->$ ] and edit with [OK].

## Warning:

Note the warning: "Output can change".
4 Select "OK" with [ $->$ ] "OK" and confirm with [OK].
5 Select "Process pressure" from the list and confirm with [OK].

Select the adjustment unit To switch over to another adjustment unit (in the example from bar to mbar), proceed as follows:7)

1 Push [OK] in the measured value display, the menu overview will be displayed.


2 Confirm the menu "Basic adjustment" with [OK], the menu item "Units of measurement" will be displayed.


3 Activate the selection with [OK] and select the requested unit with $[\rightarrow$ ] (in the example mbar).

4 Confirm with [OK] and move to position correction with $[->]$.

The adjustment unit is now changed from bar to mbar.

Carry out position correcstion
-
$:$
$m$


Proceed as follows:
1 Edit the offset value in the menu item "Position correction" with [OK].
7) Selection options: mbar, bar, psi, $\mathrm{Pa}, \mathrm{kPa}, \mathrm{MPa}, \mathrm{inHg}, \mathrm{mmHg}$, in $\mathrm{H}_{2} \mathrm{O}, \mathrm{mmH}_{2} \mathrm{O}$.

2 Set the requested offset value，e．g．the actual measured value with reciprocal sign with $[->]$ and ［ + ］．

3 Confirm with［OK］and move to min．（zero）adjust－ ment with $[->]$ ．

Carry out zero adjustment Proceed as follows：
1 Edit the mbar value in the menu item＂zero＂with ［OK］．


2 Set the requested mbar value with［ + ］and［ $->]$ ．
3 Confirm with［OK］and move to span adjustment with ［ $\rightarrow$ ］．

The zero adjustment is finished．

## Information：

The zero adjustment shifts the value of the span adjustment．The span，i．e．the difference between these values，however，remains unchanged．

## －Information：

To adjust with pressure，you simply enter the indicated actual measured value．If the adjustment ranges are exceeded，the message is displayed＂Outside para－ meter limits＂．The editing procedure can be interrupted with［ESC］or the displayed limit value can be accepted with［OK］．

## Carry out span adjustment Proceed as follows：

1 Edit the mbar value in the menu item＂span＂with ［OK］．


Information:
The displayed pressure for $100 \%$ corresponds e.g. to the nominal range of the sensor (in the above example $1.0 \mathrm{bar}=1000 \mathrm{mbar})$.

2 Set the requested mbar value with [ $->$ ] and [OK].
3 Confirm with [OK] and move to the menu overview with [ESC].

The span adjustment is finished.

## $i$

## Information:

To adjust with pressure, you simply enter the indicated actual measured value. If the adjustment ranges are exceeded, the message is displayed "Outside parameter limits". The editing procedure can be interrupted with [ESC] or the displayed limit value can be accepted with [OK].

The setup of VEGABAR 64 for process pressure measurement is finished. All other menu items are described in the separate operating instructions manual of the indicating and adjustment module PLICSCOM.
uél Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume Setup with the in ing and adjustment module PLICSCOM


### 6.5 Menu schematic



## Display



## Diagnostics



## \section*{Service}



## Info



27525-EN-050421

## 7 Setup with PACTware ${ }^{\text {TM }}$

### 7.1 Connecting the PC

Connecting the PC directly to the sensor


Fig. 23: PC connected directly to the sensor
1 RS232 connection
2 VEGABAR 64
$3 I^{2} C$ adapter cable for VEGACONNECT 3
Necessary components:

- VEGABAR 64
- PC with PACTware ${ }^{T M}$ and suitable VEGA-DTM
- VEGACONNECT 3 with $I^{2} \mathrm{C}$ adapter cable (article no. 2.27323)
- power supply unit

Connecting the PC to the signal cable


Fig. 24: Connecting the PC to the signal cable
1 RS232 connection
2 VEGABAR 64
3 HART adapter cable for VEGACONNECT 3
4 HART resistance 250 Ohm
Necessary components:

- VEGABAR 64
- PC with PACTware ${ }^{T M}$ and suitable VEGA-DTM
- VEGACONNECT 3 with HART adapter cable (art. no. 2.25397)
- HART resistance approx. 250 Ohm
- power supply unit


## Note:

With power supply units with integrated HART resistance (internal resistance approx. 250 Ohm ), an additional external resistance is not necessary (e.g. VEGATRENN 149A, VEGADIS 371, VEGAMET 381). In such cases, VEGACONNECT 3 can be connected parallel to the $4 \ldots 20 \mathrm{~mA}$ cable.

### 7.2 Parameter adjustment with PACTware ${ }^{\text {TM }}$

Further setup steps are described in the operating instructions manual DTM Collection/PACTware ${ }^{T M}$ attached to each CD and which can also be downloaded
from our homepage. A detailed description is available in the online help of PACTware ${ }^{\text {rM }}$ and the VEGA-DTMs.

## Note:

Keep in mind that for setup of VEGABAR 64, DTMCollection $11 / 2002$ or a newer version must be used.
All currently available VEGA-DTMs are provided in the DTM Collection on CD and can be obtained from the responsible VEGA agency for a token fee. This CD includes also the up-to-date PACTware ${ }^{\text {TM }}$ version. The basic version of this DTM Collection incl. PACTware ${ }^{\text {TM }}$ is also available as a free-of-charge download from the Internet.

## 8 Maintenance and fault rectification

### 8.1 Maintenance

When used as directed in normal operation, VEGABAR 64 is completely maintenance-free.

### 8.2 Fault rectification

Causes of malfunction

Fault rectification

24 hour service hotline

Checking the 4 ... 20 mA signal

VEGABAR 64 offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Power supply
- Signal processing.

The first measures are to check the output signal as well as to evaluate the fault messages via the adjustment module PLICSCOM. The procedure is described below. Further comprehensive diagnostics can be carried out with a laptop with the software PACTware ${ }^{\text {TM }}$ and the suitable DTM. In many cases, the causes can be determined in this way and faults can be rectified.

Should these measures not be successful, please call in urgent cases the VEGA service hotline under the phone number +49 1805858550.

The hotline is available to you 7 days a week round-theclock. Since we offer this service world-wide, the support is only available in the English language. The service is free of charge, only the standard telephone costs will be charged.

Connect a hand-held multimeter with a suitable measuring range acc. to the wiring plan.
? $4 \ldots 20 \mathrm{~mA}$ signal not stable

- level fluctuations
$\rightarrow$ set integration time via PLICSCOM or PACTware ${ }^{\text {TM }}$
- no atmospheric pressure compensation
$\rightarrow$ check the pressure compensation in the housing and clean the filter element, if necessary
? $4 \ldots 20 \mathrm{~mA}$ signal missing
- incorrect connection to power supply
$\rightarrow$ Check connection acc. to chapter "Connection procedure" and correct, if necessary, acc. to chapter "Wiring plans"
- no power supply
$\rightarrow$ check cables for line break, repair, if necessary
- supply voltage too low or load resistance too high
$\rightarrow$ check and adapt, if necessary
? Current signal greater than 22 mA or less than 3.6 mA
- electronics module or measuring cell defective
$\rightarrow$ exchange instrument or return it for repair
- Fault messages via PLICSCOM
$\rightarrow$ see below

Fault messages via PLICSCOM

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.
? E013

- no measured value available ${ }^{8)}$
$\rightarrow$ return instrument for repair
? E017
- adjustment span too small
$\rightarrow$ repeat with modified values
e) Fault message can come up it the pressure is higher than the nominal range


## ? E036

- no operable sensor software
$\rightarrow$ carry out a software update or return instrument for repair


## ? E041

- hardware error
$\rightarrow$ exchange instrument or return it for repair


### 8.3 Exchanging the electronics

The electronics of VEGABAR 64 consists of the measuring cell electronics and the processing electronics. The measuring cell electronics in the process fitting is not accessible to the user. The processing electronics is in the form of a module in the housing. If this electronics is defective, it can be exchanged by the user.

The electronics modules differ only in their signal output and are suitable for all VEGABAR series 50 and 60 sensors. The following types are available:

- BR-E.60H (4 ... $20 \mathrm{~mA} / \mathrm{HART}$ )
- BR-E.60P (Profibus PA)
- BR-E.60F (Foundation Fieldbus)

An exchange of the same type is thus possible. If there is no electronics module available on site, it can be ordered from the responsible VEGA agency. It can be ordered with or without serial number.

The electronics with serial number includes orderspecific data such as housing, process fitting, seal etc. The electronics without serial number includes no order-specific data. The serial number can be found on

### 8.4 Instrument repair

If it is necessary to repair VEGABAR 64 please proceed as foliows:

You can download a return form ( 23 KB ) from our homepage www.vega.com under: "Services - Downloads - Forms and Certificates - Repair form".

By doing this you help us carry out the repair quickly and without having to call back for needed information.

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument.
- Send the instrument to the respective address of your agency. In Germany to the VEGA headquarters in Schiltach.


## 9 Dismounting

### 9.1 Dismounting procedure

## Warning:

Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel, high temperatures, corrosive or toxic products etc.

Take note of chapters "Mounting" and "Connecting to power supply" and carry out the listed steps in reverse order.

### 9.2 Disposal

VEGABAR 64 consists of materials which can be recycled by specialised recycling companies. We have purposely designed the electronic modules to be easily separable. Mark the instrument as scrap and dispose of it according to government regulations (electronic scrap ordinance, ...).

Materials: see "Technical data"
If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

## 10 Supplement

## 10．1 Technical data

## General data

Materials，wetted parts
－Process fitting ．
－Diaphragm
－Seal，measuring cell
Materials，non－wetted parts
－Housing
－Seal ring between housing and housing cover
－Inspection window in housing cover for PLICSCOM
－Ground terminal
－Connection cable between IP 68 housing and remote electronics
－Plug connector
－Cover screw plug connector
－Type plate support with IP 68 version on cable

## Weight

316 L （1．4435 or 1．4404），PVDF，PVDF plated，Hastelloy C4 plated
sapphire ceramic ${ }^{\oplus}$（ $99.9 \%$ oxide ceramic）
Viton，Kalrez 6375，EPDM
plastic PBT（Polyester），Alu－die casting powder－coated，316L（1．4435）
NBR（stainless steel housing），silicone （Alu／plastic housing）
Polycarbonate（UL746－C listed）
316Ti／316L（1．4571／1．4435）
PUR，FEP，PE

## PA

StSt
PE hard
$0.8 \ldots 8 \mathrm{~kg}$（ $1.8 \ldots 17.6 \mathrm{lbs}$ ），depending on the process fitting

## Output variable

Output signal
Resolution
Fault signal
Current limitation
Load
Integration time (63 \% of the input variable)
Rise time
Fulfilled NAMUR recommendation

4 ... $20 \mathrm{~mA} / \mathrm{HART}$
$1.6 \mu \mathrm{~A}$
current output unchanged; 20.5 mA ;
22 mA ; $<3.6 \mathrm{~mA}$ (adjustable)
22 mA
see load diagram in Power supply
0 ... 999 s , adjustable
150 ms (ti: $0 \mathrm{~s}, 0 \ldots 100 \%$ )
NE 43

## Additional output variable - temperature

Processing is made via HART multidrop, Profibus PA and Foundation Fieldbus

Range
Resolution
$-50 \ldots+150^{\circ} \mathrm{C}\left(-58 \ldots+302^{\circ} \mathrm{F}\right)$ $1^{\circ} \mathrm{C}\left(1.8^{\circ} \mathrm{F}\right)$

## Input variable

Adjustment range of the zero/span adjustment:

- zero
$-50 \ldots+95 \%$ of the nominal measuring range
- span
$-120 \ldots+120 \%$ of the nominal measuring range ${ }^{9}$

Adjustment range of the min. adjustment:

- percentage value
- pressure value
from $-10 \ldots 110 \%$ of the nominal range from $-50 \ldots 150 \%$ of the nominal range
- Adjustment range of the max. adjustment:
- percentage value
- pressure value
from $-10 \ldots 110 \%$ of the nominal range from $-50 \ldots 150 \%$ of the nominal measuring range

1:30 (no limitation)
Recommended max. turn down

| Nominal range | Overload resistance | Vacuum resistance |
| :--- | :--- | :--- |
| Gauge pressure | 15 bar $/ 1.500 \mathrm{kPa}$ | -0.2 bar$/-20 \mathrm{kPa}$ |
| $0 . .0 .1$ bar/0...10 kPa |  |  |

9) -120: Values less than -1.0 bar cannot be adjusted.

| Nominal range | Overload resistance | Vacuum resistance |
| :---: | :---: | :---: |
| $0 . .0 .2 \mathrm{bar} / 0 . . .20 \mathrm{kPa}$ | $20 \mathrm{bar} / 2.000 \mathrm{kPa}$ | －0．4 bar／－40 kPa |
| $0 . .0 .4 \mathrm{bar} / 0 . .40 \mathrm{kPa}$ | $30 \mathrm{bar} / 3.000 \mathrm{kPa}$ | －0．8 bar／－80 kPa |
| $0 . .1 .0 \mathrm{bar} / 0 . .100 \mathrm{kPa}$ | $35 \mathrm{bar} / 3.500 \mathrm{kPa}$ | －1．0 bar／ 100 kPa |
| $0 . .2 .5$ bar／0．． 250 kPa | $50 \mathrm{bar} / 5.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| 0．．． 5 bar／0．．． 500 kPa | $65 \mathrm{bar} / 6.500 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| $0 . . .10 \mathrm{bar} / 0 \ldots 1.000 \mathrm{kPa}$ | $90 \mathrm{bar} / 9.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| 0．．． $25 \mathrm{bar} / 0 . .2 .500 \mathrm{kPa}$ | $130 \mathrm{bar} / 13.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| 0．．． $60 \mathrm{bar} / 0 \ldots 6.000 \mathrm{kPa}$ | $200 \mathrm{bar} / 20.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| $-1.0 \ldots+0.0 \mathrm{bar} /-100 . .0 \mathrm{kPa}$ | $35 \mathrm{bar} / 3.500 \mathrm{kPa}$ | －1．0 bar／ 100 kPa |
| －1．0 $\ldots+1.5 \mathrm{bar} /-100 \ldots+150 \mathrm{kPa}$ | $50 \mathrm{bar} / 5.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| －1．0 $\ldots+5.0 \mathrm{bar} / 100 . .+500 \mathrm{kPa}$ | $65 \mathrm{bar} / 6.500 \mathrm{kPa}$ | －1．0 barl－100 kPa |
| $-1.0 \ldots+10 \mathrm{bar} /-100 \ldots+1.000 \mathrm{kPa}$ | $90 \mathrm{bar} / 9.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| $-1.0 \ldots+25 \mathrm{bar} /-100 \ldots+2.500 \mathrm{kPa}$ | $130 \mathrm{bar} / 13.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| $-1.0 \ldots+60 \mathrm{bar} /-100 \ldots+6.000 \mathrm{kPa}$ | $300 \mathrm{bar} / 30.000 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| $-0.05 \ldots+0.05$ bar／－5 $\ldots+5 \mathrm{kPa}$ | $15 \mathrm{bar} / 1.500 \mathrm{kPa}$ | －0．2 bar／－20 kPa |
| －0．1．．+0.1 bar／ $10 \ldots+10 \mathrm{kPa}$ | $20 \mathrm{bar} / 2.000 \mathrm{kPa}$ | －0．4 bar／ 40 kPa |
| $-0.2 \ldots+0.2 \mathrm{bar} /-20 \ldots+20 \mathrm{kPa}$ | $30 \mathrm{bar} / 3.000 \mathrm{kPa}$ | －0．8 bar／ 80 kPa |
| $-0,5 \ldots+0.5$ bar／$-50 \ldots+50 \mathrm{kPa}$ | $35 \mathrm{bar} / 3.500 \mathrm{kPa}$ | －1．0 bar／－100 kPa |
| Âbsolute prassure |  |  |
| 0．．．1．0 bar／0．．． 100 kPa | $35 \mathrm{bar} / 3.500 \mathrm{kPa}$ |  |
| 0．．．2．5 bar／0．．． 250 kPa | $50 \mathrm{bar} / 5.000 \mathrm{kPa}$ |  |
| 0．．． $5 \mathrm{bar} / 0 . .500 \mathrm{kPa}$ | $65 \mathrm{bar} / 6.500 \mathrm{kPa}$ |  |
| $0 . .10 \mathrm{bar} / 0 . .1000 \mathrm{kPa}$ | $90 \mathrm{bar} / 9.000 \mathrm{kPa}$ |  |
| 0．．． $25 \mathrm{bar} / 0 \ldots 2.500 \mathrm{kPa}$ | $130 \mathrm{bar} / 13.000 \mathrm{kPa}$ | － |
| 0．．．60 bar／0 ．． 6.000 kPa | $200 \mathrm{bar} / 20.000 \mathrm{kPa}$ |  |

Accuracy (similar to DIN EN 60770-1)
Reference conditions acc. to DIN EN 61298-1

- Temperature
- Relative humidity
- Pressure

Determination of characteristics Characteristics
$18 \ldots 30^{\circ} \mathrm{C}\left(64.4 \ldots 86^{\circ} \mathrm{F}\right)$
45 ... 75 \%
860 ... 1060 mbar ( 86 ... 106kPa/ 12.5 ... 15.4 psi$)$
limit point adjustment acc. to DIN 16086 linear

Deviation in characteristics ${ }^{10)}$
Deviation in characteristics

- Turn down 1:1
$<0.075$ \%
- Turn down up to $1: 5$
<0.075 \%
- Turn down up to 1:10
<0.1 \%
Deviation in characteristics ${ }^{11}$
- Turn down 1:1
<0.05 \%
- Turn down up to 1:5
<0.05 \%
- Turn down up to 1:10
<0.075 \%


## Influence of the ambient temperature

Average temperature coefficient of the zero signal ${ }^{12)}$

- Turn down 1:1
0.05 \%/10 K
- Turn down up to 1:5
0.1 \%/10 K
- Turn down up to 1:10
0.15 \%/10 K


## Long-term stability (similar to DIN 16086, DINV 19259-1 and IEC 60770-1)

Long-term drift of the zero signal ${ }^{13)}<0.1 \% / 2$ years

[^3]
## Ambient conditions

Ambient，storage and transport temperature
－without PLICSCOM
$-40 \ldots+80^{\circ} \mathrm{C}\left(-40 \ldots+176^{\circ} \mathrm{F}\right)$
－with PLICSCOM
$-20 \ldots+70^{\circ} \mathrm{C}\left(-4 \ldots+158^{\circ} \mathrm{F}\right)$

## Process conditions

Product temperature standard version，depending on the meas．cell seal ${ }^{(4)}$
－Viton
－EPDM
－Kalrez 6375
Product temperature version with extended temperature range，depending on the meas．cell seal as well as order specification
－Viton
－EPDM
－Kalrez 6375
Calibration position
Influence of the installation position
Vibration resistance
$-20 \ldots+150^{\circ} \mathrm{C}\left(-4 \ldots+302^{\circ} \mathrm{F}\right)$
$-20 \ldots+150^{\circ} \mathrm{C}\left(-4 \ldots+302^{\circ} \mathrm{F}\right)$
$-10 \ldots+150^{\circ} \mathrm{C}\left(14 \ldots 302^{\circ} \mathrm{F}\right)$
upright，diaphragm points downward $<0.2 \mathrm{mbar} / 20 \mathrm{~Pa}$（ 0.003 psi ）
mechanical vibrations with 4 g and 5 ．．． $100 \mathrm{~Hz}^{15}$
${ }^{14)}$ With process fitting PVDF max．$+100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right)$ ．
15）Tested acc．to the regulations of German Lloyd，GL directive 2

## Electromechanical data

Cable entry/plug ${ }^{16)}$

- Single chamber housing
- Double chamber housing

Spring-loaded terminals
Connection cable between IP 68 instrument and remote electronics:

- max. length
- Min. bending radius
- Diameter
- colour - standard
- colour - Ex version
- $1 \times$ cable entry $\mathrm{M} 20 \times 1.5$ (cable- $\varnothing$ 5 ... 9 mm ), $1 \times$ blind stopper M20×1.5
or:
- $1 \times$ closing cap $1 / 2$ NPT, $1 \times$ blind stopper $1 / 2$ NPT
or:
- 1x plug (depending on the version), $1 x$ blind stopper M20×1.5
- 1x cable entry M20x1.5 (cable-ø 5 ... 9 mm ), $1 \times$ blind stopper M20x1.5, plug M12×1 for VEGADIS 61 (option)
or:
- $1 \times$ closing cap $1 / 2$ NPT, $1 \times$ blind stopper $1 / 2$ NPT, plug M12×1 for VEGADIS 61 (option)
or:
- $1 \times$ plug (depending on the version), $1 x$ blind stopper M20×1.5, plug M12×1 for VEGADIS 61 (option)
for wire cross sections up to $2.5 \mathrm{~mm}^{2}$
$180 \mathrm{~m}(590 \mathrm{ft})$
25 mm (with $25^{\circ} \mathrm{C} / 77^{\circ} \mathrm{F}$ )
approx. 8 mm
black
blue


## Indicating and adjustment module

Power supply and data transmission
Indication
Adjustment elements
Protection

- unassembled
- mounted into the sensor without cover

Materials

- Housing
- Inspection window
through sensor via gold-plated sliding contacts ( ${ }^{2} \mathrm{C}$ bus)
LC display in dot matrix
4 keys
IP 20
IP 40

ABS
Polyester foil

## Power supply

Power supply

- non-Ex instrument
- EEx ia instrument
- Exd instrument

Permissible residual ripple

- $<100 \mathrm{~Hz}$
- 100 Hz ... 10 kHz

Load
$U_{s s}<1 \mathrm{~V}$
12 ... 36 V DC
12 ... 30 V DC
18 ... 36 V DC
$\mathrm{U}_{\mathrm{ss}}<10 \mathrm{mV}$
see diagram


Fig．25：Voltage diagram
1 HART load
2 Voltage limit EEx ia instrument
3 Voltage limit non－Ex instrument／Exd instrument
4 Power supply

## Electrical protective measures

## Protection

－Housing ${ }^{17)}$
－Housing for remote electronics （with IP 68 version）

## Overvoltage category

Protection class

IP 66／IP 67 or IP 68
IP 65

III
II

17）IP 66／IP 67：Instruments with gauge measuring ranges can no longer detect the ambient pressure when being submerged，e．g．in water．This can falsity the measured value．

IEC
FM
Ship approvals
Others

ATEX II 1G, 1/2G, 2G EEx ia IIC T6; ATEX II $1 / 2 \mathrm{G}, 2 \mathrm{G}$ EEx d ia IIC T6;
ATEX II 1/2D, 2D IP6X T; ATEX II $1 / 2 \mathrm{G}$, 2G EEx m e ia IIC T6; ATEX II 1/2D, 2D IP6X T
IEC Ex ia IIC T6
FM CII, Div2 (NI)+Cl.II, III, Div1 (DIP); FM Cl.I-II, Div1 (IS)

GL, LRS, ABS, CCS, RINA, DNV WHG
${ }^{18)}$ Deviating data with Ex applications: see separate safety instructions.
${ }^{19)}$ Depending on order specification.

### 10.2 Dimensions

## Housing



Fig. 26: Housing versions (with integrated PLICSCOM the height of the housing increases by $9 \mathrm{~mm} / 0.35$ in)
1 Plastic housing
2 Stainless steel housing
3 Aluminium double chamber housing
4 Aluminium housing

IP 68 version with cable outlet


Fig. 27: IP 68 version with cable outlet
5 axial
6 lateral

## Remote electronics with IP 68 version



Fig．28：Remote electronics with IP 68 version

## VEGABAR 64, threaded and hygienic fitting - part 1



Fig. 29: VEGABAR 64, threaded and hygienic fitting

VEGABAR 64, threaded and hygienic fitting - part 2


Fig. 30: VEGABAR 64, threaded and hygienic fitting


Supplement

## VEGABAR 64, flange connection


$\mathrm{EA}, \mathrm{FB}, \mathrm{FE}, \mathrm{FH}, \mathrm{FI}$


| $\mathrm{mm7}$ | DN | PN | D | $b$ | k | $d 2$ | d4 | 1 | RL | d5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| (1) EA | 40 | 40 | 150 | 18 | 110 | $4 \times 018$ | 88 | 3 | - | - |
| F8 | 50 | 40 | 165 | 20 | 125 | $4 \times 018$ | 102 | 3 | - | - |
| FE | 80 | 40 | 200 | 24 | 160 | $8 \times 018$ | 138 | 3 | - | - |
| (2) FH | 2" 1 | lbs | $6^{\circ}$ | $3 / 4^{4}$ | $43 / 4^{\circ}$ | $4 x 0^{5 / 8}{ }^{\prime \prime}$ | $35 /{ }^{\circ}$ | $1 / 8{ }^{*}$ | - | - |
| Fl | 3" 1 | los | $71 / 2^{*}$ | 15/15 ${ }^{\circ}$ | 6 | $4 \times 05 / 8^{\circ}$ | $5{ }^{4}$ | $1 / 8^{*}$ | - | - |
| (3) EB | 40 | 40 | 150 | 18 | 110 | $4 \times 018$ | 88 | 3 | (4) | 38 |
| ED | 50 | 40 | 165 | 20 | 125 | $4 \times 018$ | 102 | 3 |  | 38 |
| EE | 80 | 40 | 200 | 24 | 160 | $8 \times 18$ | 138 | 3 |  | 38 |


| inch | DN | PN | D | $b$ | k | d2 | d4 | $\mathfrak{f}$ | RL | d5 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| (1) EA | 40 | 40 | (29/32 | 45/64* | $421 / 64^{\circ}$ | 4×8 ${ }^{45 / 64 * * ~}$ | $3^{15 / 32^{\circ}}$ | $1 / 9^{*}$ | - | - |
| FB | 50 | 40 | $61 / 2^{*}$ | 25/32 ${ }^{\circ}$ | $459 / 64^{\circ}$ | $4 \times 8.45 / 64^{-}$ | 41/64* | $1 / 8^{\prime \prime}$ | - | - |
| FE | 80 | 40 | 7 $718^{\circ}$ | 15/19 ${ }^{\circ}$ | 618/64 ${ }^{\circ}$ | $8 \times 6{ }^{45 / 64}{ }^{\circ}$ | 57/16 ${ }^{\circ}$ | 1/8* | - | - |
| (2) FH | 2"1 | lbs | 6 | $3 / 4{ }^{\prime \prime}$ | $43 / 4^{*}$ | $4 \times 05 / 0^{\circ}$ | $35 / 9^{\circ}$ | $1 / 9^{\circ}$ | - | - |
| FI | 3"1 | lbs | $71 / 2^{*}$ | 15/18 ${ }^{\circ}$ | $6 "$ | 4×0 5/8' | $5{ }^{*}$ | $1 / 8^{*}$ | - | - |
| (3) EA | 40 | 40 | 529/32 ${ }^{\circ}$ | $45 / 64^{\circ}$ | $4^{21 / 64}{ }^{\circ}$ | $4 \times 80^{5 / 64}{ }^{\circ}$ | $315 / 32^{\circ}$ | $1 / 8^{\circ}$ | (4) | $11 / 2^{*}$ |
| FB | 50 | 40 | $61 / 2^{*}$ | $25 / 32^{\circ}$ | $439 / 54^{\circ}$ | $4 \times 0.45 / 64^{\circ}$ | $41 / 64^{\circ}$ | $1 / 8^{*}$ |  | $11 / 2^{\circ}$ |
| FE | 80 | 40 | $77 / 8^{\circ}$ | 15/16 ${ }^{\circ}$ | $619 / 60^{\circ}$ | $8 \times 00^{45 / 6 A^{\circ}}$ | $57 / 16^{\circ}$ | $1 / 8^{\circ}$ |  | $11 / 2^{*}$ |

Fig. 31: VEGABAR 64, flange connection
1 Flange connection acc. to DIN 2501
2 Flange connection acc. to ANSI B 16.5
3 Flange with extension
4 Order-specific

## VEGABAR 64, threaded fitting for paper industry



Fig. 32: VEGABAR 64, threaded fitting for paper industry

## VEGABAR 64, extension fitting for paper industry



Fig. 33: VEGABAR 64, extension fitting for paper industry

### 10.3 Certificate

## CE declaration of conformity



Fig. 34: CE declaration of conformity

## Manufacturer declaration

## Manufacturer declaration no. 24633

```
Messrs. VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
declares that the Pressure Transmitter type VEGABAR 52, 53, 61, 64, 65, 66, 67 with electronics H ( \(4 . .20 \mathrm{~mA}\) HART)
```

in accordance with OIN/EN 60079-14/1998 paragraph .5.2.3 tem c 1
and when used correctly under the condition that the operator follows the instructions in the documents tisted:

- Mounting and operating instructions in the Operating Instructions manual
- Data and instructions of this manufacturer declaration
- Installation regulations
are suitable tor use in Zone 2
The max. surface temperature increase* during operation is 43 K .
With an ambient temperature of $70^{\circ} \mathrm{C}$ on the housing and a product temperature of $70^{\circ} \mathrm{C}$, the max. surface temperature ${ }^{*}$ is $113^{\circ} \mathrm{C}$ during operation.

Measures to maintain the explosion protection during operation:

- Permissible operating voltage: Umin. $=14 \mathrm{~V}$; Umax. $=36 \mathrm{~V}$.
- The instrument must be installed and operated in such a way that ignition due to electrostatic charge is not expected (depending on the version, the process fitting or the housing are made of electrically non-conductive plastic).
- The availability, the perfect quality and the correct position of the seal between the lower part of the housing and the cover must be ensured; the cover must be screwed on tightly.
- If the insirument is operated with opened cover, the adjustment module PLICSCOM is mounted or its keys are pushed, it must be ensured that no explosive atmosphere is present.
- Make sure that the cable entry is tight and strain-relieved; the outer diameter of the connection cable must be adapted to the cable entry; the pressure screw of the cable eniry must be tightened carefully.
- Free openings for cable and cable entries musi be covered tightly.
- The surface temperature must not exceed the ignition temperature of the concemed explosive atmosphere.
- VEGABAR66, 67 must be mounted in such a way that contact of the sensor to the vessel wall can be excluded by taking vessel installations and flow conditions in the vessel into account.
*Single component in the instrument
This instrument was judged by a person meeting the requirements acc. to DIN/EN 60079-14.
VEGA Grieshaber KG
Schiltach, den 01.07.04

i.V. Fruhauf

Fig. 35: Manufacturer declaration

VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
Germany
Phone +497836 50-0
Fax +49 7836 50-201
E-mail: info@de.vega.com
www.vega.com
\% $C \in$
All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

SP103 Heroes Avenue Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume 3 OM Manual

## Appendix 5: Operating Instructions VEGADIS 12

Supplier/Manufacturer: Vega<br>Model/Part Number:<br>DIS12:XBXX<br>Manufacturer Contact Detail:

398 The Boulevarde,
Kirrawee,
NSW - 2232
(02) 95426662

## Operating Instructions VEGADIS 12



## Safety information

Please read this manual carefolly, and also lake note of country-specilic installalion standards (e.g. the VDE regulations in Germany) as well as all prevailing safety regulations and accident prevention rules.

For safety and warranty reasons, any internal work on the instruments, aparl from thal involved in normal installation and eleclrical conneclion, must be carried out by qualited VEGA personnel.

## Note Ex area

Please note the approval documents (yellow binder), and especially the included safety data sheet.

## Contents

## , V區令

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## 1 Product description

### 1.1 Function and configuration

VEGADIS 12 is an external connection housing with integrated adjustment elements. It is connected via the VEGA special cable with breather capillaries or a llree-wire standard cable to the hydrostatic pressure transmilter VEGAWELL $72-4 \ldots 20 \mathrm{~mA} /$ HART $^{*}$.
VEGABAR 74 or VEGABAR 75. VEGADIS 12 is connected to the supply and signal circuit of the pressure transmitter and does not require a separate external energy source.

VEGADIS 12 has the following functions:

- adjustment of zero, span and i
- atmospheric pressure compensation for the pressure transmitter
- measured value display (oplional).

As a slandard feature. VEGADIS 12 is equipped with an adjusiment module for the pressure transmitter. The oplional display is located in the housing cover and is equipped with a bar graph and a digital display indication. In this version, additional adjustment elements for indication scaling are infegrated.

### 1.2 Types and versions

## VEGADIS 12 without display



## VEGADIS 12 with display



### 1.3 Technical data

## Standard data

Materials and weight

| Housing | high-resistance plastic PBT (Polyester) |
| :--- | :--- |
| Ground terminal | stainless steel 1.4305 |
| Display window | Lexan |
| Breather facility | PTFE filter element 1 |
| Weight | approx. 0.5 kg |

## Adjustment and indicating elements

| Adjustment elements | 2 keys, 1 rotary switch |
| :--- | :--- |
| Adjustment elements with display | $2 \times 2$ keys, $2 \times 1$ rotary switch |
| Display (option) | LC multifunctional display with |
|  | - bar graph $(20$ segments $)$ |
|  | - digital value $(4$ digits) |
|  | - tendency indicator for rising or talling values |

Connection
Cable entry $\quad \mathrm{M} 20 \times 1.5$ (for cable $\varnothing 5 \ldots 9 \mathrm{~mm}$ )
Screw terminals for wire cross-section up to $2.5 \mathrm{~mm}^{2}$
Adjustment circuit
Connection to
VEGAWELL 72 - 4 ... $20 \mathrm{~mA} /$ HART $^{\circledR}$.
VEGABAR 74 or VEGABAR 75
connection cable
VEGA special cable with breather capillaries
or 3 -wire standard cable
Cable length

Supply and signal circuit (analogue transmission, 4 ... 20 mA )
Supply voltage via pressure transmitter
in conjunction with VEGADIS 12

- without display
- with display

Max. input current
Range of the current signal
Max. permissible load
12 ... 36 V DC
$17 \ldots 36 \vee D C$
150 mA
$3.5 \ldots 22 \mathrm{~mA}$
depending on the supply voltage (see load diagrams)

Load diagram without display


Load diagram with display


## Protective measures

Housing
Protection class
Overvoltage category

IP65:
III
III

## Ambient conditions

Ambient temperature

- VEGADIS 12
$-40^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$
- VEGADIS 12 with display
$-20^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$
Storage and transport temperature $\quad-40^{\circ} \mathrm{C} \ldots+85^{\circ} \mathrm{C}$
" Maintaining the housing protection IP 65 requires the use of a seal in the cable entry fitting to the cable. If the supplied seal does not fit, the customer hias to provide a suitable one.


### 1.4 Approvals

If a pressure transmitter or the external housing is used in hazardous areas, approved versions should be used.

The respective official documents (test reporls, test cerlificates and conformity certificates) must be noted for these applications. These are supplied with the respective instrument.

## General approvals

VEGADIS 12 CENELEC EEx ia IIC

## CE conformity ( $\in$

The external housings VEGADIS 12 or VEGADIS 12 Ex meet the protective regulations of EMC (89/336/EWG) and NSR (73/23/EWG). The conformity has been judged acc. to the following standards:

| EMC | Emission | EN 50081 |
| :--- | :--- | :--- |
| NSR | Susceplibility | EN 50082 |
|  |  | EN 61010 |

## NAMUR regulations

Full compliance with NAMUR regulations NE21, May 1993.
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### 1.5 Dimensions

without display


Họ 13.5
with display

$\mathrm{P} 0: 3$

## 2 Mounting

VEGADIS 12 can be mounted in the following ways:

- on carrier rail $35 \times 7.5$ acc. 10 EN 50022
- on mounting sheet or to the wall.

In case of vertical wall mounting. the cable entry musi point downwards to avoid moisture ingress.

If VEGADIS 12 is additionally used for almospheric pressure compensation for the pressure transmitter, the following must be noted:

- there must be the same atmospheric pressure on the breather facility as on the vessel
- the breather laciility musl not be clogged or dirty.


## 3 Electrical connection

### 3.1 Connection instructions

VEGADIS 12 is connected to the supply and signal circuit of the pressure transmitter and does not require a separate external energy source.

## Block diagram



The electronics in the pressure transmitter is designed in two-wire technology and requires a supply voliage of $12 \ldots 36 \mathrm{~V}$ DC, with display $17 \ldots 36 \vee D C$. Supply voltage and current signal are led via the same twowire connection cable to the connection terminals. The third cable between pressure transmitter and VEGADIS 12 is used for transmission of the adjustment data.

The external energy is provided via a separate power supply unit:

- power supply unit, e.g. VEGASTAB 690
- processing unit with integrated DC current source (e.g. active DCS input)

Make sure that the external energy source is reliably separated from the mains circuits acc. to DIN VDE 0106, part 101. The above mentioned VEGA instruments meet this requirement and protection class III is therefore ensured.

The external energy source must deliver a terminal voltage of at least 12 V or 17 V to the transmitter. The actual terminal voltage on the transmitter depends on the following factors:

- output voltage $U_{H}$ of the external energy source under nominal load.
- load resistances of the instruments in the current circuit.

For electrical connection in general, the following points should be given attention:

- The connection must be made according to the national installation standards (e.g. in Germany acc. to the VDE regulations).
- To avoid damage of the electronics, the terminal voltage must not exceed 36 V .
- The connection elements have built-in protection against polarity reversal.
- The wiring between pressure transmitter and VEGADIS 12 or between VEGADIS 12 and the power supply can be made with standard three or two-wire cable.
- If strong electromagnetic interferences are expected, screened cable is recommended. The screening must be made on both ends. For use in Ex areas. the installation regulations must be noted.
- If overvoltages are expected, we recommend the installation of VEGA overvoltage arresters.
- A seal fitting the cable must be used in the cable entry.


### 3.2 Wiring plan

## VEGADIS 12 without display

VEGADIS 12

## Pressure transmitter with

 direct cable outlet

## VEGADIS 12 with display

VEGADIS 12

Pressure transmitter with direct cable outlet


## 4 Setup

### 4.1 Adjustment elements



## Adjustment system (transmitter)

- Choose the requested function with the rotary switch.
- With the "+" and "-" keys you modify the signal current to the requested values or set the suitable integration time.
- Set the rotary switch to position 'OPERATE". The sel values are transferred to the EEPROM memory and remain there even in case of voltage loss.


### 4.2 Adjustment and indicating elements (version with display)



## Adjustment system (transmitter)

(see section 4.1)

## Adjustment system (display) <br> - With the rotary switch you

 choose the requested function.- With the "+" and "-" keys you change the display indication to the requested values or set the suitable decimal point.
- Then set the rotary switch to position "OPERATE". The set values are transferred to the EEPROM memory and remain there even in case of voltage


### 4.3 Adjustment of the transmitter

## Adjustment

To adjust the beginning of the measuring range and end value of the measuring range, connect an ammeter to terminals 10 and 12. The measured value is identical to the output current.

## 1 Adjust zero

(vessel empty)

- Set the rotary switch to zero.
- Set a current of 4 mA by pushing the "+" and '-' key.


## 2 Adjust span

(max. vessel level)

- Set the rotary switch to span.
- Set a current of 20 mA by pushing the " + " and '-" key.

Adjustment range of the measuring range final value:
$3.3 \% \ldots 120 \%$ of nominal range

## Adjustment instructions:

- A modification of the beginning of the measuring range does not influence the adjusted span.
- It is also possible to adjust currents for partial fillings, e.g. 8 mA for $25 \%$ and 16 mA for $75 \%$. The electronics then calculates automatically the current values for $0 \%$ and $100 \%$ (only possible with a delta $\geq 3 \%$ ).
- The current value first changes in steps of $6 \mu \mathrm{~A}$ steps. then after approx. 10 sec . of pressing, in steps of about $300 \mu \mathrm{~A}$.
- If the current values react to the key pressing with a time delay, this can have two reasons:
- the last adjustment was carried out with a level considerably deviating from the actual level.


## Integration time

An integration time $t_{i}$ of $0 \ldots 10 \mathrm{sec}$ can be set for damping level fluctuations.

Procedure:

- Set rotary switch to $t_{i}$.
- By pushing the $\because$ key 10 times, make sure that the integration time is set to 0 sec.
- For every 1 sec requested integration time. push the " + " key once.

The integration time is the time required by the current output signal to reach $90 \%$ of the actual level after a sudden level change.

### 4.4 Scaling of the indication

The display provides the current values
$4 \ldots 20 \mathrm{~mA}$ as bar graph and as digital value.

## Bar graph

At 4 mA no segment of the bar graph appears, at 20 mA all segments appear. This assignment is fixed.

## Digital value

The digital value can be scaled individually between -9999 $\ldots+9999$ via.the adjustment module.

## 1 Adjust zero

- Set the rotary switch to zero.
- Set the requested value, e.g. 0 by pushing the "+" and "-' key.


## 2 Adjust end

- Set the rotary switch to end.
- Set the requested value, e.g. 1000 by pushing the ' + ' and ' - ' key.


## 3 Adjust the decimal point (point)

- Set the rotary switch to point.
- Set the requested values, e.g. 8888 (no decimal point) by pushing the "+" and "-" key.


## 5 Diagnostics

### 5.1 Maintenance

VEGADIS 12 is maintenance-free.

### 5.2 Failure rectification

In case of an instrument failure, please check the following:

- the atmospheric pressure compensation
- the electrical connections and components.


## Check atmospheric pressure compensation

First of all open the housing cover. The indicated measured value must not change. However, if the indicated value changes nevertheless, the compensation of the atmospheric pressure is not ensured. Please therefore check:

- the breather facility on the housing
- the capillaries in the special cable.


## Note:

There must be always the same atmospheric pressure on the breather facility as on the open vessel.

## Check electrical components



## Instruction for Ex applications

Deviating from the previous assignment, the terminals 10 and 12 are here used for brief connection to a certified, active, floating (max. value: 470 mW ) or to an individual passive, floating measuring instrument. For connection, the regulations for wiring of intrinsically safe circuits (measuring instrument, supply and signal circuit) must be noted.

## Voltage

- Check the terminal voltage on VEGADIS 12 (must be at least 12 V DC or 17 V DC with display).


## Current

| Current value | Condition |
| :--- | :--- |
| $3.8 \ldots 20.5 \mathrm{~mA}$ | standard range for output <br> current |
| 0 mA | signal cable interrupted |
| $<3.6 \mathrm{~mA}$ | electronics or pressure <br> sensor element defective |
| 22 mA | electronics or pressure <br> sensor element defective |

'Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume

## VEGA Grieshaber KG

Am Hohenstein 113
77761 Schiltach

## Germany

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Fax (0 78 36) 50-201
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www.vega.com

## © $C \in$ § $\varepsilon x$

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the latest information at the time of printing

Technical data subject to alterations

## Appendix 6: GRUNDFOS Instructions s1, s2, s3, SA. SV 7.5-155kW

| Supplier/Manufacturer: | GRUNDFOS |
| :--- | :--- |
| Manufacturer Details: |  |
|  |  |
|  |  |
|  |  |
|  | Acacia Ridge, |
|  | QLD -4110 |
|  | (07) 32721980 |
| Model/Type: | S21154M3B513ZB93 |
| No. Supplied: | 3 |
| Serial Nos: | 182521 |
|  | 182522 |
|  | 182523 |

## S1, S2, S3, SA, SV

## 7.5-155 kW

(GB) Installation and operating instructions
(D) Montage- und Betriebsanleitung
(F) Notice d'installation et d'entretien
(I) Istruzioni di installazione e funzionamento
(E) Instrucciones de instalación y funcionamiento
(P) Instruções de instalação e funcionamento

(NL) Installatie- en bedieningsinstructies
(S) Monterings- och driftsinstruktion
(SF) Asennus- ja käyttöohjeet
(DK) Monterings-og driftsinstruktion


## Declaration of Conformity

We GRUNDFOS declare under our sole responsibility that the products $\mathbf{\$ 1}, \mathbf{\$ 2}$, $\mathbf{\$ 3}$
SA, SV, $7.5-155 \mathrm{~kW}$, to which this deciaration celates, are in conformity with the Council Directives on the approximation of the laws of the EC Momber States relating to

- Machinery (98/37/EC).

Standard used: EN 292
Electromagnetic compatibility ( $89 / 336 / E E C$ ).
Standards used: EN 61 000-6-2 and EN 61 000-6-3
Electricat equipment designed for use within certain voltage limits (73/23/EEC) [95).
Standards used: EN 60 335-1 and EN 60 335-2-41.

- ATEX 94/9/EC

Standards used: EN 50 014, EN 50 018. EN 13 463-1 and pr EN 13 463-5.

## Konformitătserklärung

Wir GRUNDFOS erkdaren in alleiniger Verantwortung, daß dio Produkte St, S2, St, SA, SV, $7.5-155 \mathrm{~kW}$. auf die sich diese Erklarung beziehy, tim den folgenden Puchtlinien des Rates zur Angleichung der Rechtsvorschriteh der EG:Mitgliedstaaten ubereinstimmen:

- Maschinen (98/37/EG)

Norm, die verwender wurde: EN 292.

- Elektromagnetische Vertraglichkeit/69/336/EWG).

Normen, die verwendet wurderj-EN 61 000-6-2 und EN 61 000-6-3.

- Elaktrische Betriobsmittel zyy Verwondung innerhalb bestimmer

Spannungsgrenzen (73/227:WG) [95]
Normen, die verwendgr wurden: EN 60 335-1 und EN 60 335-2-41.

- ATEX 94/9/EG.

Normen. die verwondet wurden: EN 50 014, EN 50 018. EN 13463 -1 und pr EN 13 463-5.

## Déclaration de Conformitê

Nous GRUNDFOS declarons sous notre seule responsabilite que les produrts S1. S2, S3, SA, SV, $7,5-155 \mathrm{~kW}$ auxquels se rétere cette déclaration sont conformes aux Directives du Conseil concernant le rapprochement dếs légisiabions dees Etats membres CE retatives a

- Machines ( $98 / 37 / C E$ ).

Standard utilise: EN 292

- Compatibilité electromagnétique (8g/036/CEE)

Standards utilisés: EN 61 000-6-7 of EN 61 000-6-3.

- Materiel electrique destine a eptiployer dans certaines limites de tension (73/23/CEE) [95].
Standards utilises: EN G8 335-1 et EN 60 335-2-41
- ATEX 94/9/EC

Standards utilises. EN 50 014. EN 50 018, EN 13 463-1 et pr EN 13 463-5

## Dichiarazione di Conformità

Noi GRUNDFOS dichiariamo sotto la nostra esclusiva responsabilita che i prodotri S1, S2, S3, SA, SV, 7,5-155 kW, ai quali questa pichiarazione si rifensce, sono conformi ale Direttive det opnsigtio concernentill ravvicinamento delle legislazioni degh Stall membri CE mative a

- Mácchine (98/37/CE).

