AXIS INDUSTRIAL ESTATE

SEWERAGE PUMPING STATION SP315

AXIS PLACE, LARAPINTA

ELECTRICAL SWITCHBOARD

OPERATION AND MAINTENANCE MANUAL

Developed by:

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CONTENTS

1.0 INTRODUCTION

These operating instructions cover the Sewerage Pumping Station No.SP315 electrical equipment supplied by J & P Richardson Industries Pty Ltd in 2011.

1.1 Operating Instructions

Normal operation of the pumping station is in the automatic mode with control by means of a Master Programmable Logic controller (PLC) / Radio Telemetry Unit (RTU) which receives level signals from the Level Measurement System in the wet well / Electronic Level Relays / Float Switches.

Manual operation control of the station is available by means of the selector switches on the switchboard.

2.0 DESCRIPTION OF OPERATION

2.1 Mode Selection

The station can be operated either automatically or manually with mode selection being made by means of the mode selector switches mounted on each pump section of the switchboard. These selector switches are designated with the following mode selections AUTO-OFF-MAN.

2.2 Manual Control

Each pumping unit can be run in manual control from the motor control centre by: -

a). Selecting the "MAN" setting on the "MODE SELECTOR SWITCHES" as described in Clause 2.1.
b). Starting by "START" pushbutton.
c). Stopping by "STOP" pushbutton.

N.B. DO NOT LEAVE IN MANUAL WHILE STATION UNATTENDED

2.3 Automatic Control

For automatic control of the station: -

a). The "MODE SELECTOR SWITCHES" on the switchboard should be in the "AUTO" position.
b). The "DUTY SELECTOR SWITCH" should be set to provide the desired pump operation sequence. The "DUTY SELECTOR SWITCH" is marked:-

1-2; 2-1

The pumps should be alternated at regular intervals to ensure that each pump unit has a reasonably equal running time. The total running hours of each pump unit is displayed on the hourmeter located on each pump section of the switchboard.
c). The automatic duty selection is done via the PLC software.
d). The automatic starting, & stopping of the pumps is controlled by signals from the Master PLC.

For NORMAL OPERATION, each of the pump selector switches should have "AUTO" mode selected.

In the AUTOMATIC mode the selected Duty Pump unit will start automatically as preset by the level in the wet well. In the event of the duty pump not being capable of supplying enough flow to continue draining the wet well and the well level rises to a second preset level, then the Standby Pump unit will automatically start, to provide additional pumping. The supplementary pump unit also takes over for the respective pump duty on the occurrence of one the Duty Pump unit failing.

3.0 PUMPS

SUPPLIER:

Grundfos Pumps Pty Ltd
30 Blanck Street
Ormeau Qld 4208

Ph: (07) 5540 6700
Fax: (07) 5540 6710

MODEL:	S1.100.200.650.4.66H.S.406.G.N.D
SERIAL No.'s:	1029001, 1029002
kW RATING:	68
MOTOR SPEED:	1476rpm
FULL LOAD CURRENT:	129A
VOLTAGE:	415V

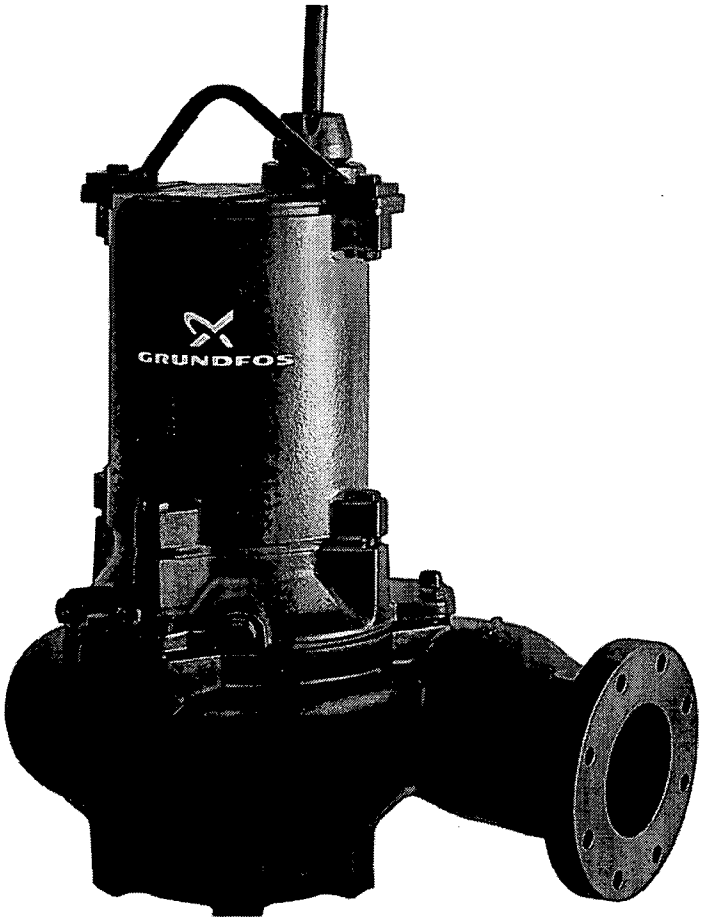
GRUNDFOS **INSTRUCTIONS**

S pumps, ranges 50 - 70

S1, S2, S3, SA, SV
7.5 - 155 kW

Installation and operating instructions

GB D F I E P GR NL S FIN DK
PL RU SI HR SER RO BG CZ SK TR EE



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GRUNDFOS

(GB) Declaration of Conformity

We **Grundfos** declare under our sole responsibility that the products **S pumps, ranges 50-70, 7.5-155 kW**, to which this declaration relates, are in conformity with the Council Directives on the approximation of the laws of the EC Member States relating to

- **Machinery (98/37/EC)**
  Standards used: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 and EN 809: 1998.
- **Electrical equipment designed for use within certain voltage limits (73/23/EEC)**
  Standard used: EN 60204-1: 1997.
- **Electromagnetic compatibility (89/336/EEC)**
  Standards used: EN 61000-6-2: 1999 and EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Applies only to products intended for use in potentially explosive environments, Ex II 2G, and equipped with the separate ATEX approval plate and EC-type examination certificate. Further information, see below.

(D) Konformitätserklärung

Wir, **Grundfos**, erklären in alleiniger Verantwortung, dass die Produkte **S-Pumpen der Baugrößen 50-70, 7,5-155 kW**, auf die sich diese Erklärung bezieht, mit den folgenden Richtlinien des Rates zur Angleichung der Rechtsvorschriften der EG-Mitgliedstaaten übereinstimmen:

- **Maschinen (98/37/EG)**
  Normen, die verwendet wurden: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 und EN 809: 1998.
- **Elektrische Betriebsmittel zur Verwendung innerhalb bestimmter Spannungsgrenzen (73/23/EWG)**
  Norm, die verwendet wurde: EN 60204-1: 1997.
- **Elektromagnetische Verträglichkeit (89/336/EWG)**
  Normen, die verwendet wurden: EN 61000-6-2: 1999 und EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  Gilt nur für Produkte, die für den Gebrauch in potentiell explosiver Umgebung nach Ex II 2G bestimmt und mit einem separaten ATEX-Typenschild und einem EG-Prüfzeugnis ausgestattet sind. Weitere Informationen, siehe unten.

(F) Déclaration de Conformité

Nous **Grundfos** déclarons sous notre seule responsabilité que les **pompes S, tailles 50-70, 7,5-155 kW**, auxquelles se réfèrent cette déclaration, sont conformes aux Directives du Conseil concernant le rapprochement des législations des états membres à la CE relatives à

- **Machines (98/37/CE)**
  Normes utilisées: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 et EN 809: 1998.
- **Matériel électrique destiné à employer dans certaines limites de tension (73/23/CEE)**
  Norme utilisée: EN 60204-1: 1997.
- **Compatibilité électromagnétique (89/336/CEE)**
  Normes utilisées: EN 61000-6-2: 1999 et EN 61000-6-3: 2001.
- **ATEX 94/9/CE**
  S'applique uniquement aux pompes utilisées dans des environnements potentiellement explosifs, Ex II 2G, équipées d'une plaque séparée avec norme ATEX et d'un certificat d'examination type CE. Pour plus d'informations, voir ci-après.

(I) Dichiarazione di Conformità

Grundfos dichiara sotto sua unica responsabilità che le **pompe S, della gamma 50-70, da 7,5-155 kW**, a cui questa dichiarazione si riferisce, sono conformi alle Direttive del Consiglio sul riavvicinamento delle legislazioni degli Stati Membri CE

- **Macchine (98/37/CE)**
  Norme usate: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 e EN 809: 1998.
- **Materiale elettrico destinato ad essere utilizzato entro certi limiti di tensione (73/23/CEE)**
  Norma usata: EN 60204-1: 1997.
- **Compatibilità elettromagnetica (89/336/CEE)**
  Norme usate: EN 61000-6-2: 1999 e EN 61000-6-3: 2001.
- **ATEX 94/9/CE**
  Si riferisce solo ai prodotti per uso in ambienti potenzialmente esplosivi EX II 2G, con targa di approvazone ATEX a parte e certificato tipo EC. Per ulteriori informazioni, vedere oltre.

(E) Declaración de Conformidad

Nosotros **Grundfos** declaramos bajo nuestra única responsabilidad que las **Bombas S, gamas 50-70, 7,5-155 kW**, a las cuales se refiere esta declaración, son conformes con las Directivas del Consejo relativas a la aproximación de las legislaciones de los Estados Miembros de la CE sobre

- **Máquinas (98/37/CE)**
  Normas aplicadas: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 y EN 809: 1998.
- **Material eléctrico destinado a utilizarse con determinadas límites de tensión (73/23/CEE)**
  Norma aplicada: EN 60204-1: 1997.
- **Compatibilidad electromagnética (89/336/CEE)**
  Normas aplicadas: EN 61000-6-2: 1999 y EN 61000-6-3: 2001.
- **ATEX 94/9/CE**
  Se aplica sólo a productos concebidos para su utilización en entornos potencialmente explosivos, Ex II 2G, equipados con una placa independiente de homologación ATEX y certificado de prueba tipo CE. Para información adicional, ver más abajo.

(P) Declaração de conformidade

Nós, **Grundfos**, declaramos sob nossa responsabilidade que as **Bombas S, gamas 50-70, 7,5-155 kW**, acerca das quais esta declaração se refere, estão em conformidade com as Directivas do Conselho em harmonia com as leis dos Estados Membros da UE referentes a

- **Máquinas (98/37/CE)**
  Normas utilizadas: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 e EN 809: 1998.
- **Material eléctrico destinado a ser utilizado dentro de certos limites de tensão (73/23/CEE)**
  Norma utilizada: EN 60204-1: 1997.
- **Compatibilidade electromagnética (89/336/CEE)**
  Normas utilizadas: EN 61000-6-2: 1999 e EN 61000-6-3: 2001.
- **ATEX 94/9/CE**
  Aplica-se apenas a produtos cuja utilização é em ambientes potencialmente explosivos, Ex II 2G, equipados com uma chapa de aprovação ATEX e certificado tipo EC. Para mais informações consulte abaixo.

Notified body: Baseefa. No 1180. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.
Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

Range	Certificate No	Standards used
50	Baseefa 02ATEX0203X	EN 50014: 1997, EN 50018: 2000, EN 13463-1: 2001, prEN 13463-5: 2002
54	Baseefa 02ATEX0206X	
58	Baseefa 02ATEX0200X	
62	Baseefa 02ATEX0201X	
70	Baseefa 02ATEX0202X	
70*	Baseefa 06ATEX0002X	EN 60079-0: 2004, EN 13463-1: 2001, EN 13463-6: 2005 EN 60079-1: 2004, EN 13463-5: 2003

* Installation version 7

Notified body: Baseefa. No 1180. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.
Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

(GR) Δήλωση Συμμόρφωσης

Εμείς η **Grundfos** δηλώνουμε με αποκλειστικά δική μας ευθύνη ότι τα προϊόντα **Αντλίες S, σειρές 50-70, 7,5-155 kW**, στα οποία αναφέρεται η δήλωση αυτή, συμμορφώνονται με την Οδηγία του Συμβουλίου επί της σύγκλισης των νόμων των Κρατών Μελών της ΕΕ όσον αφορά τα

- **Μηχανήματα (98/37/EC)**
  Πρότυπα που χρησιμοποιήθηκαν: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 και EN 809: 1998.
- **Ηλεκτρικές συσκευές σχεδιασμένες γιά χρήση εντός ορισμένων ορίων ηλεκτρικής τάσης (73/23/EEC)**
  Πρότυπο που χρησιμοποιήθηκε: EN 60204-1: 1997.
- **Ηλεκτρομαγνητική συμβατότητα (89/336/EEC)**
  Πρότυπα που χρησιμοποιήθηκαν: EN 61000-6-2: 1999 και EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Ισχύει μόνο για προϊόντα που απευθύνονται για χρήση σε δυνητικά εκρηκτικά περιβάλλοντα, Ex II 2G, εφοδιασμένα με τη χωριστή πινακίδα έγκρισης ATEX και πιστοποιητικό εξέτασης τύπου EC. Για περισσότερες πληροφορίες, βλέπε κατωτέρω.

(NL) Overeenkomstigheidsverklaring

Wij **Grundfos** verklaren, geheel onder eigen verantwoordelijkheid, dat de producten **S Pompen serie 50-70 van 7,5-155 kW**, waarop deze verklaring betrekking heeft in overeenstemming zijn met de Richtlijnen van de Raad inzake onderlinge aanpassing van de wetgevingen van de Lid-Staten betreffende

- **Machines (98/37/EG)**
  Normen: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 en EN 809: 1998.
- **Elektrisch materiaal bestemd voor gebruik binnen bepaalde spanningsgrenzen (73/23/EEG)**
  Norm: EN 60204-1: 1997.
- **Elektromagnetische compatibiliteit (89/336/EEG)**
  Normen: EN 61000-6-2: 1999 en EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  Is alleen van toepassing op pompen welke gebruikt worden in een explosie gevaarlijke omgeving, Ex II 2G, met een afzonderlijke ATEX-goedkeurings plaatje en EG-type onderzoekscertificaat. Voor verdere informatie, zie onderstaand.

(S) Försäkran om överensstämmelse

Vi **Grundfos** försäkrar under ansvar, att produkterna i **Serie S, typstorlek 50-70, 7,5-155 kW,** som omfattas av denna försäkran, är i överensstämmelse med Rådets Direktiv om inbördes närmande till EU-medlemsstaternas lagstiftning, avseende

- **Maskinell utrustning (98/37/EC)**
  Använda standarder: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 och EN 809: 1998.
- **Elektrisk utrustning avsedd för användning inom vissa spänningsgränser (73/23/EC)**
  Använd standard: EN 60204-1: 1997.
- **Elektromagnetisk kompatibilitet (89/336/EC)**
  Använda standarder: EN 61000-6-2: 1999 och EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Gäller endast produkter avsedda att användas i exposionsfarlig miljö, Ex II 2G, utrustade med separat ATEX-godkännandeskylt och EC-typ-kontrollintyg. För ytterligare information, se nedan.

(FIN) Vastaavuusvakuutus

Me **Grundfos** vakuutamme omalla vastuullamme, että **S-pumput, sarjat 50-70, 7,5-155 kW**, joita tämä vakuutus koskee, ovat EY:n jäsenvaltioiden lainsäädännön yhdenmukaistamiseen tähtäävien Euroopan neuvoston direktiivien vaatimusten mukaisia seuraavasti:

- **Koneet (98/37/EY)**
  Käytetyt standardit: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 ja EN 809: 1998.
- **Määrättyjen jänniterajoitusten puitteissa käytettävät sähköiset laitteet (73/23/EY)**
  Käytetty standardi: EN 60204-1: 1997.
- **Elektromagneettinen vastaavuus (89/336/EY)**
  Käytetyt standardit: EN 61000-6-2: 1999 ja EN 61000-6-3: 2001.
- **ATEX 94/9/EY**
  Koskee vain tuotteita, jotka on tarkoitettu käytettäviksi mahdollisesti räjähdysvaarallisissa ympäristöissä, Ex II 2G, varustettuina erillisellä ATEX-hyväksyntäkilvellä ja EY-tyyppitarkastustodistuksella. Katso lisätietoja jäljempänä.

(DK) Overensstemmelseserklæring

Vi **Grundfos** erklærer under ansvar at produkterne **S pumper, byggestørrelse 50-70, 7,5-155 kW** som denne erklæring omhandler, er i overensstemmelse med Rådets direktiver om indbyrdes tilnærmelse til EF medlemsstaternes lovgivning om

- **Maskiner (98/37/EF)**
  Anvendte standarder: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 og EN 809: 1998.
- **Elektrisk materiel bestemt til anvendelse inden for visse spændingsgrænser (73/23/EØF)**
  Anvendt standard: EN 60204-1: 1997.
- **Elektromagnetisk kompatibilitet (89/336/EØF)**
  Anvendte standarder: EN 61000-6-2: 1999 og EN 61000-6-3: 2001.
- **ATEX 94/9/EF**
  Gælder kun produkter til eksplosionsfarlige omgivelser, Ex II 2G, med et separat ATEX-godkendelsesskilt og EF-typeprøvningscertifikat. Yderligere oplysninger, se nedenfor.

(PL) Deklaracja zgodności

My **Grundfos**, oświadczamy z pełną odpowiedzialnością, że nasze wyroby **pompy z typoszeregu S, korpus 50-70, o mocy 7,5-155 kW**, których deklaracja niniejsza dotyczy, są zgodne z następującymi wytycznymi Rady d/s ujednolicenia przepisów prawnych krajów członkowskich EG:

- **maszyny (98/37/EG)**
  zastosowane normy: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 i EN 809: 1998.
- **wyposażenie elektryczne do stosowania w określonym zakresie napięć (73/23/EWG)**
  zastosowana norma: EN 60204-1: 1997.
- **zgodność elektromagnetyczna (89/336/EWG)**
  zastosowane normy: EN 61000-6-2: 1999 i EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  dotyczy tylko produktów przeznaczonych do pracy w środowisku potencjalnie zagrożonym wybuchem, Ex II 2G, wyposażonych w odzielną tabliczkę znamionową ATEX i certyfikat typu EG (examination certyficate). Więcej informacji na ten temat, patrz poniżej.

Range	Certificate No	Standards used
50	Baseefa 02ATEX0203X	EN 50014: 1997, EN 50018: 2000, EN 13463-1: 2001, prEN 13463-5: 2002
54	Baseefa 02ATEX0206X	
58	Baseefa 02ATEX0200X	
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70*	Baseefa 06ATEX0002X	EN 60079-0: 2004, EN 13463-1: 2001, EN 13463-6: 2005 EN 60079-1: 2004, EN 13463-5: 2003

* Installation version 7

Notified body: Baseefa. No 1180. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.
Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

(RU) Декларация о соответствии

Мы, компания **Grundfos**, со всей ответственностью заявляем, что изделия - насосы **S, типоразмеров 50-70, 7,5-155 кВт**, к которым относится данная декларация, соответствуют следующим требованиям Совета Евросоюза об унификации законодательных предписаний стран-членов ЕС:

- **Машиностроение (98/37/EC)**
  Применявшиеся стандарты: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 и EN 809: 1998.
- **Электрические машины для эксплуатации в пределах определенного диапазона значений напряжения (73/23/ЕЭС)**
  Применявшиеся стандарты: EN 60204-1: 1997.
- **Электромагнитная совместимость (89/336/ЕЭС)**
  Применявшиеся стандарты: EN 61000-6-2: 1999 и EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Действительно только для изделий, разрешённых для использования в потенциально взрывоопасных условиях, Ex II 2G, с маркировкой ATEX на фирменной табличке и Сертификатом (свидетельством) типовой проверки ЕС. Подробная информация представлена ниже.

(SI) Izjava o ustreznosti

Mi, **Grundfos**, pod polno odgovornostjo izjavljamo, da so naši izdelki **S črpalke velikosti 50-70, 7,5-155 kW**, na katere se ta izjava nanaša, v skladu z naslednjimi smernicami Sveta za izenačevanje pravnih predpisov držav članic Evropske skupnosti:

- **Stroji (98/37/EG)**
  Uporabljeni normi: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 in EN 809: 1998.
- **Električne opreme, izdelane za uporabo v okviru določenih meja napetosti (73/23/EWG)**
  Uporabljena norma: EN 60204-1: 1997.
- **Elektromagnetne kompatibilnosti (89/336/EWG)**
  Uporabljeni normi: EN 61000-6-2: 1999 in EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  Velja samo za proizvode namenjene uporabi v potencialno eksplozivnih okoljih, Ex II 2G, opremljene z dodatno tipsko ploščico z ATEX odobritvijo in certifikatom EG o skladnosti tipa. Za več informacij glejte spodaj.

(HR) Izjava o usklađenosti

Mi, **Grundfos**, pod punom odgovornošću izjavljujemo, da su naši proizvodi **S crpke, veličine 50-70, 7,5-155 kW**, na koje se ova izjava odnosi, u skladu s odredbama Komisije za izjednačavanje pravnih propisa država članica Europske zajednice vezano za:

- **Strojevi (98/37/EZ)**
  korištene norme: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 i EN 809: 1998.
- **Električni pogonski uređaji za uporabu unutar određenih granica napona (73/23/EEZ)**
  korištena norma: EN 60204-1: 1997.
- **Elektromagnetska kompatibilnost (89/336/EEZ)**
  korištene norme: EN 61000-6-2: 1999 i EN 61000-6-3: 2001.
- **ATEX 94/9/EZ**
  Odnosi se samo na proizvode namijenjene uporabi u potencijalno eksplozivnom okružju, Ex II 2G, opremljene s dodatnom ATEX pločicom i certifikatom EZ o ispitivanju. Više informacija potražite niže u tekstu.

(SER) Izjava o konformitetu

Mi, **Grundfos**, pod punom odgovornošću izjavljujemo, da su naši proizvodi **S pumpe, veličine 50-70, 7,5-155 kW**, na koje se ova izjava odnosi, u skladu sa direktivama Saveta za izjednačavanje pravnih propisa država članica Evropske zajednice vezano za:

- **mašine (98/37/EG)**
  korišćeni standardi: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 i EN 809: 1998.
- **električna oprema razvijena za korišćenje unutar određenih naponskih granica (73/23/EWG)**
  korišćeni standardi: EN 60204-1: 1997.
- **elektromagnetna kompatibilnost (89/336/EWG)**
  korišćeni standardi: EN 61000-6-2: 1999 i EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  primenjuje se samo na proizvode namenjene upotrebi u potencijalno eksplozivnim okolinama, Ex II 2G, opremljene sa dodatnom ATEX pločicom i EG-tip ispitnim sertifikatom. Više informacija potražite u tekstu dole.

(RO) Declarație de conformitate

Noi **Grundfos** declarăm cu întreaga responsabilitate că **pompele S, gama 50-70, 7,5-155 kW**, la care se referă această declarație sunt în conformitate cu Directivele Consiliului la legile apropiate ale Statelor Membre CE referitoare la:

- **Utilaj (98/37/CE)**
  Standarde aplicate: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 şi EN 809: 1998.
- **Echipament electric proiectat pentru a fi folosit în anumite limite de tensiune (73/23/CEE)**
  Standard aplicat: EN 60204-1: 1997.
- **Compatibilitatea electromagnetică (89/336/CEE)**
  Standarde aplicate: EN 61000-6-2: 1999 şi EN 61000-6-3: 2001.
- **ATEX 94/9/CE**
  Se aplică doar produselor care se pot folosi în medii cu potenţial explozibil, Ex II 2G, sunt conţin plăcuţă separată de certificare ATEX şi certificat de examinare de tip CE. Mai multe informaţii, vezi mai jos.

(BG) Декларация за съответствие

Ние, фирма **Grundfos**, заявяваме с пълна отговорност, че **помпите модел S, типорамери 50-70, 7,5-155 kW**, за които се отнася настоящата декларация, отговарят на следните указания на Съвета за уеднаквяване на правните разпоредби на държавите членки ЕО:

- **Машини (98/37/ЕО)**
  Приложени норми: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 и EN 809: 1998.
- **Електрически машини и съоръжения за употреба в рамките на определени граници на напрежение на електрическия ток (73/23/ЕИО)**
  Приложена норма: EN 60204-1: 1997.
- **Електромагнетична поносимост (89/336/ЕИО)**
  Приложени норми: EN 61000-6-2: 1999 и EN 61000-6-3: 2001.
- **ATEX 94/9/ЕО**
  Приложими само за продукти, предназначени за използване в потенциално взривоопасни среди, клас Ex II 2G, доставени с ATEX сертификат и ЕО. Сертификат за изпитание.

Range	Certificate No	Standards used
50	Baseefa 02ATEX0203X	EN 50014: 1997, EN 50018: 2000, EN 13463-1: 2001, prEN 13463-5: 2002
54	Baseefa 02ATEX0206X	
58	Baseefa 02ATEX0200X	
62	Baseefa 02ATEX0201X	
70	Baseefa 02ATEX0202X	
70*	Baseefa 06ATEX0002X	EN 60079-0: 2004, EN 13463-1: 2001, EN 13463-6: 2005 EN 60079-1: 2004, EN 13463-5: 2003

* Installation version 7

Notified body: Baseefa. No 1180. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.
Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

(CZ) Prohlášení o konformitě

My **Grundfos** prohlašujeme na svou plnou odpovědnost, že výrobky **Čerpadla S, řady 50-70, 7,5-155 kW**, na něž se toto prohlášení vztahuje, jsou v souladu s ustanoveními směrnice Rady pro sblížení právních předpisů členských států Evropského společenství v oblastech:

- **strojírenství (98/37/EG)**
  použité normy: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 a EN 809: 1998.
- **provozování spotřebičů s tolerancí napětí (73/23/EWG)**
  použitá norma: EN 60204-1: 1997.
- **elektromagnetická kompatibilita (89/336/EWG)**
  použité normy: EN 61000-6-2: 1999 a EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  platí pouze pro výrobky určené pro použití v potencionálně výbušném prostředí, Ex II 2G, opatřené samostatným typovým štítkem s označením ATEX a certifikátem o zkoušce typu EG. Další informace jsou uvedeny níže.

(SK) Prehlásenie o konformite

My **Grundfos** prehlasujeme na svoju plnú zodpovednosť, že **čerpadlá S, rady 50-70, 7,5-155 kW**, na ktoré sa toto prehlásenie vzťahuje, sú v súlade s ustanovením smernice Rady pre zbližovanie právnych predpisov členských štátov Európskeho spoločenstva v oblastiach:

- **Strojné zariadenia (98/37/EG)**
  Použité normy: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 a EN 809: 1998.
- **Prevádzkovanie elektrotechnických zariadení v rámci určitých napäťových tolerancií (73/23/EWG)**
  Použitá norma: EN 60204-1: 1997.
- **Elektromagnetická kompatibilita (89/336/EWG)**
  Použité normy: EN 61000-6-2: 1999 a EN 61000-6-3: 2001.
- **ATEX 94/9/EG**
  Platí iba pre výrobky určené pre použitie v potenciálne výbušnom prostredí, Ex II 2G, vybavené samostatným typovým štítkom s označením ATEX a certifikátom o skúške typu EG. Ďalšie informácie sú uvedené nižšie.

(TR) Uygunluk Beyannamesi

Grundfos olarak bu beyannameye konu olan **S pompaların, 50-70 ürün aralığının, 7,5-155 kW**, AB üyesi ülkelerin kanunlarını birbirine yaklaştırma üzerine Konsey direktifleriyle uyumlu olduğunun yalnızca bizim sorumluluğumuz altında olduğunu beyan ederiz.

- **Makina (98/37/EC)**
  Kullanılan standartlar: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 ve EN 809: 1998.
- **Belli voltaj sınırlarında kullanılmak üzere üretilmiş elektrik donanımı (73/23/EEC)**
  Kullanılan standartlar: EN 60204-1: 1997.
- **Elektromanyetik uyumluluk (89/336/EEC)**
  Kullanılan standartlar: EN 61000-6-2: 1999 ve EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Potansiyel patlayıcı ortamlarda kullanılan, Örn. II 2G, uzere parcalı olarak ATEX onay etiketi ve EC tip muayene sertifikası verilebilmektedir. Ayrıntılı bilgi için, bkz. aşağıda.

(EE) Vastavuse deklaratsioon

Meie **Grundfos** deklareerime enda ainuvastutusel, et **S pumbed, suurusklass 50-70, 7,5-155 kW**, mida käesolev juhend käsitleb, on vastavuses EL nõukogu Direktiividega EMÜ liikmesriikide seaduste ühitamise kohta, mis käsitlevad:

- **Masinad (98/37/EC)**
  Kasutatud standardit: EN ISO 12100-1: 2003, EN ISO 12100-2: 2003 ja EN 809: 1998.
- **Madalapinge-elektriseadmed (73/23/EEC)**
  Kasutatud standardit: EN 60204-1: 1997.
- **Elektrimagnetilist ühilduvust (89/336/EEC)**
  Kasutatud standardit: EN 61000-6-2: 1999 ja EN 61000-6-3: 2001.
- **ATEX 94/9/EC**
  Kehtib ainult toodetele, mis on mõeldud kasutamiseks potentsiaalselt plahvatusohtlikus keskkonnas, Ex II 2G, varustatud eraldi ATEX tunnustuse andmesildiga ja EC-tüüpi kontrollsertifikaadiga. Täiendav info, vaata alla.

Bjerringbro, 15th January 2007

Peter Jungklas Nybo
Technical Manager

Range	Certificate No	Standards used
50	Baseefa 02ATEX0203X	EN 50014: 1997, EN 50018: 2000, EN 13463-1: 2001, prEN 13463-5: 2002
54	Baseefa 02ATEX0206X	
58	Baseefa 02ATEX0200X	
62	Baseefa 02ATEX0201X	
70	Baseefa 02ATEX0202X	
70*	Baseefa 06ATEX0002X	EN 60079-0: 2004, EN 13463-1: 2001, EN 13463-6: 2005 EN 60079-1: 2004, EN 13463-5: 2003

* Installation version 7

Notified body: Baseefa. No 1160. Staden Lane, Buxton, Derbyshire SK17 9RZ, UK.
Manufacturer: Oy GRUNDFOS Environment Finland Ab, Kaivokselantie 3-5, Vantaa, Finland.

S pumps, ranges 50 - 70

S1, S2, S3, SA, SV
7.5 - 155 kW

CONTENTS

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

1. General description

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

The booklet also includes specific instructions for the explosion-proof pumps.

1.1 Applications

The S1, S2, S3, SA and SV pumps are designed for the pumping of wastewater in a wide range of municipal, private and industrial applications.

Depending on version, the pumps can be used for submerged or dry installation.

Maximum solids size: 145 mm.

1.1.1 Potentially explosive environments

In potentially explosive environments, the explosion-proof S1, S2, S3 and SV pumps must be used, see *1.5.1 Ex certification and classification* and *8.3 Explosion-proof S1, S2, S3 and SV pumps*.

Note: The explosion classification of the pump is EEx dIIB T3 or EEx dIIB **T4**. The installation must in each individual case be approved by the local fire-fighting authorities.

1.2 Operating conditions

1.2.1 pH value

All pumps can be used for pumping liquids with a pH value between 4 and 10.

1.2.2 Liquid temperature

0°C to +40°C.

1.2.3 Ambient temperature

–20°C to +40°C.

1.2.4 Density and viscosity of pumped liquid

Maximum density: 1000 kg/m³.

Maximum kinematic viscosity: 1 mm²/s (1 cSt).

Note: When pumping liquids with a density and/or a kinematic viscosity higher than the values stated above, motors with correspondingly higher outputs must be used.

1.2.5 Level of pumped liquid

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

The pump must always be filled with the liquid to be pumped.

An additional level switch must be installed to ensure that the pump is stopped in case the stop level switch is not operating.

To ensure adequate cooling of the motor during operation, the following minimum requirements must be met:

- **Versions 1 and 4:**
  The pump must always be covered by the pumped liquid to the middle of the motor.
- **Versions 2 and 5:**
  The pump housing must always be covered by the pumped liquid.
- **Versions 3 and 6:**
  No special requirements.
- **Version 7:**
  The liquid level must be at least 350 mm above the pump inlet, see fig. 7.

1.2.6 Operating mode

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

Motor size	Starts per hour
7.5 - 21.0 kW, 2- and 4-pole	20
15.0 kW, 12-pole 16.0 kW, 6-pole 22.0 - 155 kW	15

1.2.7 Enclosure class

IEC IP 68.

1.3 Sound pressure level

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

1.4 Type key

All S1, S2, S3, SA and SV pumps described in this booklet are identified by the type code stated in the confirmation of order and other documentation supplied with the pump. The code consists of 14 items as shown in the table below.

Please note that the pump types described in this booklet are not necessarily available in all variants. The shaded code items are stated on the pump nameplate.

S	1	X	17	4		M	1	A		5	11		Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14

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Code item		Description		
1. Pump type	S	Grundfos submersible wastewater pumps, type S		
2. Impeller type	1	Single-channel		
	2	Two-channel		
	3	Three-channel		
	V	SuperVortex		
	A	Axial		
3. Motor specification	[ ]	Standard, not certified		
	X	Explosion-proof motor		
	A	In conformity with the ATEX directive		
4. Motor power		Motor power in kW		
5. Motor pole number		Motor speed at		
			50 Hz min^{-1}	60 Hz min^{-1}
	2	2-pole	3000	3600
	4	4-pole	1500	1800
	6	6-pole	1000	1200
	8	8-pole	750	900
	10	10-pole	600	720
	12	12-pole	500	600
6. Pump generation	[ ]	1st generation		
	A	2nd generation		
	B	3rd generation, etc.		
		The generation code distinguishes between structurally different pumps which have the same power rating		
7. Head	[ ]	No classification		
	E	Extra-low		
	L	Low		
	M	Medium		
	H	High		
	S	Super-high		
8. Installation version	1	Submerged installation on auto-coupling		
	2	Submerged installation on auto-coupling. Pump with cooling jacket.		
	3	Vertical dry installation with base stand. Pump with cooling jacket.		
	4	Submerged installation, portable		
	5	Submerged installation, portable. Pump with cooling jacket.		
	6	Horizontal dry installation with base stand and bracket. Pump with cooling jacket.		
	7	Vertical column installation		
9. Interchangeability		The letter (A, B, C...) indicates the interchangeability of parts between otherwise identical pumps. Pumps with no or the same letter have full interchangeability of parts and use the same spare parts catalogue.		
10. Number of phases	[ ]	Three-phase		
11. Frequency	5	50 Hz		
	6	60 Hz		
12. Voltage and starting		50 Hz		60 Hz
	01	400 V, DOL	01	460 V, DOL
	11	400 V, star-delta	11	460 V, star-delta
	02	230 V, DOL	03	500 V, DOL
	12	230 V, star-delta	13	500 V, star-delta
	03	415 V, DOL	05	380 V, DOL
	13	415 V, star-delta	15	380 V, star-delta
	04	500 V, DOL	07	220 V, DOL
	14	500 V, star-delta	17	220 V, star-delta
	06	690 V, DOL		
13. Special equipment	U	Flanges sized according to ANSI specifications		
14. Non-standard parts	Z	See confirmation of order for further details		

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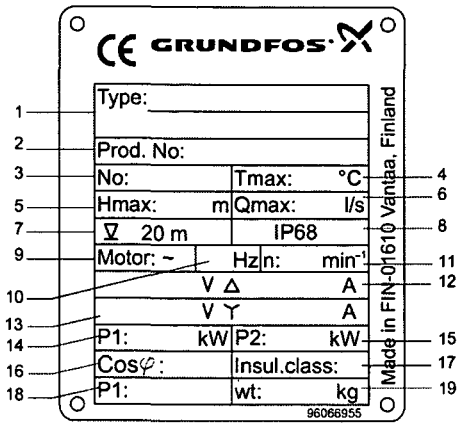
1.5 Nameplates

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



TM03 4293 2006

Fig. 1 Pump nameplate

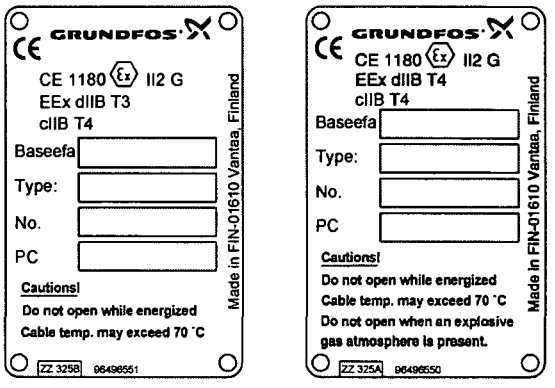
Pos.	Description
1	Type designation
2	SAP code
3	Serial number
4	Maximum liquid temperature
5	Maximum head
6	Maximum flow
7	Maximum installation depth
8	Enclosure class
9	Number of phases
10	Frequency
11	Rated speed
12	Voltage/current, delta connection
13	Voltage/current, star connection
14	Power input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

1.5.1 Ex certification and classification

Explosion-proof pumps have been approved by Baseefa (2001) Ltd. in conformity with the essential health and safety requirements relating to the design and construction of equipment intended for use in potentially explosive atmospheres given in Annex II to the Council Directive 94/9/EC (ATEX).

The certified pumps (Ex-pumps) are supplied with an approval plate fixed in the visible place close to the nameplate.

Fig. 2 shows the approval plates for the pumps equipped optionally with the motors classified to T3 or T4 temperature class.



TM02 6795 1803

Fig. 2 Nameplates of explosion-proof pumps, T3 and T4 classification.

The approval plate gives the following details:

CE	CE mark.
1180	Number of Quality Assurance notified body.
Ex	EU ex-symbol.
II	Equipment group (II = non-mining).
2	Equipment category (high protection).
G	Type of explosive atmosphere.
EEx	Motor explosion-proof according to European standard.
d	Motor withstands explosion pressure.
IIB	Gas Group.
T3	Maximum surface temperature of the motor is 200°C.
T4	Maximum surface temperature of the motor is 135°C.
c	Constructional safety.
Baseefa	Certificate number.
No.	HA.
PC	Production code.

2. Safety

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

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

For safety reasons, all work in pits must be supervised by a person outside the pump pit.

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

3. Transportation and storage

The pump is supplied from the factory in proper packing in which it should remain until it is to be installed.

Make sure that the pump cannot roll or fall over.

All lifting equipment must be rated for the purpose and checked for damages before any attempts are made to lift the pump. The lifting equipment rating must under no circumstances be exceeded. The pump weight is stated on the pump nameplate.

Always lift the pump by its lifting bracket or by means of a fork-lift truck, **never** by means of the motor cable or the hose/pipe.

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

For long periods of storage, the pump must be protected against moisture and heat.

Storage temperature: –30°C to +60°C.

After a long period of storage, the pump should be inspected before it is put into operation. Make sure that the impeller can rotate freely. Pay special attention to the condition of the shaft seals and the cable entry.

4. Installation

The loose nameplate supplied with the pump should be fixed at the installation site.

All safety regulations must be observed at the installation site, e.g. the use of blowers for fresh-air supply to the pit.

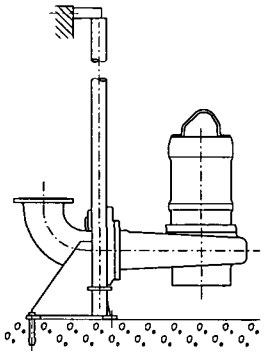
Do not put your hands or any tool into the pump suction or discharge port after the pump has been connected to the electricity supply, unless the pump has been switched off by removing the fuses or switching off the mains switch. It must be ensured that the electricity supply cannot be accidentally switched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

Prior to installation, check the oil level in the oil chamber, see *8.1 Oil check and oil change*.

The S1, S2, S3, SA and SV pumps are designed for various installation versions.

Figures 3 to 7 show the possible installation versions.

Versions 1 and 2:
Submerged installation on auto-coupling

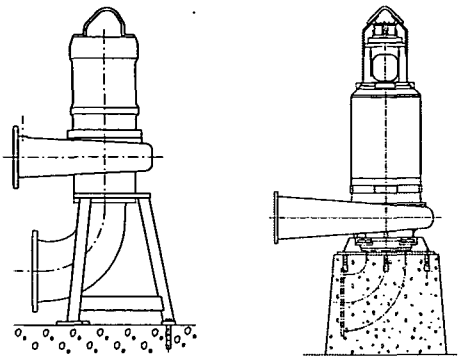


TM02 4000 4601

Fig. 3

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

Version 3:
Vertical dry installation with base stand

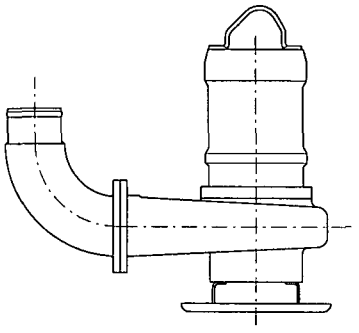


TM02 4001 4601 / TM02 4023 4701

Fig. 4

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

Versions 4 and 5:
Submerged installation, portable

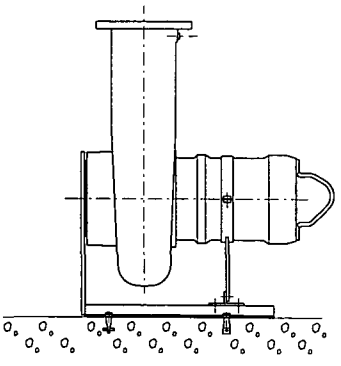


TM02 4002 4601

Fig. 5

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

Version 6:
Horizontal dry installation with base stand and bracket



TM02 4003 4601

Fig. 6

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

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Version 7:
Vertical column installation

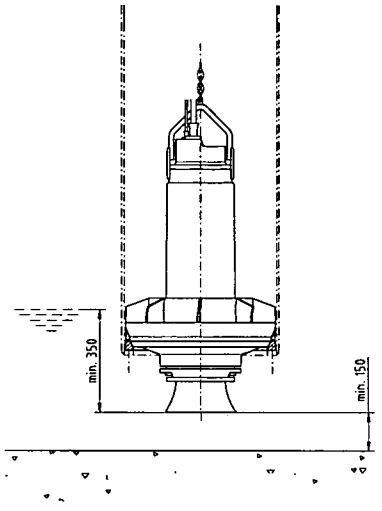


Fig. 7

Vertical column installation in steel pipe or concrete shaft.

4.1 Submerged installation on auto-coupling

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

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

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

4.2 Dry installation

Pumps in dry installation are installed permanently in a pump room.

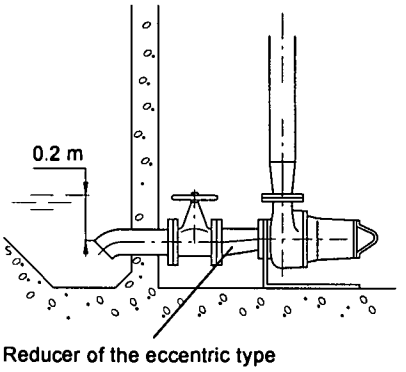
The pump motor is enclosed and watertight and will not be damaged if the installation site is flooded with water.

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

In order to facilitate service on the pump, isolating valves should be fitted on either side of the pump.

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

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



Reducer of the eccentric type

Fig. 8

4.3 Submerged installation, portable

1. Fit the ring stand to the pump suction flange.
2. Fit a 90° elbow to the pump discharge port and connect the discharge pipe/hose.

If a hose is used, make sure that the hose does not buckle and that the inside diameter matches that of the discharge port.

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

4.4 Vertical column installation

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

4.5 Pump controller

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

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

Depending on application, different types of level control equipment can be used.

The **LC** controller is fitted with two or three level switches: Two for start and stop of pump. The third level switch, which is optional, is for high-level alarm.

The **LCD** controller is fitted with three or four level switches: One for common stop and two for start of the pumps. The fourth level switch, which is optional, is for high-level alarm.

When installing the level switches, the following points should be observed:

1. To prevent air intake and vibrations in submerged pumps, the **stop level switch** must be fitted in such a way that the pump is stopped before the liquid level is lowered below the top of the pump housing.
   As a principal rule for pumps in dry installation, the lowest stop level must be at least 20 cm above the opening of the suction pipe, see fig. 8.
2. The **start level switch** should be installed in such a way that the pump is started at the required level; however, the pump must always be started before the liquid level reaches the bottom inlet pipe to the pit.
3. The **high-level alarm switch**, if installed, should always be installed about 10 cm above the start level switch; however, alarm must always be given before the liquid level reaches the inlet pipe to the pit.

Note: The pump controller must not be installed in potentially explosive environments.

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

4.6 Thermal switches

Three bimetallic thermal switches are built into the stator windings, and a contact will open in case of overtemperature, i.e. 150°C.

The supply voltage to the thermal switches must be 12-230 VAC.

The thermal switches are connected to the monitoring cable, see *6. Electrical connection*, and must be connected to the safety circuit of the separate pump controller.

Note: The motor starter of the pump controller must include a circuit which automatically disconnects the electricity supply in case the protective circuit for the pump is opened.

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

4.7 Moisture switches

Non-explosion-proof pumps have one moisture switch, which is fitted in the chamber below the motor top cover.

Explosion-proof pumps have two moisture switches connected in series, which are fitted in the chamber below the motor top cover.

The moisture switch is non-reversing and must be replaced after use.

The moisture switches are connected in series with the thermal switches and connected to the monitoring cable, see *6. Electrical connection*, and must be connected to the safety circuit of the separate pump controller.

Note: The motor starter of the pump controller must include a circuit which automatically disconnects the electricity supply in case the protective circuit for the pump is opened.

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4.8 Thermistors

Thermistors are available as accessories.

The thermistors are used for the monitoring of bearing and stator temperatures instead of thermal switches and must be connected to the thermistor relay in the control cabinet.

The following limit temperatures are used:

- 90°C – alarm for bearing temperature.
- 130°C – pump stop caused by high bearing temperature.
- 150°C – pump stop caused by high stator temperature.

At room temperature, the thermistor resistance is approx. 100 Ω

The bearing temperature monitoring is not available in explosion-proof pumps.

4.8.1 Checking after installation of pump

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

4.9 Pt100 temperature sensor

The Pt100 temperature sensor is available as an accessory.

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

The sensor resistance is

- 100 Ω at 0°C,
- 138.5 Ω at 100°C and
- approx. 108 Ω at room temperature.

The Pt100 is not available for explosion-proof pumps.

4.9.1 Checking after installation of pump

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

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4.10 WIO sensor

The WIO sensor is available as an accessory for pumps with motor sizes of 5.5 to 21 kW.

The sensor measures the water content in the oil chamber.

The sensor consists of a plate capacitor which is immersed in the oil and measures the electronic circuit, emitting a 4-20 mA proportional current signal. Connect the WIO sensor as described in the instruction for the WIO sensor (96591899).

4.11 Fitting the WIO sensor

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

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

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

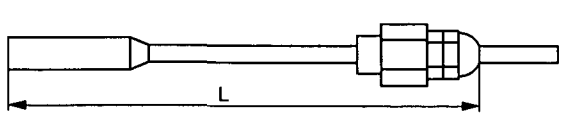

Fig. 9 Dimensions of WIO sensor

Motor size	Inserting depths L [mm]
5.5 - 12.5 kW	80
13.5 - 21 kW	90

5. Electrical data

Input voltage:	12 - 24 VDC
Output current:	3.4 - 22 mA
Power consumption:	0.6 W
Ambient temperature:	0 to 70°C

5.1 Sensor signals

4 - 20 mA	=	0- 20% water in oil Accuracy better than 2%
22 mA	=	Warning: Water content far outside measuring range
3.5 mA	=	Alarm: Air in the oil chamber

Note: The sensor signal is only valid when oil and water is mixed (when the pump is running).

6. Electrical connection

The electrical connection should be carried out in accordance with local regulations.

The supply voltage and frequency are marked on the pump nameplate.

The voltage tolerance must be within ±5% of the rated voltage.

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

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

The pump must be connected to a motor starter.

The wiring diagrams for direct-on-line starting and star-delta starting are shown in fig. 10 and fig. 11, respectively.

P1 and P2 are connected in series with the thermal switches and the moisture switches.

Direct-on-line starting

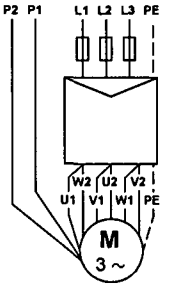

Fig. 10

Star-delta starting

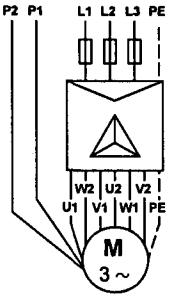

Fig. 11

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

Cross section of phase wire (S) of the installation [mm²]	Minimum cross section of earth wire [mm²]
S ≤16	S
16 < S ≤35	16
S > 35	0.5 *S, max. 70

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

7. Start-up

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

Proceed as follows:

1. Remove the fuses or switch off the mains switch.
2. Check the oil level in the oil chamber. See *8.1 Oil check and oil change*.
3. Check whether the impeller can rotate freely.
4. Check whether the monitoring units, if used, are operating satisfactorily.

5. Make sure that the pump is submerged in the liquid.
   For pumps in dry installation, it must be ensured that there is liquid in the pit.

Make sure that the pump has been filled with the liquid to be pumped.
Pumps in dry installation must be vented by means of the vent plug in the pump housing.

6. Open the isolating valves, if fitted.
7. Check whether the system has been filled with liquid and vented.
8. Check the setting of the level switches.
9. Start the pump and check the pump operation for abnormal noise or vibrations.

Note: In case of abnormal noise or vibrations from the pump or other pump or supply failures, stop the pump immediately. Do not attempt to restart the pump before the cause of the fault has been found and the fault corrected.

10. After start-up, the actual pump duty point must be established as accurately as possible so that it can be checked whether the operating conditions are as desired.

Note: The pump may be started for a very short period without being submerged for checking of direction of rotation.

The operation of the pump should always take place in accordance with established routines with scheduled checks of pump monitoring equipment and accessories (valves, etc.). Make sure that the pump and equipment settings cannot be changed by unauthorized persons.

7.1 Checking the direction of rotation

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

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

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

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

8. Maintenance and service

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

Maintenance and service must be carried out by specially trained persons.

The maintenance and service work on explosion-proof pumps must be carried out by Grundfos or a service workshop authorized by Grundfos.

Before carrying out maintenance and service, it must be ensured that the pump has been thoroughly flushed with clean water. Rinse the pump parts in water after dismantling.

Pumps running normal operation should be inspected every 2000 operating hours or at least once a year. If the pumped liquid is very muddy or sandy, the pump should be inspected every 1000 operating hours or every six months.

The following points should be checked:

- **Power consumption**
- **Oil level and oil condition**
  When the pump is new or after replacement of the shaft seals, check the oil level after one week of operation.
  The oil becomes greyish white like milk if it contains water. This may be the result of a defective shaft seal. The oil should be changed if it contains water. See *8.1 Oil check and oil change*.
  Note: Used oil must be disposed of in accordance with local regulations.
  The oil chamber contains 1.9 to 12.4 litres of SAE 10 W 30 motor oil depending on pump size.
- **Cable entry**
  Make sure that the cable entry is watertight and that the cables are not sharply bent or pinched.
- **Impeller clearance**
  Check the impeller clearance. See *8.2 Inspection and adjustment of impeller clearance*.
- **Pump parts**
  Check the pump housing, etc. for possible wear. Replace defective parts.
- **Ball bearings**
  Check the shaft for noisy or heavy operation (turn the shaft by hand). Replace defective ball bearings.
  A general overhaul of the pump is usually required in case of defective ball bearings or poor motor function. This work must be carried out by an authorized service workshop.

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

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

8.1 Oil check and oil change

The oil chamber has two screws, A and B, for oil drainage, oil filling and level control. Horizontally installed pumps (version 6) have a third screw, C, for oil drainage.

On horizontally installed pumps (version 6), the oil screws are always positioned as shown in fig. 12.

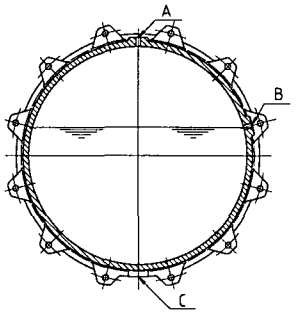

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Fig. 12

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

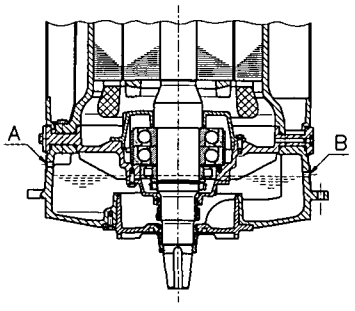

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Fig. 13

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Proceed as follows:

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

When slackening the screw A of the oil chamber, note that pressure may have built up in the chamber. Do not remove the screw until the pressure has been fully relieved.

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2. Place a clean container under the pump to collect all the drained-off oil. Slacken the screw B pointing to the side and observe the oil level. The drained-off quantity of oil indicates whether the lower mechanical shaft seal is leaking, which may be normal.
3. Turn the pump or remove the screw C and allow all the oil to drain from the chamber into the container. Pour an oil sample into a glass container and observe the condition of the oil.
   Clear oil can be reused.
   Emulsified oil must be changed and disposed of.
   Note: Used oil must be disposed of in accordance with local regulations.
   Low oil level may indicate that the upper mechanical shaft seal is defective. Contact an authorized service workshop for further overhaul of the pump and repair, if required.
4. Fill the oil chamber with oil through the top hole A until the oil level reaches the hole B. Replace the O-rings by new rings, insert the screws and tighten securely.

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

8.2 Inspection and adjustment of impeller clearance

Adjustment of the impeller clearance is only relevant for pumps with channel impellers (S1, S2 and S3 pumps).

The correct impeller clearance is 0.7 mm ±0.2 mm. The clearance should be adjusted if it is worn to 1.2 mm or more.

The procedures for adjustment of the impeller clearance are different for pumps in submerged installation (versions 1, 2, 4 and 5) and pumps in dry installation (versions 3, 6 and 7).

The various procedures are described in the following sections:

8.2.2 Adjustment of impeller clearance for pumps without inlet funnel in submerged installation,

8.2.3 Adjustment of impeller clearance for pumps with inlet funnel in submerged installation,

8.2.4 Adjustment of impeller clearance for pumps without slide ring in dry installation,

8.2.5 Adjustment of impeller clearance for pumps with slide ring in dry installation,

8.2.6 Adjustment of impeller clearance of axial pumps.

8.2.1 Inspection of impeller clearance for pumps in submerged installation

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

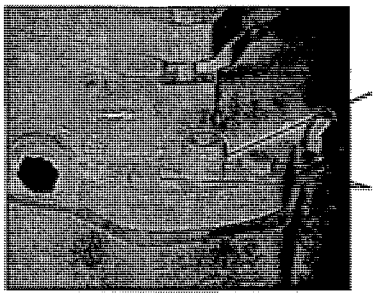

Fig. 14

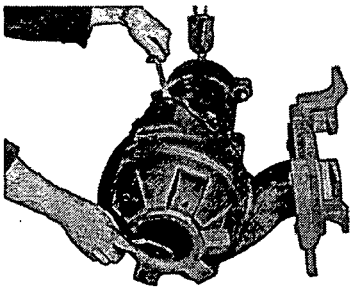

Fig. 15

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

8.2.2 Adjustment of impeller clearance for pumps *without* inlet funnel in submerged installation

Procedure:

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

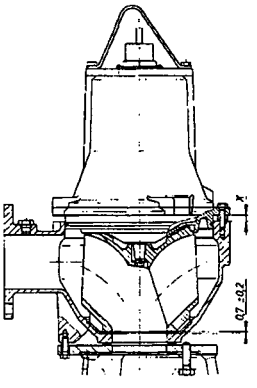

Fig. 16

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

8.2.3 Adjustment of impeller clearance for pumps *with* inlet funnel in submerged installation

Procedure:

1. Slacken all fixing screws and adjusting screws between pump housing and motor.
2. Tap on the pump housing at several points using a rubber mallet to loosen the pump housing from the motor.
3. Close the impeller clearance by tightening three of the fixing screws until the impeller touches the inlet funnel. Do not use unnecessary force.
4. Slacken the fixing screws and open the clearance to 0.7 mm ±0.2 mm by tightening the three adjusting screws, see fig. 17. Check that the clearance is equal all around the suction opening.

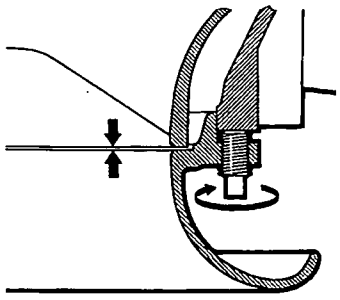

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Fig. 17

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

8.2.4 Adjustment of impeller clearance for pumps *without* slide ring in dry installation

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

Procedure:

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

8.2.5 Adjustment of impeller clearance for pumps *with* slide ring in dry installation

The impeller clearance can be adjusted while the pump is mounted on the base stand and connected to the pipework, see fig. 18.

Procedure:

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

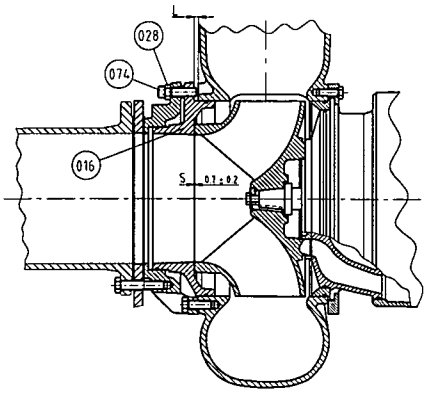

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Fig. 18

8.2.6 Adjustment of impeller clearance of axial pumps

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

8.3 Explosion-proof S1, S2, S3 and SV pumps

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

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

In the event of subsequent repairs, the existing plate should be replaced by a new updated plate and earlier markings are recorded.

The repairing workshop must keep records of performed overhauls and repairs together with records of all previous overhauls, repairs and possible modifications. Copies of the repairing workshop's detailed records should be filed by the owner or operator together with the original type certificate of the explosion-proof motor in question.

8.3.1 Motor cable

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

8.3.2 Cable entry

Only EExd cable entry parts corresponding to the cable diameter may be used. The corresponding cable dimension marking is stamped on the inlet or the cable entry.

Secure the cable entry to the motor top cover by tightening the screws evenly one by one until the cable entry is lying flat against the top cover.

8.3.3 Spare parts

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

8.4 Contaminated pumps

Note: If a pump has been used for a liquid which is injurious to health or toxic, the pump will be classified as contaminated.

If Grundfos is requested to service the pump, Grundfos must be contacted with details about the pumped liquid, etc. *before* the pump is returned for service. Otherwise Grundfos can refuse to accept the pump for service.

Possible costs of returning the pump are paid by the customer.

However, any application for service (no matter to whom it may be made) must include details about the pumped liquid if the pump has been used for liquids which are injurious to health or toxic.

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9. Fault finding chart

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

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

10. Disposal

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

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

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Gebze Organize Sanayi Bölgesi
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Факс: (3712) 53-36-35

Addresses revised 10.01.2007

BE › THINK › INNOVATE ›

Being responsible is our foundation
Thinking ahead makes it possible
Innovation is the essence

96478964 0107	242
Repl. 96478964 0603 96488038 0903	

www.grundfos.com

GRUNDFOS

4.0 VALVES

SUPPLIER: TYCO NORTHGATE
88 FREDERICK STREET
NORTHGATE Qld 4013

Ph: (07) 3266 2255
Fax: (07) 3260 5221

MODEL: 100 DIA DF METAL SEAT SLUICE VALVE
300 DIA DF METAL SEAT SLUICE VALVE

SUPPLIER: VALVECO INDUSTRIES

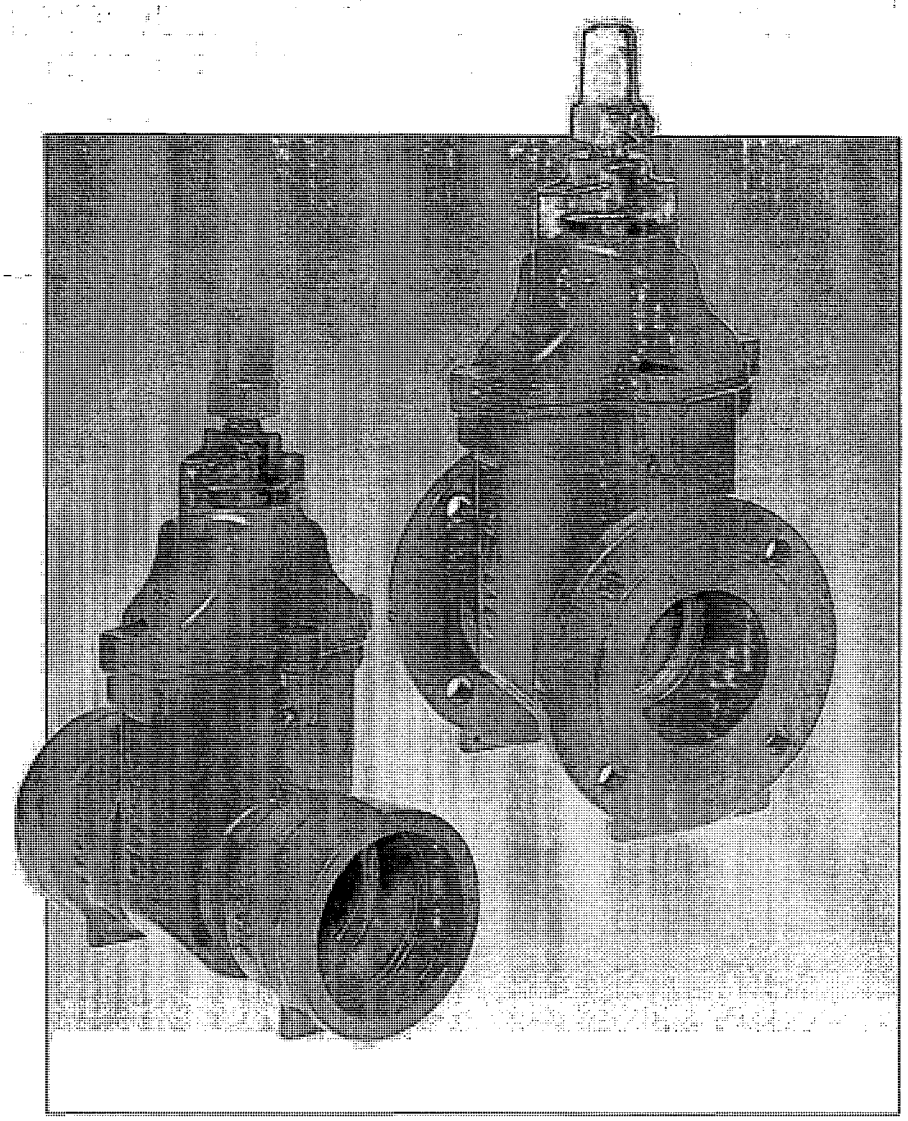
Ph: (07) 3859 6860
Fax: (07) 3859 6869

MODEL: 300 DIA. VALMATIC FLEX CHECK VALVE

Metal Seated Gate Valves - Figure 400
DN80 - DN900

tyco Water

Figure 400 metal seated gate valves are designed and manufactured to AS 2638.1



Features

- Ductile Iron body and bonnet for high strength and impact resistance.
- Solid gunmetal gate for DN80-DN200, ductile iron fusion coated gate with gunmetal rings for larger sizes.
- Grade 431 Stainless Steel spindle for high strength and corrosion resistance.
- Gunmetal dezincification resistant top casting incorporating dual O-ring seals and wiper ring for long life operation.
- Back seal facility to allow for replacement of seals under full operating pressure.
- Thermally bonded polymeric coating for long life corrosion protection.
- Isolated fasteners for corrosion protection.
- Anti-friction thrust washer for low operating torques.
- Integral cast in feet for safe and easy storage.
- Integral lifting lugs for installation convenience.
- Anticlockwise closing or clockwise closing available.
- Key, handwheel or gearbox operation available.

General Application

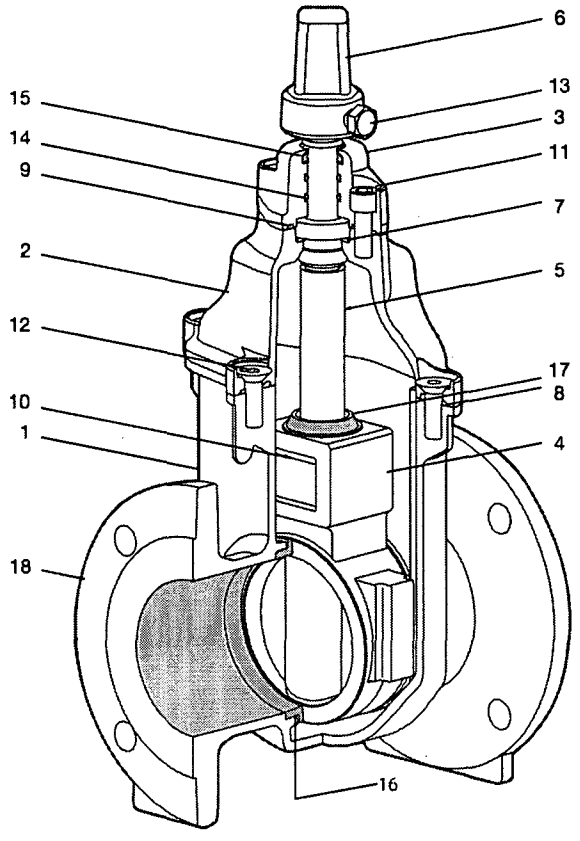
Figure 400 metal seated gate valves are suitable for use with drinking water and waste water, in below or above ground applications. Used for the isolation of sections and branches in pipelines.

Technical Data

Size Range: DN80-DN900
Allowable Operating Pressure: 1600 kPa or 3500 kPa
Maximum Temperature: 40°C
End Connections:
Flanged to AS 4087 Fig B5 or B6
TYTON® Socket
Certifications:
WSAA Appraisal No. 02/07
ISC AS 2638 Certified Product License No. PRD/R61/0412/2 (DN80-DN750)
Certified to AS 4020 - suitable for contact with drinking water.

A.B.N. 75 087 415 745

Metal Seated Gate Valves - Figure 400
DN80 - DN900

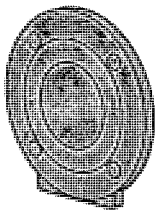


Parts List

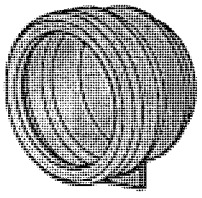
No	Description	Material	Standard
1	Body	Ductile Iron	AS 1831 400-15
2	Bonnet	Ductile Iron	AS 1831 400-15
3	Seal Retainer	Gunmetal	AS 1565 C83600
4	Gate	DN80-DN200 Gunmetal DN225-DN900 Ductile Iron	AS 1565 C83600 AS 1831 400-15
5	Spindle	Stainless Steel	ASTM A 276 431
6	Spindle Cap	Ductile Iron	AS 1831 400-15
7	Thrust Washer	Acetal	-
8	Body Gasket	EPDM	AS 1646
9	Bonnet Gasket	EPDM	AS 1646
10	Gate Nut	Gunmetal	AS 1565 C83600
11	Socket Head Screws	High Tensile Alloy Steel	-
12	Countersunk Screws	High Tensile Alloy Steel	-
13	Hex Head Screw	Stainless Steel	ASTM A276 316
14	O-Rings	Nitrile Rubber	AS 1646
15	Wiper Ring	Nitrile Rubber	AS 1646
16	Seat Rings	Gunmetal	AS 1565 C83600
17	Backseal Grommet	Nitrile Rubber	AS 1646
18	Polymeric Coating	-	AS/NZS 4158

Metal Seated Gate Valves - Figure 400
DN80 - DN900

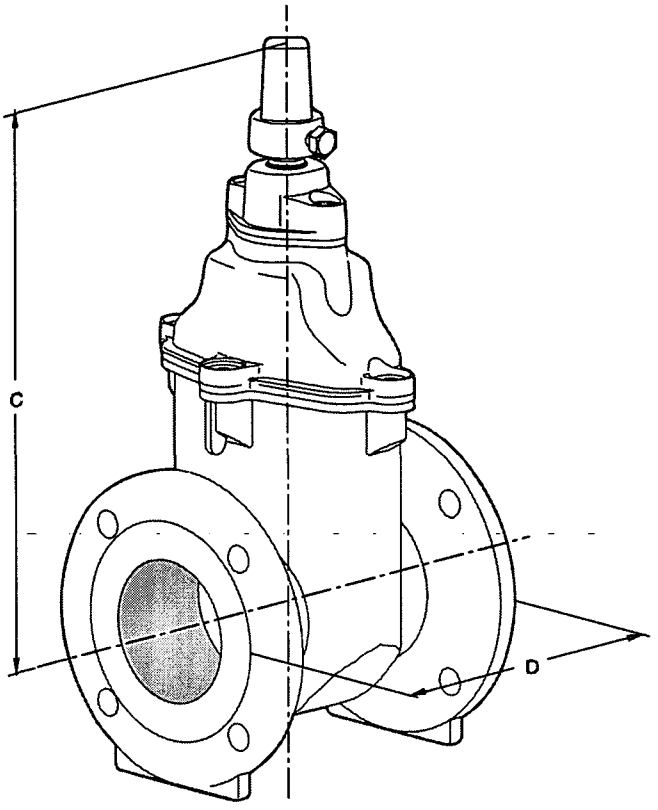
End Connections



Flange



Socket



Dimensions (mm)

Valve Size	C	D PN 16 TYTON Socket	D PN 16 Flange AS4087 Fig B5	D PN 35 Flange AS4087 Fig B6	Turns to Close	Approx. Mass kg
80	367	-	203	280	20	18
100	402	150	229	305	23	24
150	502	170	267	330	26	43
200	610	195	292	380	34	75
225	649	205	305	405	38	85
250	723	235	330	420	42	110
300	810	245	356	430	50	160
375	960	275	381	610	62	340
450	1145	-	432	660	76	560
500	1290	-	457	710	82	710
600	1467	-	508	785	98	940
750	2255	-	610	950	62	2700
900	2550	-	711	711 (PN 25)	74	3500

Note:
For compatability with Series 1 PVC (white) pipe, PLASTYT gaskets may be used in TYTON sockets.

Metal Seated Gate Valves - Figure 400
DN80 - DN900

Available Range

	Metal Seated Gate Valves Inside Screw		
	PN 16		PN 35
DN	Fl-Fl	Sc-Sc	Fl-Fl
80	✓		✓
100	✓	✓	✓
150	✓	✓	✓
200	✓	✓	✓
225	✓	✓	✓
250	✓	✓	✓
300	✓		✓
375	✓		
450	✓		✓
500	✓		✓
600	✓		✓
750	✓		✓
900	✓		PN25
Fig No.	400	400	400
Coating			
Polymeric Coating	✓	✓	✓
Options			
Anticlockwise Closing	✓	✓	✓
Clockwise Closing	✓	✓	✓
Gear Actuator	✓		✓
Flange Drilling Fig B5 (TC)	✓		
Flange Drilling Fig B6 (HP)			✓

Recommended Specification

- Gate valves shall be metal seated conforming to AS2638.1.
- The allowable operating pressure shall be 1600 kPa/3500 kPa.
- Operation shall be by means of a key/handwheel.
- The direction of closing shall be anticlockwise/clockwise.
- The valve body and bonnet shall be cast in Ductile Iron and coated with a thermally applied polymeric coating to AS/NZS 4158.
- The gate shall be cast in Ductile Iron and coated with a thermally bonded polymeric coating. Gate sealing rings shall be dezincification resistant copper alloy mechanically fixed to the body and gate. Solid gunmetal gates are also acceptable.
- The spindle shall be Grade 431 Stainless Steel incorporating a failsafe thrust collar.
- The spindle seal retainer shall be manufactured from a dezincification resistant copper alloy to AS1565.
- The spindle seal shall be affected by a minimum of two O-rings, which can be replaced under full operating pressure.
- Fasteners shall be completely isolated from the external environment.
- Valves shall be manufactured under a product certification scheme and each valve marked in accordance with the certification body's requirements.

5.0 FLOWMETER

SUPPLIER: ENDRESS & HAUSER
P.O. BOX 797
NORTH RYDE NSW

Ph: (02) 8877 7000
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MODEL: 300 Dia. Promag 50W3H-S50A1AK4ABAD

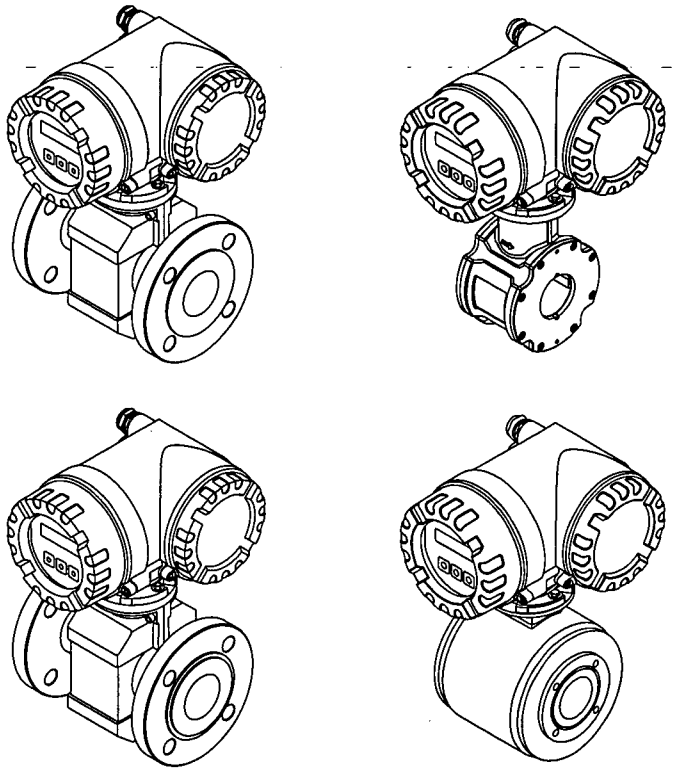
Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Operating Instructions

Proline Promag 50

Electromagnetic flow measuring system

HART® FIELD COMMUNICATION PROTOCOL



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Valid as of version
V 2.03.XX (device software)

Endress+Hauser
People for Process Automation

Table of contents

1 Safety instructions

1.1 Designated use

The measuring device described in this Operating Manual is to be used only for measuring the flow rate of conductive fluids in closed pipes.

A minimum conductivity of 20 µS/cm is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 µS/cm.

Examples:
- Acids, alkalis,
- Drinking water, wastewater, sewage sludge,
- Milk, beer, wine, mineral water, etc.

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

1.2 Installation, commissioning and operation

Please note the following:
- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood this Operating Manual and must follow the instructions it contains.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in the Operating Manual is mandatory.
- With regard to special fluids, including fluids used for cleaning, Endress+Hauser will be happy assist in clarifying the corrosion-resistant properties of wetted materials.
  However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of wetted materials in a specific application.
  The user is responsible for the choice of suitable wetted materials in the process.
- If welding work is performed on the piping system, do not ground the welding appliance through the Promag flowmeter.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be grounded apart from when special protective measures are taken (e.g. galvanically isolated SELV or PELV power supply)
- Invariably, local regulations governing the opening and repair of electrical devices apply.

1.3 Operational safety

Please note the following:
- Measuring systems for use in hazardous environments are accompanied by separate Ex documentation, which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this Ex documentation indicates the approval and the certification body (e.g. Ⓔx Europe, FM USA, CSA Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326 and NAMUR Recommendations NE 21 and NE 43.
- Depending on the application, the seals of the process connections of the Promag H sensor require periodic replacement.

- When hot fluid passes through the measuring tube, the surface temperature of the housing increases. In the case of the sensor, in particular, users should expect temperatures that can be close to the fluid temperature. If the temperature of the fluid is high, implement sufficient measures to prevent burning or scalding.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

1.4 Return

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use".
The devices can, however, be a source of danger if used incorrectly or for anything other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in this Operating Manual by the following icons:

Warning!
"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.

Caution!
"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.

Note!
"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

2 Identification

2.1 Device designation

The flow measuring system consists of the following components:

- Promag 50 transmitter
- Promag D, Promag L, Promag W, Promag P or Promag H sensor

In the *compact version*, the transmitter and sensor form a single mechanical unit; in the *remote version* they are installed separately.

2.1.1 Nameplate of the transmitter

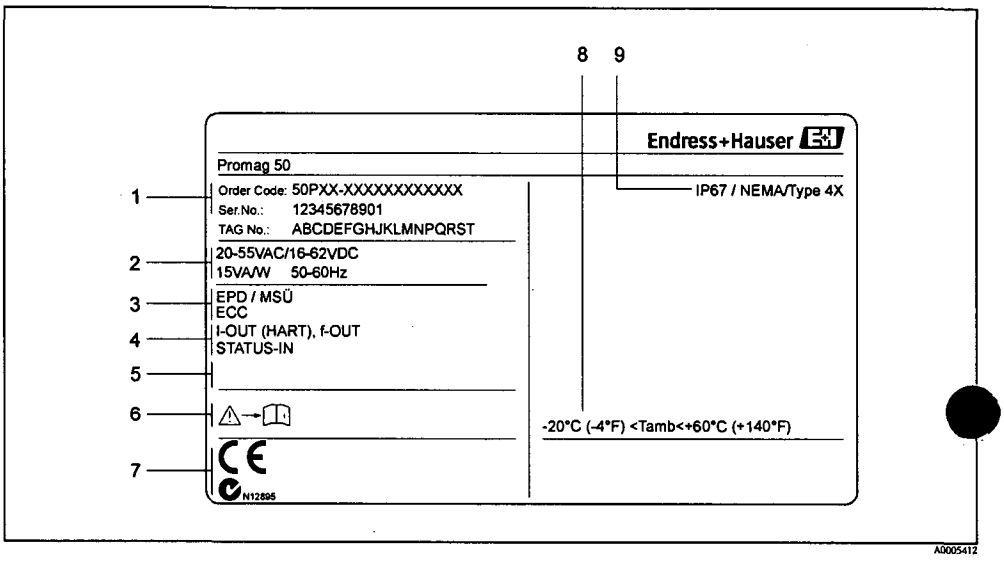


Fig. 1: Nameplate specifications for the "Promag 50" transmitter (example)

1 Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.
2 Power supply, frequency, power consumption
3 Additional information:
EPD/MSÜ: with Empty Pipe Detection
ECC: with electrode cleaning
4 Outputs available:
I-OUT (HART): with current output (HART)
f-OUT (HART): with frequency output
STATUS-IN: with status input (power supply)
5 Reserved for information on special products
6 Observe device documentation
7 Reserved for additional information on device version (approvals, certificates)
8 Permitted ambient temperature range
9 Degree of protection

2.1.2 Nameplate of the sensor

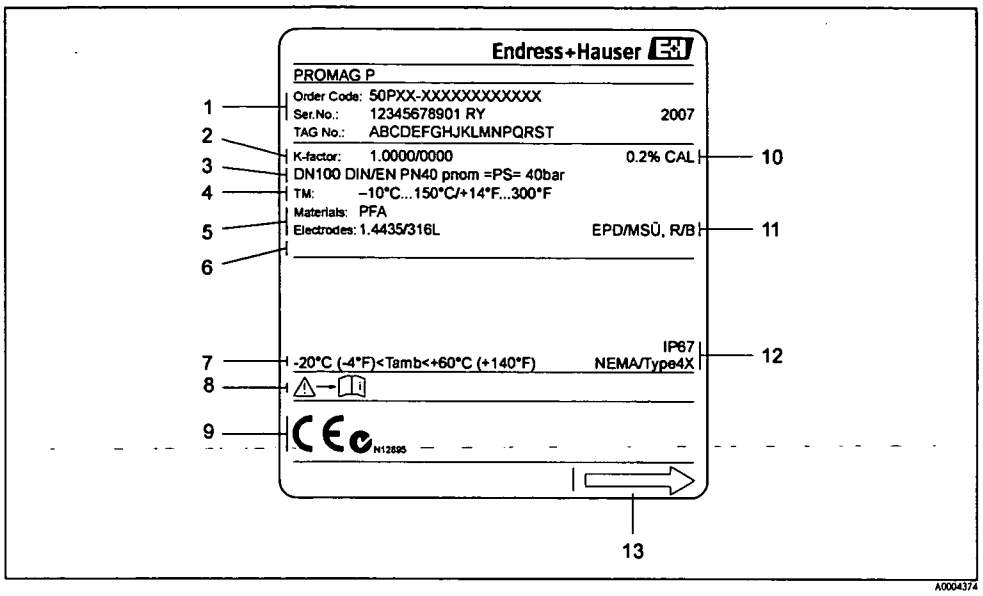


Fig. 2: Nameplate specifications for the "Promag" sensor (example)

1 *Ordering code/serial number: See the specifications on the order confirmation for the meanings of the individual letters and digits.*
2 *Calibration factor with zero point*
3 *Nominal diameter / Pressure rating*
4 *Fluid temperature range*
5 *Materials: lining/measuring electrodes*
6 *Reserved for information on special products*
7 *Permitted ambient temperature range*
8 *Observe device documentation*
9 *Reserved for additional information on device version (approvals, certificates)*
10 *Calibration tolerance*
11 *Additional information (examples):*
- *EPD/MSÜ: with Empty Pipe Detection electrode*
- *R/B: with reference electrode*

12 *Degree of protection*
13 *Flow direction*

2.1.3 Nameplate, connections

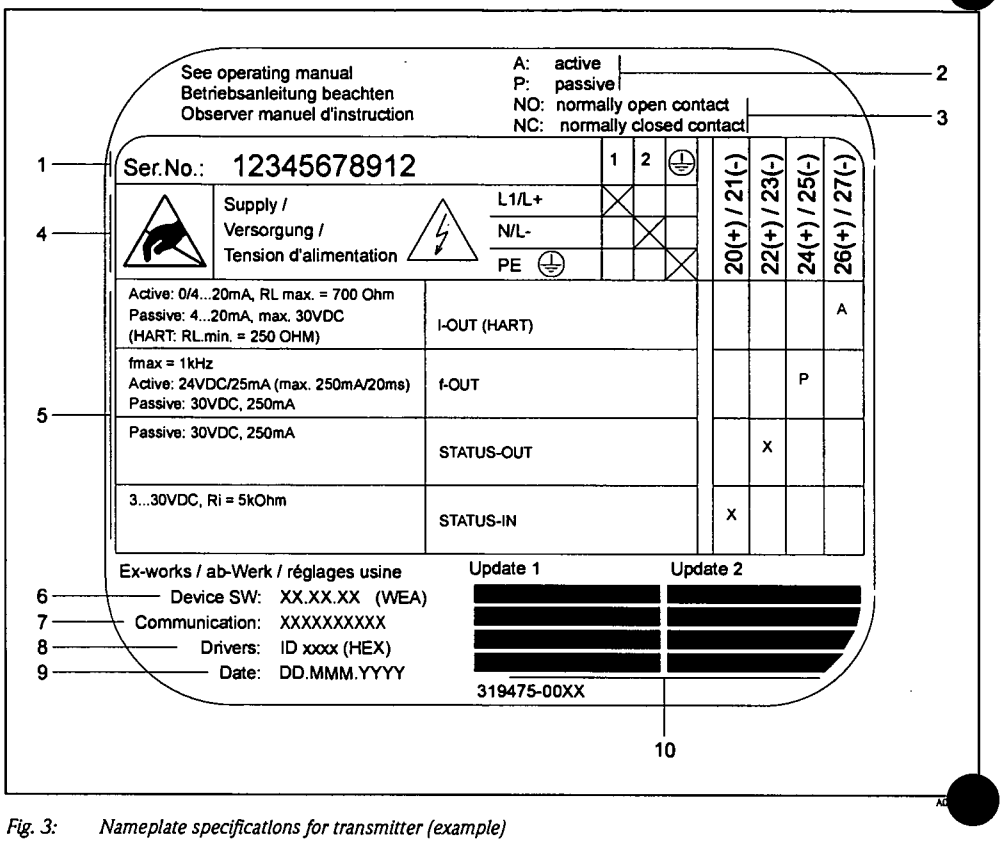


Fig. 3: Nameplate specifications for transmitter (example)

1 *Serial number*
2 *Possible configuration of current output*
3 *Possible configuration of relay contacts*
4 *Terminal assignment, cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC*
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L– for DC
5 *Signals present at inputs and outputs, possible configuration and terminal assignment (20 to 27), see also "Electrical values of inputs/outputs"*
6 *Version of device software currently installed*
7 *Installed communication type, e.g.: HART, PROFIBUS PA, etc.*
8 *Information on current communication software (Device Revision and Device Description), e.g.: Dev. 01 / DD 01 for HART*
9 *Date of installation*
10 *Current updates to data specified in points 6 to 9*

2.2 Certificates and approvals

The devices are designed to meet state-of-the-art safety requirements in accordance with sound engineering practice. They have been tested and left the factory in a condition in which they are safe to operate.

The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Safety requirements for electrical equipment for measurement, control and laboratory use" and with the EMC requirements of IEC/EN 61326/A1.

The measuring system described in this Operating Manual is therefore in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

The measuring system meets the EMC requirements of the Australian Communications and Media Authority (ACMA)

2.3 Registered trademarks

KALREZ® and VITON®
Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®
Registered trademark of Ladish & Co., Inc., Kenosha, USA

HART®
Registered trademark of the HART Communication Foundation, Austin, USA

HistoROM™, S-DAT®, Field Xpert™, FieldCare®, Fieldcheck®, Applicator®
Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

3 Installation

3.1 Incoming acceptance, transport and storage

3.1.1 Incoming acceptance

On receipt of the goods, check the following:
- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

3.1.2 Transport

The following instructions apply to unpacking and to transporting the device to its final location:
- Transport the devices in the containers in which they are delivered.
- Do not remove the protective plates or caps on the process connections until you are ready to install the device. This is particularly important in the case of sensors with PTFE linings.

Special notes on flanged devices

Caution!
- The wooden covers mounted on the flanges from the factory protect the linings on the flanges during storage and transportation. In case of Promag L they are additionally used to hold the lap joint flanges in place. Do not remove these covers until **immediately before** the device in the pipe.
- Do not lift flanged devices by the transmitter housing, or the connection housing in the case of the remote version.

Transporting flanged devices DN ≤ 300 (≤ 12")

Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.

Warning!
Risk of injury if the measuring device slips. The center of gravity of the assembled measuring device might be higher than the points around which the slings are slung.
At all times, therefore, make sure that the device does not unexpectedly turn around its axis or slip.

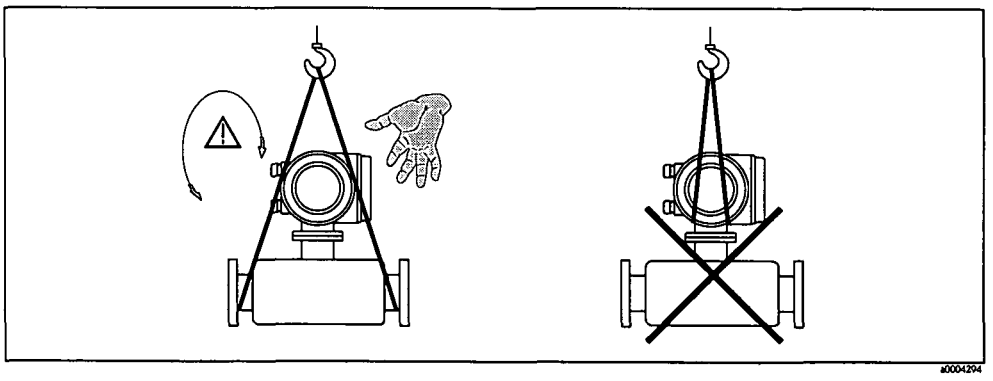


Fig. 4: Transporting sensors with DN ≤ 300 (≤ 12")

Transporting flangeddevices DN > 300 (> 12")

Use only the metal eyes on the flanges for transporting the device, lifting it and positioning the sensor in the piping.

Caution!
Do not attempt to lift the sensor with the tines of a fork-lift truck beneath the metal casing. This would buckle the casing and damage the internal magnetic coils.

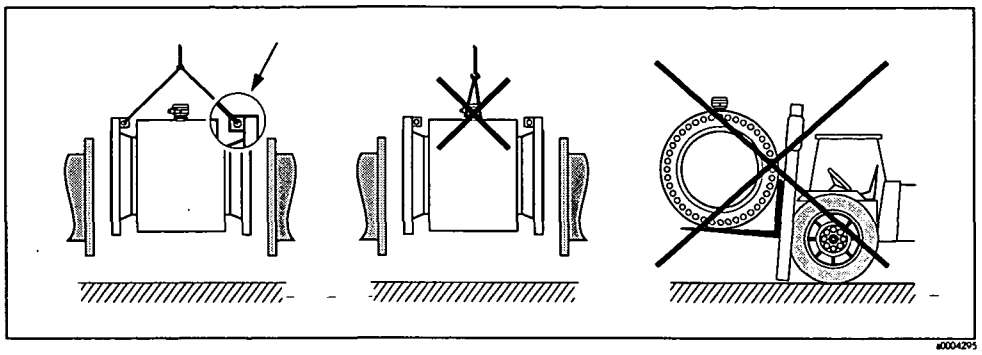


Fig. 5: Transporting sensors with DN > 300 (> 12")

3.1.3 Storage

Please note the following:
- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors → 101.
- Do not remove the protective plates or caps on the process connections until you are ready to install the device. This is particularly important in the case of sensors with PTFE linings.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- Choose a storage location where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

3.2 Installation conditions

3.2.1 Dimensions

The dimensions and installation lengths of the sensor and transmitter can be found in the "Technical Information" for the device in question. This document can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section on → 🖹 116.

3.2.2 Mounting location

Entrained air or gas bubble formation in the measuring tube can result in an increase in measuring errors.

Avoid the following locations:

- Highest point of a pipeline. Risk of air accumulating!
- Directly upstream from a free pipe outlet in a vertical pipeline.

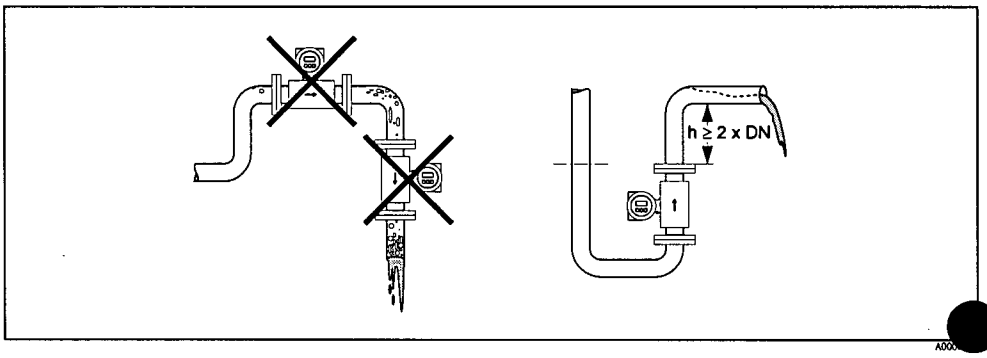


Fig. 6: Mounting location

Installation of pumps

Do **not** install the sensor on the intake side of a pump. This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube. Information on the lining's resistance to partial vacuum can be found on → 🖹 105.

It might be necessary to install pulse dampers in systems incorporating reciprocating, diaphragm or peristaltic pumps. Information on the measuring system's resistance to vibration and shock can be found on → 🖹 101.

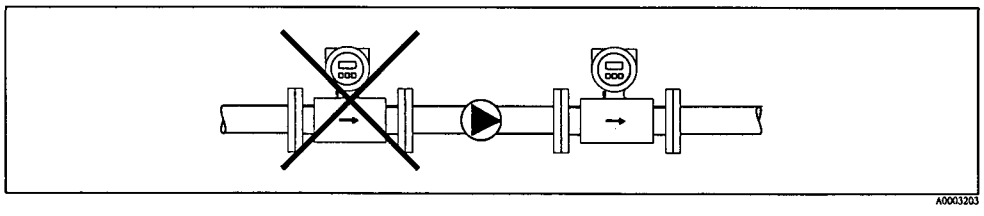


Fig. 7: Installation of pumps

Partially filled pipes

Partially filled pipes with gradients necessitate a drain-type configuration.
The Empty Pipe Detection function (EPD → 74) offers additional protection by detecting empty or partially filled pipes.

Caution!
Risk of solids accumulating. Do not install the sensor at the lowest point in the drain. It is advisable to install a cleaning valve.

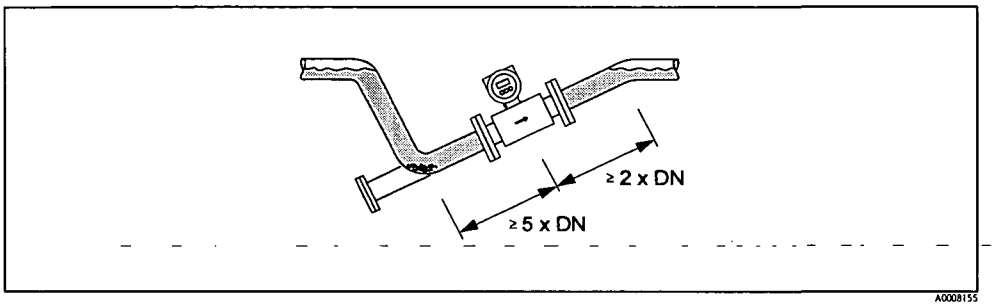


Fig. 8: Installation in a partially filled pipe

Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length h ≥ 5 m (16.4 ft). This precaution is to avoid low pressure and the consequent risk of damage to the lining of the measuring tube.
This measure also prevents the system losing prime, which could cause air pockets. Information on the lining's resistance to partial vacuum can be found on → 105.

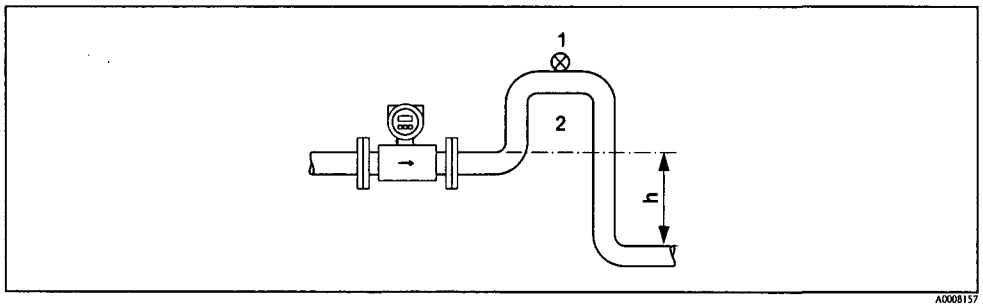


Fig. 9: Measures for installation in a down pipe

1 Vent valve
2 Pipe siphon
h Length of down pipe

3.2.3 Orientation

An optimum orientation position helps avoid gas and air accumulations and deposits in the measuring tube. However, Promag offers the additional Empty Pipe Detection (EPD) function to ensure the detection of partially filled measuring tubes, e.g. in the case of degassing fluids or varying process pressure:

- Electrode Cleaning Circuit (ECC) for applications with accretive fluids, e.g. electrically conductive deposits (→ "Description of Device Functions" manual).
- Empty Pipe Detection (EPD) ensures the detection of partially filled measuring tubes, e.g. in the case of degassing fluids (→ 🖹 74)
- Exchangeable Measuring Electrodes for abrasive fluids (→ 🖹 93)

Vertical orientation

This is the ideal orientation for self-emptying piping systems and for use in conjunction with Empty Pipe Detection.

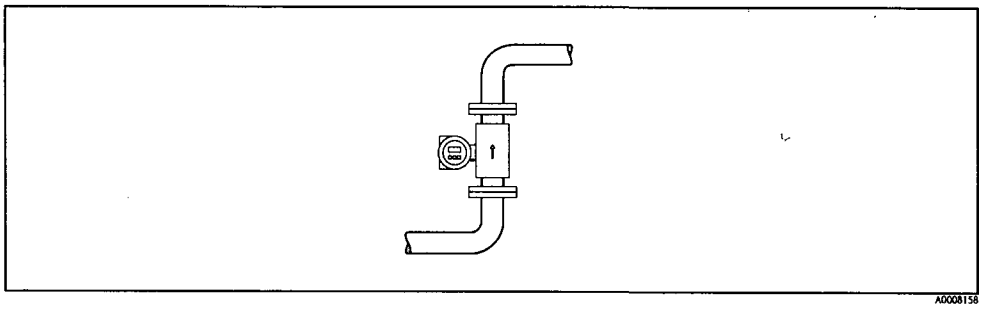


Fig. 10: Vertical orientation

Horizontal orientation

The measuring electrode plane should be horizontal. This prevents brief insulation of the two measuring electrodes by entrained air bubbles.

Caution!
Empty Pipe Detection functions correctly only when the measuring device is installed horizontally and the transmitter housing is facing upward (→ 🖹 10). Otherwise there is no guarantee that Empty Pipe Detection will respond if the measuring tube is only partially filled or empty.

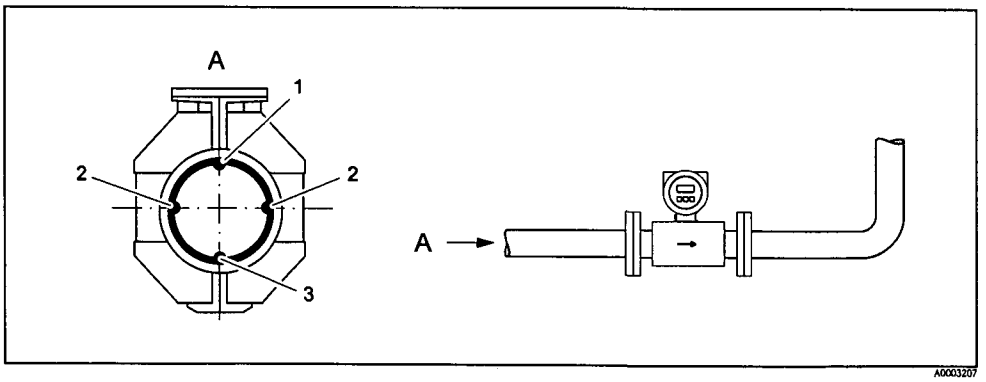


Fig. 11: Horizontal orientation

1 EPD electrode for the detection of empty pipes (not with Promag D and Promag H (DN 2 to 15; 1/12" to ½"))
2 Measuring electrodes for signal detection
3 Reference electrode for the potential equalization (not with Promag D and H)

Inlet and outlet run

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc. The following inlet and outlet runs must be observed in order to meet accuracy specifications:
- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

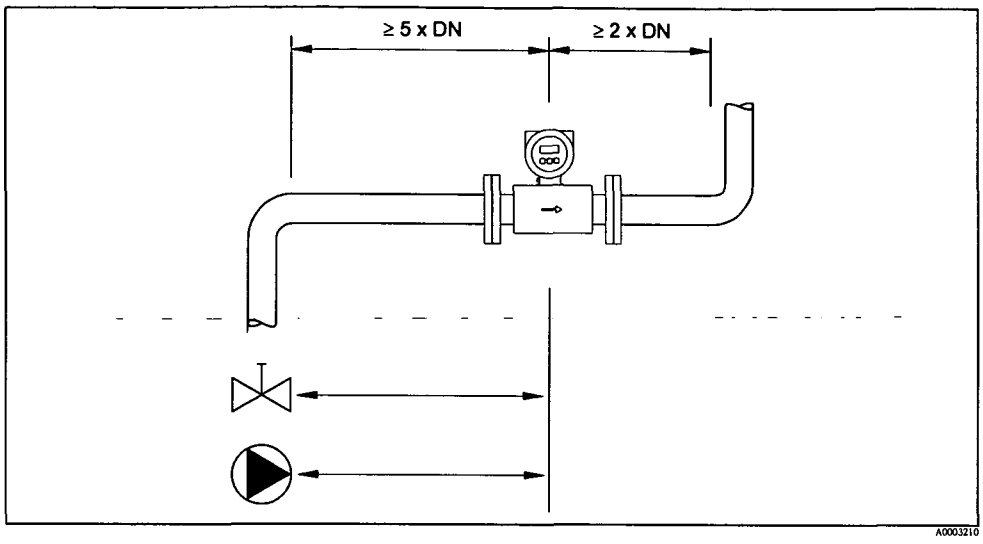


Fig. 12: Inlet and outlet runs

3.2.4 Vibrations

Secure the piping and the sensor if vibration is severe.

