# QUEENSLAND URBAN UTILITIES 

SEWERAGE PUMP STATIONS RELIABILITY IMPROVEMENTS PROJECT (SPRIO9bc)

SP162 JILBA ST
SUBMERSIBLE SEWERAGE PUMP STATION UPGRADE

## SWITCHBOARD OPERATION AND MAINTENANCE MANUAL



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## REVISION CONTROL

| Revision | Date | Revision Details | Responsible Officer |
| :--- | :--- | :--- | :--- |
| Issue 1 | Feb 2013 | Final Revision Issued to QUU |  |
|  | $\vdots$ |  |  |
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## 1 INTRODUCTION

### 1.1 DESCRIPTION OF WORKS

The description of works is broken up into two sections; section A contains information relating to switchboard design and manufacture. Part $B$ contains information relating to the installation work, civil work, testing and commissioning of the switchboard upgrade.

The following sections are exerts from the original "Scope of works and project specification" document.

### 1.1.1 PART A DESIGN AND CONSTRUCT

The Contractor and its nominated Designers shall be responsible (but not limited) to the following scope of works under Part A:
a) Design site specific detail drawings and documentation for the new switchboards using QUU's template designs attached in Appendix 3 of this specification for all Switchboards and ancillaries, including cabling and cable management systems (note: AutoCAD files of template drawings will be made available to the Designers for preparation of each site specific̣ design);
b) Assessment of the existing supply capacity (transformer and main feeder cabling) relative to the site demand, particularly where new pumps/ motors are to be used;
c) Assessment of the existing pump/ motor details to aid correct sizing:and selection of the drive (DOL, SS or VSD) and associated power/ control equipment;
d) Carry out power system analysis and design for the new switchiboard's protection devices coordination with the Supply. Authority's mains supply fuse switches and liaise with the Supply Authority to resolve, if any abnormalities are found in the rating and fault discrimination of the protection devices;
e) Carry out earthing system design in accord with AS3000 requirements. Implement in the electrical and civil detail designs for construction as part of site installation works.
f) Assessment of the existing support structure and potential radio path obstacles (power lines, trees, buildings, etc.) associated with the telemetry radio commuñications (this is relative to any new location of the switchboard relative to the existing switchboard position - change to the radio path);
g) Design new Switchboard position so that there is 2000 clearance between switchboard doorfaces and sewer access openings If switchboard is more than 2 m from wet well, fit a pump disconnect box adjacent to the wet well. Carry out detail design of new or extended concrete slabs; cable pits and conduits if required for any of the sites for the installation of new switchboards;
h) Submit detail design drawings for each site to QUU for approval before proceeding with manufacture (Refer 2.2.4);
i). Material procurement; fabrication and assembly of Switchboard(s) in compliance with the detail design prepared for each site. Note: procurement lead times äre the responsibility of the Contractor and delays and/or alternatives shall not be considered a variation to the Works (Refer 2.2.4);
j). Contractor's internal testing of switchboards to Contractor's quality standards;
k) Preparation of Contractor's internal test results for QUU review prior to Factory Acceptance Test (FAT) to be witnessed by QUÜ;
I) Preparation of FAT documentation, schedules and test sheets for QUU approval based upon current QUU standards / templates;
m) Factory acceptance testing of new Switchboards witnessed by QUU and in the presence of the Part B Contractor (if different from Part A Contractor);
n) Preparation of the final Switchboard assembly in readiness for transportation (by the Part-B Contractor).
o) Switchboard loading onto Part B Contractor vehicle. The Contractor will be required to coordinate site delivery with the Part B Contractor and other third parties as required. The Contractor shall not seek compensation for any delays experienced by Part B works and site readiness to accept the Part A Switchboard;
p) Inspection of the Switchboard installation prior to energisation onsite;
q) Defect rectification;
r) 12 Months unlimited and unconditional warranty from Practical Completion;
s) Provision of spare parts as recommended by the switchboard manufacturer to support the installed fleet.

### 1.1.2 INSTALLATION AND COMMISSIONING

Note: the exact details of Part B: Site Works for each site shall be determined and documented
during detail design. The following listed work items are generic requirements which are expected to apply for each site:
a) Verification of field scope of works prior to submittal of quotation;
b) Site safety management and taking all site responsibilities as the Principal Contractor on site;
c) Preparation of all documentation required for site installation works including Contract Management Plan, Switchboard Changeover Commissioning Plan, etc as listed in this specification.
d) Complete a QUU Site Induction Training course to all site staff prior to site access to obtain a Class A key (2 day course);
e) Seek and obtain any approvals and permits needed to carry out the works from state, federal and local authorities as required;
f) Site mobilisation and establishment of all temporary works;
g): Carry out site surveys if required under detail design for construction of new switchboards slabs;
h) Apply for QUU's Permit To Work at all sites within this Scope of Works;
i) Design verification and installation of all civil works established during detail design for each site including earthing system as per the Part A Contractor's detail design.
j) Design verification, supply and installation of all new electrical cabling works (if determined by the detail design that require replacement), together with all necessary supports, fixtures and fittings, required to complete the Contract Works.
k) Materials and equipment procurement, transport, storage, protection and handling as specified for each site in the following sections;
I) Switchboard delivery, off-loading and placing / securing into position;
m) Provision of all field equipment and devices as listed in Section 3.3.1 Field Equipment;
n) Supply, installation, termination and continuous operation of a temporary Switchboard suitable for the control and operation of wet well Duty pump(s). This shall be used to ensure the automatic flow control of the site during the transfer of power and control of the existing pumps from the existing Switchboard to the new Switchboard. No less than the number of existing Duty pumps shall be connected to this temporary Switchboard;
o) Provide independent battery backed audible \& visual level alarming for the site changeover and switchboard commissioning;
p) On-site and:off-site co-ordination with the Supply Authority for connection/disconnection of new/old Switchboard source of supply and all works associated with the provision, final connection, testing and certification of the new service as required;
q) Modifications, as required, to the existing electrode box to house all new level probes as per Contractor's detail design;
r) Replacement of any conduits and cable pits and detail design;
s) Pre-commissioning and commissioning of the new Switchboards and all field connected equipment and systems, in conjunction with QUU. (Note: the Contractor shall provide assistance for full and complete on-site testing and commissioning of the RTU Code in conjunction with Queensland Urban Utilities);
t) Development of a Site Acceptance Test (SAT) document for QUU approval (test plan/strategy and full complement of test sheets) that clearly defines the logical sequence and structured testing of the complete installation (Switchboard and all field devices) in accordance with the Contractor's detail drawings/documentation and QUU's standard templates. This includes preparation of a Switchboard changeover commissioning plan for the site installation works;
u) Carry out SAT in conjunction with the QUU Commissioning Engineer and RTU Programmer;
v) Onsite training for QUU field staff following successful completion of the SAT (date/time to be agreed by QUU);
w) Complete removal and off-site disposal of the existing Switchboard, and all waste plant / equipment in accordance with current legislation, local regional and national statutory instruments. The existing Switchboagrd and all equipment contained within shall remain the property of Queensland Urban Utilities and shall be packaged, labelled and delivered to the QUU's Brisbane Depot at Eagle Farm.
x) Restoration of site on completion;
y) As Constructed drawings and documentation as detailed within this specification;
z) Provide full compliance certificaltion of all new electrical works;
aa) Defect rectification based upon priority levels;
bb) 12 Months unlimited and unconditionial warranty from Practical Completion;

SP162 - Jilba St, Indooroopilly

### 1.2 FACILITY LOCATION AND MAP

The Jilba St sewerage pump facility is located in Indooroopilly QLD 4068. See map below for details.


Map showing location of Jilba St switchboard

## SECTION 2: SWITCHBOARD INFORMATION AND TECHNICAL DATA - CONTENTS PAGE

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## 2. SWITCHBOARD INFORMATION AND TECHNICAL DATA

2.1 SWITCHBOARD DESIGNATION AND MANUFACTURER INFORMATION

SP162 - JILBA ST
Sunline Contract Number - Q12B04
Sunline Switchboard Number - Q12B04B
Contact Details:
Email - admin@sunline.net.au
Phone - (07)38813433
Fax - (07) 38813611
Address - 7 Duntroon Street, Brendale QLD 4500
2.2 SWITCHBOARD EQUIPMENT SCHEDULE

The following pages list all internal components within the Jilba St Switchboard.

| ITEM | QTY | DESCRIPTION | MANUFACTURER | Catalogue no | OPT | REMARKS |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 |  |  |  |  | $N$ |  |
| 2 | 1 | MANUAL TRANSFER SWITCH | TERASAKI | MTSS2PE12533 | F | $\begin{gathered} \text { Set Ir. } 0.8(100 \mathrm{~A}) \\ \text { Char }=6 \end{gathered}$ |
| 3 |  | - TO SUIT MAIN SWITCHES 02 \& 03 S25PE/125 | TERASAIU | Q2 FITTED WTH N/O AUX CONTACT | F |  |
| 4 | 1 | Q4 PUMP1 CIRCUIT BREAKER + T2HS Handle | TERASAIU | S125G]/50 + T2HS12R5GM | - | $\begin{gathered} \text { Set Ir }=0.8(40 \mathrm{~A}) \\ \mathrm{Im}=6(300 \mathrm{~A}) \end{gathered}$ |
| 5 | 1 | Q5 PUMP2 CIRCUT BREAKER + T2HS Handle | TERASAKI | S125GJ/50 + T2HS12R5GM | - | $\begin{gathered} \text { Set Ir }=0.8(40 \mathrm{~A}) \\ \operatorname{Im}=6(300 \mathrm{~A}) \end{gathered}$ |
| 6 |  |  |  |  | E |  |
| 7 | 1 | Q7 ENERBEX PHASE: FAILURE CIRCUIT BREAKER | TERASAKI | DTCB15306C | - |  |
| 8 |  |  |  |  |  |  |
| 9 | 1 | Q9 SUB-DISTRIBUTION BOARD CIRCUIT BREAKER | TERASAKI | E125NJ/50 | - | Set Ir. 0.8 (40A) Itn $=6$ (300A) |
| 10 | 1 | Q10 STATION MAINS PHASE FAILURE CIRCUIT BREAKER | TERASAKI | DTCB6306C | - |  |
| 11. $:$ | 1 | Q11 SA GPO CIRCUİ BREAKER : | TERASAKI | DSRCBH-16-30A | . |  |
| 12 | 1 | Q12 RTU LAPTOP GPO CIRCUITT BREAKER | TERASAKI | DSRCBH-10-30A | - |  |
| 13 | 1 | Q13 SPARE | TERASAKI | DTCB6106C | E |  |
| 14 | 1 | Q14 SPARE | TERASAKI | DTCB6110C | E. |  |
| 15 | 1 | Q15 GENERATOR AUXILIARY SUPPLY CIRCUIT BREAKER | TERASAKI | DSRCBH-10-30A | - |  |
| 16 | 1 | Q16 SPARE CIRCUTT BREAKER | TERASAKI | DSRCBH-6-30A |  |  |
| 17 : | 1 | Q17 SURGE FILTER CIRCUT BREAKĖR | TERASAKI | DTCB6110C | - |  |
| $\therefore 18$ | 1 | Q18 EM PUMP CNTRL \& SURCHARGE IMMINENT CB | TERASAKI | - DTCB6106C | - |  |
| 19 | 1 | Q19 SPARE CIRCUT: BREAKER | TERASAKI | DTCB6106C : | K | . |
| 20 | 1 | Q20 3 PHASE OUTLET CIRCUTT BREAKER | TERASAKI | $\therefore$ DTCB6310C $\quad \therefore$ | $\therefore:$ | $\begin{gathered} \text { PLUS DSRCM-32-30- } \\ \text { 3PN } \end{gathered}$ |
| 21 | 1 | Q21 SPARE | TERASAKI | DTCB6106C | Q | $\therefore$ |
| 22 | . | $\therefore$ : $\therefore \therefore$ : |  | $\cdots$. : $\cdot$ | M: | $\cdots$ |
| 23 | ! |  | . ${ }^{\text {a }}$ | $\therefore \because$ | $v$ |  |
| 24 |  | NOT USED |  |  | : |  |
| $25:$ | : : | NOT USED ${ }^{\text {a }}$ : |  | $\because \because$ |  | ... |
| 26 | 1 | Q30 RTU POWER SUPPLY CIRCUTT BREAKER | TERASAKI | DTCB6104C | - | $\because$ |
| 27 | 1 | Q31 5URGE FILTER ALARM•RELAY CIRCUIT BREAKER | TERASAKI | DTCB6104C | - | . |
| $\because 28$ | 1 | Q32 SPARE . | $\therefore$ TERASAKI | DTCB6104C : | H | $\therefore$. ${ }^{\text {a }}$ |
| 29 | 1 | Q33 SPARE | TERASAKI | DTCB6104C | - |  |
| 30 |  | NOTT USED $\because \because \cdot$ |  | . |  |  |
| 31 | 2 | PUMP 240VAC CONTROL CIRCUIT BREAKER. | T取ASAK 110 | 3 DTCB6104C | - | 04-1; 05-1 |


| 32 | 2 | PUMP 24VDC CONTROL CIRCUIT BREAKER | TERASAKI | DTCB6110C | - | QD4, 005 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 33 | 1 | BATTERY SHORT CCT PROTECTION CIRCUIT BREAKER | TERASAKI | DTCB6210C | - | QD6 |
| 34 | 2 | PUMP 240VAC-24VDC POWER SUPPLY | WEIDMULLER | 8951340000 | - | 120W 5A/24VDC |
| 35 |  |  |  |  |  |  |
| 36 | 1 | DISTRIBUTION BOARD CHASSIS | TERASAKI | CD-2-24/18-3U | - |  |
| 37 | 3 | F1 - SURGE DIVERTER CIRCUIT FUSES | NHP | 63AMP 63MS | - | FUSES \& HOLDERS |
| 38 | 3 | SURE DIVERTER | CRITEC | TDS1100-2SR-277 | - |  |
| 39 | 1 | SURE FILTER ALARM RELAY - SFAR | CRITEC | DAR-275V | - | : |
| 40 | 1 | SURE REDUCTION FLIER - SRF | CRITEC | TDF-10A-240V | - |  |
| 41 | 1 | ENEREX MAINS PHASE FAILURE RELAY PFRE | CARLO GAVAZZI | DPB01CM48W4 | - |  |
| 42 |  |  |  |  |  |  |
| 43 | 1 | STATION MAINS PHASE FAILURE RELAY - PFRS | CARLO GAVAZZI | DPB01CM48W4 | - | $\therefore$ |
| 44 |  | NOT USED | . |  |  |  |
| 45 | 1 | MAIN NEUTRAL LINK | TBA | TBA | - | INSULATED |
| 46 | 1 | MAIN EARTH LINK | TBA | TBA | - |  |
| 47 | 1 | DIST. BD NEUTRAL LINK - 24 WAY | TBA | TBA | - | INSULATED |
| 48 | 1 | DIST. BD EARTH LINK - 24 WAY | TBA | TBA | - |  |
| 49 | 1 | SURGE DIVERTER NEUTRAL LINK | CUPSSAL | L5A | - | INSULATED |
| 50 | 1 | INSTRUMENT: EARTH LIM ( | TBA | TBA | - | INSULATED |
| 51 | 1 | FLTERED SUPPLY NẸUTRAL LINK | CUPSAL | - L7 | - | INSULATED |
| 52 | 1 | 3 PHASE SWITCHED OUTLE:T | ' CLIPSAL' | $\because 56 C 410 .$. | - | $\begin{aligned} & \text { USE ENCLOSURE AS } \\ & \text { SHROUD } \end{aligned}$ |
| 53 | 1 | 1 PHASE OUTLET 15A | CLİIPSAL | 15/15-90B (SHROUD) | - |  |
| 54 | 1 | LAPTOP GPO - TWIN 10A | CLIPSAL | $25+449 A+449 A P$ | $\because$ |  |
| 55 | 1 | 1 PHASE OUTLET - GENERATOR ANCILLARY POWER | CLIPSAL | 56SO310 | F | IP56 |
| 56 | 1 | 3 PHASE N\&E APPLIANCE INLET GENERATOR POWER | MENNEKES | MEN361 125A | F: | $\begin{gathered} \text { C/W PROTECTIVE CAP } \\ 40787 \end{gathered}$ |
| 57 |  | NOT USED |  | $\therefore$. . |  | $\ldots$ : |
| . $98{ }^{\circ}$ |  | -. . . |  | $\therefore$ |  | . . |
| 59 | 2 | PUMP SOFT STARTER: | DANFOSS MCD 500 | $\text { CD5-0037B }=\text { MODBUS }$ СОMMS |  | : |
| 60 | 2 | EXTERNAL KEYPAD KIT | DANFOSS LCP501 | 175G0096. . | - | $\cdots$ |
| 61 |  |  |  |  |  |  |
| 62 | 2 | PUMP LINE CONTACTOR - K1 (24VDC COIL) | SPRECHER \& SCHUH | CA7-37 |  | 24VDC COIL |
| 63 |  |  | Page 12 of |  | - | . |


| 64 |  |  |  |  | c |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 65 | 2 | PUMP FAULT RELAY - K3 | IDEC | RH2B-ULD-DC24V | - | + SH2B-05 |
| 66 | 1 | PUMP1 RUN RELAY - 1K6 | IDEC | RH2B-ULD-DC24V | - | + SH2B-05 |
| 67 | 1 | PUMP2 RUN RELAY - 2K6 | IDEC | RH2B-ULD-DC24V | 0 | + SH2B-05 |
| 68 | 2 | PUMP CONTROL CCT POWER ON reLay - k5 | DEC | RH2B-ULD-DC24V | - | + 5H2B-05 |
| 69 | 2 | PUMP1 E/STOP RELAY - 1K4/2K4 | IDEC | RH2B-ULD-DC24V | - | + SH2B-06 |
| 70 | 2 | POWER ON RESET TIMER - 1 KTT / 2KTT | SPRECHER \& SCHUH | RZ7-FSA 3E U23 | - | ON DELAY |
| 71 |  | : : |  |  | B |  |
| 72 |  |  |  |  | B |  |
| 73 | 2 | PUMP RUN COMMAND RELAY - K20 | IDEC | RH2B-ULD-DC24V | - | -SH28-05 |
| 74 | 2 | PUMP FAULT RESET RELAY - K21 | IDEC | RH2B-ULD-DC24V | - | $+5 \mathrm{H} 2 \mathrm{~B}-05$ |
| 75 | 2 | PUMP EMERGENCY MODE INTERRUPT RELAY - K22 | IDEC | RH2B-ULD-DC24V | - | -5H2B-05 |
| 76 | 2 | PUMP START PUSHBUTTON - S1 | SPRECHER \& SCHUH | D7P-F3-PX10 | - |  |
| 77 | 2 | PUMP STOP PUSHBUTTON - 52 | SPRECHER \& SCHUH | D7P-F4-PX10 | - |  |
| 78 | 2 | PUMP EM/STOP PUSHBUTTON - S3 | SPRECHER \& SCHUH | D7P-MT34-PX01S | - | $\begin{gathered} \text { C/W D7-15YE112• } \\ \text { PXOIS } \end{gathered}$ |
| 79 | 2 | PUMP RESET PUSHBUTTON - 54 | SPRECHER \& SCHUH | D7P-F6-PX10 | - | -D7P-PX10 |
| 80 | 2 | PUMP HOUR RUN METER - HRM | NHP | RQ4801080VDC | - | 24VDC |
| 81 | 2 | PUMP POWER SOCKET OUTLET + incline sleeve | MARECHAL | $\begin{gathered} \text { DS3 } 3134013972+ \\ 51 \text { CA058 } \\ \hline \end{gathered}$ | J |  |
| 82 | 2 | PUMP POWER INLET PLUG + HANDLE | MARECHAL | $\begin{gathered} . \\ \quad \text { SS } 3138013972+ \\ 313 A 013 \\ \hline \end{gathered}$ | J | -NILSEN SUPPLY- |
| 83 |  | - . |  |  |  |  |
| 84 |  | - . | $\cdots$ |  |  |  |
| 85 |  |  | $\cdots$ |  | E |  |
| 86 |  |  |  |  | E |  |
| 87 |  |  |  |  | 'E | : |
| 88 |  | . ${ }^{\text {- }}$ | $\cdots$ | . | E |  |
| 89 | $\because$ | . . . ${ }^{\text {. }}$ | . |  | E |  |
| 90 | 1 | PUMP 240VAC-24VDC POWER.SUPPLY | WEIDMULLER. | 8951340000: | - | $120 \mathrm{~W} 5 \mathrm{~A} / 24 \mathrm{VDC}$ |
| 91 | 1 | EMERGENCY PUMP MODE 24VDC CIRCUIT BREAKER | TERASAKI | DTCB6110C | : | QD18 |
| 92 | 1 | LR3- WET WELL HIGH LEVEL RELAY | MULTITRODE | MTR-5 | - | 24VDC |
| 93 | 1 | WWR - WET WELL WASHER RELAY . | IDEC | RH2B-ULD-DC24V |  |  |
| 94 |  | - . ${ }^{\text {a }}$ | $\therefore \cdot \cdot$ |  | 0 |  |
| 95 | 1 | SIR - SURCHARGE IMMINENT LEVEL RELAY | MU4Tgimpg of 363 | MTR-5 | - | 24VDC |


| 96 | 2 | SINGLE POINT PROBES | MULTITRODE | 2 off -020130FSP-Shield | - | -NILSEN SUPPLY- |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 97 | 1 | EMERGENCY PUMPING MODE RELAY PUMP1 - EMG1 | IDEC | RH2B-ULD-DC24V | - | +SH2B-05 |
| 98 | 1 | SURCHARGE IMMINENT DELAY TIMER - SIDT | SPRECHER \& SCHUH | RZ7-FSA 3E U23 | - | ON DELAY |
| 99 | 1 | EMERGENCY PUMPING MODE TIMER EMGDT | OMRON | H3CA-A | - | DIGITAL MULTIFUNCTION TIMER |
| 100 | 1 | EMERGENCY PUMPING MODE TIMER PUIP2- EMG2 | SPRECHER \& SCHUH | RZ7-FSA 3E U23 | - | ON DELAY |
| 101 | 2 | EMERGENCY PUMPING MODE SWITCH S5 | SPRECHER \& SCHUH | D7P-LSM25 + D7PX10 | - | + D7PN3Y + D7PX10 |
| 102 | 1 | EM PUMP RTU RELAY - EMG3 | IDEC | RH2B-ULD-DC24V | - | +SH2B-05 |
| 103 |  |  |  |  | F |  |
| 104 |  |  |  |  | F |  |
| $105^{\prime}$ |  |  |  |  | F |  |
| 106 |  |  |  |  | F |  |
| 107 |  |  |  |  | F |  |
| 108 |  |  |  |  | F |  |
| 109 |  |  |  |  | F |  |
| 110 |  |  |  |  | F |  |
| 111 |  |  |  |  | F |  |
| 112 |  |  |  |  | F |  |
| 113 |  |  |  |  | 'F |  |
| 114 |  | $\because$ | - |  | F: | $\because$. |
| 115 | 1 | GRAPHIC DISPLAY - FREE ISSUE | REDLION | G306A000 | - | FREE ISSUE |
| 116 |  | NOT USED |  | : | $\therefore$ | $\therefore$. |
| 117 |  |  | $\because$ |  |  | : |
| 118 | 1 | STATION LOCAL/REMOTE SWITCH S10 | KRAUS \& NAIMĖR | CADI1-A720-600-FT2-F758 | - | ENGRAVE 'LOCAL REMOTE' |
| 119 | 1 | ELECTRODES TEST RELAY - ETR | : IDEC | RH4B-ULD-24VDC | - | +SH4B-05 |
| 120 |  | . . | - . | . . | P | $\therefore \quad$. |
| 121 | 1 | WET WELL:LEVEL INDICATOR : | CROMPTON INSTRUMENTS | $\begin{gathered} 244-01 K G-H G-I P-S R ~ 4- \\ 20 \mathrm{~mA} \end{gathered}$ | - | 0-100\% ADJ RED POINTER |
| 122 |  | . . . . | : | : $\cdot$. $:$ | J |  |
| 123 | 6 | SW/BD DOOR MICRO SẆITCHES | OMRON | DZ-10GW2-1B | - | 8 OFF N/O |
| 124 | 1 | SW/BD DISCONNECT COMPART. DOOR PROXIMITY SWITCH | PEPPERL \& FUCHC | NCB5-18GM40-Z0 | - | LOCATION TBA |
| 125 | 4 | SW/BD INTERNAL LED LIGHTS | LUMIFA | $\because$ LF1B-C3S-2THWW4 | $\because$ | . ${ }^{\text {b }}$. |
| . 126 |  |  |  |  | E | $\cdots$ |
| 127 |  | . ${ }^{\text {. }}$ | Page 14 of | 3 | S |  |


| 128 |  |  |  |  | S |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 129 |  |  |  |  | K |  |
| 130 |  |  |  |  | K |  |
| 131. |  | NOT USED |  |  |  |  |
| 132 |  |  |  |  | H |  |
| 133. | 1 | WET WELL LEVEL PROBE - FREE ISSUE - | VEGA - VEGAWELL5? | WL52XXA4AMD1DD1X | - | SET RANGE TO = 4m |
| 134 | 1 | WET WELL LEVEL ADJUSTMENT UNIT -FREE ISSUE- | VEGA - VEGADIS62 | DIS62XXKMAXX | $\because$ |  |
| 135 |  |  |  |  | G |  |
| 136 | 1 | DELIVERY PRESSURE ADJUSTMENT UNIT | TBA | TBA | - |  |
| 137: | 1 | DELIVERY PRESSURE TRANSMITER | VEGA VEGABAR52 | BR52XXCA1EHPMAS L=?? | U | RANGE $=25 \mathrm{~m}$ |
| 138 | 1 | TRICLOVE FITTING FOR VEGABAR52 | VEGA | ADAPTOR 4 | U |  |
| 139 | 1 | RTU POWER SUPPLY 24VDC | POWERBOX | PB251-24CM-CC-T | - |  |
| 140 | 1 | RADIO 24V/13.8VDC CONVERTER | POWERBOX | PBIH-2412J-CC | R |  |
| 141: |  |  |  |  | I |  |
| 142 | 2 | BATTERIES - INCLUDING SPILL TRAYS | YUASA | UXH50-12 | - |  |
| 143. | 1 | RADIO - FREE ISSUE - | TRIO | <<DR900-0?A02-D>> | R | FREE ISSUE |
| 144 | 1 | RADIO ANTENNA - NILSEN SUPPLY- | TRIO | YAGI ANT13AL | R | 15 ELEMENT 13dB ALUM |
| 145 | 1 | RADIO COAX SURGE PROTECTION UNIT: | POLYPHASER CORPORATION | .IS-50NX-C2 | R | Mounted on Din Rail |
| 146 | 1 | TELEMETRY UNIT - FREE ISSUE | LOGICA CMG | MD3311EAL/271D-0-7 | - | FREE ISSUE |
| 147 |  |  | . |  | I |  |
| 148 |  |  | - |  | I: |  |
|  | $\cdots$ | $\therefore \therefore$ | . |  |  | $\because$ |
| 153 |  | $\therefore$ | - |  |  |  |
| 156 | 1 | ANTENNA MAST c/w 20 mm NYLON CABLE GLAND | CT STHEETMETAL | SHEET 22 | R | LENGTH = 6 MTRS |
| 157 | 1 | INTERNAL COAX CABLE (Radio to Lightning Arrester) | TRIO: | TRIO - SMAM/NM/TL23 | R | Cable No X01 |
| 158 | 1 | EXTERNAL COAX CABLE (Lightning Arrester to Aerial) | R.F. INDUSTRIES | ANDREW - CNT400 | R | Cable No X02 - NILSEN SUPPLY- |
| 159 | 2 | COAX PLUG (For CNT400 cable) | PULSE | $\mathrm{N}-203 \mathrm{HS}$ | R | Straight cable plug crimp |
| 160 | 1 | U CLAMPS | R.F. INDUSTRIES | UNV | R | $\because \cdot \cdot$ |
|  |  | SWITCHBOARD TERMINALS |  |  |  |  |
| 164 | Lot | MINIATURE.THERMAL CIRCUIT BREAKER | PHOENIX CONTACT | TCP 'x'A + UK6FSI/C | - | " $x$ " = Current Rating |
| . 164 | Lot | THROUGH TERMINALS (Grey \& Blue as Required) | PHOENIX CONTACT | PIT 2.5 . |  | PIT 2.5-BU (for -VE) |
| 164 | Lot | DISCONNECT TERMINALS (Grey \& Blue as Required) | PHOENP自GENTAGT 363 | 3 PIT 2.5-MT | - | PIT 2.5-MT-BU (for VE) |


| 1643 | Lot | COMBI PLUG TERMINALS (Grey \& Blue as Required) | PHOENIX CONTACT | PПT 2.5/1P | - | PIT 2.5/1P-BU (for VE) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 164 | Lot | COMBINATION PLUG/FUSE TERMINALS | PHOENIX CONTACT | ST 2.5-TWIN-TG/1P | - | $\begin{gathered} \text { +FUSE P-FU } 5 \times 20 \\ \text { led } 24 \end{gathered}$ |
| 1645 | Lot | COMBINATION PLUG/LINK TERMINALS | PHOENIX CONTACT | ST 2.5-TWIN-MT/1P | - |  |
| 165 | Lot | COMBI PLUGS (Grey, Blue \& Green as Required) | PHOENIX CONTACT | PP-H 2.5/1 (R, M \& L) | - | Combinations to Suit |
| 165 | Lot | COMBI PLUGS Housing \& Sleeve) | PHOENIX CONTACT | Housing $=$ PH 25/x | - | Sleeve $=\mathbf{C P H} \times$ |
| 165 | Lot | GROUP MARKER CARRIER | PhOENIX CONTACT | UBE | - |  |
| 165 | Lot. | PLUG-IN BRIDGE | PHOENIX CONTACT | FBS | - | AS REQUIRED |
| 164 | 2 | TEST PLUG | PHOENIX CONTACT: | - PS-5 |  |  |
| 164 | Lot | COVER PROFILE (SHROUDING) + CARRIER PLATE | PHOENIX CONTACT | AP-2 + AP2-TU | - | AS REQUIRED |
| 165 |  | $\therefore$. |  |  | - |  |
| 166 |  |  |  |  | - |  |
|  |  | MISCELLANEOUS | . |  |  |  |
| 167 |  |  |  |  |  |  |
| 168 | 1 | ENERGEX PADLOCK - 45mm brass pin tumbler | H.A. REED LOCKSMITHS | KEY No 325 \& S/S Shackle | - | c/w 2 KEYS |
| 169 | Lot | WET WELL CONOUIT SEALING BUNGS | RUBBER | TO SUIT CONOUTTS | - | Detail "W" |
| 170 | Lot | S/STEEL FITTINGS AS DETAILED FOR PRESSURE TX | FITIINGS | STAINLESS STEEL | U | Sheet 19 |
| 171 | 1 | EARTH ROD CONNECTION BOX | NESCO | PIT-03 | - |  |
| 172. | 1 | LINE TAP - BONDING TO EARTHING ROD. | CLPSAL | BP26 | - |  |
| 173 | 1 | EARTHING ROD | COPPER ROD | . 13 mm Diameter | - | - : |
| 174: |  |  | - |  | E | $\therefore$ |
| 175 |  |  | : - . . . | : | $\mathrm{a}_{\text {: }}$ | - - |
| 176 |  |  | $\therefore$ |  | E |  |
| 177 |  | , |  |  | E | : |
| 178 |  |  |  | : | E | $\cdot$ |
| 179 |  | . $\quad . \quad$. |  | : . | E. | - . |
| 180 | : | $\therefore{ }^{\prime}$ | .. ${ }^{\text {a }}$ |  | E | $\ldots$. ${ }^{\text {a }}$ |
| 181 | 2 | CORROSION INHIBITOR . . | - CORTEC | VPCI-110 OR.111: | - | FROM AP CONTROLS |
| 182 | : | $\therefore \cdots$ | - | $\therefore$ : | $\therefore \dot{E}$ | $\therefore:$ |

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### 2.3 SWITCHBOARD MAINTENANCE INFORMATION



This operation and Maintenance Manual has been prepared after perusal of the documents listed hereunder AS/NZS 3439. 1-2002 Low Voltage Switchgear \& Control gear Assemblies AS 2467 981 Maintenance of Electrical Switchgear.

The recommendations contained herein are offered as a guideline for the preparation of maintenance programmes by Engineers and/or Maintenance Personnel.

Alternative programmes may be devised by the end user to suit his specific requirements, in event, it is recommended detailed reference be made to the above mentioned Standards.

The following Boards are covered by these instructions:-

- Pump Panel SP162


## MAINTENANCE PROGRAMME

A recommended Maintenance Program for the switchgear is detailed below.
A. Commissioning

The switchgear should be transported to site, located and leveled and the shipping sections bolted together.

Upon completion of this exercise the switchgear should be subjected to commissioning tests as outlined in attached Maintenance Data sheet ' $A$ ' prior to connection of mains and submains cables.

## B. Inspections

An initial inspection of the switchboard should be performed within 12 months of commissioning and repeated at yearly intervals throughout the life of the switchgear. This may be programmed to coincide with a 'shut down' in the event of other works being carried out within the installation. For recommendation as to operations to be carried out during these inspections refer to attached Maintenance Data Sheet ' $B$ '.

## C. Examinations

The switchgear should be carefully examined at five (5) yearly intervals. For recommendations as to operations to be carried out during these periodic examinations refer to attached Maintenance Data Sheet ' C '.
D. Overhaul

The switchgear should be shut down' for a complete overhaul every fifteen (15) years. Depending on the size and complexity of the switchgear it may be necessary to program a total 'shut down' over a period of several days (week-end or holiday week-end). For recommendations as to operations to be carried out during this major overhaul exercise refer to attached Maintenance Data Sheet ' $D$ '

## MAINTENANCE DATA SHEET - A

Commissioning Tests
Prior to placing the switchgear into service, examinations and testing, as detail hereunder, should be performed.

- Ensure correct tension of busbar joints.
- Ensure cubicle joining hardware is securely tightened.
- Ensure all control cables are joined at terminals adjacent to 'transport splits'. Particular attention should be given to cables associated with current transformer secondary windings.
- Ensure all Terminations (power, control and metering) are tightened correctly.
- Carry out Insulation Resistance Test and Dielectric Test as desçibed below.

Insulation Resistance Test (AS/NZS.3000-2000, Clause 6.3.3.3.) Apply a D.C. Voltage ( 500 V min.) between all conductors ( $A, B, C \& N$ ) and earth.

Should ohmic readings be recorded below 10 megohms contact our Engineering Department.
Note: It is advisable that these tests be performed on the switchboard prior to the connection of mains and sub-mains cables. Remove all potential fuses to eliminate the possibility of 'back feed' through protection equipment. Close all mains and sub-mains switching devices during the tests.

- Clean interior of switchboard and wipe over exterior surfaces (covers etc.).
- Polish exterior panels (Kitten Cream Polish No. 1).


## MAINTENANCE DATA SHEET - B

## Inspections

It is recommended that the switchgear be inspected within one year ( 12 months) from the date of commissioning and at annual intervals. This exercise should include the inspections detailed hereunder.

- Check for foreign matter such as dust, magnesium oxide, swarf, cable insulation, conductor stands etc. dislodged during operation and remove from enclosure.
- Visual inspection of heavy current busbar joints for signs of discoloration due to loose jointing hardware.
- Random check of tension of busbar jointing hardware.
- Touch Test to exterior and interior panels/shrouds etc. to establish that no abnormal temperature rises are present within the switchgear enclosure (particularly within the vicinity of heavy current busbars and switching devices).
- Visual internal examination and replacement of damaged parts of heavy current interruption devices which have been subjected to a fault current. Such devices include air circuit breakers and moulded case circuit breakers. Particular attention should be given to main and arcing contact wear and condition and correct fit and condition of arc control devices.
- Check all control and meter wiring for loose connections.
- Check to ensure all seals are in order.
- Check all cover fastening hardware is tight and that cover sealing strips are not damaged.
- Visually check all Spare Parts Cabinets to ensure any used items have been replaced. Replace.
- Visual inspection of paintwork for damage. Touch up if required.
- Thermographic scan of Busbar System.


## MAINTENANCE DATA SHEET - C

## Examinations

It is recommended that the switchgear be examined at five (5) yearly intervals commencing from the date of commissioning. This exercise should include the examinations detailed hereunder.

- Check for foreign matter such as dust, swarf, cable insulation, conductor strands etc. dislodged during operation and remove from enclosure.
- Check condition of insulation and barriers for signs of splitting or deterioration. Replace or repair as necessary.
- Examine busbar system for any indication of abnormal temperatures. Infra-red scanning may be utilized if desired.
- Random check of tension of busbar jointing hardware.
- Touch Test to exterior and interior panels/shrouds etc. to establish that no abnormal temperature rises are present within the switchgear enclosure (particular within the vicinity of heavy current busbars and switching devices).
- Visual internal examinations and replacement of damaged parts of all heavy current interruption devices. Such devices include air circuit breakers and moulded case circuit breakers. Particular attention should be given to main and arcing contact wear and condition and correct fit and condition of arc control devices.
- Check all control and meter wiring for loose connections.
- Check to ensure all seals are in order.
- Check all cover fastening hardware is tight and that cover sealing strips are not damaged.
- Visual inspection of paintwork for damage. Touch up if required.
- Check labels to ensure that any changes to equipment functions have been correctly documented.


## MAINTENANCE DATA SHEET - D

## Overhaul

It is recommended that the switchgear be shut-down and subjected to a complete overhaul at intervals not exceeding fifteen (15) years. This exercise will involve very careful planining as, if carried out correctly it may take several days to complete. Should temperature checks be required, these should be carried out prior to the overhaul with the switchboard operating under normal 'load' conditions.

The following aspects should be addressed during this operation.

- Remove all covers and segregation shrouds over busbars and examine the busbar system for:a) Split or 'holed' insulation. b) Discoloration of annealing of busbars due to abnormal temperature. c) Oxidization of conductors (not normal).
- Tighten all busbar hardware to recommended tensions.
- Strip down, lubricate and generally service all switching devices in accordance with manufacturer's recommendations. Replace any faulty equipment.
- Check for foreign matter such as dust, swarf, cable insulation, conductor strands etc. dislodged during operation and remove from enclosure.
- Check all wiring for loose connections.
- Carry out insulation Resistance Test and Dielectric Test as described below, with main switches and sub-mains switches closed.
- Insulation Resistance Test (AS/NZS.3000-2000, clause 6.3.3.3.) Apply a D.C Voltage ( 500 V min.) between all conductors ( $\mathrm{A}, \mathrm{B}, \mathrm{C} \& \mathrm{~N}$ ) and earth.
- Check to ensure all seals are in order.
- Check all cover fastening hardware is tight and that cover sealing strips are not damaged.
- Visual inspection of paintwork for damage. Touch up if required.
- Check operation of protective equipment (if deemed necessary).


### 2.4 RECOMMENDED TEGG SERVICES

In order to improve reliability of the switchboard installation, Nilsen recommends TEGG services after the defects liability period. TEGG servicing is an international standard of maintenance and testing and provides a guarantee for switchboard components backed by a $24 / 7$ emergency call out service.

Please see the following pages for a summary of the services Nilsen Electrical - Engineering Services Division can provide.

For further information please see the contact details below.


## GUARANTEED PROGRAMS

TEGG PRIME<br>TEGG PREMIUM<br>TEGG BASIC<br>TEGG BUILDERS

## rece BilloERS



## TEGG PRIME

- Energised and de-energised testing
- De-energised preventative maintenance
- Guaranteed repair or replacement on components that suffer a sudden and accidental breakdown
- Provides overtime for guaranteed repairs
- Includes extra expediting service (express freight)
- Includes downstream resultant damage protection for EDS
- Includes temporary power
- Includes emergency generator if required


TEGG PROGRAM COMPARISON

| Features | TEGG Prime | TEGG Premium | TEGG Basic |
| :---: | :---: | :---: | :---: |
| Visual Inspection | Yes | Yes | Yes |
| Infared Thermographic Inspection | Yes | Yes | Yes |
| Ulitrasonic Inspection | Yes | Yes | Yes |
| Somprehensive IR Report | Yes | Yes | Yes |
| TEGG Task View | Yes | Yes | Yes |
| Predictive \& Proactive Service | Yes | Yes | No |
| Electronic Equipment Inventory | Yes | Yes | No |
| Energized Testing \& Analysis | Yes | Yes | No |
| De-Energized Testing \& Analysis | Yes | Optional | No |
| De-Energized Preventve Maintenance | Yes | Optional | No |
| Guaranteed Servvice | Yes | Yes | Yes |
| Guaranteed Repair \& Replacement | Life | Life | 90 Days |
| $24 / 7$ Exergency Call Out | Yes | Yes | Yes |
| Overtime for Repairs on Guarantee | Yes | Yes | No |
| Downstream Resultant Damage Repairs | Yes | No | No |
| Express Shipments for Repairs | Yes | No | No |
| Temporary Power (Wiring) | Yes | No | No |
| Emergency Power (Generator) | Yes | No | No |

### 2.5 SWITCHBOARD COMPONENT MANUFACTURERS TECHNICAL DATA

## The following pages contain manufacturer's technical data for the components within the switchboard. The list below breaks the technical data down by page to assist with navigation.

## SWITCHBOARD COMPONENT TECHNICAL DATA LIST

ANDREW CNT-400 COAX CABLE ..... 26
CARLO GAVAZZI MONITORING RELAYS DPBO1CM ..... 28
CLIPSAL 3PH \& 1PH SWITCHED OUTLETS ..... 33
CLIPSAL NUETRAL \& EARTH LINKS ETC ..... 43
CORTEC - CORROSION INHIBITOR VPCI-110 ..... 52
CRITEC SURGE DIVERTER ..... 54
CRITEC SURGE REDUCTION FILTER TDF ..... 59
DANFOSS SOFT START VLT ..... 61
DANFOSS CONTROL PANEL VLT LCP501 ..... 73
DINLINE ALARM RELAY DAR-275V ..... 75
IDEC INTERNAL LED LIGHTS ..... 77
IDEC RH SERIES RELAY ..... 80
MARECHAL DSN PLUGS ..... 82
MULTITRODE MTR RELAY ..... 94
multitrode probe ..... 95
NHP DINT CHASSIS ..... 99
NHP MCB DSRCBH ..... 101
NHP MCB DTCB6116C ..... 111
OMRON - HC3A TIMER ..... 121
OMRON DZ LIMIT SWITCH ..... 136
PEPPER \& FUCHS PROXIMITY SWITCH NCB5-18GM40-Z0 ..... 141
PHEONIX THERMAL CIRCUIT BREAKER ..... 143
POLYPHASER SURGE PROTECTION UNIT IS-50NX-C2 ..... 148
POWERBOX CM SERIES ..... 149
POWERBOX DC-DC CONVERTER ..... 151
PULSE COAX CONNECTOR ..... 154
RED LION DISPLAY ..... 155
SPREECHER \& SCHUH ELECTRONIC TIMING RELAY F-RZ7 ..... 163
SPREECHER \& SCHUH CA7 CONTACTORS ..... 165
SPREECHER \& SCHUH PUSH BUTTONS \& SWITCHES ..... 194
TERASAKI 3 POLE MCCB ..... 199
TRIO RADIO MODEM ..... 207
VEGABAR 52 PRESSURE TRANSMITTER ..... 209
VEGADIS 62 ADJUSTMENT UNIT ..... 211
VEGAWELL 52 PROBE ..... 213
WEIDMULLER POWER SUPPLY 8951340000 ..... 229
YUASA BATTERY UXH50-12 ..... 233
SP162 - Jilba St Issue: 1

# Product Specifications 

A CommScope Company

CNT-400<br>CNT-400, Cinta ${ }^{\text {TM }} 50$ Ohm Braided Coaxial Cable, variable, black PE jacket



## CHARACTERISTICS

Construction Materials

| Jacket Color | Black |
| :--- | :--- |
| Jacket Material | Non-halogenated PE |
| Braid Material | Tinned copper |
| Shield Tape Material | Aluminum |
| Dielectric Material | Foam PE |
| Inner Conductor Material | Copper-clad aluminum wire |

Dimensions

| Cable Weight | $0.10 \mathrm{~kg} / \mathrm{m}$ |
| :--- | :--- |
| Diameter Over Dielectric | 7.240 mm \| 0.285 in |
| Diameter Over Jacket | 10.290 mm \| 0.405 in |
| Inner Conductor OD | $2.740 \mathrm{~mm} \mathrm{\mid} 0.108 \mathrm{in}$ |
| Nominal Size | 0.400 in |
| Outer Conductor OD | 8.080 mm \| 0.318 in |

Electrical Specifications

| Cable Impedance | 50 ohm |
| :--- | :--- |
| Capacitance | $78 \mathrm{pF} / \mathrm{m} \mathrm{\mid} 24 \mathrm{pF} / \mathrm{ft}$ |
| dc Resistance, Inner Conductor | $4.490 \mathrm{ohms} / \mathrm{km} \mathrm{\mid} 1.370 \mathrm{ohms} / \mathrm{kft}$ |
| dc Resistance, Outer Conductor | $5.610 \mathrm{ohms} / \mathrm{km} \mathrm{\mid l} 1.710 \mathrm{ohms} / \mathrm{kft}$ |
| dc Test Voltage | 2500 V |
| Jacket Spark Test Voltage (rms) | 8000 V |
| Maximum Frequency | 16.20 GHz |
| Operating Frequency Band | $30-6000 \mathrm{MHz}$ |
| Peak Power | 16.0 kW |


\section*{Product Specifications <br> | Shielding Effectiveness | $>90 \mathrm{~dB}$ |
| :--- | :--- |
| Velocity | $85 \%$ |}

Environmental Specifications

| Installation Temperature | $-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.+185^{\circ} \mathrm{F}\right)$ |
| :--- | :--- |
| Operating Temperature | $-40^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.+185^{\circ} \mathrm{F}\right)$ |
| Storage Temperature | $-70^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}\left(-94^{\circ} \mathrm{F}\right.$ to $\left.+185^{\circ} \mathrm{F}\right)$ |

General Specifications

| Cable Type | CNT-400 |
| :--- | :--- |
| Braid Coverage | $86 \%$ braid |
| 3rand | Cinta $^{T M}$ |

Mechanical Specifications

| Bending Moment | $0.7 \mathrm{~N}-\mathrm{m}$ | 0.5 ft lb |
| :--- | :--- | :--- | :--- |
| Flat Plate Crush Strength | $0.7 \mathrm{~kg} / \mathrm{mm}$ | \| $40.0 \mathrm{lb} / \mathrm{in}$ |
| Minimum Bend Radius, Single Bend | 25.40 mm \| 1.00 in |  |
| Tensile Strength | $73 \mathrm{~kg} \mathrm{\mid} 160 \mathrm{lb}$ |  |

Performance

| Frequency | Attenuation (dB/100 m) | Attenuation (dB/100 ft) |
| :--- | :--- | :--- |
| $\mathbf{3 0 ~ M H z}$ | 2.49 | 0.76 |
| 50 MHz | 3.18 | 0.97 |
| 150 MHz | 4.92 | 1.50 |
| 220 MHz | 6.23 | 1.90 |
| 450 MHz | 8.86 | 2.70 |
| $\mathbf{9 0 0 ~ M H z}$ | 12.80 | 3.90 |
| 1500 MHz | 16.70 | 5.10 |
| 1800 MHz | 18.40 | 5.60 |
| 2000 MHz | 19.40 | 5.90 |
| 2400 MHz | 21.65 | 6.60 |
| $\mathbf{5 0 0 ~ M H z}$ | 22.00 | 6.70 |
| 3000 MHz | 24.60 | 7.50 |
| 4000 MHz | 28.87 | 8.80 |
| 4500 MHz | 30.84 | 9.40 |
| 5000 MHz | 32.81 | 10.00 |
| 5200 MHz | 33.46 | 10.20 |
| 5500 MHz | 34.78 | 10.60 |
| 5800 MHz | 35.76 | 10.90 |
| 6000 MHz | 36.42 | 11.10 |

Regulatory Compliance/Certifications

| Agency | Classification |
| :--- | :--- |
| RoHS 2002/95/EC Compliant |  |

## Monitoring Relays True RMS 3-Phase, 3-Phase+N, Multi-function Types DPBO1, PPBO1



## Product Description

3-phase or 3-phase+neutral line voltage monitoring relay for phase sequence, phase loss, over and under voltage (separately adjustable set
points) with built-in time delay function.
Supply ranges from 208 to 480 VAC covered by two multivoltage relays.

- TRMS 3-phase over and under voltage, phase sequence and phase loss monitoring relays
- Detect when all 3 phases are present and have the correct phase sequence (except for $\mathbf{N}$ versions)
- Available versions (W4) supplied between phase and neutral
- Detect if all the 3-phase-phase or phase-neutral voltages are within the set limits
- Upper and lower limits separately adjustable
- Measure their own power supply
- Selection of measuring range by DIP-switches
- Adjustable voltage on relative scale
- Adjustable delay function ( 0.1 to 30 s )
- Output: 8 A SPDT relay N.E.
- For mounting on DIN-rail in accordance with DIN/EN 50022 (DPB01) or plug-in module (PPB01)
- 22.5 mm Euronorm housing (DPB01) or 36 mm plug-in module (PPB01)
- LED indication for relay, alarm and power supply ON



## Type Selection

| Mounting | Phase sequence detection | Output | Supply: 208 to 240 VAC | Supply: <br> 380 to 415 VAC | Supply: <br> 380 to 480 VAC |
| :---: | :---: | :---: | :---: | :---: | :---: |
| DIN-rail | yes | SPDT | DPB 01 C M23 | DPPB 01 C M48 W4 | DPB $01 . \mathrm{C}$ M48 |
| Plug-in | yes | SPDT | PPB 01 C M23 | PPB 01 C M48 W4 |  |
| Plug-in | yes | SPPT | - ... | PPB 01 CM48 |  |
| DIN-rail | no | SPDT | DPB 01 C•M23 N | DPB 01 C M48 N W4 | DPB 01 C M48 N |
| Plug-in | no | SPDT | PPB 01 C M23 N | PPB 01 C M48 N W4 | .. . |
| Plug-in | no | SPDT | - | PPB 01 C M48 ${ }^{\text {N }}$ |  |

## Input Specifications



Output Specifications

| Output Rated insulation voltage | SPDT relay 250 VAC |
| :---: | :---: |
| Contact ratings ( $\mathrm{AgSnO}_{2}$ ) | $\mu$ |
| Resistive loads AC 1 | 8 A @ 250 VAC |
| DC 12 | 5 A @ 24 VDC : |
| Small inductive loads AC 15 | 2:5 A @ 250 VAC |
| DC 13 | 2.5 A @ 24 VDC |
| Mechanical life | $\geq 30 \times 10^{6}$ operations' |
| Electrical life | $\geq 10^{5}$ operations <br> (at $8 \mathrm{~A}, 250 \mathrm{~V}, \cos \varphi=1$ ) |
| Operating frequency | $\leq 7200$ operations/h |
| Dielectric strength |  |
| . Dielectric voltage | 2 kVAC (rms) |
| Rated impulse withstand volt. | 4. kV (19.2/50 $\mu \mathrm{s}$ ) |

## Supply Specifications



## General Specifications

| Power ON delay | $1 \mathrm{~s} \pm 0.5 \mathrm{~s}$ or $6 \mathrm{~s} \pm 0.5 \mathrm{~s}$ |
| :---: | :---: |
| Reaction time |  |
| Incorrect phase sequence or total phase loss |  |
|  | <200ms |
| Voltage level | (input signal variation from |
|  | $-20 \%$ to $+20 \%$ or from |
|  | +20\% to -20\% of set value) |
| Alarm ON delay | $<200 \mathrm{~ms}$ (delay < 0.1 s) |
| Alarm OFF delay | $<200 \mathrm{~ms}$ (dèlay < 0.1 s ) |
| Accuracy | (15 min warm-up time) |
| Temperature drift | $\pm 1000 \mathrm{ppm} /{ }^{\circ} \mathrm{C}$ |
| Delay ON alarm | $\pm 10 \%$ on set value $\pm 50 \mathrm{~ms}$ |
| Repeatability | $\pm 0.5 \%$ on full-scale |
| Indication for |  |
| P.ower supply ON | LED; green |
| Alarm ON | LED, red flilashing 2 Hz |
|  | during delay time) |
| Output relay ON | LED, yellow |
| Environment |  |
| Degree of protection | IP'20. |
| Pollution degree | 3 (DPB01); 2 (PPB01) |
| Operating temperature |  |
| (1) Max. voltage, 50 Hz | -20 to $60^{\circ} \mathrm{C}, \mathrm{R}: \mathrm{H} .<95 \%$ |
| (3) Max. voltage, 60 Hz | -20 to $50^{\circ} \mathrm{C}, \mathrm{R}$.H. < $95 \%$ |
| Storage temperature | -30 to $80^{\circ} \mathrm{C}, \mathrm{R}$ H. $<95 \%$ |
| Housing |  |
| Dimensions DPB01 | $22.5 \times 80 \times 99.5 \mathrm{~mm}$ |
| PPB01 | $36 \times 80 \times 94 \mathrm{~mm}$ |
| Material | PA66 or Noryl |
| Weight | Approx. 120 g |
| Screw terminals |  |
| Tightening torque | Max. 0:5 Nm according to IEC 60947 |
| Product standard | EN 60947-5-1 |
| Approvals | UL, CSA |
|  | (except for W4 versions) CCC (GB14048.5) only DPB |
| CE Marking | L.V. Directive 2006/95/EC |
|  | EMC Directive 2004/108/EC |
| EMC |  |
| Immunity | According: to EN 61000-6-2 |
| Emissions | According to EN 61000:6-3 |

## Mode of Operation

Connected to the 3 phases (and neutral) DPB01 and PPB01 operate when all 3 phases are present at the same time, the phase sequence is correct (not $N$ versions) and the phasephase (or : phase-neutral) voltage levels are within set limits.

If one or more phase-phase or phase-neutral voltages exceeds the upper set level or drops below the lower set :vel, the red LED starts
flashing 2 Hz and the output relay releases after the set time period. In any case if phase-neutral measurement is selected both phasephase and.. phase-neutral voltages :are monitored. If the phase sequence is wrong or one phase is lost, the output relay releases immediately.
Only 200 ms delay occurs. The failure is indicated by the red LED flashing 5 Hz during the alarm condition.

Example 1
(mains network monitoring)
The relay monitors over and under voltage, phase loss and correct phase sequence.
In case of $N$ versions, the relay monitors over and under voltage.

Example 2
(load monitoring)
The relay releases in case of interruption of one or more phases, when one or more voltages drop below the lower set level or exceed the upper set level.

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## Function/Range/Level and Time Delay Setting



Adjust the input range setting the DIP switches 3 and 4 as shown below.

Select the desired function setting the DIP switches 1 and 2 as shown below.

To access the DIP swiches Selection of level and time open the grey plastic cover as shown below

## delay:

Upper knob:
Setting of lower level on relative scale.

Centre knob:
Setting of upper level on relative scale.

Lower knob:
Setting of delay on alarm time on absolute scale ( 0.1 to 30 s ).

|  |  | $\begin{aligned} & \text { Power ON } \\ & \text { ON: } 6 \mathrm{~s} \pm \\ & \text { OFF: } 1 \mathrm{~s} \pm 0 \end{aligned}$ | $\begin{aligned} & \text { delay } \\ & 0.5 \mathrm{~s} \\ & 0.5 \mathrm{~s} \end{aligned}$ |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Monitored <br> ON: Phase OFF: Phase | voltage <br> -Neutral <br> -Phase |  |  |  |
| $\therefore \because \quad$ 星 |  | Measuring | range |  |  |  |
| $\because \because \%$ |  | SW3 | ON | ON | OFF | OFF |
|  |  | SW4 | ON | OFF | ON | OFF |
|  |  | $\begin{aligned} & \text { M23 Ph-Ph } \\ & \text { Voltage } \end{aligned}$ | 208 VAC | 220 VAC | 230 VAC | 240 VAC |
|  |  | $\begin{aligned} & \text { M48 Ph-Ph } \\ & \text { Voltage } \end{aligned}$ | 380 VAC | 400 VAC | 415 VAC | 480 VAC <br> DPB01CM 48, <br> DPB01CM 48 N <br> only. |
|  | $\square$ | $\overline{\mathrm{M} 48 \mathrm{Ph}-\mathrm{N}}$ Voltage | 220 VAC | 230 VAC | 240.VAC |  |

## Operation Diagrams



Operation Diagrams (cont.)


CARLO GAVAZZI



Relay ON $\qquad$ $\because \quad \square$
 $\stackrel{\square}{\square}$

Red LED. ON ${ }^{\text {fer } 6 \%_{1}}$
 $\qquad$

${ }^{\prime *}$ ) N versions don't detect incorrect phase sequence.

## Wiring Diagrams

Example 1


## Example 2



DPB01

## Example 1



## Example 2



PPBO1

## Note

When DPB01 or PPB01 is used with phase indicator lamps (see examples in the following diagrams), the lamp H 1 or H 2 might be dimly lit when there is a phase loss in L1 or L2. This might happen if the lamps used are the typical low power indicator lamps, and there are no other loads present.
This fact can be avoided by using W4 models. Note that the neutral must be always connected to the device.


## Dimensions




Providing the strength, reliability and durability demanded of today's industry

Combination Switched Socket Outlets


56C310,GY
e Clipsal range of three phase combinations includes two module units and one-piece cover models. All internal phase connections between switches and sockets are factory wired.

The 4 and 5 pin, 10 and 20A one-piece cover models have integral wiring between the switch and socket outlet. Installation time is reduced by not having to check factory wire terminations. There is also no likelihood of wires falling out during installation.



## 56CV315,R0

Combination sockets feature a clear dustproof and hoseproof flap with a snap catch latch. Both the superseded non IP56 plain plugs and the current IP66 retention ring plugs can be accommodated. $250 \mathrm{~V}, 110 \mathrm{~V}$ and extra low voltage two module combinations are also available.

Earth and neutral connectors accommodating $3 \times 6 \mathrm{~mm}^{2}$ cables are supplied with 500 V models.

## Options available

- Less Enclosure - add LE to Catalogue Number e.g. 56C410 becomes 56C410LE.
- Versions with key operated switches available to special order.

| Catalogue Number | No. of switch poles | $\underset{(\operatorname{Amp})}{\substack{\text { min }}}$ | $\begin{aligned} & \mathrm{U}_{1} / \mathrm{U}_{8} \\ & \text { (Volt) } \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| 56 C 210 | 1 Pole | 10A | 110 V |
| 56C215/32 | 1 Pole | 15A | 32 V |
| 56C3/110 | 1 Pole | 10A | 110 V |
| 56C310RP | 1 Pole | 10A | 250 V |
| $56 \mathrm{C310}$ | 1 Pole | 10A | 250 V |
| 56 C 310 HD | 1 Pole | 10A | 250 V |
| 56C310L | 1 Pole | 10A | 250 V |
| $56 \mathrm{C315}$ | 1 Pole | 15A | 250 V |
| 56C315HD | 1 Pole | 15A | 250 V |
| 56 C 320 | 1 Pole | 20A | 250 V |
| 56C320F | 1 Pole | 20A | 250 V |
| 56 C 332 | 1 Pole | 32A | 250 V |
| 56C310D | 2 Pole | 10A | 250 V |
| 56C315D | 2 Pole | 15A | 250 V |
| 56 C 410 | 3 Pole | 10A | 500 V |
| $56 \mathrm{C416K}$ | 3 Pole | 16A | 500 V |
| $56 \mathrm{C420}$ | 3 Pole | 20A | 500 V |
| 56 C 432 | 3 Pole | 32 A | 500 V |
| 56 C 440 | 3 Pole | 40 A | 500 V |
| $56 \mathrm{C450}$ | 3 Pole | 50A | 500 V |
| 56 C 510 | 3 Pole | 10A | 500 V |
| 56 C 520 | 3 Pole | 20A | 500 V |
| 56 C 532 | 3 Pole | 32 A | 500 V |
| 56 C 540 | 3 Pole | 40 A | 500 V |
| 56 C 550 | 3 Pole | 50A | 500 V |
| $56 \mathrm{C610}$ | 3 Pole | 10 A | 500 V |
| 56 C 710 | 3 Pole | 10A | 500 V |
| $56 \mathrm{C720}$ | 3 Pole | 20 A | 500 V |


| Catalogue Number | No . of switch poles | $\underset{(\operatorname{Amp})}{\mathrm{I}_{\mathrm{meq}}}$ | $\begin{aligned} & U_{i} / U_{a}, \\ & \text { (Volt) } \end{aligned}$ |
| :---: | :---: | :---: | :---: |
| 56CV310 | 1 Pole | 10A | 250 V |
| 56CV310HD | 1 Pole | 10A | 250 V |
| 56CV315 | 1 Pole | 15A | 250 V |
| 56CV315HD | 1 Pole | 15A | 250 V |
| 56CV320 | 1 Pole | 20A | 250 V |
| 56CV332 | 1 Pole | 32A | 250 V |
| 56CV410 | 3 Pole | 10A | 500 V |
| 56 CV 416 K | 3 Pole | 16A | 500 V |
| 56CV420 | 3 Pole | 20A | 500 V |
| 56 CV 432 | 3 Pole | 32A | 500 V |
| 56CV440 | 3 Pole | 40A | 500 V |
| 56 CV 450 | 3 Pole | 50A | 500 V |
| 56CV510 | 3 Pole | 10A | 500 V |
| 56CV520 | 3 Pole | 20A | 500 V |
| 56CV532 | 3 Pole | 32A | 500 V |
| 56 CV 540 | 3 Pole | 40A | 500 V |
| 56CV550 | 3 Pole | 50A | 500 V |
| 56 CV 610 | 3 Pole | 10A | 500 V |
| 56 CV 710 | 3 Pole | 10A | 500 V |
| 56CV720 | 3 Pole | 20A | 500 V |

Reler to page 57 Ior explanation of sodet conligurations.

# Combination Switched Socket Outlets 

- Internal interlock facility available on three phase, one piece cover combinations - add I to Catalogue Number e.g. 56CV410 becomes 56CVI410.
- Resistant Orange - add RO to Catalogue Number e.g. 56CV410 becomes 56CV410,RO.
- Resistant White - add RW to Catalogue Number e.g. 56C410 becomes 56C410,RW.
- Two piece versions available in Chemical Grey. Chemical Grey - add CG to Catalogue
Number e.g. 56C410 becomes 56C410,CG.

| TWO PIECE |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| le (A) Utilisation Category |  |  | M Rating | Number of Sockets | Cond. Term Size in $\mathrm{mm}^{2}$ |  | IP Rating | 0/A Dims. <br> (H) $\times(W) \times(\mathrm{D})$ | Matching Plug Straight | Matching <br> Plug Angle | Socket Contig |
| AC21A | AC22A | AC23A |  |  | Min. | Max/Cond. |  |  |  |  |  |
| 10 | 8 | 8 | M80 | 2 Parallel Flat | 1.5 | 6 | 66 | 204×101×83 | 56P210 | - | D |
| 15 | 10 | 8 | M80 | 2 Polarised | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P215/32 |  | E |
| 10 | 8 | 8 | M80 | 2 Round \& Flat Earth | 1.5 | 6 | 66 | 204×101×83 | $56 \mathrm{P} 3 / 110$ | ?- | $J$ |
| 10 | 8 | 8 | M80 | 3 Round | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P310RP |  | G |
| 10 | 8 | 8 | M80 | 3 Flat | 1.5 | 6 | 66 | 204x101×83 | 56P310 | - | A |
| 10 | 10 | 11 | M100 | 3 Flat w/heawy duty switch | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56 P 310 |  | A |
| 10 | 8 | 8 | M80 | 2 Flat \& Round Earth | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P310SL | - - | C |
| - | 10 | 8 | M80 | 3 Flat | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P315 |  | B |
|  | 15 | 15 | M120 | 3 Flat w/heavy duty switch | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P315 | - | B |
| 20 | 20 | 21 | M150 | 3 Round | 2.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P320 | 56PA320 | H |
| 20 | 20 | 20 | M150 | 3 Flat | 2.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P320F | $\xrightarrow{\text { C- }}$ | F |
| 32 | 32 | 28 | M180 | 3 Round | 6 | 16 | 66 | $204 \times 101 \times 108$ | 56P332 | 56PA332 | 1 |
| 10 | 10 | 11 | M100 | 3 Flat double pole | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P310 | - | A |
| 15 | 15 | 15 | M120 | 3 Flat double pole | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P315 |  | B |
| 10 | 10 | 11 | M100 | 4 Round | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56 P 410 | 56PA410 | K |
| 16 | 16 | 15 | M120 | Unique key config. | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56 P 416 K | 56PA416K | M |
| 20 | 20 | 21 | M150 | 4 Round | 2.5 | 6 | 66 | $204 \times 101 \times 108$ | 56 P 420 | 56PA420 | L |
| 32 | 32 | 28 | M180 | 4 Round | 4 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 432 | 56 PA 432 | N |
| 40 | 40 | 35 | M200 | 4 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 440 | 56 PA440 | 0 |
| 50 | 50 | 35 | M250 | 4 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 450 | 56PA450 | P |
| 10 | 10 | 11 | M100 | 5 Round | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P510 | $56 \mathrm{PA510}$ | Q |
| 20 | 20 | 21 | M150 | 5 Round | 2.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P520 | $56 \mathrm{PA520}$ | R |
| 32 | 32 | 28 | M180 | 5 Round | 4 | 16 | 66 | $204 \times 101 \times 108$ | 56P532 | 56PA532 | S |
| 40 | 40 | 35 | M200 | 5 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56P540 | 56 PA540 | T |
| 50 | 50 | 35 | M250 | 5 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56P550 | 56PA550 | U |
| 10 | 10 | 11 | M100 | 6 Round | 1.5 | 6/2.5 | 66 | $204 \times 101 \times 108$ | 56P610 | 56PA610 | V |
| 10 | 10 | 11 | M100 | 7 Round | 1.5 | 6/2.5 | 66 | $204 \times 101 \times 108$ | 56P710 | 56 PA710 | W |
|  | 20 | 21 | M150 | 7 Round | 2.5 | 6/2.5 | 66 | $204 \times 101 \times 108$ | 56P720 | 56PA720 | X |


| ONE PIECE |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| le (A) Utilisation Category |  |  | M Rating | Number of Sockels | Cond. Term Size in mm |  | IP Rating | 0/A Dims. (H) $x(W) \times(D)$ | Matching Plug Straight | Matching Plug Angle | Socket Config |
| AC21A | AC22A | AC23A |  |  | Min. | MaxCond. |  |  |  |  |  |
| 10 | 8 | 8 | M80 | 3 Flat | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P310 | - | A |
| 10 | 10 | 11 | M100 | 3 Flat w/heawy duty switch | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P310 |  | A |
| 15 | 10 | 8 | M80 | 3 Flat | 1.5 | 6 | 66 | $204 \times 101 \times 83$ | 56P315 |  | B |
| 15 | 15 | 15 | M120 | 3 Flat w/heaw duty switch | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P315 |  | B |
| 20 | 20 | 21 | M150 | 3 Round | 2.5 | 6 | 66 | $204 \times 101 \times 108$ | 56P320 | 56PA320 | H |
| 32 | 32 | 28 | M180 | 3 Round | 6 | 16 | 66 | $204 \times 101 \times 108$ | 56P332 | 56 PA 332 | I |
| 10 | 10 | 11 | M100 | 4 Round | 1.5 | 10 | 66 | $204 \times 101 \times 108$ | 56 P 410 | 56 PA410 | K |
| 16 | 16 | 15 | M120 | Unique key contig. | 1.5 | 6 | 66 | $204 \times 101 \times 108$ | 56 P 416 K | 56PA416K | M |
| 20 | 20 | 21 | M150 | 4 Round | 2.5 | 10 | 66 | $204 \times 101 \times 108$ | 56P420 | 56PA420 | L |
| 32 | 32 | 28 | M180 | 4 Round | 4 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 432 | 56PA432 | N |
| 40 | 40 | 35 | M200 | 4 Round | 6 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 440 | $56 \mathrm{PA440}$ | 0 |
| 50 | 50 | 35 | M250 | 4 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56 P 450 | 56PA450 | P |
| 10 | 10 | 11 | M100 | 5 Round | 1.5 | 10 | 66 | $204 \times 101 \times 108$ | 56P510 | 56PA510 | Q |
| 20 | 20 | 21 | M150 | 5 Round | 2.5 | 10 | 66 | $204 \times 101 \times 108$ | 56P520 | 56PA520 | R |
| 32 | 32 | 28 | M180 | 5 Round | 4 | 16 | 66 | $204 \times 101 \times 108$ | 56P532 | 56PA532 | S |
| in | 40 | 35 | M200 | 5 Round | 6 | 16 | 66 | $204 \times 101 \times 108$ | 56P540 | 56PA540 | T |
|  | 50 | 35 | M250 | 5 Round | 10 | 16 | 66 | $204 \times 101 \times 108$ | 56P550 | 56PA550 | U |
| 10 | 10 | 11 | M100 | 6 Round | 1.5 Page 6 6, 6.50 f 36366 |  |  | $204 \times 101 \times 108$ | 56P610 | 56PA610 | V |
| 10 | 10 | 11 | M100 | 7 Round | 1.5 | 6/2.5 | 66 | $204 \times 101 \times 108$ | 56P710 | 56PA710 | W |
| 20 | 20 | 21 | M150 | 7 Round | 2.5 | 6/2.5 | 66 | $204 \times 101 \times 108$ | 56P720 | 56PA720 | X |

Note: AC utilisation categories to ASNZSS3947.3 $I_{n m}$-Conventional Enclosed Themal Current $U_{i}$-lnsulation Vollage $U_{s}$-Operalional Voltage

Surface Socket Outlets


56S0310,GY


56S0520,RO


56S0710,RW

## Extra Low Voltage and 3 Phase sockets

Clipsal Surface Socket Outlets range in size from 32 V 10 A to 500 V 50 A .

All sockets feature hoseproof and dust resistant flaps with automatic snap catch latches. The transparent flap enables instant visual inspection of socket condition and pin configuration.

The full range of sockets accommodate both the superseded IP56 plain plugs and the current IP66 retention ring plugs in order to rationalise the number of variations required.

Earth and neutral connectors accommodating $3 \times 6 \mathrm{~mm}^{2}$ cable are supplied with all 500 V models.

Terminal housings are moulded in tough polyester to minimise damage.

| Catalogue Number | $\underset{\text { (Amp) }}{1}$ | $\begin{aligned} & \mathrm{U}_{\mathrm{J}} / \mathrm{U}, \\ & \text { (Volit) } \end{aligned}$ | Number of Sockels | Cond. Term Size in mm |  | $\stackrel{\text { IP }}{\text { Rating }}$ | 0/A Dims.$\text { (H) } \times \text { (V) } \times \text { (D) }$ | Matching Plug Straight | Matching Plug Straight | Sockel Config. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Min. | Max Cond. |  |  |  |  |  |
| 56S0210 | 10A | 110 V | 2 Parallel Flat | 1.5 | 16 | 66 | 107x101×77 | 56 P 210 |  | D |
| 56S0215/32 | 15A | 32 V | 2 Pin Polarised | 1.5 | 6 | 66 | $107 \times 101 \times 77$ | 56P215/32 | - | E |
| 56S03/110 | 10A | 110 V | 2 Round Live \& Flat Earth | 1.5 | 6 | 66 | 107×101x77 | 56P3/110 | - | J |
| ${ }^{56 S 0310 R P}$ | 10A | 250 V | 3 Round | 1.5 | 6 | 66 | 107x101×77 | 56P310RP |  | G |
| 56S0310 | 10A | 250 V | 3 Flat | 1.5 | 6 | 66 | 107x101x77 | 56P310 | , | A |
| 5650315 | 15A | 250 V | 3 Flat | 1.5 | 6 | 66 | 107x101x77 | 56P315 |  | B |
| 56S0310A | 10A | 250V | 3 Flat auto-swithed D/P | 1.5 | 10 | 66 | 107x101×77 | 56P310 | - | A |
| 56S0315A | 15 A | 250 V | 3 Flat auto-switched D/P | 1.5 | 10 | 66 | 107x101×77 | 56 P 315 |  | B |
| 56S0310L | 10A | 250V | 2 Flat \& Round Earth | 1.5 | 6 | 66 | 107×101×77 | 56P310SL |  | C |
| 5650320 | 20 A | 250 V | 3 Round | 2.5 | 6 | 66 | 107×101 $\times 102$ | 56 P 320 | 56PA320 | H |
| 56S0320F | 20A | 250V | 3 Flat Pins | 2.5 | 6 | 66 | 107x101×77 | 56P320F |  | F |
| 5650332 | 32 A | 250 V | 3 Round | 6 | 16 | 66 | $107 \times 101 \times 102$ | 56 P 332 | 56PA332 | 1 |
| 5650410 | 10A | 500V | 4 Round | 1.5 | 6 | 66 | 107×101×102 | 56P410 | 56PA410 | K |
| 56S0416K | 16 A | 500 V | Unique key configuration | 1.5 | 6 | 66 | 107×101 102 | 56P416K | 56PA416K | M |
| 5650420 | 20A | 500V | 4 Round | 2.5 | 6 | 66 | 107×101×102 | 56 P 420 | 56PA420 | L |
| 5650432 | 32A | 500 V | 4 Round | 4 | 16 | 66 | $107 \times 101 \times 102$ | 56P432 | 56PA432 | N |
| 56S0440 | 40A | 500V | 4 Round | 6 | 16 | 66 | 107×101×102 | 56P440 | 56PA440 | 0 |
| 5680450 | 50A | 500 V | 4 Round | 10 | $16^{\prime \prime}$ | 66 | 107×101 102 | 56P450 | 56PA450 | P |
| 56S0510 | 10A | 500 V | 5 Round | 1.5 | 6 | 66 | 107×101×102 | 56P510 | 56PA510 | 0 |
| 56S0520 | 20A | 500 V | 5 Round | 2.5 | 6 | 66 | 107x101x102 | 56 P 520 | 56PA520 | R |
| 5650532 | 32A | 500 V | 5 Round | 4 | 16 | 66 | 107×101×102 | 56 P 332 | 56PA532 | S |
| 5650540 | 40A | 500 V | 5 Round | 6 | 16 | 66 | 107×101 102 | 56 P 540 | 56PA540 | T |
| 5650550 | 50A | 500 V | 5 Round | 10 | $16^{*}$ | 66 | 107×101×102 | 56P550 | 56PA550 | U |
| 5650610 | 10A | 500 V | 6 Round | 1.5 | $6 / 2.5$ | 66 | 107×101x102 | 56P610 | 56PA610 | v |
| 5650710 | 10A | 500 V | 7 Round | 1.5 | $\text { Page } \frac{6 / 2.5}{672.5} \text { of } 363 \frac{66}{66}$ |  | 107×101×102 | $56 P 710$ | 56PA710 | W |
| 5680720 | 20A | 500 V | 7 Round | 2.5 |  |  | $107 \times 101 \times 102$ | $56 P 720$ | 56PA720 | X |

Note: 5650320 and 5650320 F come with the facility to fit auxiliary switch $5650 A U X 15$.
$\cdots-L 1, L 2,13$ Cable size max $25 \mathrm{~mm}^{2} I_{3 n}$-Conventional Enclosed Themal Curent $U_{\text {, }}$ - Insulation Voltage

## 14 Clipsal 56 and 66 Series

## Surface Socket Outlets



## Spare Parts Internal Socket Housings

A full range of replacement internal socket housings is available for 3 phase 56 SO models. They eliminate the need to replace an entire unit if only the internal socket housing is damaged. Socket terminal housings are moulded in durable polyester.