Norme di riferimento: EN 292

- Compatibita elettromagneticar(89/336/CEE).

Norme di rilerimento: EN el ODD-6-2 e EN 61 000-6-3.

- Materiale elettrico desjilato ad essere ubilizzato entro certi limit di tensione (73/23/CEE) [95].
Norme di riferimgho: EN $60335-1$ e EN $60335-2-41$
- ATEX 94/9/EC

Norme di rilerimento: EN 50 014, EN 50 018, EN 13 463-1 e pr EN 13 463-5

## Declaración de Conformidad

Nosotros GRUNDFOS declaramos bajo nuestra ùnica respongabilidad que los productos \$1, \$2, 83, 8A, SV, 7,5 - $\mathbf{1 5 5} \mathbf{~ k W}$ a los cuales serfefiere esta declaración son Conformes con las Directivas del Consejo relativara la aproximación de las legrslaciones de los Estados Miembros de la CE sobre

- Máquinas ( $98 / 37 /$ CE).

Norma aplicada: EN 292

- Compalibilidad eloctromagnetica (8gr336/CEE).

Normas aplicadas: EN $61000-6,2$ y EN 61 000-6-3

- Material electrico destinado z-rilizarse con determinados limites de tension (73/23/CEE) [95).
Normas aplicadas: EN 56 335-1 y EN 60 335-2-41.
ATEX 94/9/EC.
Normas aplicadasy EN 50 014. EN 50 018, EN $13463-1$ y pr EN $13463-5$.


## Declaração de Conformidade

Nós GRUNDFOS declaramos sob nossa unica responsabilidade que as produtos S1, S2, S3, SA, SV, 7,5 - 155 kW aos quais servtere esta declarapão estáo em contormidade com as Directivas do Conselbo das Comunidades Europeias relativas à aproximaçảo das legislaçōes dos Estodos Membros respeitantes à

- Máquinas ( $98 / 37 / C E$ )

Norma utilizada: EN 292

- Compatibilidade electromyghética (89/336/CEE)

Normas utilizadas: EN 51 000-6-2 e EN 61 000-6-3.

- Material eléctrico destinado a ser utlizado dentro de certos limites de tensäo (73/23/CEE) (95)
Normas uilisodas: EN 60 335-1 e EN 60 335-2-41
- ATEX 94/9/EC.

Normas utilizadas: EN 50 014, EN 50 018. EN 13 463-1 e pr EN 13 463-5.

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- Mnxavinara (98/37/EK).

Пpóruno nou xpпоuнonoujenke: EN/292.


 пौestpakìs táonc (73/32/EOK) [95].

ATEX 94/9/EK
 pr EN 13 463-5.

## Overeenkomstigheidsverklaring

Wif GRUNDFOS verkaren geheet onder eigen verantwoordelijkheid dat de produkten S1, S2, S3, SA, SV, 7,5-155 kW warop deze verklaring betrekking heett in oworeenstemming ziin met de Richtlinen van de Raad inzake de onderlinge aanpassing van de wetgevingen van de Lid Sitalen betreffende

- Machines ( $98 / 37 / E G$ ).

Norm: EN 292

- Elektromagnetische compalibitheit (89/336/EEG)

Normen: EN 61 000-6-2 yn EN B1 000-6-3.

- Elektrisch materiaal bestomd voor gebruik binnen bepaalde spanningsgrenzen (73/23/EEG) (95)
Normen: EN 5e 335-1 en EN 60 335-2-41
- ATEX 94/9/EC

Normen: EN 50 014, EN 50018 . EN 13 463-1 en pr EN 13 463-5

## Försäkran om överensstämmelse

Vi GRUNDFOS tórsakrar under ansvar, att proclukterpar- $\mathbf{8 1}, \mathbf{S 2}, \mathbf{S 3}, \mathbf{S A}, \mathbf{8 V}$, $7.5-155 \mathrm{~kW}$, som omtattas av denna lörsâkran, ay-roverensstammelse med Rådets Direktiv om inbordes närmande till EU-medleprstaternas lagstiffining, avseende

- Maskinell utrustning (98/37/EC).

Anvand standard: EN 292
Elektromagnetisk kompatibilitet ( $69 / 336 / E C$ )
Anvainda standarder: EN 61 000-6-2 och EN 61 000-6-3

- Elokirisk material avsedd for anvaindning inom vissa spänningsgränser (73/23/EG) [95].
Arvända standardey. EN 60 335-1 och EN 60 335-2-41
ATEX $94 / 9 / E C$
Anvànda stargarder: EN 50 014, EN 50 018, EN 13 463-1 och pr EN 13 463-5.


## Vastaavuusvakuutus

Me GRUNDFOS vakuutamme yksin vastuullisosti, etta tuotteet S1, S2, S3, SA, SV $75-155 \mathrm{~kW}$, jota tămş vakuutus koskea, noudattavat direktivejał jotka kăsittelevât EY:n jâsenvaltioiden konsellisia laitteita hoskervien lakien yhdenmukaisuutta seur: - Koneet (98/37/EY)

Kâyletly standardi: EN 292.

- Elektromagneettinen vastaavuys (89/336/EY)

Kaytetyt standardit: EN 61 s00-6-2 ja EN 61 000-6-3

- Mäarattyjen |änniterajoitysten puitteissa kàytettảvât sähkoiset lantteet (73/23/EY) [95]
Kaytetyt standardi: EN 60 335-1 ja EN 60 335-2-41.
- ATEX 94/9/EG

Kaytetyt standardit: EN 50 014. EN 50018 , EN 13 463-1 ja pr EN 13 463-5

## Overensstemmelseserklæring

Vi GRUNDFOS erkierer under ansvar, at produkterne, 81, S2, S3, SA, SV,
$7.5-155 \mathrm{~kW}$, som denne erkleering omhandier, or W. Werensstemmelse med Fádets direktiver orn indbyrdes tilnaermeise til EF medignsstaternes lovgivning om

- Maskiner ( $98 / 37 / E F$ ).

Anvendi standard. EN 292

- Elektromagnetisk kompatibilitet (8g/ $36 / \mathrm{EQF}$ )

Anvendte standarder: EN 61 oggr6-2 og EN 61 000-6-3.
Elektrisk materiel bestemt til ativendelse inden for visse spaendingsgraenser (73/23/EOF) [95].
Anvendte standarder. EN 60 335-1 og EN 60 335-2-41.
ATEX 94/9/EC.
Anvendte standarder: EN 50014 . EN 50018 . EN 13 463-1 og pr EN 13 463-5,

Bjerringbro, 1st Juge 2003


Kenth Hvid Nielsen Technical Manager

## S1, S2, S3, SA, SV <br> 7.5-155 kW

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Before beginning installation procedures, these installation and operating instructions should be studied carefully. The installation and operation should also be in accordance with local regulations and accepted codes of good practice.

## 1. General description

This booklet includes instructions for installation, operation and maintenance of GRUNDFOS submersible wastewater pumps, types S1, S2, S3, SA and SV, fitted with motors of 7.5 to 155 kW .
The booklet also includes specific instructions for the explosionproof pumps.

### 1.1 Applications

The S1, S2, S3, SA and SV pumps are designed for the pumping of wastewater in a wide range of municipal, private and industrial applications.
Depending on version, the pumps can be used for submerged or dry installation.
Maximum solids size: 145 mm .

### 1.1.1 Potentially explosive environments

In potentially explosive environments, the explosion-proof $\mathrm{S} 1, \mathrm{~S} 2$, S3 and SV pumps must be used, see sections 1.5.1 Ex certification and classification and 7.3 Explosion-proof S1, S2, S3 and SV pumps.
Note: The explosion classification of the pump is EEx dllB T3 or EEx dIIB T4. The installation must in each individual case be approved by the local fire-fighting authorities.

### 1.2 Operating conditions

1.2.1 pH value

All pumps can be used for pumping liquids with a pH value between 4 and 10.
1.2.2 Liquid temperature
$0^{\circ} \mathrm{C}$ to $+40^{\circ} \mathrm{C}$.

### 1.2.3 Ambient temperature

$-20^{\circ} \mathrm{C}$ to $+40^{\circ} \mathrm{C}$.
1.2.4 Density and viscosity of pumped liquid

Maximum density: $1000 \mathrm{~kg} / \mathrm{m}^{3}$.
Maximum kinematic viscosity: $1 \mathrm{~mm}^{2} / \mathrm{s}(1 \mathrm{cSt})$.
Note: When pumping liquids with a density and/or a kinematic viscosity higher than the values stated above, motors with correspondingly higher outputs must be used.

### 1.2.5 Level of pumped liquid

In the case of submerged pump installation, the lowest stop level must always be above the pump housing.

The pump must always be filled with the liquid to be pumped.
An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating.
To ensure adequate cooling of the motor during operation, the following minimum requirements must be met:

- Versions 1 and 4:

The pump must always be covered by the pumped liquid to the middle of the motor.

- Versions 2 and 5:

The pump housing must always be covered by the pumped liquid.

- Versions 3 and 6:

No special requirements.

- Version 7 :

The liquid level must be at least 350 mm above the pump inlet, see fig. 7.

### 1.2.6 Operating mode

The pumps are designed for continuous operation or for intermittent operation with the maximum number of starts per hour stated in the table below:

| Motor size | Starts per hour |
| :--- | :---: |
| $7.5-21.0 \mathrm{~kW}, 2$ - and 4-pole | 20 |
| $15.0 \mathrm{~kW}, 12$-pole |  |
| $16.0 \mathrm{~kW}, 6$-pole |  |
| $22.0-155 \mathrm{~kW}$ | 15 |

### 1.2.7 Enclosure class

IEC IP 68.

### 1.3 Sound pressure level

The sound pressure level of the pump is lower than the limiting values stated in the EC Council Directive 98/37/EC relating to machinery.

### 1.4 Type key

All S1, S2, S3, SA and SV pumps described in this booklet are identified by the type code stated in the confirmation of order and other documentation supplied with the pump. The code consists of 14 items as shown in the table below.
Please note that the pump types described in this booklet are not necessarily available in all variants. The shaded code items are stated on the pump nameplate.

| S | 1 | $X$ | 17 | 4 |  | - M | 1 | A |  | 5 | 11 | $\cdots$ | Z |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |



### 1.5 Nameplates

All pumps can be identified by means of the nameplate on the motor top cover, see fig. 1. If the nameplate is missing or damaged, the pump can be identified by the serial number stamped under the nameplate.
Fig. 1


| Pos. | Description |
| :---: | :--- |
| 1 | Type designation |
| 2 | SAP code |
| 3 | Serial number |
| 4 | Maximum liquid temperature |
| 5 | Maximum head |
| 6 | Maximum flow |
| 7 | Maximum installation depth |
| 8 | Enctosure class |
| 9 | Number of phases |
| 10 | Frequency |
| 11 | Rated speed |
| 12 | Voltage/current, delta connection |
| 13 | Voltage/current, star connection |
| 14 | Power input |
| 15 | Shaft power |
| 16 | Power factor |
| 17 | Insulation class |
| 18 | Production code, year/week |
| 19 | Weight of the pump |

### 1.5.1 Ex certification and classification

Explosion-proof pumps have been approved by Baseefa (2001) Ltd. in conformity with the essential health and safety requirements relating to the design and construction of equipment intended for use in potentialify explosive atmospheres given in Annex II to the Council Directive 94/9/EC (ATEX)
Thie certified pumps (Ex-pumps) are supplied with an approval plate fixed in the visible place close to the nameplate.
Fig. 2 shows the approval plates for the pumps equipped optionally with the motors classified to T3 or T4 temperature class.
Fig. 2


The approval plate gives the following details:

| CE | CE mark. |
| :--- | :--- |
| 1180 | Number of Quality Assurance notified body. |
| (G3) | EU ex-symbol. |
| II | Equipment group ( 11 = non-mining). |
| 2 | Equipment category (high protection). |
| G | Type of explosive atmosphere. |
| EEx | Motor explosion-proof according to European stand- <br> ard. |
| d | Motor withstands explosion pressure. |
| IIB | Gas Group. |
| T3 | Maximum surface temperature of the motor is $200^{\circ} \mathrm{C}$. |
| T4 | Maximum surface temperature of the motor is $135^{\circ} \mathrm{C}$. |
| C | Constructional safety. |
| Baseefa | Certificate number. |
| No. | HA. |
| PC | Production code. |

## 2. Safety



Pump installation in pits must be carried out by specially trained persons.


Persons should not enter the installation area when an explosive atmosphere is present.

For safety reasons, all work in pits must be supervised by a person outside the pump pit.
Pits for submersible wastewater pumps contain wastewater with toxic and/or disease-causing substances. Therefore, all persons involved must wear appropriate personal protective equipment and clothing and all work on and near the pump must be carried out under strict observance of the hygiene regulations in force.

## 3. Transportation and storage

The pump is supplied from the factory in proper packing in which it should remain until it is to be installed.
Make sure that the pump cannot roll or fall over.
All lifting equipment must be rated for the purpose and checked for damages before any attempts are made to lift the pump. The lifting equipment rating must under no circumstances be ex-
ceeded. The pump weight is stated on the pump nameplate.

${ }_{3}^{2}$
Always lift the pump by its lifting bracket or by means of a fork-lift truck, never by means of the motor cable or the hose/pipe.

Note: Do not remove the protection from the free end of the supply cable until the electrical connections are to be made. The free cable end must never be exposed to moisture or water, whether it isprotected or not. Non-compliance may involve the risk of damage to the motor.
For long periods of storage, the pump must be protected against moisture and heat.

Storage temperature: $-30^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$.
Affer a long period of storage, the pump should be inspected before it is put into operation. Make sure that the impeller can rotate freely. Pay special attention to the condition of the shaft seals and the cable entry.

## 4. Installation

The loose nameplate supplied with the pump should be fixed at the installation site.
All safety regulations must be observed at the installation site, e.g. the use of blowers for fresh-air supply to the pit.


Do not put your hands or any tool into the pump suction or discharge port after the pump has been connected to the electricity supply, unless the pump has been switched off by removing the fuses or switching off the mains switch. It must be ensured that the electricity supply cannot be accidentally switched on.

Prior to installation, check the oil level in the oil chamber, see section 7.1 Oil check and oil change.
The S1, S2, S3, SA and SV pumps are designed for various installation versions.
Figures 3 to 7 show the possible installation versions.
Fig. 3
Versions 1 and 2:
Submerged installation on auto-coupling


Permanent installation in pit. The pump can easily be pulled out and lowered into the pit by means of the guide rails. The liquid level can be set lower for version 2 than for version 1.

Fig. 4
Version 3:
Vertical dry installation with base stand


Permanent installation in a pump room. The pump is bolted to the suction and discharge pipes by means of flange connections. Pumps with DN 500 or DN 600 flange are to be installed on a concrete foundation (see the above figure to the right).

Fig. 5
Versions 4 and 5: Submerged installation, portable


For portable use in pit or temporary installation.
The liquid level can be set lower for version 5 than for version 4.

Fig. 6
Version 6:
Horizontal dry installation with base stand and bracket


Permanent installation in a pump room. The pump is bolted to the suction and discharge pipes by means of flange connections.


Vertical column installation in steel pipe or concrete shaft.

### 4.1 Submerged installation on auto-coupling

Pumps for permanent installation can be installed on a stationary auto-coupling and operated completely or partially submerged in the pumped liquid.

1. Dritl mounting holes for the guide rail bracket on the inside of the pit and fasten the guide rail bracket provisionally with two screws.
2. Place the auto-coupling base unit on the bottom of the pit. Use a plumb line to establish the correct positioning. Fasten the auto-coupling with expansion bolts. If the bottom of the pit ic uneven, the auto-coupling base unit must be supported so at it is level when being fastened.
i. nisemble the discharge pipe in accordance with the generally accepted procedures and without exposing the pipe to distortion or tension.
3. Insert the guide rails into the rings of the auto-coupling base unit and adjust the length of the rails accurately to the guide rail bracket at the top of the pit.
4. Unscrew the provisionally fastened guide rail bracket. Insert the expansion dowels into the guide rails. Fasten the guide rail bracket on the inside of the pit. Tighten the bolts in the expansion dowels.
5. Clean out debris from the pit before lowering the pump into the pit.
6. Fit the guide claw to the pump.
7. Slide the guide claw of the pump between the guide rails and lower the pump into the pit by means of a chain secured to the lifting bracket of the pump. When the pump reaches the auto-coupling base unit, the pump will automatically connect tightly.
8. Hang up the end of the chain on a suitable hook at the top of the pit and in such a way that the chain cannot come into con tact with the pump housing.
9. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook at the top of the pit. Make sure that the cables are not sharply bent or pinched.
10. Connect the motor cable and the monitoring cable, if any.

Note: The end of the cable must not be submerged, as water may \& ate through the cable into the motor.

### 4.2 Dry installation

Pumps in dry installation are installed permanently in a pump room.
The pump motor is enclosed and watertight and will not be damaged if the installation site is flooded with water.

1. Mark and drill mounting holes in the concrete floor/concrete foundation.
2. Fit the bracket or base stand to the pump.
3. Fasten the pump with expansion bolts.
4. Check that the pump is vertical/horizontal

In order to facilitate service on the pump, isolating valves should be fitted on either side of the pump.
5. Fit the suction and discharge pipes and isolating valves, if used, and ensure that the pump is not stressed by the pipework.
6. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
7. Connect the motor cable and the monitoring cable, if any

Note: It is recommended to use a reducer between the suction pipe and the pump in horizontal installations. The reducer must be of the eccentric type and must be installed so that the straight edge is pointing upwards. In this way, the accumulation of air in the suction pipe is avoided and the risk of disturbance of operation is eliminated, see fig. 8 .
Fig. 8


### 4.3 Submerged installation, portable

1. Fit the ring stand to the pump suction flange.
2. Fit a $90^{\circ}$ elbow to the pump discharge port and connect the discharge pipe/hose.

If a hose is used, make sure that the hose does not buckle and that the inside diameter matches that of the discharge port.
3. Lower the pump into the liquid by means of a chain secured to the lifting bracket of the pump. It is recommended to place the pump on a plane, solid foundation. Make sure that the pump is hanging from the chain and not the cable.
4. Hang up the end of the chain on a suitable hook at the top of the pit and in such a way that the chain cannot come into contact with the pump housing
5. Adjust the length of the motor cable by coiling it up on a relief fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
6. Connect the motor cable and the monitoring cable, if any

### 4.4 Vertical column installation

1. Weld the ring stand supplied with the pump onto the lower opening of the riser pipe or concrete it into place at the lower opening of the concrete shaft.
2. Fasten a chain to the lifting bracket and uncoil the supply cable.
3. When the ring stand has been positioned in the right place, lower the pump into place in the pump shaft. Make sure that the O-ring seal is positioned correctly in the groove on the outside of the pump housing. Three guide pins on the ring stand will guide the pump into the right position and prevent it from turning in the seat when running.
4. Hang up the end of the chain on a suitable hook at the top of the pit and in such a way that the chain cannot come into contact with the pump housing.
5. Adjust the length of the motor cable by coiling it up on a reliet fitting to ensure that the cable is not damaged during operation. Fasten the relief fitting to a suitable hook. Make sure that the cables are not sharply bent or pinched.
6. Connect the motor cable and the monitoring cable, it any.

### 4.5 Pump controller

The S1, S2, S3, SA and SV pumps can be connected to a separate GFUNDFOS pump controller for level control, which is available as an accessory:

- type LC for one-pump installations and
- type LCD for two-pump installations

Depending on application, different types of level control equipment can be used.
The LC controller is fitted with two or three level switches:
Two for starl and stop of pump. The third level switch, which is optional, is for high-level alarm.
The LCD controller is fitted with three or four level switches: One for common stop and two for start of the pumps. The fourth level switch, which is optional, is for high-level alarm.
When installing the level switches, the following points should be observed:

1. To prevent aị intake and vibrations in submerged pumps, the stop level switch must be fitted in such a way that the pump is stopped before the liquid level is lowered below the top of the pump housing.
As a principal rule for pumps in dry installation, the lowest stop level must be at least 20 cm above the opening of the suction pipe, see fig. 8 .
2. The start level switch should be installed in such a way that the pump is started at the required level; however, the pump must always be started before the liquid level reaches the bottom iniet pipe to the pit.
3. The high-level alarm switch, if installed, should always be installed about 10 cm above the start level switch; however, alarm must always be given before the liquid level reaches the inlet pipe to the pit.
Note: The pump controller must not be installed in potentially explosive environments.

Pumps installed in potentially explosive atmosphere must always be filled with the liquid to be pumped.
An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating.

### 4.6 Thermal switches

Three bimetallic thermal switches are built into the stator windings, and a coritact will open in case of overtemperature, i.e. $150^{\circ} \mathrm{C}$.
The supply voltage to the thermal switches must be $12-230$ VAC. The thermal switches are connected to the monitoring cable, see section 5. Electrical connection, and must be connected to the safety circuit of the separate pump controller.
Note: The motor starter of the pump controller must include a circuit which automatically disconnects the electricity supply in case the prolective circuil for the pump is opened.

The installer/user should provide an automatic device which disconnets the electricity supply in case the thermal switches or the moisture switches are not operating.

### 4.7 Moisture switches

Non-explosion-proof pumps have one moisture switch, which is fitted in the chamber below the motor top cover
Explosion-proof pumps have two moisture switches connected in series, which are fitted in the chamber below the motor top cover.
The moisture switch is non-reversing and must be replaced after use.
The moisture switches are connected in series with the thermal switches and connected to the monitoring cable, see section
5. Electrical connection, and must be connected to the safety circuik of the separate pump controller.
Note: The motor starter of the pump controller must include a circuit which automatically disconnects the electricity supply in case the protective circuit for the pump is opened.

### 4.8 Thermistors

Thermistors are available as accessories.
The thermistors are used for the monitoring of bearing and stator temperatures instead of thermal switches and must be connected to the thermistor relay in the control cabinet.
The following limit temperatures are used:

- $90^{\circ} \mathrm{C}$ - alarm for bearing temperature.
- $130^{\circ} \mathrm{C}$ - pump stop caused by high bearing temperature.
- $150^{\circ} \mathrm{C}$ - pump stop caused by high stator temperature.

At room temperature, the thermistor resistance is approx. $100 \Omega$.
The bearing temperature monitoring is not available in explosion-proot pumps.

### 4.8.1 Checking after installation of pump

1. Using a multimeter, check whether the circuit resistance is $<150 \Omega$ / thermistor.
2. Using a multimeter, check whether the insulation between circuit and stator housing within the highest range is outside the scale (not measurable $\infty$ ).
3. Carry out similar measurements at the end of the supply cable.

### 4.9 Pt100 temperature sensor

The Pt100 temperature sensor is available as an accessory.
The Pt100 sensor is primarily used for the monitoring of bearing temperature, but it can also be used in the stator.
The sensor resistance is

- $100 \Omega$ at $0^{\circ} \mathrm{C}$,
- $138.5 \Omega$ at $100^{\circ} \mathrm{C}$ and
- approx. $108 \Omega$ at room temperature.

The Pt100 is not available for explosion-proof pumps.

### 4.9.1 Checking after installation of pump

1. Using a muttimeter, check whether the resistance at room temperature is approx. $108 \Omega$.
2. Using a multimeter, check whether the insulation between circuit and stator housing within the highest range is outside the scale (not measurable $\infty$ ).
3. Carry out similar measurements at the end of the supply cable.
4. During pump check, the Pt100 sensor must be connected to a recording device.

### 4.100CT1 water-in-oil sensor

The OCT1 waterin-oil sensor is available as an accessory.
The sensor measures the water content in the oil chamber.
The sensor consists of a plate capacitor which is immersed in the oil and measures the electronic circuit, emitting a 4-20 mA proportional current signal. Connect the OCT1 sensor as shown in "7. 9

### 10.1 Fitting the OCT1 sensor

The OCT1 sensor is to be fitted in the filling hole of the oil chamber instead of the oil screw.

1. Remove the oil screw.
2. Push the sensor into the oil filling hole.
3. Push the sensor to a suitable depth in the oil chamber without letting it touch the rotating parts, but so deep that the sensor is completely covered by the oil. Recommended inserting depths for different pump types appear from the table below
4. Screw the bush into the thread for the oil screw.

Note: Before refitting after oil change, the OCT1 sensor must be cleaned with white spirit (mineral turpentine).
Fig. 9


| Motor size | Inserting depths $L$ [mm] |
| :---: | :---: |
| 7.5-12.5 kW | 80 |
| $\begin{aligned} & 13.5-21 \mathrm{~kW} \\ & 22-29 \mathrm{~kW}, 2-, 4 \text { - and } 6 \text {-pole } \end{aligned}$ | 90 |
| $15 \mathrm{~kW}, 12$-pole 20-28 kW, 8-pole 20-50 kW, 4-pole | 110 |
| $\begin{aligned} & 22 \cdot 35 \mathrm{~kW}, 10 \text {-pole } \\ & 35-50 \mathrm{~kW} ; 8 \text {-pole } \\ & 58-155 \mathrm{~kW} \end{aligned}$ | 140 |

Technical specifications

| Measuring range | $20-100 \mathrm{pF}$. |
| :--- | :--- |
| Sensor capacitance in air | 9 pF. |
| Measuring range for water <br> content | $0-60 \%$ corresponding to <br> $4-20 \mathrm{~mA}$. |
| Temperature range | $0-70^{\circ} \mathrm{C}$. |
| Supply voltage | $0-30 \mathrm{VDC}$ max. 23 mA. |
| Material, supply cable | Polyurethane. |
|  | EEx ia IIB T4, Ui $=34 \mathrm{~V}, \mathrm{Ii}=$ <br> $100 \mathrm{~m}, \mathrm{Ci}=220 \mathrm{nF}, \mathrm{Li}<$ <br> In uH. <br> Ex approval <br> ments, the sensor must be con <br> nected via an approved Exi <br> separator. |

## ;. Electrical connection

The electrical connection should be carried out in accordance with local regulations.
The supply voltage and frequency are marked on the pump nameplate.
The voltage tolerance must be within $\pm 5 \%$ of the rated voltage.

Make sure that the motor is suitable for the electricity supply available at the installation site.


The pump must be connected to an external mains switch with a contact separation of at least 3 mm in each pole.

The pump must be connected to a motor starter.
The wiring diagrams for direct-on-line starting and star-delta starting are shown in fig. 10 and fig. 11, respectively.
P 1 and P 2 are connected in series with the thermal switches and the moisture switches.
Fig. 10


Fig. 11


The top cover of explosion-proof pumps is provided with an external earth terminal to ensure the connection to earth. The electrical installation must include an external connection from this terminal to earth. The earth wire must fulfil all electrical safety regulations in force.

| Cross section <br> of phase wire (S) <br> of the installation <br> $\left[\mathrm{mm}^{2}\right]$ | Minimum <br> cross section <br> of earth wire <br> [mm $\left.^{2}\right]$ |
| :---: | :---: |
| $\mathrm{S} \leq 16$ | S |
| $16<\mathrm{S} \leq 35$ | 16 |
| $\mathrm{~S}>35$ | $0.5^{\circ} \mathrm{S}$, max. 70 |

Before installation and the first start-up of the pump, the cable condition should be checked visually to avoid short circuits.

## 6. Start-up



Before manual starting or changeover to automatic control, make sure that no persons are working on or near the pump.
Proceed as follows:

1. Remove the fuses or switch off the mains switch.
2. Check the oil level in the oil chamber. See section 7.1 Oil check and oil change.
3. Check whether the impeiler can rotate freely.
4. Check whether the monitoring units, if used, are operating satisfactorily.
5. Make sure that the pump is submerged in the liquid.

For pumps in dry installation, it must be ensured that there is liquid in the pit.


Make sure that the pump has been filled with the liquid to be pumped.
Pumps in dry installation must be vented by means of the vent plug in the pump housing.
6. Open the isolating valves, if fitted
7. Check whether the system has been filled with liquid and vented.
8. Check the setting of the level switches.
9. Start the pump and check the pump operation for abnormal noise or vibrations.
Note: In case of abnormal noise or vibrations from the pump or other pump or supply failures, stop the pump immediately. Do not attempt to restart the pump before the cause of the fault has been found and the fault corrected.
10. After start-up, the actual pump duty point must be established as accurately as possible so that it can be checked whether the operating conditions are as desired.

Note: The pump may be started for a very short period without being submerged for checking of direction of rotation.
The operation of the pump should always take place in accordance with established routines with scheduled checks of pump monitoring equipment and accessories (valves, etc.). Make sure that the pump and equipment settings cannot be changed by unauthorized persons

### 6.1 Checking the direction of rotation

An arrow cast in the pump housing indicates the correct direction of rotation. The pump must rotate clockwise when seen from the drive end. Observe the movement of the pump (jerk) when started. If the pump moves counter-clockwise, the direction of rotation is correct.

As an alternative, the direction of rotation can be checked as follows:

1. Start the pump and check the quantity of liquid or the discharge pressure.
2. Stop the pump and interchange two of the phases to the motor.
3. Restart the pump and check the quantity of liquid or the discharge pressure.
4. Stop the pump.
5. Compare the results taken under points 1 and 3 . The connection which gives the larger quantity of liquid or the higher pressure is the correct direction of rotation.

Note: The pump must only run for a shont period when suspended from a chain.

## 7. Maintenance and service

Before starting work on the pump, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the electricity supply cannot be accidentally switched on. All rotating parts must have stopped moving.

Maintenance and service must be carried out by specially trained persons


The maintenance and service work on explosionproof pumps must be carried out by GRUNDFOS or a service workshop authorized by GRUNDFOS.

Before carrying out maintenance and service, it must be ensured that the pump has been thoroughly flushed with clean water. Rinse the pump parts in water after dismantling. Pumps running normal operation should be inspected every 2000 operating hours or at least once a year. If the pumped liquid is very muddy or sandy, the pump should be inspected every 1000 operating hours or every six months.

The following points should be checked:

## - Power consumption

- Oil level and oil condition

When the pump is new or after replacement of the shaft seals. check the oil level after one week of operation.
The oil becomes greyish white like milk if it contains water.
This may be the result of a defective shaft seal. The oil should be changed if it contains water. See section 7.1 Oil check and oil change.
Note: Used oil must be disposed of in accordance with local regulations.
The oil chamber contains 1.9 to 12.4 litres of SAE 10 W 30 motor oil depending on pump size.

- Cable entry

Make sure that the cable entry is watertight and that the cables are not sharply bent or pinched.

- Impeller clearance

Check the impeller clearance. See section 7.2 Inspection and adjustment of impeller clearance.

- Pump parts

Check the pump housing, etc. for possible wear. Replace defective parts.

- Ball bearings

Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings.
A general overhaul of the pump is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorized service workshop.

The ball bearings must be replaced at least every 25,000 operating hours.

Note: Out of consideration for the heat-conducting ability, the pump should be cleaned on the outside at regular intervals.

### 7.1 Oil check and oil change

The oil chamber has two screws, $A$ and $B$, for oil drainage, oil filling and level control. Horizontally installed pumps (version 6) have a third screw, C , for oil drainage.
On horizontally installed pumps (version 6), the oil screws are always positioned as shown in fig. 12.
Fig. 12


In the case of pumps with 8 - or 10 -pole motors of $22-50 \mathrm{~kW}$ and pumps with motors larger than 50 kW , the oil can be changed while the pump is standing upright. The screw B is used for the indication of the oil level in the oil chamber, see fig. 13.
Fig. 13


## Proceed as follows:

1. Place the pump in such a position that the screw $A$ is pointing upwards.

When slackening the screw A of the oil chamber, note that pressure may have built up in the chamber. Do not remove the screw until the pressure has been fully relieved.
.. Place a clean container under the pump to collect all the drained-off oil. Slacken the screw B pointing to the side and observe the oil level. The drained-off quantity of oil indicates whether the lower mechanical shaft seal is leaking, which may be normal
3. Turn the pump or remove the screw $C$ and allow all the oil to drain from the chamber into the container. Pour an oil sample into a glass container and observe the condition of the oil. Clear oil can be reused.
Emulsified oil must be changed and disposed of.
Note: Used oil must be disposed of in accordance with local regulations.
Low oil level may indicate that the upper mechanical shaft seal is defective. Contact an authorized service workshop for further overhaul of the pump and repair, if required.
4. Fill the oil chamber with oil through the top hole $A$ until the oil level reaches the hole $B$. Replace the O-rings by new rings, insert the screws and tighten securely.

Use viscosity grade SAE 10 W 30.
ONDINA 917 can be used in temperature class T4 applications only.

### 7.2 Inspection and adjustment of impeller clearance

Adjustment of the impeller clearance is only relevant for pumps with channel impellers ( $\mathrm{S} 1, \mathrm{~S} 2$ and S 3 pumps).
The correct impeller clearance is $0.7 \mathrm{~mm} \pm 0.2 \mathrm{~mm}$. The clearance should be adjusted if it is worn to 1.2 mm or more.
The procedures for adjustment of the impeller clearance are diferent for pumps in submerged installation (versions 1, 2, 4 and i) and pumps in dry installation (versions 3, 6 and 7).

The various procedures are described in the following sections:
7.2.2 Adjustment of impeller clearance for pumps without inlet funnel in submerged installation,
7.2.3 Adjustment of impeller clearance for pumps with inlet funnel in submerged installation,
7.2.4 Adjusiment of impeller clearance for pumps without slide ring in dry installation,
7.2.5 Adjustment of impeller clearance for pumps with slide ring in dry installation,
7.2.6 Adjustment of impeller clearance of axial pumps.
7.2.1 Inspection of impeller clearance for pumps in submerged installation

1. Lay the pump flat on a work bench
2. Locate the six fixing screws securing the pump housing to the motor and the three adjusting screws, see fig. 14.
3. Check the clearance between impeller and pump housing all the way round using a feeler gauge.
4. Turn the impeller by hand and check at several points, see fig. 15.

Fig. 14


Fig. 15


If the impeller clearance needs adjustment, follow one of the procedures described below.

### 7.2.2 Adjustment of impeller clearance for pumps without inlet funnel in submerged installation

Procedure

1. Slacken all fixing screws and adjusting screws between pump housing and motor.
2. Tap on the pump housing at several points using a rubber mallet to loosen the pump housing from the motor.
3. Close the impeller clearance by tightening three of the fixing screws until the impeller touches the pump housing. Do not use unnecessary force.
4. Slacken the fixing screws and open the clearance to 0.7 mm $\pm 0.2 \mathrm{~mm}$ by tightening the three adjusting screws, see fig. 16 . Check that the clearance is equal all around the suction opening.
Fig. 16

5. Tighten all fixing screws and check that the clearance is still equal all around the suction opening.
7.2.3 Adjustment of impeller clearance for pumps with inlet funnel in submerged installation
Procedure:
6. Slacken all fixing screws and adjusting screws between pump housing and motor.
7. Tap on the pump housing at several points using a rubber mallet to loosen the pump housing from the motor.
8. Close the impeller clearance by tightening three of the fixing screws until the impeller touches the inlet funnel. Do not use unnecessary force.
9. Slacken the fixing screws and open the clearance to 0.7 mm $\pm 0.2 \mathrm{~mm}$ by tightening the three adjusting screws, see fig. 17 . Check that the clearance is equal all around the suction opening.

Fig. 17

5. Tighten all fixing screws and check that the clearance is still equal all around the suction opening.

### 7.2.4 Adjustment of impeller clearance for pumps without slide ring in dry installation

The impeller clearance can be adjusted while the pump is mounted on the base stand and connected to the pipework, see fig. 16.
Procedure:

1. Slacken all fixing screws and adjusting screws between pump housing and motor.
2. Tap on the pump housing at several points using a rubber mallet to loosen the pump housing from the motor.
3. Close the impeller clearance by tightening three of the fixing screws until the impeller touches the pump housing. Do not use unnecessary force.
4. Measure the distance $X$ between the shaft seal housing and the pump housing at three points using a slide caliper, see fig. 16.
5. Slacken the fixing screws and pull the motor $0.7 \mathrm{~mm} \pm 0.2 \mathrm{~mm}$ out by tightening the three adjusting screws and using the distance $X$ as reference.
6. Tighten all fixing screws and check that the distance $X$ at the three reference points is equal.

### 7.2.5 Adjustment of impeller clearance for pumps

 with slide ring in dry installationThe impeller clearance can be adjusted while the pump is mounted on the base stand and connected to the pipework, see fig. 18.
Procedure:

1. Slacken all fixing screws (028).
2. Close the impeller clearance $S$ by tightening the adjusting screws (074) evenly. Do not use unnecessary force.
3. Measure and note the distance "L" between pump housing and suction cover at the adjusting screws. Use a slide caliper
4. Slacken the adjusting screws (074).
5. Tighten the fixing screws (028) evenly so that the distance "L" measured at the adjusting screws is increased by 0.7 mm $\pm 0.2 \mathrm{~mm}$.
6. Tighten the adjusting screws and retighten the fixing screws.
7. Check the distance "L" and readjust, if necessary.

Fig. 18


### 7.2.6 Adjustment of impeller clearance of axial pumps

The impeller clearance of a new pump is 0.8 mm and it cannot be adjusted. If the impeller clearance is worn to 3 mm or more, the propeller and the suction part must be replaced in order to ensure the original duty point and efficiency.

### 7.3 Explosion-proof S1, S2, S3 and SV pumps

Overhauled and repaired explosion-proof motors are marked with a repair plate giving the following information:

- The repair symbol R.
- Name or registered trade mark of the repairing workshop.
- Workshop reference number relating to the repair.
- Date of overhaul or repair.

In the event of subsequent repairs, the existing plate should be replaced by a new updated plate and earlier markings are recorded.
The repairing workshop must keep records of performed overhauls and repairs together with records of all previous overhauls, repairs and possible modifications. Copies of the repairing workshop's detailed records should be filed by the owner or operator together with the original type certificate of the explosion-proof motor in question.

### 7.3.1 Motor cable

Only cables which are approved by the manufacturer and suitable for the cable entry as to diameter, number of leads, conductor cross section and sheath material may be used for the motor.

### 7.3.2 Cable entry

Only EExd cable entry parts corresponding to the cable diameter may be used. The corresponding cable dimension marking is stamped on the inlet or the cable entry.
Secure the cable entry to the motor top cover by tightening the screws evenly one by one until the cable entry is lying flat against the top cover.

### 7.3.3 Spare parts

Damaged motor parts, such as top cover and cable entry, should always be replaced by new and approved parts. Motor parts must not be reconditioned by machining, re-tapping, welding, etc.

### 7.4 Contaminated pumps

Note: If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated. If GRUNDFOS is requested to service the pump, GRUNDFOS must be contacted with details about the pumped liquid, etc. before the pump is returned for service. Otherwise GRUNDFOS can refuse to accept the pump for service.
Possible costs of returning the pump are paid by the customer. However, any application for service (no matter to whom it may be made) must include details about the pumped liquid if the pump has been used for liquids which are injurious to health or toxic.

## 8. Disposal

Disposal of this product or parts of it must be carried out according to the following guidelines:

1. Use the local public or private waste collection service.
2. In case such waste collection service does not exist or cannot handle the materials used in the product, please deliver the product or any hazardous materials from it to your nearest GRUNDFOS company or service workshop.

## 9. Fault finding chart



Before attempting to diagnose any fault, make sure that the fuses have been removed or the mains switch has been switched off. It must be ensured that the electricity supply cannot be accidentally switched on. All rotating parts must have stopped moving.
The safety instructions in section 2. Safety must be read and observed.

| Fault | Cause | Remedy |
| :---: | :---: | :---: |
| 1. Pump does not start or stops without visible cause. | a) No electricity supply. | Check electricity supply and fuses. Start the pump manually and check contactor operation. |
| 2. Pump does not start or stops. The control panel of the controller indicates that the motor starter or protection equipment has tripped out. | a) Missing phase. | Check electricity supply and fuses. |
|  | b) Pump momentarily overloaded. | If the fault does not disappear automatically, find the cause. |
|  | c) Impeller blocked by impurities. | Check impeller and clean as required. |
|  | d) Motor starter not set correctly. | Check and set as required according to rated current. |
|  | e) Thermal switches tripped out. Insufficient motor cooling. | Allow the motor to cool. Ensure adequate cooling by lowering the pump into the liquid, versions 1 and 4. |
|  | f) Moisture switch in motor tripped out. | Contact authorized service workshop. |
|  | $g)$ Motor cable defective. | Check for visual damages. Contact authorized service workshop. |
|  | h) Fluctuating voltage. | Check voltage. Permissible deviation is $\pm 5 \%$. |
| 3. Pump runs but does not deliver the rated flow. | a) Wrong direction of rotation. | Check the direction of rotation and possibly interchange two phases to the motor. |
|  | b) Impeller loose or worn. | Check impeller and adjust as required. |
|  | c) Pump or pipework blocked by impurities. | Check pump and pipework and clean as required. |
|  | d) Pump head too high. | Check by measuring the pressure and reinstall discharge pipe or install new pump. |
|  | e) Valves closed or blocked. <br> Non-return valve not operating. | Check valve position and clean as required. |
|  | f) Air in pump or suction pipe. | Vent the pump and suction pipe. Increase the stop level in the pit or reinstall suction pipe. |
|  | g) Pumped liquid too dense. | Dilute the liquid or change the process. |
|  | h) Pump not properly connected to auto-coupling. | Pump down the liquid level in pit. Lift out the pump and relocate the pump on the auto-coupling. |
|  | i) Leakage in pipework. | Check pipework for leaks and make tight as required. |
|  | j) Pump pit flushing system inadvertently activated. | Check function and repair as required. |
| 4. Pump starts, but stops immediately. | a) Clogged pump causes motor starter to trip out. | Check pump and clean as required. |
|  | b) Overheated motor causes thermal switches to trip out. | Allow pump to cool. Check for cause as above. |
|  | c) Level switch out of adjustment or defective. | Clean or set level switch or replace as required. |
| 5. Pump vibrating or emitting excessive noise. | a) Pump partly choked by impurities. | Check pump and clean as required. |
|  | b) Wrong direction of rotation. | Check the direction of rotation and possibly interchange two phases to the motor. |
|  | c) Pump operates outside specified operating range. | Check operating conditions. |
|  | d) Pump defective. | Check pump for damages. Repair the pump or contact an authorized workshop, if necessary. |
|  | e) Pump not properly connected to auto-coupling. | Pump down the liquid level in pit. Lift out the pump and relocate the pump on the auto-coupling. |
|  | f) Pump cavitates. | Check pump for partial suction blockage and clean as required. Check duty point and adjust as required. |
|  | 9) Base stand, auto-coupling, ring stand or guide rails not installed correctly. | Check installation and tighten bolts where necessary. |
| 6. Oil watery or emulsified. | a) Lower mechanical seal leaking. | Contact authorized service workshop. |
| 7. Low oil leveil. | a) Upper mechanical seal leaking. | Contact authorized service workshop. |



## Appendix 7: Operating \& Maintenance Manual of Passive Harmonic Filter System

| Supplier/Manufacturer: | Capacitor Technologies Pty Ltd |
| :--- | :--- |
| Model/Part Number:: | CT-1HTF041503-007302A |
| Contact: | (02) 98991747 |

## OPERATING AND MAINTENANCE MANUAL

OF

PASSIVE HARMONIC FILTER SYSTEM

## CAPACITOR TECHNOLOGIES PTY LTD

MELBOURNE : 0397585866

SYDNEY:029899 1749

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2. COMPONENTS
3. TRANSPORTATION \& INSTALLATION
4. COMMISSIONING
5. PREVENTIVE MAINTENANCE
6. OPERATING INSTRUCTION FOR
REACTIVE POWER CONTROL RELAY
AND DRAWINGS

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Attachment

# GUIDE FOR COMMISSIONING OPERATION AND MAINTENANCE OF REACTIVE VA CONTROL SYSTEM 

## GENERAL REMARKS

The PASSIVE HARMONIC FILTER SYSTEM described in this guide is the latest up-todate technology.

The filter unit, utilizing the advantages of both passive and active filter capabilities, is capable of auto-adapt to the constant load changes of the VSD, and significantly reduces the existing current harmonics.

## RATING

The rating of the filter banks is mentioned in enclosed drawings.

## ENCLOSURE

The filter bank is enclosed in a free standing sheet metal cabinet. The cabinet is adequately ventilated.

## STANDARD

The automatic filter banks comply with AS 3000, AS 1013, IEC 831 and other relevant Standards.

## SAFETY PRECAUTIONS

CAPACITORS STORE CHARGE! NEVER TRUST A CAPACITOR TO BE BLED OFF COMPLETELY. A METER OR GROUND STRAP SHOULD BE USED TO CHECK EACH STUD BEFORE HANDLING.

# CAUTION: LETHAL VOLTAGES PRESENT INSIDE EQUIPMENT. UNDER NO CIRCUMSTANCES SHOULD UNQUALIFIED PERSONNEL BE ALLOWED TO WORK ON THE EQUIPMENT. 

## REACTIVE VA CONTROL RELAY

The reactive VA control relay is microprocessor controlled and have the following:

- Built in cos 0 digital display
- Uniform working duty for all capacitor stages using cyclic operation mode
- Built in active and reactive current factor digital display
- Provision for manual and automatic switching
- Unused stages is not switched on
- Have a fault signal indication
- Stage ratios for sequential operation/expansion
- Potential free fault contacts

For more information please read attached Operating Instruction for Reactive Power Control Relay.

## CHANGE OF PROGRAM

The Control Relay will be programmed during commissioning, and should not be changed by unauthorised persons.

## CAPACITORS

There are 3 phase capacitors in one cylindrical aluminium case with built in over pressure disconnectors.

The capacitors are made of self-healing type metallised polypro-pylene foils. They are vacuumed, impregnated and free of PCB.

The capacitors are able to operate at a minimum cooling air temperature of $-10^{\circ} \mathrm{C}$ and up to a maximum cooling air temperature of $+60^{\circ} \mathrm{C}$. Discharge resistors are installed on each of the 3 phase cylindrical capacitors which discharge them.