Caution!
If vibrations are too severe, we recommend the sensor and transmitter be mounted separately. Information on resistance to vibration and shock can be found on → 101.

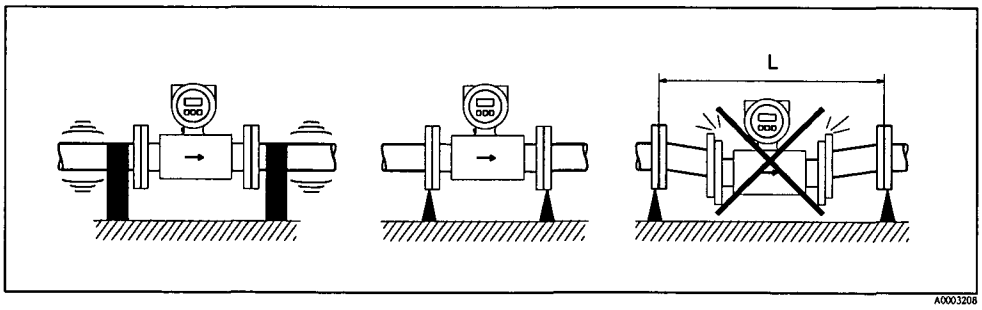


Fig. 13: Measures to prevent vibration of the device (L > 10 m (32.8 ft))

3.2.5 Foundations, supports

If the nominal diameter is DN ≥ 350, mount the sensor on a foundation of adequate load-bearing strength.

Caution!
Risk of damage.
Do not support the weight of the sensor on the metal casing: the casing would buckle and damage the internal magnetic coils.

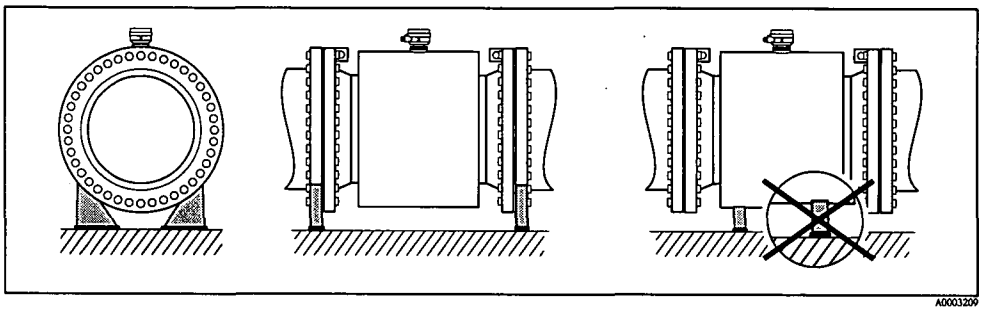


Fig. 14: Correct support for large nominal diameters (DN ≥ 350)

3.2.6 Adapters

Suitable adapters to DIN EN 545 (double-flange reducers) can be used to install the sensor in larger-diameter pipes.
The resultant increase in the rate of flow improves measuring accuracy with very slow-moving fluids. The nomogram shown here can be used to calculate the pressure loss caused by reducers and expanders.

Note!
The nomogram only applies to liquids of viscosity similar to water.

1. Calculate the ratio of the diameters d/D.
2. From the nomogram read off the pressure loss as a function of flow velocity (*downstream* from the reduction) and the d/D ratio.

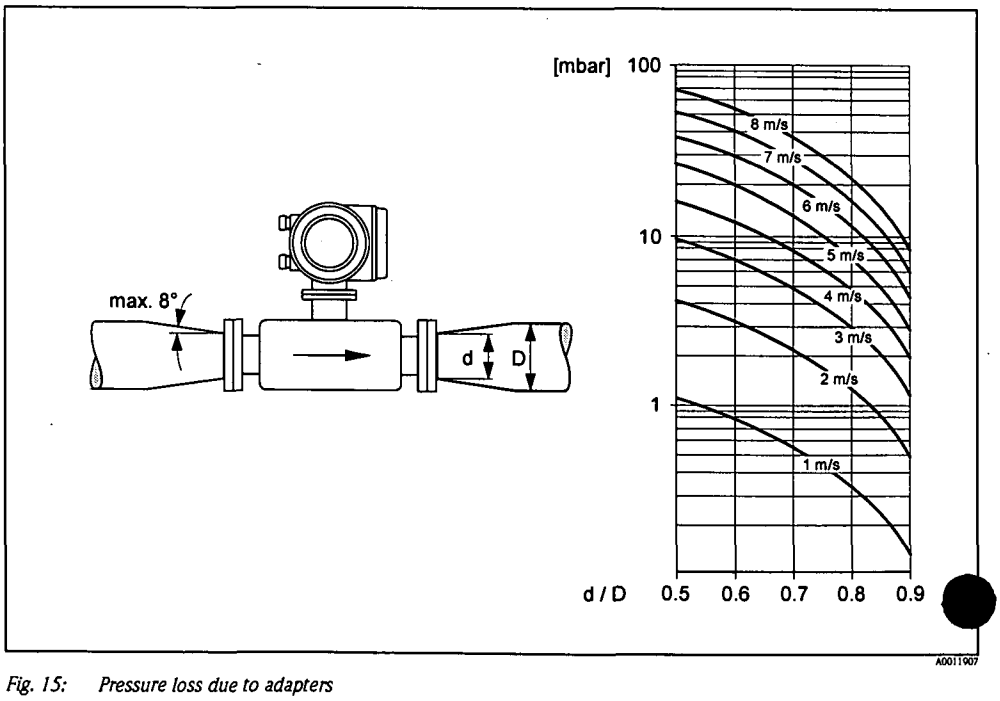


Fig. 15: Pressure loss due to adapters

3.2.7 Nominal diameter and flow rate

The diameter of the pipe and the flow rate determine the nominal diameter of the sensor. The optimum velocity of flow is between 2 and 3 m/s (6.5 to 9.8 ft/s)

The velocity of flow (v), moreover, has to be matched to the physical properties of the fluid:
- v < 2 m/s (v < 6.5 ft/s): for abrasive fluids
- v > 2 m/s (v > 6.5 ft/s): for fluids producing buildup

Note!
Flow velocity can be increased, if necessary, by reducing the nominal diameter of the sensor (→ 🖹 17).

Recommended flow (SI units)

Nominal diameter	Promag D	Promag L	Promag W	Promag P	Promag H
[mm]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [dm³/min]				
2	–	–	–	–	0.06 to 1.8
4	–	–	–	–	0.25 to 7
8	–	–	–	–	1 to 30
15	–	–	–	4 to 100	4 to 100
25	9 to 300	–	9 to 300	9 to 300	9 to 300
32	–	–	15 to 500	15 to 500	–
40	25 to 700	–	25 to 700	25 to 700	25 to 700
50	35 to 1100	35 to 1100	35 to 1100	35 to 1100	35 to 1100
65	60 to 2000	60 to 2000	60 to 2000	60 to 2000	60 to 2000
80	90 to 3000	90 to 3000	90 to 3000	90 to 3000	90 to 3000
100	145 to 4700	145 to 4700	145 to 4700	145 to 4700	145 to 4700
125	–	220 to 7500	220 to 7500	220 to 7500	–
[mm]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [m³/h]				
150	–	20 to 600	20 to 600	20 to 600	–
200	–	35 to 1100	35 to 1100	35 to 1100	–
250	–	55 to 1700	55 to 1700	55 to 1700	–
300	–	80 to 2400	80 to 2400	80 to 2400	–
350	–	–	110 to 3300	110 to 3300	–
375	–	–	140 to 4200	–	–
400	–	–	140 to 4200	140 to 4200	–
450	–	–	180 to 5400	180 to 5400	–
500	–	–	220 to 6600	220 to 6600	–
600	–	–	310 to 9600	310 to 9600	–
700	–	–	420 to 13500	–	–
800	–	–	550 to 18000	–	–
900	–	–	690 to 22500	–	–
1000	–	–	850 to 28000	–	–
1200	–	–	1250 to 40000	–	–
1400	–	–	1700 to 55000	–	–
1600	–	–	2200 to 70000	–	–
1800	–	–	2800 to 90000	–	–
2000	–	–	3400 to 110000	–	–

Recommended flow (US units)

Nominal diameter	Promag D	Promag L	Promag W	Promag P	Promag H
[inch]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [gal/min]				
1 1/12"	–	–	–	–	0.015 to 0.5
5/32"	–	–	–	–	0.07 to 2
5/16"	–	–	–	–	0.25 to 8
1/2"	–	–	–	1.0 to 27	1.0 to 27
1"	2.5 to 80	–	2.5 to 80	2.5 to 80	2.5 to 80
1 1/4"	–	–	4 to 130	4 to 130	–
1 1/2"	7 to 190	7 to 190	7 to 190	7 to 190	7 to 190
2"	10 to 300	10 to 300	10 to 300	10 to 300	10 to 300
2 1/2"	16 to 500	16 to 500	16 to 500	16 to 500	16 to 500
3"	24 to 800	24 to 800	24 to 800	24 to 800	24 to 800
4"	40 to 1250	40 to 1250	40 to 1250	40 to 1250	40 to 1250
5"	–	60 to 1950	60 to 1950	60 to 1950	–
6"	–	90 to 2650	90 to 2650	90 to 2650	–
8"	–	155 to 4850	155 to 4850	155 to 4850	–
10"	–	250 to 7500	250 to 7500	250 to 7500	–
12"	–	350 to 10600	350 to 10600	350 to 10600	–
14"	–	–	500 to 15000	500 to 15000	–
15"	–	–	600 to 19000	–	–
16"	–	–	600 to 19000	600 to 19000	–
18"	–	–	800 to 24000	800 to 24000	–
20"	–	–	1000 to 30000	1000 to 30000	–
24"	–	–	1400 to 44000	1400 to 44000	–
28"	–	–	1900 to 60000	–	–
30"	–	–	2150 to 67000	–	–
32"	–	–	2450 to 80000	–	–
36"	–	–	3100 to 100000	–	–
40"	–	–	3800 to 125000	–	–
42"	–	–	4200 to 135000	–	–
48"	–	–	5500 to 175000	–	–
[inch]	Min./max. full scale value (v ≈ 0.3 or 10 m/s) in [Mgal/d]				
54"	–	–	9 to 300	–	–
60"	–	–	12 to 380	–	–
66"	–	–	14 to 500	–	–
72"	–	–	16 to 570	–	–
78"	–	–	18 to 650	–	–

3.2.8 Length of connecting cable

In order to ensure measuring accuracy, comply with the following instructions when installing the remote version:

- Fix cable run or lay in armored conduit. Cable movements can falsify the measuring signal especially in the case of low fluid conductivities.
- Route the cable well clear of electrical machines and switching elements.
- Ensure potential equalization between sensor and transmitter, if necessary.
- The permitted connecting cable length L_{max} is determined by the fluid conductivity (→ 16). A minimum conductivity of 20 µS/cm is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5 µS/cm.
- The maximum connecting cable length is 10 m (32.8 ft) when empty pipe detection (EPD → 74) is switched on.

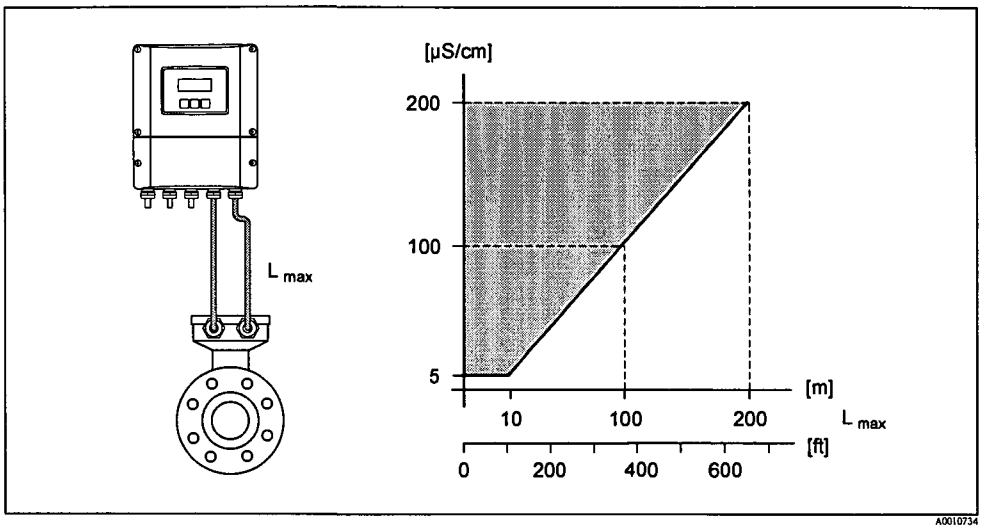


Fig. 16: Permissible cable length for the remote version

Area shaded gray = permitted range
Lmax = connecting cable length in [m]
Fluid conductivity in [µS/cm]

3.3 Installation instructions

3.3.1 Installing the Promag D sensor

The sensor is installed between the pipe flanges with a mounting kit. The device is centered using recesses on the sensor (→ 🖹 22).

Note!
A mounting kit consisting of mounting bolts, seals, nuts and washers can be ordered separately (→ 🖹 77). Centering sleeves are provided with the device if they are required for the installation.

Caution!
When installing the transmitter in the pipe, observe the necessary torques (→ 🖹 23).

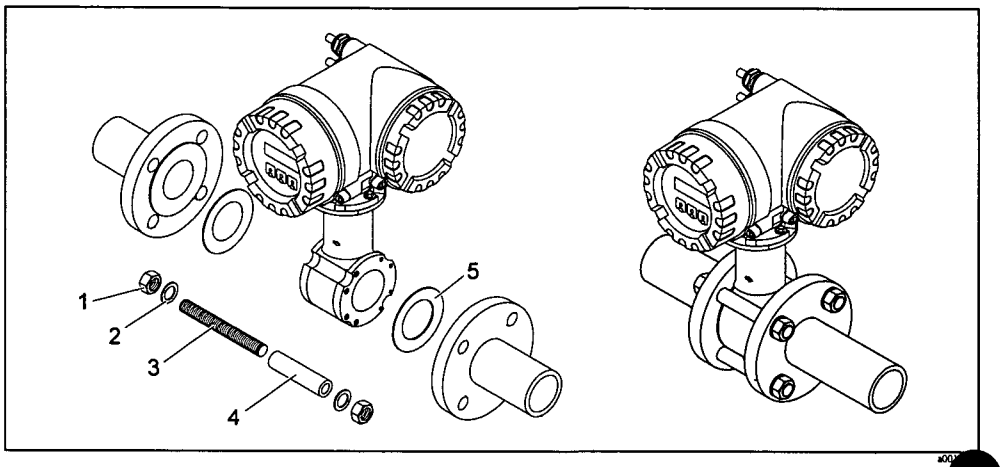


Fig. 17: Mounting the sensor

1 Nut
2 Washer
3 Mounting bolt
4 Centering sleeve
5 Seal

Seals

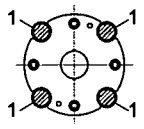
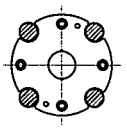
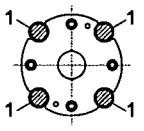
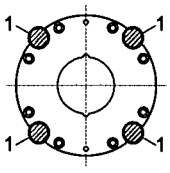
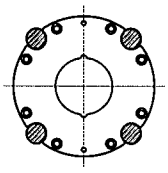
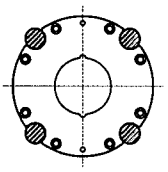
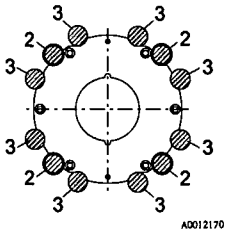
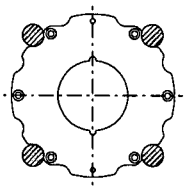
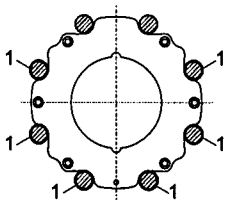
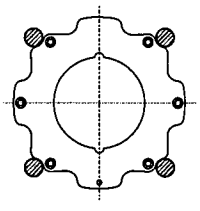
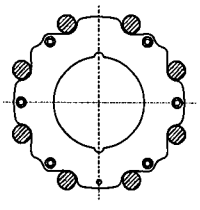
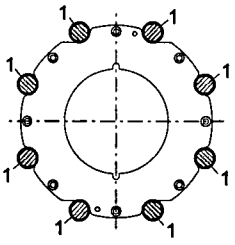
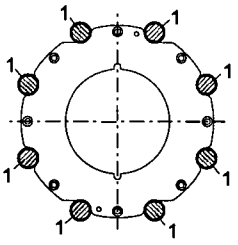
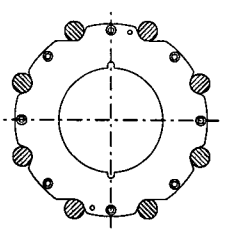
When installing the sensor, make sure that the seals used do not project into the pipe cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Note!
Use seals with a hardness rating of 70° Shore.

Arrangement of the mounting bolts and centering sleeves

The device is centered using recesses on the sensor. The arrangement of the mounting bolts and the use of the centering sleeves supplied depend on the nominal diameter, the flange standard und the pitch circle diameter.

	Process connection		
	EN (DIN)	ANSI	JIS
DN 25 to 40 (DN 1" to 1 ½")	 A0010896	 A0010824	 A0010896
DN 50 (DN 2")	 A0010897	 A0010825	 A0010825
DN 65	 A0012170	—	 A0012171
DN 80 (DN 3")	 A0010898	 A0010827	 A0010826
DN 100 (DN 4")	 A0012168	 A0012168	 A0012169

1 = Mounting bolts with centering sleeves
2 = EN (DIN) flanges: 4-hole → with centering sleeves
3 = EN (DIN) flanges: 8-hole → without centering sleeves

Screw tightening torques (Promag D)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

The tightening torques apply to situations where an EPDM soft material flat seal (e.g. 70 Shore) is used.

Tightening torques, mounting bolts and centering sleeves for EN (DIN) PN 16

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque [Nm] with a process flange with a	
			smooth seal face	raised face
25	4 × M12 × 145	54	19	19
40	4 × M16 × 170	68	33	33
50	4 × M16 × 185	82	41	41
65[1)]	4 × M16 × 200	92	44	44
65[2)]	8 × M16 × 200	–[3)]	29	29
80	8 × M16 × 225	116	36	36
100	8 × M16 × 260	147	40	40

[1)] EN (DIN) flanges: 4-hole → with centering sleeves
[2)] EN (DIN) flanges: 8-hole → without centering sleeves
[3)] A centering sleeve is not required. The device is centered directly via the sensor housing.

Tightening torques, mounting bolts and centering sleeves for JIS 10 K

Nominal diameter [mm]	Mounting bolts [mm]	Centering sleeve length [mm]	Tightening torque [Nm] with a process flange with a	
			smooth seal face	raised face
25	4 × M16 × 170	54	24	24
40	4 × M16 × 170	68	32	25
50	4 × M16 × 185	– *	38	30
65	4 × M16 × 200	– *	42	42
80	8 × M16 × 225	– *	36	28
100	8 × M16 × 260	– *	39	37

* A centering sleeve is not required. The device is centered directly via the sensor housing.

Tightening torques, mounting bolts and centering sleeves for ANSI Class 150

Nominal diameter [inch]	Mounting bolts [inch]	Centering sleeve length [inch]	Tightening torque [lbf · ft] with a process flange with a	
			smooth seal face	raised face
1"	4 × UNC 1/2" × 5.70"	– *	14	7
1 ½"	4 × UNC 1/2" × 6.50"	– *	21	14
2"	4 × UNC 5/8" × 7.50"	– *	30	27
3"	4 × UNC 5/8" × 9.25"	– *	31	31
4"	8 × UNC 5/8" × 10,4"	5,79	28	28

* A centering sleeve is not required. The device is centered directly via the sensor housing.

3.3.2 Installing the Promag L sensor

Caution!
- The protective covers mounted on the two sensor flanges are used to hold the lap joint flanges in place and to protect the PTFE liner during transportation. Consequently, do not remove these covers until immediately before the sensor is installed in the pipe.
- The covers must remain in place while the device is in storage.
- Make sure that the lining is not damaged or removed from the flanges.

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 25
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment
- To comply with the device specification, a concentrical installation in the measuring section is required

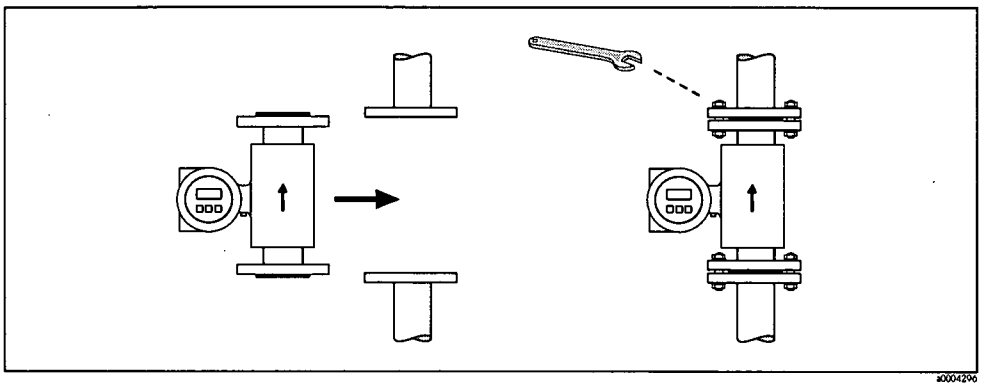


Fig. 18: Installing the Promag L sensor

Seals

Comply with the following instructions when installing seals:
- **No** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 77).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 55.

Screw tightening torques (Promag L)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Promag L tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque Polyurethan [Nm]	Max. tightening torque PTFE [Nm]
50	PN 10/16	4 × M 16	15	40
65*	PN 10/16	8 × M 16	10	22
80	PN 10/16	8 × M 16	15	30
100	PN 10/16	8 × M 16	20	42
125	PN 10/16	8 × M 16	30	55
150	PN 10/16	8 × M 20	50	90
200	PN 10	8 × M 20	65	130
250	PN 10	12 × M 20	50	90
300	PN 10	12 × M 20	55	100
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag L tightening torques for ANSI

Nominal diameter [mm]	Nominal diameter [inch]	ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque Polyurethane [Nm]	Max. tightening torque Polyurethane [lbf · ft]	Max. tightening torque PTFE [Nm]	Max. tightening torque PTFE [lbf · ft]
50	2"	Class 150	4 × 5/8"	15	11	40	29
80	3"	Class 150	4 × 5/8"	25	18	65	48
100	4"	Class 150	8 × 5/8"	20	15	44	32
150	6"	Class 150	8 × ¾"	45	33	90	66
200	8"	Class 150	8 × ¾"	65	48	125	92
250	10"	Class 150	12 × 7/8"	55	41	100	74
300	12"	Class 150	12 × 7/8"	68	56	115	85

3.3.3 Installing the Promag W sensor

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 26
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment

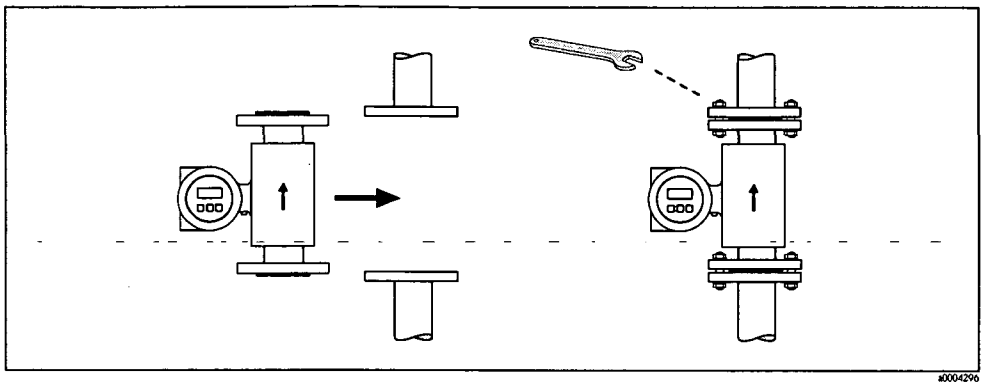


Fig. 19: Installing the Promag W sensor

Seals

Comply with the following instructions when installing seals:
- Hard rubber lining → additional seals are **always** necessary.
- Polyurethane lining → **no** seals are required.
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit!
Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 77).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 55

Screw tightening torques (Promag W)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Tightening torques for:
- EN (DIN)→ 27
- JIS→ 29
- ANSI→ 28
- AWWA → 29
- AS 2129 → 30
- AS 4087 → 30

Promag W tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm] Hard rubber	Polyurethane
25	PN 40	4 × M 12	-	15
32	PN 40	4 × M 16	-	24
40	PN 40	4 × M 16	-	31
50	PN 40	4 × M 16	-	40
65*	PN 16	8 × M 16	32	27
65	PN 40	8 × M 16	32	27
80	PN 16	8 × M 16	40	34
80	PN 40	8 × M 16	40	34
100	PN 16	8 × M 16	43	36
100	PN 40	8 × M 20	59	50
125	PN 16	8 × M 16	56	48
125	PN 40	8 × M 24	83	71
150	PN 16	8 × M 20	74	63
150	PN 40	8 × M 24	104	88
200	PN 10	8 × M 20	106	91
200	PN 16	12 × M 20	70	61
200	PN 25	12 × M 24	104	92
250	PN 10	12 × M 20	82	71
250	PN 16	12 × M 24	98	85
250	PN 25	12 × M 27	150	134
300	PN 10	12 × M 20	94	81
300	PN 16	12 × M 24	134	118
300	PN 25	16 × M 27	153	138
350	PN 6	12 × M 20	111	120
350	PN 10	16 × M 20	112	118
350	PN 16	16 × M 24	152	165
350	PN 25	16 × M 30	227	252
400	PN 6	16 × M 20	90	98
400	PN 10	16 × M 24	151	167
400	PN 16	16 × M 27	193	215
400	PN 25	16 × M 33	289	326
450	PN 6	16 × M 20	112	126
450	PN 10	20 × M 24	153	133
450	PN 16	20 × M 27	198	196
450	PN 25	20 × M 33	256	253
500	PN 6	20 × M 20	119	123
500	PN 10	20 × M 24	155	171
500	PN 16	20 × M 30	275	300
500	PN 25	20 × M 33	317	360
600	PN 6	20 × M 24	139	147
600	PN 10	20 × M 27	206	219
600 *	PN 16	20 × M 33	415	443
600	PN 25	20 × M 36	431	516
700	PN 6	24 × M 24	148	139
700	PN 10	24 × M 27	246	246
700	PN 16	24 × M 33	278	318

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm] Hard rubber	Polyurethane
700	PN 25	24 × M 39	449	507
800	PN 6	24 × M 27	206	182
800	PN 10	24 × M 30	331	316
800	PN 16	24 × M 36	369	385
800	PN 25	24 × M 45	664	721
900	PN 6	24 × M 27	230	637
900	PN 10	28 × M 30	316	307
900	PN 16	28 × M 36	353	398
900	PN 25	28 × M 45	690	716
1000	PN 6	28 × M 27	218	208
1000	PN 10	28 × M 33	402	405
1000	PN 16	28 × M 39	502	518
1000	PN 25	28 × M 52	970	971
1200	PN 6	32 × M 30	319	299
1200	PN 10	32 × M 36	564	568
1200	PN 16	32 × M 45	701	753
1400	PN 6	36 × M 33	430	398
1400	PN 10	36 × M 39	654	618
1400	PN 16	36 × M 45	729	762
1600	PN 6	40 × M 33	440	417
1600	PN 10	40 × M 45	946	893
1600	PN 16	40 × M 52	1007	1100
1800	PN 6	44 × M 36	547	521
1800	PN 10	44 × M 45	961	895
1800	PN 16	44 × M 52	1108	1003
2000	PN 6	48 × M 39	629	605
2000	PN 10	48 × M 45	1047	1092
2000	PN 16	48 × M 56	1324	1261
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag W tightening torques for ANSI

Nominal diameter [mm]	Nominal diameter [inch]	ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	Hard rubber [lbf · ft]	Polyurethane [Nm]	Polyurethane [lbf · ft]
25	1"	Class 150	4 × ½"	-	-	7	5
25	1"	Class 300	4 × 5/8"	-	-	8	6
40	1 ½"	Class 150	4 × ½"	-	-	10	7
40	1 ½"	Class 300	4 × ¾"	-	-	15	11
50	2"	Class 150	4 × 5/8"	-	-	22	16
50	2"	Class 300	8 × 5/8"	-	-	11	8
80	3"	Class 150	4 × 5/8"	60	44	43	32
80	3"	Class 300	8 × ¾"	38	28	26	19
100	4"	Class 150	8 × 5/8"	42	31	31	23
100	4"	Class 300	8 × ¾"	58	43	40	30
150	6"	Class 150	8 × ¾"	79	58	59	44
150	6"	Class 300	12 × ¾"	70	52	51	38
200	8"	Class 150	8 × ¾"	107	79	80	59
250	10"	Class 150	12 × 7/8"	101	74	75	55
300	12"	Class 150	12 × 7/8"	133	98	103	76
350	14"	Class 150	12 × 1"	135	100	158	117
400	16"	Class 150	16 × 1"	128	94	150	111
450	18"	Class 150	16 × 1 1/8"	204	150	234	173
500	20"	Class 150	20 × 1 1/8"	183	135	217	160
600	24"	Class 150	20 × 1 ¼"	268	198	307	226

Promag W tightening torques for JIS

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber	Polyurethane
25	10K	4 × M 16	-	19
25	20K	4 × M 16	-	19
32	10K	4 × M 16	-	22
32	20K	4 × M 16	-	22
40	10K	4 × M 16	-	24
40	20K	4 × M 16	-	24
50	10K	4 × M 16	-	33
50	20K	8 × M 16	-	17
65	10K	4 × M 16	55	45
65	20K	8 × M 16	28	23
80	10K	8 × M 16	29	23
80	20K	8 × M 20	42	35
100	10K	8 × M 16	35	29
100	20K	8 × M 20	56	48
125	10K	8 × M 20	60	51
125	20K	8 × M 22	91	79
150	10K	8 × M 20	75	63
150	20K	12 × M 22	81	72
200	10K	12 × M 20	61	52
200	20K	12 × M 22	91	80
250	10K	12 × M 22	100	87
250	20K	12 × M 24	159	144
300	10K	16 × M 22	74	63
300	20K	16 × M 24	138	124

Promag W tightening torques for AWWA

Nominal diameter [mm]	[inch]	AWWA Pressure rating	Threaded fasteners	Max. tightening torque Hard rubber [Nm]	[lbf · ft]	Polyurethane [Nm]	[lbf · ft]
700	28"	Class D	28 × 1 ¼"	247	182	292	215
750	30"	Class D	28 × 1 ¼"	287	212	302	223
800	32"	Class D	28 × 1 ½"	394	291	422	311
900	36"	Class D	32 × 1 ½"	419	309	430	317
1000	40"	Class D	36 × 1 ½"	420	310	477	352
1050	42"	Class D	36 × 1 ½"	528	389	518	382
1200	48"	Class D	44 × 1 ½"	552	407	531	392
1350	54"	Class D	44 × 1 ¾"	730	538	633	467
1500	60"	Class D	52 × 1 ¾"	758	559	832	614
1650	66"	Class D	52 × 1 ¾"	946	698	955	704
1800	72"	Class D	60 × 1 ¾"	975	719	1087	802
2000	78"	Class D	64 × 2"	853	629	786	580

Promag W tightening torques for AS 2129

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber
80	Table E	4 × M 16	49
100	Table E	8 × M 16	38
150	Table E	8 × M 20	64
200	Table E	8 × M 20	96
250	Table E	12 × M 20	98
300	Table E	12 × M 24	123
350	Table E	12 × M 24	203
400	Table E	12 × M 24	226
450	Table E	16 × M 24	226
500	Table E	16 × M 24	271
600	Table E	16 × M 30	439
700	Table E	20 × M 30	355
750	Table E	20 × M 30	559
800	Table E	20 × M 30	631
900	Table E	24 × M 30	627
1000	Table E	24 × M 30	634
1200	Table E	32 × M 30	727

Promag W tightening torques for AS 4087

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] Hard rubber
80	PN 16	4 × M 16	49
100	PN 16	4 × M 16	76
150	PN 16	8 × M 20	52
200	PN 16	8 × M 20	77
250	PN 16	8 × M 20	147
300	PN 16	12 × M 24	103
350	PN 16	12 × M 24	203
375	PN 16	12 × M 24	137
400	PN 16	12 × M 24	226
450	PN 16	12 × M 24	301
500	PN 16	16 × M 24	271
600	PN 16	16 × M 27	393
700	PN 16	20 × M 27	330
750	PN 16	20 × M 30	529
800	PN 16	20 × M 33	631
900	PN 16	24 × M 33	627
1000	PN 16	24 × M 33	595
1200	PN 16	32 × M 33	703

3.3.4 Installing the Promag P sensor

Caution!
- The protective covers mounted on the two sensor flanges guard the PTFE, which is turned over the flanges. Consequently, do not remove these covers until **immediately before** the sensor is installed in the pipe.
- The covers must remain in place while the device is in storage.
- Make sure that the lining is not damaged or removed from the flanges.

Note!
Bolts, nuts, seals, etc. are not included in the scope of supply and must be supplied by the customer.

The sensor is designed for installation between the two piping flanges.
- Observe in any case the necessary screw tightening torques on → 32
- If grounding disks are used, follow the mounting instructions which will be enclosed with the shipment

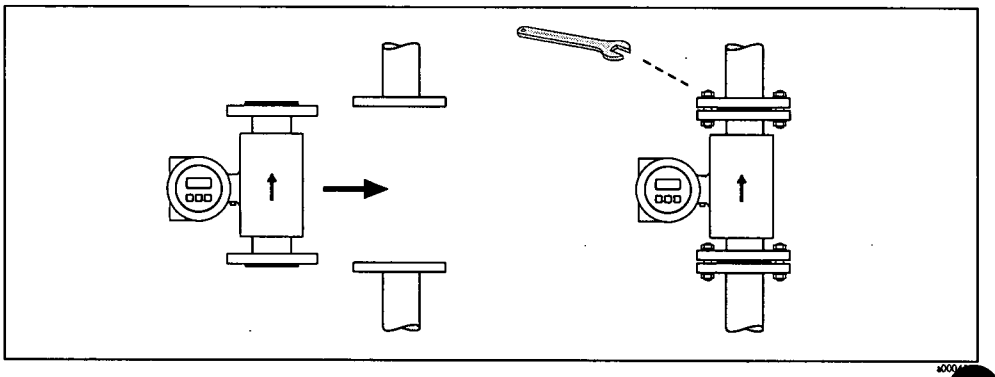


Fig. 20: Installing the Promag P sensor

Seals

Comply with the following instructions when installing seals:
- PFA or PTFE lining → **No** seals are required!
- For DIN flanges, use only seals according to EN 1514-1.
- Make sure that the seals do not protrude into the piping cross-section.

Caution!
Risk of short circuit! Do not use electrically conductive sealing compounds such as graphite! An electrically conductive layer could form on the inside of the measuring tube and short-circuit the measuring signal.

Ground cable

- If necessary, special ground cables for potential equalization can be ordered as an accessory (→ 77).
- Information on potential equalization and detailed mounting instructions for the use of ground cables can be found on → 55

Installing the high-temperature version (with PFA lining)

The high-temperature version has a housing support for the thermal separation of sensor and transmitter. The high-temperature version is always used for applications in which high ambient temperatures are encountered **in conjunction with** high fluid temperatures. The high-temperature version is obligatory if the fluid temperature exceeds +150 °C.

Note!
You will find information on permissible temperature ranges on → 🖹 102

Insulation

Pipes generally have to be insulated if they carry very hot fluids, in order to avoid energy losses and to prevent accidental contact with pipes at temperatures that could cause injury. Guidelines regulating the insulation of pipes have to be taken into account.

Caution!
Risk of measuring electronics overheating. The housing support dissipates heat and its entire surface area must remain uncovered. Make sure that the sensor insulation does not extend past the top of the two sensor shells.

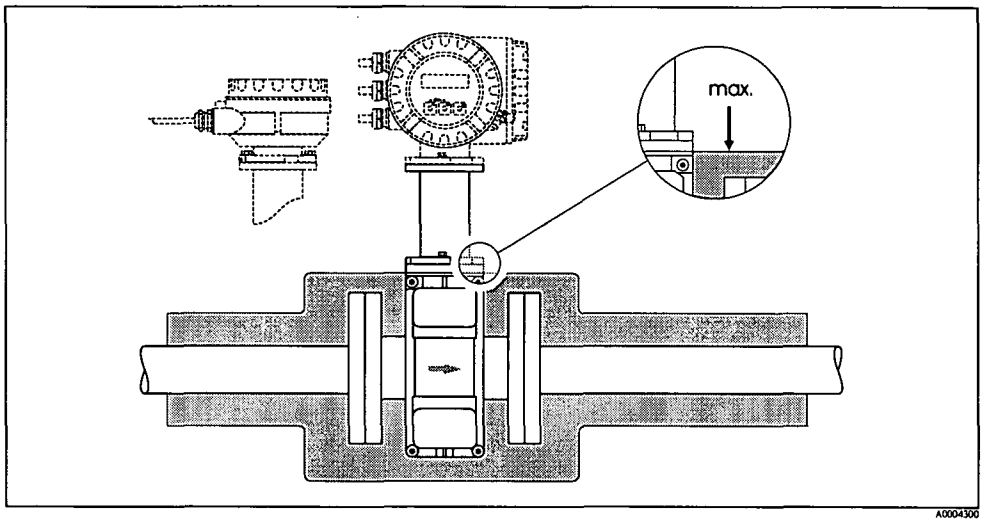


Fig. 21: Promag P (high-temperature version): Insulating the pipe

Tightening torques for threaded fasteners (Promag P)

Please note the following:
- The tightening torques listed below are for lubricated threads only.
- Always tighten the screws uniformly and in diagonally opposite sequence.
- Overtightening the screws will deform the sealing faces or damage the seals.
- The tightening torques listed below apply only to pipes not subjected to tensile stress.

Tightening torques for:
- EN (DIN) → 🖹 33
- ANSI → 🖹 34
- JIS → 🖹 34
- AS 2129 → 🖹 35
- AS 4087 → 🖹 35

Promag P tightening torques for EN (DIN)

Nominal diameter [mm]	EN (DIN) Pressure rating [bar]	Threaded fasteners	Max. tightening torque [Nm] PTFE	PFA
15	PN 40	4 × M 12	11	–
25	PN 40	4 × M 12	26	20
32	PN 40	4 × M 16	41	35
40	PN 40	4 × M 16	52	47
50	PN 40	4 × M 16	65	59
65 *	PN 16	8 × M 16	43	40
65	PN 40	8 × M 16	43	40
80	PN 16	8 × M 16	53	48
80	PN 40	8 × M 16	53	48
100	PN 16	8 × M 16	57	51
100	PN 40	8 × M 20	78	70
125	PN 16	8 × M 16	75	67
125	PN 40	8 × M 24	111	99
150	PN 16	8 × M 20	99	85
150	PN 40	8 × M 24	136	120
200	PN 10	8 × M 20	141	101
200	PN 16	12 × M 20	94	67
200	PN 25	12 × M 24	138	105
250	PN 10	12 × M 20	110	–
250	PN 16	12 × M 24	131	–
250	PN 25	12 × M 27	200	–
300	PN 10	12 × M 20	125	–
300	PN 16	12 × M 24	179	–
300	PN 25	16 × M 27	204	–
350	PN 10	16 × M 20	188	–
350	PN 16	16 × M 24	254	–
350	PN 25	16 × M 30	380	–
400	PN 10	16 × M 24	260	–
400	PN 16	16 × M 27	330	–
400	PN 25	16 × M 33	488	–
450	PN 10	20 × M 24	235	–
450	PN 16	20 × M 27	300	–
450	PN 25	20 × M 33	385	–
500	PN 10	20 × M 24	265	–
500	PN 16	20 × M 30	448	–
500	PN 25	20 × M 33	533	–
600	PN 10	20 × M 27	345	–
600 *	PN 16	20 × M 33	658	–
600	PN 25	20 × M 36	731	–
* Designed acc. to EN 1092-1 (not to DIN 2501)				

Promag P tightening torques for ANSI

Nominal diameter [mm]	Nominal diameter [inch]	ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque PTFE [Nm]	PTFE [lbf · ft]	PFA [Nm]	PFA [lbf · ft]
15	½"	Class 150	4 × ½"	6	4	–	–
15	½"	Class 300	4 × ½"	6	4	–	–
25	1"	Class 150	4 × ½"	11	8	10	7
25	1"	Class 300	4 × 5/8"	14	10	12	9
40	1 ½"	Class 150	4 × ½"	24	18	21	15
40	1 ½"	Class 300	4 × ¾"	34	25	31	23
50	2"	Class 150	4 × 5/8"	47	35	44	32
50	2"	Class 300	8 × 5/8"	23	17	22	16
80	3"	Class 150	4 × 5/8"	79	58	67	49
80	3"	Class 300	8 × ¾"	47	35	42	31
100	4"	Class 150	8 × 5/8"	56	41	50	37
100	4"	Class 300	8 × ¾"	67	49	59	44
150	6"	Class 150	8 × ¾"	106	78	86	63
150	6"	Class 300	12 × ¾"	73	54	67	49
200	8"	Class 150	8 × ¾"	143	105	109	80
250	10"	Class 150	12 × 7/8"	135	100	–	–
300	12"	Class 150	12 × 7/8"	178	131	–	–
350	14"	Class 150	12 × 1"	260	192	–	–
400	16"	Class 150	16 × 1"	246	181	–	–
450	18"	Class 150	16 × 1 1/8"	371	274	–	–
500	20"	Class 150	20 × 1 1/8"	341	252	–	–
600	24"	Class 150	20 × 1 ¼"	477	352	–	–

Promag P tightening torques for JIS

Nominal diameter [mm]	JIS Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE	PFA
25	10K	4 × M 16	32	27
25	20K	4 × M 16	32	27
32	10K	4 × M 16	38	–
32	20K	4 × M 16	38	–
40	10K	4 × M 16	41	37
40	20K	4 × M 16	41	37
50	10K	4 × M 16	54	46
50	20K	8 × M 16	27	23
65	10K	4 × M 16	74	63
65	20K	8 × M 16	37	31
80	10K	8 × M 16	38	32
80	20K	8 × M 20	57	46
100	10K	8 × M 16	47	38
100	20K	8 × M 20	75	58
125	10K	8 × M 20	80	66
125	20K	8 × M 22	121	103
150	10K	8 × M 20	99	81
150	20K	12 × M 22	108	72
200	10K	12 × M 20	82	54
200	20K	12 × M 22	121	88
250	10K	12 × M 22	133	–
250	20K	12 × M 24	212	–
300	10K	16 × M 22	99	–
300	20K	16 × M 24	183	–

Promag P tightening torques for AS 2129

Nominal diameter [mm]	AS 2129 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE
25	Table E	4 × M 12	21
50	Table E	4 × M 16	42

Promag P tightening torques for AS 4087

Nominal diameter [mm]	AS 4087 Pressure rating	Threaded fasteners	Max. tightening torque [Nm] PTFE
50	PN 16	4 × M 16	42

3.3.5 Installing the Promag H sensor

The sensor is supplied to order, with or without pre-installed process connections. Pre-installed process connections are secured to the sensor with 4 or 6 hex-head threaded fasteners.

Caution!
The sensor might require support or additional attachments, depending on the application and the length of the piping run. When plastic process connections are used, the sensor must be additionally supported mechanically. A wall-mounting kit can be ordered separately from Endress+Hauser as an accessory (→ 🖹 77).

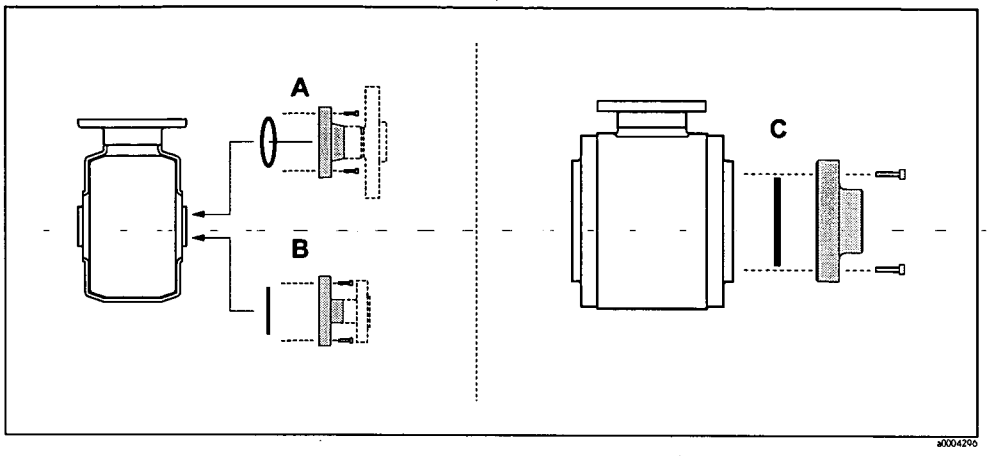


Abb. 22: Promag H process connections (DN 2...25 / DN 40...100, 1/12"...1" / DN 1½"...4")

A = DN 2...25, 1/12"...1"/ process connections with O-ring
- *welding flanges (DIN EN ISO 1127, ODT / SMS),*
- *flange (EN (DIN), ANSI, JIS), flange PVDF (EN (DIN), ANSI, JIS)*
- *external and internal thread, hose connection, PVC adhesive fitting*

B = DN 2...25, 1/12"...1"/ process connections with aseptic gasket vseal
- *weld nipples (DIN 11850, ODT/SMS)*
- *Clamp (ISO 2852, DIN 32676, L14 AM7)*
- *coupling (DIN 11851, DIN 11864-1, SMS 1145)*
- *flange DIN 11864-2*

C = DN 40...100, 1½...4"/ process connections with aseptic gasket seal
- *weld nipples (DIN 11850, ODT/SMS)*
- *Clamp (ISO 2852, DIN 32676, L14 AM7)*
- *coupling (DIN 11851, DIN 11864-1, ISO 2853, SMS 1145)*
- *flange DIN 11864-2*

Seals

When installing the process connections, make sure that the seals are clean and correctly centered.

Caution!
- With metal process connections, you must fully tighten the screws. The process connection forms a metallic connection with the sensor, which ensures a defined compression of the seal.
- With plastic process connections, note the max. torques for lubricated threads (7 Nm / 5.2 lbf ft). With plastic flanges, always use seals between connection and counter flange.
- The seals must be replaced periodically, depending on the application, particularly in the case of gasket seals (aseptic version)!
  The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the fluid temperature. Replacement seals can be ordered as accessories → 🖹 77.

Usage and assembly of ground rings (DN 2 to 25, 1/12" to 1")

In case the process connections are made of plastic (e.g. flanges or adhesive fittings), the potenti between the sensor and the fluid must be equalized using additional ground rings.
If the ground rings are not installed this can affect the accuracy of the measurements or cause the destruction of the sensor through the electrochemical erosion of the electrodes.

Caution!

- Depending on the option ordered, plastic disks may be installed at the process connections instead of ground rings. These plastic disks serve only as spacers and have no potential equalization function. In addition, they provide a sealing function at the interface between the sensor and process connection. For this reason, with process connections without ground rings, these plastic disks/seals must not be removed, or must always be installed.
- Ground rings can be ordered separately from Endress+Hauser as accessories (→ 77). When placing the order, make certain that the ground ring is compatible with the material used for the electrodes. Otherwise, there is a risk that the electrodes may be destroyed by electrochemical corrosion! Information about the materials can be found on → 112.
- Ground rings, including the seals, are mounted within the process connections. Therefore, the fitting length is not affected.

1. Loosen the four or six hexagonal headed bolts (1) and remove the process connection from the sensor (4).
2. Remove the plastic disk (3), including the two O-ring seals (2).
3. Place one seal (2) in the groove of the process connection.
4. Place the metal ground ring (3) on the process connection.
5. Now place the second seal (2) in the groove of the ground ring.
6. Finally, mount the process connection on the sensor again.
   With plastic process connections, note the max. torques for lubricated threads (7 Nm / 5.2 lbf ft).

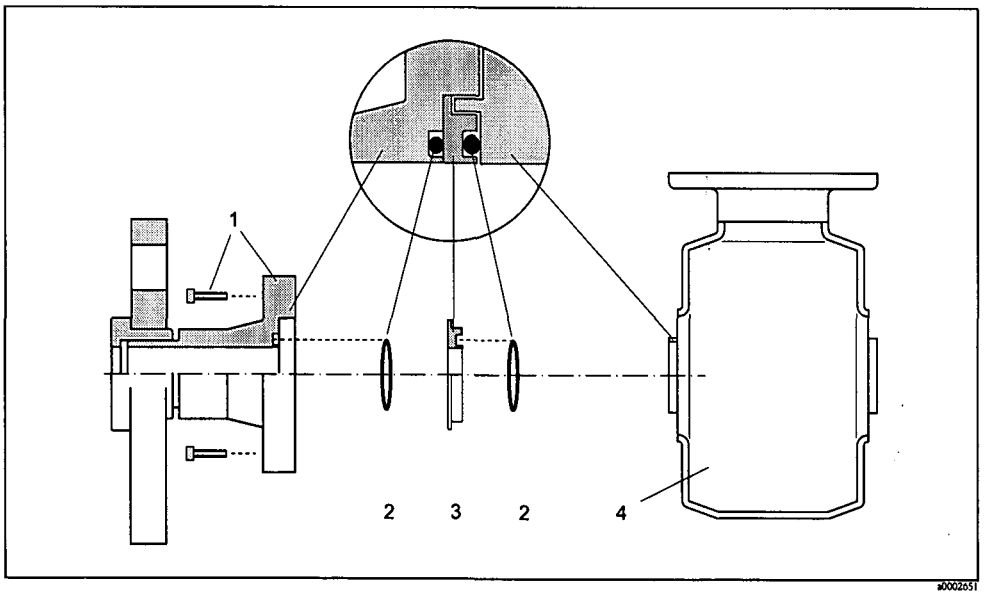


Fig. 23: Installing ground rings with Promag H (DN 2 to 25, 1/12" to 1")

1 = Hexagonal-headed bolt (process connection)
2 = O-ring seals
3 = Ground ring or plastic disk (spacer)
4 = Sensor

Welding the transmitter into the piping (weld nipples)

Caution!
Risk of destroying the measuring electronics. Make sure that the welding machine is *not* grounded via the sensor or the transmitter.

1. Tack-weld the sensor into the pipe. A suitable welding jig can be ordered separately as an accessory (→ 🖹 77).
2. Loosen the screws on the process connection flange and remove the sensor, complete with the seal, from the pipe.
3. Weld the process connection to the pipe.
4. Reinstall the sensor in the pipe. Make sure that everything is clean and that the seal is correctly seated.

Note!
- If thin-walled foodstuffs pipes are not welded correctly, the heat could damage the installed seal. It is therefore advisable to remove the sensor and the seal prior to welding.
- The pipe has to be spread approximately 8 mm to permit disassembly.

Cleaning with pigs

If pigs are used for cleaning, it is essential to take the inside diameters of the measuring tube and process connection into account. All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation "Technical Documentation" → 🖹 116.

3.3.6 Turning the transmitter housing

Turning the aluminum field housing

Warning!
The turning mechanism in devices with Ex d/de or FM/CSA Cl. I Div. 1 classification is not the same as that described here. The procedure for turning these housings is described in the Ex-specific documentation.

1. Loosen the two securing screws.
2. Turn the bayonet catch as far as it will go.
3. Carefully lift the transmitter housing:
   - Promag D: approx. 10 mm (0.39 inch) above the securing screws
   - Promag L, W, P, H: to the stop
4. Turn the transmitter housing to the desired position:
   - Promag D: max. 180° clockwise or max. 180° counterclockwise
   - Promag L, W, P, H: max. 280° clockwise or max. 20° counterclockwise
5. Lower the housing into position and re-engage the bayonet catch.
6. Retighten the two securing screws.

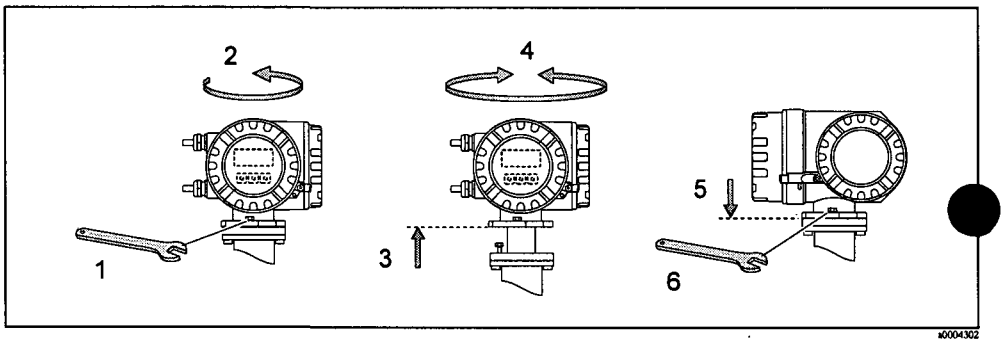


Fig. 24: Turning the transmitter housing (aluminum field housing)

Turning the stainless-steel field housing

1. Loosen the two securing screws.
2. Carefully lift the transmitter housing as far as it will go.
3. Turn the transmitter housing to the desired position (max. 2 × 90° in either direction).
4. Lower the housing into position.
5. Retighten the two securing screws.

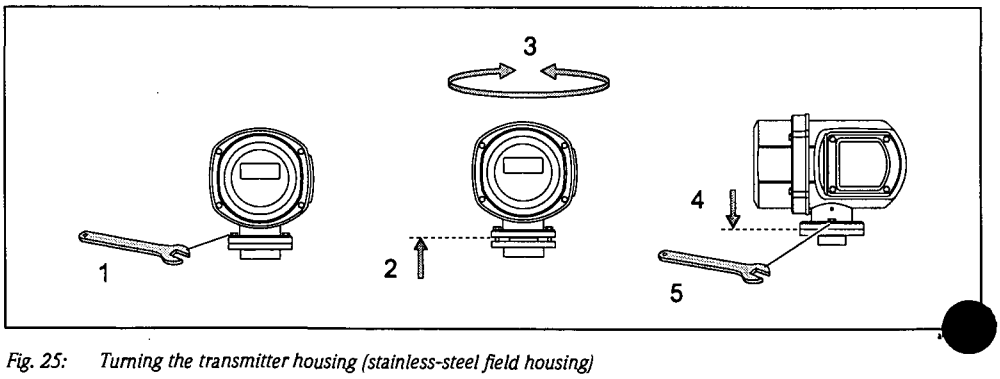


Fig. 25: Turning the transmitter housing (stainless-steel field housing)

3.3.7 Turning the onsite display

1. Unscrew the cover of the electronics compartment from the transmitter housing.
2. Press the side latches on the display module and remove it from the electronics compartment cover plate.
3. Turn the display to the desired position (max. 4 × 45° in both directions) and reset it onto the cover plate of the electronics compartment.
4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

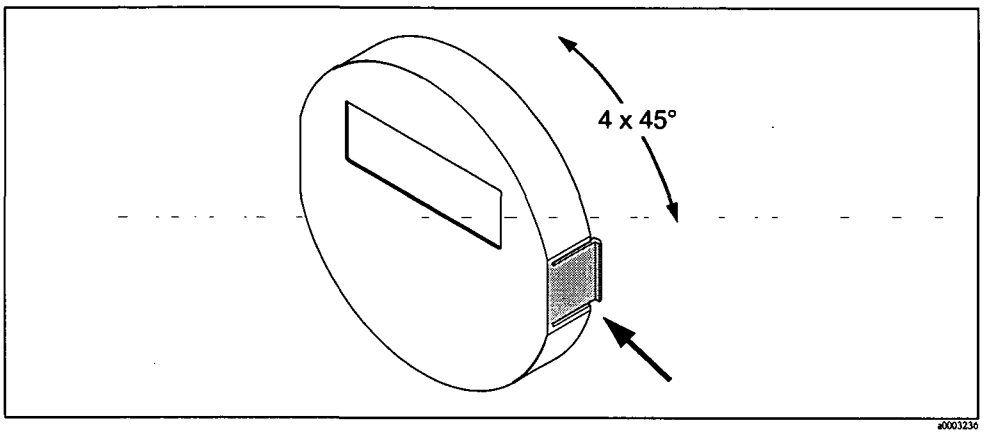


Fig. 26: Turning the local display (field housing)

3.3.8 Installing the wall-mount housing

There are various ways of installing the wall-mount transmitter housing:

- Direct wall mounting
- Installation in control panel (with separate mounting kit, accessories) → 42
- Pipe mounting (with separate mounting kit, accessories) → 42

Caution!

- Make sure that the ambient temperature does not exceed the permissible range at the mounting location, –20 to +60 °C (–4 to + °140 F), optional –40 to +60 °C (–40 to +140 °F). Install the device at a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

Direct wall mounting

1. Drill the holes as illustrated in the graphic.
2. Remove the cover of the connection compartment (a).
3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
   – Securing screws (M6): max. Ø 6.5 mm (0.26")
   – Screw head: max. Ø 10.5 mm (0.41")
4. Secure the transmitter housing to the wall as indicated.
5. Screw the cover of the connection compartment (a) firmly onto the housing.

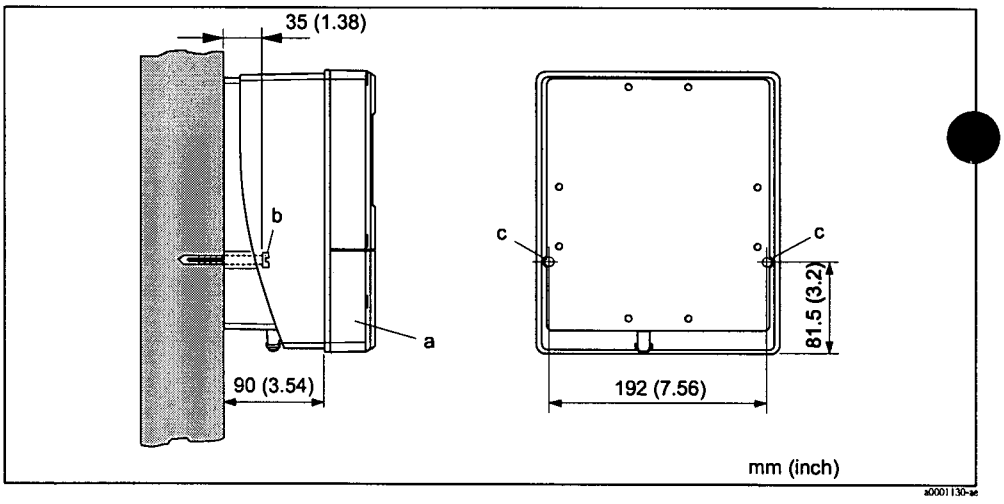


Fig. 27: Mounted directly on the wall

Panel-mounted installation

1. Prepare the opening in the panel as illustrated in the graphic.
2. Slide the housing into the opening in the panel from the front.
3. Screw the fasteners onto the wall-mount housing.
4. Place the threaded rods in the fasteners and screw them down until the housing is seated tightly against the panel. Afterwards, tighten the locking nuts. Additional support is not necessary.

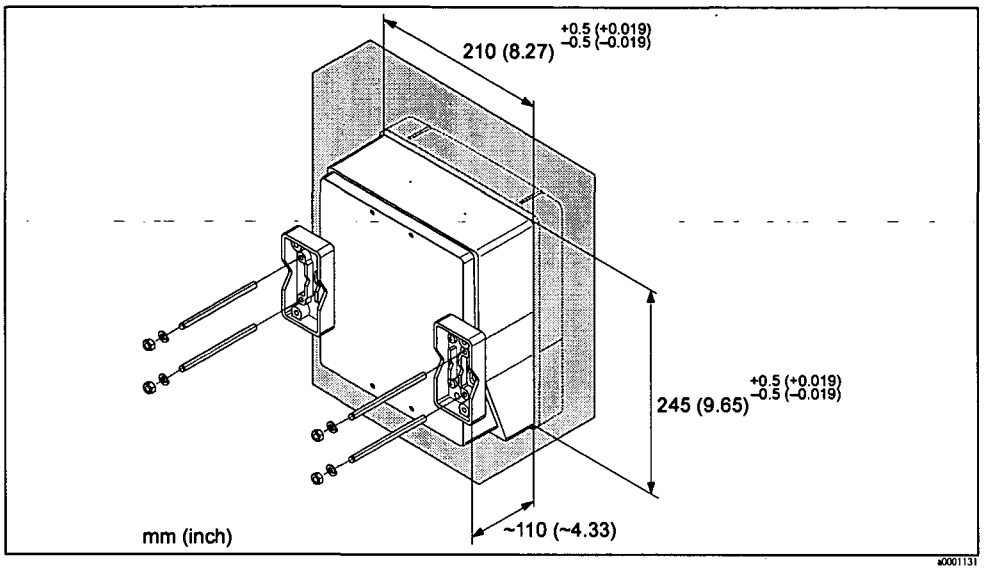


Fig. 28: Panel installation (wall-mount housing)

Pipe mounting

The assembly should be performed by following the instructions in the graphic.

Caution!
If the device is mounted to a warm pipe, make certain that the housing temperature does not exceed +60 °C (+140 °F), which is the maximum permissible temperature.

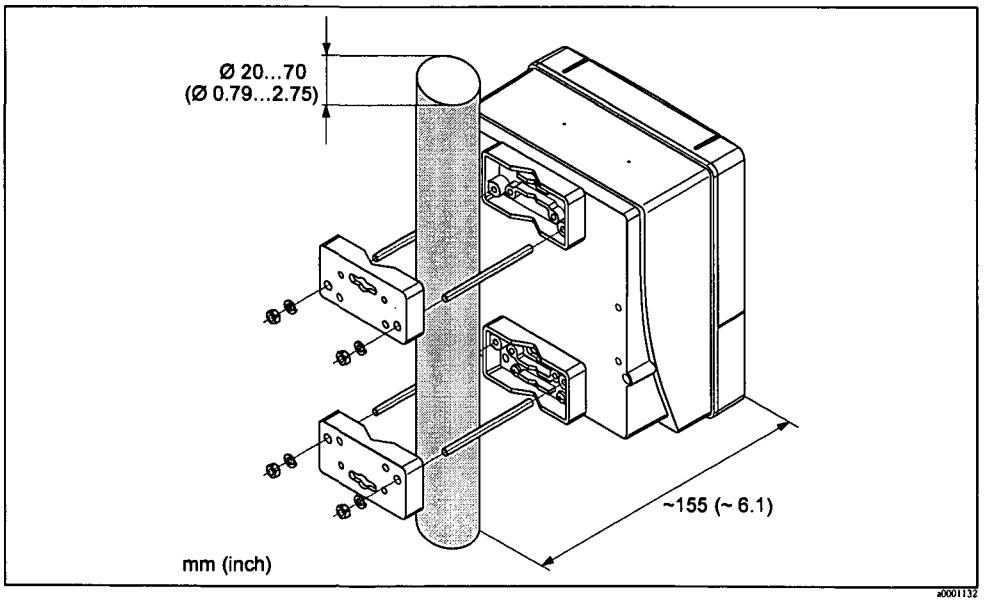


Fig. 29: Pipe mounting (wall-mount housing)

3.4 Post-installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	-
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, minimum fluid conductivity, measuring range, etc.?	→ 🖹 100
Installation	**Notes**
Does the arrow on the sensor nameplate match the actual direction of flow through the pipe?	-
Is the position of the measuring electrode plane correct?	→ 🖹 15
Is the position of the empty pipe detection electrode correct?	→ 🖹 15
Were all screws tightened to the specified torques when the sensor was installed?	Promag D → 🖹 23 Promag L → 🖹 25 Promag W → 🖹 26 Promag P → 🖹 32
Were the correct seals used (type, material, installation)?	Promag D → 🖹 21 Promag L→ 🖹 24 Promag W → 🖹 26 Promag P → 🖹 31 Promag H → 🖹 36
Are the measuring point number and labeling correct (visual inspection)?	-
Process environment / process conditions	**Notes**
Were the inlet and outlet runs respected?	Inlet run ≥ 5 × DN Outlet run ≥ 2 × DN
Is the measuring device protected against moisture and direct sunlight?	-
Is the sensor adequately protected against vibration (attachment, support)?	Acceleration up to 2 g by analogy with IEC 600 68-2-8

4 Wiring

Warning!
When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.
Please do not hesitate to contact your Endress+Hauser representative if you have any questions.

Note!
The device does not have an internal circuit breaker. For this reason, assign the device a switch or power-breaker switch capable of disconnecting the power supply line from the mains.

4.1 Connecting the remote version

4.1.1 Connecting Promag D, L, W, P, H

Warning!
- Risk of electric shock! Switch off the power supply before opening the device. Do **not** install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock! Connect the protective conductor to the ground terminal on the housing before the power supply is applied.

Caution!
- Only sensors and transmitters with the same serial number can be connected to one another. Communication problems can occur if the devices are not connected in this way.
- Risk of damaging the coil driver. Always switch off the power supply before connecting or disconnecting the coil cable.

Procedure

1. Transmitter: Remove the cover from the connection compartment (a).
2. Sensor: Remove the cover from the connection housing (b).
3. Feed the signal cable (c) and the coil cable (d) through the appropriate cable entries.

   Caution!
   Route the connecting cables securely (see "Connecting cable length" → 44).
4. Terminate the signal and coil current cable as indicated in the table:
   Promag D, L, W, P → Refer to the table → 47
   Promag H → Refer to the "Cable termination" table → 48
5. Establish the wiring between the sensor and the transmitter.
   The electrical wiring diagram that applies to your device can be found:
   - In the corresponding graphic:
     → 30 (Promag D) → 31 (Promag L, W, P); → 32 (Promag H)
   - In the cover of the sensor and transmitter

   Note!
   The cable shields of the Promag H sensor are grounded by means of the strain relief terminals (see also the "Cable termination" table → 48)

   Caution!
   Insulate the shields of cables that are not connected to eliminate the risk of short-circuits with neighboring cable shields inside the connection housing.
6. Transmitter: Screw the cover on the connection compartment (a).
7. Sensor: Secure the cover on the connection housing (b).

Promag D

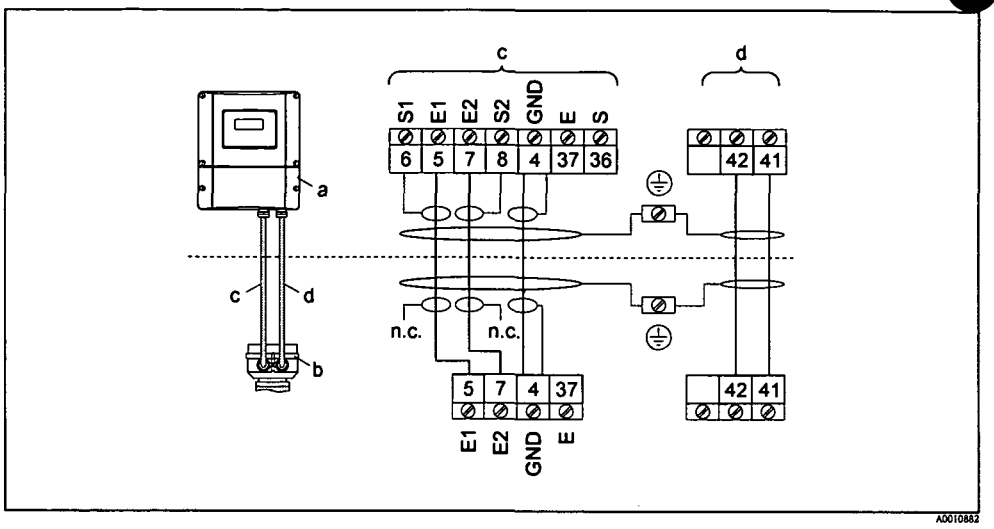


Fig. 30: Connecting the remote version of Promag D

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

Promag L, W, P

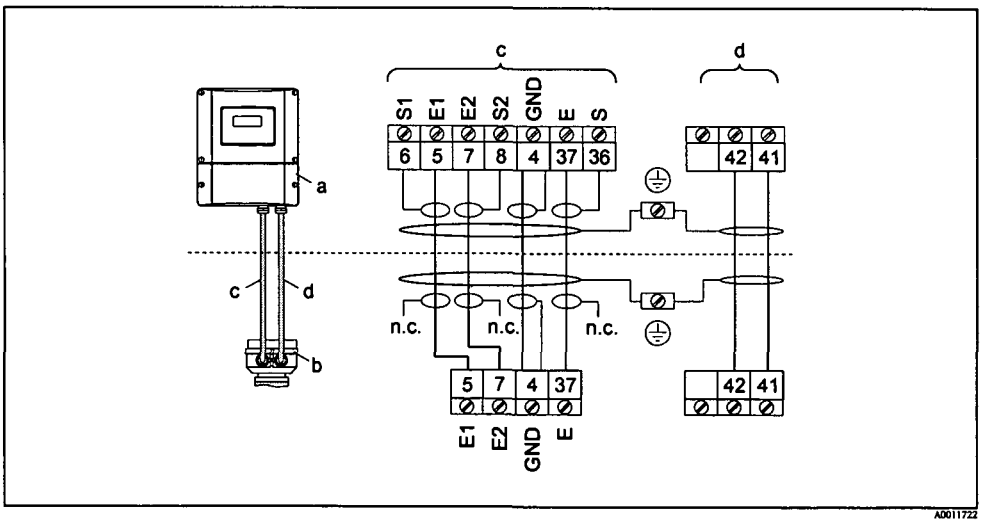


Fig. 31: Connecting the remote version of Promag L, W, P

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

Promag H

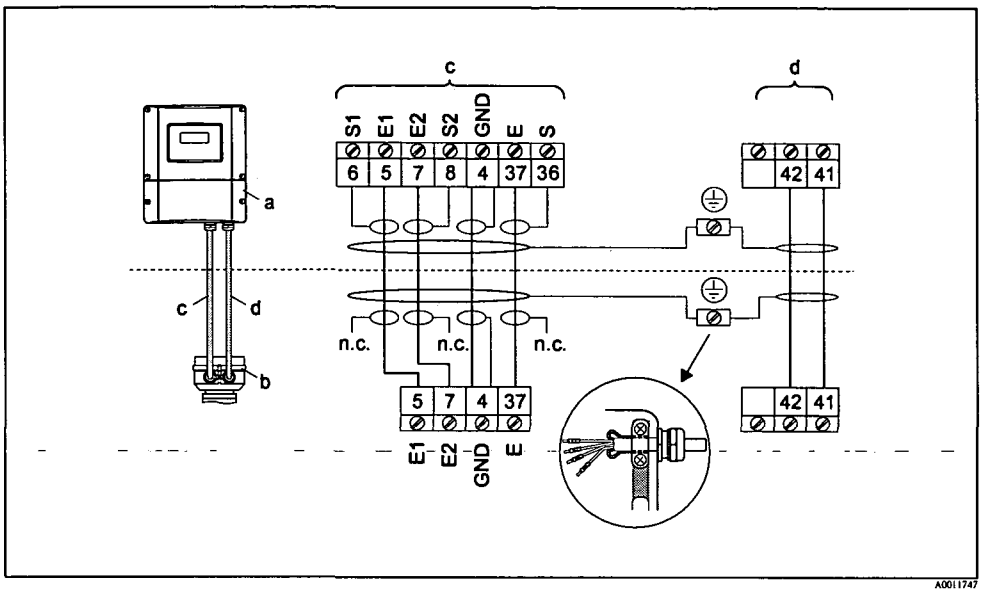


Fig. 32: Connecting the remote version of Promag H

a Wall-mount housing connection compartment
b Cover of the sensor connection housing
c Signal cable
d Coil current cable
n.c. Not connected, insulated cable shields

Wire colors/Terminal No.:
5/6 = braun, 7/8 = white, 4 = green, 37/36 = yellow

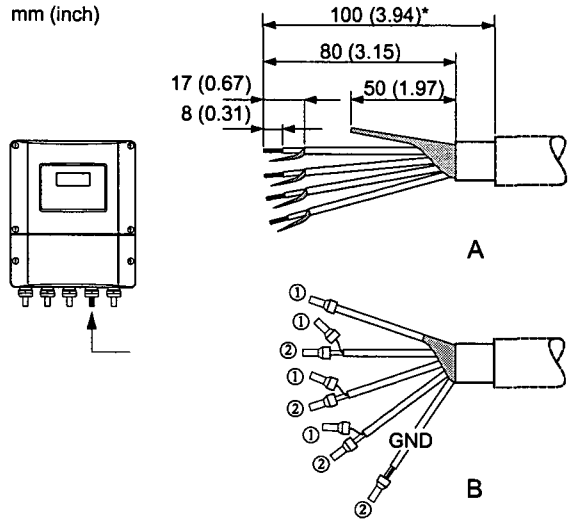
Cable termination for the remote version
Promag D / Promag L / Promag W / Promag P

Terminate the signal and coil current cables as shown in the figure below (Detail A).
Ferrules must be provided on the fine-wire cores (Detail B: ① = red ferrules, Ø 1.0 mm; ② = white ferrules, Ø 0.5 mm).
* Stripping only for reinforced cables

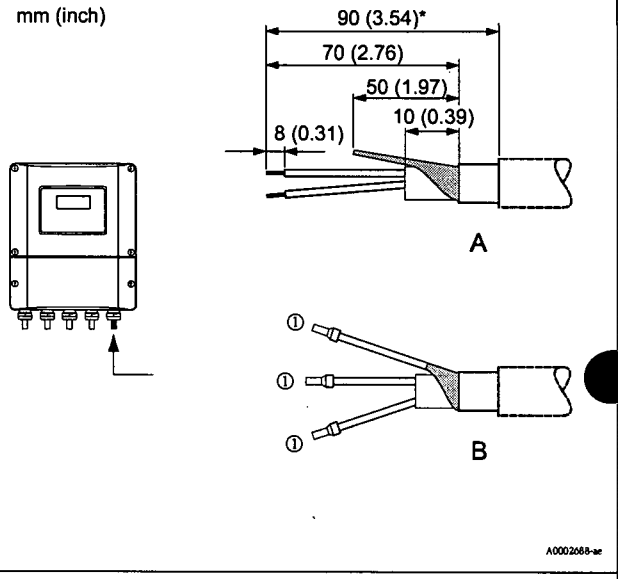
Caution!
When fitting the connectors, pay attention to the following points:
- *Signal cable* → Make sure that the ferrules do not touch the wire shield on the sensor side.
  Minimum distance = 1 mm (exception "GND" = green cable)
- *Coil current cable* → Insulate one core of the three-core wire at the level of the core reinforcement; you only require two cores for the connection.

TRANSMITTER

Signal cable

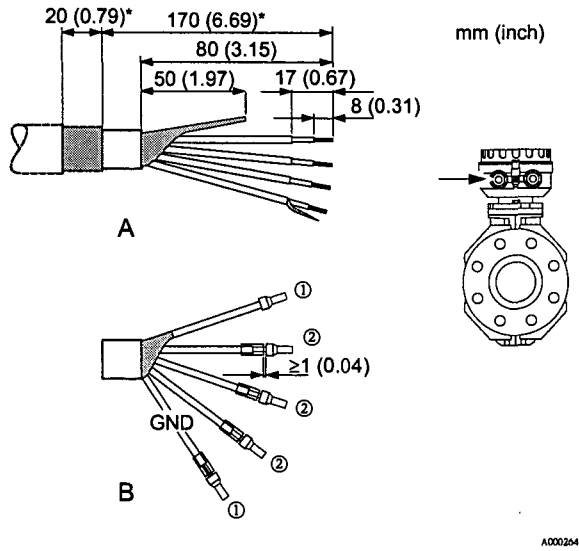


Coil current cable

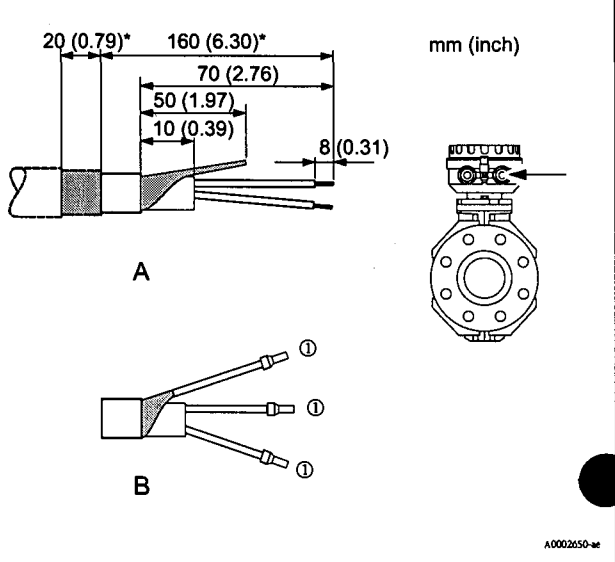


SENSOR

Signal cable



Coil current cable



Cable termination for the remote version Promag H

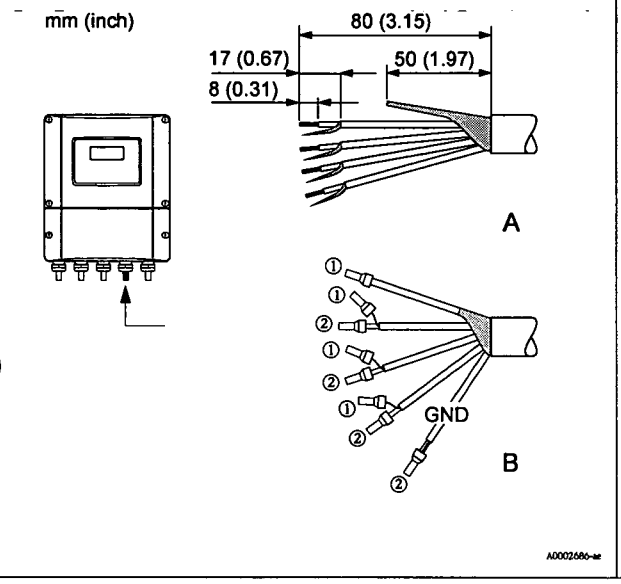
Terminate the signal and coil current cables as shown in the figure below (Detail A).
Ferrules must be provided on the fine-wire cores (Detail B: ① = red ferrules, Ø 1.0 mm; ② = white ferrules, Ø 0.5 mm).

Caution!
When fitting the connectors, pay attention to the following points:

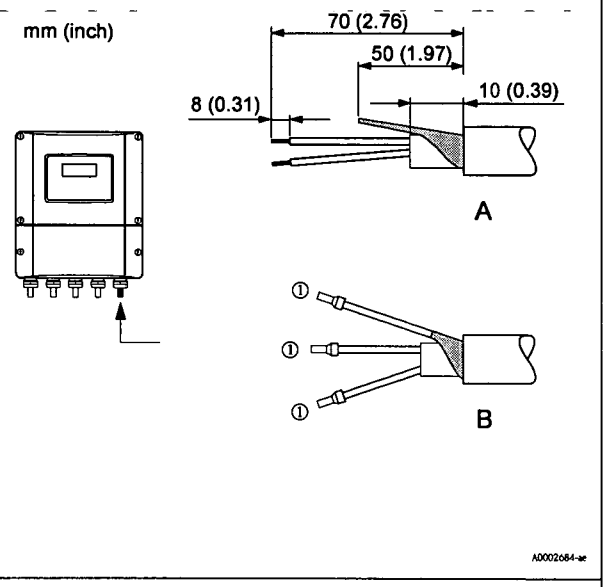
- *Signal cable* → Make sure that the ferrules do not touch the wire shield on the sensor side. Minimum distance = 1 mm (exception "GND" = green cable).
- *Coil current cable* → Insulate one core of the three-core wire at the level of the core reinforcement; you only require two cores for the connection.
- On the sensor side, reverse both cable shields approx. 15 mm over the outer jacket. The strain relief ensures an electrical connection with the connection housing.

TRANSMITTER

Signal cable

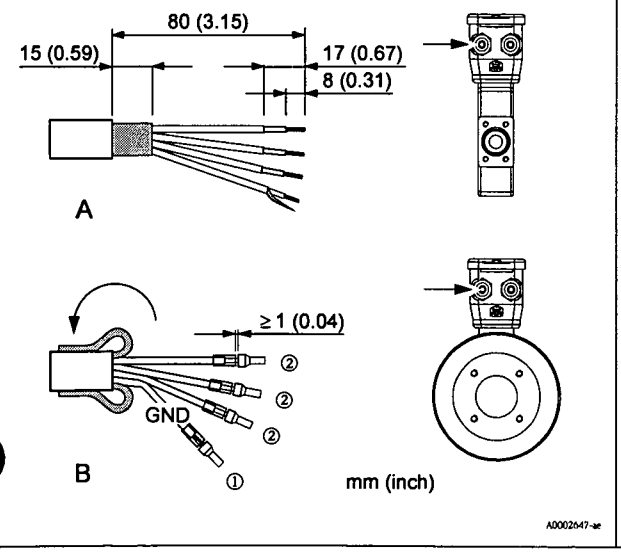


Coil current cable

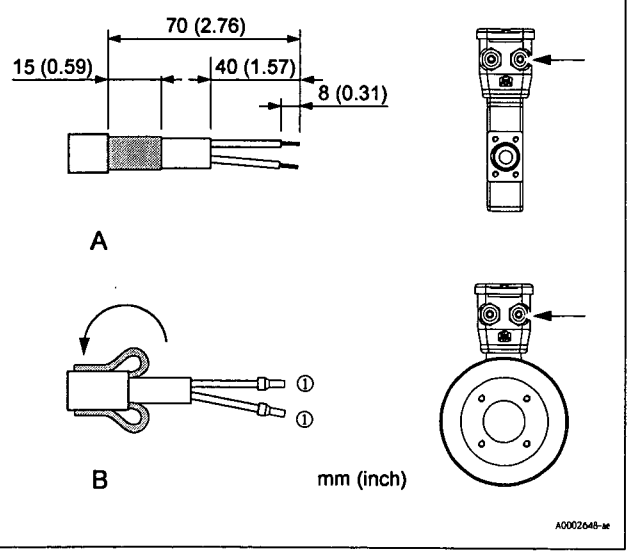


SENSOR

Signal cable



Coil current cable



4.1.2 Cable specifications

Signal cable

- 3 × 0.38 mm² PVC cable with common, braided copper shield (Ø ~7 mm) and individually shielded cores
- With Empty Pipe Detection (EPD): 4 × 0.38 mm² PVC cable with common, braided copper shield (Ø ~ 7 mm) and individually shielded cores
- Conductor resistance: ≤ 50 Ω/km
- Capacitance: core/shield: ≤ 420 pF/m
- Permanent operating temperature: –20 to +80 °C
- Cable cross-section: max. 2.5 mm²

Coil cable

- 2 × 0.75 mm² PVC cable with common, braided copper shield (Ø ~ 7 mm)
- Conductor resistance: ≤ 37 Ω/km
- Capacitance: core/core, shield grounded: ≤ 120 pF/m
- Operating temperature: –20 to +80 °C
- Cable cross-section: max. 2.5 mm²
- Test voltage for cable insulation: ≥1433 V AC r.m.s. 50/60 Hz or ≥2026 V DC

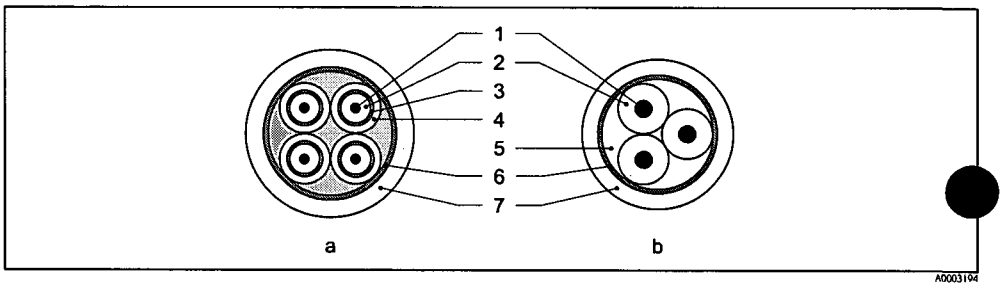


Fig. 33: Cable cross-section

a Signal cable
b Coil current cable

1 Core
2 Core insulation
3 Core shield
4 Core jacket
5 Core reinforcement
6 Cable shield
7 Outer jacket

Reinforced connecting cables

As an option, Endress+Hauser can also deliver reinforced connecting cables with an additional, reinforcing metal braid. Reinforced connecting cables should be used when laying the cable directly in the ground, if there is a risk of damage from rodents or if using the measuring device below IP 68 degree of protection.

Operation in zones of severe electrical interference:

The measuring device complies with the general safety requirements in accordance with EN 61010 and the EMC requirements of IEC/EN 61326.

Caution!
Grounding is by means of the ground terminals provided for the purpose inside the connection housing. Ensure that the stripped and twisted lengths of cable shield to the ground terminal are as short as possible.

4.2 Connecting the measuring unit

4.2.1 Connecting the transmitter

Warning!
- Risk of electric shock! Switch off the power supply before opening the device. Do not install or wire the device while it is energized. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock! Connect the protective conductor to the ground terminal on the housing before the power supply is applied (not necessary if the power supply is galvanically isolated).
- Compare the specifications on the nameplate with the local voltage supply and frequency. Also comply with national regulations governing the installation of electrical equipment.

1. Remove the cover of the connection compartment (f) from the transmitter housing.
2. Feed the power supply cable (a) and the signal cable (b) through the appropriate cable entries.
3. Perform the wiring:
   - Wiring diagram (aluminum housing) → 34
   - Wiring diagram (stainless steel housing) → 35
   - Wiring diagram (wall-mount housing) → 36
   - Terminal assignment → 52
4. Screw the cover of the connection compartment (f) firmly onto the transmitter housing.

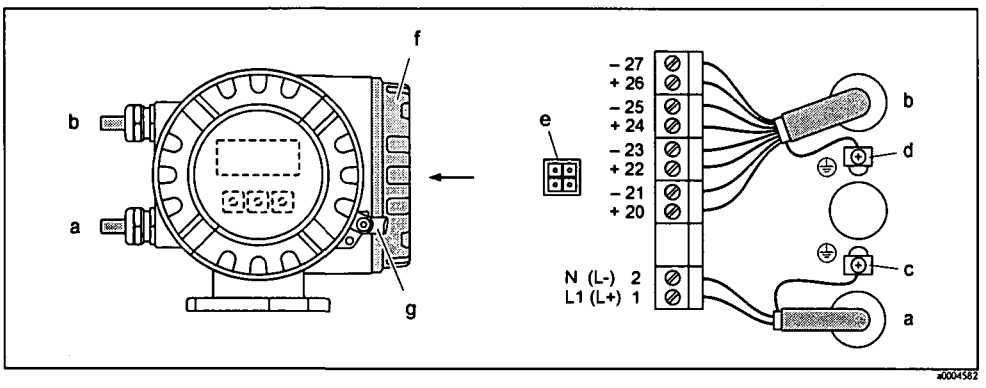


Fig. 34: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
b Signal cable: Terminals Nos. 20–27 → 52
c Ground terminal for protective ground
d Ground terminal for signal cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment
g Securing clamp

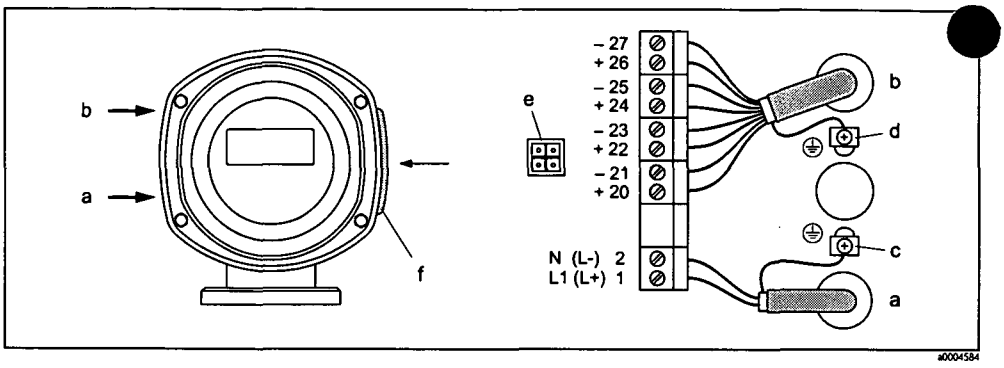


Fig. 35: Connecting the transmitter (stainless steel field housing); cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
b Signal cable: Terminals Nos. 20–27 → 52
c Ground terminal for protective ground
d Ground terminal for signal cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment

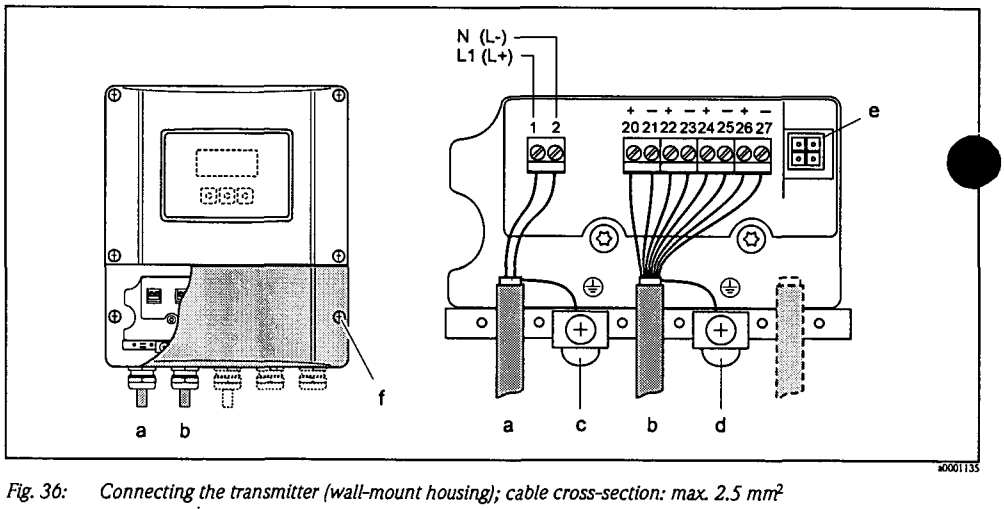


Fig. 36: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm²

a Cable for power supply: 85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC
Terminal No. 1: L1 for AC, L+ for DC
Terminal No. 2: N for AC, L- for DC
b Signal cable: Terminals Nos. 20–27 → 52
c Ground terminal for protective ground
d Ground terminal for signal cable shield
e Service connector for connecting service interface FXA193 (Fieldcheck, FieldCare)
f Cover of the connection compartment

4.2.2 Terminal assignment

Order version	Terminal No. (inputs / outputs) 20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 (+) / 27 (-)
50***-**********W	-	-	-	Current output HART
50***-**********A	-	-	Frequency output	Current output HART
50***-**********D	Status input	Status output	Frequency output	Current output HART
50***-**********S	-	-	Frequency output Ex i	Current output, Ex i, active, HART
50***-**********T	-	-	Frequency output Ex i	Current output, Ex i, passive, HART

Note!
Functional values of the inputs and outputs → 97

4.2.3 HART connection

Users have the following connection options at their disposal:
- Direct connection to transmitter by means of terminals 26(+) and 27 (–)
- Connection by means of the 4 to 20 mA circuit.
- The measuring loop's minimum load must be at least 250 Ω.
- After commissioning, make the following settings:
  - CURRENT SPAN function → "4–20 mA HART"
  - Switch HART write protection on or off → 64

Connection of the HART handheld communicator

See also the documentation issued by the HART Communication Foundation, and in particular HCF LIT 20: "HART, a technical summary".

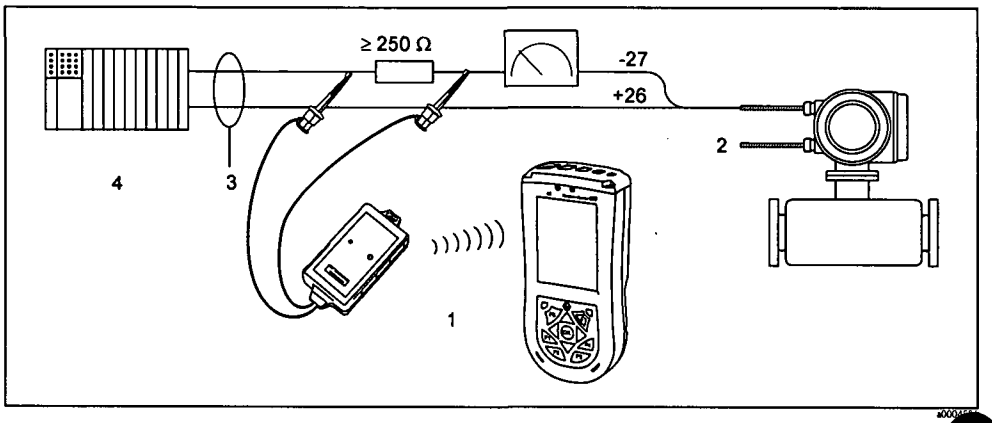


Fig. 37: Electrical connection of HART handheld Field Xpert SFX100

1 HART handheld Field Xpert SFX100
2 Auxiliary energy
3 Shielding
4 Other devices or PLC with passive input

Connection of a PC with an operating software

In order to connect a PC with operating software (e.g. "FieldCare"), a HART modem (e.g. "Commubox FXA195") is needed.

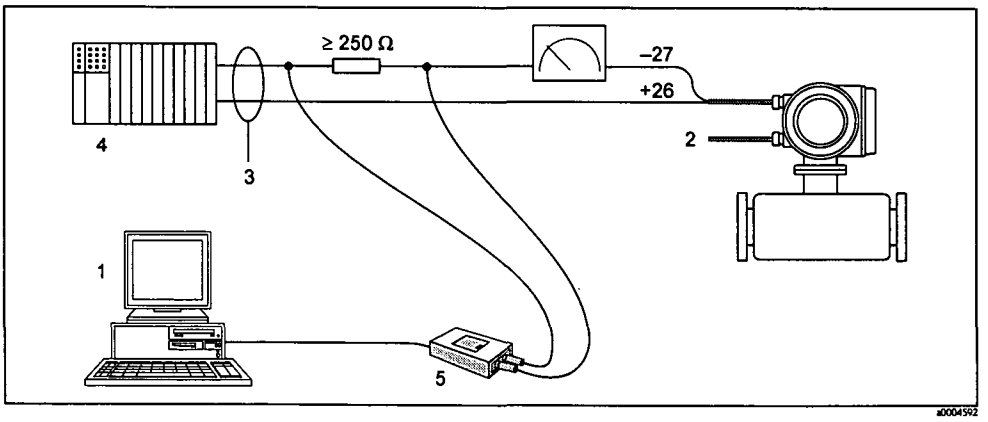


Fig. 38: Electrical connection of a PC with operating software

1 PC with operating software
2 Auxiliary energy
3 Shielding
4 Other devices or PLC with passive input
5 HART modem, e.g. Commubox FXA195

4.3 Potential equalization

Warning!
The measuring system must be included in the potential equalization.

Perfect measurement is only ensured when the fluid and the sensor have the same electrical potential. This is ensured by the reference electrode integrated in the sensor as standard.

The following should also be taken into consideration for potential equalization:
- Internal grounding concepts in the company
- Operating conditions, such as the material/grounding of the pipes (see Table)

4.3.1 Potential equalization for Promag D

- No reference electrode is integrated!
  For the two ground disks of the sensor an electrical connection to the fluid is always ensured.
- Exampels for connections → 54

4.3.2 Potential equalization for Promag W, P, L

- Reference electrode integrated in the sensor as standard
- Exampels for connections → 55

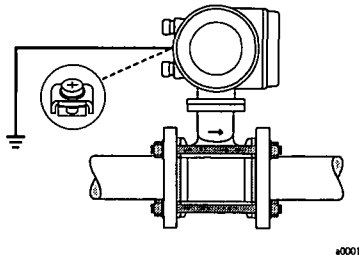
4.3.3 Potential equalization for Promag H

No reference electrode is integrated!
For the metal process connections of the sensor an electrical connection to the fluid is always ensured.

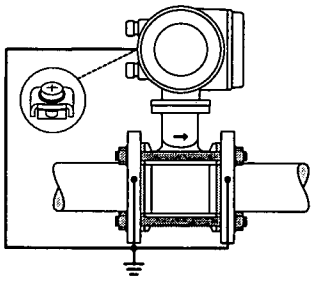
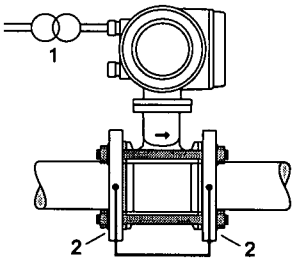
Caution!
If using process connections made of a synthetic material, ground rings have to be used to ensure that potential is equalized (→ 37). The necessary ground rings can be ordered separately from Endress+Hauser as accessories (→ 77).