## Options available

- Less Enclosure - add LE to catalogue number e.g. 56 SO 410 becomes 56SO410LE.
- Resistant Orange - add RO to catalogue number e.g. 56SO410 becomes 56SO410,RO.
- Resistant White - add RW to catalogue Number e.g. 56SO310 becomes 56SO310RW.


56S0410G Series

| Catalogue Number | $\underset{(\mathrm{Amp})}{\mathrm{l}}$ | $\begin{gathered} \text { U } \\ \text { (Voii) } \end{gathered}$ | Number of Sockels | Cond. Term Size in mm² |  | Socket Configuration |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Min. | Max/Cond. |  |
| 56S0320G | 20A | 250 V | 3 Round | 2.5 | 6 | H |
| 56S0332G | 32 A | 250 V | 3 Round | 6 | 16 | 1 |
| 56S0410G | 10A | 500 V | 4 Round | 1.5 | 6 | K |
| 56S0416KG | 16A | 500 V | Unique key configuration | 1.5 | 6 | M |
| 56S0420G | 20A | 500 V | 4 Round | 2.5 | 6 | L |
| 56S0432G | 32A | 500 V | 4 Round | 6 | 16 | N |
| 56S0440G | 40A | 500 V | 4 Round | 10 | 16 | 0 |
| 56S0450G | 50 A | 500 V | 4 Round | 10 | 16 | P |
| 56S0510G | 10A | 500 V | 5 Round | 1.5 | 6 | Q |
| 56S0520G | 20A | 500 V | 5 Round | 2.5 | 6 | R |
| 56S0532G | 32 A | 500 V | 5 Round | 6 | 16 | S |
| 56S0540G | 40 A | 500 V | 5 Round | 10 | 16 | T |
| 56S0550G | 50A | 500 V | 5 Round | 10 | 16 | U |
| 56S0610G | 10A | 500 V | 6 Round | 1.5 | 6/2.5 | V |
| 56S0710G | Page | 3630 V | 7 Round | 1.5 | 6/2.5 | W |
| 56S0720G | 20A | 500 V | 7 Round | 2.5 | 6/2.5 | X |

$\mathrm{I}_{\mathrm{m}}$-Corventional Enclosed Thernal Current $\mathrm{U}_{1}$-Insulation Voltage

| Cable Size - Nominal Area <br> of Conductor mm | No. and Diameter of <br> Wires for Standard <br> Conductor No./min | Overall Diameter of <br> ASNZS300U Table E7 mm |
| :---: | :---: | :---: |
| 0.5 | $1 / 0.80$ | 2.5 |
| 1 | $1 / 1 / 13$ | 2.9 |
| 1.5 | $1 / 1.38$ | 3.2 |
| 2.5 | $7 / 0.50$ | 3.3 |
| 4 | $1 / 1.78$ | 3.6 |
| 6 | $7 / 0.67$ | 3.8 |
| 10 | $7 / 0.85$ | 4.8 |
| 16 | $7 / 1.04$ | 5.3 |
| 25 | $7 / 1.35$ | 6.3 |
| 35 | $7 / 1.70$ | 7.3 |
| 50 | $19 / 1.35$ | 9.4 |
| 70 | $19 / 1.53$ | 10.4 |
| 95 | $19 / 1.78$ | 12.0 |
| 120 | $37 / 1.14$ | 13.8 |
| 150 | $37 / 2.20$ | 16 |
| 185 | $37 / 2.25$ | 17.7 |
| 240 | $37 / 2.25$ | 19.7 |
| 300 | $61 / 2.25$ | 22 |
| 400 | $61 / 2.52$ | 25.1 |
| 500 | $61 / 2.85$ | 27.9 |
| 630 | $61 / 3.20$ | 31.4 |
|  | $127 / 2.52$ | 34.9 |
|  |  | 38.9 |

Dimensions, standard copper and aluminium conductors 1 core $0.6 / 1 \mathrm{kV} \mathrm{PVC}$ insulated cable to AS/NZS5000, $75^{\circ} \mathrm{C}$
Note: For exact dimensions refer to manufacturers' details.

> Useful 3-Phase Formulae
> kW $=$ Line Amps $\times$ Line Volts $\times 1.732 \times$ P.E 1000
> kVA $=$ Line Amos $\times$ Line Volts $\times 1.732$
> 1000
> $\ldots$... $=$ kV.A $\times$ P.F.

## Electric Motors

| Power Output $=$ | Power Input $\times$ Efficiency |
| ---: | :--- |
| kW Output | $=\mathrm{kW}$ Input $\times$ Efficiency |
| kW Output | $=\frac{1.732 \times \text { Line Volts } \times \text { Line Amps } \times \text { P.F. } \times \text { Efficiency }}{1000}$ |
| kV.A Input | $=\frac{1.732 \times \text { Line Volts } \times \text { Line Amps }}{1000}$ |
| Line Amperes $=$ | $\frac{1000 \times \mathrm{kW} \text { Output }}{\text { Line Volts } \times 1.732 \times \text { P.F. } \times \text { Efficiency }}$ |
| Line Amperes $=$ | $\frac{1000 \times \mathrm{kV} . \mathrm{A} \text { Input }}{\text { Line Volts } \times 1.732}$ |

The power factor is usually taken as 0.8 (as an all-round figure) but this varies with the speed and size of the motor. The efficiency varies from $85 \%$ in small motors to $90 \%$ and over for large motors.

| Measure | Symbol | Unit |
| :---: | :---: | :---: |
| Length | S | m |
| Area | A | $\mathrm{m}^{2}$ |
| Volume | V | $\mathrm{m}^{3}$ |
| Weight | m | kg |
| Density | P | $\mathrm{kg} / \mathrm{m}^{3}$ |
| Time | t | S |
| Frequency | F | Hz |
| Rotary Speed | $n$ | $\mathrm{s}^{-1}$ |
| Linear Speed | $v$ | $\mathrm{ms}^{-1}$ |
| Acceleration | a | $\mathrm{ms}^{2}$ |
| Power | F | N (Newton) |
| Pressure | P | Pa (Pascal) |
| Torque | M | Nm |
| Work | W | $J$ (Joule) |
| Power | P | W (Watt) |
| Reactive Voltampere |  | Var |
| Voltampere |  | V.A |
| Current | 1 | A (Ampere) |
| Operational Current | 1th | A |
| Conventional Enclosed | the | A |
| Thermal Current | 61/2.85 | 31.4 |
| Voltage | U | $V$ (Volts) |
| Insulated Voltage | Ui | V |
| Operational Voltage | Ue | V |
| Resistance | R | (0hm) |
| Impedance | Z |  |
| Reactance | X |  |
| Reluctance | S | AWb |
| Capacitance | C | $F$ (Farad) |
| Quantity of Electricity | Q | C (Coulomb) |
| Magnetic Field Strength | H | A/m |
| Magnetic Flux | $\emptyset$ | Wb (Weber) |
| Inductance | L | H (Henry) |
| Magnetic Flux Density | B | T (Tesca) |
| Temperature | $t$ | ${ }^{\circ} \mathrm{C}$ (Centigrade) |
| Illuminance | E | 1 x (Lux) |
| Luminance | L | $\mathrm{cd} / \mathrm{m}^{2}$ |
| Luminous Flux | 0 | Im (Lumen) |
| Luminous Intensity | 1 | cd (Candela) |

Abbreviations tor Multiples and Sub Muliples


## Common Conversion Factors

| Quality | Non-SI Unit | Metric | Conversion Factors (approx.) Non-SI to Metric (SI) Units | Metric (SI) to Non-SI Units |
| :---: | :---: | :---: | :---: | :---: |
| Length | Inch (in) | Millimetre (mm) or Centimetre (cm) | $1 \mathrm{in}=25.4 \mathrm{~mm}$ | $1 \mathrm{~cm}=0.39 \mathrm{in}$ |
|  | Foot (tt) | Centimetre (cm) or Metre (m) | $1 \mathrm{ft}=30.5 \mathrm{~cm}$ | $1 \mathrm{~m}=3.28 \mathrm{ft}$ |
|  | Yard (yd) | Metre (m) | $1 \mathrm{yd}=0.914 \mathrm{~m}$ | $1 \mathrm{~m}=1.09 \mathrm{yd}$ |
|  | Mile | Kilometre (km) | 1 mile $=1.61 \mathrm{~km}$ | $1 \mathrm{~km}=0.62$ mile |
| Area | Square Inch ( $\mathrm{in}^{2}$ ) | Square Millimetre ( $\mathrm{mm}^{2}$ ) | $1 \mathrm{in}^{2}=645 \mathrm{~mm}^{2}$ | $1 \mathrm{~mm}^{2}=0.002 \mathrm{in}^{2}$ |
|  | Square Inch ( $\mathrm{in}^{2}$ ) | Square Centimetre ( $\mathrm{cm}^{2}$ ) | $1 \mathrm{in}^{2}=6.45 \mathrm{~cm}^{2}$ | $1 \mathrm{~cm}^{2}=0.155 \mathrm{in}^{2}$ |
|  | Square Foot ( (2) $^{2}$ ) | Square Centimetre $\left(\mathrm{cm}^{2}\right)$ or Square Metre ( $\mathrm{m}^{2}$ ) | $1 \mathrm{ft}^{2}=929 \mathrm{~cm}^{2}$ | $1 \mathrm{~m}^{2}=10.76 \mathrm{tt}^{2}$ |
|  | Square Yard (ydx) | Square Metre ( $\mathrm{m}^{2}$ ) | $1 \mathrm{yd}^{2}=0.836 \mathrm{~m}^{2}$ | $1 \mathrm{~m}^{2}=1.20 \mathrm{yd}^{2}$ |
|  | Acre | Hectare (ha) | 1 acre $=0.405$ ha | 1 ha $=2.47$ acres |
|  | Square Mile | Square Kilometre (km²) | 1 Square Mile $=2.59 \mathrm{~km}^{2}$ | $1 \mathrm{~km}^{2}=0.387$ sq. mile |
| Volume | Cubic Inch ( $\mathrm{in}^{3}$ ) | Cubic Centimetre ( $\mathrm{cm}^{3}$ ) | $1 \mathrm{in}^{3}=16.4 \mathrm{~cm}^{3}$ | $1 \mathrm{~cm}^{3}=0.06 \mathrm{in}^{3}$ |
|  | Cubic Inch ( $\mathrm{ft}^{3}$ ) | Cubic Decimetre ( $\mathrm{dm}^{3}$ ) or | $1 \mathrm{ft}^{3}=28.3 \mathrm{dm}^{3}$ | $1 \mathrm{~m}^{3+}=35.3 \mathrm{ft}^{3}$ |
|  | Cubic Yard (yd ${ }^{\text {3 }}$ ) | Cubic Metre ( $\mathrm{m}^{3}$ ) | $1 \mathrm{yd}^{3}=0.765 \mathrm{~m}^{3}$ | $1 \mathrm{~m}^{3}=1.31 \mathrm{yd}^{3}$ |
| Volume (Fluids) | Fluid Ounce UK (fl. oz UK) | Millilitre (ml) | $1 \mathrm{fl} .02(\mathrm{UK})=28.4 \mathrm{ml}$ | $1 \mathrm{ml}=0.035 \mathrm{fl} .02$ (UK) |
|  | Pint UK (pt UK) | Millilitre (ml) or Litre (l) | 1 pint UK=568 ml | $11=1.76$ pint (UK) |
|  | Gallon UK (gal UK) | Litre ( 1 ) or Cubic Metre ( $\mathrm{m}^{3}$ ) | 1 gal UK $=4.551$ | $1 \mathrm{~m}^{3}=220$ gallons (UK) |
|  | Fluid Ounce US (FI. oz US) | Millilitre (ml) | 1fl. 02 (US) $=29.6 \mathrm{ml}$ | $1 \mathrm{ml}=0.034 \mathrm{fl}$. . oz (US) |
|  | Pint US (gal US) | Litre (I) or Millilitre | 1 pint (US) $=473 \mathrm{ml}$ | $11=2.11$ pint (US) |
|  | Gallon US (gal US) | Litre | 1 gallon (US) $=3.791$ | $11=0.264$ gallon (US) |
| Mass | Ounce (0z) | Gram (g) | $10 \mathrm{z}=28.3 \mathrm{~g}$ | $1 \mathrm{~g}=0.03502$ |
|  | Pound (lb) | Gram (g) or kilogram (kg) | $1 \mathrm{lb}=454 \mathrm{~g}$ | $1 \mathrm{~kg}=2.20 \mathrm{lb}$ |
|  | Ton | Tonne (t) | 1 ton $=1.02$ tonne | 1 tonne $=0.984$ ton |
|  | tael | Gram (g) | 1 tael $=37.8 \mathrm{~g}$ | $1 \mathrm{~g}=0.026$ tael |
|  | Catty | Kilogram (kg) | 1 catty $=0.605 \mathrm{~kg}$ | $1 \mathrm{~kg}=1.65$ cattoes |
|  | Picul | Kilogram (kg) | 1 picul $=60.50 \mathrm{~kg}$ | $1 \mathrm{~kg}=0.017$ picul |
| Force | Pound Force (lbf) | Newton (N) | $1 \mathrm{lbt}=4.45 \mathrm{~N}$ | $1 \mathrm{~N}=0.225 \mathrm{lbf}$ |
|  | Kilogram Force (kgi) | Newton (N) | $1 \mathrm{kgf}=9.81 \mathrm{~N}$ | $1 \mathrm{~N}=0.102 \mathrm{kgf}$ |
| Pressure | Pound Force per square inch (psi) | kilopascal (kPa) | $1 \mathrm{psi}=6.86 \mathrm{kPa}$ | $1 \mathrm{kPa}=0.145 \mathrm{psi}$ |
|  | Kilogram force per square centimetre ( $\mathrm{kgt} / \mathrm{cm}^{2}$ ) | kilopascal (kpa) | $1 \mathrm{~kg} / \mathrm{cm}^{2}=98 \mathrm{kPa}$ | $1 \mathrm{kPa}=0.01 \mathrm{kgf} / \mathrm{cm}^{2}$ |
|  | Inch of water (in $\mathrm{H}_{2} \mathrm{O}$ ) | Pascal (Pa) | 1 in $\mathrm{H}_{2} \mathrm{O}=249 \mathrm{~Pa}$ | $1 \mathrm{~Pa}=0.004$ in $\mathrm{H}_{2} \mathrm{O}$ |
|  | Bar | kilopascal (kPa) | $1 \mathrm{Bar}=100 \mathrm{kPa}$ | $1 \mathrm{kPA}=0.01$ bar |
| Velocity | Mile per hour (mph) | Kilometre per hour (km/h) | 1 mile $=1.61 \mathrm{~km} / \mathrm{h}$ | $1 \mathrm{~km} / \mathrm{h}=0.62 \mathrm{mph}$ |
| Temperature | Fahrenheit temp. (F) | Celsius temp. (C) | $\frac{{ }^{\circ} \mathrm{C}=5(\mathrm{OF}-32)}{9}$ | $\frac{{ }^{\circ} \mathrm{F}=\left(9 \times{ }^{\circ} \mathrm{C}\right)+32}{5}$ |
| Density | Pound per cubic inch ( $\mathrm{lb} / \mathrm{in}^{3}$ ) | $\begin{gathered} \text { Gram per cubic } \\ \text { centimetre }\left(\mathrm{g} / \mathrm{cm}^{3}\right) \\ =\text { tonne per cubic metre }\left(\mathrm{V} \mathrm{~m}^{3}\right) \end{gathered}$ | $1 \mathrm{lb} / \mathrm{in}^{3}=27.7 \mathrm{tm}^{3}$ | $1 \mathrm{t} / \mathrm{m}^{3}=0.036 \mathrm{lb} / \mathrm{in}^{3}$ |
|  | Pound per cubic foot ( $\mathrm{lb} / \mathrm{t}^{3+}$ ) | Kilogram per cubic metre ( $\mathrm{kg} / \mathrm{m}^{3}$ ) | $1 \mathrm{lb} / \mathrm{tt}^{3}=16.02 \mathrm{~kg} / \mathrm{m}^{3}$ | $1 \mathrm{~kg} / \mathrm{m}^{3}=0.06 \mathrm{lb} / \mathrm{t}^{3}$ |
|  | Ton per cubic yard (ton/yd ${ }^{3}$ ) | Tonne per cubic metre ( $\mathrm{t} / \mathrm{m}^{3}$ ) | $1 \mathrm{ton} / \mathrm{yd}=1.33 \mathrm{t} \mathrm{m}^{3}$ | $1 \mathrm{t} / \mathrm{m}^{3}=0.752$ ton/ $/ \mathrm{dd}^{3}$ |
| Energy | British thermal unit (Btu) | Kilojoule (kJ) | $1 \mathrm{Btu}=1.06 \mathrm{~kJ}$ | $1 \mathrm{~kJ}=0.948 \mathrm{Btu}$ |
|  | Therm | Megajoule (MJ) | 1 Therm = 106 MJ | $1 \mathrm{MJ}=9.48 \times 10^{-3}$ therm |
|  | Calorie (dietician) | Kilojoule (kJ) | $1 \mathrm{Cal}($ dietician $)=4 \mathrm{~kJ}$ | $1 \mathrm{~kJ}=0.23 \mathrm{CaI}$ (dietician) |
| Power | Horsepower (hp) | Kilowat (kW) Page 40 of 363 | $1 \mathrm{hp}=0.746 \mathrm{~kW}$ | $1 \mathrm{~kW}=1.34 \mathrm{hp}$ |
| Fuel Consumption | Mile per gallon (mpg) | Littes per 100 m | $\frac{(n) \times \mathrm{mpg}=2821 / 100 \mathrm{~km}}{\mathrm{n}}$ | $\frac{(\mathrm{n}) \times 1 / 100 \mathrm{~km}=282}{\mathrm{n}}$ |

## Switch Wiring Diagram Types

| $\xrightarrow{1}$ + ${ }_{\text {- }}^{\text {- }}$ | Switch is 30 Series mech. |  |  |
| :---: | :---: | :---: | :---: |
|  | 56C215/32 | $56 \mathrm{C310C}$ | 56SW 110 |
|  | 56C210 | 56C3/110 | 56SW115 |
|  | 56C310 | 56C310RP |  |
|  | 56C315 | 56CV310 |  |
|  |  | 56CV315 |  |



Switch terminals are not identified
Switch is backwired
Conductor termination is pressure plate type
56 C 320 56SW110HD
56CV310HD 56SW115H
56CV310HD 56SW120
56SW132
56SW 150
56SW163

Switch terminals are not identified
Switch is backwired
Conductor termination is pressure plate type
56C310D
-56C315D

Switch terminats are not identified
Switch is backwired
Conductor termination is pressure plate type

| 56 C 410 | 56 CV 410 | 56 CV 710 | 56 K 1 SW 310 |
| :--- | :--- | :--- | :--- |
| 56 C 420 | 56 CV 420 | 56 CV 720 | 56 K 1 SW 320 |
| 56 C 416 K | 56 CV 510 | 56 CV 432 | 56 K 2 SW 310 |
| 56 C 510 | 56 CV 520 | 56 CV 532 | 56 K 2 SW 320 |
| 56 C 520 | 56 CV 416 K | 56 CV 440 | Pag |
|  | 56 CV 610 | 56 CV450 |  |

.56CV610 56CV450


| 56SWH | 66CV450 | 56SW363/2 | 56C610 | 56C432 | 56C550 |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 56SWH 325 | 66CV463 | 56SW363 | 56C710 | 56C532 | 56CV540 |
| 56SWH 363 |  | 56SW350 | 56C720 | 56C450 | 56CV550 |
| 56SWH 340 |  | 56SW332 | 56 C 440 | 56C540 | 56SW310 |
| 56SWH 380 |  |  |  |  | 56SW320 |




## Switch Wiring Diagram Types



Switch is 30 Series mech.
56SW110/2
56SW115/2
56SSW10
56SSW15


If neutral potential is applied to remote terminal timer function is overridden

56SW420
56SWH425
56SWH440
56SWH463
66CV550
66CV563
66CV750
66CV763



56PB (No Marking, Colour Green, Non Latching)
56PBS (Stop, Colour Red, Non Latching)
${ }^{3} \mathrm{BS} 1$ (Emergency Stop, Marked on Switch and Plate, Colour Red Mushroom, Latching
BS2 (Stop, Colour Red Mushroom, Latching)
56/2PB (Stop/Start, Colour Red/Green, Non Latching)
56/2PBS1 (Stop, Colour Red Mushroom, Latching)(Start, Colour Green, Non Latching)


Switch is 30 Series mech.
Conductor termination is pressure plate type
56CTC
56CTC15
56CTC2SO
56 CTC 2 SO 15
56TC
56 TC7
$56 T C D B$


## Wiring Diagram Types




56CTC Series wiring identification
Switches are 30 series mech



## HEAVY DUTY LINKS

## BP165/7

500V 165A 7 Hole Link.


## BP165/7ETP

500V 165A 7 Hole Link with tin-plate link and screws. Two screws per tunnel. Black unbreakable, transparent polycarbonate base and cover.
Dimensions: $100 \times 43 \times 40 \mathrm{~mm}$. Terminal bar: $16 \times 16 \times 76 \mathrm{~mm}$. 2 tunnels: 9.5 mm diameter accommodate $50 \mathrm{~mm}^{2}$ cables.
1 tunnel: 8.0 mm diameter accommodates $35 \mathrm{~mm}^{2}$ cable.
2 tunnels: 7.1 mm diameter accommodate $25 \mathrm{~mm}^{2}$ cables. 2 tunnels: 5.5 mm diameter accommodate $16 \mathrm{~mm}^{2}$ cables. Mounting centres: $71 \times 29 \mathrm{~mm}$. Available in red.

## BP165/7BW

500V 165A 7 Hole Back Wiring Link.
2 terminal tunnels: 9.5 mm diameter accommodate $50 \mathrm{~mm}^{2}$ cable, have single screw connection.
5 remaining terminals have 2 screws per tunnel. See BP165/7 above.
Temperature rating: $120^{\circ} \mathrm{C}$ maximum.

## BP165/13

500V 165 A 13 Hole Link. Two screws per tunnel. Black unbreakable, transparent polycarbonate base and cover.
Dimensions: $120 \times 47 \times 52 \mathrm{~mm}$. Terminal Bar: $19 \times 16 \times 95.3 \mathrm{~mm}$. 2 tunnels: 9.5 mm diameter accommodate $50 \mathrm{~mm}^{2}$ cable. 5 tunnels: 6.4 mm diameter accommodate $16 \mathrm{~mm}^{2}$ cable. 6 tunnels: 4.8 mm diameter accommodate $10 \mathrm{~mm}^{2}$ cable. Mounting centres: $90 \times 34 \mathrm{~mm}$. Available in red.
Temperature rating: $125^{\circ} \mathrm{C}$ maximum.


## BP165/13ETP

Same as BP165/13 with electro tinplate link and screws.

## BP350/7

500 V 7 Hole Link. Incoming cables clamped with single grub screw. Supplied with Allen key. Two screws per take off tunnel. Black base and cover.
Dimensions: $120 \times 47 \times 52 \mathrm{~mm}$. Terminal bar: $25.4 \times 19 \times 95.3 \mathrm{~mm}$. 2 tunnels: 15.0 mm diameter accommodate $120 \mathrm{~mm}^{2}$ cables.
2 tunnels: 9.5 mm diameter accommodate $50 \mathrm{~mm}^{2}$ cables.
2 tunnels: 8.0 mm diameter accommodate $35 \mathrm{~mm}^{2}$ cables.
1 tunnel: 5.5 mm diameter accommodates $16 \mathrm{~mm}^{2}$ cables.
Mounting centres: $90 \times 34 \mathrm{~mm}$.
Available in red.
Temperature rating $125^{\circ} \mathrm{C}$ maximum.


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## BP350/7ETP

Same as BP350/7 with electro tinplate link and screws.

## BP350/13

500 V 13 Hole Link. Incoming cables clamped with single grub screw. Supplied with Allen key. Two screws per take off tunnel. Black unbreakable, transparent polycarbonate base and cover.
Dimensions: $120 \times 47 \times 52 \mathrm{~mm}$. Terminal bar: $25.4 \times 19 \times 95.3 \mathrm{~mm}$. 2 tunnels: 15.0 mm diameter accommodate $120 \mathrm{~mm}^{2}$ cables.
1 tunnel: 8.0 mm diameter accommodates $35 \mathrm{~mm}^{2}$ cable. 8 tunnels: 5.5 mm diameter accommodate $16 \mathrm{~mm}^{2}$ cable. 2 tunnels: 4.8 mm diameter accommodate $10 \mathrm{~mm}^{2}$.
Mounting centres: $90 \times 34 \mathrm{~mm}$. Available in red.
Temperature rating: $125^{\circ} \mathrm{C}$ maximum.


## BP350/13ETP

Same as BP350/13 with electro tin-plate link and screws.

## LINK BARS

## BP90A Series 90A Link Bars.

Bar Section: $13 \times 9.5 \mathrm{~mm}$.
Bars have two 5.5 mm diameter tunnels with two screws, for up to $16 \mathrm{~mm}^{2}$ cables.
One 5.2 mm diameter tunnel with two screws for M.E.N.
All other tunnels 5.2 mm diameter with one screw to accommodate up to $16 \mathrm{~mm}^{2}$ cables.
Single screw tunnels are numbered.


## BP165A Series 165A Link Bars

 Bar Section: $19 \times 9.5 \mathrm{~mm}$.Bars have two $3 / 8^{\prime \prime}$ hexagon head bolts, for up to 165 amp. cable lugs.
One 5.8 mm diameter tunnel with two screws for M.E.N.
All other tunnels 5.8 mm diameter with one screw to accommodate up to $16 \mathrm{~mm}^{2}$ cables.
Single screw tunnels are numbered.
Available electro tin-plated.


BP165B Series 165A Link Bars Bar Section: $19 \times 9.5 \mathrm{~mm}$.
Bars have one $3 / 8^{\prime \prime}$ hexagon head bolt for up to 165 amp cable lug. One tunnel 5.8 mm diameter, with two screws for M.E.N.
All other tunnels 5.8 mm diameter with one screw to accommodate up to $16 \mathrm{~mm}^{2}$ cables.
Single screw tunnels are numbered.
 Available electro tin-plated.
Un-numbered bars available on request.

| Catalogue <br> Number | Single Screw <br> Tunnels | Overall <br> Length $(\mathbf{m m})$ |
| :--- | :---: | :---: |
| BP90A6 | 6 | 72 |
| BP90A12 | 12 | 110 |
| BP90A18 | 18 | 148 |
| BP90A24 | 24 | 186 |
| BP90A30 | 30 | 224 |
| BP90A36 | 36 | 262 |


| Catalogue <br> Number | Single Screw <br> Tunnels | Overall <br> Length $(\mathrm{mm})$ |
| :--- | :---: | :---: |
| BP165A12 | 12 | 145 |
| BP165A18 | 18 | 188 |
| BP165A24 | 24 | 230 |
| BP165A30 | 30 | 273 |
| BP165A36 | 36 | 315 |
| BP165A42 | 42 | 358 |
| BP165A48 | 48 | 401 |
| BP165A54 | 54 | 443 |
| BP165A60 | 60 | 486 |
| BP165A72 | 72 | 571 |
| BP165A80 | 80 | 628 |
| BP165A84 | 84 | 656 |


| Catalogue <br> Number | Single Screw <br> Tunnels | Overall <br> Length $(\mathbf{m m})$ |
| :--- | :---: | :---: |
| BP165B12 | 12 | 123 |
| BP165B18 | 18 | 165 |
| BP165B24 | 24 | 208 |
| BP165B30 | 30 | 250 |
| BP165B36 | 36 | 293 |
| BP165B42 | 42 | 336 |
| BP165B48 | 48 | 378 |
| BP165B54 | 54 | 421 |
| BP165B60 | 60 | 463 |
| BP165B72 | 72 | 549 |
| BP165B80 | 80 | 605 |
| BP165B84 | 84 | 633 |

BP165C Series 165A Link Bars Bar Section: $19 \times 9.5 \mathrm{~mm}$.
Bars have one $3 / 8^{\prime \prime}$ hexagon head bolt for up to 165 amp cable lug. All tunnels 5.8 mm diameter with two screws to accommodate up to $16 \mathrm{~mm}^{2}$ cables.
Tunnels are numbered.
Available electro tin-plated.


BP165D Series 165A Link Bars Bar Section: $19 \times 9.5 \mathrm{~mm}$.
Bars have two $3 / 8^{\text {n }}$ hexagon head bolts, for up to 165 amp . cable lugs. All tunnels 5.8 mm diameter with two screws accommodating up to $16 \mathrm{~mm}^{2}$ cables.
Tunnels all numbered.
Electro bars available on request.


| Catalogue <br> Number | Double Screw <br> Tunnels | Overall <br> Length $(\mathbf{m m})$ |
| :--- | :---: | :---: |
| BP165C6 | 6 | 95 |
| BP165C12 | 12 | 116 |
| BP165C18 | 18 | 158 |
| BP165C24 | 24 | 201 |
| BP165C30 | 30 | 243 |
| BP165C36 | 36 | 286 |
| BP165C42 | 42 | 329 |
| BP165C48 | 48 | 371 |
| BP165C54 | 54 | 414 |
| BP165C60 | 60 | 456 |
| BP165C72 | 72 | 542 |
| BP165C80 | 80 | 598 |
| BP165C84 | 84 | 627 |


| Catalogue <br> Number | Double Screw <br> Tunnels | Overall <br> Length $(\mathbf{m m})$ |
| :--- | :---: | :---: |
| BP165D6 | 6 | 95 |
| BP165D12 | 12 | 138 |
| BP165D18 | 18 | 180 |
| BP165D24 | 24 | 223 |
| BP165D30 | 30 | 266 |
| BP165D36 | 36 | 308 |
| BP165D42 | 42 | 351 |
| BP165D48 | 48 | 393 |
| BP165D54 | 54 | 436 |
| BP165D60 | 60 | 478 |
| BP165D72 | 72 | 564 |
| BP165D80 | 80 | 621 |
| BP165D84 | 84 | 650 |

Un-numbered bars on request.

## BP165D18 Series 165A Link Bars

Bar Section: $19 \times 9.5 \mathrm{~mm}$.
Bars have two $3 / 8^{\prime \prime}$ hexagon head bolts, for up to 165 amp cable lugs. All tunnels 5.8 mm diameter with two screws, accommodate up to $16 \mathrm{~mm}^{2}$ cables.
Tunnels all numbered.
Available on request.

## Alternative Connections for

Link
Most Link Bars in the BP165A, BP165B, BP165C, BP165D and BPN Series are available with various types of connections if required.

## Stud Connection

8 mm and 9.5 mm Threaded Studs soldered in bars with hexagonal lock nuts.

## Line Taps

Blue Point No. BP22, BP24, BP25, BP26 and BP28 Line Taps may also be incorporated if required.

## Medium Duty Neutral Bars With $2 \times$ BP22 Line Taps Front Wiring

## BPMD2/10 Series

Complete with $2 \times$ BP22 Line Taps. $13 \times 9.5 \mathrm{~mm}$ brass.

All bars have 1-1/4 Whitworth screw with flat brass washer and 2 number BPMD2 Line Taps provided for incoming cables ( $16 \mathrm{~mm}^{2}$ ).
All 4 mm diameter tunnels with single screw per tunnel for up to $6 \mathrm{~mm}^{2}$ cable.
All tunnels are numbered. Two 4 mm diameter countersunk recessed fixing holes.
Back wired neutral bar.


## Bare Links with Mounting Blocks

## BPQL Series

90A Link Bars with moulded mounting blocks. (BP165FD) Bar section $13 \times 13 \mathrm{~mm}$.
Temperature rating: $190^{\circ} \mathrm{C}$ maximum. Two $1 / 4^{\prime \prime}$ hexagon head studs for 90 ampere cable lugs.
All 5.5 diameter tunnels with single screw to accommodate up to $16 \mathrm{~mm}^{2}$ cables.
All tunnels are numbered.


| Catalogue <br> Number | Single Screw <br> Tunnels | Overall <br> Length $(\mathrm{mm})$ |
| :--- | :---: | :---: |
| BPMD2/3 | 3 | 105 |
| BPMD2/4 | 4 | 111 |
| BPMD2/5 | 5 | 121 |
| BPMD2/7 | 7 | 135 |
| BPMD2/9 | 9 | 150 |
| BPMD2/0 | 10 | 157 |
| BPMD2/12 | 12 | 174 |
| BPMD2/5 | 15 | 195 |
| BPMD2/18 | 18 | 219 |
| BPMD2/20 | 20 | 235 |
| BPMD2/24 | 24 | 268 |
| BPMD2/25 | 25 | 275 |
| BPMD2/30 | 30 | 313 |
| BPMD2/36 | 36 | 357 |


| Catalogue <br> Number | Single Screw <br> Tunnels | Overall <br> Length $(\mathbf{m m})$ |
| :--- | :---: | :---: |
| BPQL12 | 12 | 143 |
| BPQLL8 | 18 | 182 |
| BPQLL4 | 24 | 219 |
| BPQLL30 | 30 | 257 |
| BPQL26 | 36 | 295 |
| BPQL48 | 48 | 363 |
| BPQL50 | 50 | 383 |
| BPQL60 | 60 | 447 |

## Line Taps

Line Taps can be drilled, tapped and
fitted with screws on request.

## BP22

Line Tap for $16 \mathrm{~mm}^{2}$ cables.
Overall length 30 mm .


## BP22ETP

As above but electro tin-plated.

## BP24

Line Tap for $35 \mathrm{~mm}^{2}$ cables.
Overall length 35 mm .
BP24ETge 48 of 363
As above but electro tin-plated.

## BP25

Line Tap for $50 \mathrm{~mm}^{2}$ cables.
Overall length 44 mm .

## BP25ETP

As above but electro tin-plated.

## BP26

Line Tap for $95 \mathrm{~mm}^{2}$ cables.
Overall length 50 mm .

## BP26ETP

As above but electro tin-plated.

BP28
Line Tap for $185 \mathrm{~mm}^{2}$ cables.
Overall length 67 mm .
BP28ETP
As above but electro tin-plated.

## CLIPSAL

NEUTRAL / ACTIVE / METER
LINKS
Clipsal Links are produced from Impact Resistant materials to prevent cracking in transit or during installation.

The transparent covers enable you to check wiring and locate the sealing screw at a glance. The sealing screw (nylon with brass insert) resists stripping. Voltage and amperage ratings are clearly marked on both the cover and brass bar.

All links are available with black or red covers and bases for neutral, active or meter applications as required by local authorities.

## -Type - 500 Volt 140 Ampere

## L4T35

500V 140A 4 Hole Neutral Link with two screws per tunnel. Black base and cover.

## L4T35R

500V 140A 4 Hole Active Link. Red base and cover.

Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 28 mm . 1 tunnel 8.7 mm diameter accommodate $1 \times 25 \mathrm{~mm}^{2}$ cable.
3 tunnels 7.7 mm diameter accommodate $1 \times 25 \mathrm{~mm}^{2}$ cable. Certificate of Suitability No. CS2252N.


## Mini Links with Cover

500V 100A
2 screws per tunnel.

## L5

500 V 100A 5 Hole Neutral Link with two screws per tunnel. Black base and cover.

## L5R

500 V 100A 5 Hole Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 3 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$. 2 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$.

## L5BW

500 V 110A 5 Hole Back Wiring Neutral Link with two screws per tunnel. Black base and cover.

## L5BWR

500V 110A 5 Hole Back Wiring Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 5 tunnels, 7 mm diameter accommodate $1 \times 25 \mathrm{~mm}^{2}$. Transparent black cover, with cut outs.

## L6

500 V 100A 6 Hole Neutral Link with two screws per tunnel. Black base and cover.

## L6R

500 V 100A 6 Hole Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 3 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 3 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable.

## L6/25

500 V 110A 6 Hole Neutral Link with 2 screws per tunnel. Black base and cover.

## L6/25R

500 V 110A 6 Hole Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 2 tunnels, 7.5 mm diameter accommodate $2 \times 25 \mathrm{~mm}^{2}$ cable. 1 tunnel, 5.5 mm diameter accommodates $1 \times 16 \mathrm{~mm}^{2}$ cable. 3 tunnels, 4.7 mm diameter accommodate $3 \times 10 \mathrm{~mm}^{2}$ cable. Transparent black cover with cut-outs.

L7
500 V 100A 7 Hole Neutral Link with two screws per tunnel. Black base and cover.


## L7R

500 V 100A 7 Hole Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 3 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 4 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable.

## L7BW

500V 100A 7 Hole Back Wiring Neutral Link with two screws per tunnel. Black base and cover.

## L7BWR

500V 100A 7 Hole Active Link. Red base and cover.
Dimensions: $65 \times 46 \times 43 \mathrm{~mm}$. Mounting centres: 46 mm . 2 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cables. 5 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cables. Transparent black cover, with cut-outs.

## L8

500V 100A 8 Hole Neutral Link with two screws per tunnel. Black base and cover.
Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$. Mounting centres: $59 \times 67 \mathrm{~mm}$. 3 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 5 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. Transparent black cover with cut-outs.

## $L 10$

500V 100A 10 Hole Neutral Link with two screws per tunnel.
3 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 7 tunnels, 5.8 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.


## L10BW

500V 100A 10 Hole Back Wiring Neutral Link with two screws per tunnel.
Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.

## $L 12$

500 V 100A 12 Hole Neutral Link with two screws per tunnel.
2 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 4 tunnels, 5.5 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 6 tunnels, 4.5 mm diameter accommodate $1 \times 10 \mathrm{~mm}^{2}$ cable. Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.

## L14

500V 100A 14 Hole Neutral Link with two screws in 8 tunnels and one screw in 6 tunnels.
2 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 6 tunnels, 5.5 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 6 tunnels, 4.5 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.

## $L 16$

500V 100A 16 Hole Neutral Link with two screws in 6 tunnels and one screw in 10 tunnels.
2 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 4 tunnels, 5.5 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 10 tunnels, 4.5 mm diameter accommodate $1 \times 10 \mathrm{~mm}^{2}$ cable. Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.

## L18

500V 100A 18 Hole Neutral Link with two screws in 6 tunnels and one screw in 12 tunnels.
2 tunnels, 6.3 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 4 tunnels, 5.5 mm diameter accommodate $1 \times 16 \mathrm{~mm}^{2}$ cable. 12 tunnels, 4.5 mm diameter accommodate $1 \times 10 \mathrm{~mm}^{2}$ cable. Dimensions: $86 \times 57 \times 40 \mathrm{~mm}$.

| Tunnel Diameters |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
| Catalogue <br> Number | $4.7 \mathrm{~mm}^{2}$ <br> for $10 \mathrm{~mm}^{2}$ <br> cable | 6.3 mm <br> for $16 \mathrm{~mm}^{2}$ <br> cable | 5.7 mm <br> for $16 \mathrm{~mm}^{2}$ <br> cable | 7 mm <br> for $25 \mathrm{~mm}^{2}$ <br> cable |  |
| L5 | - | 3 | 2 | - |  |
| L5BW | - | - | - | 5 |  |
| L6 | - | 3 | 3 | - |  |
| L6/25 | 3 | - | 1 | 2 |  |
| L7 | - | 3 | 4 | - |  |
| L7BW | - | 2 | 5 | - |  |


| Tunnel Diameters |  |  |  |
| :--- | :---: | :---: | :---: |
| Catalogue <br> Number | 6.3 mm <br> for $16 \mathrm{~mm}^{2}$ <br> cable | 5.5 mm <br> for $16 \mathrm{~mm}^{2}$ <br> cable | 4.5 mm <br> for $10 \mathrm{~mm}^{2}$ <br> cable |
| L8 | 3 | 5 | - |
| L10 | 3 | 7 | - |
| L10BW | 2 | 8 | - |
| L12 | 2 | 4 | 6 |
| L14 | 2 | 6 | 6 |
| L16 | 2 | 4 | 10 |
| L18 | 2 | 4 | 12 |

## Mini Links Less Cover

500 V 100A
Mounting centres: 46 mm .

## L5A

5 Hole - two screws per tunnel.
Black base.


## L6A

6 Hole - two screws per tunnel.
Black base.

## L6RA

6 Hole - two screws per tunnel.
Red base.

## L7A

7 Hole - two screws per tunnel.
Black base.
Overall dimensions: $57 \times 30 \times 26 \mathrm{~mm}$. Mounting centres: 46 mm .
Tunnel and cable detail same as L5 to L7 Series Covered Links.

## Standard Links Less Cover

500 V 100A
Mounting centres: $59-67 \mathrm{~mm}$.

## L8A

8 Hole - two screws per tunnel.


L10A
10 Hole - two screws per tunnel.

## L12A

12 Hole - two screws per tunnel.

## L14A

14 Hole - two screws per tunnel.

## L16A

16 Hole - two screws in 6 tunnels, and one screw in 10 tunnels.

## L18A

18 Hole - two screws per tunnel in 6 tunnels, and one screw in 12 tunnels.
Overall dimensions: $80 \times 32 \times 22 \mathrm{~mm}$.
Mounting centres: $59-67 \mathrm{~mm}$.
Tunnel and cable detail same as L8 to L18 Series Covered Links.
All link bases are black.

## Brass Link Bars

## 500 V 100A

## L5P

5 Hole - two screws per tunnel. Length 41 mm .

## L6P

6 Hole - two screws per tunnel. Length 48 mm .
L7P
7 Hole - two screws per tunnel.
Length 54 mm .

## L8P

8 Hole - two screws per tunnel. Length 61 mm .


## L10P

10 Hole - two screws per tunnel. Length 75 mm .

## L12P

12 Hole - two screws per tunnel. Length 80 mm .
Brass bar section: $13 \times 10 \mathrm{~mm}$.
Tunnel and cable detail same as L5 to L12 Series Covered Links.

## L14P

14 Hole - two screws in 8 tunnels and one screw in 6 tunnels.


## L16P

16 Hole - two screws in 6 tunnels and one screw in 10 tunnels.

## L18P

18 Hole - fwo screws in 6 tunnels and one screw in 12 tunnels.
Brass bar section: $19 \times 10 \mathrm{~mm}$ tunnel.
Cable detail same as L14 and L18
Series Covered Links.
'roducts of Gerard Industries Pty Ltd ABN 27007873529

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## VPCIM EMITTING SYSTEMS \& ELECTRONIC PRODUCTS

## $\mathrm{VpCl}^{\otimes}-110$ Emitter, Patented



## PRODUCT DESCRIPTION

Cortec ${ }^{*} \mathrm{VpCl}-110$ emitters are designed to provide corrosion protection for metal components and parts enclosed in non-ventilated control boxes, cabinets, or tool boxes up to 10 cubic feet ( 283 liters) in volume. The Vapor phase Corrosion Inhibitor $(\mathrm{VpCl})$ emits vapors which form a molecular layer on internal metal surfaces to protect critical, complex, and expensive electronic equipment and other metal components during operation, shipping, or storage. $\mathrm{VpCl}_{\mathrm{p}}-110$ is a small foam emitter through which corrosion inhibitors are slowly released, and moisture and air pollutants can enter to be absorbed. It provides long-term protection against corrosion even in the presence of adverse conditions including salt, moisture, airborne contaminants, $\mathrm{H}_{2} \mathrm{~S}$, $\mathrm{SO}_{2}, \mathrm{NH}_{3}$, and others.

## TYPICAL APPLICATIONS

$\mathrm{VpCl}-110$ can be effectively used for:

- Operations, packaging, and storage electrical equipment
- Marine navigation and communication electronic equipment
- Aerospace electrical controls
- Electric motors

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- Switching equipment
- Fuse boxes and power boxes
- Medical equipment
- Electrical wireways and terminal boxes
- Scientific and measuring instruments
- Telecommunications equipment
- Remote electronics devices
- Tool-boxes, parts-storage, and other containers holding metals


## FEATURES

- Economical to use
- Provides continuous protection for up to 24 months during operation and/or shutdown
- Effective in polluted and humid environments
- Does not interfere with electrical, optical, or mechanical performance
- Multimetal protection
- Quick and easy installation
- Non-toxic and safe to handle
- Compact and space-saving
- Free of nitrites, halogens, and phosphates
- No spraying, wiping, or dipping required
- Low VOC values
- Meets Southern California Clean Air Act and other National and local regulations
- Self-stick back
- Self-stick date label
- Accepted by FDA for corrosion protection of electrical and electronic equipment within food processing plants
- Canadian Food Inspection Agency acceptance for indirect food contact
- NSN 6850-01-456-2971
- Conforms to MIL I-22110C
- Federal Standard 101, Ardec Technical Report 99. 05, Picatinny Arsenal, New Jersey, USA


## METHOD OF APPLICATION

$\mathrm{VpCl}-110$ is extremely simple and convenient to install. The device should be installed at the earliest possible time. Simply select a space within enclosure where corrosion protection would be useful. Verify the surface is clean and free of debris. Peel off the protective peel strip from the bottom of the device and attach it to the clean surface.
$\mathrm{VpCl}-110$ emitters can be installed in any position. For volumes greater than 10 cubic feet ( 283 liters), use more than one device. If the enclosure is not totally airtight, or if the access doors are opened frequently, replace the $\mathrm{VpCl}-110$ device more often than every 2 years. After periods of heavy maintenance replace the device. For additional protection spray the enclosure very lightly with ElectriCorr ${ }^{\otimes} \mathrm{VpCl}-238$ or $\mathrm{VpCl}-239$.

## SPECIFICATIONS

Packaging
Protection

Standard Size

12 individually wrapped emitters per carton emitters per carton
up to $10 \mathrm{ft}^{3}$ (283 liters) per device
Foam device with adhesive backing $2.5^{\prime \prime} \mathrm{D} \times 2^{\prime \prime} \mathrm{H}$ $(6.4 \mathrm{~cm} \mathrm{D} \times 5 \mathrm{~cm} \mathrm{H}$ )

FOR INDUSTRIAL USE ONLY
KEEP OUT OF REACH OF CHILDREN
KEEP CONTAINER TIGHTLY SEALED
NOT FOR INTERNAL CONSUMPTION
CONSULT MATERIAL SAFETY DATA SHEET FOR MORE INFORMATION

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## BतITECH

## CRITEC ${ }^{\text {® }}$ Transient Discriminating <br> Surge Diverters



## urge Protection And Surge Ratings

The stress, which an SPD will experience under surge conditions, is a function of many complex and interrelated parameters. These include:

- Location of the SPD(s) within the structure - are they located at the main distribution board or within the facility at secondary board, or even in front of the end-user equipment?
- Method of coupling the lightning strike to the facility for example, is this via a direct strike to the structures LPS, or via induction onto building wiring due to a nearby strike?
- Distribution of lightning currents within the structure for example, what portion of the lightning current enters the earthing system and what remaining portion seeks a path to remote grounds via the power distribution " "stem and equipotential bonding SPDs?
.,'pe of power distribution system - the distribution of lightning current on a power distribution system is strongly influenced by the grounding practice for the neutral conductor. For example, in the TN-C system with its multiple earthed neutral, a more direct and lower impedance path to ground is provided for lightning currents than in a $\Pi T$ system.
- Additional conductive services connected to the facility - these will carry a portion of the direct lightning current and therefore reduce the portion which flows through the power distribution system via the lightning equipotential bonding SPD.
- Type of waveshape - it is not possible to simply consider the peak current which the SPD will have to conduct, one also has to consider the waveshape of this surge. It is also not possible to simply equate the areas under the current-time curves (also referred to as the action integral) for SPDs under different waveshapes.
ly attempts have been made to quantify the electrical ronment and "threat level" which an SPD will experience at different locations within a facility. The new IEC ${ }^{\text {sM }}$ standard on lightning protection, IEC 62305-4 "Protection against lightning - Part 4: Electrical and electronic systems within structures" has sought to address this issue by considering the highest surge magnitude which may be presented to an SPD based on the lightning protection level (LPL) being considered. For example, this standard postulates that under a LPLI the magnitude of a direct strike to the structure's LPS may be as high as 200kA $10 / 350$. While this level is possible, its statistical probability of occurrence is approximately $1 \%$. In other words, $99 \%$ of discharges will be less than this postulated 200 kA peak current level.

An assumption is made that $50 \%$ of this current is conducted via the building's earthing system, and $50 \%$ returns via the equipotential bonding SPDs connected to
a three wire plus neutral power distribution system. It is also assumed that no additional conductive service exists. This implies that the portion of the initial 200 kA discharge experienced by each SPD is 25 kA .

Simplified assumptions of current dispersion are useful in considering the possible threat level, which the SPD(s) may experience, but it is important to keep in context the assumptions being made. In the example above, a lightning discharge of 200kA has been considered. It follows that the threat level to the equipotential bonding SPDs will be less than 25 kA for $99 \%$ of the time. In addition, it has been assumed that the waveshape of this current component through the SPD(s) will be of the same waveshape as the initial discharge, namely $10 / 350$, while in reality the waveshape have been altered by the impedance of building wiring, etc.
Many standards have sought to base their considerations on field experience collected overtime. For example, the $\operatorname{IEEE}{ }^{\circ}$ guide to the environment C62.41.1 and the recommended practice C62.41.2 present two scenarios of lightning discharge and different exposure levels under each of these depending on the location where the SPD is installed. In this standard, Scenario II depicts a direct strike to the structure, while Scenario I depicts a nearby strike and the subsequent conducted current into a structure via power and data lines. The highest surge exposure considered feasible to an SPD installed at the service entrance to a facility under Scenario I is $10 \mathrm{kA} 8 / 20$, while under Scenario II it is considered to be 10kA 10/350 (exposure Level 3).

From the above, it is apparent that the selection of the appropriate surge rating for an SPD depends on many complex and interconnected parameters. When addressing such complexities, one needs to keep in mind that one of the more important parameters in selecting an SPD is its limiting voltage performance during the expected surge event, and not the energy withstand which it can handle.


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## Advanced Technologies - The ERICO ${ }^{\circledR}$ Advantage

## Transient Discriminating Technology

To meet the fundamental requirements of performance, longer service life and greater safety under real world conditions, ERICO has developed Transient Discriminating (TD) Technology.

This quantum leap in technology adds a level of "intelligence" to the Surge Protection Device enabling it to discriminate between sustained abnormal over-voltage conditions and true transient or surge events. Not only does this help ensure safe operation under practical application, but it also prolongs the life of the protector since permanent disconnects are not required as a means of achieving internal over-voltage protection.

## Traditional Technologies

Conventional SPD technologies utilize metal oxide varistors and/ or silicon avalanche diodes to clamp or limit transient events. However, these devices are susceptible to sustained $50 / 60 \mathrm{~Hz}$ mains over-voltage conditions which often occur during faults to the utility system. Such occurrences present a significant safety hazard when the suppression device attempts to clamp the peak of each half cycle on the mains over-voltage. This condition can cause the device to rapidly accumulate heat and in turn fail with the possibility of inducing a fire hazard.

## The Core of TD Technology

The secret to ERICO's Transient Discriminating Technology is its active frequency discrimination circuit. This patented device can discriminate between a temporary over-voltage (TOV) condition

and a very fast transient, which is associated with lightning or switching-induced surges. When the transient frequencies are detected, the patented Quick-Switch within TD activates to allow the robust protection to limit the incoming transient. The frequency discriminating circuit that controls the Quick-Switch helps ensure that the SPD device is immune to the effects of a sustained 50 or 60 Hz TOV. This allows the device to keep operating, in order to help provide safe and reliable transient protection, even after an abnormal over-voltage condition has occurred.

## Meeting \& Exceeding UL® Standards

The CRITEC* range of surge protection devices from ERICO* employing TD Technology has been specifically designed to meet and exceed the new safety requirements of UL 1449 Edition 3. To meet the abnormal over-voltage testing of UL 1449 Edition 3, many manufacturers of SPD devices have incorporated fuse or thermal disconnect devices which permanently disconnect all protection from the circuit during an over-voltage event. Transient Discriminating Technology on the other hand will allow the SPD device to experience an abnormal overvoltage up to twice its nominal operating voltage and still remain operational even after this event! This allows the device to help provide safe, reliable and continuous protection to your sensitive electronic equipment. TD Technology is especially recommended for any site where sustained over-voltages are known to occur, and where failure of traditional SPD technologies cannot be tolerated.

The UL 1449 testing standard addresses the safety of an SPD device under temporary and abnormal overvoltage conditions, but does not specifically mandate a design that will give a reliable, long length of service in the real world. Specifically, UL 1449 tests that the SPD remains operational at $10 \%$ above nominal supply voltage, allowing SPD manufacturers to design products that permanently disconnect just above that. Most reputable manufacturer's designs allow for up to a $25 \%$ overvoltage, while ERICO's TD Technology gives even greater overhead.


## TDS 1100

## CRITEC ${ }^{\oplus}$ TDS Surge Diverter - TDS 1100 Series

## Features

- CRITEC TD Technology with thermal disconnect protection
- Compact design fits into DIN distribution panel boards and motor control centers
- 35 mm DIN rail mount - DIN 43880 profile matches mmmon circuit oreakers
- Indication flags and voltage-free contacts provide remote status monitoring
- Separate plug and base design facilitates replacement of a failed surge module
- 100kA $8 / 20 \mu \mathrm{~s}$ maximum surge rating provides rotection suitable - or sub-distribution panels and a long operational life
- Available in various operating voltages to suit most common power distribution systems
- CE, UL ${ }^{\circ} 1449$ Edition 3 Listed

Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.
The TDS1100 series of surge suppressors provide economical and reliable protection from voltage transients on power distribution systems. They are conveniently packaged for easy installation on 35 mm DIN rail within main distribution panelboards.
CRITEC ${ }^{\text { }}$ TD technology helps ensure reliable and continued operation during sustained and abnormal over-voltage events. Internal thermal disconnect devices help ensure safe behavior
 at end-of-life. A visual indicator flag provides user-feedback in the event of such operation. As standard, the TDS1100 provides a set of voltage-free contacts for remote signaling that maintenance is due.
The convenient plug-in module and separate base design facilitates replacement of a failed surge module without needing to undo installation wiring.


| Model | TDS 1002 SR150 | ITDS11002SR240 | [TDS11002SR277 | \|TDS11002SR560 |
| :---: | :---: | :---: | :---: | :---: |
| ItemNumber for Europe | 702409 | 702411 | 702412 | 702413 |
| Nominal Voltage, $\mathrm{U}_{2}$ | 120-150 VAC | 220-240VAC | 240-277VAC | 480-560 VAC |
| Max Cont. Operating Voltage, $U_{5}$ | 170 VAC | 275 VAC | 32.0 VAC | 610VAC |
| Stand-off Voltage | 240VAC | 1440VAC | 480VAC | 700VAC |
| Frequency | O-100Hz |  |  |  |
| Short Circuit Current Rating, le |  |  |  |  |
| Back-up Overcurremt Protection | 125AgL, if supply $>100 \mathrm{~A}$ |  |  |  |
| Technology | TD with thermal disconnect |  |  |  |
| Max Discharge Current, Lex | 100kA8/20]s |  |  |  |
| Impulse Current, ino | 12.5kA 10/350]s |  |  |  |
| Nominal Discharge Current, ${ }_{\text {L }}$ | 50kA8/20]s 140kA $8 / 20 \mathrm{Js}$ |  |  |  |
| Protection Modes | Single mode ( $\mathrm{L}-\mathrm{G}, \mathrm{L}-\mathrm{N}$ or $\mathrm{N}-\mathrm{G}$ ) |  |  |  |
| Voltage Protection Level, $\mathrm{U}_{\text {\% }}$ | $\begin{aligned} & 400 \mathrm{~V} \text { e } 3 \mathrm{kA} \\ & 1.0 \mathrm{kV} 20 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} \otimes 3 \mathrm{kA} \\ & 1,2 \mathrm{kV}=20 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 800 \mathrm{~V} \beta 3 \mathrm{kA} \\ & 1.6 \mathrm{kV}=20 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 1.8 \mathrm{kV} e 3 \mathrm{kA} \\ & 2.4 \mathrm{kV} \text { 20kA } \end{aligned}$ |
| Status | N/O, N/C Change-over contact, $250 \mathrm{~V} \sim 10.5 \mathrm{~A}, \max 1.5 \mathrm{~mm}^{2}$ (i14AWG) terminals Mechanical flag / remote contacts ( $R$ model only) |  |  |  |
| Dimensions $\mathrm{H} \times \mathrm{D} \times \mathrm{W}: \mathrm{mm}$ (in) | $90 \times 68 \times 35(3.54 \times 2.68 \times 1.38)$ |  |  |  |
| Module Width | 2 M |  |  |  |
| Welght kg (bs) | 0.24(0.53) |  |  |  |
| Endosure | OIN 43890, Ul94V-0 thermoplastic, ip 20 (NEMA-1) |  |  |  |
| Connection | $525 \mathrm{~mm}^{2}$ (i4AWG) stranded$535 \mathrm{~mm}^{2}$ ( 42 AWG ) solid |  |  |  |
| Mounting | 35 mmtoghat DiN rail |  |  |  |
| Temperature | -40 ${ }^{\circ} \mathrm{C}$ to $80^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to 176\% |  |  |  |
| Humidity | $0 \% \text { to } 90 \%$ |  |  |  |
| Approvals |  |  |  |  |
| Surge Rated to Meet |  |  |  |  |
| Replacement MOV Module | T05150M150 | ITOS150M240 | ITDS150M27 | TT0S150M560 |



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 retion, property damage, serious hodily injury and death.

## Features

- CRITEC ${ }^{\text {T }}$ Transient Discriminating (TD) Technology provides increased service life
- In-line series protection
- High efficiency low pass sine wave filtering - ideal for the protection of switched mode power supplies
- Three modes of protection: L-N, L-PE \& N-PE
- 35 mm DIN rail mount - simple installation
- LED status indication and opto-isolated output - for remote status monitoring
- CE, UL 1449

Ed. 3 Listed

## CRITEC ${ }^{\circledR}$ Transient Discriminating Filter

The TDF series has been specifically designed for process control applications to protect the switched mode power supply units on devices such as PLC controllers, SCADA systems and motor controllers. Units are UL' Recognized and available for 3A, 10A and 20A loads and suitable for $110-120 \mathrm{~V}$ ac/dc and $220-240 \mathrm{Vac}$ circuits.
The TDF is a series connected, single phase surge filter providing an aggregate surge capacity of $50 \mathrm{kA}(8 / 20 \mu \mathrm{~s})$ across L-N, L-PE, and N-PE. The low pass filter provides up to 65 dB of attenuation to voltage transients. Not only does this reduce the residual let-through voltage, but it also helps further reduce the steep voltage rate-of-rise providing superior protection for sensitive electronic equipment.


| Model | TDF3AI20V | TDF3A240V | TDFIOAI20V | TTDFIOA240V | [TDF20A120V | TDF20A240V |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| tem Number for Europe | 700001 | 700002 | 700003 | 700004 | 700005 | 700006 |
| Nominal Voltage, $\mathrm{U}_{\mathrm{n}}$ | 110-120V | 220-240 V | $110-120 \mathrm{~V}$ | 220-240 V | 110.120 V | 220-240 V |
| pistribution System | TN-C.S, TN-S |  |  |  |  |  |
| Max Cont. Operating | 170VAC | 340 VAC | 170VAC | 340VAC | 170VAC | 340 VAC |
| Stand-off Voltage | 240 V | 400 V | 240 V | 4000 | 240 V | 400V |
| Frequency | O-60Hz | 50/60Hz | 0-60Hz |  |  | 50/60Hz |
| Max LIne Current, | 3A |  | 10A |  | 20 A |  |
| Operating Current $\mathrm{FO}_{0}$ | 135 mA | 250 mA | 240 mA | 480 mA | 240 mA | 480 mA |
| Max Discharge Current, san | $\begin{aligned} & 10 \mathrm{kA} 8 / 20 \mathrm{ps} \mathrm{~N} \cdot \mathrm{PE} \\ & 20 \mathrm{kA} 820 \mathrm{ps} \text { L-N } \\ & 20 \mathrm{kA} 820 \mathrm{ps} \text { L.PE } \end{aligned}$ |  |  |  |  |  |
| Protection Modes | All modes protected |  |  |  |  |  |
| rechnology | In-line series low pass sine wave filter TD Technology |  |  |  |  |  |
| Voltage Protection Level, $\mathrm{U}_{\mathrm{p}}$ | $\begin{aligned} & 500 \mathrm{~V} \text { e } 500 \mathrm{~A} \\ & 250 \mathrm{~V} \text { e } 3 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} \text { e 500A } \\ & 600 \mathrm{~V} \text { e 3kA } \end{aligned}$ | $\begin{aligned} & 500 \mathrm{~V}-500 \mathrm{~A} \\ & 250 \mathrm{~V} \text { - } 3 \mathrm{kA} \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} \text { e } 500 \mathrm{~A} \\ & 600 \mathrm{~V} \text { e } 3 \mathrm{kA} \\ & \hline \end{aligned}$ | $\begin{aligned} & 500 \mathrm{~V} \because 500 \mathrm{~A} \\ & 250 \mathrm{~V} \text { \& } 3 \mathrm{kA} \\ & \hline \end{aligned}$ | $\begin{aligned} & 700 \mathrm{~V} \text { e } 500 \mathrm{~A} \\ & 600 \mathrm{~V} \text { e } 3 \mathrm{kA} \\ & \hline \end{aligned}$ |
| Plitering | -62d8 e 100kHz $\quad 1-65 d 88100 \mathrm{kHz}$ |  |  |  |  |  |
| Status | Green LED. On=0k. Isolated opto-coupler output |  |  |  |  |  |
| Dimensions $\mathrm{H} \times \mathrm{D} \times \mathrm{W}$ : mm (in) | $90 \times 68 \times 72$ $90 \times 68 \times 144$ <br> $(3.54 \times 2.68 \times 2.83)$ $(3.54 \times 2.68 \times 5.67)$ |  |  |  |  |  |
| Module Width | 4 M |  | 8M |  |  |  |
| Weight: kg ( bs ) | 0.7 (1.54) |  | 1.18 (3.25) |  | 11.57(3.46) |  |
| Enclosure | OIN 43880, UL94V-0 thermoplastic, IP 20 (NEMA ${ }^{\text {a }}$-1) |  |  |  |  |  |
| Connection | $1 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}(18 \mathrm{AWG}$ to $\$ 10)$ |  |  |  |  |  |
| Mounting | 35 mm top hat DIN rail |  |  |  |  |  |
| eack-up Overcurrent | 3A |  | 10A |  | 20A |  |
| Protection |  |  |  |  |  |  |
| temperature | -35 ${ }^{\circ} \mathrm{C}$ to $55^{\circ} \mathrm{C}\left(-31^{\circ} \mathrm{F}\right.$ to $\left.131^{\circ} \mathrm{F}\right)$ |  |  |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |  |  |
| Approvals | C-IICk, CE (NOM 3A, 120V), CSA 22.2, UL' 1283. UL* 1449 Ed 3 Recoanized Component Trpe 2 |  |  |  |  |  |
| Surge Rated to Meet |  |  |  |  |  |  |  |  |  |  |

(1) Opto-coupler output can be connected to DINLINE Alarm Relay (DAR275V) to provide Form C dry contacts.

[^0]
## Features

- In-line series protection
- EMI/RFI noise filtering - protects against industrial electrical noise
- Compact design - fits into motor control and equipment panels
- Three modes of protection: L-N, L-PE \& N-PE
- 35 mm DIN rail mount - simple installation
- LED power indicator


## CRITEC ${ }^{\circledR}$ Dinline Surge Filter

The "two port" DSF series has been specifically designed for process control applications to protect the switched mode power supply units on devices such as PLC controllers, SCADA systems and motor controllers. The 30 V unit is suitable for 12 V and $24 \mathrm{Vac} / \mathrm{dc}$ signaling and control systems.
The 6A DSF series incorporates a space efficient, low pass, series filter which provides attenuation to high frequency interference. The larger 20A model provides status indication and a higher surge rating, making this ideal for the protection of higher risk equipment.


| Moder | [DSF6R 300 | [DSFE6AI50V | [DSF6A275V | [DS520.275V |
| :---: | :---: | :---: | :---: | :---: |
| tem Number for Europe | 702090 | 701000 | 701030 | 701020 |
| Nominal Voltage, U, | 24 | $1110-120 \mathrm{~V}$ | 120.240 |  |
| Distribution System | $1 \mathrm{i}^{2} 2 \mathrm{~W}+\mathrm{G}$ |  |  |  |
| System Compatibility | TINS, TiNC.S |  |  |  |
| Max Cont. Operating Volv- | 3 3VVAC 38VVC | 150 VAC | ${ }^{27} 7$ VAC |  |
| ye, |  | 50060 Hz |  |  |
| Trequency | 0.60 Hz |  |  |  |  |  |
| Max Line Current. | 6A |  |  | 204 |
| Operating Current © $\mathrm{U}_{\text {, }}$ | 7 mA |  |  |  |
| Max Discharge Current, Lum | 4 kA 820 ps | ${ }^{16 \mathrm{kA}} \mathrm{E} / 20 \mathrm{ps}$ |  |  |
| Protection Modes | All modes protected |  |  |  |
| Fiechnology | In-line series filter MOV |  |  |  |
| Voltage Protection teve, $\mathrm{U}_{\text {U }}$ | 110V0 3 kA | [400VO3kA [750V ${ }^{\text {a }}$ kA |  | 7rove ska |
| Filtering | -3088 300 kHz |  |  | -308062xhz |
| status | LED power indicator |  |  | Status indicator |
| pimensions $\mathrm{H} \times \mathrm{D} \times \mathrm{W}$ : mm (in) | $\begin{aligned} & 90 \times 68 \times 36 \\ & (3.54 \times 2.68 \times 1.42) \end{aligned}$ |  |  | $\begin{aligned} & 90 \times 68 \times 72 \\ & (3.54 \times 2.68 \times 2.83) \end{aligned}$ |
| Module Width | 2 M |  |  | 4 M |
| Weight kg (10) | $0.2(0.441)$ |  |  | 0.7 (1.543) |
| Endosure |  |  |  |  |
| Connection | $1 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}$ (18)WG to (10AWG) |  |  |  |
| Mounting | 35 mm top hat DIN |  |  |  |
| Back-up Overcurrent | ${ }^{68}$ |  |  | ${ }^{20 A}$ |
| Protection |  |  |  |  |
| temperature | -35 $3^{\circ} \mathrm{C}$ to $55^{\circ} \mathrm{C}(3.31 \%$ to 131\%) |  |  |  |
| Humidity | 0\% to 90\% |  |  |  |
| Approvals |  |  |  |  |
| Surge Rated to Meet | ANSIDEEE ${ }^{\circ} \mathrm{C}$ (62.41.2 $\mathrm{Cot} A \operatorname{CatB}$ |  |  |  |

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## WARNING

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www.erico.com

## Danfoss VLT ${ }^{\otimes}$ Soft Starter The single speed drive



## Soft starts:

## Protects processes, products and equipment with smooth motor control

An AC motor switched directly on to the mains power supply will struggle to reach its nominal speed as quickly as possible.

This draws maximum current from the power supply and accelerates the application with its maximum torque. Depending on the application, this can cause different problems.

Applications like pumps, conveyers, centrifuges and bandsaws must be started slowly, and sometimes stopped slowly, to prevent mechanical shocks such as water hammer, and strains on bands, couplings and shafts.

## Principle of Phase Angle Control

A soft starter is an electronic device that regulates the voltage to the motor and this provides a smooth transition from standstill to full speed operation of the application.

VLT ${ }^{\circ}$ Soft Starters all use the principle of phase angle control: Back-to-back coupled thyristors ramp up the motor voltage.

In some VLT ${ }^{\circ}$ Soft Starters, current transformers measure the motor current, providing feedback for starting current control but also for numerous motor and application protection functions.


| VLT ${ }^{\text {S }}$ Soft Starter MCD 500 | VLT ${ }^{\text {® }}$ Compact Starter MCD 200 | VLT ${ }^{\text {P }}$ Soft Starter MCD 100 |
| :---: | :---: | :---: |
| - Fully featured Soft Starter for motors up to 1100 HP <br> - Total motor starting solution <br> - Advanced protection features <br> - Adaptive Acceleration Control <br> - Inside Delta connection <br> - 4 line graphical display <br> - Multiple programming setup menus | Compact Soft Starter for motors up to 150 HP <br> Voltage ramps, current limit start and intregrated motor protection Integral bypass design reduces heat dissipation <br> Wide power range with advanced accessory modules | - Micro Soft Start controller for motors up to 15 HP <br> - Extremely robust SCR design with heavy ratings as standard <br> - Unlimited number of starts per hour <br> Contactor style design for easy selection, installation and commissioning |



## VLT ${ }^{\ominus}$ Soft Starter MCD 500

## VLT ${ }^{\circ}$ Soft Starter MCD 500 is a total motor starting solution. Current transformers measure motor current and provide feedback for controlled motor ramp profiles.

AAC, the Adaptive Acceleration Control, automatically employs the best starting and stopping profile for the application. Adaptive Acceleration Control means that for each start and stop, the soft starter compares and adapts the process to the chosen profile best suited to the application.

The VLT* Soft Starter MCD 500 has a four-line graphical display and a logic keypad making programming easy. Advanced setup is possible displaying operational status.

Three menu systems: Quick Menu, Application Setup and Main Menu provide optimum programming approach.

The perfect solution, also for more severe applications:

- Pumps
- Conveyors
- Fans
- Mixers
- Compressors
- Centrifuges
- Mills
- Saws
- And many more


## Power range

$21-1600 \mathrm{~A}, 10-1100 \mathrm{HP}$ (1.2 MW inside Delta Connection) Versions for 200-690 VAC


| Features | Benefits |
| :---: | :---: |
| User friendly |  |
| AAC Adaptive Acceleration Control | - Automatically adapts to the chosen starting and stopping profile |
| Adjustable bus bars allow for both top and bottom entry on 360-1600 amp models ( $200-1100 \mathrm{HP}$ ) | - Space saving, less cable cost and easy retrofitting |
| DC injection braking distributed evenly over three phases | - Less installation cost and less stress on the motor |
| Inside Delta (6-wire connection) | - Smaller soft starter can be selected for the application |
| Log menus, 99 events and trip $\log$ provide information on events, trips and performance | - Eases analysis of the application |
| Auto Reset | - Less down-time |
| Jog (slow-speed operation) | - Application flexibility |
| Second-order thermal model | - Allows motors to be used to their full potential without damage from overloading |
| Internal bypass contactors ( $21-215 \mathrm{~A}, 10-150 \mathrm{HP}$ ) | - Save space and wiring compared to external bypass <br> - Very little heat dissipates when running. Eliminates costly external fans, wiring or bypass contactors |
| Auto-start/stop clock | - Application flexibility |
| Compact size - amongst the smallest in their class | - Saves space in cabinets and other application setups |
| 4-line graphical display | - Optimum programming approach and setup for viewing operational status |
| Multiple programming setup (Standard Menu, Extended Menu, Quick Set) | - Simplifies the programming, allowing maximum flexibility |
| 8 language display options | - Serving the whole world |

## Dimensions

| Current rating [ A ] | Weight [lbs] | Height [inches] | Width [inches] | Depth [inches] | Frame size |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 21, 37, 43 and 53 | 9.25 | 11.61 | 5.90 | 7.20 | G1 |
| 68 | 9.92 |  |  | 8.38 |  |
| 84,89 and 105 | 10.8 |  |  |  |  |
| 131, 141, 195 and 215 | 32.8 | 17.24 | 10.82 | 9.84 | G2 |
| 245 | 52.6 | 18.11 | 15.35 | 10.98 | G3 |
| 360,380 and 428 | 77 | 27.12 | 16.92 | 11.82 | G4 |
| 595, 619,790 and 927 | 100 |  |  |  |  |
| 1200,1410 and 1600 | 264 | 33.70 | 23.03 | 14.33 | G5 |



## MCD 500 operation options

## Starting:

- AAC Adaptive Acceleration
- Control
- Current Ramp
- Constant Current
- Kickstart


## Stopping:

- Coast to stop
- TVR soft Stop
- AAC Adaptive deceleration Control
- Brake


Three Adaptive Acceleration Control (AAC) start profiles; early, constant and late acceleration


Constant current/ current ramp - here shown with kickstart

## Control Panel VLT ${ }^{\oplus}$ LCP 501



With the Control Panel VLT* LCP 501 being a full function interface, everything you can do on the VLT ${ }^{\text {e }}$ Soft Starter MCD 500 is possible via the LCP 501.

The screen view set-up is selected from 8 views. Options include 7 standard and 1 user programmable view.

## Language selection:

English, Chinese, German, Spanish, Portuguese, French, Italian, Russian.

The VLT ${ }^{\circ}$ LCP 501 is connected to the MCD 500 by using a 10 ft cable using 9 pin (D-sub) plug and 10 ft cable provided with the IP 65 (NEMA 12) door-mount kit.
Once connected, the soft starter asks whether you want to copy parameters from LCP to starter or starter to LCP (if different).

100\% easy connection

- The Modbus, Profibus and Device net modules use another port on the MCD 500 (at the side of the soft starter)
- Separate LCP 501 output at the bottom for 9 pin plug and 10 ft cable
- One ordering number (LCP with door-mount kit and cable)
- Plug \& play connection (also if soft starter is powered up)
- One cable for power and communication
- Powered up by soft starter
- Copy of parameter set-up


## VLT ${ }^{\oplus}$ Compact Soft Starter MCD 200

## Danfoss VLT ${ }^{\text {® }}$ Compact Soft Starter series MCD 200 includes two families of soft starters in the power range from 10-150 HP.

The series offers easy DIN rail mounting for sizes up to $40 \mathrm{HP}, 2$-wire or 3-wire start/stop control and excellent starting duty ( $4 \times \mathrm{l}$ e for 6 seconds).

Heavy starting ratings at $4 \mathrm{xI}_{\mathrm{e}}$ for 20 seconds.

Compatible with grounded delta power systems.

## The perfect match for:

- Pumps
- Fans
- Compressors
- Mixers
- Conveyors
- And many more


## Power range:

■ $10-150 \mathrm{HP}$

MCD 201


MCD 202
MCD 202 provides enhanced soft start functionality and various motor protection features


| Features | Benefits |
| :--- | :--- |
| Small footprint and compact size | - Saves panel space |
| Built-in bypass | - Minimizes installation cost and <br> eliminates power loss <br>  <br> Reduces heat build up. Savings in <br> components, cooling, wiring and labor |
| Advanced accessories | - Allows enhanced functionality |
| Advanced SCR control algorithms <br> balance output waveform | - Allowing more starts per hour, <br> accepting higher load |
| Reliable | Maximum up-time |
| Essential motor protection (MCD 202) | - Reduces overall project investment |
| Max. ambient temperature $50^{\circ} \mathrm{C}$ without derating | - No external cooling or oversizing necessary |
| User friendly | Save commissioning |
| Easy to install and use |  |
| Easy DIN rail mounting for sizes up to 40 HP | - Saves time and space |



## Remote operation

 Remote operation of MCD 201 and MCD 202 is facilitated by the dedicated remote operator kit.The operator (IP 54/NEMA 12) is mounted on the cabinet front and allows remote control, status indication and motor monitoring of an individual VLT* Soft Starter using RS485 serial communication.