The capacitors have the following overload capacity:

$$
\begin{array}{ll}
\text { voltage } & -1.1 \times \text { Ur } 8 \text { hours daily } \\
& -1.15 \times \text { Ur } 30 \text { minutes daily } \\
& -1.2 \times \text { Ur } 5 \text { minutes } \\
& -1.3 \times \text { Ur } 1 \text { minute } \\
\text { current } \quad & -2 \text { times the rated current at } 400 \mathrm{VAC} / 50 \mathrm{~Hz} \text { permanently. } \\
& -350 \text { times the rated current at } 400 \mathrm{VAC} / 50 \mathrm{~Hz} \text { during short peak } \\
\text { currents. }
\end{array}
$$

The power loss in the capacitors does not exceed 0.5 watts per kVAr .
Power capacitors do not require any maintenance work. In case of a capacitor fault, the defective one can be identified by visual inspection.

## EXHAUST FAN

The ventilation fan is installed in the enclosure for cooling and keeping reasonable temperature of equipment.

Before using, check the fan for possibility of transit damage.
Ensure that the duct is clear of any debris that could be drawn into the impeller. Check fan is free to rotate. After starting check for excessive vibration.

The fans are provided with sealed - for - life bearings and are virtually maintenance free.
The electric circuit of the fans has adjustable thermostat controller which has been adjusted by Capacitor Technologies.

As a rule the thermostat controller does not need any preventive maintenance, but if a temperature failure related with the controller occurs, the thermostat controller should be readjusted.

## BLOCKING REACTORS

If Blocking Reactors are provided in Reactive VA control system they will be detuned below 5th harmonic to avoid occurrence of resonance condition due to presence of 5 th, 7 th, 11 th or other higher order harmonics.

## TRANSPORTATION

The Passive Harmonic Filter Unit is fixed on the pallet and covered by foam sheet and plastic. A wooden frame is also fixed on top of the packing which prevents transport damage.

For transportation of the Passive Harmonic Filter Unit following methods can be used:
The Passive Harmonic Filter Unit can be moved by forklift using forks through the pallet or using lifting lugs (supplied loose with unit). The unit must be tied to the forklift to prevent any vertical movement during the transportation.

## INSTALLATION

## 1. Site Conditions

The Passive Harmonic Filter Unit is to be installed in a clean environment. The floor should be clean and free of dust or other material which can be sucked by fan provided in the panel as these may block the air passage and result in insufficient cooling of various components.

The Passive Harmonic Filter Unit is to be secured properly in its position by bolting it to the floor. Holes have been provided in the base channels of the unit for this purpose.

The ambient air temperature should not exceed $+45^{\circ} \mathrm{C}$.

## 2. Inspection

The following inspections are mandatory prior to installation of the Passive Harmonic Filter Unit.
2.1 Mechanical Inspection

Unpack the unit from the pallet and examine carefully for any transport damage.

Note: The most commonly encountered transport damage is caused by dropping of the palliated unit which can result in a displacement of various components like capacitors, bus-bars and etc. All the joints to be examined carefully and manufacturer consulted if any damage of consequence is found. Move the panel to final location and bolt down.
2.2 Electrical Inspection

Carry out Insulation Resistance Test of conductors, Resistance of Earthing System.
2.3 Connection of Mains Supply Cable

It is important that the phase provided with the current transformer is connected to terminal "L1" (red phase) and that the phase sequence in clockwise direction is established.

### 2.4 Current Transformer Arrangement

The primary current of the current transformer is determined by the current input of the load circuit. The value of the primary current depends on the maximum current load or on the value of the connected load or on the size of the transformer.

The current transformer must be built into the phase "L1" in such a way that the total current of the load circuit to be corrected and of the Passive Harmonic Filter flows through the current transformer.

## COMMISSIONING

Before the Passive Harmonic Filter Unit (P.H.F. Unit) can be put into operation it has to be commissioned.

There are a few main points which should be examined:

1. Visually check cable connections inside of P.H.F. Unit, paint, presence of drawings and manuals.
2. Do Insulation Resistance and Resistance of Earthing System Tests.
3. If above named Tests are OK. Reactive Power Control Relay should be programmed.
4. How to programme the Control Relay:

Please read carefully enclosed Operating Instruction for Reactive Power Control Relay and follow programming procedure.
5. Measure current for every step and for whole P.H.F. Unit.

## PREVENTIVE MAINTENANCE

The Passive Harmonic Filter Unit is designed by CAPACITOR TECHNOLOGIES to survive for long use.

However, preventive maintenance can become an important aspect to durability for equipment of this nature.

Power, bus-bar and control circuitry connections should remain tight as sent from the factory or after being secured. However carelessness or thermal contraction and expansion could result in an improper connection. A resistive joint may thus occur. This is usually recognised by discolouration of the cable colour near the connectors, inability to get rated power where it had been obtained previously, or unstable operation of the equipment.

During periods of diagnosis for unusual troubles or annual shutdown maintenance, it is good to check connections.

The following is provided as a guide in periodic preventive maintenance checks. Failure to provide proper maintenance may result in component failure and/or system breakdown.

## RECOMMENDED MINIMUM MAINTENANCE SCHEDULE

| Before | After | 6 month | 12 month |
| :--- | :--- | :--- | :--- |
| start up | $\underline{\text { first week }}$ | periods | periods |

Tighten bolts \& screws

X
X
X
X
Cleaning equipment X

WARNING: When working inside the enclosure, disconnect

## TROUBLE SHOOTING TESTS

BASIC POWER CIRCUIT CHECK. These tests should be performed before applying power to unit on installation or after a failure has occurred. If fuses are found to have blown, a capacitor check should be made. Making these checks will be time well spent rather than gambling that everything is proper in applying power to the system.
a) FUSES- check the power fuses with the multimeter conditioned for ohmmeter test on the Rxl scale. A good fuse will read zero ohms. A defective fuse will read more than 1000 ohms.

The various control fuses will usually be good when checked after most fault conditions. If necessary, they can easily be checked by removing them from their respective sockets. If removed, ensure they are returned properly. Control fuses will usually relate to obvious problem such as no relay reading, no switching from stage to stage, etc.
b) CAPACITORS- If a capacitor develops a short with the casing, it will usually read near to zero ohms on the ohmmeter check between its terminals and case. If the multimeter indicates a different reading on the multimeter, the capacitor is most likely good. If a short is observed on the meter and capacitors are paralleled, it will be necessary to isolate the individual capacitors and identify the faulty one.

Beyond that an individual capacitor is fitted with an overpressure disconnector as an additional safety measure.

If the self-heating process does not operate (e.g. because of voltage, current or thermal overload) the cover plate, which is designed as an overload valve, comes up and ruptures. This causes the internal connecting wires to the coils of the capacitor to separate to the mains.



## View from below



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## 1. Summary of Instructions

On delivery, the control relay is set to pre-programmed standard values (see Table 1, pages 12-14
The reactive power control relay RM 9606 is self-regulating (i.e. it detects and adjusts to the voltage phase connection requency, and the response current (c/k ratio) automatically.
Before a reactive power control system (capacitor bank) can be put into opera tion, the target power factor (cos phi rate 1) has to be programmed.

How to programme the control relay:
a) The control relay should be connected as shown in Fig. 1 (see page 9).
b) Apply voitage to the control relay :".... appears on the digital display. The control relay now identifies the location of the current and voltage source. This process takes at least 2 minutes and maximum of 15 minutes. If this is no the case, see Pos. 8, page 33 . The power factor ( $\cos$ phi) is displayed.
c) Press the "Set" button for 8 seconds A "-1-" appears on the digital display and the "manual" LED flashes.
d) By repressing the "Set" button the tar get power factor ( $\cos$ phi) is displayed - necessary, reprogramme to the pressing either the "+" or "" bato by il the required target power factor (cos til the required target power factor (cos phi) is displayed.

If no numbers appear on the display then the control relay must be briefly disconnected from the volt age source and then the "Set" but ton has to be pressed again ac cording to c ).
e) To confirm the value press the "Set" button again. A "-2-" will appear on the display.
f) Now press the "-" button twice unti "End" appears on the display. Store this value by pressing the "Set" button. The target power factor (cos phi rate 1) is then stored safely in a non-volatile mem ary.

To prevent unintentional reprogramming the set mode can only be activated within the first 5 minutes after the operating voltage has been applied. If the set mode has been activated within the first 5 min utes, you have one hour to complete the programming. In order to obtain the set mode again after this period of time the control relay must be briefly dis connected from the voltage source

Table 1 on pages 12-14 lists all 24 preprogrammed standard values and their programme ranges. The function of the pre-programmed standard values is described in Section 5.

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from the measured voltage and the signals of the current transformer. If the re active power portion exceeds certain threshold values, which the control relay has measured at the time of testing (auto-adaption) or are set as per section 5, a switching action will take place at the switching outputs.
In the case of inductive reactive current (inductive reactive power) one or more control contacts of the reactive powe control relay are closed after an adjust able time delay.
This causes the RM 9606 to switch capacitor steps onto the power source sup ply as and when required in order to achieve the programmed target pow factor (cos phi). If the inductive reactive current portion of the load is reduced, the excess of reactive current causes the capacitor steps to be switched off line.

The control relay RM 9606 allows a vaiety of possible settings to meet the conditions on site. The relay's cyclic opera tion prolongs the life of all connected devices by averaging the length of time that the capacitor stages are switched on. 2.1 Automatic Identification of Voltage and Current Source
When voltage is initially applied to the control relay, it determines the location of the current and voltage sources (auto matic phase rotation), i.e. it identi-fies in which phase and at which phase angle the current path and the voltage path are
connected. Should the control relay fail to dentify the current and voltage source due to power instabilities, repeat the pro cedure when the power has stabilized. It is also possible to programme the phasing manually:

Resetting of the control relay and reidentification of voltage and curren sources is initiated by pressing buttons " + ", "-" and "Set" simultaneously for a least 8 secs.

### 2.2 Automatic c/k ldentification of Connected Capacitor Stages

Having determined the voltage and current source identification the RM 9606 automatically calculates the $c / k$ identification. During the identification process all the control contacts of the relay are individually switched on and off again The stage currents ascertained are the stored. These values determine the stag sequence. In this way it can also be de termined which switching outputs are in use.

The processes for the automatic identif cation of voltage and current source and/or the automatic identification of ca pacitor stages are only carried out when switching on or pressing the combination of buttons for the first time (see section 2.1).

The RM 9606 checks stored stage currents al specific time intervals during normal operation. If it determines that a capacitor stage has failed this stage (stage without capacitance) will be ig nored in future normal operations.

All failed stages are switched on from time to time in order to re-check their capacitance. If a capacitor stage is added later on, or defect fuses are exchanged, the RM 9606 itself identifies this after some time and the stage is then integrated into the normal operation again. However, we recommend that if capacitor stages are added at a later date, the setup procedure be repeated (see section 2.1).

## Important

In case of low voltage networks being fed by several transformers switched in parallel, the capacitor current is distributed to all the transformers. If measurements are not carried out via a summation transformer the current change, measured by the control relay, is too low when switching on the capacitor stages, which
can lead to errors during the automatic stage identification process. In such situations we recommend that the stage identification be switched off and the relevant values be programmed manually (see sections 5.5 to 5.8 ).

### 2.3 Automatic Setting of Switching

 Time Delayin order to keep the wear of the capacitor's contactors down to a minimum the response time of the control relay is lengthened or shortened automatically according to the frequency of the change of the load.

### 2.4 Power Feedback

The RM 9606 is equipped with a four quadrant control. This means that even when active power is fed back onto the main bus, the control relay ensures compensation for the reactive power which has been drawn from the mains. In this case the LED "Regen" lights up. When power is fed back, no "kinked" charac teristic will result (see sections 6.1 to 6.3).

## 3. Installation and Connection

The reactive power control relay RM 9606 automatically determines the location of the current and voltage sources (automatic phase rotation). It may be connected either to iwo phases (phase/phase) or to one phase and neutral (phase/neutral).

### 3.1 Installation

The control relay is inserted through the front of a panel cut-out of $138 \mathrm{~mm} \times 138$ mm and screwed tight by fixing screws provided.
Control relays supplied on their own are provided with insulated fixing screws. These can used for installing into switchgear cabinets or cubicles for Protective Class II. Furthermore, a sealing ring is supplied, which must be used when installing in switchgear cabinets or cubicles with Enclosure IP 54.
The pre-mounted terminal connections allow a quick and easy assembly. The control relay is electrically connected by multiple terminal plugs supplied with the relay.

### 3.2 Voltage Connection

The control relay should preferably be connected to the three-phase system as shown in Fig. 1 (page 9).
The supply voltage of the control relay should be connected in the same phase as the contactor voltage.

## IMPORTANT:

The control relay is designed for a mains voltage supply of 230 VAC and 400 VAC (phase/neutral or phasel phase).
For voltages greater or equal to 400 VAC, a control transformer for the VAC, a control transformer for the
supply of the controller must be used. supply of the controller must be used.
It is not allowed to load the switch It is not allowed to load the
contacts above 380 VAC max.
contacts above 380 VAC max.
Please observe the additional remarks Please observe the additional remarks in section 3.4.
3.3 Current Transformer Connection The outputs S1 and S2 of the current transformer are connected to the terminals S1 and S2 of the control relay. In order to keep the load of the current order to keep the load of the current
transformer as low as possible the supply transformer as low as possible the supply
lines should have a cross-section area of $2.5 \mathrm{sq} . \mathrm{mm}$.
Attention:
After connection the short-circuiting bridge must be removed from the current transformer.

Fig 1: Circuit Diagram


### 3.4 Additional Remarks

The voltage connection of the contro relay RM 9606 can also be carried out between phase and phase. In 400 Volt mains supply the connection is carried out at " 400 Volt" and "N/L"; in 230 Volt mains supply at " 230 Volt" and "N/L" accordingly. In order to maintain the function of the undervoltage monitoring it is absolutely necessary to make sure that the control voltage of the contactors is in the same phase as the control relay supply.
The control relay terminals of the supply voltage and measuring voltage " $\mathrm{N} / \mathrm{L}$ " and " $230 \mathrm{~V} / 400 \mathrm{~V}$ " must be externally protected by fuses. During maintenance
work the terminals must be de-energized The control voltage for the contactors is connected to terminal $P$. In the control relay this circuit is potential-free. So as not to overload the control contacts the sum of the holding currents of all the contactor coils connected may not exceed a value of 5 A .

A potential-free alarm signal contact is accessible on the terminals "a" and "b" The contact closes when either there is no mains voltage applied to the control relay or when an alarm is signalled (see section 6.3).
When there is an alarm signal, the LED "alarm" lights up and the relevant LED begins to flash on the control relay.

## 4. Putting into Operation

After the control relay has been installed as described in section 3, the relay can then be put into operation.
4.1 Putting into Operation for the First Time
When the control relay is put into operation for the first time it tries to determine the mode of connection and the size of the steps.
The display shows "...." and after a dis charge time for the capacitors the steps are switched on and off again one after the other. This process can take up to 15 minutes.
If the identification process is not concluded after this time there is probably a fault.
(See section 8, "Trouble Shooting", page 32.)

## Note:

In order that the control relay can determine the mode of connection one capacitor stage must be switched on. The control circuit as well as at least The controcircuit as well as at least
one capacitor stage must be fully one capac
functional.

It is also possible to discontinue the identification process by switching off the automatic connection and stage current identifications. This takes place in set mode and at the same time it is neces-
sary to programme manually the connection and stage parameter (see section 5 ).

After identification the actual cos phi appears on the display and the control relay begins to function.

If the cos phi shown does not coincide with the real cos phi, the identification process must be repeated.
This can be done by pressing the buttons "+", "-" and "Set" simultaneously for at least 8 secs.

### 4.2 Putting into Operation Again

After a mains failure the control relay immediately starts the normal control programme again. The data which were determined whilst being put into operation for the first time are stored in a nonvolatile memory.
By pressing the buttons "+", "-" and "Set" simultaneously for at least 8 secs. these data are erased from the memory and the control relay again begins to determine the mode of connection and size of steps.
It is assumed that the automatic connection and stage current identifications are switched on (see section 5 )

## 5. Programming (Set)

In order to permit the widest possible use of the control relay, multiple settings are available. For simplification, the control relay is set to standard values when delivered from the factory (see Table 1, page 12).

The user only needs to change the target power factor ( $\cos$ phi) or a few values to suit his special requirements. As a protection against unintentional reprogramming, the set mode (programming mode) ming, the set mode (programming mode) erating voltage is applied. If the set mode erating voltage is applied. If the set mode has been activated within the first five
minutes, it remains available for one minutes, it remains available for one hour. In order to reach the set mode again after this period, it is necessary to disconnect the control relay from its source for a short period of time
The procedure for checking or repro gramming the set values is as follows:
man
Set ${ }_{6}$

- Press the "man/Set" button for at leas eight seconds to switch to the set mode. The display then shows "-1-" This number corresponds to the firs variable which is displayed or can be changed in the following sequence
(see Table 1). The actual value ap pears in the display when the "man/Set" button is pressed again.
- By pressing the "+" or "-" button the next higher or next lower setting can be attained.
- Press the "man/Set" bulton repeatedly the mode numbers appear followed by the programmed value (see Table 1).
- If the displayed variable does not have to be changed, it is possible to proceed simply by pressing the "man/Set button or, if the mode number is dis played, by pressing the "+" or "-" but. ton.
- If the " + " button is pressed again after mode number "-24-" appears on the display, or if the "- button is pressed again after mode number "-1-" appears on the display, then the display will show "End".
- By confirming the display "End" by pressing the "man/Set" button the control relay assumes normal opera tion; the preset values are then permanently stored in a non-volatile memory.

During the "set mode" none of the capacitor steps are changed and there is no change to the alarm contact.
The significance of the individual variables is described as follows

## Table 1 Programming of Values

| Programme Mode No. | Description | Pre-programmed standard value | Programme Range |
| :---: | :---: | :---: | :---: |
| -1- | Targel Power <br> Factor <br> Tariff 1 | ind 0.92 | from cap 0.95 to ind 0.8 , in increments of 0.01 steps |
| -2- | Parallel shift PS Tariff 1 | -1.0 (Target cos phi is lower limit value) | $\begin{aligned} & \text { from }-2 \text { to }+4 \\ & \text { in increments of } 0.5 \text { steps } \end{aligned}$ |
| -3- | Limitation L Tariff 1 | +1.0 (Overcompensation is avoided) | from -2 to +2 <br> in increments of 0.5 steps |
| -4- | Switching time delay (in secs.) Tariff 1 | 45 | 5 to 500 secs. in 1 sec. Steps or at high speed in 5 sec. steps *) |
| -5- | Automatic c/k identification (ON/OFF) | On | On = automatic mode OFF = manual entry (when"On", the programme switches directly to mode number 13) |
| -6- | Manual c/kvalue setting | 2.0 | from 0.02 to 2.0 in 0.01 steps or at high speed in 0.05 steps*) |
| -7- | Switching sequence | 1:1:1:1:1 | $1: 1: 1: 1: 1 \ldots$ $1: 1: 2: 4: 4 \ldots$ $1: 2: 3: 4: 4 \ldots$ <br> $1: 1: 2: 2: 2 \ldots$ $1: 1: 2: 4: 8 \ldots$ $1: 2: 3: 6: 6 \ldots$ <br> $1: 1: 2: 2: 4 \ldots$ $1: 2: 2: 2: 2 \ldots$ $1: 2: 4: 4: 4 \ldots$ <br> $1: 1: 2: 3: 3 \ldots$ $1: 2: 3: 3: 3 \ldots$ $1: 2: 4: 8: 8 \ldots$ |

") By pressing the buttons "+" or "-" for some time, the high-speed mode will be activated.
Table 1 Programming of Values

| Programme Mode No. | Description | Pre-programmed standard value | Programme Range |
| :---: | :---: | :---: | :---: |
| -8- | Number of contactors used | 6 | from 1 to 6 |
| -9- | Fixed steps | 0 | $\begin{aligned} & 0 \text { to } 3 \\ & 0=\text { no fixed step } \\ & 1=\text { Output } 1 \text { fixed } \\ & 2=\text { Outputs } 1 \text { and } 2 \text { fixed } \\ & 3=\text { Outputs } 1 \text { to } 3 \text { fixed } \\ & \hline \end{aligned}$ |
| -10- | Automatic identification of voitage and current source (ON/OFF) | On | ```On = automatic OFF = manual When"On", mode }11\mathrm{ can only be read and not changed.``` |
| -11- | Enter or read mode of connection | Automatic identification | see Table 2 |
| -12- | Switching-off time (discharge time) in secs. | 30 | 5 to 900 secs. In 1 sec. Steps or at high speed in steps of 5 secs.*) |
| -13- | Setting cylic/noncyclic.(in series) switching rotation (ON/OFF) | On | $\mathrm{ON}=$ cyclic switching OFF = non-cyclic (in series) switching |
| -14- | Number of switching operations until alarm activates | 80 | from OFF to 1000 The value must be set in thousands of switching operations. |
| -15- | Cancelling the individual switching operation counters | 0 | A number from 1 to 6 must be set. When exiting the menu the counter of the corresponding stage number will be erased. „ALL" erases all counters |

) By pressing the buttons "+" or "-" for some time the high-speed mode will be activated.

Table 1: Programming of Values

| Progranme Mode No. | Description | Pre-programmed standard value | Programme Range |
| :---: | :---: | :---: | :---: |
| -16- | Current transformer ratio | 1 | 1 to 6000 in steps of 1 or at high speed in steps of 5 *) |
| -17- | Primary/Secondary voltage ratio | 1 | 1 to 300 in steps of 1 or at high speed in steps of 5 *) |
| -18- | 5th Harmonic Threshold U5 in \% | 5 | from 1 to $20 \%$ in $0.1 \%$ steps or $0.5 \%$ steps at high speed *) |
| -19- | 7th Harmonic Threshold U7 in \% | 4 | from 1 to $20 \%$ in $0.1 \%$ steps or $0.5 \%$ steps at high speed *) |
| -20- | 11 th Harmonic Threshold U11 in \% | 3 | from 1 to $20 \%$ in $0.1 \%$ steps or $0.5 \%$ steps at high speed ${ }^{*}$ ) |
| -21- | 13th Harmonic Threshold U13 in \% | 2.1 | from 1 to $20 \%$ in $0.1 \%$ steps or $0.5 \%$ steps at high speed ${ }^{*}$ ) |
| -22- | Switch-off harmonic overcurrent | 1.3 | from 1.05 to 3.0 times the nominal value in 0.05 steps or 0.1 in crements at high speed *) |
| -23- | cos phi alarmtripping signal | ON | ON or OFF <br> By setting "OFF" a cos phi alarm can be suppressed. |
| -24- | Total kvar display | Will only be displayed when in operation. | By pressing "set" button the total applied power in kvar will be displayed. |

) By pressing the buttons "+" or "." for some time the high-speed mode will be activated

Table 2: Connection Mode

| Mode | CT Location | Transfo S1 | Con- <br> n S2 | Voltage Path L/N L |
| :---: | :---: | :---: | :---: | :---: |
| 0 | L1 | I | k | N and L1 |
| 1 | L1 | k | 1 | L1 and L3 |
| 2 | L1 | k | 1 | N and L3 |
| 3 | L1 | 1 | k | L3 and L2 |
| 4 | L1 | 1 | k | $N$ and L2 |
| 5 | L1 | k | 1 | L2 and L1 |
| 6 | L1 | k | 1 | $N$ and L1 |
| 7 | L1 | 1 | k | L1 and L3 |
| 8 | L1 | I | k | N and L3 |
| 9 | L1 | k | 1 | L3 and L2 |
| 10 | L1 | k | 1 | N and L2 |
| 11 | L1 | 1 | k | L2 and L1 |

Note:
The mode of connection is identical when the current path lies in phase L2 or L3 and the voltage path is phase shifted in the same direction.

Example of mode of connection " 3 " :

- Current path in phase
L2
- Voltage path
L3 and L1

This is also in case when the transformer connection and the voltage path are in the re verse order.
5.1 Setting of Target Power Factor (cos phi)

The desired target cos phi can be set rom cap. 0.9 to ind 0.8 in 0.01 steps.
The mode of operation of this adjustment can be seen in Figs. 2 and 3.
If the control relay operates within the band range shown no switching operations will be activated.
However, if the control relay operates outside the band range, the RM 9606 will try to come within the band range with the minimum of switching

Fig. 2 Control response after setting tar
get cos phi $=1 ; \mathrm{L}=$ OFF; PS $=0$


Fig. 3 Control response after setting target cos phi $=0.92$ ind: $L=O F F ; P S=0$


In Fig. 3 the behaviour of the control relay during feedback operation can also be seen. The "kink" in the band (characte ristic line) is not reflected in the feedback operation but is extended at the point o intersection of the reactive power centre line (axis) with the feedback operation line.
By shifting the band into the capacitive range (see Fig. 5 in section 5.2) the occurrence of an inductive reactive powe during the feedback operation can be virtually avoided

When a capacitive target cos phi mode is set, the control band is reflected on the current side of the feedback side (see Fig. 8).

### 5.2 Parallel Shift (PS)

This setting causes a parallel displace ment (by the value set) of the characte ristic shown above and, specifically, in he inductive direction in the case of a positive sign and in the capacitive o rection in the case of a negative sign.
The values -2 to +4 can be set in 0.5 steps. The effects are illustrated by the two examples in Figs. 4 and 5.

Fig. 4 Control response after setting target cos $\mathrm{phi}=1$; $\mathrm{L}=\mathrm{OFF} ; \mathrm{PS}=+1.0$


The set target cos phi is therefore the upper limit of the control band.

Fig. 5 Control response after setting tar get cos phi $=0.92$ ind: $L=O F F \cdot P S=-1.0$


The set target cos phi forms the lower limit of the control band

### 5.3 Limitation (L)

This setting gives new possibilities tha could not be attained before due to op posing requirements.
The range of values for $L$ are -2 to +2 in steps of 0.5 and the setting "OFF" and in the case of a target cos phi setting $=1.0$ has the same effect as the parallel dis placement (paragraph 5.2). For a targe cos phi setting other than 1,0 there is a "kinked" characteristic as shown in Fig. 6

The limitation therefore specifies an absolule reactive power limit, below which the control band does not go.

Fig. 6 Control response after setting tar get cos phi $=0.92$ ind; $L=+1.0$


This setting has the following effects:

- The cos phi set is attained, on the av erage, in the "upper" power range
- Over-compensation (capacitive load) is avoided in the low load range.

An appropriate combination of "paralle shift" and "limitation" is illustrated in Fig. 7

Fig. 7 Control response after setting tar get $\cos p h i=0.92 ; P S=-1,0 ; L=+1,0$


This example illustrates

- In the "upper" power range the set power factor (cos phi) is specified as the lower limit value.
- Over-compensation is avoided in the low load range.

This setting is the normal setting on delivery from the factory and represents the best possible control characteristic for most applications.

The following Figure shows the characteristic of the control band when set for a capacitive target cos phi.

Fig. 8 Control response after setting target $\cos p h i=0.95 \mathrm{cap} ; L=-1,0 ; P S=0$


### 5.4 Switching Time Delay

The switching time delay period can be set between the values of 5 to 500 secs. in 5 second increments. When a capacitor stage is switched on or off the control relay waits for the switching time delay before the switching process takes place. If more stages are required the switching time delay is shortened depending on the number of stages required. For example: 2 stages required $=$ switching time delay 12 (reduced by one-half) or 3 stages required $=$ switching time delay 13 (reduced by one-third.)
In order to keep the wear on the contacts to a minimum, the switching delay time should be set to less than 45 secs. in exceptional cases only. The discharge period, which ensures that the capacitors are fully discharged before they are
switched on again, overrides the switching delay time (see paragraph 5.12).

### 5.5 Automatic Stage Current (c/k)

 Identification On/OffThe RM 9606 has an automatic c/k identification, i.e. it calculates the appropriate response current the first time the control relay is energized. This procedure is repeated until the amount of capacitive power for each stage is determined and the cik value has been calcuiated. The automatic $c / k$ identification feature can be set to "On" or "Off"
When set to "On" the RM 9606 operates with the stage currents that the control relay has automatically calculated and when set to "Off", the c/k value can be programmed manually according to Table 3, on page 21.

### 5.6 Response Current (c/k)

The control relay RM 9606 calculates a control characteristic from the cos phi, the parallel shift and the limitation (in Figs. 2-8 shown as a dotted line) and has a tolerance band of 0.65 times the smallest stage in inductive as well as in capacitive direction (marked with bold line). pacitive direction (marked with bold line).
The relay consistently achieves this conThe relay consistently achieves this con-
trol band by switching on and off systemtrol band by switching on and off system-
atically. It is assumed that the connected atically. It is assumed that the connected
capacitor stages are sufficiently dimensioned.

The response current corresponds to half the width of the tolerance band, within which the reactive current can change without capacitor stages being switched on or off.

This is essential to ensure that the sys tem does not oscillate. The total width of the tolerance band is selected in such a way that it corresponds to approx. 1.3 times the reactive current of the smalles capacitor stage.
The response current can be set be tween 0.02 and 2.0 A in steps of 0.01 A The correct setting for a 400 V voltage system and a current transformer with 5 A secondary current can be taken from Ta ble 3.

In the case of other voltages or current ransformers for which the primary cur rent is not given, the response curren can be calculated from the general for mula:

Equation 1

$$
c / k=0,65 \cdot \frac{Q}{U \cdot \sqrt{3} \cdot k}=0,375 \cdot \frac{Q}{U \cdot k}
$$

$c / k=$ Response current to set in $A$
$Q=$ Capacitor stage rating in var (not the total)
$U=$ Mains voltage in $V$ on the primary side

* $=$ of the current transformer renvsecondary current)

Table 3: Response Current at mains voltage 400 VAC -50 Hz

| Current | c/k-adjustment for mains voltage $400 \mathrm{VAC}, 50 \mathrm{~Hz}$ Stage rating of capacitor bank (not total rating) in kvar |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| A /A | 2,5 | 5 | 6,25 | 7,5 | 10 | 12,5 | 15 | 20 | 25 | 30 | 40 | 50 | 60 | 100 |
| $30 / 5$ | 0,40 | 0,80 | 0,98 | 1,20 | 1,60 |  |  |  |  |  |  |  |  |  |
| $40 / 5$ | 0,30 | 0,60 | 0,74 | 0,90 | 1,20 | 1,50 |  |  |  |  |  |  |  |  |
| $50 / 5$ | 0,24 | 0,48 | 0,59 | 0,72 | 0,96 | 1,20 | 1,44 |  |  |  |  |  |  |  |
| 6015 | 0,20 | 0,40 | 0,49 | 0,60 | 0,80 | 1,00 | 1,20 | 1,60 |  |  |  |  |  |  |
| $75 / 5$ | 0,16 | 0,32 | 0,39 | 0,48 | 0,64 | 0,80 | 0,96 | 1,28 | 1,60 | 1,92 |  |  |  |  |
| $100 / 5$. | 0,12 | 0,24 | 0,30 | 0,36 | 0,48 | 0,60 | 0,72 | 0,96 | 1,20 | 1,44 | 1,92 |  |  |  |
| $150 / 5$ | 0,08 | 0,16 | 0,20 | 0,24 | 0,32 | 0,40 | 0,48 | 0,64 | 0,80 | 0,96 | 1,28 | 1,60 | 1,92 |  |
| $200 / 5$ | 0,06 | 0,12 | 0,15 | 0,18 | 0,24 | 0,30 | 0,36 | 0,48 | 0,60 | 0,72 | 0,96 | 1,20 | 1,44 |  |
| $250 / 5$ | 0,05 | 0,10 | 0,12 | 0,14 | 0,19 | 0,24 | 0,29 | 0,38 | 0,48 | 0,58 | 0,77 | 0,96 | 1,15 | 1,92 |
| $300 / 5$ | 0,04 | 0,08 | 0,10 | 0,12 | 0,16 | 0,20 | 0,24 | 0,32 | 0,40 | 0,48 | 0,64 | 0,80 | 0,96 | 1,60 |
| $400 / 5$ | 0;03 | 0,06 | 0,08 | 0,09 | 0,12 | 0,15 | 0,18 | 0,24 | 0,30 | 0,36 | 0,48 | 0,60 | 0,72 | 1,20 |
| $500 / 5$ | 0,02 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19 | 0,24 | 0,29 | 0,38 | 0,48 | 0,58 | 0,96 |
| $600 / 5$ |  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,16 | 0,20 | 0,24 | 0,32 | 0,40 | 0,48 | 0,80 |
| $750 / 5$ |  | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,13 | 0,16 | 0,19 | 0,26 | 0,32 | 0,38 | 0,64 |
| $1000 / 5$ |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19 | 0.24 | 0,29 | 0,48 |
| $1500 / 5$ |  |  | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,13 | 0,16 | 0,19 | 0,32 |
| $2000 / 5$ |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,24 |
| $2500 \quad 15$ |  |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,19 |
| $3000 / 5$ |  |  |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,16 |
| $4000 / 5$ |  |  |  |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,12 |
| $5000 \quad 15$ |  |  |  |  |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,10 |
| $6000 / 5$ |  |  |  |  |  |  |  |  |  | 0,02 | 0,03 | 0,04 | 0,05 | 0,08 |

In case the stage sizes, the current transformer or the rated voltage of the capacitor bank do not coincide with the values in the above table, then the formula on page 20 must be used to calculate the $c / k$ value

### 5.7 Switching Sequence

When the automatic $c / k$ identification is switched on every optional switching sequence is possible. Necessary condition: Every multiple of the smallest stage must be possible by switching an optional number of connected stages.

If the automatic $c / k$ identification is switched off, the switching sequence (switching programme) can be reset to the following combinations of capacitor stages:

| $1: 1: 1: 1: 1 \ldots$ | $1: 1: 2: 4: 4 \ldots$ | $1: 2: 3: 4: 4 \ldots$ |
| :--- | :--- | :--- |
| $1: 1: 2: 2: 2 \ldots$ | $1: 1: 2: 4: 8 \ldots$ | $1: 2: 3: 6: 6 \ldots$ |
| $1: 1: 2: 2: 4 \ldots$ | $1: 2: 2: 2: 2 \ldots$ | $1: 2: 4: 4: 4 \ldots$ |
| $1: 1: 2: 3: 3 \ldots$ | $1: 2: 3: 3: 3 \ldots$ | $1: 2: 4: 8: 8 \ldots$ |

The smallest capacitor stage is always " 1 "; the subsequent stages are either the same (1:1:1...) or are larger. In the sec ond line above a more accurate result can be achieved with the same numbe of switching contactors.
Capacitor steps of the same size are switched cyclically, i.e. a step which has just been switched off will only be switched on again after all the othe steps have been switched on. This achieves the most even contact switching.
5.8 Number of Contactors Used

When the automatic $c / k$ identification is switched off, any value between 1 and 6 can be programmed. If, for example. there are five stages in a capacitor bank. these stages are connected to the control outputs " 1 " to " 5 " and the number of the control outputs is programmed to " 5 "." This prevents the control relay from activating control outputs which are not connected.
The capacitor switching sequence is of no importance for this setting.

### 5.9 Specifying Fixed Steps

The control relay RM 9606 allows the first three control outputs to be treated as fixed steps. Fixed steps are steps which are not included in the normal control cycle but are switched on immediately after the control relay is switched on and always remain switched on. The set discharge period is maintained. The target cos phi setting is ignored.
The following settings are possible:
$0=$ No fixed steps
1 = Control output " 1 " is fixed
$2=$ Control outputs " 1 " and "2" are fixed
$3=$ Control outputs ". 1 " to " 3 " are fixed
The switching sequence does not take into account the fixed steps.

### 5.10 ON/OFF Connection Identifica-

 tionThe control relay has an automatic connection identification feature (refer to section 2.1). The following adjustments are possible:

- Connection identification "ON"
- Connection identification "OFF"

When "ON" is set the connection recognised by the control relay can be read under the mode number 11 in accordance with Table 1 (not variable). When "OFF" is set the connection is manually programmed according to Table 2.

### 5.11 Connection Made

Normally the connection mode should be set to automatic operation. If however the control relay fails to determine the connection mode after 15 minutes due to very high load changes or phase imbalances, it should be entered manually in accordance with Table 2.

### 5.12 Setting Capacitor Discharge Time

In order to ensure that after switch-off, a capacitor step is not switched on again before the capacitor has been sufficiently discharged, the switch-off time can be set. The switch-off time can be set from between 5 and 900 seconds.

### 5.13 Setting Cyclic/Non-Cyclic

 Switching RotationIn certain cases, for example when there are filtered and non-filtered steps within one system, it is necessary to ensure that the control relay does not operate cyclically. For such applications, this feature can be disconnected. This means:
ON : Cyclic switching is possible when there are at least two switching steps of the same size.

OFF: No cyclic switching; the steps are switched on in series starting with the lowest rating. The lower step ratings are always selected first.
5.14 Number of Switching Processes until Alarm Functions

In order to help when maintaining the capacitor bank the RM 9606 has a counter for each switching process. Whilst in manual operation the actual reading on the counter for each stage can be seen (see paragraph 6.2). By selecting the maximum number of switching processes the control relay itself indicates when maintenance is required The cates when maintenance is required. The stage which has exceeded the limits is indicated by flashing (about every 10 secs), on the display (e.g. "St. 4" for the 4th stage). At the same time an alarm signal is given. To cancel the alarm signal please see description in paragraph 5.15.
Before entering the number of switching
processes this number must be divided by 1000 . This means for example, for 100,000 switching processes for one stage the number 100 has to be entered before the alarm is triggered.
The fact that an alarm is indicated for a stage has no influence on the behaviour of the RM 9606.
5.15 Cancelling the Switching Process Counter
The switching process counters can be cancelled individually or jointly.
If Programme Number 15 is selected the reading " 0 " appears on the display. Using the buttons " + " or " - " a stage number between 1 and 6 or "ALL" can be selected. When exiting this programme number by using the button "man"/Set" the last stage number to be shown on the display will be cancelled. The appearance of "ALL" on the display indicates that all counters have been cancetled.
If none of the counters are to be cancelled the display has to be switched back to " 0 ".

### 5.16 Current Transformer Ratio

In order to display the active current (IP). reactive current (IQ) and apparent current (IS) as actual values, the ratio between the primary current and the secondary current of the current transformer used must be entered. If the current transformer ratio is not entered, the value displayed must be multiplied by the current transformer ratio.
$V$ alues between 1 and 7000 can be entered (e.g. 1000/5A $\rightarrow 200$ ).

### 5.17 Primary/Secondary Voltage

## Transformer Ratio

If a voltage transformer is used in a measuring circuit the primary/secondary voltage transformer ratio must be entered in order to enable the "missing kvar rating to target cos phi" to function.
The ratio of the primary/secondary voltage should be entered. If there is no voltage transformer the value " 1 " must be entered. Programmable primary/secondary voltage ratios range from 1 to 300 .

### 5.18 Setting 5th Harmonic Threshold

The control relay RM 9606 has a har monic monitoring system for the 5th, 7 th 11 th and 13 th harmonics. If the fimiting value is exceeded, there is an alarm signal, i.e. the alarm contact closes and the "Alarm" LED lights up for as long as the limiting value is exceeded. The
"Harmonic" LED flașhes until the alarm is switched off. The order and the maximum value of the harmonics which have been exceeded are displayed by pressing the "Set" button several times. The "Set" button must be pressed repeatedly until the flashing "Harmonic" LED goes out.
5.19 Setting 7th Harmonic Threshold In this case, the limiting value for the 7th harmonic is programmed
5.20 Setting 11th Harmonic Threshold In this case, the limiting value for the 11 th harmonic is programmed.
5.21 Setting 13th Harmonic Threshold In this case, the limiting value for the 13th harmonic is programmed

### 5.22 Harmonic Over-Current Signal

The control relay RM 9606 is able to determine the ratio between the rms current and the fundamental ripple current (50-60 Hz ) in the capacitor. If this ratio is exceeded by the set value for at least one minute, due to harmonics and the resulting amplifications caused by resonances, then the control relay switches off all the stages that are switched on. At the same time the alarm goes off. After about 4 minutes the capacitor stages required are switched on again.
By pressing the "Set" button the maximum value appears on the display.

In the case of filtered stages being used for compensation, set this used for compensation, set this
threshold to the highest value (hence nactive).

### 5.23 Suppressing the cos phi Alarm

As already mentioned, the control relay tries to attain the prescribed control band If this is not possible, because insufficien capacitor stages are available, an alarm is indicated after some minutes (depending on the amount of deviation, Also an alarm is indicated if there is a capacifive cos phi outside the control band.
By selecting "OFF" the alarm indication can be suppressed.

### 5.24 Total kvar Display

Provided the current transformer ratio has been entered, the total kvar will appear in the display, when the "Set" button is pressed according to Mode 24

## 6. Operation

### 6.1 Modes of Display

The choice of displays is independent of the control relay operation and can be reprogrammed at any time. To the right of the digital display there are three LED's indicating which display mode is active, either "Power Factor (cos phi)". "Ampere" or "Harmonic".
Five modes of display can be selected by pressing the appropriate bution:
6.1.1 Actual Power Factor (cos phi)

The power factor display (LED "Power Factor" (cos phi) is on) is the standard display. It can be activated from another mode of display by pressing buttons "IQ", "IP" or "Harm".
The symbols "+" for ind. and "-" for cap. show whether the power factor is inductive or capacitive. The LED "Regen" indicates that the power is regenerative. Active and reactive currents are measured separately. The fundamental oscillation portions $(50-60 \mathrm{~Hz}$ ) of both measured variables are filtered out mathematically variables are filtered out mathematically ensures accuracy over the entire range ensures accuracy over the entire range
down to a cos phi value of 0 . The minidown to a cos phi value of 0 . The mini-
mum apparent current for a correct mum apparent current for a correct
power factor (cos phi) display is approx power factor (cos phi) display is approx
0.02 A . When the apparent current falls below 0.02 A for three consecutive measurements one capacitor step is
switched off and if there is no change in the measured current, all remaining steps are switched off and " $1=0$ " appears on the display.
6.1.2 Reactive Current (IQ)

## 

The display indicates the reactive current portion in the current transformer circuit. The "+" or "."LEDs indicate whether the current is inductive or capacitive. The LED "Ampere" lights up.
From this mode of display, the effect of adding or removing capacitor steps manually can be monitored.
If the current transformer ratio $(k)$ is pro If the current transformer ratio $(k)$ is pro-
grammed via the set mode the actual grammed via the set mode the actual
reactive current is displayed; otherwise the current portion is displayed and has to be multiplied by the current trans former ratio to obtain the actual value former ratio io obtain the actual value
Press "IQ", "IP" or "Harm" to exit the disPres

### 6.1.3 Active Current (IP)

## 4ipex

This display shows the active current on the fundamental oscillation in the current transformer circuit. The LED "Ampere" lights up.
The current direction is also displayed, which is helpful during tests. The LED "Regen" shows that the generative active power is fed back into the mains
If the current transformer ratio ( $k$ ) is programmed into the relay, the actual active current is displayed; otherwise the current portion is displayed and must be multiplied by the current transformer ratio to obtain the actual value. Press buttons "IQ", "IP" or "Harm" to exit the display.

### 6.1.4 Apparent Current (IS)



By pressing the "IQ" and "IP" buttons simuitaneously the apparent current of the fundamental oscillation in the current transformer circuit is displayed. The LED "Ampere" lights up.
If the current transformer ratio is programmed via the set mode, the apparent current is displayed; otherwise the current portion is displayed and must be
multiplied by the current transformer ratio to obtain the actual value.
Press buttons "IQ", "IP" or "Harm" to exit the display.
6.1.5 Harmonics


This display shows the 5th, 7th, 11 th and 13 th harmonics on voltage. The previous harmonic reading appears on the display in \% and the LED "Harmonic" lights up By pressing the "+" or "-".buttons several times the display either cycles in as cending or descending order. For exam ple, if "5. 2.9" appears on the display, this means that the 5th harmonic is contained in the voltage to a portion of $2.9 \%$ of the fundamental.
Press the button "Harm" to exit the display.
6.2 Manual Operation (man)

## mand

When the "man/Set" button is pressed for more than 3 secs. the control relay switches to manual operation and the LED "manual" begins to flash. The capacitor steps can be switched on or of by pressing the "+" or "-" button. By
pressing the button " + " or "." the steps to be switched can be selected. The stage number (e.g. "1.ON") appears on the display. After about 12 secs. (do not press any buttons during this time) this stage will be switched on. If this stage was already switched on then "1. OFF" will appear in the display. After about 12 secs. this stage will be switched off. Then the display will change to the last displayed value.
During this "waiting time of 12 secs." the During this "waiting time of 12 secs." the
switching counter of this stage will be switching counter of this stage will be
shown. The value is given as factor 0.001 shown. The value is given as factor 0.001
and as far as possible values after the and as far as possible values after the
decimal point will be given. This means, decimal point
for example:
for example:
" 0.350 " corresponds to 350 switching operations.
By pressing the " + " button several times stages $2-6$ will appear in ascending sequence on the display. They can be switched on/off in the same way. In manual mode the programmed switching off time (discharge time) is taken into consideration, i.e. when switching on a step which was previously switched off the switching-off time is the same as the discharge time. If a stage was identified as a zero stage (without power) the corresponding numbers would indicate this by flashing.
Press "man/Set" button to exit manual mode.

### 6.3 Alarms

The potential-free alarm contact (a/b) closes whenever the operating voltage is not applied. In the case of the correct operating voltage the contact closes if there is an alarm. The conditions for an alarm can be seen in paragraphs 6.3.1 to 6.3.6

The LED "Alarm" lights up for as long as a state of alarm exists. When an alarm is signalized, an alarm marker is put into action (LEDs "power factor", "Ampere" or" Harmonic" will flash or there is an indication on the display. The alarm markers remain active after the alarm until they are acknowledged by pressing the "Set" button.
After acknowledgement the flashing alarm marker goes out.
The alarm signals have no influence on the control behaviour or performance of the control relay.

### 6.3.1 cos phi Alarm

If the threshold values set for "switch-on" and "switch-off" are exceeded and no further change can take place in the output steps, the alarm signal functions Exception: when the cos phi alarm is switched off; see mode no. 23, page 14). By pressing the "Set" button the amount of capacitive or reactive power missing to reach the target power factor is flashed by the display.