4.3.4 Exampels for potential equalization connections for Promag D

Standard case

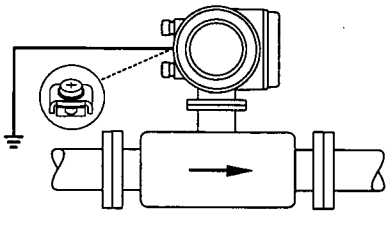
Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal, grounded pipe ▪ Plastic pipe ▪ Pipe with insulating lining Potential equalization takes place via the ground terminal of the transmitter (standard situation). Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 a00012172 *Fig. 39: Via the ground terminal of the transmitter*

Special cases

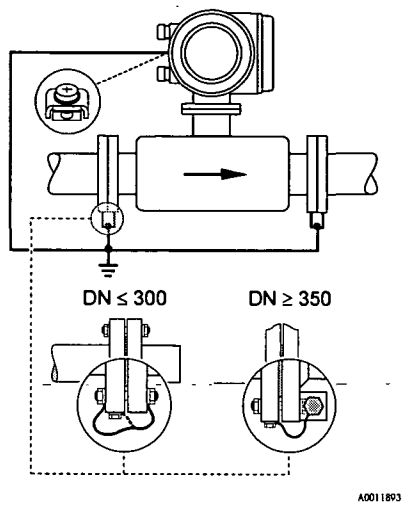
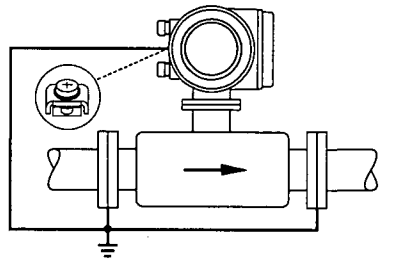
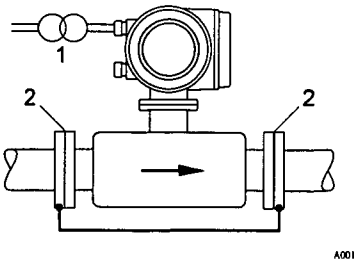
Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal pipe that is not grounded This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Potential equalization takes place via the ground terminal of the transmitter and the two pipe flanges. Here, the ground cable (copper wire, 6 mm² (0.0093 in²)) is mounted directly on the conductive flange coating with flange screws.	 a00012173 *Fig. 40: Via the ground terminal of the transmitter and the flanges of the pipe .*
When using the measuring device in a: ▪ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, 6 mm² (0.0093 in²)). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ▪ The applicable regulations regarding potential-free installation must be observed. ▪ There should be **no** electrically conductive connection between the pipe and the device. ▪ The mounting material must withstand the applicable torques.	 a00012174 *Fig. 41: Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

4.3.5 Exampels for potential equalization connections for Promag L, W, P

Standard case

Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal, grounded pipe Potential equalization takes place via the ground terminal of the transmitter (standard situation). Note! When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.	 A0011892 *Fig. 42: Via the ground terminal of the transmitter*

Special cases

Operating conditions	Potential equalization
When using the measuring device in a: ▪ Metal pipe that is not grounded This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, 6 mm² (0.0093 in²)) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose. Ground cable installation depends on the nominal diameter: ▪ DN ≤ 300: The ground cable is mounted directly on the conductive flange coating with the flange screws. ▪ DN ≥ 350: The ground cable is mounted directly on the metal transport bracket. Note! The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.	 *Fig. 43: Via the ground terminal of the transmitter and the flanges of the pipe*
When using the measuring device in a: ▪ Plastic pipe ▪ Pipe with insulating lining This connection method also applies in situations where: ▪ Customary potential equalization cannot be ensured ▪ Excessively high equalizing currents can be expected Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, min. 6 mm² (0.0093 in²)). When installing the ground disks, please comply with the enclosed Installation Instructions.	 *Fig. 44: Via the ground terminal of the transmitter*
When using the measuring device in a: ▪ Pipe with a cathodic protection unit The device is installed potential-free in the pipe. Only the two flanges of the pipe are connected with a ground cable (copper wire, 6 mm² (0.0093 in²)). Here, the ground cable is mounted directly on the conductive flange coating with flange screws. Note the following when installing: ▪ The applicable regulations regarding potential-free installation must be observed. ▪ There should be **no** electrically conductive connection between the pipe and the device. ▪ The mounting material must withstand the applicable torques.	 *Fig. 45: Potential equalization and cathodic protection* *1 Power supply isolation transformer* *2 Electrically isolated*

4.4 Degree of protection

The devices meet all the requirements of IP 67 degree of protection.

Compliance with the following points is mandatory following installation in the field or servicing in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- All threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter → 🖹 49.
- Firmly tighten the cable entries.
- The cables must loop down before they enter the cable entries ("water trap"). This arrangement prevents moisture penetrating the entry. Always install the measuring device in such a way that the cable entries do not point up.
- Remove all unused cable entries and insert plugs instead.
- Do not remove the grommet from the cable entry.

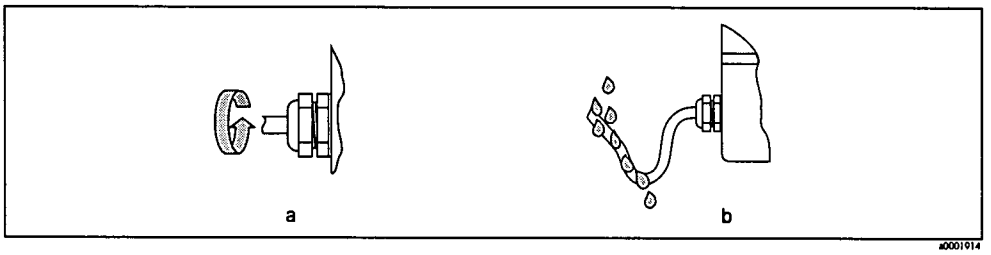


Fig. 46: Installation instructions, cable entries

Caution!
Do not loosen the threaded fasteners of the sensor housing, as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.

Note!
The Promag L, Promag W and Promag P sensors can be supplied with IP 68 rating (permanent immersion in water to a depth of 3 meters (10 ft)). In this case the transmitter must be installed remote from the sensor.
The Promag L sensors with IP 68 rating are only available with stainless steel flanges.

4.5 Post-connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	-
Electrical connection	**Notes**
Does the supply voltage match the specifications on the nameplate?	▪ 85 to 250 V AC (50 to 60 Hz) ▪ 20 to 28 V AC (50 to 60 Hz) 11 to 40 V DC
Do the cables used comply with the necessary specifications?	→ 🖹 49
Do the cables have adequate strain relief?	-
Is the cable type route completely isolated? Without loops and crossovers?	-
Are the power-supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	-
Have the measures for grounding/potential equalization been correctly implemented?	→ 🖹 54
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 🖹 57
Are all housing covers installed and firmly tightened?	-

5 Operation

5.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device.
The display area consists of two lines; this is where measured values are displayed, and/or status variables (direction of flow, partially filled pipe, bar graph, etc.). You can change the assignment of display lines to variables at will in order to customize the display to suit your needs and preferences (→ "Description of Device Functions" manual).

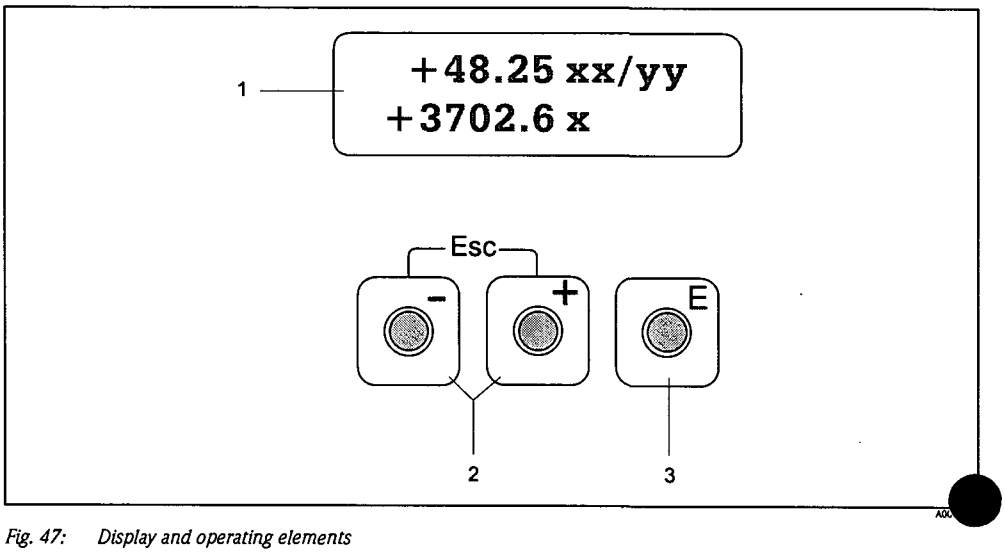


Fig. 47: Display and operating elements

1 Liquid crystal display
The two-line liquid-crystal display shows measured values, dialog texts, error messages and information messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).
- *Upper display line: Shows primary measured values, e.g. volume flow in [ml/min] or in [%].*
- *Lower display line: Shows supplementary measured variables and status variables, e.g. totalizer reading in [m3], bar graph, measuring point designation*

2 Plus/minus keys
- *Enter numerical values, select parameters*
- *Select different function groups within the function matrix*

Press the +/- keys simultaneously to trigger the following functions:
- *Exit the function matrix step by step → HOME position*
- *Press and hold down +/- keys for longer than 3 seconds → Return directly to HOME position*
- *Cancel data entry*

3 Enter key
- *HOME position → Entry into the function matrix*
- *Save the numerical values you input or settings you change*

5.2 Brief operating instructions on the function matrix

Note!
- See the general notes on → 61.
- Detailed description of all the functions → "Description of Device Functions" manual

The function matrix comprises two levels, namely the function groups and the functions of the function groups.
The groups are the highest-level grouping of the control options for the device. A number of functions is assigned to each group. You select a group in order to access the individual functions for operating and configuring the device.

1. HOME position → E → Enter the function matrix
2. Select a function group (e.g. OPERATION)
3. Select a function (e.g. LANGUAGE)
   Change parameter/enter numerical values:
   ± → select or enter enable code, parameters, numerical values
   E → save your entries
4. Exit the function matrix:
   – Press and hold down Esc key (⌐ESC) for longer than 3 seconds → HOME position
   – Repeatedly press Esc key (⌐ESC) → return step by step to HOME position

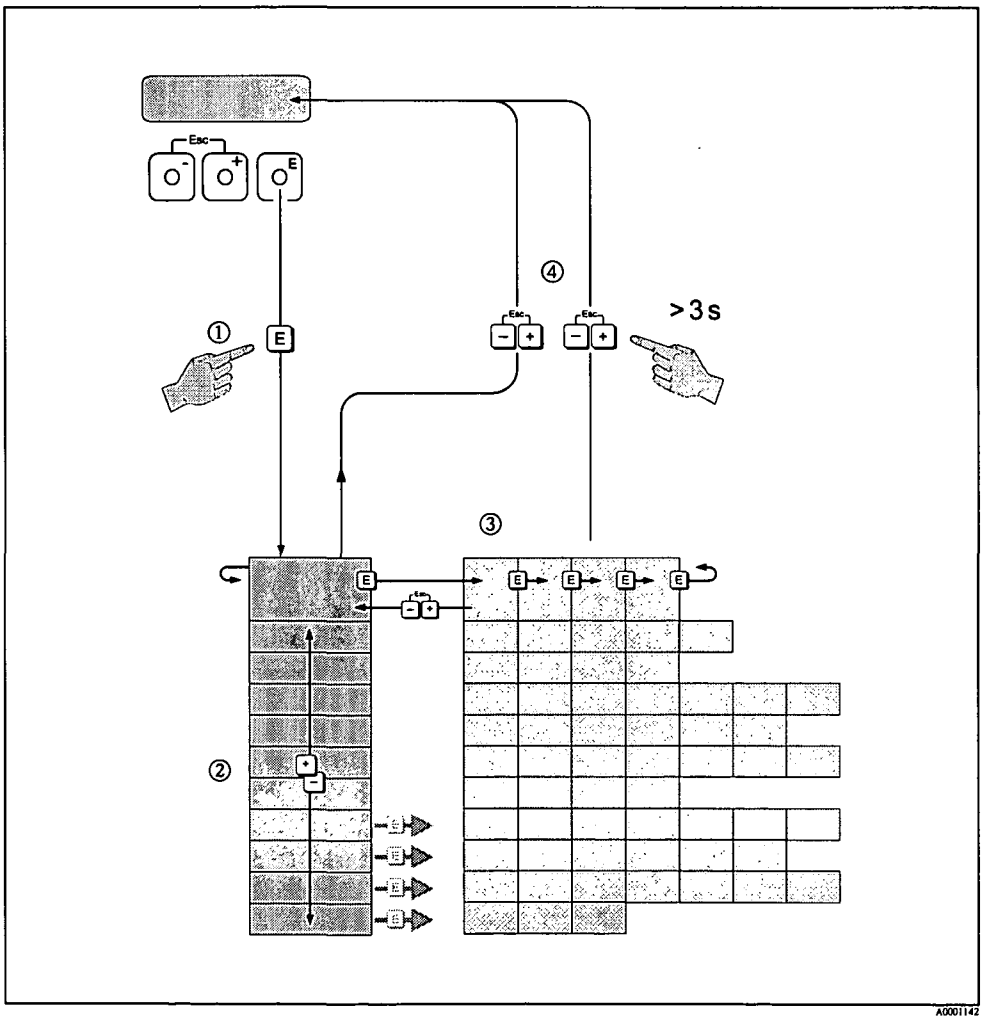


Fig. 48: Selecting functions and configuring parameters (function matrix)

5.2.1 General notes

The Quick Setup menu (→ 📄 71) is adequate for commissioning in most instances. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged in a number of function groups.

Comply with the following instructions when configuring functions:
- You select functions as described on → 📄 60.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries.
  Press ± to select "SURE [YES]" and press E again to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.

Note!
- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs in the normal way.
- If the power supply fails, all preset and configured values remain safely stored in the EEPROM.

Caution!
All functions are described in detail, including the function matrix itself, in the "Description of Device Functions" manual, which is a separate part of these Operating Instructions.

5.2.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 50) has to be entered before settings can be changed.
If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data (→ see the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:
- If programming is disabled and the ± operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is specified as the customer's code, programming is always enabled.
- The Endress+Hauser service organization can be of assistance if you mislay your personal code.

Caution!
Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy.
There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization.
Please contact Endress+Hauser if you have any questions.

5.2.3 Disabling the programming mode

Programming is disabled if you do not press the operating elements within 60 seconds following automatic return to the HOME position.
You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

5.3 Displaying error messages

5.3.1 Type of error

Errors which occur during commissioning or measuring operation are displayed immediately. If two or more system or process errors occur, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:
- *System errors* → 🖹 81*:*
  This group comprises all device errors, e.g. communication errors, hardware faults, etc.
- *Process errors* → 🖹 83:
  This group comprises all application errors, e.g. empty pipe, etc.

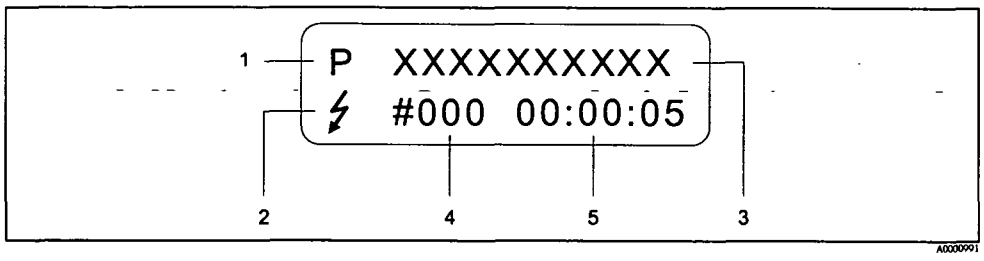


Fig. 49: Error messages on the display (example)

1 Error type:
– P = process error
– S = system error
2 Error message type:
– ϟ = fault message
– ! = notice message
3 Error designation: e.g. EMPTY PIPE = measuring tube is only partly filled or completely empty
4 Error number: e.g. #401
5 Duration of most recent error occurrence (in hours, minutes and seconds)

5.3.2 Error message types

Users have the option of weighting certain errors differently, in other words having them classed as "Fault messages" or "Notice messages". You can define messages in this way with the aid of the function matrix (→ "Description of Device Functions" manual).
Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)

- Displayed as → Exclamation mark (!), error type (S: system error, P: process error)
- The error in question has no effect on the outputs of the measuring device.

Fault message ϟ)

- Displayed as → Lightning flash (ϟ), error type (S: system error, P: process error).
- The error in question has a direct effect on the outputs.
  The response of the individual outputs (failsafe mode) can be defined in the function matrix using the "FAILSAFE MODE" function (→ "Description of Device Functions" manual).

Note!
For security reasons, error messages should be output via the status output.

5.4 Communication

In addition to local operation, the measuring device can be configured and measured values can be obtained by means of the HART protocol. Digital communication takes place using the 4–20 mA current output HART → 53.

The HART protocol allows the transfer of measuring and device data between the HART master and the field devices for configuration and diagnostics purposes.
The HART master, e.g. a handheld terminal or PC-based operating programs (such as FieldCare), require device description (DD) files which are used to access all the information in a HART device. Information is exclusively transferred using so-called "commands". There are three different command classes:

- *Universal commands:*
  All HART device support and use universal commands.
  The following functionalities are linked to them:
  – Identify HART devices
  – Reading digital measured values (volume flow, totalizer, etc.)
- *Common practice commands:*
  Common practice commands offer functions which are supported and can be executed by most but not all field devices.
- *Device-specific commands:*
  These commands allow access to device-specific functions which are not HART standard. Such commands access individual field device information, amongst other things, such as empty/full pipe calibration values, low flow cutoff settings, etc.

Note!
The device has access to all three command classes. A list of all the "Universal commands" and "Common practice commands" is provided on → 65.

5.4.1 Operating options

For the complete operation of the measuring device, including device-specific commands, there are DD files available to the user to provide the following operating aids and programs:

Field Xpert HART Communicator

Selecting device functions with a HART Communicator is a process involving a number of menu levels and a special HART function matrix.
The HART manual in the carrying case of the HART Communicator contains more detailed information on the device.

Operating program "FieldCare"

FieldCare is Endress+Hauser's FDT-based plant Asset Management Tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flow measuring devices are accessed via a service interface or via the service interface FXA193.

Operating program "SIMATIC PDM" (Siemens)

SIMATIC PDM is a standardized, manufacturer-independent tool for the operation, configuration, maintenance and diagnosis of intelligent field devices.

Operating program "AMS" (Emerson Process Management)

AMS (Asset Management Solutions): program for operating and configuring devices.

5.4.2 Current device description files

The following table illustrates the suitable device description file for the operating tool in question and then indicates where these can be obtained.

HART protocol:

Valid for device software:	2.03.XX	→ Function DEVICE SOFTWARE
Device data HART Manufacturer ID: Device ID:	 11_{hex} (ENDRESS+HAUSER) 41_{hex}	 → Function MANUFACTURER ID → Function DEVICE ID
HART version data:	Device Revision 6/ DD Revision 1	
Software release:	07.2009	

Operating program:	Sources for obtaining device descriptions:
Handheld Field Xpert SFX100	Use update function of handheld terminal
FieldCare / DTM	▪ www.endress.com → Download ▪ CD-ROM (Endress+Hauser order number 56004088) ▪ DVD (Endress+Hauser order number 70100690)
AMS	www.endress.com → Download
SIMATIC PDM	www.endress.com → Download

Tester/simulator:	Sources for obtaining device descriptions:
Fieldcheck	Update by means of FieldCare with the flow device FXA193/291 DTM in the Fieldflash module

Note!
The "Fieldcheck" tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.

5.4.3 Device variables

The following device variables are available using the HART protocol:

Code (decimal)	Device variable
0	OFF (not assigned)
1	Volume flow
250	Totalizer 1
251	Totalizer 2

At the factory, the process variables are assigned to the following device variables:
- Primary process variable (PV) → Volume flow
- Second process variable (SV) → Totalizer 1
- Third process variable (TV) → not assigned
- Fourth process variable (FV) → not assigned

Note!
You can set or change the assignment of device variables to process variables using Command 51.

5.4.4 Switching HART write protection on/off

The HART write protection can be switched on and off using the HART WRITE PROTECT device function (→ "Description of Device Functions" manual).

5.4.5 Universal and common practice HART commands

The following table contains all the universal commands supported by the device.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Universal commands			
0	Read unique device identifier Access type = read	none	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 65 = Promag 50 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9–11: Device identification
1	Read primary process variable Access type = read	none	– Byte 0: HART unit code of the primary process variable – Bytes 1–4: Primary process variable Factory setting: Primary process variable = Volume flow Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.
2	Read the primary process variable as current in mA and percentage of the set measuring range Access type = read	none	– Bytes 0–3: actual current of the primary process variable in mA – Bytes 4–7: % value of the set measuring range Factory setting: Primary process variable = Volume flow Note! You can change the assignment of device variables to process variables using Command 51.
3	Read the primary process variable as current in mA and four dynamic process variables Access type = read	none	24 bytes are sent as a response: – Bytes 0–3: primary process variable current in mA – Byte 4: HART unit code of the primary process variable – Bytes 5–8: Primary process variable – Byte 9: HART unit code of the second process variable – Bytes 10–13: Second process variable – Byte 14: HART unit code of the third process variable – Bytes 15–18: Third process variable – Byte 19: HART unit code of the fourth process variable – Bytes 20–23: Fourth process variable *Factory setting:* ▪ Primary process variable = Volume flow ▪ Second process variable = Totalizer 1 ▪ Third process variable = OFF (not assigned) ▪ Fourth process variable = OFF (not assigned) Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
0	Set HART shortform address Access type = write	Byte 0: desired address (0 to 15) Factory setting: 0 Note! With an address >0 (multidrop mode), the current output of the primary process variable is set to 4 mA.	Byte 0: active address
11	Read unique device identification using the TAG (measuring point designation) Access type = read	Bytes 0-5: TAG	Device identification delivers information on the device and the manufacturer. It cannot be changed. The response consists of a 12 byte device ID if the given TAG agrees with the one saved in the device: – Byte 0: fixed value 254 – Byte 1: Manufacturer ID, 17 = E+H – Byte 2: Device type ID, 65 = Promag 50 – Byte 3: Number of preambles – Byte 4: Universal commands rev. no. – Byte 5: Device-specific commands rev. no. – Byte 6: Software revision – Byte 7: Hardware revision – Byte 8: Additional device information – Bytes 9-11: Device identification
12	Read user message Access type = read	none	Bytes 0-24: User message Note! You can write the user message using Command 17.
13	Read TAG, descriptor and date Access type = read	none	– Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date Note! You can write the TAG, descriptor and date using Command 18.
14	Read sensor information on primary process variable	none	– Bytes 0-2: Sensor serial number – Byte 3: HART unit code of sensor limits and measuring range of the primary process variable – Bytes 4-7: Upper sensor limit – Bytes 8-11: Lower sensor limit – Bytes 12-15: Minimum span Note! ▪ The data relate to the primary process variable (= volume flow). ▪ Manufacturer-specific units are represented using the HART unit code "240".
15	Read output information of primary process variable Access type = read	none	– Byte 0: Alarm selection ID – Byte 1: Transfer function ID – Byte 2: HART unit code for the set measuring range of the primary process variable – Bytes 3-6: upper range, value for 20 mA – Bytes 7-10: lower range, value for 4 mA – Bytes 11-14: Damping constant in [s] – Byte 15: Write protection ID – Byte 16: OEM dealer ID, 17 = E+H Factory setting: Primary process variable = Volume flow Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
16	Read the device production number Access type = read	none	Bytes 0-2: Production number
17	Write user message Access = write	You can save any 32-character long text in the device under this parameter: Bytes 0-23: Desired user message	Displays the current user message in the device: Bytes 0-23: Current user message in the device
18	Write TAG, descriptor and date Access = write	With this parameter, you can store an 8 character TAG, a 16 character descriptor and a date: – Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date	Displays the current information in the device: – Bytes 0-5: TAG – Bytes 6-17: descriptor – Bytes 18-20: Date
19	Write the device production number Access = write	Bytes 0-2: Production number	Bytes 0-2: Production number

The following table contains all the common practice commands supported by the device.

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
Common practice commands			
34	Write damping value for primary process variable Access = write	Bytes 0-3: Damping value of the primary process variable "volume flow" in seconds *Factory setting:* Primary process variable = Current output damping	Displays the current damping value in the device: Bytes 0-3: Damping value in seconds
35	Write measuring range of primary process variable Access = write	Write the desired measuring range: – Byte 0: HART unit code of the primary process variable – Bytes 1-4: upper range, value for 20 mA – Bytes 5-8: lower range, value for 4 mA *Factory setting:* Primary process variable = Volume flow Note! ▪ The start of the measuring range (4 mA) must correspond to the zero flow. ▪ If the HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.	The currently set measuring range is displayed as a response: – Byte 0: HART unit code for the set measuring range of the primary process variable – Bytes 1-4: upper range, value for 20 mA – Bytes 5-8: lower range, value for 4 mA Note! ▪ Manufacturer-specific units are represented using the HART unit code "240". ▪ You can change the assignment of device variables to process variables using Command 51.
38	Device status reset (configuration changed) Access = write	none	none Note! It is also possible to execute this HART command when write protection is activated (= ON)!
40	Simulate input current of primary process variable Access = write	Simulation of the desired output current of the primary process variable. An entry value of 0 exits the simulation mode: Bytes 0-3: Output current in mA *Factory setting:* Primary process variable = Volume flow Note! You can set the assignment of device variables to process variables using Command 51.	The momentary output current of the primary process variable is displayed as a response: Bytes 0-3: Output current in mA
42	Perform master reset Access = write	none	none

Command No. / HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
44	Write unit of primary process variable Access = write	Set unit of primary process variable. Only units which are suitable for the process variable are transferred to the device: Byte 0: HART unit code *Factory setting:* Primary process variable = Volume flow Note! ▪ If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit. ▪ If you change the unit of the primary process variable, this has a direct impact on the system units.	The current unit code of the primary process variable is displayed as a response: Byte 0: HART unit code Note! Manufacturer-specific units are represented using the HART unit code "240".
48	Read additional device status Access = read	none	The device status is displayed in extended form as the response: Coding: see table → 🖹 69
50	Read assignment of the device variables to the four process variables Access = read	none	Display of the current variable assignment of the process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Factory setting:* ▪ Primary process variable: Code 1 for volume flow ▪ Second process variable: Code 250 for totalizer ▪ Third process variable: Code 0 for OFF (not assigned) ▪ Fourth process variable: Code 0 for OFF (not assigned)
51	Write assignment of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable *Factory setting:* ▪ Primary process variable: Volume flow ▪ Second process variable: Totalizer 1 ▪ Third process variable: OFF (not assigned) ▪ Fourth process variable: OFF (not assigned)	The variable assignment of the process variables is displayed as a response: – Byte 0: Device variable code to the primary process variable – Byte 1: Device variable code to the second process variable – Byte 2: Device variable code to the third process variable – Byte 3: Device variable code to the fourth process variable
53	Write device variable unit Access = write	This command sets the unit of the given device variables. Only those units which suit the device variable are transferred: – Byte 0: Device variable code – Byte 1: HART unit code Code of the supported device variables: See information → 🖹 64 Note! ▪ If the written unit is not the correct one for the device variable, the device will continue with the last valid unit. ▪ If you change the unit of the device variable, this has a direct impact on the system units.	The current unit of the device variables is displayed in the device as a response: – Byte 0: Device variable code – Byte 1: HART unit code Note! Manufacturer-specific units are represented using the HART unit code "240".
59	Write number of preambles in response message Access = write	This parameter sets the number of preambles which are inserted in the response messages: Byte 0: Number of preambles (4 to 20)	The current number of preambles is displayed in the response telegram: Byte 0: Number of preambles

5.4.6 Device status and error messages

You can read the extended device status, in this case, current error messages, via Command "48
The command delivers information which is partly coded in bits (see table below).

Note!
- You can find a detailed explanation of the device status and error messages and their elimination on → 69
- Bits and bytes not listed are not assigned.

Byte	Bit	Error No.	Short error description
0	0	001	Serious device error
	1	011	Measuring amplifier has faulty EEPROM
	2	012	Error when accessing data of the measuring amplifier EEPROM
1	1	031	S-DAT: defective or missing
	2	032	S-DAT: Error accessing saved values
	5	051	I/O and the amplifier are not compatible.
3	3	111	Totalizer checksum error
	4	121	I/O board and amplifier not compatible.
4	3	251	Internal communication fault on the amplifier board.
	4	261	No data reception between amplifier and I/O board
5	0	321	Coil current of the sensor is outside the tolerance.
	7	339	Flow buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
6	0	340	
	1	341	
	2	342	
	3	343	Frequency buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
	4	344	
	5	345	
	6	346	
	7	347	Pulse buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
7	0	348	
	1	349	
	2	350	
	3	351	Current output: Flow is out of range.
	4	352	
	5	353	
	6	354	
	7	355	Frequency output: Flow is out of range.
8	0	356	
	1	357	
	2	358	

Byte	Bit	Error No.	Short error description
8	3	359	Pulse output: Flow is out of range.
	4	360	
	5	361	
	6	362	
10	7	401	Measuring tube partially filled or empty
11	2	461	EPD calibration not possible because the fluid's conductivity is either too low or too high.
	4	463	The EPD calibration values for empty pipe and full pipe are identical, and therefore incorrect.
12	1	474	Maximum flow value entered is overshot
	7	501	Amplifier software version is loaded. Currently no other commands are possible.
13	0	502	Upload/download of device files. Currently no other commands are possible.
14	3	601	Positive zero return active
	7	611	Simulation current output active
15	0	612	
	1	613	
	2	614	
	3	621	Simulation frequency output active
	4	622	
	5	623	
	6	624	
	7	631	Simulation pulse output active
16	0	632	
	1	633	
	2	634	
	3	641	Simulation status output active
	4	642	
	5	643	
	6	644	
17	7	671	Simulation of the status input active
18	0	672	
	1	673	
	2	674	
	3	691	Simulation of response to error (outputs) active
	4	692	Simulation of volume flow active

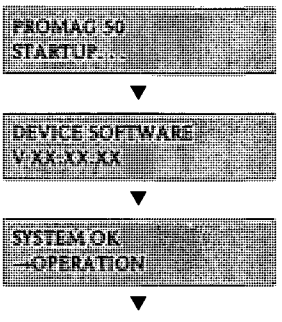
6 Commissioning

6.1 Function check

Make sure that all final checks have been completed before you start up your measuring point:
- Checklist for "Post-installation check" → 43
- Checklist for "Post-connection check" → 58

6.2 Switching on the measuring device

Once the connection checks have been successfully completed, it is time to switch on the power supply. The device is now operational. The measuring device performs a number of post switch-on self-tests. As this procedure progresses the following sequence of messages appears on the local display:



Start-up message

Current software version

Beginning of normal measuring mode

Normal measuring mode commences as soon as start-up completes.
Various measured-value and/or status variables (HOME position) appear on the display.

Note!
If start-up fails, an error message indicating the cause is displayed.

6.3 Quick Setup

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the operating program, e.g. FieldCare.
If the measuring device is equipped with a local display, all the important device parameters for standard operation, as well as additional functions, can be configured quickly and easily by means of the following Quick Setup menu.

6.3.1 "Commissioning" Quick Setup menu

This Quick Setup menu guides you systematically through the setup procedure for all the major device functions that have to be configured for standard measuring operation.

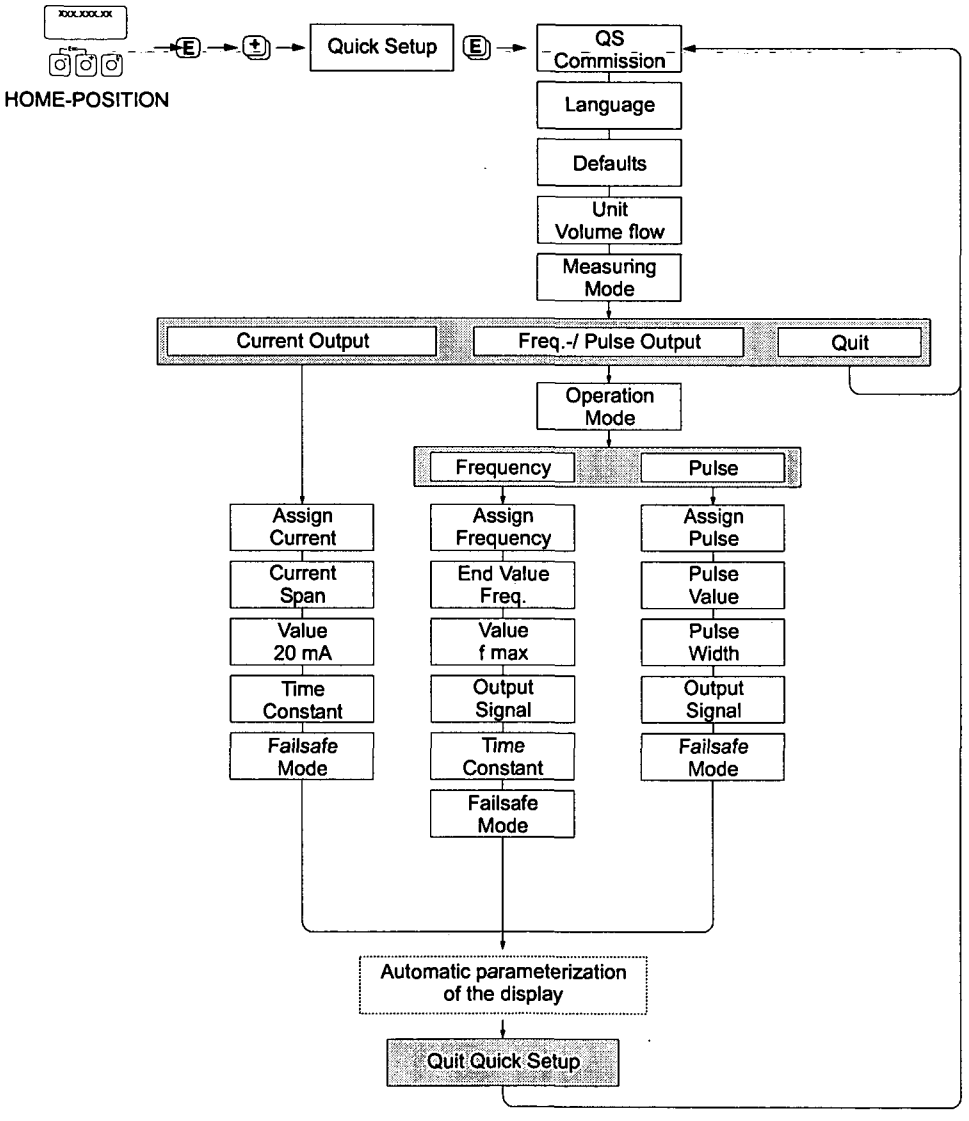


Fig. 50: "QUICK SETUP COMMISSIONING" menu for the rapid configuration of important device functions

6.4 Configuration

6.4.1 Current output: active/passive

The current output is configured as "active" or "passive" by means of various jumpers on the I/O board.

Warning!
Risk of electric shock! Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

1. Switch off power supply.
2. Remove the I/O board → 88
3. Position the jumper → 51

   Caution!
   Risk of destroying the measuring device. Set the jumpers exactly as shown in the graphic. Pay strict attention to the position of the jumpers as indicated in the graphic.
4. Installation of the I/O board is the reverse of the removal procedure.

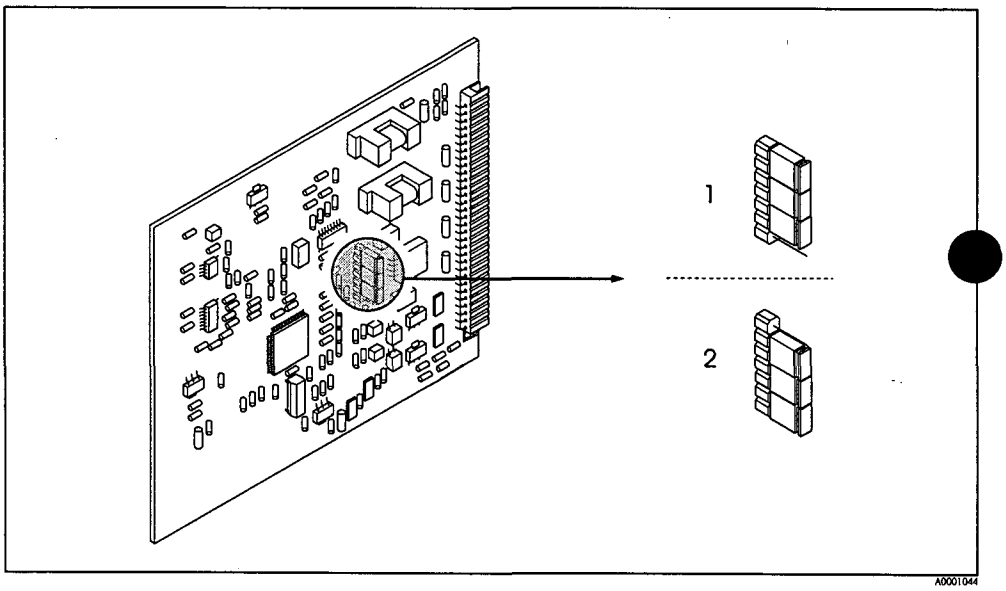


Fig. 51: Configuring current outputs using jumpers (I/O board)

1 Active current output (factory setting)
2 Passive current output

6.5 Adjustment

6.5.1 Empty-pipe/full-pipe adjustment

Flow cannot be measured correctly unless the measuring tube is completely full.
This status can be permanently monitored using the Empty Pipe Detection:

- EPD = Empty Pipe Detection (with the help of an EPD electrode)
- OED = Open Electrode Detection (Empty Pipe Detection with the help of the measuring electrodes, if the sensor is not equipped with an EPD electrode or the orientation is not suitable for using EPD).

Caution!
Detailed information on the empty-pipe/full-pipe adjustment procedure can be found in the "Description of Device Functions" manual:

- EPD/OED ADJUSTMENT (carrying out the adjustment).
- EPD (switching on and off EPD/OED).
- EPD RESPONSE TIME (input of the response time for EPD/OED).

Note!

- The EPD function is not available unless the sensor is fitted with an EPD electrode.
- The devices are already calibrated at the factory with water (approx. 500 µS/cm). If the fluid conductivity differs from this reference, empty-pipe/full-pipe adjustment has to be performed again on site.
- The default setting for EPD when the devices are delivered is OFF; the function has to be activated if required.
- The EPD process error can be output by means of the configurable relay output.

Performing empty-pipe and full-pipe adjustment (EPD)

1. Select the appropriate function in the function matrix:
   HOME → [E] → ⊞ → PROCESS PARAMETER → [E] → ⊞ → EPD ADJUSTMENT
2. Empty the piping:
   - The wall of the measuring tube should still be wet with fluid during EPD empty pipe adjustment
   - The wall of the measuring tube/the measuring electrodes should **no longer** be wet with fluid during OED empty pipe adjustment
3. Start empty-pipe adjustment: Select "EMPTY PIPE ADJUST" or "OED EMPTY ADJUST" and press [E] to confirm.
4. After empty-pipe adjustment, fill the piping with fluid.
5. Start full-pipe adjustment: Select "FULL PIPE ADJUST" or "OED FULL ADJUST" and press [E] to confirm.
6. Having completed the adjustment, select the setting "OFF" and exit the function by pressing [E].
7. Switch on empty pipe detection in the EPD function:
   - EPD empty pipe adjustment: Select ON STANDARD or ON SPECIAL and press [E] to confirm
   - OED empty pipe adjustment: Select OED and confirm with [E].

   Caution!
   The adjustment coefficients must be valid before you can activate the EPD function. If adjustment is incorrect the following messages might appear on the display:
   - FULL = EMPTY
     The adjustment values for empty pipe and full pipe are identical. In cases of this nature you must repeat empty-pipe or full-pipe adjustment!
   - ADJUSTMENT NOT OK
     Adjustment is not possible because the fluid's conductivity is out of range.

6.6 Data storage device (HistoROM)

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. It is possible to plug these modules into other devices to copy device configurations from one device to another, for example.

6.6.1 HistoROM/S-DAT (sensor-DAT)

The S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., diameter, serial number, calibration factor, zero point.

7 Maintenance

No special maintenance work is required.

7.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

7.2 Seals

The seals of the Promag H sensor must be replaced periodically, particularly in the case of gasket seals (aseptic version).
The period between changes depends on the frequency of cleaning cycles, the cleaning temperature and the fluid temperature.

Replacement seals (accessories) → 77.

8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Your Endress+Hauser service organization can provide detailed information on the specific order codes on request.

8.1 Device-specific accessories

Accessory	Description	Order code
Proline Promag 50 transmitter	Transmitter for replacement or storage. Use the order code to define the following specifications: ▪ Approvals ▪ Degree of protection/version ▪ Cable for remote version ▪ Cable entry ▪ Display/power supply/operation ▪ Software ▪ Outputs/inputs	50XXX – XXXXX******

8.2 Measuring principle-specific accessories

Accessory	Description	Order code
Mounting set for Promag 50 transmitter	Mounting set for the transmitter (remote version). Suitable for: ▪ Wall mounting ▪ Pipe mounting ▪ Panel-mounted installation Mounting set for aluminum field housing. Suitable for: ▪ Pipe mounting	DK5WM – *
Wall-mounting kit for Promag H	Wall-mounting kit for the Promag H sensor.	DK5HM – **
Cable for remote version	Coil and signal cables, various lengths.	DK5CA – **
Mounting kit for Promag D, wafer version	Mounting kit consisting of: ▪ Mounting bolts ▪ Nuts incl. washers ▪ Flange seals ▪ Centering sleeves (if required for the flange)	DKD** – **
Set of seals for Promag D	Set of seals consisting of two flange seals.	DK5DD – ***
Mounting kit for Promag H	Mounting kit consisting of: ▪ 2 process connections ▪ Threaded fasteners ▪ Seals	DKH** – ****
Set of seals for Promag H	For regular replacement of the seals of the Promag H sensor.	DK5HS – ***
Welding jig for Promag H	Weld nipple as process connection: welding jig for installation in pipe.	DK5HW – ***
Adapter connection for Promag A, H	Adapter connections for installing a Promag 10 H instead of a Promag 30/33 A or Promag 30/33 H DN 25.	DK5HA – *****
Ground rings for Promag H	Ground rings for potential equalization.	DK5HR – ***
Ground cable for Promag L, W, P	Ground cable for potential equalization.	DK5GC – ***
Ground disk for Promag L, W, P	Ground disk for potential equalization.	DK5GD – * * ***

Accessory	Description	Order code
Process display RIA45	Multifunctional 1-channel display unit: ▪ Universal input ▪ Transmitter power supply ▪ Limit relay ▪ Analog output	RIA45 – ******
Process display RIA251	Digital display device for looping into the 4 to 20 mA current loop.	RIA251 – **
Field display unit RIA16	Digital field display device for looping into the 4 to 20 mA current loop.	RIA16 – ***
Application Manager RMM621	Electronic recording, display, balancing, control, saving and event and alarm monitoring of analog and digital input signals. Values and conditions determined are output by means of analog and digital output signals. Remote transmission of alarms, input values and calculated values using a PSTN or GSM modem.	RMM621 – **********

8.3 Communication-specific accessories

Accessory	Description	Order code
HART Communicator Field Xpert SFX 100	Handheld terminal for remote configuration and for obtaining measured values via the HART current output (4 to 20 mA) and FOUNDATION Fieldbus. Contact your Endress+Hauser representative for more information.	SFX100 – *******
Fieldgate FXA320	Gateway for remote interrogation of HART sensors and actuators via Web browser: ▪ 2-channel analog input (4 to 20 mA) ▪ 4 binary inputs with event counter function and frequency measurement ▪ Communication via modem, Ethernet or GSM ▪ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone ▪ Limit value monitoring with alarm by e-mail or SMS ▪ Synchronized time stamping of all measured values.	FXA320 – *****
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via Web browser: ▪ Web server for remote monitoring of up to 30 measuring points ▪ Intrinsically safe version [EEx ia]IIC for applications in hazardous areas ▪ Communication via modem, Ethernet or GSM ▪ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone ▪ Limit value monitoring with alarm by e-mail or SMS ▪ Synchronized time stamping of all measured values ▪ Remote diagnosis and remote configuration of connected HART devices	FXA520 – ****
FXA195	The Commubox FXA195 connects intrinsically safe Smart transmitters with HART protocol to the USB port of a personal computer. This makes the remote operation of the transmitters possible with the aid of configuration programs (e.g. FieldCare). Power is supplied to the Commubox by means of the USB port	FXA195 – *

8.4 Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and planning flowmeters. The Applicator software can be downloaded from the Internet or ordered on CD-ROM for installation on a local PC. Contact your Endress+Hauser representative for more information.	DXA80 – *
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed out and used for official certification. Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser Web site: www.endress.com
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 – **********
FXA193	Service interface from the device to the PC for operation via FieldCare.	FXA193 – *

9 Troubleshooting

9.1 Troubleshooting instructions

Always start troubleshooting with the checklist below if faults occur after start-up or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.

Check the display	
No display visible and no output signals present.	1. Check the supply voltage → terminals 1, 2 2. Check the power line fuse → 🖹 92 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC / 16 to 62 V DC: 2 A slow-blow / 250 V 3. Measuring electronics defective → order spare parts → 🖹 77
No display visible, but output signals are present.	1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → 🖹 88 2. Display module defective → order spare parts → 🖹 77 3. Measuring electronics defective → order spare parts → 🖹 77
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the ⊡-⊡ buttons and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.
Measured value indicated, but no signal at the current or pulse output.	Electronics board defective → order spare parts → 🖹 77
↓	
Error messages on display	
Errors which occur during commissioning or measuring operation are displayed immediately. Error messages consist of a variety of icons: the meanings of these icons are as follows (example): – Error type: **S** = system error, **P** = process error – Error message type: ↯ = fault message, ! = notice message – **EMPTY PIPE** = Type of error, e.g. measuring tube is only partly filled or completely empty – **03:00:05** = duration of error occurrence (in hours, minutes and seconds) – #401 = error number ☝ Caution! ▪ See the information on → 🖹 62! ▪ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice message only.	
Error number: No. 001 – 399 No. 501 – 699	System error (device error) has occurred → 🖹 81
Error number: No. 401 - 499	Process error (application error) has occurred → 🖹 83
↓	
Other error (without error message)	
Some other error has occurred.	Diagnosis and rectification → 🖹 84

9.2 System error messages

Serious system errors are **always** recognized by the device as "Fault message", and are shown as a lightning flash (ϟ) on the display. Fault messages immediately affect the outputs.

Caution!
In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. The necessary procedures on → 🖹 6 must be carried out before you return a flowmeter to Endress+Hauser. Always enclose a duly completed "Declaration of Contamination" form. You will find a master copy of this form at the back of this manual.

Note!
Also observe the information on → 🖹 62.

No.	Error message / Type	Cause	Remedy (spare part → 🖹 87)
S = System error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 0xx → Hardware error			
001	S: CRITICAL FAILURE ϟ: # 001	Serious device error	Replace the amplifier board.
011	S: AMP HW EEPROM ϟ: # 011	Amplifier: Defective EEPROM	Replace the amplifier board.
012	S: AMP SW EEPROM ϟ: # 012	Amplifier: Error accessing EEPROM data	The EEPROM data blocks in which an error has occurred are displayed in the TROUBLESHOOTING function. Press Enter to acknowledge the errors in question; default values are automatically inserted instead of the errored parameter values. Note! The measuring device has to be restarted if an error has occurr in a totalizer block (see error No. 111 / CHECKSUM TOTAL).
031	S: SENSOR HW DAT ϟ: # 031	1. S-DAT is not plugged into the amplifier board correctly (or is missing). 2. S-DAT is defective.	1. Check whether the S-DAT is correctly plugged into the amplifier board. 2. Replace the S-DAT if it is defective. Check that the new replacement DAT is compatible with the measuring electronics. Check the: - Spare part set number - Hardware revision code 3. Replace measuring electronics boards if necessary. 4. Plug the S-DAT into the amplifier board.
032	S: SENSOR SW DAT ϟ: # 032		
No. # 1xx → Software error			
101	S: GAIN ERROR AMP ϟ: # 101	Gain deviation compared to reference gain > 25%.	Replace the amplifier board.
111	S: CHECKSUM TOTAL ϟ: # 111	Totalizer checksum error.	1. Restart the measuring device. 2. Replace the amplifier board if necessary.
121	S: A / C COMPATIB. !: # 121	Due to different software versions, I/O board and amplifier board are only partially compatible (possibly restricted functionality). Note! - This message is only listed in the error history. - Nothing is shown on the display.	Module with lower software version has either to be updated by FieldCare with the required software version or the module has to be replaced.
No. # 2xx → Error in DAT / no communication			
251	S: COMMUNICATION I/O ϟ: # 251	Internal communication fault on the amplifier board.	Replace the amplifier board.
261	S: COMMUNICATION I/O ϟ: # 261	No data reception between amplifier and I/O board or faulty internal data transfer.	Check the BUS contacts.

No.	Error message / Type	Cause	Remedy (spare part → 🖹 87)
. # 3xx → System limits exceeded			
321	S: TOL. COIL CURR. ϟ: # 321	Sensor: Coil current is out of tolerance.	⚠ Warning! Switch off power supply before manipulating the coil current cable, coil current cable connector or measuring electronics boards! Remote version: 1. Check wiring of terminals 41/42 → 🖹 44 2. Check coil current cable connector. Compact and remote version: Replace measuring electronics boards if necessary
339 to 342	S: STACK CUR OUT n !: # 339 to 342	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE (ϟ) ▪ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared. ▪ Clear the temporary buffer by the measures described under Item 1.
343 to 346	S: STACK FREQ. OUT n !: # 343 to 346		
347 to 350	S: STACK PULSE OUT n !: # 343 to 346	The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.	1. Increase the setting for pulse weighting 2. Increase the max. pulse frequency if the totalizer can handle a higher number of pulses. 3. Increase or reduce flow, as applicable. Recommendations in the event of fault category = FAULT MESSAGE (ϟ) ▪ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared. ▪ Clear the temporary buffer by the measures described under Item 1.
351 to 354	S: CURRENT RANGE n !: # 351 to 354	Current output: flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
355 to 358	S: FREQ. RANGE n !: # 355 to 358	Frequency output: flow is out of range.	1. Change the upper or lower limit setting, as applicable. 2. Increase or reduce flow, as applicable.
359 to 362	S: PULSE RANGE !: # 359 to 362	Pulse output: the pulse output frequency is out of range.	1. Increase the setting for pulse weighting 2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.). *Determine the pulse width:* – Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration. – Variant 2: Enter the maximum (pulse) frequency as the half "reciprocal value" that a pulse must be present at the connected counter to ensure its registration. Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is: $\frac{1}{2 \cdot 10\ \text{Hz}} = 50\ \text{ms}$ a0004437 3. Reduce flow.

No.	Error message / Type	Cause	Remedy (spare part → 87)
No. # 5xx → Application error			
501	S: SW.-UPDATE ACT. !: # 501	New amplifier or communication (I/O module) software version is loaded. Currently no other functions are possible.	Wait until the procedure is finished. The device will restart automatically.
502	S: UP-/DOWNLOAD ACT !: # 502	Uploading or downloading the device data via operating program. Currently no other functions are possible.	Wait until the procedure is finished.
No. # 6xx → Simulation mode active			
601	S: POS. ZERO-RETURN !: # 601	Positive zero return active ☝ Caution! This message has the highest display priority!	Switch off positive zero return
611 to 614	S: SIM. CURR. OUT. n !: # 611 to 614	Simulation current output active	
621 to 624	S: SIM. FREQ. OUT. n !: # 621 to 624	Simulation frequency output active	Switch off simulation
631 to 634	S: SIM. PULSE n !: # 631 to 634	Simulation pulse output active	Switch off simulation
641 to 644	S: SIM. STAT. OUT n !: # 641 to 644	Simulation status output active	Switch off simulation
671 to 674	S: SIM. STATUS IN n !: # 671 to 674	Simulation status input active	Switch off simulation
691	S: SIM. FAILSAFE !: # 691	Simulation of response to error (outputs) active	Switch off simulation
692	S: SIM. MEASURAND !: # 692	Simulation of a measured variable active (e.g. mass flow).	Switch off simulation
698	S: DEV. TEST ACT. !: # 698	The measuring device is being checked on site via the test and simulation device.	–

9.3 Process error messages

✎ Note!
Also observe the information on → 62.

No.	Error message / Type	Cause	Remedy (spare part → 87)
P = Process error ϟ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
401	EMPTY PIPE ϟ: # 401	Measuring tube partially filled or empty	1. Check the process conditions of the plant 2. Fill the measuring tube
461	ADJ. NOT OK !: # 461	EPD calibration not possible because the fluid's conductivity is either too low or too high.	The EPD function cannot be used with fluids of this nature.
463	FULL = EMPTY ϟ: # 463	The EPD calibration values for empty pipe and full pipe are identical, therefore incorrect.	Repeat calibration, making sure procedure is correct → 74.

9.4 Process errors without messages

Symptoms	Rectification
Remark: You may have to change or correct certain settings in functions in the function matrix in order to rectify the fault.	
Flow values are negative, even though the fluid is flowing forwards through the pipe.	1. Remote version: – Switch off the power supply and check the wiring → 🖹 44 – If necessary, reverse the connections at terminals 41 and 42 2. Change the setting in the "INSTALLATION DIRECTION SENSOR" function accordingly
Measured-value reading fluctuates even though flow is steady.	1. Check grounding and potential equalization → 🖹 54 2. Check the fluid for presence of gas bubbles. 3. In the "SYSTEM DAMPING" function → increase the value
Measured-value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	1. Check grounding and potential equalization → 🖹 54 2. Check the fluid for presence of gas bubbles. 3. Activate the "LOW FLOW CUTOFF" function, i.e. enter or increase the value for the switching point.
Measured-value reading on display, even though measuring tube is empty.	1. Perform empty-pipe/full-pipe adjustment and then switch on Empty Pipe detection → 🖹 74 2. Remote version: Check the terminals of the EPD cable → 🖹 44 3. Fill the measuring tube.
The current output signal is always 4 mA, irrespective of the flow signal at any given time.	1. Select the "BUS ADDRESS" function and change the setting to "0". 2. Value for creepage too high. Reduce the value in the "LOW FLOW CUTOFF" function.
The fault cannot be rectified or some other fault not described above has arisen. In these instances, please contact your Endress+Hauser service organization.	The following options are available for tackling problems of this nature: **Request the services of an Endress+Hauser service technician** If you contact our service organization to have a service technician sent out, please be ready to quote the following information: – Brief description of the fault – Nameplate specifications (→ 🖹 7): order code, serial number **Returning devices to Endress+Hauser** The necessary procedures (→ 🖹 6) must be carried out before you return a flowmeter requiring repair or calibration to Endress+Hauser. Always enclose a duly completed "Declaration of Conformity" form with the flowmeter. You will find a master copy of this form at the back of this manual. **Replace transmitter electronics** Components in the measuring electronics defective → order spare parts → 🖹 77

9.5 Response of outputs to errors

Note!
The failsafe mode of totalizers, current, pulse and frequency outputs can be customized by means of various functions in the function matrix. You will find detailed information on these procedures in the "Description of Device Functions" manual.

You can use positive zero return to set the signals of the current, pulse and status outputs to their fallback value, for example when measuring has to be interrupted while a pipe is being cleaned. This function takes priority over all other device functions: simulations, for example, are suppressed.

Failsafe mode of outputs and totalizers		
	Process/system error is current	Positive zero return is activated
Caution! System or process errors defined as "Notice messages" have no effect whatsoever on the inputs and outputs. See the information on → 65		
Current output	MINIMUM VALUE 0–20 mA → 0 mA 4–20 mA → 2 mA 4–20 mA HART → 2 mA 4–20 mA NAMUR →3.5 mA 4–20 mA HART NAMUR →3.5 mA 4–20 mA US → 3.75 mA 4–20 mA HART US → 3,75 mA 0–20 mA (25 mA) → 0 mA 4–20 mA (25 mA) → 2 mA 4–20 mA (25 mA) HART → 2 mA MAXIMUM VALUE 0–20 mA → 22 mA 4–20 mA → 22 mA 4–20 mA HART → 22 mA 4–20 mA NAMUR → 22.6 mA 4–20 mA HART NAMUR → 22.6 mA 4–20 mA US → 22.6 mA 4–20 mA HART US → 22.6 mA 0–20 mA (25 mA) → 25 mA 4–20 mA (25 mA) → 25 mA 4–20 mA (25 mA) HART → 25 mA HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
Pulse output	MIN/MAX VALUE → FALLBACK VALUE Signal output → no pulses HOLD VALUE Last valid value (preceding occurrence of the fault) is output. ACTUAL VALUE Fault is ignored, i.e. normal measured-value output on the basis of ongoing flow measurement.	Output signal corresponds to "zero flow"

Failsafe mode of outputs and totalizers		
	Process/system error is current	Positive zero return is activated
Frequency output	*FALLBACK VALUE* Signal output → 0 Hz *FAILSAFE LEVEL* Output of the frequency specified in the FALLSAFE VALUE function. *HOLD VALUE* Measured value display on the basis of the last saved value preceding occurrence of the fault. *ACTUAL VALUE* Measured value display on the basis of the current flow measurement. The fault is ignored.	Output signal corresponds to "zero flow"
Totalizer	*STOP* The totalizers are paused until the error is rectified. *ACTUAL VALUE* The fault is ignored. The totalizer continues to count in accordance with the current flow value. *HOLD VALUE* The totalizer continues to count the flow in accordance with the last valid flow value (before the error occurred).	Totalizer stops
Status output	In the event of a fault or power supply failure: Status output → non-conductive	No effect on status output

9.6 Spare parts

Detailed troubleshooting instructions are provided in the previous sections → 80
The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.
Fault rectification can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.

Note!
You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate → 7

Spare parts are shipped as sets comprising the following parts:
- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

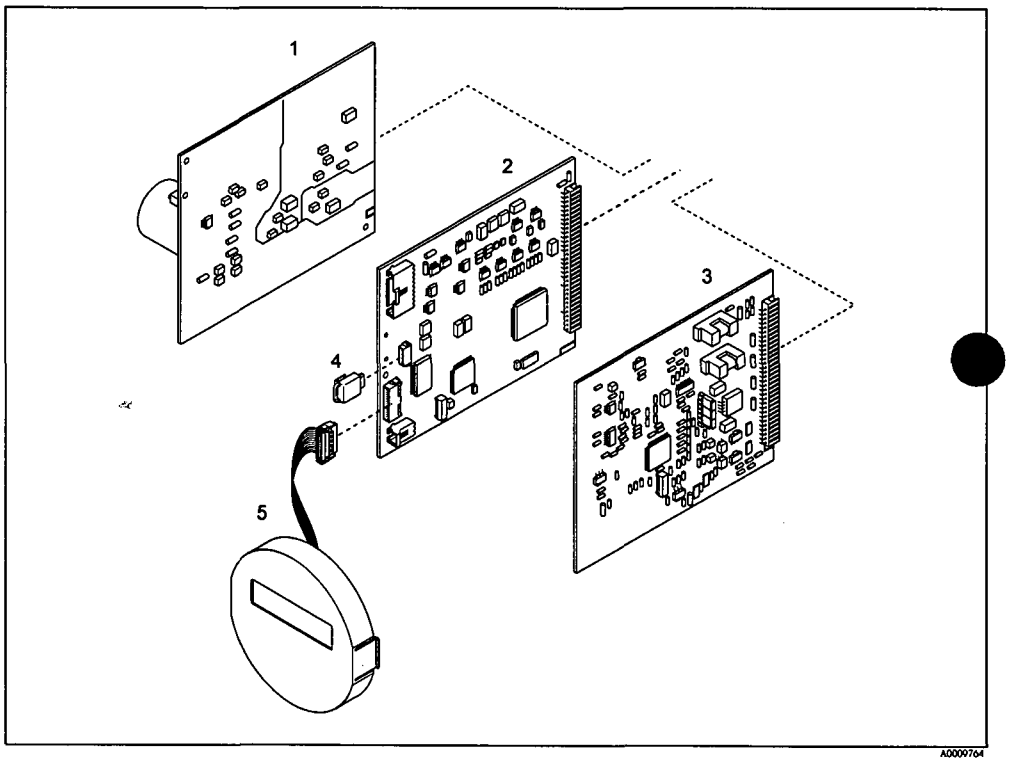


Fig. 52: Spare parts for Promag 50 transmitter (field and wall-mounted housings)

1 Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
2 Amplifier board
3 I/O board (COM module)
4 HistoROM / S-DAT (sensor data memory)
5 Display module

9.6.1 Removing and installing printed circuit boards

Field housing: removing and installing printed circuit boards → 53

Warning!
- Risk of electric shock!
  Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purpose-built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!
Use only original Endress+Hauser parts.

1. Switch off power supply.
2. Unscrew cover of the electronics compartment from the transmitter housing.
3. Remove the local display (1) as follows:
   – Press in the latches (1.1) at the side and remove the display module.
   – Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
4. Remove the screws and remove the cover (2) from the electronics compartment.
5. Remove the boards (4, 6): Insert a suitable tool into the hole (3) provided for the purpose and pull the board clear of its holder.
6. Remove amplifier board (5):
   – Disconnect the plug of the electrode signal cable (5.1) including S-DAT (5.3) from the board.
   – Loosen the plug locking of the coil current cable (5.2) and gently disconnect the plug from the board, i.e. without moving it to and fro.
   – Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

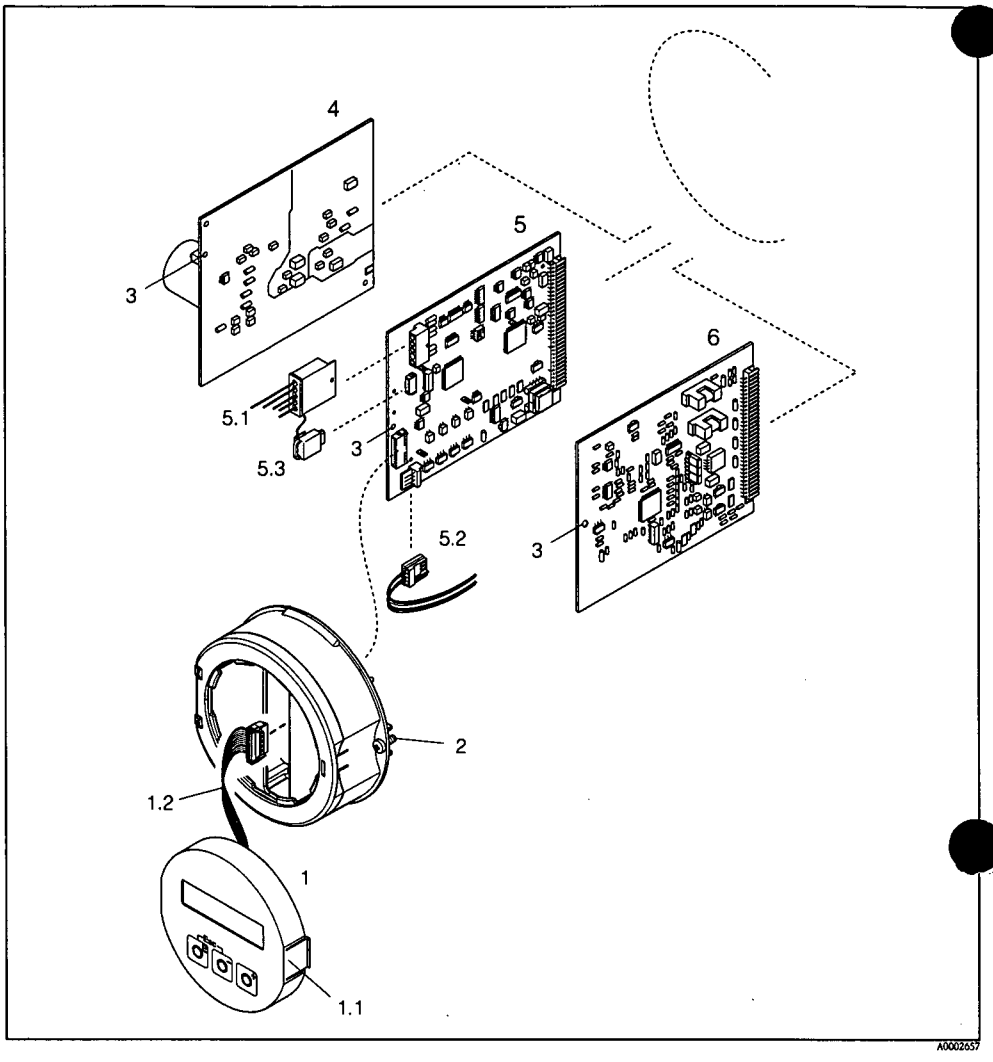


Fig. 53: Field housing: removing and installing printed circuit boards

1 Local display
1.1 Latch
1.2 Ribbon cable (display module)
2 Screws of electronics compartment cover
3 Aperture for installing/removing boards
4 Power supply board
5 Amplifier board
5.1 Electrode signal cable (sensor)
5.2 Coil current cable (sensor)
5.3 Histo-ROM / S-DAT (sensor data memory)
6 I/O board

Wall-mount housing: removing and installing printed circuit boards → 🖹 91

Warning!
- Risk of electric shock!
  Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purpose-built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.
- When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions.

Caution!
Use only original Endress+Hauser parts.

1. Switch off power supply.
2. Remove the screws and open the hinged cover (1) of the housing. Remove screws of the electronics module (2).
3. Then push up electronics module and pull it as far as possible out of the wall-mounted housing.
4. Disconnect the following cable plugs from amplifier board (7):
   – Electrode signal cable plug (7.1) including S-DAT (7.3).
   – Plug of coil current cable (7.2). To do so, loosen the plug locking of the coil current cable and gently disconnect the plug from the board, i.e. without moving it to and fro.
   – Ribbon cable plug (3) of the display module.
5. Remove the screws and remove the cover (4) from the electronics compartment.
6. Remove the boards (6, 7, 8): Insert a suitable tool into the hole (5) provided for the purpose and pull the board clear of its holder.
7. Installation is the reverse of the removal procedure.

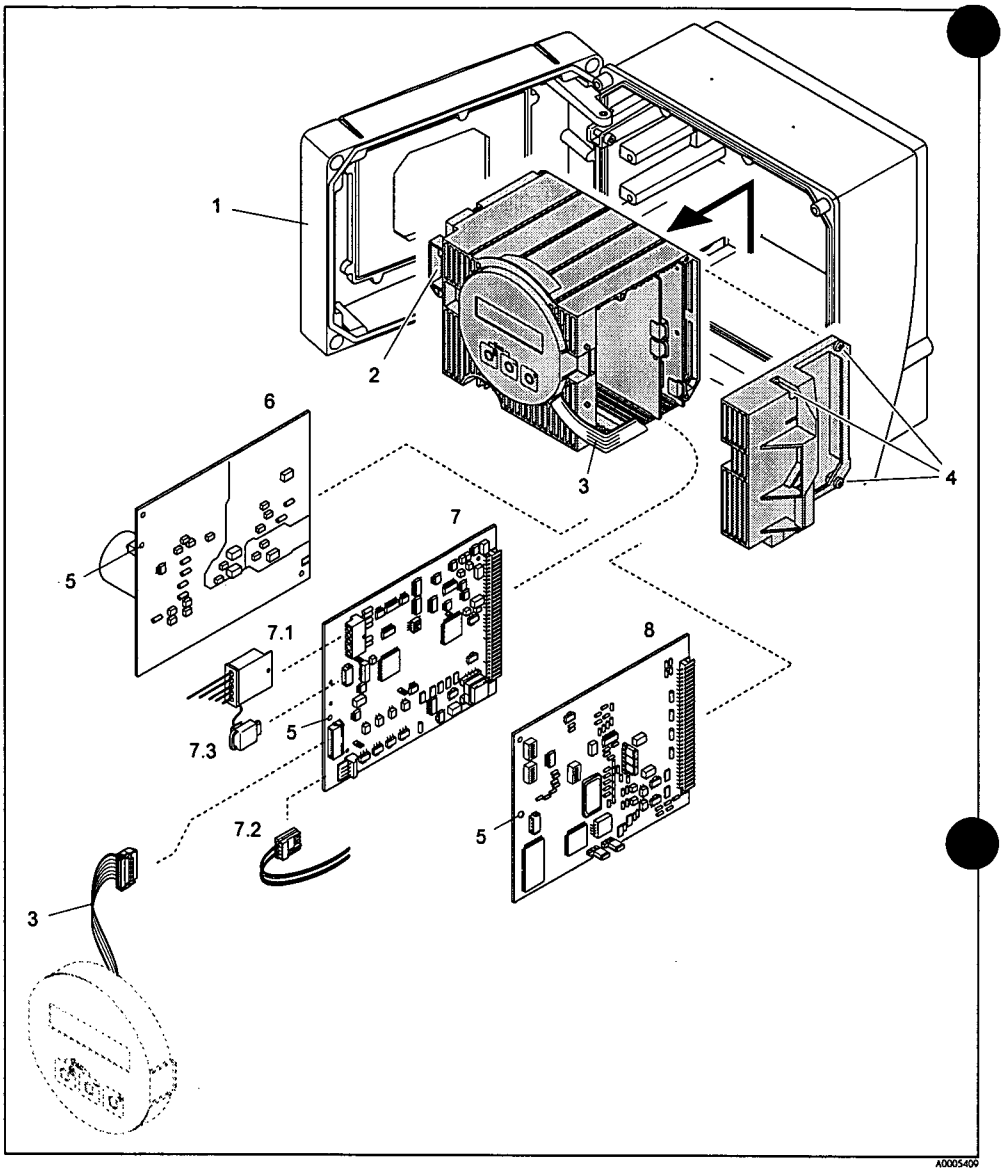


Fig. 54: Wall-mount housing: removing and installing printed circuit boards

1 Housing cover
2 Electronics module
3 Ribbon cable (display module)
4 Cover of electronics compartment (3 screws)
5 Aperture for installing/removing boards
6 Power supply board
7 Amplifier board
7.1 Electrode signal cable (sensor)
7.2 Coil current cable (sensor)
7.3 Histo-ROM / S-DAT (sensor data memory)
8 I/O board

9.6.2 Replacing the device fuse

Warning!
Risk of electric shock! Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power supply board (→ 🖹 92).
The procedure for replacing the fuse is as follows:

1. Switch off power supply.
2. Remove the power supply board: field housing → 🖹 88, wall-mount housing → 🖹 90
3. Remove cap (1) and replace the device fuse (2).
   Use only fuses of the following type:
   - Power supply 20 to 55 V AC / 16 to 62 V DC → 2.0 A slow-blow / 250 V; 5.2 × 20 mm
   - Power supply 85 to 260 V AC → 0.8 A slow-blow / 250 V; 5.2 × 20 mm
   - Ex-rated devices → see the Ex documentation.
4. Installation is the reverse of the removal procedure.

Caution!
Use only original Endress+Hauser parts.

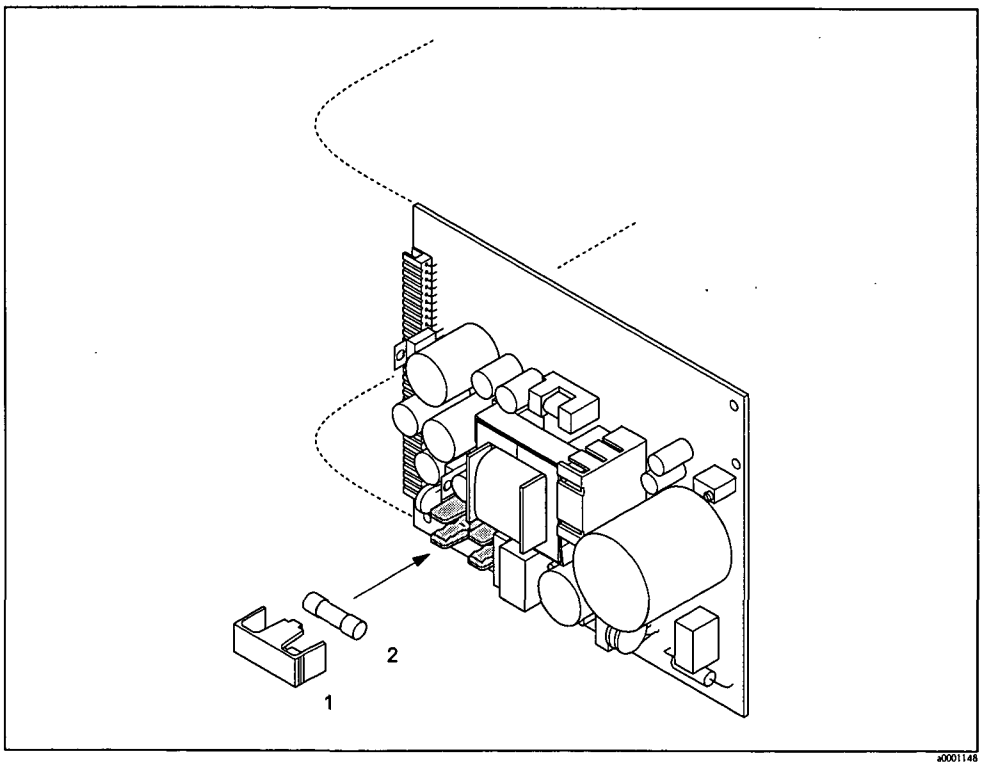


Fig. 55: Replacing the device fuse on the power supply board

1 Protective cap
2 Device fuse

9.6.3 Replacing the exchangeable electrode

The Promag W sensor (DN 350 to 2000; 14" to 78") is available with exchangeable measuring electrodes as an option. This design permits the measuring electrodes to be replaced or cleaned under process conditions.

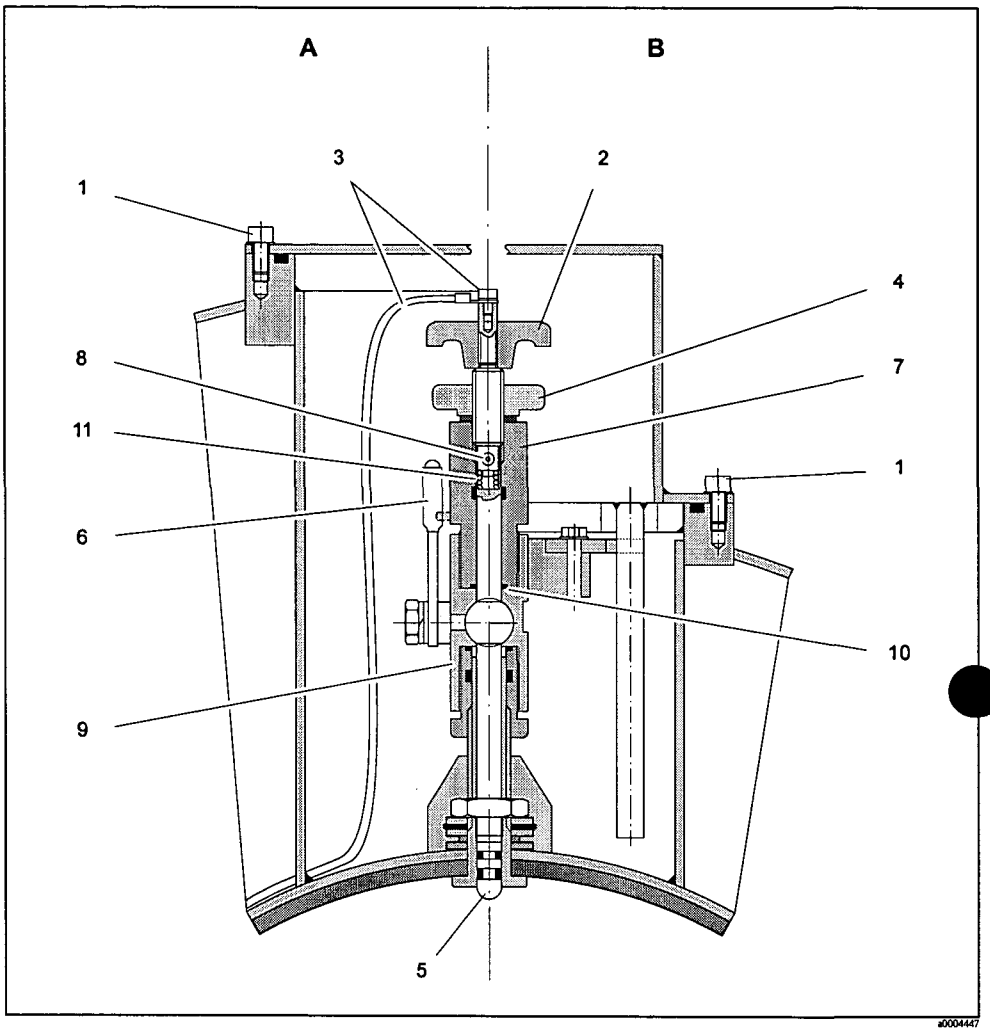


Fig. 56: Apparatus for replacing exchangeable measuring electrodes

View A = DN 1200 to 2000 (48" to 78")

View B = DN 350 to 1050 (14" to 42")

1 Allen screw
2 Handle
3 Electrode cable
4 Knurled nut (locknut)
5 Measuring electrode
6 Stop cock (ball valve)
7 Retaining cylinder
8 Locking pin (for handle)
9 Ball-valve housing
10 Seal (retaining cylinder)
11 Coil spring

Removing the electrode	Installing the electrode
1 Loosen Allen screw (1) and remove the cover.	1 Insert new electrode (5) into retaining cylinder (7) from below. Make sure that the seals at the tip of the electrode are clean.
2 Remove electrode cable (3) secured to handle (2).	2 Mount handle (2) on the electrode and insert locking pin (8) to secure it in position. Caution! Make sure that coil spring (11) is inserted. This is essential to ensure correct electrical contact and correct measuring signals.
3 Loosen knurled nut (4) by hand. This knurled nut acts as a locknut.	3 Pull the electrode back until the tip of the electrode no longer protrudes from retaining cylinder (7).
4 Remove electrode (5) by turning handle (2). The electrode can now be pulled out of retaining cylinder (7) as far as a defined stop. Warning! Risk of injury. Under process conditions (pressure in the piping system) the electrode can recoil suddenly against its stop. Apply counter-pressure while releasing the electrode.	4 Screw the retaining cylinder (7) onto ball-valve housing (9) and tighten it by hand. Seal (10) on the cylinder must be correctly seated and clean. Note! Make sure that the rubber hoses on retaining cylinder (7) and stop cock (6) are of the same color (red or blue).
5 Close stop cock (6) after pulling out the electrode as far as it will go. Warning! Do not subsequently open the stop cock, in order to prevent fluid escaping.	5 Open stop cock (6) and turn handle (2) to screw the electrode all the way into the retaining cylinder.
6 Remove the electrode complete with retaining cylinder (7).	6 Screw knurled nut (4) onto the retaining cylinder. This firmly locates the electrode in position.
7 Remove handle (2) from electrode (5) by pressing out locking pin (8). Take care not to lose coil spring (11).	7 Use the Allen screw to secure electrode cable (3) to handle (2). Caution! Make sure that the machine screw securing the electrode cable is firmly tightened. This is essential to ensure correct electrical contact and correct measuring signals.
8 Remove the old electrode and insert the new electrode. Replacement electrodes can be ordered separately from Endress+Hauser.	8 Reinstall the cover and tighten Allen screw (a).

9.7 Return

Caution!
Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

The following steps must be taken before returning a flow measuring device to Endress+Hauser, e.g. for repair or calibration:
- Always enclose a duly completed "Declaration of contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EC REACH Regulation No. 1907/2006.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.

Note!
You will find a preprinted "Declaration of contamination" form at the back of these Operating Instructions.

9.8 Disposal

Observe the regulations applicable in your country!

9.9 Software history

Date	Software version	Changes to software	Operating Instructions
11.2009	Amplifier: V 2.03.XX	Introduction of Calf history	71106181 / 12.09 71105332 / 11.09
06.2009	Amplifier: V 2.02.XX	Introduction of Promag L	71095684 / 06.09
03.2009	Amplifier: V 2.02.XX	Introduction of Promag D Introduction of new nominal diameter	71088677 / 03.09
11.2004	Amplifier: 1.06.01 Communication module: 1.04.00	Software update relevant only for production	50097089 / 10.03
10.2003	Amplifier: 1.06.00 Communication module: 1.03.00	Software expansion: ▪ Language groups ▪ Flow direction pulse output selectable New functionalities: ▪ Second Totalizer ▪ Adjustable backlight (display) ▪ Operation hours counter ▪ Simulation function for pulse output ▪ Counter for access code ▪ Reset function (fault history) ▪ Up-/download with FieldTool	50097089 / 10.03

Date	Software version	Changes to software	Operating Instructions
08.2003	Communication module: 1.02.01	Software expansion: ▪ New / revised functionalities New functionalities: ▪ Current span NAMUR NE 43 ▪ Failsafe mode function ▪ Troubleshooting function ▪ System and process error messages ▪ Response of status output	50097089 / 08.03
08.2002	Amplifier: 1.04.00	Software expansion: ▪ New / revised functionalities New functionalities: ▪ Current span NAMUR NE 43 ▪ EPD (new mode) ▪ Failsafe mode function ▪ Acknowledge fault function ▪ Troubleshooting function ▪ System and process error messages ▪ Response of status output	50097089 / 08.02
03.2002	Amplifier: 1.03.00	Software expansion: ▪ Suitability for custody transfer measurement Promag 50/51	none
06.2001	Amplifier: 1.02.00 Communication module: 1.02.00	Software expansion: ▪ New functionalities: New functionalities: ▪ General device functions ▪ "OED" software function ▪ "Pulse width" software function	50097089 / 06.01
09.2000	Amplifier: 1.01.01 Communication module: 1.01.00	Software expansion: ▪ Functional adaptations	none
08.2000	Amplifier: 1.01.00	Software expansion: ▪ Functional adaptations	none
04.2000	Amplifier: 1.00.00 Communication module: 1.00.00	Original software Compatible with: ▪ FieldTool ▪ Commuwin II (version 2.05.03 and higher) ▪ HART Communicator DXR 275 (from OS 4.6) with Rev. 1, DD1	50097089 / 04.00

Note!
Uploads or downloads between the individual software versions are only possible with a special service software.

10 Technical data

10.1 Technical data at a glance

10.1.1 Application

→ 🖹 5

10.1.2 Function and system design

Measuring principle	Electromagnetic flow measurement on the basis of Faraday's Law.
Measuring system	→ 🖹 7

10.1.3 Input

Measured variable	Flow velocity (proportional to induced voltage)
Measuring range	Typically v = 0.01 to 10 m/s (0.033 to 33 ft/s) with the specified accuracy
Operable flow range	Over 1000 : 1
Input signal	*Status input (auxiliary input)* ■ Galvanically isolated ■ U = 3 to 30 V DC ■ Ri = 5 kΩ ■ Can be configured for: totalizer reset, positive zero return, error message reset.

10.1.4 Output

Output signal	*Current output* ■ Galvanically isolated ■ Active/passive can be selected: – Active: 0/4 to 20 mA, R_L < 700 Ω (HART: $R_L \geq 250$ Ω) – Passive: 4 to 20 mA, supply voltage V_S 18 to 30 V DC, $R_i \geq 150$ Ω) ■ Time constant can be selected (0.01 to 100s) ■ Full scale value adjustable ■ Temperature coefficient: typ. 0.005% o.f.s./°C, resolution: 0.5 µA o.f.s. = of full scale value *Pulse/frequency output* ■ Galvanically isolated ■ Passive: 30 V DC / 250 mA ■ Open collector ■ Can be configured as: – Pulse output Pulse value and pulse polarity can be selected, max. pulse width adjustable (0.5 to 2000 m – Frequency output Full scale frequency 2 to 1000 Hz (f_{max} = 1.25 Hz), on/off ratio 1:1, pulse width max. 10 s.

Signal on alarm	*Current output* Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43) *Pulse/frequency output* Failsafe mode can be selected *Status output* "Not conductive" in the event of fault or power supply failure
Load	See "Output signal"
Switching output	*Status output* ■ Galvanically isolated ■ Max. 30 V DC/250 mA ■ Open collector ■ Can be configured for: error messages, empty pipe detection (EPD), flow direction, limit values
Low flow cut off	Low flow cut off, switch-on point can be selected as required
Galvanic isolation	All circuits for inputs, outputs, and power supply are galvanically isolated from each other.

10.1.5 Power supply

Electrical connections	→ 📄 44
Supply voltage (power supply)	■ 85 to 260 V AC, 45 to 65 Hz ■ 20 to 55 V AC, 45 to 65 Hz ■ 16 to 62 V DC
Cable entry	*Power supply and signal cables (inputs/outputs):* ■ Cable entry M20 × 1.5 (8 to 12 mm/0.31 to 0.47 inch) ■ Sensor cable entry for armored cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63 inch) ■ Threads for cable entries ½" NPT, G ½" *Connecting cable for remote version:* ■ Cable entry M20 × 1.5 (8 to 12 mm/0.31 to 0.47 inch) ■ Sensor cable entry for armored cables M20 × 1.5 (9.5 to 16 mm / 0.37 to 0.63 inch) ■ Threads for cable entries ½" NPT, G ½"
Cable specifications	→ 📄 50
Power consumption	*Power consumption* ■ AC: <15 VA (incl. sensor) ■ DC: <15 W (incl. sensor) *Switch-on current* ■ Max 3 A (<5 ms) for 260 V AC ■ Max. 13.5 A (<5 ms) for 24 V DC
Power supply failure	■ Lasting min. 1 cycle frequency: ■ EEPROM saves measuring system data ■ S-DAT: exchangeable data storage chip which stores the data of the sensor (nominal diameter, serial number, calibration factor, zero point etc.)
Potential equalization	→ 📄 54

10.1.6 Performance characteristics

Reference operating conditions

To DIN EN 29104 and VDI/VDE 2641:

- Fluid temperature: +28 °C ± 2 K
- Ambient temperature: +22 °C ± 2 K
- Warm-up period: 30 minutes

Installation:

- Inlet run >10 × DN
- Outlet run > 5 × DN
- Sensor and transmitter grounded.
- The sensor is centered in the pipe.

Maximum measured error

- Current output: plus typically ± 5 µA
- Pulse output: ± 0.5% o.r. ± 1 mm/s
  Option: ± 0.2% o.r. ± 2 mm/s (o.r. = of reading)
  (o.r. = of reading)

Fluctuations in the supply voltage do not have any effect within the specified range.

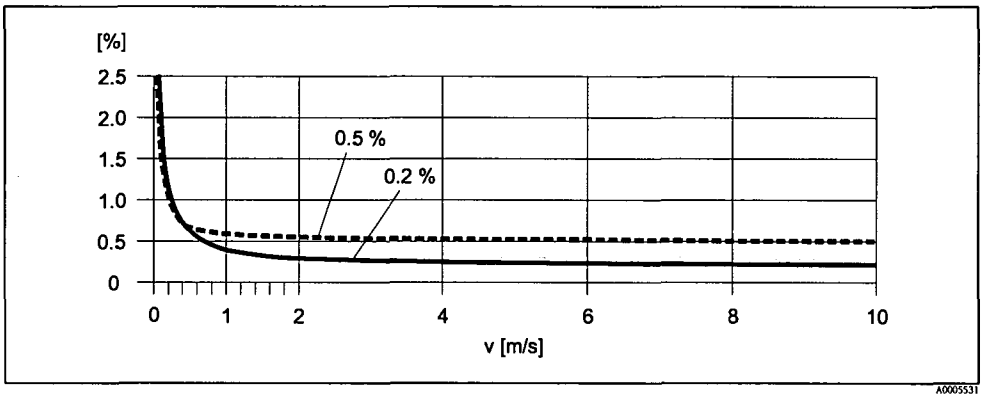


Fig. 57: Max. measured error in % of reading

Repeatability

Max. ± 0.1% o.r. ± 0.5 mm/s (o.r. = of reading)

10.1.7 Operating conditions: Installation

Installation instructions

Any orientation (vertical, horizontal), restrictions and installation instructions → 🖹 13

Inlet and outlet run

If possible, install the sensor upstream from fittings such as valves, T-pieces, elbows, etc. The following inlet and outlet runs must be observed in order to meet accuracy specifications (→ 🖹 16, → 🖹 12):

- Inlet run: ≥ 5 × DN
- Outlet run: ≥ 2 × DN

Adapters

→ 🖹 17

Length of connecting cable

→ 🖹 20

10.1.8 Operating conditions: Environment

Ambient temperature range

- Transmitter:
  - Standard: –20 to +60 °C (–4 to +140 °F)
  - Optional: –40 to +60 °C (–40 to +140 °F)

Note!
At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired.

- Sensor:
  - Flange material carbon steel: –10 to +60 °C (+14 to +140 °F)
  - Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)

Caution!
- The permitted temperature range of the measuring tube lining may not be undershot or overshot (→ "Operating conditions: Process" → "Medium temperature range").
- Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.
- The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.

Storage temperature

The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.

Caution!
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.
- A storage location must be selected where moisture does not collect in the measuring device. This will help prevent fungus and bacteria infestation which can damage the liner.

Degree of protection

- Standard: IP 67 (NEMA 4X) for transmitter and sensor
- Optional: IP 68 (NEMA 6P) for remote version of Promag L, W and P sensor. Promag L only with stainless steel flanges.

Shock and vibration resistance

Acceleration up to 2 g following IEC 60068-2-6
(high-temperature version: no data available)

CIP cleaning

Caution!
The maximum fluid temperature permitted for the device may not be exceeded.

CIP cleaning is possible:
Promag P, Promag H

CIP cleaning is not possible:
Promag D, Promag L, Promag W

SIP cleaning

Caution!
The maximum fluid temperature permitted for the device may not be exceeded.

SIP cleaning is possible:
Promag H

SIP cleaning is not possible:
Promag D, Promag L, Promag W, Promag P

Electromagnetic compatibility (EMC)

- As per IEC/EN 61326 and NAMUR Recommendation NE 21
- Emission: to limit value for industry EN 55011

10.1.9 Operating conditions: Process

Medium temperature range

The permissible temperature depends on the lining of the measuring tube

Promag D

0 to +60 °C (+32 to +140 °F) for polyamide

Promag L

- –20 to +50 °C (–4 to +122 °F) for polyurethane (DN 50 to 300)
- –20 to +90 °C (–4 to +194 °F) for PTFE (DN 50 to 300)

Promag W

- 0 to +80 °C (+32 to +176 °F) for hard rubber (DN 65 to 2000)
- –20 to +50 °C (–4 to +122 °F) for polyurethane (DN 25 to 1200)

Promag P

Standard
- –40 to +130 °C (–40 to +266 °F) for PTFE (DN 15 to 600 / 1/2" to 24"), Restrictions → see the following diagrams
- –20 to +130 °C (–4 to +266 °F) for PFA/HE (DN 25 to 200 / 1" to 8"), Restrictions → see the following diagrams
- –20 to +150 °C (–4 to +302 °F) for PFA (DN 25 to 200 / 1" to 8"), Restrictions → see the following diagrams

Optional
High-temperature version (HT): –20 to +180 °C (–4 to +356 °F) for PFA (DN 25 to 200 / 1" to 8")

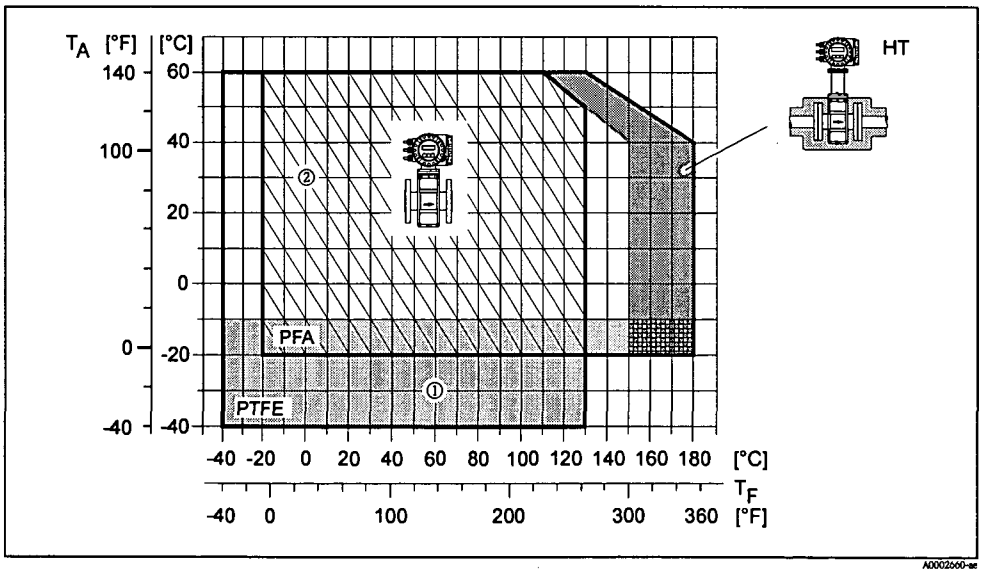


Abb. 58: Compact version Promag P (with PFA- or PTFE-lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation
① = light gray area → temperature range from –10 to –40 °C (–14 to –40 °F) is valid for stainless steel version only
② = diagonal hatched area → foam lining (HE) and degree of protection IP 68 = fluid temperature max. 130°C / 266 °F

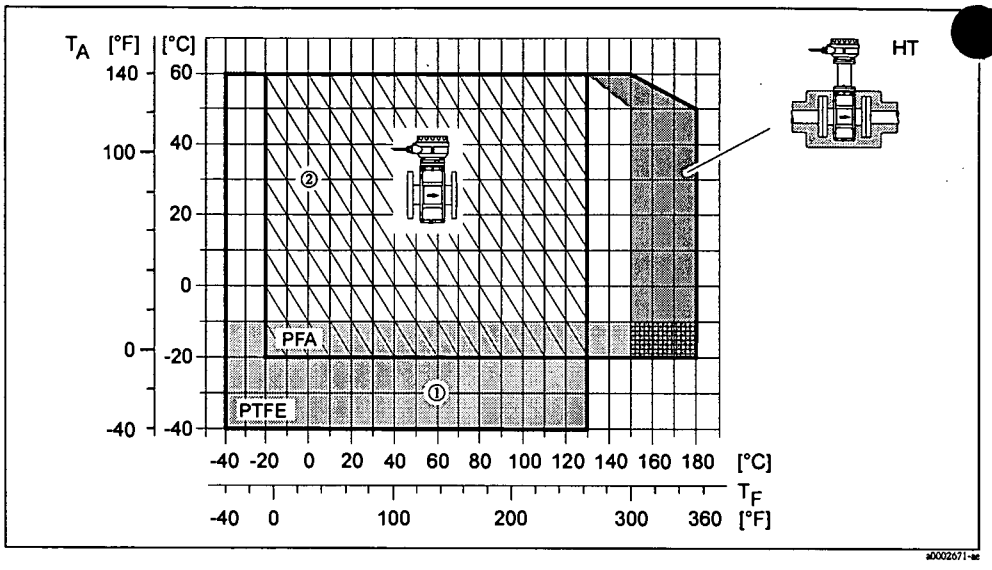


Abb. 59: Remote version Promag P (with PFA- or PTFE-lining)

T_A = ambient temperature; T_F = fluid temperature; HT = high-temperature version with insulation
① = light gray area → temperature range from –10 to –40 °C (–14 to –40 °F) is valid for stainless steel version only
② = diagonal hatched area → foam lining (HE) and degree of protection IP68 = fluid temperature max. 130°C / 266 °F

Promag H

Sensor:
- DN 2 to 25: –20 to +150 °C (–4 to +302 °F)
- DN 40 to 100: –20 to +150 °C (–4 to +302 °F)

Seals:
- EPDM: –20 to +150 °C (–4 to +302 °F)
- Silicone: –20 to +150 °C (–4 to +302 °F)
- Viton: –20 to +150 °C (–4 to +302 °F)
- Kalrez: –20 to +150 °C (–4 to +302 °F)

Conductivity

The minimum conductivity is ≥ 5 µS/cm (≥ 20 µS/cm for demineralized water)

Note!
Note that in the case of the remote version, the requisite minimum conductivity is also influenced by the length of the connecting cable → 20

Medium pressure range (nominal pressure)

Promag D

- EN 1092-1 (DIN 2501)
  - PN 16
- ANSI B 16.5
  - Class 150
- JIS B2220
  - 10 K

Promag L

- EN 1092-1 (DIN 2501)
  - PN 10 (DN 50 to 300)
  - PN 16 (DN 50 to 150)
- EN 1092-1, lap joint flange, stampel plate
  - PN 10 (DN 50 to 300)
- ANSI B 16.5
  - Class 150 (2" to 12")

Promag W

- EN 1092-1 (DIN 2501)
  - PN 6 (DN 350 to 2000)
  - PN 10 (DN 200 to 2000)
  - PN 16 (DN 65 to 2000)
  - PN 25 (DN 200 to 1000)
  - PN 40 (DN 25 to 150)
- ANSI B 16.5
  - Class 150 (1" to 24")
  - Class 300 (1" to 6")
- AWWA
  - Class D (28" to 78")
- JIS B2220
  - 10 K (DN 50 to 300)
  - 20 K (DN 25 to 300)

- AS 2129
  - Table E (DN 80, 100, 150 to 1200)
- AS 4087
  - PN 16 (DN 80, 100, 150 to 1200)

Promag P

- EN 1092-1 (DIN 2501)
  - PN 10 (DN 200 to 600)
  - PN 16 (DN 65 to 600)
  - PN 25 (DN 200 to 600)
  - PN 40 (DN 15 to 150)
- ANSI B 16.5
  - Class 150 (½" to 24")
  - Class 300 (½" to 6")
- JIS B2220
  - 10 K (DN 50 to 300)
  - 20 K (DN 15 to 300)
- AS 2129
  - Table E (DN 25, 50)
- AS 4087
  - PN 16 (DN 50)

Promag H

The permissible nominal pressure depends on the process connection and the seal:
- 40 bar → flange, weld nipple (with O-ring seal)
- 16 bar → all other process connections

Pressure tightness

Promag D

Measuring tube: 0 mbar abs (0 psi abs) with a fluid temperature of ≤ 60 °C (≤ 140 °F)

Promag L (Measuring tube lining: Polyurethane)

Promag L Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures		
		25 °C	50 °C	80° C
[mm]	[inch]	77 °F	122 °F	176° F
50 to 300	2 to 12"	0	0	-

Promag L
Measuring tube lining: PTFE

Promag L Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures			
		25 °C		90 °C	
		77 °F		194 °F	
[mm]	[inch]	[mbar]	[psi]	[mbar]	[psi]
50	2"	0	0	0	0
65	-	0	0	40	0.58
80	3"	0	0	40	0.58
100	4"	0	0	135	1.96
125	-	135	1.96	240	3.48
150	6"	135	1.96	240	3.48
200	8"	200	2.90	290	4.21
250	10"	330	4.79	400	5.80
300	12"	400	5.80	500	7.25

Promag W

Promag W Nominal diameter		Measuring tube lining	Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures						
			25 °C	50 °C	80° C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]		77 °F	122 °F	176° F	212 °F	266 °F	302 °F	356 °F
25 to 1200	1 to 48"	Polyurethane	0	0	-	-	-	-	-
65 to 2000	3 to 78"	Hard rubber	0	0	0	-	-	-	-

Promag P
Measuring tube lining: PFA

Promag P Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures					
		25 °C	80° C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]	77 °F	176° F	212 °F	266 °F	302 °F	356 °F
25	1"	0	0	0	0	0	0
32	-	0	0	0	0	0	0
40	1 ½"	0	0	0	0	0	0
50	2"	0	0	0	0	0	0
65	-	0	*	0	0	0	0
80	3"	0	*	0	0	0	0
100	4"	0	*	0	0	0	0

Promag P Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures					
		25 °C	80° C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]	77 °F	176° F	212 °F	266 °F	302 °F	356 °F
125	-	0	*	0	0	0	0
150	6"	0	*	0	0	0	0
200	8"	0	*	0	0	0	0
* No value can be quoted.							