Dimensions

| Power range (575 V) | $10-\mathbf{4 0} \mathrm{HP}$ | $\mathbf{5 0 - 7 5} \mathrm{HP}$ | $100-\mathbf{1 5 0} \mathrm{HP}$ |
| :--- | :---: | :---: | :---: |
| Height [inches] | 7.99 | 8.46 | 9.44 |
| Width [inches] | 3.85 | 5.70 | 7.9 |
| Depth [inches] | 6.49 | 7.59 | 8.42 |

## VLT ${ }^{\oplus}$ Soft Starter MCD 100

## Danfoss VLT* ${ }^{\text {S }}$ Soft Start Controller MCD 100 is a cost effective and extremely compact soft starter for AC motors up to 15 HP , due to a unique semiconductor design.

MCD 100 is a true "fit and forget" product. Selection can be made on the basis of the motor power - exactly as with traditional contactors.

MCD 100 products provide timed voltage ramp up and down. Ramp time can be individually adjusted with rotary switches from 0.4 to 10 seconds.

The start torque can be adjusted from 0 to $85 \%$ of the direct on-line torque.

All sizes are rated for line voltage up to 600 V AC.

The perfect match for:

- Pumps
- Fans
- Compressors
- Mixers
- Conveyors
- and many more


| Features | Benefits |
| :--- | :--- |
| Small footprint and compact size | - Saves panel space |
| Selection can be based on motor power | - Easy selection |
| Universal control voltage | - Simplifies selection |
| - Keeps stock at a minimum |  |
| "Fit and forget" contactor design | - Simplifies installation |
| Reliable | Reduces required panel space |
| Robust semiconductor design | - Reliable operation |
| Almost unlimited number of starts <br> per hour without derating | - Prevents unauthorized changes |
| Max. ambient temperature $50^{\circ} \mathrm{C}$ <br> without derating | - No external cooling or oversizing necessary |
| User-friendly | Save commissioning and operating cost |
| Easy to install and use | - Saves times |
| Digitally controlled rotary switches | - Secures precise settings and |
| Easy DIN rail mounting for sizes up to 40 HP | - Simplifies installation |



Dimensions

| Model | Power size (HP) | Rated current (Amps) | Dimensions (inches) $\mathrm{H} \times \mathrm{W} \times \mathrm{D}$ | Approvals |
| :---: | :---: | :---: | :---: | :---: |
| MCD 100 | 2 | $\begin{gathered} 3 \mathrm{~A} \\ \mathrm{AC}-53 \mathrm{~b}: 4-10: 110 \end{gathered}$ | $4.01 \times 0.88 \times 4.88$ | UL, CSA, CE |
|  | 10 | 15 A AC-53a: 8-3: 100-3000 AC-58a: 6-6: $100-3000$ | $4.33 \times 1.77 \times 5.03$ |  |
|  | 15 | $\begin{gathered} 25 \text { A } \\ \text { AC-53a: 8-3: } 100-3000 \\ \text { AC-58a: 6-6: } 100-3000 \end{gathered}$ | $4.33 \times 3.54 \times 5.03$ |  |

## Serial communication

MCD 201, MCD 202 and MCD 500 come with optional plug-in modules for serial communication.

|  | MCD 100 | MCD 201 | MCD 202 | MCD 500 |
| :---: | :---: | :---: | :---: | :---: |
| Start/stop, reset | - | - | . | - |
| LED for start, run, trip | $\square$ | $\square$ | - | ■ |
| Trip codes | - | - | ! | m |
| Current display |  |  | - | $\square$ |
| Motor temp. display |  |  | . | - |
| 4-20 mA output |  |  | - | $\square$ |
| Programming keypad, graphical display |  |  |  | - |

## Ordering type codes

VLT ${ }^{\text {© }}$ Compact Starter MCD 200


VLT ${ }^{\circ}$ Soft Starter MCD 500


## Size indications

Size indication for
VLT ${ }^{\text {® }}$ Compact Starter MCD 200

| Model | Power size (HP) | $\begin{aligned} & \text { Rated current } \\ & \text { AC- } \left.53 b^{*} \text { (Amps }\right) \end{aligned}$ | Dimensions (inches) HxW×D | Approvals |
| :---: | :---: | :---: | :---: | :---: |
| MCD 201/ MCD 202 | 10 | 18 A: 4-6:354 | $7.99 \times 3.85 \times 6.49$ | $\begin{aligned} & \text { UL } \\ & \mathrm{C}-\mathrm{UL} \\ & \mathrm{CE} \\ & \text { CCC } \\ & \text { C-tick } \\ & \text { Lloyds } \end{aligned}$ |
|  | 20 | 34 A: 4-6:354 |  |  |
|  | 25 | $42 \mathrm{~A}: 4-6: 354$ |  |  |
|  | 30 | $48 \mathrm{~A}: 4-6: 354$ |  |  |
|  | 40 | 60 A: 4-6:354 |  |  |
|  | 50 | $75 \mathrm{~A}: 4-6: 594$ | $8.46 \times 5.70 \times 7.59$ |  |
|  | 60 | 85 A: 4-6:594 |  |  |
|  | 75 | $100 \mathrm{~A}: 4-6: 594$ |  |  |
|  | 100 | $140 \mathrm{~A}: 4-6: 594$ | $9.44 \times 7.95 \times 8.42$ |  |
|  | 125 | 170 A: 4-6:594 |  |  |
|  | 150 | 200 A: 4-6:594 |  |  |

- Example: AC 53b: 42 A: 4-6: 354 starting current max. 4 times FLC (42 A)
in 6 seconds. 354 seconds minimum between starts.

Size indication for
VLT ${ }^{\text {© }}$ Soft Starter MCD 100

| Model | Power size <br> (HP) | Rated current <br> (Amps) | Dimensions <br> (inches) <br> $\mathrm{H} \times \mathrm{W} \times \mathrm{D}$ | Approvals |
| :---: | :---: | :---: | :---: | :---: |
| MCD 100 | 10 | $3 \mathrm{~A}: 5-5: 10$ <br> (AC 53b) | $4.01 \times 0.88 \times 4.88$ |  |

Size indication for VLT ${ }^{*}$ Soft Starter MCD 500

| $\begin{aligned} & \text { Motor size } \\ & \text { (HP) } \\ & \text { @ } 400 \mathrm{~V} \end{aligned}$ | $\begin{aligned} & \text { Frame size } \\ & \text { code } \end{aligned}$ | Starts per hour | Max. FLC | Rated FLC (104 F, 3,280 ft), outside delta motor connection |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Light 300\%, 30s, Internal bypass |  | Medium $\mathbf{4 0 0 \%}$, 20s, Internal bypass |  | Heavy 450\%, 30s, Internal bypass |  |
| 15 | $\begin{gathered} \text { G1 } \\ \text { (no fan) } \end{gathered}$ | 10 | 23 | 21 |  | 17 |  | 15 |  |
| 25 |  | 10 | 43 | 37 |  | 31 |  | 26 |  |
| 30 |  | 10 | 50 | 43 |  | 37 |  | 30 |  |
| 35 |  | 10 | 53 | 53 |  | 46 |  | 37 |  |
| 40 | G1 | 6 | 76 | 68 |  | 55 |  | 47 |  |
| 50 |  | 6 | 97 | 84 |  | 69 |  | 58 |  |
| 60 |  | 6 | 100 | 89 |  | 74 |  | 61 |  |
| 75 |  | 6 | 105 | 105 |  | 95 |  | 78 |  |
| 80 | G2 | 6 | 145 | 131 |  | 106 |  | 90 |  |
| 100 |  | 6 | 170 | 141 |  | 121 |  | 97 |  |
| 125 |  | 6 | 200 | 195 |  | 160 |  | 134 |  |
| 150 |  | 6 | 220 | 215 |  | 178 |  | 149 |  |
| Motor size (HP) <br> @ 400 V | Frame size code | Starts per hour | Max. FLC | Not bypassed | External bypass | Not bypassed | External bypass | Not bypassed | External bypass |
| 175 | G3x | 6 | 255 | 245 | 255 | 195 | 201 | 171 | 176 |
| 250 |  | 6 | 360 | 360 | 360 | 303 | 310 | 259 | 263 |
| 275 |  | 6 | 380 | 380 | 380 | 348 | 359 | 292 | 299 |
| 300 |  | 6 | 430 | 428 | 430 | 355 | 368 | 301 | 309 |
| 400 | G4x | 6 | 620 | 595 | 620 | 515 | 540 | 419 | 434 |
| 500 |  | 6 | 650 | 619 | 650 | 532 | 561 | 437 | 455 |
| 600 |  | 6 | 790 | 790 | 790 | 694 | 714 | 567 | 579 |
| 700 |  | 6 | 930 | 927 | 930 | 800 | 829 | 644 | 661 |
| 800 |  | 6 | 1200 | 1200 | 1200 | 1135 | 1200 | 983 | 1071 |
| 900 | G5x | 6 | 1410 | 1410 | 1410 | 1187 | 1319 | 1023 | 1114 |
| 1000 |  | 6 | 1600 | 1600 | 1600 | 1433 | 1600 | 1227 | 1353 |

[^1]
## Specifications

| Type | VLT Soft Starter MCD 500 | VLT ${ }^{\text {S }}$ Soft Starter MCD 100 |
| :---: | :---: | :---: |
|  | The total motor starter solution. Provides advanced control methods for starting and stopping and protection of motor and application | A true "fit and forget" soft starter for DIN rail mount, MCD 100 provides basic soft start and stop function |
| Concept |  |  |
|  | Enhanced soft start and soft stop Motor and system protection $10-1100 \mathrm{HP} @ 400 \mathrm{~V}(21-1600 \mathrm{~A})$ <br> $200-690 \mathrm{~V}$ mains voltage $110-220 \mathrm{~V}$ AC or <br> 24V AC/DC control supply <br> 3-phase SCR control | Soft start Soft stop <br> $1 / 3-15 \mathrm{HP} @ 400 \mathrm{~V}$ <br> 208-600 V mains voltage <br> 24-480 V AC/DC <br> control voltage <br> 2-phase SCR control |
| Start/stop |  |  |
|  | Adaptive Acceleration Control (AAC) <br> Current limit start <br> Current ramp start <br> Dual parameter function <br> Kick-start <br> Jog | Timed voltage ramp-up <br> Adjustable start torque <br> Selectable kick-start function |
|  | Adaptive Deceleration Control (AAC) TVR soft stop (Timed Voltage Ramp) Coast to stop DC brake function - three phase Soft brake function | Timed voltage ramp-down |
| Protection |  |  |
|  | Same as MCD 202 and: <br> Under current <br> Current imbalance <br> Starter overtemperature <br> Restart delay <br> Warning before trips <br> Adjustable phase imbalance sensitivity <br> - Programmable input trip <br> - Individual phase loss trips <br> - Individual shorted SCR trips <br> - Int. bypass relay overload <br> - Int. bypass relay fail <br> Fully adjustable protections <br> Network communication timeout <br> Heatsink overtemperature <br> Battery/clock failure <br> Supply frequency <br> External trip |  |
| Outputs |  |  |
|  | Three programmable output relays: Programmable analogue output Motor thermistor |  |
| Control |  |  |
|  | 8 language graphical display and keypad Quick menu and appplication menu Buttons for start, stop, reset and remote control Inputs for two- or three-wire control <br> Optional: <br> Modules for serial communication Control Panel VLT* LCP 501 PC software | Universal two-wire control Programmable via 3 rotary switches |
| Other features |  |  |
|  | Bypass up to 150 HP <br> Configurable bus bars from 360 A and up <br> Operation timers <br> jog-slow speed operation <br> Auto reset of fault situations <br> Emergency run <br> 99 event $\log$ <br> Trip $\log$ <br> User programmable metering and monitoring <br> Simulation before connecting line voltage | Extremely robust SCR design for unlimited number of starts per hour, LED indication, IP 20 |

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| Type | VLT Compact Starter MCD 201 | VLT Compact Starter MCD 202 |
| :---: | :---: | :---: |
|  | A physically compact starter providing basic soft start and stop functionality | Physically similar to MCD 201 but providing enhanced soft start functionality and various motor protection functions |
| Concept |  |  |
|  | Soft start <br> Soft stop <br> $10-150 \mathrm{HP} @ 400 \mathrm{~V}$ <br> $3 \times 200-480$ VAC (T6 model) <br> CV1 - 24 VAC / VDC <br> CV3 - $110-240$ VAC \& 380-440 VAC <br> 2-phase SCR control | Current limit start Soft stop <br> Motor protection $10-150 \mathrm{HP} @ 400 \mathrm{~V}$ <br> $3 \times 200-480$ VAC (T6 model) CV1 - 24 VAC /VDC <br> CV3 $-110-240$ VAC \& $380-440 \mathrm{VAC}$ <br> 2-phase SCR control |
| Start/stop |  |  |
|  | Timed voltage ramp-up Adjustable initial torque | Current limit start Initial current ramp-up |
|  | Timed voltage ramp-down | Timed voltage ramp-down |
| Protection |  |  |
|  |  | Motor overload (adjustable trip class) Excess start time Reverse phase rotation Motor thermistor input Shorted SCR - no start Supply fault - no start Instantaneous overload |
| Outputs |  |  |
|  | One output relay: Line contactor control | Two output relays: Line contactor control Run contactor or trip function |
| Control |  |  |
|  | Two- or three-wire control Programmable via 3 rotary switches Reset push button <br> Optional: <br> Modules for serial communication Remote operator kit PC software | Two- or three-wire control Programmable via 8 rotary switches Reset push button <br> Optional: <br> Modules for serial communication Remote operator kit PC software |
| Other features |  |  |
|  | Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication <br> IP 20 ( $10-75 \mathrm{HP} @ 400 \mathrm{~V}$ ) <br> $\mathbb{P} 00$ ( $100-150 \mathrm{HP} @ 400 \mathrm{~V}$ ) <br> Protection kit available | Integral SCR bypass for minimum physical size and heat dissipation during nominal operation LED status indication IP 20 ( $10-75 \mathrm{HP} @ 400 \mathrm{~V}$ ) IP 00 ( $100-150 \mathrm{HP} @ 400 \mathrm{~V}$ ) Protection kit available |

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# What $\mathrm{VLT}^{\circledR}$ is all about 

## Danfoss VLT Drives is the world leader among dedicated drives providers - and still gaining market share.

## Environmentally responsible

VLT ${ }^{\bullet}$ products are manufactured with respect for the safety and well-being of people and the environment.

All activities are planned and performed taking into account the individual employee, the work environment and the external environment. Production takes place with a minimum of noise, smoke or other pollution and environmentally safe disposal of the products is preprepared.

## UN Global Compact

Danfoss has signed the UN Global Compact on social and environmental responsibility and our companies act responsibly towards local societies.

## EU Directives

All factories are certified according to ISO 14001 standard. All products fulfil the EU Directives for General Product Safety and the Machinery directive. Danfoss VLT Drives is, in all product series, implementing the EU Directive concerning Hazardous Substances in Electrical and Electrical Equipment (RoHS) and is designing all new product series according to the EU Directive on Waste Electrical and Electronic Equipment (WEEE).

## Impact on energy savings

One year's energy savings from our annual production of VLT ${ }^{\circ}$ drives will save the energy equivalent to the energy production from a major power plant. Better process control at the same time improves product quality and reduces waste and wear on equipment.

## Dedicated to drives

Dedication has been a key word since 1968, when Danfoss introduced the world's first mass produced variable speed drive for AC motors - and named it VLT ${ }^{\circ}$.

## Twenty five hundred employees

 develop, manufacture, sell and service drives and soft starters in more than one hundred countries, focused only on drives and soft starters.
## Intelligent and innovative

Developers at Danfoss VLT Drives have fully adopted modular principles in development as well as design, production and configuration.

Tomorrow's features are developed in parallel using dedicated technology platforms. This allows the development of all elements to take place in parallel, at the same time reducing time to market and ensuring that customers always enjoy the benefits of the latest features.

## MAKING MODERN LIVING POSSIBLE



## Control Panel VLT ${ }^{\oplus}$ LP 501

The VLT ${ }^{*}$ LP 501 ensures seamless plug and play communication and control of VLT* Soft Starter MCD 500.


With the Control Panel VLT ${ }^{*}$ LOP 501 being a full function interface, everything you can do on the VLT* Soft Starter MCD 500 is possible via the LCP 501.

Full control and monitoring The screen view set-up is selected from 7 standard views and one user programmable.

## Language selection:

English, Chinese, German, Spanish, Portuguese, French, Italian, Russian.

The VLT* LCP 501 is connected to the MCD 500 by using a 3 m cable using 9 pin (D-sub) plug and 3 m cable provided with the IP 65 (NEMA 12) door-mount kit.

Once connected, the soft starter asks whether you want to copy parameters from LCP to starter or starter to LCP (if different).

## Control Panel VLT* LCP 501

- Same user interface as VLT* Soft Starter MCD 500
- Plug \& play with MCD 500
- Copy/ paste of parameters
- Multiple monitoring setup
- Door-mount kit - 3m cable
- IP 65 (NEMA 12)


| Feature | Benefit |
| :--- | :--- |
| Danfoss ${ }^{*}$ FC" menu structure and button <br> interface concept | - Proven logical access ensuring easy set-up |
| Parameter upload/ download | - Saves time, simplifies set-up |
| Same user interface as |  |
| VLf* Soft Starter MCD 500 | - Effective, simple and flexible |
| Adjustable multiple monitoring views | - You see what you want to see |
| Door mount IP 65 (NEMA 12) | - Reliable in harsh environment |
| Speaks your language | - Comfortable set-up |
| $\mathbf{3}$ metre cable | - Remote Operation |
| New output on MCD 500 | - Simple to connect |

## 100\% easy connection

- The Modbus, Profibus and Device net modules use another port on the MCD 500 (at the side of the soft starter)
- Separate LCP 501 output at the bottom for 9 pin plug and 3 m cable
- One ordering number (LCP with door-mount kit and cable)
- Plug \& play connection (also if soft starter is powered up)
- One cable for power and communication
- Powered up by soft starter
- Copy of parameter set- up


> Modified MCD S00, new interface G2-GS


VIT* Soft Starter MCD 500 range - fully featured soft starters for motors up to 850 kW including total motor starting solution; advanced start, stop ond protection features; Adaptive Accelerotion Controf; Inside Delta connection; 4 line graphical display; multiple programming ser-up menues.

Power range: $21-1600 \mathrm{~A}, 7.5-850 \mathrm{~kW}$ ( 1.2 MW inside delta connection) Versions for 200-690 VAC.

Phone: 800.894 .0412 - Fax: 888.723 .4773 - Web: www.ctiautomation.net - Email: info@ctiautomation.net Page 75 of 363
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INSTALLATION INSTRUCTIONS


## MODEL NUMBER

 DAR 275V
## 1. PREPARATION

4
DANGER: Electrical shock or burn hazard. Installation of this device should only be made by qualified personnel. Failure to lockout electrical power during installation or maintenance can result in fatal electrocution or severe burns. Before making any connections be sure that power has been removed from all associated wiring, electrical panels, and other electrical equipment.

## CAUTION NOTES:

1. The installation of this device should follow all applicable electrical codes, such as the National Electrical Code.
2. Check to make sure line voltage does not exceed DAR275V voltage ratings.
3. Follow all instructions to ensure correct and safe operation.
4. Do not attempt to open or tamper with the DAR in any way as this may compromise performance and will void warranty. No user serviceable parts are contained.

## 2. INTRODUCTION

Selected DSD, TDS \& TDF DINLINE Surge Protection Devices include status monitoring circuits which provide visual status display of device capacity. They may also provide a low voltage opto-coupler alarm output circuit that can be connect to the DAR to provide potential free (Form C) change-over contacts. The DAR alarm contacts may be used to provide output to external alarm systems or remote monitoring circuits.
One DAR can be used per DSD/TDS/TDF opto-coupler alarm or up to 16 DSD opto-coupler alarms can be connected in series to the one DAR to provide a common output. It is recommended that the DAR be powered from the same power circuit that feeds the device(s) being monitored, however the DAR can be powered from other circuits. This allows for example, one DAR unit to be connected to separate SPDs that are protecting a three phase circuit.

Note. Depending upon the usage of the DAR output contacts, failure of power to the DAR may be interpreted as a failure of one or more of the SPDs being monitored. Visual inspection of the DAR and SPDs status displays would determine this.

## 3. MOUNTING

The DAR is designed to clip to 35 mm (top hat) DIN rails (standard EN50022). Unless otherwise mechanically restrained, use horizontal DIN rails with the DAR module spring clips to the bottom and the label text the correct way up.
NOTE: The DAR must be installed in an enclosure or panel that:

- prevents the DAR temperature from exceeding $131^{\circ} \mathrm{F}\left(55^{\circ} \mathrm{C}\right)$
- provides adequate electrical and safety protection
- prevents the ingress of moisture and water
- allows DAR status indicators to be inspected


## 4. ELECTRICAL CONNECTION

The interconnecting wiring should:

- be of size \#10 to \#14 AWG ( $2.5 \mathrm{~mm}^{2}$ to $6 \mathrm{~mm}^{2}$ ) solid or stranded conductor.
- The wire insulation should be stripped back $5 / 16^{\prime \prime}(8 \mathrm{~mm})$.
- NOTE: Do not use greater than 9inlbs ( 1 Nm ) of torque when tightening the terminals.


## CONNECTION TO TELECOMMUNICATIONS NETWORKS

The DAR is approved for use in Australia where the alarm contacts may be connected to private lines or building cabling associated with the telecommunications network. NO direct connection to the public switched network should be made.

## INSTALLATION INSTRUCTIONS

## 5. INTERCONNECTION

When connecting the DAR to a single opto-coupler output the + terminal of the SPD should connect to the + terminal on the DAR. The - terminal should connect to the - terminal.


When connecting the DAR to multiple opto-couplers the optocouplers should be connected in series with + terminal of one connected to the - terminal of the next. The DAR + terminal should connect to + SPD terminal at one end of the series connection and the - DAR terminal connect to the - SPD terminal at the other end of the series connection.


## 5. STATUS INDICATION



## 6. FUSING AND ISOLATION

Overcurrent protection must be installed in the upstream circuit of the power supply to the DAR to provide protection to the unit itself and the wiring in case of fault conditions.

The fuse rating should be based on the wiring size used to connect to the DAR Ph \& N terminals. Australian regulations AS3000-1991, Table B2 specifies the following upstream protection for single phase circuits, unenclosed in air.

| Cable Size | HRC Fuse or | CB Rewirable Fuse |
| :--- | :---: | :---: |
| $1.5 \mathrm{~mm}^{2}$ | 16 A | 12 A |
| $2.5 \mathrm{~mm}^{2}$ | 20 A | 16 A |
| $4 \mathrm{~mm}^{2}$ | 25 A | 20 A |
| $6 \mathrm{~mm}^{2}$ | 32 A | 25 A |

Where overcurrent protection of the appropriate rating or smaller is already fitted in the upstream circuit, overcurrent protection at the DAR will not be required

## 6. MAINTENANCE \& TESTING

Before removing a DAR unit from service, ensure that the power has been removed. Maintenance, testing and replacement should only be undertaken by qualified personnel.

Testing of a DAR unit which is connected to a fully functional DSD unit can be accomplished by removing power to the DSD only. The DAR Status indication and output contacts should alter from the Normal to Fault condition.

Testing of the DAR unit alone may be accomplished by disconnecting the $+/$-connections to the unit. When power is applied the DAR "Fault" Status Indicator should be illuminated. By connecting the $+/-$ terminals together, the "Normal" Status Indicator should be illuminated. The output contacts should alter to the appropriate state.

## 7. USE OF OTHER INTERFACES

Only DAR units are recommended for the interfacing of equipment to the DSD, TDS \& TDF opto-coupler alarm output circuit(s). The direct connection of other equipment to these opto-coupler alarm outputs may not provide sufficient isolation or exceed the opto-coupler specifications. This may damage the SPD and/or the connected equipment. Warranty may be voided under such circumstances.
NOTE: In connecting to the SPD opto-coupler alarm output(s), do not reverse the +/- connections as damage may occur

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Think Automation and beyond...

## IIDEC

## LF1B series

 LED Illumination Units LUMMFR

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IDEC CORPORATION


## Features

- Brightness: 62.5 Lumens/Watt
- Low heat generation.
- Less energy usage, longer operation life, smaller mounting space, and no electrical noise.
$.71 \%$ reduction of power and $\mathrm{CO}_{2}$ emission when compared to 20 W fluorescent lamps (LF1B-C/D)
- Thin and slim style fits into compact spaces.
- Two cover colors: clear and white (diffused light)
- Cool white, warm white, yellow and red illumination colors available.
- UL Listed \& IP54 protection against dust and water splash (IEC 60529)


## Part No. Development

## LF1B- C 3 S -2 THWW4

LED Module Arrangement
A: 3 LEDs $\times 1$ row
B: 6 LEDs $\times 1$ row
C: 12 LEDs $\times 1$ row
D: 24 LEDs $\times 1$ row
 2: 24V DC
Degree of Protection S: IP54

LED Illumination Color
THWW4: Cool white
TLWW4: Warm white
SHY6: Yellow
SHR6: Red

Cover
3: Clear plastic
4: White plastic

## LED Optics Specifications

| Illumination Color |  | Cool White | Warm White | Yellow | Red |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Luminous Intensity (typ.) (Single LED module) |  | 5000 mcd | 4500 mod | 2300 mod | 1800 mod |
| Color Temperature (typ.)/Dominant Wavelength (typ.) |  | 5500 K | 2800 K | 590 nm | 625 nm |
| Reference lluminance (typ.) at 500 mm (clear cover) | 3 LEDs $\times 1$ row | 901 x | 601 x | 201 x | 20 lx |
|  | 6LED $\times 1$ row | 1701 x | 110 lx | 401 x | 401 x |
|  | 12 LEDs $\times 1$ row | 3301 x | 200 lx | 75 lx | 75 lx |
|  | 24. LED $\times 1$ row | 560 lx | 350 lx | 125 lx | 125 tx |

Note: Illumination colors and illuminance may vary. Specifications shonage tri8abp868ble are typical values and may vary depending upon actual environment.

LF1B Series Illumination Units

## Performance Specifications

| Rated Voltage |  | 24V DC (non-polarized) |
| :---: | :---: | :---: |
| Input Current (hy) (at the rated voltage) | LFIB-A | 30 mA |
|  | LF1B-B | 60ma |
|  | LFFIB-C | 120 mA |
|  | LFIB-D | 240 mA |
| Power Consumpton (typ.) (at the rated voltuga) | LFIB-A | 0.6 W |
|  | LFIB-B | 1.5W |
|  | LF1B-C | 2.9W |
|  | LF1B-D | 5.0W |
| Invuiaton Rosistance |  | 100ma minimum ( 500 V DC megger) |
| Diplectric Strength |  | 1000 V AC, 1 minute (between live and dead parts) |
| Vibration Resistance (darnage limith) |  | Frequency: 5 to 55 Hz Amplitude: 0.5 mm |
| Shock Resistance (damage limits) |  | $1000 \mathrm{~m} / \mathrm{s}^{2}$ |
| Operasing Temperature |  | -30 to +55 ${ }^{\circ} \mathrm{C}$ (no freazing) |
| Operasing Humidity |  | 45 to 85\% RH (no condensation) |
| Storape Temperature |  | -35 to $+70^{\circ} \mathrm{C}$ (no freezing) |
| Operating Atrnosphere |  | No corrosive gas |
| Life |  | 40000 hours (The total illumination duration in which the luminance maintains a minimum of $70 \%$ of the initial value) |
| Degree of Protection |  | IP54 |
| Material |  | End cover, conduit polyamide Cover: polycarbonate Wire: US20276T AW324 $\times 2 \mathrm{C}$ |
| Weight (approx) | LFIB-A | 959 |
|  | LF1B-B | 1259 |
|  | LFIB-C | 1650 |
|  | LFIB-D | 2559 |

- Do not use the LF1B illumination units in environments subject to corrosive gases, otherwise illuminance may deteriorate.


## Dimensions



| Type No. | A | B | C |
| :--- | :---: | :---: | :---: |
| LF1B-A | 134 | 64 | 123 |
| LF1B-B | 210 | 140 | 199 |
| LF1B-C | 330 | 260 | 319 |
| LF1B-D | 580 | 510 | 589 |



All dimensions in mm.

## Internal Circuit



## IIDEC

 C200s IDEC Corporation. All Riglas Reserved. PDF only. Updated 07/09


## Relay Selection Guide

Call (800) 262.IDEC

## RH Series - Compact Power Relays



- Small industrial 10A GP relay
- SPDT, DPDT, 3PDT, 4PDT contacts
- Options: indicator LED, check-button and surge suppression diode
- DIN rail, through panel, and PCB type sockets available
- SPDT and DPDT 500K cycle UL tested for maximum life expectancy


## 



|  |  |  |  | RH1 |  | RH2 |  | RH3 | RH4 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Contact Material |  |  | Silver cadmium oxide ( AgCd 0$)$ |  |  |  |  |  |
|  | Contact Rating |  |  | 10A |  |  |  |  |  |
|  | Minimum Load (reference values) |  |  | $30 \mathrm{mA@24VDC}, 100 \mathrm{mA@5VDC}$ |  |  |  |  |  |
|  | Dimensions ( $\mathrm{w} \times \mathrm{d} \times \mathrm{h}$ ) mm |  |  | $14 \times 27.5 \times 42$ |  | $21 \times 27.5 \times 42$ |  | $31 \times 27.5 \times 42$ | $41 \times 27.5 \times 42$ |
|  | Relays |  | Standard DIN | il Mount | Finger-safe DIN Rail Mount |  | Through Panel Mount |  | PCB Mount |
|  | RH1B |  | SH1B-05 | SHIB-05C |  |  | SH1B-51 |  | SH1B-62 |
|  | RH2B |  | SH2B-05 | SH2B-05C |  |  | SH2B-51 |  | SH2B-62 |
|  | RH3B |  | SH3B-05 | SH3B-05C |  |  | SH3B-51 |  | SH3B-62 |
|  | RH4B |  | SH4B-05 | SH4B-05C |  |  | SH4B-51 |  | SH4B-62 |
|  | Relays / Sockets |  |  | Description |  | For DIN Mount Socket |  | For Through Panel \& PCB Mount Socket |  |
|  |  | RH1B |  | Pullover Wire Spring |  | SY2S-02F1 |  | SY4S-51F1 |  |
|  |  | RH2B |  |  |  | SY4S-02F1 |  |  |  |
|  |  | RH3B |  |  |  | SH3B-05F1 |  |  |  |
|  |  | RH4B |  |  |  | SH4B-02F1 |  |  |  |
|  |  | RH1B | 2B, RH3B, RH4B | Leaf Spring (side latch) |  | SFA-202 |  | SFA-302 |  |
|  |  | RH1B | 2B, RH3B, RH4B | Leaf Spring (top latch) |  | SFA-101 |  | SFA-301 |  |
|  |  | all DIN mount sockets |  | Aluminum DIN Rail (1 meter length) |  | BNDN1000 |  | - |  |
|  |  |  |  | DIN Rail End Stop Page ${ }^{\text {Bry }} \mathbf{5}$ 2 of 363 |  |  |  | - |  |



With the DSN range, MARECHAL ELECTRIC provides the only plug and socket-outlet that remains watertight in every situation. Such watertightness is provided just by inserting the
plug and is maintained when you remove the plug from the socket-outlet and close the lid. There is no need to turn any sealing ring!

## Electrical features

- From 20 to 63 Amps - Voltage up to 1000 Volts AC and up to 250 Volts DC
- Integral switching device as del.
- Equipped w and lifetime
- Socket-outlet safely shutter provides $I \mathrm{P} 4 \times$ protection
- Unique keying system allows discrimina
(voltage, frequency, $A C$ and $D C$ cur.
- Number of cycles under normal open than those required by IEC/EN 60309-1 standard (depending on rated current an $(32 \mathrm{~A})$ and 4 auxiliary contacts $(63 \mathrm{~A})$
- Versions with 2 auxiliary contacts $(32$ A) and 4 auaiary


## Mechanical features

- IP66 and IP67 automatic watertightness as standard


Remove the plug from the socket-outet and close the lid: the same "click"
Indicates that IP66/67 has been achieved.

- Resistance to high pressure washing
- Casings made of glass fibre reinforced polyester providing excellent resistance:
- to most chemicals and environmental conditions (including UV and Gamma rays)
- to shocks $(\mathrm{OKoB})$ in a broad range of temperatures
- Ambient temperature: $-40^{\circ} \mathrm{C}$ to $+60^{\circ} \mathrm{C}$
(for temperatures outside this range, please contact us)
- Spring -assisted terminals unafiecied by vibra
- Self-opening lid; self-returning lid on request


## Regulatory features

DSN decontartors comply with:

- The IEC $60309-1$ international standard and EN $60309-1$ European standard
(plugs and socket-outlets for industrial purposes),
- The European Low Voltage Directive (decree $\mathrm{N}^{\circ} 95-1081$ dated
$3^{2}$ October 1995),
- The french decree $\mathbb{N}^{\circ} 88-1056$ dated $14^{\dagger}$ November 1988
relating to workers' protection,
- The decrees relating to workers' protection in Belgium, Spain and Italy,
- The load breaking capacity according to utilisation categories AC 22 and AC. 23 of IEC/ EN 60947-3 (switch standard). Also certified by VERITAS LCIE, UL, AS and CSA (French, American, Australian and Canadian inspection laboratories).
* STANDARDS
(1) underwriters



Marechal's modular system



Example : a woll mounting socket-outlet includes an active part, the socket-outlet (female) and an installation accessory,

(B)

the wall box. Each part has its own part number. Therefore, the order should have two part numbers.

## DSN part number system

- Standard DSN part numbers are made up of 7 characters. All part numbers start with a ' 6 '.
- The choice of an option or a version with auxiliary contacts results in adding a suffix (from 1 to 3 characters).

| $1{ }^{10}$ character | $2{ }^{2}$ character | $3^{46}$ character | $4^{*}$ character | Charac | ters from 5 to 7 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Range | Casing | Rated current | Usage |  | Supply voltage** | Frequency | Polarity |
| $6=$ DSN | 1 = Blue poly | 1=DSNi (20A) | $4=$ Socket-outlet | 08A $=$ | 20-24V | 50 Hz | 2 P |
|  | 4 $=$ Grey poly | $3=$ DSN3 $\left.^{\text {( } 32 \mathrm{~A}}\right)$ | 8 = Inlet | 035 = | 110-130V | 50 Hz | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ |
|  | 5 = Black poly | 6 = DSN6 (63A) |  | $033=$ | 190-230V | 50 Hz | $3 \mathrm{P}+\mathrm{E}$ |
|  |  |  |  | $015=$ | $220-250 \mathrm{~V}$ | 50 Hz | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ |
|  |  |  |  | $013=$ | 380-440V | 50 Hz | $3 \mathrm{P}+\mathrm{E}$ |
|  |  |  |  | 017 = | 380-440V | 50 Hz | $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ |
|  |  |  | $A=$ Installation accessory | $013=$ | Handle |  |  |
|  |  |  |  | $027=$ | Indined sleeve |  |  |
|  |  |  |  | $053=$ | Wall box |  |  |

*2 24 different power supplies (voltage, frequency) and 12 polarities are avallabler see international standard and colour-code on page 8

## Check that the DSN part number meets the need

Example : the need is for a $20 \mathrm{~A}, 400 \mathrm{~V}, 3^{P}+E$ blue poly wall mounting socket.

- The DSN with a 20A rated current is DSNa (see pages 22 and 23 ).
- Order a 20A socket-outlet (S) and a wall box (B).
- In the standard socket-outlet part number table, select the part number for a $400 \mathrm{~V}, 3^{\mathrm{P}+E}$ socket-outlet: 6114013
- In the standard wall box part number table, choose the accessory that suits you e.g. a $30^{\circ}$ blue poly wall box with a M20 threaded entry: 61 1A 053

You can check the two part numbers found:


Advantages
Core range
DSN1-20A
DSN3 32 A
DSN6.63A
Dimensions

## The DSN core range

The following table describes the most frequent configurations. Take a look:
If the required configuration is there, do not look further in the 'part number' pages.
Each configuration includes two part numbers: one for the active part (socket-outlet or inlet) and one other for the installation accessory (wall box, inclined sleeve or handle).

| Wall mounting <br> socket | Inclined <br> socket | Coupler socket | Plug | Wall mounting <br> appliance inlet | Inclined <br> appliance inlet |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Socket-outlet | Socket-outlet | Socket-outlet | Inlet | Inlet |  |
| B Wall box | Si Inclined sleeve | H Handle | H Handle | B Wall box | Si Inclined sleeve |

DSN1 20 A

| Voltage Polarity | Part Number |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $230 \mathrm{~V} \quad 1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | 6114015 | 6114015 | 6114015 | 6118015 | 6118015 | 6118015 |
| + installation accessory: | 61 1A 053 | 61 1A 027 | 61 1A 013 | 61 1A 013 | 611 1 053 | 61 1A 027 |
| 400 V 3P+E | 6114013 | 6114013 | 6114013 | 6118013 | 6118013 | 6118013 |
| + installation accessory: | 61 1A 053 | 61 1A 027 | 611 A 013 | 611 A 013 | 61 1A 053 | 61 1A 027 |
| 400V* $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | $6114017^{*}$ | 6114017 * | 6114017 * | 6118017 | 6118017 | 6118017 |
| + installation accessory: | 61 1A 053 | 61 1A 027 | 61 1A 013 | 611 A 013 | 611 1 053 | 61 1A 027 |
| Example described at bottom of previous page |  |  |  |  |  |  |

## DSN3 32A

| Voltage Polarity | Part Number |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $230 \mathrm{~V} \quad 1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | 6134015 | 6134015 | 6134015 | 6138015 | 6138015 | 6138015 |
| + installation accessory: | 613 A 053 | 613 A 027 | 613 A 013 | 613 A 013 | 613 053 | 61 3A 027 |
| $400 \mathrm{~V} \quad 3 \mathrm{P}+\mathrm{E}$ | 6134013 | 6134013 | 6134013 | 6138013 | 6138013 | 6138013 |
| + installation accessory: | 61 3A 053 | 613 A 027 | 613 A 013 | 613 A 013 | 6134053 | 613 A 027 |
| 400 V * $\quad 3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | 6134017 * | 6134017 * | 6134017 * | 6138017 | 6138017 | 6138017 |
| + installation accessory: | 613 A 053 | 613 A 027 | 613 A 013 | 61 3A 013 | 613 A 053 | 61 3A 027 |

## DSN6 63A

| Voltage Polarity | Part Number |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $230 \mathrm{~V} \quad 1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | 6164015 | 6164015 | 6164015 | 6168015 | 6168015 | 6168015 |
| + installation accessory: | 6164053 | 6164027 | 616 A 013 | 6164013 | 616 A 053 | 61 6A 027 |
| 400 V - 3P+E | 6164013 | 6164013 | 6164013 | 6168013 | 6168013 | 6168013 |
| + installation accessory: | 6164053 | 6164027 | 6164013 | 6164013 | 61 6A 053 | 61 6A 027 |
| 400 V * $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | 6164017 * | $6164017^{*}$ | 6164017 * | 6168017 | 6168017 | 6168017 |
| + installation accessory: | 616 A 053 | 6164027 | 616 A 013 | 6164013 | 616 053 | 61 6A 027 |

[^2]

| Main features: |  |  |  |
| :---: | :---: | :---: | :---: |
| - (socket-outlet) IP | 66/67 | - Wiring (min - max) flexible | $1 / 2.5 \mathrm{~mm}^{2}$ |
| - (socket-outlet + inlet) IP | 66/67 | -Wiring (min - max) stranded | $1.5 / 4 \mathrm{~mm}^{2}$ |
| - IK | 08 | - Other wiring on request |  |
| - Umax | $500 \mathrm{VAC}-250 \mathrm{~V}$ DC | max flexible / stranded | $10 / 16 \mathrm{~mm}^{2}$ |
| - Rated currents (IEC / EN 60309-1) |  | 20A/400V | 20A/500V |
| - Rated currents and operating voltages |  | 20A/400V | 20A/500V |
| (load breaking capacity according to IEC/ EN 60947-3) |  | (AC23) | (AC22) |

## (S) Socket-outlet (female)



## (I) Inlet (male)



| Voltage | Polarity | Material | Part \# |
| :--- | :--- | :--- | :--- |
| $\mathbf{2 0 - 2 4 V}$ | 2 P | Polyester | 611408 A |
| $\mathbf{1 1 0 - 1 3 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6114035 |
| $\mathbf{1 9 0 - 2 3 0 V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6114033 |
| $\mathbf{2 2 0 - 2 5 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6114015 |
| $\mathbf{3 8 0 - 4 4 0 V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6114013 |
| Dual voltage* | $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6114017 |


| Voltage | Polarity | Material | Part \# |
| :--- | :--- | :--- | :--- |
| $20-24 \mathrm{~V}$ | 2 P | Polyester | 611808 A |
| $\mathbf{1 1 0 - 1 3 0 \mathrm { V }}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6118035 |
| $\mathbf{1 9 0 - 2 3 0 \mathrm { V }}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6118033 |
| $220-250 \mathrm{~V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6118015 |
| $380-440 \mathrm{~V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6118013 |
| $\mathbf{3 8 0 - 4 4 0 \mathrm { V }}$ | $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6118017 |

*See front cover flap
Other voltages, polarities: see page 8

Version with self-closing lid (IP54):
Please consult us


| Inlet accessories |  |
| :--- | :--- |
| PP67 cap | 61 1A 126 |
| Ejecling mechanism (shark fin) | 61 1A 338 |
| Tension cord | 31 1A 336 |

## Installation accessories



The boxes are supplied without any cable gland.
The $70^{\circ}$ boxes are not dililed (dililed at extra cosp).

(A)

Industrial - Domestic adapters


Domestic socket-outtet 10/16A 230V

+ Wrucsaraindustrial inet $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$

| Type | Material | Part number |
| :--- | :--- | :--- |
| UK | Poly | 6118015 D40* |
| FR with satety shutter | Poly | 61 18 015 D16 |

*AII these domestic socket-outtets are available to forelgn standards : reptace D4O by D11 for France, D30 for Germany,



See description on page 137
Page 88 of 363


Padlocking shaft
(Padlock not supplied)


Stop button


IP67 Inlet cap


Sell-closing lid for inlet


Closing mechanlsm (finger draw plates sold per unit)


Tension cord



Socket-outlet (female)


| Voltage | Polarity | Material | Part \# |
| :--- | :--- | :--- | :--- |
| $\mathbf{2 0 - 2 4 V}$ | $2 P$ | Polyester | 613408 A |
| $110-130 \mathrm{~V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6134035 |
| $\mathbf{1 9 0 - 2 3 0 V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6134033 |
| $\mathbf{2 2 0 - 2 5 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6134015 |
| $380-440 \mathrm{~V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6134013 |
| Dual voltage* | $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6134017 |

*See front cover flap
Other voltages, polarities: see page 8

Socket-outlet (Umax 400 V ) with auxiliary contacts With 2 auxiliay contacts (30A) Socket \# +972
If you want to add an option to this kind of socket-outlet: call us at +33 (0) 145116000 .

Socket-outlet options

| Device for sell-ejecting coupler socket | Socket \# + 354 |
| :---: | :---: |
| Device for sell-ejecting plug | Socket \# + 352 |
| Sell-returning lid | Sockel \# + R |
| $180^{\circ}-$ opening lid | Socket \# + 10 |
| $180^{\circ}$-opening and sell-reluming lid | Socket \# + 18 |
| Padlocking shatt for 1 padlock 3 mm 0 | Socket \# + 840 |
| Padlocking shaft up to 3 padlocks 3 mm @ | Socket \# + 844 |
| Stop button | Socket \# + 453 |

If you want to equip a socket-outtet with two or more options: call us at $+33(0) 145116000$.

Socket-outlet accessories
Closing mechanism (finger draw plate)
$613 A 346$
Page 89 of 363

## Installation accessories




Industrial - Domestic adapters

Domestic socket-outlet 10/16A 230V + Mrechar industrial inlet $1 \mathrm{P}+\mathrm{N}+\mathrm{E}, 10 \mathrm{~A} 230 \mathrm{~V}$ fuse protection

| Type | Material | Part number |
| :--- | :--- | :--- |
| UK | Poly | 6138015 D40* |
| FR with safety shutter | Poly | 6138015 D16 |

> *All these domestic socket-outets are available to foreign standards : replace D4O by D11 for france, D30 for Germany, D06 for Ilay, DO8 for Switzerland, D67 for Australia, D8O for USA etc

Supply boxes with self-ejecting coupler socket for emergency vehicles
See description on page 137


These wall boxes are designed for:

- easy wiring, recommended for large conductor cross-sections (up to $5 \times 35 \mathrm{~mm}^{2}$ )
- entries and exits either at top, bottom or sides
- stock reduction, as the same wall box is common to several products
The sleeves are angled $\left(70^{\circ}\right)$ to reduce the socket-outlet protrusion and impact risk (fork lifts ...).

See full range of boxes on page 86

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- See Operating Instuction on page 168


Padlocking shaft
(Padlock not supplied)


Stop button

Accessories


IP67 Inlet cap


Self-closing lid for inlet


Tension cord
DECONTACTOR ${ }^{\text {TM }}$
Certificate no. FR 60037180-537184N



## Main features:

| - (socket-outiet) IP | 66/67 | - Umax |  | $1000 \mathrm{VAC}-250 \mathrm{~V}$ DC |
| :---: | :---: | :---: | :---: | :---: |
| -(socket-outlet + inlet) IP | 66/67 | - Wiring (min - max) flexible |  | $6 / 16 \mathrm{~mm}^{2}$ |
| - IK | 08 | -Wiring (min - max) stranded |  | $6 / 25 \mathrm{~mm}^{2}$ |
| - Rated currents (IEC/EN |  | $63 \mathrm{~A} / 400 \mathrm{~V}$ | 63A/690V | $45 \mathrm{~A} / 1000 \mathrm{~V}$ |
| - Rated currents and opera |  | $63 \mathrm{~A} / 400 \mathrm{~V}$ | 63A/690V |  |
| (load breaking capacity a | 947-3) | (AC23) | (AC22) | ) |

## (S) Socket-outlet (female)



| Voltage | Polarity | Material | Part \# |
| :--- | :--- | :--- | :--- |
| $\mathbf{2 0 - 2 4 V}$ | $2 P$ | Polyester | 616408 A |
| $\mathbf{1 1 0 - 1 3 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6164035 |
| $\mathbf{1 9 0 - 2 3 0 V}$ | $3 P+E$ | Polyester | 6164033 |
| $\mathbf{2 2 0 - 2 5 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6164015 |
| $380-\mathbf{4 4 0 V}$ | $3 P+\mathrm{E}$ | Polyester | 6164013 |
| Dual voltage* | $3 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6164017 |


| Voltage | Polarity | Material | Part \# |
| :--- | :--- | :--- | :--- |
| $\mathbf{2 0 - 2 4 V}$ | 2 P | Polyester | $6168 \mathbf{0 8 A}$ |
| $\mathbf{1 1 0 - 1 3 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6168035 |
| $\mathbf{1 9 0 - 2 3 0 V}$ | $3 P+E$ | Polyester | 6168033 |
| $\mathbf{2 2 0 - 2 5 0 V}$ | $1 \mathrm{P}+\mathrm{N}+\mathrm{E}$ | Polyester | 6168015 |
| $\mathbf{3 8 0 - 4 4 0 V}$ | $3 \mathrm{P}+\mathrm{E}$ | Polyester | 6168013 |
| $\mathbf{3 8 0 - 4 4 0 V}$ | $3 P+N+E$ | Polyester | 6168017 |

- See front cover flap
Other voltages, polarities: see page 8
Socket-outlet (Umax 400 V ) with auxiliary contacts

| With 2 a uxiliary contacts (16A) | Sockel \# +972 |
| :--- | :--- |
| With 4 aucilary contacts $(16 \mathrm{~A})$ | Socket \# +264 |

If you want to add an option to this kind of socket-outtet: call us at +33 (0) 145116000.

| Socket-outlet options |  |
| :---: | :---: |
| Device for sell-ejecling coupler socket | Socket I + 354 |
| Device for sell-ejecting plug | Socket \# + 352 |
| Sell-returning lid | Socket I + R |
| $180^{\circ}$-opening lid | Socket I + 10 |
| $180^{\circ}$-opening and sell-retuming lid | Socket \#+ 18 |
| Pedlocking shat for 1 padlock 3 mm 0 | Socket \# + 840 |
| Padlocking shat up to 3 padlocks 3 mm 0 | Socket \# + 844 |
| Stop button | Socket \# + 453 |


| Inlet accessories |  |
| :--- | :--- |
| P67 cap | 61 6A 126 |
| Sell-dosing lid | 31 3A 226 |
| Ejecting mechanism (shark fin) | 61 6A 338 |
| Tension cord | 31 1A 336 |

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## Also see:

Full range of boumar pyge io Dimuntionsis page 29 Technicof Manual page 160

Advantuges
Core ranige
DSN $\quad 20 \mathrm{~A}$
DSN3-32A
DSN6-63A
Dimensions

## Installation accessories



The boxes ane supplied without any cable gland. The $70^{\circ}$ boxes are not driled (otilled at extra cost).


Perfect cable fit and broad tightening range

A special anchoring system provides a perfect cable fit and a broad tightening range (multi-layer bush to choose best



DSN
Advantages
Core range
DSNT - 20 A
DSN3-32A
DSN6 - 63 A
Dimensions


DSNI $\begin{array}{lllllllll}\text { DSNMDSN24C } & 50 & 32 & 36 & 67 & 58 & 48 & 13 & 4.5\end{array}$ DSNBDDSN37C

| A | B8 | B4 | C | D | E | $H$ | Bd |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 50 | 24 | 27 | 57 | 37 | 42 | 14 | 4.5 |
| 50 | 32 | 38 | 57 | 58 | 48 | 13 | 4.5 |
| 54 | 39 | 44 | 78 | 68 | 55 | 15 | 5 |

 A B CA CAD CP D E1 E1D E2 H Od

|  | $A$ | B | CA | CAB | CP | D | E1 | E1D | E2 | H | Od |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DSN1 | 115 | 113 | 45 | 68 | 57 | 90 | 36 | 56 | 78 | 38 | 4.5 |
| DSHMDSN24C | 112 | 105 | 84 | 84 | 87 | 107 | 70 | 70 | 70 | 18 | 6 |
| DSHOSMBTC | 132 | 128 | 89 | 89 | 78 | 12 | 77 | 77 | 88 | 24 | 55 |

DSUGDSN37C


Coupler socket connected (Ai)/ disconnected (Ao) in a $30^{\circ}$ wall mounting appliance intet

B8: $180^{\circ}$ OPENMG LD

$70^{\circ}$ wall mounting appllance Intet


| A | B | CA | D | E1 | E2 | H2 | Bd |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 179 | 154 | 127 | 127 | 116 | 96 | 39 | 6.5 |
| 184 | 160 | 127 | 127 | 116 | 96 | 39 | 6.5 |
| 209 | 203 | 170 | 170 | 159 | 139 | 39 | 6.5 |

$\longrightarrow$ Coupler socket connected (As)/ disconnected (Ao) in a $70^{\circ}$ wall mounting appliance inlet


DSNI
DSN3MSN2AC
DSNEDSN37C
$\begin{array}{llllll}\text { A1 } & \text { AO } & 8 & B 1 & 80 & \text { Be }\end{array}$ $\begin{array}{llllll}195 & 201 & 188 & 235 & 250 & 141\end{array}$ $\begin{array}{llllll}228 & 234 & 228 & 253 & 280 & 164\end{array}$ $\begin{array}{lllllll}262 & 209 & 259 & 322 & 341 & 180\end{array}$
$30^{\circ}$ Inclined appliance intet

D1: driling 6


|  | A | 目 | CA | CAb | 0 | 01 | E1 | E1b | E2 | Qd |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DSNI | 96 | 102 | 45 | 68 | 90 | 75 | 36 | 56 | 78 | 4.5 |
| DSNMOSN24C | 93 | 114 | 75 | 78 | 107 | 65 | 63 | 83 | 95 | 5.5 |

DSNEMSN37C $\begin{array}{llllllllll}103 & 122 & 76 & 76 & 107 & 65 & 63 & 63 & 95 & 5.5\end{array}$


|  | A | B | CA | D | E1 | E2 | @d |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DSNI | 101 | 154 | 127 | 127 | 116 | 96 | 4.5 |
| DSNBMOSN24C | 106 | 160 | 127 | 127 | 116 | 96 | 4.5 |
| DSNG/DSN37C | 131 | 203 | 170 | 170 | 159 | 139 | 4.5 |

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DSNI
OSN3MDSN24C
DSNBDSNB7C


Coupler socket connected (A.1)/ disconnected (A 0 ) in a $30^{\circ}$ inclined appliance inlet

Be: 100 Openng lo

|  | A1 | A0 | B | B1 | B0 | B8 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
| DSN1 | 185 | 196 | 162 | 151 | 157 |  |
| DSN3DSN24C | 195 | 210 | 209 | 171 | 180 |  |
| DSNGOSN37C | 204 | 230 | 235 | 176 | 193 | 213 |



A1 AO B B1 B0 B8
$\begin{array}{llllll}117 & 123 & 188 & 235 & 250 & 141\end{array}$ $\begin{array}{lllllll}150 & 156 & 226 & 263 & 200 & 164\end{array}$ $\begin{array}{lllllll}184 & 191 & 259 & 322 & 341 & 185\end{array}$

## MTR Level Relay



The MTR level relay has proven itself to be simple and extremely reliable in pump stations everywhere. The MTR controls one pump or one alarm. The MTRA controls one pump and one alarm.

- Safe

The extra low sensing voltage ensures maintenance staff and operators are protected at all times.

- Four sensitivities

Allows the relay to operate effectively in a wide range of conductive liquids.

- Activation delays

Each output can have a different time delay to overcome wave action and turbulence.

- LED indication

High intensity LED indicators ensure clear signals.
Power On (green). Alarm On (red). Pump On (yellow).

- Dipswitch programmable

All settings are easily selectable from the front panel.

- Proven reliability

The proven design and performance of the relay ensures long-term reliability of the MultiTrode system.

- I.S application

Perfect for $1 . S$ application when used with an MTISB.

- Unique two-sensor operation (MTRA only) Pump and alarm can be controlled using two or three sensors. Two-sensor operation is ideal for budget applications or where space is limited.
- DIN rail or screw mounting
- Low installed cost


## Specifications



| Power Supply: |  |
| :---: | :---: |
| Supply Voltage AC | 24, 110, 240, 415VAC* - 50/60Hz |
| Power Consumption | 3.5 Watts max *(MTR only) |
| Supply Voltage DC | 12 or 24VDC, |
| Power Consumption | 3 Watts max |
| Environmental Range: |  |
| Centigrade | $-10^{\circ}$ to $+60^{\circ} \mathrm{C}$ |
| Fahrenheit | $+14^{\circ}$ to $+140^{\circ} \mathrm{F}$ |


| Avallable Models \& Ordering Information |  |  |
| :---: | :---: | :---: |
| 415VAC | MTR-1 | n/a |
| 240VAC | MTR-2 | MTRA-2 |
| 110VAC | MTR-3 | MTRA-3 |
| 24VAC | MTR-4 | MTRA-4 |
| 24VDC | MTR-5 | MTRA-5 |
| 12VDC | MTR-6 | MTRA-6 |

## Multitrode

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Boca Raton Florida 33487
Tel: +15619948090 Fax: +15619946282
sales@multitrode.net


Page 96 of 363 WATER • WASTEWATER • PUMP STATION • TECHNOLOGY

## The Probe... Dip it. Set it. Leave it.



Why is it easier to install than other level devices?

All you do is hang the Probe on its own cable into your wet well, using the bracket we supply. Installation is simple - any one of your technicians could do it in an hour or so. What's more, you install the Probe relatively low down in the wet well, so compared to ball floats it allows the well to be cleaned out more thoroughly. That means less debris build-up, odors and pump clogs.

## MTISB Intrinsically Safe Barrier

The MTISB is used between Multirode Probes and control equipment. It eliminates the risk of dangerous energy entering the potentially explosive environment where the Probe is located. 5 -chamel (MTISB5) and 10-channel (MTSB10) bariers avalable.


MultiTrode's Probe is the most reliable and cost-effective level sensor available in the water and wastewater industry today.

- 10+ year lifetime
- Cost effective and virtually maintenance free
- Very low and reliable pump cut-out
- Unaffected by build up (fat, grease, sludge and foam)
- Reduces maintenance cost
- Intrinsically safe when installed with MTISB barrier
- Eliminates false readings
- Simple to install and maintain
- Cuts the risk of spills
- UL, ULC, CTick, and CE Approved


## Why is it so Reliable?

There are no electronics and no moving parts - which results in a long lifetime. That's why it gets a 10-year warranty!


How would your Ultrasonic hold up to this application?

The MultiTrode Probe is unaffected by fat, foam, grease and sludge.


Ordering Information and Examples

| Model Code | Probe Length | Number al Sensars | Sensor Seperation |
| :---: | :---: | :---: | :---: |
| 0.2/1-xx | $8 \mathrm{in} / 0.2 \mathrm{~m}$ | 1 | N/A |
| 0.5/3- $\alpha$ | $16 \mathrm{n} / 0.5 \mathrm{~m}$ | 3 | $6 \mathrm{n} / 150 \mathrm{~mm}$ |
| 1.0/10- $\alpha$ | $40 \mathrm{n} / 1.0 \mathrm{~m}$ | 10 | $4 \mathrm{~h} / 100 \mathrm{~mm}$ |
| 1.5/10-x x | $60 \mathrm{in} / 1.5 \mathrm{~m}$ | 10 | $6 \mathrm{in} / 150 \mathrm{~mm}$ |
| 2.0/10-x | $80 \mathrm{in} / 2.0 \mathrm{~m}$ | 10 | $8 \mathrm{in} / 200 \mathrm{~mm}$ |
| 2.5/10-xx | $96 \mathrm{in} / 2.5 \mathrm{~m}$ | 10 | $10 \mathrm{n} / 250 \mathrm{~mm}$ |
| 3.0/10- $\alpha$ | $115 \mathrm{n} / 3.0 \mathrm{~m}$ | 10 | $12 \mathrm{in} / 300 \mathrm{~mm}$ |
| 6.0/10-xx | $224 \mathrm{in} / 6.0 \mathrm{~m}$ | 10 | $24 \mathrm{in} / 600 \mathrm{~mm}$ |
| 9.0/10-xx | $368 \mathrm{in} / 9.0 \mathrm{~m}$ | 10 | $35 \mathrm{in} / 900 \mathrm{~mm}$ |

[^3]

In the complicated world of water and wasterwater management, there is good reason why MultTrode stands unrivalled amongst its peers: We are committed to a singular vision of developing the latest technological advancements to provide sophisticated solutions to every day challenges in the water and wastewater industries.

Key to our success is the importance we place on customer satisfaction and solution-based products to save you time and money. From pump station management systems to engineering support, Multitrode encompasses it all. By investing heavily in R\&D, we remain on the cutting edge of technology and always ahead of our competitors.

Our products are proven. Our results are tangible. MultiTrode is unrivalled.

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Allsales(0)mulitiodacom

MUITIROOEB and MUISMAFTE are regitered radenaks of Multiode Pyy Lti in Austala, USA, and Europe Desigrs regestered for the MiSimst Pump Controler Pemote and Base Modies in Austala, USA Europe and Crina. Patens pending in Austrata, USA and Eurcue

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## Panelboards, loadcentres and accessories

| 12 | CD-2-12/18-3U |  |
| :---: | :---: | :---: |
| 18 | CD-2-18/18-3U |  |
| 24 | CD-2-24/18-3U |  |
| 30 | CD-2-30/18-3U |  |
| 36 | CD-2-36/18-3U |  |
| 42 | CD-2-42/18-3U |  |
| 48 | CD-2-48/18-3U |  |
| 54 | CD-2-54/18-3U | : |
| 60 | CD-2-60/18-3U | , |
| 72 | CD-2-72/18-3U |  |
| 78 | CD-2-78/18-3U |  |
| 84 | CD-2-84/18-3U |  |
| 96 | CD-2-96/18-3U |  |
| Accessories |  |  |
| Description |  | Cat. No. |
| Split tariff kit 250/355 A (supplied loose) |  | STKCD |
| Split tariff kit (fitted) |  | REFER NHP |
| Plastic tee-off cap 250 / 355 A |  | CD250T0PC |


| Technical data - CD/CT busbar chassis <br> Description |  |  |
| :--- | :--- | :--- |
| Busbar rating | $(\mathrm{Amp})$ | 250 |
| Voltage rating | $(\mathrm{V})$ | 415 |
| Short circuit rating | $(\mathrm{kA})$ | 20 |
| Short circuit time | $(\mathrm{sec})$ | 0.2 |
| Insulation material |  | Polyolefin |
|  |  | PPA-441 |

Catalogue number structure - CD/CT busbar chassis


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## Panelboards, loadcentres and accessories

## Dimensions (mm)

CD chassis 250 to suit Din-T6, 10 and 15


## Miniature circuit breakers

## Din-Safe single pole width residual current circuit breaker (RCBO)

- Standards AS/NZS 61009
- Approval N17482
- One modute wide ( 18 mm )
- Short circuit, overcurrent and earth leakage protection
- Short circuit protection 10 kA
- Sensitivity 10 and 30 mA
- Din rail mount
- Suits CD chassis
- Type " $A$ " residual current device ( $A C / D C$ )


| Amp rating <br> (A) | Modules $(18 \mathrm{~mm})$ | Voltage $(\mathrm{AC})$ | Short circuit <br> (kA) | Trip Sensitivity $(\mathrm{mA})$ | (at. No ${ }^{1}$ ) ${ }^{2}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: |
| 6 | 1 | 240 | 10 | 30 | DSRCBH0630A |
| 10 | 1 | 240 | 10 | 30 | DSRCBH1030A |
| 16 | 1 | 240 | 10 | 30 | DSRCBH1630A |
| 20 | 1 | 240 | 10 | 30 | DSRCBH2030A |
| 25 | 1 | 240 | 10 | 30 | DSRCBH2530A |
| 32 | 1 | 240 | 10 | 30 | DSRCBH3230A |
| 40 | 1 | 240 | 10 | 30 | DSRCBH4030A |
| 6 | 1 | 240 | 10 | 10 | 1 DSRCBH0610A |
| 10 | 1 | 240 | 10 | 10 | DSRCBH1010A |
| 16 | 1 | 240 | 10 | 10 | DSRCBH1610A |
| 20 | 1 | 240 | 10 | 10 | DSRCBH2010A |
| 25 | 1 | 240 | 10 | 10 | 1] DSRCBH2510A |
| 32 | 1 | 240 | 10 | 10 | [i] DSRCBH3210A |
| 40 | 1 | 240 | 10 | 10 | 1] DSRCBH4010A |

Note: ${ }^{\text {i }}$ ) Neutral not switched.
${ }^{2}$ Will not accept side mounting accessories.

## 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 protection 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 ( $I \Delta n$ ) 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)

Note: A 1.2 m long pigtail lead is included as standard.


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## 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



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

## Din-T MCBs + RCDs Technical data

## Tripping curves according to EN 60898

The following tables show the average tripping curves of the Terasaki Din-T MCBs based on the thermal and magnetic characteristics.

## Curve C



# Din-T MCBs + RCDs Technical data 

## What is an RCD?

The RCD (Residual Current Device) is a device intended to protect people against indirect contact, the exposed conductive parts of the installation being connected to an appropriate earth electrode. It may be used to provide protection against fire hazards due to a persistent earth fault current, without operation of the overcurrent protective device.
RCDs having a rated residual operating current not exceeding 30 mA are also used as a means for additional protection in case of failure of the protective means against electric shock (direct contact).

## Working Principle

The main components of an RCD are the following:

- The core transformer: which detects the earth fault current.
- The relay: when an earth fault current is detected, the relay reacts by tripping and opening the contacts.
- The mechanism: element to open and close the contacts either manually or automatically.
- The contacts: to open or close the main circuit.

The RCD constantly monitors the vectorial sum of the current passing through all the conductors. In normal conditions the vectorial sum is zero ( $11+12-0$ ) but in case of an earth fault, the vectorial sum differs from zero (I1+I2-Id), this causes the actuation of the relay and therefore the release of the main contacts.


## Definitions related to RCDs

RCCB $=$ Residual Current Circuit Breaker without overcurrent protection.
RCBO $=$ Residual Current Círcuit Breaker
with overcurrent protection.

## Breaking capacity

A value of $A C$ component of a prospective current that an $R C C B$ is capable of breaking at a stated voltage under prescribed conditions of use and behaviour.

## Residual making and breaking capacity ( $\mathrm{I} \Delta \mathrm{m}$ )

$A$ value of the $A C$ component of a residual prospective current A value of the AC component of a residual prospective current (Only applicable to RCB0)
which an RCCB can make, carry for its opening time and breaPage 104 of 363 under specified conditions of use and behaviour.

## Conditional residual short-circuit current (I $\Delta \mathrm{C}$ )

$A$ value of the $A C$ component of a prospective current which an RCCB protected by a suitable SCPD (short-circuit protective device) in series, can withstand, under specific conditions of use and behaviour.

## Conditional short-circuit current (Inc)

$A$ value of the $A C$ component of a residual prospective current which an RCCB protected by a suitable SCPD in series, can withstand, under specific conditions of use and behaviour.

## Residual short-circuit withstand current

Maximum value of the residual current for which the operation of the RCCB is ensured under specified conditions, and above which the device can undergo irreversible alterations.

## Prospective current

The current that would flow in the circuit, if each main current path of the RCCB and the overcurrent protective device (if any) were replaced by a conductor of negligible impedance.

## Making capacity

A value of AC component of a prospective current that an RCCB is capable to make at a stated voltage under prescribed conditions of use and behaviour.

## Open position

The position in which the predetermined clearance between open contacts in the main circuit of the RCCB is secured.

## Closed position

The position in which the predetermined continuity of the main circuit of the RCCB is secured.

## Tripping time

The time which elapses between the instant when the residual operating current is suddenly attained and the instant of arc extinction in all poles.

## Residual current ( $\mathrm{I} \Delta \mathrm{n}$ )

Vector sum of the instantaneous values of the current flowing in the main circuit of the RCCB.

## Residual operating current

Value of residual current which causes the RCCB to operate under specified conditions.

## Rated short-circuit capacity (Icn)

Is the value of the ultimate short-circuit breaking capacity assigned to the circuit breaker. (Only applicable to RCBO)

## Conventional non-tripping current (Int)

A specified value of current which the circuit breaker is capable of carrying for a specified time without tripping. (Only applicable to RCBO)

## Conventional tripping current (It)

A specified value of current which causes the circuit breaker to trip within a specified time.

# Din-T MCBs + RCDs Technical data <br> RCDs classification according to EN 61008/61009 

RCDs may be classified according to: The behaviour in the presence of DC current
(types for general use).

- Type AC
- Type A

The time-delay (in the presence of residual current)

- RCDs without time delay: type for general use
- RCDs with time delay: type $S$ for selectivity

Type AC $\left.\sim{ }^{1}\right)^{2}$ )
The type AC RCDs are designed to release with sinusoidal residual currents which occur suddenly or slowly rise in magnitude.


| Residual current | Tripping time |
| :---: | :---: |
| $0.5 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=\infty$ |
| $1 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<300 \mathrm{~ms}$ |
| $2 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<150 \mathrm{~ms}$ |
| $5 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=\leq 40 \mathrm{~ms}$ |



Tripping curve type $A C$
${ }^{1}$ ) Standard in Australia
${ }^{2}$ ) Type A acceptable in Australia

## $\begin{array}{llll}\text { Type } A & \cong & 3 \\ \text { ) }\end{array}{ }^{4}$ )

Certain devices during faults can be the source of nonsinusoidal earth leakage currents (DC components) due to the electronic components e.g. diodes, thyristors etc.
Type A RCDs are designed to ensure that under these conditions the residual current devices operate on sinusoidal residual current and also with pulsating direct current(*) which occur suddenly or slowly rise in magnitude.
(*) Pulsating direct current: current of pulsating wave form which assumes, in each period of the rated power frequency, the value 0 or a value not exceeding $0.006 \mathrm{~A} D C$ during one single interval of time, expressed in angular measure of at least $150^{\circ}$.

Residual current Tripping time

1. For sinusoidal residual current

| $0.5 \times I \Delta n$ | $t=\infty$ |
| ---: | :--- |
| $1 \times I \Delta n$ | $t=<300 \mathrm{~ms}$ |
| $2 \times I \Delta n$ | $t=<150 \mathrm{~ms}$ |
| $5 \times I \Delta n$ | $t=\leq 40 \mathrm{~ms}$ |

2. For residual pulsating direct current

|  | At point of wave $0^{\circ}$ |  |
| :---: | :---: | :---: |
|  | $0.35 \times \mathrm{I} \Delta \mathrm{n}$ | $t=\infty$ |
|  | $1.4 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<300 \mathrm{~ms}$ |
|  | $2.8 \times I \Delta n$ | $\mathrm{t}=<150 \mathrm{~ms}$ |
|  | $7 \times I \Delta n$ | $\mathrm{t}=\leq 40 \mathrm{~ms}$ |
|  | At point of wave $90^{\circ}$ |  |
|  | $0.25 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=\infty$ |
|  | $1.4 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<300 \mathrm{~ms}$ |
|  | $2.8 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<150 \mathrm{~ms}$ |
|  | $7 \times I \Delta n$ | $\mathrm{t}=\leq 40 \mathrm{~ms}$ |
| At point of wave $135^{\circ}$ |  |  |
| $\xrightarrow[\sim]{\Omega}$ | $0.11 \times \mathrm{I} \Delta \mathrm{n}$ | $t=\infty$ |
|  | $1.4 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=<300 \mathrm{~ms}$ |
|  | $2.8 \times I \Delta n$ | $\mathrm{t}=<150 \mathrm{~ms}$ |
|  | $7 \times \mathrm{I} \Delta \mathrm{n}$ | $\mathrm{t}=\leq 40 \mathrm{~ms}$ |

Tripping curve type A Page 105 of 363

[^4]${ }^{4}$ ) DSRCBH is type A.

## Din-T MCBs + RCDs Technical data

## Nuisance tripping

All DinSafe RCDs have a high level of immunity to transient currents, against current impulses of $8 / 20 \mu$ s according to EN $61008 / 61009$ and VDE 0664.T1.


RCDs have a high level of immunity against alternating currents of high frequency according to EN 61008/61009.


Din-T MCBs + RCDs Technical data
Use of an RCBO (DSRCBH)


## TEST-BUTTON

To ensure the correct functioning of the RCBO, the test-button T shall be pressed frequently. The device must trip when the test-button is pressed.


## CONTACT POSITION INDICATOR

Printing on the toggle to provide information of the real contact position.


O-OFF
Contacts in open position. Ensure a distance between contacts $>4 \mathrm{~mm}$.


I-ON
Contacts in closed position. Ensure continuity in the main circuit.

## CABLE CONNECTION

The power supply (L) must be done at the bottom terminal, and the supply neutral flying cable (black) shall be connected to the neutral bar.
Load connection shall be done in both terminals at the top side (L out / N out).
The earth reference cable (FE white) ensures protection against earth leakage in case of loss of supply neutral.


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TOGGLE
To manually switch the RCBO ON or OFF

## Din-T MCBs + RCDs Technical data

## Product related information

Influence of temperature on RCBOs (DinSafe DSRCB)
The thermal calibration of the RCBO was carried out at an ambient temperature of $30^{\circ} \mathrm{C}$. Ambient temperatures different from $30^{\circ} \mathrm{C}$ influence the bimetal and this results in earlier or later thermal tripping.

0.5-6 A



## Din-T MCBs + RCDs Technical data

## Tripping current as a function of the frequency

All RCDs are designed to work at frequencies of $50-60 \mathrm{~Hz}$, therefore to work at different values, we must consider the variation of the tripping sensitivity according to the tables below. It should be taken into consideration that there is a no tripping risk when pushing the test-button, due to the fact that such action is made by means of an internal resistor with a fixed value.
RCBO DSRCBH ${ }^{3}$ )

| Type AC ${ }^{1}$ ) | 10 Hz | 30 Hz | 50 Hz | 100 Hz | 200 Hz | 300 Hz | 400 Hz |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 30 mA | 0.62 | 0.65 | 0.80 | 0.91 | 1.24 | 1.55 | 1.88 |
| 100 mA | 0.74 | 0.71 | 0.80 | 0.95 | 1.16 | 1.38 | 1.59 |
| 300 mA | 0.80 | 0.74 | 0.80 | 0.97 | 1.19 | 1.44 | 1.64 |
| 500 mA | 1.10 | 0.81 | 0.80 | 0.89 | 1.18 | 1.38 | 1.68 |
| Type A $^{2}$ ) |  |  |  |  |  |  |  |
| 30 mA | 8.17 | 3.13 | 0.75 | 1.70 | 3.10 | 3.52 | 3.67 |
| 100 mA | 6.81 | 2.71 | 0.75 | 1.43 | 2.35 | 2.58 | 2.71 |
| 300 mA | 6.20 | 2.16 | 0.75 | 0.49 | 0.87 | 0.74 | 0.95 |
| 500 mA | 4.34 | 1.53 | 0.75 | 0.39 | 0.59 | 0.62 | 0.64 |

Notes: ${ }^{1}$ ) The standard NHP/Terasaki type is the "type $A C$ " in Australia, Type " $A$ " in New Zealand.
${ }^{2}$ ) The standard NHP/Terasaki DSRCBH single pole RCBO is "type $A^{\prime \prime}$ in Australia and New Zealand.
${ }^{3}$ ) The numbers in the table above are multipliers, e.g. A "DSRCD" at 50 hz has an 0.8 multiplier. Therefore a 30 mA , "type $A C^{\prime \prime}$ RCD will trip at $(0.8 \times 30 \mathrm{~mA}) 24 \mathrm{~mA}$.

## Power losses

The power losses are calculated by means of measuring the voltage drop between the incoming and the outgoing terminal of the device at rated current. Power loss per pole:
RCB0-Single pole DSRCBH

| In (A) | 6 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Z (mOhm) | 45.8 | 16.4 | 12.5 | 10.6 | 7.3 | 5.4 | 3.2 | 2.6 | 1.9 | 1.4 |
| Pw (W) | 1.65 | 1.7 | 2.1 | 2.7 | 2.9 | 3.3 | 3.4 | 4.2 | 4.8 | 5.6 |

## Din-T MCBs + RCDs Technical data RCBO (DSRCB) let-through energy I't

The benefit of an RCBO in short-circuit conditions, is its ability to reduce the value of the let-through energy that the short-circuit would be generating.