Pressing the "Set" button again shows the actual power factor in the display and the alarm marker "cos phi"(Power Factor) no longer flashes.

### 6.3.2 Harmonic Alarm

When the programmed threshold values are exceeded the alarm goes off. By pressing the "Set" button several times the display shows the order and the maximum values of the exceeded har monics starting with the maximum deviation. The button "Set" must be pressed repeatedly until the "Harmonic" alarm marker no longer flashes.

### 6.3.3 Over-current Alarm

If the ratio between the rms current value and the fundamental wave current (50-60 Hz ) in the capacitor is exceeded by the programmed factor, the alarm goes off. By pressing the "Set" button the display shows the maximum value of the ratio. By pressing the "Set" button again the display shows the actual power factor (cos phi) and the alarm marker "Ampere no longer flashes.

Attention: The over-current ratio is only a computed value and cannot be applied to systems with filter circuits.

### 6.3.4 " $\mathrm{U}=0$ " Alarm

The voltage applied during automatic identification is stored by the control relay as rated voltage.
In order to use the control relay again at 230 VAC after it has been in operation at 400 VAC it is necessary to wait until " $\mathrm{U}=0$ " appears on the display. By pressing the buttons "+", "-" and "man/Set" simultaneously for about 5 secs. the new voltage (in this case 230 VAC) can be accepted as rated voltage.

### 6.3.5 " $\mathrm{C}=0$ " Alarm

If the control relay does not recognise a capacitor stage during the processes for the automatic identification and recogni tion of connected capacitor stages this is shown by the " $\mathrm{C}=0$ " indicator and an alarm.
The attempts to recognize are carried ou inspite of the indication.

### 6.3.6 "I=0" Signal

If there is an interruption in the current path for at least 3 secs. the control relay immediately switches off a capacitor step. If no change in the current results, the steps which are still on are then switched off.
No alarm is triggered off

## 7. Technical Data

Mode of Connection:
Phase/Phase connection or Phase/Neutral connection. Current via curren transformer in optional phase (see Fig. 1 page 9).
Operating Voltage:

| Supply <br> Vollage | Mains Connec- <br> tion Voltage | Absolule per <br> missiblelthres- <br> hotd values |
| :--- | :--- | :--- |
| $230-400 \mathrm{~V}$ | 220 to 400 V | $198 \ldots .462 \mathrm{~V}$ |

Attention: The terminals for 230 V and
400 V are internally bridged.

## Frequency:

$50 \mathrm{~Hz} / 60 \mathrm{~Hz}$ ( 48 to 62 Hz ).
Consumption of Supply Voltage:
Approx. $9 / 11 \mathrm{VA}$ at $0 / 6$ switched-on control contacts.

## Current path:

For current transformer ... / A to ... 5 A .
Consumption in Current Path:
Max. 1,8 VA at 5 A transformer rated current.

Control Contacts
6 potential-free contacts.
Loading Capacity of the Control Contacts:
Swilching voltage
acc. to VDE 0110 Group B 380 VAC
Cc. to VDE 0110 Group C 250 VAC

Total switching current 5 A max.
Switching load 1800 VA max

## Fault Signal Contacts

Loading capacity as control contacts.
No-Voltage Trip
(Undervoltage Monitoring).
For a voltage loss of longer than 15 ms all capacitor stages connected are switched off. After voltage is restored the control relay switches the required steps on.

## Zero Current Trip:

For a current loss of longer than 3 secs. capacitor stages connected are switched off. After current is restored the control relay switches the required steps on.
Operating Elements:
Foil keyboard with 4 buttons.
LED Indicators:
12 LEDs
4 1/2 character digital display
Temperature Range:
$25^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$ according to DIN VDE 0660, Part 500, para. 6.1.1.1.
Casing:
Black synthetic plastic.
Flame-resistant to UL-94. Class VO.

## Fastening:

Through the front panel by means of a screwdriver.
Front Panel:
$144 \times 144 \mathrm{~mm}$ (to DIN 43700 )
Panel Cut Out:
$138 \times 138 \mathrm{~mm}$ (to DIN 43700 )

## Mounting Depth:

40 mm
Weight:
approx. $0,9 \mathrm{~kg}$
Mounting Position: as desired
Terminals:
Plug-in connector blocks
(supplied with the control relay).

Enclosure:
Terminals IP 20
Casing IP 54
(when using sealing ring)
Design:
o VDE 0160, Protective Class II
Insulation Group B
(when using insulated fastening screws)
Fusing:
External required

## 8. Trouble Shooting

| Pos. | Faults | Possible Causes | Necessary Action |
| :---: | :---: | :---: | :---: |
| 1 | Control relay does not function, digital display remains blank. | There is either no voltage or the wrong voltage has been applied to the control relay. | Check whether the correct operating voltage is applied to the control relay. |
| 2 | " $\mathrm{U}=0$ " flashes on the display for some time | The operating voltage applied to the relay is too low. | Check the operating voltage. If the voltage is correct press the buttons "+", "-" and "Set" to recognise this voltage as rated voltage. |
| 3 | Relay does not respond to manual operation. in spite of having voltage and digital display is operational. | End of delay time of approx. 10 secs. was not observed. | For example, if "1.ON" appears on the display wait untit the control relay has switched on the first step. |
|  |  | Relay was not in manual mode. | "Man" button must be pressed until the LED "manual" flashes. |
| 4 | Step display (LED 1-6) lights up but capacitor contactors are not activated. | Control circuit is not connected properly or there is no control voltage. | Check the control circuit according to the circuit diagram and check fuses. |
|  |  | There is no neutral on the contactors. |  |
| 5 | Control relay does not complete the automatic identification process. | Unstable power supply (power factor fluctuation). | Wait for power supply to stabilize and set c/k factor and mode of connection manually. |
| 6 | " $\mathrm{C}=0$ " appears on the display during the autcmatic identification process. | Fault in control circuit (Contactors do not switch on.) | Check the control circuit according to the circuit diagram and check fuses. |
|  |  | Capacitor stage fuses are missing or are defect. | Check whether voltage is applied to the capacitors after the switching process. |
|  |  | Current transformer is mounted on the wrong place. | Check whether the position of the current transformer corresponds with that on the circuit diagram. |
| 7 | "\|=0" flashes on the display. | Current transformer wire is disconnected. | Use ammeter to check current in current path ( $1 \mathrm{~min} \geq 0,02 \mathrm{~A}$ ). |


| Pos. | Faults | Possible Causes | Necessary Action |
| :---: | :---: | :---: | :---: |
| 8 | Despite inductive load no steps are switched on when relay is in automatic mode. | When programming the $\mathrm{c} / \mathrm{k}$ factor of the control relay, the switching time delay or discharge time have been set too high. | Check programming of control relay and change if necessary. |
|  |  | In automatic operation the circuit $c / k$ factor was not correctly identified. | Check the control according to the circuit diagram and repeat the automatic test procedure. |
|  |  | Another current measuring meter (e.g. ammeter) was connected in parallel with the control relay's current path. | The current paths of the various measuring instruments must be connected in series. |
| 9 | In automatic mode one stage is continually switched on or off (hunting). | The c/k factor was set too low. | Correctly set $/ / k$ factor according to the table. |
|  |  | High load change: The delay time was set too low. | Set higher delay time. |
| 10 | The cos phi display is less than the target cos phi, although the control relay has switched on all stages. | Mode of connection incorrectly programmed. | Reset mode of connection. |
|  |  | Fault in control circuit. | Check whether the capacitor contactors have been energized. |
|  |  | Fault in capacitor circuit. | Check the fuses and contacts of the capacitor contactors. Measure the current of each capacitor stage with a clamp-on current meter. |
|  |  | System undersized. | Press "Set" button and read the missing power from the display. |
|  |  | Failure in identification process. | Repeat identification process. |
| 11 | Control relay does notswitch off all stagesduring times of low loador facility shut-down. | c/k factor set too high. | Set c/k factor according to the table. |
|  |  | Control relay is in manual mode. | Press "Man" button. |



SPECIFICATION
Material: $\quad$ 2MM TK Zinc plated mlo steel
paint : PONDER COATED
COLOUR: ORANGE $\times 15$
PROTECTION: IPS4
Gland plate: aluminum jmm tk - top entry
LABEL SCHEDULE
$11 \begin{gathered}\text { MANUFACTUREO BY } \\ \text { CAPACITOR IECHOLOGES }\end{gathered}$

12


15


FRONT ELEVATION
FRONT ELEVATION (panels removed)

Active 10/12/2014

## Appendix 8: OCT1 Oil Condition Transmitter

| Supplier/Manufacturer: | GRUNDFOS |
| :--- | :--- |
| Model Number: | OCT1 |
| Part Number: | 96476771 |
| Manufacturer Details: | $\ddots$ |
|  |  |
|  | 68 Murdoch Cct, |
|  |  |
|  | Acacia Ridge, |
|  | QLD -4110 |
|  |  |
|  |  |
|  |  |

Rev. 2
HSY
5 September 2003
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## OCT 1

## Oil Condition Transmitter



The OCT 1 Oil Condition Transmitter is a new probe for seal oil water content monitoring in sewage water pumps. This advanced instrument provides more reliable information of the amount of water in the oil chamber.

The OCT 1 Oil Condition Transmitter can be used in explosive environments, because the new design is intrinsically safe complying with EN50020.

Modern submersible pumps normally use a shaft sealing arrangement with double mechanical seals separated by an oil-filled chamber. This construction protects the motor from water intrusion. As some minor water leakage through the primary seal is inevitable, it is very important to detect any increase in the water content. The change indicates wearing of the seal and should be notified well before the alarm level.

## Oy Grundfos Environment Finland Ab

Visit address
Kaivokselantie 3-5 01610 Vantaa, Finland Trade Reg. No. 738.707

Postal address
P.O.BOX 1036

00101 Helsinki, Finland

Tel. +358-9-561 420
Fax +358-9-566 8289

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HSY
5 September 2003
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Such an early warning is valuable information for maintenance and enables prediction of the required actions. The improved sensitivity of the OCT 1 makes the monitoring more accurate than ever before.

## Operation

The operation of the OCT 1 is based on capacitive measurement of the dielectricity factor of water/oil emulsion. The factor is strongly dependent on the water content in the emulsion.
The probe is located below the oil level. The stainless steel guard tube of the probe is perforated allowing free flow of the emulsion. The integrated electronics is embedded and sealed into the probe providing the standard analog output of $4 \ldots 20 \mathrm{~mA}$.

## Interfaces

As an independent probe with standard analog output, the OCT 1 Oil Condition Transmitter can be connected to various control systems. Grundfos provides both a local stand-alone monitoring device, SARI 2 Monitor, and the more powerful PumpManager 2000 for remote monitoring.

The SARI 2 is a monitoring device for motor insulation resistance and seal oil water content for sewage water pumps. It clearly exceeds the capacity of the standard safety devices, but can also be used for local and automatic stopping of the pump. Separate information of the Monitor is available.

The OCT 1 Oil Condition Transmitter can also be used with the PumpManager 2000 or other suitable telemetry system. The connection can be built via the SARI 2 (digital pulse width modulated input) or directly (analog input).
The PumpManager 2000 continuously receives the measured data, compares them to the pre-set alarm limits and stores to the local memory.
The stored data can be further relayed to the Remote Monitoring system for the trend analysis by the respective software. The values are daily averages of the measurements.

## Measurement Range and Calibration

The operation range of the OCT 1 Oil Condition Transmitter is $5 . . .60 \% \mathrm{H}_{2} \mathrm{O}$. A recommended alarm limit is $20 . . .40 \%$.
The Transmitter is factory calibrated and there is no need for regular recalibration.

| Oy Grundfos Environment Finland Ab |  |  |
| :--- | :---: | :--- |
| Visit address | Postal address | Tel. $+358-9-561420$ |
| Kaivokselantie 3-5 | P.O.BOX 1036 | Fax $+358-9-5668289$ |
| 01610 Vantaa, Finland | 00101 Helsinki, Finland |  |
| Trade Reg. No. 738.707 | $\because$ |  |

## GIRUDFOS.

Rev. 2
HSY
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## Explosive Environment

OCT 1 Oil Condition Transmitter is an intrinsically safe apparatus complying with EN50020 and the following input specifications:

EEx ia IIB T4
$\begin{array}{llll}\mathrm{U}_{\mathrm{i}}: & 34 \mathrm{~V} & \mathrm{I}_{\mathrm{i}}: & 100 \mathrm{~mA} \\ \mathrm{~L}_{\mathrm{i}}: & 10 \mu \mathrm{H} & \mathrm{C}_{\mathrm{i}}: & 220 \mathrm{nF}\end{array}$
When the signal cable and other possible connection components are in the explosive interior the OCT 1 cable shall be connected to a safety barrier complying with EN50020 and the same or better output specifications as shown above. The barrier is installed outside the hazardous environment, normally into the control panel.


Figure 1. Electrical connections of OCT 1 and SARI 2

## Installation

The OCT 1 is normally installed into the oil chamber of the pump through the oil plug. The minimum size of the plug is $3 / 8$ ". See Figure 2.
In Grundfos pumps the OCT 1 can replace the UH-40 probe especially in the above mentioned external installations. In large pumps, where the UH-40 may have been installed internally into the motor flange, see Figure 3, the replacement is individually checked.

## Oy Grundfos Environment Finland Ab

Rev. 2 HSY

## Specifications

Dimensions
Cable
Output:
Operating temperature
Enclosure
Electromagnetic interference
length $60 \mathrm{~mm} \times$ diameter 14 mm 10 m , longer lengths on request
4 to 20 mA
$0 \ldots 70^{\circ} \mathrm{C}$
IP 68
CE approved


Figure 2. External installation through oil plug


Figure 3. Internal installation (not available for explosive environments)

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Tel. +358-9-561 420
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00101 Helsinki, Finland

## Appendix 9: Knife Gate Valve Data Sheets

Manufacturer:
Model/Series Number:
Supplier Contact:

Expert
EXPERT 600 KGV
ITW Tech Flow
3/29 Collinsvale Street,
Rocklea QLD-4108
(07) 32770111

## G.A.Drawing of

KNIFE EDGE GATE VALVE
(Suitable For Actuator Mounting)


| $\square$ | DESIGN FEATURES AND MATERIALS |  |  |
| :---: | :---: | :---: | :---: |
| 0 | NO | DESCRIPTION | MATERIAL |
| Ø | 01 | BODY | CF8M |
| $\frac{山}{T}$ | 02 | DOOR (GATE) | CF8M / SS 316 |
| $\cdots$ | 03 | GLAND PACKING | PTFE |
| ! | 04 | GLAND | CF8M |
| , | 05 | SPINDLE | SS 316 |
|  | 06 | YOKE | SS 316 |
|  | 07 | SEALING RING | PTFE |

DIMENSIONS sizes in mm

| NOMINAL SIZES | 300 |
| :---: | ---: |
| A | 76 |
| E | 20 |
| F | 12 |
| G | 406 |
| N | 731 |

\#VALVE TO OPEN CLOCKWISE.

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

1. AS CONTINUOUS IMPROVEMENT IN DESIGN PROCESS THE DIMENSIONS MENTIONED HERE ARE SUBJECTED TO CHANGE
2. TESTING STANDARDS AS PER MSS SP-81.
3. FLANGE DRILLING AS PER AS2129 TABLE 'D',

CUSTOMER NAME : ITW TECHFLOW, 3/29 COLLINSVALE ST, ROCKLEA OLD.
REF.: PO.NO-15749 DT 19.07.2004.

Mfd by : EXPERT ENGINEERING ENTERPRISES
C-13,UDYAMBAG,BELGAUM - 590008.
KARNTAKA,INDIA.
Ph.:91-0831-2442090/2440377 Fax: 91-0831-2442091
www.expertvalves.com expert@sancharnet,in

Drawing No.
01G30001E

Revision No. 01

## G.A.Drawing of <br> KNIFE EDGE GATE VALVE

(Suitable For Actuator Mounting)
$\varnothing B \times 16$ THICK
UNTAPPED CIRCLE
 N (CLOSE)
 IN SS 316.

E' TAP 'F' NO. OF HOLES ON PCD 'ØG' BOTH SIDE
 START,RH THREADS, 2 TPI) (ACME SCREW THREADS)


VIEW AT X

DESIGN FEATURES AND MATERIALS

| NO | DESCRIPTION | MATERIAL |
| :---: | :--- | :--- |
| 01 | BODY | CF8M |
| 02 | DOOR (GATE) | CF8M / SS 316 |
| 03 | GLAND <br> PACKING | PTFE |
| 04 | GLAND | CF8M |
| 05 | SPINDLE | SS 316 |
| 06 | YOKE | SS 316 |
| 07 | SEALING RING | PTFE |

NOTE:

1. AS CONTINUOUS IMPROVEMENT IN DESIGN PROCESS THE DIMENSIONS MENTIONED HERE ARE SUBJECTED TO CHANGE.
2. TESTING STANDARDS AS PER MSS SP-81.
3. FLANGE DRILLING AS PER AS2129 TABLE 'D'.

DIMENSIONS sizes in mm

| NOMINAL SIZES | 300 | 600 |
| :---: | ---: | ---: |
| A | 76 | 114 |
| B | 150 | 175 |
| E | 20 | 27 |
| F | 12 | 16 |
| G | 406 | 756 |
| N | 731 | 1372 |
| $P$ | 75 | 125 |

\#VALVE TO OPEN CLOCKWISE.
*
top plate will have centre
BORE OF $\varnothing 38 \mathrm{~mm}$.

CUSTOMER NAME : ITW TECHFLOW, $3 / 29$ COLLINSVALE ST, ROCKLEA OLD.
: REF.: PO.NO-15749 OT 19.07.2004.

Drawing No.
Revision No.

01G300/60001E
00

## - G.A.Drawing of

KNIFE EDGE GATE VALVE

## (Manualy operated)



CHECKED. Gr:
DESIGN FEATURES AND MATERIALS

| NO | DESCRIPTION | MATERIAL |
| :---: | :--- | :--- |
| 01 | BODY | CF8M |
| 02 | DOOR (GATE) | CF8M / SS 316 |
| 03 | GLAND |  |
|  | PACKING | PTFE |
| 04 | GLAND | CF8M |
| 05 | SPINDLE | SS 316 |
| 06 | YOKE | SS 316 |
| 07 | YOKE SLEEVE | GUN METAL |
| 08 | HAND WHEEL | MILD STEEL |
| 09 | SEALING RING | PTFE |

\#VALVE TO OPEN CLOCKWISE.

## NOTE:

1. AS CONTINUOUS IMPROVEMENT IN DESIGN PROCESS THE DIMENSIONS MENTIONED HERE ARE SUBJECTED TO CHANGE.
2. TESTING STANDARDS AS PER MSS SP-81.
3. FLANGE DRILING AS PER AS2129 TABLE D:

CUSTOMER NAME : ITW TECHFLOW, $3 / 29$ COLLINSVALE ST, ROCKLEA OLD.
$\therefore \quad$ REF.: PO.NO- 15749 DT 19.07.2004.

Drawing No.
01G60001D

Revision No.

00

Att: Mr. Gordon Waddell.
HVAC/HPPS (QId) P/L
101 Cobalt Street,
Carole Park. QId. 4300.
$\boldsymbol{R e}$ : Test Certificates.
Dear Sir,
Please find attached test certificates for 'Expert Valves' on your order No:Q53138/3251Q.
Regards,
Gary Schwarzrock.






HEAT TRFATMENTSOLUTION ANHEALED AT 1980 OEG.C. SOAKED FOR SHOURS ANO THEN WATER QUENCHED. ACIO PICXLED.
CHEAMCAR, COMPOSITMSN

AECHANIC..W. IKopr:KIFs




KFMAKKS:
IGCT CARRIED OUT AS PER ASTM A262 PRACTJCE "A" FOUND SATISFACTORY.

## CIISTOMRR：M／S EXPERT ENGINEERING ENTERPRIGES karnataká

ORDER REF：：
MAFERIAL，SPECIFICATION ASTH A 3SIH－D3 Grade CF8H
CUSTOMER SPA：CIFICATION：
heat treatmentsolution annealed at 1080 oeg．c．gogked for bhours ano then water QUENCHED．ACID PICKLEO．

CHEMLCAI，COMPOSHILON 5

| Elcment | C | Mn | Si | 口 | S | Ni | Cr | Mo |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Minimum | $\cdots$ | －－ | －－－ | －－－ | － | 9.000 | 18.008 | 2.000 |  |  |  |  |
| Miximum | ． 880 | 1.900 | 1.500 | ． 840 | ． 840 | 12.008 | 21.000 | 3.000 |  |  |  |  |
| Actuall | ． 871 | ． 930 | ． 969 | ． 819 | ． 013 | 9．370 | 18.769 | 2.195 | L－ |  |  |  |

mechanical dionomikites




REMARKS ：

Page 1 of 1


Fininelry iduntifictation M CBn Cerlificate No．

Vialid up to

139 dt .19 .09 .2003
30.03 .2006
formakfrs rf．presintative
For Makl：RS


Muntiger Quality Asmanes：＂

TO．Na，： 03550

HATI：：25－SEP－D4
HFWI＇Mo．：H25：74

HEAT DATE：21／89／2004



## TESI CURIIFICATE



HEAT TREATMENT: gOLUTION ANHEALED AT 1980 DEG.C.SOAKED FOR $3 H O U F G$ AND THEN WATEK QUENCHED. ACID PICKLED.

CHEMICAL COMPOSITION G

| 1 t | C. | Mn | Si | P | 5 | Ni | Cr | Ho |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Minimum | -- | --- | - | --- | --- | 9.800 | 18.000 | 2.000 |  |  |  |
| Maximum | . 888 | 1250 | 1.500 | .840 | .048 | 12.000 | 21.888 | 3.009 |  |  |  |
| Actual | . 068 | . 929 | . 984 | . 022 | .814 | 9.874 | 19.340 | 2.224 |  |  |  |

MECHANICAI. PROPERTIES


DETAILS OF CASTINGS POURED (Poured yuintily may not mateh widn :upply quantity)


REMARKS :

## JIMDAL STAINLESS

Customer＇s Narre and Adoress


REHARKS ：
（I）CULRFACE FINISH AS PER ASTM A $182: N O 1$.
（2）MANUFACTURIH PROCESS：EAF－ASM－HRF－EJNCAST：
（3）SAFPLE DIRETIIOM－TRAKGUERSE


（b）CERILFICATION OK CKEMICAL AHD MECHANICAL TESTIME BASIS．


Form No．：OAD／35F W．E．F： 01.10 .2003
 of the matarlal specifikeliun and has deer．found io miter these requirements．
（b）Testheg and Cortification in accordanee with requiremanta of 5 FN .10204 elause 3.1 n

MALNAD HiN
Factary : 36-A, Shimoga Bhadrwathi Induarial Arr, Machenahalli . 577 222. Shimuga Grantu : CASIINGS


## TEST CERTIFICATE

| CUSTOMER: K/S | EXPERT ENGINEE ATAKA | RING EN | ERPRISES | T.C.. No. <br> DAIE: | 14281 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| ODNPQ REP: |  |  |  |  | $20-14 \mathrm{H}-103$ |
| Manemal Specification | ASTM A494M-00 | Orado | CW-12m | HEAT No. : | 190659 |
| CUSTOMER SPECTFICATION |  |  |  | HEAT DATE : | 2R/日S/20ns |

HEAT TREATMENT : SOLUTION ANNEALED AT 1183 DEG-C.SOAKED FOR THOURG AND TMEN KAFYD AIKCOOLED.

CHEMICAL COMPOSITTON \%

| Element | c | mn | 5 i | P | S | Ni | C.r | mo | $v$ | 50 | 4. |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| imum | --- | --- | --- | -- . | --- | --- | 15.504 | 16.08\% | . 200 | 4.520 | B. 750 |  |
| Maximum | .120 | 1.800 | 1.088 | .840 | . 830 | --- | 17.580 | 18.000 | .40 | 7.500 | 5.250 |  |
| Actual | .841 | . 447 | . 569 | . 066 | .008 | BAL | 16.648 | 17.696 | . 277 | 5.656 | 4.339 |  |

## MECHANICAL PROPERTLES

| - | $\begin{gathered} \text { YS } \\ \text { KG. PRQMMH } \end{gathered}$ | $\begin{gathered} \text { UTS } \\ \text { ro.FISQ MM } \end{gathered}$ | ELONGATION OL.SOMM |  | HAk!onfss BHN | AFND TFST 48 | impact test xeswiss |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Minimum | 24.84 | 34.4\% | 4.80. | --- | --- |  |  |  |  |  |
| Maximum |  | -- |  |  |  |  |  |  |  |  |
| Actual | 39.848 | 38.870 | 4.208 | --- |  |  |  |  |  |  |

DETAILS OF CASTINCS POURED (Poured quantify may not matrh with supply quantity)

| . T 日 | DESCRIPTION | DRAWINO NO. | QUANTITY |
| :---: | :---: | :---: | :---: |
| 918030 | 358 Mm PV KGU EODY | 1135801000 | 1 |
| 910834 | 350 MM KGV DOOR (FLATE) | 113500600 | 1 |
| $910050^{\circ}$ | 300 KEV GLAND | : | 1 |
|  |  | (IFE: $\because$ ) VARIFIED <br> Acep:iforidej जnab F.I. C <br> Date: $05 \cdot 07.03$ | ${ }^{-}$ |

RGMARKS:

Faut 1 Of 1

Certified that the material of constrution confinms to above material ppecification and cubtomer requiremencs in all axpects and the requiremeate of lodian Ruiler Regulasiont

Foundry Identification $M \quad 135 \mathrm{dt} .10 .04 .2081$
CBE Cordfictat No.
30.86.2003

Valid un in

For MAKERS REPRESENTATIVE


Manager Quality Assurnemec © Subínania

## Appendix 10: Gate Valve Data Sheet

Manufacturer:
Model/Serial Number:
Model/Serial Number:
Model/Serial Number:
Model/Serial Number:
Supplier Contact:

## AVK

100 FBE 57/40
150 FBE 57/40
300 FBE 57/40
375 FBE 57/40
ITW Tech Flow
3/29 Collinsvale Street,
Rocklea QLD - 4108
(07) 32770111

To AS 2638.2
Stem sealing exchangeable under pressure
Face to face dimension to AS 2638.2
Flange and drilling to AS 4087 Figure B5 (AS 2129 Table D)

| Component list |  |  |  |
| :--- | :--- | :--- | :--- |
| 1. Valve body | 7. Bonnet gasket | 13. Gland flange | 19. Stem cap |
| 2. Wedge casting | 8. Bonnet | 14. Bushing | 20. Stem cap bolt |
| 3. Wedge rubber | 9. Hot melt seal | 15. Washer |  |
| 4. Stem nut | 10. O-ring seal | 16. O-ring seal |  |
| 5. Stem | 11. Stem collar | 17. Gland bolts |  |
| 6. Bonnet bolts | 12. O-ring seal | 18. Wiper ring |  |



| $\begin{aligned} & \text { Ref. nos. } \\ & \text { CTC } \end{aligned}$ | $\begin{aligned} & \text { fef. nos. } \\ & \text { CTO } \end{aligned}$ | DN | $\underset{\text { nve }}{\mathrm{L}}$ | $\underset{~}{\text { H }}$ | $\begin{gathered} \mathrm{D}_{\mathrm{m}} \end{gathered}$ | $\begin{aligned} & 0 \\ & m m \end{aligned}$ | $\begin{gathered} \text { Dh } \\ \mathrm{mm} \end{gathered}$ | $\begin{aligned} & \text { ds } \\ & \text { mm } \end{aligned}$ | Holes | $\underset{\text { min }}{F}$ | Weight kilos |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 57-050-402 | 57-050-403 | 50. | 178 | 335 | 98 | 165 | 114 | 18,5 | 4 | 35 | 17 |
| 57-065-402 | 57-065-403 | $65^{\circ}$ | 190 | 344 | 103 | 185 | 127 | 18,5 | 4 | 35 | 18 |
| 57-080-402 | 57-080-403 | 80 | 203 | 350 | 122 | 185 | 146 | 18.5 | 4 | 35 | 19 |
| 57-100-402 | 57-100-403 | 100 | 229 | 380 | 154 | 215 | 178 | 18.5 | 4 | 35 | 27 |
| 57-150-402 | 57-150-403 | 150 | 267 | 485 | 209 | 280 | 235 | 18.5 | 8 | 35 | 49 |
| 57-200-402 | 57-200-403 | 200 | 292 | 595 | 264 | 335 | 292 | 18.5 | 8 | 35 | 74 |
| 57-225-402 | 57-225-403 | 225 | 305 | 595 | 296 | 370 | 324 | 18.5 | 8 | 35 | 98 |
| 57-250-402 | 57-250-403 | 250 | 330 | 680 | 328 | 405 | 356 | 22.5 | 8 | 35 | 102 |
| 57-300-402 | 57-300-403 | 300 | 356 | 755 | 376 | 455 | 406 | 22.5 | 12 | 35 | 147 |
| 57-375-402 | 57-375-403 | 375 | 381 | 905 | 463 | 550 | 495 | 26.5 | 12 | 35 | 240 |
| 57-400-402 | 57-400-403 | 400 | 406 | 930 | 503 | 620 | 521 | 26.5 | 12 | 35 | 285 |
| *Not specified in AS 2638.2 |  |  |  |  |  |  |  |  |  |  |  |

気展


AVK RESILIENT SEAT SLUICE GATE VALVE PN 16
57/40

| Materials: |  |
| :--- | :--- |
| Gland flange, <br> body and bonnet | Ductile iron, 500-7 to AS 1831 |
| Stem cap | Ductile iron, 400-12 to AS 1831 |
| Coating | Fusion bonded epoxy resin <br> - Internally and externally to |
|  | AS 4158 |
| Stem | Stainless steel, 316 S 11 |
| Stem sealing | NBR wiper ring, 2 NBR O-rings |
| Wedge | Ductile iron, 500-7 to AS 1831, <br> core fully vulcanised with EPDM <br> rubber, with integral wedge nut of <br> dezincification resistant brass, |
|  | CZ 132 to AS 2345 |
| Bushing | Polyamid <br> Thrust coilar and |
| Dezincification resistant brass, <br> CZ 132 to AS 2345 |  |
| Bonnet bolts | Stainless steel 304, sealed with <br> hot melt |
| Gland flange | Stainless steel 316 |
| bolts |  |
| Bonnet gasket | EPDM rubber |



\footnotetext{
The designs, materials and specitications shown are subject to change without notice due to our continuing program of product development.

| AVX Austraila Pty Lid | 3N5740EO |
| :---: | :---: |
| 7 Rosberg Road, Wingfield, SA 5013 Austalia | Augusi 2005 |
| Tet: +61\%83596166 |  |
| Fax: +61 \% 83596417 |  |
| e-mail: infoeavkraluos.com.atu |  |



AVK RESILIENT SEAT SLUICE GATE VALVE PN 16

| Use: |
| :--- |
| For water, sewage and neutral liquids |
| to max. $40^{\circ} \mathrm{C}$ |
|  |
|  |

## Tests:

Hydraulic test to AS 2638.2:
Seat: 16 bar
Body: 24 bar
Operating torque test

| Materials: |  |
| :---: | :---: |
| Gland flange, body and bonnet | Ductile iron, 500-7 to AS 1831 |
| Stem cap | Ductile iron, 400-12 to AS 1831 |
| Coating | Fusion bonded epoxy resin - Internally and externally to AS 4158 |
| Stem | Stainless steel, 316 S 11 |
| Stem sealing | NBR wiper ring, 2 NBR O-rings |
| Wedge | Ductile iron, 500-7 to AS 1831, core fully vulcanised with EPDM rubber, with integral wedge nut of dezincification resistant brass, CZ 132 to AS 2345 |
| Bushing | Polyamid |
| Thrust collar and stem seal box | Dezincification resistant brass, CZ 132 to AS 2345 |
| Bonnet bolts | Stainless steel 304, sealed with hot melt |
| Gland flarige bolts | Stainless steel 316 |
| Bonnet gasket | EPDM rubber |



| The designs, materials and specilications shown are subject to change without notice due to our continuing program of product devalopment. |
| :--- |
| AVK Australia Pty Lid |
| 7 Rosberg Road, Wingfield. SA 5013 Australia |
| Aughst 2005 |

7 Rosberg Road, Wingfield. SA 5013 Australia
el: +61883596166
-mail: info@avkvalves.comau

Page 1 of 1

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7 Rosberg Road
f: +61883596417
Wingfield SA 5013
e: info@avkvalves.com.au
Australia
w: www.avkvalves.com.au

## Tender Specification <br> Series 57/40



Resilient seated gate valve.
Body and bonnet of Ductile Iron to AS1831 Grade 500-7,DN 80-400.
Flanges and drilling to AS4087 Figure B5, PN 16.
Face-to-Face and general dimensions to AS2638.2
Wedge of ductile iron with fixed wedge nut, fully encapsulated with EPDM rubber.

Stem of stainless steel 316 .

Stem sealing consists of 30 -rings in a nylon bearing and a wiper ring.
Bonnet gasket in groove between body and bonnet.
Countersunk bonnet bolts encircled by the bonnet gasket and sealed with hot melt.

Epoxy coating to AS4158 - internally and externally.
Like AVK series $57 / 40$ or approved equivalent.

SP 103 OPERATING AND MAINTENANCE MANUAL Part 5: Appendices

Contract No:: BW. 30079-02/03 M \& E Fitout \& Commissioing SP103 Heroes Ave Pump Station

## Appendix 11: Reflux Valve Data Sheets

| Manufacturer: | Dobbie Dicco |
| :---: | :---: |
| Model/Serial Number: | Dobbie Dico 300 Reflux Valves |
| Model/Serial Number: | Dobbie Dico 375 Reflux Valves |
| Supplier Contact: | ITW Tech Flow |
|  | 3/29 Collinsvale Street, |
|  | Rocklea QLD - 4108 |
|  | (07) 32770111 |




APPROVED FOR MANUFACTURE


375 mm REFLUX VALVE SPECIFICATIONS

| No | PART | MATERIAL | STANDARD | GRADE |
| :---: | :---: | :---: | :---: | :---: |
| 1 | BODY | DUCTILEIRON | AS1831 | AS 500-7 |
| 2 | COVER | DUCTILE IRON | AS1831 | AS 500-7 |
| 3 | BOLTS | GALV. CARBON STEEL | AS1252 | HIGH STRENGTH STRUCTURAL |
| 3 | BOLT ALTERNATIVE | STAINLESS STEEL | AS2837 | 304 OR 316 |
| 4 | BLANKING PLUG | OR BRASS | AS3688 | 352 |
| 5 | FLAP SPINDLE | STAINLESS STEEL | AS2837 | 316 OR 416 |
| 6 | SEATING RING | GUNMETAL | AS 1565 | [83600 |
| 7 | FLAP | GUNMETAL | AS1565 | C83600 |
| 8 | HINGE | GUNMETAL | AS 1565 | C83600 |
| 9 | HINGE SPINDLE | STAINLESS STEEL | AS2837 | 316 OR 416 |
| 10 | GASKET | RUBBER | AS4020 | $\times 83683$ |
| 11 | SPINDLE BUSH | GUNMETAL OR DR BRASS | AS 1565 | (83600 |
| 12 | WASHER | STAINLESS STEEL | AS2837 | 316 OR 304 |
| 13 | SPLIT PIN | STAINLESS STEEL | AS2837 | 316 OR 304 |
| 14 | GLAND NUT | GUNMETAL | AS1565 | C83600 |
| 15 | BLEED PLUG | DR BRASS | AS3688 | 352 |
| 16 | LEVER ARM IFF REQ'DI | STRUCTURAL STEEL | AS3679 | 250 |
| 17 | COUNTERWEIGHT (IF REQ'D) | GREY CAST IRON | A51830 | T220 |
| 18 | LIMIT SWITCH [IF REQ'DI | AS SPECIFIED |  |  |
| 19 | CAM (IF REQ'O) | STAINLESS STEEL | AS2837 | 316 OR 304 |

a.S. FLANGE SPECIFICATIONS

| VALVE | FLANGE | FLANGE | FACE/FACE | LENGTH | MIN WALL | NO. BOLT | BOLT HOLE | BOLT HOLE |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CLASS | DIAM. | THICKNESS | LENGTH | TOL. $+/-$ | THICKNESS | HOLES | DIAM. | PC.D. |
| 16 | 550 | 33 | 820 | 2 | $X$ | 12 | 26 | 495 |
| 35 | 580 | 42 | 820 | 2 | $\times$ | 16 | 30 | 521 |


 ADOBOOYMPRKITCS




300 mm REFLUX VALVE SPECIFICATIONS

| No | PART |  |  | MATERIAL |  |  | STANDARD | GRADE |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | BODY |  |  | OUCTILEIRON |  |  | AS1831 | AS 500-7 |  |  |
| 2 | COVER |  |  | DUCTILE IRON |  |  | AS 1831 | AS 500-7 |  |  |
| 3 | 80LTS |  |  | GALV. CARBON STEEL |  |  | AS 1252 | HIGH STRENGTH STRUCTURAL |  |  |
| 3 | BOLT AL TERNATIVE |  |  | STAINLESS STEEL |  |  | AS2837 | 304 OR 316 |  |  |
| 4 | 8L ANKING PLUG |  |  | DR BRASS |  |  | BS1256 | 352 |  |  |
| 5 | FLAP SPINDLE |  |  | STAINLESS STEEL |  |  | AS2837 | 316 OR 416 |  |  |
| 6 | SEATING RING |  |  | GUNMETAL |  |  | AS1565 | C83600 |  |  |
| 7 | FLAP |  |  | GUNMETAL |  |  | AS 1565 | C83600 |  |  |
| 8 | HINGE |  |  | GUNMETAL |  |  | AS1565 | C83600 |  |  |
| 9 | HINGE SPINDLE |  |  | STAINLESS STEEL |  |  | AS2837 | 316 OR 416 |  |  |
| 10 | GASKET |  |  | RUBBER |  |  | AS4020 | $\times 83683$ |  |  |
| 11 | SPINDLE BUSH |  |  | GUNMETAL OR OR BRASS |  |  | AS1585 | C83600 |  |  |
| 12 | WASHER |  |  | STAINLESS STEEL |  |  | AS2837 | 316 OR 304 |  |  |
| 13 | SPLIT PIN |  |  | STAINLESS STEEL |  |  | AS2837 | 316 OR 304 |  |  |
| 14 | GLAND NUT |  |  | GUNMETAL |  |  | AS1565 | C83600 |  |  |
| 15 | BLEED PLUG |  |  | OR BRASS |  |  | AS 3688 | 352 |  |  |
| 16 | LEVER ARM (IF REQ'D) |  |  | STRUCTURAL STEEL |  |  | AS3679 | 250 |  |  |
| 17 | COUNTERWEIGHT (IF REQ'D) |  |  | GREY CASTIRON |  |  | AS 1830 | T220 |  |  |
| 18 | LIMIT SWITCH (IF REQ'D) |  |  | AS SPECIFIED |  |  |  | 31608304 |  |  |
| 19 | CAM (IF REQ'D) |  |  | STAINLESS STEEL |  |  | AS2837 |  |  |  |
|  | A.S. FLANGE SPECIFICATIONS |  |  |  |  |  |  |  |  |  |
|  | VALVE | FLANGE | FLAN |  | FACE/FACE | LENGTH | MIN WALL | No. BOLT | BOLT HOLE | BOLT HOLE |
|  | CLASS | DIAM. | THICK | NESS | LENGTH | TOL.+1- | THICKNESS | HOLES | DIAM. | P.C.D. |
|  | 16 | 455 |  | 30 | 700 | 2 | 23 | 12 | 22 | 406 |
|  | 35. | 490 |  | 38 | 700 | 2 | 23 | 16 | 26 | 438 |



## Appendix 12: Ductile Pipe and Fittings Data Sheets

Supplier/Manufacturer:
Contact:

Tyco Water
88. Fredrick Street, Northgate,
QLD - 4013
(07) 3266.2255
Dhaged

## ERECO Flow Control

## THCO 1/

## Features

- Ductile Iron fittings for high strength and impact resistance
- Suitable for 'in ground' or 'above ground ' applications
- Fittings can be encapsulated with a thermal bonded polymeric coating or cement lined and bitumen coated to suit local utility specifications.
- Self anchoring joints. No need for external anchorages.
- Integrally cast flanges on fittings.
- All flange dimensions comply with AS4087.
- Alternate flange dimensions available on request.

Flanged fittings are manufactured to AS/NZS 2280. Flange dimensions comply with AS 4087.


[^4]
## Technical Data

Size Range: DN80-DN750 Allowable Operating Pressure: 1600 or 3500 kPa Standards: AS/NZS 2280 - Ductile iron pressure pipes and fittings Certification:

## ProductMark Licence

PRD/R61/0412/1
Certified to AS 4020 - Suitable for contact with drinking water.



Specitying a high pressure DN150 fusion coated flanged tee with a DN100 branch.


Specifying a 22.5 degree standard pressure DN100 cement lined, bitumen coated bend.

 Flow Control

## 




## 解 <br> Flow Control

Flanged bends are manufactured to AS/NZS 2280. Flange dimensions comply with AS 4087.

## Tyco beater




| Nominal Size DN | b | w | h |
| :---: | :---: | :---: | :---: |
| 80 | 229 | 165 | 11 |
|  |  |  |  |
| 150 | 279 | 190 | 165 |
|  |  |  |  |
| 225 | 330 | 260 | 216 |
|  |  |  |  |
| 300 | 406 | 345 | 260 |
|  |  |  |  |
| 450 | 572 | 500 | 356 |
|  |  |  |  |
| 600 | 737 | 665 | 457 |

## TEACD Flow Control

Flanged tees are manufactured to AS/NZS 2280. Flange dimensions comply with AS 4087.

## THec Mater





を朗co
Flow Control

Flanged tapers are manufactured to AS/NZS 2280. Flange dimensions comply with AS 4087.

## Tyca leader




## 1420 Flow Control

## TMaci lixaxter

## Features

- Ductile Iron components for high strength and impact resistance.
- Fasteners are grade 316 Stainless Steel for long life operation.
- Thrust type available to provide longitudinal restraint.
- Non-Thrust type available where restraint is separately provided.
- Cement lined and bitumen coated or fusion coated with Rilsan Nylon 11 for long life corrosion protection.
- Studs are fully threaded.


General Application

Dismantling Joints are used in pipelines where valves may need to be removed for future maintenance or replacement.

## Technical Data

Size Range:
DN100-DN750
Allowable Operating Pressure:
1600 kPa or 3500 kPa
End Connections:
Flanged to AS 4087 Figure B5
Flanged to AS 4087 Figure B6


|  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Nominal <br> Size <br> DN | $\int_{A}$ | Joint | cions | $Y$ | $\left\lceil\begin{array}{c} \text { Rubber } \\ \text { iD } \times \mathrm{d} \end{array}\right\rceil$ | No. of Studs | Stud <br> Size | de B | Z | No. of Nuts |
| 100 | 30 | 126 | 400 | 175 | $104 \times 16$ | 4 | M16 | 340 | 10 | 5 |
| 150 | 30 | 181: | 400 | 175 | $155 \times 16$ | 8 | M16 | 340 | 10 | 5 |
| 200 | 30 | 236 | 400 | 175 | $206 \times 16$ | 8 | M16 | 340 | 10 | 5 |
| 225 | 30 | 263 | 400 | 17.5 | $232 \times 19$ | 8 | M16 | 340 | 10 | 5 |
| 250 | 30 | 290 | 400 | 175 | $268 \times 19$ | 8 | M20 | 340 | 13 | 5 |
| 300 | 30 | 349 | 400 | 175 | $298 \times 13$ | 12 | M20 | 340 | 13 | 5 |
| 375 | 35 | 430 | 600 | 260 | $410 \times 13$ | 12 | M24 | 495 | 16 | 5 |
| 450 | 35 | 511 | 600 | 260 | $500 \times 20$ | 12 | M24 | 495 | 16 | 5 |
| 500 | 40 | 564 | 600 | 260 | $555 \times 20$ | 16 | M24 | 495 | 16 | 5 |
| 600 | 45 | 671 | 600 | 260 | $660 \times 20$ | 16 | M27 | 495 | 16 | 5 |
| 750 | 47 | 831 | 600 | 260 | $780 \times 25$ | 20 | M30 | 495 | 18 | 5 |



## Monfhush




|  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Nominal <br> Size <br> DN |  | ions <br> H | $\left\lceil\begin{array}{c}\text { Rubber } \\ \text { ID x d }\end{array}\right\rceil$ | $\begin{gathered} \text { No. } \\ \text { of } \\ \text { Studs } \end{gathered}$ | Stud Size | Det | z | No. of Nuts |
| 100 | 30 | 126 | $104 \times 16$ | 8 | M16 | 195 | 10 | 3 |
| 150 | 30 | 181 | $155 \times 16$ | 12 | M20 | 195 | 13 | 3 |
| 200 | 31 | 236 | $206 \times 16$ | 12 | M20 | 195 | 13 | 3 |
| 225 | 34 | 263 | 232 $\times 19$ | 12 | . M24 | 275 | 16 | 3 |
| 250 | 34 | 290 | $268 \times 19$ | 12 | M24 | 275 | 16 | 3 |
| 300 | 38 | 349\% | $298 \times 19$ | $16^{\prime}$ | M24 | 275 | 16 | 3 |
| 375 | 42 | 430 | $410 \times 24$ | 16 | M27 | 275 | 16 | 3 |
| 450 | 46 | 511 | $500 \times 20$ | 20 | M30 | 275 | 18 | 3 |
| 500 | 49 | 564 | $555 \times 20$ | 24 | M30 | 275 | 18 | 3 |
| 600 | 54 | 671 | $660 \times 20$ | 24 | M33 | 330 | 20 | 3 |
| 750 | 59 | 831 | $780 \times 25$ | 28 | M33 | 330 | 20 | 3 |

[^5]



Specifying a non-thrust type DN300 Class 16 dismantling joint.

```
Example 300 DIS JNT NTHRTUST S/S TC \(\quad\) FC
Nominal Size
100-750
Name
Type
Thrus
Non thrus
Fastener Type
SS - Stainless Steel
End Type
TC - Flanged AS 4087 Figuire B5
HP - Flànged AS 4087, Figure B6
Extra Information
FC - Fusion Coated
DI - Ductile Iron
OICL - Ductile Iron Cement Lined
```


tefcos
Flow Control

Flanged bellmouths are manufactured to AS/NZS 2280 requirements. Flange dimensions comply with AS 4087.


|  |  |  |
| :---: | :---: | :---: |
| Nominal Size |  |  |
|  |  |  |
| DN | $b$ | h |
| 100 | 200 | 152 |
|  |  |  |
| 200 | 374 | 305 |
| PG225w, |  |  |
| 250 | 445 | 380 |
|  |  |  |
| 375 | 755 | 525 |
|  |  |  |
| 500 | 770 | 650 |
|  |  |  |
| 750 | 1250 | 845 |

SP103 Heroes Avenue Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume 3 OM Manual

## Appendix 13: Uniflange Data Sheets

Manufacturer:
Supplier Contact:

Uniflange
Tyco Water
88 Fredrick Street,
Northgate,
QLD - 4013
(07) 32662255


## AUSTRALIAN CATALOGUE



## UNI-FLANGE DESIGN ELEMENTS

The design of the Uni-Fiane Adapter is ratly quite simple. We took the best features of three differem producis and combined them into one fiting.