Promag P
Measuring tube lining: PTFE

Promag P Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures								
		25 °C		80° C	100 °C		130 °C		150 °C	180 °C
		77 °F		176° F	212 °F		266 °F		302 °F	356 °F
[mm]	[inch]	[mbar]	[psi]		[mbar]	[psi]	[mbar]	[psi]		
15	½"	0	0	0	0	0	100	1.45	–	–
25	1"	0	0	0	0	0	100	1.45	–	–
32	-	0	0	0	0	0	100	1.45	–	–
40	1 ½"	0	0	0	0	0	100	1.45	–	–
50	2"	0	0	0	0	0	100	1.45	–	–
65	-	0	0	*	40	0.58	130	1.89	–	–
80	3"	0	0	*	40	0.58	130	1.89	–	–
100	4"	0	0	*	135	1.96	170	2.47	–	–
125	-	135	1.96	*	240	3.48	385	5.58	–	–
150	6"	135	1.96	*	240	3.48	385	5.58	–	–
200	8"	200	2.90	*	290	4.21	410	5.95	–	–
250	10"	330	4.79	*	400	5.80	530	7.69	–	–
300	12"	400	5.80	*	500	7.25	630	9.14	–	–
350	14"	470	6.82	*	600	8.70	730	10.59	–	–
400	16"	540	7.83	*	670	9.72	800	11.60	–	–
450	18"	Partial vacuum is impermissible!								
500	20"									
600	24"									
* No value can be quoted.										

Promag H (Measuring tube lining: PFA)

Promag H Nominal diameter		Resistance of measuring tube lining to partial vacuum Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures					
		25 °C	80° C	100 °C	130 °C	150 °C	180 °C
[mm]	[inch]	77 °F	176° F	212 °F	266 °F	302 °F	356 °F
2 to 100	1/12 to 4"	0	0	0	0	0	0

Limiting flow → 18

Pressure loss
- No pressure loss if the sensor is installed in a pipe of the same nominal diameter (Promag H: only DN 8 and larger).
- Pressure losses for configurations incorporating adapters according to DIN EN 545 (see "Adapters" → 17)

10.1.10 Mechanical construction

Design, dimensions

The dimensions and installation lengths of the sensor and transmitter can be found in the "Technical Information" for the device in question. This document can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section on → 🖹 116.

Weight (SI units)

Promag D

Weight data of Promag D in kg				
Nominal diameter		Compact version	Remote version (without cable)	
[mm]	[inch]		Sensor	Transmitter
25	1"	4.5	2.5	6.0
40	1 ½"	5.1	3.1	6.0
50	2"	5.9	3.9	6.0
65	2 ½"	6.7	4.7	6.0
80	3"	7.7	5.7	6.0
100	4"	10.4	8.4	6.0
Transmitter Promag (compact version): 3.4 kg (Weight data valid without packaging material)				

Promag L (lap joint flanges)

Weight data of Promag L in kg									
Nominal diameter		Compact version				Remote version (without cable)			
						Sensor			Transmitter
[mm]	[inch]	EN (DIN)		ANSI		EN (DIN)		ANSI	
50	2"	PN 16	10.6	Class 150	10.6	PN 16	8.6	Class 150	8.6	6.0
65	2 ½"		12.0		–		10.0		–	6.0
80	3"		14.0		14.0		12.0		12.0	6.0
100	4"		16.0		16.0		14.0		14.0	6.0
125	5"		21.5		–		19.5		–	6.0
150	6"		25.5		25.5		23.5		23.5	6.0
200	8"	PN 10	45		45	PN 10	43		43	6.0
250	10"		65		65		63		73	6.0
300	12"		70		–		68		–	6.0
Transmitter Promag (compact version): 3.4 kg (Weight data valid for standard pressure ratings and without packaging material)										

Promag L (lap joint flanges, stamped plate)

Weight data of Promag L in kg					
Nominal diameter		Compact version		Remote version (without cable)	
[mm]	[inch]	EN (DIN)		Sensor EN (DIN)	Transmitter
50	2"	PN 10	7.2	PN 10	5.2	6.0
65	2 ½"		8.0		6.0	6.0
80	3"		9.0		7.0	6.0
100	4"		11.5		9.5	6.0
125	5"		15.0		13.0	6.0
150	6"		19.0		17.0	6.0
200	8"		37.5		35.5	6.0
250	10"		56.0		54.0	6.0
300	12"		57.0		55.0	6.0
Transmitter Promag (compact version): 3.4 kg (Weight data valid for standard pressure ratings and without packaging material)					

Promag W

Weight data of Promag W in kg

Nominal diameter		Compact version						Remote version (without cable)						
								Sensor						Trans-mitter
[mm]	[inch]		EN (DIN) / AS*		JIS		ANSI/ AWWA		EN (DIN) / AS*		JIS		ANSI/ AWWA	
25	1"	PN 40	7.3	10K	7.3	Class 150	7.3	PN 40	5.3	10K	5.3	Class 150	5.3	6.0
32	1 ¼"		8.0		7.3		–		6.0		5.3		–	6.0
40	1 ½"		9.4		8.3		9.4		7.4		6.3		7.4	6.0
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	6.0
65	2 ½"		12.0		11.1		–		10.0		9.1		–	6.0
80	3"	PN 16	14.0		12.5		14.0	PN 16	12.0		10.5		12.0	6.0
100	4"		16.0		14.7		16.0		14.0		12.7		14.0	6.0
125	5"		21.5		21.0		–		19.5		19.0		–	6.0
150	6"		25.5		24.5		25.5		23.5		22.5		23.5	6.0
200	8"		45		41.9		45		43		39.9		43	6.0
250	10"		65		69.4		65		63		67.4		73	6.0
300	12"		70		72.3		110		68		70.3		108	6.0
350	14"	PN 10	115				175	PN 10	113				173	6.0
400	16"		135				205		133				203	6.0
450	18"		175				255		173				253	6.0
500	20"		175				285		173				283	6.0
600	24"		235				405		233				403	6.0
700	28"		355				400		353				398	6.0
–	30"		–				460		–				458	6.0
800	32"		435				550		433				548	6.0
900	36"		575				800		573				798	6.0
1000	40"		700				900		698				898	6.0
–	42"	PN 6	–			Class D	1100	PN 6	–			Class D	1098	6.0
1200	48"		850				1400		848				1398	6.0
–	54"		–				2200		–				2198	6.0
1400	–		1300				–		1298				–	6.0
–	60"		–				2700		–				2698	6.0
1600	–		1700				–		1698				–	6.0
–	66"		–				3700		–				3698	6.0
1800	72"		2200				4100		2198				4098	6.0
–	78"		–				4600		–				4598	6.0
2000	–		2800				–		2798				–	6.0

Transmitter Promag (compact version): 3.4 kg
(Weight data valid for standard pressure ratings and without packaging material)
*Flanges according to AS are only available for DN 80, 100, 150 to 400, 500 and 600

Promag P

Weight data of Promag P in kg

Nominal diameter		Compact version						Remote version (without cable)					
									Sensor				Trans-mitter
[mm]	[inch]	EN (DIN) / AS*		JIS		ANSI / AWWA		EN (DIN) / AS*		JIS		ANSI / AWWA	
15	½"	PN 40	6.5	10K	6.5	Class 150	6.5	PN 40	4.5	10K	4.5	Class 150	4.5	6.0
25	1"		7.3		7.3		7.3		5.3		5.3		5.3	6.0
32	1 ¼"		8.0		7.3		–		6.0		5.3		–	6.0
40	1 ½"		9.4		8.3		9.4		7.4		6.3		7.4	6.0
50	2"		10.6		9.3		10.6		8.6		7.3		8.6	6.0
65	2 ½"	PN 16	12.0		11.1		–	PN 16	10.0		9.1		–	6.0
80	3"		14.0		12.5		14.0		12.0		10.5		12.0	6.0
100	4"		14.4		14.7		16.0		14.0		12.7		14.0	6.0
125	5"		16.0		21.0		–		19.5		19.0		–	6.0
150	6"		21.5		24.5		25.5		23.5		22.5		23.5	6.0
200	8"	PN 10	45		41.9		45	PN 10	43		39.9		43	6.0
250	10"		65		69.4		75		63		67.4		73	6.0
300	12"		70		72.3		110		68		70.3		108	6.0
350	14"		115				175		113				173	6.0
400	16"		135				205		133				203	6.0
450	18"		175				255		173				253	6.0
500	20"		175				285		173				283	6.0
600	24"		235				405		233				403	6.0

Transmitter Promag (compact version): 3.4 kg
High-temperature version: + 1.5 kg
(Weight data valid for standard pressure ratings and without packaging material)
* Flanges according to AS are only available for DN 25 and 50.

Promag H

Weight data of Promag H in kg

Nominal diameter		Compact version	Remote version (without cable)	
			Sensor	
[mm]	[inch]	DIN		Transmitter
2	1/12"	5.2	2	6.0
4	5/32"	5.2	2	6.0
8	5/16"	5.3	2	6.0
15	½"	5.4	1.9	6.0
25	1"	5.5	2.8	6.0
40	1 ½"	6.5	4.5	6.0
50	2"	9.0	7.0	6.0
65	2 ½"	9.5	7.5	6.0
80	3"	19.0	17.0	6.0
100	4"	18.5	16.5	6.0

Transmitter Promag (compact version): 3.4 kg
(Weight data valid for standard pressure ratings and without packaging material)

Weight (US units)

Promag D

Weight data of Promag D in lbs				
Nominal diameter		Compact version	Remote version (without cable)	
[mm]	[inch]		Sensor	Transmitter
25	1"	10	6	13
40	1 ½"	11	7	13
50	2"	13	9	13
80	3"	17	13	13
100	4"	23	19	13
Transmitter Promag (compact version): 7.5 lbs (Weight data valid without packaging material)				

Promag L (ANSI)

Weight data of Promag L in lbs					
Nominal diameter		Compact version		Remote version (without cable)	
[mm]	[inch]			Sensor	Transmitter
50	2"	Class 150	23	Class 150	19	13
80	3"		31		26	13
100	4"		35		31	13
150	6"		56		52	13
200	8"		99		95	13
250	10"		143		161	13
Transmitter Promag (compact version): 7.5 lbs (Weight data valid for standard pressure ratings and without packaging material)					

Promag P (ANSI/AWWA)

Weight data of Promag P in lbs					
Nominal diameter		Compact version		Remote version (without cable)	
[mm]	[inch]			Sensor	Transmitter
15	½"	Class 150	14	Class 150	10	13
25	1"		16		12	13
40	1 ½"		21		16	13
50	2"		23		19	13
80	3"		31		26	13
100	4"		35		31	13
150	6"		56		52	13
200	8"		99		95	13
250	10"		165		161	13
300	12"		243		238	13
350	14"		386		381	13
400	16"		452		448	13
450	18"		562		558	13
500	20"		628		624	13
600	24"		893		889	13
Transmitter Promag (compact version): 7.5 lbs High-temperature version: 3.3 lbs (Weight data valid for standard pressure ratings and without packaging material)					

Promag W (ANSI/AWWA)

Weight data of Promag W in lbs					
Nominal diameter		Compact version		Remote version (without cable)	
				Sensor	Transmitter
[mm]	[inch]				
25	1"	Class 150	16	Class 150	12	13
40	1 ½"		21		16	13
50	2"		23		19	13
80	3"		31		26	13
100	4"		35		31	13
150	6"		56		52	13
200	8"		99		95	13
250	10"		143		161	13
300	12"		243		238	13
350	14"		386		381	13
400	16"		452		448	13
450	18"		562		558	13
500	20"		628		624	13
600	24"		893		889	13
700	28"	Class D	882	Class D	878	13
–	30"		1014		1010	13
800	32"		1213		1208	13
900	36"		1764		1760	13
1000	40"		1985		1980	13
–	42"		2426		2421	13
1200	48"		3087		3083	13
–	54"		4851		4847	13
–	60"		5954		5949	13
–	66"		8159		8154	13
1800	72"		9041		9036	13
–	78"		10143		10139	13

Transmitter Promag (compact version): 7.5 lbs
(Weight data valid for standard pressure ratings and without packaging material)

Promag H

Weight data of Promag H in lbs				
Nominal diameter		Compact version	Remote version (without cable)	
			Sensor	Transmitter
[mm]	[inch]			
2	1/12"	11	4	13
4	5/32"	11	4	13
8	5/16"	12	4	13
15	½"	12	4	13
25	1"	12	6	13
40	1 ½"	14	10	13
50	2"	20	15	13
65	2 ½"	21	17	13
80	3"	42	37	13
100	4"	41	36	13

Transmitter Promag (compact version): 7.5 lbs
(Weight data valid for standard pressure ratings and without packaging material)

Material

Promag D

- Transmitter housing: powder-coated die-cast aluminum
- Sensor housing: powder-coated die-cast aluminum
- Measuring tube: polyamide, O-rings EPDM
  (Drinking water approvals: WRAS BS 6920, ACS, NSF 61, KTW/W270)
- Electrodes: 1.4435/316L
- Ground disks: 1.4301/304

Promag L

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing: powder-coated die-cast aluminum
- Measuring tube: stainless steel 1.4301 or 1.4306/304L
- Electrodes: 1.4435, Alloy C-22
- Flange
  - EN 1092-1 (DIN 2501): 1.4306; 1.4307; 1.4301; RSt37-2 (S235JRG2)
  - ANSI: A105; F316L
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Promag W

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 25 to 300: powder-coated die-cast aluminum
  - DN 350 to 2000: with protective lacquering
- Measuring tube
  - DN ≤ 300: stainless steel 1.4301 or 1.4306/304L
    (for flanges made of carbon steel with Al/Zn protective coating)
  - DN ≥ 350: stainless steel 1.4301 or 1.4306/304
    (for flanges made of carbon steel with protective lacquering)
- Electrodes: 1.4435 or Alloy C-22, Tantalum
- Flange
  - EN 1092-1 (DIN2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B
    (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - ANSI: A105; F316L
    (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - AWWA: 1.0425
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L
    (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - AS 2129
    - (DN 150, 200, 250, 300, 600) A105 or RSt37-2 (S235JRG2)
    - (DN 80, 100, 350, 400, 500) A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L, Alloy C-22, Titanium, Tantalum

Promag P

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum
  - Wall-mounted housing: powder-coated die-cast aluminum
- Sensor housing
  - DN 15 to 300: powder-coated die-cast aluminum
  - DN 350 to 2000: with protective lacquering
- Measuring tube
  - DN ≤ 300: stainless steel 1.4301 or 1.4306/304L; for flanges made of carbon steel with Al/Zn protective coating
  - DN ≥ 350.: stainless steel 1.4301 or 1.4306/304L; for flanges made of carbon steel with Al/Zn protective coating
- Electrodes: 1.4435, Platinum, Alloy C-22, Tantalum, Titanium
- Flange
  - EN 1092-1 (DIN2501): 1.4571/316L; RSt37-2 (S235JRG2); C22; FE 410W B (DN ≤ 300: with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - ANSI: A105; F316L (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - AWWA: 1.0425
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L (DN ≤ 300 with Al/Zn protective coating; DN ≥ 350 with protective lacquering)
  - AS 2129
    - (DN 25) A105 or RSt37-2 (S235JRG2)
    - (DN 40) A105 or St44-2 (S275JR)
  - AS 4087: A105 or St44-2 (S275JR)
- Seals: to DIN EN 1514-1
- Ground disks: 1.4435/316L or Alloy C-22

Promag H

- Transmitter housing:
  - Compact housing: powder-coated die-cast aluminum or stainless steel field housing (1.4301/316L)
  - Wall-mounted housing: powder-coated die-cast aluminum
  - Window material: glas or polycarbonate
- Sensor housing: stainless steel 1.4301
- Wall mounting kit: stainless steel 1.4301
- Measuring tube: stainless steel 1.4301
- Electrodes:
  - Standard: 1.4435
  - Option: Alloy C-22, Tantalum, Platinum
- Flange:
  - All connections stainless-steel 1.4404/316L
  - EN (DIN), ANSI, JIS made of PVDF
  - Adhesive fitting made of PVC
- Seals
  - DN 2 to 25: O-ring (EPDM, Viton, Kalrez), gasket seal (EPDM, Viton, silicone)
  - DN 40 to 100: gasket seal (EPDM, Viton, silicone)
- Ground rings: 1.4435/316L (optional: Tantalum, Alloy C-22)

Material load diagram

The material load diagrams (pressure-temperature graphs) for the process connections are to be found in the "Technical Information" documents of the device in question:
List of supplementary documentation → 🖹 116.

Fitted electrodes

Promag D

- 2 measuring electrodes for signal detection

Promag L, W and P

- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection
- 1 reference electrode for potential equalization

Promag H

- 2 measuring electrodes for signal detection
- 1 EPD electrode for empty pipe detection (apart from DN 2 to 15)

Process connections

Promag D

Wafer version → without process connections

Promag L

Flange connections:
- EN 1092-1 (DIN 2501)
- ANSI

Promag W and P

Flange connections:
- EN 1092-1 (DIN 2501)
  - DN ≤ 300 = form A
  - DN ≥ 350 = flat face
  - DN 65 PN 16 and DN 600 PN 16 only as per EN 1092-1
- ANSI
- AWWA (only Promag W)
- JIS
- AS

Promag H

With O-ring:
- Weld nipple DIN (EN), ISO 1127, ODT/SMS
- Flange EN (DIN), ANSI, JIS
- Flange made of PVDF EN (DIN), ANSI, JIS
- External thread
- Internal thread
- Hose connection
- PVC adhesive fitting

With gasket seal:
- Weld nipple DIN 11850, ODT/SMS
- Clamp ISO 2852, DIN 32676, L14 AM7
- Threaded joint DIN 11851, DIN 11864-1, ISO 2853, SMS 1145
- Flange DIN 11864-2

Surface roughness

All data relate to parts in contact with fluid.

- Liner → PFA: ≤ 0.4 µm (15 µin)
- Electrodes: 0.3 to 0.5 µm (12 to 20 µin)
- Process connection made of stainless-steel (Promag H): ≤ 0.8 µm (31 µin)

10.1.11 Human interface

Display elements

- Liquid crystal display: illuminated, two-line, 16 characters per line
- Custom configurations for presenting different measured-value and status variables
- 2 totalizers

Note!
At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired.

Operating elements

- Local operation with three keys (⊟, +, E)
- "Quick Setup" menus for straightforward commissioning

Language groups

Language groups available for operation in different countries:
- Western Europe and America (WEA):
  English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe/Scandinavia (EES):
  English, Russian, Polish, Norwegian, Finnish, Swedish and Czech
- Southeast Asia (SEA):
  English, Japanese, Indonesian

Note!
You can change the language group via the operating program "FieldCare".

Remote operation

Operation via HART protocol and Fieldtool

10.1.12 Certificates and approvals

CE mark

The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

C-tick mark

The measuring system meets the EMC requirements of the Australian Communications and Media Authority (ACMA)

Ex approval

Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI etc.) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is available upon request.

Sanitary compatibility

Promag D, L, W and P

No applicable approvals or certification

Promag H

- 3A authorization and EHEDG-tested
- Seals: in conformity with FDA (except Kalrez seals)

Drinking water approval

Promag D, L and W

- WRAS BS 6920
- ACS
- NSF 61
- KTW/W270

Promag P and H

No drinking water approval

Pressure Equipment Directive	*Promag D and L* No pressure measuring device approval *Promag W, P and H* Measuring devices with a nominal diameter smaller than or equal to DN 25 correspond to Article 3 (3) of the EC Directive 97/23/EC (Pressure Equipment Directive) and have been designed and manufactured according to good engineering practice. Where necessary (depending on the fluid and process pressure), there are additional optional approvals to Category II/III for larger nominal diameters.
Other standards and guidelines	■ EN 60529 Degrees of protection by housing (IP code). ■ EN 61010-1 Safety requirements for electrical equipment for measurement, control and laboratory use ■ IEC/EN 61326 Electromagnetic compatibility (EMC requirements) ■ ANSI/ISA-S82.01 Safety Standard for Electrical and Electronic Test, Measuring, Controlling and related Equipment - General Requirements. Pollution degree 2, Installation Category II. ■ CAN/CSA-C22.2 (No. 1010.1-92) Safety requirements for Electrical Equipment for Measurement and Control and Laboratory Use. Pollution degree 2, Installation Category I. ■ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment. ■ NAMUR NE 43 Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.

10.1.13 Ordering information

Your Endress+Hauser service organization can provide detailed ordering information and information on the order codes on request.

10.1.14 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor → 🖹 77.
Your Endress+Hauser service organization can provide detailed information on the specific order codes on request.

10.1.15 Documentation

- Flow measuring technology (FA005D/06)
- Technical Information Promag 50D (TI082D/06)
- Technical Information Promag 50L (TI097D/06)
- Technical Information Promag 50W, 53W (TI046D/06)
- Technical Information Promag 50P, 53P (TI047D/06)
- Technical Information Promag 50H, 53H (TI048D/06)
- Description of Device Functions Promag 50 HART (BA049D/06)
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, etc.

Index

Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination
Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.
Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.
Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System** / *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*
Temperature / *Temperatur* _____ [°F] _____ [°C]
Pressure / *Druck* _____ [psi] _____ [Pa]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits-schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

Company data / *Angaben zum Absender*

Company / *Firma* _____
Address / *Adresse* _____
Phone number of contact person / *Telefon-Nr. Ansprechpartner:* _____
Fax / E-Mail _____
Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

P/SF/Konta XIV

(place, date / *Ort, Datum)* _____ Name, dept./*Abt.* (please print / *bitte Druckschrift*) _____ Signature / *Unterschrift* _____

www.endress.com/worldwide

Endress+Hauser

People for Process Automation

BA046D/06/en/12.09
71106181
FM+SGML6.0 ProMoDo

6.0 TEST SHEETS

Robertsons
lifting · rigging · height safety

Certificate of Test and Examination

Customer Name And Address:
J & P Richardson Industries
114 Campbell Avenue
WACOL QLD 4076

Customer Order No.: 215626
Sales Order No.: 330186
Job No.: 156017

Test/Report Date: 31/08/10
Test Type: Proof Test

Certificate No.: 113377
Laboratory: BRISBANE

Identification Markings	Description	Effective Length	Finish	W.L.L.	Angle	QTY	Minimum Load / Force Applied (kN)
G9677 G9678	13mm Gr.50 s/s pump chain	14500MM	Stainless Steel	2.5t	Direct	2	49.1kn

Result: Pass

Manufacturer: JLR

Complies to Test Procedure: JLR LQM 13.1

Additional Notes on Test Results

Site:

Location:

The above articles were tested and examined by a competent person

Signed:

Authorised Signatory: Jason Heppes

Head Office
BRISBANE SOUTH
4 Burchill St
Loganholme Q 4129
P 07 3801 0811
F 07 3209 6325

ROBERTSONS
BRISBANE NORTH
5 Johnstone Rd
Brendale Q 4500
P 07 3881 1445
F 07 3881 2662

GC. Q.COAST
39 Lever Drive
Burleigh Heads Q 4220
P 07 5535 9277
F 07 5535 9366

TOOWOOMBA
345 Taylor St
Toowoomba Q 4350
P 07 4634 6568
F 07 4634 8533

MACKAY
79 Boundary Rd
Paget Q 4740
P 07 4952 5520
F 07 4952 5545

GLADSTONE
4 Tranberg St
Gladstone Q 4680
P 07 4972 8611
F 07 4972 8699

MELBOURNE
9 Byron St
Williamstown VIC 3016
P 03 9397 3833
F 03 9397 3844

DANDENONG
28 Swift Way
Dandenong South VIC 3175
P 03 9768 3244
F 03 9768 3422

PERTH
16-18 Newdale Rd
Welshpool WA 6106
P 08 9451 1522
F 08 9451 1533

SYDNEY
50 Stanmat St North
Silverwater NSW 2128
P 02 9748 3044
F 02 9748 4120

A&D LIFTING
NEWCASTLE
33 Fircrofts Drive
Thornton NSW 2322
P 02 4966 8622
F 02 4966 8611

MUSWELLBROOK
Lot 49 Thomas Mitchell Drive
Muswellbrook NSW 2333
P 02 6541 5100
F 02 6543 3233

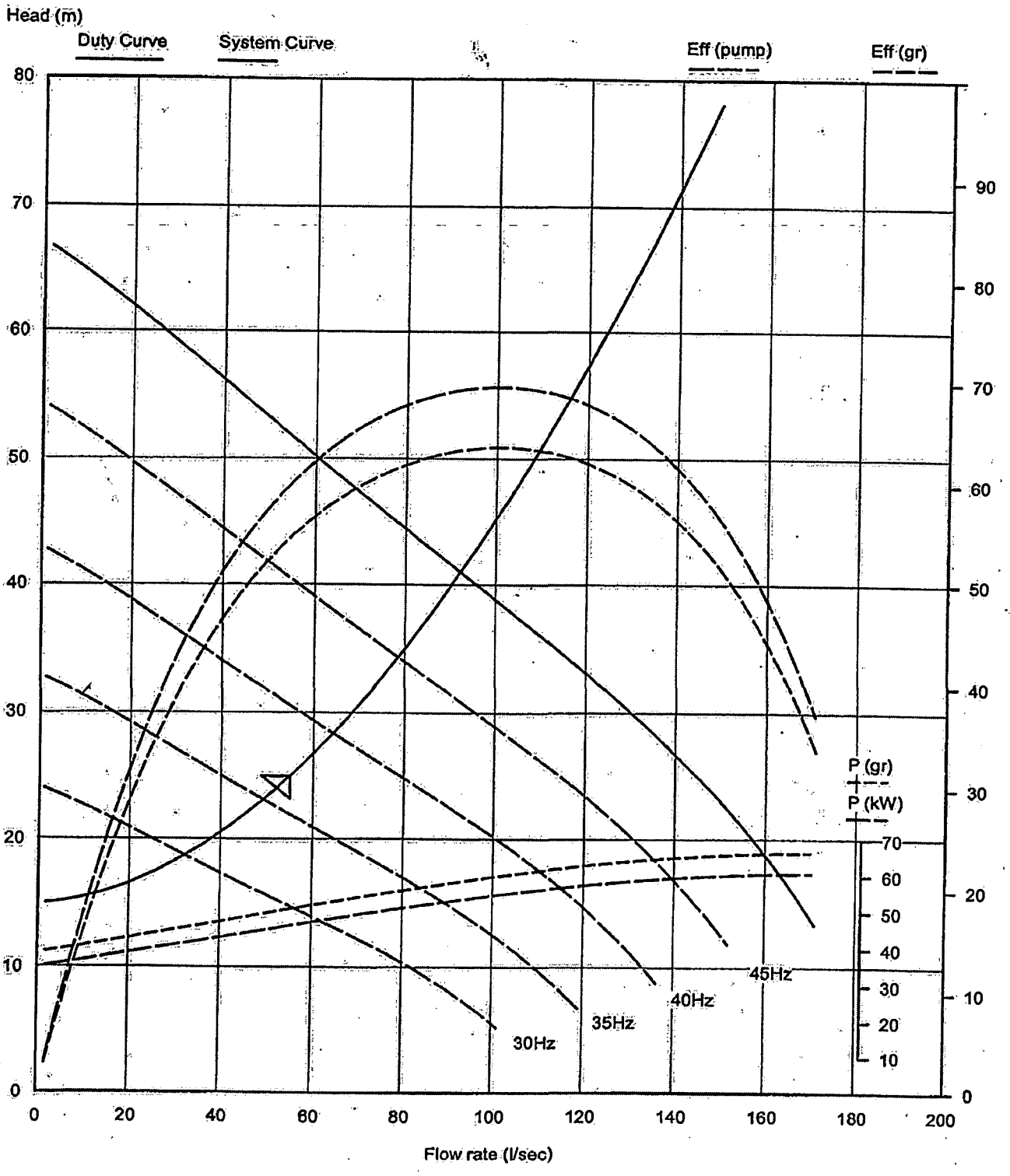
GRUNDFOS

S1-654-AH1

Project Ref SPS315 AXIS PL

Curve no:	942768
Pn	68 kW
Nn	1476 1/min

REQUIRED DUTY		PUMP DUTY POINT DATA			
Flow	55 l/sec	Flow	92.2 l/sec	P (pump)	53.5 kW
Head	25 m	Head	41.0 m	Eff (pump)	69.3 %
		Energy	176 kWh/1000m3	P (gr)	58.6 kW
				Eff (gr)	63.4 %



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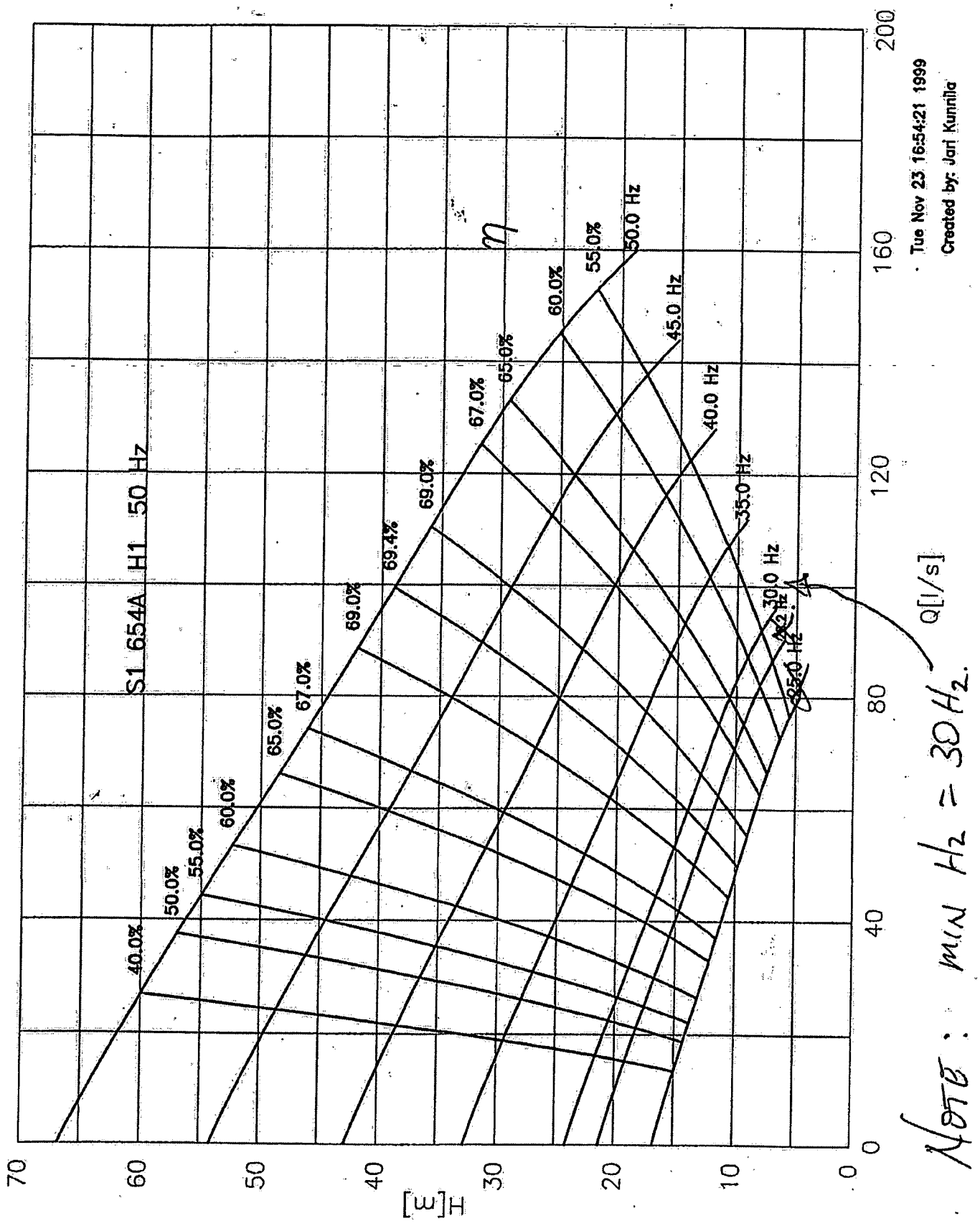


Note: min H_2 = 30 H_2.

d-2768.txt

7.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

7.1 Circuit Breakers / Chassis' / Isolators

7.2 Control Devices / GPO'S / Relays

7.3 Surge Protection

7.4 Switches / Indicators / Pushbuttons

7.5 Power Supplies

7.6 Instrumentation

7.7 Variable Speed Drive

7.8 Earth / Neutral Links

7.9 Terminals

7.1 CIRCUIT BREAKERS / CIRCUIT BREAKER CHASSIS / ISOLATORS

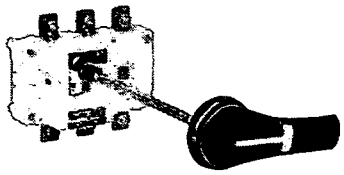
- TERASAKI – S250GJ/3250 – CIRCUIT BREAKER
- TERASAKI – S125NJ/350 – CIRCUIT BREAKER
- TERASAKI – T2F253SLNG – 125A SHROUD
- TERASAKI – T2HS12RSGM – HANDLE
- TERASAKI – T2AXDOM3STA – N/O AUXILIARY CONTACT
- TERASAKI – DSRCBH 6-30A – CIRCUIT BREAKER
- TERASAKI – DSRCBH 10-30A – CIRCUIT BREAKER
- TERASAKI – DSRCBH 16-30A – CIRCUIT BREAKER
- TERASAKI – DTCB15306 – CIRCUIT BREAKER
- TERASAKI – DTCB6310C – CIRCUIT BREAKER
- TERASAKI – DTCB6306C – CIRCUIT BREAKER
- TERASAKI – DTCB6110C – CIRCUIT BREAKER
- TERASAKI – DTCB6106C – CIRCUIT BREAKER
- TERASAKI – DTCB6104C – CIRCUIT BREAKER
- TERASAKI – CD-2-30/18-3U – CIRCUIT BREAKER CHASSIS
- TERASAKI – S400NE/3400 – CIRCUIT BREAKER
- TERASAKI – T2HS40RSGM – HANDLE
- TERASAKI – T2CF403SLNG – 400A SHROUDS
- SOCOMEC – SLB400 3P – ISOLATOR
- SOCOMEC – 2694 3051 – SHROUDS (IP20)
- SOCOMEC – 2998 0013 – PHASE BARRIERS

NHP

socomec
Innovative Power Solutions

SLB Standard load-break switches

SIRCO 125 to 4000 A

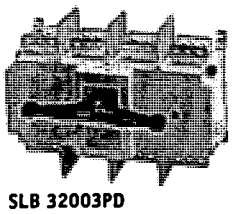


SLB 2003P
With panel mount handle

The SIRCO range of load-break switches offer compact solutions for switching from 125 A to 4000 A [4]). Base mounting is standard. The SIRCO range are a proven, reliable design that are well suited to harsh Australian conditions.

Front operated - supplied with direct or ext. handle

	AC 21 400 V (A)	AC 23 400 V (A)	AC 23 400 V (kW)	No. of poles	Cat. No. [1])[2])	Direct or External handle Price $
125 A	125	125	63	3	SLB1253P_	415.00
				4	SLB1254P_	560.00
160 A	160	160	80	3	SLB1603P_	550.00
				4	SLB1604P_	670.00
200 A	200	200	100	3	SLB2003P_	590.00
				4	SLB2004P_	780.00
250 A	250	250	132	3	SLB2503P_	650.00
				4	SLB2504P_	840.00
315 A	315	315	160	3	SLB3153P_	810.00
				4	SLB3154P_	1070.00
400 A	400	400	220	3	SLB4003P_	960.00
				4	SLB4004P_	1260.00
500 A	500	500	280	3	SLB5003P_	1290.00
				4	SLB5004P_	1590.00
630 A	630	500	280	3	SLB6303P_	1470.00
				4	SLB6304P_	1910.00
800 A	800	800	450	3	SLB8003P_	2060.00
				4	SLB8004P_	2690.00
1000 A	1000	1000	560	3	SLB10003P_	2960.00
				4	SLB10004P_	3980.00
1250 A	1250	1250	710	3	SLB12503P_	3980.00
				4	[i] SLB12504P_	5160.00
1600 A	1600	1250	710	3	SLB16003P_	4700.00
				4	SLB16004P_	6100.00
1800 A	1800	1250	710	3	SLB18003P_	5600.00
				4	[i] SLB18004P_	7040.00
2000 A	2000	1600	710	3	SLB20003P_	6570.00
				4	[i] SLB20004P_	8440.00
2500 A	2500	1600	710	3	SLB25003P_	7780.00
				4	[i] SLB25004P_	9850.00
3200 A	3200	1600	710	3	SLB32003P_	9470.00
				4	[i] SLB32004P_	12200.00
4000 A	3200	1250	710	3	SLB40003P_ [3])	21900.00
				4	[i] SLB40004P_ [3])	28140.00



SLB 32003PD
With direct mount handle

Accessories for SIRCO M switches

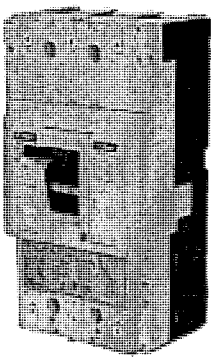
Notes: [1]) Insert D for direct mount handle or leave blank for panel mount pistol handle complete with 320 mm shaft.
[2]) 6 and 8 pole switches available on indent. Refer to NHP.
[3]) Supplied with 2 N/O and 2 N/C auxiliaries as standard.
[4]) Refer NHP for 5000 A and 6300 A load break switches.
[i] Available on indent only

Price Schedule 'B2'

GST not included

TERASAKI
Innovators in Protection Technology

TemBreak 2 Electronic type MCCB
S400NE



50 kA

Current rating: **100 – 400 A**

Interrupting capacity:

	Voltage	Icu	Ics
AC use	380/415	50	50

Overcurrent Relay:

- Electronic, for general and selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current Ir is adjustable from 40% – 100% of the nominal rated current *In*.
- STD setting 2.5 – 10 (x I_R) [1]
- INST setting 13 – 14 (x I_R) [1]

Dimensions (mm)

Poles	3	4
H	260	260
W	140	185
D (less toggle)	103	103

S400NE 3 Pole

Ampere Rating NRC	Adj. Ir Min - Max.	Cat. No. [2]
250	100 - 250	S400 NE 3 250
400	160 - 400	S400 NE 3 400

S400NE 4 Pole

Ampere Rating NRC	Adj. Ir Min - Max.	Cat. No. [2]
250	100 - 250	S400 NE 4 250
400	160 - 400	S400 NE 4 400

Notes: [1] The STD and Instantaneous pickup current (I_{sd} & I_i) settings are not individually adjustable, however by selecting different curve types and different I_R settings the values will vary. Curve 1 & 2 I_{sd} = 2.5 x I_R, curve 3 I_{sd} = 5 x I_R, curve 4 - 7 I_{sd} = 10 x I_R. I_R dial setting 0.4 – 0.9 I_i = 14 x I_R and I_R dial setting 0.95 – 1.0 I_i = 13 x I_R. Refer curve examples & setting data in Section 12.
NRC = Nominal rated current, I_R = Current adjustment dial setting,
STD = Short Time Delay, INST = instantaneous

[2] For GF, PTA and NPP refer S400GE MCCB.

Cross reference table	Section
Accessories	4
Application data	12
Characteristic curves	5
OCR / Trip unit set-up	5
Motor starting	12
Selectivity & Cascade	12
Chassis	6
Dimensions and mounting	5

Base standards
IEC 60947-2
AS/NZS 60947-2
EN 60947-2
JIS C 8201-2-1 Ann. 1
CE Mark

Approvals
ASTA (UK,AUS)
Marine
Lloyd's / UK
ABS / USA
GL / Germany
BV / France
NK / Japan
DNV / Norway

Replaces: XS400SE

Note: Check exact ratings or dimensions to suit your application requirement

NHP

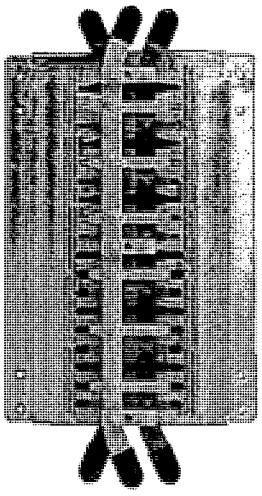
Panelboards, loadcentres and accessories

Concept busbar chassis assemblies for Din-T MCBs

- Standards AS/NZS 3439.1
- Current rating 250 A and 355 A
- Withstand rating 250 A/20 kA for 0.2 sec
- Withstand rating 355 A/25 kA for 0.3 sec
- Splayed busbar to suit 160 A and 250 A switch
- Top and bottom feed – splayed top & bottom
- Tee-offs stripped and 50 % capped
- Top power feed stripped and capped
- Full 35 mm DIN rail, improved MCB mounting security
- Improved insulation coating

CONCEPT Din-T – 250 & 355 A to suit Din-T MCBs (18 mm pole pitch) [2]

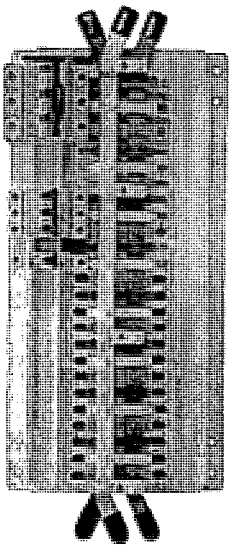
Pole capacity	250 A Cat. No. [1]	355 A Cat. No. [1]
12	CD-2-12/18-3U	[i] CD-3-12/18-3U
18	CD-2-18/18-3U	[i] CD-3-18/18-3U
24	CD-2-24/18-3U	CD-3-24/18-3U
30	CD-2-30/18-3U	[i] CD-3-30/18-3U
36	CD-2-36/18-3U	CD-3-36/18-3U
42	CD-2-42/18-3U	CD-3-42/18-3U
48	CD-2-48/18-3U	CD-3-48/18-3U
54	CD-2-54/18-3U	[i] CD-3-54/18-3U
60	CD-2-60/18-3U	CD-3-60/18-3U
72	CD-2-72/18-3U	CD-3-72/18-3U
78	CD-2-78/18-3U	[i] CD-3-78/18-3U
84	CD-2-84/18-3U	CD-3-84/18-3U
96	CD-2-96/18-3U	CD-3-96/18-3U



3 pole CD chassis to suit Din-T MCBs

CONCEPT Din-T – Hybrid suits Din-T and Din-T10H MCBs (27/18 mm pole pitch)

Pole capacity 27 mm	Pole capacity 18 mm	355 A Cat. No. [1]
6	12	CDH-3-6/12-27/18-3U
6	24	CDH-3-6/24-27/18-3U
6	36	CDH-3-6/36-27/18-3U
12	30	CDH-3-12/30-27/18-3U
12	42	CDH-3-12/42-27/18-3U
12	60	CDH-3-12/60-27/18-3U



3 pole hybrid CD chassis to suit Din-T and Din-T10H MCBs

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	CD250TOPC

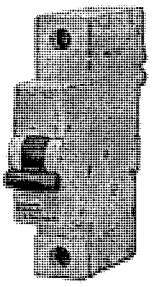
Notes: [1]) 4 pole and other special configurations available to special order refer NHP.
[2]) Not suitable for CONCEPT economy Panelboards. Contact NHP for availability.
'OFF' (line) side of MCB connects to chassis tee-off.
MCB DIN clips may be disengaged or removed when mounting onto "CD" chassis. If applicable use insulated tool provided to disengage DIN clip when removing MCB from chassis.
[i] Available on indent only.

Technical data	Page
Dimensions	2 - 61 to 2 - 62

Miniature circuit breakers

Din-T15 series 15 kA, 20 kA, 25 kA MCBs

- Standards AS/NZS 60947-2
- Current range 6-63 Amp 1, 2, 3 and 4 pole
- Sealable and lockable handle
- Modular design
- Mounts on NC or CD chassis
- Industrial applications



DTCB15
1 pole

1 pole 1 module [1]

In (A)	Icu (kA)	C - Curve 5 - 10 In
6	25	DTCB15106C
10	25	DTCB15110C
13	25	[i] DTCB15113C
16	25	DTCB15116C
20	25	DTCB15120C
25	25	DTCB15125C
32	20	DTCB15132C
40	20	DTCB15140C
50	15	DTCB15150C
63	15	DTCB15163C

2 pole 2 modules [1]

In (A)	Icu (kA)	C - Curve 5 - 10 In
6	25	[i] DTCB15206C
10	25	DTCB15210C
13	25	[i] DTCB15213C
16	25	DTCB15216C
20	25	DTCB15220C
25	25	[i] DTCB15225C
32	20	[i] DTCB15232C
40	20	[i] DTCB15240C
50	15	[i] DTCB15250C
63	15	[i] DTCB15263C

3 pole 3 modules [1]

6	25	DTCB15306C
10	25	DTCB15310C
13	25	[i] DTCB15313C
16	25	DTCB15316C
20	25	DTCB15320C
25	25	DTCB15325C
32	20	DTCB15332C
40	20	DTCB15340C
50	15	DTCB15350C
63	15	DTCB15363C

4 pole 4 modules [1] [2]

6	25	[i] DTCB15406C
10	25	[i] DTCB15410C
13	25	[i] DTCB15413C
16	25	[i] DTCB15416C
20	25	[i] DTCB15420C
25	25	[i] DTCB15425C
32	20	[i] DTCB15432C
40	20	[i] DTCB15440C
50	15	[i] DTCB15450C
63	15	[i] DTCB15463C

In (A)	6 - 63
1 P	240 V AC
2 P	240/415 V AC
3 P	240/415 V AC
4 P	240/415 V AC

Shock resistance (in x, y, z direction)
20 g with shock duration of 10 ms (minimum 18 shocks)
40 g with shock duration of 5 ms (minimum 18 shocks)

Vibration resistance (in x, y, z direction)
3 g in frequency range 10 to 55 Hz (operating time at least 30 mins) according to IEC 60068-2-6

Storage temperature
from -55 °C to +55 °C according to VDE 0664 parts 1 and 2

Operating temperature
from -25 °C to +55 °C according to VDE 0664 Parts 1 and 2.

Use at 400 Hz
At 400 Hz the magnetic tripping current is approximately 50 % higher than at AC 50/60 Hz

Notes: [1] Refer Section 3 for kA ratings at 240/415 V. The above ratings are at 415 V AC.
[2] All poles include overcurrent and short circuit protection.
[i] Available on indent only.
The LINE-side is the OFF or bottom of the MCB and connects to CD chassis tee-offs.

Accessories	Page
Add-on RCD	1 - 28 to 1 - 29
Shunt trip	1 - 36 to 1 - 38
UVT	1 - 39 to 1 - 40
Auxiliary/alarm	1 - 32 to 1 - 35
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2
Busbar chassis	2 - 52

Technical data	Page
Technical data	Section 3
Tripping characteristics	3 - 6, 3 - 8
Dimensions	3 - 24

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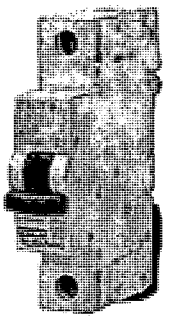
Miniature circuit breakers

Din-T6 series 6 kA MCB

- Standards AS/NZS 60898
- Approval No. N17481
- Current range 2-63 Amps 1, 2 and 3 pole
- Sealable and lockable handle
- Available in curve type C and D
- Mounts on NC or CD chassis
- Padlockable in off position



DTCB6
1 pole

1 pole 1 module

In (A)	C – Curve 5-10 In Cat. No.	In (A)	D – Curve 10-20 In Cat. No.
2	DTCB6102C	2	DTCB6102D
4	DTCB6104C	4	DTCB6104D
6	DTCB6106C	6	DTCB6106D
10	DTCB6110C	10	DTCB6110D
13	DTCB6113C	13	[i] DTCB6113D
16	DTCB6116C	16	DTCB6116D
20	DTCB6120C	20	DTCB6120D
25	DTCB6125C	25	DTCB6125D
32	DTCB6132C	32	DTCB6132D
40	DTCB6140C	40	DTCB6140D
50	DTCB6150C	50	DTCB6150D
63	DTCB6163C	63	DTCB6163D

2 pole 2 modules

2	DTCB6202C	2	DTCB6202D
4	DTCB6204C	4	DTCB6204D
6	DTCB6206C	6	DTCB6206D
10	DTCB6210C	10	DTCB6210D
13	[i] DTCB6213C	13	[i] DTCB6213D
16	DTCB6216C	16	DTCB6216D
20	DTCB6220C	20	DTCB6220D
25	DTCB6225C	25	DTCB6225D
32	DTCB6232C	32	DTCB6232D
40	DTCB6240C	40	DTCB6240D
50	DTCB6250C	50	DTCB6250D
63	DTCB6263C	63	DTCB6263D

3 pole 3 modules

2	DTCB6302C	2	DTCB6302D
4	DTCB6304C	4	DTCB6304D
6	DTCB6306C	6	DTCB6306D
10	DTCB6310C	10	DTCB6310D
13	[i] DTCB6313C	13	[i] DTCB6313D
16	DTCB6316C	16	DTCB6316D
20	DTCB6320C	20	DTCB6320D
25	DTCB6325C	25	DTCB6325D
32	DTCB6332C	32	DTCB6332D
40	DTCB6340C	40	DTCB6340D
50	DTCB6350C	50	DTCB6350D
63	DTCB6363C	63	DTCB6363D

Short circuit capacity 6 kA

In (A)	2 - 63
1 P	240 V AC
2 P	240 - 415 V AC
3 P	240 - 415 V AC

DC use	1 P	2 P [1])
Short circuit	20 kA	25 kA
Max.voltage (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 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 X, Y, Z directions).

3 g in frequency range 10 to 55 Hz
(operating time at least 30 min).
According to IEC 60068-2-6.

Storage temperature

From -55 °C to +55 °C, according to IEC 88 part 2 - 1 (duration 96 hours).

Operating temperature

From -25 °C to +55 °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 AC 50/60 Hz.

Accessories	Page
Add on RCD	1 - 28, 1 - 29
Auxiliary/alarm	1 - 32 to 1 - 35
Shunt trip	1 - 36 to 1 - 38
UVT	1 - 39, 1 - 40
Padlockable bracket	1 - 45
Link bars & terminals	1 - 44, 1 - 45
Enclosures	Section 2
Busbar chassis	2 - 52

Technical data	Page
Technical data	Section 3
Tripping characteristics	3 - 6, 8
Dimensions	3 - 24

Notes: [1]) 2 pole MCB connected in series.
The line side is the "OFF" (bottom) side of the MCB, and connects to NC or CD chassis tee-offs.
[i] Available on indent only.

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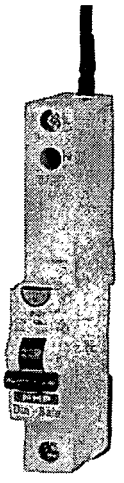
1

Miniature circuit breakers

Din-Safe single pole width residual current circuit breaker (RCBO) 10 kA



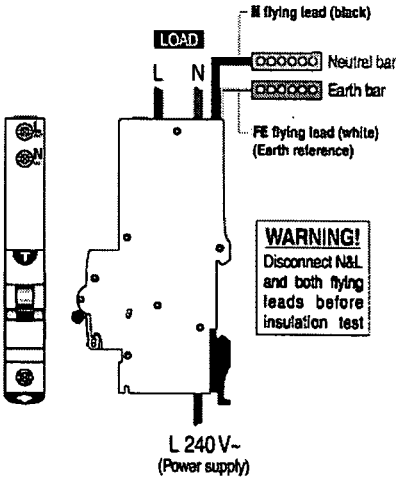
- Standards AS/NZS 61009
- Approval N17482
- One module wide (18 mm)
- Short circuit, overcurrent and earth leakage protection
- Short circuit protection, 10 kA
- Sensitivity 30 mA, 10 mA
- DIN rail mount
- Suits NC or CD chassis
- Type 'A' residual current device
- 240 V AC

Trip sensitivity	Amp rating (A)	Cat. No [1][2]
10 mA	6	[i] DSRCBH0610A
	10	DSRCBH1010A
	16	DSRCBH1610A
	20	DSRCBH2010A
	25	[i] DSRCBH2510A
	32	[i] DSRCBH3210A
	40	[i] DSRCBH4010A
30 mA	6	DSRCBH0630A
	10	DSRCBH1030A
	16	DSRCBH1630A
	20	DSRCBH2030A
	25	DSRCBH2530A
	32	DSRCBH3230A
	40	DSRCBH4030A

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

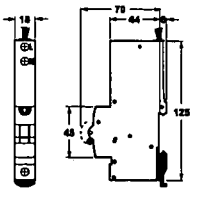


Operation

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 6 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 (IΔn) is 30 mA.
- The white 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)



Accessories	Page
Padlock bracket	1 - 45
Link bars and terminals	1 - 44 to 1 - 45
Enclosures	Section 2

Technical data	Page
Tripping characteristics	Section 3
Technical data / wiring	Section 3

Notes: [1] Neutral not switched.
[2] Will not accept Din-T side mounting accessories.
30 mA tripping characteristics: 0.5 x IΔn = no tripping, 1 x IΔn = T ≤300 mS
2 x IΔn = T ≤150 mS, 5 x IΔn = T ≤40 mS
Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.
[i] Available on indent only.

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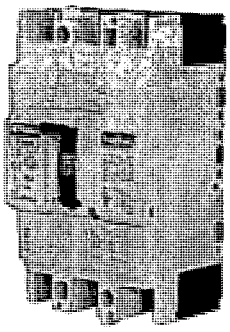
TemBreak 2 Thermal magnetic type MCCB
S125NJ



36 kA

Current rating: **12.5 – 125 A**

Interrupting capacity:

	Voltage	Icu	Ics
AC use	380/400	36	36
DC use	250V	25	19

Trip unit:

Adjustable thermal (0.63 Ir to 100% Ir) and adjustable magnetic (refer below)

Dimensions (mm)

Poles	3
H	155
W	90
D (less toggle)	68
Toggle cut-out	48
	105 (on chassis)

S125NJ 3 Pole

Ampere Rating NRC	Adj. Ir [1] Min - Max.	Adj. Im [1] Min - Max.	Cat. No.
20	12.5 - 20	120 - 240	S125 NJ 3 20
32	20 - 32	192 - 384	S125 NJ 3 32
50	32 - 50	300 - 600	S125 NJ 3 50
63	40 - 63	378 - 756	S125 NJ 3 63
100	63 - 100	600 - 1200	S125 NJ 3 100
125	80 - 125	750 - 1250	S125 NJ 3 125

Cross reference table	Section
Accessories	4
Application data	12
Characteristic curves	5
OCR/ Trip unit set-up	5
Motor starting	12
Selectivity & Cascade	12
Chassis	6
Dimensions and mounting	5

Base standards
IEC 60947-2
AS/NZS 60947-2
EN 60947-2
JIS C 8201-2-1 Ann. 1
CE mark

Approvals
ASTA (UK,AUS)
Marine
Lloyd's / UK
ABS / USA
GL / Germany
BV / France
NK / Japan
DNV / Norway

Notes: [1]) Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
Magnetic only MCCBs available on request.

Replaces: XS125NJ

Note: Check exact ratings or dimensions to suit your application requirement

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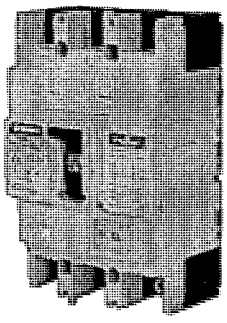
TemBreak 2 Thermal magnetic type MCCB
S250GJ



65 kA

Current rating: **100 – 250 A**

Interrupting capacity:

	Voltage	*Icu*	Ics
AC use	380/415	65	36
DC use	250V	40	40

Trip unit:

Adjustable thermal (0.63 Ir to 100 % Ir) and adjustable magnetic (6 Im to 10 Im)

Dimensions (mm)

Poles	3	4
H	165	165
W	105	140
D (less toggle)	68	68
Toggle cut-out	48	
	105 (on chassis)	

S250GJ 3 Pole

Ampere Rating NRC [2])	Adj. Ir [1]) Min - Max.	Adj. Im [1]) Min - Max.	Cat. No.
250	160 - 250	1500 - 2500	S250 GJ 3 250

S250GJ 4 Pole

Ampere Rating NRC [2])	Adj. Ir [1]) Min - Max.	Adj. Im [1]) Min - Max.	Cat. No.
250	160 - 250	1500 - 2500	S250 GJ 4 250

Special fixed low magnetic types - 3 poles

Ampere Rating NRC	Adj. Ir [1]) Min - Max.	Fixed Magnetic	Cat. No.
250	160 - 250	750 A	S250 GJ S023160
		1000 A	S250 GJ 250M1000

Cross reference table	Section
Accessories	4
Application data	12
Characteristic curves	5
OCR / Trip unit set-up	5
Motor starting	12
Selectivity & Cascade	12
Chassis	6
Dimensions and mounting	5

Base standards
IEC 60947-2
AS/NZS 60947-2
EN 60947-2
JIS C 8201-2-1 Ann. 1
CE Mark

Approvals
ASTA (UK,AUS)
Marine
Lloyd's / UK
ABS / USA
GL / Germany
BV / France
NK / Japan
DNV / Norway

Notes: [1]) Adj. Ir: Adjustable thermal setting
Adj. Im: Adjustable magnetic setting
NRC: Nominal rated current
[2]) For lower amp ratings in the same frame size, refer S160GJ.
Magnetic only MCCBs available on request.
To obtain MCCBs that accept additional internal auxiliary circuits add 'EA' to the above Cat. No.'s. E.g. S250GJ3250EA. Otherwise leave blank.

Replaces: XH250NJ, TL250NJ

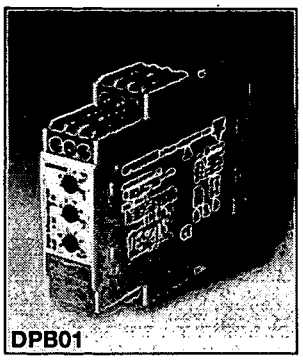
Note: Check exact ratings or dimensions to suit your application requirement

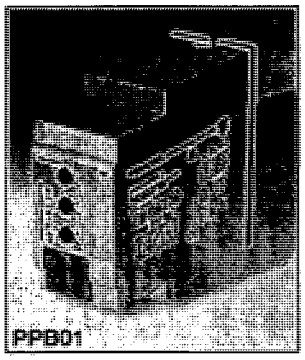
7.2 CONTROL DEVICES / GPO'S / RELAYS

- CARLO GAVAZZI – DPB-01-C-M48 – PHASE FAILURE RELAY
- MULTITRODE MTR-5 – HIGH LEVEL RELAY
- MULTITRODE MTR-2 – SURGE IMMINENT LEVEL RELAY
- CLIPSAL – 2025 + 449A + 449AP BASE – LAPTOP GPO (TWIN 10A)
- CLIPSAL – 2015 - OUTLET
- CLIPSAL – 56C410 – 3 PHASE SWITCHED OUTLET
- CLIPSAL – 56S0310 – GENERATOR ANCILLARY POWER
- SPRECHER AND SCHUH – CA6-140-EI11-240V – PUMP E-STOP CONTACTOR
- IDEC – RH2B-UL-24VDC – PUMP RELAY
- IDEC – RH4B-UL-24VDC – RELAY
- IDEC – RH2B-UL-240VAC – PUMP CONTROL RELAY
- POWERLOCK-NRG – PL4/PD/SET – 1PHASE GENERATOR POWER

Monitoring Relays
3-Phase, 3-Phase+N, Multi-function
Types DPB01, PPB01

CARLO GAVAZZI


DPB01


PPB01

- 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
- Detect if all the 3-phase-phase or phase-neutral voltages are within the set limits
- Upper and lower limits separately adjustable
- Measure on own power supply
- Selection of measuring range by DIP-switches
- Adjustable voltage on relative scale
- Adjustable delay function (0.1 to 30 s)
- Output: 8 A SPDT relay N.E.
- For mounting on DIN-rail in accordance with DIN/EN 50 022 (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

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.

Ordering Key

DPB 01 C M23

- Housing
- Function
- Type
- Item number
- Output
- Power supply

Type Selection

Mounting	Output	Supply: 208 to 240 VAC	Supply: 380 to 480 VAC
DIN-rail	SPDT	**DPB 01 C M23**	**DPB 01 C M48**
Plug-in	SPDT	**PPB 01 C M23**	**PPB 01 C M48**

Input Specifications

Input	
L1, L2, L3, N	DPB01: Terminals L1, L2, L3, N PPB01: Terminals 5, 6, 7, 11 Measure on own supply
Measuring ranges	
208 to 240 Δ VAC	177 to 275 Δ VAC
380 to 480 Δ VAC (DPB01CM48)	323 to 550 Δ VAC
380 to 415 Δ VAC (PPB01CM48)	323 to 475 Δ VAC
Ranges	
Upper level	+2 to +22% of the nominal voltage
Lower level	-22 to -2% of the nominal voltage

Note: The imput voltage must not exceed the maximum rated voltage or drop below the minumum rated voltage reported above.

Output Specifications

Output		SPDT relay
Rated insulation voltage		250 VAC
Contact ratings ($AgSnO_2$)		μ
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		≥ 30 x 10^6 operations
Electrical life		≥ 10^5 operations (at 8 A, 250 V, cos φ = 1)
Operating frequency		≤ 7200 operations/h
Dielectric strength		
Dielectric voltage		2 kVAC (rms)
Rated impulse withstand volt.		4 kV (1.2/50 μs)

Specifications are subject to change without notice (26.11.01)

DPB01, PPB01

CARLO GAVAZZI

Supply Specifications

Power supply	Overvoltage cat. III (IEC 60664, IEC 60038)
Rated operational voltage through terminals:	
L1, L2, L3, N (DPB01)	
5, 6, 7, 11 (PPB01)	
M23 - Delta Voltage:	208 to 240 VAC ± 15% 45 to 65 Hz
M48 - Delta Voltage:	380 to 480 VAC ± 15% 45 to 65 Hz
M48 - Star Voltage:	220 to 277 VAC ± 15% 45 to 65 Hz
Rated operational power	
DPB01CM23, PPB01CM23	13 VA @ 230 ΔVAC, 50 Hz
DPB01CM48, PPB01CM48	13 VA @ 400 ΔVAC, 50 Hz
	Supplied by L1 and L2

General Specifications

Power ON delay	1 s ± 0.5 s or 6 s ± 0.5 s
Reaction time	
Incorrect phase sequence or total phase loss	< 200 ms
Voltage level	(input signal variation from -20% to +20% or from +20% to -20% of set value)
Alarm ON delay	< 200 ms (delay < 0.1 s)
Alarm OFF delay	< 200 ms (delay < 0.1 s)
Accuracy	(15 min warm-up time)
Temperature drift	± 1000 ppm/°C
Delay ON alarm	± 10% on set value ± 50 ms
Repeatability	± 0.5% on full-scale
Indication for	
Power supply ON	LED, green
Alarm ON	LED, red (flashing 2 Hz during delay time)
Output relay ON	LED, yellow
Environment	
Degree of protection	IP 20
Pollution degree	3 (DPB01), 2 (PPB01)
Operating temperature	
@ Max. voltage, 50 Hz	-20 to 60°C, R.H. < 95%
@ Max. voltage, 60 Hz	-20 to 50°C, R.H. < 95%
Storage temperature	-30 to 80°C, R.H. < 95%
Housing dimensions	
DIN-rail version	22.5 x 80 x 99.5 mm
Plug-in version	36 x 80 x 87 mm
Weight	Approx. 120 g
Screw terminals	
Tightening torque	Max. 0.5 Nm according to IEC 60947
Approvals	UL, CSA
CE Marking	Yes
EMC	Electromagnetic Compatibility
Immunity	According to EN 61000-6-2
Emissions	According to EN 50081-1

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 and the phase-phase (or phase-neutral) voltage levels are within set limits.

If one or more phase-phase or phase-neutral voltages exceeds the upper set level or drops below the lower set level, the red LED starts flashing 2 Hz and the output relay releases after the set time period. In any case if phase-neutral measurement is selected both phase-phase 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.

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.

DPB01, PPB01

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Function/Range/Level and Time Delay Setting

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

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

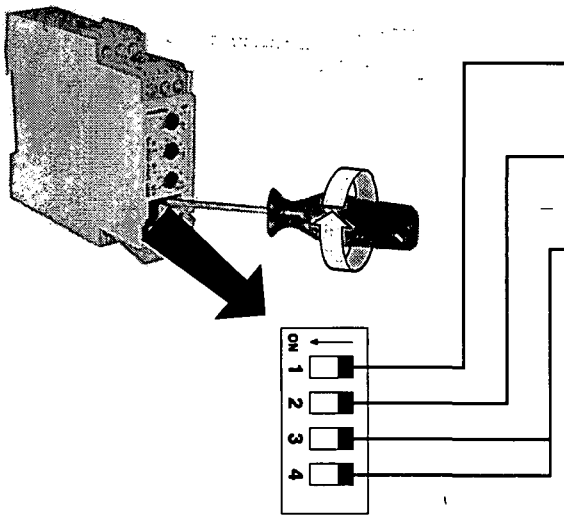
To access the DIP swiches open the grey plastic cover as shown below

Selection of level and time delay:

Upper knob:
Setting of lower level on relative scale.

Centre knob:
Setting of upper level on relative scale.

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



Power ON delay
ON: 6 s ± 0.5 s
OFF: 1 s ± 0.5 s

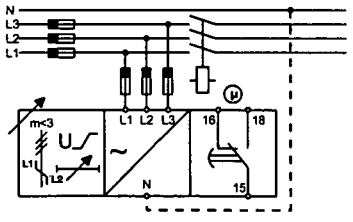
Monitored voltage
ON: Phase-Neutral
OFF: Phase-Phase

Measuring range

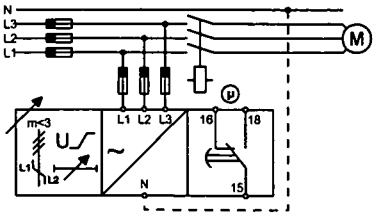
SW3	ON	ON	OFF	OFF
SW4	ON	OFF	ON	OFF
M23 Ph-Ph Voltage	208 VAC	220 VAC	230 VAC	240 VAC
M48 Ph-Ph Voltage	380 VAC	400 VAC	415 VAC	480 VAC DPB01 only
M48 Ph-N Voltage	220 VAC	230 VAC	240 VAC	277 VAC DPB01 only

Wiring Diagrams

Example 1

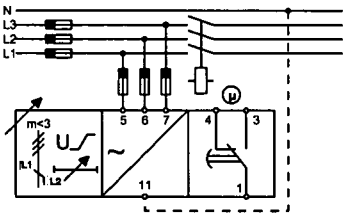


Example 2

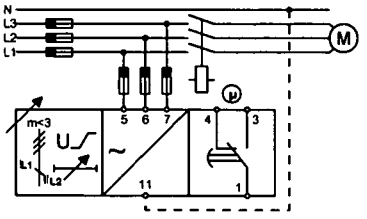


DPB01

Example 1



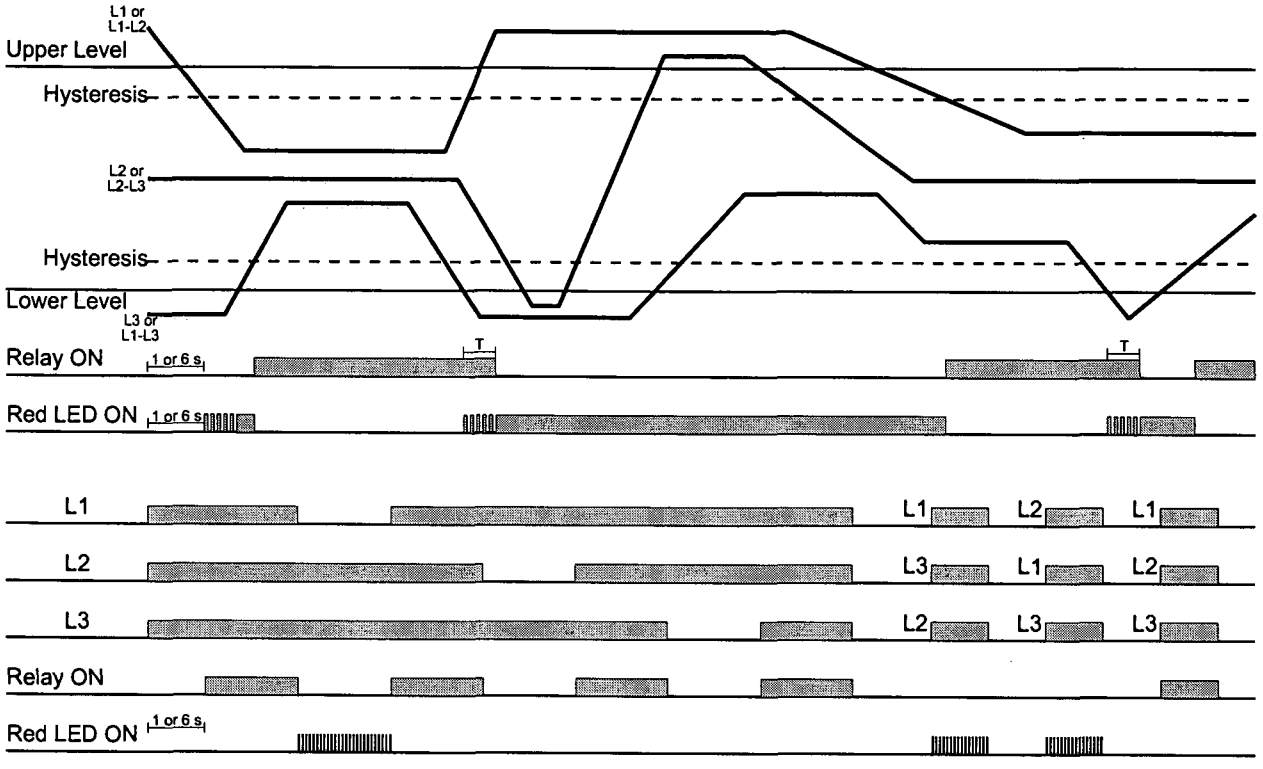
Example 2



PPB01

CARLO GAVAZZI

Operation Diagrams



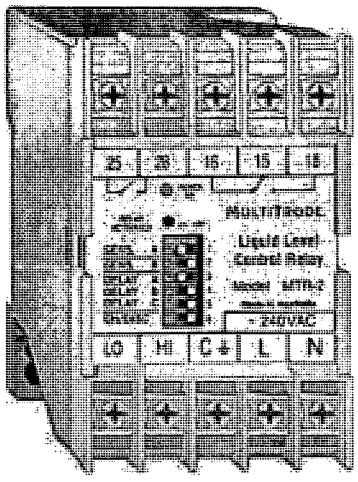
Specifications are subject to change without notice (26.11.01)

1 Introduction

The MultiTrode level control relay is a solid-state electronic module in a hi-impact plastic case with a DIN rail attachment on the back, making a snap-on-snap-off installation. Any number of relays can be easily added to the DIN metal rail then wired together to form a complex pumping system that other wise may have to be controlled and operated by a programmed PLC.

The relay is normally matched with the MultiTrode probe which works in conjunction with the relay and uses the conductivity of the liquid to complete an electrical circuit.

2 Electrical Overview



There are 10 screw terminals on the unit. Facing the relay as shown, we look at the bottom terminals (left to right):

- Lo – (Charge mode). This is the point when the probe is dry the relay will turn on.
- Lo – (Discharge mode). This is the point when the probe in the tank is dry the relay will turn off.
- Hi – (Charge mode). This is the point when the probe in the tank is wet a relay will turn off
- Hi – (Discharge mode). This is the point when the probe in the tank is wet a relay will turn on.
- C - is common earth. All earth bonding must be terminated here for correct operation.
- " L " is "live" (240V AC)
- " N " is "neutral" (240V AC)

If the tank is plastic, or if you are conducting tests in a plastic bucket, or the vessel has no earth point inside, you must install an earth rod within the tank, vessel or bucket and make sure that it is bonded back to C on the relay unit.

3 DIP Switches

3.1 DIP Switches

(See Wiring Diagram for full program functions.)

3.1.1 DIP 1 & 2

DIP 1 and 2 control the Sensitivity, in other words the cleaner the liquid the higher the sensitivity setting must be. Concentrated acids, minerals are by their own chemical composition highly conductive, so a low level of sensitivity is required, purified water is almost an insulator against electrical current flow so a higher sensitivity inside the relay is required.

3.1.2 DIP 3, 4 & 5

DIP switches 3, 4 and 5, control delay on activation. For example, in discharge mode with DIP switches 3, 4 and 5 set to 10 seconds, when the Hi point becomes wet it will activate the motor and it will take 10 seconds of continual coverage of the probe sensor to make the relay close and start the pump. This is invaluable when the probe is in a turbulent part of a well where fluid is splashing around touching the sensors momentarily, and false activation cannot be tolerated.

3.1.3 DIP 6

DIP switch 6 controls the charge/discharge function. Set "ON" for charge, and "OFF" for discharge

3.2 Relay Contacts & their Applications

3.2.1 Contacts 15, 16 & 18

Contacts 15, 16, and 18 are used for electronic or visual notification of a change in state at the pump itself. Contacts 15, 16, and 18 are used for more advanced applications because they are a changeover relay, their state may be the same as contacts 25, 28 or the opposite. Both sets of contactors are triggered simultaneously. An example is when in discharge mode, (see Figure 1).

You have a gravity flow coming in so the fluid reaches the lower sensor PB1, contacts 15 and 18 are open (15 being common to both contact 16 and 18) contacts 25 and 28 are also normally open but contacts 15 16 in this current situation are closed, whether PB1 is wet or dry is of no concern all will stay the same. The level now rises to PB2 and both relays change state, contacts 25 and 28 close to turn on the pump, contacts 15 and 16 are open, with 15 and 18 closed.

In advanced applications this state change may be fed into a logic device to indicate the pump is running or the pump has stopped and perhaps light an LED or incandescent light source for visual confirmation that a change has occurred in the relay.

3.2.2 Contacts 25 & 28

Contacts 25 and 28 are used to control pump states. Contacts 25 and 28 are mostly used for turning on motors via a starting relay or solenoid, so, these sets of contacts react to the rising or falling levels of the fluid inside the tank, they will operate to turn on a pump in discharge mode when the top sensor is wet and in charge mode turn on the pump when the bottom sensor is dry.

4 Practical Overview

4.1 Discharge Mode – DIP switch 6 set to "OFF"

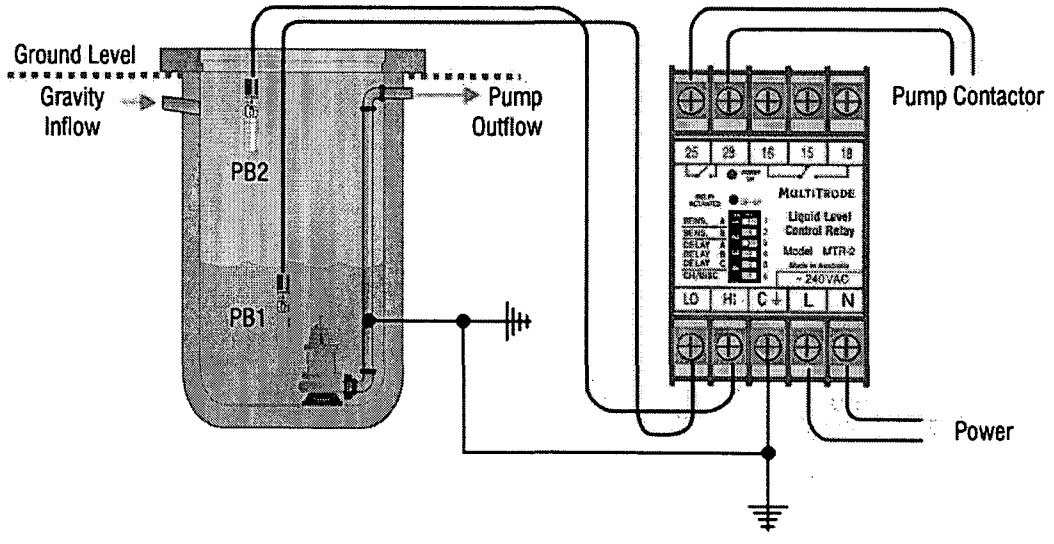
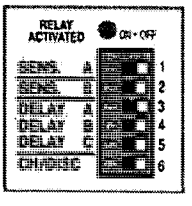


Figure 1 – Discharge Mode

Figure 1 shows two probes, (PB1 connected to Lo and PB2 connected to Hi). The pit is mostly underground and there is a gravity-fed inlet at the top left-hand side. The pit is empty with PB1 completely dry. Dipswitch 6 is set to "OFF."



The relay operation depends on the electrical conductivity of liquid in the pit, i.e. no liquid = no current flow. The level starts to rise and covers PB1.

This is a discharge operation so we do not want the relay to close and start a pump until the well is full so as the water rises it reaches PB2, the relay closes and the pump starts. The level now drops below PB2 but the pump still continues to run, the level continues to drop below PB1 the relay opens the pump stops.

4.2 Charge Mode – DIP switch 6 set to "On"

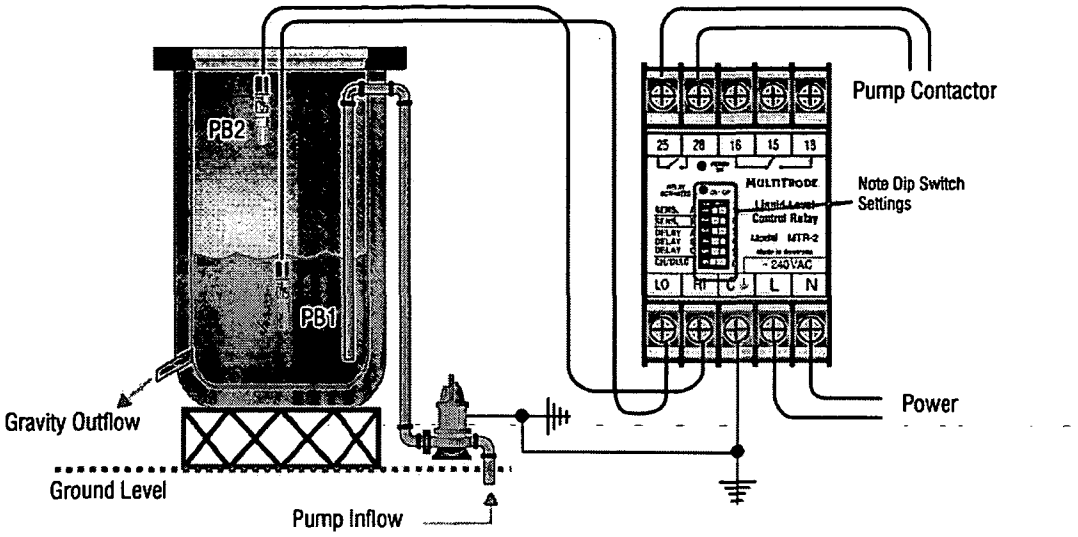
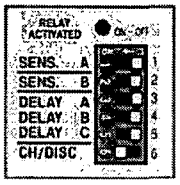


Figure 2 – Charge Mode

Note: "C" is connected to common bonded earth. The unit will not operate correctly if not earthed.

Let's look at the same relay but in a tank that is charging (DIP 6 is now on). See Figure 3, where liquid is being pumped into a tank, and discharging through a gravity feed, the tank is on steel stands "x" metres above the ground.



With the tank full, PB1 and PB2 will be wet, the relay is off, and the pump has stopped. Water is slowly fed out from the bottom, and now as PB2 (HI) becomes dry nothing happens; the water now drops to below PB1 (Lo), and the pumps restarts to fill the tank.

The pump will continue to fill the tank until PB2 (HI), becomes wet again.

4.3 MTRA Relay with Alarm (Discharge Applications Only)

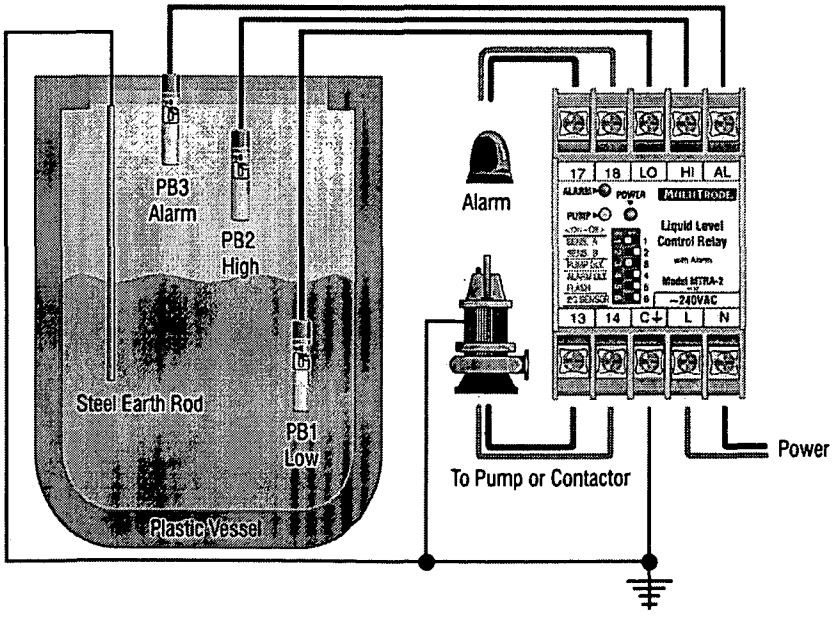


Figure 3 - MTRA Operation

The MTRA relay works in the same way as the MTR relay except the MTRA has a separate alarm output, and does not have a charge mode. The planned application is to close a contact to illuminate a warning alarm light. . Various other applications have included introducing a third probe to latch another relay.

In Figure 2 we see three probes in a pit that is plastic, note the steel rod in the tank. (In a plastic vessel a steel rod must be used to create an earth return in the liquid so probes can function.) PB1, PB2, and PB3 are dry, and the relay power LED is on. When water enters the pit and wets PB1, nothing happens, water now reaches PB2 causing contacts 13 and 14 to close, the pump LED to light, and the water to drop.

If, for example, the pump has its inlet partially blocked, the level continues to rise and wets PB3. This closes a separate relay that can activate a red flashing light, an audible fog horn or send a 5 volt pulse into another device with the common cause to warn human beings that a spill is due to occur. If the pumps become unclogged and PB3 becomes dry the alarm opens again and breaks the circuit that stops the light from flashing or the foghorn from sounding.

5 Most Common Installation Problems

The relay requires a path between the probes to earth through the liquid. If you are testing in a plastic bucket, have installed the probe in a plastic tank or have no good earthing in the vessel you will need to install a separate earth and make sure all earth bonding comes back to the C terminal. Most problems like these are traced back to a lack of or poor earthing, or open circuits in the probe wiring.

Now is the time to check the relay by using "the bridge testing line technique" remember you must simulate a fluid flow to correctly ascertain a good relay or a bad one. (All DIPswitch settings from 1 to 6 should be off.)

Cut two pieces of insulated flexible copper wire one black one red 250 mm long, strip both ends back 10 mm on both cables, and join one black end and one red end. Insert the joined ends into C on the relay box, observing all safe electrical practises. You should have one black wire and one red wire free.

Set your relay for discharge mode (DIP switch 6 is off) with no sensors connected to the unit, connect the red wire to Lo – nothing should happen (if it does return the relay for replacement or repair*). Now connect the black wire to the Hi terminal the relay activated LED should light instantly (if it does not, the relay should be returned for repair*).

6 Troubleshooting

I have checked all the DIPswitches and settings but in discharge mode as soon as the bottom sensor gets wet the pump turns on then turns off almost straight away.	• This is the most common problem encountered with relay set up and commissioning, the probe in the bottom of the tank is wired into the Hi terminal instead of the Lo terminal.
The installation went fine but now and again the pump will not turn on even though I am sure the probe is wet.	• Check the sensitivity level set on the relay, some times the level is set for foul water but due to changes in the flow the water becomes grey or clear, try changing the setting from 20KΩ to 80KΩ and monitor the results carefully.
All wiring is complete and all DIPswitches have been checked but the pump will not turn on at all.	• If you have completed the test schedule for the relay and it passed then check the wiring to the sensors – for this is now where the problem lies or in the earthing arrangements. If possible check the resistance between the sensor cable and the steel sensor on the probe to prove a solid connection.

*** Please contact your distributor or agent before returning any product for repair or warranty claim.**

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COMBINATION SWITCHED SOCKET OUTLETS

The 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.

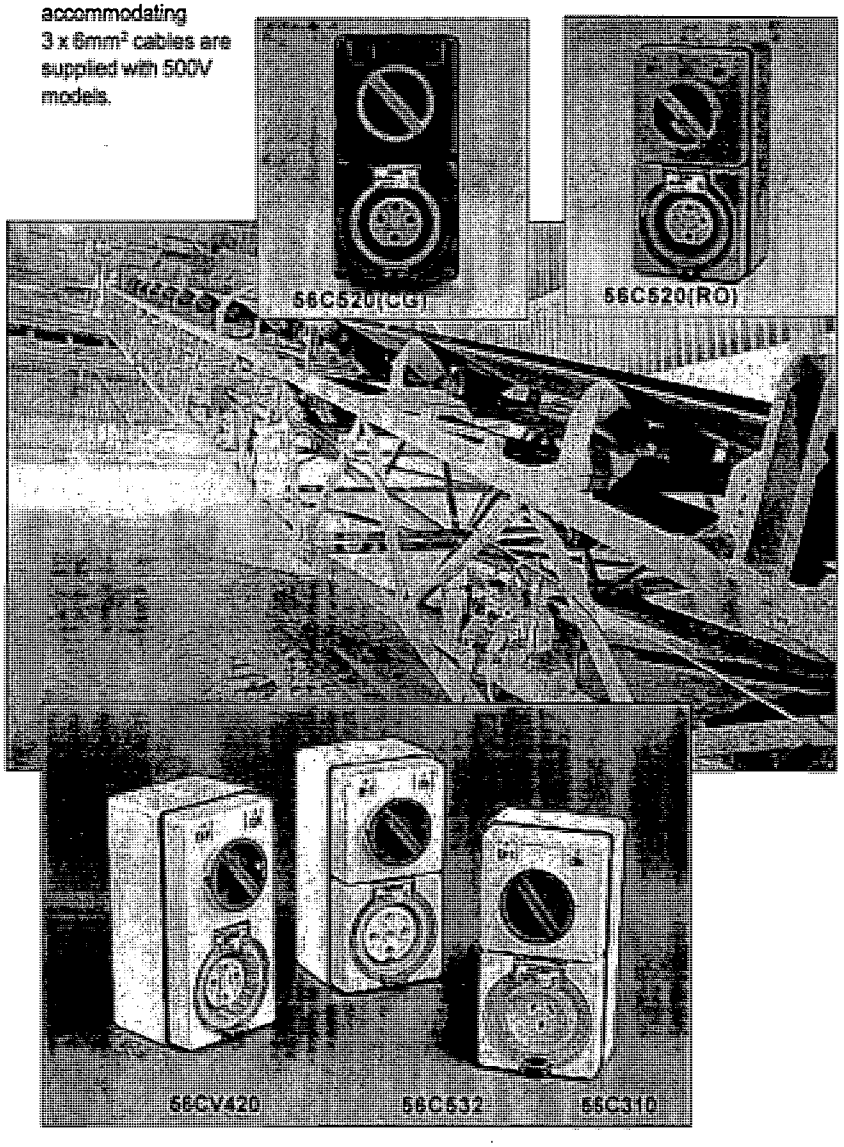
The 4 and 5 pin, 10 and 20A one-piece cover models have integral wiring between the switch and socket outlet. Installation time is reduced by not having to check factory wire terminations. There is also no likelihood of wires falling out during installation.

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. 250V, 110V and extra low voltage two module combinations are also available.

Earth and neutral connectors accommodating 3 x 6mm² cables are supplied with 500V models.

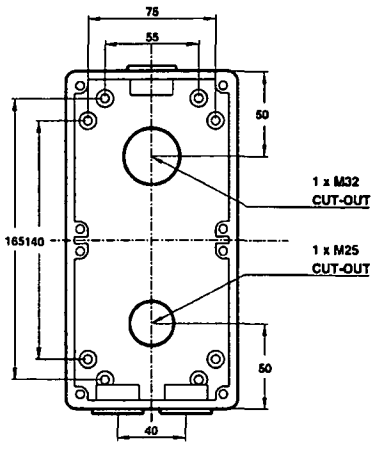
Options available

- With Neon - add N to Catalogue Number - e.g. 56C410 becomes 56C410N.
- Less Enclosure - add LE to Catalogue Number e.g. 56C410 becomes 56C410LE.
- Versions with key operated switches available to special order.
- 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 56CV410RO.
- Resistant White - add RW to Catalogue Number e.g. 56C410 becomes 56C410RW.
- Two piece versions available in Chemical Grey. Chemical Grey - add CG to Catalogue Number e.g. 56C410 becomes 56C410CG.

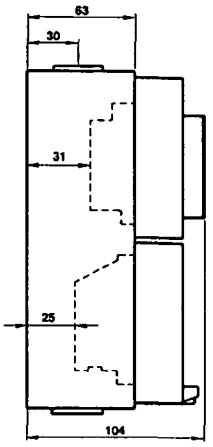


Catalogue Number	No. of swit. poles	I_{nc} (A)	Ui/Ue. (V)
56C210	1	10	250
56C215/32	1	15	32
56C3/110	1	10	110
56C310RP	1	10	250
56C310	1	10	250
56C310HD	1	10	250
56C310L	1	10	250
56C315	1	15	250
56C315HD	1	15	250
56C320	1	20	250
56C332	1	32	250
56C310D	2	10	250
56C315D	2	15	250
56C410	3	10	500
56C416K	3	16	500
56C420	3	20	500
56C432	3	32	500
56C440	3	40	500
56C450	3	50	500
56C510	3	10	500
56C520	3	20	500
56C532	3	32	500
56C540	3	40	500
56C550	3	50	500
56C610	3	10 20 cont	500
56C710	3	10 20 cont	500
56C720	3	20 20 cont	500

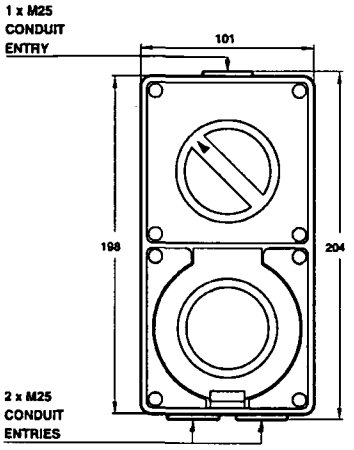
Catalogue Number	No. of swit. poles	I_{nc} (A)	Ui/Ue. (V)
56CV310	1	10	250
56CV310HD	1	10	250
56CV315	1	15	250
56CV315HD	1	15	250
56CV410	3	10	500
56CV416K	3	16	500
56CV420	3	20	500
56CV432	3	32	500
56CV440	3	40	500
56CV450	3	50	500
56CV510	3	10	500
56CV520	3	20	500
56CV532	3	32	500
56CV540	3	40	500
56CV550	3	50	500
56CV610	3	10 20 cont	500
56CV710	3	10 20 cont	500
56CV720	3	20 20 cont	500



FRONT MOUNTING ENCLOSURE

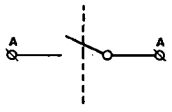


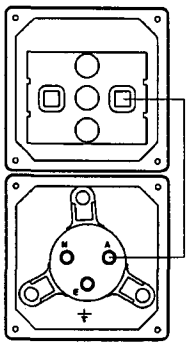
SIDE COMPLETE



FRONT COMPLETE

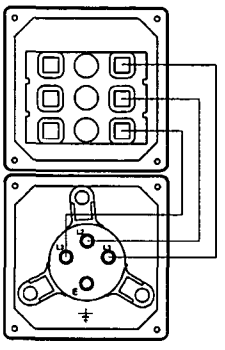
56C320





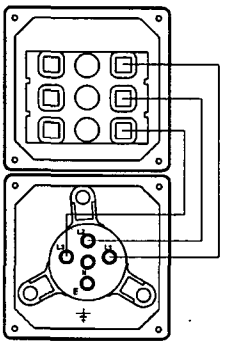
REAR MECHANISMS

56C410
56C420
56C416K



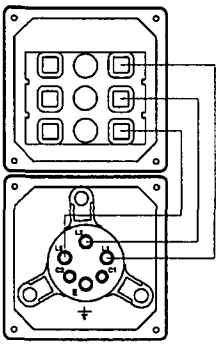
REAR MECHANISMS

56C510
56C520



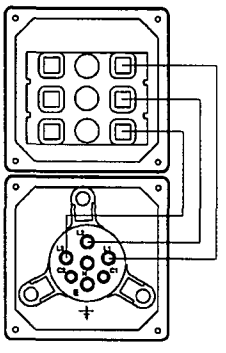
REAR MECHANISMS

56C610

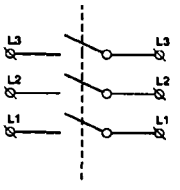


REAR MECHANISMS

56C710
56C720



REAR MECHANISMS



SWITCH TERMINALS
ARE NOT IDENTIFIED

SWITCH IS
BACKWIRED

CONDUCTOR TERMINATION
IS PRESSURE PLATE TYPE

HOW TO ORDER SWITCHED SOCKET OUTLETS

Switched Socket Outlets are often referred to as GPOs (General Purpose Outlets), Powerpoints or Power Outlets. So that there is no confusion, the description 'Switched Socket Outlets' will be used throughout this brochure. Single and Twin Socket Outlets are available in 2000 Series in horizontal and vertical formats.

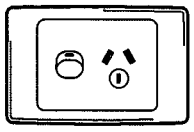
Catalogue Numbers will vary depending on the number of sockets and whether the product is horizontally or vertically mounted.

This number indicates the **number of switched sockets** included in the product. The plate size remains the same for both single and twin switched socket outlets, only the number of switches and sockets vary.

2 0 1 5 V

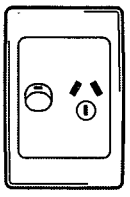
The letter '**V**' indicates that the product is **vertically mounted.** Where there is no letter '**V**', the product is **horizontally mounted.**

Single Horizontal



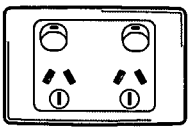
2015

Single Vertical



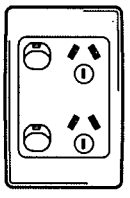
2015V

Twin Horizontal



2025

Twin Vertical



2025V

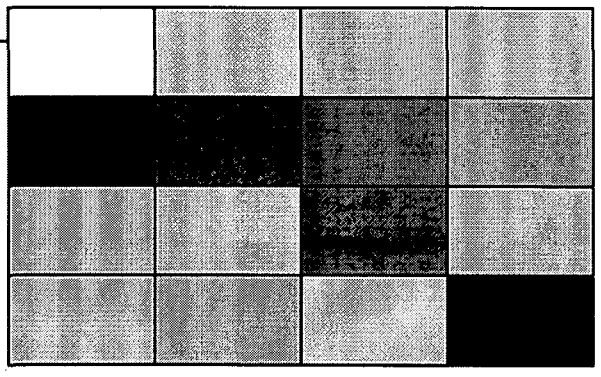
Please note: Single Automatically Switched Socket Outlets are also available (Catalogue Number 2010 Page 28).

Special Features and Options

2000 Series Switched Socket Outlets may also be ordered with special features, including an extra switch mechanism, safety shutters, neons, double pole switched versions, deep plate format products and more. Please see the main part of the brochure for Combination (Page 30) and Automatic (Page 28) versions with special features.

Ordering Colours

When ordering Switched Socket Outlets, colour variations also have to be taken into consideration, as the Catalogue Number will change depending on the colour of the product. Each colour has its own 'code', for example, the code for White Electric is **'WE'** and the code for Cream is **'CM'**. The Catalogue Number for a 2000 Series Twin Switched Socket Outlet in White Electric is 2025,**WE**.



Refer to '2000 Series Colours' on page 12 for colour options and their corresponding codes.

SURFACE MOUNTED SWITCHED SOCKET OUTLETS & ACCESSORIES

2000 Series Surface Mounted Switched Socket Outlets and accessories are innovative products that allow extra wiring room for single and double powerpoints. These understated products take up very little wall space, resulting in a much safer installation and a product that is aesthetically pleasing. 2000 Series Surface Mounted Switched Socket Outlets and accessories are perfect for situations where wiring room is limited.

Surface Mounting Kit (2000SMK)

This kit enables you to surface mount standard size 2000 Series gridplates. Included in the kit is a 2449ASD Surface Mounting Spacer Flange and a 2000SM Deep Surround. These items are also available separately.

Surface Mounting Flange (2449ASD)

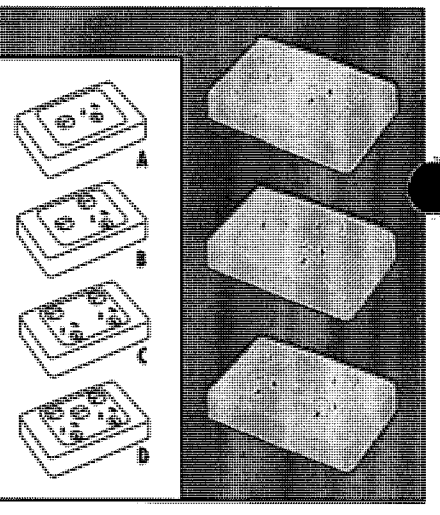
A 2000 Series Surface Mounting Flange (2000SM) for 2000 Series accessories is available.