Din-T single pole width RCD (DSRCBH)
Curve C

Let-through energy at 230 V


RCCB - Din-Safe safety switch (DSRCD)
RCBO - Din-Safe (DSRCBH)


Dimensions in mm

## Din-T MCBs + RCDs Technical data



## Miniature circuit breakers

## Din-T6 series 6 kA MCB <br> E Standards AS/NZS 4898 <br> - Approval No. N17481 <br> - Current range 2-63 Amps 1, 2 and 3 pole <br> - Sealable and lockable handle <br> - Available in curve type C and D <br> - Mounts on CD chassis ( 250 A and 355 A )

1 pole 1 module

| $\ln ($ A $)$ | C - Curve 5-10 In |
| :--- | :--- |
| 2 | DTCB6102C |
| 4 | DTCB6104C |
| 6 | DTCB6106C |
| 10 | DTCB6110C |
| 13 | DTCB6113C |
| 16 | DTCB6116C |
| 20 | DTCB6120C |
| 25 | DTCB6125C |
| 32 | DTCB6132C |
| 40 | DTCB6140C |
| 50 | DTCB6150C |
| 63 | DTCB6163C |

2 pole 2 modules

| 2 | DTCB6202C |
| :--- | :--- |
| 4 | DTCB6204C |
| 6 | DTC86206C |
| 10 | DTCB6210C |
| 13 | DDTCB6213C |
| 16 | DTCB6216C |
| 20 | DTCB6220C |
| 25 | DTCB6225C |
| 32 | DTCB6232C |
| 40 | DTCB6240C |
| 50 | DTCB6250C |
| 63 | DTCB6263C |

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 |



Short circuit capacity 6 kA

| In (A) | $2-63$ |  |
| :--- | :--- | :--- |
| $1 P$ | 240 V AC |  |
| $2 P$ | $240-415 \mathrm{~V} \mathrm{AC}$ |  |
| 3 P | $240-415 \mathrm{~V} \mathrm{AC}$ |  |
| DC use | 1 P | $\left.2 \mathrm{P}^{\mathrm{I}}\right)$ |
| Short circuit | 20 kA | 25 kA |
| Max.voltage $(\mathrm{DC})$ | 48 V | 110 V |

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 (In X, Y, 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 $\mathrm{X}, \mathrm{Y}, \mathrm{Z}$ 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 $\mathrm{AC} 50 / 60 \mathrm{~Hz}$.

Notes: ${ }^{3}$ ) 2 pole MCB connected in series. The tine side is the "OFF" (bottom) side of the MCB, and connects to CD chassis tee-offs. i] Available on indent only.

## Din-T MCBs Technical data

## Characteristics according to BS EN 60898

Miniature Circuit Breakers are intended for the protection of wiring installations against both overloads and short-circuits in domestic or commercial wiring installations where operation is possible by uninstructed people

## Tripping characteristic curves



## Magnetic release

An electromagnet with plunger ensures instantaneous tripping in the event of short-circuit. The NHP Din-T range has 3 different types, following the current for instantaneous release: types B, C and $D$ curve.

| Icn <br> (A) | Test current | Tripping time | Applications |
| :---: | :---: | :---: | :---: |
| B | $\begin{aligned} & 3 \times \text { In } \\ & 5 \times \text { In } \end{aligned}$ | $\begin{gathered} 0.1<\mathrm{t}<45 \mathrm{~s}(\mathrm{In} \leq 32 \mathrm{~A}) \\ 0.1<\mathrm{t}<90 \mathrm{~s}(\mathrm{In}>32 \mathrm{~A}) \\ \mathrm{t}<0.1 \mathrm{~s} \end{gathered}$ | Only for resistive loads eg: <br> - electrical heating <br> - water heater <br> - stoves. |
| C | $\begin{aligned} & 5 \times \mathrm{In} \\ & 10 \times \mathrm{In} \end{aligned}$ | $\begin{gathered} 0.1<\mathrm{t}<15 \mathrm{~s}(\mathrm{In} \leq 32 \mathrm{~A}) \\ 0.1<\mathrm{t}<30 \mathrm{~s}(\mathrm{In}>32 \mathrm{~A}) \\ \mathrm{t}<0.1 \mathrm{~s} \end{gathered}$ | Usual loads such as: <br> - lighting <br> - socket outlets <br> - small motors |
| D | $\begin{aligned} & 10 \times \text { In } \\ & 20 \times \mathrm{In} \end{aligned}$ | $\begin{gathered} 0.1<t<4 \mathrm{~s}\left({ }^{* \star}\right)(\mathrm{In} \leq 32 \mathrm{~A}) \\ 0.1<\mathrm{t}<8 \mathrm{~s}(\mathrm{In}>32 \mathrm{~A}) \\ \mathrm{t}<0.1 \mathrm{~s} \end{gathered}$ | Control and protection of circuits having important transient inrush currents (large motors) |

## Thermal release

The release is initiated by a bimetal strip in the event of overload. The standard defines the range of releases for specific overload values. Reference ambient temperature is $30^{\circ} \mathrm{C}$.

| Test <br> current | Tripping <br> time |
| :---: | :---: |
| $1.13 \times \operatorname{In}$ | $\mathrm{t} \geq 1 \mathrm{~h}(\operatorname{In} \leq 63 \mathrm{~A})$ |
|  | $\mathrm{t} \geq 2 \mathrm{~h}(\mathrm{In}>63 \mathrm{~A})$ |
| $1.45 \times \operatorname{In}$ | $\mathrm{t}<1 \mathrm{~h}(\operatorname{In} \leq 63 \mathrm{~A})$ |
|  | $\mathrm{t}<2 \mathrm{~h}(\mathrm{In}>63 \mathrm{~A})$ |
| $2.55 \times \operatorname{In}$ | $1 \mathrm{~s}<\mathrm{t}<60 \mathrm{~s}(\operatorname{In} \leq 32 \mathrm{~A})$ |
|  | $1 \mathrm{~s}<\mathrm{t}<120 \mathrm{~s}(\operatorname{In}>32 \mathrm{~A})$ |

Rated short-circuit breaking capacity (Icn)
Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: $0-\mathrm{t}-\mathrm{CO}$.
After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 900 V . Moreover, the MCB shall be capable of tripping when loaded with 2.8 In within the time corresponding to 2.55 In but greater than 0.1 s .
Service short-circuit breaking capacity (Ics)
Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: 0-t-CO-t-CO.
After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 1500 V . Moreover, the MCB shall not trip at a current of 0.96 In . The MCB shall trip within 1 h when current is 1.6 In .

0 - Represents an opening operation
C - Represents a closing operation followed by an automatic opening.
t - Represents the time interval between two successive short-circuit operations: 3 minutes.

The relation between the rated short-circuit capacity (Icn) and the rated service short-circuit breaking capacity (Ics) shall be as follows:

| Inn (A) | Ics (A) |
| :---: | :---: |
| $\leq 6000$ | 6000 |
| $>6000$ | 0.75 Icn min. 6000 |
| $\leq 10000$ | 0.75 Icn min. 7500 |
| $>10000$ |  |

In both sequences all MCBs are tested for emission of ionized gases during short-circuit (grid distance), in a safety distance between two MCBs of 35 mm when devices are installed in two different rows in the enclosure. This performance allows the use of any NHP/Terasaki enclosure.


## Din-T MCBs Technical data

## Tripping curves according to EN 60898

The following tables show the average tripping curves of the Terasaki Din-T MCBs based on the thermal and magnetic characteristics.

## Curve C



## Din-T MCBs Technical data

## Influence of ambient air temperature on the rated current

The maximum value of the current which can flow through an MCB depends on the nominal current of the MCB, the conductor cross-section and the ambient air temperature.

The values shown in the table below are for devices in free air. For devices installed with other modular devices in the same switchboard, a correction factor (K) shall be applied relative to the mounting situation of the MCB, the ambient temperature and the number of main circuits in the installation.

| No of devices | K $^{1}$ ) |
| :---: | :--- |
| 2 or 3 | 0.9 |
| 4 or 5 | 0.8 |
| 6 or 9 | 0.7 |
| $>10$ | 0.6 |

## Calculation example

Within a distribution board consisting of eight 2 Pole, $16 \mathrm{~A},{ }^{\prime} \mathrm{C}$ ' curve type MCBs, with an operating ambient temperature of $45^{\circ} \mathrm{C}$, which is the highest temperature the MCB can operate at without unwanted tripping?

## Calculation

The correction factor $\mathrm{K}=0.7$, for use in an eight circuit installation: $16 \mathrm{~A} \times 0.7=11.2 \mathrm{~A}$
As the MCB is working at $45^{\circ} \mathrm{C}$ it shall be given another factor ( $90 \%=0.9$ ):
In at $45^{\circ} \mathrm{C}=$ In at $30^{\circ} \mathrm{C} \times 0.9=11.2 \mathrm{~A} \times 0.9=10.1 \mathrm{~A}$.

Note: ${ }^{1}$ ) Applicable for MCBs working at maximum rated currents.

The thermal calibration of the MCBs was carried out at an ambient temperature of $30^{\circ} \mathrm{C}$. Ambient temperatures different from $30^{\circ} \mathrm{C}$ influence the bimetal and this results in earlier or later thermal tripping.


10 A


16-40 A


## 50-63 A



Page 115 of $363: 1 \mathrm{P}$ (single pole)

## Din-T MCBs Technical data

## Effects of frequency on the tripping characteristic

All the MCBs are designed to work at frequencies of $50-60 \mathrm{~Hz}$. therefore to work at different values, consideration must be given to the variation of the tripping characteristics. The thermal tripping does not change with variation of the frequency but the magnetic tripping values can be up to $50 \%$ higher than the ones at $50-60 \mathrm{~Hz}$.

## Tripping current variation

| 60 Hz | 100 Hz | 200 Hz | 300 Hz | 400 Hz |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 1.1 | 1.2 | 1.4 | 1.5 |

## Power losses

The power losses are calculated by measuring the voltage drop between the incoming and the outgoing terminals of the device at rated current.

## Power loss per pole

| In <br> (A) | Voltage drop (V) | Energy loss <br> (W) | Resistance (m0hm) |
| :---: | :---: | :---: | :---: |
| 0.5 | 2.230 | 1.115 | 4458.00 |
| 1 | 1.270 | 1.272 | 1272.00 |
| 2 | 0.620 | 1.240 | 310.00 |
| 3 | 0.520 | 1.557 | 173.00 |
| 4 | 0.370 | 1.488 | 93.00 |
| 6 | 0.260 | 1.570 | 43.60 |
| 8 | 0.160 | 1.242 | 19.40 |
| 10 | 0.160 | 1.560 | 15.60 |
| 13 | 0.155 | 2.011 | 11.90 |
| 16 | 0.162 | 2.586 | 10.10 |
| 20 | 0.138 | 2.760 | 6.90 |
| 25 | 0.128 | 3.188 | 5.10 |
| 32 | 0.096 | 3.072 | 3.00 |
| 40 | 0.100 | 4.000 | 2.50 |
| 50 | 0.090 | 4.500 | 1.80 |
| 63 | 0.082 | 5.160 | 1.30 |
| 80 | 0.075 | 6.000 | 0.90 |
| 100 | 0.075 | 7.500 | 0.75 |
| 125 | 0.076 | 9.500 | 0.60 |

## Limitation curves

## Let-through energy I't

The limitation capacity of an MCB in short-circuit conditions, is its capacity to reduce the value of the let-through energy that the short-circuit would be generating.
Peak current Ip
Is the value of the maximum peak of the short-circuit current limited by the MCB.


See following pages

Din-T MCBs Technical data
Din-T 6
6 kA
C curve
$\mathbf{I}^{2} \mathrm{t}$ Let-through energy at $\mathbf{2 4 0 / 4 1 5} \mathrm{V}$


Id Limited peak current at $230 / 400 \mathrm{~V}$


## Din-T MCBs Technical data

## Use of standard MCB for DC use

For MCBs designed to be used in alternating current but used in installations in direct current, the following should be taken into consideration:

- For protection against overloads it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is similar to alternating current.

E For protection against short-circuits it is necessary to connect the two poles to the MCB. In these conditions the tripping characteristic of the MCB in direct current is $40 \%$ higher than the one in alternating current.

Use in DC selection table

|  | Rated <br> current (A) | 48 V 1 pole <br> Series | Icu (kA) | 110 V 2 poles in series | 250 V 1 pole |
| :--- | :--- | :---: | :---: | :---: | :---: | | 440 V 2 poles in series |
| :---: |
| Icu (kA) |

## Din-T MCBs Technical data

## Text for specifiers

## MCB Series Din-T 6

- According to EN 60898 standard
- For DIN rail mounting according to DIN EN 50022; EN 50022; future $\mathbb{E N} 60715$; IEC 60715 (top hat rail 35 mm )
- Grid distance 35 mm
- Working ambient temperature from $-25^{\circ} \mathrm{C}$ up to $+50^{\circ} \mathrm{C}$
- Approved by CEBEC, VDE, KEMA, IMQ.
- 1 pole is a module of 18 mm wide
- Nominal rated currents are: 0.5/1/2/3/4/6/10/13/16/20/25/32/40/50/63 A
- Tripping characteristics: $B, C, D$ ( $B$ curve Din-T 10 only).
- Number of poles: $1 \mathrm{P}, 1 \mathrm{P}+\mathrm{N}, 2 \mathrm{P}, 3 \mathrm{P}, 3 \mathrm{P}+\mathrm{N}, 4 \mathrm{P}$
- The short-circuit breaking capacity is: $6 / 10 \mathrm{k} A$, energy limiting class 3
- Terminal capacity from 1 up to $35 \mathrm{~mm}^{2}$ rigid wire or 1.5 up to $25 \mathrm{~mm}^{2}$ flexible wire.
- Screw head suitable for flat or Pozidrive screwdriver
- Can be connected by means of both pin or fork busbars
- The toggle can be sealed in the ON or OFF position
- Rapid closing
- Both incoming and outgoing terminals have a protection degree of IP 20 and they are sealable
- Isolator function thanks to Red/Green printing on the toggle.
- Maximum voltage between two phases; $440 \mathrm{~V} \sim$
- Maximum voltage for utilisation in DC current: 48 V 1 P and 110 V 2 P
- Two position rail clip
- Mechanical shock resistance 40 g (direction $\mathrm{x}, \mathrm{y}, \mathrm{z}$ ) minimum 18 shocks 5 ms half-sinusoidal acc. to IEC 60068-2-27
- Vibration resistance: 3 g (direction $\mathrm{x}, \mathrm{y}, \mathrm{z}$ ) minimum 30 min . according to IEC 60068-2-6
Extensions can be added on both left or right hand side
- Auxiliary contact
- Shunt trip
- Undervoltage release
- Motor operator
- Panelboard switch
- Add-on RCD can be coupled.


## Din-T MCBs Technical data



Notes Refer pages 3-23, 24 for information on SAFE-T MCBs.
Page 120 of $\left.363^{*}\right) 0.5-4 \mathrm{~A} / 6-25 \mathrm{~A} / 32-40 \mathrm{~A} / 50-63 \mathrm{~A}$ ${ }^{1}{ }^{1}$ ) Prefered values of rated control supply voltage (IEC $60947-2$ ): $24 \mathrm{~V}, 48 \mathrm{~V}, 110 \mathrm{~V}, 125 \mathrm{~V}, 250 \mathrm{~V}$ ) 10 ( 125 V DC)
${ }^{\text {f }} 10$ ( 250 VDC )
${ }^{\text {y }}$ ) On request.

Din-T MCBs Technical data
Miniature circuit breakers - Din-T 6

Dimensions in mm.


## Solid-state Timer

## DIN-sized ( $48 \times 48$, $45 \times 75 \mathrm{~mm}$ ) Timer with <br> Digital Setting and LCD Display

- Dual power supplies for free AC/DC.
- Eight operation modes selectable with one unit.
- Any desired time can be set digitally within a range from 0.1 seconds to $9,990 \mathrm{hrs}$.
- Four external signal inputs.
- ON/OFF indicator for control output and bar indicator for remaining time.
- Conforms to UL, CSA, and CE marking.



## Ordering Information

| Operation/resetting system | Operation mode | Terminal | Time-limit contact | Instantaneous contact | Mounting |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Surface mounting/ track mounting | Flush mounting |
| Time-limit operation/selfresetting/external resetting (see note 2) | 8 operation modes (selectable) (see note 3) | 11-pin round socket | SPDT | --- | H3CA-A | H3CA-A |
|  |  | Front screw |  |  | H3CA-FA | --- |
| Time-limit operation/ self-resetting | ON-delay operation | 8-pin round socket | DPDT | --- | H3CA-8 | H3CA-8 |
|  |  |  | SPDT | SPDT | H3CA-8H | H3CA-8H |

Note: 1. Specify both the model number and supply voltage when ordering for the H3CA-8H and H3CA-8.
2. The operation/resetting system depends on the selected operation mode. For details, see "Timing Chart".
3. The 8 operation modes are as follows:
A: ON-delay operation
E: Interval operation

B: Repeat cycle operation
F: One-shot and flicker operation
C: Signal ON/OFF-delay operation (1)
G: Signal ON/OFF-delay operation (2)
D: Signal OFF-delay operation (1)
H: Signal OFF-delay operation (2)

## Accessories (Order Separately)

| Timer | Track mounted socket |
| :--- | :--- | :--- | :--- |
| (See note.) |  |

Note: Track mounted socket can be used as a front connecting socket.

## Specifications

## Time Ranges

A desired time can be set within a range of 0.1 s to $9,990 \mathrm{hrs}$ by combining the three thumbwheel switch modules for time setting and one module for time unit selection.


## Ratings

| Item | H3CA-A/H3CA-FA | H3CA-8 | H3CA-8H |
| :---: | :---: | :---: | :---: |
| Rated supply voltage (See note 2.) | 24 to $240 \mathrm{VAC}(50 / 60 \mathrm{~Hz})$, <br> 12 to 240 VDC (permissible ripple: 20\% max.) | $100 / 110 / 120,200 / 220 / 240 \mathrm{VAC},(50 / 60 \mathrm{~Hz})$, <br> 24 VDC, 110 VDC (permissible ripple: $20 \%$ max.) (See note 1.) |  |
| Operating voltage range | 90\% to $110 \%$ of rated supply voltage | 85\% to $110 \%$ of rated supply voltage |  |
| Power consumption | AC: approx. 4 VA DC: approx. 2 W | AC: approx. $10 \mathrm{VA} / 1 \mathrm{~W}$ DC: approx. 1 W | AC: approx. $10 \mathrm{VA} / 1.5 \mathrm{~W}$ DC: approx. 2 W |
| Control outputs | 3 A at 250 VAC, resistive load (cos $\phi$ Minimum applicable load | = 1) A-8, H3CA-A and H3CA-FA: A-8H: | 10 mA at 5 VDC (failure level: Preference value) 100 mA at 5 VDC (failure level: Preference value) |

Note:1. Single-phase, full-wave rectified power sources may be used for 24 to 240 VDC.
2. Refer to Safety Precautions for All Times when combining the Timer with an AC 2-wire proximity sensor.

- Characteristics



## Engineering Data

## Life-test Curve



Reference: A maximum current of 0.15 A can be switched at $125 \mathrm{VDC}(\cos \phi=1)$. Maximum current of 0.1 A can be switched if L/R is 7 ms . In both cases, a life of 100,000 operations can be expected.
Note: 1. The H3CA Series has been tested for the following: impulse voltages, noise (via noise simulator, for Lloads, and for relay oscillation), and resistance to static electricity.
2. Minimum applicable load ( P reference values):

H3CA-A(FA), H3CA-8H: 100 mA at 5 VDC
H3CA-8: 10 mA at 5 VDC

## Nomenclature

## H3CA-A/H3CA-8H



Operation Mode Selector (Fixed to "A" in H3CA-8H)
A: ON-delay operation
A: ON-delay operal
C: Signal ON/OFF-delay operation (1)
Signal OFF-delay operation (1) Interval operation
One-shot and ficker operation
Signal ON/OFF-delay operation (2)
Signal OFF-delay operation (2)

H3CA-FA


## Jperation

## $\square$ Timing Chart

## H3CA-A (FA)

ON-delay Operation (A Mode)


Note: The minimum signal input time is 0.05 s .
Flicker Operation (B Mode)
Signal Start


Note: The minimum signal input time is $0: 05 \ddot{\mathrm{~s}}$

## Power-ON Start/Power-OFF Reset



## Power-ON Start/Power-OFF:Reset



Signal ON/OFF-delay Operation 1 (C Mode)


Signal OFF-delay Operation 1 (D Mode)


Note: 1: The minimum signal input time is 0.05 s .
2. Operation 1 refers to the version in which the output relay operates when the Start signal is ON.

Interval Operation ( E Mode)

Note: The minimum signal input time is 0.05 s .

## One-shot and Flicker Operation (F Mode)

Signal Start


Note: The minimum signal input time is 0.05 s .
Signal ON/OFF-delay Operation 2 (G Mode)



Note: The minimum signal input time is 0.05 s .
Signal ON/OFF-delay Operation 2 (H Mode)


Note: 1. The minimum signal input time is 0.05 s .
2. Operation 2 refers to the version in which the output relay does not operate when the Start signal is ON.

## tow to Use Gate Signal Input



Note: 1: This timing chart indicates the gate input in operation mode A (ON-delay operation).
2. The set time is the sum of $t_{1}$ and $t_{2}$.

## How to Use Check Signal Input

If a check signal is input to the timer during the lapse of a set time, the remaining set time will become 0 and the timer will enter the next control state. Also, while a check signal is being input, the elapsed time measurement of the set time is not performed. ON-delay Operation


Repeat Cycle Operation


## H3CA-8H



## Dimensions

Note: All units are in millimeters unless otherwise indicated.

- Timers

H3CA-Al-8H


Panel Cutouts
When mounting a single unit $\mathrm{t}=1$ to 3.2 mm


Horizontally connecting $n$ units No front cover:
$N=(48 n-2.5)+1 /-0$
With front cover:
$N=\{48 n-2.5+(n-1) \times 3\}^{+1 /}-0$


H3CA-FA


Mounting Holes
 between two adjacent timers should be 10 mm min .

## Accessories (Order Separately)

## Track Mounted Front Connecting Socket

P2CF-11


## Back Connecting Socket

P3GA-11


## Terminal Arrangement (Bottom View)



P3G-08
Terminal Arrangement (Bottom View)


Mounting Height of Timer with Socket



H3CA

## Mounting Track (Meets DIN EN50022)



Note: This dimension applied to-PFP-50N.

## End Plate

PFP-M


PFP-100N2


Note: A total of $12-25 \times 4.5$ elliptic holes are provided with 6 holes cut from each rail end at a pitch of 10 mm between holes.

PFP-S


## Adapter for Flush Mounting

Y92F-30


Note: Pay attention to the orientation of the adapter when mounting two or more timers in a vertical or horizontal line.

## Protective Cover

## Y92A-48B/Y92A-48D

The protective cover protects the front panel, particularly the time setting section, against dust, dir and water drip, as well as prevents the set value from being altered due to accidental contact with the time setting knob.


Note: The Y92A-48B Protective Cover is made of a hard plastic and therefore, must be removed to change the timer set value. However, since the Y92A-48D Protective Cover is made of PVC, the set value can be altered by pressing on the surface of the cover. It may be, however, difficult to make setting changes of the Timer with the Y92A-48B Protective Cover attached, which must be taken into consideration before using the Y92A-48B Protective Cover. When attaching the Y92A-48A to the Timer to be panel-mounted, use the Y92F-30 Mounting Adapter along with the Timer. The Protective Cover cannot be; however, used for the H3CA-FA Series.

Terminal Arrangement


Note:

1. *C: Check: 3-4
*G: Gate: 3-5
*S: Start: 3-6
*R: Reset: 3-7
2. Conventional time-limit contacts are symbolized as ${ }_{9}^{\circ} \mathrm{t}$ However, the contacts of H3CA-A are symbolized as $/ \mathrm{f}$ because timer has 8 operation modes.

H3CA-FA


Note: 1. *C: Check: X-E1
*G: Gate: X-D1
*S: Start: X-C1
*R: Reset: X-B1
2. Conventional time-limit contacts are symbolized as: 5 However, the contacts of H3CA-FA are symbolized as " $\delta$ because timer has 8 operation modes.

## Input Connections

## Signal Inputs

Connect the start input contact between terminals (3) and (6) the reset input contact between terminals (3) and (7), the gate input contact between terminals (3) and (5), and the check input contact between terminals (3) and (4).


For each signal input contact, use a gold-plated contacts with high reliability: Be sure that these input signals satisfy the following requirements: a resistance of $1 \mathrm{k} \Omega$ (max.) and a residual voltage of 1 $V$ (max.) when the contact is made.

## Solid-state Signal Inputs

Connect the start input transistor between terminals (3) and (6), the reset input transistor between terminals (3) and (7), the gate input transistor between terminals (3) and (5), and the check input transistor between terminals (3) and (4).


For signal input, use an open collector type transistor with characteristics: $\mathrm{V}_{\mathrm{CEO}}=20 \mathrm{~V}$ min., $\mathrm{V}_{\mathrm{CE}(\mathrm{S})}=.1 \mathrm{~V}$ max., $\mathrm{IC}=50 \mathrm{~mA}$ min. and $\mathrm{I}_{\text {CBO }}=0.5 \mu \mathrm{~A}$ max. In addition, be sure that the input signals satisfy the following requirements: a resistance of $1 \mathrm{k} \Omega$ (max.) and a residual voltage of 1 V (max.) when the transistor is ON , and a resistance of $200 \mathrm{k} \Omega$ (min.) when the transistor is OFF.

From a solid-state circuit (proximity sensor, photoelectric sensor, or the like) with rated power supply voltage ranging from 6 to 30 VDC, input signals can also be applied by other than an open collector type transistor as shown in the following diagram. The input signal from a solid-state circuit is applied when output transistor Tr turns ON. In terms of signal voltage, the signal is input when it goes from a high to low level. Again, the residual voltage should be 1 V (max.) when the transistor is ON. As the current output from the timer to Tr is approximately 0.1 mA , this connection is possible provided the residual voltage is kept to a maximum of 1 V .


Note: Except for the power supply circuitry, avoid the laying of input signal wires in parallel or in the same conduit with high-tension or power lines. It is recommended to use shielded wires or wiring with independent metal conduits for the shortest possible distance.

H3CA-8H


H3CA-8.


## EApplication Examples

Standard type H3CA is used for the following application examples. In the schematic diagrams, each thick the indicates the wiring necessary for selecting the desired operation mode.

## ON-delay Operation (A Mode)

## Power-ON Start/Power-OFF Reset



Flicker Operation (B Mode)
Power-ON Start/Power-OFF Reset


Signal ON/OFF-delay Operation 1 (C Mode)
Signal ON/OFF-start/Instantaneous Operation/ Time-limit Reset


Signal StarUSignal Reset


Signal.OFF-delay Operation 1 (D Mode)
Signal Start/Instantaneous Operation/Time-limit Reset


Signal ON/OFF-delay Operation 2 (G Mode)

Signal ON/OFF-start/Instantaneous Operation/ Time-limit Reset

Signal Start/Signal Reset


Signal Start/Signal Reset


Signal OFF-delay Operation 2 (H Mode)
Signal/nstantaneous Operation/Time-limit Reset


## Safety Precautions

## How to Change Operation Mode

Operate the pushbuttons of the thumbwheel switch, located at the leftmost position on the front panel to set the operation mode. Eight operation modes (A, B, C, D, E, F, G, and H) are selectable and the selected operation mode is displayed in the operation mode display window.


Note: The operation mode is fixed to " $A$ " for H3CA-8H. The characters are yellow.

## How to Change Time Unit and Rated Time

Operate the pushbuttons of the rightmost thumbwheel switch to select the desired time unit. Seven time units $(0.1 \mathrm{~s}, \mathrm{~s}, 0.1 \mathrm{~m}, \mathrm{~m}$, $0.1 \mathrm{~h}, \mathrm{~h}$, or 10 h ) are selectable and the selected time unit is displayed in the time unit display window. The desired rated time is specified by operating the three thumbwheel switches in the middle of the front panel. The range of rated time is 001 to 999 for each unit.


Note: The characters are yellow.
Time Unit and Rated Time

| Time unit | Rated time |
| :--- | :--- |
| 0.1 s | 0.1 to 99.9 s |
| s | 1 to 999 s |
| 0.1 m | 0.1 to 99.9 m |
| m | 1 to 999 m |
| 0.1 h | 0.1 to 99.9 h |
| h | 1 to 999 h |
| 10 h | 10 to $9,990 \mathrm{~h}$ |

## - CAUTION

1. Do not change the time unit, rated time, or operation mode while the timer is in operation. Otherwise, the timer may malfunction or be damaged. Be sure to turn off the power supply to the timer before changing the timer unit, rated time or operation mode.
?. Note that output will be generated in C, D, E, G, or H mode even if the rated time is set to 000 . No output will be generated in $A, B$, or F mode.

## Connecting the Operating Power Supply

The H3CA-8 $\square$ contains a capacitor-drop power circuit. Use a sinusoidal power supply with a commercial frequency. Do not use power supplies with a high frequency component (such as inverter power supplies) for Timers with 100 to 240-VAC specifications. Using these power supplies can damage internal circuits.
The power supply connections to the H3CA-A and H3CA-FA can be made without regard to polarity for both AC and DC power supplies; just connect to the specified terminals (2 and 10, or A1 and A2). When connecting a DC power supply to the H3CA-8 or H3CA-8H, however, the polarity must be connected as indicated.
Although there is a wide range of power connectable to the H3CA-A and H3CA-FA, be sure that there is no inductive voltage or residual voltage applied to the timer power supply terminals (2 and 10, or A1 and A2) when the power switch is turned OFF. (Inductive voltage can be generated in the power supply line if it is placed in parallel with high-voltage or power lines.)
A DC power supply can be connected if its ripple factor is $20 \%$ or less and the mean voltage is within the rated operating voltage range of the Timer.

Connect the power supply voltage through a relay or switch in such a way that the voltage reaches a fixed value at once or the Timer may not be reset or a timer error could result.
H3CA-8 and H3CA-8H Timers with AC specifications are equivalent to capacitor loads. When switching the Timer power supply with an SSR, use an SSR with a withstand voltage of twice the power supply voltage.
Since the H3CA-8 and H3CA-8H Timers of AC specifications externally discharges a part of internal energy when the power is turned OFF, it may malfunction if an extremely sensitive relay is used with the following sequence circuit.
If such a malfunction occurs, change the circuit configuration as shown below on the right side.


## Input/Output

The operation of the output contacts varies with the operation specifications. Before making connections, check the operation specifications and operating conditions using the application examples provided.
The H3CA-A and H3CA-FA do not use transformers. Simultaneous inputting power from iwo or more power supplies to separate timers or counters from a single input contact or transistor is not possible.

For the power supply of an input device, use an isolating transformer, of which the primary and secondary windings are mutually isolated and the secondary winding is not grounded.


A transformer is not used in the power supplies for the H3CA-A and H3CA-FA. You can therefore receive: an electrical shock by touching the input terminals when the power supply voltage is being applied. Take adequate precautions to protect against electrical shock.
Inputs to input signal terminals are made by shorting the individual input terminals to the common terminal (terminal 3 for the H3CA-A or terminal (X) for the H3CA-FA). Internal circuits may be damaged if connections are made to any other terminals or if voltages are applied.
If contacts are used to short the terminals, they will be switching a low voltage (approximately 5 VDC) and current (approximately $100 \mu \mathrm{~A})$. You must therefore use high-reliability contacts with a contact resistance of $1 \mathrm{k} \Omega$ or less when shorted and residual voltage of 1 V maximum when shorted.
The reset input will take priority if both the set and reset inputs are turned ON simultaneously.

## Others

Holding relays are used for outputs on the H3CA-A Series. Dropping the Unit or otherwise subjecting it to shock can cause the relay to reverse or to move to the center position.

How to Mount the Timer on Mounting Track

When mounting a H3CA-FA Timer on a socket mounting track, observe the following procedures:

## Mounting

First hook portion $A$ of the timer to an edge of the track and then depress the timer in direction $B$.


## Dismounting

Pull out portion C with a round-blade screwdriver and remove the timer from the mounting track.

## Special-purpose Basic Switch

## DZ

## DPDT Basic Switch for Two Independent Circuit Control

- Ideal for switching the circuits operating on two different voltages, and for controlling two independent circuits.
- Interchangeable with OMRON Z Basic Switches, as both switches are identical in mounting hole dimensions, mounting pitch and pin plunger position.

Be sure to read Safety Precautions on page 4 and Safery Precautions for All Basic Switches.


For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Model Number Structure

Model Number Legend

DZ-10G $\square-1 \square$
(1) (2)(3) ${ }^{(4) / 5)}$
(1) Ratings
$10: 10 \mathrm{~A}$ (250 VAC)
(2) Contact Gap

G $: 0.5 \mathrm{~mm}$

## (3) Actuator

None: Pin plunger
V : Hinge lever
V22 : Short hinge roller lever
V2 : Hinge roller lever
W : Hinge lever
W22 : Short hinge roller lever
W2 : Hinge roller lever
(4) Contact Form

1 : DPDT
(5) Terminals

A : Solder terminal
B : Screw terminal

## Ordering Information

| Actuator | Terminal |  | Solder terminal (-1A) | Screw terminal (-B) ${ }^{\text {S }}$ |
| :---: | :---: | :---: | :---: | :---: |
|  |  |  | Model | Model |
| Pin plunger | - |  | DZ-10G-1A | DZ-10G-1B |
| Hinge lever |  | High or | DZ-10GW-1A | DZ-10GW-18 |
|  |  | Low OT | DZ-10GV-1A | DZ-10GV-18 |
| Short hinge roller lever |  | High OT | DZ-10GW22-1A | DZ-10GW22-18 |
|  |  | Low OT | DZ-10GV22-1A | DZ-10GV22-1B |
| Hinge roller lever |  | High OT | DZ-10GW2-1A | DZ-10GW2-18 |
|  |  | Low OT | DZ-10GV2-1A | DZ-10GV2-1B |

## Specifications

## Ratings

| Rated voltage | Non-Inductive load (A) |  |  |  | Inductive load (A) |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Resistive load |  | Lamp load |  | Inductive load |  | Motor load |  |
|  | NC | NO | NC | NO | NC | NO | NC | NO |
| 125 VAC | $\begin{aligned} & 10 \\ & 10 \end{aligned}$ |  | 2 | 1 | $\begin{aligned} & 6 \\ & 4 \end{aligned}$ |  | 3 | 1.5 |
| 250 VAC |  |  | 1.5 | 0.7 |  |  | 2 | 1 |
| 8 VDC | 10 |  | 3 | 1.5 |  |  | 5 | 2.5 |
| 14 VDC | 10 |  | 3 | 1.5 |  |  | 5 | 2.5 |
| 30 VDC | 10 |  | 3 | 1.5 |  |  | 3 | 1.5 |
| 125 VAC | $\begin{gathered} 0.5 \\ 0.25 \\ \hline \end{gathered}$ |  | $\begin{aligned} & 0.5 \\ & 0.25 \end{aligned}$ |  | $\begin{aligned} & 0.05 \\ & 0.03 \\ & \hline \end{aligned}$ |  | $\begin{aligned} & 0.05 \\ & 0.03 \\ & \hline \end{aligned}$ |  |
| 250 VDC |  |  |  |  |  |  |  |  |

Certified Standard Ratings
Ask your OMRON representative for information on certified models. UL/CSA

| Rated voltage | DZ-10G |
| :---: | :---: |
| 125 VAC | $10 \mathrm{~A} 1 / 8 \mathrm{HP}$ |
| $\mathbf{2 5 0 ~ \mathrm { VAC }}$ | $10 \mathrm{~A} 1 / 4 \mathrm{HP}$ |
| 480 VAC | 2 A |
| $\mathbf{1 2 5 ~ V D C}$ | 0.5 A |
| 250 VDC | 0.25 A |

Note: 1. The above values are for steady-state current.
2. Inductive load has a power factor of 0.4 min . (AC) and a time constant of 7 ms max. (DC).
3. Lamp load has an inrush current of 10 times the steady-state current.
4. Motor load has an inrush current of 6 times the steady-state current.
5. The ratings values apply under the following test conditions:
(1) Ambient temperature: $20 \pm 2^{\circ} \mathrm{C}$
(2) Ambient humidity: $65 \pm 5 \% \mathrm{RH}$
(3) Operating frequency: 20 operations/min


Characteristics

| Operating speed |  | 0.1 mm to $1 \mathrm{~m} / \mathrm{s}$ *1 |
| :---: | :---: | :---: |
| Operating frequency | Mechanical | 240 operations/min |
|  | Electrical | 20 operations/min |
| Insulation resistance |  | $100 \mathrm{M} \Omega \mathrm{min}$. (at 500 VDC$)$ |
| Contact resistance |  | $15 \mathrm{~m} \Omega$ max. (initial value) |
| Dielectric strength |  | 1,000 VAC, $50 / 60 \mathrm{~Hz}$ for 1 min between non-continuous terminals 1,500 VAC, $50 / 60 \mathrm{~Hz}$ for 1 min between current-carrying metal parts and non-current-carrying metal part, and between current-carrying metal part and ground and between switches |
| Vibration resistance | Malfunction | 10 to $55 \mathrm{~Hz}, 1.5-\mathrm{mm}$ double amplitude *2 |
| Shock resistance | Destruction | $1,000 \mathrm{~m} / \mathrm{s}^{2} \mathrm{max}$. |
|  | Malfunction | $300 \mathrm{~m} / \mathrm{s}^{2} \mathrm{max} .{ }^{* 1}{ }^{\text {*2 }}$ |
| Durability | Mechanical | 1,000,000 operations min. |
|  | Electrical | 500,000 operations min. |
| Degree of protection |  | IP00 |
| Degree of protection against electric shock |  | Class I |
| Drgof tracking index (PTI) |  | 175 |
| bient operating temperature |  | $-25^{\circ} \mathrm{C}$ to $80^{\circ} \mathrm{C}$ (with no icing) |
| Ambient operating humidity |  | 35\% to 85\%RH |
| Weight |  | Approx. 30 to 50 g |

${ }^{*}$ 1. The values are for pin plunger models. (Contact your OMRON representative for other models.)
*2. Malfunction: 1 ms max.

## Contact Specifications

| Contacts | Material | Silver alloy |
| :--- | :--- | :---: |
|  | Gap(standard value) | 0.5 mm |
| Inrush current | NC | 30 A max. |
|  | NO | 15 A max. |

## Engineering Data

Mechanical Durability (DZ-10G-1B)


Electrical Durability (DZ-10G-1B)


## Structure

Contact Form (DPDT)


Dimensions
(Unit: mm)
Tarminals

Ider Terminals (-1A)


## Screw Terminals (-1B)



Six M3 pan head screws (with toothed washer)

Dimensions and Operating Characteristics
The solder terminal model has a suffix "-1 A " in its model number and its omitted dimensions are the same as the corresponding dimensions of the pin plunger model.

## Pin Plunger

DZ-10G-1B


| Operating force | OF $\max$. | 5.59 N |
| :--- | :--- | :---: |
| Release force | RF $\min$. | 0.56 N |
| Pretravel | PT $\max$. | 1.7 mm |
| Overtravel | OT $\min$. | 0.13 mm |
| Movement Differential | MD $\max$. | 0.4 mm |
| Operating Position | OP | $15.6 \pm 0.4 \mathrm{~mm}$ |

Hinge Lever
DZ-10GW-1B


| OF | $\max$ | 1.67 N |
| :--- | :--- | :---: |
| RF | $\min$. | 0.27 N |
| OT | $\min$. | 1.6 mm |
| MD | $\max$. | 4 mm |
| FP | $\max$. | 46.3 mm |
| OP |  | $21.8 \pm 1 \mathrm{~mm}$ |



| OF | max. | 1.96 N |
| :--- | :--- | :---: |
| RF | $\min$. | 0.13 N |
| PT | $\max$. | 6 mm |
| OT | $\min$. | 0.4 mm |
| MD | $\max$. | 1.7 mm |
| OP |  | $18.3 \pm 1 \mathrm{~mm}$ |

Short Hinge Roller Lever DZ-10GW22-1B


Hinge Roller Lever DZ-10GW2-1B


DZ-10GV2-1B


| OF | max. | 2.65 N |
| :--- | :--- | :---: |
| RF | $\min$. | 0.33 N |
| PT | $\max$. | 4 mm |
| OT | $\min$. | 0.26 mm |
| MD | $\max$. | 1.1 mm |
| OP |  | $29.4 \pm 0.8 \mathrm{~mm}$ |

[^5]
## nafety Precautions

Refer to Safety Precautions for All Basic Switches.

## Precautions for Safe Use

## Terminal Conrection

When soldering lead wires to the Switch, make sure that the capacity of the soldering iron is 60 W maximum. Do not take more than 5 s to solder any part of the Switch. The characteristics of the Switch will deteriorate if a soldering iron with a capacity of more than 60 W is applied to any part of the Switch for 5 s or more.

## Operation

- Make:sure that the switching frequency or speed is within the specified range.

1. If the switching speed is extremely slow, the contact may not be switched smoothly, which may result in a contact failure or contact welding.
2. If the switching speed is extremely fast; switching shock may damage the Switch soon. If the switching frequency is too high, the contact may not catch up with the speed.
The rated permissible switching speed and frequency indicate the switching reliability of the Switch:
The life of a Switch is determined at the specified switching speed. The life varies with the switching speed and frequency even when they are within the permissible ranges: In order to determine the life of a Switch model to be applied to a particular use, it is best to conduct an appropriate durability test on some samples of the model under actual conditions.

- Make sure that the actuator travel does not exceed the permissible OT position. The operating stroke must be set to $70 \%$ to $100 \%$ of the rated OT.


## Precautions for Correct Use

Mounting Location

- Do not use the switch alone in atmospheres such as flammable or explosive gases. Arcing and heat generation associated with switching may cause fires or explosions.
- Switches are generally not constructed with resistance against water. Úse a protective cover to prevent direct spraying if the switch is used in locations subject to splashing or spurting oil or water; dust adhering.

- Install the switch in a location that is not directly subject to debris and dust from cutting. The actuator and the switch body muist be protected from accumulated cutting debris and dirt.

- Do not use the switch in locations subject to hot water (greater than $60^{\circ} \mathrm{C}$ ) or in water vapor.
- Do nol use the switch outside the specified temperature and atmospheric conditions.
The permissible ambient temperature depends on the model. (Refer to the specifications in this catalog.) Sudden thermal changes may cause thermal shock to distort the switch and result in faults.

- Mount a cover if the switch is to be installed in a location where worker inattention could result in incorrect operation or accidents.

- Subjecting the switch to continuous vibration or shock may result in contact failure or faulty operation due to abrasion powder and in reduced durability. Excessive vibration or shock will cause the contacts to operate malfunction or become damaged. Mount the switch in a location that is not subject to vibration or shock-and in a direction that does not subject the switch to resonance.
- If silver contacts are used with relatively low frequency for a long time or are used with microloads, the sulfide coating produced on the contact surface will not be broken down and contact faults will result. Use a microload switch that uses gold contacts.
- Do not use the switch in atmospheres with high humidity or heat or in harmful gases, such as sulfide gas ( $\mathrm{H}_{2} \mathrm{~S}, \mathrm{SO}_{2}$ ), ammonia gas $\left(\mathrm{NH}_{3}\right)$, nitric acid gas $\left(\mathrm{HNO}_{3}\right)$, or chiorine gas ( $\mathrm{Cli}_{2}$ ). Doing so may impair functionality, such as with damage due to contacting faults or corrosion.
- The switch includes contacts. If the switch is used in an atmosphere with silicon gas, arc energy may cause silicon oxide $\left(\mathrm{SiO}_{2}\right)$ to : accumulate on the contacts and result in contact failure. If there is silicon oil, silicon filling, silicon wiring, or other silicon products in the vicinity of the switch, use a contact protection circuit to limit arcing and remove the soüree of the silicon gas.


## Mounting

Use M4 mounting scirews with plane washers or spring washers to securely mount the Switch. Tighten the screws to a torque of 1.18 to $1.47 \mathrm{~N} \cdot \mathrm{~m}$.
Mounting Holes
Two, 4.2 dia. mounting holes or
M4 screw hotes

Accessories (Order separately)
Refer to $Z / A / X / D Z$ Common Accessories for details about Terminal Covers, Separators, and Actuators.

# Read and Understand This Catalog <br> Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments. 

## g. -

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OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

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It is our:practice to change model numbers when published ratings or features are changed, or when significant construction changes are made However, some specifications of the products, may be changed without any notice.: When in doubt, special model numbers may be assigned to fix or eștạblish key specifications for yọur:application on your request. ' . Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

## DIMENSIÖNS AND WEIGHTS

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The information in this document has been carefully checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical, or proofreading errors, or omissions.

Comfort series
5 mm embeddable


## C

| General specifications ${ }^{\text {a }}$ : $\quad$ : | $\cdots \cdots$ |
| :---: | :---: |
| Switching element function | DC Make function |
| Rated operating distance $s_{n} \ldots . . \therefore$ | $5 \mathrm{~mm} \quad \ldots \quad \therefore$ |
| Installation $\cdot \cdots:$ : $\because$ : | embeddable : |
| Assured operating distance $\mathrm{s}_{\mathrm{a}} \ldots$ | 0 ... $4.05 \mathrm{~mm}{ }^{\text {* }}$ |
| Reduction factor $\mathrm{r}_{\mathrm{Al}}$ | 0.37 |
|  | 0.33 : . . . |
| Reduction factor-rveA | 0.7 |
| Nominal ratings |  |
| Operating voltage $U_{B}$ | $5 \ldots 60 \mathrm{~V}$ : |
| Switching frequency f - . | $0 \ldots 350 \mathrm{~Hz}$ |
| Hysteresis H | 1 ... 10 typ. $5 \%$ |
| Reverse polarity protection $\quad \therefore$ : | tolerant $\because$ |
| Short-circuit protection | pulsing |
| Voltage drop $\mathrm{U}_{\mathrm{i}}$, ${ }^{\text {a }}$ | $55 \mathrm{~V} \therefore \quad \therefore \quad$ |
| Operating current $I_{L}$ | $2 \ldots 100 \mathrm{~mA}$ |
| Of-state curient ! | $0 \ldots 0.5$ mia typ. |
| Indication of the switching state | alí direction:LED, yellow |
| Standard conformity $\quad \because \cdot \cdot$ | - . . $\cdot$ |
| Standards | EN 60947-5-2:2004 |
| Ambient conditions . . : | .. .. $\cdots$.. $\because$ |
| Ambient temperature | $-25 \ldots 70^{\circ} \mathrm{C}$ (248 $\left.\ldots 343 \mathrm{~K}\right)$ |
| Mechanical specifications $\quad \therefore \quad . \quad$. | $\therefore \quad \cdots \quad \therefore \quad \therefore \quad:$ |
| Connection type | 2 m, PUR cable |
| Cable version | PA. |
| Core cross-section | $0.34 \mathrm{~mm}^{2}$. |
| Housing material | Stainless steel |
| Sensing face | PBT |
| Protection degree . $\quad . \quad$ : | IP67 : |

## Connection type:

20


Comfort series
5 mm embeddable


## C



## Connection_type:

Z1


## Thermal device circuit breaker - TCP 0.25A - 0712123

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Thermal miniature circuit breaker, pluggable in screw-type fuse terminal block UK 6-FSI/C and spring-cage fuse terminal block ST 4-FSI/C

The illustration shows version TCP 2A

Why buy this product
I. A version with screw or spring-cage connection is used as a basic terminal block
[ The reclosable thermal circuit breaker is available in ten nominal current levels ranging from 0.1 to 10 A
Compact design
[r The integrated switching function enables immediate reclosure and therefore ensures the availability of the system


Key commercial data

| Packing unit | 1 |
| :---: | :---: |
| Minimum order quantity | 20 |
| Catalog page | Page 197 (TT-2011) |
| GTIN |  |
| Custom tariff number | 85362010 |
| Country of origin | INDONESIA |

## Technical data

## General

| Installation instructions | When mounted in rows, the nominal device current can be limited <br> to just $80 \%$ or must be overdimensioned accordingly. |
| :--- | :--- |
| Degree of protection | IP40 (Actuation area) |
| Mounting type | On base element |
| Color | black |
| Number of positions | 1 |
| Surge voltage category | II |
| Insulating material | PPS |
| Inflammability class according to UL 94 | Vo |

## Dimensions

## Thermal device circuit breaker - TCP 0.25A - 0712123

## Technical data

Dimensions


Technical data

| Fuse $\because, \ldots$, | Slow-blow : | . |
| :---: | :---: | :---: |
|  | Automatic device: |  |
|  | 2.5 kV . |  |
| Rated voltage $\quad . .$. | 250 VAC |  |
| Rated voltage $\quad \begin{array}{lllllll} & \ldots & \ldots & \ddots & \ddots & \ddots\end{array}$ | 65 V :DC |  |
|  | $250 \cdot 10$ |  |
| Rated voltage ${ }^{\text {Ra }}$, | 72 V 0 ) |  |
|  | 0.25 A |  |
|  | $\geq 100 \mathrm{M} \Omega(500 \mathrm{VDC})$ |  |
| Rated short-circuit switching capacity lon | $1.5 \mathrm{~A}(250 \mathrm{~V}$ AC / 65 V DC$)$ |  |
| Rated short-circuit switching capacity $l_{0 n} . \quad \because$ | $6.25 \mathrm{~A}(30 \mathrm{VDC})$ |  |
| Short-circuit switching capacity $l_{k} \quad \therefore \quad: \%$ | 2000 A 250 V AC / UL 1077 |  |
| Shopt-circuit switching capacity $\mathrm{l}_{\mathrm{k} \cdot}$ | 2000 A 72 V DC / UL 1077 |  |
| Dielectric strength $\cdots$ $\because \sim$ $\cdots$ | $3000 \mathrm{~V} \cdot \mathrm{AC}$ (Actuation area) |  |
|  | 1500 V AC (Installation area) |  |
| Cycles, max. ${ }_{\text {, }}$ | 6000 (At $1 \times \mathrm{I}_{\mathrm{n}}$, low-induction) | : |
|  | 3000 (At $1 \times \mathrm{x} \mathrm{I}_{\mathrm{n}}$, inductive) |  |
| Cycles, max $\because \because \because \square$ | 500 (At $2 \times \mathrm{I}_{\mathrm{n}}$, inductive) |  |
| Pollution degree $\%$, $\because \cdots$ | 2.: | $\cdots$. $\cdot$ |
| Surge voltage category $\because$ $\ddots$ $\ddots$ $\cdots$ $\because$ | 11 |  |
| Insulating material group . $\because \cdots$, | IIIL | : |
| Ambient temperature (operation) | $-20^{\circ} \mathrm{C} \ldots 60^{\circ} \mathrm{C}$ | $\cdots$ |

## Standards

Standard - Electrical safety $\because \because, \quad$ EN 60934

## Classifications

ETIM


## Thermal device circuit breaker - TCP 0.25A - 0712123

## Classifications

UNSPSC

eCl@ss


Approvals
Approvals

## Approvals

CSA / UL Recognized / VDE Zeichengenehmigung / cUL Recognized / GOST / cULus Recognized

Ex Approvals
$\qquad$

Approvals submitted

Approval details


UL Recognized

Thermal device circuit breaker - TCP 0.25A - 0712123

## Approvals

```
VDE Zeichengenèhmigung
```

$\square$
cUL Recognized 6
$\square$
$\operatorname{cost} 6$

## Accessories

## Accessories

Marking
Flat zack marker sheet - ZBFM 5NWH:UNBEDRUCKT - 0803595

Flat zack marker sheet, Sheet, white, Unlabeled, Can be labeled with: Plotter, Mounting type: Snap into flat marker groove, For terminal block width: 5.2 mm , Lettering field: $5 \times 4.5 \mathrm{~mm}$

Flat zack marker sheet - ZBFM 5/OG:UNBEDRUCKT - 0807180


Flat zack marker sheet, Sheet; orange, Unlabeled, Can be labeled with: Plotter, Mounting type: Snap into flat marker groove, For terminal block width: 5.2 mm , Lettering field: $5 \times 4.5 \mathrm{~mm}$

## Additional products

Fuse:modular terminal block:- UK 6-FSI/C - 3118203


Flat-type fuse terminal block, cross section: 0.2-6 $\mathrm{mm}^{2}$, AWG: $26-8$, width: 8.2 mm , color: black

Thermal device circuit breaker - TCP 0.25A - 0712123

Diagram


Trigger characteristic.

Application drawing


Fuse terminal block in single arrangement,
block consisting of one fuse terminal block and 4 feed-through terminal
blocks


## IS-50NX-C2

## dc blocked protector

Flange mounted, dc block, single transmitter coaxial lightning protection for 125 MHz to 1 GHz with N female connectors

## Specifications for PolyPhaser IS-50NX-C2

Mount Type
Flange
Frequency Range
125 MHz to 1 GHz
Protected Side Connector
N Female
Surge Side Connector
N Female:
Turn On Voltage
$600 \mathrm{Vdc} \pm 20 \%$
VSWR
$\leq 1.1: 1,125 \mathrm{MHz}$ to 1 GHz
Insertion Loss
$\leq 0.1 \mathrm{~dB}$
RF Power
125 to 220 MHz @ $375 \mathrm{~W}, 220$ to $700 \mathrm{MHz} @ 125 \mathrm{~W}, 700$ to $1000 \mathrm{MHz} @ 50 \mathrm{~W}$

## PB251-CM Series

## 220-330 WATTS DC UPS

## FEATURES

- Chassis Mount
- Ultra-low noise output
- Independent battery charging output
- DC output OK \& battery OK alarms \& LEDs
- Battery-LVD and alarm
- Over-temperature protection
- Battery fuse fail LED


## SPECIFICATIONS

| INPUT |  |
| :---: | :---: |
| Voltage: | 190 to 264 vac, or 225 to 400Vdc |
| Line regulation: | 0.2\%typical |
| Current | 1.4A maximum |
| Inrush current | 10A maximum |
| Frequency: | 45 to 65 Hz |
| OUTPUT |  |
| Voltage | See table |
| Current | See table |
| Load regulation | 0.5 typical |
| Current limit type - load cet | Constant current |
| Current limit type - batt. cet | Constant current |
| Short circuit protection | Indeffinite, auto-resetting |
| Over-voltage protection | 17.5 to 20 OV latching ( 13.8 Vdc output) |
| Ripple \& nolse 100 MHz bandwidth | $28 \mathrm{mVp}-\mathrm{p}$ ( $\mathbf{1 3 . 8 V d c}$ output) $55 \mathrm{mVp}-\mathrm{p}$ (27.6Vdc output) |
| ENVIRONMENTAL |  |
| Operating temperature | 0 to $70^{\circ} \mathrm{C}$ amblent with derating. 5 to $90 \%$ relative humidity (non-condensing) |
| Over-temperature protection | Automatic \& auto-resetting |
| Cooling requirement | Natural convection |
| Efficiency | 80\% minimum |


| STANDARDS \& APPROVALS |  |
| :---: | :---: |
| Safety | Complies with AS/NZS 60950, class 1, NSW Office of Fair Trading Approval N20602 |
| EMC | Emissions comply with AS/NZS CISPR11, Group 1, Class B. Complies with ACA EMC Scheme, Safety \& EMC Regulatory Compllance Marked |
| Isolation $V$ p-o/p $\mathrm{V} p$-ground o/p-ground | 4242 VDC for 1 minute 2121VDC for 1 minute 707VDC for 1 minute |
| ALAPMS \& BATTERY FUNGTIONS |  |
| Converter 0N/OK alarm | Indicated by voltage-free changeover relay contacts \& green LED: $O N=O K$ |
| green LED | ON=PSU OK |
| Battery low (\& fuse) alarm | Alarm voltage 11V. Adjustable 10.2-12.6V contact Sales Office. Indicated by voltagefree changeover relay contacts \& green LED: ON=BATT OK |
| Low voltage disconnect | 9.6 to 12 V adjustable Contact Sales office. |
| Charger over-load protection | Auto-resetting electronic circuit breaker |
| Reverse polarity protection | Internal battery fuse |
| Battery to load voltage drop | 0.2 to. 0.25V typical |
| MECHANCAL |  |
| Case size | $264 \mathrm{~L} \times 172 \mathrm{~W} \times 67 \mathrm{Hmm}$ |
| Case size with heatsink | $264 \mathrm{~L} \times 186 \mathrm{~W} \times 67 \mathrm{Hmm}$ |
| Rack mount option | Refer to PB251-RM Series |

## SELECTION TABLE

| MODEL |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: |
| NUMBER | VDC | OUTPUT | ILOAD | IBATT |

NOTE: Non standard battery charging current available on request le PB251-12CM-H-10 for 10A.

## PB251-CM Series

## 220-330 WATTS DC UPS

## TECHNICAL ILLUSTRATIONS



## PBIH Series

## 15-150 WATTS DC/DC SINGLE OUTPUT

## FEATURES

- Wide selection of models
- 4 input voltage ranges
- High efficiency
- Low output ripple
- Proven reliability
- Good thermal margins



## SPECIFICATIONS

| InPUT |  | OPERATING |  |
| :---: | :---: | :---: | :---: |
| Input voltage | 12VDC (9.2-16) | Efficiency | 70\%-89\% |
|  | 24 VDC (19-32) <br> 48VDC (38-63) | Satety Isolation (1 minute) | Type - 12, 24, 48V input <br> Input-Case: 1500VAC <br> Output-Case: 500VAC <br> Type- 110 V input <br> Input-Output: 2000VAC <br> Input-Case: 2000VAC <br> Output- Case: 500VAC |
|  | $\begin{aligned} & \text { 48VDC (38-63) } \\ & 10 \mathrm{VDC}(85-140) \end{aligned}$ |  |  |
| Inrush current | 20A max, for 110V only |  |  |
| OUIPUT |  |  |  |
| Output voltage | See table |  |  |
| Voltage adjustment | $\pm 10 \%, \pm 5 \%$ for PBIH-F |  |  |
| Output current | See table | Insulation resistance | 50Mż (500VDC) Input - Case |
| Ripple \& noise | Output Volts $\times 1 \%+50 \mathrm{mV}$ to - 100 mV pk-pk | Parallel operation | Consult sales office for details |
| Line regulation | 0.8\% over input range | Remote control | PBIH-R Series: Open link: output normal Short link: output oft |
| Load regulation | 0.9\%, 0\%-100\% load |  |  |
| Temperature coefficient | $0^{\circ} \mathrm{C}$ to $50^{\circ} \mathrm{C}, 0.03 \%$ per ${ }^{\circ} \mathrm{C}$ |  |  |
| Overvoltage protection | O.V. clamp, PBIH-F Output shutdown, PBIH-G, J, M, R - Input must be switched off for at least 30 S to reactivate | ENVIRONMENTAL |  |
|  |  | Operating temperature | $0^{\circ} \mathrm{C}$ to $70^{\circ} \mathrm{C}$. |
|  |  | Temperature derating | Derate $100 \%$ load from $50^{\circ} \mathrm{C}-70^{\circ} \mathrm{C}$ at $1.5 \%$ per ${ }^{\circ} \mathrm{C}$ to $30 \%$ load. |
| Overcurrent protection | Fold back - PBIH-F Current limiting. PBIH-G, J, M, R (PBIH-R series is adjustable); PBIH110xxR models are not adjustable | Cooling | Convection cooled |
|  |  | Storage temperature | $-20^{\circ} \mathrm{C}$ to $+85^{\circ} \mathrm{C}$ |
|  |  | Humidity | 85\% |
| Drift | Output V $\times 0.5 \%+15(\mathrm{mV})$ per 8 hrs atter 1 hr warm-up | Shock | 30G, PBIH-F, G and J |
| Rise Time | $\begin{aligned} & 200 \mathrm{~ms} \text { max. }- \text { PBIH-F, M, R } \\ & 100 \mathrm{~ms} \text { max. }- \text { PBIH-G, } \mathrm{J}\left(\text { at } 25^{\circ} \mathrm{C}\right) \end{aligned}$ | Vibration | ( 5 Hz - $10 \mathrm{~Hz}, 10 \mathrm{~mm}$ ), <br> ( $10 \mathrm{~Hz}-50 \mathrm{~Hz}$ ) 2G, PBIH-F, G and J |
| Holdup time | 10 ms (only 110 V input) | STANDARDS AND APPRO | Als |
| Remote sense | PBIH-R Series only | Safety | Designed to UL1950 |
|  |  | C-Tick | AS/NZS CISPR11 Group 1, Class A |
|  |  | MECHANICAL |  |
|  |  | Weight | PBIH-F: 250g <br> PBIH-6: 380g <br> PBIH-J: 410 g <br> PBIH-M : 800g <br> PBIH-R: 1.4 kg |

## PBIH Series

15-150 WATTS DC/DC SINGLE OUTPUT

## SELECTION TABLE

| MODEL NUMBER <br> PBIH-1205F | INPUT <br> 9.2-16V | OUTPUT |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | 5 V | 3A |  |
| PBIH-1212F | 9.2-16V | 12 V | 1.2 A | 15W |
| PBIH-1215F | 9.2-16V | 15V | 1A | 15W |
| PBIH-1224F | 9.2-16V | 24 V | 0.62A | 15W |
| PBIH-2405F | 19-32V | 5 V | 3A | 15W |
| PBIH-2412F | 19-32V | 12 V | 1.2A | 15W |
| PBIH-2415F | 19-32V | 15V | 1A | 15W |
| PBIH-2424F | 19-32V | 24 V | 0.62A | 15W |
| PBIH-4805F | 38-63V | 5 V | 3A | 15W |
| PBIH-4812F | 38-63V | 12V | 1.2A | 15W |
| PBIH-4815F | 38-63V | 15V | 1A | 15W |
| PBIH-4824F | 38-63V | 24 V | 0.62A | 15W |
| PBIH-11005F | 85-140V | 5 V | 3A | 15W |
| PBIH-11012F | 85-140V | 12 V | 1.2A | 15W |
| PBIH-11015F | $85-140 \mathrm{~V}$ | 15 V | 1A | 15W |
| PBIH-11024F | $85-140 \mathrm{~V}$ | 24 V | 0.62A | 15W |
| PBIH-1205G | 9.2-16V | 5 V | 5A | 25W |
| PBIH-1212G | 9.2-16V | 12 V | 2.1A | 25W |
| PBIH-1215G | 9.2-16V | 15V | 1.7A | 25W |
| PBIH-1224G | 9.2-16V | 24 V | 1.1A | 25W |
| PBIH-1248G | 9.2-16V | 48 V | 0.5A | 25W |
| PBIH-2405G | 19-32V | 5 V | 5A | 25W |
| PBIH-2412G | 19-32V | 12 V | 2.1 A | 25W |
| PBIH-2415G | 19-32V | 15V | 1.7A | 25W |
| PBIH-2424G | 19-32V | 24 V | 1.1A | 25W |
| PBIH-2448G | 19-32V | 48 V | 0.5A | 25W |
| PBIH-4805G | 38-63V | 5 V | 5A | 25W |
| PBIH-4812G | 38-63V | 12V | 2.1A | 25W |
| PBIH-4815G | $38-63 \mathrm{~V}$ | 15 V | 1.7A | 25W |
| PBIH-4824G | 38-63V | 24 V | 1.1A | 25W |
| PBIH-4848G | 38-63V | 48 V | 0.5A | 25W |
| PBIH-110056 | 85-140 | 5 V | 5 A | 25W |


| MODEL NUMBER <br> PBIH-11012G | INPUT <br> 85-140V | OUTPUT |  | OUTPUT POWER |
| :---: | :---: | :---: | :---: | :---: |
|  |  | 12V | 2.1A |  |
| PBIH-11015G | 85-140V | 15 V | 1.7A | 25 W |
| PBIH-11024G | 85-140V | 24 V | 1.1A | 25 W |
| PBIH-11048G | $85-140 \mathrm{~V}$ | 48 V | 0.5A | 25 W |
| PBIH-1205J | 9.2-16V | 5 V | 8A | 40W |
| PBIH-1212J | 9.2-16V | 12 V | 3.3A | 40W |
| PBIH-1215J | 9.2-16V | 15 V | 2.7A | 40w |
| PBIH-1224J | $9.2-16 \mathrm{~V}$ | 24 V | 1.7A | 40W |
| PBIH-1248J | 9.2-16V | 48 V | 0.8A | 40W |
| PBIH-2405J | 19-32V | 5 V | 10A | 50W |
| PBIH-2412J | 19-32V | 12 V | 4.3A | 50W |
| P8iH-2415J | 19-32V | 15 V | 3.4A | 50W |
| PBIH-2424J | 19-32V | 24 V | 2.5 A | 50W |
| PBIH-2448J | 19-32V | 48 V | 1A | 50W |
| PBIH-4805J | 38-63V | 5 V | 10A | 50W |
| PBIH-4812J | 38-63V | 12 V | 4.3A | 50W |
| PBIH-4815J | 38.63 V | 15 V | 3.4A | 50W |
| PBIH-4824J | 38-63V | 24 V | 2.5 A | 50W |
| PBH-4848J | 38-63V | 48 V | 1A | 50W |
| PBIH-11005J | 85-140V | 5 V | 10A | 50W |
| PBIH-11012J | 85-140V | 12 V | 4.3A | 50W |
| PBIH-11015J | 85-140V | 15 V | 3.4A | 50W |
| PBIH-11024J | 85-140V | 24 V | 2.5A | 50W |
| PBIH-11048J | 85-140 V | 48 V | 1A | 50W |
| PBIH-1205M | 9.2-16V | 5 V | 18A | 100W |
| PBIH-1212M | 9.2-16V | 12 V | 9A | 100W |
| PBIH-1215M | 9.2-16V | 15 V | 7 A | 100W |
| PBIH-1224M | 9.2-16V | 24 V | 4.5 A | 100W |
| PBIH-1248M | 9.2-16V | 48 V | 2A | 100W |
| PBIH-2405M | 19-32V | 5 V | 20A | 100W |
| PBIH-2412M | 19-32V | 12 V | 9 A | 100W |
| PBIH-2415M | 19-32V | 15V | 7A | 100W |


| MODEL NUMBER <br> PBIIK-2424M | INPUT <br> 19-32V | OUTPUT |  | OUTPUT POWER <br> 100W |
| :---: | :---: | :---: | :---: | :---: |
|  |  | 24 V | 5A |  |
| PBIH-2448M | 19-32V | 48 V | 2A | 100W |
| PBIH-4805M | 38-63V | 5 V | 20A | 100W |
| PBIH-4812M | 38-63V | 12 V | 9A | 100W |
| PBIH-4815M | 38-63V | 15 V | 7A | 100W |
| PBIH-4824M | 38-63V | 24 V | 5A | 100W |
| PBII-4848M | 38-63V | 48 V | 2A | 100W |
| PBIH-11005M | 85-140V | 5 V | 20A | 100W |
| PBIH-11012M | 85-140V | 12 V | 9A | 100W |
| PBIH-11015M | 85-140V | 15V | 7A | 100W |
| PBIH-11024M | 85-140V | 24 V | 5A | 100W |
| PBIH-11048M | 85-140V | 48 V | 2A | 100W |
| PBIH-1205R | 9.2-16V | 5 V | 27A | 150W |
| PBIH-1212R | 9.2-16V | 12 V | 13A | 150W |
| PBIH-1215R | 9.2-16V | 15 V | 10A | 150W |
| PBIH-1224R | $9.2-16 \mathrm{~V}$ | 24 V | 6.5 A | 150W |
| PBIH-1248R | 9.2-16V | 48 V | 3.3A | 150W |
| PBIH-2405R | 19-32V | 5 V | 30A | 150W |
| PBIH-2412R | 19-32V | 12 V | 14 A | 150W |
| PBIH-2415R | 19-32V | 15 V | 11A | 150W |
| PBIH-2424R | 19-32V | 24 V | 7A | 150W |
| PBIH-2448R | 19-32V | 48 V | 3.5A | 150W |
| PBIH-4805R | $38-63 \mathrm{~V}$ | 5 V | 30A | 150W |
| PBIH-4812R | $38-63 \mathrm{~V}$ | 12 V | 14A | 150W |
| PBIH-4815R | $38-63 \mathrm{~V}$ | 15 V | 11A | 150W |
| PBIH-4824R | $38-63 \mathrm{~V}$ | 24 V | 7 A | 150W |
| PBIH-4848R | 38-63V | 48 V | 3.5A | 150W |
| PBIH-11005R | 85-140V | 5 V | 30A | 150W |
| PBIH-11012R | 85-140V | 12 V | 14 A | 150W |
| PBIH-11015R | $85-140 \mathrm{~V}$ | 15 V | 11A | 150W |
| PBIH-11024R | 85-140V | 24 V | 7A | 150W |
| PBIH-11048R | 85-140 | 48 V | 3.5A | 150W |

PBIH-F


## PBIH Series

## 15-150 WATTS SINGLE OUTPUT

PBIH-G


PBIH-J


PBIH-R



DATA SHEET

## Coax Cable Connector

$\mathrm{N}-203 \mathrm{HS}$
N -201

## Description



Straight Cable Plug Crimp
Suits Cables: LMR400 CNT400 BELDEN 9913

| Technical Data |  |
| :--- | :--- |
| Electrical |  |
| Impedance | 50 Ohm |
| Max Frequency | 11 GHz |

Mechanical \& Environmental Data

| Centre contact | Crimp |  |  |
| :---: | :---: | :---: | :---: |
| Outer Contact | $5 / 8^{\prime \prime}-24$ threaded coupling |  |  |
| Mating |  |  |  |
| Durability | 500 matings |  |  |
| Coupling nut retention | 100 lbs Max |  |  |
| Cable Retention | 40 lbs min |  |  |
| Tempreture Range | $-65^{\circ}$ to $165^{\circ} \mathrm{C}$ |  |  |
| Vibration | MIL-STD-202 Test Cond B |  |  |
| Salt Spray | MIL-STD-101 Test Cond B |  |  |
| Thermal Shock | MIL-STD-107 Test Cond B |  |  |
| Material Data |  |  |  |
| Parts | Material | Plating |  |
|  |  | $\mathrm{N}-203 \mathrm{HS}$ | $\mathrm{N}-201$ |
| Connector Body | Brass | Silver | White Bronze |
| Centre contact | Brass | Gold | Gold |
| Insulation | Teflon | - | - |
| Gasket | Silicone Rubber | - | - |
| Crimp Ferrule | Anneald Copper | Silver | White Bronze |

# redion <br> Tel +1 (717) $767-6511$ <br> Fax +1 (717) 764-0839 

 Bulletin No. G306A-F Drawing No. LP0666 Released 05/12www:redlion.net

## MODEL G306A - GRAPHIC COLOR LCD OPERATOR INTERFACE TERMINAL WITH TFT QVGA DISPLAY AND TOUCHSCREEN



FOR USE IN HAZARDOÜS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
PROCESS CONTROL EOUIPMENT

- CONFIGURED USING CRIMSON SOFTWARE (BUILD 424 OR NEWER)
- UP.TO 5 RS-232/422/485 COMMUNICATIONS PORTS (2. RS-232 AND 1 RS-422/485. ON BOARD. 1 RS-232 AND 1 RS422/485 ÓN OPTIONAL COMMUNICATIONS CARDI
- 10 BASE T/100 BASE-TX ETHERNET PORT TO NETWORK UNITS AND HOST WEB PAGES
- usb port to dównloád tïe unit's cóonfiguration from A PC OR FOR DATA TRANSFERS TO A PC
- UNIT'S CONFIGURATION IS STORED IN NON-VOLATILE MEMORY (B MBYTE FLASH).
- COMPACTFLASH SOCKEIT TO INCREASE MEMORY CAPACITY
- 5.7-INCH TFT ACTIVE MATRIX 256 COLOR QVGA $320 \times 240$ PIXEL LCD WILED BACKLIGHT
- 5-BUTTON KEYPAD FOR ON-SCREEN MENUS
- thitee front panel led indicators
- POWER UNIT FROM 24 VIDC $\pm 20 \%$ SUUPPLY
- resistive analog toulhscreen


## GENERAL DESCRIPTION

The G306A Operator Interface Terminal combines unique capabilities normally expected from high-end units with a very affordable price It is built around a high performance core with integrated functionality. This core allows the G306A to perform many of the normal features of the Paradigm range of Operator Interfaces while improving and adding new features.
The G306A is able to communicate with many different types of hardware using high-speed RS $232 / 422 / 485$ communications ports : and Elhemet 10 Base T/100 Base-TX commuinications. In addition, the G306A features USB for fast. downloads of configuration files and access to trending and data logging A CompactFlash socket is provided so that Flash cards can be used to collect your trending and data logging information as well as to store larger configuration files.

In addition to accessing and controlling of external resources, the G306A allows a user to easily view and enter information. Users can enter data through the touchscreen and/or front panel 5-button keypad.

## SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment. connected to it If cquipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
Do not use the controller to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the controller.


The protective conductor terminial is bonded to conductive parts of the equipment: for safety purposes and must be connected to an extermal protective earthing system.:


WARNING - EXPLOSION HAZARD SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2


CompactFlash is a registered trademark of CompactFlash Association.

## CONTENTS OF PACKAGE

- G306A Operator Interface.
- Panel gasket.
- Template for panel cutout.
- Hardware packet for mounting unit into panel.
- Terminal block for connecting power.


## ORDERING INFORMATION

| MODEL NO. | DESCRIPTION | PART NUMBER |
| :---: | :---: | :---: |
| G306A | Operator Interface for indoor applications: textured finish with.embossed keys | G306A000 |
| G3CF | CompactFlash Card 5 | G3CFxixx |
| G3RS | RS232/485 Optional Communication Card. | G3RS0000 |
| G3CN | CANopen Optional Comminication Card: | $\therefore$ G3CN0000 |
| G3DN | DeviceNet option card for G 3 operatór intérfaces with isolated high speed communications poits | G3DN0000 |
| G3PBDP | Profibus DP Optional Communication Card | G3PEDP00 |
| PSDR7 | DIN Rail Power Supply | PSDR 7000 |
| SFCRM2 | Crimson $2.0^{2} \quad \because \ldots$ | SFCRM200 |
| CBL | RS-232 Programming Cable | CBLPROGO |
|  | USB Cable | CBLUSBOO |
|  | Communications Cables ${ }^{1}$ | CBLxxaxx |
| DR | DIN Rail Mountable Adapter Products ${ }^{3} \cdot$. | DRxxxucx |
|  | Replacement Battery ${ }^{4}$ | BNL20000 |
| G3FILM | Protective Films $\because \quad \because \because \because$ | G3FILMO6 |

l Contact your Red Lion distitributor or .visit ouṛ: webesite for: complete selection.
${ }^{2}$ Use this part number to purchase the Crimsons software on CD with a printed manual, USB cable, and RS-232 cable. Otherwiṣe, download for free from www.redlion net:
${ }^{3}$ Red Lion offers RJ modular jack adapters. Refer to the DR literature for complete details..
${ }^{4}$ Battery type is lithium coin ty pe CR2025. 156 of 3 hanustrial grade two million write cycles.