The FI_ANGE is made of ductite iron: lougher and stronger than the conventional grey iron threaded ilange. Impact rasistant the flange also resists breakage when bolts


The RESTRANT is provided by a set serew locking device similar to that used in mechanical joint restraner glands. This principle has been in use throughout the worko in liea of concree thrust blocks and other resaraining devices. for more
than 40 yars.

## AUSTRALIAN STANDARD AS 2129 / AS 4087

Technical Data and Availability

## Fl.ANGE

Manufacared from dactile iron in accordanee with ASTM A 536.
Drilling and O.D. in accordance with
is 54. Wh:
Pipe O.D's shown in tables are to the following standards.


| Sied 50 mum to 150 mm | $-\mathrm{-a}$ |
| :--- | ---: |
| - AS 1674 |  |
| Sied 200 mm and abowe | -B 36.10 |
| Iran all sizes | - AS 2280 |

$\begin{array}{lr}\text { Sied } 50 \text { mom to } 150 \mathrm{~mm} & -\mathrm{-aS}-\mathrm{AS} 1674 \\ \text { Sied } 200 \text { mm and abowe } & -\mathrm{BS} 36.10 \\ \text { Iron all sizes } & -A S 2280\end{array}$

SEIT SCREW
Manufactured from AISI 4140 steel. Tensile 1310 MPa . Heat treated and zinc plated. Stainless steel (A|SI 410) and "Unitorque" set serews also avaitable.

GASKET
Stundard gusker suppliced with the Uni-Flange Adapier Flange is SBR (Buna-S). Suinable for water and mistemater, and most moderate chemicals. Temperature range $.54^{\circ} \mathrm{w} 100^{\circ} \mathrm{C}$.
Other gaskels wailable inelude: EPDM. CR, NBR, FPM.

## recommended set

 SCREW TORQUE| 50.100 mm | 95 Nm |
| ---: | ---: |
| 150.375 mm | 125 Nm |
| 400.600 mm | 160 Nm |

Tahle C/Class 16 Series 470

| Nom <br> Pije <br> Siac | Stecl <br> Pipe <br> ©1). | $\begin{aligned} & \text { Casi Iron } \\ & \text { pips } \\ & \text { O.D. } \end{aligned}$ | $\lambda$ | F | $B C$ | D | Boll Hole D: . | No. Bolis | Se Sercu Size | Wet. <br> Approx. <br> (Kgs.) | Fant No. Sted Pipx | Fran No. ins Fipx |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 80.) | $\cdots$ | 150 | si | 1 H | 25 | 1s | 4 | $1 \% \times 1$ | 2 | $4 \mathrm{M}-5050$ | $\cdots$ |
| 6.5 | 76.1 | $\cdots$ | 165 | 51 | $\ldots$ | 97 | 18 | 4 | $1 / 2 \times 1$ | $?$ | $4 \times 3-065$ | $\cdots$ |
| Xi | 88.9 | 65 | 185 | S! | 1.45 | 27 | Is | 1 | $1 / 5 \times 1$ | 3 | 270-5080 | 170-C. 180 |
| 100 | 114.3 | 121.4 | 215 | 54 | 178 | 27 | 18 | 4 | $\cdots 1$ | 4 | 470.5100 | :70.C. 1100 |
| 150 | 16.51 | 173 | 250 | (x) | 23.5 | 27 | 13 | 8 | $\gamma_{1} \times 1 i_{3}$ | 6 | 473-5-150 | $473 . C-150$ |
| 20 | 219.1 | 232.2 | 335 | 64 | 292 | 27 | 18 | $\checkmark$ |  | 9 | 47.5 .200 | $47 \mathrm{C}-20 \mathrm{C}$ |
| 225 | - | 259.1 | 370 | 64 | 324 | 27 | 18 | \$ | $\%_{*} \times 1 \%$ | 11 | - | $4 \mathrm{H} \cdot \mathrm{C} \cdot 235$ |
| 250 | 270 | 2860 | 405 | 6.4 | 356 | 27 | 22 | 8 | $4 \times 1$ | 13 | 470-5.230 | $170 \cdot \mathrm{C} 250$ |
| 30) | 323.9 | 345.4 | 45.5 | 67 | 416 | 30 | 22 | 12 | $3 / 4.1 H_{4}$ | is | 470.5.300 | 43.600 |
| 350 | 355.6 | - | 525 | 71 | 470 | 35 | 26 | 12 | $\cdots \times 1 H_{4}$ | 24 | $4 \pi-5.350$ | - - |
| 775 | -- | 426.2 | 550 | 30 | 405 | 35 | 26 | 12 | $4 \% \times 1 \%$ | 24 | -- | $470-6.35$ |
| 40 | 406.5 | $\cdots$ | 580 | 8.3 | 521 | $41)$ | 26 | T. | $34 \times 2$ | 30 | 470.5-400 | - - |
| 450 | 4570 | 507.0 | 640 | 86 | 584 | 40 | 26 | $\because$ | $y_{4} \times 2$ | 30 | $470-5.450$ | $470-(43)$ |
| 500 | 5080 | 5600 | 705 | 89 | 041 | 45 | 25 | 16 | $1 / 4 \times 2$ | 40 | $470.5-500$ | $4 \mathrm{O}-\mathrm{C}-500$ |
| 000 | ¢000 | 6 c 70 | 825 | 92 | 360 | 48 | 30 | 16 | $33_{4} \times 2$ | 50 | 470-5-600 | 470. $\mathrm{C}-6 \mathrm{ch} 7$ |

ALSO AVAILABLE (IN BOTH 'C'\& 'E') TO SUIT THE FOLLOWING PIPE OD'S
Table : Series $474 \quad 150 \mathrm{~mm} \mathrm{NB} \cdot 168.3 \mathrm{~mm}$. $300 \mathrm{~mm} \mathrm{NB} \cdot 337.0 \mathrm{~mm} \quad 375 \mathrm{~mm} \mathrm{NB} \cdot 419.0 \mathrm{~mm}$

| Nom. <br> Pipc <br> Size | Sted <br> Pige <br> Q, D. | Casiron Pip 0,0 , | $\wedge$ | A | BC | D | Bolt <br> Hoie <br> Dia. | $\begin{aligned} & \text { No, } \\ & \text { Bublis. } \end{aligned}$ | Se: Scres Sixe | Wyt. <br> Approx. <br> (Kys.? | Part No. Sled Pipe | Panca. Iron Pipe |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 60.3 | ".an | 150 | 3) | 114 | 25 | 18 | 4 | $\cdots \times 1$ | 2 | 47-5-6150 | - |
| 65 | 76.1 | $\cdots$ | 165 | 51 | 127 | 27 | 18 | 4 | $1 / 41$ | 3 | +74-5-665 | - |
| 80 | 38.9 | 965 | 18.5 | 51 | 1.6 | 27 | 18 | 4 | $3 \times 1$ | 3 | 17.5.5.0380 | 474.C. 380 |
| wn | 114. | 121.9 | 25 | 54 | 13. | 27 | 18 | 8 | $\cdots \times 1$ | 4 | 4.74.5.100 | +74-C.400 |
| 150 | 105. | 17?.9 | 280 | (6) | 235 | 27 | 22 | 8 | $\% \times 11 \%$ | 6 | 474-5-150 | - 4 A - 400 |
| 200 | 219.1 | 23.2 | 335 | 64 | 392 | 27 | 22 | 8 | $4 / 8 \times 1 / 4$ | 9 | +7-5.200 | 474. 200 |
| 225 | .. | 2591 | 370 | 0 | 324 | 37 | 22 | 12 | 淐 $=1 \%$ | ! 1 | - | 874, c-22s |
| 250 | 2730 | 2860.1 | 405 | 64 | 35 h | 27 | 22 | 12 | $\gamma_{3} \times 1{ }^{1} i_{4}$ | 13 | 474-5-250 | 474.2050 |
| $30 \mathrm{k})$ | 323.9 | 345.4 | -4.55 | 67 | 4) | 30 | 2 ij | 12 | $Y_{8} \because 1 H_{2}$ | 15 | 474.5.70) | 476.900 |
| 350 | 355 | -- | 325 | 7 | 40 | 3.5 | 26 | 12 | $\%_{4} \times 110$ | 24 | $474.5 \cdot 300$ | - |
| 3 | - | 426.2 | 5.50 | ว) | 49.5 | 3 | 26 | 12 | ${ }^{4} \times 1{ }^{1}$ | 24 | - | $474.60 .37 \%$ |
| H0) | 406.5 | $\cdots$ | 580 | 83 | 521 | 40 | 26 | 12 | $1_{2} \times 2$ | 30 | 474-5-400 | -m |
| .150 | 457.0 | SiPo | 8 c 0 | 86 | 584 | 40 | 26 | is | $4 \times 2$ | 30 | $47.4 .5 \times 450$ | 4 $34-\mathrm{C}-450$ |
| soo | 5080 | 5600 | 705 | 89 | 6-11 | 45 | 26 | 16 | $\times 1 \times 2$ | 40 | 472.5.500 | 174.C-5 $(x)$ |
| AM | 610.0 | 6670 | 825 | 9 | 386 | 48 | 33 | 16 | $\pi_{4} \times 2$ | 50 | 474.5-590 | $474.6(0)$ |

## UNI-FLANGE ASSEMBLY INSTRUCTIONS



1. Pipe end should be cut square and be free of burrs. Clean the plain end of the pipe. Thoroughly lubricate the pipe and gasket with a soap based pipe lubricant. Slide the flange onto the pipe with the gasket cavity facing the end of the pipe. Slide the lubricated gasket over the pipe end, with the tapered end facing the gasket cavity in the flange. (No gaskel is necessary or should be used to seal the flange faces).
2. Slide the flange forward until the gasket is evenly sealed in the flange cavity, with the leading edge of the gasket flush with the end of the pipe. (The end of the pipe should butl against the facing flange, it cannot be more than 6 mm from the facing flange). Hand tighten the set screws against the pipe surface.
3. Using conventional thange bolts, mate the Uni-flange to the standard fange. Be sure to eventy tighten the bolis atcrately on opposite sides. (Use the star method like lightening the lug mats on a car wheel). Do not over-tighten the flange bolts. It is not neeessary to bring the Uni-flange Adapter io a face to face conact with the standard fange. A gap of approximately 3 mm between the flanges is normal.
4. Snug dowa all the set serews evenly. Tighten in an alternating manner (star method) to the torque walues specified. Use of a torque wrench is required.

DEFLECTION

| Nom. <br> Pipe <br> Size <br> (mm) | Maximura Angle Deflection | Deflection MM/ Length |
| :---: | :---: | :---: |
| 50 | $4^{3}-02$ | 387 |
| 65 | $3^{\circ}-56$ | 377 |
| 80 | $33^{5}-50$ | 368 |
| 100 | $3{ }^{\circ} 4^{\circ}$ | 358 |
| 150) | 3.36 | 345 |
| 200 | $3^{-}-30^{\circ}$ | 320 |
| 225 | $3^{\circ} \cdot 15$ | 312 |
| 250 | $33^{\circ} \cdot 13$ | 308 |
| 300 | $2^{2} .35$ | 232 |
| 350 | $2^{2} \cdot 20^{\circ}$ | 22.4 |
| 375 | $2^{\circ}-10$ | 208 |
| 400 | $2{ }^{\circ}-175^{\circ}$ | 200 |
| 450 | $2^{\circ} .00$ | 192 |
| 500 | $1{ }^{\circ} .56$ | 18.5 |
| 600 | 15.37 | 155 |

## THRUST RESTRAINT

| Nom. <br> Pipe <br> Size <br> ( mm ) | Set Screw Torque (Nm) | Working Pressure Max. ( $\mathrm{H} \cdot \mathrm{Pa}$ ) | Thrust at Working Pressure (Kgs) | Uni-flange <br> Thrust Restraint (Kgs) |
| :---: | :---: | :---: | :---: | :---: |
| 50 | 75 | 1.609) | 354 | 6,000 |
| 65 | 95 | 1.600 | 554 | 6.000 |
| 80 | 95 | 1.600 | 630 | 6.000 |
| 100 | 95 | 1.600 | 1.184 | 6.000 |
| 150 | 125 | 1.600 | 2.853 | 16.000 |
| 200 | 125 | 1.600 | 5.140 | 16.000 |
| 22.5 | 125 | 1.600 | 6.505 | 16.000 |
| 250 | 125 | 1.600 | 8.160 | 16.600 |
| 300 | 125 | $1.60 .4)$ | 12.111 | 24.0009 |
| 350 | 125 | 1.000 | 9.096 | 24.000 |
| 375 | 125 | 1.004) | 12.090 | 24.000 |
| 400 | 160 | 1.000 | 12.049 | 3.3000 |
| +50 | 160 | 1.000) | 17.216 | 33.000 |
| 500 | 160 | 1.000 | 21.215 | +4.1000 |
| 600 | 160 | 1.000 | 30.376 | 4.000 |

## UNI-FLANGE ADVANTAGES

- Job ate bibrication using plan end pipe.

Un-Flange eliminates the problems of pre-enginecred preFabricated piping systems. Pipe sizing need not be so preetse. because lengits can be cun and made up to suit site requirements. Misatakes in labrication or drawings can be easily recified on-site, instead of relying on off-site suppliers. machinisas and babrieators. DOWN TIME SAVINGS are consitierathe.

- Plain end pipe is ansiderabiv less expensive of use than threaded ar maned pipe.

With the Uni-Fhane Adapter Flange Series. plain end pipe is all you need. And because pipe lengitis can be cul and nade up to suit site requirements. cutofts may be urifzed to cot duwn on waste.

- Imeflage has builion end restain.

Buith-in. so mo ue raks anchoring or fising is necesory:

- Uni-Plange altaws a detcoliomatexibility setine and in mprowed euting mance.

When installing the pipe misalignment can wfen be altowed Far by usitg the deflection seting itrorporated in the design of the Uai-Flange Adapter. There is an alkwance of $A$ in. beawen pipe and mating natee, whichatiows for a lower degree of :ccuraty than would be necessay wih rigid nanged systems.

- Uni-Flange needs no special equipmen fer instalation.

No thrending or wetding equipmen is needed.

- Fasi and casy installation whom skilled hitar

If yu an use a weach wo wan use Umi Flange


- Eamunate boll hole ahamem problens.

Uni-Flange can be Feely mated tefore bolt ighenim: cablige casy bola hote alizmen.


Insatathons of water. watewater and scwige piping systems are made casier on ste when the Uni-Flange methed is applise It an all-intone comection.


## UNI-FLANGE ADAPTER SERIES

The Uni-Fkage Adapter Flange Seriex joins values. Fitune. ard equipatem with integral hanged ends to piain end pipe. whthere the need of pipe ciad prepasation, Absolately no thesiding. welding. ar genowing is mecessary.
 Series vinually eliminates the problems inherent with pre-
 inacearate damensionat deatits and the dependenee on brissite suppliens is na longer a major concera when the Uni-Flange Adapter Serics is ulilized with water. wastewatier and sewage pipions sytem:

The tworking principle of the Uni-Ftange Adupter Flunge is relatively simple. Slide the thatege over phain end pipo and follone it what a sumdard mectsinicil joim gitsket. When the Uni-fiange Alapter is brought to abte deatnst an existims

 rexame is provided when the set serevs are tightenced.
Our enndidence in in pertiormance has hetped mote the Uni-ftange Adapter ore of the fastesi growing biteas in ofo
 Wate Authoritics and sacitad try maty Comsuling Engincers floroughout sustatia, and thas proved. through mumerous ficld trials that it can excect the capabithics of threated fanges. wekicd natnees and fanged eobupling adapters.
MMBW ath fasurance Combeit of лustalia approved. Undentriecrs ! mboratory Listed and Factory Matant Sysam Approved, the Uni-Flame Adapter Flange is wimply lie best atea in prping sifice the hange.

M.L.K. Industries - 33 Forge Road, Mount Evelyn 3796, Victoria, Australia For further information - Contact:

## UNI-FLANGE INSTALLATION INSTRUCTIONS



1. Pipe end should be cut square and be free of burrs. Clean the plain end of the pipe. Thoroughly lubricate the pipe and gasket with a soap based pipe lubricant. Slide the flange onto the pipe with the gasket cavity facing the end of the pipe. Slide the lubricated gasket over the pipe end, with the tapered end facing the gasket cavity in the flange. (No other gasket is necessary or should be used to seal the flange faces.)
2. Slide the flange forvard until the gasket is evenly seated in the flange cavity, and the Uni-flange face is flush with the end of the pipe. (The end of the pipe should butt against the facing flange, it cannot be more than 6 mm from the facing flange). Hand tighten the set screws against the pipe surface.
3. Using conventional flange bolts, mate the Uni-flange to the standard flange. Be sure to evenly tighten the bolts altemately on opposite sides. (Use the star method like tightening the lug nuts on a car wheel). Do not over-iighten the flange bolts. It is not necessary to bring the Uni-flange Adapter to a face to face contact with the standard flange. A gap of approximately 3 mm between the flanges is nomal.
4. Snug down all the set screws evenly. Tighten in an altemating manner (star method) to the torque values specified. Use of a torque wrench is recommended.

Note: In installations where rapid or excessive surges may occur, or extreme thrusts encountered (e.g. near pumps or $90^{\circ}$ bends): Uni-flange engineers recommend the use of tie rods for additional thrust restraint.

THRUST RESTRAINT

| Nom. <br> Pipe <br> Size <br> (mm) | Sel Screw Torque ( Nm ) K9 Pipe | Sel Screw Torque ( Nm ) K. 12 /Steel Pipe | Working Pressure Max. ( kPa ) | Thrust at Working Pressure (Kys) | Uni-flange Thrust Restraint (Kgs) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 50 |  | 90 | 1.600 | 354 | 6.000 |
| 65 |  | 90 | 1.600 | 554 | 6,000 |
| so | 70 | 90 | 1.600 | 630 | 6.000 |
| 100 | 70 | 90 | 1.640 | 1.181 | 6.000 |
| 150 | So | 110 | 1.600 | 2.885 | 16.000 |
| 200 | 80 | 110 | 1.600 | 5,126 | 15,000 |
| 225 | 80 | 120 | 1,600 | 6.487 | 16,000 |
| 250 | 90 | 120 | 1.600 | 8.137 | 16.000 |
| 300 | 9 | 120 | 1.600 | 12.07 | 24.000 |
| 30 |  | 120 | 1.000 | 9.971 | 24,000 |
| 375 | 9 | 120 | 1.000 | $12.05 \%$ | 24.000 |
| 400 |  | 120 | 1.000 | 12.016 | 33.000 |
| 450 | 120 | 160 | 1.000 | 17.168 | 33.000 |
| 500 | 120 | 160 | 1.000 | 21.159 | 44.000 |
| 810 | 120 | 160 | 1.000 | 30.291 | 44,000 |

DEFLECTION

| Nom. <br> Pipe <br> Size <br> $(\mathrm{mm})$ | Maximum <br> Angle <br> Deflection | Deflection <br> mm/ <br> Length |
| :---: | :---: | :---: |
| 50 | $4^{\circ}-02^{\circ}$ | 387 |
| 65 | $3^{\circ}-36^{\circ}$ | 377 |
| 80 | $3^{\circ}-50^{\circ}$ | 368 |
| 100 | $3^{\circ}-44^{\circ}$ | 358 |
| 150 | $3^{\circ}-36^{\circ}$ | 345 |
| 200 | $3^{\circ}-20^{\circ}$ | 320 |
| 225 | $3^{\circ}-15^{\circ}$ | 312 |
| 250 | $3^{\circ}-13^{\circ}$ | 308 |
| 300 | $2^{\circ}-35^{\circ}$ | 232 |
| 350 | $2^{\circ}-20^{\circ}$ | 234 |
| 375 | $2^{\circ}-10^{\circ}$ | 208 |
| 400 | $2^{\circ}-05$ | 200 |
| 450 | $2^{\circ}-00^{\circ}$ | 192 |
| 500 | $1^{\circ}-56$ | 185 |
| 600 | $1^{\circ} .37^{\circ}$ | 155 |

Note: Uni-hange thrust restraint figures are based on K12/Steel Pipe set screw torques.

## Appendix 14: Transfer and Load Break Switches

Manufacturer:
Supplier Contact:

NHP
MPA Engineering 3/22-24 Strathwyn Street
Brendale QLD 4500
0738810722 :

## SLine horizontal uneven transfer switches

Rod interlock/horizontal mounting $3 / 3$ pole type, $3 / 4$ pole and 4/4 pole
The versatility and flexibility of the rod interlock mechanism. used in uneven transferswitch range enables us to provide the widest array of transfer switches available on the Australian market.

Uneven transfer switches are mounted on a white painted steel base plate, fully wired to:terminals and feature two auxiliary contacts as standard per MCCB, a total of four are provided ( 1 per MCCB is available for customer use). For details refer to NHP.


## TemPower ACB transfer switches

TemPower transfer switches are available in almost any combination of ACB's between AT06A and AH60C ( 6300 amp ) 3 pole and 3 pole/ 4 pole are possible.

TemPower. transfer switches are available in fixed or withdrawable. models

TemPower ACB's are assembled with all mechanical interlock fittings. The interconnecting mechanical interlock rod or wire is assembled and fitted by the customer. Specify length.

Special models
Featuring 3 way interlocks are available. Please refer to NHP for detailed information

## Moulded case interlocked pairs

The versatility of the cable mechanical interlock fitting allows us to offer almost any combination of MCCB's from 400 ampere to 2500 ampere as an interlock pair.


Interlock 3 pole type

## Enclosed transfer switches

Standard features include:

## J IP 55 rated enclosure

- Common load side busbars
$\square$ Standard 240 V control or other voltage on application
E Earth and neutral bars
Optional features:
Busbar flags for large cable termination
L Logic Panel




## Standard basic transfer switches

Walking beam interlock 3 pole and 4 pole combination The standard basic transfer switch comprises two motor operated circuit breakers mechanically and electrically interlocked for safety.
An additional auxiliary switch for customer use is supplied as standard on each circuit breaker. The complete assembly is mounted on a white painted steel base plate and wired to terminals for simple 3 wire customer connection.


Manual transfer switch (no motors) 3P/3P combination shown

| Adj. amp rating (A) | 415VI/C | MCCB | Cat. No. |
| :---: | :---: | :---: | :---: |
| 63-100 | 18KA | XS125CJ100 | BSich33 |
| 80-125 | 18kA | XS125CJ125 |  |
| 63-100 | 30kA | XS125NJ100 | BSNAB3 |
| 80-125 | 30kA | XS125NJ125 | BSIN233 |
| 63-100 | 50 kA | XH125NJ100 |  |
| 80-125 | 50kA | XH125NJ125 | $\frac{5 B H I N}{23}$ |
| 100-160 | 35 kA | XS250NJ160 | HMBS2N1334x |
| 160-250 | 35kA | XS250NJ250 |  |
| 100-160 | 50kA | XH250NJ160 | $\text { WBH2N133\% } \mathrm{BK}$ |
| 160-250 | 50kA | XH250NJ250 |  |
| 160-250 | 35KA | XS400CJ250 | BSAC233 |
| 250-400 | 35KA | XS400CJ400 |  |
| 160-250 | 50kA | XS400NJ250 | H-8BS4N233 ${ }^{\text {S }}$ |
| 250-400 | 50 kA | XS400NJ400 |  |
| 125-250 | 50kA | XS400SE250 | H6S545233] |
| 200-400 | 50kA | XS400SE400 | WBS4SH333 |
| 125-250 | 65kA | XH400SE250 | $811 \leq 233$ |
| 200-400 | 65kA | XH400SE400 | WBH4S433 |
| 250-400 | 45kA | XS630CJ400 | WBS6C433 |
| 400-630 | 45kA | XS630CJ630 | BS66633/41 |
| 250-400 | 65kA | XS630NJ400 | $2 \mathrm{KBS6N} 433$ |
| 400-630 | 65kA | XS630NJ630 | YyBS6N633 \% |
| 315-630 | 50kA | XS630SE630 | B4ES6633\%tyty |
| 315-630 | 65kA | XH630NJ630 |  |
| 500-800 | 65kA | XS800NJ800 | WBS8N833 ${ }^{\text {a }}$ |
| 400-800 | 50kA | XS800SE800 | BS8S833 |
| 400-800 | 65kA | XH800SE800 | WhBHBSB336 |
| 500-1000 | 65kA | XS1250SE1000 | 8BS12S1033374 |
| 630-1250 | 65kA | XS1250SE1250 | W8S12S1233 ${ }^{\text {W }}$ |
| 800-1600 | 85kA | XS1600SE1600 | Vinsicsic33 |
| 1000-2000 | 100kA | XS2000NE2000 | $\text { MSS } 20 \mathrm{~N} 2033$ |
| 1250-2000 | 100kA | XS2500NE2500 | $\text { BS } 25 N 2533$ |



MCCB selection
Cascading
Selectivity/discrimination

## INSTRUCTION OF TYPE XMC SPRING CHARGING MOTOR OPERATOR

he Type XMC Spring Charging Motor Operator uses a combination of an electric motor and a losing spring as mechanical operating power for electrical ON-OFF(RESET) control of a circuit reaker. The ON operation is achieved by a release of the energy stored in the compressed closing jring and transmitting this energy to the breaker handle via the operating mechanism.
he OFF operation is achieved by rotation of the motor, which operates the breaker handle via the itchet mechanism and operating mechanism. Operation of the motor also charges (compresses) the osing spring to make it ready for next operation.

(1) Manual handle
(2) Manual handle socket
(3) Trip button(Red-coloured)
(4) ON-OFF indicator
(5) ON button(PUSH TO ON)
(6) Lock plate
(7) Wing screw to hold manual handle in place
(8) position adjust screw

Fig. 1. General view of motor operator

MOUNTING AND REMOVAL OF TYPE XMC MOTOR OPERATOR $M C$ is mounted on breaker in the shipment made.
For applicable 800A and smaller frame breakers, remove the XMC from breaker once (see [] Removal Procedure), and install the breaker in a swithboard, then mount the XMC on it (see [2] Mounting Procedure), because it is unable to install the breaker with XMC
For applicable 1000A and larger frame breakers, install the breaker with XMC.

(8) Position adjust screw
(9) Locknut
(10) Mounting screw, hex head, M5, 4 pcs
(11) Mounting base
(133) Handle catch
(13) Guide
(Provided only for applicable breakers of 400A frame and 250A frame)
(44 Control circuit terminals
Fig. 2. Mounting
(The sketch shows the case of applicable breakers of 400A frame and 250A frame)

[^6]$\qquad$ $\because$ $\qquad$ $\ldots$

Fig. 4. Control circuit diagrm

.ock-in-OFF Feature
IC may be padlocked in OFF position. Put XMC in OFF position, pull out the lock plate(6), pass shackle of a padlock through the slot in the lock plate, and lock the padlock. Under this idition, no ON operation is possible either manually or electrically.
o push the lock plate back into home, lift it a little nd disengage it from the XMC front cover he lock plate cannot be pulled out when XMC is in N position.
he lock plate can accept up to three padlocks. See ig. 5 for acceptable shackle diameter.
Cautionary Information
Jupply the control power voltage within an acceptable operating voltage range for electrical operations. The acceptable operating voltage range is 85 to $110 \%$ of the nameplate voltage if AC , and 75 to $110 \%$ if DC.
The dielectric withstand voltage of XMC is 1500 V $A C$ for one minute between the control circuit terminals together terminal E. (500V AC for one


Fig. 5. Padlocking $X M C$ in OFF position minute for 24 V DC use)
The ON-OFF indicator shows the ON and OFF positions of XMC. and does not directly indicate the ON or OFF condition of the breaker. For example, the indicator will continue to show ON even if the breaker is tripped
When the breaker is tripped by its long time delay element, it takes several minutes for the element(thermal-magnetic trip) to return to its normal position. (This time length varies depending on the breaker rated current and the magnitude of overcurrent.) Allow 5 to 10 minutes when attempting an ON operation after tripping.

TERASAKI ELECTRIC CO., LTD.

## 11. OPERATING INSTRUCTIONS

## (1) Manual Operations (see Fig. 1)

1-1 ON Operation
The closing spring is charged when the XMC is in OFF position (XMC ON-OFF indicator shows OFF).
Pushing the ON button (PUSH TO ON) mechanically releases the charged closing spring. which, in turn, closes the breaker

NOTE: The ON button is provided with a clear cover to prevent the accidental operation.
To push it, loosen the fixing screw and open the cover.
1-2 OFF Operation (Spring Charging)
The manual handle for OFF operation is stored on top of the XMC and held in place by the wing screw. Loosen the wing screw (7) and remove the manual handle (1), then set it into the manual handle socket (3). Pumping this handle (up and down strokes) about 30 cycles turns OFF the breaker and, at the same time, charges the closing spring,

NOTE: Be sure to return the manual handle to its storage position and secure it in place by the wing screw after use
Completion of Spring Charging and OFF indication
An additional manual-handie pumping of several cycles is necessary to completely charge the closing spring after the breaker is actually turned OFF
By handle pumping for OFF operation, the lettering "OFF" in the ON-OFF indicator window moves up past its normal position and then returns to the normal position. After confirming this, give additional pumping of 2 or 3 cycles to completely charge the closing spring
XMC, when in OFF position, keeps the breaker handle in its RESET position.
1-3 RESET Operation
Perform the OFF operation to reset the tripped breaker.
1-4 Emergency OFF (TRIP) Operation
To manually turn OFF the breaker in urgency or emergency, press the trip button (red-coloured) (3)
(2) Electrical Operations (see Control circuit For A.C. in Fig. 4)

2-1 ON Operation
In OFF position (ON-OFF indicator shows OFF), the closing spring is charged. Closing the ON control switch (CS1) energizes the latch release coil (LRC), which, in turn, release the closing spring.
This turns ON the breaker via the breaker-handle operating mechanism.
When the spring is released, the limit switch (LS1) opens to de-energize the LRC
2-2 OFF Operation (Spring Charging)
Closing the OFF/RESET control switch (CS2) energizes the control relay (Ry2), which self-seals and energizes the motor (M). The motor turns OFF the breaker as well as charging the closing spring. When the spring is completely charged, the limit switch (LS3) opens to de-energize both M and Ry2.
2-3 RESET Operations
To reset the tripped breaker, close the OFF/RESET control switch (CS2)
Operation is the same as in OFF operation
2-4 Automatic Resetting



PROJECT: SECTION: CIRCUIT DESIGNATION:


1. VERIFICATION OF OPTIONS AND SETTINGS. Tick or Fill In Rating and/or Setting of Option fitted.

## LEFT HAND PCB

[. MCCB SERIAL No: $C 347 \mathrm{C}$ No. of POLES: 3 SETTINGS:-
(NORMAL) EMERGENCY (Tick applicable) MOTOR OPERATOR SERIAL No: c: 9109 THERMAL GOO MAGNETIC_STO ELECTRONIC Settings:- $\mathrm{In}_{1} \quad \mathrm{I}_{1} \quad \mathrm{~T}_{1} \quad \mathrm{I}_{2} \quad \mathrm{~T}_{2} \quad \mathrm{I}_{2} \mathrm{t} \quad \mathrm{Off} / \mathrm{On} \mathrm{Ip} \quad \mathrm{T}_{\mathrm{P}} \quad \mathrm{IG}_{\mathrm{I}} \quad \mathrm{T}_{\mathrm{G}} \quad \mathrm{I}_{3}$ mCCB CATALOGUE TYPE:$x 563031630$

RIGHT HAND MCCB ROCB SERIAL No: COT 4480 MOTOR OPERATOR SERIAL NO: $6410^{6}$ o. of POLES: 3 SETTINGS:THERMAL 630 MAGNETIC STD ELECTRONIC Settings:- In $\mathrm{I}_{1} \quad \mathrm{~T}_{1} \quad \mathrm{I}_{2} \quad \mathrm{~T}_{2} \quad \mathrm{Lt}$ MCCB CATALOGUE TYPE:-- $\times 5 \times 3 \mathrm{~N}]$ $630 \overline{30}$


## ENCLOSED TRANSFER SWITCH

Equipment mounted in Enclosure Type:
Confirm any Special Requirements:
$\qquad$

## 2. FUNCTIONAL TESTS

## ^MANUAL TRANSFER SWITCH

Check manual operation of each Circuit Breaker.
Check operation of each accessory fitted to Circuit Breaker.
Check Mechanical Interlock by attempting to close Circuit Breaker while opposite is closed.

## FUNCTIONAL TESTS cont;

## BASIC TRANSFER SWITCH

## 奖

Check Electric operation of each Circuit Breaker.
Chock operation of each accessory fitted to Circuit Breaker.
Check Electrical Interlocking by attempting to close Circuit Breaker while opposite is closed. Check Mechanical Interlock by attempting to close Circuit Breaker while opposite is closed.

3. DIELECTRIC TEST

Test Voltage -2000 V AC between all Terminals as follows for 1 second:
Terminal to Terminal.
Terminal to Earth.
Left MCCB to Right MCCB.


TESTED BY:-
 DATE: 17, 91,4

| OETL |  |  |
| :---: | :---: | :---: |
| 400 A | 630 A | 800 A |

OETL 400...800: Includes handle OHB125N12 and shaft OXP12X166


OETL 400 D1
OETL 630 K 3 OETL $800 \mathrm{K3}$ (Outboard model)


OETL 400 KV12
OETL 630 KV12
OETL 800 KV12 (Inboard model)


OETL 400 KV22
OETL 630 KV22
OETL 800 KV22 (Inboard model)


Standard steel enclosed 'self assembly' version

SHAFTLOACATIONS

| 3 Pole Inboard shaft | कौ7 | Cat. No. | OETL 400 KV 12 | OETL 630 KV12 | OETL 800 KV12 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 3 Pole Outboard shaft |  | Cat. No. | OETL400. 1 | OETL 630 K 3 | OETL 800 K 3 |
| 4 Pole Inboard shaft |  | Cat. No. | OETL 400 KV 22 | OETL 630KV22 | OETL 800 KV 22 |
| 4 Pole <br> Outboard shaft |  | Cat. No. | $\text { OETL } 400 \mathrm{D4}$ | $\text { OETL } 630 \mathrm{~K} 4$ | OETL 800 K 4 |

## Technical information

| Rated thermal current and rated oper. current AC 20/DC |  | In | ir A | 500 | 630 | 800 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | 20 In | ure A | 500 | 630 | 720 |
| Rated operational current/power for typical |  |  | kW | 200 | 315 | 355 |
| motor loads. 4 | $415 \mathrm{~V}, \mathrm{AC} 23$ |  | A | 500 | 630 | 720 |
| Rated operational 415 V, AC 22 |  |  | A | 500 | 630 | 800 |
| currents 4 | $415 \mathrm{~V}, \mathrm{AC} 21$ |  | A | 500 | 630 | 800 |
| Rated short circuit current, 500 V |  |  | kA | 100 | 100 | 100 |
| with back-up fuses of size: ${ }^{2}$ ) |  |  | A | 500 | 800 | 800 |
| Short circuit making capacity, peak value |  |  | kA | 65 | 80 | 80 |
| Short time withstand current, r.m.s | and 0.2 s |  | kA | $\left.31^{3}\right)$ | 38 | 38 |
|  | 1.0 s |  | kA | 17 | 17 | 17 |
| Rated <br> operational <br> current/poles in series | DC23, up to 48 V |  | kA | 400/1 | 630/1 | 800/1 |
|  | (Inductive <br> loads) | 110 V | A | 400/2 | 630/2 | 800/2 |
|  |  | 220 V | A | 400/2 | 630/2 | 630/2 |
|  | DC22, up to 48 V |  | A | 400/1 | 630/1 | 800/1 |
|  | (Mixed loads) | 110 V | A | 400/2 | 630/2 | 800/2 |
|  |  | 220 V | A | 400/2 | 630/2 | 800/2 |
|  | DC21, up to 48 V |  | A | 400/1 | $630 / 1$ | $800 / 1$ |
|  | (Resistive | 110 V | A | 400/2 | 630/2 | 800/2 |
|  | loads) | 220 V | A | 400/2 | 630/2 | 800/2 |
| Outline dims. - | H |  | mm | 205/205 | 223/223 | 223/223 |
| $3 P / 4 \mathrm{P}$ <br> (Outboard shaft) | $W^{\prime}$ ') |  | mm | 216/262 (228/274) | 248/310 (260/330) | 264/334 (260/330) |
|  | D |  | mm | 130/130 | 130/130 | 130/130 |
| Max. with longer shaft $D$ |  |  | mm | 580 | 580 | 580 |

Notes: ') Width dimensions in () relate to "Inboard shaft" styles eg. OETL 400 KV12.
${ }^{2}$ ) IEC 269.
${ }^{\text {J }}$ ) kA 0.25 s


Midline steel enclosed
'custom made' version

Eclipse 'self
assembly' steel enclosed version

Strömberg Switchline
$\mathbb{N B}$

## Load-break switches OETL 400...800A - Front operated Dimensional drawings ( mm )



|  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Switch type | No. of poles | A | B | C | 0 | E | F | G | H | 1 |
| OETL 40001 | 3 | 216 | 153 | 205 | 216 | 180 | 25 | 11 | 4 | 175 |
| OETL 40004 | 4 | 262 | 199 | 205 | 262 | 180 | 25 | 11 | 4 | 175 |
| OETL 630k3 | 3 | 248 | 185 | 223 | 248 | 185 | 40 | 13.5 | 5 | 207 |
| OETL 630K4 | 4 | 310 | 247 | 223 | 310 | 185 | 40 | 13.5 | 5 | 269 |
| OETL 800K3 | 3 | 264 | 201 | 223 | 264 | 185 | 40 | 13.5 | 5 | 223 |
| OETL 800K4 | 4 | 334 | 271 | 223 | 334 | 185 | 40 | 13.5 | 5 | 293 |

3 POLE
OETL 400/630/800KV12

4 POLE
OETL 400/630/800KV22


| Th00月 0 Sh ftS |  |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Switch type | No. of poles | A | 8 | C | D | E | F | G | H | 1 | J | K | $\cdots$ |
| OETL 400KV12 | 3 | 228 | 206 | 205 | 46 | 180 | 25 | 11 | 4 | 228 | 94 | 104 | 101 |
| OETL 400KV22 | 4 | 274 | 252 | 205 | 46 | $\cdot 180$ | 25 | 11 | 4 | 274 | 140 | 104 | 101 |
| OETL 630KV12 | 3 | 260 | 238 | 223 | 70 | 185 | 40 | 13.5 | 5 | 260 | 102 | 128 | 109 |
| OETL 630KV22 | 4 | 330 | 308 | 223 | 70 | 185 | 40 | 13.5 | 5 | 330 | 172 | 128 | 109 |
| OETL 800KV12 | 3 | 260 | 238 | 223 | 70 | 185 | 40 | 13.5 | 5 | 260 | 102 | 128 | 109 |
| OETL 800 KV 22 | 4 | 330 | 308 | 223 | 70 | 185 | 40 | 13.5 | 5 | 330 | 172 | 128 | 109 |

SP103 Heroes Avenue Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissioning Volume 3 OM Manual


## Appendix 15: MCCB's

Manufacturer:<br>Supplier Contact:<br>NHP<br>MPA Engineering<br>3/22-24 Strathwyn Street<br>Brendale QLD 4500<br>0738810722



XS125CJ (18KA) 3 pole

| Ampere rating | Min | Max | Cat. No. |
| :---: | :---: | :---: | :---: |
| 20 | 12.5 | 20 |  |
| 32 | 20 | 32 |  |
| 50 | 32 | 50 |  |
| 63 | 40 | 63 |  |
| 100 | 63 | 100 |  |
| 125 | 80 | 125 |  |
| 125 | Non-Auto | for 1 sec ) | ResinNN3 ${ }^{\text {a }}$ |

## XS125NJ (30kA) 2 pole

Ampere

| rating | Min | Max | Cat. No. |
| :---: | :---: | :---: | :---: |
| 20 | 12.5 | 20 |  |
| 32 | 20 | 32 | 19xS125N3220 |
| 50 | 32 | 50 |  |
| 63 | . 40 | 63 |  |
| 100 | 63 | 100 | \%xS 25 NH |
| 125 | 80 | 125 |  |

## XS125NJ (30kA) 3 pole

| 20 | 12.5 | 20 |  |
| :---: | :---: | :---: | :---: |
| 32 | 20 | - 32 |  |
| 50 | 32 | 50 |  |
| 63 | 40 | 63 |  |
| 100 | 63 | 100 |  |
| 125 | 80 | 125 |  |

## XS125NJ (30kA) 4 pole

| 20 | 12.5 | 20 |  |
| :---: | :---: | :---: | :---: |
| 32 | 20 | 32 |  |
| 50 | 32 | 50 | XS125N5 504.6 |
| 63 | 40 | 63 | ¢ $6125 N J 6348 \mathrm{th}$ |
| 100 | 63 | 100 | $\text { R } \times 25 \mathrm{NN} 1004 \mathrm{C}$ |
| 125 | 80 | 125 |  |

Notes: ') MCCB's only.
${ }^{2}$ ) Load-break isolating switch only-no overload or short circuit prolection.
${ }^{3}$ ) Poles in series.
${ }^{\text {1 }}$ ) Short time rating. Refer rating chart for technical details.
2 pole models use a 3 pole body with centre pole disabled.
Special generator protection MCCB's available - low instantaneous magnetic setting.

## Dimensions (mm)

| Description |  | Height | Width | Depth | kg |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| XS125CJ | 3 pole | 155 | 90 | 86 | 1.3 |
| $X S 125 \mathrm{NJ}$ | 2 pole | 155 | 90 | 86 | 1.3 |
| XS125NJ | 3 pole | 155 | 90 | 86 | 1.3 |
| XS125NJ | 4 pole | 155 | 120 | 86 | 1.58 |

定

Short circuit capacity

| Model | UC | Voltage |
| :--- | :--- | :--- |
| $X S 125 \mathrm{CJ}$ | $18 \mathrm{kA}($ AS2184 $)$ | 415 V 50 Hz |
| $X S 125 \mathrm{NJ}$ | $30 \mathrm{kA}($ AS2184 $)$ | 415 V 50 Hz |
| DC use | $\left.1 / C^{3}\right)$ | Voltage |
| $X S 125 \mathrm{CJ}$ | 10 kA | 250 VDC |
| $X S 125 \mathrm{NJ}$ | 15 kA | 250 VDC |

Refer this section for ratings to AS 3947-2 and AS 2184, and Ics/lcu.

Product extensions
Chassis (TemWay, MHC, UHC)
Panelboards (TPX)
TemCurve

Base standards
ECC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2/Australia AS 2184-1990/Australia ${ }^{\text {1 }}$
NEMA USA
ANSI C37. 13/USA
JIS C 8372IJAPAN
JEC 160IJAPAN

Approvals
ASTAUKK, Aust. standards
Marine
NKIJAPAN
LRJUK
ABIUSA
GUGERMANY
BV/FRANCE
DNV NORWAY


Types of connections and mountings
MCCB accessories
Plug-in Type
Switchboard use


Types of plug-in mounting blocks for switchboard use

| Series | Breaker | Pole | Type |
| :---: | :---: | :---: | :---: |
| XS | XS125CJ | 2, 3, | XDM2 |
|  | XS125NJ |  |  |
|  | XE225NC | 3, 4 | XDM3 |
|  | XS250NJ |  |  |
|  | XS400 | 3, 4 | XDM4 |
|  | XS630 | 3, [4 | XDM6 |
|  | XS800 |  | XDM6 |
|  | XS1250 | 3, (i) 4 | i $\mathrm{XDM8}$ |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| XM XM30PB |  |  |  |

IP 20 degree of protection and safety trip ') are availabie for plug-in type breakers, for switchboard and distribution board use.Available on indent only



Rear-connection type (RC)

Bolt stud


Applicable breakers
コ XS series
XS125CJ, XS125NJ
$\lrcorner X H$ series
XH125NJ, XH125PJ



## Types of connections and mountings

MCCB accessories
Plug-in Type
Switchboard use


Types of plug-in mounting blocks for
switchboard use

| Series | Breaker | Pole | Type |
| :---: | :---: | :---: | :---: |
| XS | XS125CJ | 2, 3, 4 | XDM2 |
|  | XS125NJ |  |  |
|  | XE225NC | 3. ${ }^{\text {d }}$ | XDM3 |
|  | XS250NJ |  |  |
|  | XS400 | 3, ${ }^{1}$ | XDM4 |
|  | XS630 | 3, [] 4 | XDM6 |
|  | XS800 | 3, 4 | XDM6 |
|  | XS1250 | 3, $\mathrm{i}^{4}$ | [ $]$ XDM8 |
|  |  |  |  |
| XM XM30PB |  |  |  |

## Plug-in type

Degree of protection
The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529 Standard Safety Trip (Trip first plug-in mechanism) indent.
] The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in' the breaker when it is in the "ON" position.

Application table (up to 100A frame)

| Breaker | IP cover code | Pole | Qty Req. |
| :--- | :--- | :--- | :--- |
| XS 125 | IP 20 | $2,3 P$ | $1=2$ |

XH125

IP 20 degree of protection and safety trip ') are available for plug-in type breakers, for switchboard and distribution board use.