Surface Mounting Block (449A)

The 449A Mounting Block is designed to accept all standard pattern 2000 Series grid assemblies. This product is ideal for use where a 2000 Series installation is required with surface wiring. The 449A has six mounting screw positions and twelve combined cable/conduit cut-outs.

SURFACE MOUNTED SWITCHED SOCKET OUTLETS

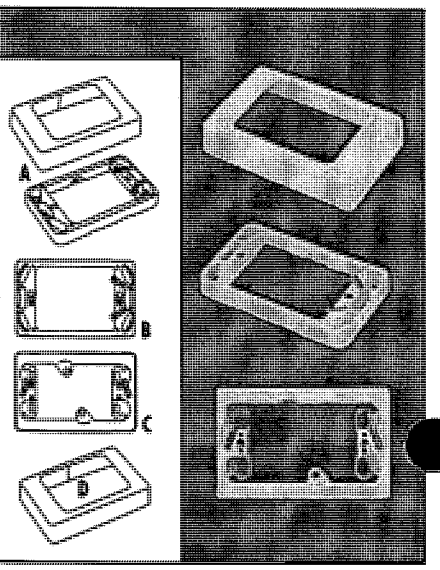
Cat. No.		Length	Width	Depth	Mounting Centres
All Products		116mm	78mm	30mm	84mm apart
2015SM	A	Single Switched Socket Outlet, 250V/10A - standard pattern surface mounted single combination switched socket with deep type curved sided surround.			
2015XASM	B	Single Switched Socket Outlet, 250V/10A - standard pattern surface mounted single combination switched socket with deep type curved sided surround, with removable extra switch.			
2025SM	C	Twin Switched Socket Outlet, 250V/10A - standard pattern surface mounted double combination switched socket with deep type curved sided surround.			
2025XASM	D	Twin Switched Socket Outlet, 250V/10A - standard pattern surface mounted double combination switched socket with deep type curved sided surround, with removable extra switch.			

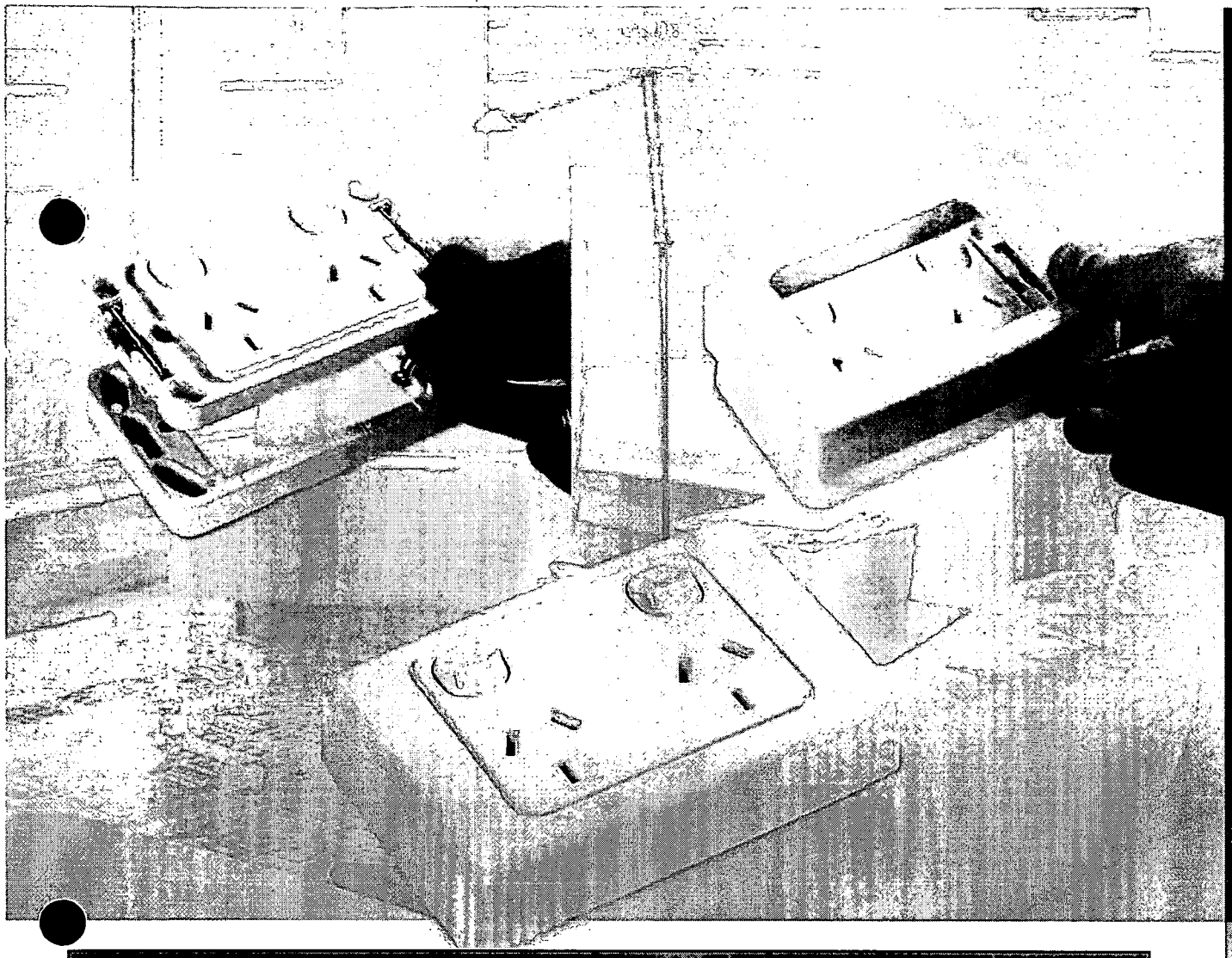


* Refer to **Page 53** for mounting templates.

SURFACE MOUNTED ACCESSORIES

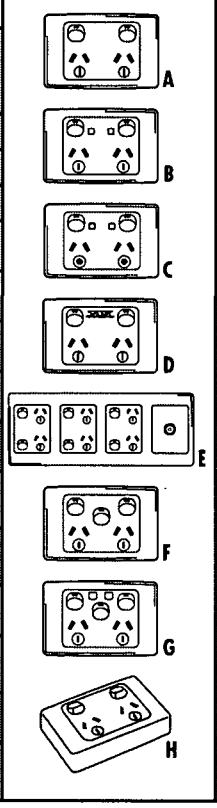
Cat. No.		Length	Width	Depth	Mounting Centres
2000SMK		116mm	78mm	27mm	84mm apart
2449ASD		114mm	69mm	14mm	84mm apart
449A		122mm	80mm	34mm	84mm apart
2000SM		116mm	78mm	26mm	N/A
2000SMK	A	Surface Mounting Kit for 2000 Series grid assemblies. Incorporates 2449ASD Surface Mounting Spacer Flange and 2000SM Deep Surround.			
2449ASD	B	Mounting Flange for 2000 Series accessories, six mounting positions (for use with 2000SM Deep Surround).			
449A	C	Surface Mounting Block for 2000 Series, six mounting positions and twelve combined cable/conduit cut-outs.			
2000SM	D	Surface Mounting Deep Surround, standard pattern, curved sided.			





STANDARD SIZE TWIN SWITCHED SOCKET OUTLETS - HORIZONTALLY MOUNTED

Cat. No.		Length	Width	Depth	Mounting Centres
2025, 2025S, 2025N, 2025L, 2025XA, 2025XAN, 2025FO		116mm	76mm	28mm	84mm apart
2025QC		116mm	76mm	31mm	84mm apart
2025SM		116mm	76mm	30mm	84mm apart
2025V3/30PF		290mm	116mm	13mm	See template
2025	A	Twin Switched Socket Outlet, 250V/10A.			
2025S	A	Twin Switched Socket Outlet, 250V/10A, with safety shutters.			
2025N	B	Twin Switched Socket Outlet, 250V/10A, with safety shutters and neons.			
2025L	C	Twin Switched Socket Outlet, 250V/10A, with round earth pin.			
2025QC	A	Twin Switched Socket Outlet, 250V/10A, Quick Connect.			
2025FO	D	Twin Switched Socket Outlet, 250V/10A, printed with 'NOT PROTECTED BY SAFETY SWITCH. FRIDGE/FREEZER ONLY'.			
2025V3/30PF	E	"Powertainment™" Six Socket Outlets, F-Type Pay TV Outlet in 2000/4 Surround, 250V/10A.			
2025XA	F	Twin Switched Socket Outlet, 250V/10A, with removable extra switch.			
2025XAN	G	Twin Switched Socket Outlet, 250V/10A with safety shutters, neons and removable extra switch.			
2025SM	H	Twin Switched Socket Outlet, 250V/10A, with surface mounting kit.			
2025XAS	F	Twin Switched Socket Outlet, 250V/10A, with removable extra switch and safety shutters.			

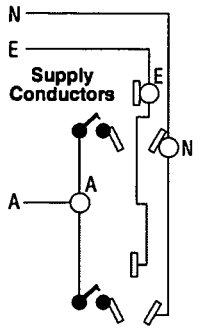


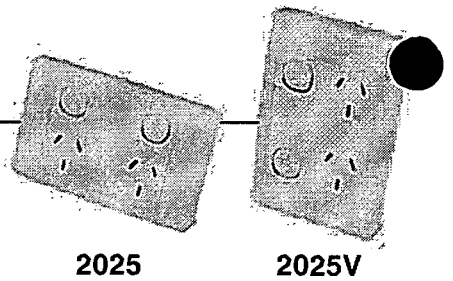
All models accommodate 4 x 2.5mm² cables. 30 Series Switch Terminals accommodate 3 x 2.5mm² on the 2025XA and 2025XAN. All models have a base projection of 13mm, except for 2025QC which has a base projection of 14mm.

* Refer to **Page 62** for more information on "Powertainment™".
* Refer to **Page 53** for mounting templates.

SCHEMATIC WIRING DIAGRAMS

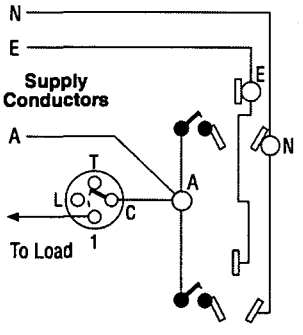
Standard Pattern Mounting Twin Combination

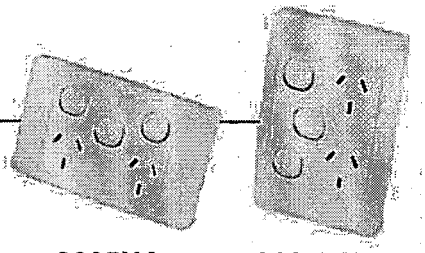




2025 2025V

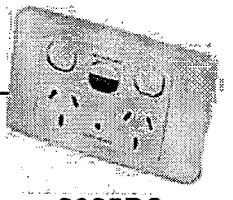
Twin Switched Sockets with Extra Switch



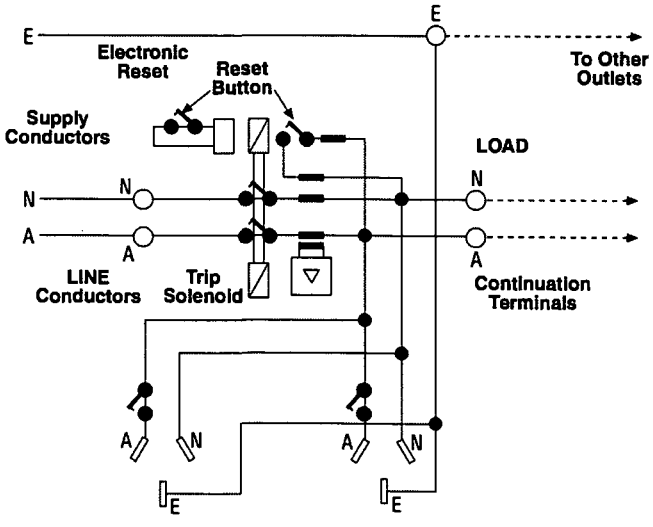


2025XA 2025VXA

Earth Leakage Protected Twin Switched Sockets



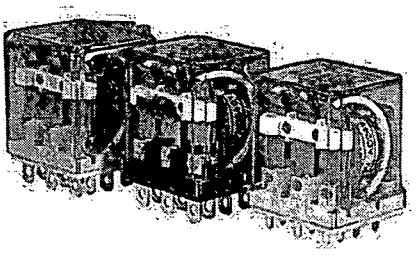
2025RC



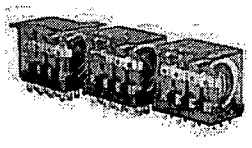
RH Series Compact Power Relays

SPDT through 4PDT, 10A contacts
Compact power type relays

The RH series are miniature power relays with a large capacity. The RH relays feature 10A contact capacity as large as the RR series but in a miniature package. The compact size saves space.



Part Number Selection

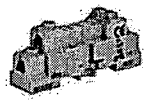
Contact	Model	Part Number: Blade Terminal	Part Number: PCB Terminal	Coil Voltage Code (Standard Stock in bold)
SPDT 	Basic	RH1B-U	RH1V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH1B-UL	—	
	With Check Button	RH1B-UC	—	
	With Indicator and Check Button	RH1B-ULC	—	
	Top Bracket Mounting	RH1B-UT	—	
	With Diode (DC coil only)	RH1B-UD	RH1V2-UD	DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH1B-ULD	—	**DC12V**, **DC24V**, DC48V, DC110V
DPDT 	Basic	RH2B-U	RH2V2-U	AC6V, AC12V, **AC24V**, **AC110-120V**, **AC220-240V** DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator	RH2B-UL	RH2V2-UL	
	With Check Button	RH2B-UC	—	
	With Indicator and Check Button	RH2B-ULC	—	
	Top Bracket Mounting	RH2B-UT	—	
	With Diode (DC coil only)	RH2B-UD	RH2V2-UD	DC6V, **DC12V**, **DC24V**, DC48V, DC100-110V
	With Indicator and Diode (DC coil only)	RH2B-ULD	—	
3PDT 	Basic	RH3B-U	RH3V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH3B-UL	RH3V2-UL	
	With Check Button	RH3B-UC	—	
	With Indicator and Check Button	RH3B-ULC	—	
	Top Bracket Mounting	RH3B-UT	—	
	With Diode (DC coil only)	RH3B-D*	RH3V2-D*	DC6V, DC12V, DC24V, DC4BV, DC110V
	With Indicator and Diode (DC coil only)	RH3B-LD*	—	
4PDT 	Basic	RH4B-U	RH4V2-U	AC6V, AC12V, **AC24V**, AC110V, **AC120V**, AC220V, **AC240V** DC6V, **DC12V**, **DC24V**, DC48V, DC110V
	With Indicator	RH4B-UL	RH4V2-UL	
	With Check Button	RH4B-UC	—	
	With Indicator and Check Button	RH4B-ULC	—	
	Top Bracket Mounting	RH4B-UT	—	
	With Diode (DC coil only)	RH4B-UD	RH4V2-UD	DC6V, DC12V, DC24V, DC48V, DC110V
	With Indicator and Diode (DC coil only)	RH4B-LD*	—	

1. *Carries no UL recognition mark.
2. PCB terminal relays are designed to mount directly to a circuit board without any socket.

Ordering Information
When ordering, specify the Part No. and coil voltage code:
(example) **RH3B-U** **AC120V**
Part No. — Coil Voltage Code

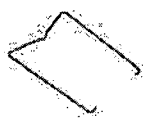
Sockets (for Blade Terminal Models)

Relays	Standard DIN Rail Mount [1]	Finger-safe DIN Rail Mount [1]	Through Panel Mount	PCB Mount
RH1B	SH1B-05	SH1B-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

1. DIN Rail mount socket comes with two horseshoe clips. Do not use unless you plan to insert pullover wire spring. Replacement horseshoe clip part number is Y778-011.

Hold Down Springs & Clips

Appearance	Description	Relay	For DIN Mount Socket	For Through Panel & PCB Mount Socket	Min Order Qty
	Pullover Wire Spring	RH1B	SY2S-02F1 [2]	SY4S-51F1	10
		RH2B	SY4S-02F1 [2]		
		RH3B	SH3B-05F1 [2]		
		RH4B	SH4B-02F1 [2]		
	Leaf Spring (side latch)	RH1B, RH2B, RH3B, RH4B	SFA-202 [3]	SFA-302 [3]	20
	Leaf Spring (top latch)	RH1B, RH2B, RH3B, RH4B	SFA-101 [3]	SFA-301 [3]	

2. Must use horseshoe clip when mounting in DIN mount socket. Replacement horseshoe clip part number is Y778-011.
3. Two required per relay.

AC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C								Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	AC 50Hz				AC 60Hz										
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	170	240	330	387	150	200	280	330	330	9.4	6.4	5.4	110%	80% maximum	30% minimum
12	86	121	165	196	75	100	140	165	165	39.3	25.3	21.2			
24	42	60.5	81	98	37	50	70	83	83	153	103	84.5			
110	9.6	—	18.1	21.6	8.4	—	15.5	18.2	18.2	—	2,200	1,800			
110-120	—	9.4-10.8	—	—	—	8.0-9.2	—	—	—	—	—	—			
120	8.6	—	16.4	19.5	7.5	—	14.2	16.5	16.5	—	10,800	7,360			
220	4.7	—	8.8	10.7	4.1	—	7.7	9.1	9.1	—	10,800	7,360			
220-240	—	4.7-5.4	—	—	—	4.0-4.6	—		—	18,820	—	—			
240	4.9	—	8.2	9.8	4.3	—	7.1	8.3	8.3	—	12,100	9,120			

DC Coil Ratings

Voltage (V)	Rated Current (mA) ±15% at 20°C				Coil Resistance (Ω) ±10% at 20°C				Operation Characteristics (against rated values at 20°C)		
	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	Max. Continuous Applied Voltage	Pickup Voltage	Dropout Voltage
6	128	150	240	250	47	40	25	24	110%	80% maximum	10% minimum
12	64	75	120	125	188	160	100	96			
24	32	36.9	60	62	750	650	400	388			
48	16	18.5	30	31	2,690	2,600	1,600	1,550			
100-110	—	8.2-9.0	—	—	—	12,250	—	—			
110	8	—	12.8	15	13,800	—	8,600	7,340			

Standard coil voltages are in **BOLD**.

Contact Ratings

Maximum Contact Capacity						
Model	Continuous Current	Allowable Contact Power		Rated Load		
		Resistive Load	Inductive Load	Voltage (V)	Res. Load	Ind. Load
SPDT	10A	1540VA 300W	990VA 210W	110 AC	10A	7A
				220 AC	7A	4.5A
				30 DC	10A	7A
DPDT 3PDT 4PDT	10A	1650VA 300W	1100VA 225W	110 AC	10A	7.5A
				220 AC	7.5A	5A
				30 DC	10A	7.5A

Note: Inductive load for the rated load — cos ø = 0.3, L/R = 7 ms

TÜV Ratings

Voltage	RH1	RH2	RH3	RH4
240V AC	10A	10A	7.5A	7.5A
30V DC	10A	10A	10A	10A

AC: cos ø = 1.0, DC: L/R = 0 ms

UL Ratings

Voltage	Resistive			General Use			Horse Power Rating		
	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4	RH1 RH2	RH3	RH4
240V AC	10A	7.5A	7.5A	7A	6.5A	5A	1/3 HP	1/3 HP	—
120V AC	10A	10A		7.5A	7.5A		1/6 HP	1/6 HP	—
30V DC	10A	10A	—	7A	—	—	—	—	—
28V DC	—	—	10A	—	—	—	—	—	—

CSA Ratings

Voltage	Resistive				General Use				Horse Power Rating
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	RH1, 2, 3
240V AC	10A	10A	—	7.5A	7A	7A	7A	5A	1/3 HP
120V AC	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6 HP
30V DC	10A	10A	10A	10A	7A	7.5A	—	—	—

Socket Specifications

	Sockets	Terminal	Electrical Rating	Wire Size	Torque
DIN Rail Mount Sockets	SH1B-05	(Coil) M3 screws (contact) M3.5 screws with captive wire clamp	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in•lbs 9 - 11.5 in•lbs
	SH2B-05 SH3B-05 SH4B-05	M3.5 screws with captive wire clamp	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in•lbs
Finger-safe DIN Rail Mount	SH1B-05C	(coil) M3 screws (contact) M3.5 screws with captive wire clamp, fingersafe	250V, 10A	Maximum up to 2–#12AWG	5.5 - 9 in•lbs 9 - 11.5 in•lbs
	SH2B-05C SH3B-05C SH4B-05C	M3.5 screws with captive wire clamp, fingersafe	300V, 10A	Maximum up to 2–#12AWG	9 - 11.5 in•lbs
Through Panel Mount Socket	SH1B-51 SH2B-51 SH3B-51 SH4B-51	Solder	300V, 10A	—	—
PCB Mount Socket	SH1B-62	PCB mount	250V, 10A	—	—
	SH2B-62 SH3B-62 SH4B-62	PCB mount	300V, 10A	—	—

Accessories

Description	Appearance	Use with	Part No.	Remarks
Aluminum DIN Rail (1 meter length)		All DIN rail sockets	BNDN1000	IDEC offers a low-profile DIN rail (BNDN1000). The BNDN1000 is designed to accommodate DIN mount sockets. Made of durable extruded aluminum, the BNDN1000 measures 0.413 (10.5mm) in height and 1.37 (35mm) in width (DIN standard). Standard length is 39" (1,000mm).
DIN Rail End Stop		DIN rail	BNL5	9.1 mm wide
Replacement Hold-Down Spring Anchor		DIN mount sockets and hold down springs	Y778-011	For use on DIN rail mount socket when using pullover wire hold down spring. 2 pieces included with each socket.

Specifications

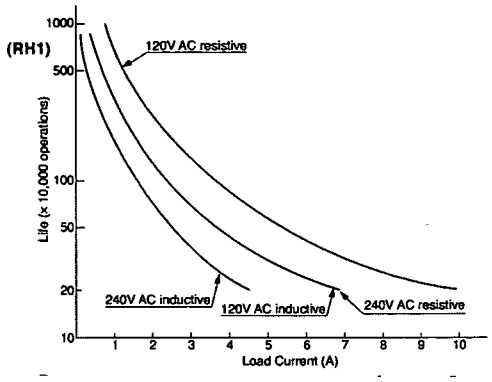
Contact Material		Silver cadmium oxide
Contact Resistance [1]		50mΩ maximum
Minimum Applicable Load		24V DC, 30 mA, 5V DC, 100 mA (reference value)
Operate Time [2]	SPDT, DPDT	20ms maximum
	3PDT, 4PDT	25ms maximum
Release Time [2]	SPDT, DPDT	20ms maximum
	3PDT, 4PDT	25ms maximum
Power Consumption (approx.)	SPDT	AC: 1.1VA (50Hz), 1VA (60Hz) DC: 0.8W
	DPDT	AC: 1.4VA (50Hz), 1.2VA (60Hz) DC: 0.9W
	3PDT	AC: 2VA (50Hz), 1.7VA (60Hz) DC: 1.5W
	4PDT	AC: 2.5VA (50Hz), 2VA (60Hz) DC: 1.5W
Insulation Resistance		100MΩ minimum (500V DC megger)
Dielectric Strength [3]	SPDT	Between live and dead parts: 2,000V AC, 1 minute Between contact and coil: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute
	DPDT, 3PDT, 4PDT	Between live and dead parts: 2,000V AC, 1 minute Between contact and coil: 2,000V AC, 1 minute Between contacts of different poles: 2,000V AC, 1 minute Between contacts of the same pole: 1,000V AC, 1 minute
Operating Frequency		Electrical: 1,800 operations/hour maximum Mechanical: 18,000 operations/hour maximum
Vibration Resistance		Damage limits: 10 to 55Hz, amplitude 0.5 mm Operating extremes: 10 to 55Hz, amplitude 0.5 mm
Shock Resistance		Damage limits: 1,000m/s² (100G) Operating extremes: 200m/s² (20G - SPDT, DPDT) 100m/s² (10G - 3PDT, 4PDT)
Mechanical Life		50,000,000 operations minimum
Electrical Life	DPDT	500,000 operations minimum (120V AC, 10A)
	SPDT, 3PDT, 4PDT	200,000 operations minimum (120V AC, 10A)
Operating Temperature [4]	SPDT	–25 to +50°C (no freezing)
	DPDT, 3PDT, 4PDT	–25 to +40°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Weight (approx.)		SPDT: 24g, DPDT: 37g, 3PDT: 50g, 4PDT: 74g

Note: Above values are initial values.
1. Measured using 5V DC, 1A voltage drop method
2. Measured at the rated voltage (at 20°C), excluding contact bouncing
   Release time of relays with diode: 40 ms maximum
3. Relays with indicator or diode: 1000V AC, 1 minute
4. For use under different temperature conditions, refer to Continuous Load Current vs. Operating Temperature Curve. The operating temperature range of relays with indicator or diode is –25 to +40°C.

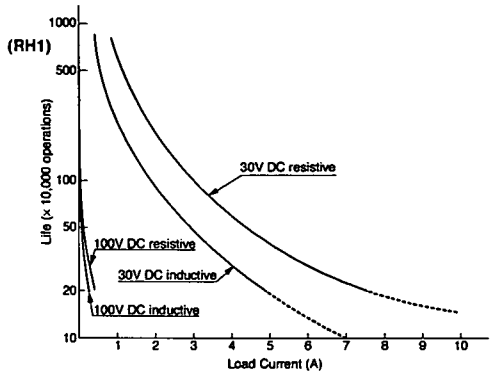
Characteristics (Reference Data)

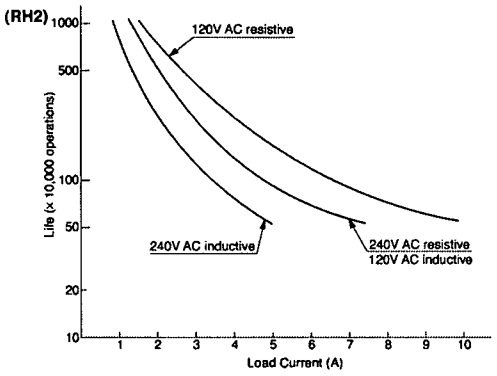
Electrical Life Curves

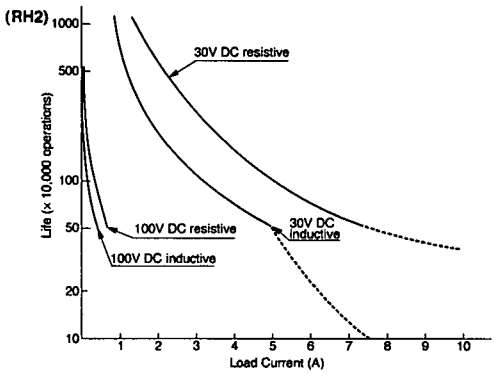
AC Load

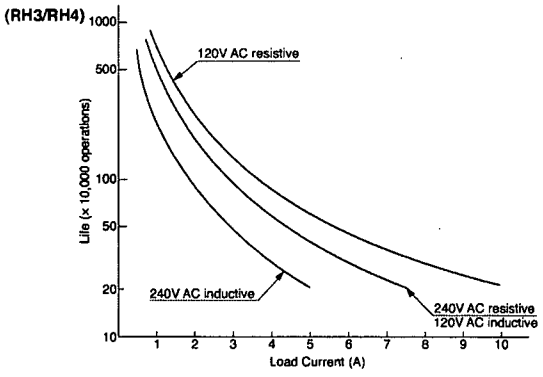


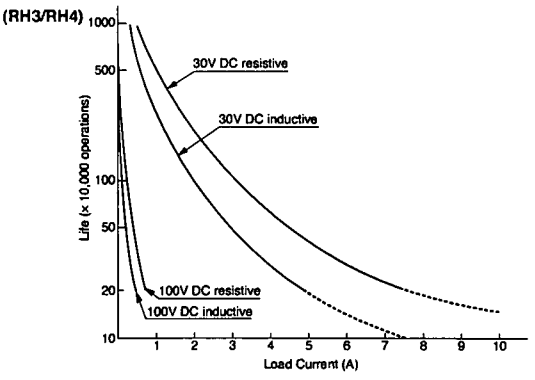
DC Load



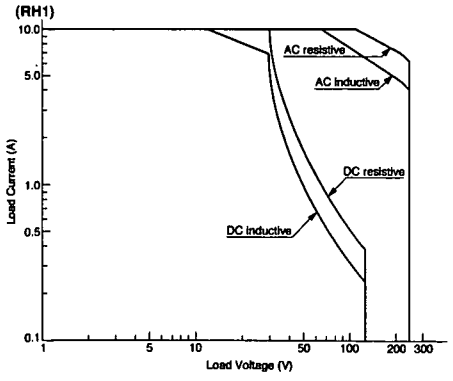


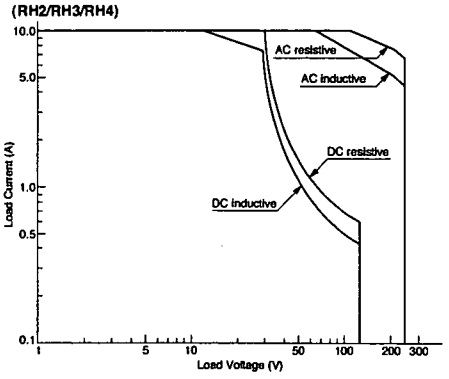






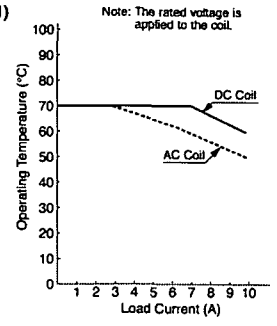
Maximum Switching Capacity



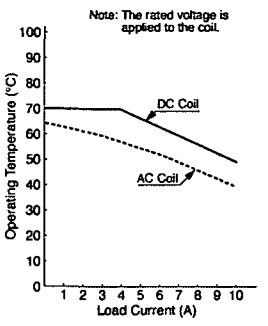


Continuous Load Current vs. Operating Temperature Curve (Basic Type, With Check Button, and Top Bracket Mounting Type)

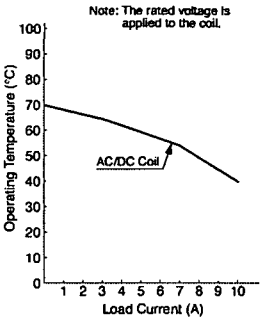
(RH1)



(RH2)



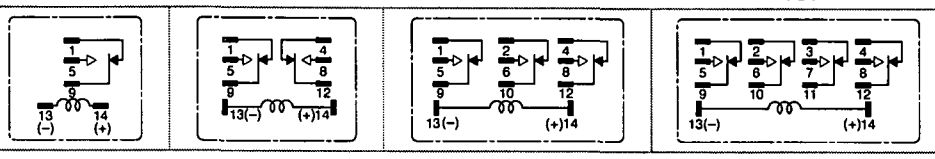
(RH3/RH4)



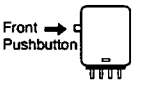
Internal Connection (View from Bottom)

Basic Type

SPDT DPDT 3PDT 4PDT

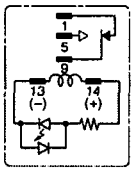
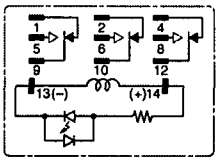
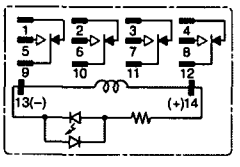
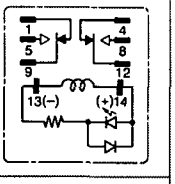
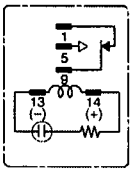
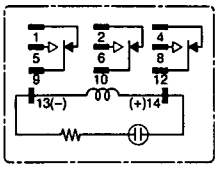
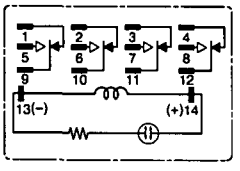
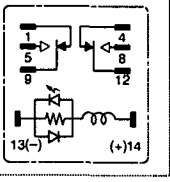


With Check Button



Contacts can be operated by pressing the check button.

With Indicator (-L type)

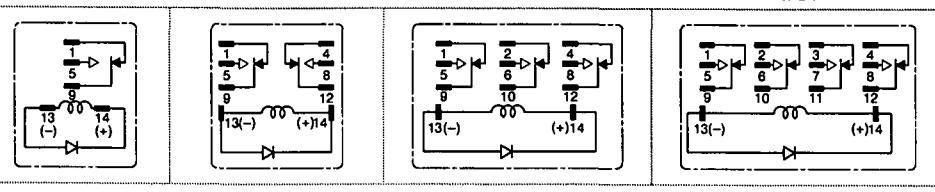
	SPDT	3PDT	4PDT		DPDT
Below 100V AC/DC				Below 24V AC/DC	
100V AC/DC and over				24V AC/DC and over	

When the relay is energized, the indicator goes on.

- Relay coils less than 100V DC do not contain a protection diode (except DPDT).
- Relay coils below 100V use LED indicator, coils above 100V use neon lamp indicator.

With Diode (-D type)

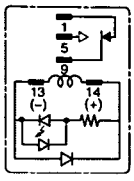
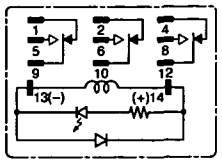
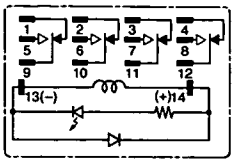
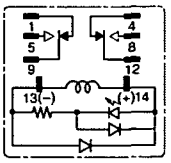
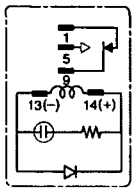
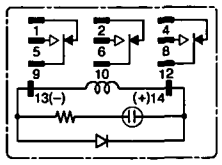
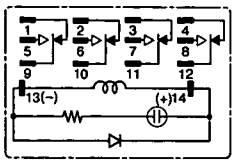
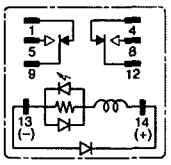
SPDT DPDT 3PDT 4PDT



Contains a diode to absorb the back emf generated when the coil is de-energized. The release time is slightly longer. Available for DC coil only.

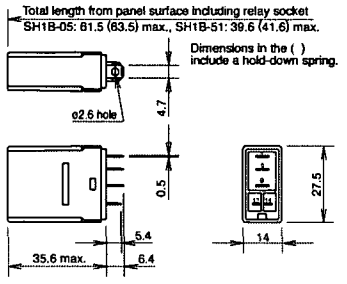
- Diode Characteristics
  Reverse withstand voltage: 1,000V
  Forward current: 1A

With Indicator LED & Diode (-LD type)

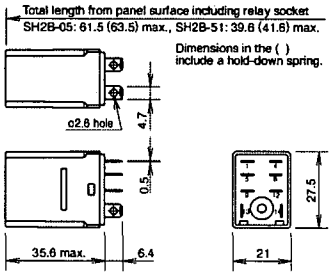
	SPDT	3PDT	4PDT		DPDT	
Below 100V DC				Below 24V AC/DC		Contains an LED indicator and a surge absorber, and has the same height as the basic type.
100V DC and over				24V AC/DC and over		

Dimensions (mm)

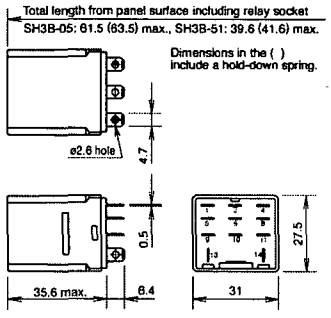
RH1B-U/RH1B-UL/RH1B-UD/RH1B-ULD



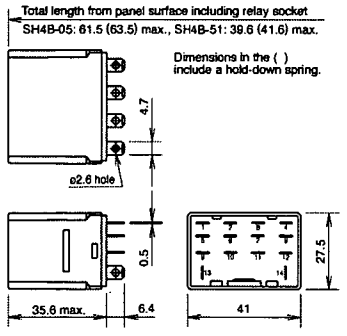
RH2B-U/RH2B-UL/RH2B-UD/RH2B-ULD



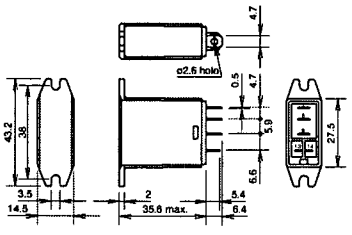
RH3B-U/RH3B-UL/RH3B-D/RH3B-LD



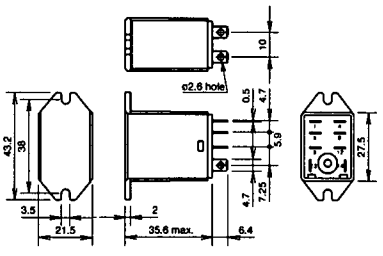
RH4B-U/RH4B-UL/RH4B-UD/RH4B-LD



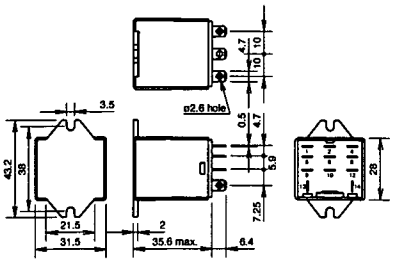
RH1B-UT



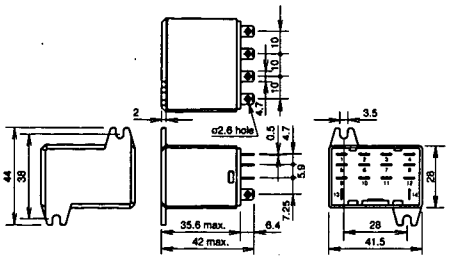
RH2B-UT



RH3B-UT

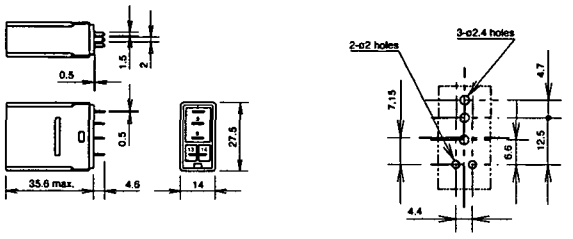


RH4B-UT

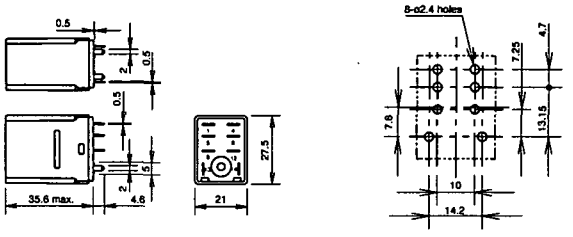


Dimensions con't (mm)

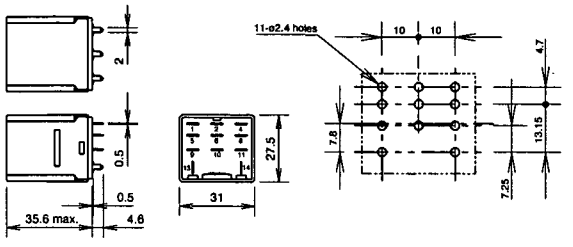
RH1V2-U/RH1V2-UD



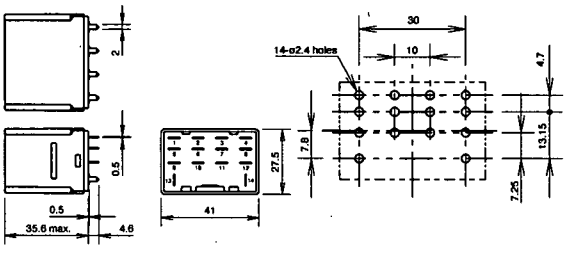
RH2V2-U/RH2V2-UL/RH2V2-UD



RH3V2-U/RH3V2-UL/RH3V2-D

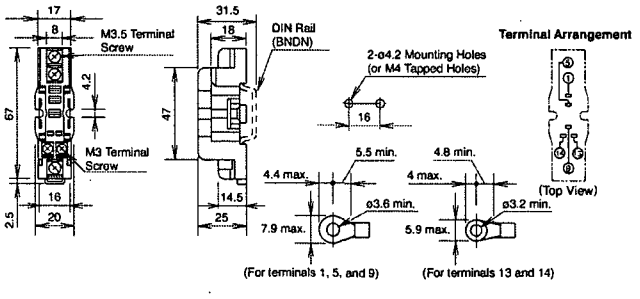


RH4V2-U/RH4V2-UL/RH4V2-UD

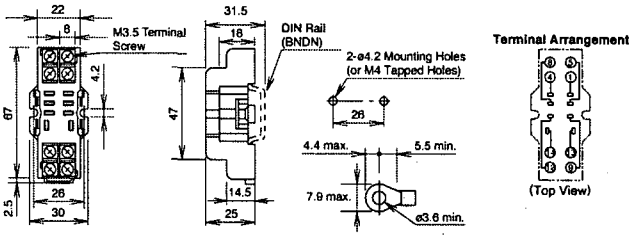


Standard DIN Rail Mount Sockets

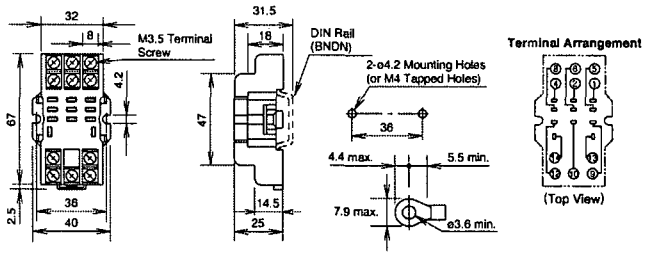
SH1B-05



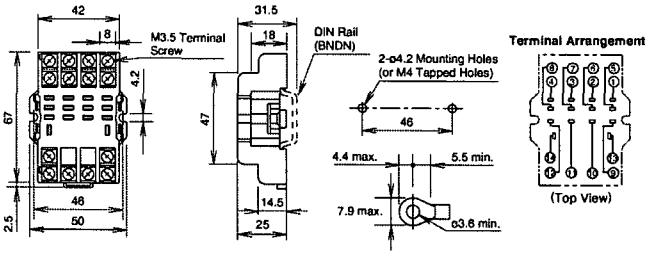
SH2B-05



SH3B-05



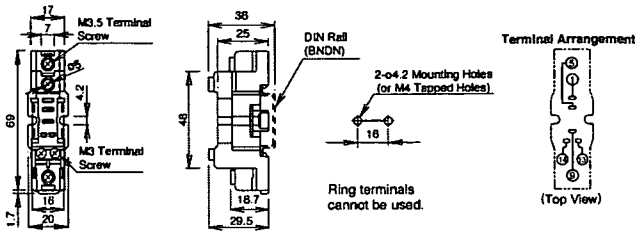
SH4B-05



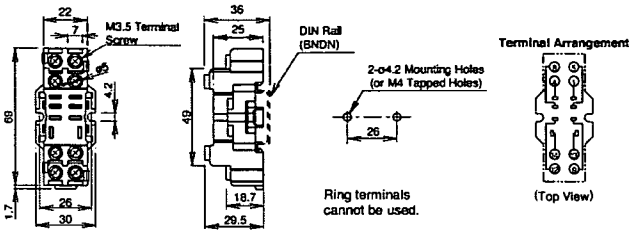
Dimensions con't (mm)

Finger-safe DIN Rail Mount Sockets

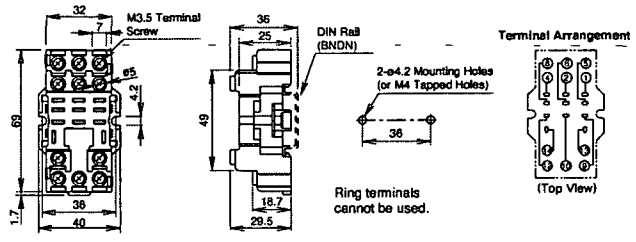
SH1B-05C



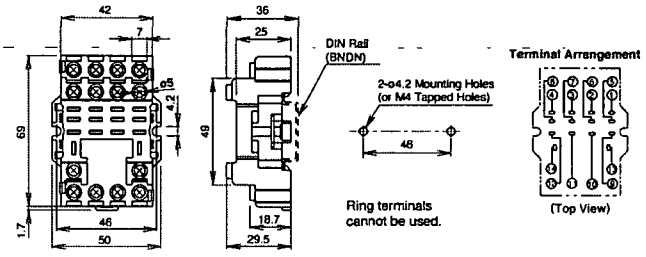
SH2B-05C



SH3B-05C

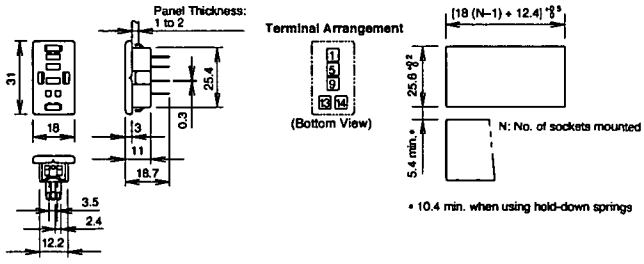


SH4B-05C

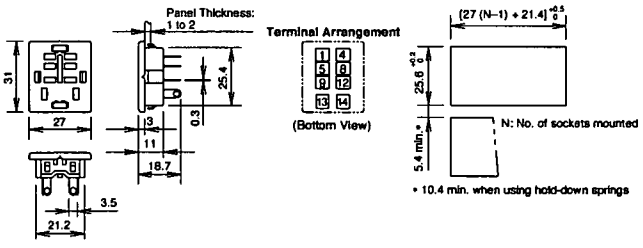


Through Panel Mount Socket

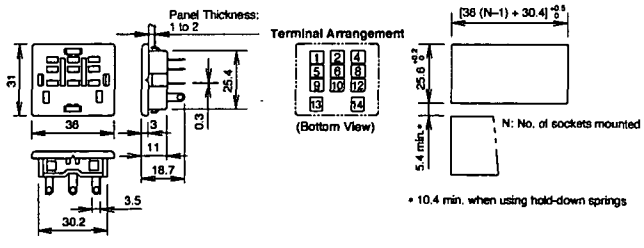
SH1B-51



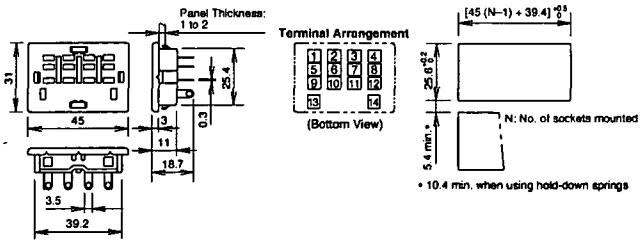
SH2B-51



SH3B-51



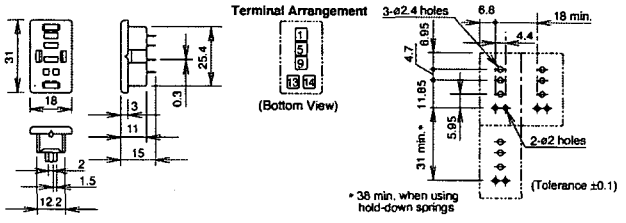
SH4B-51



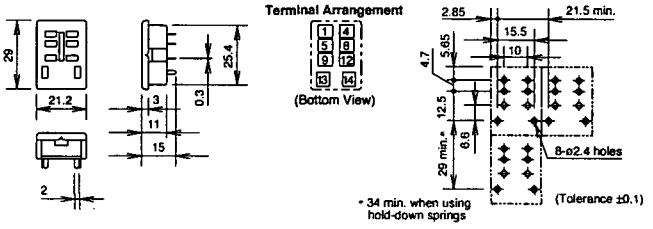
Dimensions con't (mm)

PCB Mount Sockets

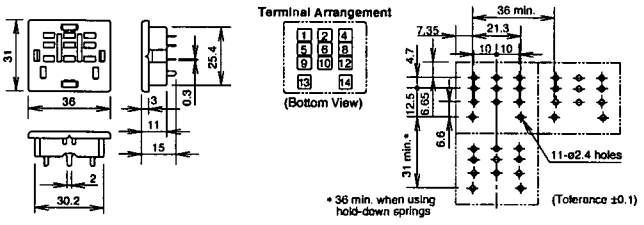
SH1B-62



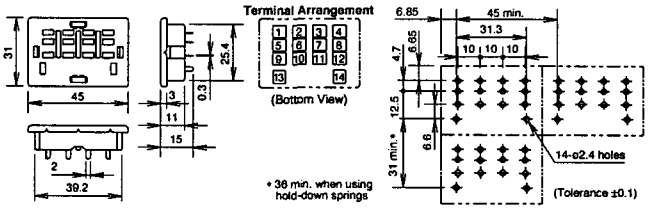
SH2B-62



SH3B-62



SH4B-62



sprecher+schuh

CA6-95
CA6-110
CA6-140
CA6-180

Conventional coil
Konventionelle Spule
Bobine conventionnel
Bobina convenzionale
Bobina convencional

Contactor - Installation instructions
To be commissioned and maintained only by qualified personnel; pay attention to the operating instructions!

Schütz - Montageanleitung
Inbetriebsetzung und Wartung nur durch Fachpersonal; Betriebsanleitung beachten!

Contacteur - Instructions de montage
Mise en service et entretien: seulement par du personnel spécialisé ; respecter les instructions d'exploitation!

Relé o contattore - Istruzioni per il montaggio
Messa in servizio e ma-nutenzione solo da personale specializzato; attenersi alle istruzioni per l'esercizio!

Contactor - Instrucciones de montaje
¡Puesta en servicio y mantenimiento exclusivamente por personal especializado; respetar las instrucciones de puesta en servicio y mantenimiento!

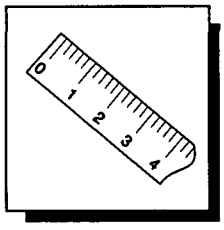
Limited touch protection:
- IP 00 to IEC 529
- IP 20 to IEC 60947 with terminal block CA6-HB1 resp. CA6-HB2
- Finger-proof to DIN VDE 0106, part 100, with single cover CA6-HA1 resp. CA6-HA2

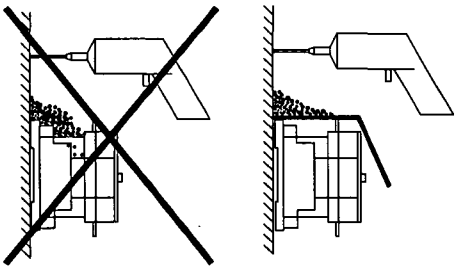
Eingeschränkter Berührungsschutz:
- IP 00 nach IEC 529
- IP 20 nach IEC 60947 mit Rahmenklemmenblock CA6-HB1 bzw. CA6-HB2
- Fingersicher nach DIN VDE 0106, Teil 100, mit Einzelabdeckung CA6-HA1 bzw. CA6-HA2

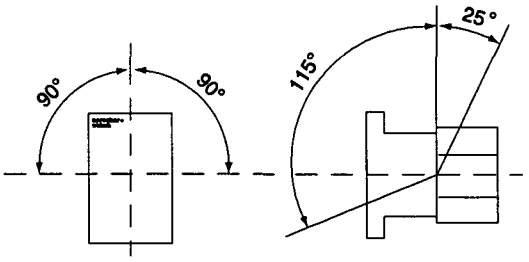
Protection limitée contre le contact:
- IP 00 selon IEC 529
- IP 20 selon IEC 60947 avec le bloc de bornes CA6-HB1 resp. CA6-HB2
- Sécurité contre l'introduction des doigts selon DIN VDE 0106, partie 100, avec le couvercle séparé CA6-HA1 resp. CA6-HA2

Protezione di contatto limitata:
- IP 00 secondo IEC 529
- IP 20 secondo IEC 60947 con quadro di blocco dei morsetti CA6-HB1 rispet CA6-HB2
- Sicurezza dita secondo DIN VDE 0106, parte 100, con copertura sin gola CA6-HA1 rispet. CA6-HA2

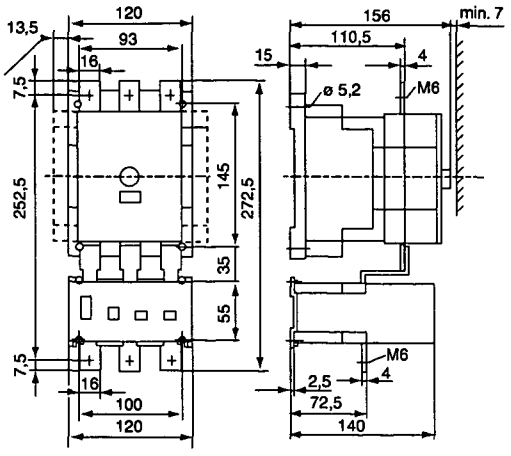
Protección limitada con tra el contacto de partes en tensin:
- IP 00 según CEI 529
- IP 20 según CEI 60947 con bornes de conexión en caja CA6-HB1 o tambien CA6-HB2
- Protección segura según DIN VDE 0106 parte 100 con cubierta de protección CA6-HA1 o tambien CA6-HA2



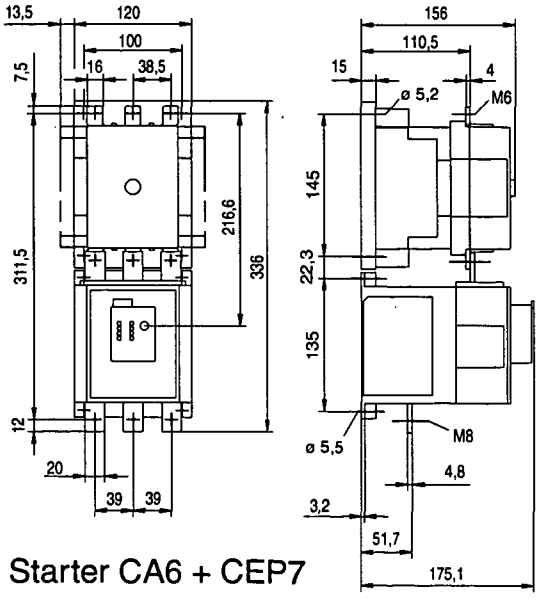




CA6-95
CA6-110



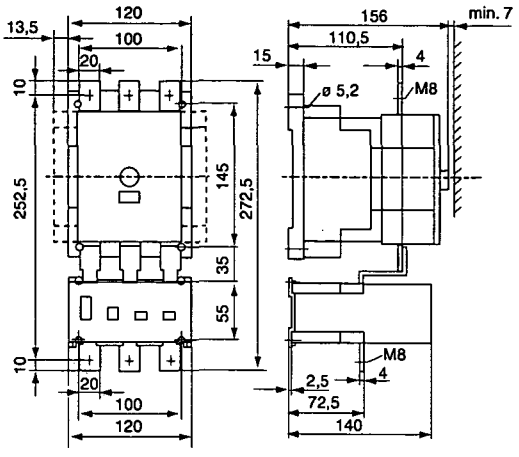
Starter CA6 + CEF1



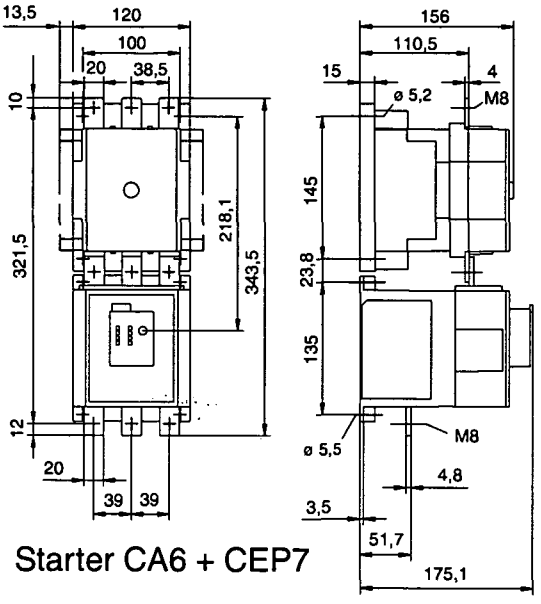
Starter CA6 + CEP7

CA6-140
CA6-180

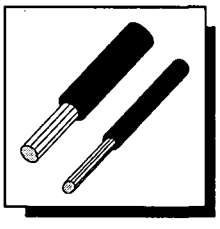
sprecher+schuh

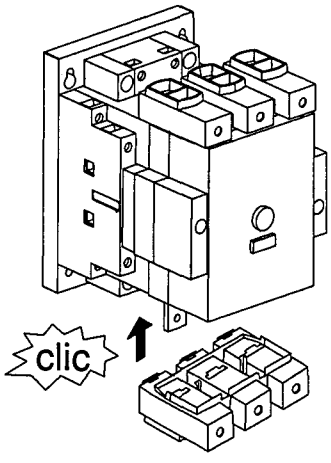


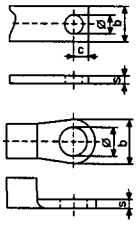
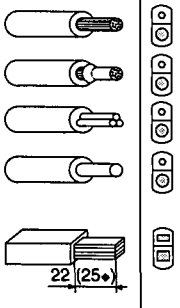
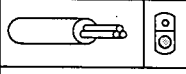
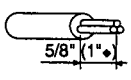
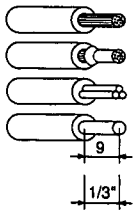
Starter CA6 + CEF1



Starter CA6 + CEP7





			CA6-95 CA6-110	CA6-140 ◆ CA6-180 ◆
	SW = 10 mm (13 mm ◆)		**HF110** b max. 20 mm ø min. 6,1 mm c max. 10 mm s max. 5 mm DIN 46234 b max. 20 mm s max. 5 mm T: 8...10 Nm	**HF180** b max. 25 mm ø min. 8,3 mm c max. 12,5 mm s max. 5 mm DIN 46234 b max. 25 mm s max. 5 mm T: 10...12 Nm
L1 L2 L3 1 3 5 2 4 6 T1 T2 T3	SW = 5 mm		**CA6-HB1** 16...35 mm² 16...70 mm² 16...50 mm² 16...95 mm² 16...50 mm² 16...95 mm² 3...9 x 16 mm 3...12 x 16 mm T: 8...10 Nm	**CA6-HB2** 16...35 mm² 16...95 mm² 16...50 mm² 16...120 mm² 16...50 mm² 16...120 mm² 3...9 x 20 mm 3...14 x 20 mm T: 10...12 Nm
			No. 6...1/0 AWG No. 6...3/0 MCM	No. 6...1/0 AWG No. 6...250 MCM
	SW = 3/16 (5/16" ◆)		**CA6-105-HU** No. 6...2/0 AWG T: 70...90 lb-in	**CA6-170-HU** No. 6 AWG...250 MCM T: 90...110 lb-in
13 83 14 84 A1 A2	Pozidriv Nr. 2		2 x 1...2,5 mm² 2 x 1...4 mm² 2 x 1...4 mm² T: 1.4...2,3 Nm 2 x No. 16...12 AWG T: 12...20 lb-in	

2

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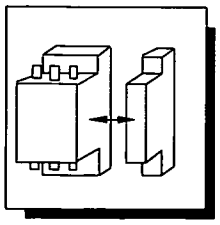


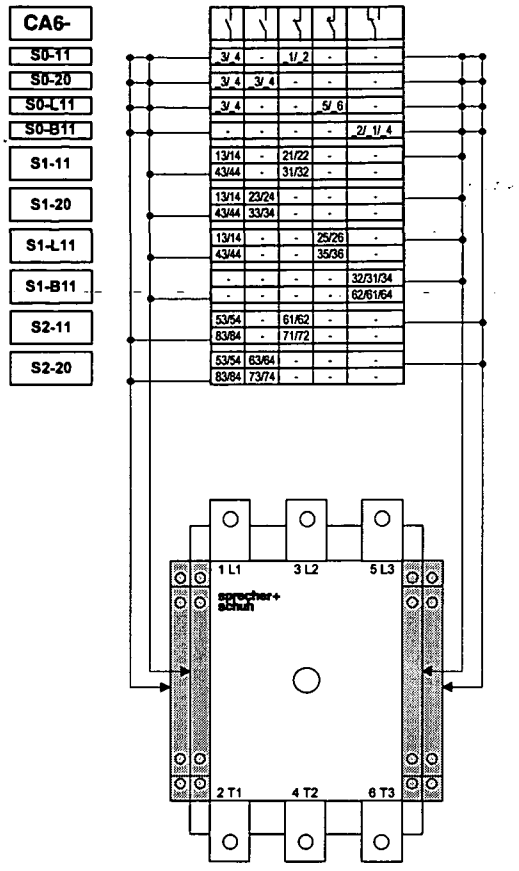
Safety Contactor
Both N.C. feedback contacts must be monitored to provide mirror contact performance.

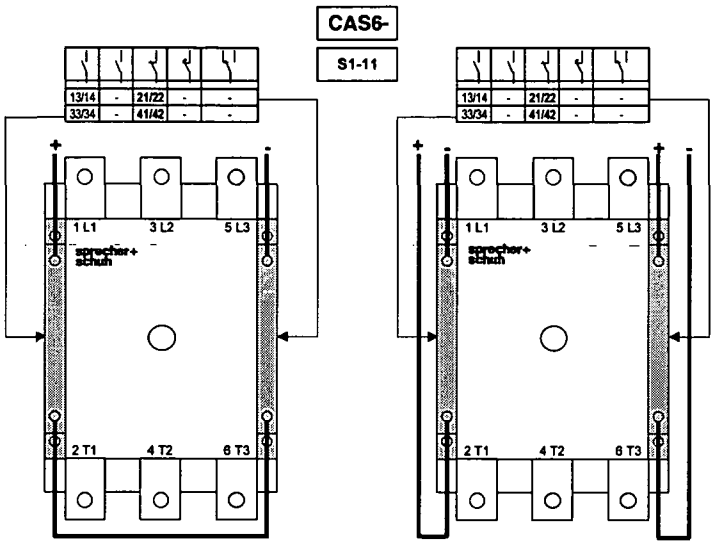
Sicherheits-schütz
Beide Oeffner Kontakte müssen überwacht werden, um die Mirror Kontaktbedingung zu erfüllen.

Contacteur de sécurité
Les deux contacts à ouverture doivent être surveillés pour remplir la condition de Mirror contact.

Contattore di sicurezza
Entrambi i contatti NC devono essere controllati per fornire le prestazioni del contatto Mirror.

Contactor de seguridad
Ambos contactos a abertura deben ser supervisados para satisfacer la condición de Mirror contacto.





N.C. feedback contacts monitored with 1 safety relay channel (series wired).

Öffner Kontakte werden mit 1 Sicherheitsrelais überwacht (Serieschaltung).

Contacts à ouverture sont surveillés avec 1 relais de sécurité le (circuit de série).

Contatti NC controllati con 1 scanalatura del relè di sicurezza (circuito serie).

Contactos a abertura supervisados con 1 canal del relais de seguridad (circuito de serie).

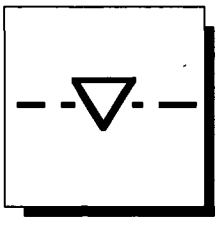
N.C. feedback contacts monitored with 2 safety relay channels (parallel wired).

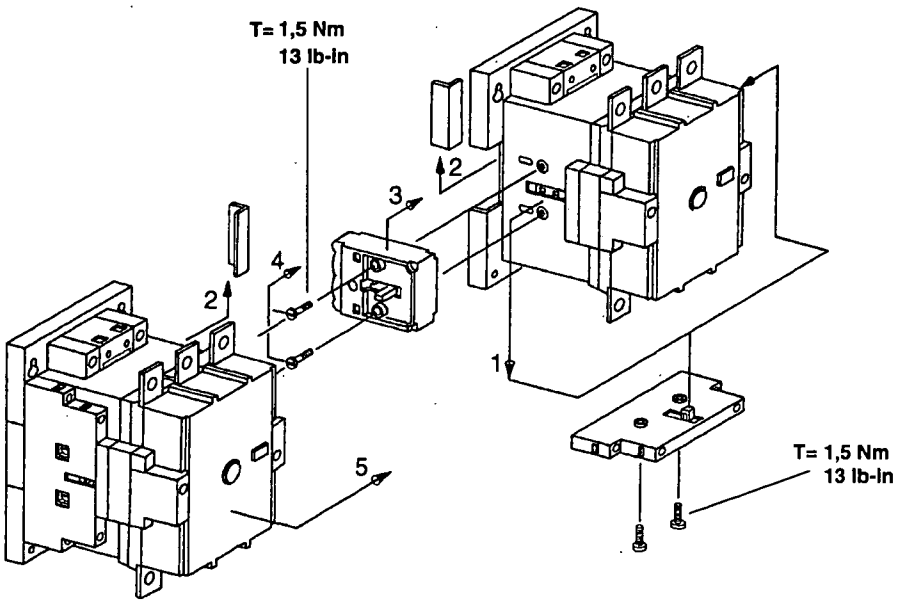
Öffner Kontakte werden mit 2 Sicherheitsrelais überwacht (Parallelschaltung).

Contacts à ouverture sont surveillés avec 2 relais de sécurité le (circuit de parallèle).

Contatti NC controllati con 1 scanalature del relè di sicurezza (circuito parallelo).

Contactos a abertura supervisados con 2 canales del relais de seguridad (circuito paralelo).





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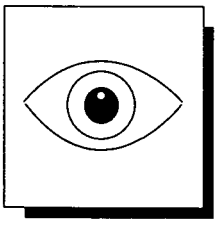
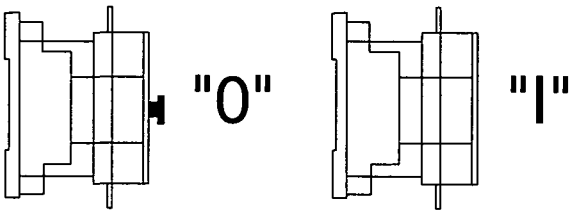
schuh





Operation and Maintenance:

Dangerous electric voltage; switch off before commencing work!

After a short circuit the main contacts and arc-chute must be examined!

With the arc-chute removed the contactor is mechanically locked. When the coil is energized the arc-chute is mechanically locked. Before removing the arc-chute, switch off the contactor!

If the contacts are welded, the arc-chute can be removed by exerting more force. Slight welds can possibly be separated with a screwdriver.
Attention: do not bend the contacts!

The main contacts, arc-chute, magnet coil and auxiliary switch block can be replaced.

Use original spare parts only to assure the reliability of the contactor!

Betrieb und Wartung:

Gefährliche elektrische Spannung; vor Beginn der Arbeiten Gerät spannungsfrei schalten!

Nach einem Kurzschluss müssen Hauptschaltstücke und Löschkammer überprüft werden!

Bei entfernter Löschkammer ist das Schütz mechanisch verriegelt. Bei erregter Spule ist die Löschkammer mechanisch verriegelt. Vor dem Abnehmen der Löschkammer ist das Schütz auszuschalten!

Bei verschweissten Kontaktstücken kann die Löschkammer mit erhöhter Betätigungskraft entfernt werden. Leichte Verschweissungen können ggf. mit Schraubendreher getrennt werden.
Achtung: Kontaktstücke nicht verbiegen!

Austauschbar sind Hauptschaltstücke, Löschkammer, Magnetspule und Hilfsschalterblöcke.

Nur Original-Ersatzteile verwenden, um die Betriebssicherheit der Schütze zu gewährleisten!

Emploi et maintenance:

Tension électrique dangereuse; déclencher l'appareil avant de commencer les travaux!

Après un court-circuit, il faut vérifier les pièces de la commutation principale ainsi que la chambre d'extinction!

Le contacteur est verrouillée mécaniquement lorsque l'on enlève la chambre d'extinction. La chambre d'extinction est verrouillée mécaniquement lorsque la bobine est excitée. Déclencher le contacteur avant d'enlever la chambre d'extinction!

Si les pièces de contact sont soudées, la chambre d'extinction peut être enlevée en exerçant une force accrue. Des soudures légères peuvent être défailes, le cas échéant, au moyen d'un tournevis.
Attention: ne pas plier les pièces de contact!

Les éléments suivants peuvent être remplacés: pièces de commutation principale, chambre d'extinction, bobine magnétique et bloc de commutation auxiliaire.

N'utiliser que des pièces de rechange d'origine afin d'assurer la sécurité de fonctionnement des contacteurs!

Funzionamento e manutenzione:

Tensione elettrica pericolosa; prima di iniziare i lavori, disinserire la corrente dell'apparecchio!

Dopo un cortocircuito, i pezzi di contatto principale e la camera di spegnimento sono da verific-are!

A camera di spegnimento distaccata, il relé è bloccato meccanicamente. A bobina eccitata, la camera di spegnimento è bloccata meccanicamente. Prima di smontare la camera di spegnimento, disinserire il contattore! In presenza di pezzi di contatto fissati con saldatura, la camera di spegnimento è smontabile solo applicando una ragguardevole forza fisica. Saldature leggere possono casomai essere separate con un cacciavite.
Attenzione: non storcere i pezzi di contatto!

Scambiabili sono i pezzi di contatto principale, la camera di spegnimento, la bobina magnetica e i blocchi di contatto ausiliari.

Impiegare solo pezzi di ricambio originali, affinché garantire la sicurezza del contattore!

Servicio y mantenimiento:

¡Tensión eléctrica peligrosa; desconectar la tensión en el aparato antes de comenzar los trabajos!

¡Después de un cortocircuito es necesario verificar los contactos principales y la cámara de extinción!

Cuando se retira la cámara de extinción el contactor queda enclavado mecánicamente en posición desconectado. Cuando el contactor está conectado la cámara de extinción está enclavada mecánicamente ¡Desconectar el contactor antes de retirar la cámara de extinción! En caso de soldadura de contactos, es posible desmontar la cámara de extinción actuando sobre los tornillos con un mayor esfuerzo. Si la soldadura de contactos es ligera, estos pueden separarse con un atornillador.
¡Atención: no doblar las piezas de contacto!

Los contactos principales, la cámara de extinción, la bobina y los bloques de contactos auxiliares pueden ser reemplazados.

¡Utilizar únicamente piezas de recambio originales para asegurar el funcionamiento correcto de los contactores!

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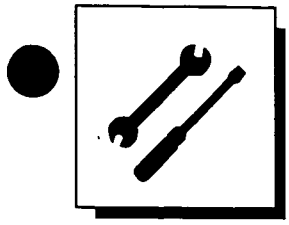
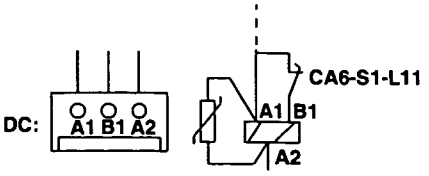
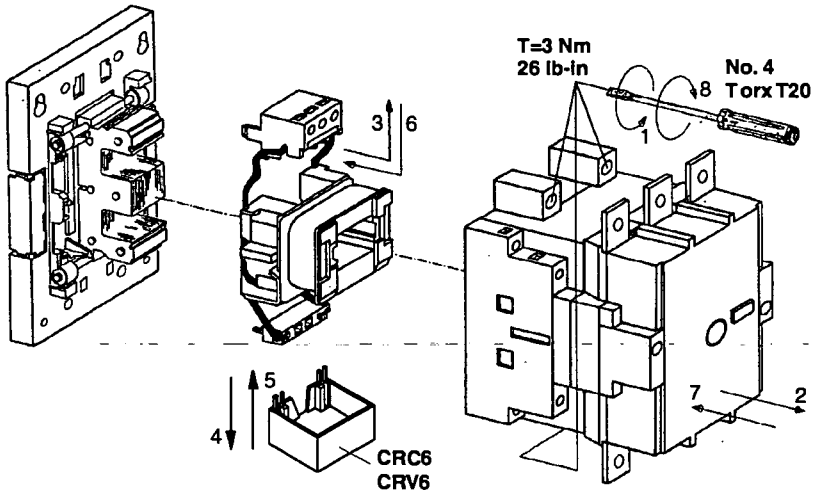
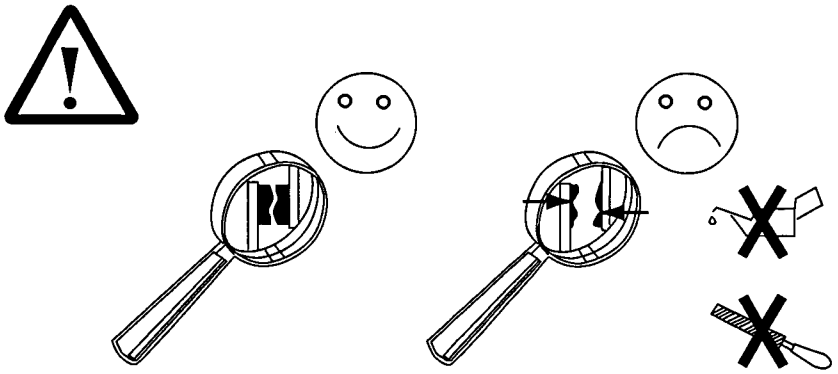
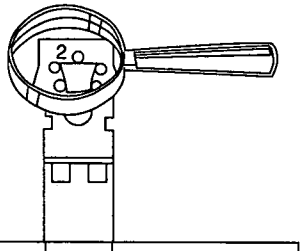
schuh



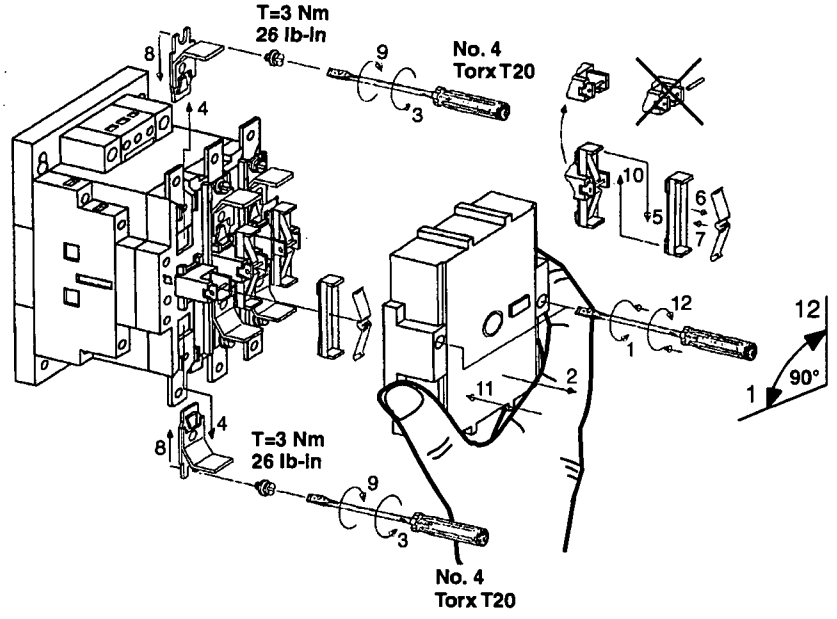








Type	Nr.	✉ ☎
CA6-95	1	22.951.111-01
CA6-110	2	22.951.112-01
CA6-140	33	22.951.113-01
CA6-180	44	22.951.114-01



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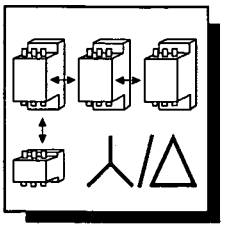

Type	d2	a
CA6-105-PS	135	150
CA6-105-PU	255	270
CA6-105-PY	275	390

Type
CA6-MS110
CA6-MU85
CA6-MU110
CA6-MY110

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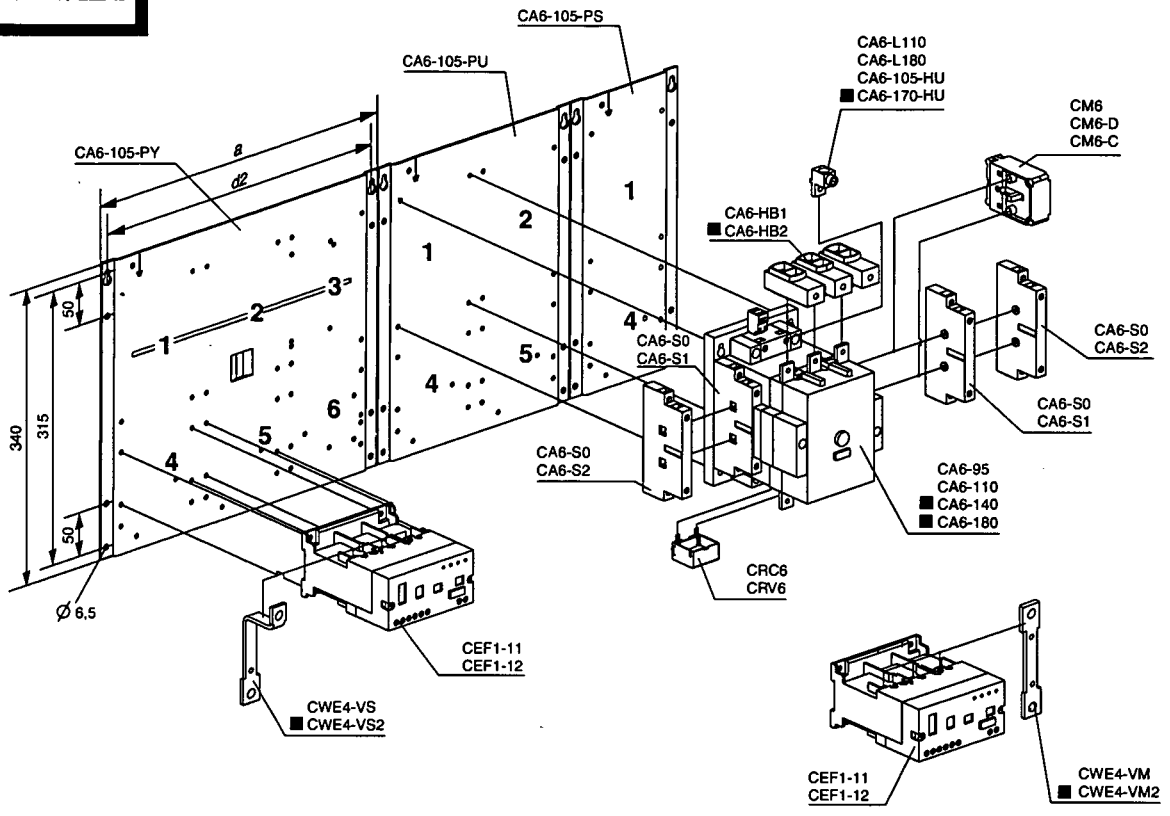
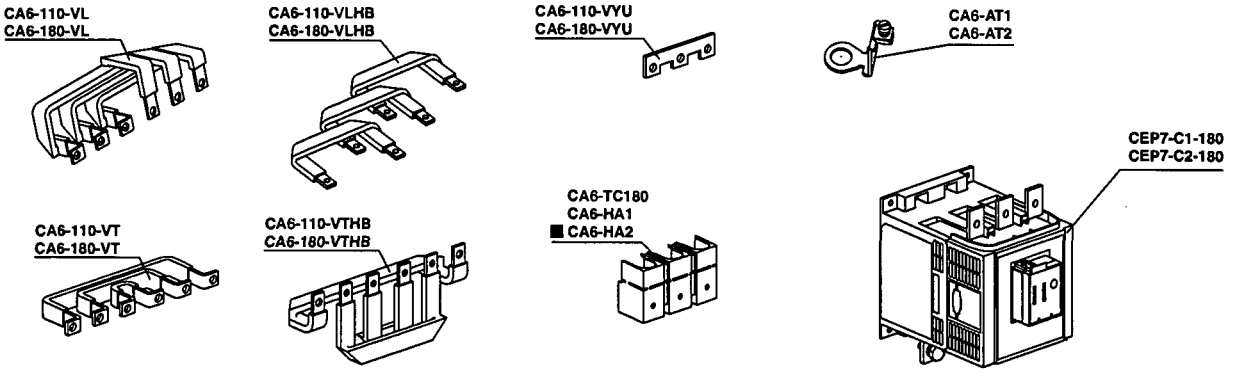




K1M		K2M		K3M	F1	F2	K4T	K1A
CA6-95	CM6 CM6-D	CA6-95	CM6-C	CA7-60	CEF1	CEF1	RZ7-FSY2D	CS3 CS4
CA6-110		CA6-110		CA7-72				
CA6-140 ■		CA6-140 ■		CA7-85				
CA6-95	CM6 CM6-D	CA6-95	CM6 CM6-D	CA6-95				
CA6-110		CA6-110		CA6-95				
CA6-140 ■		CA6-140 ■		CA6-95				
CA6-180 ■		CA6-180 ■		CA6-110				

Technische Änderungen vorbehalten
22.801.956-01 / 12. 2003
Ausgabe 1

6

Connectors

ITT

Power lock, single pole, 400A, 1000V

Engineered for high current industrial applications

The VEAM Power Lock connector series for field installation power distribution system offers the ultimate in safety and reliability under the most severe operating conditions.

Power Lock is available in four standard formats which allow complete hook up through the standard daisy chain principle. There are two Source connectors, one for panel mounting and one for cable attachment. These are identified as Panel Source and Line Source (Male contacts). The other two types are Drain connectors. These connectors are identified as Panel Drain and Line Drain (Female contacts).

Maximum current rating (400A)	400A
Maximum current rating (660A)	660A
Cable range (400A)	Max 120mm², min 25mm² (with reducer)
Cable range (660A)	Max 240mm², min 50mm² (with reducer)
Maximum rated voltage to earth:	2 kV AC / 3 kV DC
Minimum flashover:	9.5 kV DC or AC peak
Operating temperature range:	-30°C to +125°C
Insulation resistance:	>5 M ohms @500V DC
Ingress protection (mated):	IP67
Protection against electrical shock:	IP2X
Flammability:	UL94-V0

Connectors

NRG Sequential Mating System

A robust, space saving NRG Sequential Mating System. Presented in a 19 inch rack format, it guarantees the correct mating for Power lock power distribution connectors (ordered seperately). The NRG 2U patented cam action ensures the proper sequence of Earth, Neutral, Phase 1, Phase 2 and Phase 3 is adhered to.

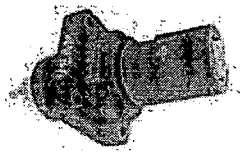
The NRG 2U includes, unlocking and locking keys, finger connected contacts and has a lid which provides protection to IP67.

Part No.	Type
NRG2U.SL.PDAU400	Drain
NRG2U.SL.PSAU400	Source

Line Drain

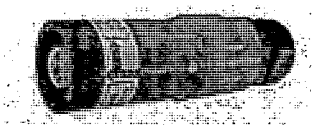
Part No.	Colour
NLDFT1RS120M40A	Red
NLDFT2WS120M40A	White
NLDFT3BLS120M40A	Blue
NLDFTEGNS120M40A	Earth
NLDFTNBKS120M40A	Black

Panel Drain



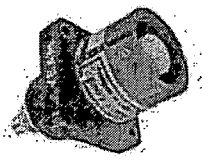
Part No.	Colour
NPDFT1RLT4	Red
NPDFT2WLT4	White
NPDFT3BLLT4	Blue
NPDFTEGNLT4	Earth
NPDFTNBKLT4	Black

Line Source



Part No.	Colour
NLS1RS120M40A	Red
NLS2WS120M40A	White
NLS3BLS120M40A	Blue
NLSEGNS120M40A	Earth
NLSNBKS120M40A	Black

Panel Source



Part No.	Colour
NPS1RLT4	Red
NPS2WLT4	White
NPS3BLLT4	Blue
NPSEGNLT4	Earth
NPSNBKLT4	Black

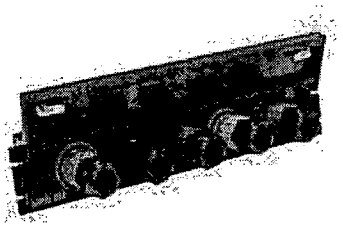
Connectors

ITT

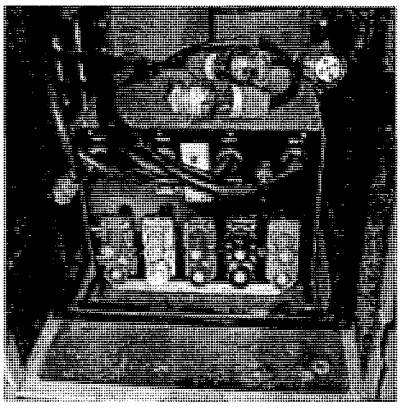
Power lock, single pole, 660A, 1000V

Engineered for high current industrial applications

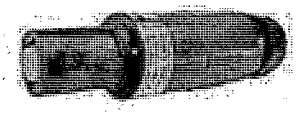
NRG Sequential Mating System



Part No.	Type
NRG2U.SL.PDAU660	Drain
NRG2U.SL.PSAU660	Source

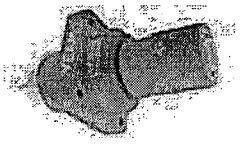


Line Drain



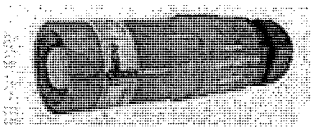
Part No.	Colour
NLDFT1RS240M40B	Red
NLDFT2WS240M40B	White
NLDFT3BLS240M40B	Blue
NLDFTEGNS240M40B	Earth
NLDFTNBKS240M40B	Black

Panel Drain



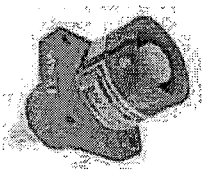
Part No.	Colour
NPDFT1RLT6	Red
NPDFT2WLT6	White
NPDFT3BLLT6	Blue
NPDFTEGNLT6	Earth
NPDFTNBKLT6	Black

Line Source



Part No.	Colour
NLS1RS240M40B	Red
NLS2WS240M40B	White
NLS3BLS240M40B	Blue
NLSEGNS240M40B	Earth
NLSNBKS240M40B	Black

Panel Source



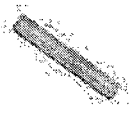
Part No.	Colour
NPS1RLT6	Red
NPS2WLT6	White
NPS3BLLT6	Blue
NPSEGNLT6	Earth
NPSNBKLT6	Black

Accessories

Reduction Kit

Part No.	Size
A00602825	R95 - R70
A00602831	R95 - R50
A00602840	R95 - R35
A00602830	R95 - R25

Cotter Pin

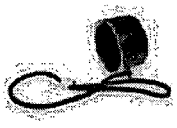


Part No.	Suits
L/D S00347	Line drain
L/S S00348	Line source

Release Key

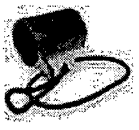
Part No.	Type
39005800046	Blue
LL0023N	Black

Protective Cap

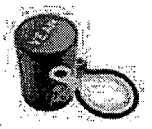


Part No.	Suits
PCLS5M40A/S	Line source

Part No.	Suits
PCPS5	Panel source



Part No.	Suits
PCLD5M40A/S	Line drain



Part No.	Suits
PCPD5	Panel drain

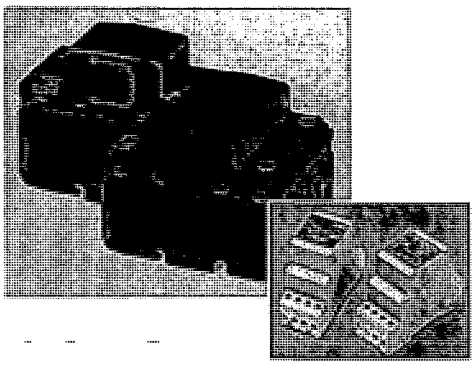
7.3 SURGE PROTECTION

- CRITEC – TDS1100-2SR-277 – SURGE DIVERTER
- CRITEC – TDF-10A-240V – 10A SURGE FILTER
- CRITEC – DAR-275V – SURGE FILTER ALARM RELAY
- NHP – NV63-FW – SURGE DIVERTER FUSE

CRITEC® DDI/DAR/TDS SC

Asia/Australia
Europe
Latin America

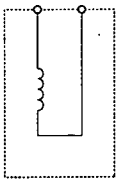
DIN Decoupling Inductor/ DINLINE Alarm Relay & Surge Counter



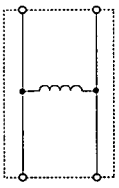
- Use for decoupling of spark gaps and MOVs – allows correct coordination of different SPD technologies
- 35 mm² tunnel terminals – accepts large cable size
- 63A model features top and bottom terminals – flexible installation
- The DINLINE Alarm Relay (DAR) is used with TDF products where alarm contacts are required for remote signaling
- The TDS-SC Surge Counter provides a non-resettable record of the number of surges diverted

Decoupling inductors are installed between spark gap and MOV protection devices to help ensure correct coordination. As the decoupling inductors are installed in series with the load, two units are available, a compact unit for circuits up to 35A and a larger unit for 63A circuits.

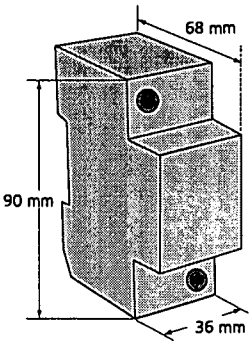
The DAR (DINLINE Alarm Relay) can be connected to TDF units to provide potential free change-over alarm contacts. The TDS SC (Surge Counter) unit is designed to provide visual indication of the number of surges registered. It uses a current transformer through which the ground conductor connecting to one, or all, of the surge protection modules is fed. Current diverted by the operation of the surge module, which exceeds a 300A trip threshold, will be registered on the counter.



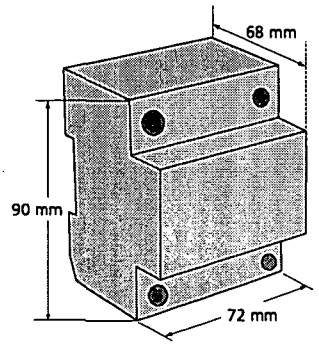
DDI 35



DDI 63



DDI 35



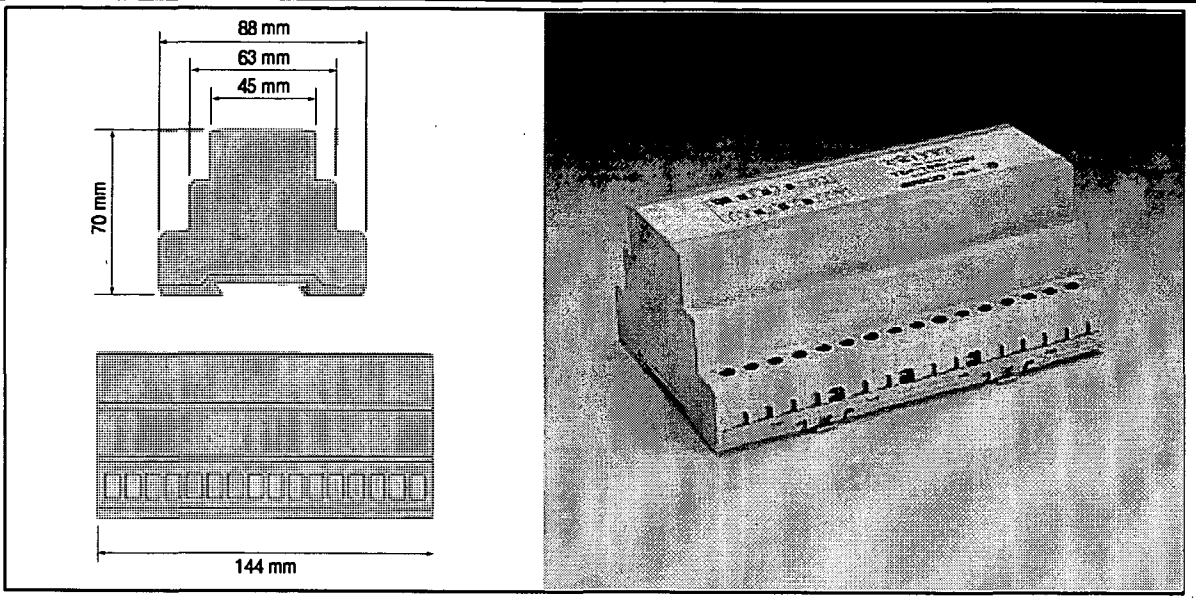
DDI 63

Model	DDI 35	DDI 63	DAR275V	TDS SC
Item Number for Europe	700465	700475	700900	701250
Nominal Voltage U_n	-	-	20-110V---, 100-240V~	–
System Compatibility(1)	-	-	TN-C, TN-S, TN-C-S & TT	
Max. Cont. Operating Voltage U_c	500V~ 200V---		275V	-
Stand-off Voltage	-	-	275V	-
Operating Current @ U_n	-	-	20mA	-
Frequency	0 to 60Hz			-
Max. Line Current I_L	35A @ 40°C	63A @ 40°C	-	-
Temperature Increase	45° C @ max line current (I_L)		-	-
Inductance	7.5µH	15µH	-	-
Resistance	4.5mΩ	1.7mΩ	-	-
Technology	-	-	CT - trip threshold 300A 8/20µs	
Status	-	-	Red/Green LEDs Change-over contact(1)	Maximum count 9999 Non-resettable
Dimensions	2 M. 90 mm x 68 mm x 36 mm (3.5" x 2.6" x 1.4") approx.	4 M. 90 mm x 68 mm x 72 mm (3.5" x 2.6" x 2.8") approx.	2 M. 90 mm x 68 mm x 36 mm (3.5" x 2.6" x 1.4") (excluding CT)	
Weight	0.45 kg (1 lb) approx.	1 kg (2.2 lb) approx.	0.2 kg (0.44 lb)	
Enclosure	DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1)			
Connection	≤35 mm² (#2AWG) solid ≤25 mm² (#4AWG) stranded		1 mm² to 6 mm² (#18AWG to #10)	
Mounting	35 mm top hat DIN rail			
Back-up Overcurrent Protection	35A	63A	-	-
Temperature	-40°C to +70°C (-40°F to +158°F)		-35°C to +55°C (-31°F to +131°F)	
Humidity	0% to 90%			
Approvals	CE		CSA22.2 C-Tick, AS 3260, CE	-

(1) Form C = Change-over contact (Form C dry contact), 400V~/3A 1 mm² to 6 mm² (#18AWG to #10AWG) connecting wire

FACILITY ELECTRICAL PROTECTION

CRITEC™



Detailed specifications for ERICO's

TRANSIENT DISCRIMINATING FILTER, TDF-10A SERIES

Applications

Lightning transients and surges are a major cause of expensive electronic equipment failure and business disruption. Damage may result in loss of computers, data commmunications, loss of revenue, and loss of profits. The new Transient Discriminating Filter™ family of TVSS devices offer economical and reliable protection from power transients with the convenence of easy installation on 35mm DIN rail mountings.

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 available for 3A, 10A and 20A loads and in a range of clamping voltages including 30V, 150V, 275V. The range is intended for use in conjunction with ERICO's Universal Transient Barrier UTB's to provide a coordinated approach to protection of both the power and data control circuits.

The TDF is a series connected **single phase surge filter** providing an aggregate surge capacity of 50kA (8/20µs) - 20kA L-N & L-G and 10kA N-G. The space efficient low pass filter, provides some 65dB of attenuation to voltage transients. Not only does this reduce the residual let through voltage, but it helps further reduce the steep rates of rise of voltage and current providing superior protection for sensitive electronic equipment.

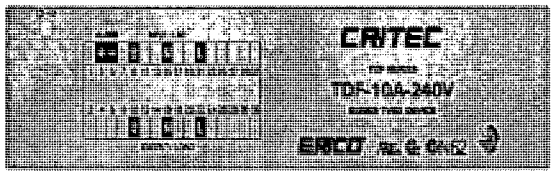
Features

- Compact design fits into most distribution boards and motor control centres
- High efficiency filtering - ideal for the protection of switched mode power supplies from large dv/dt and di/dt transients
- Three modes of protection L-N, L-G, N-G
- 35mm DIN rail mount - DIN 43 880 profile matches common MCB's
- LED indication and opto-isolated output for remote status monitoring
- Transient Discriminating Technology ensures safe operation during abnormal over-voltage events
- UL1449 Edition 2 recognized
- Large 50kA surge capacity provides a high level of protection and long operational life
- 5 year limited warranty

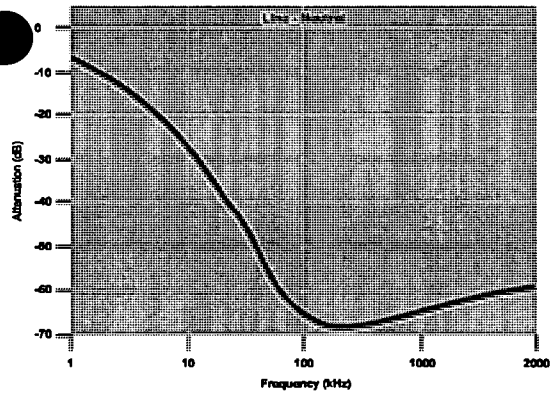
CADWELD® WELDED ELECTRICAL CONNECTIONS CRITEC® SURGE PROTECTION DEVICES ERITECH® LIGHTNING PROTECTION/GROUNDING ERICO®

PROCESS CONTROL TVSS PROTECTION

SPECIFICATIONS



Operation:		
Models available	TDF-10A-120V	TDF-10A-240V
Nominal line voltage	120VAC/125VDC	240VAC
Max Continuous Operating Voltage MCOV	170Vrms	340Vrms
Max Load Current	10A	
Input frequency	50/60Hz	
Earth leakage current	<0.2mA	
Protection:		
Max aggregate surge rating	50kA 8/20µs	
Protection modes	L-N, L-G and N-G	
Max surge current/mode L-N	20kA 8/20µs	
L-G	20kA 8/20µs	
N-G	10kA 8/20µs	
SPD circuit description	Series low pass LC filter Transient Discriminating Technology Thermal fusing	
Filter:		
Inductor	Ferrite cored	
Capacitor type	X & Y grade interference suppression polypropylene film	
Attenuation @100kHz L-N	65dB	
Performance:		
UL1449 SVR L-N	500V	700V
ANSI/IEEE C62.41 Cat B3 - 500A ringwave	22V	28V
Cat C1 - 3kA, 8/20µs	262V	481V
Alarms and Indicators:		
Protection status indication	Red LED, On = OK. Opto-isolated output	
Physical Data:		
Dimensions(W x D x H)	144mm x 88mm x x70mm	
Weight	750g (approx)	
Enclosure material	Flame Retardant UL94V-O	
Connection means	Screw terminals	
Wire size	1.0mm² - 6.0mm²	
Mounting method	DIN T35 Rail	
Enclosure style	DIN 43880	
Environmental rating	IP20	
Opearting temperature	-30°C to +55°C	
Humidity	0-90%	
Surface finish	Spark eroded finish	
Warranty	5 years	
Test standards:		
Approvals	UL1449 Ed 2, UL1283 recognised, CSA22.2 C-Tick AS3260	
Surge rated to meet	ANSI/IEEE C62.41 Cat A, Cat B, Cat C AS/NZS 1768-1991 Cat A, B, C	



Frequency performance of TDF-10A filter

Due to a policy of continual product development, specifications are subject to change without notice.