## SPECIFICATIONS

1. POVER REQUIIREMENTS:

- Must use a Class 2 circuit according to National Electrical Code (NEC), NFPA-70 or Canadian Electrical Code (CEC), Par I, C22. 1 or a Limited Power Supply (LPS) according to IEC 60950-I or Limited-energy circuit according to IEC 61010-1.
Power connection via removable three position terminal block:
Sụpply Voltage: $\because \quad+24$ VDC $+20 \%$
Typical Poweril: 8.W.
Maximum Power ${ }^{2}$ : 10 W
Notes:

1. Typical power with $+24 \cdot$ VDC, RS232/485 commimications, Ethernet. commumications, CompactFlash card installed, and disploy at full brightress.
2. Maximuin power indicaites the most power that can be dran'mfrom the G306A. Refer to "Power Supply Requirements" under "Installing and Powering the G306A:"
3. The G306A's circuil common is not connected to the enclosure of the unit. See "Conmecting to Earth Ground" in the section "Installing and Powering the G306A."
4. Read "Power Supply, Requirementṣ" in the section "Installing and 'Powiering the G306A'" for additional power supply information.
5. BATTERY: Lithium coin cell. Typical lifetime of 10 years.
6. LCD DISPLAY:

| SIZE | 5.7-nich |
| :---: | :---: |
| TYPE: | $\therefore$ TFT |
| COLORS | 256. |
| PIXELS. | $320 \times 240$ |
| BRIGHTNESS : | $380 \mathrm{~cd} / \mathrm{m}^{2}$ |
| BACKLIGHT. | 50,000 HR TYP. |

*Lifetime at room temperature. Refer to "Display" in "Sofiware/Unit Operation"
4. 5-KEY KEYPAD: for on-screen menus.
5. TOUCHSCREEN: Resistive analog
6. MEMORY:

On Boand User Memory: 8 . Mbyte of non-volatile Flash memory.
Memory Card: CompactFlash. Type II slot for Type 1 and Type 11 CompactFlash cards.
7. COMMUNICATIONS:

USB Port: Adheres to USB specification 1.1. Device only using Type B connection.

| WARNING. DO NOT CONNECT OR DISCONNECT CABLES WHILE POWER IS APPLIED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. USB PORT.IS FOR SYSTEM SET-UP.AND DIAGNOSTICS AND IS NOT INTENDED' FOR PERMANENT CONNECTION. |  |
| :---: | :---: |
|  |  |

Serial Ports: Format and Baud Rates for each port are individually software programmable up to 115,200 baud
PGM Port: RS232 port via RJ12.
COMMS Ports: RS422/485 port via RJ45, and RS232 poort via RJI2.
DH485 TXEN: Transmit enable; open collector, $\mathrm{V}_{\mathrm{OH}}=15 \mathrm{VDC}$, $\mathrm{V}_{\mathrm{OL}}=0.5 \mathrm{~V} @ 25 \mathrm{~mA}$ max.
Note:- For additional information: on the conmunications or :signal conimon and connections to earith ground please see the "Conizecting to Earth Groind" in the section "Installing and Powering the.G3064. "
Ethernet Port: 10 BASE-T $\% 100$ BASE-TX
RJ45 jack is wired as a NIC (Network Interface Card)
Isolation from Ethernet network to G 3 operator interface: 1500 Vrms
8. ENVIRONMENTAL CONDITIONS

Operating Temperature Range: $0.1050^{\circ} \mathrm{C}$
Storage Temperature Range: - 20 to $70^{\circ} \mathrm{C}$
Operating and Storage Humidity: $80 \%$ maximum relative humidity (noncondensing) from 0 to $50^{\circ} \mathrm{C}$ :
Vibration according to IEC 68-2-6 Operational 5 to $8 \mathrm{~Hz}, 0.8^{\prime \prime}(p-p) ; 8$ to 500 Hz , in X, Y,Z dirẹction, duration 1 hour, 3 g :
Shock according to IEC 68-2-27: Operational $40 \mathrm{~g}, 9 \mathrm{msec}$ in 3 directions. Altitude: Up to 2000 meters.
9. CERTIFICATIONS AND COMPLIANCES:

## SAFETY

UL Listed, File \#E245515, UL61010-1,ANSI/ISA 12 12.01-2007; CAN/CSA 22.2 No. 61010.1, CSA 22.2 No 213-Mi987 and File \#Eil9259, UL61010-1, CAN/CSA 22.2 No. $61010-1$
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
Type 4X Indoor Enclosure rating (Face only), UL50
IECEE CB Scheme Test Report \#E179259-A 1-CB-3.

- Isscuèd by Underwriters Laboratoriẹs Inc.

IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment
for measurement, control, and laboratory use, Part 1 :
:IP66 Enclosure rating (Face only), IEC 529
ELECTROMAGNETIC COMPATIBILITY
Emissions and Immunity to EN: 61326: 2006: Electrical Equipment for Measurement, Control and Laboratory use.
Immunity to Industrial Locations:
Electrostatic discharge EN61000-4-2 Criterion A. 4 kV contact discharge 8 kV air discharge
Electromagnetic RF. fields EN61000-4-3 Criterion A $10 \mathrm{~V} / \mathrm{m}(80 \mathrm{MHz}$ to 1 GHz$)$ $3 . \mathrm{V} / \mathrm{m}(1.4 \mathrm{GHz}$ to 2 GHz$)$

Faṣt transients (burst)

Surge
IkV I/O sign IkV I/O signal
.

RF conducted interference
Power frequency:magnetic fields
Émissions:
Emissions
Note:

1. Criterion A Normal operation within specified limits.
2. CONNECTIONS: Compression cage-clamp terminal block.

Wire Gage: 12-30 AWG copper wire
Toŕque: 5:7 inch-póunds (56-79 N-cm)
11. CONSTRUCTION: Steel rear metal enclosure with NEMA 4XXIP66 aluminum front plate for indoor use only when correctly fitted with the gasket . provided. Installation Category II, Pollution Degree 2.
12: MOUNTING REQUIREMENTS: Maximum panel thickness is 0.25 " 6.3 mm ). For NEMA 4X/IP66́ sealing, a steel panel with a minimum thickness of $0.125^{\prime \prime}$ ( $3: 17 \mathrm{~mm}$ ) is recommended.
Maximum Mounting Stud Torque: 17 inch-pounds ( $1.92 \mathrm{~N}-\mathrm{m}$ )
: 13. WEIGHT: $3.0 \mathrm{lbs}(1.36 \mathrm{~kg})$

## DIMENSIONS In inches (mm)



## Installing and Powering the G306A

## MOUNTING INSTRUCTIONS

This operator interface is designed for through-panel mounting. A panel cutout diagram and a template are provided Care should be caken to remove any loose material from the mounting cut-out to prevent that material from falling into the operator interface during installation. A' gasket is provided to enable sealing to NEMA 4X/IP66 specification. Install the ten kep nutis provided and tighten evenly for uniform gásket compression.

Note: Tightening the kep nuts beyond a maximum of 17 inchi-pounds (1.92 $N-m$ ) may cause damage to the front pariel.


ALL NONINCENDIVE CIRCUITS MUST BE WRED USING DIVISION 2 WRING METHODS AS SPECIFIED IN ARTICLE 501-4 (b): 502-4 (b), AND 503-3 (b) OF THE NATIONAL ELECTRICAL (b): 502-4 (b), AND 503-3 (b) OF THE NATIONAL ELECTRICAL
CODE, NFPA 7O FOR INSTALLATION WTHIN THE UNITED CODE, NFPA 7Ó FOR INSTALLATION WITHIN THE UNITED
STATES, OR-AS SPECIFIED IN SECTION $19-152$ OF CANADIAN ELECTRICAL CODE FOR INSTALLATION IN CANADA:

## CONNECTING TO EARTH GROUND



The protective conductor terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing sysiem

Each G306A has a chassis ground tenminal on the back of the unit. Your unit should be connecied to earth ground (protective earth).

The chassis ground is not connected to signal common of the unit. Maintaining isolation between earth ground and signal common is not required to operate your unit. But, other equipment connected to this unit may require isolation between signal common and earth ground. To maintain isolation berveen signial comnon and earth ground care must be taken when connections are: made to the umin. Fọr example, a power supply with isolation between its signal common and earth ground must be used. Also, plugging in a USB cable may connect sigṇal common and earth ground!
' USB's shield may be connected to earth ground at the host. USB's shield in turn may also be connected to signal common.

## POWER SUPPLY REQUIREMENTS

The G306A requires a 24 : VDC power supply. Your unit may draw considerably less than the maximum rated power depending upon the options being used. As additional features are used your unit will draw increasing amounts of power. Items that could cause increases in current are additional communications, optional communications card, CompactFlash card, and other features programmed through Crimson.
In any case, it is very important that the power supply is mounted correctly if the unit is to operate reliably. Please take care to observe the following points:

- The power supply must be mounted close to the unit, with usually not more than 6 feet ( 1.8 m ) of cable between the supply and the operator interface. Ideally, the shortest length possible should be used
- The wire used to connect the operator interface's power supply should be at least 22 -gage wire. If a longer cable run is used, a heavier gage wire should be used. The routing of the cable should be kept away from large contaciors, inverters, and other devices which may generate significant electrical noise.
- A power supply with an NEC Class 2 or Limited Power Source (LPS) and SELV rating is to be used. This type of power supply provides iṣolation to acceṣsible circuits from hazardous voltage levels generated by a mains poiver supply due to single faults. SELV is ạn actronym for "safety exträ-löiv voltage." Safery extra-low voltage circuits shall exhibit voltages sạfe tọ touch both unḍder normal operating conditions and after a single fauilt, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.


## Installing An Option Card



WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN OISCONNECTED ANO THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Each option card comeṣ with a cable for communications and three screws for ataching the option card to the G306's rear coveri. To install the option card, remove all power and VO cominunications cables from the unit: Use the three screws provided to mount the option card to the rear cover of the G306 as shown in Figure 1.


Figure 1

Connect the cable froin the option card to CN11 on the main board of the G306 as shown in Figure 2. Be sure both ends of the cable are firmly seated into their appropriate connector housing: Carefully replace the rear cover by reversing the instructions for removing the rear cover.

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## Communicating With the G306A

## CONFIGURING A G306A

The G306A is configured using Crimsons software Crimson is available as a free download from Red Lion's website, or it can be purchased on CD. Updates to Crimson for new features and drivers are posted on the website as they become available. By configuring the G306A using the latest version of Crimson, you are assured that your unit has the most up to date feature set. Crimson software can configure the G306A through the RS232 PGM port, USB port, or CompactFlash.
The USB port is connected using a standard USB cable with a Type B connector. The driver needed to use the USB port will be installed with Crinison.

The RS232 PGM pôrt uses a programming cable made by Red Lion to connect to the DB9 COM port of your computer. If you choose to make your own cable, use the "G306A Port Pin Out Diagram" for wiring information.

The CompactFlash can be used to prograri a G3 by placing a configuration file and firmware on the CompactFlash card: The card is then insented into the target G3 and powered. Refer to the Crimson literature for more information on the proper names and locations of the files.

## USB; DATA TRANSFERS FROM THE COMPACTFLASH CARD



WARNING - DO NOT CONNECT OR DISCONNECT CABLES WHILE POWER IS APPLIED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. USB PORT IS FOR SYSTEM SET-UP AND DIAGNOSTICS AND IS NOT INTENDED FOR PERMANENT CONNECTION.

In order to transfer data from the CompactFlash card via the USB port, a driver must be installed on your computer. Thẹs driver is installed with Crimson and is located in the folder C:UProgramin Files\Red Lion ControlsiCrimson 2.0Devicel after Crimson is installed. This may have already been accomplished if your G306A was configured using the USB port.

Orice the driver is installed, connect the G306A to your PC with a USB cable, and follow "Moumting the CompactFlash" instructions in the Crimson 2 user manual.

## CABLES AND DRIVERS

Red Lion has a wide range of cables and drivers for use with many different communication types. A list of these drivers and cables along with pin outs is available from Red Lion's website. New cables and drivers are added on a regular basis. If making your own cable, refer to the "G306A Port Pin Outs" for wiring information.

## ETHERNET COMMUNICATIONS

Ethermet communications can be established at either 10 BASE-T or 100 BASE-TX. The G306A uniti's RJ45 jack is wired as a NIC (Network Interface Card). For example, when wiring to a hub or switch use a straight-through cable, but when connecting to another NIC use a crossover cable.

The Ethermet connector contains two LEDs. A yellow LED in the upper right, and a bi-color green/amber LED in the upper left. The LEDs represent the following statuses:

| LED COLOR | DESCRIPTION |
| :--- | :--- |
| YELLOW. solid | Link established. $\cdots$ |
| YELLOW flashing | Data being.tranisferred. $\quad$. |
| GREEN | 10 BASE-T Communications |
| AMBER | 100 BASE-TX Communications |

On the rear of each unit is a unique 12-digit MAC address and a block for marking the unit with an IP address. Refer to the Crimson manual and Red Lion's website for additional information on Ethernet communications.

G306A PORT PIN OUTS


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## RS232 PORTS

The G306A has tivo RS232 ports. Țeere is the PGM port and the COMMS port. Although only one of these poris can be used for programming, both ports can be used for communications with a PLC.

The RS232 ports can be used for either master or slave protocols with any G306A configuration.

Examples of RS232 communications could involve another Red Lion product or a PC. By using a cable.with RJ12.ends on it, and a twist in the cable, RS232 communications with another G 3 product or the Modular. Controller can be established. Red Lion part numbers for cables with a twist in them are CBLPROG $0^{1}$, CBLRLCO $^{1}{ }^{2}$, or CBLRC02 ${ }^{3}$.

G3 RS232 to a PC

| ! | Connections |  |  |
| :---: | :---: | :---: | :---: |
| G3: RJ12 | Name | PC: DB9 | Name: |
| ¢ 4 | COMM | 1 i | ${ }^{\circ} \mathrm{C}$ CD |
| 5 | Tx | 2 | Rx |
| 2 | Rx | - 3 | Tx |
|  | N/C | 4 | DTR. |
| 3 | COM | 5: | GND |
|  | $\mathrm{N} / \mathrm{C}$ | 6 | DSR |
| 1 | CTS ${ }^{\text { }}$ | 7 | RTS |
| 6 | RTS | 8 | CTS |
|  | N/C | 9 | R! |

CONNECTING A G3OGA OPERATOR

${ }^{1}$ CBLPROG0 can also be used to communicate with either a PC or an ICM5
${ }^{2}$ DB9 adapter not included, I foot long.
${ }^{3}$ DB9 adapter not included, 10 feet long

G3 to Modular Controller (CBLRLC05)


## RS422/485 COMMS PORT

The G306A has one RS422/485 pori. This port can be configured to act as either RS422 or RS485.


Note: All Red Lion devices connect $A$ to $A$ and $B$ to $B$, except for Paradign devices. Refer to www redlion. net for additional information.

## DH485 COMMUNICATIONS

The G306A's RS422/485 COMMS port can also be used for Allen Bradley DH485 communications.

WARNING: DO NOT use a standard DH485 cable to connect this port to Allen Bradley equipment. A cable and wiring diagram are available from Red Lion.

Examples of RS485 2-Wire Connections G3 to Red Lion RJ11 (CBLRLC00) DLC, IAMS, ITMS, PAXCDC4C

|  | Connections : $:$ : |  | : : |
| :---: | :---: | :---: | :---: |
| G3: RJ45 | Name | $\therefore$ RLC: RJ11 | Name: |
| $\because 5$ | $\cdots$ TxEN $\because \cdot$ | $\because \quad \mathbf{2} \cdot \square$ | TxEN |
| $\therefore \quad 6 \ldots$. | COM.: | .. . 3 | $\therefore$ COM |
| $\cdots \quad 1 \cdots$ | TxB: | $\cdots \because 5$ | $\because$ $B-$ $\cdots$ $\cdots$ |
| .. 2 | $\therefore$ TxA $\because$ | $\therefore \quad 4$ | A+ :'Pagd |


| Connections |  |  |  |
| :---: | :---: | :---: | :---: |
| RJ45: RLC | Name | RJ45: A-B . | $\therefore$ Name $\cdot \therefore$ |
| 1. | TXXB | $\because 1 \quad \because$ | $\because \quad A \quad \because \quad \because$ |
| $\because 2$ | TxA | 2 $\quad \vdots$ | $\because B$ |
| $\ldots 3,8$ | RxA | $=: .$. | 24 V |
| 4,7 | RxB | $\because-\quad$. | COMM |
| 5 $\ldots$. | TXEN | $\because 5$ | $\cdots \quad$ TxEN $\cdot . . .$. |
| . 66 | COMM : | 4 . ${ }^{\text {. }}$ | $\because S H I E L D$ |
| 4,7 | TxB | $:^{-\cdots \cdots}$ | $\bigcirc \mathrm{COMM}$ |
| of 363 3. 8 | $\therefore$ TxA | $\ldots$. - : |  |

## Software/Unit Operation

## CRIMSON® SOFTWARE

Crimson software is available as a free download from Red Lion's website or it can be purchased on a CD, see "Ordering Information" for part number. The latest version of the software is always available from the website, and updating your copy is free.

## DISPLAY

This operator interface uses a liquid crystal display (LCD) for displaying text and graphics. The display utilizes aa LED backlight for lighting the display. The backlight can be dimmed for low light conditions:

The LED backlight has a limited lifelime, Backlight lifetime is based upon the amount of time the display is turned on at full intensity. Tuming the backlight. of ivhen the display is not in use can extend the lifetime of your backlight. This can be accoinplished through the Crimson ${ }^{3}$ software when configuring your unit.

## FRONT PANEL LEDS

There are three from panel LEDs. Shown below is the defaut status of the LEDs

| RED. |
| :--- | :--- | :--- | :--- |
| RED (TOP, LABELED "PWR') |

${ }^{1}$ The operaior interface is shipped without in conliguration. Alter downlozding a configuration, if the light semains in the flashing stite continuously, try cycling power. If the LED still continues to fash, iry downtoading a configuration again.
? Do not turn off power to the unit while this light is flickering. The unit writes dala in two minute intervals. Later Microsolt operating systems will not lock the drive unless they need to write data; Windows 98 may lock the drive any time it is mounted, thereby interfering with logging Refer to "Mounting the CompactFlash". in the Crimion? ? User Manual:

## TOUCHSCREEN

This operator interface utilizes a resistive analog touchscreen for user inpul. The unit will only produce an audible tone (beep) when a touch: on an active touchscreen cell is sensed. The touchscreen is fully functional as soon as the operator interface is initialized, and can be operated with gloved hands.

## KEYPAD

The G306A keypad consists of five keys that can be used for on-screen menus

## TROUBLESHOOTING YOUR G306A

If for any reason you have trouble operating, connecting, or simply have questions concerning your new G306A, contact Red Lion's technical support. For contact information, refer to the back page of this bulletin for phone and fax numbers.

EMAIL: techsuppongredlionnet
Web Site: hta:/hwiviredlioninet

## BATTERY \& TIME KEEPING



WARNING - EXPLOSION HAZARD - THE AREA MUST BE KNOWN TO BE NON-HAZARDOUS BEFORE SERVICING/. REPLACING THE UNIT AND BEFORE INSTALLING OR REMOVING I/O WIRING AND BATTERY.


WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HȦS BEEN DISCONNECTED AND THE AREA IS KNOWN TO BE NON-HAZARDOUS.

A battery is used to keep time when the unit is without power. Typical accuracy of the G306A time keeping is less than one miniute per month drift. The battery of a G306A'unit does not affect the unit's memory, all configurations and data is stored in non-volatile memiory.


CAUTION: The circuit board contains static sensitive components. Before handling the operator interface without the rear cover attached, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the operator interface at a static controlled clean workstation. Also, do not touch the surface areas of the circuit board. Dit, oil, or other contaminants may adversely affect circuit operation.

To change the battery of a G306A, remove poiver, cabling, and then the rear cover of the unit. To remove the cover, remove the four screws designated by the arrows on the rear of the unit. Then, by lifting the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of the PCB as shown in the illustration below. Install in the reverse manner.


Remove the old battery* from the holder and replace with the new battery. Replace the rear cover, cables, and re-apply power. Using Crimson or the unit's keypad, enter the correct time and date.

- Please nore that the old battery must be disposed of in a manner that complies will your local waste regulations. Also, the battery must not be disposed of in fire, or in a mauner whereby it may be damaged and its contents come into contact with human skin.

The battery used by the G306A is a lithium tope CR2025.


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## Optional Features and Accessories

## OPTIONAL COMMUNICATION CARD

Red Lion offers optional communication ceards for fieldbus communications. These communication cards will allow your G306A to communcate with many of the popular fieldbus protocols.

Red Lion is also offering a communications card for additional RS232 and RS422/485 communications. Visit Red Lion's ivebsite for information and availability of these cards.

## CUSTOM LOGO

Each G3 operator interface has an embossed area containing the Red Lion logo. Red Lion can provide custom logos to apply to this area: Contact your distributor for additional information and pricing.


## COMPACTFLASH SOCKET

CompactFlash socket is a Type !l socket that cạn accept eithei Type I or II cards. Use cards with a minimumim of 4 Mbytes aṇd formatted to a maximum of 2 Gbytes (See Note box below) with the G306A's CompactFlash socket. Cards are available at most computer and office supply retailers.
CompaciFlash can be used for configuration transfers, larger configurations, data logging, and trending.
 CompactFlash card while power is applied. Refer to "Front Panel LEDs."

Information stored on a CompactFlash card by a G306A can be read by a card reader attached to a PC. This information is stored in IBM (Windows ${ }^{(6)}$ ) PC compatible FATI6 file format.

## NOTE

For reliable operation of this and other Red Lion products, one of the following brands of CompactFlaslı card must be used

| SimpleTech | SMART象 ${ }^{\text {s/ }}$ Modular |
| :--- | :--- |
| SanDisk | Silicon Systems |

Not all of the above manufacturers offer CompactFlash cards recognized to UL standards, which may be required for your application.
Although RLC products limit use of CompactFlash card memory to 2 GB. cards with a laiger capacioy can be used. They MUST be formatted to 2 $G B$ and use the FAT 16 file system it is recommended to format the $C F$ card ising the format utility from within Crimson.

Red Lion Controls
Headqụarters
20. Willow Springés Circle

York PA 17406
Tel +1 (717) $767-6511$ Fax-1:(717) 764-0839

Red Lion Controls
Europe
Printerweg 10 NL -:3821 AD Amersfoort Tel +31 (0) 334723225 Fax +31 (0) 334893793

## LIMITED WARRANTY

The Company:warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the prodicts have been stored, handled, installed, and used under proper conditions. The Company's liability wider this limited warranty shall extend only to the repair or replacennent of a defective product, at The Company's option. The Company disclaims all liability for any affimation, promise or representation with respect to the products.
The customer agrees to hold Red Lion Controls hamuless from, defend, and indeunify $\operatorname{RLC}$ against danages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer; its enoployees, or sub-contractors are or may be to any extent liable, including without limitation peralties ionposed by the Cousumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.
No warranties expressed or implied are created with respect to The Company's products except those expressly contmined herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations:


## RZ7 Standard, Economy and EX

Full Featured
Functionality

Easy to Use \& Install

DIN Rail or Panel Mountable

## Hazardous Location Models

RZ7-FS High-Performance Model

## Multiple Voltage Ranges

Standard supply voltage ranges from 24...48V DC \& 24...240V AC.

## Functional Choices

Single, Multi- or Special Function models address most industrial timing needs.

## Adjustable Timing Ranges from 0.5 s up to 60 hours

Adjustment dial for 0 to $100 \%$ of timing adjustment range on both models means less inventory to stock.

## LED Output indicator

Both FS and FE models have LED indicators for output status conditions.

## Multiple Mounting Options

The RZ7 are surface or DIN -Rail mountable for easy installation.

## Special Hazardous Location Models Available

The RZ7-FS_EX models are approved for use in hazardous location areas such as in the oil \& gas industries.

- UL Class 1, Div. 2, Groups A,B,C,D

UL. Class $1, \mathrm{Zn} 2$, Group IIC

- Ex\| $\|$ G, Ex nL IIC T4 2A 32VDC max. Ta $70^{\circ} \mathrm{C}$
- cUlls E317176


Solid State Accuracy \& Reliability
Solid state electronics and microprocessor control means accuracy within $0.2 \%$ for FS , and $0.1 \%$ for FE models.

One Tool Installation
Same size screw driver installs and adjusts functions and timing ranges. No need for multiple tools.

## Safety \& Convenience Features

- IP40 finger \& hand protection
- Open, captive terminals for fast connections
- All functions accessible from front of unit
- Open screw terminals with dual chamber system for control wires


## Standard Model Approvals

- cULLs E14840
- CE Marked

RZ7-FE Economy Model

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## RZ7 Adjustable Electronic Timing Relays



Dims／Mounting $78.8 \times 22.5 \times 101 \mathrm{~mm}$ DIN or Panel

| Outputs |
| ---: |
| 2 normally open contacts（1 side common） |
| 1 single pole double contacts |
| 2 2 single pole double contacts |
| Functions |
| ON－DELAY |


| RZ7－FS |  |  |  |  |  |  |  |  |  |  |  |  |  |  | R27－FE |  |  |  |  |  |  |  |
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## Functional，Reliable Timing Relays

Sprecher＋Schuh＇s RZ7 Series of electronic timing relays offer a multitude popular output functions in a versatile，compact package．This series is especially designed for applications where a high quality timing relay is required．Timing formats include ON－delay，OFF－delay，Wye－Delta and many other choices．All models are easily installed and adjusted for set and forget it usability．

Contact your local Sprecher＋Schuh representative for more details．

[^6]－Multi－functiqs age $\boldsymbol{B}_{1}(65)$ off） 363

## sprecher+

$\begin{array}{r}\text { Technical Information } \\ \hline \text { CA7 3-Pole Contactors }\end{array}$

Electrical Data


Switching Motor Loads

| Standard IEC Ratings |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AG-2, AG-3, AG-4 | 230 V | [A] | 12 | 15 | 20 | 26.5 | 35 | 38 | 44 | 62 | 72 | 85 |
| DOL Reversing | 240 V | [ ${ }^{\text {] }}$ | 12 | 15 | 20 | 26.5 | 35 | 38 | 44 | 62 | 72 | 85 |
| $50 \mathrm{~Hz} / 60^{\circ} \mathrm{C}$ | 400 V | [ A$]$ | 9 | 12 | 16 | 23 | 30 | 37 | 43 | 60 | 72 | 85 |
|  | 415 V | [ A ] | 9 | 12 | 16 | 23 | 30 | 37 | 43 | 60 | 72 | 85 |
|  | 500 V | [ A ] | 7 | 10 | 14 | 20 | 25 | 30 | 38 | 55 | 67 | 80 |
|  | 690 V | [ A ] | 5 | 7 | 9 | 12 | 18 | 21 | 25 | 34 | 42 | 49 |
|  | 230 V | [kW] | 3 | 4 | 5.5 | 7.5 | 10 | 11 | 13 | 18.5 | 22 | 25 |
|  | 240 V | [kW] | 3 | 4 | 5.5 | 7.5 | 10 | 11 | 13 | 18.5 | 22 | 25 |
|  | 400 V | [ KW ] | 4 | 5.5 | 7.5 | 11 | 15 | 18.5 | 22 | 32 | 40 | 45 |
|  | 415 V | [ KW ] | 4 | 5.5 | 7.5 | 11 | 15 | 20 | 22 | 32 | 40 | 45 |
|  | 500 V | [kW] | 4 | 5.5 | 7.5 | 13 | 15 | 20 | 25 | 37 | 45 | 55 |
|  | 690 V | [ KW ] | 4 | 5.5 | 7.5 | 10 | 15 | 18.5 | 22 | 32 | 40 | 45 |
| UL/CSA/IEC |  |  |  |  |  |  |  |  |  |  |  |  |
| DOL Reversing | 115V | [A] | 9.8 | 9.8 | 16 | 24 | 24 | 34 | 34 | 56 | 56 | 80 |
| $60 \mathrm{~Hz} / 60^{\circ} \mathrm{C}$ | 230 V | [ A ] | 10 | 12 | 17 | 17 | 28 | 28 | 40 | 50 | 68 | 68 |
|  | 115 V | [HP] | 1/2 | 1/2 | 1 | 2 | 2 | 3 | 3 | 5 | 5 | 7-1/2 |
|  | 230 V | [ HP ] | $11 / 2$ | 2 | 3 | 3 | 5 | 5 | 7-1/2 | 10 | 15 | 15 |
|  | 200 V | [A] | 7.8 | 11 | 17.5 | 17.5 | 25.3 | 32.2 | 32.2 | 48.3 | 62.1 | 78.2 |
|  | 230 V | [ A ] | 6.8 | 9.6 | 15.2 | 22 | 28 | 28 | 42 | 54 | 68 | 80 |
|  | 460 V | [ A ] | 7.6 | 11 | 14 | 21 | 27 | 34 | 40 | 52 | 65 | 77 |
|  | 575 V | [A] | 9 | 11 | 17 | 17 | 27 | 32 | 32 | 52 | 62 | 62 |
|  | 200 V | [ $\mathrm{HP]}$ | 2 | 3 | 5 | 5 | 7-1/2 | 10 | 10 | 15 | 20 | 25 |
|  | 230 V | [ HP ] | 2 | 3 | 5 | 7-1/2 | 10 | 10 | 15 | 20 | 25 | 30 |
|  | 460 V | [MP] | 5 | 7-1/2 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 60 |
|  | 575 V | [ HP ] | 7-1/2 | 10 | 15 | 15 | 25 | 30 | 30 | 50 | 60 | 60 |
| Maximum Operating Rate (at max. amps) | AC2 | [0ps/hr] | 450 | 450 | 450 | 400 | 400 | 400 | 400 | 300 | 250 | 200 |
|  | AC3 | [ $\mathrm{ops} / \mathrm{hr}$ ] | 700 | 700 | 700 | 600 | 600 | 600 | 600 | 500 | 500 | 500 |
|  | AC4 | [ $\mathrm{ops} / \mathrm{hr}$ ] | 200 | 150 | 120 | 80 | 80 | 70 | 70 | 70 | 60 | 50 |

Technical Information

## Electrical Data

CA7-9 CA7-12 CA7-16 CA7-23 CA7-30 CA7-37 CA7-43 CA7-60 CA7-72 CA7-85

Switching Motor Loads (continued)

| AC-4 | 230 V | (N) | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 200,000 Op. Cycles | 240 V | [ ${ }^{(1)}$ | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
| 50 Hz | 400 V | [ ${ }^{\text {d }}$ | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 415 V | [ $A$ ] | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 500 V | [ 1 | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 690 V | (A) | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 230 V | [ $W$ W] | 0.75 | 1.5 | 2.2 | 2.2 | 3 | 3.7 | 4 | 6.3 | 7.5 | 11 |
|  | 240 V | [ NW ] | 0.75 | 1.5 | 2.2 | 2.2 | 3 | 4 | 4 | 7.5 | 7.5 | 11 |
|  | 400 V | [ WW] | 1.8 | 3 | 4 | 4 | 5.5 | 6.3 | 7.5 | 13 | 15 | 20 |
|  | 415 V | [ WW] | 1.8 | 3 | 4 | 4 | 5.5 | 6.3 | 7.5 | 13 | 17 | 20 |
|  | 500 V | [ WW$]$ | 2.2 | 3.7 | 5.5 | 5.5 | 7.5 | 7.5 | 10 | 15 | 20 | 25 |
|  | 690 V | [ WW$]$ | 3 | 5.5 | 7.5 | 7.5 | 10 | 11 | 15 | 22 | 25 | 32 |
| 60 Hz | 115 V | (A) | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 230 V | [ ${ }^{1}$ | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 115 V | MP] | 1/8 | 1/4 | 1/3 | 1/2 | 1/2 | $3 / 4$ | 1 | 2 | 2 | 3 |
|  | 230 V | [ MP] | $1 / 3$ | 1/2 | 1 | 1-1/2 | 2 | 2 | 2 | 3 | 5 | 5 |
|  | 200 V | (A) | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 230 V | (N) | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 460 N | [ 4 | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 575 V | [ 1 ] | 4.3 | 6.6 | 9 | 10 | 12 | 14 | 16.5 | 25.5 | 31 | 38 |
|  | 200 V | [MP] | $3 / 4$ | 1 | 2 | 2 | 3 | 3 | 3 | 7-1/2 | 7-1/2 | 10 |
|  | 230 V | [ P P] | 1 | 1-1/2 | 2 | 3 | 3 | 3 | 5 | 7-1/2 | 10 | 10 |
|  | 460 V | MPI | 2 | 3 | 5 | 5 | 7-1/2 | 10 | 10 | 15 | 20 | 25 |
|  | 575 V | MP] | 3 | 5 | 7-1/2 | 7-1/2 | 10 | 10 | 10 | 20 | 25 | 30 |
| Maximum Operating Pate |  |  | 250 | 250 | 220 | 200 | 200 | 200 | 200 | 120 | 120 | 120 |
| Wye-Delta (Star Delta) | 230 V | [ WW] | 5.5 | 7.5 | 10 | 13 | 17 | 20 | 22 | 32 | 37 | 45 |
| 50 Hz | 240 V | [0W] | 5.5 | 7.5 | 10 | 13 | 18.5 | 20 | 22 | 32 | 40 | 50 |
|  | 400 V | [ $\mathrm{W} \mid$ | 7.5 | 10 | 13 | 20 | 25 | 32 | 40 | 55 | 63 | 80 |
|  | 415 V | [ WM | 7.5 | 11 | 15 | 22 | 25 | 37 | 40 | 55 | 63 | 80 |
|  | 500 V | [ WW | 7.5 | 11 | 15 | 22 | 25 | 32 | 45 | 63 | 80 | 90 |
|  | 690V | [ WW] | 7.5 | 10 | 13 | 18.5 | 25 | 32 | 40 | 55 | 63 | 80 |
|  | 200 V | MPI | 5 | 5 | 7-1/2 | 7-1/2 | 10 | 15 | 20 | 30 | 40 | 50 |
| 60 Hz | 230 V | MP] | 5 | 7-1/2 | 10 | 10 | 15 | 20 | 25 | 40 | 50 | 60 |
|  | 460 V | MP1 | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 75 | 100 | 125 |
|  | 575V | MP] | 10 | 15 | 20 | 25 | 30 | 40 | 50 | 75 | 100 | 125 |

AC Elevator Control Ratings

| UL/ CSA | Max FLC | $[A]$ | 8.0 | 11.0 | 16.0 | 21.0 | 27.0 | 31.0 | 37.0 | 43.0 | 54.0 |
| :--- | :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 500,000 operations | 200N | $[A]$ | 7.8 | 11.0 | 11.0 | 17.5 | 25.3 | 25.3 | 32.2 | 32.2 | 48.3 |
|  | 230 V | $[\mathcal{A}]$ | 6.8 | 9.6 | 15.2 | 15.2 | 22.0 | 28.0 | 28.0 | 42.0 | 54.0 |
|  | 460 V | $[\mathcal{A}]$ | 7.6 | 11.0 | 14.0 | 21.0 | 27.0 | 27.0 | 34.0 | 40.0 | 52.0 |
|  | 575 V | $[A]$ | 6.1 | 9.0 | 11.0 | 17.0 | 22.0 | 27.0 | 32.0 | 41.0 | 52.0 |
|  | 200 V | $[\mathrm{MP}]$ | 2 | 3 | 3 | 5 | $7-1 / 2$ | $7-1 / 2$ | 10 | 10 | 15 |

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sprecher +
Technical Information
CA7 3-Pole Contactors

Electrical Data

|  |  |  | CA7-9 | CA7-12 | CA7-16 | CA7-23 | CA7-30 | CA7-37 | CA7-43 | CA7-60 | CA7-72 | CA7-85 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| AC-1 Load, 30 switching Amblent Temperature $40^{\circ} \mathrm{C}$ | $b$ | [A] | 32 | 32 | 32 | 32 | 65 | 65 | 85 | 100 | 100 | 100 |
|  | 230 N | [WW] | 13 | 13 | 13 | 13 | 26 | 26 | 34 | 40 | 40 | 40 |
|  | 240 V | [1W] | 13 | 13 | 13 | 13 | 27 | 27 | 35 | 42 | 42 | 42 |
|  | 400 V | (1)W | 22 | 22 | 22 | 22 | 45 | 45 | 59 | 69 | 69 | 69 |
|  | 415 V | [1W] | 23 | 23 | 23 | 23 | 47 | 47 | 61 | 72 | 72 | $72$ |
|  | 500 V | [WW] | 28 | 28 | 28 | 28 | 56 | 56 | 74 | 87 | 87 | 87 |
|  | 690 V | (1)W | 38 | 38 | 38 | 38 | 78 | 78 | 102 | 120 | 120 | 120 |
| Anblent Temperature $60^{\circ} \mathrm{C}$ | $6$ | [ ${ }^{\text {] }}$ | 32 | 32 | 32 | 32 | 65 | 65 | 80 | 100 | 100 | 100 |
|  | $230 \mathrm{~V}$ | $[\mathrm{WW}]$ | 13 | 13 | 13 | 13 | 26 | 26 | 32 | 40 | 40 | $40$ |
|  | 240 V | [1W] | 13 | 13 | 13 | 13 | 27 | 27 | 33 | 42 | 42 | 42 |
|  | 400 V | [1W] | 22 | 22 | 22 | 22 | 45 | 45 | 55 | 69 | 69 | 69 |
|  | 415 V | [ WW$]$ | 23 | 23 | 23 | 23 | 47 | 47 | 57 | 72 | 72 | 72 |
|  | 500 V | [ WW] | 28 | 28 | 28 | 28 | 56 | 56 | 69 | 87 | 87 | 87 |
|  | 690 V | (WW] | 38 | 38 | 38 | 38 | 78 | 78 | 95 | 120 | 120 | 120 |
| Maximum Operating Rate |  |  | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 300 | 600 | 600 | 600 |
| Continuous Current (UL/CSA) |  |  |  |  |  |  |  |  |  |  |  |  |
| General Purpose Rating ( $40^{\circ}$ ) | Open | (1) | 25 | 25 | 30 | 30 | 45 | 55 | 60 | 90 | 90 | 100 |
|  | Enclosed | (A) | 25 | 25 | 30 | 30 | 55 | 60 | 75 | 90 | 90 | 100 |
| Maximum Operating Aate |  |  | 1,400 | 1,400 | 1,200 | 1,200 | 1,200 | 1,000 | 1000 | 700 | 700 | 600 |
| Lighting Loads 0 mill |  |  |  |  |  |  |  |  |  |  |  |  |
| Elec.Dischrg.Lamps-AC-5a, single compensated | Open Enclosed | $[\mathrm{A}]$ $\text { [ } A$ | $\begin{aligned} & 22.5 \\ & 22.5 \\ & \hline \end{aligned}$ | $\begin{aligned} & 25 \\ & 25 \end{aligned}$ | $\begin{aligned} & 28 \\ & 28 \\ & \hline \end{aligned}$ | $\begin{aligned} & 29 \\ & 29 \\ & \hline \end{aligned}$ | $40.5$ | $\begin{array}{r} 45 \\ 41 \\ \hline \end{array}$ | $\begin{aligned} & 77 \\ & 57 \end{aligned}$ | $\begin{aligned} & 81 \\ & 57 \end{aligned}$ | $\begin{aligned} & 85 \\ & 81 \end{aligned}$ | $\begin{aligned} & 90 \\ & 90 \end{aligned}$ |
| Max. capacitance at prospective short circult current available at the contactor Incandescent Lamps - AC -5b | 10 kA 20 kA <br> 50 kA |  | 1,000 500 200 | $\begin{gathered} 1,000 \\ 500 \\ 200 \\ \hline \end{gathered}$ | $\begin{gathered} 1,000 \\ 500 \\ 200 \\ \hline \end{gathered}$ | $\begin{gathered} 1,000 \\ 500 \\ 200 \\ \hline \end{gathered}$ | $\begin{aligned} & 2,700 \\ & 1,350 \\ & 540 \\ & \hline \end{aligned}$ | $\begin{gathered} 2,700 \\ 1,350 \\ 540 \\ \hline \end{gathered}$ | $\begin{aligned} & 3,200 \\ & 1,600 \\ & 640 \\ & \hline \end{aligned}$ | $\begin{gathered} 4,000 \\ 2,000 \\ 800 \\ \hline \end{gathered}$ | $\begin{gathered} 4,000 \\ 2,000 \\ 800 \end{gathered}$ | $\begin{gathered} 4,700 \\ 2,350 \\ 940 \end{gathered}$ |
| Electrical endurance - 100,000 operations |  | [ 4 | 12 | 16 | 18 | 22 | 30 | 37 | 43 | 60 | 70 | 76 |
| 8witching power transformers AC-6a <br> 50Hz |  |  |  |  |  |  |  |  |  |  |  |  |
| Rated transformer current |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | (A) | 10.9 | 10.9 | 10.9 | 10.9 | 20 | 20 | 23 | 40.8 | 40.8 | 40.8 |
| $n=30$ | 230 VAC | [ (NW] | 4.3 | 4.3 | 4.3 | 4.3 | 8 | 8 | 8.2 | 16 | 16 | 16 |
|  | 240 VAC | [NWN | 4.5 | 4.5 | 4.5 | 4.5 | 8.3 | 8.3 | 10 | 17 | 17 | 17 |
|  | 400 VAC | [ (NA] | 7.5 | 7.5 | 7.5 | 7.5 | 14 | 14 | 16 | 28 | 28 | 28 |
|  | 415 VAC | [ NW ] | 7.8 | 7.8 | 7.8 | 7.8 | 14 | 14 | 17 | 29 | 29 | 29 |
|  | 500 VAC | [NWN | 9.4 | 9.4 | 9.4 | 9.4 | 17 | 17 | 20 | 35 | 35 | 35 |
|  | 690 VAC | [10A] | 13 | 13 | 13 | 13 | 24 | 24 | 27 | 49 | 49 | 49 |
| $n=20$ |  | (A) | 16.3 | 16.3 | 16.3 | 16.3 | 30 | 30 | 34.5 | 61.3 | 61.3 | 61.3 |
|  | 230 VAC | [ [VN] | 6.5 | 6.5 | 6.5 | 6.5 | 12 | 12 | 13.7 | 24.4 | 24.4 | 24.4 |
|  | 240 VAC | [NA | 6.8 | 6.8 | 6.8 | 6.8 | 12.5 | 12.5 | 14.3 | 25.5 | 25.5 | 25.5 |
|  | 400 VAC | (INA) | 11.3 | 11.3 | 11.3 | 11.3 | 20.8 | 20.8 | 23.9 | 42.5 | 42.5 | 42.5 |
|  | 415 VAC | [ WNA] | 11.7 | 11.7 | 11.7 | 11.7 | 21.6 | 21.6 | 24.8 | 44.1 | 44.1 | 44.1 |
|  | 500 VAC | [WN | 14.1 | 14.1 | 14.1 | 14.1 | 26 | 26 | 29.9 | 53.1 | 53.1 | 53.1 |
|  | 690 VAC | (1VA) | 19.5 | 19.5 | 19.5 | 19.5 | 35.9 | 35.9 | 41.2 | 73.3 | 73.3 | 73.3 |
| $\mathrm{n}=15$ |  | [ A ] | 22 | 22 | 22 | 22 | 40 | 40 | 46 | 82 | 82 | 82 |
|  | 230 VAC | [NW | 2.3 | 2.3 | 2.3 | 2.3 | 4.3 | 4.3 | 5.0 | 8.8 | 8.8 | 8.8 |
|  | 240 VAC | [ [VNA] | 2.4 | 2.4 | 2.4 | 2.4 | 4.5 | 4.5 | 5.2 | 9.2 | 9.2 | 9.2 |
|  | 400 VAC | [ WNW] | 4.1 | 4.1 | 4.1 | 4.1 | 7.5 | 7.5 | 8.6 | 15.3 | 15.3 | 15.3 |
|  | 415 VAC | [1NA | 4.2 | 4.2 | 4.2 | 4.2 | 7.8 | 7.8 | 8.9 | 15.9 | 15.9 | 15.9 |
|  | 500 VAC | [ 1 N/ ${ }^{\text {a }}$ | 5.1 | 5.1 | 5.1 | 5.1 | 9.4 | 9.4 | 10.8 | 18.1 | 19.1 | 19.1 |
|  | 690 VAC | [1VA | 7.0 | 7.0 | 7.0 | 7.0 | 12.9 | 12.9 | 14.9 | 26.4 | 26.4 | 26.4 |

- CA7 ratings for lighting loads are provided for technical reference. For dulRatge 168 of 363
and labeled devices, see CAL7 contactors listed in this section.

Technical Information

## Electrical Data

CA7-9 CA7-12 CA7-16 CA7-23 CA7-30 CA7-37 CA7-43 CA7-60 CA7-72 CA7-85

| Switching power transformers AC-6a |  |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Inrush | = n |  |  |  |  |  |  |  |  |  |  |  |
| Rated transtormer current |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | [A] | 10.9 | 10.9 | 10.9 | 10.9 | 20 | 20 | 23 | 40.8 | 40.8 | 40.8 |
| $n=30$ | 200 VAC | [KVA] | 3.8 | 3.8 | 3.8 | 3.8 | 6.9 | 6.9 | 8.0 | 14.1 | 14.1 | 14.1 |
|  | 208 VAC | [KVA] | 3.9 | 3.9 | 3.9 | 3.9 | 7.2 | 7.2 | 8.3 | 14.7 | 14.7 | 14.7 |
|  | 240 VAC | [kVA] | 4.5 | 4.5 | 4.5 | 4.5 | 8.3 | 8.3 | 9.6 | 17 | 17 | 17 |
|  | 480 VAC | [ [KVA] | 9.1 | 9.1 | 9.1 | 9.1 | 16.6 | 16.6 | 19.1 | 33.9 | 33.9 | 33.9 |
|  | 600 VAC | [KVA] | 11.3 | 11.3 | 11.3 | 11.3 | 20.8 | 20.8 | 23.9 | 42.4 | 42.4 | 42.4 |
|  | 660 VAC | [KVA] | 12.5 | 12.5 | 12.5 | 12.5 | 22.9 | 22.9 | 26.3 | 46.6 | 46.6 | 46.6 |
|  |  | [ A ] | 16.3 | 16.3 | 16.3 | 16.3 | 30 | 30 | 34.5 | 61.3 | 61.3 | 61.3 |
| $\mathrm{n}=20$ | 200 VAC | [kVA] | 5.6 | 5.6 | 5.6 | 5.6 | 10.4 | 10.4 | 12 | 21.2 | 21.2 | 21.2 |
|  | 208 VAC | [KVA] | 5.9 | 5.9 | 5.9 | 5.9 | 10.8 | 10.8 | 12.4 | 22.1 | 22.1 | 22.1 |
|  | 240 VAC | [ KVA ] | 6.8 | 6.8 | 6.8 | 6.8 | 12.5 | 12.5 | 14.3 | 25.5 | 25.5 | 25.5 |
|  | 480 VAC | [kVA] | 13.6 | 13.6 | 13.6 | 13.6 | 24.9 | 24.9 | 28.7 | 51 | 51 | 51 |
|  | 600 VAC | [KVA] | 16.9 | 16.9 | 16.9 | 16.9 | 31.2 | 31.2 | 35.9 | 63.7 | 63.7 | 63.7 |
|  | 660 VAC | [ WVA | 18.6 | 18.6 | 18.6 | 18.6 | 34.3 | 34.3 | 39.4 | 70.1 | 70.1 | 70.1 |
|  |  | [ A$]$ | 22 | 22 | 22 | 22 | 40 | 40 | 46 | 82 | 82 | 82 |
| $\mathrm{n}=15$ | 200 VAC | [ NVA ] | 7.5 | 7.5 | 7.5 | 7.5 | 13.9 | 13.9 | 15.9 | 28.4 | 28.4 | 28.4 |
|  | 208 VAC | [ [VVA] | 7.8 | 7.8 | 7.8 | 7.8 | 14.4 | 14.4 | 16.6 | 29.5 | 29.5 | 29.5 |
|  | 240 VAC | [KVA] | 9 | 9 | 9 | 9 | 16.6 | 16.6 | 19.1 | 34.1 | 34.1 | 34.1 |
|  | 480 VAC | [ KVA ] | 18.1 | 18.1 | 18.1 | 18.1 | 33.3 | 33.3 | 38.2 | 68.2 | 68.2 | 68.2 |
|  | 600 VAC | [KVA] | 22.6 | 22.6 | 22.6 | 22.6 | 41.6 | 41.6 | 47.8 | 85.2 | 85.2 | 85.2 |
|  | 660 VAC | [KVA] | 24.9 | 24.9 | 24.9 | 24.9 | 45.7 | 45.7 | 52.6 | 93.7 | 93.7 | 93.7 |
| DC-1 Switching - $60{ }^{\circ} \mathrm{C}$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 24VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
|  | 48VDC | (A] | 20 | 20 | 20 | 20 | 25 | 25 | 30 | 40 | 40 | 40 |
| 1 Pole | 60VDC | [ A ] | 20 | 20 | 20 | 20 | 25 | 25 | 30 | 40 | 40 | 40 |
|  | 110VDC | [A] | 6 | 6 | 6 | 6 | 8 | 8 | 9 | 11 | 11 | 11 |
|  | 220VDC | [ ${ }^{\text {a }}$ | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 2 | 2 | 2 |
|  | 440VDC | [ A$]$ | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 |
|  | 24VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
|  | 48VDC | [ A ] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
| 2 Poles in Series | 60VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
|  | 110VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
|  | 220VDC | [A] | 8 | 8 | 8 | 8 | 10 | 10 | 10 | 15 | 15 | 15 |
|  | 440VDC | [A] | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.5 | 1.5 | 1.5 |
|  | 24VDC | [ ${ }^{\text {a }}$ | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
|  | 48VDC | [ $A$ ] | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
| 3 Poles in Series | 60VDC | [ ${ }^{\text {] }}$ | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
|  | 110VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
|  | 220VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 80 | 80 |
|  | 440VDC | [A] | 3 | 3 | 3 | 3 | 3.5 | 3.5 | 4 | 5 | 5 | 5 |
| DC-2, 3, 5 Switching - $60{ }^{\circ} \mathrm{C}$ |  |  |  |  |  |  |  |  |  |  |  |  |
| Starting, reverse current braking, reversing, DC-5, $60^{\circ} \mathrm{C}$ | 24VDC | [ A ] | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
|  | 48VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 70 | 80 |
|  | 60VDC | [A] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 70 | 80 |
| Shunt Wound | 110VDC | [A] | 20 | 20 | 25 | 25 | 30 | 30 | 35 | 70 | 70 | 80 |
| 3 Poles in Series | 220VDC | [ ${ }^{\text {a }}$ | 6 | 6 | 6 | 10 | 15 | 15 | 20 | 25 | 25 | 30 |
|  |  |  |  | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |
| 3 Poles in Series | 24VDC | [ A ] | 25 | 25 | 32 | 32 | 45 | 45 | 63 | 90 | 90 | 100 |
|  | 48VDC | [ A ] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 70 | 80 |
|  | 60VDC | [ A ] | 25 | 25 | 32 | 32 | 45 | 45 | 50 | 70 | 70 | 80 |
|  | 110VDC | [ ${ }^{\text {a }}$ | 20 | 20 | 25 | 25 | 30 | 30 | 35 | 70 | 70 | 80 |
|  | 220VDC | [A] | 6 | 6 |  | e1689 | $3{ }^{6} 3$ | 15 | 20 | 25 | 25 | 30 |
|  | 440VDC | [A] | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 |

Electrical Data

|  |  |  | CA7-9 | CA7-12 | CA7-16 | CA7-23 | CA7-30 | CA7-37 | CA7-43 | CA7-60 | CA7-72 | CA7-85 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Capacitor Ratings (1) |  |  |  |  |  |  |  |  |  |  |  |  |
| Capacitor Switching AG-6b-50 Hz |  |  |  |  |  |  |  |  |  |  |  |  |
| Single Capacitor - $40^{\circ} \mathrm{C}$ | 230 V | [ WVar ] | 8 | 8 | 8.5 | 9 | 14 | 14 | 24 | 28 | 28 | 28 |
|  | 240 V | [ [-Var] | 8 | 8 | 8.5 | 9 | 14 | 14 | 25 | 29 | 29 | 29 |
|  | 400 V | [ KVar ] | 8 | 8 | 10 | 12.5 | 20 | 24 | 35 | 48 | 48 | 48 |
|  | 415 V | [ $\mathrm{WVar]}$ | 8 | 8 | 10 | 12.5 | 20 | 25 | 35 | 50 | 50 | 50 |
|  | 500 V | [ KVar ] | 8 | 8 | 10 | 12.5 | 20 | 25 | 35 | 50 | 55 | 60 |
|  | 690 V | [ War$]$ | 8 | 8 | 10 | 12.5 | 20 | 25 | 35 | 50 | 55 | 60 |
| Single Capacitor - $60^{\circ} \mathrm{C}$ | 230 V | [ WVar ] | 8 | 8 | 8.5 | 9 | 12.5 | 12.5 | 18 | 28 | 28 | 28 |
|  | 240 V | [ kVar ] | 8 | 8 | 8.5 | 9 | 12.5 | 12.5 | 18 | 29 | 29 | 29 |
|  | 400 V | [ $\mathrm{WVar]}$ | 8 | 8 | 10 | 12.5 | 20 | 21.5 | 30 | 42 | 48 | 48 |
|  | 415 V | [ $\mathrm{kVar]}$ | 8 | 8 | 10 | 12.5 | 20 | 22 | 30 | 42 | 50 | 50 |
|  | 500 V | [ [-Var] | 8 | 8 | 10 | 12.5 | 20 | 25 | 30 | 42 | 50 | 55 |
|  | 690 V | [ $\mathrm{KVar]}$ | 8 | 8 | 10 | 12.5 | 20 | 25 | 30 | 42 | 50 | 55 |
| Capacitor Bank $-40^{\circ} \mathrm{C}$ (2) | 230 V | [ $\mathrm{KVar]}$ | 5 | 5 | 8 | 9 | 12.5 | 14 | 20 | 28 | 28 | 28 |
|  | 240 V | [ WVar ] | 5 | 5 | 8 | 9 | 12.5 | 14 | 20 | 29 | 29 | 29 |
|  | 400 V | [ [-Var] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 48 | 48 |
|  | 415 V | [ W Var] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
|  | 500 V | [ $\mathrm{WVar]}$ | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
|  | 690 V | [120ar | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
| Capacitor Bank $-60^{\circ} \mathrm{C}$ ( | 230 V | [ WVar ] | 5 | 5 | 8 | 9 | 12.5 | 12.5 | 18 | 28 | 28 | 28 |
|  | 240 V | [ $\mathrm{WVar]}$ | 5 | 5 | 8 | 9 | 12.5 | 12.5 | 18 | 29 | 29 | 29 |
|  | 400 V | [ WVar ] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 48 | 48 |
|  | 415 V | [ WVar ] | 5 | 5 | 8 | 10 | $15$ | $20$ | 25 | 40 | 50 | 50 |
|  | 500 V | [ Wara ] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
|  | 690 V | [ VNar$]^{\text {a }}$ | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
| Capacitor Switching - 60Hz |  |  |  |  |  |  |  |  |  |  |  |  |
| Single Capacitor - $40^{\circ} \mathrm{C}$ | 200 V | [ $\mathrm{KVar]}$ | 5 | 5 | 8 | 9 | 12.5 | 14 | 20 | 28 | 28 | 28 |
|  | 230 V | [ [Var] | 5 | 5 | 8 | 9 | 12.5 | 14 | 20 | 29 | 29 | 29 |
|  | 460 V | [ KVar ] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
|  | 600 V | [ $\mathrm{WVar]}$ | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 60 |
| Capacitor Bank $-40^{\circ} \mathrm{C}$ (2) | 200 V | [ KVar ] | 5 | 5 | 8 | 9 | 12.5 | 12.5 | 18 | 28 | 28 | 28 |
|  | 230 V | [ [1/ar] | 5 | 5 | 8 | 9 | 12.5 | 12.5 | 18 | 29 | 29 | 29 |
|  | 460 V | [ WVar ] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |
|  | 600 V | [ KVar ] | 5 | 5 | 8 | 10 | 15 | 20 | 25 | 40 | 50 | 50 |

## Electrical Data

|  |  | CA7-9 |  | CA7-12 | CA7-16 | CA7-23 | CA7-30 | CA7-37 | CA7-43 | CA7-60 | CA7-72 | CA7-85 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Resistance and Watt Loss /, AC3 |  |  |  |  |  |  |  |  |  |  |  |  |
| Resistance per power pole |  | [m] | 2.7 | 2.7 | 2.7 | 2.0 | 2.0 | 2.0 | 1.5 | 0.9 | 0.9 | 0.9 |
| Watt Loss - 3 power poles |  | (1) | 0.66 | 1.2 | 2.1 | 3.2 | 5.4 | 8.2 | 8.3 | 0.7 | 14.0 | 19.5 |
| Coll and 3 power poles | AC | (M) | 3.3 | 3.8 | 4.7 | 6.2 | 8.4 | 11.2 | 11.5 | 11 | 13.8 | 17.5 |
|  | DC | [ 1 ] | 6.7 | 7.2 | 8.1 | 12.4 | 14.6 | 17.4 | 18.4 | 11 | 13.8 | 17.5 |
| Coll only | AC | (M) | 2.6 | 2.6 | 2.6 | 3.0 | 3.0 | 3.0 | 3.2 | 4.5 | 4.5 | 4.5 |
|  | DC | (M) | 6.0 | 6.0 | 6.0 | 9.2 | 9.2 | 9.2 | 10.0 | 4.9 | 4.9 | 4.8 |

Short-Circuit Coordination
Max. Fuse or clrcult breaker ratings

| DIN Fuses -96, gl |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Available Fauth Current | (N) | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 kA |
| Type ${ }^{-1 "(6900) ~-~}$ | (A) | 50 | 50 | 50 | 80 | 125 | 125 | 160 | 250 | 250 | 250 |
| Type *2" 6900 ) | ( ${ }^{1}$ | 25 | 35 | 35 | 40 | 80 | 80 | 100 | 160 | 160 | 160 |
| BS 83 Fuses |  |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | (A) | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA | 80 KA |
| Type "1" (690V) - | (A) | 25 | 32 | 35 | 50 | 63 | 80 | 100 | 100 | 125 | 160 |
| Type -2" $^{\prime \prime}$ (6900) 0 | (A) | 25 | 32 | 35 | 50 | 63 | 80 | 100 | 100 | 125 | 160 |
| Class K1, RK1 Fuses |  |  |  |  |  |  |  |  |  |  |  |
| Avallable Fault Current | [ A | 100 KA | 100 Ka | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA |
| Type $2^{2}$ (600V) 0 | [A] | 15 | 20 | 20 | 30 | 40 | 50 | 50 | 80 | 100 | 100 |
| cill Short-Circult Ratings |  |  |  |  |  |  |  |  |  |  |  |
| Class 161, RK1, K5, and RKS Fuses |  |  |  |  |  |  |  |  |  |  |  |
| Avallable Fautl Current | (1) | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA |
| CuL Max. Aating (600M) Type 1 | (A) | 35 | 40 | 70 | 90 | 110 | 125 | 150 | 200 | 250 | 300 |
| Class CC \& CSA HRCI Fuses |  |  |  |  |  |  |  |  |  |  |  |
| Available Faut Current | [ 1 | 100 KA | 100 KA | 100 KA | 100 KA | $\sim$ | - | - | - | - | - |
| cul Max. Aating (600V) 0 Type 2 | [ $A$ | 15 | 20 | 30 | 30 | - | - | - | - | - | - |
| Class J CSA \& HRCI-J Fuses |  |  |  |  |  |  |  |  |  |  |  |
| Avallable Fault Current | (A] | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 Ka | 100 KA | 100 kA |
| cll Max. Rating (600V) © Type 2 | [ ${ }^{\text {a }}$ | 15 | 20 | 30 | 30 | 50 | 50 | 70 | 80 | 100 | 150 |
| Inverse-Time Circult Breaker 0 |  |  |  |  |  |  |  |  |  |  |  |
| Avaliable Faull Current | (A] | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 10 KA | 10 KA |
| cll Max, Rating 480V e Type 1 | (A) | 30 | 30 | 50 | 50 | 125 | 125 | 125 | 250 | 250 | 250 |
| ctl Max, Rating 600V O Type 1 | (A] | $\sim$ | $\sim$ | $\sim$ | - | 125 | 125 | 125 | 250 | 250 | 250 |
| Short Time Current Withstand Ratings |  |  |  |  |  |  |  |  |  |  |  |
| $\mathrm{ta} 60^{\circ} \mathrm{C}$ | (A) | 170 | 170 | 170 | 215 | 300 | 304 | 375 | 700 | 700 | 700 |
| Off Time Between Operations | Min.] | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 | 20 |

[^7]Technical Information

## Electrical Data

Short Circuit Coordination I, AC3
Type 2 Coordination Comblnations (contactor, overload and fuses) - Per UL 508 and IEC 60947-4-1

| Contactor | Overload Relay | Withstand Rating | Maximum Voltage | Max. Amp Rating (UL. Class CC or J Fuses) |
| :---: | :---: | :---: | :---: | :---: |
| CA7-9 | CEP7-M/NB32-0.32... | 100 kA | 600 V | 1 |
|  | CEP7-M/MB32-1.0... | 100 kA | 600 V | 2 |
|  | CEP7-M/NB32-2.9... | 100kA | 600 V | 6 |
|  | CEP7-M/MB32-5... | 100kA | 600 V | 10 |
|  | CEP7-M/M832-12... | 100 kA | 600V | 15 |
| CA7-12... | CEP7-M/MB32-12... | 100 kA | 600V | 20 |
| CA7-16... | CEP7-M/NB32-32... | 100 kA | 600 V | 20 |
| CA7-23... | CEP7-M/AB32-32... | 100kA | 600V | 30 |
| CA7-30.. | CEP7-M/N837-37... | 100 kA | 600y | 40 |
| CA7-37... | CEP7-M/NB37-37... | 100 kA | 600 V | 50 |
| CA7-43... | CEP7-M/NB45-45... | 100kA | 600V | 50 |
| CA7-60... | CEP7-M/NB85-85... | 100kA | 600 V | 80 |
| CA7-72... | CEP7-M/M885-85... | 100 kA | 600 V | 100 |
| CA7-85... | CEP7-M/NB85-85... | 100kA | 600 V | 100 |

## CEP7 First Generation Scheduled for Obsolesence 2006

UL Listed Combinations (contactor, overload and circult breaker) - Per UL 508

| Contactor | Overload Relay | Withstand Rating | Maximum Voltage | Max. Amp Rating (UL Listed Circuit Breaker) |
| :---: | :---: | :---: | :---: | :---: |
| CA7-9... 12 | CEP7-M/E32-2.9... 12 | 5kA | 480V | 30 |
|  | CT7-24-0.16... 10 |  |  |  |
| CA7-12 | CT7-24-16 |  |  |  |
| CA7-16... 23 | CEP7-M/A32-2.9.. 32 | 5kA | 480 V | 50 |
|  | CT7-24-0.16... 16 |  |  |  |
| CA7-23 | CT7-24-24 |  |  |  |
| CA7-30... 37 | CEP7-M/A37-12. 37 | 5kA | 600V | 125 |
|  | CT7-24-16...CT7-45-30 |  |  |  |
| CA7-37 | C77-45-45 |  |  |  |
| CA7-43 | CEP7-M/A45..45 | 5kA | 600 V | 125 |
|  | C77-45-30..45 |  |  |  |
| CA7-60 | CEP7-M/AE5 .. 85 | SikA | 600 V | 250 |
|  | C77-75-30..60 |  |  |  |
| CA7-72 | CEP7-M/A85...85 | 10kA | 600 V | 250 |
|  | C77-75-30...75 |  |  |  |
| CA7-85 | CEP7-M/A85... 85 | 10kA | 600 V | 250 |
|  | CT7-75-30..CT7-100-90 |  |  |  | Technical Information CA7 Contactors \& Overload Relay

## Short Circuit Ratings

Standard Fault Short Circult Ratings per UL508 and CSA 22.2 No. 14

| CEP7 Second Generation Cat. No. |  | Max, avallable fault current (kA) | Conditional S.C. current, la (kA) | S.C.RD. |
| :---: | :---: | :---: | :---: | :---: |
| CEP7 | ED1AB, EEAB EDIB8, EEB8 | 1 | 600 | Sultabla for use with fuses only |
|  | EDIC8, ED1DB, ED1EB, EECB, EEDB, EEEB, EEED, EEFD, EEPB, EERB, EESB, EETD | 5 |  | Not restricted to |
|  | EEEE, EEFE, EEGE, EEUE | 10 |  |  |

IEC Short Circuit Ratings per EN60947-4-1

| CEP7 Second Generation Cat No. |  | Prospective S.C. current, Ir (kA) | Conditiona! s.c. current, Iq (kA) | $\begin{array}{\|c} \text { Max voll- } \\ \text { age (M) } \end{array}$ | S.C.P.D. |
| :---: | :---: | :---: | :---: | :---: | :---: |
| CEP7 | EDIAB, EEAB ED1BE, EEAB | 1 | 100 | 690 | Suitable for use with tuses only |
|  | $\begin{aligned} & \text { EDDCBEDED10B, } \\ & \text { EECB, EEDB, } \\ & \text { EEPS, EERB } \\ & \hline \end{aligned}$ | 1 |  |  | Not restricted <br> to |
|  | EDIEB, EEEB, EEED, EEFD, EEEE, EEFE, EESB, EETD | 3 |  |  |  |
|  | EEOE, EEVE | 5 |  |  |  |

High Fault Short Circuit Ratings per UL508 and CSA 22.2 No. 14

| CEP7 Second Generation Cat. No. |  | Contactor Cat No. | Max, starter FLC (A) | $\begin{array}{\|c\|} \hline \text { Max, avail } \\ \text { sble fault } \\ \text { current (kA) } \end{array}$ | Max voltage M | UL Class J and CSA HRCI-J fuse (A) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CEP7 | ED1AB, EEAB | CA7-09 | 0.5 | 100 | 600 | 3 |
|  | ED1发, EEB8 |  | 1 |  |  | 6 |
|  | ED1C8, ED108, EDIEB, EEEB, EECB, EEDB | CA7-09 | 09 |  |  | 20 |
|  |  | CA7-12 | 12 |  |  | 20 |
|  |  | CA7-16 | 16 |  |  | 30 |
|  |  | CA7-23 | 23 |  |  | 30 |
|  | EEED, EEFO | CA7-30 | 30 |  |  | 50 |
|  |  | CA7-37 | 37 |  |  | 50 |
|  |  | CA7-43 | 43 |  |  | 70 |
|  | EEEE, EEFE EEGE | CA7-60 | 60 |  |  | 80 |
|  |  | CA7-72 | 72 |  |  | 100 |
|  |  | CA7-85 | 85 |  |  | 150 |

IEC Type 1 and Type II Fuse Coordination with CA7 Series contactors per EN60947-4-1

| cEP7 Second Generation Cat No. |  | Contactor Cat. No. | Max. starter FLC (A) | Prospective S.C. current, Ir (kA) | Conditional S.C. current, lq (kA) | $\begin{gathered} \text { Max. voltage } \\ M \end{gathered}$ | Typel with Class J fuse (A) | Type II with Class Jfuse <br> (A) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| CEP7 | EOTAB, EEAB | CA7-09 | 0.5 | 1 | 100 | 600 | 3 | 3 |
|  | ED188, EEB8 |  | 1 |  |  |  | 6 | 6 |
|  | ED1CB, ED1DB, EECB, EEDB | CA7-09 | 09 | 1 |  |  | 20 | 15 |
|  |  | CA7-12 | 12 |  |  |  | 20 | 20 |
|  |  | CA7-16 | 16 |  |  |  | 30 | 30 |
|  |  | CA7-23 | 23 |  |  |  | 30 | 30 |
|  | E01E8, EEE8 | CA7-09 | 09 | 3 |  |  | 20 | 15 |
|  |  | C $47-12$ | 12 |  |  |  | 20 | 20 |
|  |  | CA7-16 | 16 |  |  |  | 30 | 30 |
|  |  | CA7-23 | 23 |  |  |  | 30 | 30 |
|  | EEED, EEFD | CA7-30 | 30 | 3 |  |  | 50 | 50 |
|  |  | CA7-37 | 37 |  |  |  | 50 | 50 |
|  |  | CA7-43 | 43 |  |  |  | 70 | 70 |
|  | EEEE, EEfE | CA7-60 | 60 | 3 |  |  | 80 | 80 |
|  |  | CA7-72 | 72 |  |  |  | 100 | 100 |
|  |  | CA7-85 | 85 |  |  |  | 150 | 150 |
|  | EEGE | C $77-60$ | 60 | 5 |  |  | 80 | 80 |
|  |  | CA7-72 | 72 |  |  |  | 100 | 100 |
|  |  | CA7-85 | 85 |  |  |  | 150 | 150 |

Electro－Mechanical Data

|  |  |  | CA7－9 | CA7－12 | CA7－16 | CA7－23 | CA7－30 | CA7－37 | CA7－43 | CA7－60 | CA7－72 | CA7－85 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Service Life |  |  |  |  |  |  |  |  |  |  |  |  |
| Mechanical | AC | ［Mil．］ | 13 | 13 | 13 | 13 | 13 | 13 | 12 | 10 | 10 | 10 |
|  | DC | ［Mil．］ | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 10 | 10 | 10 |
| Electrical AC－3（400V） | AC | ［Mil．］ | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 1.0 | 1.0 | 1.0 | 1.0 |
| Shipping Weights |  |  |  |  |  |  |  |  |  |  |  |  |
| AC－CA7 |  | ［kg］ | 0.39 | 0.39 | 0.39 | 0.39 | 0.48 | 0.49 | 0.51 | 1.45 | 1.45 | 1.45 |
|  |  | ［Lbs．］ | 0.86 | 0.86 | 0.86 | 0.86 | 1.06 | 1.08 | 1.12 | 3.20 | 3.20 | 3.20 |
| AC－CAU7 |  | ［kg］ | 0.85 | 0.85 | 0.85 | 0.85 | 1.08 | 1.08 | 1.15 | 3.14 | 3.14 | 3.14 |
|  |  | ［Lbs．］ | 1.89 | 1.89 | 1.89 | 1.89 | 2.39 | 2.39 | 2.54 | 6.92 | 6.92 | 6.92 |
| DC－CA7 |  | ［kg］ | 0.60 | 0.60 | 0.60 | 0.73 | 0.85 | 0.85 | 1.00 | 1.47 | 1.47 | 1.47 |
|  |  | ［Lbs．］ | 1.32 | 1.32 | 1.32 | 1.61 | 1.87 | 1.87 | 2.20 | 3.24 | 3.24 | 3.24 |
| DC－CAU7 |  | ［kg］ | 1.27 | 1.27 | 1.27 | 1.53 | 1.81 | 1.81 | 2.13 | 3.22 | 3.22 | 3.22 |
|  |  | ［Lbs．］ | 2.81 | 2.81 | 2.81 | 3.39 | 4.00 | 4.00 | 4.70 | 7.10 | 7.10 | 7.10 |
| Terminations－Power Description |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | $\xrightarrow[4]{\text { 案 }}$ | 劳 | $\underset{\substack{\text { 劳 }}}{ }$ | 莺 | － | $\frac{\square}{\square}$ | 退 | 回 | 囫 | 圂 |
|  |  |  | One saddleclamp per pole： cross，slotted or Pozidrive No．2／blade No． 3 screw |  |  |  | Dual connection；one saddleclamp and one box lug per pole；cross， slotted or Pozidrive №．2／blade №． 4 screw |  |  | Dual connection； two box lugs per pole Allen Head： $\mathbf{4 m m}, 5 / 32$ |  |  |
| 2coser | $1 \text { Wire }$ | $\left[\mathrm{mm}^{2}\right]$ | 1．．． 4 | 1．．． 4 | $1 . .4$ | 1．．． 4 | 2．5．．．10 | 2．5．．．10 | 2．5．．．16 | 2．5．．． 35 | 2．5．．． 35 | 2．5．．．35 |
|  | $2 \text { Wires }$ | $\left[\mathrm{mm}^{2}\right]$ | 1．．． 4 | 1．．． 4 | 1．．． 4 | 1．．． 4 | 2．5．．． 10 | 2．5．．． 10 | 2．5．．． 10 | 2．5．．． 25 | 2．5．．． 25 | 2．5．．． 25 |
| C6O E | 1 Wire | ［ $\mathrm{mm}^{2}$ ］ | 1．5．．．6 | 1．5．．．6 | 1．5．．．6 | 1．5．．．6 | 2．5．．． 16 | 2．5．．．16 | 2．5．．．25 | 2．5．．．50 | 2．5．．．50 | 2．5．．． 50 |
|  | 2 Wires | $\left[\mathrm{mm}^{2}\right]$ | 1．5．．． 6 | 1．5．．．6 | 1．5．．． 6 | 1．5．．． 6 | 2．5．．．16 | 2．5．．．16 | 2．5．．．16 | 2．5．．． 35 | 2．5．．． 35 | 2．5．．． 35 |
| $\triangle 50$ | 1 Wire | ［AWG］ | 16．．． 10 | 16．．． 10 | 16．．．10 | 16．．． 10 | 14．．． 4 | 14.4 | 14．．． 4 | 14．．． 1 | 14．．．1 | 14．．． 1 |
|  | 2 Wires | ［AWG］ | 16．．． 10 | 16．．． 10 | 16．．． 10 | 16．．． 10 | 14．．． 4 | 14.4 | 14．．． 4 | 14．．．1 | 14．．．1 | 14．．． 1 |
| Torque Requirement |  | ［ Nm ］ | 1．0．．． 2.5 | 1．0．．．2．5 | 1．0．．．2．5 | 1．0．．．2．5 | 2．5．．．3．5 | 2．5．．． 4 | 2．5．．．4 | 3．5．．． 6 | 3．5．．． 6 | 3．5．．． 6 |
|  |  | ［Lb－in］ | 9．．． 22 | 9．．． 22 | 9．．． 22 | $9 . . .22$ | 22．．． 31 | 22．．． 35 | 22．．． 35 | 31．．． 53 | 31．．． 53 | 31．．． 53 |
| Terminations－Control Description |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  | $\stackrel{\text { 穿 }}{2}$ | $\stackrel{\text { 荤 }}{ }$ |  | $\stackrel{\text { 企 }}{ }$ | $\stackrel{\text { 跑 }}{4}$ | $\underset{\mathbb{4}}{\text { 案 }}$ |  | $\stackrel{\text { 第 }}{ }$ | $\stackrel{\text { 等 }}{ }$ | $\xrightarrow[4]{\text { 点 }}$ |
|  |  |  | Combination Screw Head：Cross，Slotted，Pozidrive |  |  |  |  |  |  |  |  |  |
| Coils | 1 or 2 | ［ $\mathrm{mm}^{7}$ ］ | 1．5．．．6 |  |  |  |  |  |  |  |  |  |
| Wires |  | ［AWG］ | 16．．12 |  |  |  |  |  |  |  |  |  |
| Control Modules | 1or 2 | $\left[\mathrm{mm}^{2}\right]$ | 1．5．．． 6 |  |  |  |  |  |  |  |  |  |
| Torque Requirement |  | ［AWG］ | 16．．． 12 |  |  |  |  |  |  |  |  |  |
|  |  | ［ Nm ］ | 1．．．2．5 |  |  |  |  |  |  |  |  |  |
|  |  | ［ Lb －in］ |  |  |  |  | 13 |  |  |  |  |  |
| Degree of Protection－contactor |  |  | IP 2LX per IEC 529 and DIN 40050 （with wires installed） |  |  |  |  |  |  |  |  |  |
| Protection Against Accidental Contact |  |  | Safe from touch by fingers and back－of－hand per VDE 0106；Part 100 |  |  |  |  |  |  |  |  |  |


| ```Ambient Temperature Storage Operation Conditioned 15% current reduction after AC-1 at >60' C``` | $-55 . . .+80^{\circ} \mathrm{C}\left(-67 . . .176^{\circ} \mathrm{F}\right)$－ （CRI7E Electronic Interface $-50 . . .+80^{\circ} \mathrm{C}\left(-58 . . .176^{\circ}\right)$ ）］ $-25 . .+60^{\circ} \mathrm{C}\left(-13 . .140^{\circ} \mathrm{A}\right)$ $-25 \ldots+70^{\circ} \mathrm{C}\left(-13 \ldots, .158^{\circ}\right. \text { ค }$ |
| :---: | :---: |
| Altitude at installed site | 2000 meters above sea level per IEC 947－4 |
| Resistance to Corrosion／Humidity | Damp－altemating dimate：cyclic to IEC $68-2,56$ cycles <br> Dry heat．IEC $68-2,+100^{\circ} \mathrm{C}\left(212^{\circ} \mathrm{F}\right.$ ），relative humidity $<50 \%, 7$ days． <br> Damp tropical：IEC $68-2,+40^{\circ} \mathrm{C}\left(104^{\circ}\right.$ ），relative humidity $<92 \%, 56$ days． |
| Shock Resistance | IEC 68－2：Half sinusoidal shock $11 \mathrm{~ms}, 30 \mathrm{~g}$（in all three directions） |
| Vibration Resistance | IEC 68－2：Static＞2g，in normal position no malfunction $<59$ |
| Pollution Degree | 3 |
| Operating Position | Refer to Dimension Pages |
| Standards | Page 174E69843a84，EN 60947；UL 508；CSA 22．2，No． 14 |
| Approvals | CE，UL，CSA |