Rear-connection type (RC)

Bolt stud
Horizontal (standard)


Vertical

Flat bar stud


Applicable breakers
Horizontal ') XS1250, XV1250NE
Vertical XS1600, XS2000NE XS2500NE.

Notes: The arrangement of the flat bar can be made by the user.
If not specified the horizontal arrangement will be supplied.
${ }^{1}$ ) Vertical arrangement also available on request, contact NHP for details.


## Types of connections and mountings

Draw-out type (DO indent)
Two-position type
Applicable breakers :

- XS series

XS400, XS630, XS800, XS 1250.
$\square \mathrm{XH}$ series
XH160, XH250, XH400, XH630, XH800.

- The plug-in type breaker is housed in the draw-out cradle.
- The draw out cradle has two positions "connected" and "isolated".
- The auxiliary circuits are automatically connected or isolated by the auxiliary circuit terminals on the plug-in breaker.
- Manual connector type is available.

」 Safety trip (first draw out mechanism), The breaker will trip automatically if it is drawn out while still in the 'on' position.

- Position keylock in isolated position (optional). Available on request.

IP 20 degree of protection (optional). Available on request.



|  |  |  |  | Nomina | wire siz | ( $\mathrm{mm}^{2}$ ) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Frame (A) | Breaker | 1.5 | 2.5 | 4 | 6 | 10 | 16 | 25 |  |
| XM30 | XM30PB | CAL 1.5-5 | CAL2.5-5 | CAL4-5 | CAL6-5 | CAL 10-5 | CAL 16-6 |  |  |
|  |  | MT2.5-M5 | MT2.5-M5 | MT4-M5 | MT6-M5 | MT10-M5 | MT16-M5 |  | 脊 ( ) |
| 125 | XS125CJ | - | CAL2.5-8 | CAL4-8 | CAL6-8 | CAL 10-8 | CAL16-8 | CAL25-8 |  |
|  | XS125NJ | MT2.5-M8 | MT2.5-M8 | MT4-M8 | MT6-M8 | MT10-M8 | MT16-M8 | MT25-M8 |  |
|  | XH125NJ |  |  | - |  |  |  |  | * |
|  | XH125PJ |  |  |  |  |  |  |  | $\rightarrow \infty$ |
|  | TL100NJ |  |  |  |  |  |  |  |  |



Commercially available compression terminals available from CABAC - Cable Accessories and JST Australia.
Key: CAL = CABAC lugs
MT = JST lugs

Connection
(one electric cable) If low clearance occurs use a recommended tape or insulation.


## Connection

(two electric cables)
If low clearance occurs use a recommended tape or insulation.



## Ambient compensating curves



TemBreak XS250NJ

## Outline dimensions (mm)

Front connected (standard)


Breakers with terminal bars available on request.


ASL: Arrangement Standard Line H: Handle frame centre line

Outline dimensions (mm)


Outline dimensions (mm)


- Breakers with terminals bars available on request.


ASL: Arrangement Standard Line
H: Handle frame centre line
Note: For dimensions and selection of motors for TL225F refer to NHP.


## Outline dimensions (mm)

Front connected (standard)


Rear connected (optional)


Note: In the standard selection mode, both terminals on
 the line side and the load side are in the horizontal direction
Plug-in (optional)



ASL: Arrangement Standard Line H: Handle frame centre line

## XS400 series thermal magnetic type

Adjustment range 63-100\% of nominal current rating.
$\square$ Standards AS 2184/AS 3497-2.
$\square$ Max voltage (Insulation) 690V.

- Adjustable thermal and magnetic trip.

XS400CJ (35kA) 3 pole

| Ampere rating | Min | Max | Cat. No. |
| :---: | :---: | :---: | :---: |
| 250 | 160 | 250 |  |
| 400 | 250 | 400 |  |
| 400 | Non-Auto | 0.3sec) |  |

XS400NJ ( 50 kA$) 3$ pole

| 250 | 160 | 250 |  |
| :---: | :---: | :---: | :---: |
| 400 | 250 | 450 |  |

Short circuit capacity

| Model | $1 / \mathrm{C}$ | Voltage |
| :--- | :--- | :--- |
| $X S 400 \mathrm{CJ}$ | $35 \mathrm{kA}($ AS 2184 $)$ | 415 V 50 Hz |
| $X S 400 \mathrm{NJ}$ | 50 kA | 415 V 50 Hz |
| $D C$ use | UC $\left.{ }^{*}\right)$ | Voltage |
| $X S 400 \mathrm{CJ}$ | 40 kA | 250 VDC |
| $X S 400 \mathrm{NJ}$ | 40 kA | 250 VDC |

Refer to ratings chart at the front of this section. For ratings to AS 3947-2 and AS 2184, and Ics/Icu.

Dimensions (mm)

| Description |  | Height | Width | Depth | kg |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $X S 400 \mathrm{CJ} / \mathrm{NJ}$ | 3 pole | 260 | 140 | 103 | 4.7 |


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


| Product extensions |  |
| :---: | :---: |
| Chassis (TemWay. MHC. UHC) |  |
| TemCurve |  |
| Residual current relays |  |
| Base standards | Approvats |
| IEC 947-2 | ASTAUKK, Aust. standards |
| BS EN 60947 Part 2 | Marine |
| VDE 0660 Part 1 | NKJJAPAN |
| AS 3947-2/Australia | LR/UK |
| AS 2184-1990/Australia ${ }^{2}$ ) | AB/USA |
| NEMA USA | GL/GERMANY |
| ANSI C37. 13/USA | BV/FRANCE |
| JIS C 8372IJAPAN | DNV NORWAY |
| JEC 160/JAPAN |  |

Notes: ') Load-break isolating switch only - no protection. ${ }^{2}$ ) MCCB's only.



Types of connections and mountings
MCCB accessories
Plug-in Type
Switchboard use


Types of plug-in mounting blocks for

$X M$
XM30PB

## Plug-in type

Degree of protection
The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529
Standard Safety Trip (Trip first plug-in mechanism) indent.
The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in' the breaker when it is in the "ON" position.

## Application table (up to 100A frame)

| Breaker | IP cover code | Pole | Qty Req. |
| :--- | :--- | :--- | :--- |
| $X S 125$ | IP 20 | $2,3 P$ | $1=2$ |

XH125

IP 20 degree of protection and safety trip ') are available for plug-in type breakers, for switchboard and distribution board use.

## Connections and mountings

## MCCB accessories

Front-connection type (FC)

Compression terminals


Attached flat bar


Types of terminal screws (Compression terminal and bar)
Breakers and screw size
XE series XS series
(Economical)

| XS series <br> (Standard) | XH series <br> (High-fault level) | XM series <br> (Motor protection) |
| :--- | :--- | :--- |

Pan headed screw

XS125CJ M8 XH125NJ M8 XM30PB M5
XS125NJ M8 XH125PJ. M8

Hex socket head bolt

| (1) | XE225NC | M8 | XS250NJ | M8 | XH250NJ | M8 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | XH160PJ | M8 |
| $\cdots$ |  |  | XS400 | M10 | TL250NJ | M10 |
| ( 5 |  |  | XH400 | M10 | TL400NJ | M10 |
| \% |  |  | XV400 | M10 | XH250PJ | M10 |



## Notes: The arrangement of the flat bar can be made by the user.

If not specified the horizonlal arrangement will be supplied.
${ }^{1}$ ) Vertical arrangement al50 available on request, conlact NHP for delails.

A higher reliance on electrical supply and safety in commerce and industry has increased awareness in circuit breaker technology and applications. Additionally, while maximising system safety and reliability, efficient economy of overall costs is also of great importance.
The combination of these factors has given rise to more precise methods of circuit breaker application.
Two common terminologies relating to general power backup and system protection are: Selectivity (Discrimination) and Cascading (Back-up). In general terms, Selectivity is used to improve system reliability and to ensure a continuous supply of power to as high a degree as possible. Cascading on the other hand is where an upstream breaker is used to "back-up" a lower specification breaker installed downstream to clear a fault current, and is generally used where economics plays a significant part in system design.

## Selectivity (Discrimination)

Previously known as "Discrimination", the most basic form of Selectivity is where two circuit breakers are connected in series. A higher amperage breaker is installed upstream, and a lower amperage breaker downstream. Should an overload or short circuit occur downstream, the downstream breaker will trip, but the upstream breaker will not, hence feeding parts of the system which are fault-free. This is the concept of Selectivity.
Selectivity is generally used, for example in critical applications, feeding essential loads. It is important to ensure total installation power is not lost due to a small or minor fault in a sub part of the overall electrical system, for example in a local distribution board. Total power loss could affect vital systems such as in Hospitals or Computer Centres etc.

The principle of Selectivity (Discrimination) is based upon an analysis of several types of circuit breaker characteristics. These include tripping characteristics (timecurrent curves), Peak Let Through Current (I $I_{\text {main }}$ ) and Energy Let Through (IT).
Selectivity can be "enhanced" beyond the breaking capacity of the downstream device provided it is backed up by an appropriately selected upstream device, which should not trip (unlatch) under stated conditions.

## Cascading (Back-up)

Cascading is achieved by using án upstream device tö assist (back-up) a downstream device in clearing a fatt current that happens to be greater than the breaking .: capacity of the downstream device
In Cascading applications, the upstream device may have to trip (unlatch) in order to give sufficient protection to the downstream device, thus interrupting supply of power to all devices downstream. Therefore, Cascading is generally used in applications involving the supply of non-essential loads, such as basic lighting. The main benefit of Cascading is that in certain circumstances circuit breakers with breaking capacities lower than the prospective fault level, and hence lower in cost, can be safely used downstream provided it is backed-up by the relevant upstream breaker.

## Cascade / Selectivity Tables

The Selectivity and Cascade tables shown in the following pages are structured as follows.


Selectivity: The Selectivity or Enhanced Selectivity limit of the two nominated devices in series. Up to this level of fault current the downstream device will trip (unlatch) before the upstream device. Above this level, the upstream may also trip.
Cascade: The enhanced or maximum downstream fault current that can be safely interrupted when both breakers are installed in series. Both breakers may trip (unlatch).
The Selectivity and Cascade levels stated by NHP are fully compliant with the requirements of the applicable standards. Selection of breakers should be in accordance with the selection tables.
The figures stated in NHP tables are for nominated Terasaki devices only, and should not be used as guidance for using alternative brands of circuit breakers.

Miniature circuit breakers and fuse fault current limiters co-ordination chart
For fault current levels up to 50kA at 415 V


## Tembreak MCCB's

## 

Notes: ') Minimum fuse size is based on grading under overload of one MCB with one set 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.

Tables based on the following maximum pre-arching $1^{2}$ tor both $8 S 88$ and DIN fuses:
$160 \mathrm{~A}-0.62 \times 10^{5}, \quad 200 \mathrm{~A}-1.2 \times 10^{5}, \quad 250 \mathrm{~A}-2.1 \times 10^{5}$.
Suitable fuses include NHP, GEC, Siemens and Bovara-Crady.
Fuses with higher current ratings may be used providing $I^{2} t$ values are equal to, or less than the levels above.
Semi-conductor fuses have very low $\mathrm{I}^{2}$ 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.



Standard TemBreak MCCB's - Selectivity and Cascade tables at 415V
Guide


Selectivity Cascade
Upstream MCCB


Upstream MCCB

| CCB | kA (rms) | $45$ | $65$ | $50$ | $65$ | 65 | $50$ | 65 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |
| XS125NJ | 30 | 6130 | 6130 | 18/30. | 130 | 10/30 | 18/30 | 18/30 |
| KH125N1 |  |  |  |  |  |  |  |  |
| XE225NC | 18 | $6 / 25$ | $6 / 30$ | 10/30 | 10/30 | 8/30. | $12 / 30$ | 12130 |
|  |  |  |  |  |  |  |  |  |
| XH250NJ |  |  |  | \% 50 |  | 10165 | 22/50 |  |
|  |  |  |  |  |  |  |  |  |
| XS400NJ | 50 |  |  | 75/50 | 77/65 | $6 / 50$ | 10/50 | $10 \% 6$ |
|  |  |  |  |  |  |  |  |  |
| XH400NE | 65 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XS630NJ | 65 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XH630NE | 65 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XSBOONE | 50. |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
| XS1600NE | 100 |  |  |  |  |  |  |  |

Standard TemBreak MCCB's - Selectivity and*Cascade tables at 415V


## Motor Starting - Introduction

Generally, an item of switchgear is selected on the basis of one or more performance criteria, be it current/power carrying or interrupting capabilities.
Additional consideration is often necessary when several different pieces of switchgear are comnected in series, none more so than in motor starting applications. As motors play a significant part in most modern day electrical systems it is important to ensure that the components of switchgear controlling and protecting the motor will interact with each other, or in other words, they are "co-ordinated".
In order to protect and operate a motor several components may be used, each with a different function. A typical set-up is as follows:


What problems can occur?
At the instant the motor is supplied with power it draws an "in-rush current" to its terminals, before gradually decaying to a normal operating current.

Should the in-rush current be high, it could be detected by the SCPD and classed as a fault current. If a high in-rush current should occur or even after repeated stop-start (inching) operations of the motor the SCPD may trip, albeit without a fault in the system. This is commonly known as "nuisance tripping" of the SCPD.
Special care must be taken when selecting a SCPD for motor-starting applications to prevent nuisance tripping, and at the same time ensuririg adequate protection to the motor and associated cabling.

Another function of the SCPD is to protect the control device (e.g. contactor) from high-current, high-energy faults. Therefore, attention must also be paid when selecting an SCPD-Starter (contactor + thermal overload relay) combination.

When clearing a fault every SCPD has a finite opening time, which will result in an amount of fault current and energy being "let-through" to the downstream system and other devices. At the same time, a control device, such as a contactor can only withstand a finite level of fault current and energy, otherwise internal damage could occur.
Even at relatively low fault levels the electromagnetic forces created by the fault current can cause the contacts of a contactor to lift. This can cause heating or even mild arcing which in turn can damage or weld the contacts of the contactor.

Furthermore, the let-through current of the SCPD can distort the bi-metal strip in the overload relay. This can prevent the restoration of the bi-metal strip to its original configuration on cooling, altering the relay's protection characteristics and resulting in under or over protection of the motor.
What solutions are available to me?
Good component design in association with correct component co-ordination is the only way to ensure reliable protection and operation under abnormal condition.

Terasaki circuit breakers and Sprecher + Schuh starter combinations are tested to provide full and safe co-ordination for most motor starting applications.


## Motor Starting <br> What is co-ordination

The motor starter consists of a combination of contactor, overload relay and Short Circuit Protection 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 breakers must takeover 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.

It is a requirement of the Australian Standard AS 3947.4.1 that combination motor starters are capable of withstanding the effects of load side short circuits. Some damage to the combination is permitted, but this must be confined and not present a risk to the operator, or damage equipment adjacent to the starter.
Contactors and thermal overload relays only have limited ability to withstand the high current associated with a fault such as an internal motor short. Their design is optimised for performance at much lower currents and to design in the ability to control or withstand high fault levels would add to costs and possibly reduce its performance at normal levels.

## The standards

The requirements of several standards can be applied to these combination units. The Wiring Rules, AS 3000, are concerned mainly with setting standards for the fixed wiring. In this regard the concern is the wiring between the protection device and the motor.
As motors can experience short term overloading the current rating of a fuse can be up 4 times and a circuit breaker 2.5 times the full load rating of the motor. The Wiring Rules allow the overload protection and the short circuit protection to be provided by different devices. This allows magnetic only circuit breakers, or back-up type fuses, to be used in conjunction with a contactor/thermal overload relay configuration.
Isolating switches must also be provided in the motor or control circuit. These are to be in clear view of any person working on the motor, or provided with a locking device.

AS 3947.4.1 specifies testing requirements for the combination of components required to perform the motor control and protection functions. If the equipment has been mounted in a switchboard it is possible to meet the testing requirements of AS 3947.2 short circuit withstand of the outgoing circuit at the same time as the tests to AS 3947.4.1 are performed.
Both standards look at the performance of the equipment when a fault occurs on the outgoing circuit. It is accepted in these standards that some damage may be sustained by the components of the starter when subjected to short circuit conditions.

AS 3947.2 requires that during the tests the equipment installed in the switchboard performs in accordance to its own standard. A selection by the customer of the performance required needs to be made, as AS 3947.4.1 allows for Type ' 1 ' and Type '2' performance.

## Type '1'

Under short circuit conditions the starter shall not caute danger to persons or the installation. The starter itselfimay need repair.
Type '2'
After a short circuit the starter is suitable for further service. A contact weld is permitted, but it must be easily separated - for example, by a screwdriver, without significant deformation.

Type ' 2 ' co-ordination does not mean the starter is suitable for normal operation without inspection/repair of the contacts. So, in both cases it is important that the condition of the starter is checked, to ensure that the SCPD has operated and that no damage has taken place.


Notes: IEC Standards are the basis of many Australian Standards. AS 3947.4.1 is equivalent to IEC 947.4.1 and AS 3947.2 is equivalent to IEC 947.2.
Both Australian standards list some amendments to the IEC versions.

Typical arrangement for co-ordination test


## Motor Starting Protective devices selection

In most cases very little difference will be noticed in the service performance of a system using fuses as against circuit breakers.
The circuit breaker is easier when it comes to restoring power, but as tripping should only be the result of a system fault it is unwise to reclose the circuit breaker without finding the cause. In this'regard it is normal for only a "skilled person" to attend to fuse replacement and they are more likely to check for other problems.
As the circuit breaker or fuse is operating in conjunction with separate motor overioad protection, it is the contactor which responds to overload problems. This is different to a protective device on a distribution circuit. For this application the advantages of the circuit breakers easy return to service has caused a general trend towards using circuit breakers.
Consideration should be given to preventing unskilled people from reclosing a tripped circuit breaker in a motor control application. This can be done by making the switchboard only accessible to the correct people, or by requiring the switchboard to be opened to reset the circuit breaker.
It must be assumed with both Type ' 1 ' and Type ' 2 ' co-ordination that if the short circuit protective device has operated there is a fault in the motor, or wiring to it and that the starter itself needs attention.
It is the let-through energy of the protective device which determines the damage to the starter. As this varies greatly between different models, it is essential that only proven combinations are used.
NHP, Sprecher + Schuh and Terasaki have now conducted many tests on different combinations and these are detailed in the co-ordination tables.

## Terasaki circuit breakers for short circuit protection

Terasaki circuit breakers have been tested in combination with Sprecher + Schuh contactors and overioads and can be used for Type '1' and Type '2' co-ordination requirements. (Refer to following tables for actual combinations).
TemBreak
A new generation of MCCB's offering a choice of 3 series (economical, standard and high fault) and two types, ie, adjustable thermal magnetic or microprocessor based solid state OCR are available from Terasaki. Both types have common construction features and interchangeable plug-in accessories. TemBreak thermal-magnetic MCCB's offer a wide adjustment range, with $63 \%$ to $100 \%$ of rated current. Each MCCB is individually calibrated to ensure precision tripping on overcurrent.

## TemBreak electronic type

The rated current of the electronic type TemBreak is adjustable in 15 steps from $50 \%$ to $100 \%$ of the nominal rated current, using the base current (lo) select switch and the pickup current (I1) setting dial.
This is one of the essential features for precise protection co-ordination and for low voltage distribution systems.

## TemBreak motor protection circuit breaker

The XM30PB circuit breaker will protect contactor starters with direct connected overcurrent relays with ratings 1 amp to 12 amp in systems with up to 50kA rms prospective short circuit. The protection is due to the special current limiting effect of the XM30PB.

## Motor starter protection

The XM30PB circuit breaker has been developed for motor starter protection and is suitable as the Short Circuit Protection Device (SCPD) for motor starters equipped with either direct connected or CT connected overcurrent relays.

## XM30PB compared to HRC fuse

The circuit breaker tripping charactenstic is more suitable for protection of starters than the HRC fuse. Unlike the HRC fuse, the breaker can be selected to trip instantaneously at a predetermined current level just lower than the maximum breaking current of the starter contactor, thus always protecting the contactor against opening fault currents higher than its capability. This can be seen from the typical breaker and fuse tripping characteristics compared to the contactor breaking capacity in figure 1.
No protection is provided by the fuse when the overcurrent is of value B to C amps should the contactor open by earth fault relay. If the breaker is used as a SCPD then protection is provided for all currents in excess of the instantaneous trip current of the breaker. Also, the circuit breaker can be tripped by earth fault relay and so prevent the risk of contactor damage due to the long delay of the HRC fuse interruption if the fault current is of a value between $B$ and $C$.



[^7]${ }^{2}$ ) Thermal or electronic overload relays may be used. Some combinations also achieve Type ' 2 ' performance. CA 7 contactor can be replaced with equivalent CA 3 size.

## Type ' 2 ' short circuit co-ordination Terasaki Din-T at 50kA

The 10kA Din-T miniature circuit breaker gives an amazing 50 kA performance when used in the combinations shown in the co-ordination tables. For the low current ratings, the resistance of the thermal overloads assists in reducing the current to a level that the Din-T can handle with ease. For the higher ratings a Sprecher + Schuh limiter block lifts the combined performance to the 50 kA level.
All the listed Din-T combinations include a rotary isolator which allows external control. To reset the starter after a short circuit, access to the breaker is required. This can be used to prevent unskilled operators from reclosing the motor starter after a fault.
It should also be remembered that whenever the circuit breaker trips under high fault currents, the contactor must be checked for welded contacts.


KTA 3 Motor starter combination

## Type '2' co-ordination table for Din-T circuit breakers with rotary isolator DOL starting 50kA @ 415V to AS 3947.4.1

| Motor size kW | Appro amps 415 V | Sprecher Schuh isolator | Terasaki circuit breaker | Sprech Schuh current limiter | Sprecher + Schuh contactor | Schuh thermal overload relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |
| 0.55 | 15 | LA380 | Bin-T |  | CA 7 | CT 7 | 1-1:6 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  | C4 723 | CT 7.24 | 2.4-4 |
|  |  |  |  |  |  |  |  |
|  | 4.8 | 80 | DinTt | KTL 3 -65 | A 7.23 | CT 724 |  |
|  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |
| 150, 280, - LA 3-100 |  |  | Din-T 10 | KTL3-65 | CA 7-37 | CT745 | 18-30 |
|  |  |  |  |  |  |  |  |

[^8]

Notes: ') Use 'magnetic only' breaker or next higher circuit breaker/contactor combination. Refer NHP
${ }^{2}$ ) Use with separate mounting bracket.
${ }^{\text { }}$ ) Thermal or electronic overload relays may be used
Combinations based on the thermal overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.


Notes: ') Thermal or electronic overload relays may be used.
${ }^{2}$ ) Use with separate mounting bracket.
Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

Type ' 2 ' short circuit co-ordination
TYPE 2
Motor starter co-ordination table for DOL starting 85kA, 415V to AS 3947-4-1

| Motor size kW | Approx. FLC at 415 V amps | Terasaki circuit breaker | Sprecher + Schuh contactor type | Sprecher + Schuh thermal overload type ${ }^{1}$ ) | range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
|  |  |  |  |  |  |
| 1.1 | 2.6 | XM30PE/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 15 5 |  |  |  |  |  |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7.12 |
|  |  |  |  |  |  |
| 4 | 8.2 | XM30PB/10 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
|  |  |  |  |  |  |
| 7.5 | 14 | TL100NJ/20 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
|  |  |  |  |  |  |
| 10 | 19 | TL100NJ/32 | CA $7-30$ | CEP 7-M32-32-10 | 12-32 |
|  |  |  |  |  |  |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
|  |  |  |  |  |  |
| 22 | 40 | . TL100NJ/63 | CA $7-43$ | CEP 7-M45-45-10 | 14-45 |
|  |  |  |  |  |  |
| 37 | 66 | -TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
|  |  |  |  |  |  |
| 55 | 100 | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
|  |  |  |  |  |  |
| 90 | 160 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
|  |  |  |  |  |  |
| 132 | 230 | TL400NE/400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
|  |  |  |  |  |  |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

Notes: ') Thermal or electronic overload relays may be used.
Combinations based on the overload relay tripping before the circuit breaker at overload currents up to the motor locked rotor current.

## Motor circuit application table for DOL starting General applications

High fault range

| Motor rating (kW) | Approx. FLC (amps) | Din-T <br> C \& D <br> Curve |  XS125CJ <br> XS125NJ <br> Safe-T  <br> XH125NJ  |  |   XS400SE <br> XH400SE <br>  XS250NJ <br> XS400CJ  <br> XE225NC   |  |  | $\begin{aligned} & \text { XH630SE } \\ & \text { XS630SE XS800NJ } \\ & \text { XS630CJ XH800SE XS1250SE/ } \\ & \text { XS630NJ XS800SE } 1000 \end{aligned}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |  |
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|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{lllll}5.5 & 11 & 32 & 32 & 32\end{array}$ |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| $\begin{array}{lllll}10 & 19 & 50 & 50 & 50\end{array}$ |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 15-28 63 63 63 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 22 | 40 | 125): | 100 | 100 |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 30.55 \% 125 \% 160 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 45.80 - 8 , 125) 125, 160, |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 75.130 , 1 , 1 , 1225 , 250 , 250 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | 200 |  |  |  |  |  | 400 | 400 |  |  |  |
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| $185-320 \mathrm{~F}$ |  |  |  |  |  |  |  |  |  |  |  |
| $200361 . \quad \because \quad \because \quad \because \quad 630$ |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 250.430 , $630 \% 800$ |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 300 510, 6 |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | 750 |  |  |  |  |  |  |  |  |  | 000 |

Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ of full load current (FLC) continuously and $600 \%$ of FLC for at least 10 seconds. Lower circuit breaker ratings are possible in some applications. Refer NHP.
') 80,100 and 125 amp refers to Din-T10H type
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) Use magnetic-only TemBreak MCCB. Refer NHP.
Adjustable magnetic trips set to high. Thermal magnetic TemBreak adjustable $63 \%-100 \%$ of NRC (nominal rated current). Din-T MCB's are calibrated to IEC 898 Curve ' $C$ ' \& ' $D$ '. Selected sizes of ' $D$ ' Curve are available from stock. Refer NHP.


## Motor circuit application table for reduced voltage starting General applications

Breaker type and current rating，star delta，auto transformer resistor or reactance starting

|  |  |  |  | XS125CJ |  |  | XS400SE | XH630SE |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Motor | Approx： | Din－T |  | XS125NJ |  |  | XH400SE | XS630SE | XS800NJ |  |
| rating | FLC | $C \& D$ |  | XH125NJ |  | XS250NJ | XS400CJ | XS630CJ | XH800SE | XS1250SE |
| （kW） | （amps） | Curve | Safe－T | TL100NJ＇） | XE225NC | XH250NJ | XS 400 NJ | XS630NJ | XS800SE | 1000 |
| $0.37 \mathrm{k}$ | 1468 |  |  |  |  |  |  |  |  | W－＋ |
| 0.55 | 1.5 | 4 | 6 | 20 |  |  |  |  |  |  |
|  |  | 40， | 6委綡 | 20．9x | 刧 | 57xay | Whatuma |  | 3 |  |
| 1.1 | 2.6 | 6 | 6 | 20 |  |  |  |  |  |  |
| $15 \mathrm{~F}$ | $3.4: 18 \mathrm{xk}$ | $80 \times 5$ | Whex | $52014 \times 5$ |  | 4ik | $5 \mathrm{x}$ | $8$ | 14\％ | Khe |
| 2.2 | 4.8 | 10 | 10 | 20 |  |  |  |  |  |  |




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





Notes：These motor circuit application tables are to be used as a selection guide for average 3 phase， 4 pole 415 V motors for standard applications only．The table is based on holding $125 \%$ FLC continuously and $350 \%$ FLC for at least 20 seconds．
1） 80,100 and 125 amp refers to Din－T10H type．
${ }^{2}$ ）Type＇SE＇Tem8reak MCC8 only．
${ }^{2}$ ）TL100NJ up to 100 A only．
If co－ordination to IEC 947－4－1 is required refer to Type 1 and 2 co－ordination tables，contact NHP．
Din－T MCB＇s are calibrated to IEC 898 Curve＇$C$＇$\&$＇$D$＇．Selected sizes of＇$D$＇Curve are available from stock．Refer NHP．



TemBreak XV400NE mining breaker


Sprecher + Schuh 1000 V CA 6 contactor
(Refer Part A for more information)


Notes: These motor circuit application tables are to be used as a selection guide for average 3 phase, 4 pole 415 V motors for standard applications only. The table is based on holding $125 \%$ FLC continuously and $600 \%$ FLC for at least 20 seconds.
${ }^{\text {') }} 80,100$ and 125 amp refers to Din-T10H type.
${ }^{2}$ ) Type 'SE' TemBreak MCCB only.
${ }^{3}$ ) TL100NJ up to 100 A only.
Din-T MCB's are calibrated to IEC 898 Curve 'C' \& 'D'. Selected sizes of ' $D$ ' Curve are available from stock reter NHP.


Note: When used at 400 Hz , the rated current setting of the OCR must not exceed the values shown in Column 4.

## MCCB's for protection of Power Factor Correction (PFC) units

In circuits containing capacitor banks for Power Factor Correction (PFC) two conditions that the circuit breaker must overcome are as follows:

1. Voltage surges during MCCB opening.
2. Nuisance tripping due to in-rush current.
3. Voltage surges during MCCB opening

At the instant where the MCCB has to open, the voltage developed across its contacts can be up to twice the supply voltage, which can have damaging consequences should the breaker be slow to operate. If this worse case scenario actually occurs a potential re-arcing can take place across the contacts of the MCCB, until the breaker has fully opened and the distance between the contacts is at a maximum.
Re-arcing at each instant can be:
1 st re-arcing $\quad-\quad 3 \times$ supply voltage
2nd re-arcing - $5 \times$ supply voltage
3rd re-arcing - $7 \times$ supply voltage
Internal capacitor damage will occur if the voltage level is greater than the capacitor's Dielectric Strength. With modern-day protection devices, (for example the Terasaki TemBreak MCCB's) this problem will not occur.
The numerous cases of re-arcing are mainly a result of older style "deperidant manual closing" devices, which rely on the operator speed for opening or closing
All Terasaki MCCB's are of the "manually independent closing" type, with high speed opening to prevent re-arcing between the contacts.

## 2. Nuisance tripping due to in-rush current

 When feeding a circuit containing a PFC unit the circuit breaker and the PFC unit can be exposed to a large in-rush current, equal to the instantaneous value of the power source. The end result of this is a large in-rush current, which could cause the circuit breaker to operate instantaneously due to its short-circuit protection. (The value of in-rush current will depend on the source voltage, the inductance and reactance in the circuit).Special care should be taken to ensure that the MCCB selected will not nuisance trip due to high in-rush currents.

The table below shows typical MCCB selections for varying capacitor ratings, and the breaker selection is by a rule-ofthumb.

Capacitor Rated Current $=\frac{\text { kVAR } \times 1000}{\sqrt{3 \times V}}(A)$
kVAR: Capacitor Rating
V: Source Voltage
MCCB Rating $=$ Capacitor Rated Current $\times 1.5(\mathrm{~A})$
Once the MCCB rating has been determined, the MCCB type should be selected according to the short circuit fault level of the system.

## MCCB's selection for power factor capacitor application



Note: ') Select applicable short circuit rating required by system specifications.
${ }^{2}$ ) TemBreak Plus MCCBs can also be used.

## Circuit breaker selection for DC applications

The characteristics of an MCB or MCCB for DC applications are different from AC. The main differences are as follows:

1. Maximum permissible voltage is reduced in value (refer table).
2. Number of electrical operations is reduced (refer table).
3. Magnetic trip current increases by $40 \%$.

Selecting the circuit breaker
When selecting the MCB most suitable for the protection of DC circuits the following criteria must be considered:

- Rated current.
$\square$ Rated voltage which determines the number of poles required to be involved in the interruption of the circuit.
- The type of DC system used.
- Maximum short circuit current to determine the breaking capacity.
As a general rule the Isc (short circuit current at the battery terminals) can be calculated as follows:

$$
\mathrm{Isc}=\frac{\mathrm{Vb}}{\mathrm{Ri}}
$$

Where Vb - maximum discharge battery voltage
Where Ri - internal resistance (sum of all calls resistance) generally expressed in Ampere/hour capacity of the battery.

Terasaki MCB use in DC systems

| МСВ type | Breaking capacity kA ') | of poles connected in se |  |  |  | No. of operations at In | Magnetic trip increase |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |

Example: For a Din-T10 to break 10kA at 110 V DC it must have 2 poles connected in series.
Breaking capacities of TemBreak MCCB in DC systems
MCCB


## Notes:

') Time constant (LR) $<=15 \mathrm{~ms}$; excludes 50/63A where the time constant (UR) $<=4 \mathrm{~ms}$.
${ }^{2}$ ) Special version of the standard AC circuit breaker. Standard circuit breakers cannot be used at these ratings. Please specify for use on 500 or 600 V OC on application. Indent only.
${ }^{3}$ ) Magnetic trip only, without overload protection. Indent only.
For voltage levels up to and including 250V DC standard 2-pole breakers maybe be used, with both poles connected in senes. For voltage levels greater than 250 V DC 3-pole breakers must be used, with all three poles connected in series as shown.
The time constant (UR) 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 $>10 \mathrm{kA}$.

The following connection diagram should be applied to TemBreak circuit breakers when the voltage is greater than $250 \mathrm{~V} D C$.



## Circuit breaker selection for DC application (cont.)

Arrangement of breaking poles according to type of system.
Both poles insulated from earth

## Protection only



The poles required to interrupt the fault can be divided between the (+) and (-) polarities. The total number of poles connected in series should be capable of breaking the short circuit current at a voltage level of $\mathrm{U}_{\mathrm{b}}$ -

Sharing the circuit breaker interrupting poles between both polarities also ensures isolation as well as protection of the sysiem.

One polarity of the DC supply is earthed
Protection only


Full protection is assured if the total number of poles in series on the side not connected to earth are capable of breaking the short circuit current at a voltage level of $U_{b}$.

If full isolation is required then at least one interrupting pole is also required on the earthed polarity side.

Protection and Isolation


Protection and Isolation


Protection and Isolation

The centre point of the DC supply is earthed


To ensure full protection the number of poles connected in series on each polarity must be capable of breaking the maximum short circuit current, but at a reduced voltage level of $U_{b} / 2$.

Having circuit breaker interrupting poles breaking both polarities ensures isolation as well as protection of the system.

## Selection of MCCB's for use in welder circuits

1. Definitions
$\mathbf{P}=\quad$ Rated capacity of welder in KVA.
V $=\quad$ Welder rated voltage.
$11=\quad$ Maximum primary current (PN).
$\mathrm{T}_{1}=$ Current 'ON' period.
$T_{2}=$ Current 'OFF' period.
$T_{1}+T_{2}=$ One welding cycle time.
$B=$ Duty ratio, current 'ON' period divided by one welding cycle.
Ie $=$ Thermally equivalent continuous current.
2. MCCB selection
a) Current rating

It can be seen from the diagrams below that the welder only draws current intermittently. MCCB selection should be based on the thermally equivalent continuous current, i.e. the current which would produce the MCCB average temperature shown in the diagram below.
It can further be seen that the MCCB temperature will not be constant but will vary as the load varies.


## The thermally equivalent continuous current, le, may be calculated from:

$$
\text { Ie }=\frac{P \times 1000}{V} \times \sqrt{ } \quad\left(B=\frac{T_{1}}{T_{1}+T_{2}}\right)
$$

Note: The rated capacity of a spot welder is normally expressed in terms of its $50 \%$ duty ratio, ie. $B=0.5$.

Once an MCCB has been selected, it is necessary, to compare the maximum primary current $l_{1}$ and the current 'ON' period, $\mathrm{T}_{1}$ with the MCCB characteristic curve to ensure that it will not trip.


Note: A tolerance of 10 to $15 \%$ should be included to allow for variations in the supply voltage and equipment.

## General guide lines for MCCB selection

| Selection factor | MCCB rating |
| :--- | :--- |
| Resistance welders | 3.00 max |
| Transformer arc welders | 2.00 max |

SAA wiring rules states that a circuit breaker protecting a circuit from which one or more welders are supplied may be greater than the rating of the protected conductor calculated as follows:

The maximum demand of the circuit excluding that of the largest welding machine plus
i) Three times the primary current of the largest resistance welding.
ii) Two times the primary ratings of the largest transformer arc welders.


The value of $K$ varies depending on the type of welder control employed. (Some form of synchronous closing is nearly always employed in order to stabilise the welding work and to prevent nuisance tripping of the MCCB).
$K=1$ to 1.5 for synchronous type with peak control.
$K=1.4$ to 3 for synchronous type without peak control.
$K=2$ to 6 for non-synchronous soft start type.
If the protection of the thyristor stack is also required, the instantaneous trip setting must be greater than $\mathrm{Im}_{\mathrm{m}}$, but less than the surge on-state current rating of the thyristor stack:

where:
Is = surge on-state current rating of thyristor stack, in A
Im = maximum welder input current at start of welding, in A
$I_{\text {wss }}=$ MCCB Instantaneous trip setting, in A
$1.1=$ Factor to allow for $\pm 10 \%$ tolerance on the instantaneous setting
c) MCCB breaking capacity

The MCCB breaking capacity should be higher than the estimated short-circuit fault level of the system.

## Primary LV/LV transformer protection

When selecting an MCCB to protect the primary of an LV/LV transformer, the inrush current during initial energisation must be taken into account.
The magnitude of inrush current for any transformer is governed by several variables:

1. The primary winding resistance.
2. The supply impedance.
3. The excitation current.

The excitation current is, in theory at a maximum when the voltage is at a minimum, and vice versa.
Usually the level does not exceed 30 times the normal operating current.
If the inrush current is not known then a rule of thumb is that it is approximately $15 \times$ the Primary Current.


The above breaker selections are based upon inrush currents calculated using the table below

Single-phase transformer

| (kVA) | First peak multiplier | Decay time constant | First peak multiplier | Decay time constant |
| :---: | :---: | :---: | :---: | :---: |
| 5-10 | 34 | 3-6 | 32 | 3-6 |
|  |  |  |  |  |
| 30 | - | - | 26 | 3-6 |
|  |  |  |  |  |
| 75 | - | - | 20 | 4-7 |
|  |  |  |  |  |
| 150 | - | - | 16 | 6-10 |
|  |  |  |  |  |
| 300 | - | - | 12 | 6-10 |

[^9]The above table/multipliers are in general larger than the practical current levels, as the current limiting by the circuit impedance is not taken into account.

Notes: Observe the requirements of AS 3000 for No. of lighting points on a final sub-circuit.

## MCB selection for fluorescent lighting loads

## Assumptions

1. The power rating of the ballast is $25 \%$ of power of the tubes.
2. Power factor -0.6 for non compensated fittings 0.86 for compensated fittings.
3. MCB's are installed in an enclosure with external ambient of $25^{\circ} \mathrm{C}$.
4. Based on $415 / 240 \mathrm{~V} 3$ phase or 240 V single phase systems.
5. MCB is used for circuit protection only, not switching.

For switching duties of Din-T MCBs refer NHP.

This table provides details for Din-T type 'C' MCB's


## MCB selection for incandescent lighting loads

## Assumptions

1) Tungsten lamps have theoretical inrush current of 14 times normal current, when switched from cold.
2) The circuit impedance typically limits the inrush to 10 times normal running current, the inrush current peaking at 0.0007 seconds falling exponentially to normal running current within 0.1 seconds.
3) Consider the worst case, if all lamps are switched on simultaneously, then nuisance tripping of MCB may result.
4) Above is based on $415 / 240 \mathrm{~V} 3$ phase and neutral or 240 V single phase system and 240 V lamps.
5) MCB is used for circuit protection only, not switching. For switching duties of Din-T MCB's refer NHP.

Method
In order to cope with this inrush the following formula should be used to calculate breaker size:
Breaker rating = $\qquad$
Where $W=$ total wattage
Where P = Number of phases
linst $\quad=$ Minimum instantaneous tripping co-efficient.
C curve $=5$
D curve $=10$

Notes: Observe the requirements of AS 3000 for No. of lighting points on a final sub-circuit.

## TemBreak MCCB clearance requirements at 380/41.5V

Clearance requirements for MCCB's (phase to phase and earth).
When MCCB's 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 therefore 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 380/415V
When earth metal is installed within the proximity of the breakers the correct insulating distance must be maintained.

WARNING:
EXPOSED CONDUCTORS INCLUDING TERMINALS AT attached busbaris'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. Al! dimensions in mm .
When earthed metal is installed within the proximity of the breakers the correct insulating distance must be maintained (refer to Table 1). This distance is necessary to allow the exhausted arc gases to disperse.

This distance is necessary to allow the exhausted arc gases to disperse.


Table 1 below illustrates the min 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)
Table 1
This table is valid for $380 / 415 \mathrm{~V}$

B2 Distance 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 |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |
| XS125CJ, XS125NJ, XH125NJ, XH125PJ | 75 | 45 | 25 | 0 | 25 |
| XE225NC |  |  |  |  |  |
| XS250NJ | 80 | 60 | 30 | 0 | 25 |
|  |  |  |  |  |  |
| XH250PJ, XS400CJ, XS400NJ, XS400SE | 100 | 70 | 40 | 0 | 30 |
|  |  |  |  |  |  |
| XH630SE, XH800SE, XH800PE | 150 | 80 | 50 | 0 | 40 |
|  |  |  |  |  |  |
| XH630PJ, XH800PJ, XS1600NE, XS2000NE, XS2500NE | 150 | 150 | 100 | 0 | 100 |

## Clearance for mining MCCB's (1100 V) and incoming connections

The arc chamber in Terasaki TemBreak circuit breakers is located adjacent to the LINE side terminals. The chamber is vented through holes located just above each line terminal. The holes are covered by a flap which deflects when arc gases are being expelled. Even at low fault levels the arc gases that are released are very hot and reduce the dielectric strength of the air in the vicinity of the terminals. If care is not taken when installing the TemBreak this gas can cause arcing faults on the incoming bars or cables.

Significant voltage transients may also be produced as inductive circuits are switched and contribute to an arcing fault.
These problems affect all circuit breaker installations to varying degrees.
To ensure that problems are not created by the installation please observe the following recommendations.


## Notes:

1: Always observe LINE/LOAD marking.
2: Ensure insulation on incoming conductors is adequate. Do not use low grade heat shrink (some grades split at operating temperatures).
3: Minimum clearance to earth metal, Above and below breaker - 120 mm (XV1250NE-150mm) To sides of breaker -40 mm .

4: Switchboard construction to be a minimum form 2 to AS 3439.1 with IP $3 \times$ protection between busbar and circuit break zones
5: Actual construction can vary to the above but in all cases it is the responsibility of the switchboard manufacturer to ensure compliance to the relevant standard ie. AS 3439.1.
${ }^{\text {e) }}$ ) TL100EM MCCB's must use a TL100EMTLC lineside terminal cover. XV400 can use either a terminal cover or Interpole Barriers.


## Calculation of circuit fault level

## NHP Nomogram

Fault calculation
The NHP Nomogram is a simple and easy to use aid. Developed by NHP to enable convenient and accurate calculation of circuit fault current.
When selecting circuit breakers for the use in modern distribution systems, it is important to calculate the fault level and then choose an MCCB with breaking capacity that is either higher or at least equal to the circuit fault current.
How to use the Nomogram
In the nomogram all you need to know is the size and length of the cable or cables and the size of the Transformer in kVA. The fault level at the terminals of the transformer is very dependant upon the Transformer internal impedance eg. the Australian Standard for a 2000 KVA transformer is $6.5 \%-7 \%$ impedance. This results in a fault level of $40-43 \mathrm{kA}$.

However, many Supply Authorities are now installing low impedance transformer eg. $5 \%$ or less. Thus if the impedance is $5 \%$ then the fault level will be 56 kA . If the impedance is unknown on the side of caution choose $Z=$ $5 \%$ in your calculations.
eg. From the table, the maximum fault level of a 2000 kVA transformer, with $Z=5 \%$ is 56 kA . Proceed then to calculate the resultant fault level by applying the cable size and length in metres to the Transformer secondary fault level and calculate the resultant. By following the example shown it can be seen that the fault level is reduced from 50 kA to 6.7 kA .

[^10]


A series of application notes are available on Terasaki breakers from your nearest NHP branch. The notes cover the following subjects.
Ref No.

## Description

5006
5025
Specification for corrosive proofing of MCCB's
De-rated current of ACB's when enclosed
De-rated current of MCCB's when enclosed
De-rating of TemBreak electronic MCCB's when enclosed
DC applications of ACB's
Reverse connection
Thyristor protection with MCCB's ELCB's at high frequency
ACB's and MCCB's at high altitude
Circuit breaker life mechanical and electrica
TemBreak UVT: transient response time Inspection and maintenance of earth leakage and moulded case circuit breakers.

## IP rating protection against ingress of dust and liquids



|  | 1st digit <br> Degree of protection against contact and ingress of foreign bodies |  | 2nd digit <br> Degree of protection against ingress of liquids |
| :---: | :---: | :---: | :---: |
| 0 | No protection | 0 | No protection |
| 1 | Protection against ingress of solid foreign bodies with diameters greater than 50 mm | 1 | Protection against vertically falling water drops |
| 2 | Protection against contact with the fingers, protection against ingress of solid foreign bodies with diameter greater than 12 mm | 2 | Protection against obliquely falling water, up to an angle of $15^{\circ}$ |
| 3 | Protection against contact with wires etc., with diameters greater than 2.5 mm , or ingress of solid foreign bodies with diameters greater than 2.5 mm | 3 | Protection against obliquely sprayed water, up to an angle of $60^{\circ}$ from the vertical |
|  | Protection against contact with wires etc., with diameter greater than 1 mm , or ingress of solid foreign bodies with diameters greater than 1 mm | 4 | Protection against sprayed low pressure water from any direction |
|  | Complete protection against contact with live parts, protection against harmful deposits of dust | 5 | Protection against water-jets from any direction - limited ingress permitted |
| 6 | Complete protection against contact with live parts, protection against ingress of dust | 6 | Protection against strong jets of water eg. ship decks |
|  |  | 7 | Protection against temporary immersion in water |
|  |  | 8 | Protection against indefinite immersion in water - under pressure |

## Appendix 16: MCB's

Manufacturer:
Supplier Contact:

NHP<br>MPA Engineering 3/22-24 Strathwyn Street<br>Brendale QLD 4500<br>073881.0722



## Din-Safe-M add-on earth leakage modules (cont.)

The Din-Safe-M package contains all the necessary parts to combine the earth leakage module and the Din-T MCB to form a combination MCB/RCD.