Part Number	Description
TDF-10A-120V	120V 1 phase, 50kA 8/20µs, 10A series TVSS protector
TDF-10A-240V	240V 1 phase, 50kA 8/20µs, 10A series TVSS protector

Hobart	ph:+61 3 6237-3200	fax:+61 3 6273-0399	Adelaide	ph:+61 8 8366-6555	fax:+61 8 8366-6556
Sydney	ph:+61 2 9479-8500	fax:+61 2 9980-5092	Perth	ph:+61 8 9358-1233	fax:+61 8 9358-1404
Melbourne	ph:+61 3 9894-2677	fax:+61 3 9894-3216	Singapore	ph:+ 65-763-2477	fax:+ 65 763-2397
Canberra	ph:+61 2 6257-3055	fax:+61 2 6257-3127	Thailand	ph:+ 662 627-9037-8	fax:+662 627-9168

ERICO®

ERICO's coordinated approach to facility protection - CADWELD, CRITEC, ERITECH www.erico.com

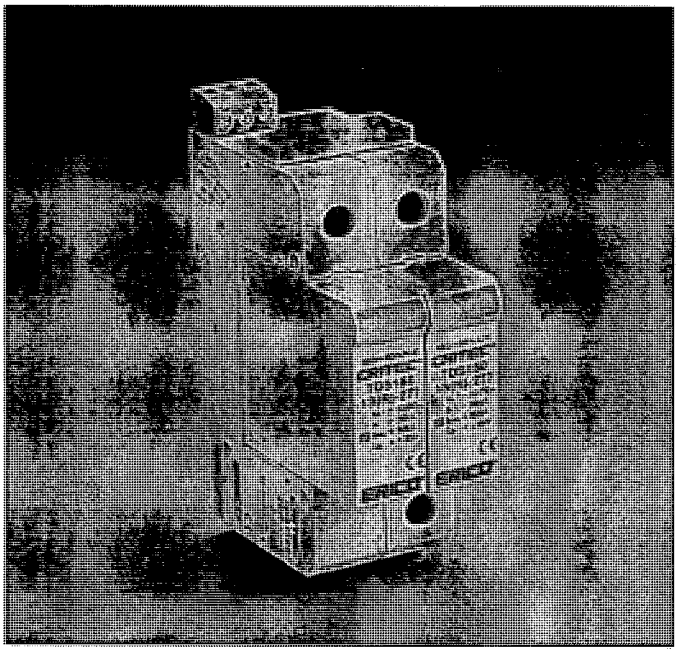
tdf10a.pm5

ERITECH®

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 43 880 profile matches common circuit breakers
- Indication flag and voltage-free contacts provide remote status monitoring
- Separate plug and base design facilitates replacement of a failed surge module
- 100kA 8/20 maximum surge rating provides protection suitable for sub-distribution panels and a long operational life
- Available in various operating voltages to suit most common power distribution systems

CRITEC® TDS1100 TDS Surge Diverter TDS1100 Series



Surges and voltage transients are a major cause of expensive electronic equipment failure and business disruption. Damage may result in the loss of capital outlays, such as computers and communications equipment, as well as consequential loss of revenue and profits due to unscheduled system down-time.

The TDS1100 series of surge suppressors provide economical and reliable protection from voltage transients on power distribution systems. They are conveniently packaged for easy installation on 35 mm DIN rail within main distribution panelboards.

CRITEC® TD technology helps ensure reliable and continued operation during sustained and abnormal over-voltage events. Internal thermal disconnect devices help ensure safe or 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.

ERICO®

ERITECH®

CRITEC® TDS1100
TDS Surge Diverter
TDS1100 Series

Model	TDS11002SR150	TDS11002SR240	TDS11002SR277	TDS11002SR560
Nominal Voltage U_n	120-150V~	220–240V~	240–277V~	480-560V~
Max. Cont. Operating Voltage U_c	170V~	275V~	320V~	610V~
Stand off Voltage	240V~	440V~	480V~	700V~
Frequency	0 - 100Hz			
Short Circuit Current Rating Isc	25kAIC			
Required Back-up Fuse	125AgL if supply > 100A			
Technology Used	TD with thermal disconnect			
Protection				
Maximum Discharge Current Imax	100kA 8/20µs			
Nominal Discharge Current In	50kA 8/20µs	40kA 8/20µs	40kA 8/20µs	40kA 8/20µs
Protection Modes	Single mode (L-G, L-N or N-G)			
Voltage Protection Level Up @ 3kA	< 400V	< 700V	< 800V	< 1.6kV
Voltage Protection Level Up @ 20kA	< 650	< 1000	< 1.1kV	< 2kV
Alarms and Indicators				
Status Indication	Mechanical flag / remote contacts Change-over, 250V~ / 0.5A, max 1.5 mm² (#14AWG) terminals			
Physical Data				
Dimensions	2 modules wide, 90 mm x 68 mm x 35 mm			
Weight	0.24 kg approx.			
Enclosure	DIN 43 880, UL94V-0 thermoplastic, IP 20 (NEMA-1)			
Connection	≤35 mm² (#2AWG) solid ≤25 mm² (#4AWG) stranded			
Mounting	35 mm top hat DIN rail			
Temperature	-40°C to +80°C (-40°F to +176°F)			
Humidity	0 to 90%			
Test Standards				
Approvals	CE, IEC™ 61643-1, UL® 1449 Pending			
Surge Rated to Meet	IEC 61643-1 Class I and II ANSI/IEEE C62.41-1991 Cat A, Cat B, Cat C			

Ordering Information

PART NUMBER	DESCRIPTION
TDS1102SR150	TDS Surge Diverter, Uc 170V, In 50kA, Imax 100kA, Remote
TDS1102SR240	TDS Surge Diverter, Uc 275V, In 40kA, Imax 100kA, Remote
TDS1102SR277	TDS Surge Diverter, Uc 320V, In 40kA, Imax 100kA, Remote
TDS1102SR560	TDS Surge Diverter, Uc 610V, In 40kA, Imax 100kA, Remote
TDS150150M	150V Replacement Surge Module
TDS150240M	240V Replacement Surge Module
TDS150277M	277V Replacement Surge Module
TDS150560M	560V Replacement Surge Module

Due to a policy of continual product development, specifications are subject to change without notice.

WARNING
ERICO products shall be installed and used only as indicated in ERICO's product instruction sheets and training materials. Instruction sheets are available at www.erico.com and from your ERICO customer service representative. Improper installation, misuse, misapplication or other failure to completely follow ERICO's instructions and warnings may cause product malfunction, property damage, serious bodily injury and death.

www.erico.com

ERICO®

E555S E171LT06ENWW 004WB6

7.4 SWITCHES / INDICATORS / PUSHBUTTONS

- KRAUS AND NAIMER – CAD11-A720-FT2-600-F7S8 – STATION LOCAL/ REMOTE SWITCH
- SPRECHER AND SCHUH – D7P-LSM22-PX10 – MODE SWITCH
- CAMSCO – SM202 – MIRCO DOOR SWITCHES
- CROMPTON INSTRUMENTS – 244-01KG-HG-IP-SR 4-20mA – WET WELL LEVEL INDICATOR
- TERASAKI – MTSS2PE12533 – MANUAL TRANSFER SWITCH
- SPRECHER & SCHUH – D7P-F301-PX10 – PUMP START PUSHBUTTON
- SPRECHER & SCHUH – D7P-F402-PX01 – PUMP STOP PUSHBUTTON
- SPRECHER & SCHUH D7P-MT34-PX02S – PUMP EMERGENCY STOP PUSHBUTTON
- SPRECEHR & SCHUH – D7P-F6-PX10 – PUMP RESET PUSHBUTTON

Construction Data

The load switches of the C, CA, CAD and CL-series offer a solution for most cam switch applications. Different contact designs, contact materials and terminals allow for their use as control switches, instrumentation switches and motor control switches, as well as in electronic circuitry and in aggressive environments according to IEC 60947-3 and VDE 0660 part 107.

The stage is the basis for all switches and can be supplied with a maximum of 2 contacts. The terminals are accessible from the side. CA and CAD switches are supplied with open terminals to facilitate wiring and are protected against accidental finger contact according to EN 50274, VDE 0660 part 514 and BGV A3. Captive plus-minus terminal screws and integrated screwdriver guides also reduce wiring.

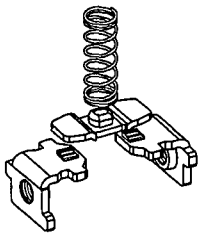
The switches of the new CL-series are supplied with rust-free and acid-resisting IDC terminals (Insulation Displacement Connection) instead of screw type terminals. The stripping or preparation of the insulation is no longer required. Eliminate errors due to i.e., stripped end of the conductor too long or too short, incorrect sleeves used, sleeves crimped incorrectly or wrong crimping tool is used, terminal screws not tightened properly etc. The CL switches reduce installation time by 60 %-70 % compared to the screw type terminals. This translates to significant cost savings. For connecting 2 conductors to a terminal an additional screw terminal with plus-minus screw is available.

If a positive manual operation or a higher DC rating is required, many of these switches can be fitted with a snap action latching mechanism - suffix „S" - to the switch type.

The cam-operated switches L350-L2000 are continuous current rated for off-load switching. They may be used to switch resistive or low inductive loads.

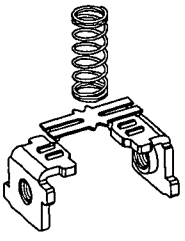
Special Contact Systems

CA4/CA4-1



High contact reliability by multiple cross-point contacts, electronic compatible, CA4 with 1 µ and CA4-1 with 35 µ gold plating.

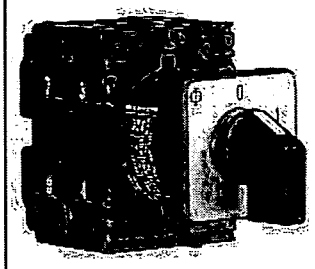
CAD11/CAD12



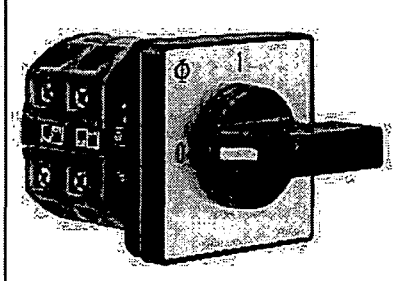
H-bridge with „cross-wire" contact system, high contact reliability also at lower voltages. CAD11 with gold-plated contacts, CAD12 with silver contact.

Type	Size	Possible Switching Angles	Max. No. of Stages
CA4, CA4-1	S00	30°, 45°, 60°, 90°	9
CL4	S00	30°, 45°, 60°, 90°	8
CA10-CA25	S0	30°, 45°, 60°, 90°	12
CA10S-CA25S	S0	60°	on request
CAD11, CAD12	S0	30°, 45°, 60°, 90°	12
CL10	S0	30°, 45°, 60°, 90°	10
CA10B-CA25B	S1	30°, 45°, 60°, 90°	12
C26, C32, C42	S1	20°, 30°, 45°, 60°, 90°	12
C26S, C32S, C42S	S1	60°	on request
C43, C80, C125	S2	20°, 30°, 45°, 60°, 90°	12
C315	S3	20°, 30°, 45°, 60°, 90°	12
L350/51, L630/31, L1000/01, L1250/51	S2	30°, 45°, 60°, 90°	12
L400, L600, L800, L1200, L1600, L2000	S3	30°, 45°, 60°, 90°	12

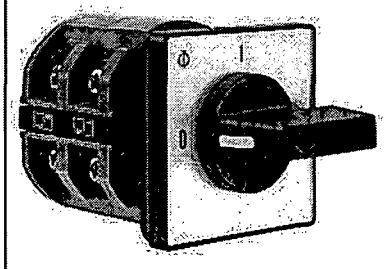
CL Switches



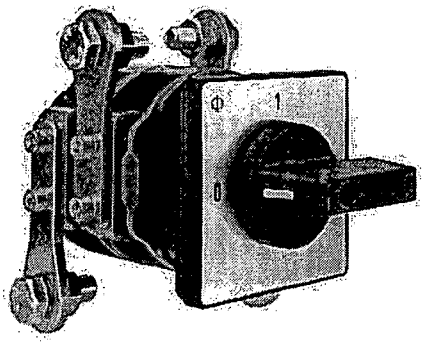
CA and CAD Switches



C Switches



L Switches



Above illustrates the standard terminal positions.

Nominal Ratings

Switch Size	Type	According to IEC 60947-3/VDE 0660 part 107			
		Insulation Voltage[1] U_i V	Thermal Current I_u/I_{th} A	Motor Rating 3 x 380 V-440 V AC-23 kW	AC-3 kW
S00 (□ 30 / 1.18"sq)	CA4	440	10	3	2,2
	CA4-1	440	10	3	2,2
	CL4	440	10	3	2,2
S0 (□ 48 / 1.89"sq)	CA10	690	20	7,5	5,5
	CA11	690	20	7,5	5,5
	CA20	690	25	11	7,5
	CA25	690	32	15	11
	CAD11	600	6	-	-
	CAD12	600	6	-	-
	CL10	690	20	7,5	5,5
S1 (□ 64 / 2.52"sq)	CA10B	690	20	7,5	5,5
	CA11B	690	20	7,5	5,5
	CA20B	690	25	11	7,5
	CA25B	690	32	15	11
	C26	690	32	15	11
	C32	690	50	22	15
	C42	690	63	30	18,5
S2 (□ 88 / 3.46"sq)	C43	690	63	30	18,5
	C80	690	115	45	30
	C125	690	150	75	37
	L350	690	350	90	37
	L351	690	350	90	37
	L630	690	630[2]	90	37
	L631	690	630[2]	90	37
	L1000	690	1000[2]	90	37
	L1001	690	1000[2]	90	37
	L1250	690	1250[2]	90	37
	L1251	690	1250[2]	90	37
S3 (□ 130 / 5.12"sq)	C315	690	315	132	55
	C316[3]	1000	315	132	55
	L400	690	500	132	55
	L600	690	800[2]	132	55
	L800	690	1100[2]	132	55
	L1200	690	1450[2]	132	55
	L1600	690	1900[2]	132	55
	L2000	690	2400[2]	132	55

For further technical details, refer to pages 40-43.
To furnish with gold contacts and quick connects see page 4.

[1]Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. [2]Ambient temperature 35 °C max. [3]Additional switch functions on request.

How to order

Disconnectors and Main Switches according to IEC 60947-3 see Catalog 500

Three types of data (shown below) are required for ordering Blue Line cam-operated switches. Code numbers for ordering are shown in this catalog.

1. Type of Switch

The type of switch required may be easily selected by referring to the table on page 3 which shows the thermal current, power rating and dimensions of each switch. For further technical details, refer to pages 40-43. Variations of contacts and terminals are shown below.

2. Switch Function

The code numbers for standard switches shown on pages 6-28 indicate the switch function, escutcheon plate, handle and any optional extras.

Additional coding to modify type and color of handle and escutcheon plate is explained below.

3. Type of Mounting

Types of mounting are shown on pages 29-35. Catalog **101** describes enclosures and optional extras.

Specify the mounting code to indicate required mounting.

CA10 A202-600 VE

Type of Switch

Extending the switch type coding the following combinations will define:

Amendment	Definition	For switch types
-1	with gold contacts[1]	CA10, CA11, CA10B, CA11B
-4	with quick connects	CA4
B	S0 switches with latching mechanism size S1	CA10, CA11, CA20, CA25, CAD12
C	S1 switches with latching mechanism size S2	C26, C32
L	with lockout-relay w/o manual release for std. sw.	CA10, C26, C32, C42
M	with lockout-relay with manual release for std. sw.	CA10, C26, C32, C42
X	with power failure release	CA10, CA11, CA20, CA25, CAD12, C26, C32, C42
Y	with power failure release and trip-free release	CA10, CA11, CA20
S	with snap action	CA10, CA11, CA20, CA25, C26, C32, C42 with 60° switching
R	with spring return latching mechanism	CA10

Example: Coding for switch type **CA10** with gold contacts is **CA10-1**.

Modification of Switches

The part number for switch function and options may be modified in cases where items are required other than standard. The modification may involve the escutcheon plate inscription, color combination of escutcheon plate and handle, type of escutcheon plate and handle or the optional extra.

Switch Size	Escutcheon Plate Frame	Handle	Escutcheon Plate Backing	Escutcheon Plate Lettering	Dash Number
S0, S1, S2, S3	electro-gray	electro-gray	brushed alu	black	-100
S0, S1, S2, S3	electro-gray	electro-gray	black	mat silver	-500
S00, S0, S1, S2, S3	black	black	brushed alu	black	-600
S00, S0, S1, S2, S3	black	black	black	mat silver	-700

[1]Technical data on request.

How to order

Modification of Switches

Color combinations of escutcheon plate and handle

The standard switch consists of a transparent escutcheon plate with brushed aluminum backing and black inscription. The escutcheon plate frame is black as well as the handle. Page 4 shows further color combinations of escutcheon plate and handle which are available. The appropriate dash number must be substituted in the switch function coding to specify other color combinations as required.

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function, electro-gray handle and electro-gray escutcheon plate frame with brushed aluminum backing and black inscription which reads 0-1 is as follows: **CA10 A202-100 E.**

The following is a list of special programs for escutcheon plate and handle combinations. They may be obtained by specifying any one of the following two (2) digit dash numbers as a part of the overall dash number. It is still necessary to prefix these two digit numbers with the first digit which represents the color combination desired.

Special programs for escutcheon plate and handle combinations

-000 = without escutcheon plate, without handle
- .01 = without escutcheon plate
- .02 = without handle
- .03 = with square escutcheon plate without lettering
- .04 = with rectangular escutcheon plate without lettering
- .05 = with square escutcheon plate without lettering and without handle
- .06 = with rectangular escutcheon plate without lettering and without handle
- .07 = standard escutcheon plate, without lettering on rectangular section
- .08 = with F-handle
- .09 = with P-handle
- .10 = escutcheon plate with frame and fixation ring only (if using switches with single hole mounting: **- .16**)
- .11 = without escutcheon plate, but with handle bearing plate
- .12 = with yellow escutcheon plate backing and red handle
- .14 = with B-handle
- .16 = escutcheon plate with frame and fixation ring only, if using switches with single hole mounting
- .17 = standard escutcheon plate and rectangular add-on escutcheon plate, if using switches with single hole mounting FT2

Example: The complete coding for switch type CA10 with a 3 pole ON/OFF switch function with electro-gray escutcheon plate frame, square escutcheon plate without lettering, brushed aluminum plate backing and electro-gray handle reads as follows: **CA10 A202-103 E.**

Handles, Escutcheon Plates and Optional Extras

The handles for standard switches shown on pages 6-28 are suitable for mounting units with four hole mounting. Alternative types of handles available are illustrated on pages 29-35.
When a handle, escutcheon plate or optional extra is required but not covered by the dash number, the code number for the selected component should be entered separately. A comprehensive range of available standard escutcheon plates is illustrated on pages 36 and 37. Non-standard or special escutcheon plate engravings are available at extra cost.
The large number of optional extras and enclosures is covered in Catalog **101.**

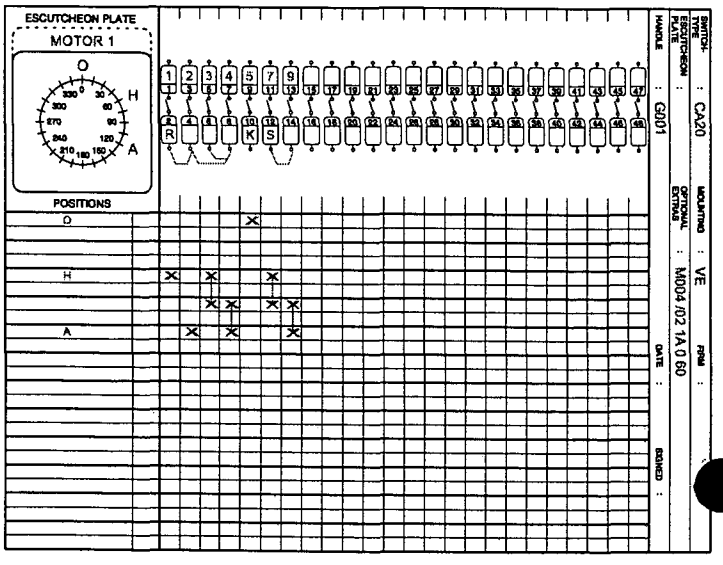
Switch Size

Blue Line switches are available in sizes S00, S0, S1, S2 and S3. These size codes indicate the dimensions of the mounting, the escutcheon plate and the handle, as well as the size of optional devices and enclosures.
Page 3 lists these sizes and the various switch types they include.

Ordering of Special Switches and Escutcheon Plates

When ordering special switches and escutcheon plates it is advisable to use our order form, as illustrated. The customer's requirements are shown in blue as an example.

For technical reasons, it may not be possible to follow the sequence of contacts requested by the customer. The final contact development which is sent with every switch will show the customer's original terminal markings.



Order forms are available on request.

Switch Function and Configuration

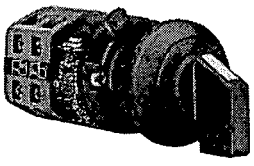
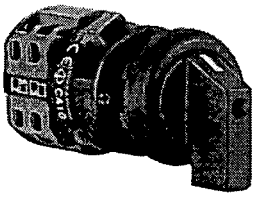
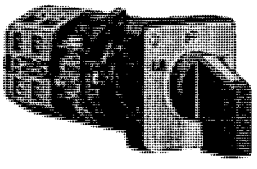
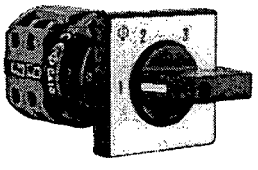
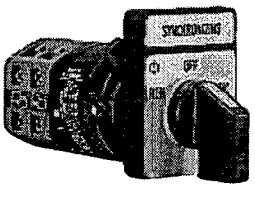
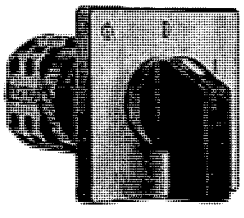
C, CA, CAD, CL Switches

Function	Escutch. Plate	Type/Handle CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10	CA10B- CA25B	C26- C315	Code	Stages	Connection Diagram
Double-throw Switches without „OFF" 60° Switching								
1 pole						A220-600	1	
2 pole						A221-600	2	
3 pole						A222-600	3	
4 pole						A223-600	4	1-4 pole
4 pole 1 pole preclose 6°[3]						A673-600	4	4 pole 1 pole preclose 6°
5 pole						A369-600	5	5 pole
6 pole						A370-600	6	
7 pole						A371-600	7	
8 pole						A372-600	8	
8 pole 2 pole preclose 6°[3]						A972-600	8	6 and 7 pole
9 pole		[2]				A373-600	9	
10 pole						A374-600	10	8 and 9 pole
11 pole			[4]			A375-600	11	
12 pole			[4]			A376-600	12	8 pole 2 pole preclose 6°
								10 and 11 pole
								12 pole
Double-throw Switches without „OFF" with electrically isolated contacts								
1 pole						A720-600	1	
2 pole						A721-600	2	
3 pole						A722-600	3	1-4 pole
4 pole						A723-600	4	
4 pole 1 pole preclose 6°[3]						A973-600	4	4 pole 1 pole preclose 6°
1 pole with spring return						A795-600	1	1 pole with spring return
Double-throw Switches without „OFF" 30° Switching								
1 pole						A120-600	1	
2 pole						A121-600	2	
3 pole						A122-600	3	1-4 pole
4 pole						A123-600	4	
1 pole with spring return						A295-600	1	
2 pole with spring return						A296-600	2	
3 pole with spring return			[1]			A297-600	3	1-3 pole
1 pole with spring return						A295-620	1	
2 pole with spring return						A296-620	2	
3 pole with spring return			[1]			A297-620	3	

[1]not available for switch type CA25 [2]not available for switch type CL4 [3]for use in a three phase four-wire system with switched neutral
[4]not available for switch type CL10

Mounting

C, CA, CAD, CL Switches

Single Hole Mounting	Terminals rotated 90°	Code	CA4 CA4-1 CL4	CAD.. CA10- CA25 CL10
With locking nut and shaft seal, protection IP 66			mm	mm
 Without escutcheon plate		FS1	16/22	
	●	FS1-V	16/22	
		FT1		22
	●	FT1-V		22
		FT3		22/30
	●	FT3-V		22/30
 With square escutcheon plate		FS2	16/22	
	●	FS2-V	16/22	
		FT2		22
	●	FT2-V		22
		FT4		22/30
	●	FT4-V		22/30
 With rectangular escutcheon plate		FS4	16/22	
	●	FS4-V	16/22	
 With size S1 escutcheon plate and heavy duty latching		FH3		22
	●	FH3-V		22
 Mounting key for locking nut		S00 T170 09		

sprecher+schuh

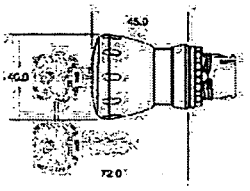
D7 Emergency stop operators 22.5 mm
Complete

2

Emergency stop operators

D7PMT44PX01

- IP 66
- Choice of "Auto Break" or standard normally closed contacts
- Extra security key release
- Complies with AS/NZS 3947.5.5:2000



Dimensions in (mm)

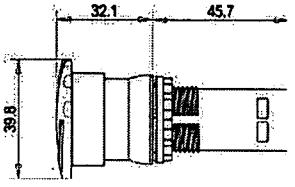
Pushbutton & Key operated types

Description	Contact	Plastic body Cat. No.	Price $	Metal body Cat. No.	Price $
Twist To Reset/Standard contact blocks					
30 mm Operator		D7P-MT34-PX01	82.50	D7M-MT34-MX01	90.50
40 mm Operator		D7P-MT44-PX01	86.00	D7M-MT44-MX01	94.00
Key To Reset/Standard contact blocks		D7P-MK44-PX01	124.00	D7M-MK44-MX01	167.00
40 mm Operator					
40 mm Operator		D7P-MT44-PX01S	106.00	D7M-MT44-MX01S	115.00

Monolithic eco-emergency stop operators

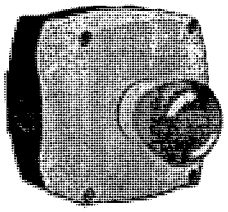
D7DMT44X01

- Complete one-piece thermoplastic operators with 40 mm red mushroom head and non-removable contacts
- Non-illuminated, push-pull and 'twist to release' mechanism in one operation
- Trigger action anti-tease operation



Emergency stop operator [2])

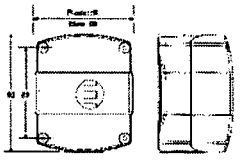
Description	Cat. No.	Price $
Emergency stop operator with 1 N/C contact	D7D-MT44-X01	59.00
Emergency stop operator with 2 N/C contacts	D7D-MT44-X02	69.50
Emergency stop operator with 1 N/O and 1 N/C contacts	D7D-MT44-X11	69.50



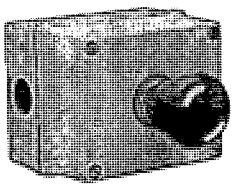
D71YM1

Enclosed emergency stop operators

- Modern low profile enclosures
- Metric cable entry knockout M16/20 mm



Description	Contact	Cat. No.	Price $
Plastic enclosures with emergency stop "Twist To Reset" operator			
Yellow enclosure 40 mm plastic operator		D71YM1	150.00
Metal enclosures with emergency stop "Twist To Reset" operator			
Grey enclosure 40 mm metal operator		D71MM1 [1])	190.00



D71MM1

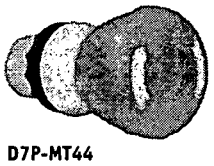
Notes: [1]) Yellow metal enclosure also available. Contact NHP.
[2]) Refer page 2 - 52 for technical infomation.

Price Schedule 'A2'

GST not included

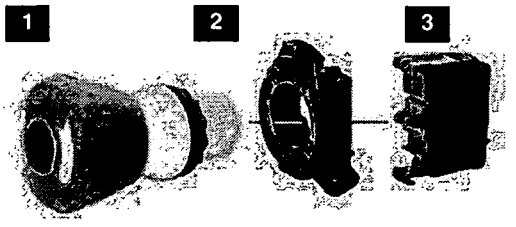
sprecher+schuh

D7 Emergency stop operators 22.5 mm
Components



D7P-MT44

- Protection class IP 66
- Individually packaged
- 3 part ordering



Operator head | Coupling plate | Contact Blocks

1 Mushroom operators

Description	Non-illuminated Plastic Cat. No.	Price $	Non-illuminated Metal Cat. No.	Price $	Illuminated Plastic Cat. No. [1]	Price $	Illuminated Metal Cat. No. [1]	Price $
30 mm Red operator	D7P-MT34	67.00	D7M-MT34	74.50	-	-	-	-
40 mm Red operator	D7P-MT44	70.50	D7M-MT44	75.00	D7P-LMT44	90.00	D7M-LMT44	95.50
60 mm Red operator	D7P-MT64	79.00	D7M-MT64	82.50	D7P-LMT64	110.00	[I] D7M-LMT64	118.00
40 mm Red operator	D7P-MK44	113.00	D7M-MK44	124.00	-	-	-	-

D7ALP

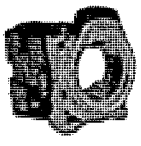
2 Coupling plates

Description	Cat. No.	Price $
Plastic coupling plate	D7-ALP	4.50
Metal coupling plate	D7-ALM	6.50

D7-X01

3 Contact blocks

Description	Operator Colour	Contacts	Panel Mount Cat. No.	Price $	DIN/Base Mount Cat. No.	Price $
Normally closed contact block	Red	1 N/C	D7-X01	11.80	D7-BX01	13.20
Normally closed contact block with spring clamp terminals	Red	1 N/C	D7-Q01	16.80	D7-BQ01	18.00
Normally closed late break	Brown	N/C L.B.	D7-X01L	15.40	D7-BX01L	16.80
Normally closed early break	Brown	N/C E.B.	D7-X01B	15.40	D7-BX01B	16.80
Normally closed low voltage (*Quadfurcated* gold contacts)	Blue	1 N/C	D7-X01V	26.20	D7-BX01V	27.40
Dual circuit 2 normally closed [2]	Red	2 N/C	D7-X02D	27.40	-	-
"Auto break" safety contact block for emergency stop operators [2]	Yellow	1 N/C safety	D7-X01S	32.00	-	-



D7PX10

2 + 3 Combined contact block and coupling plate

Description	Screw Cap Cat. No.	Price $	Metal Screw Cap Cat. No.	Price $
1 N/O contact block + coupling plate	D7PX10	16.80	D7MX10	19.60
1 N/C contact block + coupling plate	D7PX01	16.80	D7MX01	19.60
1 N/O and 1 N/C contact block + coupling plate	D7PX11	28.60	D7MX11	32.00

Notes: [1] For LED 2 lamps refer 2 - 33.
[2] Dual circuit and 'Auto Break' cannot be mounted in D7 low profile enclosures.
For Accessories refer 2 - 34.
[I] Available on indent only.

Price Schedule 'A2'

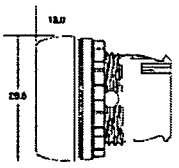
GST not included

sprecher+schuh

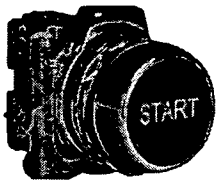
D7 Non-illuminated momentary pushbuttons 22.5 mm
Complete

2

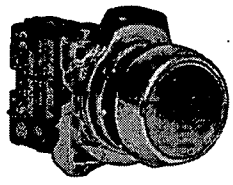
- Metal or plastic options
- Improved momentary action for fast response
- Low mounting depth from panel
- Protection class IP 66
- Laser etched markings for improved abrasion resistance



Dimensions in (mm)



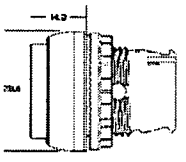
D7M-F301-MX10



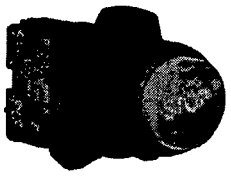
D7M-F4-MX01

Flush pushbuttons [1])

Description	Contact	Plastic body Cat. No.	Price $	Metal body Cat. No.	Price $
With Green insert	1 N/O	D7P-F3-PX10	34.00	D7M-F3-MX10	38.00
With Red insert	1 N/C	D7P-F4-PX01	34.00	D7M-F4-MX01	39.50
With Blue insert	1 N/O	D7P-F6-PX10	34.00	D7M-F6-MX10	39.50
With Green insert labelled "Start"	1 N/O	D7P-F301-PX10	37.00	D7M-F301-MX10	42.00
With Red insert labelled "Stop"	1 N/C	D7P-F402-PX01	37.00	D7M-F402-MX01	42.00
With Blue insert labelled "Reset"	1 N/O	D7P-F607-PX10	38.00	D7M-F607-MX10	41.00



Dimensions in (mm)



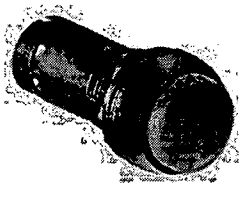
D7P-E402-PX01

Extended pushbuttons [1])

Description	Contact	Plastic body Cat. No.	Price $	Metal body Cat. No.	Price $
With Red insert labelled "stop"	1 N/C	D7P-E402-PX01	40.00	D7M-E402-MX01	43.00

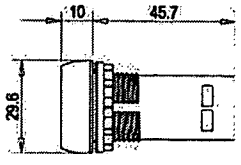
Monolithic pushbuttons

Description	1 N/O Contact Cat. No.	Price $	1 N/C Contact Cat. No.	Price $	1 N/O 1 N/C Contact Cat. No.	Price $
Flush Green	D7DF3X10	24.00	-	-	D7DF3X11	38.00
Flush Red	-	-	D7DF4X01	24.00	D7DF4X11	38.00
Flush Blue	D7DF6X10	24.00	-	-	D7DF6X11	38.00
Flush Black	D7DF2X10	24.00	D7DF2X01	24.00	D7DF2X11	38.00
Extended Red	-	-	D7DE4X01	24.00	D7DE4X11	40.50

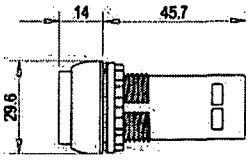


D7DE4X01

Flush



Extended



Notes: [1]) Extra contact blocks refer page 2 - 32.

Price Schedule 'A2'

GST not included

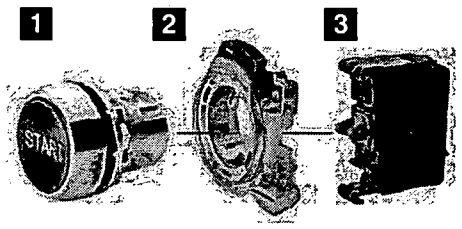
sprecher+schuh

D7 Flush type momentary pushbuttons 22.5 mm
Components

2


D7ML-F5

■ Protection class IP 66



1 Operators with flush inserts

Description		Non-illuminated Plastic Cat. No.	Price $	Non-illuminated Metal Cat. No.	Price $	Illuminated Plastic Cat. No. [1)4)]	Price $	Illuminated Metal Cat. No. [1)4)]	Price $
Operator only	- no insert	D7P-F9	14.00	D7M-F9	14.40	D7PL-F9	19.00	D7ML-F9	22.20
Operator with	White / Clear insert	D7P-F1	16.00	D7M-F1	17.80	D7PL-F7	27.00	D7ML-F7	30.50
	Black insert	D7P-F2	13.40	D7M-F2	17.20	-	-	-	-
	Green insert	D7P-F3	14.00	D7M-F3	17.20	D7PL-F3	26.00	D7ML-F3	30.00
	Red insert	D7P-F4	14.00	D7M-F4	17.80	D7PL-F4	26.00	D7ML-F4	30.50
	Amber insert [3)]	-	-	-	-	D7PL-F0	27.00	D7ML-F0	30.00
	Yellow insert	D7P-F5	14.00	D7M-F5	17.80	D7PL-F5	27.00	D7ML-F5	30.50
	Blue insert	D7P-F6	14.00	D7M-F6	17.80	D7PL-F6	27.40	D7ML-F6	30.50
	Green 'Start' insert [2)]	D7P-F301	17.00	D7M-F301	20.60	-	-	-	-
	Green 'I' insert [2)]	[i] D7P-F306	17.20	D7M-F306	20.40	-	-	-	-
	Red 'STOP' insert [2)]	D7P-F402	14.00	D7M-F402	20.60	-	-	-	-
	Red 'O' insert [2)]	[i] D7P-F405	17.20	[i] D7M-F405	20.80	-	-	-	-
	Black '→' insert [2)]	D7P-F208	17.20	D7M-F208	20.60	-	-	-	-

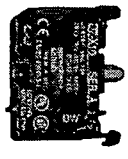

D7P-F301


D7ALP

2 Coupling plates

Description	Cat. No.	Price $
Plastic coupling plate	D7-ALP	4.50
Metal coupling plate	D7-ALM	6.50

3 Contact blocks [5)]


D7-X10

Description	Operator Colour	Contact	Panel Mount Cat. No.	Price $	DIN/Base Mount Cat. No.	Price $
Normally open contact block	Green	1 N/O	D7-X10	11.80	D7-BX10	13.20
Normally closed contact block	Red	1 N/C	D7-X01	11.80	D7-BX01	13.20
Normally open early make	Green	N/C E.M.	D7-X10E	15.40	D7-BX10E	16.80
Normally closed late break	Brown	N/C L.B.	D7-X01L	15.40	D7-BX01L	16.80

2 + 3 Combined coupling plate and contact block


D7PX10

Description	Screw Cap Cat. No.	Price $	Metal Screw Cap Cat. No.	Price $
1 N/O contact block + coupling plate	D7PX10	16.80	D7MX10	19.60
1 N/C contact block + coupling plate	D7PX01	16.80	D7MX01	19.60
1 N/O and 1 N/C contact block + coupling plate	D7PX11	28.60	D7MX11	32.00

Notes:
[1)] Additional engraved inserts available separately, refer page 2 - 41.
[2)] Laser engraved inserts supplied as a kit of two parts, i.e. operator and insert.
[3)] For optimum amber illumination it is recommended that yellow LED is specified.
[4)] Lamps & LED refer 2 - 33.
[5)] Extra contact blocks refer 2 - 32.
Accessories refer 2 - 34.
[i] Available on indent only.

Price Schedule 'A2'

GST not included

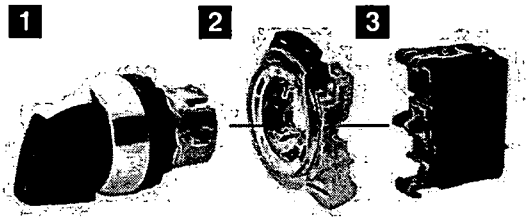
sprecher+schuh

D7 Short lever type 2-position selector switch 22.5 mm

Components

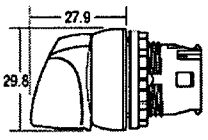
D7P-LSM26

■ Protection class IP 66



1 Operators with levers [1][3]

Description		Non-illuminated Plastic Cat. No.	Price $	Non-illuminated Metal Cat. No.	Price $	Illuminated Plastic Cat. No. [1]	Price $	Illuminated Metal Cat. No. [1]	Price $
Maintained stayput 60°	0 1	D7P-SM22	31.50	D7M-SM22	36.50	D7P-LSM2	38.00	D7M-LSM2	42.50
Spring return from left 60°	1 0	D7P-SL22	34.00	D7M-SL22	38.00	D7P-LSL2	38.00	D7M-LSL2	42.50
Spring return from right 60°	0 1	D7P-SR22	34.00	D7M-SR22	38.00	D7P-LSR2	38.00	D7M-LSR2	42.50



Contact development table

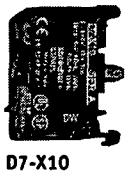
Contact type	Mounting position on latch		
N/O	All slots	0	X
N/C	All slots	X	0

X = Closed
0 = Open

D7ALP

2 Coupling plates

Description	Cat. No.	Price $
Plastic coupling plate	D7-ALP	4.50
Metal coupling plate	D7-ALM	6.50

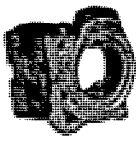


D7-X10

3 Contact blocks [2]

Description	Operator Colour	Contact	Cat. No.	Price $	Cat. No.	Price $
Normally open contact block	Green	1 N/O	D7-X10	11.80	D7-BX10	13.20
Normally closed contact block	Red	1 N/C	D7-X01	11.80	D7-BX01	13.20

2 + 3 Combined coupling plate and contact block



D7PX10

Description	Screw Cap Cat. No.	Price $	Metal Screw Cap Cat. No.	Price $
1 N/O contact block + coupling plate	D7PX10	16.80	D7MX10	19.60
1 N/C contact block + coupling plate	D7PX01	16.80	D7MX01	19.60
1 N/O and 1 N/C contact block + coupling plate	D7PX11	28.60	D7MX11	32.00

Notes: [1] LED lamps, refer page 2 - 33.
[2] Additional contact blocks refer page 2 - 32.
[3] Use D7ACP to enable additional contact center position.

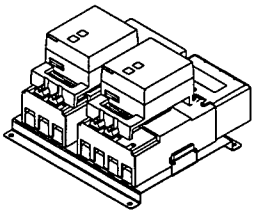
Price Schedule 'A2'

GST not included

TERASAKI
Innovators in Protection Technology

Transfer Switches

Basic Transfer Switches (BTS) – 3 or 4 pole



Features / options:

- Motor driven MCCBs
- 3 or 4 pole types
- Front mounting link interlock used
- Pre-assembled and wired on a mounting plate
- Automatic changeover controller option
- A choice of Relay-Logic, or electronic controllers
- Common load side busbar option
- Conforms to AS/NZS 60947.6.1

BTS selection chart and catalogue numbers

MCCBs used	Amp range	400 V kA I_{cu}	3 or 4 Pole outline dimensions (mm) H	W	D	3 pole BTS Cat. No.	4 pole BTS Cat. No.
S125NJ	40-63					BTSS1NJ6333 [1])	BTSS1GJ6344 [1])
S125NJ	63-100	36				BTSS1NJ10033 [1])	BTSS1GJ10044 [1])
S125NJ	80-125		260	305	180	BTSS1NJ12533 [1])	BTSS1GJ12544 [1])
S125GJ	40-63					BTSS1GJ6333	BTSS1GJ6344
S125GJ	63-100	65				BTSS1GJ10033	BTSS1GJ10044
S125GJ	80-125					BTSS1GJ12533	BTSS1GJ12544
S160NJ	40-63					BTSS16NJ6333 [1])	BTSS16GJ6344 [1])
S160NJ	63-100	36				BTSS16NJ10033 [1])	BTSS16GJ10044 [1])
S160NJ	100-160		279	340	180	BTSS16NJ16033 [1])	BTSS16GJ16044 [1])
S250NJ	160-250	36				BTSS2NJ25033	BTSS2NJ25044
S160GJ	100-160					BTSS16GJ16033	BTSS16GJ16044
S250GJ	160-250	65				BTSS2GJ25033	BTSS2GJ25044
S250PE	50-125	70	279	340	215	BTSS2PE12533	BTSS2PE12544
S250PE	100-250					BTSS2PE25033	BTSS2PE25044
S400NJ	160-250	50				BTSS4NJ25033	BTSS4NJ25044
S400NJ	250-400					BTSS4NJ40033	BTSS4NJ40044
S400GJ	160-250	70				BTSS4GJ25033	BTSS4GJ25044
S400GJ	250-400					BTSS4GJ40033	BTSS4GJ40044
S400NE	100-250	50	360	415	244	BTSS4NE25033	BTSS4NE25044
S400NE	160-400					BTSS4NE40033	BTSS4NE40044
S400GE	100-250	70				BTSS4GE25033	BTSS4GE25044
S400GE	160-400					BTSS4GE40033	BTSS4GE40044
S630GE	315-630	50				BTSS6GE63033	BTSS6GE63044
S630GE	315-630	70				BTSS6GE63033	BTSS6GE63044

Notes: [1]) 4 Pole types are rated 65 kA.

- Transfer switches are stocked off the shelf in sizes 125 A to 630 A in some sizes, while others are made to order. Contact NHP for availability.
- Refer following pages for information on TLP2 logic and TL101 electronic changeover controllers.
- Wire interlocks must be used for transfer switches combining MCCBs of different frame size (different heights).

7.5 POWER SUPPLIES

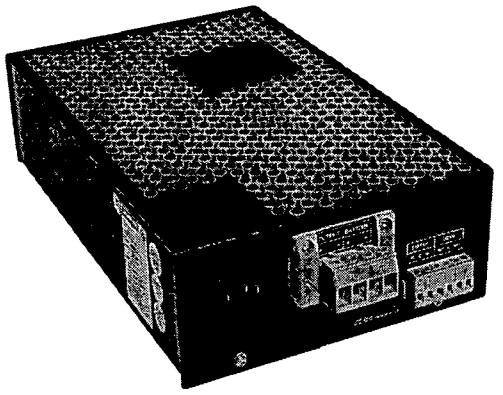
- POWERBOX – PB251-24CM-CC-T – RTU POWER SUPPLY 24VDC
- YUASA – UXH50-12 – BATTERY

PB251 Series

220-330 WATTS DC UPS

Features

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



Specifications

INPUT	
Voltage:	190 to 264 vac, or 190 to 400VDC
Line regulation:	0.2%typical
Current:	1.4A 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 cct	Constant current
Current limit type - batt. cct	Constant current
Short circuit protection	Indefi nite, auto-resetting
Over-voltage protection	17.5 to 20V latching (13.8Vdc output) 31.5 to 39V latching (27.6Vdc output)
Ripple & noise 100 MHz bandwidth	28mVp-p (13.8Vdc output) 55mVp-p (27.6Vdc output)
ENVIRONMENTAL	
Operating temperature	0 to 70°C ambient with derating, 5...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 Compliance Marked
Isolation i/p-o/p i/p-ground o/p-ground	4242VDC for 1 minute 2121VDC for 1 minute 707VDC for 1 minute
ALARMS & BATTERY FUNCTIONS	
Converter ON/OK alarm	Indicated by voltage-free changeover relay contacts &
green LED	ON=PSU OK
Battery low (& fuse) alarm	10.2 to 12.6V for 12V battery, adjustable 20.4 to 25.2V for 24V battery, adjustable Indicated by voltage-free changeover relay contacts & green LED: ON=BATT OK
Low voltage disconnect	9.6 to 12V for 12V battery, adjustable 19.2 to 24V2 for 4V battery, adjustable
Charger over-load protection	Auto-resetting electronic circuit breaker
Reverse polarity protection	Internal battery fuse
Battery to load voltage drop	0.2 to. 0.25V typical
MECHANICAL	
Case size	264 L x 172 W x 67 H mm
Case size with heatsink	264 L x 186 W x 67 H mm
Rack size	232 D x 19" W x 2RU H
Weight	1.9 kg
Weight with heatsink	2.1 kg
Weight (rack mounted version)	5.5 kg

Selection Table

MODEL NUMBER	OUTPUT VDC	OUTPUT I_{LOAD}	OUTPUT I_{BATT}	OUTPUT POWER
PB251-12CM	13.8V	16A	2A	220W
PB251-12CM-H	13.8V	20A	2A	275W
PB251-24CM	27.6V	11A	2A	300W
PB251-24CM-H	27.6V	12A	2A	330W
PB251-12RML	13.8V	20A	4A	275W
PB251-12B	13.8V	20A	4A	275W
PB251-24RML	27.6V	12A	2A	330W

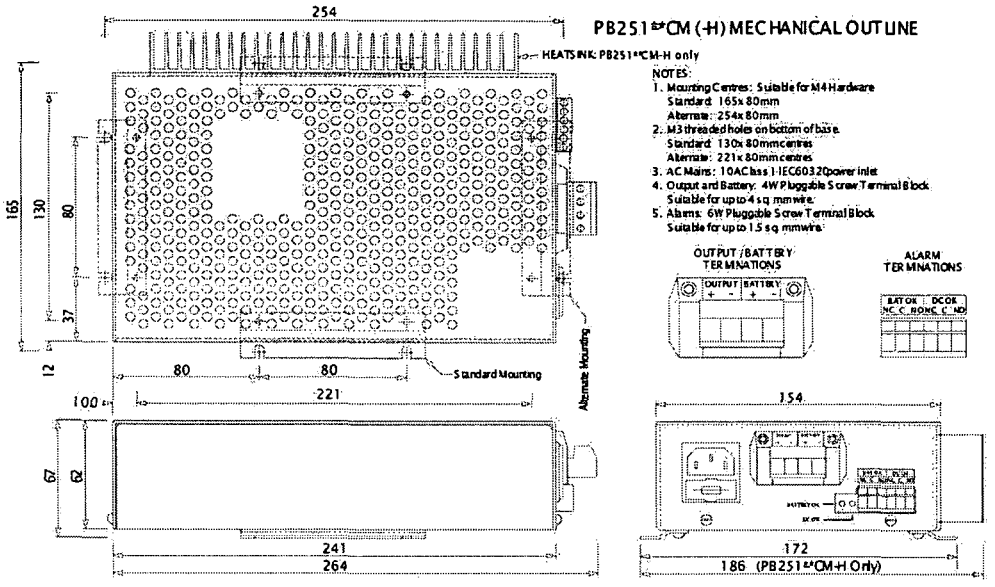
Note: Non standard battery charging current available on request. ie PB251-12CM-H-10 for 10A.

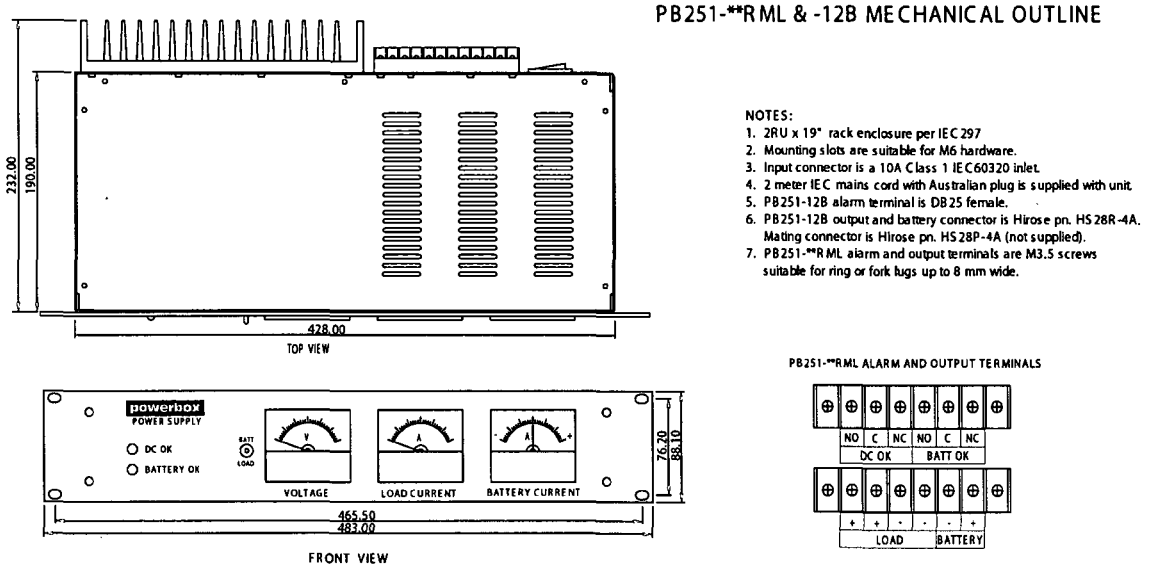
powerbox

PB251 Series

275-330 WATTS DC UPS

Technical Illustrations

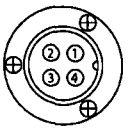




NOTES:
1. 2RU x 19" rack enclosure per IEC 297
2. Mounting slots are suitable for M6 hardware.
3. Input connector is a 10A Class 1 IEC60320 inlet.
4. 2 meter IEC mains cord with Australian plug is supplied with unit.
5. PB251-12B alarm terminal is DB25 female.
6. PB251-12B output and battery connector is Hirose pn. HS28R-4A. Mating connector is Hirose pn. HS28P-4A (not supplied).
7. PB251-**RML alarm and output terminals are M3.5 screws suitable for ring or fork lugs up to 8 mm wide.

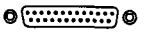
PB251-**RML ALARM AND OUTPUT TERMINALS

PB251-12B OUTPUT & BATTERY CONNECTOR



PIN1: + OUTPUT
PIN2: - OUTPUT
PIN3: + BATTERY
PIN4: - BATTERY

PB251-12B ALARM CONNECTOR

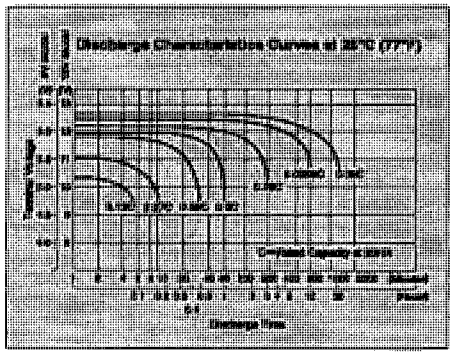


PIN 1: COMMON
PIN 6: DC OK (NC)
PIN 15: BATTERY OK (NO)

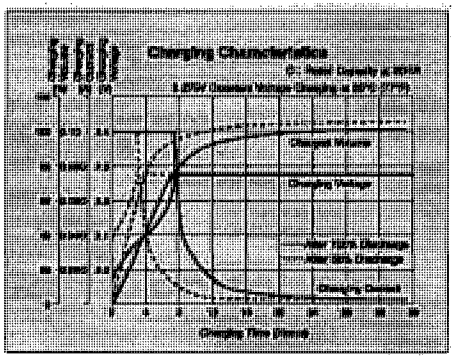
Your dependable power partner – www.powerbox.com.au

General Characteristics

■DISCHARGE CHARACTERISTICS



■CHARGING CHARACTERISTICS



Peripheral Device

A life diagnosis device for valve regulated lead-acid batteries, "JUST FEEL".
The battery monitor, JUST FEEL, diagnoses life of valve regulated lead-acid batteries.
Battery life can be diagnosed without disconnecting a power supply as a result of measuring battery internal impedance during floating charge.

- Diagnoses battery life during floating charge.
- A compact, portable device.
- Can be used for a large variety of valve regulated lead-acid batteries.
- Mounted with comparator function.
- May be used for UPS batteries.(Some models may prohibit the use of this device. If you intend to use the device for UPS, please contact us for consultation.)

●Specifications subject to change without prior notice

Distributed by:
GS Yuasa International Ltd.
1-8-1, Nishi-Shimbashi, Minato-ku
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Japan
Tel +81-3-3597-2403
Fax +81-3-3597-2409

Cat.No. UXH-13 0505-10 (NMP) Printed in Japan

YUASA

"Yuasa" Brand Maintenance-Free Valve Regulated Lead-Acid Stationary Batteries

UXH SERIES

UXH SERIES

The latest in YUASA's state-of-the-art technology has brought about a new UXH series capable of yielding even greater capacity than comparable batteries.
YUASA UXH batteries are designed with unique valve regulating devices and acid free constructions, ensuring safety and suitability to the contemporary business environment.

Designed Life

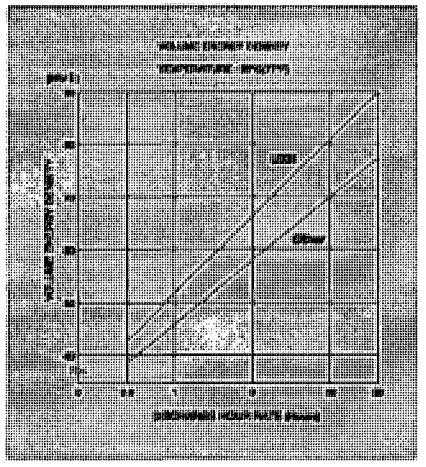
10 years

Features

Up to 15% more capacity
Maintenance-free
Higher energy efficiency
Negligible gas emissions
Valve regulated
Systems compatible
Fitted with explosion proof filter
(Except UXH100-12N and UXH200-6N)
No equalizing charge required
(Option) Flame retardant version available
No free Acid (Non-spillable Battery)

Applications

UPS
Telecommunications
Alarm systems
Fire & security systems
Emergency lighting
Engine starting
Solar powered systems
Utilities
Rail



Float charge voltage: 2.275V per cell
Permissible operating temperature: -15~45°C
Container material: ABS
Terminal: L terminal

General Specifications

Battery Model	Nominal Voltage(V)	20HR Rated Capacity(Ah) *1	Internal Resistance(mΩ) *2	Approx. Dimensions, mm(inch) Length	Width	Height	Overall Height	Approx. Weight kg(lbs.)	Explosion Proof Filter
UXH38-12	12	38	7.0	235 (9.3)	128 (5.0)	190 (7.5)	217 (8.5)	17 (37)	O
UXH50-12	12	50	6.0	299 (11.8)	128 (5.0)	190 (7.5)	217 (8.5)	21 (46)	O
UXH63-12	12	63	5.0	363 (14.3)	128 (5.0)	190 (7.5)	217 (8.5)	25 (55)	O
UXH75-6	6	75	2.2	217 (8.5)	128 (5.0)	190 (7.5)	217 (8.5)	16 (35)	O
UXH100-6	6	100	1.8	281 (11.1)	128 (5.0)	190 (7.5)	217 (8.5)	20 (44)	O
UXH125-6	6	125	1.6	345 (13.6)	128 (5.0)	190 (7.5)	217 (8.5)	24 (53)	O
UXH100-12N	12	100	4.0	407 (16.0)	172.5 (6.8)	210 (8.3)	240 (9.4)	39 (86)	x
UXH200-6N	6	200	1.3	398 (15.6)	176 (6.9)	216 (8.5)	250 (9.8)	39 (86)	x

*1 Final V[illegible]80V/cell, Temperature: 25°C(77°F)
*2 In a fu[illegible]d state and measured through a 1000Hz AC bridge.

Performance Data at 25°C(77°F)

(Amperes and Watts per cell)

Amperes to F.V.1.60 Volts Per Cell

Battery Model / Time		1 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	1 h
UXH38-12	A	141.0	119.0	86.3	63.5	50.9	42.6	37.4	33.4	30.8	28.0	22.8
	W	229.0	199.0	154.0	116.0	94.2	79.4	71.1	63.5	58.5	53.6	43.7
UXH50-12	A	185.0	156.0	114.0	83.5	67.0	56.0	49.5	44.0	40.5	37.0	30.0
	W	302.0	262.0	203.0	153.0	124.0	105.0	93.5	83.5	77.0	70.5	57.5
UXH63-12	A	233.0	197.0	143.0	105.0	84.4	70.6	62.4	55.4	51.0	46.6	37.8
	W	380.0	330.0	255.0	193.0	156.0	132.0	118.0	105.0	97.0	88.8	72.5
UXH75-6	A	278.0	234.0	170.0	125.0	101.0	84.0	74.3	66.0	60.8	55.5	45.0
	W	452.0	393.0	304.0	230.0	186.0	157.0	140.0	125.0	116.0	106.0	86.3
UXH100-6	A	370.0	312.0	227.0	167.0	134.0	112.0	99.0	88.0	81.0	74.0	60.0
	W	603.0	524.0	405.0	306.0	248.0	209.0	187.0	167.0	154.0	141.0	115.0
UXH125-6	A	463.0	390.0	284.0	209.0	168.0	140.0	124.0	110.0	101.0	92.5	75.0
	W	754.0	655.0	506.0	382.0	310.0	261.0	234.0	209.0	193.0	176.0	144.0
UXH100-12N	A	370.0	312.0	227.0	167.0	134.0	112.0	99.0	88.0	81.0	74.0	60.0
	W	603.0	524.0	405.0	306.0	248.0	209.0	187.0	167.0	154.0	141.0	115.0
UXH200-6	A	740.0	624.0	452.0	334.0	268.0	224.0	198.0	176.0	162.0	148.0	120.0
	W	1204.0	1048.0	808.0	612.0	496.0	416.0	374.0	334.0	308.0	282.0	230.0

Amperes to F.V.1.70 Volts Per Cell

Battery Model / Time		1 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	1 h	2 h	3 h
UXH38-12	A	122.0	106.0	73.7	57.4	47.9	41.4	36.5	32.3	29.3	27.0	22.0	13.7	9.9
	W	211.0	186.0	133.0	106.0	88.9	77.9	69.2	61.4	55.9	51.7	42.6	26.6	19.4
UXH50-12	A	162.0	139.0	97.0	73.5	63.0	54.5	48.0	42.5	38.5	35.5	29.0	18.0	13.0
	W	277.0	245.0	176.0	139.0	117.0	103.0	91.0	81.0	73.6	68.0	56.0	35.0	25.5
UXH63-12	A	204.0	175.0	122.0	95.1	79.4	68.7	60.5	53.6	48.5	44.7	36.5	22.7	16.4
	W	349.0	308.0	221.0	175.0	147.0	129.0	115.0	102.0	92.6	85.7	70.6	44.1	32.1
UXH75-6	A	243.0	209.0	146.0	113.0	94.5	81.8	72.0	63.8	57.8	53.3	43.5	27.0	19.5
	W	416.0	367.0	263.0	209.0	176.0	154.0	137.0	122.0	110.0	102.0	84.0	52.5	38.3
UXH100-6	A	324.0	278.0	194.0	151.0	126.0	109.0	96.0	85.0	77.0	71.0	58.0	36.0	26.0
	W	554.0	489.0	351.0	278.0	234.0	205.0	182.0	162.0	147.0	136.0	113.0	70.0	51.0
UXH125-6	A	405.0	348.0	243.0	189.0	158.0	136.0	120.0	106.0	96.3	88.8	72.5	45.0	32.5
	W	693.0	611.0	439.0	348.0	293.0	256.0	228.0	203.0	184.0	170.0	140.0	87.5	63.8
UXH100-12N	A	324.0	278.0	194.0	151.0	126.0	109.0	96.0	85.0	77.0	71.0	58.0	36.0	26.0
	W	554.0	489.0	351.0	278.0	234.0	205.0	182.0	162.0	147.0	136.0	112.0	70.0	51.0
UXH200-6	A	648.0	556.0	388.0	302.0	252.0	218.0	192.0	170.0	154.0	142.0	116.0	72.0	52.0
	W	1106.0	976.0	700.0	556.0	468.0	408.0	364.0	324.0	294.0	272.0	224.0	140.0	102.0

Amperes to F.V.1.80 Volts Per Cell

Battery Model / Time		1 min	5 min	10 min	15 min	20 min	25 min	30 min	35 min	40 min	45 min	1 h	2 h	3 h	5 h	8 h	10 h	20 h
UXH38-12	A	99.2	86.3	63.8	52.5	44.8	38.8	35.0	31.2	28.1	26.2	21.3	12.9	9.5	6.1	4.2	3.5	1.90
	W	179.0	157.0	118.0	99.2	84.7	73.7	66.9	59.7	54.3	50.5	41.4	25.1	18.6	12.2	8.4	6.8	3.80
UXH50-12	A	131.0	114.0	84.0	69.5	59.0	51.0	46.0	41.0	37.0	34.5	28.0	17.0	12.5	8.0	5.5	4.6	2.50
	W	236.0	207.0	156.0	131.0	112.0	97.0	88.0	78.5	71.5	66.5	54.5	33.0	24.5	16.0	11.0	9.0	5.00
UXH63-12	A	164.0	143.0	106.0	87.6	74.3	64.3	58.0	51.7	46.6	43.5	35.3	21.4	15.8	10.1	6.9	5.8	3.15
	W	297.0	260.0	196.0	164.0	140.0	122.0	111.0	98.9	90.1	83.8	68.7	41.6	30.9	20.2	13.9	11.5	6.30
UXH75-6	A	196.0	170.0	126.0	104.0	88.5	76.5	69.0	61.5	55.5	51.8	42.0	25.5	18.8	12.0	8.3	6.9	3.75
	W	353.0	310.0	233.0	196.0	167.0	146.0	132.0	118.0	107.0	99.8	81.8	49.5	36.8	24.0	16.5	13.5	7.50
UXH100-6	A	261.0	227.0	168.0	139.0	118.0	102.0	92.0	82.0	74.0	69.0	56.0	34.0	25.0	16.0	11.0	9.3	5.00
	W	471.0	413.0	311.0	261.0	223.0	194.0	176.0	157.0	143.0	133.0	109.0	66.0	49.0	32.0	22.0	18.0	10.00
UXH125-6	A	326.0	284.0	210.0	174.0	148.0	128.0	115.0	103.0	92.5	86.3	70.0	42.5	31.3	20.0	13.8	11.4	6.25
	W	589.0	516.0	389.0	326.0	279.0	243.0	220.0	196.0	179.0	166.0	136.0	82.5	61.3	40.0	27.5	22.8	12.50
UXH100-12N	A	261.0	227.0	168.0	139.0	118.0	102.0	92.0	82.0	74.0	69.0	56.0	34.0	25.0	16.0	11.0	9.3	5.00
	W	471.0	413.0	311.0	261.0	223.0	194.0	176.0	157.0	143.0	133.0	109.0	66.0	49.0	32.0	22.0	18.0	10.00
UXH200-6	A	520.0	452.0	336.0	278.0	236.0	204.0	184.0	164.0	148.0	138.0	112.0	68.0	50.[illegible]	32.0	22.0	18.6	10.00
	W	940.0	824.0	620.0	520.0	444.0	388.0	352.0	314.9	296.0	266.0	218.0	132.0	[illegible]	[illegible].0	44.0	36.0	20.00

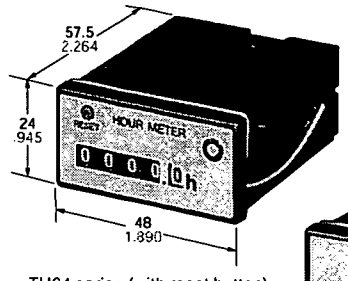
7.6 INSTRUMENTATION

- NATIONAL – TH639 – HOUR RUN METER
- SPRECHER & SCHUH – RZ7-FSA 3E U23 – SURCHARGE IMMINENT DELAY TIMER
- IDEC – GT3D-4-AF20+BASE – EMERGENCY PUMPING MODE TIMER
- REDLION – G306A000 – GRAPHIC DISPLAY
- VEGA – BR52.XXGG1GHPMAS – DELIVERY PRESSURE TRNASMITTER
- TRIO – DR900-07A02-00 – RADIO
- LOGICA – MD331EAL/27ID-0-7 – TELEMTRY UNIT
- CRITEC – SLP1-RJ11-A – MODEM SURGE PROTECTION UNIT
- SPRECHER & SCHUH – D7P-POT3 – SPEED POTENTIOMETER
- POWERBOX – PBBA-2409F-CM-CC – MODEM 24V/13.8VDC CONVERTER
- TRIO – YAGI ANT13AL – ANTENNA
- WOOMERA – 56K V.90 – TELEPHONE MODEM

Panasonic
ideas for life

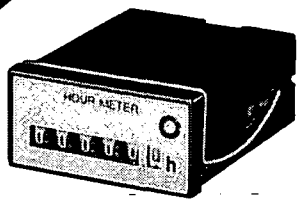
DIN HALF SIZE HOUR METER

TH63·TH64 Hour Meters



TH64 series (with reset button)

mm inch



TH63 series (without reset button)

UL File No.: E42876
CSA File No.: LR39291

2. Reset button
The hour meters can be reset to zero (TH64 series).
3. Wide-ranging measurement display
The measurement can be displayed from 0.1 hour up to 99999.9 hours (TH63 series). The dial size is the same as that of 48 × 48 DIN size hour meters (TH14 and TH24 series).
4. Easy to install
The flat terminals (#187) are used for easier wiring. There is no need to undo the lock spring.
5. High-performance sync motor with 50/60 Hz selector
The noise-resistant, accurately turning motor is employed to provide for longer period of measurement. The power frequency can be selected for 50 or 60 Hz.
6. Rotary indicator
The rotary indicator makes one turn every 72 seconds for monitoring.
7. Compliant with UL, CSA and CE.

RoHS Directive compatibility information
http://www.nais-e.com/

Features

1. Compact to save panel space
The 24 × 48 mm hour meters are just half the DIN 48 × 48 standard size. They help save the panel space.

Typical applications

Management of small generators and food processing machines; hour counting for leased equipment; maintenance management of various equipment, etc.

Specifications

Rated operating voltage		12 V AC, 24 V AC, 48 V AC, 100 V AC, 110 V AC, 115 to 120 V AC, 200 V AC, 220 V AC, 240 V AC
Allowable operating voltage range		85 to 115% of rated operating voltage
Rated frequency		50/60 Hz (selectable by switch)
Counting range		0 to 99999.9 hours (TH63 series) 0 to 9999.9 hours (TH64 series)
Minimum time display		0.1 hours (6 min)
Rated power consumption		Approx. 1.5 W
Insulation resistance (Initial value)		Min. 100 MΩ, Between live and dead metal parts (At 500 V DC)
Breakdown voltage (Initial value)		2,000 Vrms, Between live and dead metal parts
Max. temperature rise		55°C 131°F
Vibration resistance	Functional	10 to 55 Hz: 1 cycle/min double amplitude of 0.5 mm (10 min on 3 axes)
Shock resistance	Functional	Min 98 m/s² {10 G} (4 times on 3 axes)
	Destructive	Min 980 m/s² {100 G} (5 times on 3 axes)
Ambient temperature		−10 to +50°C +14 to +122°F
Ambient humidity		Max. 85% RH (non-condensing)
Weight		Approx. 80 g 2.82 oz

Product types

Type	Operating voltage	Part number	Operating voltage	Part number	Operating voltage	Part number
TH63 series (without reset button)	100V AC	TH631	24V AC	TH634	115 to 120V AC	TH637
	200V AC	TH632	48V AC	TH635	220V AC	TH638
	12V AC	TH633	110V AC	TH636	240V AC	TH639
TH64 series (with reset button)	100V AC	TH641	24V AC	TH644	115 to 120V AC	TH647
	200V AC	TH642	48V AC	TH645	220V AC	TH648
	12V AC	TH643	110V AC	TH646	240V AC	TH649

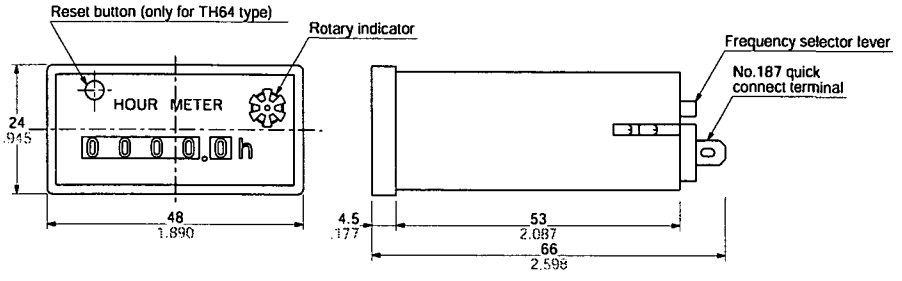
Notes) 1. Only the metallic-looking (silver) panel mounting type is available.
2. Standard products are UL-recognized as well as CSA-certified. There is no need to add "U" at the end of the part number. Just specify the standard part number when ordering.

Applicable standard

Safety standard	EN61010-1	Pollution Degree 2/Overvoltage Category II
EMC	(EMI)EN61000-6-4	
	Radiation interference electric field strength	EN55011 Group1 ClassA
	Noise terminal voltage	EN55011 Group1 ClassA
	(EMS)EN61000-6-2	
	Static discharge immunity	EN61000-4-2 4 kV contact 8 kV air
	RF electromagnetic field immunity	EN61000-4-3 10 V/m AM modulation (80 MHz to 1 GHz) 10 V/m pulse modulation (895 MHz to 905 MHz)
	EFT/B immunity	EN61000-4-4 2 kV (power supply line)
	Surge immunity	EN61000-4-5 1 kV (power line)
	Conductivity noise immunity	EN61000-4-6 10 V/m AM modulation (0.15 MHz to 80 MHz)
	Power frequency magnetic field immunity	EN61000-4-8 30 A/m (50 Hz)
	Voltage dip/Instantaneous stop/Voltage fluctuation immunity	EN61000-4-11 10 ms, 30% (rated voltage) 100 ms, 60% (rated voltage) 1,000 ms, 60% (rated voltage) 5,000 ms, 95% (rated voltage)

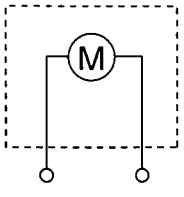
Dimensions

mm inch
General tolerance: ±0.5 ±.020



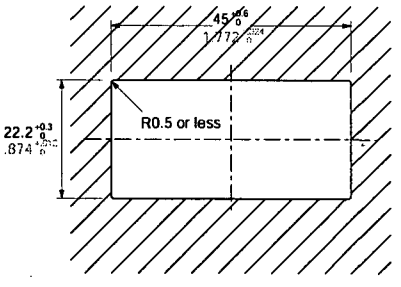
Wiring diagram

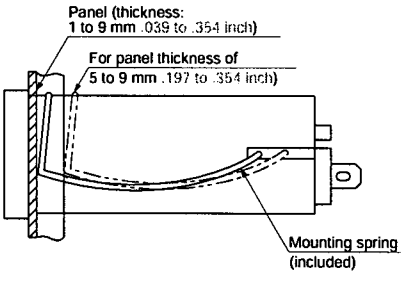
mm inch



Operating power supply

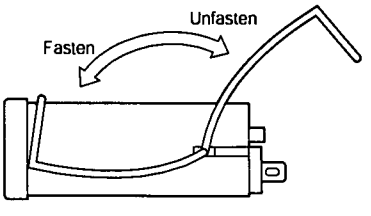
• **Panel cutout dimensions**





Mounting

1. Cut a $22.2^{+0.3}_{0} \times 45^{+0.6}_{0}$ mm ($.874^{+.012}_{0} \times 1.772^{+.024}_{0}$ inch) opening in the panel.
2. Swing the mounting spring to the rear of the hour meter and fit the hour meter into the panel opening. (There is no need to detach the mounting spring from the hour meter.) If the panel is 5 to 9 mm .197 to .354 inch thick, move the mounting spring to the other hole toward the rear of the hour meter.
3. Swing the mounting spring to the front of the hour meter to secure the hour meter to the panel.
4. Wire the supplied quick connectors and connect to the hour meter. Be sure to use the supplied insulating sleeves to cover the connectors.



sprecher+schuh

Technical Information

Series RZ7-FE Electronic Timing Relays

Technical Data

	RZ7-FE With NO Contact	RZ7-FE With SPDT Contact
Setting Accuracy	±5% of the time range final value (t_{max})	
Repeatability	±1% of the time range final value (t_{max})	
Tolerance	by voltage: ±0.01%/%ΔU by temperature: ±0.25%/°C	by voltage: ±0.001%/%ΔU by temperature: ±0.025%/°C
Supply		
Supply Voltage	24 AC or DC and 110...240VAC, 50/60Hz	24...48VDC and 24...240VAC, 50/60 Hz
Voltage Tolerance	-15%/+20% (DC), -15%/+10% (AC)	
Power Consumption	0.5W at 24VDC, 9VA at 240VAC	0.5W at 24VDC, 5VA at 240VAC
Timer Energized	100%	
Recovery Time	250ms	100ms
Voltage Isolation	–	≤30ms without reset (supply voltage)
Cable length (supply voltage control)	max. 100 meters (300 ft.)	max. 250 meters (700 ft.)
Pulse Control (B1)		
Impulse Duration	≥250ms	≥50ms (AC), ≥30ms (DC)
Input Voltage	supply voltage range	
Input Current	1mA	
Cable Length	max. 250 meters without parallel load between B1 and A2 max. 50 meters with load (<3 kΩ) between B1 and A2	
Outputs		
Contact Type	1N.O. contact	1 Form C-SPDT contact
Switching Capacity	Voltage: 250VAC Current: 5A (Resistive, AC1) Power: 1250VA according to IEC 947-5-1: 1A/250VAC (inductive load, AC14) 1A/24VDC (inductive load, DC13) according to UL508: 1A/300VAC (D300)	
Short Circuit Resistance	6A gL (fast blow fuse)	
Dielectric Withstand Voltage (contact to coil)	4000V	
Life	mechanical: 20 million operations electrical operations: 0.4 Mil. at 1A/250VAC, cosφ = 1 0.4 Mil. at 0.5A/250VAC, cosφ = 0.4 0.4 Mil. at 1A/24VDC, resistive	
State Indicator	1 LED	1 bi-color LED (Supply = green; Relay = red)
General Characteristics		
Insulation Characteristics	2 kVAC/50Hz test voltage according to VDE 0435 and 4kV 1.2/50µ surge voltage according to IEC 947-1 between all inputs and outputs	
EMC Interference Immunity	The following requirements are fulfilled: Surge capacity of the supply voltage according to IEC 1000-4-5: Level 3 (A1-A2) 110...240VAC, according to IEC 1000-4-5: Level 2 (A3-A2) 24V AC/DC. Burst according to IEC 1000-4-4: Level 3. ESD discharge according to IEC 1000-4-2: Level 3.	The following requirements are fulfilled: Surge capacity of the supply voltage according to IEC 1000-4-5: Level 3. Burst according to IEC 1000-4-4: Level 3. ESD discharge according to IEC 1000-4-2: Level 3.
EMC/Emission	electromagnetic fields according to EN 55 022: Class B	
Safe Isolation	according to VDE 106, Part 101	
Climatic Withstand	56 cycles (24h) at 25...40°C and 95% relative humidity according to IEC 68-2-30 and IEC 68-2-3	
Vibration Resistance	4g in 3 axis at 10...500Hz, test FC according to IEC 68-2-6	
Shock Resistance	50g according to IEC 68-2-27	
Protection Class	Enclosure: IP40 Terminal: IP20	
Weight	60g	60g
Approvals/Standards	UL, C-UL, CE	UL, C-UL, Germanischer Lloyd, CE
Ambient Temperature	Open: -25°C...+60°C Enclosed: -25°C...+45°C Storage: -40°C...+85°C	
Standard	EN 60947-1, EN 60947-5-1, EN 50081-1, IEC 947, UL 508, CSA 22.2	

Technical Data *(continued)*

		RZ7-FE With NO Contact	RZ7-FE With SPDT Contact
General Characteristics (continued)			
Connections	Screw terminals:	M3 for Pozidrive No: 1, Phillipsa nd slotted screws No: 3, suitable for power screwdriver	
	Rated tightening torque:	0.8Nm (max. 1.0Nm) [8.8 lb-in]	
	Wire size:	Cross-sections of 1 x 0.5mm²...2 x 1.5mm² (solid) or 2 x 1.5mm² (stranded with sleeve)	
	Finger protection:	AWG 20...14	
Mounting		according to VDE 0106 Snap-on mounting on 35mm DIN-rail Side mounting on cA7/CA4 contactors and CS7/CS4 relay s(with dovetail joint)	
Disposal		Screw fixing by Panel Mount and two screws (M4) - [surface mounting in any position] Synthetic materials without dioxin according to EC/EFTA-Notification No: 93/0141/D Electrical contacts contain cadmium	

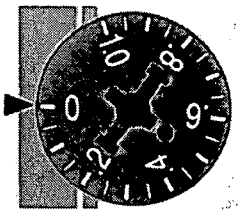
RZ7 Relative Scale Setting Knob

Series RZ7 Timing Relays have a "relative scale" setting knob numbered 0 to 1.0. Think about this as 0 to 100% of the relay's built-in time range. Example: To set an RZ7-FE timing relay (with a 0.05 to 1 minute range) to activate after 25 seconds:

1) Divide the desired activation time (25 seconds) by the maximum time limit of the relay (60 seconds).

   25 ÷ 60 = .416

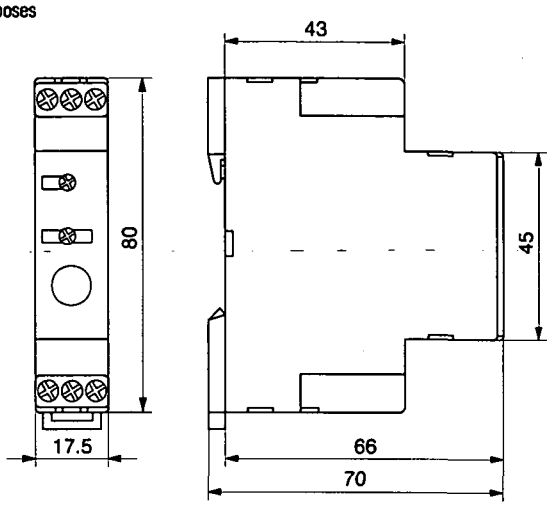
2) Rotate the setting knob to just past the .4 mark



Dimensions

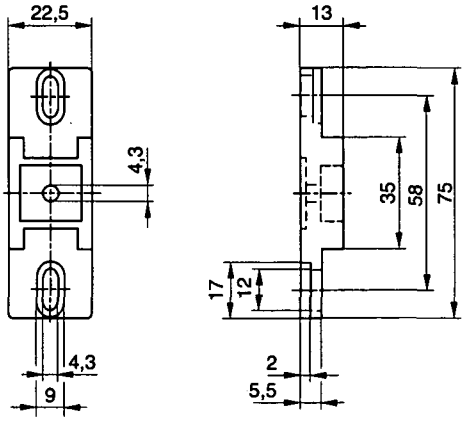
Series RZ7-FE Timing Relays *(one and two pole)*

- *Dimensions are in millimeters*
- Dimensions not intended for manufacturing purposes



Panel Mount Adaptor (26.506.221-01)

- Dimensions are in millimeters
- Dimensions not intended for manufacturing purposes



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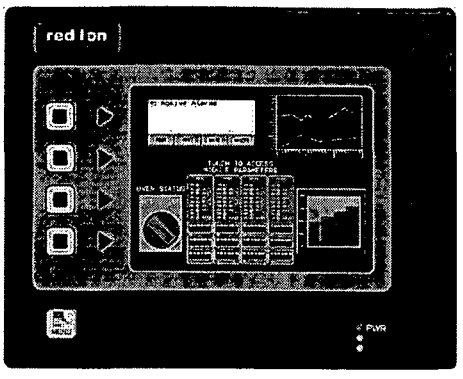
www.redlion.net

Bulletin No. G306-E
Drawing No. LP0588
Released 4/06

MODEL G306 - GRAPHIC COLOR LCD OPERATOR INTERFACE TERMINAL WITH QVGA DISPLAY AND TOUCHSCREEN



- *CONFIGURED USING CRIMSON SOFTWARE (VERSION 2.0 OR LATER)*
- *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 ON OPTIONAL COMMUNICATIONS CARD)*
- *10 BASE T/100 BASE-TX ETHERNET PORT TO NETWORK UNITS AND HOST WEB PAGES*
- *USB PORT TO DOWNLOAD THE UNIT'S CONFIGURATION FROM A PC OR FOR DATA TRANSFERS TO A PC*
- *UNIT'S CONFIGURATION IS STORED IN NON-VOLATILE MEMORY (4 MBYTE FLASH)*
- *COMPACTFLASH® SOCKET TO INCREASE MEMORY CAPACITY*
- *5.7-INCH STN PASSIVE MATRIX 256 COLOR QVGA 320 X 240 PIXEL LCD*
- *5-BUTTON KEYPAD FOR ON-SCREEN MENUS*
- *THREE FRONT PANEL LED INDICATORS*
- *POWER UNIT FROM 24 VDC ±20% SUPPLY*
- *RESISTIVE ANALOG TOUCHSCREEN*

c UL us LISTED 63YN
LABORATORY EQUIPMENT

FOR USE IN HAZARDOUS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 2

GENERAL DESCRIPTION

The G306 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 G306 to perform many of the normal features of the Paradigm range of Operator Interfaces while improving and adding new features.

The G306 is able to communicate with many different types of hardware using high-speed RS232/422/485 communications ports and Ethernet 10 Base T/100 Base-TX communications. In addition, the G306 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 G306 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 equipment 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 terminal is bonded to conductive parts of the equipment for safety purposes and must be connected to an external protective earthing system.

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

CAUTION: Risk Of Danger. Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

CompactFlash is a registered trademark of CompactFlash Association.

CONTENTS OF PACKAGE

- G306 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
G306	Operator Interface for indoor applications, textured finish with embossed keys	G306C000
G3CF	64 MB CompactFlash Card [5]	G3CF064M
	256 MB CompactFlash Card [5]	G3CF256M
	512 MB CompactFlash Card [5]	G3CF512M
G3RS	RS232/485 Optional Communications Cards	G3RS0000
G3CN	CANopen Optional Communications Cards	G3CN0000
PSDR7	DIN Rail Power Supply	PSDR7000
SFCRM2	Crimson 2.0 [2]	SFCRM200
CBL	RS-232 Programming Cable	CBLPROG0
	USB Cable	CBLUSB00
	Communications Cables [1]	CBLxxxxx
DR	DIN Rail Mountable Adapter Products [3]	DRxxxxxx
	Replacement Battery [4]	BAL3R004
G3FILM	Protective Films	G3FILM06

[1] Contact your Red Lion distributor or visit our website for complete selection.
[2] Use this part number to purchase Crimson on CD with a printed manual, USB cable, and RS-232 cable. Otherwise, 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 type CR2025.
[5] Industrial grade two million write cycles.

SPECIFICATIONS

1. **POWER REQUIREMENTS:**
   Must use Class 2 or SELV rated power supply.
   Power connection via removable three position terminal block.
   Supply Voltage: +24 VDC ±20%
   Typical Power[1]: 8 W
   Maximum Power[2]: 14 W
   Notes:
   1. Typical power with +24 VDC, RS232/485 communications, Ethernet communications, CompactFlash card installed, and display at full brightness.
   2. Maximum power indicates the most power that can be drawn from the G306. Refer to "Power Supply Requirements" under "Installing and Powering the G306."
   3. The G306's circuit common is not connected to the enclosure of the unit. See "Connecting to Earth Ground" in the section "Installing and Powering the G306."
   4. Read "Power Supply Requirements" in the section "Installing and Powering the G306" for additional power supply information.
2. **BATTERY**: Lithium coin cell. Typical lifetime of 10 years.
3. **LCD DISPLAY:**

SIZE	5.7-Inch
TYPE	STN
COLORS	256
PIXELS	320 X 240
BRIGHTNESS	165 cd/m^2
BACKLIGHT*	20,000 HR TYP.

*Lifetime at room temperature. Refer to "Display" in "Software/Unit Operation"

4. **5-KEY KEYPAD**: for on-screen menus.
5. **TOUCHSCREEN**: Resistive analog
6. **MEMORY:**
   On Board User Memory: 4 Mbyte of non-volatile Flash memory.
   Memory Card: CompactFlash Type II slot for Type I and Type II CompactFlash cards.
7. **COMMUNICATIONS:**
   USB Port: Adheres to USB specification 1.1. Device only using Type B connection.

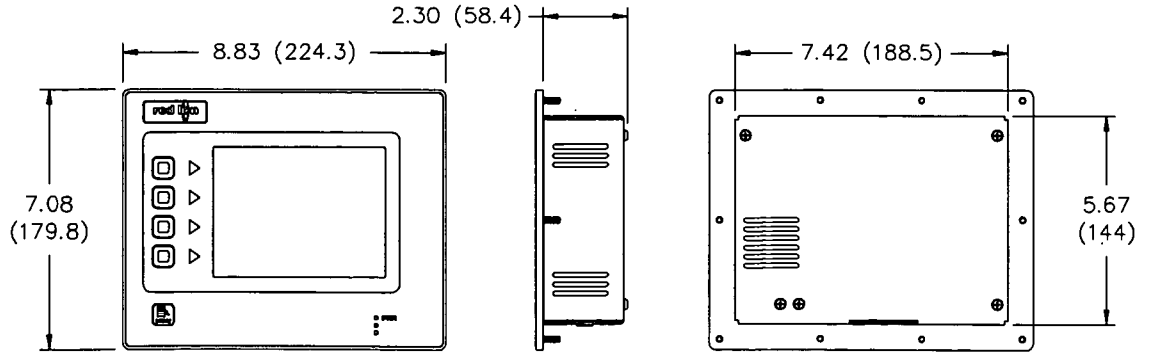
> ⚠ WARNING - DO NOT CONNECT OR DISCONNECT CABLES WHILE POWER IS APPLIED UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS. USB PORT IS FOR SYSTEM SET-UP AND DIAGNOSTICS AND IS NOT INTENDED FOR PERMANENT CONNECTION.

   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 port via RJ12.
   DH485 TXEN: Transmit enable; open collector, V_{OH} = 15 VDC, V_{OL} = 0.5 V @ 25 mA max.
   Note: For additional information on the communications or signal common and connections to earth ground please see the "Connecting to Earth Ground" in the section "Installing and Powering the G306."
   Ethernet Port: 10 BASE-T / 100 BASE-TX
   RJ45 jack is wired as a NIC (Network Interface Card).
   Isolation from Ethernet network to G3 operator interface: 1500 Vrms
8. **ENVIRONMENTAL CONDITIONS:**
   Operating Temperature Range: 0 to 50°C
   Storage Temperature Range: -20 to 70°C
   Operating and Storage Humidity: 80% maximum relative humidity (non-condensing) from 0 to 50°C.
   Vibration: Operational 5 to 8 Hz, 0.8" (p-p), 8 to 500 Hz, in X, Y, Z direction, duration: 1 hour, 3 g.
   Shock: Operational 40 g, 9 msec in 3 directions.
   Altitude: Up to 2000 meters.
9. **CERTIFICATIONS AND COMPLIANCES:**
   SAFETY
   UL Recognized Component, File #E179259, UL61010-1, CSA 22.2 No.61010-1 Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
   UL Listed, File #E211967, UL61010-1, UL1604, CSA 22.2 No. 61010.1, CSA 22.2 No. 213-M1987
   LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
   Type 4X Enclosure rating (Face only), UL50
   IECEE CB Scheme Test Certificate #US/9737/UL,
   CB Scheme Test Report #E179259-V01-S04
   Issued by Underwriters Laboratories 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: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:		
Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Emissions:		
Emissions	EN 55011	Class A

   Note:
   1. Criterion A: Normal operation within specified limits.
10. **CONSTRUCTION**: Steel rear metal enclosure with NEMA 4X/IP66 aluminum front plate for indoor use only when correctly fitted with the gasket provided. Installation Category II, Pollution Degree 2.
11. **MOUNTING REQUIREMENTS**: Maximum panel thickness is 0.25" (6.3 mm). For NEMA 4X/IP66 sealing, a steel panel with a minimum thickness of 0.125" (3.17 mm) is recommended.
    Maximum Mounting Stud Torque: 17 inch-pounds (1.92 N-m)
12. **WEIGHT**: 3.0 lbs (1.36 Kg)

DIMENSIONS In inches (mm)

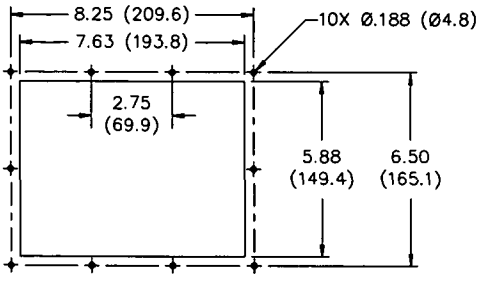


INSTALLING AND POWERING THE G306

MOUNTING INSTRUCTIONS

This operator interface is designed for through-panel mounting. A panel cut-out diagram and a template are provided. Care should be taken 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 nuts provided and tighten evenly for uniform gasket compression.

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



All tolerances ±0.010" (±0.25 mm).

ALL NONINCENDIVE CIRCUITS MUST BE WIRED USING DIVISION 2 WIRING METHODS AS SPECIFIED IN ARTICLE 501-4 (b), 502-4 (b), AND 503-3 (b) OF THE NATIONAL ELECTRICAL CODE, NFPA 70 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 system.

Each G306 has a chassis ground terminal on the back of the unit. Your unit should be connected 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 between signal common and earth ground care must be taken when connections are made to the unit.* For example, a power supply with isolation between its signal common and earth ground must be used. Also, plugging in a USB cable may connect signal common and earth ground.[1]

1. 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 G306 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 contactors, inverters, and other devices which may generate significant electrical noise.
- A power supply with a Class 2 or SELV rating is to be used. A Class 2 or SELV power supply provides isolation to accessible circuits from hazardous voltage levels generated by a mains power supply due to single faults. SELV is an acronym for "safety extra-low voltage." Safety extra-low voltage circuits shall exhibit voltages safe to touch both under normal operating conditions and after a single fault, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.

COMMUNICATING WITH THE G306

CONFIGURING A G306

The G306 is configured using Crimson 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 G306 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 G306 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 Crimson.

The RS232 PGM port 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 "G306 Port Pin Out Diagram" for wiring information.

The CompactFlash can be used to program a G3 by placing a configuration file and firmware on the CompactFlash card. The card is then inserted 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. This driver is installed with Crimson and is located in the folder C:\Program Files\Red Lion Controls\Crimson 2.0\Device\ after Crimson is installed. This may have already been accomplished if your G306 was configured using the USB port.

Once the driver is installed, connect the G306 to your PC with a USB cable, and follow "Mounting 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 "G306 Port Pin Outs" for wiring information.

ETHERNET COMMUNICATIONS

Ethernet communications can be established at either 10 BASE-T or 100 BASE-TX. The G306 unit'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 Ethernet 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.
YELLOW flashing	Data being transferred.
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.

RS232 PORTS

The G306 has two RS232 ports. There is the PGM port and the COMMS port. Although only one of these ports can be used for programming, both ports can be used for communications with a PLC.

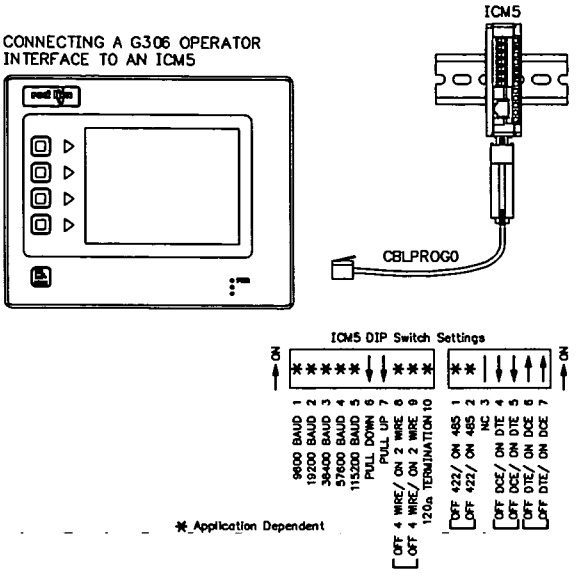
The RS232 ports can be used for either master or slave protocols with any G306 configuration.

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 G3 product or the Modular Controller can be established. Red Lion part numbers for cables with a twist in them are CBLPROG0 [1], CBLRLC01 [2], or CBLRC02 [3].

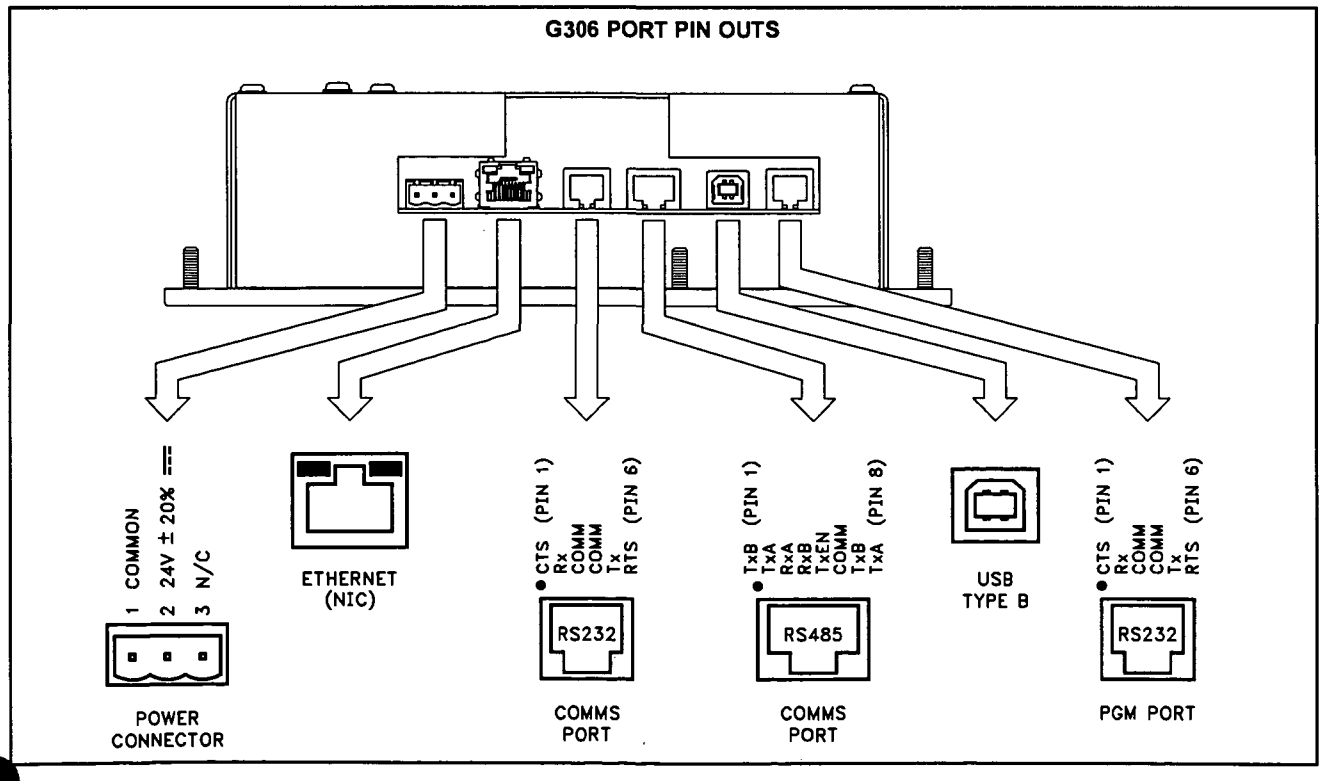
G3 RS232 to a PC

Connections			
G3: RJ12	Name	PC: DB9	Name
4	COMM	1	DCD
5	Tx	2	Rx
2	Rx	3	Tx
	N/C	4	DTR
3	COM	5	GND
	N/C	6	DSR
1	CTS	7	RTS
6	RTS	8	CTS
	N/C	9	RI

CONNECTING A G306 OPERATOR INTERFACE TO AN ICM5

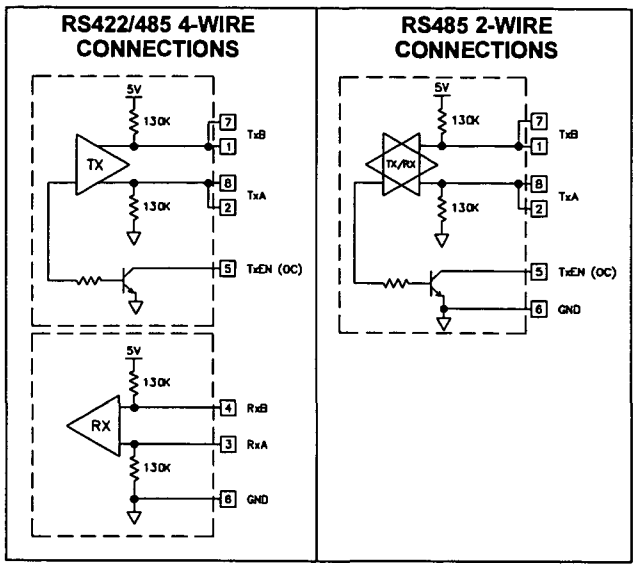


[1] CBLPROG0 can also be used to communicate with either a PC or an ICM5.
[2] DB9 adapter not included, 1 foot long.
[3] DB9 adapter not included, 10 feet long.