Technical Information
CA7 3-Pole Contactors


Coil Data

|  |  |  | CA7-9 | CA7-12 | CA7-16 | CA7-23 | CA7-30 | CA7-37 | CA7-43 | CA7-60 | CA7-72 | CA7-85 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Voltage Range |  |  |  |  |  |  |  |  |  |  |  |  |
| AC: $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Pickup | $[x \\| y]$ |  |  | $0.85 . .1 .1$ |  |  |  |  |  |  |  |  |
|  | Dropout | [ $\mathrm{x} \\| \mathrm{l}$ ] |  | 0.3..0.6 |  |  |  |  |  |  |  |  |
| DC | Pickup | [ $x$ U1] |  | $0.8 \ldots 1.1$ (9V coils $=0.65 . .1 .3 ; 24 \mathrm{~V}$ coils $=0.7 . .1 .25)$ |  |  |  |  |  |  |  |  |
|  | Dropout | [xty] |  | $0.1 . .0 .6$ |  |  |  |  |  |  |  |  |
| Coil Consumption |  |  |  |  |  |  |  |  |  |  |  |  |
| AC: $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Pickup | NAM | 70/50 | 70/50 | 70/50 | 70/50 | 80/60 | 80/50 | 130/90 | 200/110 | 200/110 | 200/110 |
|  | Hold-in | NAW | 8/2.6 | $8 / 2.6$ | $8 / 2.6$ | $9 / 3$ | $9 / 3$ | $9 / 3$ | 10/3.2 | 16/4.5 | 16/4.5 | 16/4.5 |
| True DC Coils (CA7C) | Pickup | (M) | 6.5 | 6.5 | 6.5 | 9.2 | 9.2 | 9.2 | 10.1 | ~ | ~ | ~ |
|  | Hold-ln | (M] | 6.5 | 6.5 | 6.5 | 9.2 | 9.2 | 9.2 | 10.1 | $\sim$ | - | * |
| Two Whding DC Colls | Pickup | [W] | 120 | 120 | 120 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| CATY \& Ca70 | Holde-ln | (1) | 1.1 | 1.1 | 1.1 | 1.2 | 1.2 | 1.2 | 1.3 | 4.5 | 4.5 | 4.5 |
| Operating Times |  |  |  |  |  |  |  |  |  |  |  |  |
| AC: $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Pickup | [ms] | 15... 30 | 15... 30 | 15.. 30 | 15... 30 | 15... 30 | 15... 30 | 15... 30 | 20... 40 | 20.. 40 | 20...40 |
|  | Dropout | [ms] | 10...60 | 10.. 60 | 10..60 | 10.. 60 | 10...60 | 10.. 60 | 10.. 60 | 10... 60 | 10.. 60 | 10.. 60 |
| with RC Suppressor | Dropout | [ms] | 10.. 60 | $10 . .60$ | 10.. 60 | 10.. 60 | 10... 60 | 10.. 60 | 10.. 60 | $10 . .60$ | 10.. 60 | $10 . .60$ |
| True DC Colls (CA7C) | Pickup | [ms] | 40.. 70 | 40.. 70 | $40 . .70$ | 40... 70 | 50...80 | 50...80 | $50 . .80$ | $\sim$ | $\sim$ | - |
| without Suppression | Dropout | [ms] | 7..15 | 7..15 | 7..15 | 7... 15 | 7... 15 | 7... 15 | 7... 15 | $\sim$ | $\sim$ | $\sim$ |
| with integrated Suppression | Dropout | [ms] | 14...20 | 14... 20 | 14. 20 | 17... 23 | 17...23 | 17... 23 | 17... 23 | - | * | $\sim$ |
| with External Suppression | Dropout | (ms) | 70... 85 | 70...95 | 70...95 | 80...125 | 80...125 | 80...125 | 80...125 |  | $\sim$ | $\sim$ |
| Two Winding DC Colls (CATYD) | Pickup | [ms] | 17... 26 | 17... 26 | 15... 27 | 15... 27 | 15... 27 | 15... 27 | 15... 27 | 20... 40 | 20... 40 | $20 . .40$ |
| with internal Suppression | Dropout | [ms] | 9... 20 | $9 . . .20$ | 14... 24 | 14...24 | 14... 24 | 14... 24 | 14... 24 | 20... 350 | $20 . .350$ | $20 . .350$ |

Electrical Data


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## Electrical Data

| AC-1 Load, 30 Switching Amblent Temperature $40^{\circ} \mathrm{C}$ | [A] |  | $\begin{gathered} \text { CA7-9- } \\ \text { M40(31; 22) } \end{gathered}$ | $\begin{gathered} \text { CA7-12- } \\ \text { M4O(31; 22) } \end{gathered}$ | $\begin{aligned} & \text { CA7-16- } \\ & \text { M40(31; 22) } \end{aligned}$ | $\begin{gathered} \text { CA7-23- } \\ \mathrm{M} 40(31 ; 22) \end{gathered}$ | CA7-40-M22 | CA7-40-M40 | CA7-90-M22 | CA7-90-M40 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |  |  |  |  |
|  | 6 | [WW] | 32 | 32 | 32 | 32 | 75 | 75 | 130 | 130 |
| Ambient Temperature $60^{\circ}$ | 230 V | [ WW] | 13 | 13 | 13 | 13 | 30 | 30 | 52 | 52 |
|  | 240 V | [WW] | 13 | 13 | 13 | 13 | 31 | 31 | 54 | 54 |
|  | 400 V | [ WW] | 22 | 22 | 22 | 22 | 52 | 52 | 90 | 90 |
|  | 415 V | [6W] | 23 | 23 | 23 | 23 | 54 | 54 | 83 | 93 |
|  | 500 V | [ WW ] | 28 | 28 | 28 | 28 | 65 | 65 | 113 | 113 |
|  | 690 V | [WW] | 38 | 38 | 38 | 38 | 90 | 90 | 155 | 155 |
|  | 4 | [WW] | 32 | 32 | 32 | 32 | 60 | 60 | 110 | 110 |
|  | 230 V | [KW] | 13 | 13 | 13 | 13 | 24 | 24 | 44 | 44 |
|  | 240 V | [WW] | 13 | 13 | 13 | 13 | 25 | 25 | 46 | 46 |
|  | 400 V | [WW] | 22 | 22 | 22 | 22 | 42 | 42 | 76 | 76 |
|  | 415 V | [ WW] | 23 | 23 | 23 | 23 | 43 | 43 | 79 | 79 |
|  | 500 V | [6W] | 28 | 28 | 28 | 28 | 52 | 52 | 95 | 95 |
|  | 690 V | [ $6 W$ ] | 38 | 38 | 38 | 38 | 72 | 72 | 131 | 131 |
| Max Operating Rate | lops | hour) | 1,000 | 1,000, | 1,000, | 1,000 | 300 | 300 | 600 | 600 |
| Continuous Current (UL/CSA) |  |  |  |  |  |  |  |  |  |  |
| General Purpose Rating (409) | Open | [ ${ }_{\text {] }}$ | 25 | 25 | 30 | 30 | 60 | 60 | 125 | 130 |
|  | Enclosed | (A) | 25 | 25 | 30 | 30 | 60 | 60 | 125 | 130 |
| Max. Operating Rate | lops | hour] | 1,400 | 1,400 | 1,200 | 1,200 | 1,000 | 1,000 | 600 | 600 |
| Lighting Loads 0 |  |  |  |  |  |  |  |  |  |  |
| Elec. Dischrg.Lamps-AC-5a, | Open | (A) | 22.5 | 25 | 28 | 29 | 65 | 65 | 115 | 115 |
| slingle compensated | Enclosed | (A) | 22.5 | 25 | 28 | 29 | 54 | 54 | 95 | 95 |

Incandescent Lamps AC-5b,

| Electrical endurance $-100,000$ operations |  |  | 12 | 16 | 18 | 22 | 18 | 25 | 60 | 75 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| DC-1 Switching - $60^{\circ} \mathrm{C}$ | 24VDC | (A) | 25 | 25 | 32 | 32 | 45 | 45 | 80 | 80 |
|  | 48VDC | (A) | 20 | 20 | 20 | 20 | 25 | 25 | 40 | 40 |
| 1 Pole | 60VDC | ( ${ }^{\text {N }}$ | 20 | 20 | 20 | 20 | 25 | 30 | 40 | 40 |
|  | 110VDC | (A) | 6 | 6 | 6 | 6 | 10 | 10 | 11 | 11 |
|  | 220 VOC | (N) | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.8 | 1.8 |
|  | $440 V D C$ | [ 1 ] | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.5 | 0.5 |
|  | 24VDC | [ 1 ] | 25 | 25 | 32 | 32 | 45 | 45 | 80 | 80 |
|  | 48VDC | ( ${ }^{\text {N }}$ | 25 | 25 | 32 | 32 | 45 | 45 | 80 | 80 |
| 2 Pole in Series | 60VDC | W | 25 | 25 | 32 | 32 | 45 | 45 | 80 | 80 |
|  | 110VDC | (A) | 25 | 25 | 32 | 32 | 45 | 45 | 80 | 80 |
|  | 220 VOC | (N) | 8 | 8 | 8 | 8 | 10 | 10 | 15 | 15 |
|  | 440VDC | [ ${ }^{\text {a }}$ | 1 | 1 | 1 | 1 | 1 | 1 | 1.5 | 1.5 |
|  | 24VDC | (A) | 25 | 25 | 32 | 32 | - | 48 | - | 100 |
|  | 48VDC | (A) | 25 | 25 | 32 | 32 | - | 48 | - | 100 |
| 3 Poles in Series | 60VDC | (A) | 25 | 25 | 32 | 32 | $\sim$ | 48 | - | 100 |
|  | 110VDC | (N) | 25 | 25 | 32 | 32 | - | 48 | - | 100 |
|  | 220NDC | ( ${ }^{1}$ | $25$ | $25$ | 32 | $32$ | $\sim$ | $48$ | $\sim$ | 80 |
|  | 440VDC | (A) | 3 | 3 | 3 | 3 | - | 3.5 | - | 5 |
|  | 24VOC | (A) | 25 | 25 | 32 | 32 | - | 60 | - | 110 |
|  | 48 VDC | [ N | 25 | 25 | 32 | 32 | - | 60 | - | 110 |
| 4 Poles in Series | 60VDC | (A) | 25 | 25 | 32 | 32 | $\sim$ | 60 | - | 110 |
|  | 110VDC | ( N | 25 | 25 | 32 | 32 | $\sim$ | 60 | $\sim$ | 110 |
|  | 220 VOC | W | 25 | 25 | 32 | 32 | - | 60 | - | 100 |
|  | 440 VDC | ( ${ }^{(1)}$ | 8 | 8 | 8 | 8 | $\sim$ | 10 | $\sim$ | 15 |

- CAT ratings for lighting loads are provided for technical reference. For cull ratedPage 177 of 363
and labeled devices, see CAL7 contactors listed in this section.


## sprecher +

Technical Information
CA7 4-pole Contactors

Electrical Data

|  |  | $\begin{gathered} \text { CA7-9- } \\ \text { M40(31; 22) } \end{gathered}$ | $\begin{gathered} \text { CA7-12- } \\ \text { M40(31; 22) } \end{gathered}$ | $\begin{gathered} \text { CA7-16- } \\ \text { M4O(31; 22) } \end{gathered}$ | $\begin{gathered} \text { CA7-23- } \\ \text { M40(31;22) } \end{gathered}$ | CA7-40-M22 | CA7-40-M40 | CA7-90-M22 | CA7-90-M40 |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Resistance per power pole | [ m S] | 2.7 | 2.7 | 2.7 | 2.0 | 2.0 | 1.5 | 0.8 | 0.7 |  |
| Watt Loss - 4 power poles | [/] | 2.8 | 2.8 | 2.8 | 2.0 | 11.3 | 8.4 | 13.5 | 11.8 |  |
| Coil and 4 power poles AC | [W] | 13.7 | 13.7 | 13.7 | 10.8 | 26.1 | 37.4 | 36.0 | 56.3 |  |
| DC (eve) | [W] | 17.6 | 17.6 | 17.6 | 17.4 | 32.6 | 43.9 | $\sim$ | $\sim$ |  |
| DC (2 winding) | [W] | $\sim$ | ~ | ~ | ~ | $\sim$ | $\sim$ | 32.5 | 52.8 | CA7 |
| Short Circuit Coordination |  |  |  |  |  |  |  |  |  |  |
| DIN Fuses -g6, gl |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [ A ] | 100 KA | 100 KA | 100 KA | 100 KA | 50 KA | 50 KA | 50 KA | 50 KA |  |
| Type "1" (690V) 0 | [ A ] | 50 | 50 | 50 | 80 | 160 | 160 | 250 | 250 |  |
| Type "2" (690才) ${ }^{\text {P }}$ | [ A ] | 25 | 35 | 35 | 40 | 100 | 100 | 160 | 160 |  |
| BS 88 Fuses |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [A] | 80 KA | 80 KA | 80 KA | 80 KA | $\sim$ | $\sim$ | $\sim$ | $\sim$ |  |
| Type "1" (690V) ${ }^{\text {(3) }}$ | [A] | 25 | 32 | 35 | 50 | $\sim$ | $\sim$ | $\sim$ | $\sim$ |  |
| Type "2" 690V) ${ }^{\text {a }}$ | [ $A$ ] | 25 | 32 | 35 | 50 | $\sim$ | $\sim$ | $\sim$ | $\sim$ |  |
| Class K1, RK1 Fuses |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [ A ] | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA |  |
| Type "2" (600V) 3 | [A] | 15 | 20 | 20 | 30 | 70 | 70 | 100 | 100 |  |
| cUl Short-Circuit Ratings |  |  |  |  |  |  |  |  |  |  |
| Class K1, RK1, K5, and RK5 Fuses |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [A] | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 10 KA | 10 KA |  |
| cUL. Max. Rating (600V) Type 1 | [ A ] | 35 | 40 | 70 | 90 | 125 | 125 | 300 | 300 |  |
| Class CC \& CSA HRCI Fuses |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [ A ] | 100 KA | 100 KA | 100 KA | 100 KA | $\sim$ | $\sim$ | $\sim$ | $\sim$ |  |
| cUL. Max. Rating (600V) 3 Type 2 | [ A ] | 15 | 20 | 30 | 30 | $\sim$ | $\sim$ | $\sim$ | $\sim$ |  |
| Class J CSA \& HRCI-J Fuses |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [ A ] | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA | 100 KA |  |
| cUL. Max. Rating (600V) 3 Type 2 | [A] | 15 | 20 | 30 | 30 | 700 | 70 0 | 150 © | 150 © |  |
| Inverse-Time Circuit Breaker © |  |  |  |  |  |  |  |  |  |  |
| Available Fault Current | [A] | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 5 KA | 10 KA | 10 KA |  |
| cUL Max. Rating 480V 0 Type 1 | [ ${ }^{\text {] }}$ | 30 | 30 | 50 | 50 | 125 | 125 | 250 | 250 |  |
| cUL Max. Rating 600V 3 Type 1 | [A] | $\sim$ | ~ | $\sim$ | $\sim$ | 125 | 125 | 250 | 250 |  |

Short Time Current Withstand
Ratings

| Ratings | [A] | 170 | 170 | 170 | 215 | 304 | 304 | 700 | 700 |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| $l_{\text {enf }} 60^{\circ} \mathrm{C}$ | Mime |  |  |  |  |  |  |  |  |
| Off Time Between Operations | Min. $]$ | 20 | 20 | 20 | 20 | 5 | 5 | 5 | 5 |

(1) When used as a Branch Circuit Protection device, NEC 430-152 defines the maximum rating of an Inverse-time circuit breaker to be sized at $250 \%$ of the motor nameplate FLA for most applications.
(2) UL. Listed Combination. (UL. File E41850) Per UL508A, NEC409 abd CSA 22.2 No. 14
for contactor and fuses or circuit breaker only.
3 Per IEC 60947-1 for contactor and fuses only.

- UL Testing not complete a the time of printing this catalog.


## Mechanical Data

|  |  |  | CA7-9M40(31; 22) | CA7-12- <br> M40(31; 22) | CA7-16M40(31; 22) | CA7-23- $M 40(31 ; 22)$ | CA7-40-M22 | CA7-40-M40 | $\begin{gathered} \text { CA7-90- } \\ \text { M222 } \end{gathered}$ | $\begin{gathered} \text { CA7-90- } \\ \text { M40 } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Service Life |  |  |  |  |  |  |  |  |  |  |
| Mechanical | AC | [Mil] ] | 13 | 13 | 13 | 13 | 10 | 10 | 10 | 10 |
|  | DC | [Mil.] | 13 | 13 | 13 | 13 | 10 | 10 | 10 | 10 |
| Shipping Weights |  |  |  |  |  |  |  |  |  |  |
| AC - CA7 |  | [kg] | 0.39 | 0.39 | 0.39 | 0.39 | 0.51 | 0.51 | 1.45 | 1.45 |
|  |  | [Lbs.] | 0.86 | 0.86 | 0.86 | 0.86 | 1.12 | 1.12 | 3.20 | 3.20 |
| DC- CA7 |  | [kg] | 0.60 | 0.60 | 0.60 | 0.73 | 1.00 | 1.00 | 1.47 | 1.47 |
|  |  | [Lbs.] | 1.32 | 1.32 | 1.32 | 1.61 | 2.20 | 2.20 | 3.24 | 3.24 |

Terminations - Power
Description


## Environmental and General Specifications

| Ambient Temperature <br> Storage <br> Operation | $-55 \ldots+80^{\circ} \mathrm{C}\left(-67 \ldots . .176^{\circ} \mathrm{F}\right)-\left[\mathrm{CRI7E}\right.$ Electronic Interface $\left.-50 \ldots+80^{\circ} \mathrm{C}\left(-58 \ldots . .176^{\circ} \mathrm{F}\right)\right]$ |
| :--- | :---: |
| Conditioned $15 \%$ current reduction after AC-1 at $>60^{\circ} \mathrm{C}$ | $-25 \ldots+60^{\circ} \mathrm{C}\left(-13 \ldots 140^{\circ} \mathrm{F}\right)$ |
| Altitude at installed site | $-25 \ldots+70^{\circ} \mathrm{C}\left(-13 \ldots 158^{\circ} \mathrm{F}\right)$ |
| Resistance to Corrosion/Humidity | 2000 meters above sea level per IEC $947-4$ |

Coil Data (CA7 4-Pole)

|  |  |  | CA7-9M40(31; 22) | CA7-12-$M 40(31 ; 2)^{2}$ | CA7-16-MAO(31; 22) | CA7-23Mo(31; 22) | CA7-40- M22 | $\begin{gathered} \text { CA7-40- } \\ \text { M40 } \end{gathered}$ | CA7-90M22 | $\begin{gathered} \hline \text { CA7-90- } \\ \text { M40 } \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Voltage Range |  |  |  |  |  |  |  |  |  |  |
| AC: $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Pickup | [xy] |  |  |  |  | 0.85...1.1 |  |  |  |  |  |
|  | Dropout | [ $x 11]$ |  |  | 0.3..0.6 |  |  |  |  |  |
| DC | Piclup | [x\|] |  |  | $0.8 \ldots 1.1$ (9V coils $=0.65 \ldots 1.3 ; 24 \mathrm{~V}$ colls $=0.7 \ldots 1.25)$ |  |  |  |  |  |
|  | Dropout | [ $\times 12$ |  |  | 0.1..0.6 |  |  |  |  |  |
| Coil Consumption |  |  |  |  |  |  |  |  |  |  |
| AC: $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Pickup | [NAW] | 70/50 | 70/50 | 70/50 | 70/50 | 130/90 | 130/90 | 400/240 | 400/240 |
|  | Hold-in | [NAW] | $8 / 2.6$ | 8/2.6 | $8 / 2.6$ | $9 / 3$ | 12/3.6 | 12/3.6 | 24/9 | 24/9 |
| True DC Coils (CATC) | Pickop | [ 3 ] | 6.5 | 6.5 | 6.5 | 9.2 | 10.1 | 10.1 | $\sim$ | $\sim$ |
|  | Hold-in | [M] | 6.5 | 6.5 | 6.5 | 9.2 | 10.1 | 10.1 | - | - |
| Two Winding DC Colls | Pickup | [W] | - | - | - | - | - | - | 325 | 325 |
| CATY \& CATD | Hold-in | [W] | $\sim$ | $\sim$ | - | - | - | - | 5.5 | 5.5 |
| Operating Times |  |  |  |  |  |  |  |  |  |  |
| AC. $50 \mathrm{~Hz}, 60 \mathrm{~Hz}, 50 / 60 \mathrm{~Hz}$ | Picluyp | [ms] | 15... 30 | 15... 30 | 15.. 30 | 15... 30 | 15... 30 | 15.. 30 | 20...30 | 20... 30 |
|  | Dropout | [ms] | 10... 60 | 10... 60 | 10.. 60 | 10...60 | 10...60 | 10... 60 | 20...40 | 20... 40 |
| with RC Suppressor | Dropout | [ms] | $10 . . .80$ | $10 . .60$ | $10 . .60$ | $10 . .60$ | 10... 60 | 10... 60 | 20... 40 | $20 . .40$ |
| True DC Coils (CA7C) | Piclup | [ms] | 40... 70 | 40... 70 | 40... 70 | 40...70 | 50,..80 | $50 . .80$ | $\sim$ | $\sim$ |
| without Suppression | Dropout | (ms) | 7...15 | 7... 15 | $7 . .15$ | 7...15 | 7... 15 | 7... 15 | - | - |
| with integrated Suppression | Dropout | [ms] | 14... 20 | 14... 20 | 14... 20 | 17... 23 | ~ | - | $\sim$ | $\sim$ |
| with Extermal Suppression | Dropout | (ms) | 70.. 95 | 70,..95 | 70.. 85 | $80 . .125$ | $\sim$ | $\sim$ | $\sim$ | $\sim$ |
| Two Winding DC Colls | Pickup | [ms] | - | - | - | - | - | - | 15... 20 | 20... 25 |
| with Internal Suppression | Dropout | [ms) | $\sim$ | - | - | - | $\sim$ | - | 20... 25 | 20,..25 |

Technical Information - Auxiliary Contact Data

|  | Mounted <br> Standard <br> Auxiliary | Bullt-In Auxiliary Contacts in Contactor CA7-9..CA7-23 | Front Mounted Auxiliary Contacts CA7-PK, CS7-PV, CZE/A7, CV7 | Front Mounted Bifurcated Auxilliary Contacts | Side Mounted Auxiliary Contacts CA-PA, CMI |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Electrical Contact Aatings - NEMA |  | A600, P600 | A800, 0600 |  | A800, 0600 |
| Min. Contact Rating |  | $17 \mathrm{c}, 10 \mathrm{~mA}$ | 174. 5 mA | $5 \mathrm{~V}, 3 \mathrm{~mA}$ | $17 \mathrm{~V}, 10 \mathrm{~mA}$ |
| Contact Ratings - IEC AC-15 (solenoids, contactors) rated woltage IEC 60947-5-1 | 24 V | 10 A | 6 A | 3 A | 6 A |
|  | 48 V | 10A | 6 A | 3 A | 6 A |
|  | 120 V | 10A | 6 A | 3 A | 6 A |
|  | 240 V | 10A | 5 A | 3 A | 5A |
|  | 400 V | 6A | 3 A | 2A | 3 A |
|  | 480V/500V | 2.5 A | 1.6A | 1.2A | 1.6 A |
|  | 600 V | 1A | 1 A | 0.7 A | 1A |
|  | 690 V | 1A | 1 A | 0.7 A | 1A |
| AC-12 (Control of resistive loads) IEC 60947-5-1 | $b$ | 20 A | 10A | 10A | 10A |
|  | 230 V | 8 kW |  |  |  |
|  | 400 N | 14 KW |  |  |  |
|  | 690 V | 24 kW |  |  |  |
|  | 6 | 20 A | 6 A | 6 A | 6 A |
|  | 230 V | 8 kW |  |  |  |
|  | 400 V | 14 kW |  |  |  |
|  | 690V | 24 kW |  |  |  |
| DC-12 Switching DC Loads $4 / \mathrm{n}<1 \mathrm{~ms}$, Resistive Loads IEC 60947-5-1 | 24 V | 12A | 12A | 6 A | 6 A |
|  | 48 V | 9A | 9A | 3.2 A | 3.2A |
|  | 110 V | 3.5 A | 3.5A | 0.45 A | 0.45 A |
|  | 220 V | 0.55 A | 0.55 A | 0.18 A | 0.18 A |
|  | 440 V | 0.2 A | 0.2A | 0.1 A | 0.1 A |
| DC-13 IEC 60947-5-1, Solenoids and contactors | 24 V | 5 A | 5 A | 2.5 A | 5 A |
|  | 48 V | 3 A | 3 A | 1.5A | 3 A |
|  | 110 V | 1.2A | 1.2A | 0.6 A | 1.2A |
|  | 220 V | 0.6A | 0.6 A | 0.3A | 0.6 A |
|  | 440 V | 0.3 A | 0.15 A | 0.15 A | 0.15A |

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Technical Information
CA7 Contactors

Auxiliary Contacts


Terminals

| Terminal Type |  |  |  | 器 | 器 | 带 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Maximum Wire Size per IEC 947－1 |  |  |  | 2×M4 | $2 \times 14$ | $2 \times 44$ |
| E－ | Flexible | 1 conductor | $\left[\mathrm{mm}^{\prime}\right]$ | 1．．． 4 | 0．5．．2．5 | 0．5．．．2．5 |
|  | Fermule | 2 conductor | ［mm＇］ | 1．．． 4 | 0．75．．．2．6 | 0．75．．．2．6 |
| $\square 7$ | Solld／Stranded－ | 1 conductor | ［ $\left.\mathrm{mm} \mathrm{m}^{\prime}\right]$ | 1．5．．． 6 | 0．5．．．2．5 | 0．5．．．2．5 |
|  | Conductor | 2 conductor | ［ $\mathrm{mm}^{\prime}$ ］ | 1．5．．． 6 | 0．75．．．2．6 | 0．75．．．2．6 |
| Recommended Tightening Torque |  |  | （Nm） | 1．．． 2.5 | 1．．． 15 | $1 . .15$ |
| Max．Wire Size per UUCSA |  |  | ［AWG］ | 16．．． 10 | 18．．． 14 | 18．．．14 |
| Fecommended Tightening Torque |  |  | $[$［ $b-\|n\|$ | 9． 22 | 9．．． 13 | $9 . . .13$ |

Accessories

| Latch Attachment Release，CVI－11 |  |  |
| :---: | :---: | :---: |
| Coll Consumption | NMWI （M） <br> fininlmex | AC 45／40 <br> DC 25W |
| Time Attachment |  |  |
| Reset Time at min．time setting | ［ms］ | 10 |
| at max．time setting | ［ms］ | 70 |
| Repeat Accuracy |  | $\pm 10 \%$ |

Contact Ratings（Per NEMAULL A600 \＆Q600）

| Standard | Circuit Voltage | Make （Amps／VA） | Break （Amps／NA | Continueus Amps |
| :---: | :---: | :---: | :---: | :---: |
| A600 | $\begin{aligned} & 120 A C \\ & 240 A C \\ & 480 \mathrm{AC} \\ & 600 A C \end{aligned}$ | 60NT200VA <br> 30N7200VA <br> 15N7200VA <br> 12NTT200VA | $\begin{aligned} & \hline \text { 6AN720VA } \\ & 3 \mathrm{~N} 720 \mathrm{NA} \\ & 1.5 \mathrm{~N} 720 \mathrm{VA} \\ & 1.2 \mathrm{~N} 720 \mathrm{VA} \\ & \hline \end{aligned}$ | 10 |
| 0800 | $\begin{gathered} 1250 \mathrm{C} \\ 2500 \mathrm{C} \\ 301-600 \mathrm{C} \end{gathered}$ | 0．55N69VA <br> 0．27M69VA <br> 0．1N69VA | 0．55N69NA <br> 0．27 N69VA <br> 0．1N69VA | 25 |

> Positively-Guided Contacts (Mechanically-linked) SUNA Certified
> - Ressticted guidance guarantees without restrictions from contactor to auxiliary contact and auxiliary contact to contactor.e

## sprecher+

## Determining Contact Life

To determine the contactor's estimated electrical life, follow these guidelines:

1. Identify the appropriate Utilization Category from Table A.
2. On the following pages, choose the graph for the Utilization Category selected.

Table A - IEC Special Utilization Categories, AC Ratings (1)

|  | Category | Typical Applications | Rated Current | Conditions for testing electrical life |  |  |  |  | Ops. | Conditions for lesting making and breaking capacily |  |  |  |  |  | Ops. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Make |  | Braak |  |  |  | Make |  |  | Braak |  |  |
|  |  |  |  | W/e | Whe cos | te/le | Urive | c0s |  | //le | Whe | $\cos$ | the | Whe | cos |  |
|  | AC-1 | Non-Inductive or slightly inductive loads; resistance fumaces | All values | 1 | 10.95 | 1 | 1 | 0.95 | 6000 | 1.5 | 1.05 | 0.8 | 1.5 | 1.05 | 0.8 | 50 |
|  | AG-2 | Slip-ring motors: Starting, plugging | All values | 2 | 1.050 .65 | 21 | 1.05 | 0.65 | 6000 | 4 | 1.05 | 0.65 | 4 | 1.05 | 0.65 | 50 |
|  | AC-3 | Slip-ring motors: Starting, switching off motors during running | b 17Amp <br> 17Amp <le 100 Amp los 100 Amp | $\begin{aligned} & \hline 6 \\ & 6 \\ & 6 \\ & \hline \end{aligned}$ | $\begin{array}{ll} 1 & 0.65 \\ 1 & 0.35 \\ 1 & 0.35 \end{array}$ |  | $\begin{aligned} & 0.17 \\ & 0.17 \\ & 0.17 \end{aligned}$ | 0.65 0.35 0.35 | 6000 | 10 <br> 10 <br> 80 | $\begin{aligned} & 1.1 \\ & 1.1 \\ & 1.1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.65 \\ & 0.35 \\ & 0.35 \end{aligned}$ | $\begin{array}{\|c\|} \hline 8 \\ 8 \\ \hline 60 \\ \hline \end{array}$ | $\begin{aligned} & 1.1 \\ & 1.1 \\ & 1.1 \end{aligned}$ | $\begin{aligned} & 0.65 \\ & 0.35 \\ & 0.35 \end{aligned}$ | 50 |
|  | AC-4 | Squirrel-cage motors: Starting, plugging, inching © | le 17 Amp 17Amp <lo 100 Amp les 100 Amp |  | $\begin{array}{ll} 1 & 0.65 \\ 1 & 0.35 \\ 1 & 0.35 \end{array}$ | $\begin{aligned} & \hline 6 \\ & 6 \\ & 6 \\ & \hline \end{aligned}$ | $\begin{aligned} & 1 \\ & 1 \\ & 1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.65 \\ & 0.35 \\ & 0.35 \\ & \hline \end{aligned}$ | 6000 | $\begin{array}{\|c\|} \hline 12 \\ 12 \\ 100 \\ \hline \end{array}$ | $\begin{aligned} & 1.1 \\ & 1.1 \\ & 1.1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.65 \\ & 0.35 \\ & 0.35 \end{aligned}$ | $\begin{aligned} & 10 \\ & 10 \\ & 80 \\ & \hline \end{aligned}$ | $\begin{aligned} & 1.1 \\ & 1.1 \\ & 1.1 \\ & \hline \end{aligned}$ | $\begin{aligned} & 0.65 \\ & 0.35 \\ & 0.35 \end{aligned}$ | 50 |
| $\begin{aligned} & 5 \\ & 3 \\ & \hline \end{aligned}$ | AC-5a | Switching of electric discharge lamp control |  | 2 | 1.050 .45 | 2 | 1.05 | 0.45 | 6000 | 3 | 1.05 | 0.45 | 3 | 1.05 | 0.45 | 50 |
|  | AC-5b | Switching of incandescent lamps |  | 1 | 1.05 | 1 | 1.05 |  | 6000 | 1.5 | 1.05 |  | 1.5 | 1.05 |  | 50 |
|  | AC-6a | Switching of transformers |  |  |  |  |  |  |  | Rating derrved from AC-3 rating ( $\times 0.45$ ) |  |  |  |  |  |  |
|  | AG-6b | Switching of capacily banks |  |  |  |  |  |  |  | Depends on circuit conditions of application |  |  |  |  |  |  |
|  | AC-12 | Control of resistive loads and sold state loads with lsolation by opto couplers | All values | 1 | 10.8 | 1 | 1 | 0.8 | 6050 |  |  |  |  |  |  |  |
|  | AC-13 | Control of solid state losds with transformer isolation |  |  | 10.65 | 1 | 1 | 0.65 | 6050 | 10 | 1.1 | 0.65 | 1.1 | 1.1 | 0.65 | 10 |
| 咅 | AC-14 | $\begin{aligned} & \begin{array}{l} \text { Control of small electromagnetic } \\ \text { loads } \end{array} \\ & \hline \end{aligned}$ | 72VA | 6 | 10.3 | 1 | 1 | 0.3 | 6050 | 6 | 1.1 | 0.7 | 6 | 1.1 | 0.7 | 10 |
| - | AC-15 | Control of electromagnetic logds | 72VA | 10 | 1.0 .3 | 1 | 1 | 0.3 | 6050 | 10. | 1.1 | 0.3 | 10 | 1.1 | 0.3 | 10 |
| $\frac{8}{5}$ | AC-20 | Connecting and disconnecting under no loed conditions |  | No testing required |  |  |  |  |  |  |  |  |  |  |  |  |
| $\bigcirc$ | AG-21 | Switching of resistive loads, including moderate overloads | All values | 1 | 10.95 | 1 | 1 | 0.95 | 10000 | 1.5 | 1.05 | 0.95 | 1.5 | 1.05 | 0.95 | 5 |
| $\begin{aligned} & \frac{\pi}{\pi} \\ & \frac{\pi}{3} \end{aligned}$ | AC-22 |  <br> inductive loeds, including moder- <br> ate overloads | All values | 1 | 10.8 | 1 | 1 | 0.8 | 10000 | 3 | 1.05 | 0.65 | 3 | 1.05 | 0.65 | 5 |
| \% | AC-23 | Switching of motor loads or other highly infuclive loads | All values | 1 | 10.65 | 1 | 1 | 0.65 | 10000 | 10 | 1.05 | 0.45 | 8 | 1.05 | 0.45 | 5 |

## Legend

Uo Rated operational voltage
$\boldsymbol{U}$ Voltage before make
Ur Recovery voltage
le Rated aperational current
l Making current
Ic
Brealding current
I
Inductance of test circuit
i Resistance of test circuit
3. Locate the Rated Operational Current (l) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
4. Read the estimated contact life along the vertical axis.

## Determining Contact Life

To determine the contactor's estimated electrical life, follow these guidelines:

1. Identify the appropriate Utilization Category from Table A .
2. On the following pages, choose the graph for the Utilization Category selected.
3. Locate the Rated Operational Current $\left(l_{l}\right)$ along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
4. Read the estimated contact life along the vertical axis.

Table A - IEC Special Utilization Categories, DC Ratings ©

| Category | Typical Applications | Rated Current | Conditions for testing electrical life |  |  |  |  |  | Ops. | Conditions for testing making and breaking capacity |  |  |  |  |  | 0ps. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | Make |  |  | Break |  |  |  | Make |  |  | Break |  |  |  |
|  |  |  | Mle | U/ue | cos | $\mathrm{lc} / \mathrm{ll}$ | Ur/Ve | cos |  | the | U/ue | cos | V/e | U/ue | cos |  |
| DC-1 | Non-inductive or slightly inductive loads, resistance furnaces | All Values | 1 | 1 | 1 | 1 | 1 | 1 |  | 1.5 ( 3 | 1.10 | 13 | 1.5 (3) | 1.1 앙 | 10 |  |
| DC-2 | Shunt-motors: Starting, switching off motors during running | All Values | 2.5 | 1 | 2 | 1 | 0.1 | 7.5 |  | 4 | 1.1 | 2.5 | 4 | 1.1 | 2.5 |  |
| DC-3 | Shunt motors: Starting, plugging, inching | All Values | 2.5 | 1 | 2 | 2.5 | 1 | 2 |  | 4 | 1.1 | 2.5 | 4 | 1.1 | 2.5 |  |
| DC-4 | Series-motors: Starting, switching off motors during running | All Values | 2.5 | 1 | 7.5 | 1 | 0.3 | 10 |  | 4 | 1.1 | 15 | 4 | 1.1 | 15 |  |
| DC-5 | Series-motors: Starting, plugging, inching | All Values | 2.5 | 1 | 7.5 | 2.5 | 1 | 7.5 |  | 4 | 1.1 | 15 | 4 | 1.1 | 15 |  |
| DC-15 | Electromagnets for contactors, valves, solenoid actuators | All Values | 1 | 1 | $6 \times \mathrm{P}$ © | 1 | 1 | $6 \times \mathrm{P}$ (3) |  | 1.1 | 1.1 | $6 \times P 0$ | 1.1 | 1.1 | $6 \times P 0$ |  |

```
Legend
Ue Rated operational voltage
U}\mathrm{ Voltage before make
Ur}\mathrm{ Recovery voltage
to Rated operational current
l Making current
Ic Breaking current
L Inductance of test circuit
R Resistance of test circuit
```

- Utilization categories and test conditions for AC \& DC. For contactors according to IEC 158-1, starters according to IEC 292-1 ... 4 and control switches according to IEC 337-1 and IEC 337-1A.
(2) Only according to VDE.
(3) $P=$ Ve $\times$ le rated power (W). The value " $6 \times P$ " has been derived from an empiricPage 183 of 363 relationship which covers most magnetic loads for $D C$ up to an upper limit of $\mathrm{P}=50 \mathrm{~W}$.


## Predicting Electrical Life

Sprecher + Schuh contactors are designed for superior performance in a wide variety of applications, by giving consideration to the specific load, utilization category and required electrical life, you can purchase exactly the type
and size of contactor required. This assures reliable operation and high value the ability to very closely match the contactor to the application.

Identify they appropriate utilization category. For this example, we will determine CA7 contact life for Inching and plugging squirrel-cage motors. ©

| Uutilization Category | Definition |  |
| :---: | :---: | :---: |
| AG-1 | Resistance Furneces | Non inductive or slighly inductive loads, Resistive Furnaces |
| AC-2 | Slip-ring motors | Starting and stopping of running motors |
| AC-3 | Squirrel-cage motors | Starting and stopping of running motors |
| AC-4 (1) | Squirrel-cage motors | Starting, plugging, and inching <br> (Plugging is understood as stopping or reversing the motor rapidly by reversing the motor primary connections while the motor is running. Inching [or jogging] is understood as energizing a motor once or repeatedly for shor periods to obtain small movements of the driven mechanism.) |
| AC-15 | Electromagnets | Electromapnets for contactors, valves, solenold actuators |

Choose the graph for the utilization category selected. (a graph pertaining to most Utilization Categories can be found in each contactor section.)
(3)

Locate the Rated Operational Current (le) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.


Read the estimated contact life along the vertical axis.


- A comprehensive list of Utilization Categories can be found in each contactor section,
however, these are the primary categories used in most industrial motor applications.
- The life-load curves shown here are based on Sprecher+Schuh tests according to the requirements defined in IEC 60947-4-1. Since contact life in a given application is
dependent on environmental conditions and duty cycle, actual applicationRagettie4 of 363
may vary from that indicated by the curves shown here.


## Life-Load Curves

- Locate the Rated Operational Current (i) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
- Read the estimated contact Ilfe along the vertical axis.

NOTE: The life-load curves shown here are based on Sprecher+Schuh tests according to the requirements defined in IEC 60947-4-1. Since contact Iffe in any given application is dependent on environmental conditions and duty cycle, actual application contact life may vary from that indicated by the curves shown here.



## sprechert sthuh

## Life-Load Curves

- Locate the Rated Operational Current (y) along the bottom of the chart and follow the graph lines up to the intersection of the appropriate contactor's life-load curve.
- Read the estimated contact life along the vertical axis.


## AC-3

 (tio 575)
## NOTE: The life-load curves shown here are

 based on Sprecher+Schuh tests according to the requirements deflined in IEC 60947-4-1. Since contact life in any given application is dependent on environmental conditions and duty cycle, actual application contact life may vary from that indicated by the curves shown here.Technical Information CA7 Contactors - Life Load Curves

## Life-Load Curves



## Contact Life for Mixed Utilization Categories

## AC-3 and AC-4

In many applications, the utilization category cannot be defined as elther purely $\mathrm{AC}-3$ or AC-4. In those applications, the electrical life of the contactor can be estimated with the following equation:

$$
L_{\text {mined }}=L_{\text {sas }} /\left[1+P_{\text {sec }} X\left(L_{\text {sac }} / L_{\text {sec }}-1\right)\right] \text {, where: }
$$

$L_{\text {mieed }}$ Approximate contact life in operations for a mixed AC-3/AC-4 utilization category application.
$L_{a c}$
Approximate contact life in operations for a pure AC-3 utilization category (from the AC-3 life-load curve).
$L_{\text {act }}$
Approximate contact life in operations for a pure AC-4 utilization category (from the AC-4 life-load curve).
$P_{s c t} \quad$ Percentage of $A C-4$ operations


[^8]
## sprecher+

 Technical Information
## Operating Rates

The estimated contact life shown in the life-load curves is based on the standard operating rates shown in Table B below. For applications requiring a higher operating frequency, the maximum operating power ( $P_{n}$ in KW or HP) for a given contactor must be reduced to maintain the same contact life.
To find a contactor's maximum operating power, for an operating rate greater than shown in Table B, follow these guidelines:

1. Identify the appropriate curve for the contactor and utilization category from Table B.
2. Locate the appropriate Maximum Operating Rate curve on the following pages.
3. Locate the intersection of the curve with the application's operating rate ( $\mathrm{ops} / \mathrm{hr}$.) found on the vertical axis.
4. Read the percent of maximum operating power ( Pn ) of the contactor from the horizontal axis.
5. Multiply the \% maximum power by the standard power rating. Example: The contactor selected for an AC-4 utilization category application is a CA7-16 (10HP at 460V), however, the application requires an operating rate of $200 \mathrm{ops} / \mathrm{hr}$., compared to the standard operating rate of $120 \mathrm{ops} / \mathrm{hr}$. as shown in Table B.
6. Locate the $A C-4$ Maximum Operating Rate curve on the following pages.
7. Locate the intersection of $200 \mathrm{ops} / \mathrm{hr}$ on the CA7-16 curve. The data shows that the maximum operating power of the CA7-16 contactor in this application is $60 \%$.
8. Therefore, the maximum horsepower that can be switched by the CA7-16 contactor in this application is $6 \mathrm{HP}(0.60 \times 10 \mathrm{HP})$.

Table B - Standard Operating Rates by Contactor and Utilization Category

| Contactor | AC-1 Max, ops/hr. | AC-2 <br> Max, ops/hr. | AC-3 Max. ops/hr. | AC-4 Max. ops/hr. | AC-4 $\mathrm{E}_{4}$ for 200K ops. Max. ops/hr. |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Operating Parameters and Start Time |  |  |  |  |
|  |  |  | 40\% Duty Cycle 250 ms 0 | 250 ms | 250 ms |
| CA-9 | 1000 | 500 | 700 | 200 | 400 |
| CA-12 | 1000 | 500 | 700 | 150 | 300 |
| CA-16 | 1000 | 500 | 700 | 120 | 240 |
| CA-23 | 1000 | 400 | 600 | 80 | 160 |
| CA-30 | 1000 | 400 | 600 | 80 | 160 |
| CA-37 | 1000 | 400 | 600 | 70 | 140 |
| CA-43 | 1000 | 400 | 600 | 70 | 140 |
| CA-60 | 800 | 300 | 500 | 70 | 140 |
| CA-72 | 800 | 250 | 500 | 60 | 120 |
| CA-25 | 600 | 200 | 500 | 50 | 140 |

[^9]Technical Information
CA7 Contactors - Operating Rates

## $\square 1$ Operating Rate Curves




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## sprecher +

Operating Rate Curves

AC-3
Squirrel-cage motors: starting, switching off motors during running; $\boldsymbol{u}_{\mathrm{e}}=\mathbf{2 3 0} \ldots . .460 \mathrm{VAC}$ Relative operating time $40 \%$, Starting time $t_{A}=0.25 \mathrm{~s}$


AC-4


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## Series CA7, GAU7, CAQ7, CNX, CAN7 and CAL7 (Contactors, Reversing Contactors \& Special Use Contactors)



Reversing Contactors, Capacitor Contactors \& Accessories (+...)

| Contactors with... |  | Dim. [mm] | Dim. [inches] |
| :--- | :--- | :--- | :--- |
| auxiliary contact block-front mounting | 2-, or 4-pole | $\mathrm{c} / \mathrm{c} 1+39$ | $\mathrm{c} / \mathrm{c} 1+1-37 / 64$ |
| (CAQ7) capacitor switching deck -front mounting | $\mathrm{c} / \mathrm{c} 1+39$ | $\mathrm{c} / \mathrm{c} 1+1-37 / 64$ |  |
| auxiliary contact block-side mounting | 1 -, or 2 pole | $\mathrm{a}+9$ | $\mathrm{a}+23 / 64$ |
| pneumatic timing module |  | $\mathrm{c} / \mathrm{c} 1+58$ | $\mathrm{c} / \mathrm{c} 1+2-23 / 64$ |
| electronic timing module | on coil terminal side | $\mathrm{b}+24$ | $\mathrm{~b}+15 / 16$ |
| reversing contactor w-mech.interlock | on side of contactor | $\mathrm{a}+9+\mathrm{a}$ | $\mathrm{a}+23 / 64+\mathrm{a}$ |
| mechanical latch | on coil terminal side | $\mathrm{c} / \mathrm{c} 1+61$ | $\mathrm{c} / \mathrm{c} 1+2-31 / 64$ |
| interface module | on coil terminal side | $\mathrm{b}+9$ | $\mathrm{~b}+23 / 64$ |
| surge suppressor | label sheet |  |  |
|  | marking tag sheet with clear cover |  |  |
| marking tag adapter for V7 Terminals | $+5 . \mathrm{Page} 191+0 / 3863$ |  |  |



## Series CA7 with Two Winding DC Coil





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## Series D7 Pilot Devices

22mm Design Saves Panel Space

Heavy Duty<br>Ratings

Modular Design Reduces Inventory

Order Assembled
or by Component

## Features

## TWO OPERATOR TYPES

- Plastic operator with captive front bezel
- Metal operator with die-cast zinc housing and captive shiny metal bezel


## LESS INVENTORY, MORE CHOICES

- Wide range of style choices
- Modular design for mix and match flexibility
- Endless configurations from core components


## QUICK, EASY INSTALLATION

- Tool-less mounting latch for quick assembly
- Anti-rotation tab for one person installation
- Snap-on back panel components

LONG ELECTRICAL \& MECHANICAL LIFE

- 10 million mechanical operations
- 10 million electrical cycles


## ENVIRONMENTAL RATINGS

- UL Type 4/4X/13, IP66 Sealing
- Chemical resistant industrial grade thermoplastic body
- Corrosion and UV resistant

Sprecher + Schuh's rugged D7 pilot devices offer maximum flexibility and a wide choice for all applications. This 22 mm line is aesthetically appealing and modularly designed to make assembly and interchangeability easy. The D7 operators are available in two different body styles to meet every industrial application need. Both operators exhibit a new lower profile stylish appearance while maintaining the rugged performance necessary for demanding environments.


## Fast Momilig



Complete Accessorfes
Supertor Design




Diaphragm Seal

- Flexes with operation - Dependent on lubrication






Dimensions* Apporximatey im milimeters)

## Non-lluminated and lluminated <br> Flush Push Button Operators (D7x-F) <br> 

Non-llluminated Guarded and Non-lliuminated Maintained Push Button Operators (07x-6 and D7x-FA)

lluminated and Non-lluminated Knob Selector Switch Operators (D7x-LS \& D7x-S)


Wlluminated and Man- Hemiminated
Momentary Mushroom Operators
40 mm and s.men ( $\mathrm{D7x} \mathrm{x}$-LMM \& D7x-MM)


\section*{| Operator | A |
| :---: | :---: |
| 40 mm | 39.8 |
| 60 mm | 59.8 |}

Wluminated and Non-Thuminated Twist-to-Release Operators $30 \mathrm{~mm}, 40 \mathrm{~mm}$, and 60 mm ( $07 \mathrm{x}-\mathrm{MT}$ )


Mushroom Key Release Operator 40 mm ( $07 x$-M0X)


Noc-lluminated 3-Position Mutr-function Operators (D7x-U3)

lluminated and Non-lluminated 2-Position Mutt-function Operators (07x-U2 8 07x-U2)


Togple Switch Operators (D7M-MM)


Reset Operators (D7x-R)


Selector Jog Operators (D7x-S.)


Potentiometer with Resstive Element (DTP- POT)


* For Monolithic Devices see the D7D Monolithic Fiyer
[CATALOGUE TB2-CAT]


# TEMBREAK 2 MOULDED CASE CIRCUIT BREAKERS 

TemBreak

INDUSTRIAL SWITCHGEAR \& AUTOMATION SPECIALISTS

Beyond the Standard ${ }^{\text {TM }}$

## (-) TERASAKI

## TemBreak

Simply....

## Beyond the Standard ${ }^{\text {TM }}$

## - Easy accessory fitting

- Double insulated MCCB
- 125 / 250 A adjustment flexibility
- Clear contact status
- Symmetrical design
- Elec / Mech endurance
- Low temperature rise
- Higher harmonic immunity

High insulation voltage

## TemBreak

MOULDED CASE CIRCUIT BREAKERS

MAIN CONTACT / TOGGLE STATUS VISIBILITY


TemBreak 2 MCCBs are marked with the IEC symbol indicating Direct Opening Action. The robust mechanism ensures that the force applied to the toggle is transmitted directly to the contacts.

Isolation and Machine Safety
Complies with direct action contact status requirements.


[^10]
## (-) TERASAKI <br> TemBreak

MOULDED CASE CIRCUIT BREAKERS

TEMBREAK 2

Positive OFF/ON operation.
The toggle mechanism is directly driven by the MCCB main contacts. The label logo below indicates this fact.


## Thermal Magnetic

125 A, 250 A and 400 A MCCBs

- MCCBs are fitted with adjustable thermal AND adjustable magnetic current adjustment dials


## Electronic MCCB range

- From 50 A to 630 A
- 2 frame sizes: 250 A and $400 / 630 \mathrm{~A}$



## TemBreak

MOULDED CASE CIRCUIT BREAKERS

## ELECTRICAL CHARACTERISTICS

According to IEC 60947-2, EN 60947-2, JIS C 8201-2, AS/NZS 3947-2, NEMA


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TemBreak 2 switch-disconnectors are available with the same frame dimensions as the MCCBs.

## TemBreak

## MOULDED CASE CIRCUIT BREAKERS

| 220 |  |  |  |  |  | 400 |  |  |  |  |  |  |  |  |  | 630 |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| E250 | S250 |  |  | H250 | L250 | E400 | S400 |  |  |  |  | H400 |  | 1400 |  | E630 | S630 |  |
| 3,4 | 3,4 |  |  | $\begin{array}{\|l\|} \hline 3,4 \\ \hline N J \\ \hline \end{array}$ | $\begin{array}{\|l\|} \hline 3,4 \\ \hline \mathrm{NJ} \\ \hline \end{array}$ | $\begin{array}{\|l\|} \hline 3,4 \\ \hline \text { NJ } \end{array}$ | 3,4 |  |  |  |  | 3,4 |  | 3,4 |  | $\begin{array}{\|l\|} \hline 3,4 \\ \hline \mathrm{NE} \\ \hline \end{array}$ | 3,4 |  |
| NJ | NJ | GJ | PE |  |  |  | CJ | NJ | NE | GJ | GE | NJ | NE | NJ | NE |  | CE | GE |
| - | 7.5 | 7.5 | 20 | 20 | 25 | - | 15 | 20 | 20 | 20 | 20 | 35 | 35 | 50 | 50 | 10 | 20 | 20 |
| 15 | 25 | 50 | 50 | 85 | 125 | 22 | 30 | 45 | 30 | 50 | 50 | 85 | 85 | 125 | 125 | 25 | 45 | 50 |
| 25 | 36 | 65 | 70 | 125 | 200 | 25 | 36 | 50 | 50 | 70 | 70 | 125 | 125 | 200 | 200 | 36 | 50 | 70 |
| 35 | 65 | 85 | 125 | 150 | 200 | 35 | 50 | 85 | 85 | 100 | 100 | 150 | 150 | 200 | 200 | 50 | 85 | 100 |
| 25 | 40 | 40 | - | 40 | 40 | 25 | 40 | 40 | - | 40 | $\checkmark$ | 40 | - | 40 | - | - | - | - |
| - | 7.5 | 7.5 | 15 | 15 | 20 | - | 15 | 15 | 15 | 15 | 15 | 35 | 35 | 50 | 50 | 10 | 15 | 15 |
| 12 | 25 | 25 | 50 | 65 | 100 | 22 | 30 | 45 | 45 | 45 | 45 | 65 | 65 | 100 | 100 | 25 | 45 | 45 |
| 19 | 36 | 36 | 70 | 85 | 150 | 25 | 36 | 50 | 50 | 50 | 50 | 85 | 85 | 150 | 150 | 36 | 50 | 50 |
| 27 | 65 | 85 | 125 | 150 | 150 | 35 | 50 | 85 | 85 | 85 | 85 | 150 | 150 | 150 | 150 | 50 | 85 | 85 |
| 19 | 40 | 40 | - | 40 | 40 | 19 | 40 | 40 | - | 40 | - | 40 | - | 40 | - | - | - | - |
| 10 | 22 | 25 | 35 | 45 | 65 | 15 | 22 | 25 | 25 | 30 | 30 | 45 | 45 | 65 | 65 | 15 | 25 | 30 |
| 35 | 65 | 85 | 125 | 150 | 200 | 35 | 50 | 85 | 85 | 100 | 100 | 150 | 150 | 200 | 200 | 50 | 85 | 100 |



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## INTERNAL ACCESSORIES

One size fits all!


## Smart Accessories



## SIMPLY SAFE

- Common accessory range from 125AF to 630AF
- Double insulated MCCB allowing accessory fitting while "live"
- TemBreak 2 accessory types reduce part numbers, stock, make supply more customer friendly, reduce lead times
- All accessories meet IEC 60 947-5, AS/NZS 3947-5
- Endurance tested accessories - not normally done by many manufacturers

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## (9) TERASAK <br> TemBreak

## IIOULDED CASE CIRCUIT BREAKERS



EXTERNAL ACCESSORIES

ransfer switch ink interlock

Allows for handles and motors to be mounted


Transfer switch Wire interlock

Horizontal, vertical or diagonal MCCB mounting allows for handles and motors to be mounted

Simple to fit


TemPlug
A simple plug in method for MCCBs 125 A to 630 A


## Motor fitting

Simple, quick installation in seconds requiring no tools on 125 A / 250 A MCCBs. Larger MCCBs only require a screwdriver


## Variable and fixed depth

 handlesimple, quick installation in seconds requiring no tools on 125 A / 250 A MCCBs, Larger MCCBs only require a screwdriver. IP 54 or IP 65 handles


Terminal covers
Slide-on ariagelich place, no tools required


Plug in MCCB
Safety interlock standard to maximise safety


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## D Series

## Data Radio Modem

## DR900 - Digital Radios

Trio DataCom's D Series are high performance cost effective data radio modems designed as an alternative to hard wired data transport. Transmit your data over radio with a fully integrated data radio modem designed for fixed point-to-point and point-to-multipoint applications.

The D Series is available as either a half duplex or a full duplex* $853-929 \mathrm{MHz}+/-5 \mathrm{MHz}$ radio, including a fully integrated $4800 / 9600 \mathrm{bps}$ data modem. These units operate equally well in either a stand-alone configuration, or as part of a large communication system.


This complete package forms an attractively priced product for the transmission of data over radio in fixed applications thus providing a viable alternative to costly networks of buried media.

## Features:

* Fully integrated half and full duplex ${ }^{\star}$ radio and modem
* Transparent and non-intrusive remote diagnostic facilities (Optional)
* Inbuilt data routing and multiplexing capabilties, multi-port operation
* Simultaneous delivery of multiple protocols using Trio DataCom's unique MultiStream ${ }^{T M}$ technology
* Digital Signal Processing (DSP) modem
* Selectable 300-19,200 bps asynchronous RS232 user interface
* Built-in antenna diplexer*
* Integrated supervisory data channel
* Unique collision avoidance facility, for unsolicited report-byexception
* Software selectable configuration parameters
* Internal repeater operation
* Housed in an attractive yet robust metal enclosure
* Range of ancillary equipment - full duplex base / repeater stations and hot-standby base station


## Radio

The D Series radio has been designed to meet worldwide regulatory guidelines, including FCC, and has adjustable power output up to 5 Watts. This fully synthesised radio is programmable in $6.25 / 7.5 \mathrm{kHz}$ increments to accommodate various worldwide channel spacings. The receiver section has a wide tuning range with an excellent signal-to-noise ratio. Exceptional frequency stability is achieved by intelligent microprocessor controlled temperature compensation. An extended operating temperature range of -30 to $60^{\circ} \mathrm{C}$ makes the unit ideal for commercial and industrial applications.

## Modem

The in-built modem includes a custom DSP developed for data communications over narrow band radio systems.

This system offers minimum occupied bandwidth and optimal data integrity (using the standard HDLC protocol with CCITT CRC error detection) inhibiting the transfer of any rogue unwanted data caused by interference or squelch headers / tails.
The Trio DataCom DSP provides:

- the interface between the asynchronous RS232 user communication and the synchronous radio link layer.
- an inbuilt multipexer / router which allows for simultaneous transportation of multiple protocols over the one radio network. Page 208 of 363


## Applications

The D Series is ideal for use in a variety of sophisticated and critical SCADA and Distributed Information Systems, where complex routing of multiple data protocols and remote diagnostics and wireless network management are important factors.
Remote units and a number of full duplex base station / repeater models, suitable for a variety of requirements, make up the D Series. At the top of the range, the DH model is a genuine, duplicated hot standby base for systems where nothing short of ultra reliability is acceptable.
Telemetry Systems - Utilities (Gas, Water, Electricity), Railways, Mining, Telecommunications, Industry. Where network status, system control, data collection and fault conditions are required.

Transaction Processing - Point of Sale Credit Terminals, Stock Control, Direct Order, Banks, Building Societies, Stock Brokers, Gambling Organizations, etc, where Point of Sale, inventory, credit, or transaction data requires collection and distribution.

Common Carrier Data Services - The high speed, low cost and spectrum efficiency of this device make it well suited to all forms of common carrier data networking.
Alarm Monitoring - Fire, Power, Intrusion \& Essential Services Alarm Reporting.

## designs products \& Solutions

## D Series - Data Radio Modem 1900 - Digital Radios

## Configuration

Configuration using Trio's D Series programming software (DRProg) is completely Windows ${ }^{\circ}$ based for all parameters, such as; frequency, transmitter power, digital mute level, PTT timer, system configurations, port settings.

## Network Management \& Diagnostic (Optional)

A large distributed network, or even a simple point-to-point link, requires comprehensive fault reporting and diagnostics to ensure a high level of availability. Trio D Series data radio modem products offer sophisticated in-built diagnostics using the optional TView ${ }^{\text {TM }}$ software. This capability allows the customer to remotely monitor and maintain their system, minimising the likelihood of failures, by pointing out component degradation and decreasing the time to diagnose and repair. There is no necessity to visit the master tion or interfere with the host data integrity, other than additional a transfer. For further details, consult the TView data sheet.

## Specifications:

| RADIO |  |
| :---: | :---: |
| Frequency Range** | $853-929 \mathrm{MHz}+/-5 \mathrm{MHz}$ |
| Channel Selection | Fully programmable |
| Frequency Splits | $76 \mathrm{MHz} \mathrm{Tx/Rx}$ frequency split available including simplex |
| Frequency Stability | 土1ppm ( -10 to $60^{\circ} \mathrm{C}$ ambient, opt. -30 to $70^{\circ} \mathrm{C}$ ) Higher frequency stability options are available due to intelligent processor controlled temperature compensation |
| Aging | <=1ppm/annum |
| Half / Full Duplex | half duplex or full duplex* |
| Data Rate (ri) | 4800 / 9600 bps |
| Configuration | All configuration via Windows software |
| TRANSMITTER |  |
| Tx Power | $5 \mathrm{~W}(+37 \mathrm{dBm})$ or $1 \mathrm{~W}^{*}(+30 \mathrm{dBm})$ (software programmable) |
| odulation | Narrow band digital filtering binary GMSK |
| ccupied Bandwidth | Meets various international regulatory guidelines for point-to-point and point-to-multipoint |
| Tx Attach Time | $<1 \text { mSecond }$ |
| Timeout Timer | Programmable 1-255 seconds |
| Tx Spurious | $<=-65 \mathrm{dBm}$ |
| RECEIVER |  |
| Sensitivity | -115 dBm for 12 dB SINAB |
| Blocking | $>75 \mathrm{~dB}$ (EIA) |
| Intermodulation | $<=70 \mathrm{~dB}(\mathrm{EIA})$ |
| Spurious Response | $<=70 \mathrm{~dB}$ (EIA) |
| Select. and Desense | 70 dB (EIA) |
| AFC Tracking | $\pm 3 \mathrm{kHz}$ tracking @ -90 dBm/attack time $<10 \mathrm{mS}$ |
| Mute | Programmable digital mute |

## Collision Avoidance

A unique fully integrated, yet independent, low speed supervisory data channel embedded within the primary bit-stream provides collision avoidance facilities which are transparent to the user. The use of this feature makes this product ideally suited for reliable, error free data transmissions between stations in high density point-to-multipoint data networks.

The benefits include:

- Multiple asynchronous applications operating on the one radio channel.
- Enhanced performance of report-by-exception networks.


## Related Products

* Base Stations (DB900)
* Hot Standby Base Station (DH900)
* 9 Port Stream Router Multiplexer (MSR)
* Network Management and Diagnostic Software (TView ${ }^{\text {TM }}$ )
* D Series Programming Software (DRProg ${ }^{\text {M }}$ )

| CONNECTIONS |  |
| :--- | :--- |
| User Data Port | $2 \times$ DB9 RS232 female ports <br> SMA female bulkhead (optional N) <br> 2 pin locking. Mating connector supplied |
| Antenna |  |
| Power |  |$\quad$| MODEM | Full duplex, DB9 RS232, DCE (modem), 300- <br> 19,200 <br> handshaking asynchronous, hardware/software <br> Full duplex, DB9 RS232, 300-9600 bps <br> asynchronous, software handshaking |
| :--- | :--- |
| Data Serial Port\#1 |  |

- Avallable for DR900 full duplex 1 W version ( $853 \pm 5 \mathrm{MHz} / 929 \pm 5 \mathrm{MHz}$ )

Local regulatory conditions may determine the suitablity of indvidual versions in different countries. It is the responsibility of the buyer to conflrm these regulatory condilions. Performance data indicates typical values related to the described unit. - Copyright 2004 Trio DataCom Pty led All right resened lout 1100

## VEGABAR 52

## Profibus PA

## Pressure transmitter with CERTEC ${ }^{\circledR}$ measuring cell



## Area of application

The VEGABAR 52 pressure transmitter can be used universally for measurement of gases, vapours and liquids. Also substances such as sand are not problem for the abrasion-resistant ceramic measuring cell. The VEGABAR 52 is an economical solution for a multitude of applications in all areas of industry.

## Advantages

- High plant availability through maximum overload and vacuum resistance of the ceramic measuring cell
- Measurement down to the last drop through extremely small measuring ranges with high accuracy.
- Low costs for maintenance thanks to wear-free ceramic measuring cell


## unction

The heart of the pressure transmitter is the pressure measuring cell that transforms pressure into an electrical signal. This pressure-dependent signal is converted into a standard output signal by the integrated electronics.
The sensor element is the CERTEC ${ }^{\oplus}$ measuring cell with excellent longterm stability and high overload resistance. The CERTEC ${ }^{\text {® }}$ measuring cell is also equipped with a temperature sensor. The temperature value can be displayed via the indicating and adjustment module or processed via the signal output.

| Measuring ranges | $\begin{aligned} & -1 \ldots+72 \mathrm{bar} /-100 \mathrm{kPa} \ldots+7200 \mathrm{kPa} \\ & (-14.5 \ldots+1044 \mathrm{psig}) \end{aligned}$ |
| :---: | :---: |
| Smallest measuring range | +0.1 bar/+10 kPa (+1.45 psig) |
| Deviation | $<0.075 \%$, optionally up to $<0.05 \%$ |
| Process fitting | Thread G1⁄2 (EN 837), thread from G1 $1 / 2$ (DIN 3852-A), flanges from DN 25 or ANSI $1^{\prime \prime}$, fittings for the food processing and paper industry |
| Process temperature | $-40 \ldots+150^{\circ} \mathrm{C}\left(-40 \ldots+302{ }^{\circ} \mathrm{F}\right)$ |
| Ambient, storage and transport temperature | $-40 \ldots+80^{\circ} \mathrm{C}\left(-40 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| Betriebsspannung | $9 \ldots 32 \mathrm{~V}$ DC |


#### Abstract

Materlals The wetted parts of the instrument are made of 316L, PVDF, Hastelloy, C4-plated or Sapphire-ceramic ${ }^{\oplus}$. The process seal is available in FKM, FFKM as well as EPDM. You will find a complete overview of the available materials and seals in the "configurator" on our homepage under www.vega.com/configurator.


## Housing versions

The housings are available as single chamber or double chamber version in plastic, stainless steel or aluminium.
They are available in protection ratings up to IP 68 ( 25 bar) with external electronics.

## Electronics versions

The instruments are available in different electronics versions. Apart from the two-wire electronics with $4 \ldots 20 \mathrm{~mA}$ or $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$, two purely digital versions with Profibus PA and Foundation Fieldbus are available.

## Approvals

The instruments are suitable for use in hazardous areas and are approved e.g. according to ATEX and IEC. The instruments have also different ship approvals such as e.g. GL, LRS or ABS.
You can find detailed information on the existing approvals in the "configurator" on our homepage under www.vega.com/configurator.

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## Bedienung

Die Bedienung des Gerätes erfolgt über das optional einsetzbare Anzeige- und Bedienmodul PLICSCOM oder über einen PC mit der Bediensoftware PACTware und entsprechendem DTM. Eine alternative Bedienmöglichkeit ist das herstellerspezifische Bedienprogramm PDM.


Elektrischer Anschluss

lektronik- und Anschlussraum Einkammergehãuse

[^11]Details zum elektrischen Anschluss finden Sie in der Betriebsanleitung des Gerätes auf unserer Homepage unter www.vega.com/downloads.

## Dimensions


imensions VEGABAR 52
1 Threaded version G1⁄2 A (manometer connection EN 837)

2 Threaded version G1 $1 / 2$ A
3 Flange version DN 50

## Information

You can find further information about the VEGA product line on our homepage www.vega.com.
In the download section under www.vega.com/downloads you'll find free operating instructions, product information, brochures, approval documents, instrument drawings and much, much more.
There, you will also find GSD and EDD files for Profibus PA systems as well as DD and CFF files for Foundation Fieldbus systems.

## Instrument selection

With the "finder" you can select the most suitable measuring principle for your application: www.vega.com/finder.
You can find detailed information on the instrument versions in the "configurator" on our homepage under www.vega.com/configurator.

## Contact

You can find the VEGA agency serving your area on our homepage www.vega.com.

## VEGADIS 62

External indicating and adjustment unit without additional external energy


## Application area

VEGADIS 62 is suitable for measured value indication and adjustment of standard sensors with HART protocol. The instrument is looped directly into the $4 \ldots 20 \mathrm{~mA}$ signal line at any location. A separate external power supply is not required. VEGADIS 62 also operates exclusivaly as an indicating instrument in a 4 ... 20 mA current loop.

## Your benefit

- Minimum time and cost expenditure for on-site parameter adjustment via clearly arranged display with simple 4-key adjustment
- Reliable and easy adjustment of the HART sensors through clear text indication with graphic support


## Function

VEGADIS 62 measures the current in the current loop and indicates the measured value in digital and quasianalogue format. The instrument operates in different modes. In basic mode at $4 \ldots 20 \mathrm{~mA}$, the instrument can be scaled individually via the adjustment keys. In HART standard and HART multidrop mode, the instrument listens continuously to the HART communication between control system and sensor. It adapts itself automatically to modifications of unit and/or measuring range.

| Technical data |  |
| :---: | :---: |
| General data |  |
| Materials |  |
| - Housing | plastic PBT, Alu die-casting, 316L |
| - Inspection window in housing cover for indicating and adjustment module | Polycarbonate (UL-746-C listed) |
| - Ground terminal | 316TV/316L |
| Weight approx. | 0.35 kg ( 0.772 lbs ) |
| Supply circuit |  |
| Voltage supply and data transmission | via the signal circuit |
| Current range | $3.5 \ldots 22.5 \mathrm{~mA}$ |
| Indicating and adjustment module |  |
| Display |  |
| - Principle | LCD |
| - Measured value presentation | 7 segments, 5 -digit, height of digits $9 \mathrm{~mm}(0.354 \mathrm{in})$, indication range -99999 ... 99999 |
| - Bar graph | 20 segments |
| - Info line | 14 segments, 6 -digit, height of digits 5.5 mm ( 0.217 in ) |
| Adjustment elements | 4 keys |
| Materials |  |
| - Housing | ABS |
| - Inspection window | Polyester foil |
| Ambient conditions |  |
| Amblent temperature | $-20 \ldots+70^{\circ} \mathrm{C}\left(-4 \ldots+158^{\circ} \mathrm{F}\right)$ |
| Storage and transport temperature | $-40 \ldots+80^{\circ} \mathrm{C}\left(-40 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| Electromechanical data |  |
| Cable gland | $2 \times$ cable entry M20 $\times 1.5$ (cable: © $5 \ldots 9 \mathrm{~mm}$ ) |
| Spring-loaded terminals for wire cross-section |  |
| - Massive wire, cord | $0.2 \ldots 2.5 \mathrm{~mm}^{2}$ (AWG $24 . . .14$ ) |
| - Stranded wire with end sleeve | $0.2 \ldots 1.5 \mathrm{~mm}^{2}$ (AWG $24 . . .16$ ) |
| Electrical protective measures |  |
| Protection rating |  |
| - Housing plastic | IP 66/1P 67 |
| - Housing Aluminium, stainless steel | IP 66/IP 68 (0.2 bar) |

## Approvals

You can find detailed information on the existing approvals in the "configurator' on our homepage under wowwega.com/configurator.

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## Adjustment

The adjustment of VEGADIS 62 is menu-controlled via four keys on the front and one LC display.


Indicating and adjustment elements
1 Status information (HART mode, unit lock, warning or error information) 2 Unit and information line
3 Digital measured value indication
3 Bar graph for quasianalogue measured value indication
3 Adjustment keys

## Electrical connection



## Wiring plan VEGADIS 62

1 To the sensor
2 For power supply
3 For connection cable to indicating and adjustment module


Installation example VEGADIS 62 in conjunction with an individual sensor

## 1 Sensor

2 VEGADIS 62
3 HART resistance $>150 \Omega$ (necessary with low impedance power supply)
4 Voltage supply/Processing
You can find details of the electrical connection in the operating instruction of the instrument on www.vega.com/downloads.

## Dimensions



## Info

You can find further information about the VEGA product line on our homepage www.vega.com.
In the download section under www.vega.com/downloads you'll find dage 213 of 363

## Pressure measurement

## -ocess pressure/Hydrostatic

VEGAWELL 52


## Product Information

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## Contents

1 Description of the measuring principle ..... 3
2 Type overview ..... 4
3 Mounting instructions ..... 5
4 Electrical connection
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8 Product code ..... 15

## Take note of safety instructions for Ex applications

Please note the Ex specific safety information which you can find oñour homepage www.vega.comlservicesidownloads and which comes with every instrument. In hazardous areas you should take note of the appropriate regulations, conformity and type approval certificates of the sensors and power supply units. The sensors must only be operated on intrinsically safe circuits. The permissible electrical values are stated in the certificate.

## 1 Description of the measuring principle

## Measuring principle

VEGAWELL 52 pressure transmitters work according to the hydrostatic measuring principle, which functions independently of the dielectric properties of the product and is not influenced by foam generation.

The sensor element of VEGAWELL 52 is the dry ceramic-capacitive CERTEC ${ }^{\oplus}$ measuring cell in two sizes. Base element and diaphragm consist of high purity sapphire-ceramic ${ }^{\oplus}$.

The hydrostatic pressure of the product causes via the diaphragm a capacitance change in the measuring cell. This capacitance change is converted into an appropriate output signal.


Fig. 1: Configuration of the CERTEC ${ }^{\text {® }}$ measuring cell with VEGAWELL 52
1 Diaphragm
2 Soldered glass bond
3 Base element
The advantages of the CERTEC ${ }^{(8}$ measuring cell are:

- Very high overload resistance
- No hysteresis
- Excellent long-term stability
- Completely front flush installation
- Good corrosion resistance
- Very high abrasion resistance


## Wide application range

VEGAWELL 52 is suitable for level measurement in deep wells and ballast tanks as well as for gauge measurement in open flumes. Typical media are drinking water and waste water as well as water containing abrasive substances. All signal outputs are available in $4 \ldots 20 \mathrm{~mA}$ and $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100.