All parts required to complete this unit are supplied - including protection caps, clips and assembly instruction sheet.

Din-Safe-M module and MCB combination offer the following functions:
$\beth$ Protection against earth leakage faults thus protecting against:

- indirect contact
- direct contact
- fire
- Trip Sensitivities ( $I \Delta n$ ):
- 30 mA
- 100 mA
- 300 mA

〕 Short circuit protection.

- Overload protection.

Operation
The combined Din-T MCB/Din-Safe-M earth leakage modiule has two operating toggles which indicate the reason for the trip:

- 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 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.


## Test button

The built-in test facility simulates an earth fault ensuring correct operation of MCB + RCD components.

Testing is recommended monthly.


Fitting of Din-T auxiliary and alarm switches or Din-T shunt are not affected and will function as normal.


## Din－Safe single pole width residual current circuit breaker（RCBO）

－Standards AS／NZ 1009.
－Approval N17482．
－Mines department approval－Pending．
－One module wide（ 18 mm ）．
$」$ Short circuit，overcurrent and earth leakage protection．
」 Short circuit protection 10 kA ．
$\lrcorner$ Sensitivity 10 and 30 mA ．
」 Din rail mount．
$\lrcorner$ Suits CD chassis．

| Amp <br> rating | Modules <br> （18mm） | Voltage AC | Short circuit | Trip Sensitivity ${ }^{3}$ | $\left.{ }^{3}\right)$ Cat．No ${ }^{1}$ ）${ }^{2}$ ） |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 | 1 | 240 | 10 kA | 30 mA | ［DSRCBH0630A |
| 10 | 1 | 240 | 10 kA | 30 mA | DSRCBH1030A |
| 16 | 1 | 240 | 10 kA | 30 mA | DSRCBH1630A |
| 20 | 1 | 240 | 10 kA | 30 mA | DSRCBH2030A |
| 25 | 1 | 240 | 10 kA | 30 mA | DSRCBH2530A |
| 32 | 1 | 240 | 10 kA | 30 mA | DSRCBH3230A |
| 40 | 1 | 240 | 10 kA | 30 mA | ［］SSRCBH4030A |
| 6 | 1 | 240 | 10 kA | 10 mA | ［i］DSACBH0610A |
| 10 | 1 | 240 | 10 kA | 10 mA | ［］DSRCBH1010A |
| 16 | 1 | 240 | 10 kA | 10 mA | ［］DSRCBH1610A |
| 20 | 1 | 240 | 10 kA | 10 mA | ［］DSRCBH2010A |
| 25 | 1 | 240 | 10 kA | 10 mA | ［ $]$ DSRCBH2510A |
| 32 | 1 | 240 | 10 kA | 10 mA | ［］DSRCBH3210A |
| 40 | 1 | 240 | 10 kA | 10 mA | ［JDSRCBH4010A |

Note：＇）Neutral not switched
${ }^{3}$ ）Mines Dept．approval applies to
${ }^{2}$ ）Will not accept side mounting accessories

30 mA units only．

## Operation

This unit combines the overload and short circuit protection of an MCB with earth leakage protection of an RCD．The unit occupies one，sub－ circuit（one pole）of the distribution board and provides single phase prolection against overload，short circuit and earth leakage current．
－The MCB element provides thermal and magnetic tripping protection which is rated to 10 kA prospective fault current．
－The RCD element of the device provides core－balance detection of the difference between the active and neutral currents and amplification to provide high sensitivity．The rated residual operating current $(1 \Delta n)$ is 10 mA or 30 mA ．
－The green／yellow earth reference cable in case of loss of supply neutral ensures the device will continue to provide earth leakage protection and will operate normally upon detection of an earth leakage current．

Dimensions（mm）



Application
The Din－Safe single pole width residual current circuit breaker will fit the standard Din－T chassis for use in NHP panelboards．The design makes it possible to provide an MCB complete with earth leakage protection in an 18 mm wide module which allows a greater number of devices to be fitted into a distribution board．

## Connection diagram



Accessories
Padlock bracket
Link bars and terminals Page 1．33，$\because$
Enclosures
Section 2
Technical data
Tripping characteristics
Page 3－29
Technical data／wiring Page 3－35

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

Din－Safe－M add－onearth leakage mocules
」 Standard AS 3190.
」 Approval No．N11974．
－Mines Department Approval－Pending．
」 Offers protection against overcurrent， earth leakage and short circuit faults when added to Din－T MCB．
－Test button．
－Indication of trip position．
Din－Safe－M modules to suit Din－T6， 10 and $15{ }^{6}$ ）



Notes：＇Mines approval for 30 mA units only．
${ }^{2}$ ） $1 \mathrm{P}+\mathrm{N}$ and $3 \mathrm{P}+\mathrm{N}$ type supply neutral is connected by ＇pigtail＇cable．
${ }^{3}$ ）Dimensions of Din－Safe－M unit only；add MCB dimensions for total installed width．
${ }^{\text {a }}$ ）＂MCB rating＂refers to the max．MCB size the module can be fitted to．
${ }^{\text {s）}} \mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}$ refers to dimensional diagrams refer page 3－45．
${ }^{6}$ ）Not suitable for Din－T 10 H ．
i）Available on indent only．


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


Din－T 6 series 6 kA MCB
－Standards AS3111，IEC 898.
－Approval No．N17481．
」 Current range 2－63 Amps 1， 2 and 3 pole．
」 Sealable and lockable handle．
」 Available in curve type $C$ and $D$ ．
$\lrcorner$ Mounts on CD chassis（250 A and 355 A）．

| 1 pole 1 module $\ln (A)$ | $\begin{aligned} & \text { C-Curve } \\ & 5-10 \mathrm{In} \end{aligned}$ |
| :---: | :---: |
| 2 | DTCB6102C |
| 4 | DTCB6104C |
| 6 | DTCB6106C |
| 10 | DTCB6110C |
| 13 | （1）DTCB6113C |
| 16 | DTCB6116C |
| 20 | DTCB6120C |
| 25 | DTCB6125C |
| 32 | DTCB6132C |
| 40 | DTCB6140C |
| 50 | DTCB6150C |
| 63 | DTCB6163C |


| 2 pole 2 modules |  |
| :--- | ---: |
| 2 | DTCB6202C |
| 4 | DTCB6204C |
| 6 | DTCB6206C |
| 10 | DTCB6210C |
| 13 | DTCB6213C |
| 16 | DTCB6216C |
| 20 | DTCB6220C |
| 25 |  |
| 32 |  |
| 40 |  |
| 50 |  |
| 63 |  |

3 pole 3 modules

| 2 | DTCB6302C |
| :---: | :---: |
| 4 | DTCB6304C |
| 6 | DTCB6306C |
| 10 | DTCB6310C |
| 13 | DTCB6313C |
| 16 | DTCB6316C |
| 20 | DTCB6320C |
| 25 | DTCB6325C |
| 32 | DTCB6332C |
| 40 | DTCB6340C |
| 50 | DTCB6350C |
| 63 | DTCB6363C |


| D－Curve |
| ---: |
| $10-20$ In |
| DTCB6102D |
| DTCB6104D |
| DTCB6106D |
| DTCB6110D |
| DTCB6113D |
| DTCB6116D |
| DTCB6120D |
| DTCB6125D |
| DTCB6132D |
| DTCB6140D |
| DTCB6150D |
| DTCB6163D |


| DTCB6202D |
| ---: |
| DTCB6204D |
| DTCB6206D |
| DTCB6210D |
| DTCB6213D |
| DTCB6216D |
| DTCB6220D |
| DTCB6225D |
| DTCB6232D |
| DTCB6240D |
| DTCB6250D |
| DTCB6263D |

DTCB6302D
i］DTCB6304D
BDTCB6306D DTCB6310D
－DTCB6313D DTCB6316D DTCB6320D DTCB6325D DTCB6332D DTCB6340D DTCB6350D DTCB6363D

Short circuit capacity 6 kA


Use at DC
When using Din－T6 in a DC application the magnetic tripping current is approximately $40 \%$ higher than in AC $50 / 60 \mathrm{~Hz}$ ．

Shock resistance（ $\ln \mathrm{X}, \mathrm{Y}, \mathrm{Z}$ directions）． 20 g with shock duration 10 ms （minimum 18 shocks）． 40 g with shock duration 5 ms （minimum 18 shocks）．

Vibration resistance（in $X, Y, Z$ directions）．
3 g in frequency range 10 to 55 Hz （operating time at least 30 min ）
According to IEC 60068－2－6
Storage temperature
From $-55^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$ ，according to IEC 88 part $2-1$ （duration 96 hours）．

Operating temperature
From $-25^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$ ，according to VDE 0664 parts 1 and 2.

Use at 400 Hz
At 400 Hz the magnetic trip current is approximately $50 \%$ higher than in $A C 50 / 60 \mathrm{~Hz}$ ．

| Accessories | Section |
| :---: | :---: |
| Add on RCD | 1－21 |
| Auxiliary／alarm | 1－31 |
| Shunt trip | 1－29 |
| UVT | 1－30 |
| Padlockable bracket | 1－33 |
| Link bars \＆terminals | 1－33， 39 |
| Enclosures | 2 |


| Technical dàta | Section |
| :---: | :---: |
| Technical data | 3 |
| Tripping characteristics | 3－6，8 |
| Dimensions | 3－22 |
| Notes：＇） 2 pole MCB connected in series． |  |
| The line side is the＂OFF＂（bottom）side of the |  |
| Available on ind |  |



## Miniature circuit breakers (cont.)

The NHP range of miniature circuit breakers features a complete range of quality products for the protection of an electrical installation against overcurrent, short circuit and earth leakage.

The choice of miniature circuit breakers is influenced by:
(i) the magnitude of the prospective short circuit current determined by

- the size of conductors.
- the capacity of the supply transformer.
- the distance between the transformer and the short circuit point.
(ii) The required selectivity or association of the upstream circuit breaker or fuses and the downstream devices:
(iii) The earthing system and the maximum cable length.
(iv) The maximum nominal current required by the circuit.
(v) The expected initial current determined by the type of load.

The Din-T series of miniature circuit breakers can offer an application solution in every area.
Supporting the Din-T series of circuit breakers are an assortment of accessories which complete the range they include:

- Auxiliary and alarm switches.
- Earth leakage modules type Din-Safe-M.
- Earth leakage circuit breakers type Din-Safe-MCB
- Earth leakage safety switches type Din-Safe.
- Earth leakage relays Din-Safe-R.
- Surge diverters.
- Time switches.
- DIN rail mountable meters.
- Main switches:
- Changeover switches
- Impulse relays.
- Hour run meters.
- DIN rail mount contactors
- Pilot lights.
- Pushbuttons.
- Busbar combinations and lugs.
- Insulated and metal enclosures.
- Shunt trips
- Under-voltage trips




## Miniature circuit breakers

The range of miniature circuit breakers stocked by NHP fall into two categories.

Safe-T range which is the NEMA style zero point extinguishing circuit breaker. This range covers 6 to 100 A in 1,2,3 and 4 pole configurations with a short circuit rating of 6 kA . Being a zero point extinguishing circuit breaker minimal current limiting is experienced during a short circuit. This situation in the past has been acceptable and was compensated for by designing a system to cope with the high currents.

However as systems became more detalled and sophisticated there was a need to find an alternative which would have features allowing greater control than using fuses or zero point extinguishing circuit breakers. This alternative was the Din-T range of miniature circuit breakers.

Din-T miniature circuit breakers are current limiting type device with a wide range of short circuit capacities, current ratings and curve types to choose from. Din-T circuit breakers are available in 6,10 and 15 kA from 0.5 to 125 A in 1,2,3, and 4 pole configurations.

As a brief comparison of the current limiting abilities of the Safe-T and Din-T circuit breakers, consider the graphs below.

Prior to miniature circuit breakers the most common device for overcurrent and short circuit protection was a fuse.

Fuses however have major disadvantages such as:

- After overcurrent or short circuit the fuse had to be replaced. In the case of a circuit breaker a reset only is required.
- Fuses could be replaced with different current ratings quite easily to overcome apparent problems.
- During overloads in three phase systems "single phasing" can occur when just one fuse blows. Especially for motor loads this is a great disadvantage.
- Fuses deteriorate with age.

Fuses have higher wattage losses.
The introduction of circuit breakers brought advantages such as:

- Less downtime - Quick reset.
- High circuit integrity due to different curve types and difficulty in interchanging different MCBs versus fuse cartridges.
- Increased personal safety through lower risk of contact with live parts.
- Simultaneous trip of all phases in a three phase system.
- No deterioration with age.
- Lower watts loss than a fuse.


3. Arc extinction time (orange stage) from arc formation to complete arc extinction. Din-T style $2 \times$ milliseconds, Safe-T style $10 \times$ milliseconds.
Because total operating time of Din-T is much faster than Safe-T style MCB, the level of let through energy in MCB is dramatically reduced. This is demonstrated by the difference in the $I^{2}$ t areas detailed above.


These graphs indicate the three stages of arc formation arc extinction and $l^{2} t$ let through values.

1. Instantaneous trip time (yellow slage) indicates fault current levels just prior to magnetic trip mechanism response. ( 7 -10In).
2. Magnetic response time (red stage) from time of magnetic trip operation to lime of arc being formed. Din-T style $1 . x$ millisecond. Sate-T style $3 \times$ milliseconds.

## Appendix 17: Contactors

Manufacturer:
Supplier Contact $\quad \therefore \quad$ MHP

$\quad$| MPA Engineering |
| :--- |
|  |
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|  |
|  |
|  |
|  |
|  |
|  |
|  |
|  |



Ratings to IEC 947 and AS $3497400 / 415$ V


Contactor CA 7-9


Contactor CA $7-72$


Contactor CA 6-105-EI


Contactor CA 6-170-EI


Contactor CA 6-250-EI


Contactor CA 6-420-EI

O For CA 7 contactors with coil terminals on line side, add ...V AC to Catalogue No. Eg - CA 7-9-10-240 V AC ${ }^{\text { }}$ )
O For CA 7 contactors with coil terminals on load side, add ...V AC-U to Catalogue No. Eg - CA 7-9-10-240 V AC-U
$A C 3$ AC $\left.3 \quad A C 1^{\prime}\right) A C 1^{\prime \prime}$ ) Auxiliary contacts
$400 / 415 \mathrm{~V} 400 / 415 \mathrm{~V}$ Amps Amps standard

| $\left.k W^{1}\right)$ | Amps ') | $40^{\circ} \mathrm{C}$ | $60^{\circ} \mathrm{C}$ | $\mathrm{N} / \mathrm{O}$ | N/C | Max. | Cat. No. ${ }^{2}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 | 9 | 32 | 32 | 1 | 0 | 9 | CA79910 VAC |
|  |  |  |  | 0 | 1 | 9 |  |
| 5.5 | 12 | 32 | 32 | 1 | 0 | 9 | CA $7210 . \mathrm{VAC}$ : |
|  |  |  |  | 0 | 1 | 9 | CA7-1201. VAC |
| 7.5 | 16 | 32 | 32 | 1 | 0 | 9 | CA 766-10. VAC. |
|  |  |  |  | 0 | 1 | 9 | CA7 1601 VAC, |
| 11 | 23 | 32 | 32 | 1 | 0 | 9 | $\text { CA7 } 23.10 \mathrm{~V} \mathrm{~V} \mathrm{CAC}$ |
|  |  |  |  | 0 | 1 | 9 | CA 723-01, VAC, |
| 15 | 30 | 50 | 45 | 0 | 0 | 8 | CA7 $30000 . \mathrm{VAC}$, |
| 18.5 | 37 | 50 | 45 | 0 | 0 | 8 | CA7,3700 VACLTL |
| 22 | 43 | 85 | 63 | 0 | 0 | 8 |  |
| 30 | 60 | 100 | 100 | 0 | 0 | 8 | FCA $760000 \mathrm{VACW}, \mathrm{T}$ |
| 37 | 72 | 100 | 100 | 0 | 0 | 8 | CA $782700 . \mathrm{VAC}$, |
| 45 | 85 | 100 | 100 | 0 | 0 | 8 | CA $78.550 .4 . V A C V Y$ |
| 55 (45) | 95 (33) | 160 | 135 | 1 | 1 | 8 |  |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 | CA $6105.11 . \mathrm{VAC}$ |
| 90 (75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | CA 6140411 VVAC , |
| 75 (55) | 130 (40) | 160 | 135 | 1 | 1 | 8 |  |
| 90 (75) | 155 (55) | 250 | 210 | 1 | 1 | 8 | (AA6-140 El-11. V AC) |
| 100 (90) | 170 (65) | 250 | 210 | 1 | 1 | 8 | CA $6=170=\mathrm{EL} 11 . \mathrm{VAC}$ ) |
| 132 (111) | 225 (80) | 350 | 300 | 1 | 1 | 8 | CA $6210 \mathrm{EL11.VAC)}$ |
| 150 (133) | 258 (95) | 350 | 300 | 1 | 1 | 8 | CAF6-250, E11, VAC) |
| 185 (163) | 320 (115) | 450 | 380 | 1 | 1 | 8 | CA 6-300-E1-11, VAC |
| 250 (225) | 425 (160) | 500 | 425 | 1 | 1 | 8 | CA 6-420-E11. VAC) |
| 220 (220) | 370 (155) | 500 | 420 | 2 | 2 | 8 | CA 5-370. CA AC) ${ }^{\text {a }}$ |
| 265 (280) | 450 (200) | 600 | 510 | 2 | 2 | 8 | CA5-450., VACs), |
| 325 (355) | 550 (250) | 780 | 645 | 2 | 2 | 8 | CA 5-550. VAC $\mathrm{AC}^{\text {a }}$ ) |
| 430 (500) | 700 (340) | 1000 | 850 | 2 | 2 | 8 | CA 5-700. V AC ${ }^{\text {a }}$ ) |
| 520 (550) | 860 (380) | 1100 | 930 | 2 | 2 | 8 |  |
| 600 | 1000 | 1200 | 1020 | 1 | 1 | 8 | CA 5-1000, V/ACS) |
| 700 | 1150 | 1350 | 1150 | 1 | 1 | 8 | CA $51200.4 \mathrm{AC}^{5}$ ). |

Notes: ') 1000 volt ratings ( ).
${ }^{2}$ ) Add control voltage to Cat. No. when ordering: 24, 32, 110, 240, 415, 440V 50 Hz . Standard voltages for CA 6-105-EI...250-EI are 24, 48, 110, 240 and 415 V AC. Standard voltages for CA 6-300-EI...420-EI 48, 110, 240 and 415 V AC. Standard voltages for CA 5-370...1200, 110, 240 and $415 \vee \mathrm{AC}$.
${ }^{3}$ ) All CA 7 coils can be reversed for line or load side coil terminals as required. Both versions are held in NHP stock for convenience.
${ }^{\text {*) }}$ Electronically controlled mechanism (ECM) with interface suffix (EI).
${ }^{5}$ ) $55^{\circ} \mathrm{C}$ enclosed.
${ }^{\circ}$ ) Contact NHP for recommended cable size.
240/415 V rated coils are suitable for use on 230/400 V in accordance with AS 60038: 2000.

## Innovation and ease of use provide solutions for your control systems

Coil terminals are always in the correct position
The coil terminations on the CA 7 contactors can be supplied optionally at the top or the bottom of the contactor. It is also a simple task to change this on site should the requirements change.

When CA 7 contactors are used in combination with KTA 7 circuit motor circuit breakers the bottom coil terminations are used. For use with standard CT 7 thermal or CEP 7 electronic overloads the top coil termination should be selected.

Mechanical interlocks save space
Only 9 mm wide, the CM 7 mechanical interlock snaps into place between any of the CA 7 contactors. It is allowed also to interlock different sizes of the CA 7 range with the same interlock.
The basic mechanical interlock is supplemented by a variation with built in N/C auxiliary contacts for electrical interlocking. This version is also only 9 mm wide and further minimises space requirements.


With Sprecher + Schuh you can choose the best protection for your motors.



CA 7 contactors provide improved wiring terminals
The main terminals of all CA 7 contactors are designed to accept at least two cables. At the same time they comply with safety standards regarding touch protection.
The larger contactors CA 7-30 and upwards employ a special cage terminal which allows the connection of two cables in separate chambers.
The ease of wiring with CA 7 contactors saves both time and money.


High tech electronic protection type CEP 7 in trip class 10 or 20.


Standard thermal overloads type CT 7

Refer Catalogue C-CO
MCCB or fuse DOL starting 50/65 kA @ $400 / 415$ V to AS 3947.4.1

## TemBreak Moulded Case Circuit Breaker or fuse

Terasaki

| Motor size kW | Approx. amps | $\begin{aligned} & \text { circuit or } \\ & \text { breaker } \end{aligned}$ | NHP HRC <br> fuse to BS88 | Sprecher + Schuh contactor type | Sprecher + Schuh thermal $0 / L$ relay type | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | NTIA-6 | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | NTIA-6 | CA $7-9$ | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | NTIA-10 | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | NTIA-16 | CA 7-9 | CT 7-24 | 4-6 |
| 3.0 | 6.5 | XM30PB/10 | NTIA-16 | CA $7-9$ | CT 7-24 | 6-10 |
| 4.0 | 8.2 | XM30РB/12 | NTIA-25 | CA 7-9 | CT 7-24 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | NTIA-32 | CA 7-12 | CT 7-24 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | NTIS-40 | CA 7-16 | CT 7-24 | 10-16 |
| 11 | 21 | XH125NJ/32 | NTIS-50 | CA 7-23 | CT 7-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | NTIS-63 | CA 7-30 | CT 7-45 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | NTCP-80 | CA 7-37 | CT 7-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | NTCP-80 | CA 7 -43 | CT 7-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | NTCP-100 | CA 7-60 | CT 7-75 | 45-60 |
| 37 | 66 | XH125NJ/100 | NTF-160 | CA 7-72 | CT 7-75 | 60-75 |
| 45 | 80 | XH125NJ/125 ${ }^{\text {') }}$ | NTF-160 | CA 6-85 | CT 7-100 | 70-90 |
| 55 | 100 | XH125NJ/125 ${ }^{\text {' }}$ ) | NTF-200 | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 ${ }^{\text {) }}$ | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ) | NTKF-315 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 132 | 225 | XH400NE/400 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XH400NE/400 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XH400NE/400 | NTMF-400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 185 | 310 | XH400NE/400 | NTTF-450 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XH400NE/400 | NTTM-500 | CA 6-420-EI/CA 5-450 | CEF 1-41/42 | 160-400 |
| 250 | 425 | XH630NE/630 | NTTM-630 | CA 6-420-EI/CA 5-450 | CEF 1-52 | 160-630 |
| 315 | 530 | XH630NE/630 | NTLM-710 | CA 5-550 | CEF 1-52 | 160-630 |

Notes: Fuses 65 kA . XH125NJ circuit breaker combinations limited to 50 kA , others 65 kA .
Overloads may be changed to different types eg. thermal style to electronic.
Some combinations also gives Type '2' performance.
') Use 'magnetic only' breaker - Refer NHP.
240/415 V rating suitable for use on 230/400 V in accordance with AS 60038: 2000

Refer Catalogue C.CO

TemBreak circuit breakers DOL starting $50 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS 3947.4.1

TemBreak MCCE

| Motor size KW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| 4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7.30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA 7-30 | CT 7-24-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | CA 7-43 | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43 | CT 7-45-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | CA 7-43 | CT 7-45-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{2}$ ) | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 6-85 | CT $7.75{ }^{2}$ ) | 60.75 |
| 45 | $80^{-}$ | XH125NJ/125 | CA 6-105-EI | CT 6-90 | 70-90 |
| 55 | 100 | XH125NJ/1.25 ${ }^{\text {' }}$ ) | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 | C A6-170-El | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ${ }^{\prime}$ ) | CA 6-210-E1 | CEF 1-41/42 | 160-400 |
| 132 | 225 | XS400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XS400SE/400 | CA 6-250-E1 | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400SE/400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 6-420-Ei | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

Notes: Overloads may be thermal or electronic.
Combinations based on the overload lripping before the circuit breaker at overload currents up to the motor locked rotor current.
') Use 'magnetic only' breaker or next higher circuit breaker / contactor combination.
${ }^{2}$ ) Use with separate mounting bracket.
Data for 65 KA co-ordination available refer Cat. C-CO
$240 / 415 \mathrm{~V}$ rating suitable for use on 230/400 V in accordance with AS 60038:2000


Din-T circuit breakers with rotary isolator. DOL starting.
50 kA @ 400/415 V to AS 3947.4.1

| Motor size kW | Approx. amps @ 400/415 V | Sprecher + Schuh isolator | Terasaki circuit breaker | Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Schuh thermal O/L relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | LA 7-80 | Din-T 10 / 4 | - | CA 7-9 | CT 7-24 | 0.6-1.6 |
| 0.55 | 1.5 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 1-1.6 |
| 0.75 | 1.8 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 7-80 | Din-T 10/6 | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | LA 7-80 | Din-T 10 / 10 | KTL 3-65 | CA 7-23 | CT 7-24 | 4-6 |
| 3 | 6.5 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4 | 8.2 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 5.5 | 11 | LA 7-80 | Din-T 10/20 | KTL 3-65 | CA 7-23 | CT 7-24 | 10-16 |
| 7.5 | 14 | LA 7-80 | Din-T 10/32 | KTL 3-65 | CA 7-30 | CT 7-45 | 10-16 |
| 11 | 21 | LA 7-80 | Din-T 10/40 | -KTL 3-65 | CA 7-30 | CT 7-24 | 16-24 |
| 15 | 28 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 18-30 |
| 18.5 | 34 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |

Note: $\quad 240 / 415 \mathrm{~V}$ rating suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS $60038: 2000$

Refer Catalogue C-CO
TemBreak circuit breakers DOL starting
TemBreak MCCB
$50 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS 3947.4.1

| Motor size kW | Approx. amps | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh overload relay | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.55 | 1.5 | XM30PB/2 | CA 7-9 | CT 7-24-1.6 | 1-1.6 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CT 7-24-2.4 | 1.6-2.4 |
| 1.1 | 2.6 | XM30PB/4.0 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CT 7-24-4 | 2.4-4 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-16 | CT 7-24-6 | 4-6 |
| 3 | 6.5 | XM30PB/10 | CA 7-30 | CT 7-24-10 | 6-10 |
| 4 | 8.2 | XM30PB/12 | CA 7-30 | CT 7-24-10 | 6-10 |
| 5.5 | 11 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 7.5 | 14 | XH125NJ/20 | CA 7-30 | CT 7-24-16 | 10-16 |
| 11 | 21 | XH125NJ/32 | CA 7-30 | CT 7-24-24 | 16-24 |
| 15 | 28 | XH125NJ/50 | CA 7-43 | CT 7-45-30 | 18-30 |
| 18.5 | 34 | XH125NJ/50 | CA 7-43. | CT 7-45-45 | 30-45 |
| 22 | 40 | XH125NJ/63 | CA 7-43 | CT 7-45-45 | 30-45 |
| 30 | 55 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{2}$ ) | 45-60 |
| 37 | 66 | XH125NJ/100 | CA 6-85 | CT 7-75 ${ }^{\text {² }}$ ) | 60-75 |
| 45 | 80 | XH125NJ/125 | CA 6-105-EI | CT 6-90 | 70-90 |
| 55 | 100 | XH125NJ/125 ') | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | XH250NJ/250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | XH250NJ/250 | C A6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | XH250NJ/250 ${ }^{\text {) }}$ | CA 6-210-E1 | CEF 1-41/42 | 160-400 |
| 132 | 225 | XS400SE/400 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
| 150 | 250 | XS400SE/400 | $\therefore$ CA 6-250-EI | CEF 1-41/42 | 160-400 |
| 160 | 270 | XS400SE/400 | ${ }^{2}$ CA $6-300-\mathrm{El}$ | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 6-420-EI | CEF 1-41/42 | 160-400 |
| 200 | 361 | XS400SE/400 | CA 5-450 | CEF 1-22 ${ }^{2}$ ) | 160-400 |
| 250 | 425 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |
| 320 | 538 | XS630SE/630 | CA 5-700 | CEF 1-52 ${ }^{2}$ ) | 160-630 |

Notes: Overloads may be thermal or electronic.
Combinations based on the overload tripping before the circuit breaker at overload currents up to the motor locked rotor current.
${ }^{\text {' }}$ ) Use 'magnetic only' breaker or next higher circuit breaker / contactor combination.
${ }^{2}$ ) Use with separate mounting bracket.
Oata for 65 kA co-ordination available refer Cat. C-CO.
$240 / 415 \mathrm{~V}$ rating suitable for use on 230/400 V in accordance with AS 60038: 2000

Refer catalogue SACS

## The highest switching capacity in the smallest space



## Compact without compromise

Compact without compromise is the best way to describe the CA 7 range of contactors and motor protection relays from Sprecher + Schuh. In spite of the new compact dimensions, the CA 7 range features high breaking capacity and extraordinary flexibility. Up to 18.5 kW the contactors are only 45 mm wide and even the largest 45 kW frame is only 72 mm wide. The CA 7 contactors are the main component in the new Advanced Control System (ACS).

With CA 7 you have flexibility with auxiliary contacts
Common auxiliaries from 9 to 85 amps
Three fitting positions
O Front mounting
O Side mounting left
O Side mounting right
Alternatively you can choose to combine left, right and front mounting auxiliary contacts to fulfil your requirements.
Instead of the top mounted auxiliary contacts, on or off delay timing modules or mechanical latches can be fitted.



Motor switching rating AC $3 @ 400 / 415$ V

| CA 7-9 | 4 kW | $45 \mathrm{~mm}$ |  | 9 A |
| :---: | :---: | :---: | :---: | :---: |
| CA 7-12 | 5.5 kW |  |  | 12 A |
| CA 7-16 | 7.5 kW |  |  | 16 A |
| CA 7-23 | 11 kW |  | 5xaticimex | 23 A |
| CA 7-30 | 15 kW | 45 |  | 30 A |
| CA 7-37 | 18.5 kW | 45 mm | [ [5x ㄷ, | 37 A |
| CA 7-43 | 22 kW | 54 mm | 7 | 43 A |
| CA 7-60 | 30 kW |  | Hex | 60 A |
| CA 7-72 | 37 kW | 72 mm |  | 72 A |
| CA 7-85 | 45 kW |  | [-7 | 85 A |

## With CA 7 you have more clip on accessories

Common accessories from 9 to 85 amps
On and off delay pneumatic timers
O Coil mounted electronic timers on delay, off delay, star delta
O Coil mounted 24 V DC interface

- Coil mounted RC and varistor suppressor modules

O Mechanical latch
O Mechanical interlock
O Mechanical interlock with integrated N/C interlock contacts
O Moulded wire link sets for DOL, reversing and star delta starters
O Large choice of front and side mounting auxiliary contacts

| General | CT 7.24 | CT 7-45 | CT 7.75 | CT 7-100 |
| :--- | :--- | :--- | :--- | :--- |
| Weight | $[\mathrm{kg}]$ | 0.13 | 0.21 | 0.21 |

Standards
Climatic

IEC 947, EN 60947 , OIN VOE 0660, UL. LRS, GUS, CSA

| Ambient temperature open | $-25 \ldots+60^{\circ} \mathrm{C}$ |
| :---: | :---: |
| enclosed | $-25 . . .50^{\circ} \mathrm{C}$ |
| Temperature compensation | continuous temperature range $-5 \ldots+40^{\circ} \mathrm{C}$ to IEC 947 , <br> EN 60947: PTB: $-5 \ldots+50^{\circ} \mathrm{C}$ |
| Shock resistance (sinusoidal 10 ms ) [G] | 10 |
| Protection | $1 \mathrm{P} 00 \quad \mathrm{P}$ 2LX |
| Protection | touch proof (VDE 0106, Part 100) |

Contactor, timer and overload selection chart for auto transformer starters

| ATS kW | Line contactor | Trans contactor | Star contactor | Timer | Overioad |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | CA 7-23-10 | CA 7-16-10 | CA 7-9-10 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 15 | CA $7.30-00$ | CA 723-10 | CA 7-12-10 | RZ7 FSY2D | CEP 7-M37-37-10 |
| 18.5 | CA 7-37-00 | CA 7-30-00 | CA 7-16-10 | RZ7 FSY20 | CEP 7-M37-37-10 |
| 22 | CA 7-43-00 | CA'7-30-00 | CA 7-23-10 | RZ7 FSY2D | CEP 7-M45-45-10 |
| 30 | CA 7-60-00 | CA 7-37-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 37 | CA 7-72-00 | CA 7-43-00 | CA 7-30-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 45 | CA 7-85-00 | CA 7-60-00 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 55 | CA 6-85-11 | CA 7-60-00 | CA 7-43-00 | R27 FSY2D | CT 6-110 |
| 75 | CA 6-105-11 | CA 7-85-00 | CA 7-60-00 | RZ7 FSY2D | CT 6-150 |
| 90 | CA 6-140El-11 | CA 6-85-11 | CA 7-72-00 | RZ7 FSY2D | CT 6-200 |
| 110 | CA 6-170EI-11 | CA 6-105-11 | CA 7-85-00 | RZ7 FSY2D | CEF 1-41 |
| 132 | CA6-210El-11 | CA 6-140El-11 | CA 6-105-11 | RZ7 FSY20 | CEF 1-41 |
| 150 | CA 6-250El-11 | CA 6-140El-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| ,185 | CA 6-300El-11 | CA 6-210El-11 | CA 6-140El-11 | R27 FSY2D | CEF 1-41 |
| 220 | CA 6-420EJ-11 | CA 6-210E1-11 | CA 6-140-EI-11 | RZ7 FSY20 | CEF $1-41$ |

Contactor, timer and overload selection chart for star delta starters

| SDS kW | Line contactor | Delta contactor | $\begin{aligned} & \text { Star } \\ & \text { contactor } \end{aligned}$ | Timer | Overload |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 7.5 | CA 7-9.10 | CA 7-9-01 | CA 7-9-01. | RZ7 FSY2D | CEP 7-M 3-12-10 |
| 11 | CA 7-12-10 | CA 7-12-01 | CA 7-9-01 | R27 FSY2D | CEP 7-M32-32-10 |
| 15 | CA 7-16-10 | CA 7-16-01 | CA 7-9-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 18.5 | CA 7-23-10 | CA 7-23-01 | CA 7-12-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 22 | CA 7-23-10 | CA 7-23-01 | CA 7-16-01 | RZ7 FSY2D | CEP 7-M32-32-10 |
| 30-37 | CA 7-37-00 | CA 7-37-00 | CA 7-23-01 | RZ7 FSY2D | CEP 7-M44-45-10 |
| 45 | CA 7-60-11 | CA 7-60-11 | CA 7-30-00 | RZ7 FSY20 | CEP 7-M85-85-10 |
| 55 | CA 7-60-11 | CA 7-60-11 | CA 7-37-00 | RZ7 FSY2D | CEP 7-M85-85-10 |
| 75 | CA 7-85-00 | CA 7-85-00 | CA 7-43-00 | R27 FSY2D | CEP 7-M85-85-10 |
| 90 | CA 6-85-11 | CA 6-85-11 | CA 7-60-00 | RZ7 FSY2D | CT 6-90 |
| 110 | CA 6-105-11 | CA 6-105-11 | CA 7-72-00 | RZ7 FSY20 | CT 6-110 |
| 132 | CA 6-140EI-11 | CA 6-140EI-11 | CA 7-85-00 | RZ7 FSY2D | CT 6-150 |
| 150 | CA 6-170EI-11 | CA 6-170El-11 | CA 6-85-00 | RZ7 FSY2D | CTA 6-200 |
| 185 | CA 6-210E1-11 | CA 6-210EI-11 | CA 6-105-11 | RZ7 FSY2D | CEF 1-41 |
| 220 | CA 6-210-EI-11 | CA 6-210-El-11 | CA 6-140-EI-11 | R27 FSY20 | CEF 1-41 |



## Contactor (AC control)

| Type | a | b | c | c1 | c2 | od | d1 | d2') |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9...CA 7-23 ${ }^{\text { }}$ ) | 45 | 81 | 80.5 | 75.5 | 6 | 4.5 | 60 | 35 |
| CA 7-30...CA 7-37 | 45 | 81 | 97.5 | 92.6 | 6.5 | 4.5 | 60 | 35 |
| CA 7-43 | 54 | 81 | 100.5 | 95.6 | 6.5 | 4.5 | 60 | 45 |
| CA 7-60...CA 7-85 | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 | 55 |

(DC control)

| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{c}$ | $\mathbf{c 1}$ | $\mathbf{c 2}$ | od | $\mathbf{d 1}$ |
| :--- | ---: | ---: | ---: | ---: | ---: | ---: | ---: |
| CA 7-9C...CA 7-16C | 45 | 81 | 106.5 | 101.5 | 6 | 4.5 | 60 |
| CA 7-23C | 45 | 81 | 123.5 | 119 | 6 | 4.5 | 60 |
| CA 7-30C...CA 7-37C | 45 | 81 | 141.5 | 136.5 | 6.5 | 4.5 | 60 |
| CA 7-43C | 54 | 81 | 144.5 | 140 | 6.5 | 4.5 | 60 |
| CA 7-60C...CA 7-85C | 72 | 122 | 117 | 111.5 | 8.5 | 5.4 | 100 |

## Accessories

| Contactor with |  | (AC control) (mm) | (DC control) (mm) |
| :---: | :---: | :---: | :---: |
| Front mounting auxiliary contact | 2 or 4 pole | $\mathrm{c} / \mathrm{c} 1+39$ | $\mathrm{c} / \mathrm{c} 1+39$ |
| Side mounting auxiliary contact | 1 or 2 pole | a + 9 | $a+9$ |
| Pneumatic timing module |  | $\mathrm{c} / \mathrm{c} 1+58$ | - |
| Electronic timing module | coil mounting | $b+24$ | $b+24$ |
| Mechanical interlock | mounts between contactors | $a+9$ | $a+9$ |
| Mechanical latch |  | $\mathrm{c} / \mathrm{c} 1+61$ | - |
| Interface | coil mounting | $b+9$ | - |
| Suppressor | coil mounting | $b+3$ | $b+3$ |
| With inscriptions ${ }^{3}$ ) | labels | +0 | +0 |
|  | label support system V4N5 | +5.5 | +5.5 |

Notes: ') DIN Rail mounting 35 mm to EN 50022.
${ }^{2}$ ) Dimensions for 4 pole contactors same as 3 pole with auxiliary.
${ }^{\text {J }}$ ) Dimensions with inscriptions.

Automatic Type ' 2 ' co-ordination ') with no-oversizing of contactors

DOL starting
50/65 kA @ 400/415 V


| Motor <br> size <br> kW | Approx. <br> amps @ <br> $400 / 415 \mathrm{~V}$ | Sprecher + <br> Schuh <br> circuit breaker | Setting <br> range <br> amps | Sprecher + Schuh <br> contactor | Magnetic <br> amps |
| :--- | :--- | :--- | :--- | :--- | :--- |
| 0.18 | 0.60 | KT 7-25S | $0.40-0.63$ | 8.2 | CA 7-9 |
| 0.25 | 0.80 | KT 7-25S | $0.63-1.00$ | 13 | CA 7-9 |

Definition Type '2' co-ordination according to IEC 947-4-1:

- The contactor or the starter must not endanger persons or systems in the event of a short circuit
- The contactor or the starter must be suitable for further use
- No damage to the overload relay or other parts may occur with the exception of welding of the contactor or starter contacts provided that these can be easily separated without significant deformation (such as with a screwdriver)
- In the event of a short circuit, fast opening current limiting circuit breakers KT 7 make it possible to build economical, fully short circuit co-ordinated starter combinations in accordance with IEC 947-4-1, Type '2' co-ordination
- Type '2' co-ordination without oversizing of contactors means: Type ' 1 ' = Type ' 2 '

Note: ') What is meant by Automatic Type '2' co-ordination?
The high speed operation of the new KT 7 motor protection circuit breakers means that contactors need not be oversized to achieve type ' 2 ' co-ordination. Simply select the normal AC 3 rated contactor and the corresponding KT 7 circuit breaker and type ' 2 ' co-ordination is assured.
2401415 V rating suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS 60038: 2000


Refer Catalogue C-CO
Fuse protection DOL starting ${ }^{1}$ )
Fuse
50/65 kA @ $400 / 415$ V to AS 3947.4.1

| Motor size kW | Approx. amps @ $400 / 415$ V | NHP HRC fuse to BS88 | Sprecher + Schuh contactor | Sprecher + Schuh overload relay $\left.{ }^{2}\right)^{\prime}$ ) | Setting range amps |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | NTIA-4 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 0.75 | 1.8 | NTIA-6 | CA 7-9 | CEP 7 | 1.0-2.9 |
| 1.5 | 3.4 | NTIA-10 | CA 7-9 | CEP 7 | 1.6-5 |
| 2.2 | 4.8 | NTIA-16 | CA 7-9 | CEP 7 | 3.7-12 |
| 4.0 | 8.2 | NTIA-20 | CA 7-9 | CEP 7 | 3.7-12 |
| 5.5 | 11 | NTIA-25 | CA 7-12 | CEP 7 | 3.7-12 |
| 7.5 | 14 | NTIA-32 | CA 7-16 | CEP 7 | 12-32 |
| 11 | 21 | NTIS-50 | CA 7-30 | CEP 7 | 12-32 |
| 15 | 28 | NTIS-63 | CA 7-30 | CEP 7 | 12-37 |
| 18.5 | 34 | NTCP-80 | CA 7-37 | CEP 7 | 12-37 |
| 22 | 40 | NTCP-80 | CA 7-43 | CEP 7 | 14-45 |
| 30 | 55 | NTCP-100 | CA 7-60 | CEP 7 | 26-85 |
| 37 | 66 | NTF-125 | CA 7-72 | CEP 7 | 26-85 |
| 45 | 80 | NTF-160 | CA 7-85 | CEP 7 | 26-85 |
| 55 | 100 | NTF-200 | CA 6-105-EI | CT 6-110 | 85-110 |
| 75 | 130 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
| 90 | 155 | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
| 110 | 200 | NTKF-315 | CA 6-210-EI | CEF 1-41/42 ${ }^{\text {* }}$ ) | 160-400 |
| 132 | 225 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 ${ }^{4}$ ) | 160-400 |
| 150 | 250 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 ${ }^{\text {( }}$ ) | 160-400 |
| 185 | 320 | NTTM-450 | CA 6-300-EI | CEF 1-41/42 ${ }^{\text {( }}$ ) | 160-400 |
| 250 | 425 | NTTM-560 | CA 6-420-EI | CEF 1-52 ${ }^{4}$ ) | 160-630 |
| 320 | 538 | NTLM-710 | CA 5-550 | CEF 1-52 ${ }^{\text {) }}$ | 160-630 |
| 380 | 650 | NTLM-800 | CA 5-700 | CEF 1-11/12P ${ }^{4}$ ) | 300-1200 |

Notes: ') Fuses with equal or lower let through energy may also be used
${ }^{\text {z }}$ ) Thermal overloads may be used instead of electronic CEP 7
${ }^{3}$ ) Above 37 kW overloads may also be electronic or thermal.
${ }^{4}$ ) CET 4 may be used instead of CEF 1.
$240 / 415 \mathrm{~V}$ rating suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS 60038:2000

SP103 Heroes Avenue Indooroopilly SPS Redirection of Heroes Ave SPS Mechanical and Electrical Fitout and Commissionina Yolume 30 M

Refer Catalogue $\mathrm{C}-\mathrm{CO}$
TemBreak circuit breakers DOL starting. 85 kA @ 400/415 V to AS 3947.4.1

| Motor size kW | Approx. FLC © $400 / 415 \mathrm{~V}(\mathrm{~A})$ | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh thermal O/L type | Setting range (A) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2.0 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | ХM30PB/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | хM30РB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 4 | 8.2 | XM30PB/10 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL100NJ/20 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7.30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | TL100NJ/50 | CA 7-43 | CEP 7-M37-37-10 | 12-37 |
| 22 | 40 | TL100NJ/63 | CA 7-43 | CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100 | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 90 | 160 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 110 | 200 | TL250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE 400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6-300-EI | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE1400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

Din-T circuit breakers with rotary isolator. DOL starting.
$50 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS 3947.4.1

| Motor size kW | Approx. amps @ $400 / 415 \mathrm{~V}$ | Sprecher + Schuh isolator | Terasaki circuit breaker | :. Sprecher + Schuh current limiter | Sprecher + Schuh contactor | Sprecher + <br> Schuh <br> thermal <br> O/L relay | Thermal overload range |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | LA 7-80 | Din-T 10 / 4 | - | CA 7-9 | CT 7.24 | 0.6-1.6 |
| 0.55 | 1.5 | LA 7-80 | Din-T $10 / 4$ | - | CA 7-9 | CT 7.24 | 1-1.6 |
| 0.75 | 1.8 | LA 7-80 | Din-T 10/4 | - | CA 7-9 | CT 7-24 | 1.6-2.4 |
| 1.1 | 2.6 | LA 7-80 | Din-T $10 / 6$ | - | CA 7-23 | CT 7-24 | 2.4-4 |
| 1.5 | 3.4 | LA 7-80 | Din-T. $10 / 6$ | - | CA 7.23 | CT 7-24 | 2.4-4 |
| 2.2 | 4.8 | LA 7.80 | Din-T $10 / 10$ | KTL 3-65 | CA 7-23 | СT 7-24 | 4-6 |
| 3 | 6.5 | LA 7-80 | Din-T 10 / 16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 4 | 8.2 | LA 7-80 | Din-T 10/16 | KTL 3-65 | CA 7-23 | CT 7-24 | 6-10 |
| 5.5 | 11 | LA 7.80 | Din-T 10/20 | KTL 3-65 | CA 7.23 | CT 7-24 | 10-16 |
| 7.5 | 14 | LA 7-80 | Din-T 10/32 | KTL 3-65 | CA 7-30 | CT 7-45 | 10-16 |
| 11 | 21 | LA 7-80 | Din-T $10 / 40$ | KTL 3-65 | CA 7-30 | CT 7.24 | 16-24 |
| 15 | 28 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 18-30 |
| 18.5 | 34 | LA 7-100 | Din-T 10/63 | KTL 3-65 | CA 7-37 | CT 7-45 | 30-45 |

Note: $\quad 240 / 415 \mathrm{~V}$ rating suitable for use on $230 / 400 \mathrm{~V}$ in accordance with AS 60038: 2000



Dimensions in (mm)
CEP 7, CEP 7s and CEP 7-B mounted on CA 7 contactors


| Cat. No. | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{b 1}$ | $\mathbf{c}$ | $\mathbf{e 1}$ | $\mathbf{e 2}$ | $\mathbf{d 1}$ | $\mathbf{d 2}$ | $\boldsymbol{h}$ | $\mathbf{j}$ | $\boldsymbol{\text { od }}$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9/12/16/23 with CEP 7 or CEP 7S | 45 | 131 | 86 | 88.5 | 16.5 | 69 | 60 | 35 | 86.5 | 2 | 4.2 |
| CA 7-9/12/16/23 with CEP 7-B | 54 | 137 | 97 | 90.7 | 5.1 | 59 | 60 | 35 | 85.1 | 2 | 4.2 |
| CA 7-30/37 with CEP 7 or CEP 7S | 45 | 136.5 | 91.5 | 92 | 16.5 | 69 | 60 | 35 | 104 | 2 | 4.2 |
| CA 7-30/37 with CEP 7-B | 54 | 137 | 97 | 92.1 | 5.2 | 59 | 60 | 35 | 104.7 | 2 | 4.2 |
| CA 7-43 with CEP 7, CEP 7S or CEP 7-B | 54 | 136.5 | 91.5 | 93 | 22 | 69 | 60 | 45 | 107 | 2 | 4.2 |
| CA 7-60/72/85 with CEP 7, CEP 7S or CEP 7-B | 72 | 188.5 | 120 | 120 | 18 | 84.5 | 100 | 55 | 125.5 | 2 | 5.5 |

CEP 7 with separate mounting bracket


| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\mathbf{c}$ | d | e |
| :--- | :---: | :---: | :---: | :---: | :---: |
| CEP 7-37-P-A | 45 | 90 | 75 | 30 | 75 |
| CEP 7-45-P-A | 55 | 90 | 96.5 | 40 | 75 |
| CEP 7-85-P-A | 70 | 115 | 110 | 55 | 105 |



Dimensions in (mm)
CEP 7, CEP 7s and CEP 7-B mounted on CA 7 contactors


| Cat. No. | $\mathbf{a}$ | b | b 1 | c | e 1 | e 2 | d 1 | d 2 | h | j | od |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CA 7-9/12/16/23 with CEP 7 or CEP 7S | 45 | 131 | 86 | 88.5 | 16.5 | 69 | 60 | 35 | 86.5 | 2 | 4.2 |
| CA 7-9/12/16/23 with CEP 7-B | 54 | 137 | 97 | 90.7 | 5.1 | 59 | 60 | 35 | 85.1 | 2 | 4.2 |
| CA 7-30/37 with CEP 7 or CEP 7S | 45 | 136.5 | 91.5 | 92 | 16.5 | 69 | 60 | 35 | 104 | 2 | 4.2 |
| CA 7-30/37 with CEP 7-B | 54 | 137 | 97 | 92.1 | 5.2 | 59 | 60 | 35 | 104.7 | 2 | 4.2 |
| CA 7-43 with CEP 7, CEP 7S or CEP 7-B | 54 | 136.5 | 91.5 | 93 | 22 | 69 | 60 | 45 | 107 | 2 | 4.2 |
| CA 7-60/72/B5 with CEP 7, CEP 7S or CEP 7-B | 72 | 188.5 | 120 | 120 | 18 | 84.5 | 100 | 55 | 125.5 | 2 | 5.5 |

CEP 7 with separate mounting bracket


| Type | $\mathbf{a}$ | $\mathbf{b}$ | $\ddots$ | $\mathbf{c}$ | d |
| :--- | :---: | :---: | :---: | :---: | :---: |
| CEP 7-37-P-A | 45 | 90 | 75 | 30 | 75 |
| CEP 7-45-P-A | 55 | 90 | 96.5 | 40 | 75 |
| CEP 7-85-P-A | 70 | 115 | 110 | 55 | 105 |



# Contactors with electronically controlled mechanism (ECM) te sted to IEC 947 

CA 6 . A complete range
The CA 6 range of 1000 volt contactors is now available through to 420 amp . The range now incorporates eight sizes from 45 to 250 kW @ $400 / 415$ volts and 225 kW at 1000 volts.
Electronically controlled mechanism (ECM)
The electronically controlled mechanism has, with the release of the larger CA 6 contactors, been further improved. As well as providing the unique advantages of electronic coil control, the ECM version now includes a built in PLC interface. These are identified with the suffix El on the Cat. No.
What is "ECM"
ECM stands for "Electronically Controlled Mechanism". With the version El, an electronic circuit regulates the voltage to the contactor coil. This is achieved using an ASIC (application specific integrated circuit) which precisely controls the pick-up and drop-out levels of the contactor. This provides decisive advantages for the user.
O Very low pick-up and hold coil consumption (constant VA)
O No contact chatter because of defined pick-up and drop-out voltages
O High contact reliability due to minimised tendency to contact bounce
O Built-in suppression circuits
O Built-in PLC interface
O Wide voltage tolerance of coils suitable for $50 / 60 \mathrm{~Hz}$ (DC versions also available)
O EMC compatibility:
(Note EMC is not to be confused with ECM. EMC means that the contactors also conform to Electromagnetic compatibility standards for noise

CA 6

| Cat. No. | 4001415 V AC 3 kW | 1000 V AC 3 kW |
| :---: | :---: | :---: |
| CA 6-85 | 55 | 45 |
| CA 6-105-(EI) | 75 | 55 |
| CA 6-140-El | 90 | 75 |
| CA 6-170-EI | 100 | 90 |
| CA 6-210-E! | 132 | 111 |
| CA 6-250-EI | 150 | 133 |
| CA 6-300.EI | 185 | 163 |
| CA 6-420-EI | 250 | 225 |

Relation of pick-up to hold-in consumption



CA 6-170-EI 15 a 90 kW contactor with ECM

Extremely low pick-up and hold-in coil consumption compared with conventional contactors.