RS422/485 COMMS PORT

The G306 has one RS422/485 port. 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 Paradigm devices. Refer to www.redlion.net for additional information.

DH485 COMMUNICATIONS

The G306'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.

G3 to AB SLC 500 (CBLAB003)

Connections			
RJ45: RLC	Name	RJ45: A-B	Name
1	TxB	1	A
2	TxA	2	B
3, 8	RxA	-	24V
4, 7	RxB	-	COMM
5	TxEN	5	TxEN
6	COMM	4	SHIELD
4, 7	TxB	-	COMM
3, 8	TxA	-	24V

Examples of RS485 2-Wire Connections

G3 to Red Lion RJ11 (CBLRLC00) DLC, IAMS, ITMS, PAXCDC4C

Connections			
G3: RJ45	Name	RLC: RJ11	Name
5	TxEN	2	TxEN
6	COM	3	COM
1	TxB	5	B-
2	TxA	4	A+

G3 to Modular Controller (CBLRLC05)

Connections			
G3	Name	Modular Controller	Name
1,4	TxB	1,4	TxB
4,1	RxB	4,1	RxB
2,3	TxA	2,3	TxA
3,2	RxA	3,2	RxA
5	TxEN	5	TxEN
6	COM	6	COM
7	TxB	7	TxB
8	TxA	8	TxA

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 a cold cathode fluorescent tube (CCFL) for lighting the display. The CCFL tubes can be dimmed for low light conditions.

These CCFL tubes have a limited lifetime. Backlight lifetime is based upon the amount of time the display is turned on at full intensity. Turning the backlight off when the display is not in use can extend the lifetime of your backlight. This can be accomplished through the Crimson software when configuring your unit.

FRONT PANEL LEDS

There are three front panel LEDs. Shown below is the default status of the LEDs.

LED	INDICATION
RED (TOP, LABELED "PWR")	
FLASHING	Unit is in the boot loader, no valid configuration is loaded.[1]
STEADY	Unit is powered and running an application.
YELLOW (MIDDLE)	
OFF	No CompactFlash card is present.
STEADY	Valid CompactFlash card present.
FLASHING RAPIDLY	CompactFlash card being checked.
FLICKERING	Unit is writing to the CompactFlash, either because it is storing data, or because the PC connected via the USB port has locked the drive.[2]
FLASHING SLOWLY	Incorrectly formatted CompactFlash card present.
GREEN (BOTTOM)	
FLASHING	A tag is in an alarm state.
STEADY	Valid configuration is loaded and there are no alarms present.

1. The operator interface is shipped without a configuration. After downloading a configuration, if the light remains in the flashing state continuously, try cycling power. If the LED still continues to flash, try downloading a configuration again.
2. Do not turn off power to the unit while this light is flickering. The unit writes data in two minute intervals. Later Microsoft 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 Crimson 2 User Manual.

TOUCHSCREEN

This operator interface utilizes a resistive analog touchscreen for user input. 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 G306 keypad consists of five keys that can be used for on-screen menus.

TROUBLESHOOTING YOUR G306

If for any reason you have trouble operating, connecting, or simply have questions concerning your new G306, contact Red Lion's technical support. For contact information, refer to the back page of this bulletin for phone and fax numbers.

EMAIL: techsupport@redlion.net
Web Site: http://www.redlion.net

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.

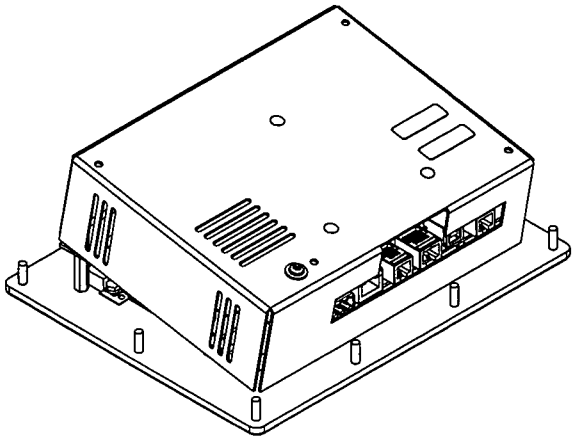
WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN DISCONNECTED AND THE AREA IS KNOWN TO BE NON-HAZARDOUS.

A battery is used to keep time when the unit is without power. Typical accuracy of the G306 time keeping is less than one minute per month drift. The battery of a G306 unit does not affect the unit's memory, all configurations and data is stored in non-volatile memory.

CAUTION: RISK OF ELECTRIC SHOCK
The inverter board, attached to the mounting plate, supplies the high voltage to operate the backlight. Touching the inverter board may result in injury to personnel.

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. Dirt, oil, or other contaminants may adversely affect circuit operation.

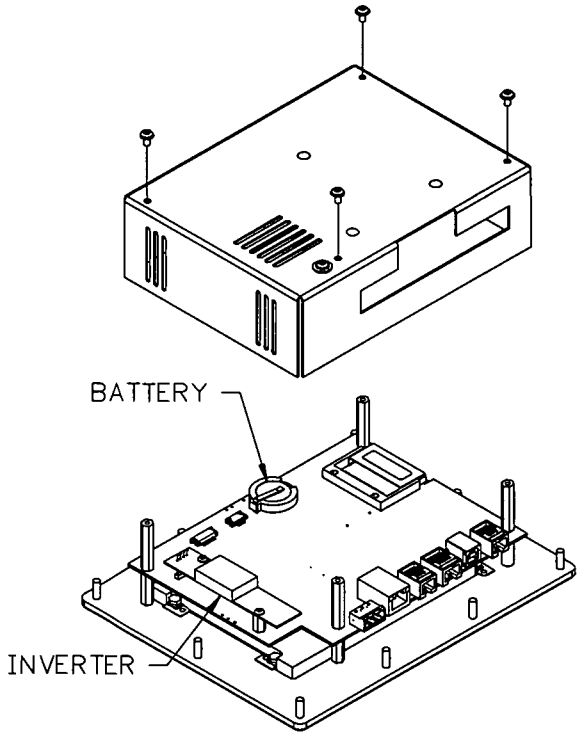
To change the battery of a G306, remove power, cabling, and then the rear cover of the unit. To remove the cover, remove the four screws designated by the arrows on the rear of the unit. Then, by lifting the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of 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 note that the old battery must be disposed of in a manner that complies with your local waste regulations. Also, the battery must not be disposed of in fire, or in a manner whereby it may be damaged and its contents come into contact with human skin.*

The battery used by the G306 is a lithium type CR2025.



OPTIONAL FEATURES AND ACCESSORIES

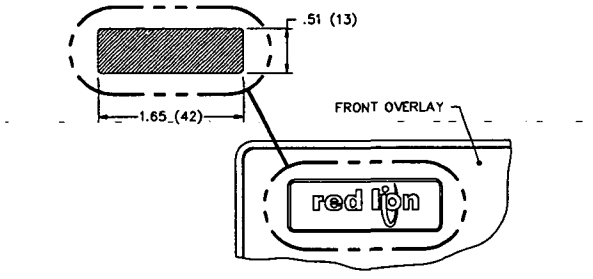
OPTIONAL COMMUNICATION CARD

Red Lion offers optional communication cards for fieldbus communications. These communication cards will allow your G306 to communicate 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 website for information and availability of these cards.

CUSTOM LOGO

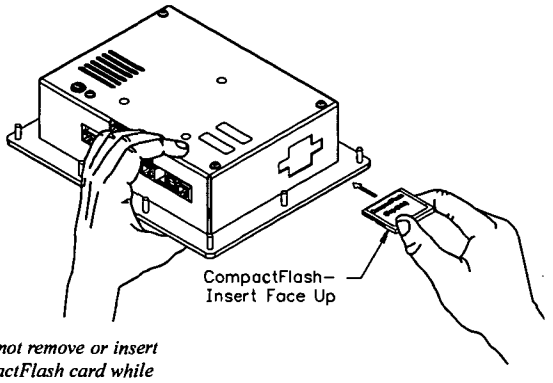
Each G3 operator interface has an embossed area containing the Red Lion logo. Red Lion can provide custom logos to apply to this area. Contact your distributor for additional information and pricing.



COMPACTFLASH SOCKET

CompactFlash socket is a Type II socket that can accept either Type I or II cards. Use cards with a minimum of 4Mbytes with the G306's CompactFlash socket. Cards are available at most computer and office supply retailers.

CompactFlash can be used for configuration transfers, larger configurations, data logging, and trending.



Note: Do not remove or insert the CompactFlash card while power is applied. Refer to "Front Panel LEDs."

Information stored on a CompactFlash card by a G306 can be read by a card reader attached to a PC. This information is stored in IBM (Windows®) PC compatible FAT16 file format.

NOTE

For reliable operation in all of our products, Red Lion recommends the use of SanDisk® and SimpleTech brands of CompactFlash cards.

Industrial grade versions that provide up to two million write/erase cycles minimum are available from Red Lion.

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 products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, 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 employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer 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 contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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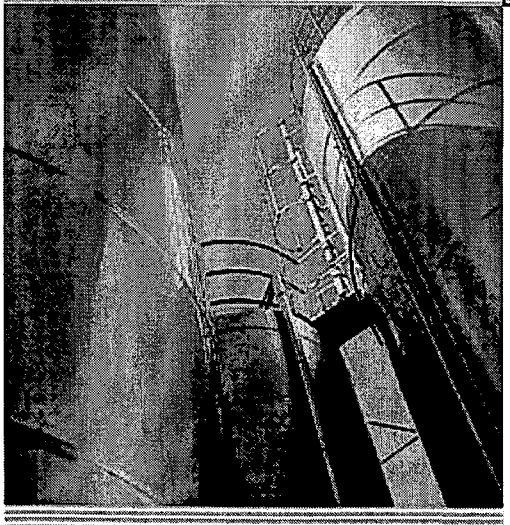
Pressure measurement

Process pressure/Hydrostatic

VEGAWELL 52

Product Information



VEGA

Contents

Take note of safety instructions for Ex applications

Please note the Ex specific safety information which you can find on our homepage www.vega.com\services\downloads 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.

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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® measuring cell in two sizes. Base element and diaphragm consist of high purity sapphire-ceramic®.

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.

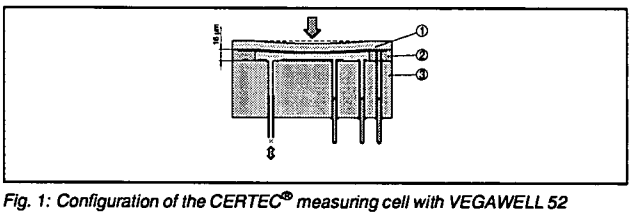

Fig. 1: Configuration of the CERTEC® measuring cell with VEGAWELL 52

1 Diaphragm
2 Soldered glass bond
3 Base element

The advantages of the CERTEC® 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 ... 20 mA and 4 ... 20 mA/HART - Pt 100.

In the 4 ... 20 mA/HART - Pt 100 version, a temperature sensor Pt 100 in four-wire technology is integrated in the transducer. Power supply or processing are carried out via an external temperature transducer.

2 Type overview

VEGAWELL 52

Measuring cell:	CERTEC®
Media:	drinking water and waste water
Process fitting:	Straining clamp, screw connection, thread
Material process fitting:	316L
Material, suspension cable:	PE, PUR, FEP
Material transmitter:	316L, 1.4462 (Duplex), each also with PE coating, PVDF, Titanium
Diameter transmitter:	depending on material and version at least 22 mm
Measuring range:	0 ... 0.1 bar up to 0 ... 25 bar
Process temperature:	-20 ... +80 °C (-4 ... +176 °F)
Deviation:	< 0.2 %, < 0.1 %
Signal output:	4 ... 20 mA, 4 ... 20 mA/HART
Operation:	depending on the version via PACTware/PC

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3 Mounting instructions

Mounting position

The following illustration shows a mounting example for VEGAWELL 52. The VEGA price list contains suitable mounting brackets under the section Accessories. With these parts, standard mounting arrangements can be realised quickly and reliably.

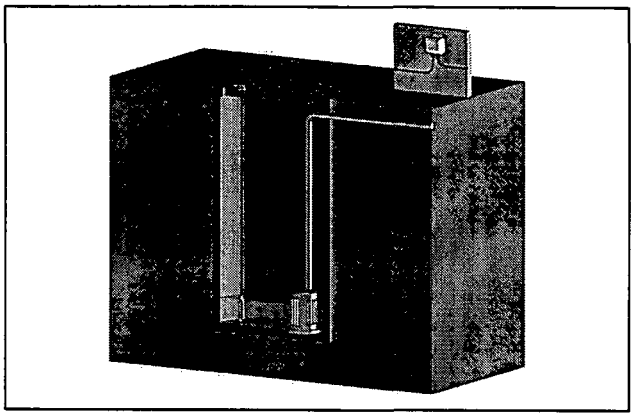

Fig. 3: VEGAWELL 52 in a pump shaft with VEGABOX 02

VEGAWELL 52 must be mounted in a calm area or in a suitable protective tube. This avoids lateral movements of the transmitter and the resulting corruption of measurement data.

Note:
As an alternative to fixing the transmitter, the use of a measuring instrument holder from VEGA's line of mounting accessories is recommended.

Beside the connection and suspension cables, the suspension cable also contains a capillary for atmospheric pressure compensation. All versions can be shortened on site.

With VEGAWELL 52, the electronics is completely integrated in the transmitter. The cable end can be lead directly to a dry connection compartment. Pressure compensation is then carried out via the filter element of the capillaries.

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

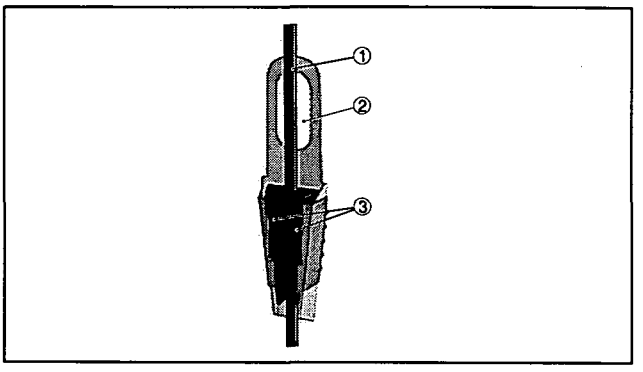

Fig. 5: Straining clamp

1 Suspension cable
2 Suspension opening
3 Clamping jaws

Mounting with screw connection

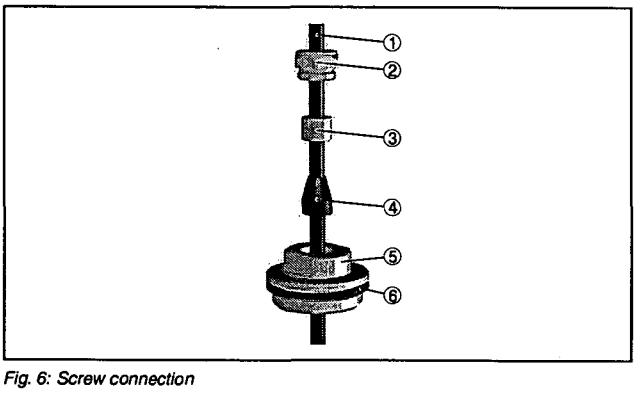

Fig. 6: Screw connection

1 Suspension cable
2 Seal screw
3 Cone bushing
4 Seal cone
5 Screw connection
6 Seal

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Mounting with housing and thread

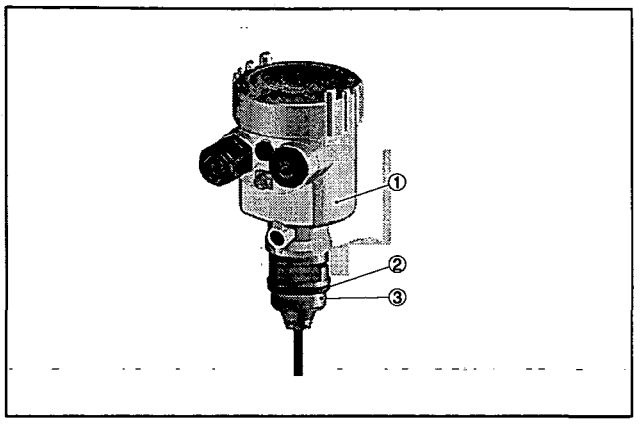

Fig. 7: Housing with thread G1½ A

1 Housing
2 Seal
3 Thread

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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 two-wire 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 ... 9 mm ensures the seal effect of the cable entry. If electromagnetic interference is expected, screened cable should be used for the signal lines.

The sensors are connected with standard two-wire cable without screen.

In Ex applications, the corresponding installation regulations must be noted for the connection cable.

4.4 Cable screening and grounding

If screened cable is necessary, the cable screen must be connected on both ends to ground potential. If potential equalisation currents are expected, the connection on the evaluation side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V).

4.5 Wiring plan VEGAWELL 52 - 4 ... 20 mA

Direct connection

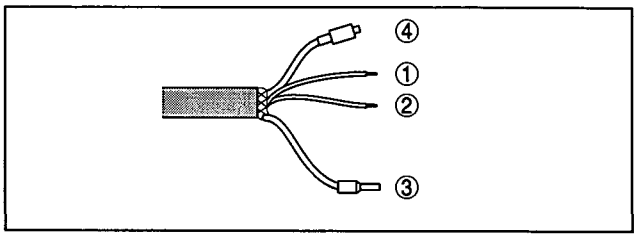

Fig. 8: Wire assignment, suspension cable

1 *blue (-): to power supply or to the processing system*
2 *brown (+): to power supply or to the processing system*
3 *Shielding*
4 *Breather capillaries with filter element*

Connection via VEGABOX 02

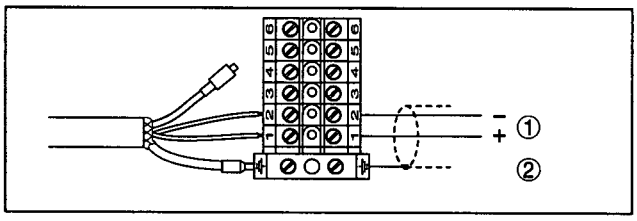

Fig. 9: Terminal assignment VEGABOX 02

1 *To power supply or the processing system*
2 *Shielding*[1)]

Connection via housing

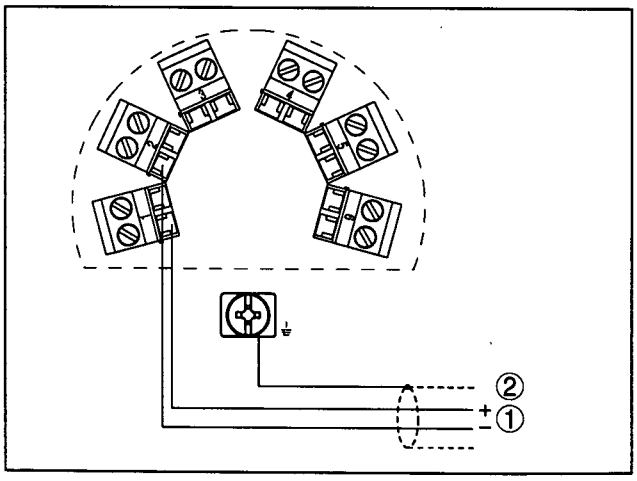

Fig. 10: Terminal assignment of the housing

1 *To power supply or the processing system*
2 *Shielding*[2)]

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.

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4.6 Wiring plan VEGAWELL 52 - 4 ... 20 mA/ HART - Pt 100

Direct connection

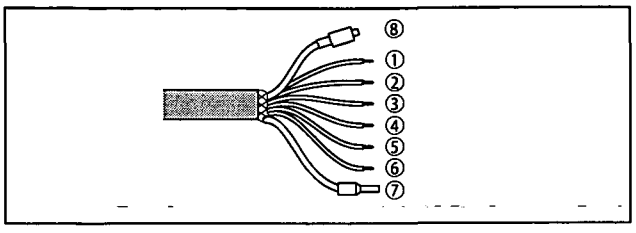

Fig. 11: Wire assignment, connection cable

1 *blue (-): to power supply or to the processing system*
2 *Brown (+): to power supply or to the processing system*
3 *White: for processing of the integrated Pt 100 (power supply)*
4 *Yellow: for processing of the integrated Pt 100 (measurement)*
5 *Red: for processing of the integrated Pt 100 (measurement)*
6 *Black: for processing of the integrated Pt 100 (power supply)*
7 *Shielding*
8 *Breather capillaries with filter element*

Connection via VEGABOX 02

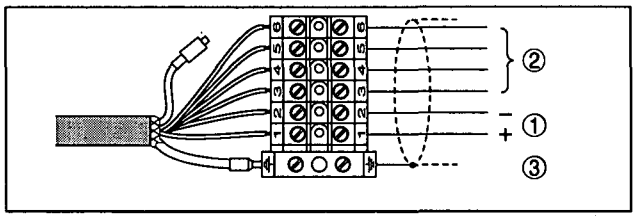

Fig. 12: Terminal assignment VEGABOX 02

1 *To power supply or the processing system (signal pressure transmitter)*
2 *To power supply or the processing system (connection cables resistance thermometer Pt 100)*
3 *Shielding*[3)]

Connection via VEGABOX 02 with integrated temperature sensor

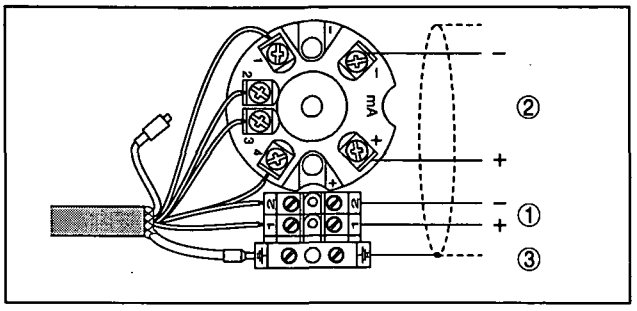

Fig. 13: Terminal assignment VEGABOX 02

1 *To power supply or the processing system (signal pressure transmitter)*
2 *For voltage supply or to processing system (resistance thermometer Pt 100)*
3 *Shielding*[4)]

Connection via housing

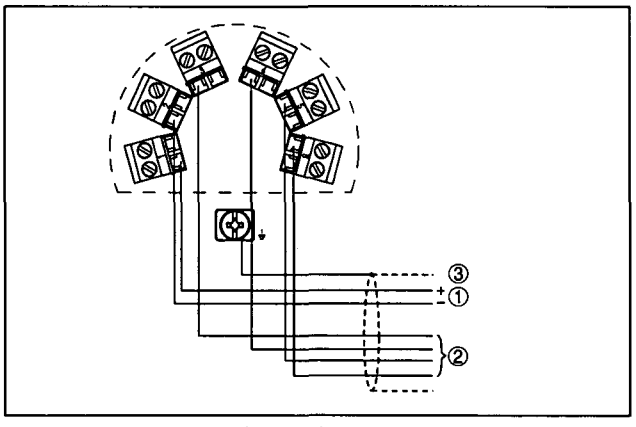

Fig. 14: Terminal assignment of the housing

1 *To power supply or the processing system (signal pressure transmitter)*
2 *For voltage supply or to processing system (resistance thermometer Pt 100)*
3 *Shielding*[5)]

---

3) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
4) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.
5) Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

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5 Operation

5.1 Overview

VEGAWELL 52 4 ... 20 mA
VEGAWELL 52 - 4 ... 20 mA has no adjustment options.

VEGAWELL 52 4 ... 20 mA/HART - Pt 100
- Adjustment software according to FDT/DTM standard, e.g. PACTware and PC
- HART handheld

5.2 Adjustment with PACTware

Connecting the PC to the signal cable

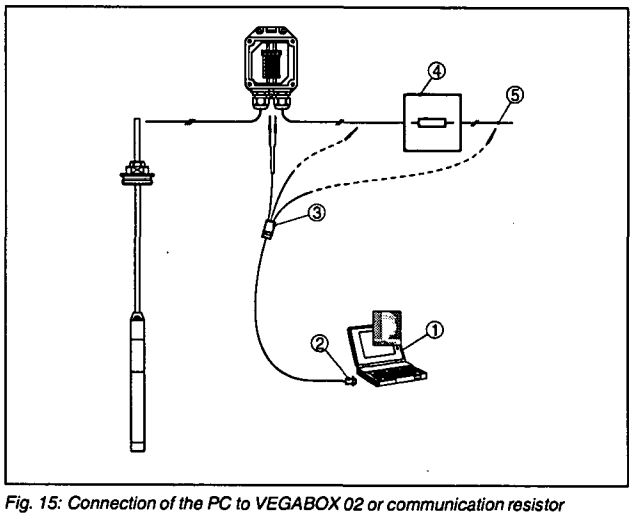

Fig. 15: Connection of the PC to VEGABOX 02 or communication resistor

1 PC with PACTware
2 RS232 interface (with VEGACONNECT 3), USB interface (with VEGACONNECT 4)
3 VEGACONNECT 3 or 4
4 Communication resistor 250 Ω
5 Power supply unit

Necessary components:
- VEGAWELL 52
- PC with PACTware and suitable VEGA DTM
- VEGACONNECT with HART adapter cable
- HART resistor approx. 250 Ω
- Power supply unit

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ω), 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 ... 20 mA cable.

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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® (99.9 % oxide ceramic)
– Measuring cell seal	FKM (VP2/A) - FDA and KTW approved, FFKM (Perlast G75S), EPDM (A+P 75.5/KW75F)
– Suspension cable	PE (FDA and KTW-approved), FEP, PUR
– Cable gland on the transmitter	316L
– Process fitting	316L
– Straining clamp	1.4301
– Unassembled screw connection	316L, PVDF
– Threaded connection on the housing	316L
Materials, non-wetted parts	
– Housing	plastic PBT (Polyester), 316L
Weight approx.	
– Basic weight	0.8 kg (1.764 lbs)
– Suspension cable	0.1 kg/m (0.07 lbs/ft)
– Straining clamp	0.2 kg (0.441 lbs)
– Screw connection	0.4 kg (0.882 lbs)
– Plastic housing	0.8 kg (1.764 lbs)
– Stainless steel housing	1.6 kg (3.528 lbs)

Input variable

Measured value	Level
Measuring range	see product code
Recommended max. turn down	10 : 1

Output variable

4 ... 20 mA	
Output signal	4 ... 20 mA
Signal resolution	2 µA
Failure signal	< 3.6 mA
Max. output current	22 mA
Run-up time	2 s
Step response time	100 ms (ti: 0 s, 0 ... 63 %)
Fulfilled NAMUR recommendations	NE 43
4 ... 20 mA/HART - Pt 100	
Output signal	4 ... 20 mA/HART
Signal resolution	2 µA
Failure signal	< 3.6 mA; 20.5 mA; 22 mA; unchanged (adjustable via PACTware)
Max. output current	22 mA
Run-up time	15 s
Step response time	200 ms (ti: 0 s, 0 ... 63 %)
Fulfilled NAMUR recommendations	NE 43

Additional output parameter - temperature

integrated resistance thermometer	Pt 100 according to DIN EN 60751
Range	-50 ... +100 °C (-58 ... +212 °F)
Resolution	1 °K

Deviation for 4 ... 20 mA version[6)]

Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Deviation with version < 0.2 %	
– Turn down 1 : 1 up to 5 : 1	< 0.2 %
– Turn down > 10 : 1	< 0.04 % x TD

6) 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 % x TD

Deviation for version 4 ... 20 mA/HART - Pt 100[7]

Applies to **digital** HART interface as well as to **analogue** current output 4 ... 20 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	< 0.2 %
– Turn down > 10 : 1	< 0.04 % x TD

Deviation with version < 0.1 %

– Turn down 1 : 1 up to 5 : 1	< 0.1 %
– Turn down > 10 : 1	< 0.02 % x TD

Influence of the product or ambient temperature

Applies to **digital** HART interface as well as to **analogue** current output 4 ... 20 mA. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

Average temperature coefficient of the zero signal

In the compensated temperature range of 0 ... +80 °C (+32 ... +176 °F), reference temperature 20 °C (68 °F).

Average temperature coefficient of the zero signal

– Turn down 1 : 1	< 0.05 %/10 K
– Turn down 1 : 1 up to 5 : 1	< 0.1 %/10 K
– Turn down > 10 : 1	< 0.15 %/10 K

Outside the compensated temperature range

Average temperature coefficient of the zero signal

– Turn down 1 : 1	typ. < 0.05 %/10 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 ... 20 mA. Specifications refer to the set span. Turn down (TD) is the relation nominal measuring range/set span.

Long-term drift of the zero signal	< (0.1 % x TD)/year

Ambient conditions

Ambient temperature

– Connection cable PE	-40 ... +60 °C (-40 ... +140 °F)
– Connection cable PUR, FEP	-40 ... +85 °C (-40 ... +185 °F)
Storage and transport temperature	-20 ... +80 °C (-4 ... +176 °F)

Process conditions

Process pressure

Max. process pressure, transmitter[8]

– Measuring range 0.1 bar (1.45 psig)	15 bar (218 psig)
– Measuring range 0.2 bar (2.9 psig)	20 bar (290 psig)
– Measuring range ≤ 0.4 bar (5.8 psig)	25 bar (363 psig)

Pressure stage, process fitting

– Unassembled screw connection	316L: PN 3, PVDF: unpressurized
– Thread on the housing	PN 3

Product temperature, depending on the version

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[7] Determined according to the limit point method according to IEC 60770, incl. non-linearity, hysteresis and non-repeatability.
[8] Limited by the overpressure resistance of the measuring cell.

Suspension cable	Transmitter	Product temperature
PE	All	-20 ... +60 °C (-4 ... +140 °F)
PUR	All	-20 ... +80 °C (-4 ... +176 °F)
PUR	PE coating	-20 ... +60 °C (-4 ... +140 °F)
FEP	All	-20 ... +80 °C (-4 ... +176 °F)
FEP	PE coating	-20 ... +60 °C (-4 ... +140 °F)

Vibration resistance — mechanical vibrations with 4 g and 5 ... 100 Hz[9)]

Electromechanical data

Suspension cable
- Configuration — six wires, one suspension cable, one breather capillary, screen braiding, foil, mantle
- Tensile strength — ≥ 1200 N (270 pound force)
- Max. length — 1000 m (3280 ft)
- Min. bending radius — 25 mm (with 25 °C/77 °F)
- Diameter approx. — 8 mm (0.315 in)
- colour (non-Ex/Ex) - PE — black/blue
- colour (non-Ex/Ex) - PUR, FEP — blue/blue

Cable entry housing or VEGABOX 02 — 1 x cable gland M20 x 1.5 (cable: ø 5 ... 9 mm), 1 x blind stopper M20 x 1.5

Screw terminals — for wire cross section 1.5 mm² (AWG 16), screen up to 4 mm² (AWG 12)

Supply voltage - 4 ... 20 mA

Operating voltage — 8 ... 36 V DC

Permissible residual ripple
- < 100 Hz — U_{ss} < 1 V
- 100 Hz ... 10 kHz — U_{ss} < 10 mV

Load — see diagram

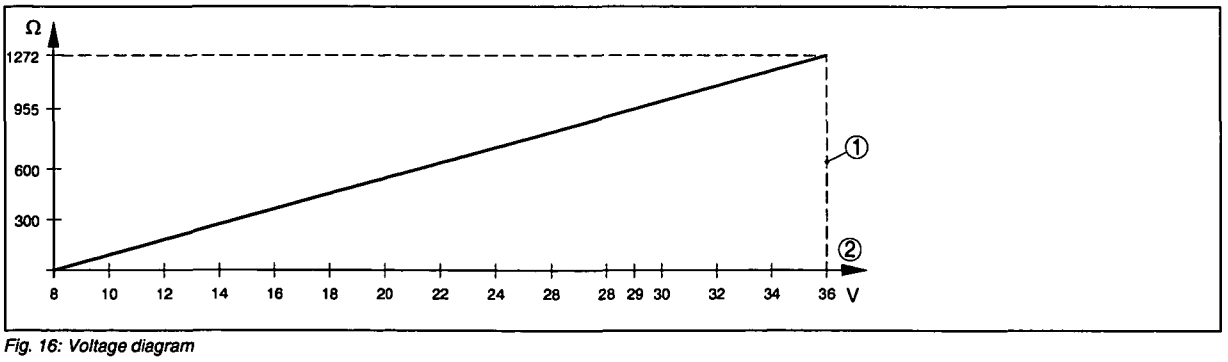

Fig. 16: Voltage diagram

1 Voltage limit
2 Operating voltage

Supply voltage - 4 ... 20 mA/HART - Pt 100

Operating voltage — 9.6 ... 36 V DC

Permissible residual ripple
- < 100 Hz — U_{ss} < 1 V
- 100 Hz ... 10 kHz — U_{ss} < 10 mV

Load — see diagram

9) Tested according to the regulations of German Lloyd, GL directive 2.

35400-EN-090130

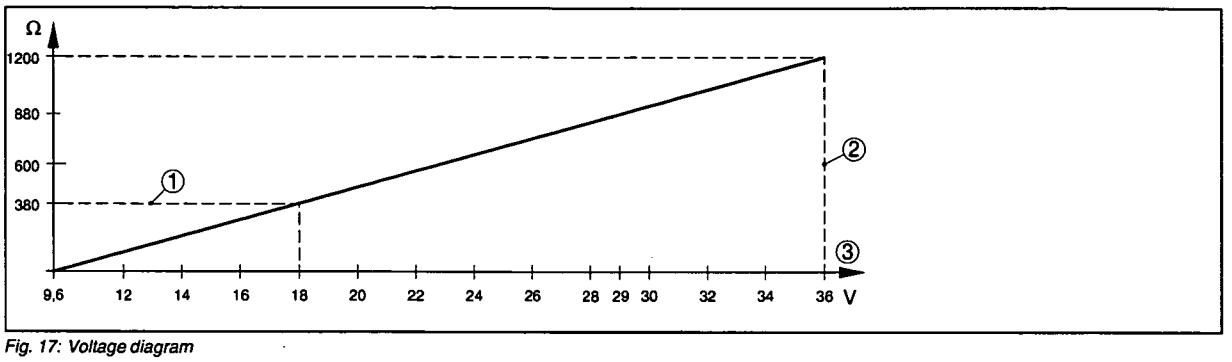

Fig. 17: Voltage diagram

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)	EN 61326-1: 2006
LVD (2006/95/EG)	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.

35400-EN-090130

7 Dimensions

VEGAWELL 52 - suspension cable 1

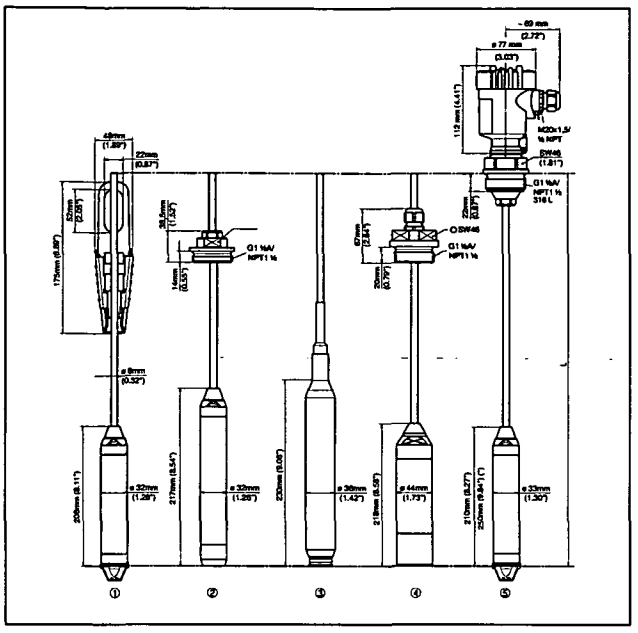

Fig. 18: VEGAWELL 52 - suspension cable

1 *Transmitter Duplex, with straining clamp*
2 *Transmitter Duplex for deep wells, with unassembled screw connection G1½ A (1½ NPT) and closing cap*
3 *Transmitter Duplex, with PE coating*
4 *Transmitter with screwed connection of PVDF*
5 *Transmitter Titanium/Titanium with glass leadthrough, with thread G1 A (1 NPT) and plastic housing*

VEGAWELL 52 - suspension cable 2

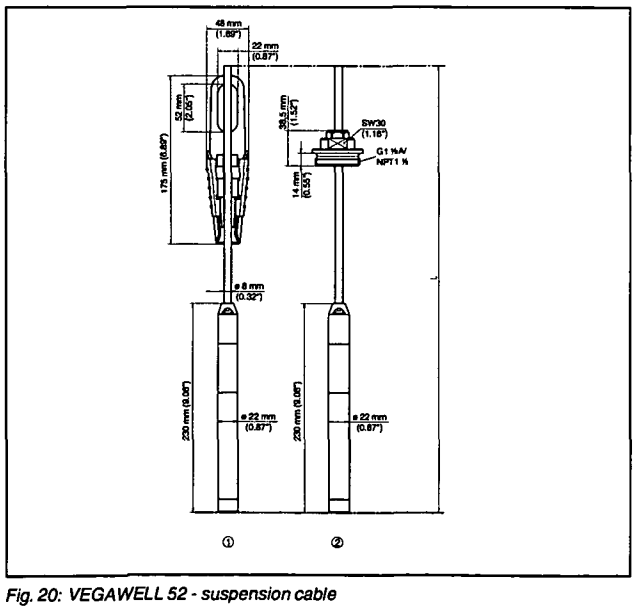

Fig. 20: VEGAWELL 52 - suspension cable

1 *Transmitter 316L, with straining clamp*
2 *Transmitter Titanium, with unassembled screw connection G1 A (1 NPT)*

VEGAWELL 52 - threaded fitting

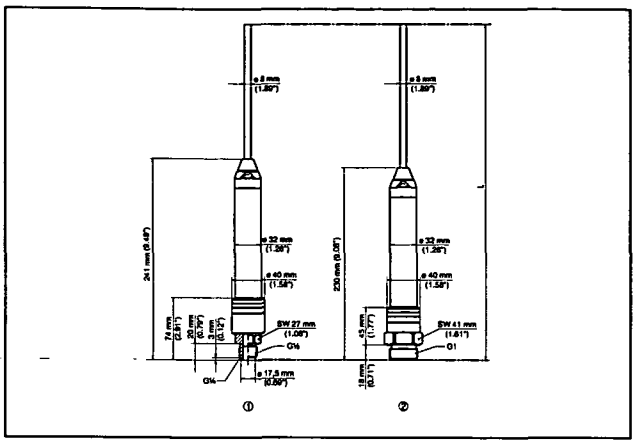

Fig. 22: VEGAWELL 52 - thread

1 *Threaded fitting G½ inner G¼*
2 *Threaded fitting G1*

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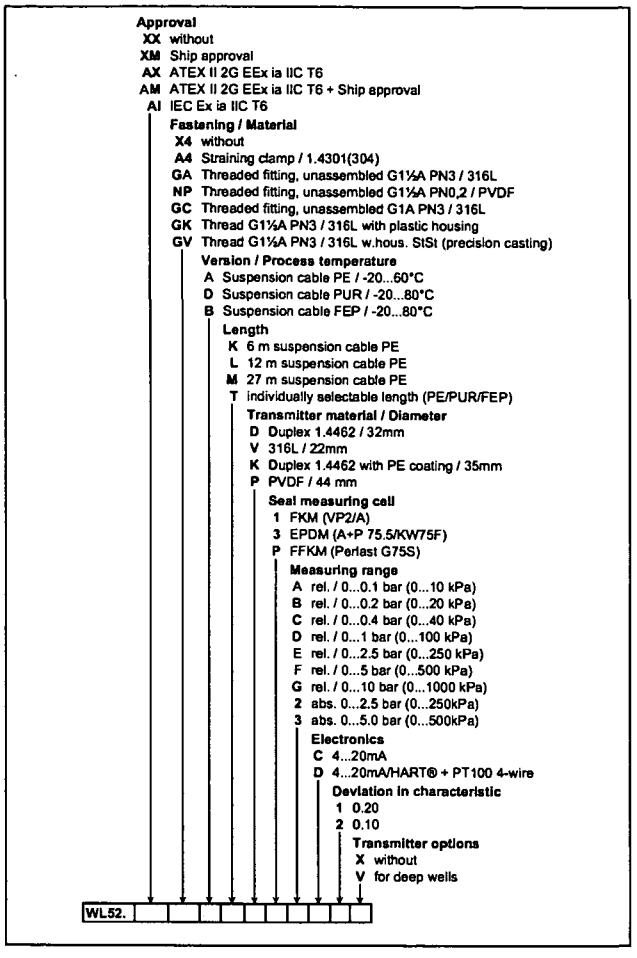
8 Product code

VEGAWELL 52



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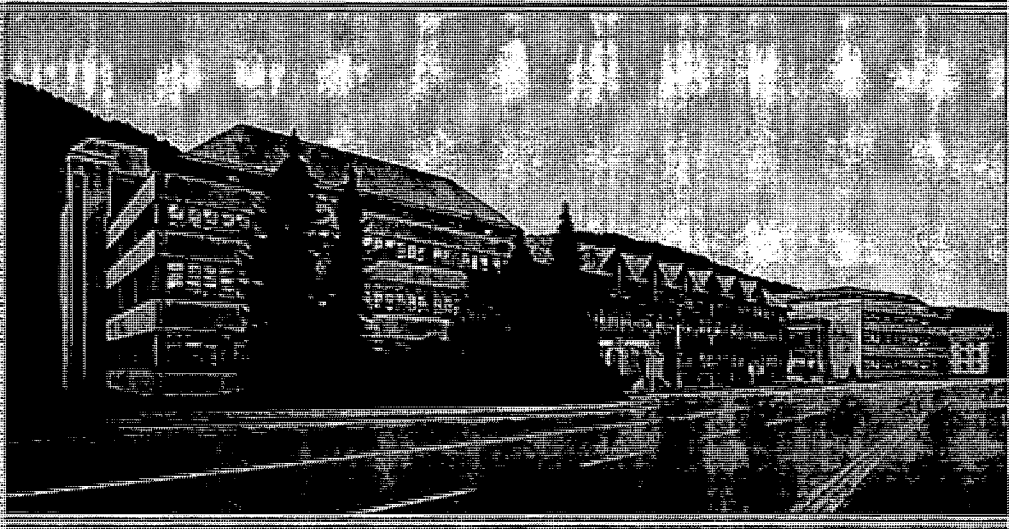

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www.vega.com

You can find at **www.vega.com** downloads of the following

- operating instructions manuals
- menu schematics
- software
- certificates
- approvals

and much, much more

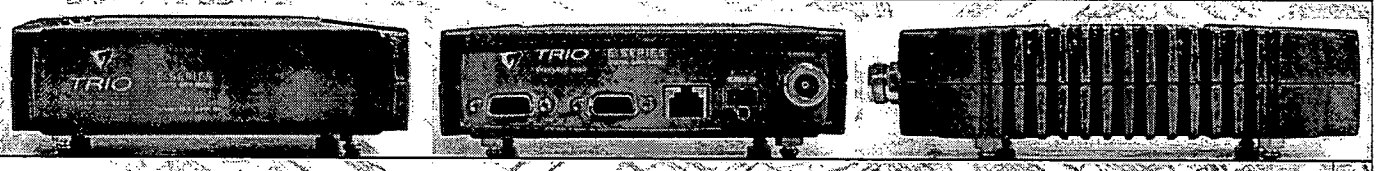
Subject to change without prior notice

35400-EN-090130

TRIO DATACOM

Remote Data Radio - ER450

E Series - Generation II



Introduction

The Trio DataCom ER450 is an advanced high speed digital data radio modem designed for the most complex and demanding requirements in both Point-to-Point and Point-to-Multipoint (Multiple Address Radio) SCADA and Telemetry systems.

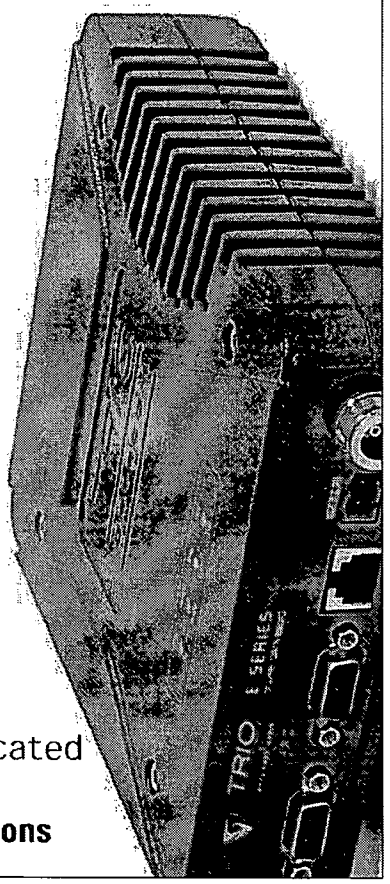
Normally used as a half duplex high performance Remote Data Radio for communicating with the full duplex EB450 Base/Repeater or EH450 Redundant 1+1 Base/Repeater stations, the versatile ER450 also serves as a low cost full duplex base/repeater or point-to-point-link station in both TRIO E Series and M Series data radio systems with the addition of the ERFD450 option, and can provide network management access for remote diagnostics in either of these systems.

Features

Radio and Modem
- True 19,200 bps over-air data rates in 12.5kHz FCC channels (also 9600 bps) - Fully integrated radio, modem and data multiplexer
- 128-bit AES encryption (export restrictions may apply)
- 12.5 or 25kHz channel operation
- Fast data turnaround
- Simplex, Half Duplex and Full Duplex (Full Duplex with ERFD450 option)
- Compatible with legacy systems (Non Packet Digital and Bell 202 Modes)
- Full specification operation from -30 to + 60C
- Hazardous Environment Certification - Class I, Division II (Groups A,B,C and D)
- Compact, rugged diecast alloy housing
- Low power consumption with sleep mode operation
- Field upgradeable firmware
- Multi-function LED Display
- Digital orderwire option
- VSWR protection

Network Management Remote Diagnostic option
(In conjunction with TView+™ Software)
- Remote fully transparent Network Management and Diagnostics
- Network wide operation from any radio modem
- Full SCADA style features such as database, trending and networking
- Over-the-air modem reconfiguration
- Full graphical presentation (HMI)

Data Ports
- Dual independent configurable data ports and separate system port
- Compatible with most industry standard data protocols: eg: MODBUS, DNP-3, IEC 870, SEL Mirrored Bits, etc.
- Selectable 300 -57.6 k bps asynchronous RS-232 interface
- Multistream™ simultaneous data streams allow for multiple vendor devices/protocols to be transported on the one radio network
- Flexible data stream routing providing optimum radio channel efficiency
- Internal repeater operation - single radio store and forward
- Channelshare™ unique integrated C/DSMA collision avoidance technology permits simultaneous polling and spontaneous alarm reporting operation in the same system

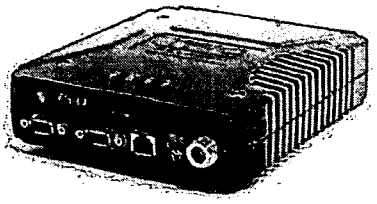


Note : Not all product features are available in every mode of operation.

Innovative and sophisticated
digital communications
designs product s and solutions

Remote Data Radio - ER450

E Series - Generation II



Radio

Frequency Range: 370-520 MHz (various sub-frequency bands available)

Frequency Splits: Various Tx/Rx frequency splits - programmable

Channel Selection: Dual synthesizer, 6.25 kHz channel step

Channel Spacing: 12.5 or 25 kHz

Frequency Accuracy: ±1ppm (-30 to +60C) (-22 to 140F) ambient

Aging: <= 1ppm/annum

Operational Modes: Simplex, Half duplex or Full duplex*

Configuration: All configuration via Windows based software

Compliances:

ETSI	EN300113, EN301489, EN60950
FCC	PART 15, PART 90
IC	RS119, ICES-001
ACA	AS4295-1995 (Data)
CSA	Class I, Division II, Groups (A,B,C,D) for Hazardous Locations ANSI/UL equivalent)

Transmitter

Tx Power: 0.05 - 5W (+37 dBm) 1 dB User configurable with over-temperature and reverse power protection

Modulation: User configurable narrow band digitally filtered binary GMSK or 4 level FSK

Tx Keyup Time: <1mS

Timeout Timer: Programmable 0-255 seconds

Tx Spurious: <= -37 dBm

PTT Control: Auto (Data) / RTS line (Port A or B) / System Port Override

Receiver

Sensitivity: -118 dBm for 12 dB SINAD

Selectivity: Better than 60 dB

Intermodulation: Better than 70 dB

Spurious Response: Better than 70 dB

AFC Tracking: Digital receiver frequency tracking

Mute: Programmable digital mute

Diagnostics (Optional)

Network wide operation from any remote terminal.

Non intrusive protocol - runs simultaneously with the application.

Over-the-air re-configuration of user parameters.

Storage of data error and channel occupancy statistics.

In-built Error Rate testing capabilities.

Connections

User Data Ports: 2 x DB9 female ports wired as DCE (modem)

System Port: RJ45 for diagnostic, configuration and re-programming

Antenna: N female bulkhead. Separate N (Tx) and SMA (Rx) connectors for full duplex.*

Power: 2 pin locking, mating connector supplied

LED Display: Multimode Indicators for Pwr, Tx, Rx, Sync, TxD and RxD data LEDs (for both port A and B)

Modem

Data Serial Port A: RS232, DCE, 600-57,600 bps asynchronous

Data Serial Port B: RS232, DCE, 300-38,400 bps asynchronous

System Port: RS232, 19,200 bps asynchronous

Flow Control: Selectable hardware / software / 3 wire interface

RF Channel Data Rate: 4800/9600/19,200 bps Half / Full duplex*

Data Buffer: 16 kbyte of on-board RAM

Bit Error Rate:
< $1x10^{-6}$ @ -110 dBm (4800 bps)
< $1x10^{-6}$ @ -108 dBm (9600 bps)
< $1x10^{-6}$ @ -106 dBm (19,200 bps)

Encryption: 128-bit AES encryption

Collision Avoidance: Trio DataCom's unique supervisory Channelshare™ collision avoidance system

Multistream™: Trio DataCom unique simultaneous delivery of multiple data streams (protocols)

Data Turnaround Time: <10mS

Firmware: Field upgradeable Flash memory

General

Power Supply: 13.8 Vdc nominal (10-16 Vdc)

Transmit Current: 750 mA nom. @ 1 W
1600 mA nom. @5 W

Receive Current: <125 mA nom

Sleep Mode: External control, < 1 mA

Dimensions: Rugged Diecast Enclosure
170 x 150 x 42mm
6.7 x 5.9 x 1.65 inches
With Mounting Plate
190 x 150 x 47mm
7.5 x 5.9 x 1.85 inches

Mounting: Fitted Mounting Plate

Weight: 1.27 kg (2.8lbs.)

Options

ERFD450 Full Duplex Operation with separate N (Tx) and SMA (Rx) connectors

DUPLX450BR External Duplexer, Band Reject (for single antenna operation)

EDOVM Digital Order Wire Voice Module

NEMA 4/R Stainless Steel Enclosure (IP65, NEMA 4 rated)

TVIEW+™ Configuration, Network Management and Diagnostic Windows GUI Software

DIAGS/E Network Management and Remote Diagnostics Facilities per Radio Modem

Related Products

EB450 Base Station

EH450 Hot Standby Base Station

MSR/9 Port Stream Router Multiplexer

MR450 Remote Data Radio

* With ERFD450 full duplex option plus external duplexer for single antenna operation

Local regulatory conditions may determine the performance and suitability of individual versions in different countries. It is the responsibility of the buyer to confirm these regulatory conditions. Performance data indicates typical values related to the described unit.

Note : Not all product features are available in every mode of operation.

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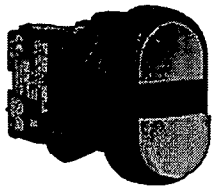
Toll Free 866 844 8746 (TRIO)
sales-na@triodatacom.com www.triodatacom.com

sprecher+schuh

D7 Multi-function momentary pushbuttons and potentiometers 22.5 mm
Complete

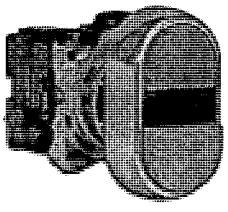
2

Multi-function operators with contact blocks



D7P-U2E4F3-PX11

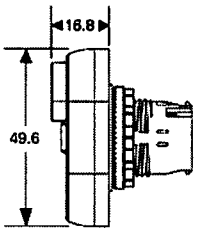
Time saving	■ Central nut fixing
	■ Snap fitting of components
Space efficient	■ 2 or 3 functions in a minimum of space
	■ Single 22.5 mm hole mounting
Economical	■ Negates the need for 3 separate devices
	■ Less mounting time
Flexible	■ Uses standard D7 rear elements
	■ 2 contact levels possible
	■ Choice of plastic or metal body
	■ IP 66 protection



D7M-U2E4F3-MX11

Dual pushbuttons

Description	Contact	Plastic body Cat. No.	Price $	Metal body Cat. No.	Price $
Momentary operation Blank inserts (Red/Green)	1 N/O, 1 N/C	D7P-U2E4F3-PX11	66.50	D7M-U2E4F3-MX11	73.50
O-I (Red/Green)	1 N/O, 1 N/C	D7P-UZEFFE-PX11	70.00	D7M-UZEFFE-MX11	73.50



Potentiometer

- Supplied as operator only or with resistive elements
- Thermoplastic body

D7P-POT

Description	Plastic body Cat. No. [1]	Price $
Operator without resistive element	D7P-POT	117.00
Operator with 1000 Ω resistive element	D7P-POT3	163.00
Operator with 5000 Ω resistive element	D7P-POT5	163.00
Operator with 10000 Ω resistive element	D7P-POT6	163.00

Notes: [1]) For technical information and spare resistive element refer page 2 - 47.
Accessories refer page 2 - 34.

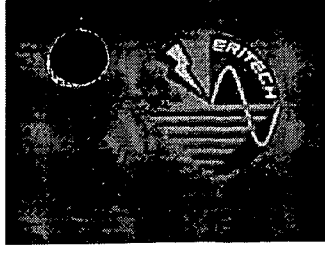
Price Schedule 'A2'

GST not included

ERITECH

Features

- RJ11 sockets – simple plug-in connection for 4 or 6 position RJ plugs
- 6.5" patch cord included – no additional cables required
- SLP RJ11 is UL® 497A Listed
- L-L & L-G protection – for comprehensive protection
- Automatic over-current protection

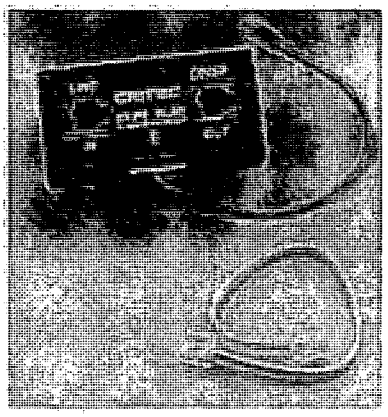


SLP

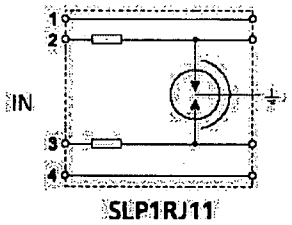
CRITEC® RJ11 Telephone Line Protection

The SLP1 RJ11 series of surge suppressors provide protection to telecommunication equipment connecting via RJ11 plugs. Designed for traditional (2 wire) telephone circuits, the product is also compatible with modems and ADSL circuits.

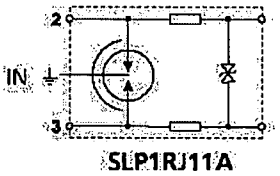
The SLP1 RJ11 is a UL Listed secondary protector intended for use in facilities where primary protective devices have been installed at the service entrance. The SLP1 RJ11A is a high-energy multi-stage primary protector intended for non UL applications where higher surge ratings are required.



Model	SLP1RJ11	SLP1RJ11A
Max Cont. Operating Voltage, U_c	<280V	
Max Discharge Current, I_{max}	500A 8/20µs	20kA 8/20µs
Dimensions H x D x W: mm (in)	38 x 28 x 76 (1.50 x 1.10 x 2.99)	
Weight: g (lbs)	50 (0.11)	
Connection	150 mm (6") 0.8 mm² (#18AWG) with earth 4 mm ring lug 165 mm (6.5") patch cord included 6 position RJ, 2 pins protected	
Mounting	Adhesive backing	
Approvals	UL®	A-Tick
Voltage Protection Level, U_p	110V T-R 500V @ 125A (T+R)-G	
Max Line Current, I_L	160 mA	120 mA
Temperature	-40°C to 65°C (-40°F to 149°F)	



SLP1RJ11



SLP1RJ11A

www.erico.com

ERICO®

E7135-WWEN E802LT07WWEN 0088.6M8

7.7 VARIABLE SPEED DRIVE

- DANFOS – FC202P75KT4E21H1
- DANFOSS – 130B1117 – EXTERNAL KEYPAD KIT

Contents

1. How to Read these Operating Instructions

1

1.1.1. Copyright, Limitation of Liability and Revision Rights

This publication contains information proprietary to Danfoss. By accepting and using this manual the user agrees that the information contained herein will be used solely for operating equipment from Danfoss or equipment from other vendors provided that such equipment is intended for communication with Danfoss equipment over a serial communication link. This publication is protected under the Copyright laws of Denmark and most other countries.

Danfoss does not warrant that a software program produced according to the guidelines provided in this manual will function properly in every physical, hardware or software environment.

Although Danfoss has tested and reviewed the documentation within this manual, Danfoss makes no warranty or representation, neither expressed nor implied, with respect to this documentation, including its quality, performance, or fitness for a particular purpose.

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Danfoss reserves the right to revise this publication at any time and to make changes to its contents without prior notice or any obligation to notify former or present users of such revisions or changes.

1

These Operating Instructions will introduce all aspects of your VLT AQUA Drive.

Available literature for VLT AQUA Drive:

- Operating Instructions MG.20.MX.YY provide the neccessary information for getting the drive up and running.
- Design Guide MG.20.NX.YY entails technical information about the drive design and customer applications.
- Programming Guide MG.20.OX.YY provides information on how to programme and includes complete parameter descriptions.

X = Revision number

YY = Language code

Danfoss Drives technical literature is also available online at www.danfoss.com/BusinessAreas/DrivesSolutions/Documentations/Technical+Documentation.

1.1.2. Approvals

CE c UL us

1.1.3. Symbols

Symbols used in these Operating Instructions.

NB!
Indicates something to be noted by the reader.

Indicates a general warning.

Indicates a high-voltage warning.

* Indicates default setting

2. Safety

2.1.1. Safety note

The voltage of the frequency converter is dangerous whenever connected to mains. Incorrect installation of the motor, frequency converter or fieldbus may cause damage to the equipment, serious personal injury or death. Consequently, the instructions in this manual, as well as national and local rules and safety regulations, must be complied with.

Safety Regulations

1. The frequency converter must be disconnected from mains if repair work is to be carried out. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
2. The [STOP/RESET] key on the control panel of the frequency converter does not disconnect the equipment from mains and is thus not to be used as a safety switch.
3. Correct protective earthing of the equipment must be established, the user must be protected against supply voltage, and the motor must be protected against overload in accordance with applicable national and local regulations.
4. The earth leakage currents are higher than 3.5 mA.
5. Protection against motor overload is set by par. 1-90 *Motor Thermal Protection*. If this function is desired, set par. 1-90 to data value [ETR trip] (default value) or data value [ETR warning]. Note: The function is initialised at 1.16 x rated motor current and rated motor frequency. For the North American market: The ETR functions provide class 20 motor overload protection in accordance with NEC.
6. Do not remove the plugs for the motor and mains supply while the frequency converter is connected to mains. Check that the mains supply has been disconnected and that the necessary time has passed before removing motor and mains plugs.
7. Please note that the frequency converter has voltage inputs other than L1, L2 and L3, when load sharing (linking of DC intermediate circuit) and external 24 V DC have been installed. Check that all voltage inputs have been disconnected and that the necessary time has passed before commencing repair work.

Installation at High Altitudes

By altitudes above 2 km, please contact Danfoss regarding PELV.

Warning against Unintended Start

1. The motor can be brought to a stop by means of digital commands, bus commands, references or a local stop, while the frequency converter is connected to mains. If personal safety considerations make it necessary to ensure that no unintended start occurs, these stop functions are not sufficient. 2. While parameters are being changed, the motor may start. Consequently, the stop key [STOP/RESET] must always be activated; following which data can be modified. 3. A motor that has been stopped may start if faults occur in the electronics of the frequency converter, or if a temporary overload or a fault in the supply mains or the motor connection ceases.

Warning:
Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.

Also make sure that other voltage inputs have been disconnected, such as external 24 V DC, load sharing (linkage of DC intermediate circuit), as well as the motor connection for kinetic back up.

2.1.2. General Warning

Warning:
Touching the electrical parts may be fatal - even after the equipment has been disconnected from mains.
Also make sure that other voltage inputs have been disconnected, (linkage of DC intermediate circuit), as well as the motor connection for kinetic back-up.
Before touching any potentially live parts of the VLT AQUA Drive FC 200, wait at least as follows:
200 - 240 V, 0.25 - 3.7 kW: wait at least 4 minutes.
200 - 240 V, 5.5 - 45 kW: wait at least 15 minutes.
380 - 480 V, 0.37 - 7.5 kW: wait at least 4 minutes.
380 - 480 V, 11 - 90 kW, wait at least 15 minutes.
525 - 600 V, 1.1 - 7.5 kW, wait at least 4 minutes.
525 - 600 V, 110 - 250 kW, wait at least 20 minutes.
525 - 600 V, 315 - 560 kW, wait at least 30 minutes.
Shorter time is allowed only if indicated on the nameplate for the specific unit.

Leakage Current
The earth leakage current from the VLT AQUA Drive FC 200 exceeds 3.5 mA. According to IEC 61800-5-1 a reinforced Protective Earth connection must be ensured by means of: a min. 10mm² Cu or 16mm² Al PE-wire or an addtional PE wire - with the same cable cross section as the Mains wiring - must be terminated separately.
Residual Current Device
This product can cause a D.C. current in the protective conductor. Where a residual current device (RCD) is used for extra protection, only an RCD of Type B (time delayed) shall be used on the supply side of this product. See also RCD Application Note MN.90.GX.02.
Protective earthing of the VLT AQUA Drive FC 200 and the use of RCD's must always follow national and local regulations.

2.1.3. Before Commencing Repair Work

1. Disconnect the frequency converter from mains
2. Disconnect DC bus terminals 88 and 89
3. Wait at least the time mentioned in section 2.1.2
4. Remove motor cable

2.1.4. Special conditions

Electrical ratings:
The rating indicated on the nameplate of the frequency converter is based on a typical 3-phase mains power supply, within the specified voltage, current and temperature range, which is expected to be used in most applications.

The frequency converters also support other special applications, which affect the electrical ratings of the frequency converter. Special conditions which affect the electrical ratings might be:

- Single phase applications
- High temperature applications which require derating of the electrical ratings
- Marine applications with more severe environmental conditions.

Consult the relevant clauses in these instructions and in the **VLT® AQUA Drive Design Guide** for information about the electrical ratings.

Installation requirements:
The overall electrical safety of the frequency converter requires special installation considerations regarding:

- Fuses and circuit breakers for over-current and short-circuit protection
- Selection of power cables (mains, motor, brake, loadsharing and relay)
- Grid configuration (IT,TN, grounded leg, etc.)
- Safety of low-voltage ports (PELV conditions).

Consult the relevant clauses in these instructions and in the **VLT® AQUA Drive Design Guide** for information about the installation requirements.

2.1.5. Caution

The frequency converter DC link capacitors remain charged after power has been disconnected. To avoid an electrical shock hazard, disconnect the frequency converter from the mains before carrying out maintenance. Wait at least as follows before doing service on the frequency converter:

Voltage	Min. Waiting Time			
	4 min.	15 min.	20 min.	30 min.
200 - 240 V	0.25 - 3.7 kW	5.5 - 45 kW		
380 - 480 V	0.37 - 7.5 kW	11 - 90 kW	110 - 250 kW	315 - 450 kW
525-600 V	0.75 kW - 7.5 kW		110 - 250 kW	315 - 560 kW
525-690 V			45 - 400 kW	450 - 630 kW

Be aware that there may be high voltage on the DC link even when the LEDs are turned off.

2.1.6. Avoid unintended Start

While the frequency converter is connected to mains, the motor can be started/stopped using digital commands, bus commands, references or via the Local Control Panel.

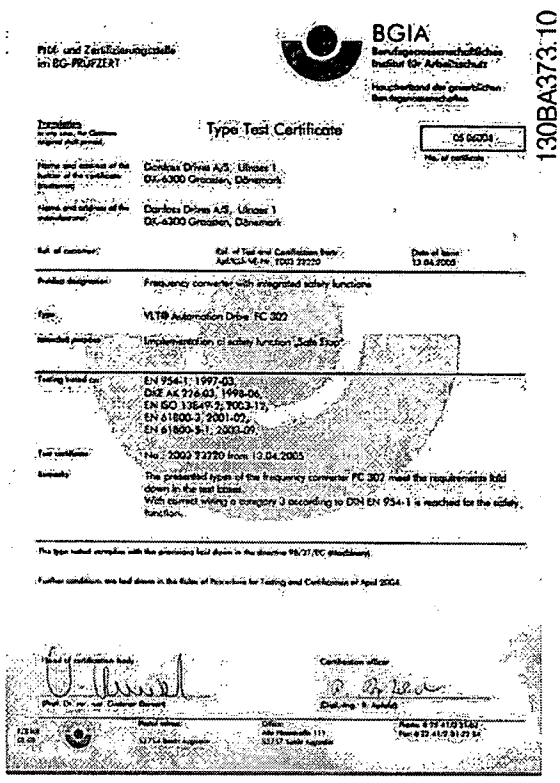
- Disconnect the frequency converter from mains whenever personal safety considerations make it necessary to avoid unintended start.
- To avoid unintended start, always activate the [OFF] key before changing parameters.
- Unless terminal 37 is turned off, an electronic fault, temporary overload, a fault in the mains supply, or lost motor connection may cause a stopped motor to start.

2.1.7. Safe Stop of the Frequency Converter (optional)

For versions fitted with a Safe Stop terminal 37 input, the frequency converter can perform the safety function *Safe Torque Off* (As defined by draft CD IEC 61800-5-2) or *Stop Category 0* (as defined in EN 60204-1).

It is designed and approved suitable for the requirements of Safety Category 3 in EN 954-1. This functionality is called Safe Stop. Prior to integration and use of Safe Stop in an installation, a thorough risk analysis on the installation must be carried out in order to determine whether the Safe Stop functionality and safety category are appropriate and sufficient. In order to install and use the Safe Stop function in accordance with the requirements of Safety Category 3 in EN 954-1, the related information and instructions of the VLT AQUA Drive Design Guide MG.20.NX.YY must be followed! The information and instructions of the Operating Instructions are not sufficient for a correct and safe use of the Safe Stop functionality!

2



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BGIA

Type Test Certificate

05 06704

Danfoss Drives A/S, Ulsnaes 1
DK-6300 Graasten, Denmark

Danfoss Drives A/S, Ulsnaes 1
DK-6300 Graasten, Denmark

Frequency converter with integrated safety functions

VLT® Automation Drive FC 302

Implementation of safety function "Safe Stop"

EN 954-1: 1997-03,
DGZ AK 226.03, 1998-06,
EN ISO 13849-2: 2003-12,
EN 61800-3: 2001-07,
EN 61800-5-1: 2003-09

No. 2005 72720 from 13.04.2005

The presented types of the frequency converter FC 302 meet the requirements laid down in the test bases.
With correct wiring a category 3 according to DIN EN 954-1 is reached for the safety function.

2.1.8. IT Mains

IT Mains

Do not connect 400 V frequency converters with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V.

For IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.

par. 14-50 RFI *Filter* can be used to disconnect the internal RFI capacitiors from the RFI filter to ground. If this is done it will reduce the RFI performance to A2 level.

2.1.9. Software Version and Approvals

VLT AQUA Drive

Software version: 1.24

This manual can be used with all VLT AQUA Drive frequency converters with software version 1.24.

The software version number can be found in parameter 15-43.

2.1.10. Disposal Instruction

Equipment containing electrical components must not be disposed of together with domestic waste.
It must be separately collected with electrical and electronic waste according to local and currently valid legislation.

2

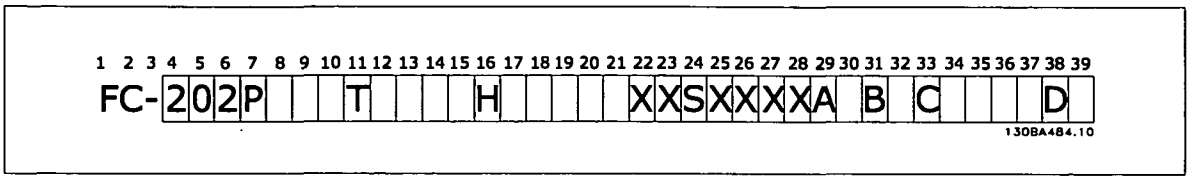
3

3. Introduction

3.1. Introduction

3.1.1. Type Code String

3



Description	Pos	Possible choice
Product group & VLT Series	1-6	FC 202
Power rating	8-10	0.25 - 630 kW
Number of phases	11	Three phases (T)
Mains voltage	11-12	S2: 220-240 VAC single phase S4: 380-480 VAC single phase T 2: 200-240 VAC T 4: 380-480 VAC T 6: 525-600 VAC T 7: 525-690 VAC
Enclosure	13-15	E20: IP20 E21: IP 21/NEMA Type 1 E55: IP 55/NEMA Type 12 E2M: IP21/NEMA Type 1 w/mains shield E5M: IP 55/NEMA Type 12 w/mains shield E66: IP66 F21: IP21 kit without backplate G21: IP21 kit with backplate P20: IP20/Chassis with backplate P21: IP21/NEMA Type 1 w/backplate P55: IP55/NEMA Type 12 w/backplate
RFI filter	16-17	HX: No RFI filter H1: RFI filter class A1/B H2: RFI filter class A2 H3: RFI filter class A1/B (reduced cable length) H4: RFI filter class A2/A1
Brake	18	X: No brake chopper included B: Brake chopper included T: Safe Stop U: Safe + brake
Display	19	G: Graphical Local Control Panel (GLCP) N: Numeric Local Control Panel (NLCP) X: No Local Control Panel
Coating PCB	20	X: No coated PCB C: Coated PCB
Mains option	21	D: Loadsharing X: No Mains disconnect switch 1: With Mains disconnect switch 8: Mains Disconnect + Loadsharing
Adaptation	22	Reserved
Adaptation	23	Reserved
Software release	24-27	Actual software
Software language	28	
A options	29-30	AX: No options A0: MCA 101 Profibus DP V1 A4: MCA 104 DeviceNet
B options	31-32	BX: No option BK: MCB 101 General purpose I/O option BP: MCB 105 Relay option BO:MCB 109 Analog I/O option
C0 options MCO	33-34	CX: No options
C1 options	35	X: No options
C option software	36-37	XX: Standard software
D options	38-39	DX: No option D0: DC back-up
The various options are described further in the *VLT AQUA Drive Design Guide*.		

Table 3.1: Type code description.

3.1.2. Frequency Converter Identification

Below is an example of an identification label. This label is situated on the frequency converter and shows the type and options fitted to the unit. See table 2.1 for details of how to read theType code string (T/C).

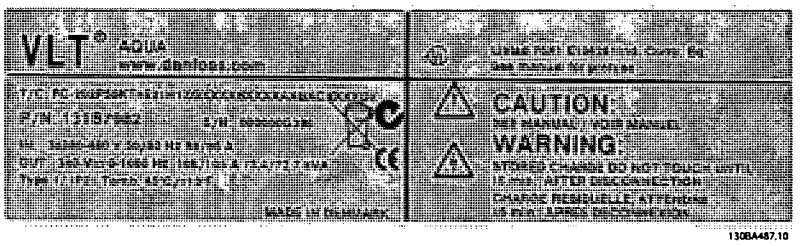


Illustration 3.1: This example shows an identification label for VLT AQUA Drive.

Please have T/C (type code) number and serial number ready before contacting Danfoss.

3.1.3. Abbreviations and Standards

Abbreviations:	Terms:	SI-units:	I-P units:
	Acceleration	m/s^2	ft/s^2
AWG	American wire gauge		
Auto Tune	Automatic Motor Tuning		
°C	Celsius		
	Current	A	Amp
I_{LIM}	Current limit		
	Energy	J = N•m	ft-lb, Btu
°F	Fahrenheit		
FC	Frequency Converter		
	Frequency	Hz	Hz
kHz	Kilohertz		
LCP	Local Control Panel		
mA	Milliampere		
ms	Millisecond		
min	Minute		
MCT	Motion Control Tool		
M-TYPE	Motor Type Dependent		
Nm	Newton Metres		in-lbs
$I_{M,N}$	Nominal motor current		
$f_{M,N}$	Nominal motor frequency		
$P_{M,N}$	Nominal motor power		
$U_{M,N}$	Nominal motor voltage		
par.	Parameter		
PELV	Protective Extra Low Voltage		
	Power	W	Btu/hr, hp
	Pressure	$Pa = N/m^2$	psi, psf, ft of water
I_{INV}	Rated Inverter Output Current		
RPM	Revolutions Per Minute		
SR	Size Related		
	Temperature	C	F
	Time	s	s,hr
T_{LIM}	Torque limit		
	Voltage	V	V

Table 3.2: Abbreviation and Standards table .

4. Mechanical installation

4.1. Before starting

4.1.1. Checklist

When unpacking the frequency converter, ensure that the unit is undamaged and complete. Use the following table to identify the packaging:

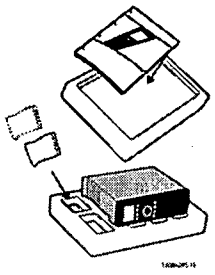
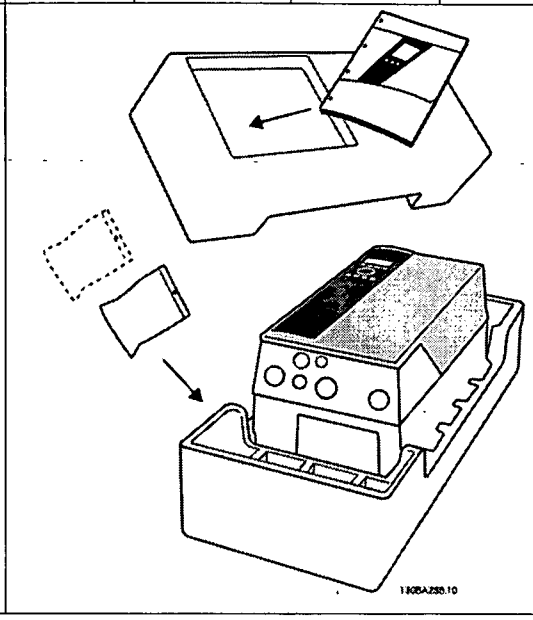
Enclosure type:	A2 (IP 20/ 21)	A3 (IP 20/21)	A5 (IP 55/ 66)	B1/B3 (IP20/ 21/ 55/ 66)	B2/B4 (IP20/ 21/ 55/66)	C1/C3 (IP20/21/ 55/66)	C2/C4 (IP20/21/ 55/66)
							
Unit size (kW):							
200-240 V	0.25-3.0	3.7	0.25-3.7	5.5-11/ 5.5-11	15/ 15-18.5	18.5-30/ 22-30	37-45/ 37-45
380-480 V	0.37-4.0	5.5-7.5	0.37-7.5	11-18.5/ 11-18.5	22-30/ 22-37	37-55/ 45-55	75 - 90/ 75-90
525-600 V	0.75-4.0	5.5-7.5	0.75-7.5	11-18.5/ 11-18.5	22-37/ 22-37	45-55/ 45-55	75 - 90/ 75-90

Table 4.1: Unpacking table

Please note that a selection of screwdrivers (philips or cross-thread screwdriver and torx), a side-cutter, drill and knife is also recommended to have handy for unpacking and mounting the frequency converter. The packaging for these enclosures contains, as shown: Accessories bag(s), documentation and the unit. Depending on options fitted there may be one or two bags and one or more booklets.

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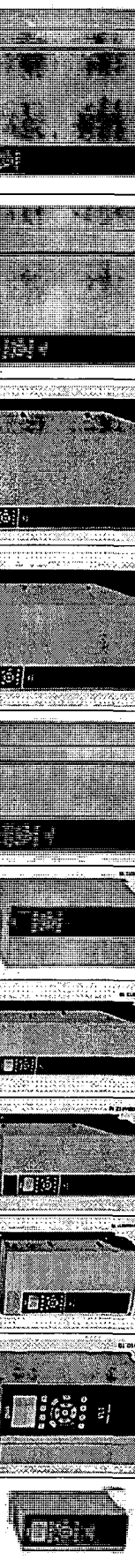
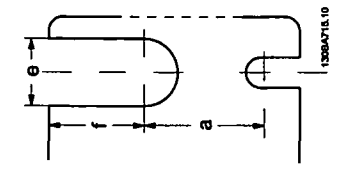
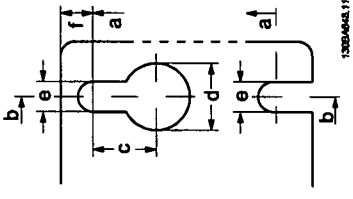
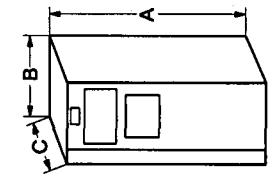
4.2.1. Mechanical Front Views

	A2	A3	A5	B1	B2	B3	B4	C1	C2	C3	C4
	IP20/21	IP20/21	IP55/66	IP21/55/66	IP21/55/66	IP20	IP20	IP21/55/66	IP21/55/66	IP20	IP20
											
											
Top and bottom mounting holes. (C3+C4 only)											
											
											
Accessory bags containing necessary brackets, screws and connectors are included with the drives upon delivery.											

All measurements in mm.
* A5 in IP55/66 only!

4.2.2. Mechanical Dimensions

Mechanical dimensions														
Frame size (kW):		**A2**		**A3**		**A5**	**B1**	**B2**	**B3**	**B4**	**C1**	**C2**	**C3**	**C4**
200-240 V		**0.25-3.0**		**3.7**		**0.25-3.7**	**5.5-11**	**15**	**5.5-11**	**15-18.5**	**18.5-30**	**37-45**	**22-30**	**37-45**
380-480 V		**0.37-4.0**		**5.5-7.5**		**0.37-7.5**	**11-18.5**	**22-30**	**11-18.5**	**22-37**	**37-55**	**75-90**	**45-55**	**75-90**
525-600 V		-		**0.75-7.5**		**0.75-7.5**	**11-18.5**	**22-30**	**11-18.5**	**22-37**	**37-55**	**75-90**	**45-55**	**75-90**
IP NEMA		20 Chassis	21 Type 1	20 Chassis	21 Type 1	55/66 Type 12	21/55/66 Type 1/12	21/55/66 Type 1/12	20 Chassis	20 Chassis	21/55/66 Type 1/12	21/55/66 Type 1/12	20 Chassis	20 Chassis
Height (mm)														
Enclosure	A**	246	372	246	372	420	480	650	350	460	680	770	490	600
..with de-coupling plate	A2	374	-	374	-	-	-	-	419	595	-	-	630	800
Back plate	A1	268	375	268	375	420	480	650	399	520	680	770	550	660
Distance between mount. holes	a	257	350	257	350	402	454	624	380	495	648	739	521	631
Width (mm)														
Enclosure	B	90	90	130	130	242	242	242	165	231	308	370	308	370
With one C option	B	130	130	170	170	242	242	242	205	231	308	370	308	370
Back plate	B	90	90	130	130	242	242	242	165	231	308	370	308	370
Distance between mount. holes	b	70	70	110	110	215	210	210	140	200	272	334	270	330
Depth (mm)														
Without option A/B	C	205	205	205	205	200	260	260	248	242	310	335	333	333
With option A/B	C*	220	220	220	220	200	260	260	262	242	310	335	333	333
Screw holes (mm)														
	c	8.0	8.0	8.0	8.0	8.2	12	12	8	-	12	12	-	-
Diameter ø	d	11	11	11	11	12	19	19	12	-	19	19	-	-
Diameter ø	e	5.5	5.5	5.5	5.5	6.5	9	9	6.8	8.5	9.0	9.0	8.5	8.5
	f	9	9	9	9	9	9	9	7.9	15	9.8	9.8	17	17
Max weight (kg)		4.9	5.3	6.6	7.0	14	23	27	12	23.5	45	65	35	50

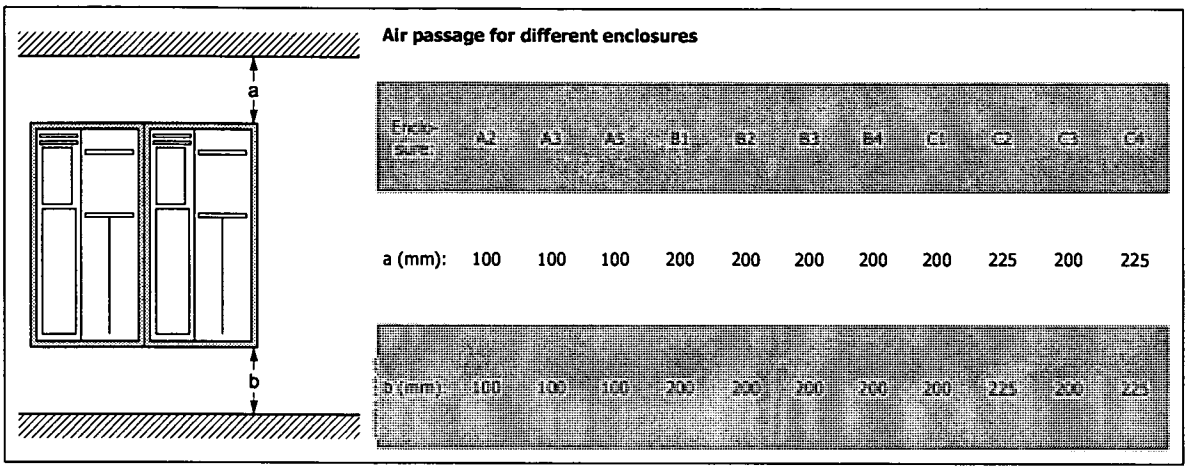
* Depth of enclosure will vary with different options installed.
** The free space requirements are above and below the bare enclosure height measurement A. See section 3.2.3 for further information.

4.2.3. Mechanical mounting

All IP20 enclosure sizes as well as IP21/ IP55 enclosure sizes except A2 and A3 allow side-by-side installation.

If the IP 21 Enclosure kit (130B1122 or 130B1123) is used on enclosure A2 or A3, there must be a clearance between the drives of min. 50 mm.

For optimal cooling conditions allow a free air passage above and below the frequency converter. See table below.



Air passage for different enclosures

Enclosure:	A2	A3	A5	B1	B2	B3	B4	C1	C2	C3	C4
a (mm):	100	100	100	200	200	200	200	200	225	200	225
b (mm):	100	100	100	200	200	200	200	200	225	200	225

1. Drill holes in accordance with the measurements given.
2. You must provide screws suitable for the surface on which you want to mount the frequency converter. Retighten all four screws.

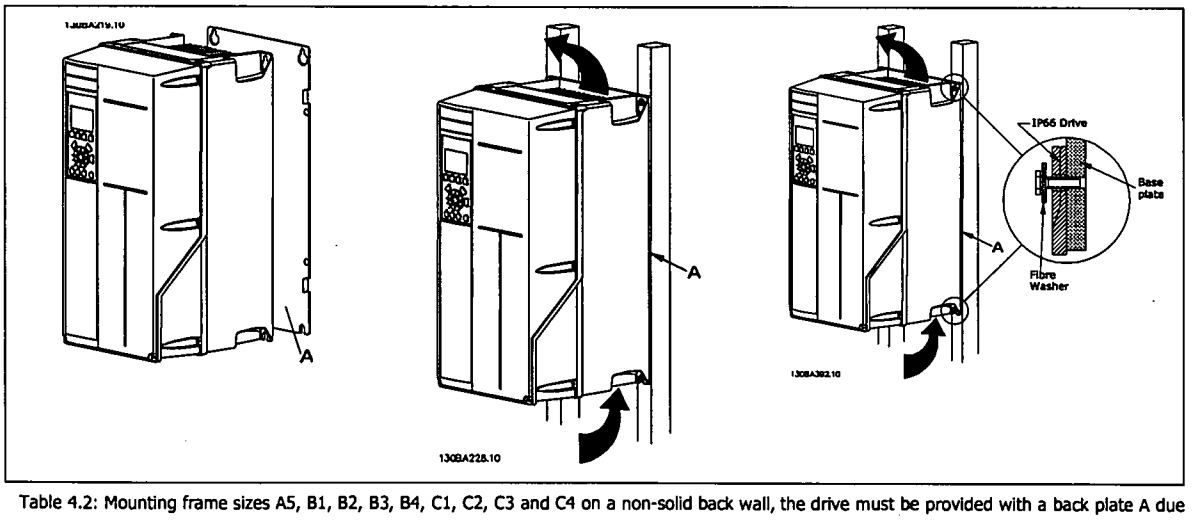


Table 4.2: Mounting frame sizes A5, B1, B2, B3, B4, C1, C2, C3 and C4 on a non-solid back wall, the drive must be provided with a back plate A due to insufficient cooling air over the heat sink.

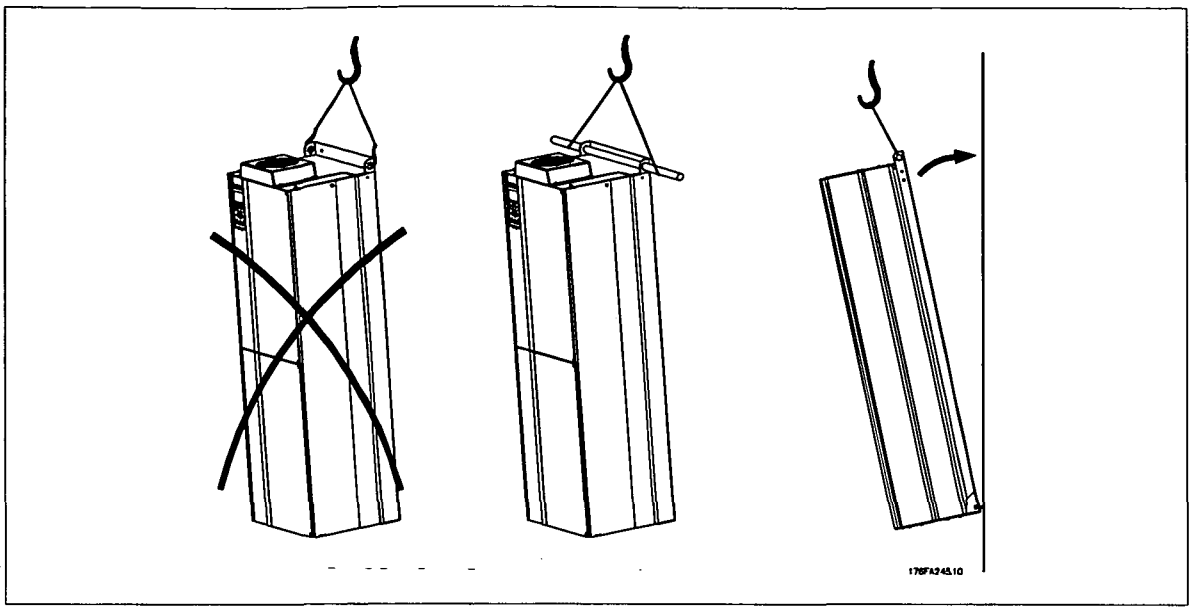


Illustration 4.1: With heavier drives, use a lift. First wall-mount the 2 lower bolts - then lift the drive onto the lower bolts - finally fasten the drive against the wall with the 2 top bolts.

4.2.4. Safety Requirements of Mechanical Installation

Pay attention to the requirements that apply to integration and field mounting kit. Observe the information in the list to avoid serious damage or injury, especially when installing large units.

The frequency converter is cooled by means of air circulation.
To protect the unit from overheating, it must be ensured that the ambient temperature *does not exceed the maximum temperature stated for the frequency converter* and that the 24-hour average temperature *is not exceeded.* Locate the maximum temperature and 24-hour average in the paragraph *Derating for Ambient Temperature.*
If the ambient temperature is in the range of 45 °C - 55 ° C, derating of the frequency converter will become relevant, see *Derating for Ambient Temperature.*
The service life of the frequency converter is reduced if derating for ambient temperature is not taken into account.

4.2.5. Field Mounting

For field mounting the IP 21/IP 4X top/TYPE 1 kits or IP 54/55 units are recommended.

4.2.6. Panel Through Mounting

A Panel Through Mount Kit is available for frequency converter series , VLT Aqua Drive and .

In order to increase heatsink cooling and reduce panel depth, the frequency converter may be mounted in a through panel. Furthermore the in-built fan can then be removed.

The kit is available for enclosures A5 through C2.

NB!
This kit cannot be used with cast front covers. No cover or imminent plastic cover must be used instead.

Information on ordering numbers is found in the *Design Guide*, section *Ordering Numbers*.
More detailed information is available in the *Panel Through Mount Kit instruction, MI.33.H1.YY*, where yy=language code.

4

5. Electrical installation

5.1. How to connect

5.1.1. Cables General

NB!
Always comply with national and local regulations on cable cross-sections.

Details of terminal tightening torques.

	Power (kW)			Torque (Nm)					
Enclosure	200-240 V	380-480 V	525-600 V	Line	Motor	DC connection	Brake	Earth	Relay
A2	0.25 - 3.0	0.37 - 4.0	0.75 - 4.0	1.8	1.8	1.8	1.8	3	0.6
A3	3.7	5.5 - 7.5	5.5 - 7.5	1.8	1.8	1.8	1.8	3	0.6
A5	0.25 - 3.7	0.37 - 7.5	0.75 - 7.5	1.8	1.8	1.8	1.8	3	0.6
B1	5.5 - 11	11 - 18.5	-	1.8	1.8	1.5	1.5	3	0.6
B2	-	22	-	4.5	4.5	3.7	3.7	3	0.6
	15	30	-	4.5[2]	4.5[2]	3.7	3.7	3	0.6
B3	5.5 - 11	11 - 18.5	11 - 18.5	1.8	1.8	1.8	1.8	3	0.6
B4	11 - 18.5	18.5 - 37	18.5 - 37	4.5	4.5	4.5	4.5	3	0.6
C1	18.5 - 30	37 - 55	-	10	10	10	10	3	0.6
C2	37	75	-	14	14	14	14	3	0.6
	45	90		24	24	14	14	3	0.6
C3	18.5 - 30	37 - 55	37 - 55	10	10	10	10	3	0.6
C4	30 - 45	55 - 90	55 - 90	14/24[1]	14/24[1]	14	14	3	0.6

Table 5.1: Tightening of terminals

1. For different cable dimensions x/y where x≤95 mm² and y≥95 mm².
2. Cable dimensions above 18.5 kW ≥ 35 mm² and below 22 kW ≤ 10 mm²

5.1.2. Enclosure Knock-outs

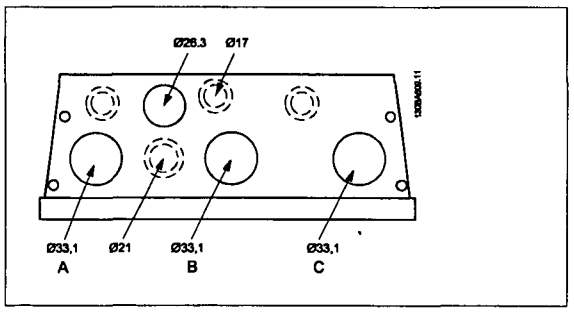


Illustration 5.1: Cable entry holes for enclosure B1. The suggested use of the holes are purely recommendations and other solutions are possible.

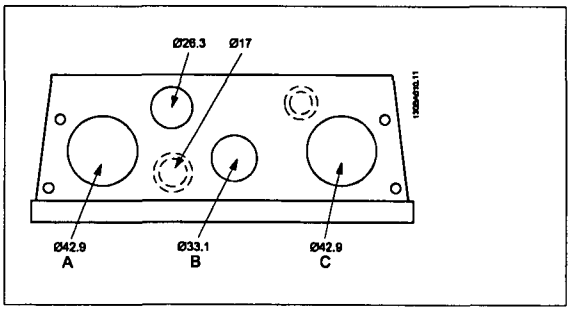


Illustration 5.2: Cable entry holes for enclosure B2. The suggested use of the holes are purely recommendations and other solutions are possible.

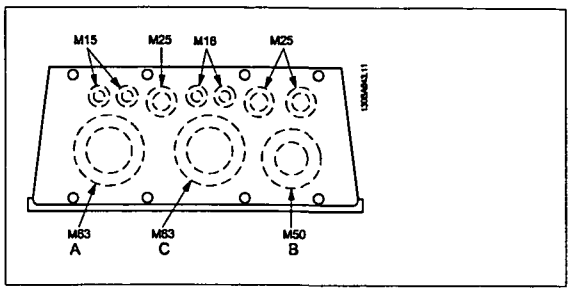


Illustration 5.3: Cable entry holes for enclosure C1. The suggested use of the holes are purely recommendations and other solutions are possible.

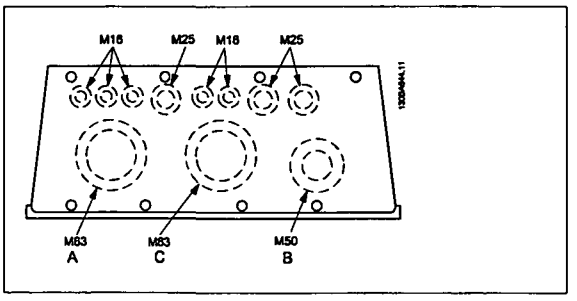


Illustration 5.4: Cable entry holes for enclosure C2. The suggested use of the holes are purely recommendations and other solutions are possible.

5

5.1.3. Fuses

Branch circuit protection:

In order to protect the installation against electrical and fire hazard, all branch circuits in an installation, switch gear, machines etc., must be shortcircuit and overcurrent protected according to the national/international regulations.

Short circuit protection

The frequency converter must be protected against short-circuit to avoid electrical or fire hazard. Danfoss recommends using the fuses mentioned in tables 4.3 and 4.4 to protect service personnel or other equipment in case of an internal failure in the unit. The frequency converter provides full short circuit protection in case of a short-circuit on the motor output.

Over-current protection:

Provide overload protection to avoid fire hazard due to overheating of the cables in the installation. Over current protection must always be carried out according to national regulations. The frequency converter is equipped with an internal over current protection that can be used for upstream overload protection (UL-applications excluded). See par. 4-18. Fuses must be designed for protection in a circuit capable of supplying a maximum of 100,000 A_{rms} (symmetrical), 500 V/600 V maximum.

Non UL compliance

If UL/cUL is not to be complied with, Danfoss recommends using the fuses mentioned in table 4.2, which will ensure compliance with EN50178:
In case of malfunction, not following the recommendation may result in unnecessary damage to the frequency converter.

Frequency converter	Max. fuse size	Voltage	Type
200-240 V			
K25-1K1	16A[1]	200-240 V	type gG
1K5	16A[1]	200-240 V	type gG
2K2	25A[1]	200-240 V	type gG
3K0	25A[1]	200-240 V	type gG
3K7	35A[1]	200-240 V	type gG
5K5	50A[1]	200-240 V	type gG
7K5	63A[1]	200-240 V	type gG
11K	63A[1]	200-240 V	type gG
15K	80A[1]	200-240 V	type gG
18K5	125A[1]	200-240 V	type gG
22K	125A[1]	200-240 V	type gG
30K	160A[1]	200-240 V	type gG
37K	200A[1]	200-240 V	type aR
45K	250A[1]	200-240 V	type aR
380-480 V			
K37-1K5	10A[1]	380-480 V	type gG
2K2-4K0	20A[1]	380-480 V	type gG
5K5-7K5	32A[1]	380-480 V	type gG
11K	63A[1]	380-480 V	type gG
15K	63A[1]	380-480 V	type gG
18K	63A[1]	380-480 V	type gG
22K	63A[1]	380-480 V	type gG
30K	80A[1]	380-480 V	type gG
37K	100A[1]	380-480 V	type gG
45K	125A[1]	380-480 V	type gG
55K	160A[1]	380-480 V	type gG
75K	250A[1]	380-480 V	type aR
90K	250A[1]	380-480 V	type aR

Table 5.2: Non UL fuses 200 V to 480 V

1) Max. fuses - see national/international regulations for selecting an applicable fuse size.