In the 4 ... $20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100 version, a temperature sensor Pt :100 in four-wire technology is integrated in the transducer. Power supply or processing are carried out via an external temperature transducer.

Type overview

## 2 Type overview

VEGAWELL 52
is

| Measuring cell: | CERTEC ${ }^{\oplus}$ |
| :--- | :--- |
| Media: | drinking water and waste water |
| Process fitting: | Straining clamp, screw connection, thread |
| Material process fitting: |  |
|  |  |
| Material, suspension cable: PE, PUR, FEP |  |

Material transmitter:
316L, 1.4462 (Duplex), each also with PE coating, PVDF, Titanium
Diameter transmitter:
depending on material and version at least 22 mm
Measuring range:
Process temperature:
$0 \ldots 0.1$ bar up to $0 \ldots 25$ bar

Deviation:
Signal output:
$2 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176^{\circ} \mathrm{F}\right)$

Operation:
$4 \ldots 20 \mathrm{~mA}, 4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$
depending on the version via PACTware/PC

## 3 Mounting instructions

## Mounting position

The following illustration shows a mounting example for VEGAWELL 52. The VEGA price list contains suitable mounting brackets under the section Accessories. With these parts, standard mounting arrangements can be realised quickly and reliably.


Fig. 3: VEGAWELL 52 in a pump shaft with VEGABOX 02
VEGAWELL 52 must be mounted in a calm area or in a suitable protective tube. This avoids lateral movements of the transmitter and the resulting corruption of measurement data.

## Note:

As an alternative to fixing the transmitter; the use of a measuring instrumentholder from VEGA's line of mounting accessories is recommended:

Beside the connection and suspension cables, the suspension. cable also contains a capillary for atmospheric pressure compensation. All versions can be shortened on site.

With VEGAWELL 52 , the electronics is completely integrated in the transmitter. The cable end can be lead directly to a dry connection compartment: Pressure compensation is then carried out via the filter element of the capillaries.

## ?

## Note:

The pressure compensation housing VEGABOX 02 is recommended for connecting VEGAWELL 52.

It contains a high-quality ventilation filter and terminals. A protective cover is optionally available for use outdoors.

## Mounting versions

The following illustrations show the different mounting versions depending on the instrument type.

Mounting with straining clamp


Fig. 5: Straining clamp
1 Suspension cable
2 Suspension opening
3 Clamping jaws

Mounting with screw connection


Fig. 6: Screw connection
1 Suspension cable
2 Seal screw
3 Cone bushing
4 Sealcone
5 Screw connection
6 Seal

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## Mounting with housing and thread



Fig．7：Housing with thread G11／2 A

## 4 Electrical connection

### 4.1 General requirements

The supply voltage range can differ depending on the instrument version. You can find exact specifications in chapter "Technical data".

The national installation standards as well as the valid: safety regulations and accident prevention rules must be observed.

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

### 4.2 Power supply

Supply voltage and current signal are carried on the same twowire cable. The requirements on the power supply are specified in chapter "Technical data".

The VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690; VEGADIS 371 as well as VEGAMET signal conditioning instruments are suitable for power supply. When one of these instruments is used, a reliable separation of the supply circuits from the mains circuits according to DIN VDE 0106 part 101 is ensured.

### 4.3 Connection cable

## In general

An outer diameter of $5 \ldots 9$ mmensures the seal effect of the cable entry. If electromagnetic interference is expected, screened cable should be used for the signal lines.

The sensors are connected with standard two-wire cable without screen.


In Ex applications, the corresponding installation regulations must be noted for the connection cable.

### 4.4 Cable screening and grounding

If screened cable is necessary, the cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. $1 \mathrm{nF}, 1500 \mathrm{~V}$ ).

### 4.5 Wiring plan VEGAWELL 52-4... 20 mA <br> Direct connection



Fig. 8: Wire assignment, suspension cable
1 blue (-): to power supply or to the processing system
2 brown (+): to power supply or to the processing system
3 Shielding
4 Breather capillaries with filter element

## Connection via VEGABOX 02



Fig. 9: Terminal assignment VEGABOX 02
1 To power supply or the processing system
2 Shielding

Connection via housing


Fig. 10: Terminal assignment of the housing

1. To power supply or the processing system.

2 Shielding ${ }^{2}$

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### 4.6 Wiring plan VEGAWELL 52-4... $20 \mathrm{~mA} /$ HART - Pt 100

## Direct connection

|  |
| :---: |

Fig. 11: Wire assignment, connection cable
1 blue (-): to power supply or to the processing system
Brown (+): to power sujply or to the processing system White: for processing of the integrated Pt 100 (power supply)
Yellow: for processing of the integrated Pt 100 (measurement)
5 Red: for processing of the integrated Pt 100 (measurement)
6 Black: for processing of the integrated Pt 100 (power supply)
7 Shielding
8 Breather capillaries with filter element

## Connection via VEGABOX 02



Fig. 12: Terminal assignment VEGABOX 02
1 To power supply or the processing sysiem (signal pressure transmitter)
2 To power supply or the processing system (connection cables resistance thermometer Pt 100
3 . Shielding ${ }^{3)}$

Connection via VEGABOX 02 with integrated temperature sensor


Fig. 13: Terminal assignment VEGABOX 02
1 To power supply or the processing system (signal pressure tranșmitter)
2 For voltage supply or to processing system (resistance thermometer Pt 100)
3 Shielding ${ }^{4}$

Connection via housing


Fig. 14: Terminal assignment of the housing
1 Topower supply or the processing system (signal pressure transmitter)
2 For voltage supply or to processing system (resistance thermometer Pt 100) 3 Shielding ${ }^{51}$

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## 5 Operation

### 5.1 Overview

VEGAWELL 524 ... 20 mA
VEGAWELL 52-4 ... 20 mA has no adjustment options.

VEGAWELL 524 ... $20 \mathrm{~mA} /$ HART - Pt 100

- Adjustment software according to FDT/DTM standard, e.g. PACTware and PC
- HART handheld


### 5.2 Adjustment with PACTware

Connecting the PC to the signal cable


Fig. 15: Connection of the PC to VEGABOX 02 or communication resistor
1 PC with PACTware
2 RS232 interface (with VEGACONNECT 3), USB interface (with VEGACONNECT 4)
3 VEGACONNECT 3 or 4
4 Communication resistor $250 \Omega$
5. Power supply unit

## Necessary components:

- VEGAWELL 52
- PC with PACTware and suitable VEGA DTM
- VEGACONNECT with HART adapter cable
- HART resistor approx. $250 \Omega$
- Power supply unit


## Note:

W With power supply units with integrated HART resistance (internal resistance approx. $250 \Omega$ ), an additional external resistance is not necessary (e. g. VEGATRENN 149A, :VEGAMET 381/624/625, VEGASCAN 693). In such cases, VEGACONNECT can be connected parallel to the $4 \ldots 20 \mathrm{~mA}$ cable:

## 6 Technical data

```
Materials and weights
    Materials, wetted parts
    - Transmitter 316L,316L with PE coating, 1.4462 (Duplex), 1.4462 with PE coating,
    PVDF,Titanium
    - Diaphragm sapphire ceramic }\mp@subsup{}{}{1010
    - Measuring cell seal
    - Suspension cable
    - Cable gland on the transmitter
    - Process fitting
    - Straining clamp
    - Unassembled screw connection
    - Threaded connection on the housing
    Materials, non-wetted parts
    - Housing plastic PBT (Polyester), 316L
    Weight approx.
    - Basic weight 0.8 kg (1.764 fbs)
    - Suspension cable . . 0.1 kg/m (0.07 lbs/ft)
    - Straining clamp
    - Screw connection
    - Plastic housing
    - Stainless steel housing
        0.2 kg (0.441 lbs)
    0.4 kg (0.882 lbs)
    0.8 kg (1.764 lbs)
    1.6 kg (3.528 lbs)
Input variable
\begin{tabular}{ll} 
Measured value & Level \\
Measuring range & see product code \\
Recommended max. turn down & \(10: 1\)
\end{tabular}
```


## Output variable

```
\(4 \ldots 20 \mathrm{~mA}\)
Output signal \(4 \ldots 20 \mathrm{~mA}\)
Signal resolution
Failure signal
\(2 \mu \mathrm{~A}\)
Max. output current
\(<3.6 \mathrm{~mA}\)
Run-up time
Step response time
22 m
2 s
Fulfilled NAMUR recommendations
100 ms (ti: 0 s, \(0 . \mathrm{i} .63 \%\) )
4 ... 20 mA/HART - Pt 100
NE 43
Output signal
Signal resolution
Failure signal
Max. output current
Run-up time
Step response time
Fulfilled NAMUR recommendations
\(4 . . .20 \mathrm{~mA} H\) HART
```

$2 \mu A$
< $3.6 \mathrm{~mA} ; 20: 5 \mathrm{~mA} ; 22 \mathrm{~mA}$ i unchanged (adjustable via PACTware)
22 mA
15 s
200 ms (ti: $0 \mathrm{~s}, 0 \therefore 63 \%$ )
NE 43

Additional output parameter - temperature
integrated resistance thermometer
Pt 100 according to DIN EN 60751
Range
Resolution

## Deviation for 4 ... 20 mA version ${ }^{5)}$

Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.
Deviation with version $<0.2 \%$

- Turn down $1: 1$ up to $5: 1$
$<0.2 \%$
- Turn down > 10: 1 $<0.04 \% \times$ TD

5) Determined according to the limit point method according to IEC 60770, incl. non-linearity, hysteresis and non-repeatability.

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Deviation with version < 0.1 \%

- Turn down 1:1 up to $5: 1<0.1 \%$
- Turn down > $10: 1$

$$
<0.02 \% \times \text { TD }
$$

## Deviation for version 4 ... 20 mA/HART - Pt 100 ${ }^{\text {¹ }}$

Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

Deviation with version < 0.2 \%

- Turn down 1 : 1 up to 5 : 1

$$
\begin{aligned}
& <0.2 \% \\
& <0.04 \% \times \text { TD }
\end{aligned}
$$

- Turn down > 10 :

Deviation with version < $0.1 \%$

- Turn down 1 : 1 up to $5: 1<0.1 \%$
- Turn down $>10: 1 \quad<0.02 \% \times$ TD

Influence of the product or ambient temperature
Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

Average temperature coefficlent of the zero signal
In the compensated temperature range of $0 \ldots+80^{\circ} \mathrm{C}\left(+32 \ldots+176^{\circ} \mathrm{F}\right)$, reference temperature $20^{\circ} \mathrm{C}\left(68^{\circ} \mathrm{F}\right)$.
Average temperature coefficient of the zero signal

- Turn down 1: 1
$<0.05 \% / 10 \mathrm{~K}$
- Turn down 1: 1 up tọ 5 : 1
< $0.1 \% / 10$ K
- Turn down > 10:1 $<0.15 \% / 10 \mathrm{~K}$

Outside the compensated temperature range
Average temperature coefficient of thee zero signal

- Turn down 1 : 1
typ. $<0.05 \% / 10 \mathrm{~K}$


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

Applies to digital HART interface as well as to analogue current output $4 \ldots 20 \mathrm{~mA}$. Specifications refer to the set span. Turn down (TD) is the relation nominal measüring range/set span.
Long-term drift of the zero signal
$<(0.1 \% \times$ TD)/year

## Ambient conditions

Ambient temperature

- Connection cable PE
$-40 \ldots+60^{\circ} \mathrm{C}\left(-40^{\circ} \ldots+140^{\circ} \mathrm{F}\right)$
$-40 \ldots+85^{\circ} \mathrm{C}\left(-40 \ldots+185^{\circ} \mathrm{F}\right)$
$-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176^{\circ} \mathrm{F}\right)$


## Process conditions

## Process pressure

Max. process pressure, , transmitter ${ }^{8)}$

- Measúring range 0.1 bar ( 1.45 psig )
- Measuring range 0.2 bar (2.9 psig)

15 bar (218 psig)

- Measuring range $\leq 0.4$ bar ( 5.8 psig ) 20 bar (290 psig)

Pressure stage, process fitting

- Unassembled screw connection

16L: PN 3, PVDF: unpressurized

- Thread on the housing

PN 3
Product temperature, depending on the version

[^14]${ }^{8)}$. Limited by the overpressure resistance of the measuring cell.
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| Suspenslon cable | Transmitter | Product temperature |
| :--- | :--- | :--- |
| PE | All | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |
| PUR | All | $-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| PUR | PE coating | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |
| FEP | All | $-20 \ldots+80^{\circ} \mathrm{C}\left(-4 \ldots+176{ }^{\circ} \mathrm{F}\right)$ |
| FEP | PE coating | $-20 \ldots+60^{\circ} \mathrm{C}\left(-4 \ldots+140^{\circ} \mathrm{F}\right)$ |

Vibration resistance mechanical vibrations with 4 g and $5 \ldots 100 \mathrm{~Hz}^{99}$

## Electromechanical data

Suspension cable

- Configuration
- Tensile strength
- Max. length
- Min. bending radius
- Diameter approx.
- colour (non-Ex/Ex) - PE
- colour (non-Ex/Ex) - PUR, FEP

Cable entry housing or VEGABOX 02
Screw terminals
six wires, one suspension cable, one breather capillary, screen braiding, foil, mantle
$\geq 1200 \mathrm{~N}$ (270 pound force)
1000 m ( 3280 ft )
25 mm (with $25^{\circ} \mathrm{C} / 77^{\circ} \mathrm{F}$ )
8 mm ( 0.315 in )
black/blue
blue/blue
$1 \times$ cable gland $\mathrm{M} 20 \times 1.5$ (cable: $\varnothing 5 \ldots 9 \mathrm{~mm}$ ), $1 \times$ blind stopper M20×1.5 for wire cross section $1.5 \mathrm{~mm}^{2}$ (AWG 16), screen up to $4 \mathrm{~mm}^{2}$ (AWG 12)

## Supply voltage - $4 \ldots 20 \mathrm{~mA}$

Operating voltage
8... $36 \vee D C$

Permissible residual ripple

| $-<100 \mathrm{~Hz}:$ | $\mathrm{U}_{\text {ss }}<1 \mathrm{~V}$ |
| :--- | :--- |
| $-100 \mathrm{~Hz} \ldots 10 \mathrm{kHz}$ | $\mathrm{U}_{\mathrm{ss}}<10 \mathrm{mV}$ |
| Load | see diagram |



Fig. 16: Voltage diagram
$i$ Voltage limit
2 Operating voltage

## Supply voltage - $4 \ldots 20 \mathrm{~mA} / \mathrm{HART}$ - Pt 100

Operating voltage
Permissible residual ripple

- $<100 \mathrm{~Hz}$
$9.6 \ldots 36 \vee D C$
- 100 Hz ... 10 kHz

Load
$\qquad$
Tested according to the regulations of German Lloyd, GL directive 2.
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Fig. 17: Voltage diagram
1 HART load
2 Voltage limit
3 Operating voltage

## Electrical protective measures

Protection

| - Transmitter | IP 68 (30 bar) |
| :--- | :--- |
| - Housing | IP $66 /$ IP 67 |
| - VEGABOX 02 | IP 65 |
| Overvoltage category | III |
| Protection class | III |

## Existing approvals or approvals applied for

Gas explosion protection
e.g. according to ATEX and IEC

Fire-damp protection
e.g. according to ATEX

Overfill protection
e.g. according to WHG

Ship approval
e.g. according to GL, LRS, ABS, RINA

The available approvals can be selected via the configurator on www.vega.com.

Depending on the version, instruments with approvals can have different technical data. For these instruments, please note the corresponding approval documents. They can be downloaded in the download section on www.vega.com.

## CE conformity

EMC (2004/108/EG)

LVD (2006/95/EG) $\quad$| EN 61326-1: 2006 |
| :--- |
| EN 61010-1:2001 |

## Environmental instructions

VEGA environment management system. certified according to DIN EN ISO 14001
You can find detailed information under www.vega.com.

## 7 Dimensions

## VEGAWELL 52 - suspension cable 1



Fig. 18: VEGAWELL 52 - suspension cable
1 Transmitter Duplex, with straining clamp
2 Transmitter Duplex for deep wells, with unassembled screw connection G1/12 A (1th NPT) and closing cap
3 Transmitter Duplex, with PE coating
4 Transmitter with screwed connection of PVDF
5 Transmitter Titanium Titanium with glass leadthrough, with thread G1 A (1 NPT) and plastic housing

VEGAWELL 52 - suspension cable 2


Fig. 20: VEGAWELL 52 - suspension cable
1 Transmitter 316L, with straining clamp
2 Transmitter Titanium, with unassembled scraw connection G1 A (1 NPT)

## 8 Product code

VEGAWELL 52

| Approval <br> $X X$ withoul <br> XM Ship approval <br> AX ATEX II 2G EEx ia IIC T6 <br> AM ATEXII 2G EEx ia IIC T6 + Ship approval <br> AI IEC Ex ia HC T6 <br> Fastening/Material <br> X4 without <br> A4 Straining clamp / 1.4301(304) <br> GA Threaded fitting, unassembled G11/2A PN3 / 316L <br> NP Threaded fitting, unassembled G11/2A PNO, 2 / PVDF <br> GC Threaded fitting, unassembled G1A PN3/316L <br> GK Thread G11/2A PN3 / 316L with plastic housing <br> GV Thread G1/2A PN3/316L w hous. StSt (precision casting) <br> Version / Process temperaturo <br> A Suspension cable PE $/ 20 \ldots 60^{\circ} \mathrm{C}$ <br> D Suspension cable PUR $/=20 \ldots 80^{\circ} \mathrm{C}$ <br> B Suspension cable FEP / -20... $80^{\circ} \mathrm{C}$ <br> Length <br> K 6 m suspension cable PE <br> L 12 m suspension cable PE <br> M 27 m suspension cable PE <br> individually selectable length (PE/PUR/FEP) <br> Transmitter material/Diameter <br> D Duplex $1.4462 / 32 \mathrm{~mm}$ <br> V 316L/22mm <br> K Duplex 1.4462 with PE coating / 35 mm <br> P PVDF / 44 mm <br> Seal measuring cell <br> 1 FKM (VP2/A) <br> 3 EPDM (A+P 75.5KK75F) <br> P FFKM (Perlast G75S) <br> Measuring rango <br> A rel. $/ 0 . .0 .1 \mathrm{bar}(0 . .10 \mathrm{kPa}$ ) <br> B rel. $/ 0 . .0 .2$ bar ( $0 . . .20 \mathrm{kPa}$ ) <br> C rel. $10 \ldots 0.4$ bar ( $0 . .40 \mathrm{kPa}$ ) <br> D rel. / $0 . .1$ bar ( $0 . . .100 \mathrm{kPa}$ ) <br> E rel. $/ 0 \ldots 2.5$ bar ( $0 . . .250 \mathrm{kPa}$ ) <br> F rel. $/ 0 . . .5$ bar ( $0 . .500 \mathrm{kPa}$ ) <br> G rel. $10 . . .10$ bar ( $0 . . .1000 \mathrm{kPa}$ ) <br> 2 abs. $0 . .2 .5$ bar ( $0 . . .250 \mathrm{kPa}$ ) <br> 3 abs. $0 . . .5 .0$ bar ( $0 . .500 \mathrm{kPa}$ ) <br> Electronics <br> C $4 \ldots 20 \mathrm{~mA}$ <br> D 4...20mA/HART(0) + PT 100.4-wire <br> Deviation in characteristic <br> 10.20 <br> 20.10 <br> Transmitter options <br> $X$ without <br> $V$ for deep wells |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |  |




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You can find at www.vega.com downloads of the following<br>- operating instructions manuals<br>- menu schematics<br>- software<br>- certificates<br>- approvals<br>and much, much more

## Datasheet

## CP M SNT 120W 24V 5A

Weidmuller Interface GmbH \& Co. KG
Klingenbergstraße 16
D-32758 Detmold
Germany
Fon: +495231 14-0
Fax +495231 14-2003
www.weidmueller.com


PRO-M = Power-Reliable-Optimized
The optimal and reliable power supply in automation technology. The solid, very narrow metal housing of the 10 different versions of the 24 V DC supply enable installation without lateral spacing, thereby saving space on the DIN rail. $A C$ and $D C$ wide-range inputs and a broad temperature range allow universal use. Thanks to its high efficiency, overload resistance and high performance reserves, the PRO-M is the reliable power supply in all applications. The 3-phase PROM power supply modules continue to work reliable even if one phase fail, i.e. in two-phase operation.

## General ordering data

| Order No. | 8951340000 |
| :--- | :--- |
| Part designation | CP M SNT 120W 24V 5A |
| Version | Power supply, switch-mode power supply unit |
| GTIN (EAN) | 4032248742554 |
| Qty. | $1 \mathrm{pc}(\mathrm{s})$. |

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Creation date September 3, 2010 10:26:49 PM CEST

Last update 28.06 .2010 / We reserve the right to make technical changes.

CP M SNT 120W 24V 5A

Technical data

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Klingenbergstraße 16
D-32758 Detmold
Germany
Fon: +495231 14-0
Fax: +495231 14-2083
wuw.weidmueller:com

## Dimensions (1)

| Weight | 0.7 kg | Length | 125 mm |
| :---: | :---: | :---: | :---: |
| Width | 40 mm | Height | 130 mm |
| temperature |  |  |  |
| Ambient temperature (operational) | $-25^{\circ} \mathrm{C} . . .40^{\circ} \mathrm{C}$ | Storage temperature | $-40^{\circ} \mathrm{C} . . .485^{\circ} \mathrm{C}$ |
| Input |  |  |  |
| AC current consumption | $\begin{aligned} & 1.1 \mathrm{~A} \text { @ } 230 \mathrm{VAC} / 2.0 \mathrm{~A} \text { © } \\ & 115 \mathrm{VAC} \end{aligned}$ | Conductor connection system | Screw connection |
| DC current consumption | 0.4 A @ 370 VDC / 1.2A@ 120 V DC | DC input voltage range | 80... 370 V DC (Derating © ${ }^{\text {a }}$ 120 VDC ) |
| Frequency range $A C$ | $47 . .63 \mathrm{~Hz}$ | Input fuse | Yes |
| Input fuse (internal) | Yes | Input voltage AC, max. | 264 V |
| Input voltage AC, min. | 85 V | Input voltage DC, max. | 370 V |
| Input voltage $\mathrm{DC}, \mathrm{min}$. | 80 V | Input voltage range AC | 85... 264 V AC (Derating (1) 100 VAC ) |
| Recommended back-up fuse | $4 \mathrm{~A} / \mathrm{DI}$, safety fuse 6 A. Char, B, circuit breaker 3...5 A. Char, C, circuit breaker | making current | max. 40 A |
| rated input voltage | $100 . .240 \mathrm{~V} \mathrm{AC}$ (wide-range input) |  |  |
| output |  |  |  |
| Conductor connection systern | Screw connection | Output current | 5 A |
| Output voltage | (adjustable via potentiometer on front) | Output voltage type | DC |
| Output voltage, max. | 29.5 V | Output voltage, min. | 22.5 V |
| Parallel connection option | yes, max. 5 | Powerboost 94 V DC, $60{ }^{\circ} \mathrm{C}$ | 6 A for $1 \mathrm{~min}, \mathrm{ED}=5 \%$ |
| Rated (nominal) output current © U U Nom | 5 A @ $60{ }^{\circ} \mathrm{C}$ | continous output current @ 24 V DC | $\begin{aligned} & 6.0 \mathrm{~A} @ 45^{\circ} \mathrm{C} 5.3 \mathrm{~A} @ 55^{\circ} \mathrm{C} \\ & 3.8 \mathrm{~A} @ 70^{\circ} \mathrm{C} \\ & \hline \end{aligned}$ |
| rated output voltage | $24 \mathrm{VDC} \pm 1 \%$ | residual ripple, breaking spikes | $<50 \mathrm{mV}$ pp \& $^{2} 24 \mathrm{VDC}, \mathrm{l}_{\mathrm{N}}$ |
| General data |  |  |  |
| AC failure bridging time @al $\mathrm{I}_{\text {Nom }}$ | $\begin{aligned} & >100 \mathrm{~ms} \text { @ } 230 \mathrm{VAC} />20 \\ & \mathrm{~ms} \text { (@) } 115 \mathrm{VAC} \end{aligned}$ | Ambient temperature (operational) | $-25^{\circ} \mathrm{C} \ldots+70^{\circ} \mathrm{C}$ |
| Current limiting | $>120 \% \mathrm{I}_{\mathrm{N}}$ | DIN Rail compatibility | TS 35 |
| Degree of efficiency | $\begin{aligned} & 90 \% \text { © } 230 \mathrm{VAC} / 88 \% @ \\ & 115 \mathrm{VAC} \end{aligned}$ | Housing version | Metal, corrosion resistant |
| Indication | Operation, green LED | MTBF | $\begin{aligned} & >500,000 \mathrm{~h} \text { ace. to IEC } 1709 \\ & \text { (SN29500 } \end{aligned}$ |
| Mounting position, installation notice | Horizontal on TS35 mounting rail, with 50 mm of clearance at top and bottom for air circulation. Can be mounted side by side with no space in between. | Power factor (approx.) | $\begin{aligned} & >0.5 \text { @ } 230 \mathrm{~V} \mathrm{AC} 1>0.6 \text { (4) } \\ & 115 \mathrm{VAC} \end{aligned}$ |
| Protection against reverse voltages from load | $30 . .35 \mathrm{~V}$ DC |  |  |

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Drawings

## Electric symbol



With DC connection, note polarity

## Product Specification UXH50-12

## Yuasa UXH Series VRLA Battery, 10 Years Design Life

Yuasa UXH batteries are constructed to yield even greater capacity than comparable batteries. The UXH uses AGM technology which ensures that there is no "free acid' In the battery. This allows the battery to be mounted either vertically or horizontally. An additional feature of this product is Yuasa's heavy duty lead calcium-lin alloy, providing the UXH battery the abllity to remain in float service for 10 years.

| General Performance |  |  |
| :--- | :--- | :--- |
| Battery | UXH50-12 |  |
| Application | Floating |  |
| Deslgn Life | 10 Years |  |
| Nominal Capacity | 50 Ah |  |
|  |  |  |
| Actual Capacity at $25^{\circ} \mathrm{C}$ | 1 hour rate to 1.70 VpC | 29.0 Ah |
|  | 3 hour rate to 1.70 Vpc | 39.0 Ah |
|  | 10 hour rate to 1.80 Vpc | 46.0 Ah |


| Electrolyte |  |
| :--- | :--- |
| Fully charge density at $20^{\circ} \mathrm{C}$ | 1.300 |
| Density Range | $1.290-1.310$ |
| Gelled/Absorbed | Absorbed |
| Mounting Orientation | Vertical/Horizontal |


| Plates |  |
| :--- | :--- |
| Positive Plates: |  |
| Number/cell | 4 |
| Type | Flat Pasted |
| Material of grid | Lead-Calcium-Tin Alloy |
| Thickness | 4.0 mm |
| Negative Plates: |  |
| Number/cell | 5 |
| Type | Flat Pasted |
| Material of grid | Lead-Calcium-Tin Alloy |
| Thickness | 2.3 mm |



- 10 Year Design Life
- High Energy Density
- Gas Pressure Venting System
- No Equalising Charge Required


Century Yuasa believes that the data presented is generally accurate for theppraesedgavijifribispresented, however expressly disclaims any representation of warranty expressed or implied, concerning the data or recommendations and in no event shall be liable for any loss or damage claimed to have arisen as a result of the use of this brochure.

## $\sqrt{v / 2}$ <br> YUASA

## Product Specification UXH50-12

Yuasa UXH Series VRLA Battery, 10 Years Design Life

| Physical Properties |  |
| :---: | :---: |
| Separators |  |
| Type | Glass Mat |
| Is glass fibre included? | Yes |
| Thickness | 1.5 mm |
| Lid \& Container Materials |  |
| Lid Material, Colour | Acrylonitrile Butadiene Styrene ABS/Dark Grey |
| Container Material, Colour | Acrylonitrile Butadiene Styrene ABS/Dark Grey |
| Flame Retardant | No |
| - fety Vent Operational Pressure | 20 kPA |
| me Arrestor Filter Fitted | Yes |
| Dimensions: |  |
| Overall Width | $299 \mathrm{~mm} \pm 3$ |
| Depth | $128 \mathrm{~mm} \pm 3$ |
| Height | $190 \mathrm{~mm} \pm 3$ |
| Overall Height | $217 \mathrm{~mm} \pm 3$ |
| Battery Welght (kg) Total (wet) | 21kg |



- Charging Characteristics


| Electrical Properties |  |  |  |
| :---: | :---: | :---: | :---: |
| Self Discharge Rate © $25^{\circ} \mathrm{C}$ | <3\% per month |  |  |
| Internal Resistance (mOHMS) | $6.0 \mathrm{~m} \Omega$ |  |  |
| Normal Charge (Amperes) | 5A |  |  |
| Max. Charge (Amperes) | 10A |  |  |
| Max. Sustained Current without damage (discharging 5 sec ) | 230A |  |  |
| Volts End of Charge | 2.275 Vpc |  |  |
|  | $20^{\circ} \mathrm{C}$ | $25^{\circ} \mathrm{C}$ | $30^{\circ} \mathrm{C}$ |
| float Voltage (Vpc) pure lloating applications | 2.290 Vpc | 2.275 Vpc | 2.260 Vpc |
| Float Current (mA) | $\sim 50 \mathrm{~mA}$ | $\sim 50 \mathrm{~mA}$ | $\sim 50 \mathrm{~mA}$ |
| Initial Short circuit current (A) | $\sim 2275$ A |  |  |
| Efficiency at 10 hour rate (\%): |  |  |  |
| Ampere-Hour | >90\% |  |  |
| Watt-Hour | >78\% |  |  |


| Torque Setting |  |
| :--- | :--- |
| Terminal Torque Setting | $\mathbf{3 . 9 - 5 . 4}$ N.m. |


| Compliant Standard |  |
| :--- | :--- |
| Battery Standard | JIS C8704-2: 1999 |

### 2.6 SITE WIDE EQUIPMENT TECHNICAL DATA

The following pages contain technical data for the material used outside of the switchboard. The list below has been added to assist in navigation of the supplied technical data.
SITE WIDE TECHNICAL DATA LIST - JILBA ST
CHEMSET BOLT ANCHOR - RAMSET ....................................................................................... 236
EARTH ROD CONNECTION BOX - DULMISON ......................................................................... 238
HYDROTITE PIT SEALANT - PARCHEM .................................................................................... 242
NITOBOND EP - PARCHEM ..................................................................................................... 246
RENDEROC HB40 - PARCHEM ................................................................................................. 250
RENDEROC HB70 - PARCHEM .................................................................................................. 255
VEGA EXTERNAL HOUSING - VEGA ......................................................................................... 259

## (2) Ramset| Chemset" Maxima Spin Capsules

Solid Concrete Anchoring

## MAXVMA <br> $\varnothing 18 \times 125 \mathrm{~mm}$

## Function

Chemset Maxima Spin Capsules are a chemical anchor system based on epoxy acrylate. The capsule is placed into the hole and the mortar is mixed during the anchor installation.

## Features and Benefits

## No measuring, no mess, no waste

- Adhesive is contained in pre-measured capsules.


## Versatile

- Use in damp holes.

Fast installation

- Cures in minutes and can be loaded in $20 \mathrm{~min}\left(a t 20^{\circ} \mathrm{C}\right.$ ).

High bond strength

- Acrylic adhesive.

High corrosion resistance

## Principal Applications

- Structural beams and columns
- Batten fixing
- Installing signs, handrails, balustrades and gates
- Racking
- Safety barriers
- Stadium seating
- Machinery hold down


## - Mor



Installation


1. Drill recommended diameter and depth hole.
2. Clean hole with hole cleaning brush. Remove all debris using hole blower.
3. Insert correct size Spin capsule into the hole.
4. Using appropriate driver accessories, drive the Chemset Anchor Stud into the hole using a hammer drill (on rotation).
5. Cure as per setting times.
6. Attach fixture and tighten nut in accordance with recommended tightening torque.

Installation temperature limits:
Substrate: $-5^{\circ} \mathrm{C}$ to $35^{\circ} \mathrm{C}$. Load should not be applied to anchor until the chemical has sufficiently cured as specified.

Service temperature limits:
$-23^{\circ} \mathrm{C}$ to $60^{\circ} \mathrm{C}$

## Setting Times

| Spin Capsules |  |
| :---: | :---: |
| Gel Iime <br> (mins) | Loading <br> Time |

## ©(2) Ramset | Chemset" Maxima Spin Capsules

Solid Concrete Anchoring
Installation and Performance Details: Using Chemset Anchor Studs (p20)

| Anchor slize, d. (mm) | Installation details |  |  |  | Minimum đimension* |  |  | Reduced Characteristic Capacity |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Drilled hole B , d. (mm) | Fixture hole $\mathrm{g}_{\text {, }}$ $d_{1}(\mathrm{~mm})$ | Anchor effective depth, h (mm) | Tightening torque, T, ( Nm ) | Edge dilstance, © $\mathrm{B}_{1}(\mathrm{~mm})$ | Anchor spacing, $3_{8}(\mathrm{~mm})$ | Substrate thickness, $b_{m}$ (mm) | $\begin{aligned} & \text { Shear } \\ & V_{\mathbf{a}}(\mathrm{kN}) \end{aligned}$ |  | Tension $N_{0}(\mathrm{kN})$ |  |
|  |  |  |  |  |  |  |  | Concrete strength MPa |  |  |  |
|  |  |  |  |  |  |  |  | 20 MPa | 20 MPa | 32 MPa | 40 MPa |
| M10 | 12 | 12 | 90 | 20 | 40 | 60 | 120 | 14.1 | 15.7 | 19.2 | 20.6 |
| M12 | 14 | 15 | 110 | 40 | 50 | 70 | 140 | 21.0 | 23.8 | 27.4 | 29.3 |
| M16 | 18 | 19 | 125 | 95 | 65 | 100 | 160 | 39.7 | 34.8 | 40.1 | 42.9 |
| M20 | 24 | 24 | 150 | 180 | 80 | 120 | 190 | 59.9 | 55.7 | 84.1 | 68.5 |
|  |  |  | 170** |  |  |  | 220 | 59.9 | 63.1 | 72.7 | 77.7 |
| M24 | 26 | 28 | 160 | 315 | 95 | 145 | 200 | 86.8 | 54.4 | 74.1 | 79.3 |
|  |  |  | 210** |  |  |  | 270 | 86.8 | 84.5 | 97.3 | 104.0 |
| For shear loads acting towards an edge or where these minimum dimensions are not achievable, please use the simplified strength limit state design process to verily capacily. |  |  |  |  |  |  |  | Reduced Characteristic |  |  |  |

- For details on Reduced Characteristic capacities reter page 3.
**Note: To achieve these non standard effective depths, use an additional CHEM10 Maxima spin capsule per hole.

Description and Part Numbers - Chemset Maxima Spin Capsules

| Capsule dimensions |  | To suit Chemset Anchor Stud | Capsule Part Mo. |
| :---: | :---: | :---: | :---: |
| Nominal E, d (mm) | Capsule Length, L (mm) | Anchor size, d, |  |
| 11 | 80 | M10 | CHEM10 |
| 13 | 95 | M12 | CHEM12 |
| 17 | 95 | M16 | CHEM16 |
| 21.5 | 115 | M20 | CHEM2024 |
| 21.5 | 115 | M24 | CHEM2024 |

## Description and Part Numbers - Accessories

| Cleaning Brush | $10-14 \mathrm{~mm}$ Hole | HCBT13 |  |
| :---: | :---: | :---: | :---: |
| Cleaning Brush | $18-22 \mathrm{~mm}$ Hole | HCBT20 |  |
| Cleaning Brush | $22-26 \mathrm{~mm}$ Hole | HCBT26 |  |
| Hole Cleaning Pump/Blower |  |  | S065990 |



## EARTHING RODS \& ACCESSORIES

- Extendable Earth Rods - Tapered
- Extendable Earth Rods - Flush

Non Extendable Rods
Airport Earthing Terminals
Survey and Mapping Data Marks
Earthing Bond
Earthing Connectors
Earth Rods Clamps
Earthing Enhancement Compounds
Connection Boxes

- Exothermic Welded Connections
- Pole Earthing Terminals
- Earth Mats


## DULMISON EARTHING RODS \& ACCESSORIES

## Non-Extendable Rods - Heavy Duty Series Earth Rod Clamps

## Type LGR - Copper Clad

Recommended Clamps: Clamp Types EP, ET, GB and FSC provide a copper to copper connection, either in parallel or right angle mode, accommodating single, two and three conductors.

| LGR 19mm |  |
| :---: | :---: |
| Rods |  |
| Length (metres) | Catalogue No. |
| 1.8 | LGR1918 |
| 2.4 | LGR1924 |
| 3.0 | LGR1930 |

## Ion-Extendable Rods - Domestic CNE1314T $1400 \mathrm{~mm} \times 13 \mathrm{~mm}$ diameter

Dulmison Manufacture a broad range of non-extenable earth rods. Each rod incorporates an integral driving point, machined
(not ground) to preserve the strength and rigidity of cold drawn steel. The flat tip was developed for penetrating all types or soil.


## Extendable Earth Rods - Taperlock Coupled Types CTE and STE

Types CTE and STE earth rods are among the simplest to use They have identical taper ends and are joined by a one-piece tapered coupling which locks upon driving. These rods may be driven by hand or machine.
Taper lock rods available with driving point (add suffix ' P ').

| Copper Clad Rods |  |  | Stainless Steel Clad Rods |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Diameter | 13 mm | 15 mm | $\mathbf{1 9 m m}$ | 13 mm | 14 mm |
| Length | Standard | Standard <br> Taperlock | Standard <br> Taperlock | Standard <br> Taperlock | Standard <br> Taperlock |
| 1200 | CTE1312 | CTE1512 | - | STE1312 | STE1412 |
| 1440 | CTE1314 | CTE1514 | - | STE1314 | STE1415 |
| 1800 | CTE1318 | CTE1518 | - | STE1318 | STE1418 |
| 2000 | - | - | CTE1920 | - |  |
| 2400 | CTE1324 | CTE1524 | - | STE1324 | STE1424 |
| 3000 | CTE1330 | CTE1530 | Page_240 of 363 | STE1330 | STE1430 |

## DULMISON EARTHING RODS \& ACCESSORIES

| Tapered Couplings, <br> Driving Points, Tools | Copper |  | Stainless Steel |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | CTE13 | CTE15 | STE13 | STE14 |  |
| $\square$ | Couplings | CCT13 | CCT15 | SCT13 | SCT15 |
| $\square$ | Driving Points |  |  |  |  |
|  | Average Driving | DPT13 | DPT15 | DPT12 | DPT15 |

Hard Driving - Points and Tools avalable

|  | Hand Driving <br> Tools |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | Average Driving | DHT15 | DHT15 | DHT15 | DHT15 |
| $\square$ | Machine Driving <br> Tools |  |  |  |  |
|  | Kango 900/950 | MDH15K | MDH15K | MDH15K | MDH15K |

Tools available for Atlas Copco / Stanley Cbrromwade

## Earthing Enhancement Compound - Earthrite

Composition: Bentonite, Gypsum, Sodium Sulphate
Features: Earthrite provides long term low ground resistance, high expension and low. shrink characteristics. Non toxic, Non corrosive.

20 kg Bag yields $0.03 \mathrm{~m}^{3}$
Application: As a dry mix or as pourable slurry.


## Earth Rod Connection Boxes

Boxes ERB1 and ERB3 feature hinged inspection lids and cable entry holes on the sides.



Cat. No. ERB3 Pólymer Concrote

## DULMISON EARTHING RODS \& ACCESSORIES

## EARTH ROD CLAMPS

- Single Conductor - Parallel

Materials - Body: High copper content alloy casting Hardware: Stainless Steel

| Part No. | Rod Size | Conductor |  |
| :---: | :---: | :---: | :---: |
|  |  | Size |  |
| $\cdot$ |  | mm $^{2}$ | diameter mm |
| GRC5 | $13-15$ | $10-35$ | $4.05-7.65$ |
| CLAMP210 | $13-15$ | $16-120$ | $5.10-14.21$ |
| EP1 | $17-19$ | $16-120$ | $5.10-14.21$ |



GRC5


CLAMP210 EP1

## " Iulti-Conductor Earthing

For two earth conductors parallel to rod, or two or three earth conductors at right angles to rod.

Materials - Body: High copper content alloy casting Hardware: Stainless Steel


## 'he CADWELD Connection

Simple - Fast - No Gas or Arc Welding. Cadweld is ideal for on-site welding of connections to a wide range of metals as follows:

Copper to:Mild Steel Copper Brass

Stainless Steel Copper Clad Steel
Monel Metal

Galvanised Steel
Some typical exothermic welded connections applicable to earthing


## Technical Data Sheet

## Hydrotite

Premium grade, water swellable, waterstop range for use in cast in-situ concrete

## DESCRIPTION

Hydrotite is a hydrophilic waterstop which exibits excellent durability and water sealing capacity. It expands as it absorbs water and fills up concrete joint gaps conforming to the gap variation, ensuring excellent sealing. Hydrotite is based on the technology of hydrophilics, a material which expands in a controlled fashion by approximately eight times by volume in the presence of moisture to create a pressure seal within the joint.

When properly installed Hydrotite is capable of sealing heads of water up to 50 m and is used throughout the construction industry to seal horizontal and vertical construction joints for poured in-situ concrete.
Hydrotite offers various profiles for in-situ concrete construction joints such as DSS0220, CJ0725-3K, CJ1020$2 \mathrm{~K}, \mathrm{CJ} 1030-4 \mathrm{M}$. It consists of a unique combination of expanding hydrophilic materials and non-expanding chloroprene rubber co-extruded together to form a single strip. The expanding section is blue with the nonexpanding section being black. The co-extruded design means that the expansion is directed across the joint for maximum sealing performance.

This expansion creates an effective compression seal within joints which shuts out the water path. Upon expansion Hydrotite turns from a dark blue colour to a light blue colour so that a visual inspection of the Hydrotite can be made and the contractor can check if the Hydrotite has pre-expanded.

Fig 1 Hydrotite CJ-0725-3K

an + alesco company

Hydrotite is treated with a delay coating to prevent it from absorbing water from the moist green concrete, to help stop any premature expansion should the joint become ponded with water prior to the second pour and to stop any premature expansion taking place before curing of the concrete. For areas where ponding or running water may be a problem, please contact Parchem or your local distributor for advice.

Some Hydrotite profiles are available with a self-adhesive backing which makes installation easier and lowers construction time and costs. The self-adhesive backing means that the purchase of other construction adhesives is not required and also saves the contractor the installation costs of applying the adhesive to the concrete.

Hydrotite, as with any hydrophilic waterstop will return to its original size if there is no more water or moisture present. Hydrotite will then re-expand when water or moisture is again introduced to the joint. Some leakage may occur before Hydrotite re-expands fully. Repeated wet and dry cycling of this nature does not effect the functioning of Hydrotite.

The standard dimension and shape of CJ-0725-3K is as per Fig. 1.


Before expansion


After expansion

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## AREAS OF APPLICATION

Hydrotite is to be used where watertight integrity is the prime issue. Typical applications where there is a need to achieve a water seal include:-

- Sewerage treatment plants
- Pipe penetrations
- Subway stations
- Water treatment plants
- Swimming pools
- Basements
- Reservoirs
- Tunnels
- Pits


## GUIDE TO PROFILE SELECTION

Shown below is a guideline of where Hydrotite profiles have been specified and used in construction joints in various projects. Joint details should be verified by the Consulting Engineer who should determine the suitability of the products for its intended use.


| Vertical Construction <br> Joints: | CJ0725-3K, CJ1020-2K, <br> CJ1030-4M, CJ2020-M |
| :--- | :--- |
| Horizontal Construction | DSS0220, CJ0725-3K, |
| Joints: | CJ1020-2K, Leakmaster |, | Joint and Leak Repairs: | RSS rods various sizes |
| :--- | :--- |
| Pipe Penetrations: | DSS0220, CJ0725-3K, <br> Leakmaster |
| ThruTie Holes: | RSS rods, RSS2519D, |

Typical Application of Hydrotite


## ADVANTAGES

- Self-adhesive properties makes installation much easier and reduces construction costs
- Co-extruded design means expansion is directed across the joint for maximum seal
- Unaffected by repeated wet and dry cycles
- No site welding as is required for traditional PVC waterstops
- Has a delay coating to help prevent premature expansion
- Extra cans of delay coating are available if required
- Changes colour as a visual alert to let you know it has expanded
- No need for special intersections, joining is by simple butt joins
- Can be applied to rough surfaces using Leakmaster gun grade waterstop
- Easy to handle and install
- Can be joined to traditional PVC waterstop
- No compaction or displacement problems
- Non toxic and non hazardous
- No need for split forming


## DESIGN CRITERIA

Hydrotite should be used to prevent the passage of water through low movement joints in both new in-situ concrete and between new and existing concrete. Hydrotite can also be used around penetrating pipe entries prior to concrete placement. Hydrotite increases in volume in the range of up to $800 \%$ and gives a resistance to hydraulic heads of up to 50 metres.

Hydrotite waterstops should be positioned to ensure that a minimum of 50 mm cover of concrete is present to accommodate pressure developed during the swelling process.

Hydrotite is suitable for applications between existing and newly placed concrete where there is little or no steel continuity and therefore some small movement may occur.

Hydrotite is generally not suitable for use in expansion joints

TABLE 1: BASIC PHYSICAL PROPERTIES OF HYDROTITE

| Item | Unit | Hydrophilic <br> Rubber |  | Chloroprene <br> Rubber |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
|  |  | Standard | Typical | Standard | Typical |
| Specific <br> Gravity |  | $1.40 \pm$ <br> 0.10 | 1.35 | $1.40 \pm$ <br> 0.10 | 1.41 |
| Hardness | (JIS- <br> A) | $50 \pm 5$ | 52 | $50 \pm 5$ | 51 |
| Tensile <br> Strength | $\mathrm{N} /$ <br> $\mathrm{mm}^{2}$ | min. 2.94 | 3.63 | min. 8.82 | 12.25 |
| Elongation | $\%$ | min. 600 | 760 | min. 400 | 435 |

## CHEMICAL RESISTANCE

The influence of pH values of concrete, grouting material and ground water upon the expansion of Hydrotite was tested using hydrophilic rubber as follows.

The specimen was immersed in each solution for seven days and the retention value of tensile strength and elongation were measured. Then, the specimen was removed from each solution and placed in tap water for seven days. The specimen was then compared with specimens that had been expanded in tap water only.

The retention value of both physical properties and expansion was compared with that of specimens tested in tap water.

## TABLE 2: BEHAVIOUR IN CHEMICAL SOLUTION

Hydrotite exhibited retention values $90 \%$ or more in the following solutions:

- pH 3 aqueous solution
- pH 5 aqueous solution
- pH 7 (tap water)
- pH 9 aqueous solution
- pH 11 aqueous solution
- Ferrous aqueous solution
- Bentonite aqueous solution
- Grout aqueous solution


## PACKAGING

| PROFILE | DIMENSIONS | METRES <br> PER <br> ROLL | METRES <br> PER <br> CARTON |
| :--- | :--- | :---: | :---: |
| DSS0220 * | $20 \mathrm{MM} \times 2 \mathrm{MM}$ | 25 | 100 |
| CJ0725-3K * | $25 \mathrm{MM} \times 7 \mathrm{MM}$ | 10 | 40 |
| CJ1020-2K * | $20 \mathrm{MM} \times 10 \mathrm{MM}$ | 10 | 50 |
| CJ1030-4M | $30 \mathrm{MM} \times 10 \mathrm{MM}$ | 10 | 40 |
| CJ2020-M | $20 \mathrm{MM} \times 20 \mathrm{MM}$ | 10 | 30 |
| RSS 1208D | 12 MM DIAMETER | 20 | 40 |
| RSS161OD | 16 MM DIAMETER | 10 | 20 |
| RSS2014D | 20 MM DIAMETER | 10 | 20 |
| RSS2519D | 25 MM DIAMETER | 5 | 10 |

* these profiles available with self adhesive backing


## LIMITATIONS

- Not recommended for use in suspended slabs or expansion joints
- Minimum of 50 mm cover of concrete over Hydrotite for reinforced concrete and 100 mm cover of concrete or unreinforced concrete based on concrete strength of $22.5 \mathrm{~N} \mathrm{~mm}^{2}$
- Expansion rate can vary in salt or contaminated water
- Not for use where excessive shrinkage may occur


## SPECIFICATION CLAUSE

Hydrophilic expanding waterstops shall be placed at the joints in the concrete at the locations shown on the drawings in accordance with the requirement of this specification.

Waterstops where shown on drawings shall be Hydrotite (fill in profile number) Hydrophilic Waterstops as supplied by Parchem.

The waterstop shall consist of a non-expansive chloroprene rubber, co-extruded with a blue hydrophilic rubber which is capable of swelling by approx. eight times by volume.

The waterstop shall be treated with a delay coating to prevent premature expansion and be able to change colour upon expansion which acts as a visial alert that the waterstop has started to expand.

The waterstop is to be installed strictly in accordance with the manufacturers recommendations.

## ADDITIONAL INFORMATION

Parchem provides a wide range of complementary products which include:

- concrete repair - cementitious and epoxy
- grouts and anchors - cementitious and epoxy
- waterproofing membranes - liquid applied, cementitious and bituminous sheet membranes
- waterstops - pvc and swellable
- joint sealants - building, civil and chemical resistant
- industrial flooring systems - cementitious and epoxy
- architectural coatings
- filler boards - swellable cork, bituminous and backing rod
- ancillary products

For further information on any of the above, please consult with your local distributor or Parchem sales office.

## IMPORTANT NOTICE

A Material Safety Data Sheet (MSDS) and Technical Data Sheet (TDS) are available from the Parchem website or upon request from the nearest Parchem sales office. Read the MSDS andTDS carefully prior to use as application or performance data may change from time to time. In emergency, contact the Poisons Information Centre (phone 13 1126 within Australia or 0800764766 in New Zealand) or see a doctor for advice.

## PRODUCT DISCLAIMER

This Technical Data Sheet (TDS) summarises our best knowledge of the product, including how to use and apply the product based on the information available at the time. You should read thisTDS carefully and consider the information in the context of how the product will be used, including in conjunction with any other product and the type of surfaces to, and the manner in which, the product will be applied. Our responsibility for products sold is subject to our standard terms and conditions of sale. Parchem does not accept any liability either directly or indirectly for any losses suffered in connection with the use or application of the product whether or not in accordance with any advice, specification, recommendation or information given by it.

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| www.parchem.co.nz | Distributed in New Zealand by: Con | crete Plus 23 Watts Road, So | kbum Ph: (03) 3430090 |  |  |

# Nitobond EP 

Epoxy resin primer, high strength bonding agent to bond concrete substrate to repair mortars

## USES

For bonding fresh wet cementitious materials to existing cementitious surfaces. For use on horizontal or vertical surfaces where mortar or concrete can be supported by formwork. The long 'open' life makes it suitable for use with formwork or where additional steel reinforcement has to be fitted. The product is ideal for roads, bridges, pavements, loading bays and factories, and for bonded or granolithic floor toppings. Nitobond EP is equally suited to internal and external applications.
Nitobond EP may also be used as part of a repair system where a substrate/repair barrier is required or where the substrate is likely to remain permanently damp or wet.

## ADVANTAGES

- Positive adhesion - exceeds that of the tensile strength of the host concrete
- Exhibits high mechanical strength
- Can be applied on to dry or damp substrates

E Solvent-free - can be used in enclosed locations

## DESCRIPTION

Nitobond EP is based on solvent-free epoxy resins containing pigments and fine fillers. It is supplied as a two-component material in pre-weighed quantities ready for on-site mixing and use. The 'base' component is white and the 'hardener' component is black, providing visual evidence (uniform grey colour) that adequate mixing has been achieved.

## TECHNICAL SUPPORT

Parchem offers a comprehensive range of high performance, high quality concrete repair and construction products. In addition, Parchem offers a technical support package to specifiers, end-users and contractors, as well as on-site technical assistance.

## DESIGN CRITERIA

Nitobond EP is designed to have an overlay time of 90 minutes at $20^{\circ} \mathrm{C}$. The minimum application temperature for Nitobond EP is $5^{\circ} \mathrm{C}$. Consult your local Parchem sales office for further information.

## PROPERTIES

| Test method | Typical result |
| :--- | :--- |
| Compressive strength: | 50 MPa |
| Tensile strength: | 20 MPa |
| Flexural strength: | 35 MPa |
| Shear strength: | 25 MPa |
| Adhesive bond <br> to concrete: | In general, the bond will <br> always exceed the tensile <br> strength of the host concrete |

THE FOLLOWING PROPERTIES WERE MEASURED AT $20^{\circ} \mathrm{C}$ :
Pot life: $\quad 35-45$ minutes

| Initial hardness: | 24 hours |
| :--- | :--- |
| Full cure: | $\mathbf{7}$ days |
| Max. overlay time: | 90 minutes |

Note: at temperatures below $20^{\circ} \mathrm{C}$, the cure rate will be slower. Conversely, at temperatures above $20^{\circ} \mathrm{C}$, the cure rate will be faster.

## SPECIFICATION CLAUSES

## EPOXY BONDING AGENT

The bonding agent shall be Nitobond ER, a two-component solvent-free epoxy resin. The 2 components shall be differentially pigmented in order to ensure visually that correct mixing has taken place prior to the application. The product shall achieve 50 MPa compressive strength, 20 MPa tensile strength, 35 MPa flexural strength and $\mathbf{2 5} \mathrm{MPa}$ shear strength. The adhesive bond to the concrete substrate shall exceed the tensile strength of the host concrete.

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## APPLICATION INSTRUCTIONS

## PREPARATION

Clean the surface and remove any dust, unsound material, plaster, oil, paint, grease, corrosion deposits or algae. Roughen the surface and remove any laitance and expose aggregate by light scabbling or grit-blasting.

Oil and grease deposits should be removed by steam cleaning, detergent scrubbing or the use of a proprietary degreaser. The effectiveness of decontamination and soundness of the substrate should then be assessed by a pull-off test.

## MIXING

Any steel reinforcement and formwork should be prepared, cut to size and shape, and made ready for assembly before mixing commences.

Care should be taken to ensure that Nitobond EP is thoroughly mixed. The 'hardener' and 'base' components should be stirred separately before mixing to disperse any settlement. The entire contents of the 'hardener' tin should then be poured into the 'base' tin and the two materials thoroughly mixed using a suitable slow-speed drill and mixing paddle for 2 minutes until a fully uniform colour is obtained. The sides of the tin should then be scraped and mixing should continue for a further 2 minutes.

To facilitate mixing and application at temperatures below $20^{\circ} \mathrm{C}$, the separate components should be warmed in hot water up to a maximum temperature of $25^{\circ} \mathrm{C}$ before beginning to mix. If heated to $25^{\circ} \mathrm{C}$, the subsequently mixed material will need to be used more speedily as the pot-life will be reduced to 20 minutes. Alternatively, the material should be stored in an environment heated to $20^{\circ} \mathrm{C}$ and only removed immediately before use.

## APPLICATION

Nitobond EP should be applied as soon as the mixing process has been completed. It should be brush or sprayapplied to the prepared surfaces.

The new concrete or screed should be applied to the coated substrate after the Nitobond EP has become tacky and within 90 minutes at $20^{\circ} \mathrm{C}$, ie. while the Nitobond EP is still tacky. If the Nitobond EP is allowed to become tackfree, a second coat will be required.
Where Nitobond EP is to be used as part of a repair system to form a substrate/repair barrier, care should be taken to achieve an unbroken coating. One coat should be applied and allowed to become tack-free. A second coat should be applied and used as the bonding coat.

As soon as the Nitobond EP has been applied, any required steel reinforcement and/or formwork should be erected and fixed securely in place.

## LOWTEMPERATURE WORIKING

The minimum application temperature is $5^{\circ} \mathrm{C}$. In temperatures below $15^{\circ} \mathrm{C}$, the separate components should be heated in warm water (up to $25^{\circ} \mathrm{C}$ ) or stored in a heated environment for 12 hours before use. These measures will facilitate mixing and application. Normal precautions for winter working with cementitious materials should then be adopted.

## HIGH TEMPERATURE WORKING

At ambient temperatures above $30^{\circ} \mathrm{C}$, the material should be stored in the shade or in an air-conditioned environment for $\mathbf{1 2}$ hours before use.

## CLEANING

Nitobond EP should be removed from tools, equipment and mixers with Parchem Solvent immediately after use. Hardened material can only be removed mechanically.

## LINIITATIONS

Nitobond EP should not be applied when the temperature is below $5^{\circ} \mathrm{C}$ or is $5^{\circ} \mathrm{C}$ and falling. If any doubts arise concerning temperature or substrate conditions, consult your local Parchem sales office. Before the application of any repair material or topping, Nitobond EP should be allowed to become tacky after its application to the host substrate. Due to the relatively slow setting time of Nitobond EP, care should be taken when the product is used in cold conditions and or when the material being subsequently applied to the Nitobond EP is rapid setting. In cold conditions ( $<15^{\circ} \mathrm{C}$ ) the Nitobond may not set quick enough to bond to a rapidly setting topping which may then "curl" due to shrinkage tension. This would result in delamination of the topping away from the host substrate. If there is a possibility of these conditions on site, users are advised to contact ParchemTechnical Helpline for specific guidance.

## Nitobond EP

Estimating
SUPPLY
Nitobond EP: $\quad 1.5$ and 6.0 litre packs
Parchem Solvent: $\quad 4$ and 20 litre cans
coverage
Nitobond EP: $\quad 4.5 \mathrm{~m}$ hitre
Note: the coverage figures for Nitobond EP is theoretical due to wastage factors and the variety and nature of possible substrates, practical coverage figures will be reduced.

STORAGE
SHELF LIFE
Nitobond EP has a shelf life of 12 months if kept in a dry store in the original unopened packs.

STORAGE CONDITIONS
Store in dry conditions in the original unopened packs. If stored at high temperatures, the shelf life may be reduced.

## ADDITIONAL INFORMATION

Parchem provides a wide range of complementary products which include：

E concrete repair－cementitious and epoxy
日 grouts and anchors－cementitious and epoxy
－waterproofing membranes－liquid applied， cementitious and bituminous sheet membranes

且 waterstops－pvc and swellable
回 joint sealants－building，civil and chemical resistant
－industrial flooring systems－cementitious and epoxy
－architectural coatings
E filler boards－swellable cork，bituminous and backing rod
ancillary products
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## PRODUCT DISCLAINIER

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## Renderoc HB40

High performance, medium weight, very low shrinkage, patch repair mortar, compatible with concrete $\mathbf{3 0 - 4 5} \mathbf{~ M P a}$

## SECTION A: GENERAL COMMENTS

## HIGH AND LOWTEMPERATURE WORKING

It is suggested that, for temperatures above $35^{\circ} \mathrm{C}$ or below $5^{\circ} \mathrm{C}$, the following guidelines are adopted as good working practise:
I. Store unmixed materials in cool, dry conditions, in original unopened bags, avoiding exposure to direct sunlight.
II. In high temperature environments, keep equipment cool, arranging shade protection if necessary. It is especially important to keep cool those surfaces of the equipment that come into direct contact with the material itself.
III. Try to avoid application during the hottest times of the day, arrange temporary shading as necessary.
IV. At lower temperatures, Renderoc HB40 should be applied only when the substrate temperature and the ambient temperature is above $5^{\circ} \mathrm{C}$ or $5^{\circ} \mathrm{C}$ and rising.
V. Make sufficient material, plant and labour available to ensure that application is a continuous process.

## EQUIPMENT

It is suggested that the following list of equipment is adopted as a minimum requirement for the correct application of this material:

| Protective clothing: | - Protective overalls, safety helmet and safety shoes |
| :--- | :--- |
| Preparation equipment: | - Good quality gloves, goggles and face-mask |
|  | - Marker chalk or pen |
|  | - Disc saw |
|  | - Electric or pneumatic concrete breaker |
|  | - Wire brush |
|  | - Proprietary grit blasting equipment or high pressure washer |
|  | - Measuring jug |
| Mixing equipment: | - Festo slow speed drill, $400-500$ rpm |
|  | + Parchem mortar mixing paddle |
|  | + Parchem 20 litre mixing pail, or proprietary forced-action mixer for multiple bag mixing |


#### Abstract

APPLICATION - POINTS OF NOTE Parchern operates a policy to encourage the use, where possible, of experienced applicators, since the long-term performance of the materials is dependant upon proper application. For contractors who wish to apply the materials themselves, Parchem is also able to offer technical assistance.


## SECTION B: APPLICATION METHOD

### 1.0 REPAIR AREAS

1.1 The areas to be repaired are to be as shown on the drawings or as indicated by the Contract Administrator. The areas are to be clearly marked out on site and agreed with the Contract Administrator before proceeding.
1.2 As the work proceeds, repair areas may be adjusted by the Contract Administrator, according to the conditions found.
1.3 Propping shall be provided as noted on the drawings or as agreed by the Contract Administrator.
1.4 The surfaces adjacent to and of areas for repair shall be cleaned to remove any dust, unsound material, plaster, oil, paint, grease, corrosion deposits, organic growth, etc.
1.5 Within the repair area, the concrete cover to reinforcement links or main bars shall be determined using a cover meter. A small area shall be chiselled out and the concrete cover and the depth of deteriorated concrete confirmed by measurement.

### 2.0 CONCRETE PREPARATION

Attention to full and proper preparation of the substrate is essential for complete repair adhesion.
2.1 Break out unsound concrete as defined within the repair zone. Using a saw, disc cutter, or other suitable tool, the perimeter of the area to be repaired shall be incised to a depth of at least 10 mm causing good arises to be formed at the outer edges all to preclude feather edging of the repair mortar.
2.2 Where the depth of breaking out corresponds to the depth of concrete cover and thereby exposes reinforcement, breaking out shall continue to expose the full circumference of the steel and to a further depth of $\mathbf{2 5 ~ m m}$ or as directed by the Contract Administrator. Breaking out shall continue along the reinforcement until non-corroded steel is reached and shall continue 50 mm beyond this point or as directed by the Contract Administrator. Special care shall be exercised to ensure that any reinforcement exposed is not cut or damaged.
2.3 All concrete surfaces to receive repair mortar shall be of a rough scabbled nature. Saw/disc cut edges shall be grit blasted to lightly roughen.
2.4 This preparation shall be such as to leave a sound exposed concrete substrate free from dust, loose particles and any deleterious matter.

## Additional considerations where concrete is affected by carbonation

2.5 After breaking out as specified the exposed surface of concrete shall be tested for carbonation by the use of a semiaqueous solution of phenolphthalein. The test shall be carried out on the freshly exposed concrete or at least within 30 minutes of being exposed. The test shall be carried out on sound, dry and clean air-blown dust free surfaces. If the concrete substrate still exhibits carbonation in the vicinity of the steel reinforcement, breaking out to remove a further 20 mm shall be carried out and the test repeated. If carbonation is still present the Contract Administrator shall be notified before proceeding further.
2.6 It is essential that no carbonated concrete substrate shall be in contact with, or within 5 mm of, the reinforcing bars. In cases where carbonation has reached within 5 mm of the reinforcing bars, the concrete shall be broken out to expose the full circumference of the steel and a further depth of $\mathbf{2 0 - 3 0} \mathbf{~ m m}$ or as directed by the Contract Administrator.

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## Additional considerations where concrete is affected by chlorides

2.7 Where it is determined that chlorides are present in the concrete the agreed area(s) shall be broken out to remove all contaminated concrete, or, having regard to the steel reinforcement, to a depth as directed by the Contract Administrator.

NOTE: Chloride values are generally expressed in percentage terms of weight of chlorides by weight of concrete: $0.05 \%$ $-0.15 \%$ medium risk; above $0.15 \%$ high risk, though where chloride penetration from external sources is involved, the risk of corrosion in the medium risk range is much greater, and corrosion has been found to occur at levels below 0.05\%.

## Reinforcing steel / concrete not affected by carbonation or chlorides

2.8 Where exposed reinforcement is sound and there are no signs of corrosion other than typical of its original condition it shall be mechanically cleaned of rust and loose mill scale. Where there are signs of corrosion deterioration it shall be cleaned of corrosion products by wet grit blasting or other approved means to achieve a surface finish to comply with a standard of steel cleanliness such as SA 2 ${ }^{1 / 2}$ (BS7079: Part A1 / ISO8501) or as directed by the Contract Administrator.
2.9 Reinforcement damaged during the removal of concrete or the preparation process shall be brought to the attention of the Contract Administrator and if required, shall be repaired or replaced.

## Concrete affected by carbonation and / or chlorides

2.10 All exposed reinforcement shall be cleaned of corrosion products by wet grit blasting or other approved means to achieve a surface finish to comply with a standard of steel cleanliness such as SA 21/2 (BS7079: Part A1 / ISO8501) or as directed by the Contract Administrator. Special care shall be taken to clean out properly any pitting that may have occurred in the steel bar.

### 3.0 REINFORCEMENT PREPARATION

3.1 When the corrosion products have been removed and if directed by the Contract Administrator, the diameter of the reinforcing bar(s) shall be measured. If considered necessary by the Contract Administrator the existing reinforcement shall be cut out and replaced and/or additional bars added in accordance with instructions. Any deep pitting of the reinforcing bars shall be brought to the attention of the Contract Administrator.
3.2 Reinforcement damaged during the removal of concrete or the preparation process shall be brought to the attention of the Contract Administrator and if required, shall be repaired or replaced.

### 4.0 ANODE INSTALLATION

4.1 Where required by specification, Galvashield $X P$ anodes shall be installed in accordance with the current Technical Data Sheet and Method Statement. Renderoc HB40 is suitable for the installation of Galvashield XP as it has a Resistivity < 15,000 ohm cm @ 28 days.

### 5.0 REINFORCEMENT PRIMER

5.1 Immediately following preparation and cleaning, the reinforcing steel shall be primed with Nitoprime Zincrich, a single component epoxy primer complying with the relevant parts of BS4652, 1971 (1979) Specification For Metallic Zinc Rich Priming Paint Type 2.
5.2 The Nitoprime Zincrich shall be brush applied to the cleaned reinforcement ensuring that all exposed steel is fully coated. Special attention shall be paid to the backs of the steel bars and where steel bars are tied together. It is essential that this coat is continuous with that of any adjacent repaired area where zinc-rich primer has been used. Avoid excessive over-painting onto the concrete and allow to dry.

### 6.0 SUBSTRATE PRIMING

6.1 For two hours prior to application of the repair mortar the prepared substrate shall be thoroughly wetted with clean water to totally satisfy absorption. Any standing or excess water shall be removed.
6.2 The concrete primer shall be Nitobond HAR acrylic emulsion that shall be worked firmly into the damp substrate with a short-bristle brush to achieve a film intimate with the contact area for immediate repair.
6.3 Single repair areas larger than $0.5 \mathrm{~m}^{2}$ shall be part primed to commence and thereafter progressively in maximum $0.5 \mathrm{~m}^{2}$ adjacent bays as application of the repair mortar proceeds.
6.4 The repair mortar shall be applied whilst the Nitobond HAR is tacky. If the primer dries before the mortar is applied, the area shall be re-primed once again.
Note: Where Renderoc HB40 is spray applied, no concrete primer shall be used. However thorough wetting of the surface must take place prior to spraying.

### 7.0 MIXING REPAIR MORTAR

7.1 Before mixing the repair mortar the contractor shall ensure that sufficient and correct areas for reinstatement are prepared and ready to receive repair mortar.
7.2 Only mixes using complete bags of Renderoc HB4O shall be allowed and part bag mixes not permitted.
7.3 The mixing shall be carried out strictly in accordance with current product instructions for use and only with appropriate mixing equipment.
7.4 The mixing water shall be potable quality and the carefully measured quantity of water $3.0-3.2$ litres for the required mix shall be placed into the mixing container before the Renderoc HB40. The quantity of water used when wet spraying Renderoc HB40 may be increased to a maximum of 3.4 litres. Consult the local Parchem representative.
7.5 The Renderoc HB40 shall be added to the mixing water and in no circumstances shall more water be added than the maximum volume stated for each bag when using the hand application method.

The mixing time shall be minimum 3-5 minutes to allow for full integration of component parts.

### 8.0 APPLICATION OF REPAIR MORTAR

8.1 Only fully integrated mixes of Renderoc HB40 at the required consistency and workability shall be used.
8.2 Trowel the mixed mortar to the prepared and primed surface of the substrate paying particular attention to packing behind and between the reinforcement, and thorough compaction overall.
8.3 Renderoc HB40 shall be applied in accordance with current instructions for use. It may be applied in one operation by building up to the required profile in wet-on-wet layers between $10-40 \mathrm{~mm}$ vertically and $10-30 \mathrm{~mm}$ overhead. Thicker sections may be achieved by building up in wet-on-dry layers, where each layer shall be wavy-line scratch keyed with a comb, cured with Nitobond AR, allowed to dry throughout and reprimed at the time of application of subsequent layers.
8.4 Sagging of the repair mortar is not acceptable and if occurring all the material of the affected repair shall be completely removed prior to repriming and refilling in two or more applications of mortar supported by formwork if required.
8.5 If formwork is used it shall be pre-treated with a varnish to prevent moisture absorption from the repair mortar. Special care shall be taken to ensure that the positioning of the formwork allows for compaction of and does not result in voids within the repair mortar.
8.6 After applying sufficient mortar to achieve a level flush with or slightly proud of the surrounding surface the Renderoc HB4O shall be finished by striking off with a straight edge and trowelled/floated depending upon circumstances.
8.7 Renderoc HB40 can also be applied by a dry spray, and a wet spray process. In spray applications where the Galvashield XP is to be incorporated into the patch repairs, allow to protect the installed Galvashield XP with a hand applied, set encasement mortar of Renderoc HB40 prior to commencing the spray application.
8.8 The repair mortar shall not be applied when the ambient or substrate temperature is below $5^{\circ} \mathrm{C}$ or above $35^{\circ} \mathrm{C}$ nor at an ambient temperature of $5^{\circ} \mathrm{C}$ on a falling thermometer. The applied repair mortar shall always be protected from freezing whilst drying.

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## Renderoc HB40

### 9.0 CURING

9.1 Details of the methods of curing shall be submitted to the Contract Administrator for approval.
9.2 Curing techniques shall be instigated immediately following application of repair mortar to any given area. Large areas $\left(0.5 \mathrm{~m}^{2}\right.$ at a time) shall be cured as trowelling progresses without waiting for completion of the whole area.
9.3 NitobondAR may be low-pressure, spray applied as a curing membrane. In fast drying conditions it will be necessary to supplement this with polyethylene sheet taped around its edges. Where a Dekguard or Emer-Clad protective coating is to be applied over the repair area then Nitobond AR shall be used as the curing membrane.
9.4 During application and curing, all work shall be protected against direct strong sunlight.

### 10.0 CLEANING

10.1 All equipment should be washed with clean water immediately after use. Cured material can only be removed by mechanical means.

## SECTION C: IMPORTANT NOTE

This method statement is offered by Parchem as a 'standard proposal' for the application of Renderoc HB40. It remains the responsibility of the Engineer to determine the correct method for any given application.

Parchem does not accept any liability either directly or indirectly for any losses suffered in connection with the use or application of the product whether or not in accordance with any advice, specification, recommendation or information given by it.

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## Renderoc HB70

## High build, high strength, very low shrinkage, patch repair mortar, compatible with concrete $\mathbf{> 4 5} \mathbf{~ M P a}$

## USES

For the reinstatement of localised patch repairs and larger areas where suitable reinforcement is incorporated. Renderoc HB70 is alkaline in nature and will protect embedded steel reinforcement. It is specifically designed for locations where high build and high compressive strengths are required or in locations where good abrasion resistance is necessary. The mortar is suitable where resistance is required to chlorides and carbon dioxide.


Important Note 1: When Renderoc HB70 is used in conjunction with Impressed Current Cathodic Protection or Norcure Realkalisation and Desalination methods, the substrate bonding primer should be an OPC: Water slurry mixed at a $2: 1$ ratio.

Polymer bonding agents should not be used. No steel primer should be applied. Please refer to Parchem for further advice.
Important note 2: Reneroc HB70 is suitable for use with the Fosroc Galvashield XP incipient anode protection, with a resistivity $<15,000$ $\Omega \mathrm{cm} @ 28$ days.

## ADVANTAGES

- High strength and high abrasion resistance
- High build repairs
- Exceptional system of shrinkage compensation, provides long-term dimensional stability
- Low permeability provides sound protection against carbon dioxide and chlorides
- Can be applied by the wet or dry spray process for fast, exceptionally high build repairs with enhanced characteristics
- Suitable for internal and external use

日 Pre-bagged to overcome site-batched variations - only the site-addition of clean water required

- Contains no chloride admixtures


## DESCRIPTION

Renderoc HB 70 is supplied as a ready to use blend of dry powders which requires only the site addition of clean water to produce a highly consistent, high strength repair mortar. The material is based on Portland cement, graded aggregates, special fillers and chemical additives and is polymer modified to provide a mortar with good handling characteristics, while minimising water demand. The hardened product exhibits excellent thermal compatibility with concrete and outstanding water repellent properties. The low water requirement ensures fast strength gain and long-term durability.

## DESIGN CRITERIA

Renderoc HB70 is designed for vertical or horizontal use. It can be applied up to 40 mm thickness in vertical sections. Greater thickness can be achieved in small pockets or by the use of formwork. In horizontal locations, Renderoc HB70 can be applied up to 150 mm thickness. Thicker sections can be built up in layers. The material should not be applied at less than 5 mm thickness. Thicknesses greater than those nominated in large areas can be achieved by spray application.

## SPECIFICATION CLAUSE

## Steel reinforcement primer

The steel reinforcement primer should be Nitoprime Zincrich, a single component zinc epoxy primer. The primer is capable of providing a protective barrier to further corrosive elements attacking the steel. It shall be fully compatible with the Renderoc concrete
repair system.

## REPAIR MORTAR

The polymer modified shrinkage-compensated reinstatement mortar shall be Renderoc $\mathrm{HB70}$ a singlecomponent cement-based blend of powders to which only the site-addition of clean water shall be permitted. The cured mortar shall achieve 70 MPa compressive strength and 10 MPa flexural strength at 28 days.