Robust and versatile
O Rated up to 1000 volts
O Type 2 co-ordination with fuses or circuit breakers
O High thermal capacity
O High switching capacity
O Mechanical interlock does not increase overall width
O Up to 8 auxiliary contacts
O Flexible busbars and mounting plates available for quick assembly of starter combinations

- Choice of electronic motor protection or CT 6 thermal overloads
O Plug-in voltage suppressors
Safety first
O Arc chamber cannot be removed with the contactor energised
O Contactor cannot be energised unless arc chambers are locked into place

O Switch position indicator (manual operation of contactor not possible)
O Closed arc chambers prevent hot gases escaping. Safety distance in front of contactor not necessary
O Touch proof design using special insulated terminal blocks and terminal covers
O No cadmium or asbestos (environmentally safe)


CA 6 contactor fitted with CEF 1-12 electronle protection provides the ideal starter.

| Stuchas <br> schul <br> Shork chut cootrinetion <br>  <br> Thes 4 whh chout breakes ors uses |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Futw |  |  |  |  |  |  |  |
| Refer Catalogue $\mathrm{C}-\mathrm{CO}$ <br> MCCB or fuse DOL starting <br> TemBreak Moulded Case |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |
| Circuit Breaker or fuse |  |  |  |  |  |  |  |
|  | Motor size kW | Approx. amps | Terasaki circuit breaker | NHP HRC fuse to BS88 | Sprecher + Schuh contactor type | Sprecher + Schuh thermal O/L relay type | Setting.range amps |
|  | 0.37 | 1.1 | XM30PB/1.4 | NTIA-6 | CA 7-9 | CT 7-24 | 1-1.6 |
|  | 0.55 | 1.5 | XM30РB/2 | NTIA-6 | CA 7-9 | CT 7-24 | 1-1.6 = |
|  | 0.75 | 1.8 | XM30PB/2.6 | NTIA-10 | CA 7-9 | CT 7-24 | 1.6-2.4 |
|  | 1.1 | 2.6 | XM30PB/4.0 | NTIA-10 | CA $7-9$ | CT 7-24 | 2.4-4 |
|  | 1.5 | 3.4 | XM30PB/5 | NTIA-10 | CA 7-9 | CT 7-24 | 2.4-4 |
|  | 2.2 | 4.8 | XM30PB/8 | NTIA-16 | CA 7-9 | CT 7-24 | 4-6 |
|  | 3.0 | 6.5 | XM30PB/10 | NTIA-16 | CA 7-9 | CT 7-24 | 6-10 |
|  | 4.0 | 8.2 | XM30PB/12 | NTIA-25 | CA 7-9 | CT 7-24 | 6-10 |
|  | 5.5 | 11. | XH125NJ/20 | NTIA-32 | CA 7-12 | CT 7-24 | 10-16 |
|  | 7.5 | 14 | XH125NJ/20 | NTIS-40 | CA 7-16 | CT 7-24 | 10-16 |
|  | 11 | 21 | XH125NJ/32 | NTIS-50 | CA 7-23 | CT 7-24 | 16-24 |
|  | 15 | 28 | XH125NJ/50 | NTIS-63 | CA 7-30 | CT 7-45 | 18-30 |
|  | 18.5 | 34 | XH125NJ/50 | NTCP-80 | CA 7-37 | CT 7-45 | 30-45 |
|  | 22 | 40 | XH125NJ/63 | NTCP-80 | CA 7-43 | CT 7-45 | 30-45 |
|  | 30 | 55 | XH125NJ/100 | NTCP-100 | CA 7-60 | CT $7-75$ | 45-60 |
|  | 37 | 66 | XH125NJ/100 | NTF-160 | CA 7-72 | CT 7-75 | 60-75 |
|  | 45 | 80 | XH125NJ/125 ') | NTF-160 | CA 6-85 | CT 7-100 | 70-90 |
|  | 55 | 100 | XH125NJ/125 ') | NTF-200 | CA 6-105-E\| | CT 6-110 | 85-110 |
|  | 75 | 130 | XH250NJ/250 | NTKF-250 | CA 6-140-EI | CT 6-150 | 105-150 |
|  | 90 | 155 | XH250NJ/250 ') | NTKF-250 | CA 6-170-EI | CT 6-200 | 140-200 |
|  | 110 | 200 | XH250NJ/250 ') | NTKF-315 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
|  | 132 | 225 | XH400NE/400 | NTMF-355 | CA 6-210-EI | CEF 1-41/42 | 160-400 |
|  | 150 | 250 | XH400NE/400 | NTMF-355 | CA 6-250-EI | CEF 1-41/42 | 160-400 |
|  | 160 | 270 | XH400NE/400 | NTMF-400 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
|  | 185 | 310 | XH400NE/400 | NTTF-450 | CA 6-300-EI | CEF 1-41/42 | 160-400 |
|  | 200 | 361 | XH400NE/400 | NTTM-500 | CA 6-420-EI/CA 5-450 | CEF 1-41/42 | 160-400 |
|  | 250 | 425 | XH630NE/630 | NTTM-630 | CA 6-420-EI/CA 5-450 | CEF 1-52 | 160-630 |
|  | 315 | 530 | XH630NE/630 | NTLM-710 | CA 5-550 | CEF 1-52 | 160-630 |

Notes: Fuses $65 \mathrm{kA} . \mathrm{XH} 125 \mathrm{NJ}$ circuit breaker combinations limited to 50 kA , others 65 kA . Overloads may be changed to different types eg. thermal style to electronic.
Some combinations also gives Type ' 2 ' performance.
') Use 'magnetic only' breaker - Refer NHP.
240/415 V rating suitable for use on 230/400 V In accordance with AS 60038: 2000


Fuse protection DOL starting ${ }^{1}$ )
Fuse
50/65 kA @ 400/415 V to AS 3947.4.1


Notes: ') Fuses with equal or lower let Ihrough energy may also be used.
${ }^{2}$ ) Thermal overloads may be used instead of electronic CEP 7
${ }^{2}$ ) Above 37 kW ovenoads may also be electronic or thermal.
${ }^{4}$ ) CET 4 may be used instead of CEF 1.
240/415 V rating suitable for use on 230/400 V in accordance with AS 60038:2000

TemBreak circuit breakers DOL starting $50 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS 3947.4:1


Refer Catalogue C -CO
TemBreak circuit breakers DOL starting. $85 \mathrm{kA} @ 400 / 415 \mathrm{~V}$ to AS 3947.4.1
MCCBs

| Motor size kW | Approx. FLC @ $400 / 415 \mathrm{~V}$ ( A$)$ | Terasaki circuit breaker | Sprecher + Schuh contactor | Sprecher + Schuh thermal O/L type | Setting range (A) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 0.37 | 1.1 | XM30PB/1.4 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.55 | 1.5 | XM30PB/2.0 | CA 7-9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 0.75 | 1.8 | XM30PB/2.6 | CA 7.9 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.1 | 2.6 | XM30PB/4 | CA 7-16 | CEP 7-M32-2.9-10 | 1.0-2.9 |
| 1.5 | 3.4 | XM30PB/5 | CA 7-16 | CEP 7-M32-5-10 | 1.6-5 |
| 2.2 | 4.8 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 3 | 6.5 | XM30PB/8 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 4 \% | $8: 2 \times 18$ | XM30PB/10 | CA 7-30 : | . CEP 7-M32-12-10 | 3.7-12 |
| 5.5 | 11 | TL100NJ/20 | CA 7-30 | CEP 7-M32-12-10 | 3.7-12 |
| 7.5 | 14 | TL100NJ/20 | CA 7.30 | CEP 7-M32-32-10 | 12-32 |
| 9 | 17 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 10 | 19 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 11 | 21 | TL100NJ/32 | CA 7-30 | CEP 7-M32-32-10 | 12-32 |
| 15 | 28 | TL100NJ/50 | CA 7-43 | CEP 7-M32-32-10 | 12-32 |
| 18.5 | 34 | ṪL100NJ/50 | CA $7-43$ | CEP 7-M37-37-10 | 12-37 |
| 22 | 40 | TL100NJ/63 | CA 7-43 | CEP 7-M45-45-10 | 14-45 |
| 30 | 55 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 37 | 66 | TL100NJ/100 | CA 7-72 | CEP 7-M85-85-10 | 26-85 |
| 45 | 80 | TL250NJ/160 | CA 6-105 | CEP 7-M85-85-10 | 26-85 |
| 55 | 100 | TL250NJ/160 | CA 6-105 | CEF 1-11/12 | 0.5-180 |
| 75 | 135 | TL250NJ/250 | CA 6-210-E1 | CEF 1-11/12 | 0.5-180 |
| 90 | 160 | TL250NJ/250 | CA 6-210-EI | CEF 1-11/12 | 0.5-180 |
| 110 | 200 | TL250NJ/250 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 132 | 230 | TL400NE/400 | CA 6-210-EI | CEF 1-41/42/52 | 160-630 |
| 160 | 270 | TL400NE/400 | CA 6-300-EI | CEF 1-41/42/52 | 160-630 |
| 200 | 361 | TL400NE/400 | CA 6-420-EI | CEF 1-41/42/52 | 160-630 |

CA 6 Contactors




| Type | a | b | c | c1 | c2 | c3 | c4 | d | d1 | d2 | ce | e1 | e2 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| СT 6-90...CT 6-110 | 120 | 148 | 193 | 161 | 151.5 | 41 | 114 | - | 85 | 100 | M6 | 39 | 8.5 |
| CT 6-150...CT 6-200 | 120 | 170 | 193 | 161 | 151.5 | 45 | 114 | - | 85 | 100 | M8 | 39 | 8.5 |
| CTA 6-90... CTA 6-100 | 120 | 133 | 193 | 161 | 151.5 | 41 | $-$ | $\checkmark$ | 85 | 100 | M6 | 39 | M6 |
| CTA 6-150...CTA 6-200 | 120 | 176 | 193 | 161 | 151.5 | 45 | - | - | 85 | 100 | M8 | 39 | M8 |



CEF $1-42$ for contactors
CA 6-210(EI) to CA 6-420EI.
Notes: ') No increase in base dimension when fitted with P1, P2 aux. For auxiliary contact P3, P4 plus 13.5 mm .
${ }^{2}$ ) Button travel -3.5 mm for "reset". 6 mm for "test".
${ }^{3}$ ) With reset magnet CMR.
${ }^{4}$ ) Space for fitting CS 4 or CS 3 or RT 3 thernistor relay (M3.5 screws and nuts required).
${ }^{3}$ ) $\mathrm{CT}=$ direct mounting on CA $6, \mathrm{CTA}=$ for separate mounting.


CA 6-105-EI, CA 6-140(EI), CA 6-170-EI + CEF 1


CA 6-210-EI...CA 6-420-EI + CWE 4-630


CA 6-210-EI...CA 6-420-EI + CEF 1-42

Notes: ') Shown mounted on optional DOL mounting plate.
${ }^{2}$ ) With one or two auxiliary contact blocks CA 6-P.
${ }^{1}$ ) For third and fourth auxiliary contact blocks add 13.5 mm each.
${ }^{\text {}}$ ) $\mathrm{R}=$ Reset bution: 3.5 mm travel $=$ Reset, 6 mm travel $=$ test .
${ }^{\text {5) }}$ Earthing terminal.
') For t... 4 CA 6-P auxiliary contact blocks.

Refer catalogue CA 6, 2212

## CA 61000 volt contactor system

The latest in switching techmology up to 1000 volts
The CA 6 contactors offer the latest in switching technology up to 1000 volts, from Sprecher + Schuh.
The development of the CA 6 range now covers the CA $6-85$ to the CA 6-420, the complete range covering 1000 volt, AC 3 ratings up to 225 kW with $400 / 415$ volt ratings up to 250 kW . Special design features of these contactors include a unique electronically controlled mechanism (ECM) which is standard on all sizes except the CA 6-85-11.
A choice of motor protection
Thermal overload relays CT 6 as well as the CEF 1 and CET 4 electronic motor protection relays are also rated at 1000 volts. They are ideally suited for combining with the CA 6 and CA 5 contactors providing a choice of quality motor protection solutions. For contactors CA 6-210 and above the standard protection can be CEF or CET 4 electronic motor protection.


## High current contactors CA 5

The CA 5-370 ... CA 5-860 high current contactors combine high switching currents up to 1000 volts together with low coil power consumption due to a specially designed coil and magnet system. These rugged and reliable contactors extend the 1000 volt switching capacities of Sprecher + Schuh contactors up to 550 kW as well as being suitable for AC $3400 / 415$ volt applications up to 500 kW .


1000 V contactor CA 5-370


1000 V contactor CA 5-550


1000 V contactor CA 5-860


## Appendix 18: Push buttons, Indicator Lights \& Thermistors

| Manufacturer: | NHP |
| :--- | :--- |
| Supplier Contact: | MPA Engineering |
|  | 3/22-24 Strathwyn Street |
|  | Brendale QLD 4500 |
|  | 0738810722 |



Refer Catalogue SO5

## Control and indicating units D5



General technical information

| Front elements | Plastic operators (D5P/S) | Metal operators (D5M/B) |
| :---: | :---: | :---: |
| Degree of prolection according to IEC 529, DIN 40050 |  |  |
| Pushbuttons, Mushroom operators, |  |  |
| Selector switch operators | IP 66 (NEMA Type 4/4X/13) |  |
| Potentiometer operator | IP 65 | all IP 66 (NEMA Type 4/13) |
| Multi-function operators without sealing cap | IP 40 |  |
| Multi-function operators with sealing cap | IP 66 |  |
| Joy sticks and wobble sticks | IP 66 |  |
| Mechanical design life |  |  |
| Pushbuttons | 10000000 Cycles | 10000000 Cycles |
| Momentary mushroom operators, |  |  |
| Selector jog, Selector switches | 500000 Cycles | 500000 Cycles |
| Special mushroom operators | 100000 Cycles | 100000 Cycles |
| Multi-function operators | 3000000 Cycles | 3000000 Cycles |
| Joysticks |  | 100000 Cycles (in each direction) |
| Vibration (assembled to panel) |  |  |
| Frequencies $10 . .2000 \mathrm{~Hz}$ |  |  |
| Displacement 1.52 mm . (peak-peak) | max. 10 G | max. 10 G |
| Shock |  |  |
| 1/2 sine wave (no damage) | 100G, 11ms | 100G, 11 ms |
| Temperature range |  |  |
| Storage | $-25^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ max. $70^{\circ} \mathrm{C} / 24 \mathrm{~h}$ | $-25^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ max. $70^{\circ} \mathrm{C} / 24 \mathrm{~h}$ |
| Operating | $-25^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ | $-25^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ |
| Humidity | $50 \% \ldots 95 \% \mathrm{RH}$ from $25^{\circ} \mathrm{C} \ldots 60^{\circ} \mathrm{C}$ | $50 \% \ldots 95 \% \mathrm{RH}$ from $25^{\circ} \mathrm{C}$. . $60^{\circ} \mathrm{C}$ |


| Back of panel components | 3-Across style |  | 3-Across style |
| :---: | :---: | :---: | :---: |
| Standard contact block ratings | NEMA A600,Q600 | Shock |  |
|  | 600 VAC | 1/2 sine wave (no damage) | 100G, 11 ms |
|  | AC 15, OC 13 to IEC 947-5 | Contact block |  |
| Low Voltage contact block ratings |  | mechanical design | 5000000 Cycles |
|  | 17... $24 \mathrm{VUC}, 5 \mathrm{~mA}$ | Temperature range |  |
| Thermal current | 10 A max. continuous current | Storage | $-25^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ max. $70{ }^{\circ} \mathrm{C} / 24 \mathrm{~h}$ |
|  | without enclosure ( $40^{\circ} \mathrm{C}$ ) | Operating | $-5^{\circ} \mathrm{C} \ldots+55^{\circ} \mathrm{C}$ |
|  | 6 A with enclosure ( $60{ }^{\circ} \mathrm{C}$ ) | Humidity | $40^{\circ} \mathrm{C} / 95 \% \mathrm{RH} / 56$ days |
| Insulation category | Group C , 500 V to VDE 0110 |  | $23^{\circ} \mathrm{C}, 83 \% / 40^{\circ} \mathrm{C}, 93 \% 20$ cycles |
|  | 600 V UL, CSA | Approvals | UL Listed / CSA Certified |
| Terminal marking | Conforming to CENELEC EN 50013 |  | SEV, CEBEC, OEMKO, NEMKO, |
| Terminals | $0.75 . .2 .5 \mathrm{~mm}^{2}$ |  | SEMKO, Seti, Germanischer Lloyd, |
|  | Min. $1 \times \# 18 . .12$ AWG |  | Bureau Veritas, Maritime Register <br> of shipping Lloyds register of |
|  | Max. $2 \times \# 14$ AWG or $1 \times \# 12 A W G$ |  | of shipping, Lloyds register of shipping |
| Short circuit protection | 10 A slow (OT,gl) |  |  |
|  | ... -. -. .-. .- - | Standard conformity | IEC 204-1, 337:SEV 1005, 1093; |
| Electrical shock protection | IP 2X (touch protection) |  | VDE 0113, 0660 part 201; <br> BS 4794; CEE 24; UL 486E |
| Vibration (assembled to panel) |  |  |  |
| Frequencies $10 \ldots 2000 \mathrm{~Hz}$ |  |  |  |
| Displacement 1.52 mm (peak-peak) | max. 10 G max. 6 h |  |  |


Refer Catalogue SD5
Contact blocks (colour coded)


Possibilities to combine (Front inounting)
There are maximum 6 contact blocks to be combined


| Technical information |  |
| :--- | :--- |
| Rated thermal current $/$ th |  |
| without enclosure | (ambient $40^{\circ} \mathrm{C}$ ) |
| with enclosure | $\left(\right.$ ambient $\left.60^{\circ} \mathrm{C}\right)$ |

Rated operating voltage $U_{e}$
O Front or base mounting
O Small overall depth
O Simple snap-on contacts
O Easy to wire
O Self-cleaning contacts
O N/O-Green
O N/C - Red
O Low voltage - Blue

| Technical information, continued |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Rated operating current $J_{e}$ |  |  |  |  |  |
|  | 24 V | 48 V | 110 V | 220 V | $30 / 240 \mathrm{~V}$ |
| $A C-1$ |  |  |  | 10 A | 10 A |
| AC-15 | 8 A | 8 A | 6 A | 3 A | 3 A |
|  | 380 V | 400 V | 415 V | 500 V | 690 V |
| $A C-1$ |  |  |  |  |  |
| AC-15 | 2.5 A | 2 A | 2.2 A | 1.5A | 0.75 A |


| Rated operating current $/ \mathbf{e}$, continued |  |  |  |  |  |
| :--- | ---: | ---: | ---: | ---: | ---: |
| $\mathrm{DC}-13$ | 24 V | 48 V | 110 V | 125 V | 220 V |
| $-01,-10$ | 3 A | 1.5 A | 0.2 A | 0.6 A | 0.1 A |
| $-01,-\mathrm{E} 10$ | 1.3 A | 0.4 A | 0.13 A | 0.13 A | 65 mA |
| $\mathrm{DC}-13$ | 250 V | 400 V | 440 V | 500 V | 600 V |
| $-01,-10$ | 0.3 A | 0.2 A | 0.04 A | 0.15 A | 0.13 A |
| $-01,-E 10$ | 65 mA | 26 mA | 26 mA |  |  |

Short-circuit withstand without welding

10 A slow (DT, gG)
Switching rate
6000 operations/hour
Fuse rating

| permissible rated current | fast (D, gF) <br> slow (DT, gG) | 16 A |
| :--- | :--- | :--- |
|  | 10 A |  |

Electrical life

| AC-11. | 0.1 A | 1 A | 2 A | 3 A |
| :---: | :---: | :---: | :---: | :---: |
| millions of operations | 10 | 3 | 1 | 0.5 |
| Contact duty | electronic circuit (H-type-bridges) <br> positive opening $\Theta$ for: D5-3X01 <br> D5-3BX01 |  |  |  |

Contact travel
800 E-...

$-38 \times 01 \mathrm{~L}$


- in preparation

Terminal marking
according to DIN EN 50013
Terminals
$0.75 \ldots 2.5 \mathrm{~mm}^{2}$
18... 12 AWG


Refer Catalogue SD5

## Lamp elements



D5-3DO,
D5-3R...

## Versions

D5-3D0, D5-3R..


Standard element Operating voltage max. 250 V

D5-30D0


With central lamp test Operating voltage max. 250 V

D5-3DBO.
D5-3RB...

D5-3DB0, D5-3RB...


With series diode and resistor 220 V AC or 240 V AC supply. Use incandescent lamp $130 \mathrm{~V} / 2.4 \mathrm{~W}$ D5-3RDD...


With central lamp test With series diode and resistor 220 V AC or 240 V AC supply. Use incandescent lamp $130 \mathrm{~V} / 2.4 \mathrm{~W}$


05-3000
D5-3RDO...
-

Possibilities to combine
05-300, 05-3R... are to be combined with maximum 4 contact blocks or 2 contact blocks and one transformer.


D5-3000, D5-3RDO... are to be combined with maximum 2 contact blocks


Central lamp test


## Transformers

Technical information
Performance
Terminal marking
Terminals
Lamp socket


05-3TS...

$\times 2$


D5-3T... (without clear lamp)
 according to DIN EN 50013 $0.75 \ldots 2.5 \mathrm{~mm}^{2}$ 8A 9s


2 W (2.6 W for Pilot lights) according to DIN EN 50013
$0.75 \ldots 2.5 \mathrm{~mm}^{2}$


6
"お"


Panel thickness range $1 . . .6 \mathrm{~mm}$ Maximum panel thickness reduced when optional legend plate holders are used

Standard momentary pushbutton flush (eg. D5P-F1)


Standard momentary pushbutton guarded (eg. D5P-G1)


Standard maintained pushbutton flush (eg. D5P-FA1)


| Front element | Legend plate carrier used | $X$ | Y |
| :--- | :--- | :---: | :---: |
| Pushbutton | Any | 30 | 50 |
| Mushroom operators 40 mm | Any | 40 | 50 |
| Mushroom operators 60 mm | Any | 60 | 60 |
| Selector jog | Any | 48 | 50 |
| Any | 60 mm diameter | 60 | 60 |
| Any | 90 mm diameter | 90 | 90 |

Illuminated momentary pushbutton flush (eg. D5P-LF3)


Illuminated momentary pushbutton guarded (eg. D5S-LG3)


Illuminated maintained pushbutton flush (eg. D5P-LFA3)


Standard and illuminated
momentary pushbutton extended (eg. D5P-E1 \& D5P-LE3)


Standard reset operator
(eg. D5P-R607W with D5-ATR...)


Pilot light
standard (eg. D5P-P3)




## Operating manvol for mechenikel t pmporature conirote $\quad E N G L \mid S H$

## 


$\frac{\text { sopigatuens: }}{\text { Tro iomperaur }}$


## 

 Thasalation suiselinosis




Setimy recescmandsicions

is racucod to epprox. .o. K .



Instrukciz obstuoi mechnonicanogo resulatero temporatury $\quad$ POLSK


Nolice fiutillation
FRANÇAIS-


## Appendix 19: EMC Fans

Manufacturer:
Supplier Contact:

NHP
MPA Éngineering 3/22-24 Strathwyn Street Brendale QLD 4500
073881.0722



EMC－compatible solutions are required when using fan－and－filter units in enclosures with increased shielding． The base parts of our fan－and－filter units are given a metallic coating in a galvanising process．All－round conductive connection between the fan housing and the mounting surface is achieved via a special EMC seal．

Technical description：
－All－round contact on the enclosure via a special EMC seal．
－Minimal number of additional fixing holes，thanks to the contact spring solution．
－Optimised noise generation and air volume．thanks to the typical Aital grille design．
－Service－friendly handling，thanks to quick replacement of the filter mat．
－The plastic housing is temperature－ resistant from $-35^{\circ} \mathrm{C}$ to $+70^{\circ} \mathrm{C}$ and is also self－extinguishing to UL 94－V0．

## Colour：

RAL 7032．To order fan－and－filter units in RAL 7035，change the final digit of the order number to a． 7 ．

## Supply includes：

Fan－and－filter units complete and ready to install．including drilling template，filter mat and assembly parts．

## EMC fan－and－filter unit




| Performance diagrams－ |
| :---: |
| see basic uni |
| SK 3321．．．．，p． 542 |
| SK 3322．．．．，p． 542 |
| SK 3323．．．．，P． 544 |
| SK 3324．．．．．P． 544 |
| SK 3325．．．．．p． 546 |
| SK 3326．．．．，p． 548 |
| SK 3327．．．．．p． 5 |

（X）：SK 3321
10 mm
SK 3322
SK 3322
10.5 mm
（Y）：SK 3321
12 mm
SK
SK 3322
14 mm

| Model No．Fan and－nter unlt SK |  | ，．$:$ |
| :---: | :---: | :---: |
| Rated operating woltage Morlhz |  | \％为为号 |
| Air throughput，unimpeded air fow |  | 的褑？ |
| Air throughput with outhet filter including standard niter mat |  |  |
| Axial tan |  | A－ |
| Rated current max． |  | $\stackrel{\square}{*}$ |
| Power |  |  |
| Noise level |  |  |
| Temperature range |  |  |
| Protection category to EN $60529 / 10.91$ |  |  |
| Model No．EMC outhet nter SK |  |  |
| A（mm） |  | ＂$\quad$ ， |
| 8 （mm） |  | $\because, ~ \because$ |
| C （mm） |  | －．${ }^{\text {¢ }}$ |
| D （mm） |  | $\cdots$ |
| E（mm） |  |  |
| F（mm） |  | $\because$ ． |
| G （mm） |  | ． |
| Special voltages available on request．Technical modifications reser |  |  |
| Accassories | Packs of | Page |
| Spare fiter mats | 5 | 568 |
| Fine filter mats | 5 | 568 |
| Thermostat | 1 | 57.1 |
| Temperature indicaler with switching contact | 1 | 570 |
| Speed control | 1 | 572 |
| Hoso－prool hood | 1 | 570 |

－Delivery times on request 550

| 5381.600 | 351．615 | 302．000 | 372．675 | 3723.000 | 2323．615－ | 3284.600 | $3321.615^{\circ}$ | 5385．600 | 3225.615 | 3326． 600 | 3726．175 | 3127.600 | 3327．615 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 2305060 | 1155060 | 23050650 | 1155050 | 2305050 | 115／5060 | 2305050 | 1155060 | 23050．50 | 1555960 | 2305060 | 1155950 | 23050550 | 1155060 |
| 20／65 mid |  | \＄5／65 mid |  |  |  | $1801160 \mathrm{~m}^{3} / \mathrm{m}$ |  | 230／285001／4 |  | 500550 $\mathrm{m}^{2} / \mathrm{m}$ |  | 700／720 mi／h |  |
| $\begin{aligned} & 1 \times 3321260 \\ & .15 / 18 \mathrm{~m} / \mathrm{m} \end{aligned}$ |  |  |  |  |  |  |  |  |  | $1 \times 3325.260$$170,205 \mathrm{~m}^{2} / \mathrm{m}$$2 \times 3325.26 \mathrm{a}$$200 / 230 \mathrm{~m} / \mathrm{m}$$1 \times 335.260$$360390 \mathrm{~m}^{\mathrm{d} / \mathrm{m}}$ |  | $\begin{aligned} & 1 \times 3325.269 \\ & 525 / 575 \mathrm{~m}^{1} / \mathrm{m} \end{aligned}$ |  |
| Sell－santing shades pole moior |  |  |  |  |  |  |  |  |  | Capaciox mava |  |  |  |
| 69 mN 58 mA | $\begin{aligned} & 138 \mathrm{mN} \\ & 115 \mathrm{~mA} \end{aligned}$ | $\begin{aligned} & 0.12 \mathrm{~N} \\ & 0.11 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.24 \mathrm{~N} \\ & 0.23 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.12 \mathrm{~N} \\ & 0.11 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.24 \mathrm{~N} \\ & 0.23 \mathrm{~A} \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.19 \mathrm{~A} \\ & 0.20 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.38 \mathrm{~N} \\ & 0.40 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.28 \mathrm{~N} \\ & 0.24 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.53 \mathrm{~N} \\ & 0.49 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.29 \mathrm{~N} \\ & 0.35 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.58 \mathrm{~N} \\ & 0.70 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 0.65 \mathrm{~N} \\ & 0.58 \mathrm{~A} \end{aligned}$ | $\begin{aligned} & 1.50 \mathrm{~N} \\ & 2.00 \mathrm{~A} \end{aligned}$ |
| $\begin{array}{r} 12.5 \mathrm{~W} / \\ 100.3 \mathrm{~W} \\ \hline \end{array}$ |  | $\begin{aligned} & 19.0 \mathrm{~W} / \\ & 18.0 \mathrm{~W} \end{aligned}$ |  |  |  | $\begin{aligned} & 30.0 \mathrm{~W} / \\ & 35.0 \mathrm{~W} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & \hline 41.0 \mathrm{~W} / \\ & 38.0 \mathrm{~W} \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 64.0 \mathrm{~W} / \\ & 80.0 \mathrm{w} \end{aligned}$ |  | $\begin{aligned} & 155.0 \mathrm{~W} / \\ & 212.0 \mathrm{~W} \\ & \hline \end{aligned}$ | $\begin{aligned} & 167.0 \mathrm{~W} / \\ & 230.0 \mathrm{~W} \\ & \hline \end{aligned}$ |
| 41／46 d8（ A |  | $46 / 49 \mathrm{~dB}$（A） |  |  |  | 52／48 dB（ $A$ ） |  | 5456dB（A） |  | 59／61 dB（ （） |  | 75／76 d8（A） |  |
| $-10{ }^{\circ} \mathrm{C}$ to $+55^{\circ} \mathrm{C}$ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| PB $\mathbb{P} \times 5$ men usima fine fitter rats and nose－prood noods |  |  |  | IP 0 sencia P $\times 5$ wher using tine iiter mass and hose－prod hoods |  | $\mathbb{P} 4$ <br> IP $\times 5$ when using fine fiter mase and hose－prood hoots |  | P4 0 standad Ip $\times 5$ mane using tire lifer mase and hoseprod hoods |  | 1443 IP X5 when using line filler mats and nose－raoct nooss |  |  |  |
| 3321.269 |  | 3322.260 |  | 3323.280 |  | 335.260 |  |  |  | 3326.260 |  |  |  |
| 116.5 |  | 148.5 |  | 204.0 |  | 255.0 |  |  |  | 323.0 |  |  |  |
| 37.0 |  | 52.0 |  | 7.5 |  | 100.0 |  |  |  | 124.0 |  | 140.0 |  |
| 90.0 |  | 122.5 |  | 176.0 |  | 22.0 |  |  |  | 290.0 |  |  |  |
| － 90.0 |  | $\square 120.0$ |  | 1220.0 |  | 0150.0 |  |  |  | $\square 225.0$ |  | 280.0 |  |
| 92．0．41 |  | 124.0 |  | 17.0 |  | 224.0 |  |  |  | 292.0 |  |  |  |
| t00． 5 |  | 132.5 |  | 185.0 |  | 23.0 |  |  |  | 30.0 |  |  |  |
| （50．25） |  | （66．25） |  | （92．5） |  | （117．0） |  |  |  | （151．0） |  |  |  |


| 3321.700 |  | 3322.700 |  | 3178.100 |  | 3172.100 |  |  |  | 3173.100 |  | 3327.700 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| － |  |  |  | 3181.100 |  | 3182.100 |  |  |  | 3183.100 |  |  |  |
| 3110.000 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3114.100 | 314.115 | 3114.100 | 3114.15 | 3114.100 | 314，115 | 3114.100 | 3114．36 | 314.100 | 3114.15 | 3114.100 | 314115 | 3214.100 | 3114.115 |
| 3120.000 | 3120.115 | 3120.000 | 3120.115 | 3120.000 | 3120.115 | 3120.000 | 3120.115 | 3120.000 | 3120.115 | 3120.000 | 3120.115 | 3120.000 | 3120.115 |
| 332 t .800 |  | 3322.800 |  | 3323.800 |  | 3324．800 |  |  |  | 3326.300 |  |  |  |

## Appendix 20: Phase Fail Relays

Manufacturer:
Supplier Contact:

Crompton Instruments
MPA Engineering
3/22-24 Strathwyn Street
Brendale QLD 4500
. 073881.0722.

## Page 1 of 2

2f: IW250PMSH - Rev 6 - Sept 02

Models Covered

| 252-PMM | 252-PMT | 252-PSF | $252-P S G$ |
| :--- | :--- | :--- | :--- |
| $253-\mathrm{PH}$ | $252-\mathrm{PMM}$ | $252-\mathrm{PMT}$ |  |

## introduction

Thermistor Trip Relay (252-PMM \& 252-PMT).
The trip inputs are monitored within settable limits. In the event of the input moving outside these limits, the unit will initiate a trip signal via a double pole changeover relay. An illuminated green LED indicates when the thermistor temperature is within normal working limits. The unit is designed such that the alarm relay is energised when normal temperatures are reached
Model 252-PMM has the facility for manual resetting. so that the trip condition remains after normal operating temperature is reached, until manual intervention occurs.

Phase Balance Relay (252-PSF \& 252-PSG)
Trip inputs are monitored within settable limits. In the event of the input moving outside these limits, the unit will initiate a trip signal via a double pole changeover relay. An illuminated red LED indicates that the supply is within limits.

## Speed Sensing Relay (253-PH3)

Trip inputs are monitored within seltable limits. In the event of the input moving outside these limits, the unit will initiate a trip signal. The illuminated red LED's indicates that the single pole output relays are in an energised state and at normal

רning speed all three relays should be energised. Units
$\geq$ factory adjusted for normal running speed $=0.75 \mathrm{~mA}$ output. The meter adjust pot on the product front is used for this requirement, which also ensures the trip levels are set to the calibrated values. Terminal 8 is connected to terminal 5 internally. Terminals 15 and 16 give a $0 / 1 \mathrm{~mA}$ signal proportiona! to speed.

No. 1 Relay energises on rising speed
No. 2 Relay energises on rising speed
No. 3 Relay de-energises on rising speed
This product is designed for use only with magnetic coil inductive sensors.

## Warning

- During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be perfur med only by qualified, properly trained personnel' abiding by local regulations. Ensure all supplies are de-energised before attempting connection or other procedures.
- It is recommended adjustments be made with the supplies de-energised, but if this is not pussible, then extreme caution should be exercised.
- Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.
- This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.
Never open circuit the secondary winding of an energised current transformer.


## Protector Trip Relays

DIN Rail \& Wall Mounted 250 Series Thermistor Trip, Speed Sensing \&

## Phase Angle

Installation
The Protector should be installed in a dry position, not in direct sunight and where the ambient temperature is reasonably stable and will not be outside the range 0 to 60 degrees Celsius. Mounting will normally be on a vertical surface but other positions will not affect the operation. Vibration should be kept to a minimum. The Protectors are designed for mounting on a 35 mm rail to DIN 46277. Alternatively they may be screw fixed; a special adaptor is supplied to mount 252 types.

To mount a protector on a DIN rail, the top edge of the cutout on the back is hooked over one edge of the rail and the bottom edge carrying the release clip clicked into place. Check that the unit is firmly fixed. Removal or repositioning may be achieved by levering down the release clip and lifting the unit $u p$ and off the rail.

Connection diagrams should be carefully followed to ensure correct polarity and phase rotation where applicable. External voltage transformers may be used on 252-PSF and 252-PSG to extend the range.

252-PMM, 252-PMT \& 253-PH3
Pick up, input and output leads should be kept separate from any other wiring.

Setting Controls (252-PSF, 252-PSG)
These products have two calibration facilities that can be set to suit operating requirements and they are factory calibrated as follows:-

1. \% unbalance set points

Voltages of and below 380 volts L-L are calibrated to $1.0 \%$ class index of rated voltage. Voltages above 380 voits L-L are calibrated to $1.5 \%$ class index of rated voltage.
2. Time Delay

For all voltage ranges $10 \%$ maximum delay.
3. Voltage Withstand

Continuous overload $=1.35 \times$ rated voltage
Setting Up (all other models)
The calibration marks around the controls are provided as a guide if the instailer does not have access to accurate equipment. The maximum error of the calibration marks is typically $10 \%$ of the span of the control concerned.

## Maintenance

The unit should be inspected to normal standards for this class of equipment. For example remove accumulations of dust and check all connections for tightness and corrosion. In the unlikely event of a repair being necessary it is recommended that the unit be returned to the factory or to the nearest Crompton Instruments Service Centre

## Electromagnetic Compatibility

This unit has been designed to provide protection against EM (electro-magnetic) interference in line with requirements of EU and other regulations. Precautions necessary to provide proper operation of this and adjacent equipment will be installation dependent and so the following can onjy be general guidance:-

- Avoid routing wiring to this unit alongside cables and products that are, or could be, a source of interference.

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Ref: IW250PMSH - Rev 6 - Sept 02

- The auxiliary supply to the unit should not be subject to excessive interference. In some cases, a supply line filter may be required.
- To protect the product against incorrect operation or permanent damage, surge transients must be controlled. it is good EMC practice to suppress differential surges to 2 kV or less at the source. The unit has been designed to automatically recover from typical transients, however in extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 5 seconds to restore correct operation.

INSTALLATION INSTRUCTIONS

## Protector Trip Relays <br> DIN Rail \& Wall Mounted 250 Series Thermistor Trip, Speed Sensing \& Phase Angle

- Screened communication and small signal leads are recommended and may be required. These and other connecting leads may require the fitting of RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems.
It is good practice to install sensitive electronic instruments that are performing critical functions in EMC enclosures that protect against electrical interference causing a disturbance in function.


252-PMM

253-PH3

252-PMM can operate in either an automatic or a manual reset mode.
For automatic the reset link
R1-R2 is to be disconnected.
For manual the reset link R1-R2 must be inserted.


Model 252


The Information contained in these installation instructions is for use only by installers trained to make electrical power installations and is intended to describe the correct method of installation for this product. However, Tyco Electronics has no control over the field conditions, which influence product installation.
$H$ is the user's responsibility to determine the suitability of the installation method in the user's field conditions. Tyco Electronics' only obligations are those in Tyco Electronics' standard Conditions of Sale for this product and in no case will Tyco Electronics be liable for any other incidental, indirecl or consequential damages arising from the use or misuse of the products. Crompton is a Irade mark.

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Phone: +441376509509 Fax: +44 1376509511


[^0]:    ## ABB Automation Ltd

    St. Neots
    Cambs.
    England. PE19 日EU
    Tet. 44 (0) 1480475321
    Fax: +44 (0) 1480217948
    2

[^1]:    1) Pressure: $-50 \ldots+150 \%$ of the nominal pressure range; temperature: $-50 \ldots+150^{\circ} \mathrm{C}$.
    2) Not with guided microwave.
[^2]:    1) Due to the flush diaphragm, no own pressure compartment is formed.
[^3]:    ${ }^{10)}$ Relating to the nominal range, incl. hysteresis and repeatability, determined acc. to the limit point method.
    ii) Only with process fitting EV, FT.
    ${ }^{12)}$ In the compensated temperature range of $0 \ldots 100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right)$, reference temperature $20^{\circ} \mathrm{C}\left(68^{\circ} \mathrm{F}\right)$.
    ${ }^{13)}$ Acc. to IEC $60770-1$, relating to the nominal range.

[^4]:    A.E.N. 75087415745

[^5]:    Note: When non-thrust dismantling joints are used on non machined DI pipe spigots, the allowable operating pressure is 2100 kPa

[^6]:    The screws associated with motor-operator mounting and removal are color-coded RED for ositive identification ot loosen any other screws.
    OWhen holdir. e $t$ (MC motor operator (hereafter referred to, "e "XMC"), keep our fingers a. from the rear serface, particularly from the hanc. , atch area. or an

[^7]:    Notes: ') Use 'magnetic only' breaker. Refer NHP for details.

[^8]:    Note: Isolator provides rotary operation for external control. May be deleted if not required.

[^9]:    Notes: First peak multiplier is the first peak current as a multiple of the transformer rated current.

[^10]:    $\therefore \because$