## PROPERTIES

The following sesults were obtained at a water:powder ratio of 0.14 and temperature of $20^{\circ} \mathrm{C}$.

| Test method | Typleal result |
| :--- | :--- |
| Compressive strength |  |
| (AS 1478.2-2006 - cured in a sealed plastic bag) |  |
|  | 20 MPa 1 day |
| - dry cura): | 70 MPa 28 days |
| Modulus of Rupture | 5.2 MPa e 1 day |
| (Flexural Strength) | 6.3 MPa © 7 days |
| (AS 1012.11-2000): | 6.4 MPa e 28 days |

Indirect Tonsille Strength

| (AS 1012.10-2000): | 2.9 MPa 1 day |
| :--- | :--- |
|  | 4.3 MPa e 7 days |
|  | 4.7 MPa © 28 days |

Chloride Diffusion Nordtest NT Build 443
(BS 1881: Part 124: 1998)

|  | $\left(2.4 \times 10^{-12} \mathrm{~m}^{2} / \mathrm{sec}\right)$ |
| :--- | :--- |
| Coefficient of thermal <br> expansion: | $7.12 \times 10^{-4} \% \mathrm{C}$ |

Setting time (AS 1012.10-2005):

| Initial set: | 3 hours, 15 minutes |
| :--- | :--- |
| Final set: | 4 hours, 30 minutes |

Fresh wet density: $\quad$ Approx. $2200 \mathrm{~kg} / \mathrm{m}^{3}$ dependent on actual consistency used

## TECHNICAL SUPPORT

Parchem offers a technical support service to specifiers, end-users and contractors, as well as on-site technical assistance.

## APPLICATION INSTRUCTIONS

## PREPARATION

Saw cut or cut back the extremities of the repair locations to a minimum depth of at least 5 mm to avoid featheredging and to provide a square edge. Break out the repair area to a minimum depth of 5 mm up to the sawn edge.
Clean the surface and remove any dust, unsound or contaminated material, plaster, oll, paint, grease, corrosion deposits or algae. Where breaking out is not required, roughen the surface and remove any laitance by light scabbling or grit-blasting.

Oil and grease deposits should be removed by steam cleaning, detergent scrubbing or the use of a proprietary degresser. The effectiveness of decontamination should then be assessed by a pull-off test.

Expose fully any corroded steel in the repair area and remove all loose scale and corrosion deposits. Steel
should be cleaned to a bright condition paying particular attention to the back of exposed steel bars. Grit-blasting is recommended for this process.

Where corrosion has occurred due to the presence of chlorides, the steel should be high-pressure washed with clean water immediately after grit-blasting to remove corrosion products from pits and imperfections within its surface.

## REINFORCING STEEL PRIMING

Apply one full coat of Nitoprime Zincrich and allow to dry before continuing. If any doubt exists about having achieved an unbroken coating, a second application should be made and, again, allowed to dry before continuing.
(If Galvashield XP are to be embedded into the Renderoc HB70 patch repair, refer to the current Galvashield XP Technical Data Sheet for priming instructions).

## SUBSTRATE PRIMING

The substrate should be thoroughly sosked with clean water and any excess removed prior to applying one coat of Nitobond HAR primer and scrubbing it well into the surlace. Renderoc HB70 is to be applied as soon as the primer becomes tacky. If the Nitobond HAR dries prior to the application of the Renderoc H870, then the Nitobond HAR is to be reprimed and the repair mortar applied when primer is tacky. If the Nitobond HAR is too wet, vertical build up of the Renderoc HB70 mortar may be difficult.
In exceptional circumstances, e.g. where a substrate/repair barrier is required or where the substrate is wet or likely to remain permanently damp, Nitobond EP bonding aid should be used. Contact your local Parchern sales office for further information.

## MIXING

Cere should be taken to ensure that Renderoc HB70 is thoroughly mixed. A forced-action mixer is essential. Mixing in a sultably sized drum using an approved spiral paddle in a slow speed ( $400 / 500 \mathrm{rpm}$ ) heavy-duty drill is acceptable for the occasional one-bag mix. Free-fall mixers must not be used. Mixing of part bags should never be attempted.

For normal applications, place 2.8-3.0 litres of drinking quality water into the mixer and, with the machine in operation, add 1 full 20 kg bag of Renderoc HB70 and mix for 3-5 minutes until fully homogeneous. Note that powder must always be added to water, Dependent on the ambient temperature and the desired consistency, the amount of water required may vary slightly but should not exceed 3.0 litres / 20 kg bag of Renderoc H870.

## APPLICATION

Exposed steel reinforcing bars should be firmly secured to avoid movement during the application process as this will affect mortar compaction, build and bond.

Apply the mixed Renderoc HB70 to the prepared substrate by gloved hand or trowel. Thoroughly compact the mortar on to the primed substrate and around the exposed reinforcement. Renderoc HB70 can be applied up to 40 mm thickness in vertical sections but greater thickness in smaller pockets or with the use of formwork. If formwork is used, it should have properly sealed faces to ensure that no water is absorbed from the repair material. In horizontal locations, Renderoc HB70 can be applied up to 150 mm thickness.

If sagging occurs during application to vertical surfaces, the Renderoc HB70 should be completely removed and reapplied at a reduced thickness on to the correctly reprimed substrate.

Note: the minimum applied thickness of Renderoc HB70 is 5 mm .

## SPRAY APPLICATION

Renderoc HB70 can be applied by the wet spray technique. In circumstances where large areas of repair are required, the rapid placement and higher build attainable by these methods offer economic advantages over hand-trowelling. The resultant repair also offers a generally more dense compound with greatly enhanced mortar/substrate bond characteristics. For further details on the wet and dry spray techniques, including selection of spraying machines and nozzles, consult Wet or Dry Spray Application Guides or your local Parchem sales office.

## FINISHING

Renderoc HB70 is finished by striking off with a straight edge and closing with a steel float. Wooden or plastic floats, or damp sponges may be used to achieve the desired surface texture. The completed surface should not be overworked.

## L.OW TEMPERATURE WORIKING

In cold conditions down to $5^{\circ} \mathrm{C}$, the use of warm water (up to $30^{\circ} \mathrm{C}$ ) is advisable to accelerate strength development. Normal precautions for winter working with cementitious materials should then be adopted. The material should not be applied when the substrate and/or air temperature is $5^{\circ} \mathrm{C}$ and falling. At $5^{\circ} \mathrm{C}$ static temperature or at $5^{\circ} \mathrm{C}$ and rising, the application may proceed.

## CURING

Renderoc HB70 is a cement-based repair mortar. In common with all cementitious materials, Renderoc HB70 must be cured immediately after finishing in accordance with good concrete practice. The use of Nitobond AR, sprayed on to the surface of the finished Renderoc in a continuous film, is recommended. Large areas should be cured as trowelling progresses $\left(0.5 \mathrm{~m}^{2}\right.$ at a time) without waiting for completion of the entire area. In fast drying conditions, supplementary curing with polythene sheeting taped down at the edges must be used. In cold conditions, the finished repair must be protected from freezing.

## OVERCOATING WITH PROTECTIVE DECORATIVE FINISHES

Renderoc HB70 is extremely durable and will provide excellent protection to the embedded steel reinforcement within the repaired locations. The surrounding parts of the structure will generally benefit from the application of a protective barrier/decorative coating to limit the advance of chlorides and carbon dioxide, thus bringing them up to the same protective standard as the repair itself. Parchem recommend the use of the Dekguard or Emer-Clad range of protective, anti-carbonation coatings. These products provide a decorative and uniform appearance as well as protecting areas of the structure which might otherwise be at risk from the environment. Dekguard or Emer-Clad products may be applied over the repair area without prior removal of the Nitobond AR curing membrane. Other curing membranes must be removed prior to the application of Dekguard or Emer-Clad products.

## Cleaning

Nitobond AR and Renderoc HB70 should be removed from tools, equipment and mixers with clean water immediately after use. Cured material can only be removed mechanically.

Equipment used with Nitoprime Zincrich and Nitobond EP should be cleaned with Parhem Solvent.

## LIMITATIONS

Renderoc HB70 should not be used when the temperature is below $5^{\circ} \mathrm{C}$ and falling. Do not mix part bags. The product should not be exposed to moving water during application. Exposure to heavy rainfall prior to the final set may result in surface scour. If any doubts arise concerning temperature or substrate conditions, consult your local Parchem office.

## HIGHTEMPERATURE WORKING

At ambient temperatures above $35^{\circ} \mathrm{C}$, the material should not be used as this will cause premature setting.

## Renderoc HB70

| ESTIMATING |  |
| :--- | :--- |
| SUPPLY |  |
| Renderoc HB70: | $\mathbf{2 0 ~ k g}$ bag |
| Nitoprime Zincrich: | $\mathbf{1}$ litre can |
| Nitobond AR: | $\mathbf{1 , 5}$ and 20 litre container |
| Nitobond HAR: | $\mathbf{1 , 5}$ and 20 litre container |
| Nitobond EP: | $\mathbf{1 . 5}$ and 6 litre pack |
| Parhem Solvent: | $\mathbf{4}$ and 20 litre can |

COVERAGE ANDYIELD

| Renderoc HB70: | Approx. 10.2 litres / 20 kg bag <br> $\left(1.0 \mathrm{~m}^{2}\right.$ © 10 mm thickness) |
| :--- | :--- |
| Nitoprime Zincrich: | $7 \mathrm{~m}^{2} /$ litre (approx.) |
| Nitobond AR: | $6.8 \mathrm{~m}^{2} / \mathrm{litre}$ |
| Nitobond EP: | $4-5 \mathrm{~m}^{2} / \mathrm{litre}$ |

Notes: the actual yield per bag of Renderoc HB70 will depend on the consistency used. The yield will be reduced if the material is applied by a spray technique. The coverage figures for liquid products are theoretical - due to wastage factors and the variety and nature of possible substrates, practical coverage figures will be reduced.

## STORAGE

## SHELF LIFE

All products have a shelf life of 12 months if kept in a dry store in the original, unopened bags or packs.

## STORAGE CONDITIONS

Store in dry conditions in the original, unopened bags or packs. If stored at high temperatures and/or high humidity conditions the shelf life may be reduced to 4-6 months. Nitobond AR should be protected from frost.

## ADDITIONAL INFORMATION

Parchem provides a wide range of complementary products which include:

- concrete repair - cementitious and epoxy
- grouts and anchors - cementitious and epoxy
tit waterproofing membranes - liquid applied, cementitious and bituminous sheet membranes

E waterstops - pve and swellable

- joint sealants - building, civil and chemical resistant

E industrial flooring systems - cementitious and epoxy

- architectural coatings

Ef filler boards - swellable cork, bituminous and backing rod

- ancillary products

For further information on any of the above, please consult with your local Parchem sales office.

## INIPORTANT NOTICE

A Material Safety Data Sheet (MSDS) andTechnical Data Sheet (TDS) are avallable from the Parchom website or upon request from the nearest Parchem sales office. Reed the MSOS and TDS carefully prior to use as application or performance data may change from time to time. In emergency, contact any Poisons Information Centre (phone 131126 within Australla) or a đoctor for advice.

## PRODUCT DISCLAIMER

This Technical Data Sheet (TDS) summarises our best knowledge of the product, including how to use and apply the product based on the information available at the time. You should read this TDS carefully and consilder the information in the context of how the produet will be used, including in conjunction with any other product and the type of surfaces to, and the manner in which, the product will be applied. Our responsibility for products sold is subject to our standard terms and conditions of sale. Parchom does not accept any Hablility elither directly or indirectly for any losses suffered In connection with the use or application of the product whether or not in accordance with any advice, specification, recommendation or Information given by it.
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## Supplementary instructions VEGABAR - External housing



Document ID: 31087


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## 1 About this document

### 1.1 Function

This supplementary manual, together with the attached operating instructions manual, has all the information you need for quick setup and safe operation. Please read this manual before you start setup.

### 1.2 Target group

This operating instructions manual is directed to trained qualified 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: If this warning is ignored, faults or malfunctions can result.
Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.
Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.


## Ex applications

This symbol indicates special instructions for Ex applications.

- List

The dot set in front indicates a list with no implied sequence.
$\rightarrow \quad$ 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 specialist personnel authorised by the plant operator.

During work on and with the device the required personal protective equipment must always be worn.

### 2.2 Appropriate use

The external housing is a replacement part for a VEGABAR series 50 or 60 pressure transmitter.

### 2.3 Safety instructions 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.

Use in dust-Ex applications is not permitted.

### 2.4 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 according 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"


## 3 Product description

### 3.1 Structure

## Scope of delivery

Constituent parts

## Application area

The scope of delivery encompasses:

- External housing
- Line bridge
- Documentation
- this operating instructions manual

The external housing consists of the following components:

- Housing
- Screwed cover for electronics or connection compartment
- Socket

Depending on the order, the screwed cover is available with or without inspection window for the indicating and adjustment module.


Fig. 1: Components of the external housing for VEGABAR
1 Screwed cover
2 Housing
3 Socket
4 Wall mounting plate

### 3.2 Principle of operation

The external housing is suitable for the following pressure transmitters in IP 68 (25 bar) version:

- VEGABAR 51, 52, 53, 54, 55, 66, 67

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3 Product description

### 3.3 Storage and transport

| Packaging | Your instrument was protected by packaging during transport. Its <br> capacity to handle normal loads during transport is assured by a test <br> according to DIN EN 24180. |
| :--- | :--- |
|  | The packaging of standard instruments consists of environment- <br> friendly, recyclable cardboard. For special versions, PE foam or PE foi <br> is also used. Dispose of the packaging material via specialised <br> recycling companies. |
| Storage and transport <br> temperature | - Storage and transport temperature see chapter "Supplement - |
| Technical data - Ambient conditions" |  |

- Relative humidity 20 ... $85 \%$


## 4 Mounting

### 4.1 General instructions



In Ex applications, only a housing with appropriate Ex approval must be used.

## Tools

### 4.2 Mounting preparations

The following tools are required for mounting:

- Allen key, size 4
- Fork wrench, wrench size 19


### 4.3 Exchange of the electronics module

The electronics module is located in the electronics compartment. The below illustration shows the position of the electronics compartment in an external housing.


Fig. 2: Single chamber housing
1 Position of the electronics compartment

Remove the electronics module from the existing housing

Proceed as follows:
1 Switch off power supply
2 Unscrew housing cover of the electronics compartment
3 Disconnect the connection cables according to the operating instructions manual of the respective sensor
4 Loosen the two holding screws of the electronics module with a Phillips screwdriver

Page 266 of 363

## Mount the electronics module into the new housing



Fig. 3: Loosening the holding screws
1 Electronics module
2 Screws (2 pcs.)
5 Pull the electronics out by holding the opening levers.
Proceed as follows:
1 Insert the electronics module carefully into the new housing.
Information:
i
The electronics module is connected via a plug. Make sure that the plug is in the correct position. The notch must be in position "18.00 h".


Fig. 4: Plug position
1 Notch
2 Screw in and tighten the two screws with a Phillips screwdriver.
3 Screw the housing cover on
The exchange of the electronics module is finished.
As a rule, an exchange of electronics must be documented internally when Ex applicatfgns aie proulped.

### 4.4 Mounting steps, external housing

## Wall mounting

1 Mark the holes according to the following drilling template
2 Depending on the mounting surface, fasten the wall mounting plate with 4 screws


Fig. 5: Drilling template - wall mounting plate

## Tip:

1
Mount the wall mounting plate so that the cable entry of the socket housing points downward. Rain and condensation water can thus drain off. The socket housing can be displaced by $180^{\circ}$ to the wall mounting plate.

Turn the cable gland of the instrument housing downward. The basic body of the instrument housing can be turned by $330^{\circ}$ without any tools.

## Warning:

The four screws of the socket housing must only be hand-screwed. A torque $>5 \mathrm{Nm}$ ( 3.688 lbf ft ) can damage the wall mounting plate.

## 5 Connect the sensor to the external housing

### 5.1 Preparing the connection

Follow the instructions in the operating instructions manual of the sensor.

### 5.2 Connection procedure

Proceed as follows:
1 Loosen the four screws on the housing socket with an Allen key
2 Remove the housing socket from the mounting plate


Fig. 6: Remove the mounting plate from the housing socket

| 1 | Screws |
| :--- | :--- |
| 2 | Wall mounting plate |
| 3 | Cable gland |

3 Lead the connection cable through the cable gland on the housing socket ${ }^{1)}$

## Tip:

The cable gland can be mounted in three positions each displaced by $90^{\circ}$. Simply exchange the cable gland against the blind plug in the suitable thread opening.

4 With four-wire sensor, remove the bridge between terminal 4 and the ground terminal, see "Wiring plan".

1) The connection cable is already preconfectioned. If necessary, shorten it to the requested length, cut the breather capillaries clean. Remove approx. 5 cm of the Bagenalie, Qfrigeapprox. 1 cm insulation from the ends of the individual wires. After shortening the cable, fasten the type plate with support back onto the cable.

5 Connect the wire ends as described in chapter "Connection plan". Take note of the numbering.

Depending on the delivery date of the sensor, the connection cable is equipped with three or four wires. Take note of the different terminal assignment in the housing socket under "Wiring plan".

6 Connect the screen to the internal ground terminal and the external ground terminal on top of the housing to potential equalisation
7 Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable
8 Attach the mounting plate again and tighten the screws
The electrical connection of the sensor to the external housing is finished.

You find the electrical connection of the electronics module in chapter "Wiring plan" or in the operating instructions manual of the respetive sensor.

### 5.3 Wiring plan

Overview VEGABAR 51, 52, 53, 54, 55


Fig. 7: External housing in conjunction with VEGABAR 51, 52, 53, 54, 55

5 Connect the sensor to the external housing

## Overview VEGABAR 66,

 67

Fig. 8: External housing in conjunction with VEGABAR 66, 67

Page 271 of 363

## Terminal compartment, housing socket threewire



Fig. 9: Connection of the sensor in the housing socket, three-wire
1 Brown
2 Blue
3 Yellow
4 Green/yellow (line bridge from supply)
5 Shielding
6 Breather capillaries

5 Connect the sensor to the external housing

Terminal compartment, housing socket fourwire


Fig. 10: Connection of the sensor in the housing socket, four-wire
1 Brown
2 Blue
3 Yellow
4 White
5 Shielding
6 Breather capillaries

Wiring plan external electronics


Fig. 11: Wiring plan, electronics
1 Voltage supply

## 6 Setup

### 6.1 Setup

Setup is carried out according to the operating instructions manual of the respective sensor.

## 7 Maintenance

### 7.1 Instrument repair

If a repair of the instrument is necessary, please proceed as follows:
You can download a return form ( 23 KB ) from our Internet homepage www.vega.com under: "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 probably a safety data sheet to the instrument
- Send the instrument to the address of the agency serving you. In Germany, send it to the company headquarters in Schiltach.


## 8 Dismounting

### 8.1 Dismounting steps

Take note of chapters "Mounting" and "Connect sensor to the external housing" and carry out the listed steps in reverse order.

### 8.2 Disposal

The instrument 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 national government regulations (e.g. in Germany according to electronic scrap ordinance).

Materials: see chapter "Technical data"
If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

## 9 Supplement

### 9.1 Technical data

## Technical data

Following you find all data deviating from the standard instrument. All other technical data are specified in the operating instruction of the respective sensor.

## General data

Material 316L corresponds to 1.4404 or 1.4435
Materials, non-wetted parts

- Housing
- Housing socket
- Wall mounting plate
- Seal between housing socket and wall mounting plate
- Seal between housing and housing cover
- Ground terminal

Weight

Plastic PBT (polyester), Alu die-casting pow-der-coated, 316L
plastic PBT (Polyester)
plastic PBT (Polyester)
TPE (fixed connected)
NBR (stainless steel housing), silicone (Alu/ plastic housing)
316L
$0.7 \ldots 1.5 \mathrm{~kg}$ ( $1.543 \ldots 3.307 \mathrm{lbs}$ ), depending on housing material

## Process conditions

Ambient, storage and transport temperature

- without indicating and adjustment module
- With indicating and adjustment module


## Electromechanical data

## Cable entry/plug2)

- Socket
- Housing
- $1 \times$ cable entry M20 $\times 1.5$ (cable: $ø 6 . . .12 \mathrm{~mm})$
- $1 \times$ cable gland M20 $\times 1.5$ (cable: $\varnothing 5 \ldots 9 \mathrm{~mm}$ ), $1 \times$ blind stopper M20 $\times 1.5$
or:
- $1 \times$ closing cap $1 / 2$ NPT, $1 \times$ blind plug $1 / 2$ NPT
or:
- $1 \times$ plug (depending on the version), 1 x blind stopper M20 $\times 1.5$
Page 277 of 363
${ }^{2}$ ) Depending on the version M12 $\times 1$, according to ISO 4400, Harting, 7/8" FF.


## Electrical protective measures

Protection rating

- Housing

IP 65

- Socket

IP 68 (1 bar)

### 9.2 Dimensions

## Basic body external housing



Fig. 12: Basic element, external housing (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 housing

## Sensor housing and external housing



Fig. 13: External housing and sensor housing
1 Lateral cable outlet
2 Axial cable outlet
Page 279 of 363

Printing date:

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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.
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## SECTION 3: AS CONSTRUCTED DRAWINGS - CONTENTS PAGE

3.1 DRAWING REGISTER ..... 284
3.2 AS CONSTRUCTED DRAWINGS ..... 286
3.3 UNDERGROUND CABLE ROUTING DETAILS ..... 315

## 3 AS CONSTRUCTED DRAWINGS

### 3.1 DRAWING REGISTER

The following page contains the drawing register for the switchboard and civil works that make up the switchboard upgrade for the sewerage pump station reliability improvement project at Jilba St

# N NiLSEN 

ABN 50115075048
379 Thynne Road, Morningside Brisbane QLD 4170
E-mail: nilsenq@nilsen.com.au

ELECTRICAL SERVICES DRAWING REGISTER
Job \#: 32887
Job Name: SP162 - Jilba St, Submersible Sewerage Pump Station Upgrade
Tel: (07) 38998866
Fax: (07) 38998766 Head Contractor/Client: Queensland Urban Utilites


### 3.2 AS CONSTRUCTED DRAWINGS

The following pages contain the as constructed drawings listed in the drawing register. For CAD and associated files please refer to the CD containing the soft copy that accompanies this manual

## Urbañutilities

## SP162 JILBA STREET SEWAGE PUMPING STATION

## SITE COVER SHEET


ENERGEX SUPPLY 3 PHASE
FEED FROM PILLAR $16 \mathrm{~mm}^{2}{ }^{2}$ (NOTE 4)

NOTES

1. INCOMING GENSET, MAIN, PUMP \& DIST. BOARD
CIRCUIT BREAKERS LINE SIDE SHRO . incut breaker rating sut faut
2. CIRCUIT BREAKER RATINGS SUIT FAULT WITH CONTACTORS \& OVERLOADS TO IEC 947-4-1.
3. ALL WIRES \& CABLE CORES ARE FERRULED
WITH GRAFOPLAST SI2O00 COMPATIBLE LABELLING.
4. POINT OF SUPPLY. DISCRIMINATION BETWEEN
TO AS 3000 OES AND PUMP CIRCUIT BREAKERS
TO
5. CABLING TO GENERATOR CONNECTION SOCKET AND CABLING FULLY SEALED TO OTHER COMPARTMENTS



SP162 Jilba Street Indoorooopilly SPS Electrical Switchboard OM Manual






SP162 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manual


SP1 62 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manual



SP162 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manual


SP162 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manual















SP162 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manua


SP162 Jilba Street Indooroopilly SPS Electrical Switchboard OM Manual



### 3.3 UNDERGROUND CABLE ROUTING DETAILS

Please refer to the civil as constructed drawings contained in section 3.2

## SECTION 4: COMMISIONING, CERTIFICATES AND TESTING INFORMATION - CONTENTS PAGE

4.1 FORM 16 ..... 317
4.2 SWITCHBOARD MANUFACTURER TEST INFORMATION ..... 322
4.3 QUU COMMISSIONING PLAN ..... 333
4.4 QUU FACTORY ACCEPTANCE TESTS (FAT) ..... 349
4.5 ENGINEER DESIGN CERTIFICATION ..... 349
4.6 LEVEL PROBE COMMISSIONING INFORMATION ..... 356
4.7 CONTRACTORS CERTIFICATE OF TESTING AND SAFETY ..... 360

## 4 COMMISIONING, CERTIFICATES AND TESTING INFORMATION

4.1 FORM 16

The following pages contain the Form 16 for the Jilba St switchboard upgrade certifying that the installation has been carried out to Australian Standards.

# Inspection Certificate / Aspect Certificate / QBSA Licensee Aspect Certificate 

| NOTE | This form is to be used for the purposes of section 10(c) and 239 of the Building Act 1975 and/or sections 32, 35B, 43, 44 and 47 of the Building Regulation 2006. |
| :---: | :---: |
| 1. Indicate the type of certificate | ( Inspection Cortificate for |
| The slages of assessable bullding work are listed in section 24 of the Buididing Rogulation 2006 or as condilioned by the building certifier. <br> An aspect of building work is part of a stage (e.g. waterprooling). | Stage of building work (lor single delached class 1 a or class 10 building or stuccure) <br> (indicate the stage) $\qquad$ <br> Aspect of building work <br> (indicate the aspect) <br> Electrical Services |
| An aspect of building work is part of a stage (e.g. waterprooling). | QBSA Licensee Aspect Certificate <br> Scope of the work <br> Scope of the work covered by the licence class under the Queensland Building Services Authority Regulation 2003 for the aspect being certified, e.g. scope of work for a waterproofing licence is "instaling waterproofing materials or systems for preventing moisture penetration". An aspect being certified may include "wet area sealing to showers". |
|  | Supply and installation of replacement Electrical switchboards as part of the SQUV - Sewerage Pump Stations Reliability Improvement Project, |
| 2. Property description <br> The desciption must idenely all land the subject of the application. <br> The lot \& plan detals (eg. SP / RP) are shown on tje documents or a rates nolice. If the plan is not registered by $\begin{aligned} & \text { ille, provide }\end{aligned}$ nomious lot and plan details. | Street address (ndude na, street, suburb/locally \& postcode) |
|  | Queensland Urban Utilities Submersible Sewerage Pump Station - Jiliba St |
|  | Indooroopilly QLD Postcode 4068 |
|  | Lot \& plan details (Attech list I necessary) |
|  | n/a |
|  | In which local government area is the land siluated? |
|  | Brisbane City Council |
| 3. Bullding/structure description | Building/structure descriplion Class of building/structure |
|  | External concrete pads/andscaped areas. |
|  | New Pump Station Control and Swilchboard |
| 4. Description of component/s certified Clearty describe the extent of woik covered by this corfificato, e.g. all structural aspects of the steel rool beams. | All Electrical works have been installed in accordance with ASINZ 3000-2007 wiring rules. |
|  |  |
|  | Page 319 of 363 |



Form 16 continuod
3asis of certification Detail the basis for giving the certificale and the extent to which tests, speciicalions, nles, slandards, codes of praclice and other publicalions, were relied upon.

| ASNZS 3000:2007 Amendment 1 2009 |
| :--- |
| BCA codes Seclion J |
|  |
|  |




Form 16 continued


### 4.2 SWITCHBOARD MANUFACTURER TEST INFORMATION

The following pages contain the switchboard manufacturer's internal inspection and test sheets.

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | B | 11 | $24 / 06 / 11$ |

## Q.A. TEST SHEET BOOKLET

## PROJECT: QUU Pump Panels

## SWITCHBOARD

TUTLE: $\quad \mathrm{SP} 162$
JOB NO:

```
Q12B04
```

LIIENT:
Nilsens

DRAWING
\& REVISION NO. :

LEGEND
$P=$ Pass
$F=$ Fail
R=Reinspect
$\mathrm{N}=$ Refer notes/comments
$>=$ greater than
$<=$ less than
$\mu \mathrm{m}=\mathrm{m} \times 10^{-6}=$ micron
ITEM 1. - SHEETMETAL
ITEMI 2. -PAINTING/POWDER COATING
ITEM 3. - ELECTRICAL INSPECTION
ITEM 4. - ELECTRICAL TEST
ITEN 5. - ELECTRICAL TEST CONT.
ITEM 6. - PRE DELIVERY CHECK SHEET
EM 7. - PRE DELIVERY CHECK SHEET CONT.
ITEM 8. - GENERAL COMMENTS

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | $B$ | 10 | $15 / 12 / 08$ |

## 1-SHEETMETAL.

## JOB NUMBER:



Fabrication by: $\square$ Enclosures (name) (name)

## COMMENTS:

## HOLD POINT No. 1

Enclosure has been inspected and is approved for powder coating.
Signed
 Date ....12-11-12

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QATEST BOOKLET | 8 | $B$ | 10 | $15 / 12 / 08$ |

2-PAINTINGI POWDER COATING.


Powder-coat by: $C$ [nd $\quad$ (companyname)

COMMENTS :

## HOLD POINT NO. 2

Paint finish has been inspected and is approved for electrical fit-out.
signed Turlles's
Date
$12-11-12$

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | B | 10 | $15 / 12 / 08$ |

## 3 - ELECTRICAL INSPECTION.


$\qquad$
COMMENTS:
$\qquad$
$\qquad$
$\qquad$
HOLD POINT No. 3

- vitchboard assembly has been inspected and is approved for electrical testing.

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | $B$ | 10 | $15 / 12 / 08$ |

## A-ELECTRUALTESTS.

## JOB NUMBER:



## OTE: * Caution - Do not Megger when electronic equipment is connected.

Note 1. Insulation is satisfactory when 2 kV voltmeter readegexp8bto 88000 V and lamp brightness is normal.
Note 2. Insulation is unsatisfactory when $2 k V$ voltmeter reads below 1800 V and lamp brightness falls.

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | B | 10 | 15/12/08 |
|  |  |  |  |  |



## COMMENTS:

## HOLD POINT No. 4

:sting has been completed successfully and switchboard assembly is approved for pre delivery inspection
Signed ........ferf1م

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | B | 10 | $15 / 12 / 08$ |

## 6 - PRE DELIVERY CHECK SHEET.

| JOB NUMBER: |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { ITEM } \\ & \text { NO. } \end{aligned}$ | I\& T.P. DESCRIPTION | PASS | FAlL | $\begin{gathered} \text { RE-INSPECT } \\ \text { P=PASS } F=F A I L \end{gathered}$ |
| 100 | Is paintwork in satisfactory condition. |  |  |  |
| 101 | Doors and panels align correctly. | 7 |  |  |
| 102 | Panel fixings and bolts secured. | 7 |  |  |
| 103 | Circuit schedule card supplied if required. | 7 |  |  |
| 104 | Internal panel fixings fitted with star washers. | , |  |  |
| 105 | Control wiring fitted with pre-insulated type lugs (If required). | $\checkmark$ |  |  |
| 106 | Main power connections fitted with heat shrink sleeving where applicable. |  |  |  |
| 107 | CT's fitted with bus bar links where required. | $N / B$ |  |  |
| 78 | Bus bars P.V.C. insulated in exposed areas (ff required). | J |  |  |
| 109 | Spare fuse clips or racks fitted (If required). | N/A |  |  |
| 110 | Schematic drawing supplied (If required). | 1 |  |  |
| 111 | Wires and terminals numbered (As required). | 7 |  |  |
| 112 | Equipment fitted as shown on as built drawings. | $\checkmark$ |  |  |
| 113 | Equipment neat, complete and straight. |  |  |  |
| 114 | Are bolts provided to terminations. | $\checkmark$ |  |  |
| 115 | Are shrouds fitted over live components in accessible areas (If required). | $\sqrt{ }$ |  |  |
| 116 | Earth bar has paint removed from contact surface with gear tray. | $1 /$ |  |  |
| 117 | Is name plate fitted, stating fault level, rating etc. |  |  |  |
|  | ARE LABELS: | < |  |  |
| 118 | Straight and clearly visible. |  |  |  |
| 119 | Correct spelling. |  |  |  |
| 120 | Fixed with double sided tape or fixed with screws. | 7 |  |  |
| 121 | As per drawing. |  |  |  |
| 122 | Fixing screws have protruding sharp points removed (If required). | 100 |  |  |
|  | IS WIRING INSTALLED IN P.V.C. DUCTS AND: |  |  |  |
| 3 | Duct lids neat and edges cleaned and a good fit. | 7 |  |  |
| 124 | Wiring leaving duct neat and regularly fixed with cable ties. | / |  |  |
| 125 | Ducts correctly fitted. | J |  |  |
|  | IS NEUTRAL BAR FITTED AND, |  |  |  |
| 128 | Correct number \& sizes in relation to terminations (watch submains) |  |  |  |
| 127 | Correctly identified and numbered. | 7 |  |  |

## Continued on page 8

## COMMENTS:

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | B | 10 | $15 / 12 / 08$ |

## 7 - PRE DELIVERY CHECK SHEET.

| JOB NUMBER: |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| $\begin{aligned} & \text { ITEM } \\ & \text { NO. } \end{aligned}$ | I \& T.P. DESCRIPTION |  | PASS | FAIL | RE-INSPECT $P=P A S S ~ F=F A I L$ |
| 128 | Check connections for firmness and correct termination procedure. |  |  |  |  |
| 129 | Are C.F.S. units fitted with cartridges and if so is size installed correct and size indicated on door of C.F.S. |  | N/L |  |  |
| 130 | Check door to ensure firm compression of seals. |  | $\mathcal{J}$ |  |  |
| 131 | Are door hinges securely fixed. |  | 1 |  |  |
| 132 | Are insect screens fitted over louvres (If required). |  | J |  |  |
| 133 | Is cable tray fitted over louvres (If required). |  | J |  |  |
| 134 | Are circuit breaker "Blanks" fitted and secure (Where required). |  | J/ |  |  |
| 135 | Have wiring diagrams and equipment instructions been packed |  | $\sqrt{ }$ |  |  |
| 136 | Has switchboard been thoroughly cleaned out. |  | , |  |  |
| $\cdot 37$ | Have photo's been taken of switchboard. Photo's are stored electronically for each project, camera to be given to the receptionist for downloading on completion of each project. |  | $y_{i s}$ |  |  |
| 138 | Have delivery details been arranged. | A. Site notification/address. | Yes |  |  |
|  |  | B. Freight company notified. | yes |  |  |
|  | HAS SWITCHBOARD BEEN SECURELY PACKED. |  |  |  |  |
| 140 | A. Bubble plastic wrapping (1 layer on face). |  | 7 |  |  |
| 141 | B. Corrugated cardboard over wrapping (1 layer). |  |  |  |  |
| 142 | C. Timber casing (Where required). |  | W0 |  |  |
| 143 | Is switchboard insured for transit. |  | Yes |  |  |
|  | NON-CONFORMANCE CHECKS |  |  |  |  |
| 144 | Have there been any non conformances raised for this project? |  | Wor |  |  |
| 145 | If the answer is "Yes" documentation must be completed? |  |  |  |  |

COMMENTS:

## HOLD POINT No. 5

Pre deliveryinspection has been completed successfully and s

| SUNLINE | Form No. | ISSUE | Revision | Date |
| :---: | :---: | :---: | :---: | :---: |
| QA TEST BOOKLET | 8 | $B$ | 10 | $15 / 12 / 08$ |

8-GENERAL COMMENTS

JOB NUMBER :

| ITEM NO. | COMMENT |
| :---: | :---: |
|  |  |
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| - $\ldots$ |  |
| $\because$ | $\therefore$ |
|  |  |
|  |  |



### 4.3 QUU COMMISSIONING PLAN

The following pages contain the approved QUU commissioning plan for Jilba St. This plan details the checks required by QUU before during and after the switchboard upgrade process.

These sheets were filled out by on-site electricians and are signed off by the site supervisor.

## 1 INTRODUCTION

## !! IMPORTANT !!

## This commissioning Procedure is not to replace the electrical contractors own internal quality control and statutory documentation.

At all times during the switchboard upgrade, the pump station must be capable of running at least 1 of the 2 puinps. To achieve this during the switchboard changeoveri, ä temporary Switchbord system will be used.

The attached document will be used by Nilsen staff in conjunction with Standäd SWMS üsed for eapch task. Refer to the list of approved SWMS procedures that will be available on site

The Project Manager is to ensure that 2 sets of For Construction Documents are available on Site during the cutover. Both sets are to be marked up with all changes
Set 1 is to stay on site after commissioning
Set 2 is to be taken off site for AutoCad conversion to As constructed Drawings

### 1.1. SEQUENCE OF WORKS

The sequence of works shall be:

1. Station Preliminaiy Works
2. Switchboard Cliangeover
a. DAY 1 -Temporary Switchboatd and preliminary's
b. DAY 2:- Commission New Switchboard (Pumps 1 \& 2)
c. DAY 3 - Remove old equipment
3. Post Chángeover

### 1.2 MAINTENANCECHECK OF EXISTING INSTALLATION

Before the works on site can commence, QUU staff to ensuire that all 2 pumps are fully operational shall perform a thorough maintenance inspection of the site. QUU to ensure that well access lids are free moving prior to works on Day 1

Notc: Printè copics of this document should be verificid for éur̃ency against the published electronic copy.

### 1.3 PRE COMMISSIONING CHECKLIST

The following checklist is to be completed and signed by the electrical contractor:

### 1.3.1 Switchboard Factory Acceptance Test

| Contrnctor Task | Complaged |
| :--- | :--- |
| FAT has been completed as per QUU FAT Document and all defects that were <br> identified bave been rectified | OKD Date: $1 / 1$ |

### 1.3.2 Civil Works Complete

| Contrnctor Task | Completán |
| :--- | :--- |
| Ensure all civil wöks are installed as per the For construction drawings | OKyf Date: $1 / 21 / 2$ |

### 1.3.3 New Switchboard Installed in Location

| Contractor Task. | Outcome |
| :---: | :---: |
| Install new Switchboard and all accessories in the location on the new concrete slab as per the For Construction Brawings has been completed. Install all required seals between the switchiboard and the well | OKP |
| Ensure draw wires are intact in all conduits | OKD |
| Check the board to ensure that all components have not been damaged or loosened in transit | OKL |
| Install Main earth to Earth rod and Test Record results here : 0.1 | OKV |
| Install Antenna, cabling añd pole ând align anteña to same compass setting as the existing antenna and lock into position | OK丁 |

### 1.3.4 New Radio Antenna Mast Location

| QUU Trisk | Result |
| :--- | :--- | :--- |
| Check the location of the antenna mast and ensure that the new position will not |  |
| be directly below electrical transmission lines. Install antenna pole, anterna and |  |
| wiring to the new switchboard. | Location okUV |

### 1.3.5 Generator Check

| QUUTask | Checlied |
| :---: | :---: |
| - The stand bye generator can start run at full load for one hour and has sufficient fuel (full tank). This test is mandatory in assuring the generator is fully operational <br> - Confirm the generator has a current inspection certificate <br> - Ensure you are inştructed on Operation <br> - Ensure cable length is sufficient to complete the works |  |

### 1.3.6 Pump Station preliminary operational checks

| QUU Task. |  |
| :--- | :--- |
| These are checks will ensúre the pump station is fully operational and that no | Clicked |
| delays will be incurred due to any pump station problem out side of the contract. |  |
| These task are desirable to have completed before the SAT but are not essential |  |
| The job can proceed if they are not done. |  |
| Commissioning Manager to request networks maintenance to inspect and rectify if |  |
| necessary |  |



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| The existing reflux valves and assoçiated limit switches are working correctly. | Narok- |
| :---: | :---: |
| The discharge pressure connection point is available and that the isolation valve is functioning correctly. | NA気 |
| The dry well extiaust fan is working correctly and quietly. | NA OK: |
| The wet well does not need pumping out. | NA ¢OK |
| The flow meters are functioning correctly. | NA LOKロ |
| Ensure that the station is fully fưnctional (all pumps can run) and fuel is full tank is filled after test. | NATO OK |

Electrical Contractor's Supervisor


QUU Comunissioning Manager
Name: John Clayton Date: $6 / 212012$
Signature:

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## 2 SWITCHBOARD CHANGEOVER PROCEDURE

The following sequence of chatige over works is the order tin which they must be followed. Two pumps must be operational at all times. After each phase has been completed, the commissioning manager will record the results and instruct the commissioning tean to commence work on the next phase.


### 2.1. DAY 1 - TEMPORARY SWITCHBOARD

### 2.1.1 Register with Control Room

| Contractor Task | Outcome |
| :--- | :--- |
| Call the QUU ControlR Rom Operator (CRO) and inform him that you are on site. |  |
| Record the CRO's Name and Officer Code and record the time of the call. |  |
| Advise CRO that you are performing a switchboard changeover and that you will |  |
| initially be taking one pump off line. | Name |
| Complete the on site Log Book | CRO: |
| Permit to Work Number and validity date |  |
| Give the operator your contact name and number and advise the operator that |  |
| communications will be lost to the pump station until the job is finished. |  |

### 2.1.2 Secure the Work Zone

| Contractor Task | Outcome |
| :--- | :--- |
| Ensure sufficient work areas are established and fenced off to stop unauthorized |  |
| entry. Ensure entry to properties is not hindered or access to the well. | NA Q OK ロ |
| Ensure QUU has notified resident of access requirements. |  |

### 2.1.3 Existing Switchboard Parameters

| Contractor Task | Outcome |
| :---: | :---: |
| Ensure that the station is füly functional (all 2 pumps can run) | P17 P3才 |
| HiSTSAHOLEONH <br> Do not proceed until the ALL 2 PUMPS are confirmed to be fully operational | Signature $\qquad$ 10630 |
| Record 3 phase motor currents from display panel (At 50 Hz ) and on a hand heid tester to verify display <br> Pump \# 1 <br> Pump \# 2 <br> Verify motor phase rotation at motor leads | U. $\qquad$ $\qquad$ W: $\qquad$ <br> U. <br> v $\qquad$ W. $\qquad$ $\square$ |



## 2．1．4 Generator Checks

| Contractor Task | Outcome |
| :---: | :---: |
| Ensure that the generator has a full fuel tank． | OK－ |
| Start the generator and measure the 3 phase volts and run one pump on load Check Phase and Pump Rotation | U． $\qquad$ $V$ $\qquad$ W． $\qquad$ 0 <br> $\sigma$ |

## 2．15 Installation of temporary pumping board and field wiring

| Contractor Task | Outcome |
| :---: | :---: |
| Install and test independent battery backed high alarm system（with Multitrode level sensor）in the wet well to provide audible and Visual alarm if the wet well level exceeds 200 mm above the current start level． | OK6 |
| Mount the temporary punping board in a secure location． | OK】 |
| Connect the temporary level probes and electrodes and temporary pumping contróls circuits | $0 \mathrm{~K} 5$ |

## 2．1．6 Test of temporary pumping board and field wiring

| Contractor Task | Oütcome |
| :---: | :---: |
| Isolate and tag and lock out Pump No． 2 and remove motor control cable from the wet well | OKJ |
| Install Pump 2 Motor control cable to Temporary Switchboard | OKV |
| Turin existing switchboard to Manual setting | OKE |
| Start Generator and turn the connected Pump 2 to manual and ensure that the well pumps down．Confirm motor currents are correct as per previous readings | OKת |
| Set the Temporaty switchboard to Auto and observe a full cycle of pumping to ensure Auto operation and checking the operation of all alarms． | OK |
| Tün Off Temporany switchboard and lock and tag out | OK】 |
| Turn Existing station back to Auto | OK／ |
| Disconnect Pump 2 from Temp switchboaid | OKV |
| Reconnect Pump 2 to existing switchboard | OK】 |
| De－isolate pump 2 on existing board and remove tag and lock |  |
| Confirm station operates corectly by watching a complete cycle of the pump． station to ensure the station stops and starts at the correct levels | $\text { OK } \mathrm{K}$ |
| Confirm all materials and site is securfe and ready for cutover Ensure Generator is Re－fuled and topped up：Generator cables are to be secưred． | OK才： |

Electical Contractor＇s Supervisor


QUU Commissioning Mănager
Name：Jo
Signature： Active Dale：

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### 2.1.7 Existing Switchboard Settings.

Runt each pump in local mode and record;

| Pump Number | Hz | Total <br> Amps | $\begin{aligned} & \text { Total } \\ & \text { LW } \\ & \hline \end{aligned}$ | Total | $\begin{aligned} & \text { Total } \\ & \text { PF }: ~ \end{aligned}$ | Voltage THD Shase | Flow L/s | Discharge Pressure (mAHD) | Wet well Level (mAHD) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | 50 |  | NA: | NA | NA | NA | NA' |  |  |
| 2 | 50 |  | NA | NA | NA | NA: | NA |  |  |
| 1 \& 2 | 50 |  | NA | NA | NA | NA | NA |  |  |


| Contractor Task |  |
| :---: | :---: |

Electrical Contractor's Supervisor
Name: $\qquad$ Date: $\qquad$

Signature:


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The contractor is to record äll settings on the existing switchboard, including but not
limited to.
Probe as foiund hanging lengths;
Starter setting
Antenna direction;
Condition of exlsting consumer malns to be reused;

### 2.1.8 Preparation for the Existing Energex consumer Mains Cutover

| ContractorTask | Outcome |
| :--- | :--- |
| Use a "wand" to determine the location of the underground services, This may have <br> been undertaken prior to this day and is acceptable as long as the markings are still <br> present | OK- |
| Expose the mains in the location where the new conduits will join together and |  |
| fence off this area |  |
| Ensure that correct materials are available to join the conduits |  |
| NOTE CABLE JOINTS ARE NOT PERMITTED |  |
| ENSURE SUFFICENT CABLE IS AVALIABLE TO INSTALL NEW MAINS |  |
| CABLES IFREQUIRED |  |
| existing cable will require insulation testing before reusing. |  |



QUU Comimissioning Manager
: : Active Date:

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| Contracto Task | Outcome |
| :--- | :--- |
| Call the QUU Control Room Operator (CRO) and inform him that you are leaving <br> site. Record the CRO's Name and Officer Code and record the time of the call. <br> Complete the log book and ensure station is secured | OKD |

## NOTICE

## THE STATION CAN NOW BE LEFT UNATTENDED AT THIS STAGE




## !!! WARNING !!!

The following works shall be continuous and the station can NOT be left unattended during this work, Multiple shifts shall be used if required and each employee can only working a maximum hours as per their WH\&S regulations.

### 2.2.1 Run Station on Temporary Switchboard (Pump 2)



Electrical Contractor's Supervisor


QUU Commissioning Manager


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| Remove Pole fuse and lock fuses in a lockout box and Tag; | OKD |
| :--- | :---: |
| TEST the existing Switchboard for DEAD using approved SWMS | OK |
| HOLD Point |  |

### 2.3 REMOVE EXISTING SWITCHBOARD WIRING

| Contractor Task | Completed |
| :--- | :--- | :--- |
| Disconnect all external equipment from the switchboard DO NOT remove from the <br> wet well until it is proved that the station has passed as SAT works. Draw ropes <br> are to be installed in all conduits | OK: |

### 2.4 REMOVE EXISTING PROBES

| Contractor Tasto |  |
| :--- | :--- | :--- |
| Remove all existing wet well level probes and Vega level sensor and their |  |
| associated cabling and conduits. Take note of existing heights of all sensors |  |
| Record Results Here |  |

### 2.5 WET WELL INSTRUMENTATION JUNCTION BOX

| Contractor Task | Completed |
| :--- | :--- |
| Remove existing Probes. Ensure that all materials that are removed from the box <br> are not permitted to fall into the wet well. | OK |

### 2.6 WET WELL SENSORS

| Contractor Task |
| :--- | :--- |
| Install all new well level probes and Vega sensor to correct heights and connect to |
| the new Switcliboard and re test each component as it is installed The switcliboard |
| $24 V D C$ can be energised to do these checks. |



### 2.7 CONNECT WET WELL AND DISCHARGE SENSORS TO NEW SWITCHBOARD

| Contractor Task | Completed |
| :--- | :--- |
| Place all new reguired wet well and discharge sensors in the correct positions and <br> wire to the new Switchboard, Test each component as it is installed + | OK |

### 2.8 CONNECT PUMP 1 TO NEW SWITCHBOARD

| Cointractor Tasik $\quad$ Comimeleted |  |
| :--- | :---: |
| Remove the montor cable for Pump 1 and install in the new switcliboard | Ok |

### 2.9 CONNECT MAINS TO NEW SWITCHBOARD

| Contractor Task | Completed |
| :--- | :--- |
| Re run the mains from the Old Switchboard to the new sivitchboard, The join point |  |
| for the conduits was uncovered previously and all materials are on site to complete. |  |
| Once new mains are installed test each leg |  |

### 2.10 CONNECT METERING

| Contractor Taisk | Completed |
| :--- | :--- |
| Energex has been arranged to be on site at .......am. Follow Energex direction to <br> complete meter installation. HOLD POINT |  |
| Energex Contact Number <br> Energex Booking Number |  |

### 2.11 POWER UP NEW SWITCHBOARD

| Contractor Task | Completcd |
| :--- | :--- |
| Once the new Meters are installed, pole fuises aie installed and mains connected. <br> Turn on Main switch and test each subsequent down streàm breaker for correct <br> operation. Conduct mandatory tests and record results before cnergising | OKQ |



### 2.12 TEST PUMP 1 IN MAÜNAL

| Contractor Task | Completed |
| :--- | :--- |
| Connect Pump 1 Motor leads from Old Switchboad to the New Switchboard. |  |
| Test Pump 1 in Manual ENSURE WELL PUMPS DOWN | OKV |
| Motor cable has already been disconnected in previous 2.8 and connected into the | OQ |
| new switchboard |  |
| Check Phase Rotation and motor ciurrent |  |

### 2.13 CONNECT AND TEST PUMP 2 IN MANUAL

| Contractor Task |
| :--- | :--- | :--- |
| Isolate and tag out pump 2 from the Temporary board, remove the pump 2 power |
| and control cable what control cable Pump No. 1 does not have one and reinstall in |
| the new conduit to the new switcliboard why is this procedure different from |
| Pump No. 1 |

## NOTE:

The new switchboard should now be fully function tested in all ojeirating modes, Renote, Local, Emergency override. Check interlocking, E-stops and all other functions. The pump station can be placed in remote and will operated in this mode until and during the SAT, the back up audible alarm can stay in place.

### 2.14 CLEAN UP

| Contractor Task | Completed |
| :--- | :--- |
| Turn Off geneirator auld remove generator cables. |  |
| Prepale site for removal of Redundant Equipment | OK © |
| Site Clean and tidy and secure |  |

### 2.15 COMMENGE SAT

Commissioning of Pump No. 1, No. 2

| QUU Programmer \& Contractor Task | Outcome |
| :--- | :--- |
| Before beginning the next step ensure that the well level is below the Duty A/B |  |
| Start Eevel (Station under the control of the new board) |  |




## SCADA Testing

QUU Programmer \& Contractor Task
The QUU Programmer must complete the following procedưres with the assistance from the Commissioning Engineer:and SCADA Commissioning Engineer in the Control Room.
SP122.The Esplannade S.A.I
Section 3: SCADA Commissioning Procedure

QUU Programmer \& Contractor Task
The QUU Programmer must complete the following procedures with the assistance from the Commissioning Engineer and SCADA Commissioning Engineer in the Control Room.
SP. 122 The Esplanade S.A.T
Section5: Site Migration to the Operational Area

| Contractor Task | Outcome |
| :--- | :--- |
| Call the QUU Control Room Operator (CRO) and inform him that you are leaving |  |
| site. Record the CRO's Name'and Officer Code and record the time of the call. |  |
| Complete the log book and ensure station is secured | OK ax |

## NOTICE <br> THE STATION CAN NOVY BE LEFT UNATTENDED AT THIS STAGE

Electrical Conftactor's Supervisor


## DAY 3 REMOVE TEMPORARY BOARD

## Remove Temporary Switchboard

## !!! WARNING !!!

The following works shall be continuous and the station can NOT be left unattended during this work, Multiple shifts shall be used if required and each employee can only working a maximum hours as per their WH\&S regulations.

### 2.15.1 Remove Switchboard

| Contractor Task | Outcome |
| :--- | :--- |
| Remove Temp Switchboard, Old QUU Switchboard, Old cables and probes | OK $\square$ |
| and Generato for Site |  |
| Ensure Site Clean and tidy, Remove temp fencing | OK $\square$ |

## 3 POST CHANGE OVER CHECKLIST

### 3.1. DELIVERABLES FROM RTU PROGRAMMER

| QUU Programmer | Date Completed |
| :--- | :---: |
| Within 7 days of the change over the following must be completed and signed off by |  |
| the QUU Programmer |  |
| Complete Section 4: Post Commissioning | 1 |
| The QUU Programmer will ensure that the Control Room Acceptance (CRA) form is |  |
| signed by the Manager of the Control Room officers. The form is to be handed to |  |
| the Contracts Manager (CM): |  |

### 3.2 DELIVERABLES FROM ELECTRICAL CONTRACTOR

| Contractor Task..... | Date Completed |
| :--- | :---: | :---: |
| All documentation required under the contract is to be provided with the time | $/$, |
| specified (AS BUULT's, Electrical Certificates and dócumentation ètc). |  |

### 3.3 DELIVERABLES FROM COMMISSIONING MANAGER

| Commissioning Manager $\quad$ Date Complcted |  |
| :--- | :--- | :--- |
| All documentation is handed to the Project Manager to that the new switchboard |  |
| asset can be capitalised and handed over to the customer: |  |
| Factory Acceptance Test Sheet - Completed \& signed off. | 0 |

Contactoris Supervisor
Näme:
Date $\qquad$
๑บั๋ Commissioning Manager

Name:
Date:
Signature

Signature:

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| Electrical Inspection Sheet - Completed \& signed off. | OKQ |
| :--- | :---: |
| Site Acceptance Test Sheet - Completed \& signed off; | OKD |
| Commissioning Plan - Completed \& signed off. | OKD |
| As built Brawings have been updated, drafted and taken to site along with the Site <br> Specific Functional Specification. | 1 |

### 3.4 SUGGESTIONS FOR IMPROVEMENT

| Suggestion | $\cdots$ | Recommended By, |
| :---: | :---: | :---: |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

Contactor's Supervisor QÚU Commissioning Manager

Name: $\qquad$ Date $\qquad$

Signature:

Name:
Date:

Signaturue:

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### 4.4 QUU FACTORY ACCEPTANCE TESTS (FAT)

Factory acceptance tests were carried out on-site in collaboration with representatives from QUU as per the scope of the contract.

QUU retained these tests and therefore these tests are not part of this manual.

### 4.5 ENGINEER DESIGN CERTIFICATION

The following pages contain the report completed by an RPEQ certified electrical engineer certifying that the design of the replacement switchboard and associated connections comply with Australian standards.

| Memo |  |  |  |
| :---: | :---: | :---: | :---: |
| Project | : Jilba Street (SP162) |  | No.: 12109 |
| To | : Bob Pritchard | Company : Nilsen |  |
| CC | $:$ a |  |  |
|  | : |  |  |
| From | : Lionel Ferris | Date | : 10 September 2012 |
| Subject | : Electrical Review |  |  |
| Attachments : Cable Selection, CB Curves |  |  |  |

We have reviewed the electrical design for the above site and confirm that compliance with the requirements of AS3000 have been met.

Voltage drop to the furthest load (pumps) is $1.40 \%$ from the point of Energex connection, well within the 5\% permitted by AS3000.

Current carrying capacities of the selected cables exceed the connected loads and the rating of the protective devices.

Automatic disconnection is required in order to satisfy touch voltage, short circuit energy withstand and fault loop impedance requires. Inspection of the circuit breaker curves indicate that the disconnection times are achieved within the permitted durations as required by AS3000 (appendix B).

Attached find cable selection data and circuit breaker curves.

## Regards

Lionel Ferris
Electrical Engineer
RPEQ5938



## Building

 ServicesDesign
Pty Ltd
Consulting Engineers

- Electrical

ABH 48139403848

## P.O. Box 296 <br> Arana Hills 4054 <br> 0730560230 <br> 员 0730410249

## Cable Size Calculation

| Job Number | 12109 | Company Name | Building Services Design |
| :---: | :---: | :---: | :---: |
| Job Name | Jilba Street | ABN |  |
| Author |  | License Number |  |
| User Name |  |  |  |
| Client |  | Date Printed | 10 Sep 2012 |
| Job Description |  |  |  |
| Load Description | MSB |  |  |
| Inputs |  |  |  |
| Run Length | 25.00 m | Voltage | $400 \mathrm{~V} / 3 \varnothing$ |
| Conductor | Copper | Max Volt Drop | 3.00 \% |
| Load | 73.71 A | Allowed Expansion | 0.00 \% |
| Efficiency | 100 \% | Power Factor | 1.00 |
| Cable Reference |  | Device Fault Limit | 0.00 kA |
| Protective Device | Custom Circuit Breaker | Protection Rating | 100.0 A |
| Cable | $1 \times 4$ core flat X-90 (XLPE) cable In underground ducts |  |  |
| Calculated to | AS3000:2007 \& AS3008.1.1:2009 |  |  |
| Additional derating factor |  | 1.00 |  |
| Ambient Temperature |  | $25.0^{\circ} \mathrm{C}$ |  |
| Depth of laying |  | 0.5 m |  |
| Number of other circuits in enclosure |  | 0 |  |
| Number of other enclosures in group |  | 0 |  |
| Parallel sets of cables in the same pipe |  | No |  |
| Spacing between enclosures |  | 0.3 |  |
| Thermal Resistivity |  | $1.2{ }^{\circ} \mathrm{C} . \mathrm{m} / \mathrm{W}$ |  |


| Solution |  |  |  |
| :---: | :---: | :---: | :---: |
| Active | $1 \times 25 \mathrm{~mm}^{2}$ |  |  |
| Neutral | $1 \times 25 \mathrm{~mm}^{2}$ |  |  |
| Earth | N/A |  |  |
| Load On Cable | 73.71 A | Operating Temperature | 55.85 degrees |
| Capacity | 107.00 A | Spare Capacity | 33.29 A |
| Phase Resistance | 0.0208 ohms | Phase Reactance | 0.0020 ohms |
| Earth Resistance | 0.0208 ohms | Earth Reactance | 0.0020 ohms |
| Volt Drop on Cable | $2.65 \mathrm{~V} / 0.66$ \% | Total Volt Drop | $2.65 \mathrm{~V} / 0.66 \%$ |
| Cable Fault Loop Imp. | 0.0465 ohms | Total Fault Loop Imp. | 0.0708 ohms |
| Max Fault Loop Imp. | 0.1392 ohms |  |  |
| Fault kA at Source | 6.00 kA | Fault kA at Destination | 4.44 kA |
| Max. Run Length | 74.77 m | Touch Potential | 75.88 V |
| Derating Factors |  | Total Derating | 1.00 |
| Cable Configuration | 1.00 | Ambient Temperature | 1.00 |
| Depth of Laying | 1.00 | Thermal Resistivity | 1.00 |
| Other Circuits | 1.00 | Cable Drum / Reel | 1.00 |

## Cable Size Calculation

| Job Number | 12109 | Company Name | Building Services Design |
| :---: | :---: | :---: | :---: |
| Job Name | Jilba Street | ABN |  |
| Author |  | License Numbe |  |
| User Name |  |  |  |
| Client |  | Date Printed | 10 Sep 2012 |
| Job Description |  |  |  |
| Load Description | Pump Subcircuit |  |  |
| Inputs |  |  |  |
| Run Length | 30.00 m | Voltage | $400 \mathrm{~V} / 3 \varnothing$ |
| Conductor | Copper | Max Volt Drop | 3.00\% |
| Load | 17.00 kW | Allowed Expansion | $0.00 \%$ |
| Efficiency | $90.00 \%$ | Power Factor | 0.80 |
| Cable Reference |  | Device Fault Limit | 0.00 kA |
| Protective Device |  | Protection Rating | 50.0 A |
| Cable | $1 \times 4$ core circular V-90 Thermoplastic cable In underground ducts |  |  |
| Calculated to | AS3000:2007 \& AS3008.1.1:2009 |  |  |
| Additional derating factor |  | 1.00 |  |
| Ambient Temperature |  | $25.0^{\circ} \mathrm{C}$ |  |
| Depth of laying |  | 0.5 m |  |
| Number of other circuits in enclosure |  | 0 |  |
| Number of other enclosures in group |  | 0 |  |
| Parallel sets of cables in the same pipe |  | No |  |
| Spacing between enclosures |  | 0.3 |  |
| Thermal Resistivity |  | $1.2{ }^{\circ} \mathrm{C} \mathrm{m} \mathrm{N}$ |  |


| Solution |  |  |  |
| :---: | :---: | :---: | :---: |
| Active | $1 \times 10 \mathrm{~mm}^{2}$ |  |  |
| Neutral | $1 \times 10 \mathrm{~mm}^{2}$ |  |  |
| Earth | $1 \times 4 \mathrm{~mm}^{2}$ |  |  |
| Load On Cable | 34.08 A | Operating Temperature | 44.20 degrees |
| Capacity | 55.00 A | Spare Capacity | 20.92 A |
| Phase Resistance | 0.0603 ohms | Phase Reactance | 0.0027 ohms |
| Earth Resistance | 0.1518 ohms | Earth Reactance | 0.0031 ohms |
| Volt Drop on Cable | $2.94 \mathrm{~V} / 0.74$ \% | Total Volt Drop | $5.59 \mathrm{~V} / 1.40$ \% |
| Cable Fault Loop Imp. | 0.2353 ohms | Total Fault Loop Imp. | 0.2968 ohms |
| Max Fault Loop Imp. | 0.6990 ohms |  |  |
| Fault kA at Source | 4.44. kA | Fault kA at Destination | 2.10 kA |
| Max. Run Length | 89.13 m | Touch Potential | 149.06 V |
| Derating Factors |  | Total Derating | 1.00 |
| Cable Configuration | 1.00 | Ambient Temperature | 1.00 |
| Depth of Laying | 1.00 | Thermal Resistivity | 1.00 |
| Other Circuits | 1.00 | Cable Drum / Reel | 1.00 |



| Inputs |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Group | Qty | Description | Phase 1 | Phase 2 | Phase 3 |
| $\mathrm{B}(\mathrm{i})$ | 2 | Laptop GPO |  |  |  |
| $\mathrm{B}(\mathrm{i})$ | 1 | Aux Controls |  |  |  |
| $\mathrm{B}(\mathrm{i})$ | 1 | 3 Phase Outlet |  |  |  |
| $\mathrm{B}(\mathrm{i})$ | 1 | Emergency Relay |  |  |  |
| D | 2 | Pump | 34.08 | 34.08 | 34.08 |


| Result |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Group | Qty | Description | Phase 1 | Phase 2 | Phase 3 |
| B(i) | 5 | Total 10A socket outlets | 14.07 | 7.58 | 4.33 |
| $D$ | 1 | Pump | 34.08 | 34.08 | 34.08 |
| $D$ | 1 | Pump | 25.56 | 25.56 | 25.56 |

## Building Services Design

PO Box 296
Arana Hills 4054

Selectivity Analysis Program

Project : Jilba Street

File : Jilba Street
Printed : 10 Sep 2012
10:35 pm

## TIME/CURRENT CURVE


(1)

Up Stream - MSB (3ø) :
Model : S250PE
OCR : 125
Trip Setting : 100 A Breaking Capacity:

Catalogue \# : S250PE 3125
Current (A)

\section*{Adjustable Settings: <br> | IR | Characteristics |
| :---: | :---: |
| 0.8 | 6 |
| 100 A |  |}



MSB (3ø)

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Building Services Design
PO Box 296
TERASAK
Arana Hills 4054
Selectivity Analysis Program
Ph No. : 0730560230

Mobile No.
Fax No. :
Email :
Project : Jilba Street
File : Jilba Street
Printed : 10 Sep 2012
10:35 pm
SUPPLY
Circuit:MSB - C (3ø)

## TIME/CURRENT CURVE

(2) Down Stream - MSB (3ø) :

Circuit I.D. : C2 (3ø)
Circuit Breaker (MCCB) Model : E125NJ
Trip Unit : 50
Trip Setting : 40 A
Breaking Capacity : 25 kA

Catalogue \#: E125NJ 350


Adjustable Settings:

| Ir | Im |
| :---: | :---: |
| 0.8 | 6 |
| 40 A | 300 A |

### 4.6 LEVEL PROBE COMMISSIONING INFORMATION

As part of the commissioning process the level probes within the wet well were commissioned to ensure the operation of the pumping station.

The following pages contain the commissioning data for the probes within the wet well.

| Range | 3 M |  | Level | Units | Percent | ma | RTU Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Max VEGA Level | 3.732 | MAHD | 100 | 20 | 4000 |
|  |  | Surcharge Occuring | 3.486 | MAHD | 91.80\% | 18.7 | 3738 |
|  |  | Surcharge Imminent + 100 mm | 3.286 | MAHD | 85.13\% | 17.6 | 3524 |
|  |  | Surcharge Imminent | 3.186 | MAHD | 81.80\% | 17.1 | 3418 |
|  |  | Inhibit start level | 2.986 | MAHD | 75.13\% | 16.0 | 3204 |
|  |  | Inhibit stop level | 2.786 | MAHD | 68.47\% | 15.0 | 2991 |
|  |  | High Alarm + 100 mm | 2.032 | MAHD | 43.33\% | 10.9 | 2187 |
|  |  | High Alarm | 1.932 | MAHD | 40.00\% | 10.4 | 2080 |
|  |  | Duty B Start Level | 1.582 | MAHD | 28.33\% | 8.5 | 1707 |
|  |  | Duty A Start Level | 1.532 | MAHD | 26.67\% | 8.3 | 1653 |
|  |  | Duty B Stop Level | 1.082 | MAHD | 11.67\% | 5.9 | 1173 |
|  |  | Duty A Stop Level | 1.032 | MAHD | 10.00\% | 5.6 | 1120 |
|  |  | Low Level alarm | 0.832 | MAHD | 3.33\% | 4.5 | 907 |
|  |  | Wet Well Probe elevation | 0.732 | MAHD | 0.00\% | 4.0 | 800 |
|  |  |  |  |  |  |  |  |
| Range | 25 M | DELIVERY PRESSURE PROBE | Pressure | Units | Percent. | ma | RTU Units |
|  |  | 20 mA Value | 29.828 | MAHD | 100.00\% | 20.0 | 4000 |
|  |  | High Alarm | 29.828 | MAHD | 100.00\% | 20.0 | 4000 |
|  |  | Low Level alarm | 4.828 | MAHD | 0.00\% | 4.0 | 800 |
|  |  | Pressure Probe 1 Elevation | 4.828 | MAHD | 0.00\% | 4.0 | 800 |



| Hanging Depths (from electrode box clamp) |  |  |
| :--- | ---: | :---: |
| Surch Imm Probe | 1.946 |  |
| M |  |  |
| High Level Probe | 3.200 |  |

[^15]| Elevation     <br> Water Height Location Water <br> Height Volume <br> in Remaining <br> Storage mmMD3311 <br> Staged Volume |  |  |  |  |  |  |  | Existing <br> Vol in LUT |
| ---: | ---: | :---: | :---: | ---: | ---: | ---: | :---: | :---: |
| BWL of PS | 0.932 | 0.000 | 17.354 | 0 | 0.000 | 0.000 |  |  |
|  | 1.066 | 0.608 | 16.746 | 134 | 0.608 | 0.608 |  |  |
|  | 1.201 | 1.216 | 16.137 | 269 | 0.608 | 1.216 |  |  |
|  | 1.335 | 1.824 | 15.529 | 403 | 0.608 | 1.824 |  |  |
|  | 1.532 | 2.714 | 14.639 | 600 | 0.890 | 2.714 |  |  |
| TWL of PS | 1.604 | 3.041 | 14.313 | 672 | 0.326 | 3.041 |  |  |
|  | 1.739 | 3.649 | 13.705 | 807 | 0.608 | 3.649 |  |  |
|  | 1.932 | 4.601 | 12.753 | 1000 | 0.952 | 4.601 |  |  |
|  | 2.007 | 5.103 | 12.251 | 1075 | 0.502 | 5.103 |  |  |
|  | 2.142 | 6.241 | 11.113 | 1210 | 1.138 | 6.241 |  |  |
|  | 2.276 | 7.337 | 10.017 | 1344 | 1.096 | 7.337 |  |  |
|  | 2.411 | 8.256 | 9.097 | 1479 | 0.920 | 8.256 |  |  |
|  | 2.545 | 9.346 | 8.008 | 1613 | 1.089 | 9.346 |  |  |
|  | 2.679 | 10.638 | 6.716 | 1747 | 1.292 | 10.638 |  |  |
|  | 2.814 | 11.634 | 5.720 | 1882 | 0.996 | 11.634 |  |  |
|  | 2.948 | 12.660 | 4.694 | 2016 | 1.026 | 12.660 |  |  |
|  | 3.083 | 13.676 | 3.678 | 2151 | 1.016 | 13.676 |  |  |
|  | 3.217 | 14.674 | 2.680 | 2285 | 0.998 | 14.674 |  |  |
|  | 3.352 | 15.849 | 1.505 | 2420 | 1.175 | 15.849 |  |  |
|  | 3.486 | 17.354 | 0.000 | 2554 | 1.505 | 17.354 |  |  |

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### 4.7 CONTRACTORS CERTIFICATE OF TESTING AND SAFETY

The following document certifies that the installed electrical equipment has been tested to ensure it is electrically safe and in accordance with wiring rules and AS3000.

Contractors License Number: 66226
Nelsen Project Number: ...32887......

## Certificate of Testing and Safety

This certificate is issued in accordance with Clause S15 of the Electrical Safety Regulations 2002, to certify the electrical equipment below, to the extent it is affected by the electrical work performed, has been tested to ensure it is lectrically safe and is in accordance with the requirements of the wiring rules and any other standard applying under this regulation to the electrical installation.

Customer:
Contact:

Address:
Date of Testing:
Quegnucans...................................
BEGAN K KAKI
SPI62 JILBA STREET. $6 / 12 / 12$
Electrical Equipment Tested: SUB MANS BART FAUST LOOP I. ... Continuity + RCD Push Button test Limitations of the Work:

Reference Documents:
Exclusions:

Signed:
Date:
Position:

The work was limited to the installation / testing of the above equipment by Nilsen personnel only.

Refer to Nilsen Engineering Services Test Report.

Any work not included within Nilsen Engineering Services Test Report.


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# Sunline Switchboards Pty. Ltd. 

A.B.N. 13010342622

7 Duntroon Street, Brendale, Qld, 4500 Australia
P.O. Box 5274, Brendale MDC, Qlḍ. 4500

International Telephone: +61738813433
International Facsimile: +61738813611
Telephone: (07) 38813433 Facsimile: (07) 38813611
Email: admin@sunline.net.au
Website: www.sunline.net.au

## CERTIFICATE OF:

(Please mark relevant check-box)

Electrioal equipment

* Work performed for:
*Name Quu
Tille

> Given name/s

Surname

* Address Queensland Urban Utilities Western Tower Level 7171 Roma St Stroot

| Brisbane |  |
| :--- | :--- |
| Suturblhown | 4000 |
| Posticodo |  |

* Electrical installation / equipment tested (detailed list of all work done):

Manufacture of replacement switchboard for SP162 Jilba Street Pumping Station.
Refer to drawings: 486/5/7-0273-001 to 486/5/7-0273-025


For electrical installations, this certifies that the electrical installation, to the extent it is affected by the electrical work, has been tested to ensure that it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying under the Electrical Safety Regulation 2002 to the electrical installation.
For electrical equipment, this certifies that the electrical equipment, to the extent it is affected by the electrical work, is electrically safe.



[^0]:    ANSi a a regitered trademak of the Anerican National suandarts hattute. EEE is a regittered vadenark of the Motitute of Eliectical and Electronia Engineer, incorpervted. Nitha is a regitered trademark of the liational Electrical Manufacturen Anocistion Ut is a regitered vademark of Underwilters Iaboratorlex. inc. WARNMNG
    SRICO products shall be installed and used only as indicated in ERICO's product instruction sheets and training materialh. Instruction sheets are avaitatle at wwwerico.com and from your Enco curtomer service representative. Improper installation, miluse, misapplication or other fallure to completely follow ERICOs instructions and waminge may cause product malfunction property damage, serious bodily infury and death.
    
    CADOY, CAOWELD, CRIEC, ENCO, ERAFEX, ERIECM, and LENTON are registered trademark of EkICO International Corporation.
    www.erico.com

[^1]:    Note: Optimise your selection with WinStart Soft Starter PC tool.

[^2]:    *A dual voltage $230 / 400 \mathrm{~V}$ socket-outlet with $3 P+N+E$ accepts a 400 V plug with $3 P+N+E$ or $3 P+E$ as well as a 230 V plug with $1 P+N+E$ (see front cover flap).
    Page 86 of 363

[^3]:    $\mathbf{x x}=10$ (for 33 ft or 10 m of cable); or 30 (for 100 ft or 30 m of cable)
    Probes are supplied with a standard length of cable in either $33 \mathrm{ft} / 10 \mathrm{~m}$ or in $100 \mathrm{ft} / 30 \mathrm{~m}$ lengths. The Probe comes in sizes ranging from 8 inches to 30 feet. It is available with 1 -sensor, 3 -sensors or 10 -sensors.
    

[^4]:    ${ }^{3}$ ) Standard in New Zealand

[^5]:    Note: Unless otherwise specified, a tolerance of $\pm 0.4$ mm applies to all dimensions 36

[^6]:    Sprecher＋Schuh US Division Headquarters
    15910 Intemational Plaza Dr，，Houston，TX 77032
    Tet：（281）442－9000；Fax（800）739－7370
    oww．sprecherschuhcom
    thlation Ne F－Rz7＿111 Mer 2011

[^7]:    - When used as a Branch Circuit Protection device, NEC 430-152 defines the maxmum rating of an Inverse-time circuit breaker to be sized at $250 \%$ of the motor nameplate FLA for most applications.
    - ULListed Combination. (UL. File E41850) Per UL508A. NEC409 abd CSA 22.2 No. 14
    for contactor and fuses or clrcuil breaker only.
    - Per IEC 60947-1 for contactor and fuses only.

[^8]:    NOTET The life-load curves shown here are based on Sprecher + Schuh tests according to the requirements defined in IEC 60947-4-1. Since contact life in any piven application is dependent on anvironmental condilitions and duty cycle, actual
    

[^9]:    - Duty Cycle or Load Factor - Defined as the "on" time for a given operating
    cyde per hour including the "start time." A 40\% Duty Cycle is calculated in
    the following manner:
    Contactor switches slx (6) times por minuta ( 1 pm ), 250 ms start time;
    40\% duty cycle.
    To determine the "on" time and "off" time:
    - Operations per hour $=360 ;[60 \mathrm{~min} \times 6 \mathrm{tpm}=360]$
    - One operating cycle $=10 \mathrm{sec} ;[60 \mathrm{~min}+6 \mathrm{tpm}=10 \mathrm{sec}]$
    - "On" time at $40 \%$ duty cycle $=4$ sec; $[10 \sec \times 0.4(40 \%)=4 \mathrm{sec}]$
    - 4 sec "on" time includes the start time of 250 ms
    -"Off" time at $40 \%$ duty cycle $=6$ sec; $[10$ sec -4 sec $=6$ sec]

[^10]:    Page 201 of 363

[^11]:    Steckverbinder für VEGACONNECT ( $1^{2} C$-Schnittstelle) Federkraftklemmen zum Anschluss der externen Anzeige VEGADIS 61 Erdungsklemme zum Anschluss des Kabelschirms
    4 Federkraftklemmen für Spannungsversorgung und Signalausgang

[^12]:    1) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
    2) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected
[^13]:    ${ }^{3)}$. Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
    ${ }^{4}$ Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
    5) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

[^14]:    7 Determined according to the limit point method according to IEC 60770, incl. non-linearity, hysteresis and non-repeatability

[^15]:    Existing RTU LUT in Main file
    ${ }^{*}$ * wet well level to volume lookup table - based on vega probe 0 level */ record 1