UL Compliance

Frequency converter	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
200-240 V							
Type	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
K25-1K1	KTN-R10	JKS-10	JJN-10	5017906-010	KLN-R10	ATM-R10	A2K-10R
1K5	KTN-R15	JKS-15	JJN-15	5017906-015	KLN-R15	ATM-R15	A2K-15R
2K2	KTN-R20	JKS-20	JJN-20	5012406-020	KLN-R20	ATM-R20	A2K-20R
3K0	KTN-R25	JKS-25	JJN-25	5012406-025	KLN-R25	ATM-R25	A2K-25R
3K7	KTN-R30	JKS-30	JJN-30	5012406-030	KLN-R30	ATM-R30	A2K-30R
5K5	KTN-R50	JKS-50	JJN-50	5012406-050	KLN-R50	-	A2K-50R
7K5	KTN-R50	JKS-60	JJN-60	5012406-050	KLN-R60	-	A2K-50R
11K	KTN-R60	JKS-60	JJN-60	5014006-063	KLN-R60		A2K-60R
15K	KTN-R80	JKS-80	JJN-80	5014006-080	KLN-R80		A2K-80R
18K5	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125		A2K-125R
22K	KTN-R125	JKS-150	JJN-125	2028220-125	KLN-R125		A2K-125R
30K	FWX-150	-	-	2028220-150	L25S-150		A25X-150
37K	FWX-200	-	-	2028220-200	L25S-200		A25X-200
45K	FWX-250	-	-	2028220-250	L25S-250		A25X-250

Table 5.3: UL fuses 200 - 240 V

Frequency converter	Bussmann	Bussmann	Bussmann	SIBA	Littel fuse	Ferraz-Shawmut	Ferraz-Shawmut
380-480 V, 525-600 V							
kW	Type RK1	Type J	Type T	Type RK1	Type RK1	Type CC	Type RK1
K37-1K1	KTS-R6	JKS-6	JJS-6	5017906-006	KLS-R6	ATM-R6	A6K-6R
1K5-2K2	KTS-R10	JKS-10	JJS-10	5017906-010	KLS-R10	ATM-R10	A6K-10R
3K0	KTS-R15	JKS-15	JJS-15	5017906-016	KLS-R16	ATM-R16	A6K-16R
4K0	KTS-R20	JKS-20	JJS-20	5017906-020	KLS-R20	ATM-R20	A6K-20R
5K5	KTS-R25	JKS-25	JJS-25	5017906-025	KLS-R25	ATM-R25	A6K-25R
7K5	KTS-R30	JKS-30	JJS-30	5012406-032	KLS-R30	ATM-R30	A6K-30R
11K	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	-	A6K-40R
15K	KTS-R40	JKS-40	JJS-40	5014006-040	KLS-R40	-	A6K-40R
18K	KTS-R50	JKS-50	JJS-50	5014006-050	KLS-R50	-	A6K-50R
22K	KTS-R60	JKS-60	JJS-60	5014006-063	KLS-R60	-	A6K-60R
30K	KTS-R80	JKS-80	JJS-80	2028220-100	KLS-R80	-	A6K-80R
37K	KTS-R100	JKS-100	JJS-100	2028220-125	KLS-R100		A6K-100R
45K	KTS-R125	JKS-150	JJS-150	2028220-125	KLS-R125		A6K-125R
55K	KTS-R150	JKS-150	JJS-150	2028220-160	KLS-R150		A6K-150R
75K	FWH-220	-	-	2028220-200	L50S-225		A50-P225
90K	FWH-250	-	-	2028220-250	L50S-250		A50-P250

Table 5.4: UL fuses 380 - 600 V

KTS-fuses from Bussmann may substitute KTN for 240 V frequency converters.

FWH-fuses from Bussmann may substitute FWX for 240 V frequency converters.

KLSR fuses from LITTEL FUSE may substitute KLNR fuses for 240 V frequency converters.

L50S fuses from LITTEL FUSE may substitute L50S fuses for 240 V frequency converters.

A6KR fuses from FERRAZ SHAWMUT may substitute A2KR for 240 V frequency converters.

A50X fuses from FERRAZ SHAWMUT may substitute A25X for 240 V frequency converters.

5.1.4. Earthing and IT mains

The earth connection cable cross section must be at least 10 mm² or 2 rated mains wires terminated separately according to *EN 50178 or IEC 61800-5-1* unless national regulations specify differently. Always comply with national and local regulations on cable cross-sections.

The mains is connected to the main disconnect switch if this is included.

NB!
Check that mains voltage corresponds to the mains voltage of the frequency converter name plate.

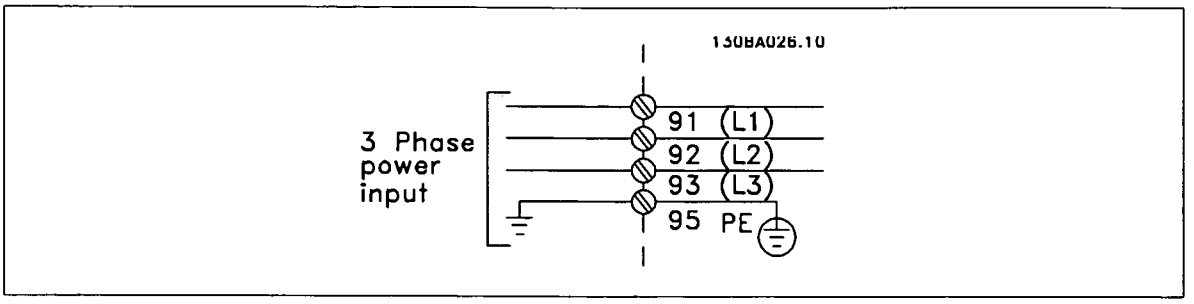


Illustration 5.5: Terminals for mains and earthing.

5

IT Mains

Do not connect 400 V frequency converters with RFI-filters to mains supplies with a voltage between phase and earth of more than 440 V.

For IT mains and delta earth (grounded leg), mains voltage may exceed 440 V between phase and earth.

5

5.1.5. Mains wiring overview

Enclosure:	A2 (IP 20/IP 21)	A3 (IP 20/IP 21)	A5 (IP 55/IP 66)	B1 (IP 21/IP 55/IP 66)	B2 (IP 21/IP 55/IP 66)	B3 (IP 20)	B4 (IP 20)	C1 (IP 21/IP 55/66)	C2 (IP 21/IP 55/66)	C3 (IP 20)	C4 (IP20)
Motor size (kW):											
200-240 V	0.25-3.0	3.7	1.1-3.7	5.5-11	15	5.5-11	15-18.5	18.5-30	37-45	22-30	37-45
380-480 V	0.37-4.0	5.5-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-600 V		1.1-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
Goto:	**5.1.6**		**5.1.7**		**5.1.8**		**5.1.9**			**5.1.10**	

Table 5.5: Mains wiring table.

5.1.6. Mains connection for A2 and A3

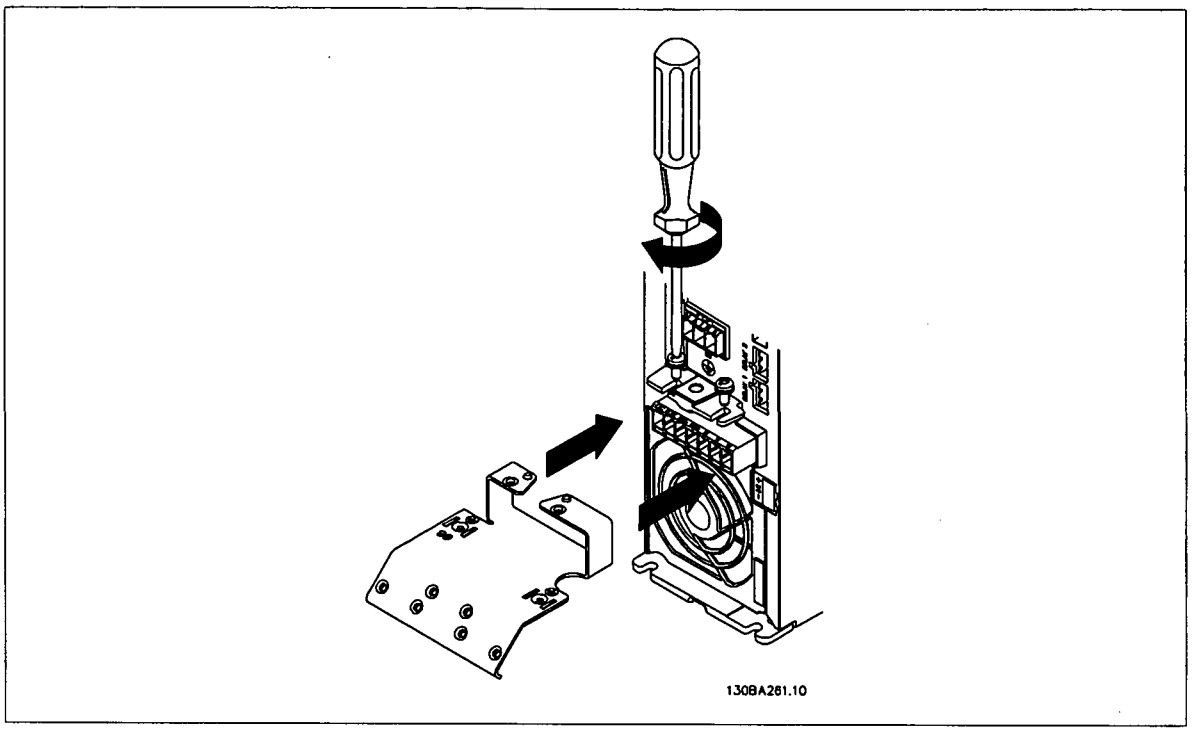


Illustration 5.6: First mount the two screws on the mounting plate, slide it into place and tighten fully.

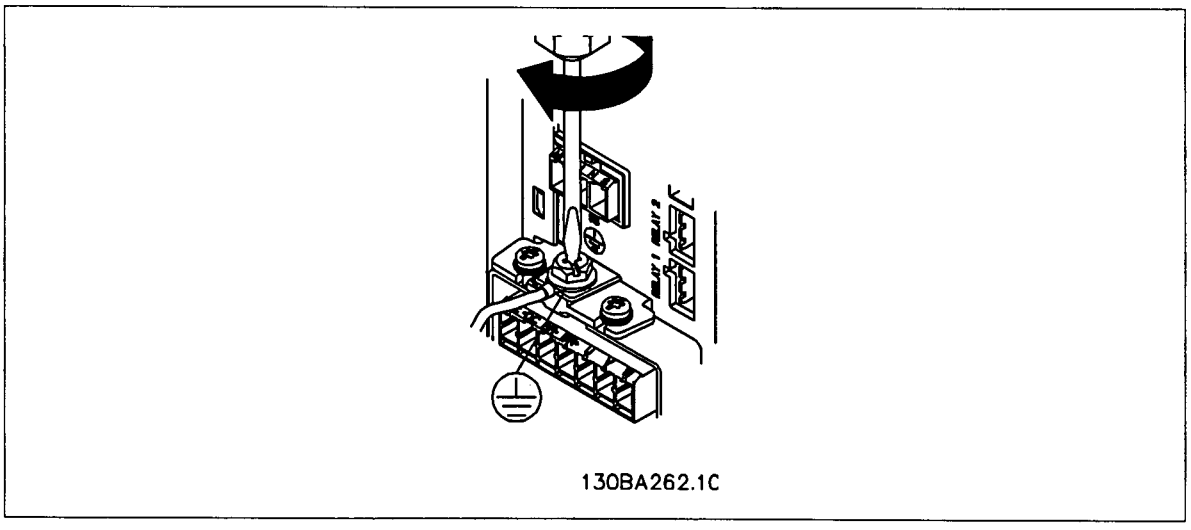


Illustration 5.7: When mounting cables, first mount and tighten earth cable.

The earth connection cable cross section must be at least 10 mm² or 2 rated mains wires terminated separately according to *EN 50178/ IEC 61800-5-1.*

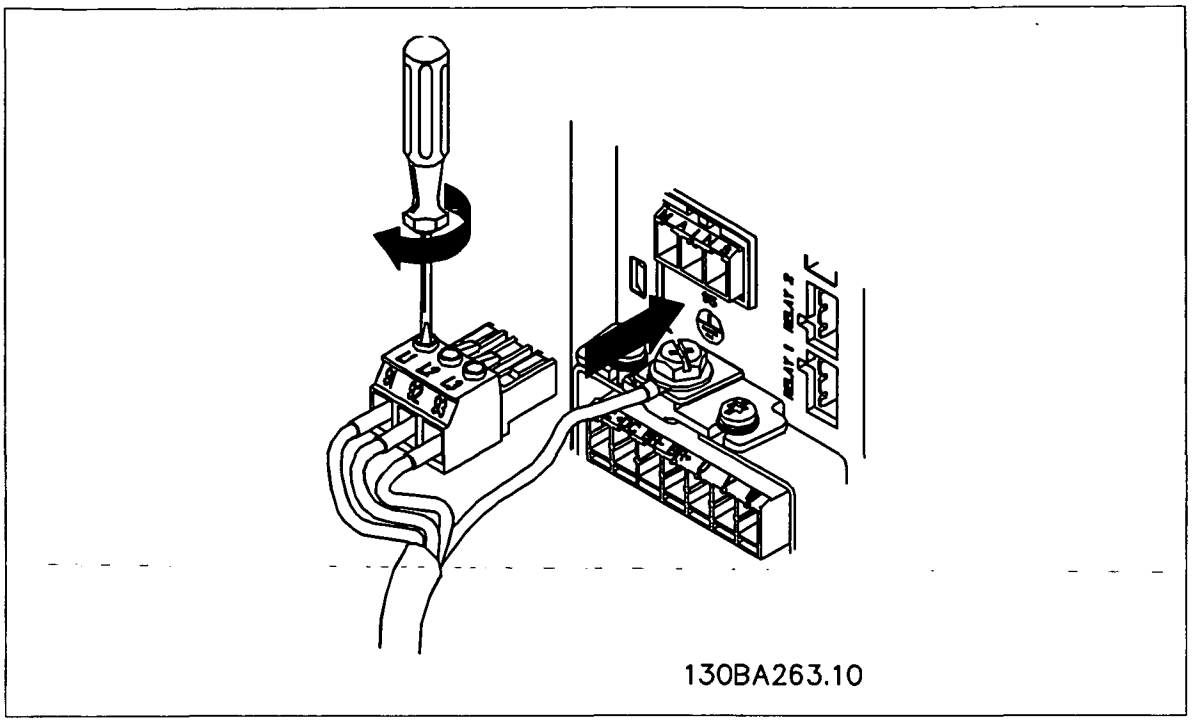


Illustration 5.8: Then mount mains plug and tighten wires.

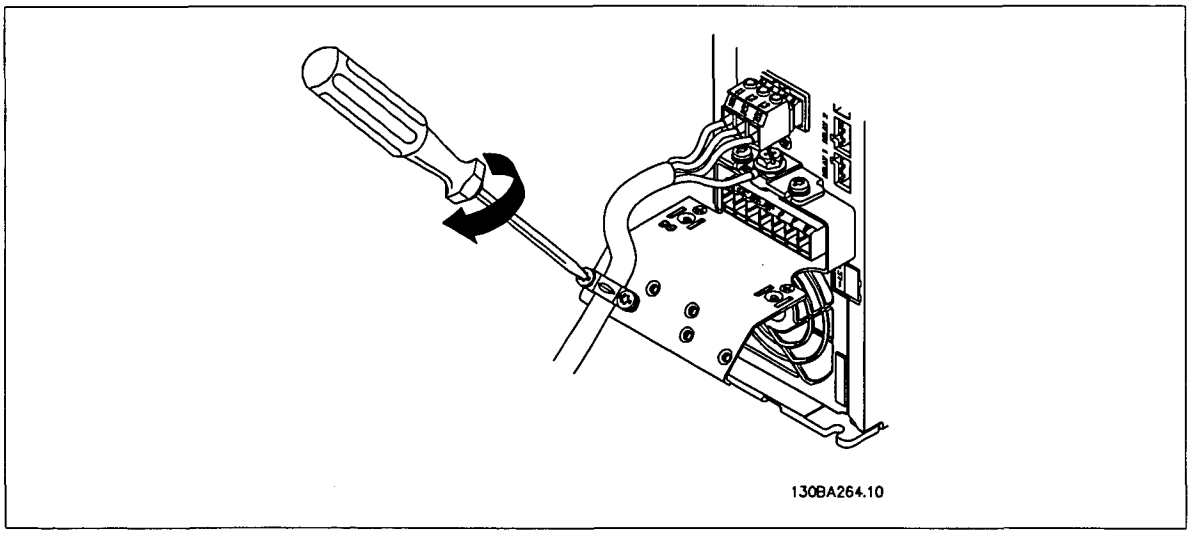


Illustration 5.9: Finally tighten support bracket on mains wires.

5.1.7. Mains connection for A5

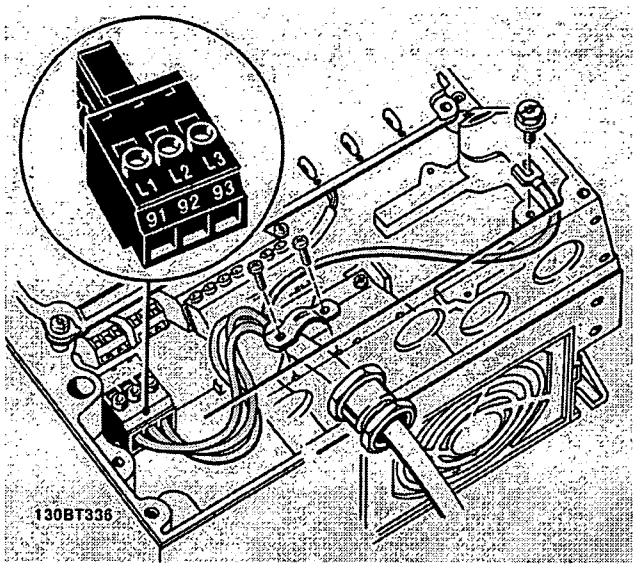


Illustration 5.10: How to connect to mains and earthing without mains disconnect switch. Note that a cable clamp is used.

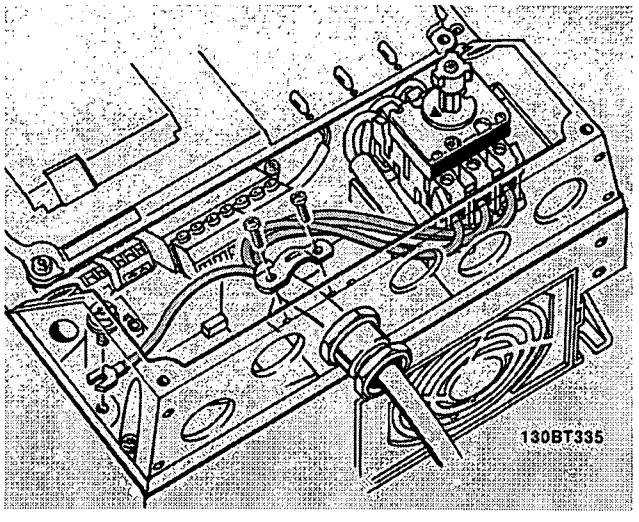


Illustration 5.11: How to connect to mains and earthing with mains disconnect switch.

5.1.8. Mains connection for B1, B2 and B3

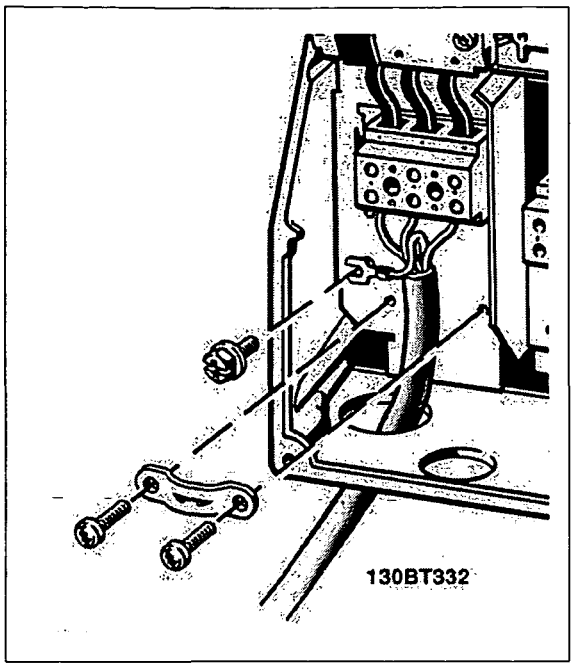


Illustration 5.12: How to connect to mains and earthing for B1 and B2

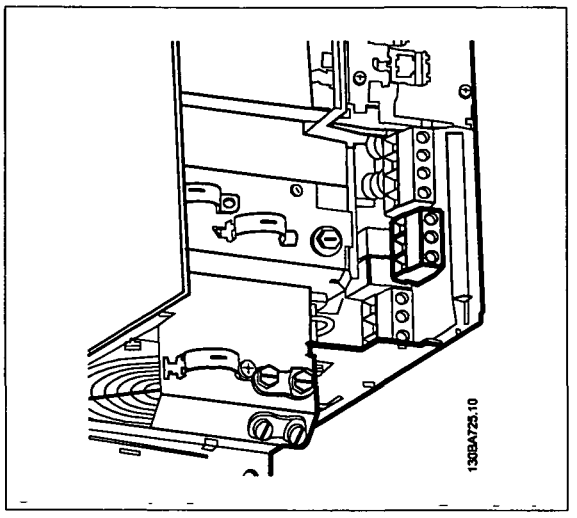


Illustration 5.13: How to connect to mains and earthing for B3 without RFI.

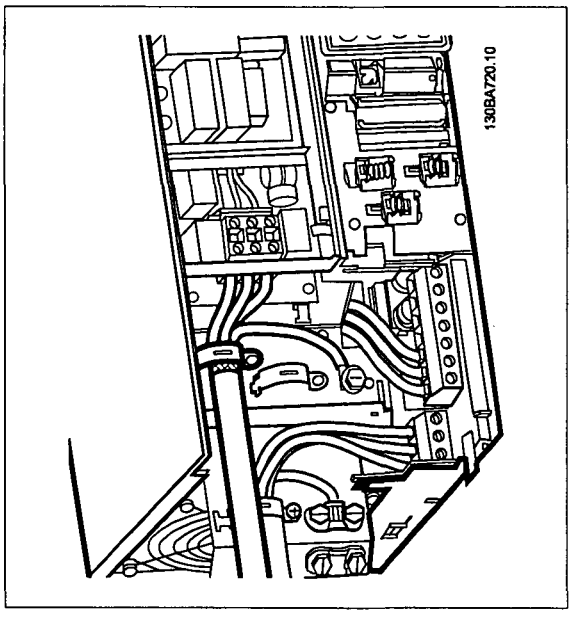


Illustration 5.14: How to connect to mains and earthing for B3 with RFI.

NB!
For correct cable dimensions please see the section General Specifications at the back of this manual.

5.1.9. Mains connection for B4, C1 and C2

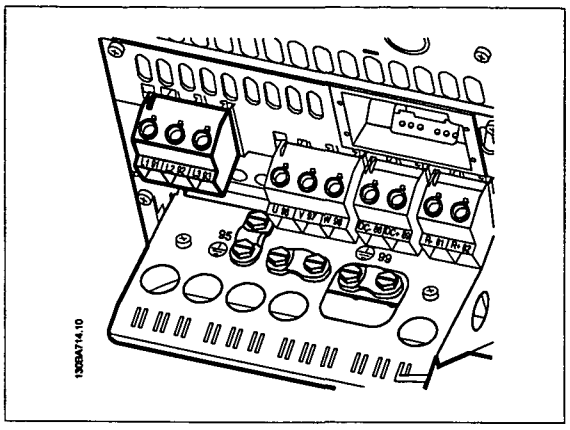


Illustration 5.15: How to connect to mains and earthing for B4.

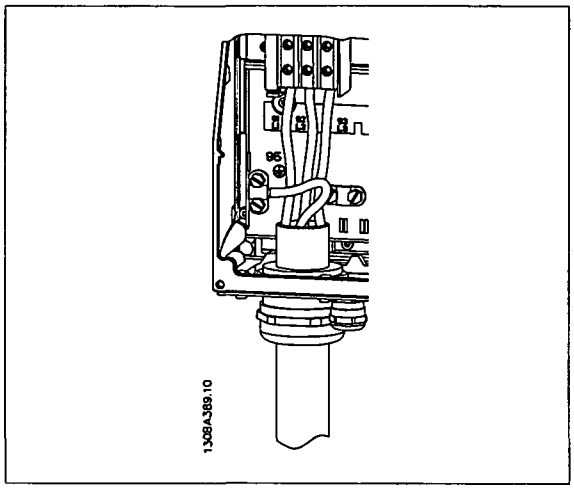


Illustration 5.16: How to connect to mains and earthing for C1 and C2.

5.1.10. Mains connection for C3 and C4

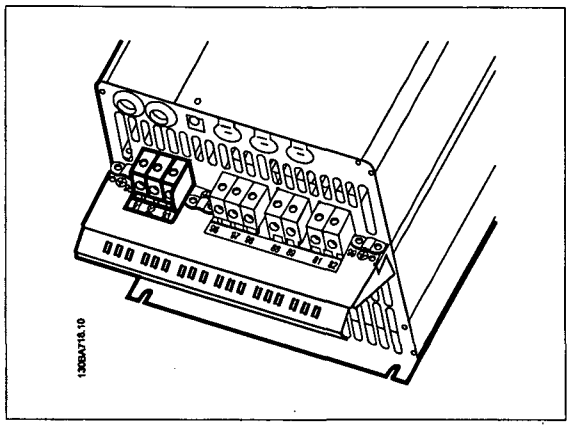


Illustration 5.17: How to connect C3 to mains and earthing.

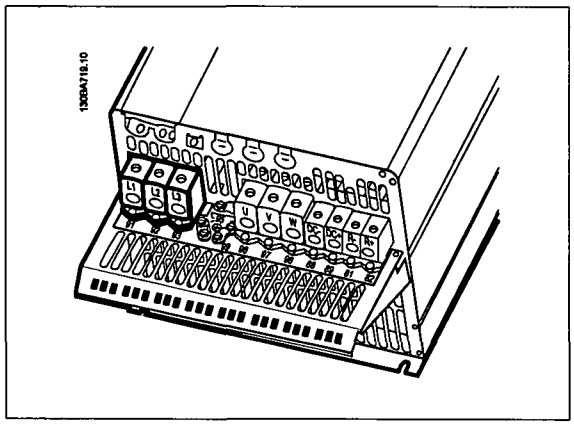


Illustration 5.18: How to connect C4 to mains and earthing.

5.1.11. How to connect motor - foreword

See section *General Specifications* for correct dimensioning of motor cable cross-section and length.

- Use a screened/armoured motor cable to comply with EMC emission specifications (or install the cable in metal conduit).
- Keep the motor cable as short as possible to reduce the noise level and leakage currents.
- Connect the motor cable screen/armour to both the decoupling plate of the frequency converter and to the metal of the motor. (Same applies to both ends of metal conduit if used instead of screen.)
- Make the screen connections with the largest possible surface area (cable clamp or by using an EMC cable gland). This is done by using the supplied installation devices in the frequency converter.
- Avoid terminating the screen by twisting the ends (pigtails), as this will spoil high frequency screening effects.
- If it is necessary to break the continuity of the screen to install a motor isolator or motor relay, the continuity must be maintained with the lowest possible HF impedance.

Cable length and cross-section

The frequency converter has been tested with a given length of cable and a given cross-section of that cable. If the cross-section is increased, the cable capacitance - and thus the leakage current - may increase, and the cable length must be reduced correspondingly.

Switching frequency

When frequency converters are used together with sine wave filters to reduce the acoustic noise from a motor, the switching frequency must be set according to the sine wave filter instruction in par. 14-01 Switching *Frequency*.

Precautions while using Aluminium conductors

Aluminium conductors are not recommended for cable cross sections below 35 mm². Terminals can accept aluminium conductors but the conductor surface has to be clean and the oxidation must be removed and sealed by neutral acid free Vaseline grease before the conductor is connected. Furthermore, the terminal screw must be retightened after two days due to the softness of the aluminium. It is crucial to ensure the connection makes a gas tight joint, otherwise the aluminium surface will oxidize again.

All types of three-phase asynchronous standard motors can be connected to the frequency converter. Normally, small motors are star-connected (230/400 V, D/Y). Large motors are delta-connected (400/690 V, D/Y). Refer to the motor name plate for correct connection mode and voltage.

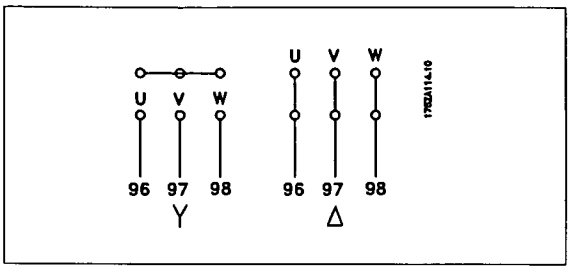


Illustration 5.19: Terminals for motor connection

5

NB!

In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a frequency converter), fit a sine-wave filter on the output of the frequency converter. (Motors that comply with IEC 60034-17 do not require an Sine-wave filter).

No.	96	97	98	Motor voltage 0-100% of mains voltage.
	U	V	W	3 cables out of motor
	U1	V1	W1	6 cables out of motor, Delta-connected
	W2	U2	V2	
	U1	V1	W1	6 cables out of motor, Star-connected
				U2, V2, W2 to be interconnected separately (optional terminal block)
No.	99			Earth connection
	PE			

Table 5.6: 3 and 6 cable motor connection.

5

5.1.12. Motor wiring overview

Enclosure:	A2 (IP 20/IP 21)	A3 (IP 20/IP 21)	A5 (IP 55/IP 66)	B1 (IP 21/IP 55/ IP 66)	B2 (IP 21/IP 55/ IP 66)	B3 (IP 20)	B4 (IP 20)	C1 (IP 21/IP 55/66)	C2 (IP 21/IP 55/66)	C3 (IP 20)	C4 (IP20)
Motor size (kW):											
200-240 V	0.25-3.0	3.7	1.1-3.7	5.5-11	15	5.5-11	15-18.5	18.5-30	37-45	22-30	37-45
380-480 V	0.37-4.0	5.5-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
525-600 V		1.1-7.5	1.1-7.5	11-18.5	22-30	11-18.5	22-37	37-55	75-90	45-55	75-90
Goto:		**5.1.13**	**5.1.14**	**5.1.15**		**5.1.16**		**5.1.17**		**5.1.18**	

Table 5.7: Motor wiring table.

5.1.13. Motor connection for A2 and A3

Follow these drawings step by step for connecting the motor to the frequency converter.

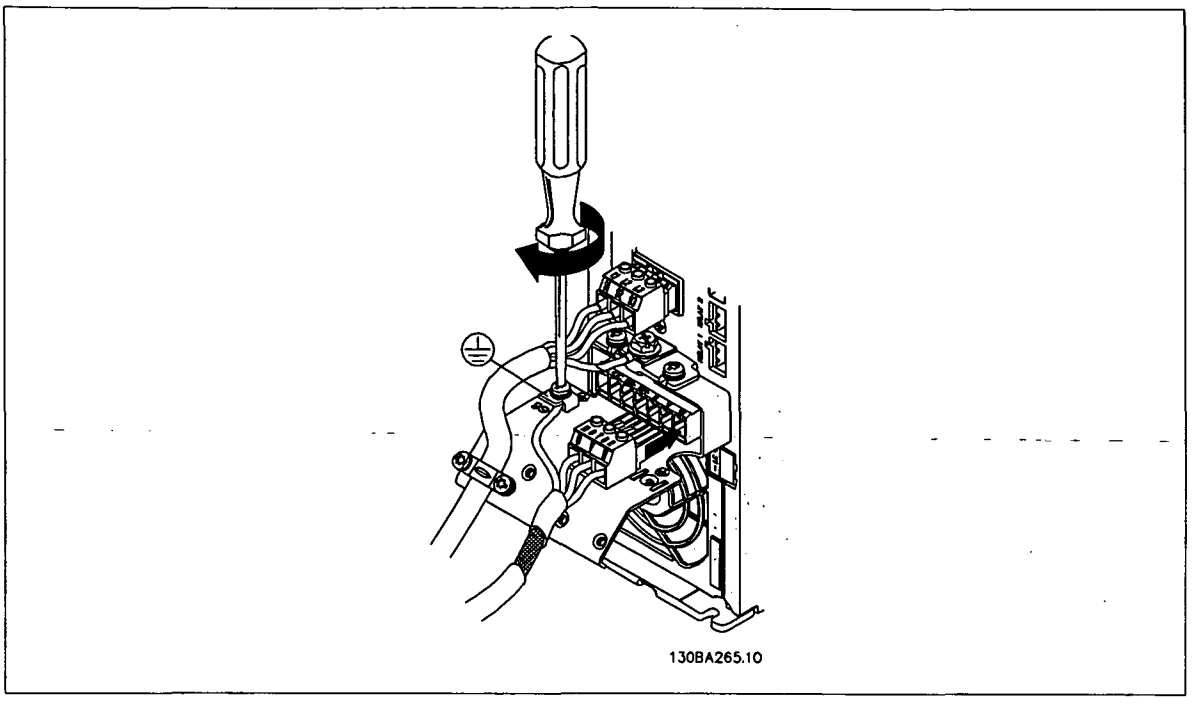


Illustration 5.20: First terminate the motor earth, then place motor U, V and W wires in plug and tighten.

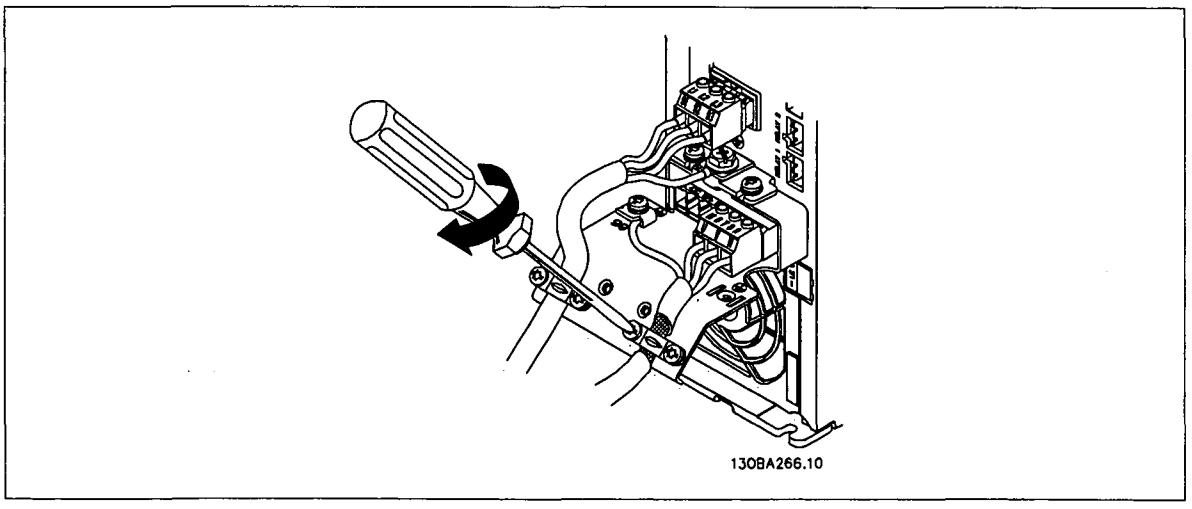


Illustration 5.21: Mount cable clamp to ensure 360 degree connection between chassis and screen, note the outer insulation of the motor cable is removed under the clamp.

5.1.14. Motor connection for A5

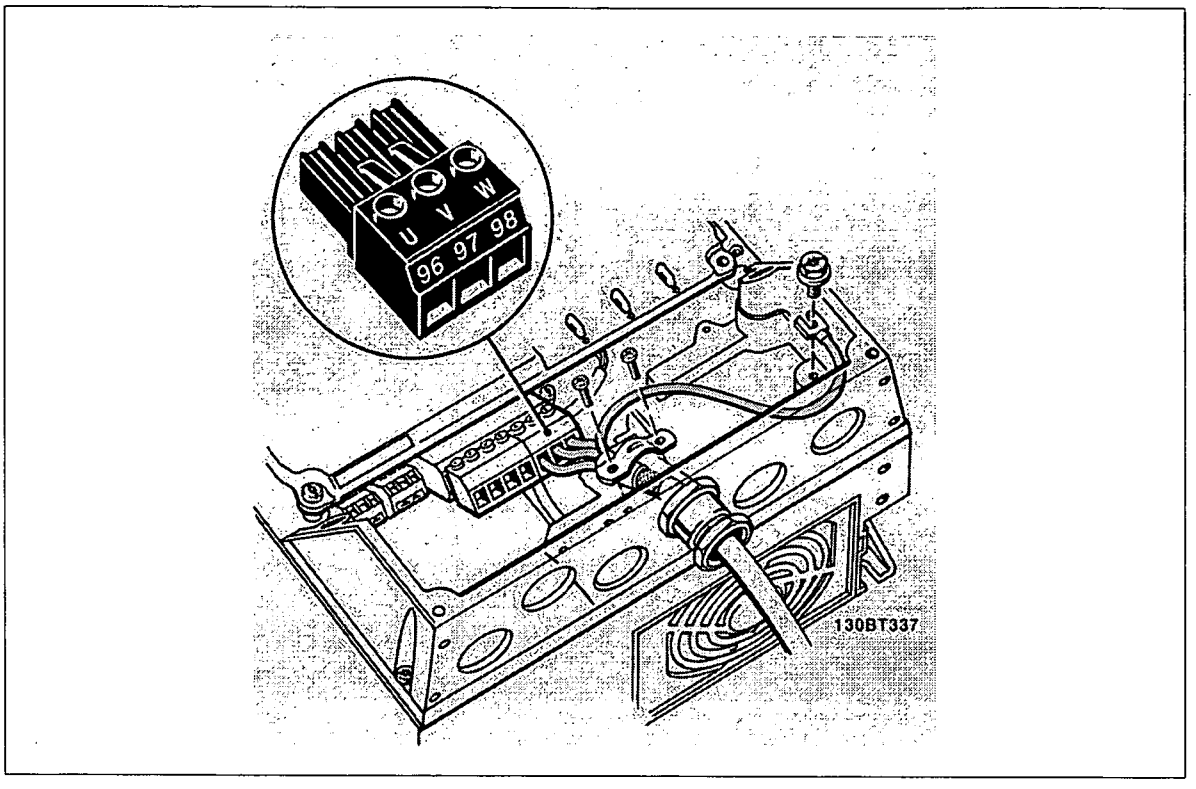


Illustration 5.22: First terminate the motor earth, then place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.15. Motor connection for B1 and B2

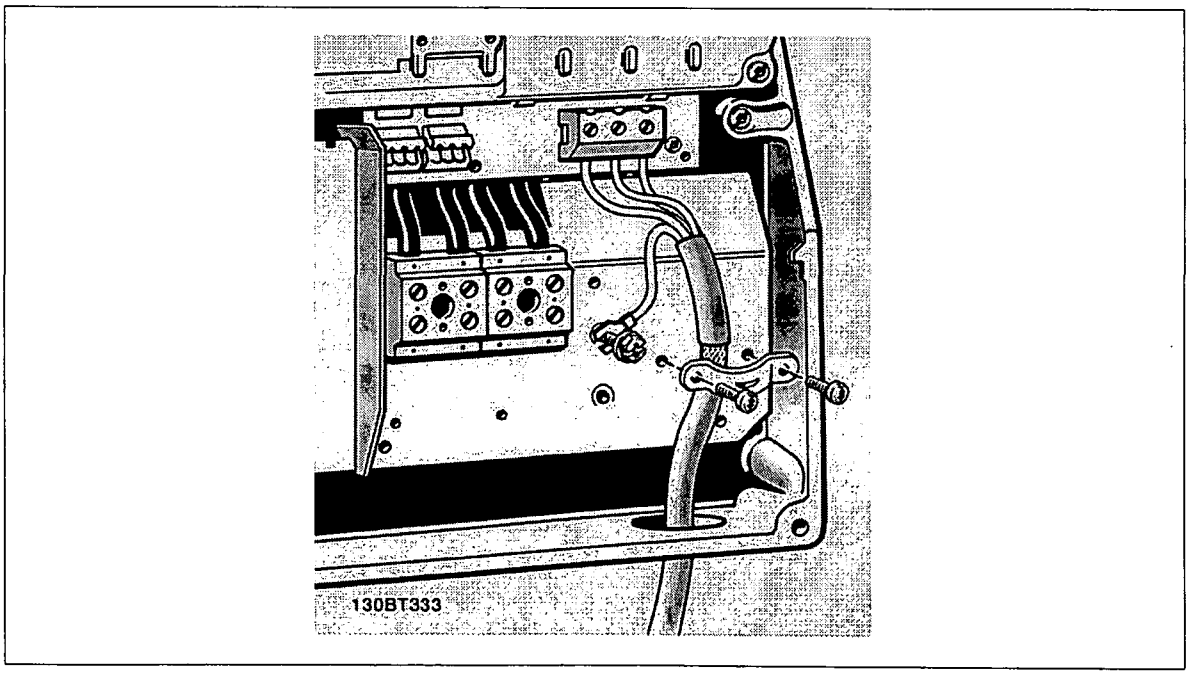


Illustration 5.23: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.16. Motor connection for B3 and B4

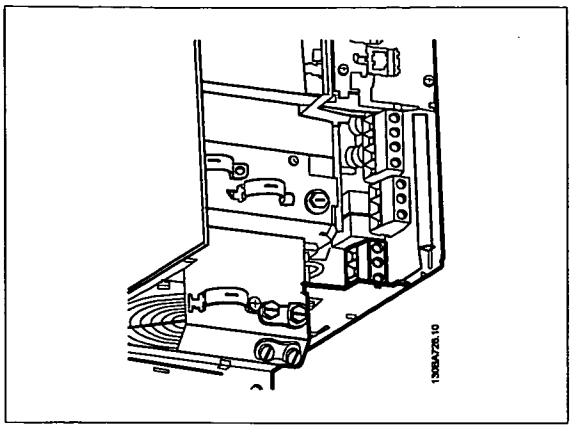


Illustration 5.24: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

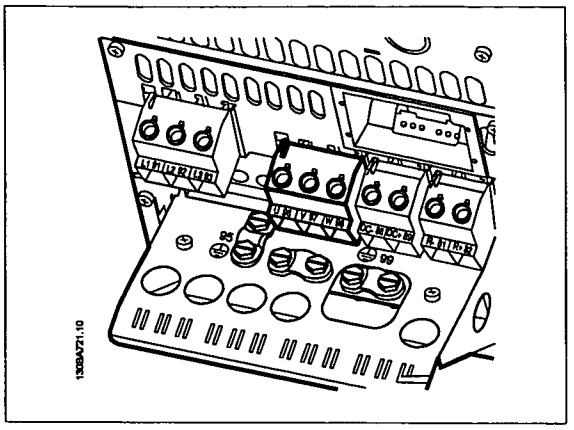


Illustration 5.25: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5

5.1.17. Motor connection for C1 and C2

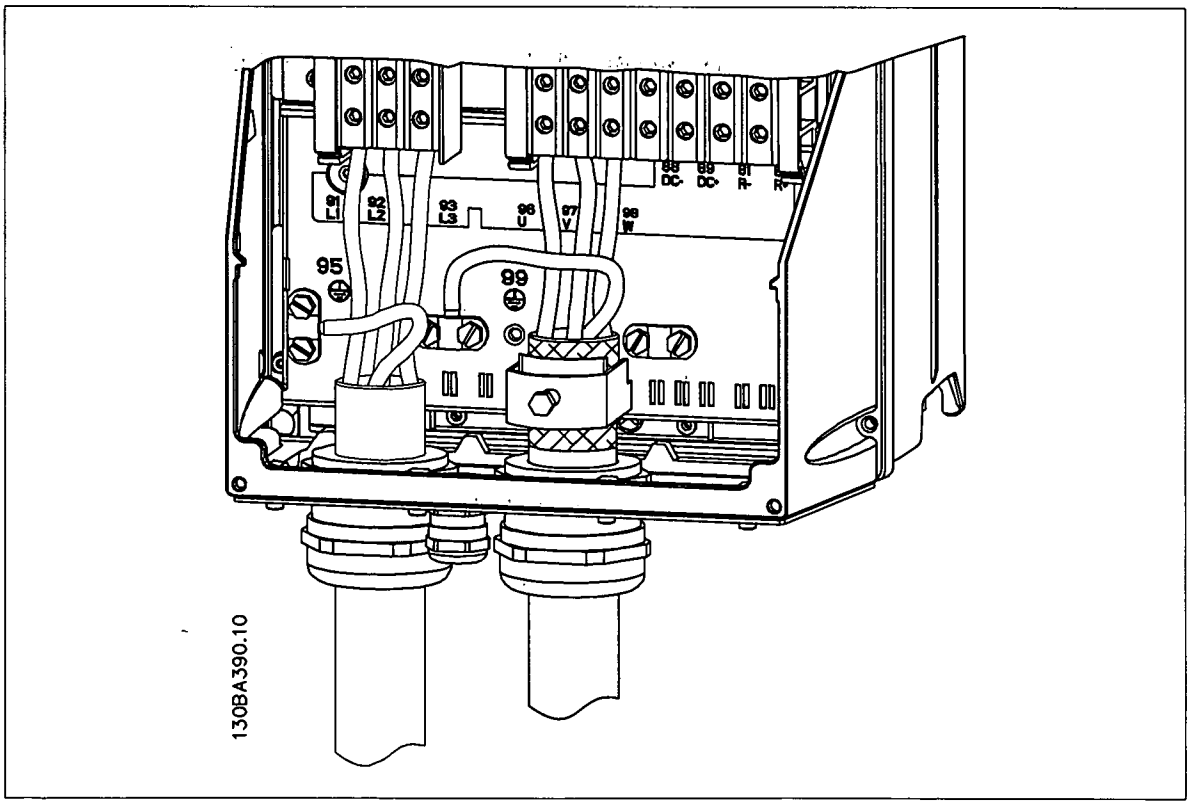


Illustration 5.26: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.18. Motor connection for C3 and C4

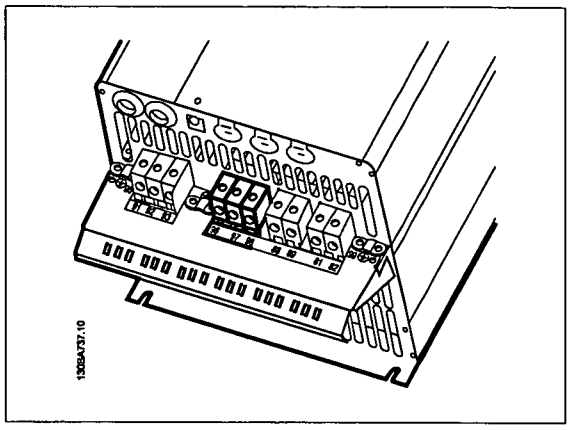


Illustration 5.27: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

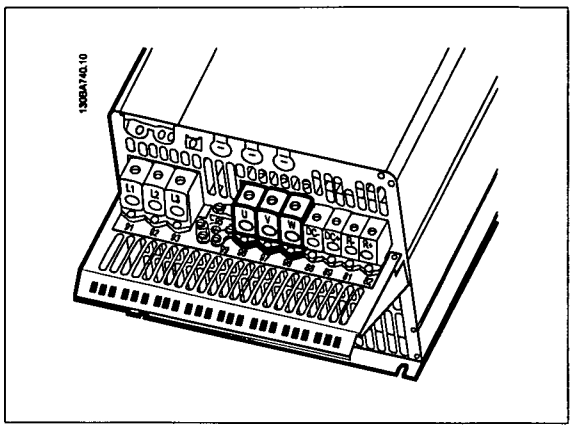


Illustration 5.28: First terminate the motor earth, then Place motor U, V and W wires in terminal and tighten. Please ensure that the outer insulation of the motor cable is removed under the EMC clamp.

5.1.19. DC bus connection

The DC bus terminal is used for DC back-up, with the intermediate circuit being supplied from an external source.

Terminal numbers used: 88, 89

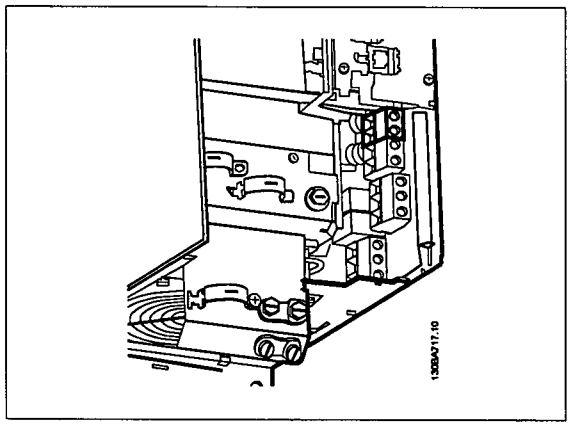


Illustration 5.29: DC bus connections for enclosure B3.

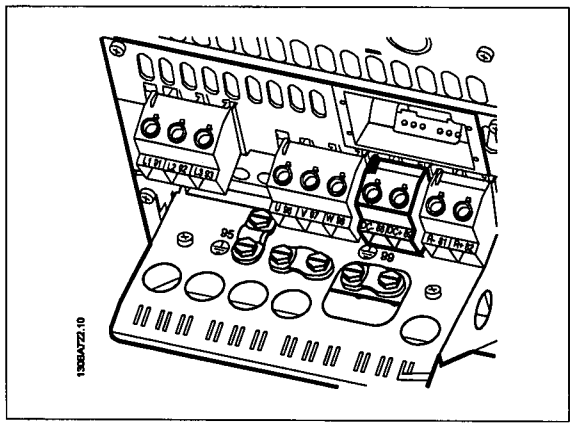


Illustration 5.30: DC bus connections for enclosure B4.

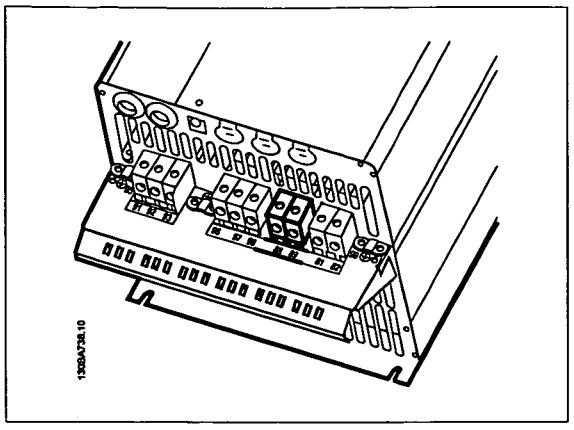


Illustration 5.31: DC bus connections for enclosure C3.

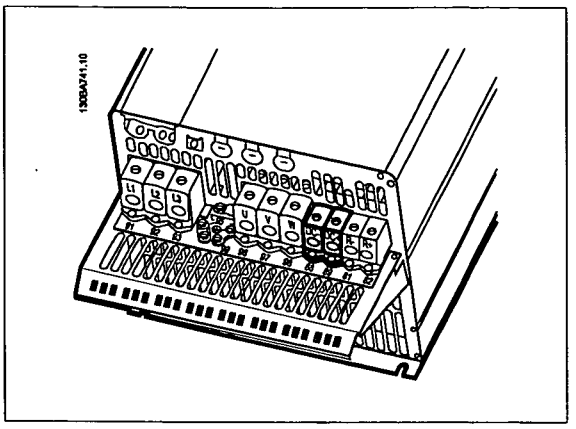


Illustration 5.32: DC bus connections for enclosure enclosure C4.

5

Please contact Danfoss if you require further information.

5.1.20. Brake Connection Option

The connection cable to the brake resistor must be screened/armoured.

Enclosure	A+B+C+D+F	A+B+C+D+F
Brake resistor	81	82
Terminals	R-	R+

NB!
Dynamic brake calls for extra equipment and safety considerations. For further information, please contact Danfoss.

1. Use cable clamps to connect the screen to the metal cabinet of the frequency converter and to the decoupling plate of the brake resistor.
2. Dimension the cross-section of the brake cable to match the brake current.

NB!
Voltages up to 975 V DC (@ 600 V AC) may occur between the terminals.

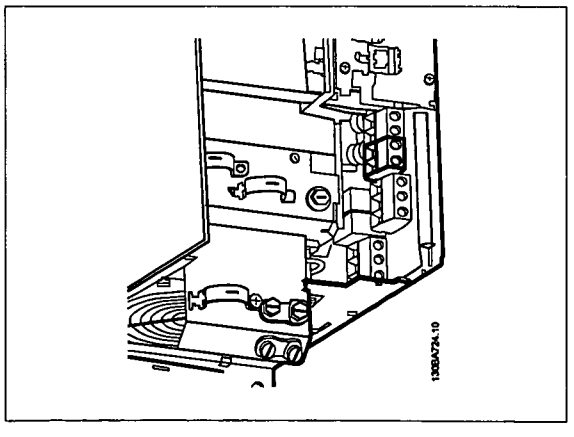


Illustration 5.33: Brake connection terminal for B3.

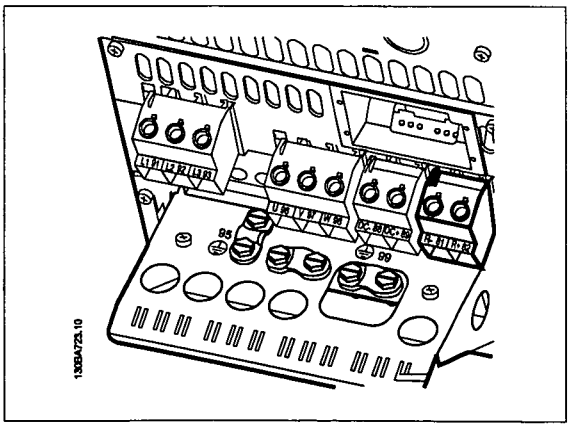


Illustration 5.34: Brake connection terminal for B4.

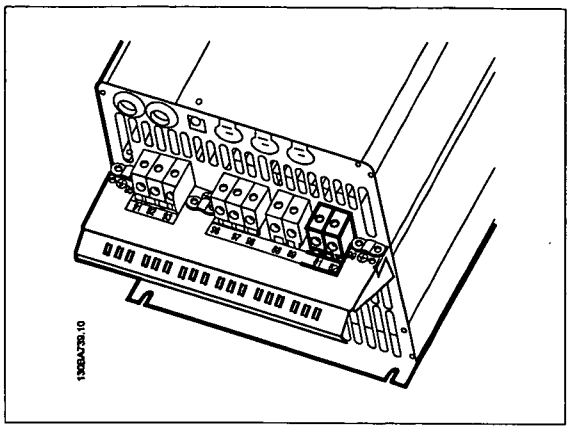


Illustration 5.35: Brake connection terminal for C3.

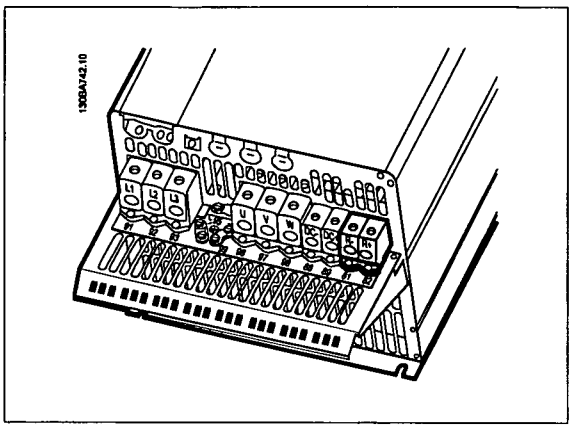


Illustration 5.36: Brake connection terminal for C4.

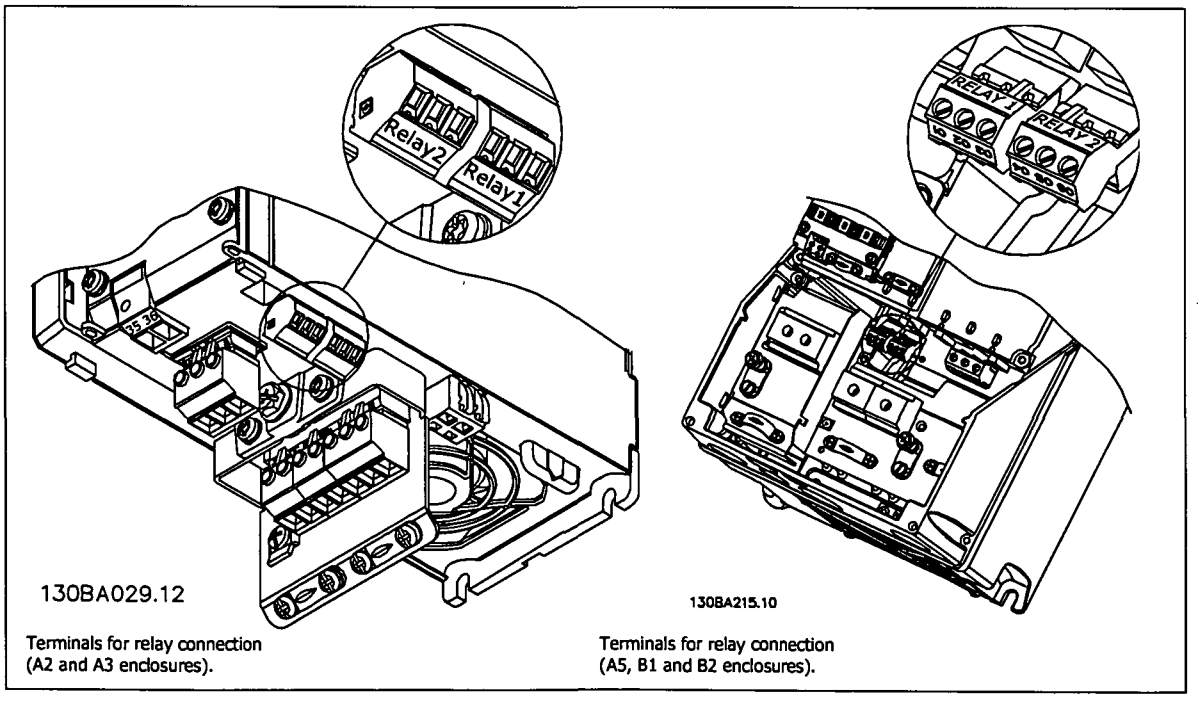
5

NB!
If a short circuit in the brake IGBT occurs, prevent power dissipation in the brake resistor by using a mains switch or contactor to disconnect the mains for the frequency converter. Only the frequency converter shall control the contactor.

5.1.21. Relay Connection

To set relay output, see par. group 5-4* Relays.

No.		
	01 - 02	make (normally open)
	01 - 03	break (normally closed)
	04 - 05	make (normally open)
	04 - 06	break (normally closed)



Terminals for relay connection (A2 and A3 enclosures).

Terminals for relay connection (A5, B1 and B2 enclosures).

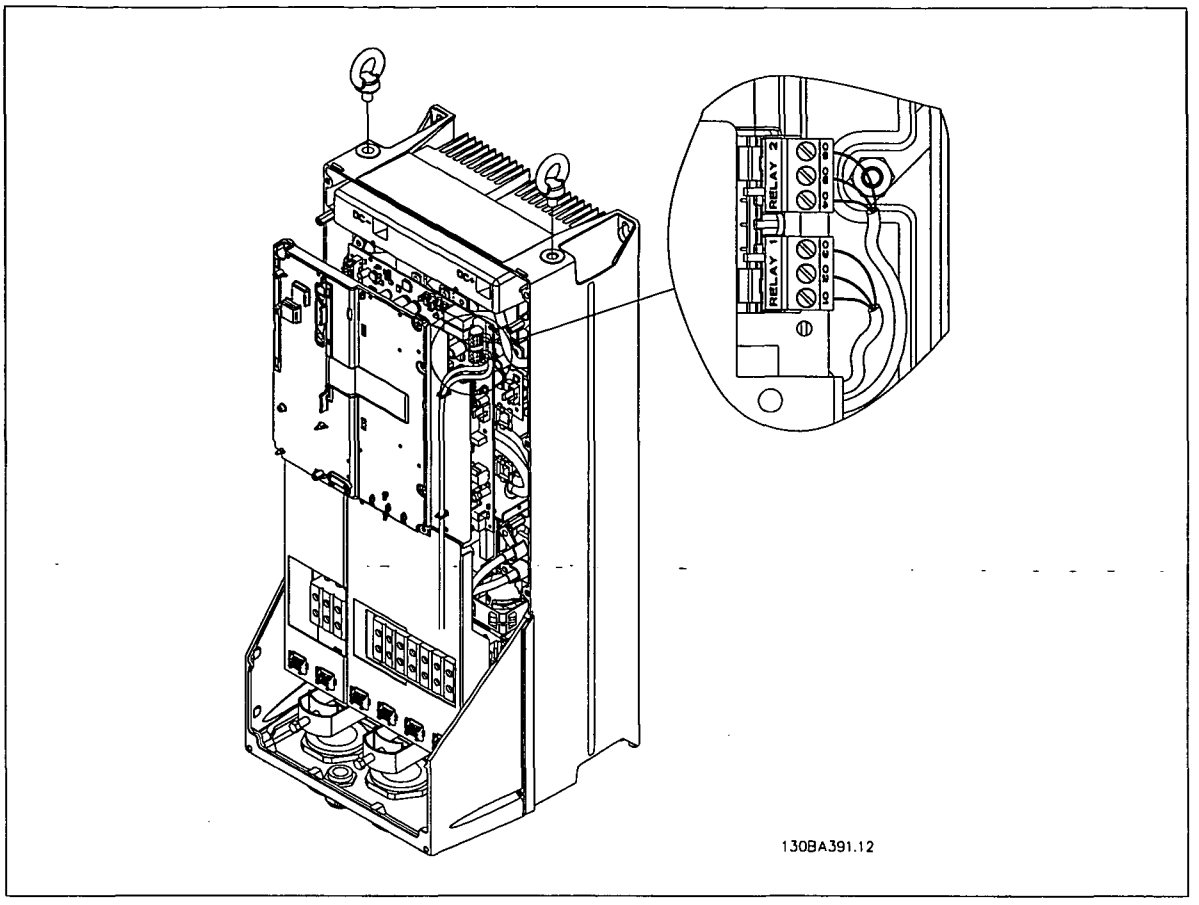


Illustration 5.37: Terminals for relay connection (C1 and C2 enclosures).
The relay connections are shown in the cut-out with relay plugs (from the Accessory Bag) fitted.

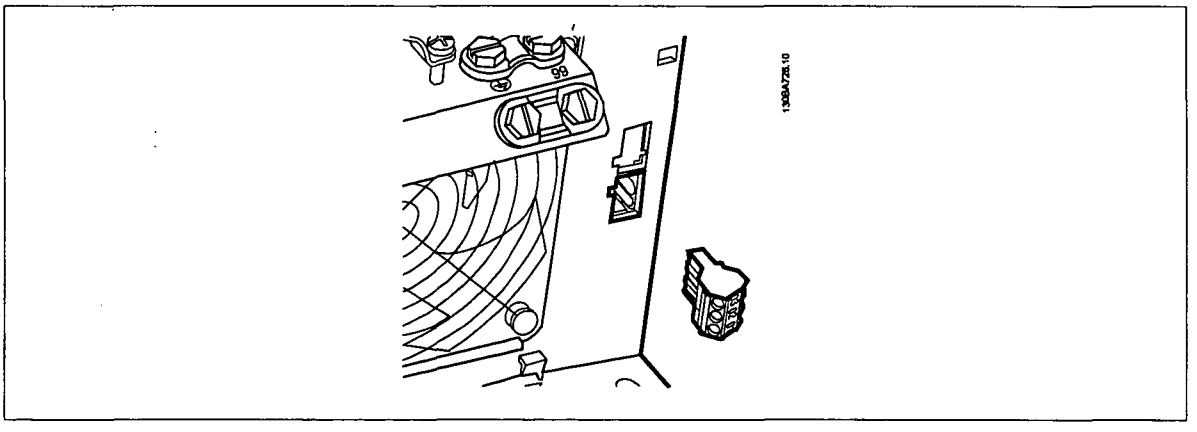


Illustration 5.38: Terminals for relay connections for B3. Only one knock-out is fitted from the factory.

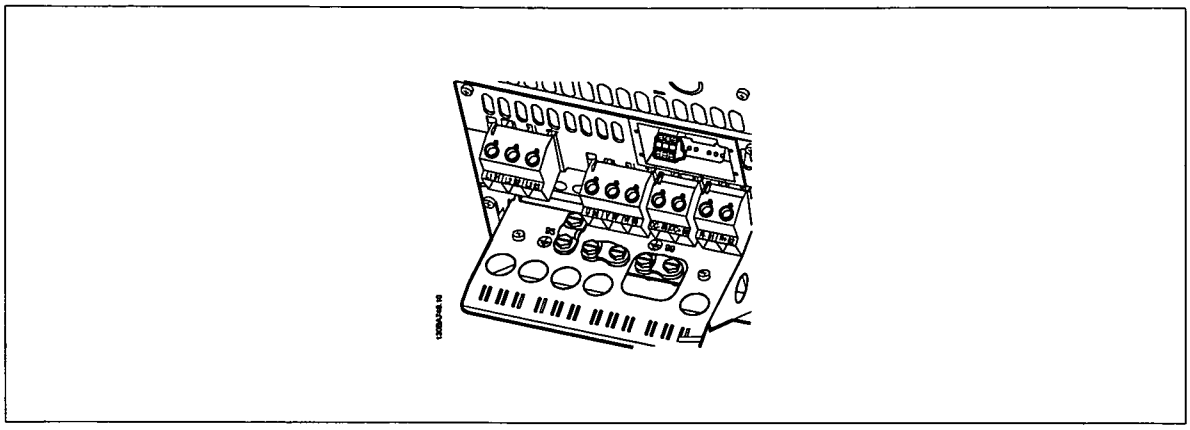


Illustration 5.39: Terminals for relay connections for B4.

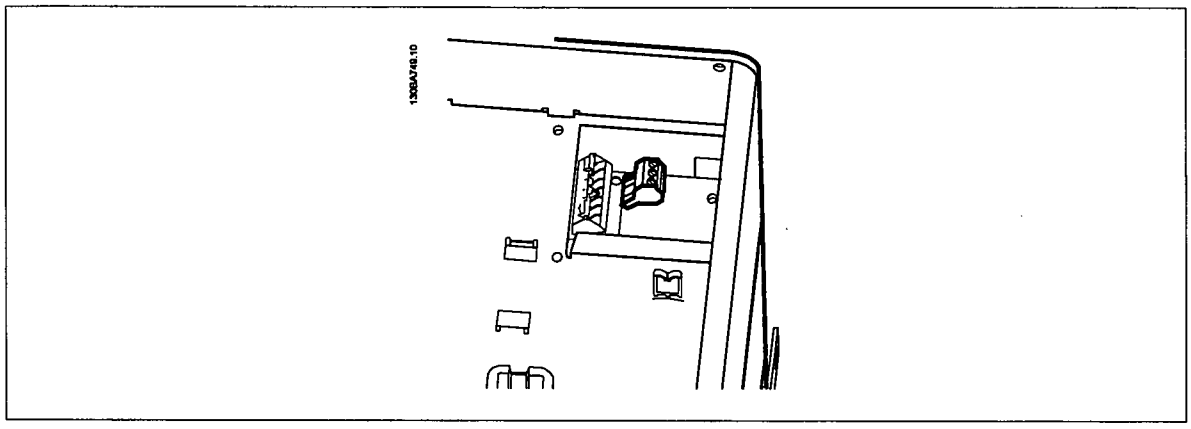


Illustration 5.40: Terminals for relay connections for C3 and C4. Located in the upper right corner of the frequency converter.

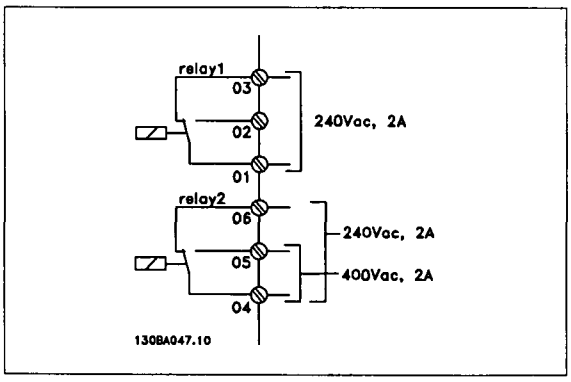
5.1.22. Relay Output

Relay 1

- Terminal 01: common
- Terminal 02: normal open 240 V AC
- Terminal 03: normal closed 240 V AC

Relay 2

- Terminal 04: common
- Terminal 05: normal open 400 V AC
- Terminal 06: normal closed 240 V AC



Relay 1 and relay 2 are programmed in par. 5-40 Function *Relay*, par. 5-41 On *Delay, Relay*, and par. 5-42 Off *Delay, Relay*.

Additional relay outputs by using option module MCB 105.

5.1.23. Wiring Example and Testing

The following section describes how to terminate control wires and how to access them. For an explanation of the function, programming and wiring of the control terminals, please see chapter, *How to programme the frequency converter.*

5.1.24. Access to Control Terminals

All terminals to the control cables are located underneath the terminal cover on the front of the frequency converter. Remove the terminal cover with a screwdriver.

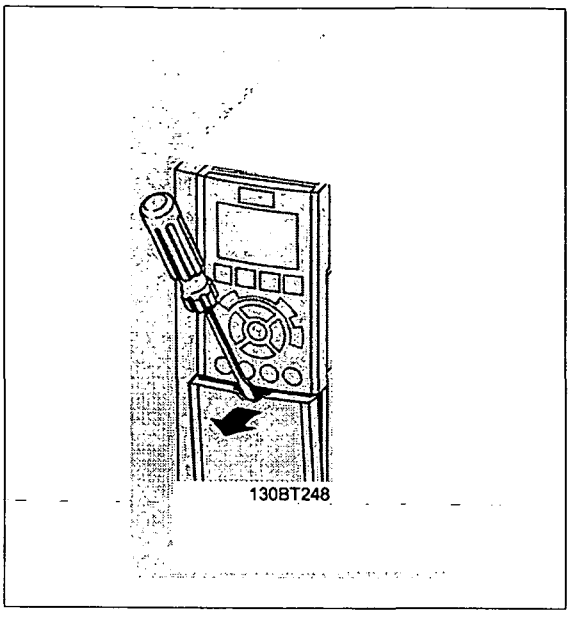


Illustration 5.41: Access to control terminals for A2, A3, B3, B4, C3 and C4 enclosures

Remove front-cover to access control terminals. When replacing the front-cover, please ensure proper fastening by applying a torque of 2 Nm.

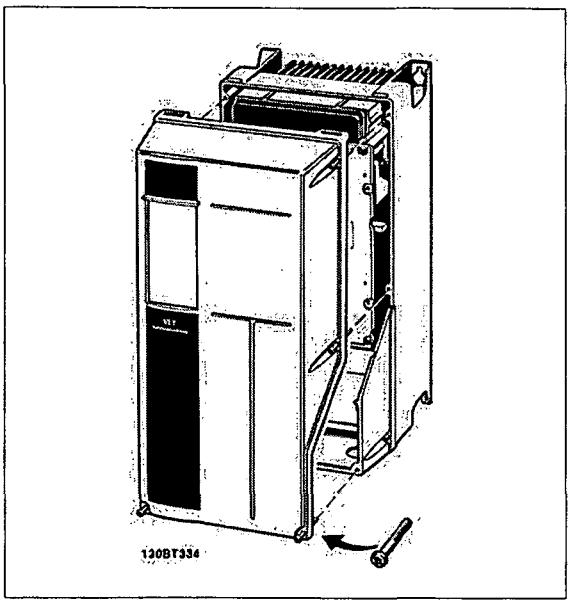


Illustration 5.42: Access to control terminals for A5, B1, B2, C1 and C2 enclosures

5.1.25. Control Terminals

Drawing reference numbers:

1. 10 pole plug digital I/O.
2. 3 pole plug RS-485 Bus.
3. 6 pole analog I/O.
4. USB connection.

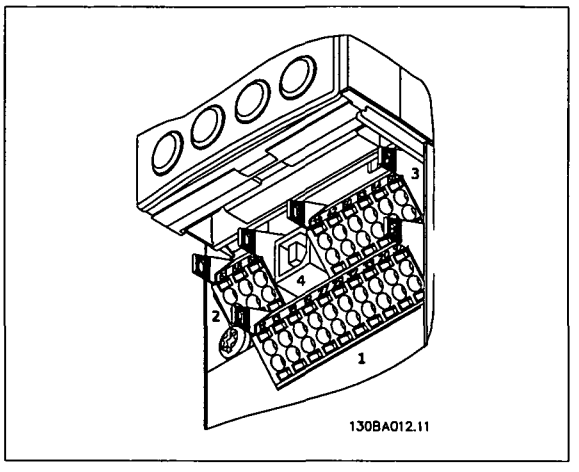


Illustration 5.43: Control terminals (all enclosures)

5.1.26. Control Cable Clamp

1. Use a clamp from the accessory bag to connect screen to frequency converter decoupling plate for control cables.

See section entitled *Earthing of Screened/Armoured Control Cables* for the correct termination of control cables.

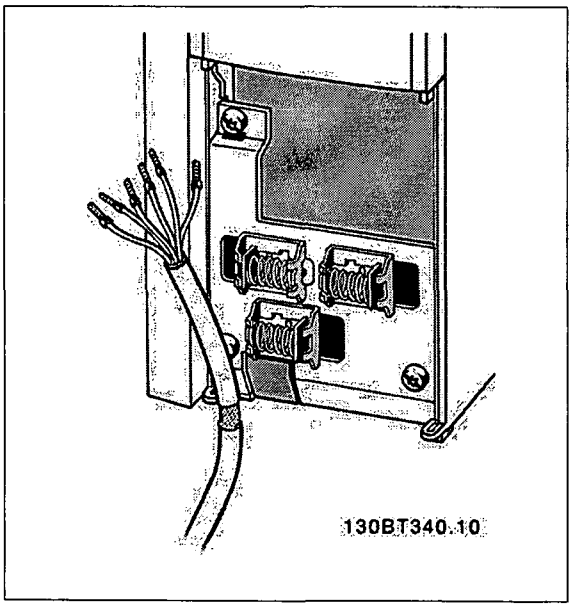


Illustration 5.44: Control cable clamp.

5.1.27. Electrical Installation and Control Cables

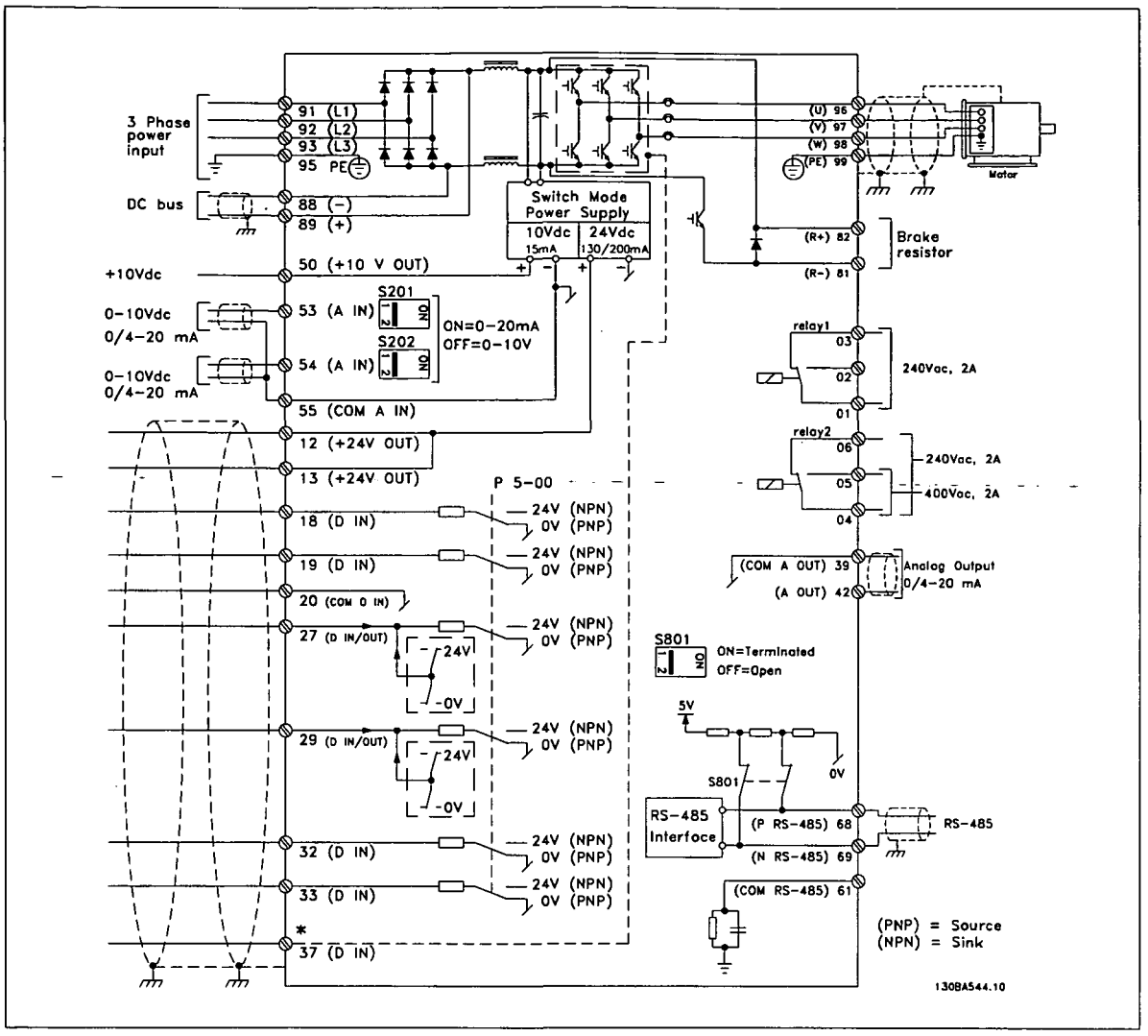


Illustration 5.45: Diagram showing all electrical terminals. (Terminal 37 present for units with Safe Stop Function only.)

Very long control cables and analog signals may, in rare cases and depending on installation, result in 50/60 Hz earth loops due to noise from mains supply cables.

If this occurs, break the screen or insert a 100 nF capacitor between screen and chassis.

NB!
The common of digital / analog inputs and outputs should be connected to separate common terminals 20, 39, and 55. This will avoid ground current interference among groups. For example, it avoids switching on digital inputs disturbing analog inputs.

NB!
Control cables must be screened/armoured.

5.1.28. How to Test Motor and Direction of Rotation.

Note that unintended motor start can occur, ensure no personnel or equipment is in danger!

Please follow these steps to test the motor connection and direction of rotation. Start with no power to the unit.

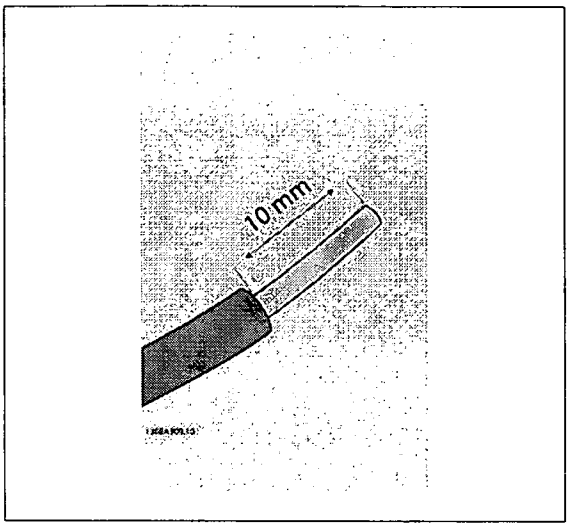


Illustration 5.46:

Step 1: First remove the insulation on both ends of a 50 to 70 mm piece of wire.

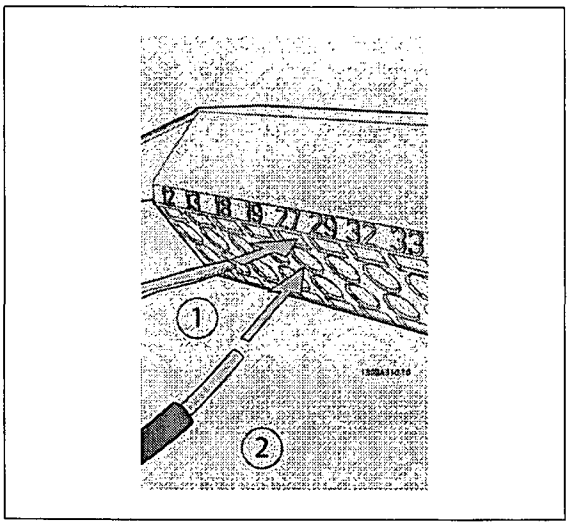


Illustration 5.47:

Step 2: Insert one end in terminal 27 using a suitable terminal screwdriver. (Note: For units with Safe Stop function, the existing jumper between terminal 12 and 37 should not be removed for the unit to be able to run!)

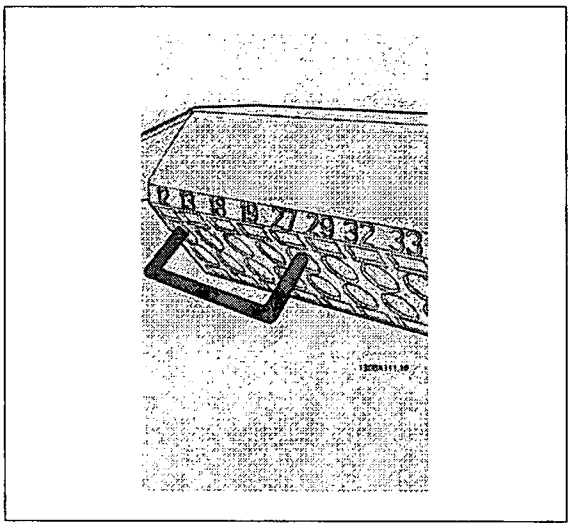


Illustration 5.48:

Step 3: Insert the other end in terminal 12 or 13. (Note: For units with Safe Stop function, the existing jumper between terminal 12 and 37 should not be removed for the unit to be able to run!)

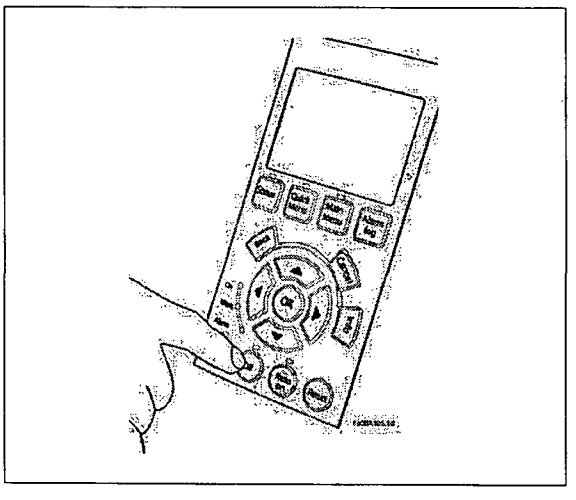


Illustration 5.49:

Step 4: Power-up the unit and press the [Off] button. In this state the motor should not rotate. Press [Off] to stop the motor at any time. Note the LED at the [OFF] button should be lit. If alarms or warnings are flashing, please see chapter 7 regarding these.

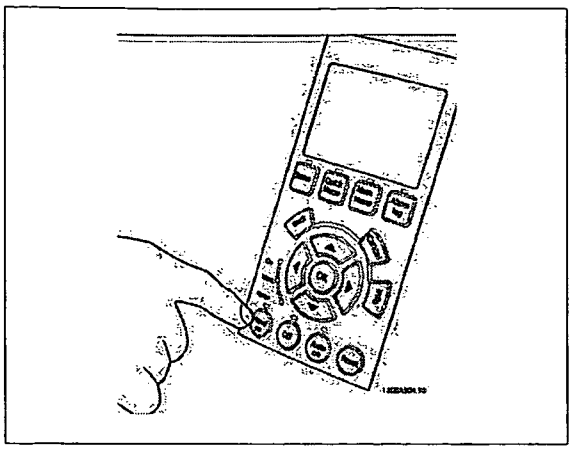


Illustration 5.50:

Step 5: By pressing the [Hand on] button, the LED above the button should be lit and the motor may rotate.

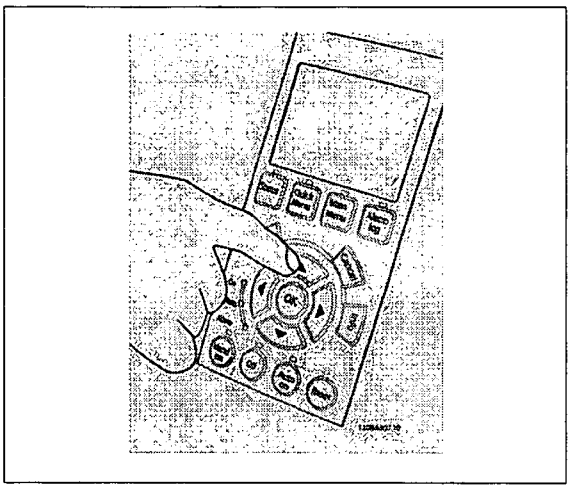


Illustration 5.51:

Step 6: The speed of the motor can be seen in the LCP. It can be adjusted by pushing the up ▲ and down ▼ arrow buttons.

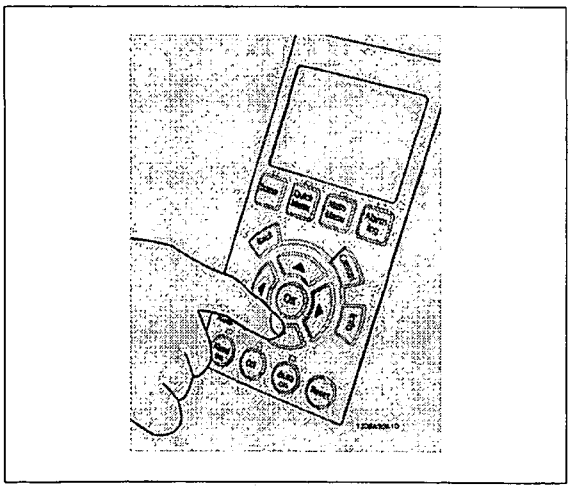


Illustration 5.52:

Step 7: To move the cursor, use the left ◄ and right ► arrow buttons. This enables changing the speed in larger increments.

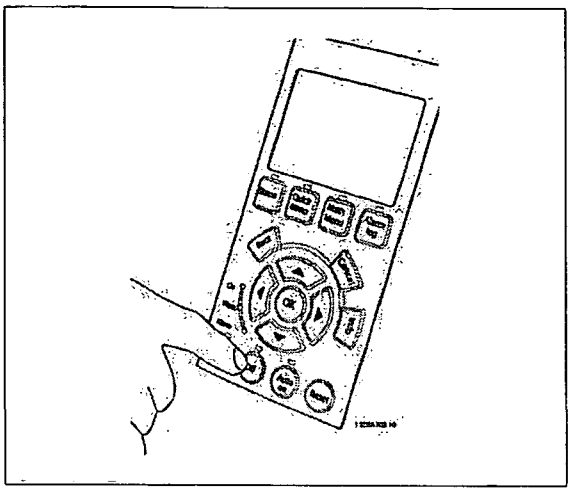


Illustration 5.53:

Step 8: Press the [Off] button to stop the motor again.

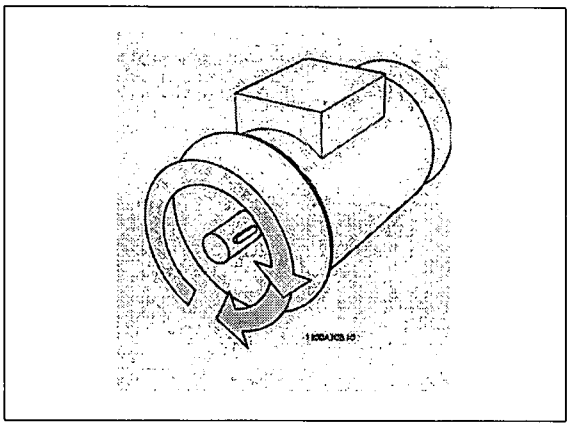


Illustration 5.54:

Step 9: Change two motor wires if the desired rotation of direction is not achieved.

Remove mains power from the frequency converter before changing motor wires.

5

5.1.29. Switches S201, S202, and S801

Switches S201 (AI 53) and S202 (AI 54) are used to select a current (0-20 mA) or a voltage (0 to 10 V) configuration of the analog input terminals 53 and 54 respectively.

Switch S801 (BUS TER.) can be used to enable termination on the RS-485 port (terminals 68 and 69).

Please note that the switches may be covered by an option, if fitted.

Default setting:

S201 (AI 53) = OFF (voltage input)

S202 (AI 54) = OFF (voltage input)

S801 (Bus termination) = OFF

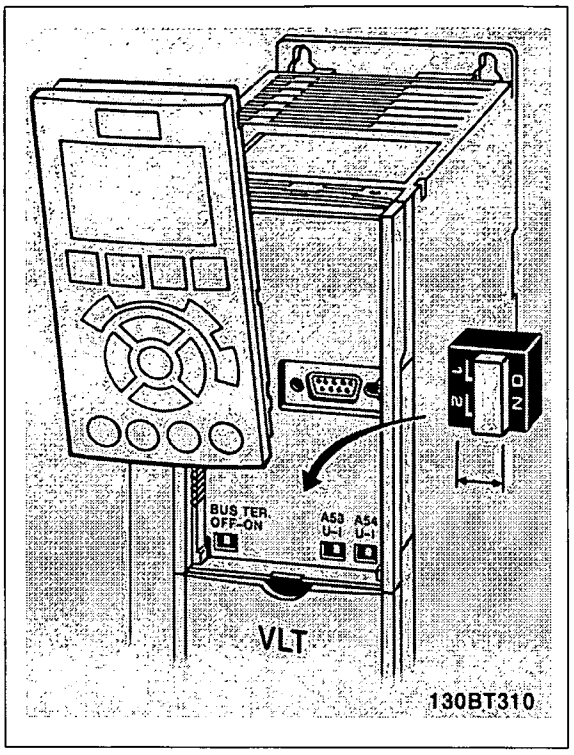


Illustration 5.55: Switches location.

5.2. Final optimization and test

5.2.1. Final optimization and test

To optimize motor shaft performance and optimize the frequency converter for the connected motor and installation, please follow these steps. Ensure that frequency converter and motor are connected, and power is applied to frequency converter.

NB!
Before power up ensure that connected equipment is ready for use.

Step 1. Locate motor name plate.

NB!
The motor is either star- (Y) or delta- connected (Δ). This information is located on the motor name plate data.

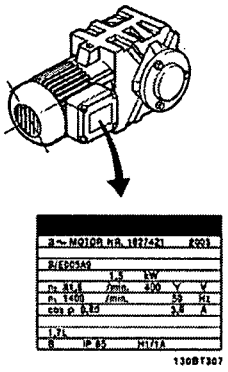


Illustration 5.56: Motor name plate example

Step 2. Enter motor name plate data in following parameter list.
To access list first press [QUICK MENU] key then select "Q2 Quick Setup".

1.	Motor Power [kW] or Motor Power [HP]	par. 1-20 par. 1-21
2.	Motor Voltage	par. 1-22
3.	Motor Frequency	par. 1-23
4.	Motor Current	par. 1-24
5.	Motor Nominal Speed	par. 1-25

Table 5.8: Motor related parameters

Step 3. Activate Automatic Motor Adaptation (AMA)

Performing AMA ensures best possible performance. AMA automatically takes measurements from the specific motor connected and compensates for installation variances.

1. Connect terminal 27 to terminal 12 or use [MAIN MENU] and set Terminal 27 par. 5-12 to *No operation* (par. 5-12 [0])
2. Press [QUICK MENU], select "Q2 Quick Setup", scroll down to AMA par. 1-29.
3. Press [OK] to activate the AMA par. 1-29.
4. Choose between complete or reduced AMA. If sine wave filter is mounted, run only reduced AMA, or remove sine wave filter during AMA procedure.
5. Press [OK] key. Display should show "Press [Hand on] to start".
6. Press [Hand on] key. A progress bar indicates if AMA is in progress.

5

Stop the AMA during operation

1. Press the [OFF] key - the frequency converter enters into alarm mode and the display shows that the AMA was terminated by the user.

Successful AMA

1. The display shows "Press [OK] to finish AMA".
2. Press the [OK] key to exit the AMA state.

Unsuccessful AMA

1. The frequency converter enters into alarm mode. A description of the alarm can be found in the *Troubleshooting* section.
2. "Report Value" in the [Alarm Log] shows the last measuring sequence carried out by the AMA, before the frequency converter entered alarm mode. This number along with the description of the alarm will assist troubleshooting. If contacting Danfoss Service, make sure to mention number and alarm description.

NB!
Unsuccessful AMA is often caused by incorrectly entered motor name plate data or too big difference between the motor power size and the frequency converter power size.

Step 4. Set speed limit and ramp time

Set up the desired limits for speed and ramp time.

Minimum Reference	par. 3-02
Maximum Reference	par. 3-03

Motor Speed Low Limit	par. 4-11 or 4-12
Motor Speed High Limit	par. 4-13 or 4-14

Ramp 1 Ramp Up Time [s]	par. 3-41
Ramp 1 Ramp Down Time 1 [s]	par. 3-42

6. Application Examples

6.1.1. Start/Stop

Terminal 18 = start/stop par. 5-10 [8] *Start*
Terminal 27 = No operation par. 5-12 [0] *No operation* (Default *coast inverse*

Par. 5-10 *Digital Input, Terminal 18* = *Start* (default)

Par. 5-12 *Digital Input, Terminal 27* = *coast inverse* (default)

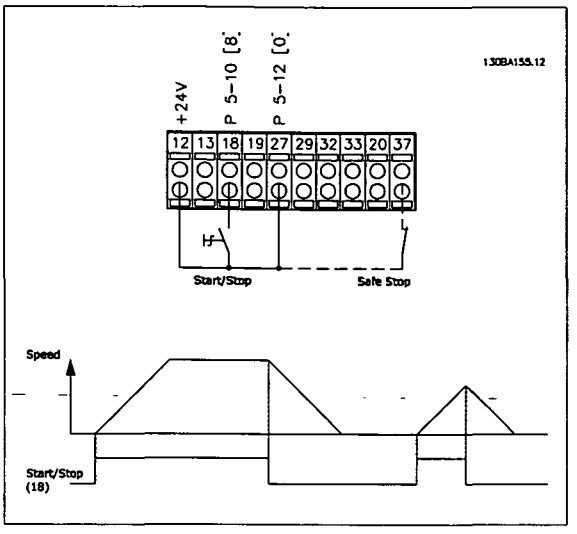
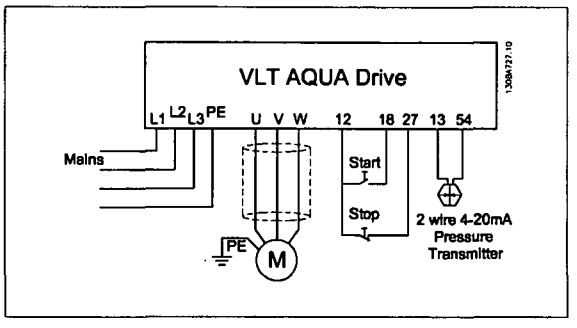


Illustration 6.1: Terminal 37: Available only with Safe Stop Function!

6.1.2. Closed Loop Wiring

Terminal 12 /13: +24V DC
Terminal 18: Start par. 5-18 [8] Start (Default)
Terminal 27: Coast par. 5-12 [2] coast inverse (Default)
Terminal 54: Analog input

L1-L3: Mains terminals
U,V and W: Motor terminals



6.1.3. Submersible Pump Application

The system consists of a submersible pump controlled by a Danfoss VLT AQUA Drive and a pressure transmitter. The transmitter gives a 4-20 mA feedback signal to the VLT AQUA Drive, which keeps a constant pressure by controlling the speed of the pump. To design a drive for a submersible pump application, there are a few important issues to take into consideration. Therefore the drive used must be chosen according to motor current.

1. The motor is a so called "Can motor" with a stainless steel can between the rotor and stator. There is a larger and a more magnetic resistant air-gap than on a normal motor hence a weaker field which results in the motors being designed with a higher rated current than a norm motor with similar rated power.
2. The pump contains thrust bearings which will be damaged when running below minimum speed which normally will be 30 Hz.
3. The motor reactance is nonlinear in submersible pump motors and therefore Automatic Motor Adaption (AMA) may not be possible. However, normally submersible pumps are operated with very long motor cables that might eliminate the nonlinear motor reactance and enable the drive to perform AMA. If AMA fails, the motor data can be set from parameter group 1-3* (see motor datasheet). Be aware that if AMA has succeeded the drive will compensate for voltage drop in the long motor cables, so if the Advanced motor data are set manually, the length of the motor cable must be taken into considerations to optimize system performance.
4. It is important that the system is operated with a minimum of wear and tear of the pump and motor. A Danfoss Sine-Wave filter can lower the motor insulation stress and increase lifetime (check actual motor insulation and the frequency converter du/dt specification). It is recommended to use a filter to reduce the need for service.
5. EMC performance can be difficult to achieve due to the fact that the special pump cable which is able to withstand the wet conditions in the well normally is unscreened. A solution could be to use a screened cable above the well and fix the screen to the well pipe if it is made of steel (can also be made of plastic). A Sine-Wave filter will also reduce the EMI from unscreened motor cables.

The special "can motor" is used due to the wet installation conditions. The drive needs to be designed for the system according to output current to be able to run the motor at nominal power.

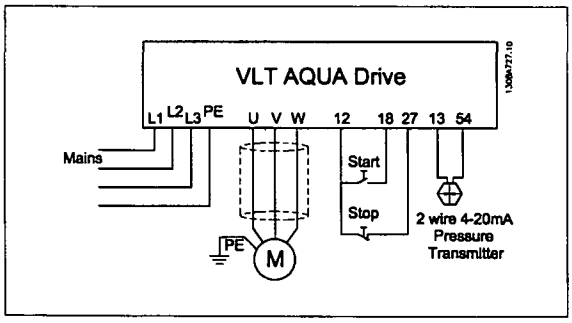
To prevent damage to the thrust bearings of the pump, it is important to ramp the pump from stop to min. speed as quick as possible. Well-known manufacturers of submersible pumps recommend that the pump is ramped to min. speed (30 Hz) in max. 2 -3 seconds. The new VLT© AQUA Drive is designed with initial and final Ramp for these applications. The initial and final ramps are 2 individual ramps, where Initial Ramp, if enabled, will ramp the motor from stop to min. speed and automatically switch to normal ramp, when min. speed is reached. Final ramp will do the opposite from min. speed to stop in a stop situation.

Pipe-Fill mode can be enabled to prevent water hammering. The Danfoss frequency converter is capable of filling vertical pipes using the PID controller to slowly ramp up the pressure with a user specified rate (units/sec). If enabled the drive will, when it reaches min. speed after startup, enter pipe fill mode. The pressure will slowly be ramped up until it reaches a user specified Filled Set Point, where after the drive automatically disables Pipe Fill Mode and continues in normal closed loop operation.
This feature is designed for irrigation applications.

Electrical Wiring

Typical parameter settings	
Typical/recommended settings in brackets().	
Parameters:	
Motor Rated Power	Par. 1-20 // par. 1-21
Motor Rated Voltage	Par. 1-22
Motor Current	Par. 1-24
Motor Rated Speed	Par. 1-28
Enable Reduced Automatic Motor Adaptation (AMA in par. 1-29)	

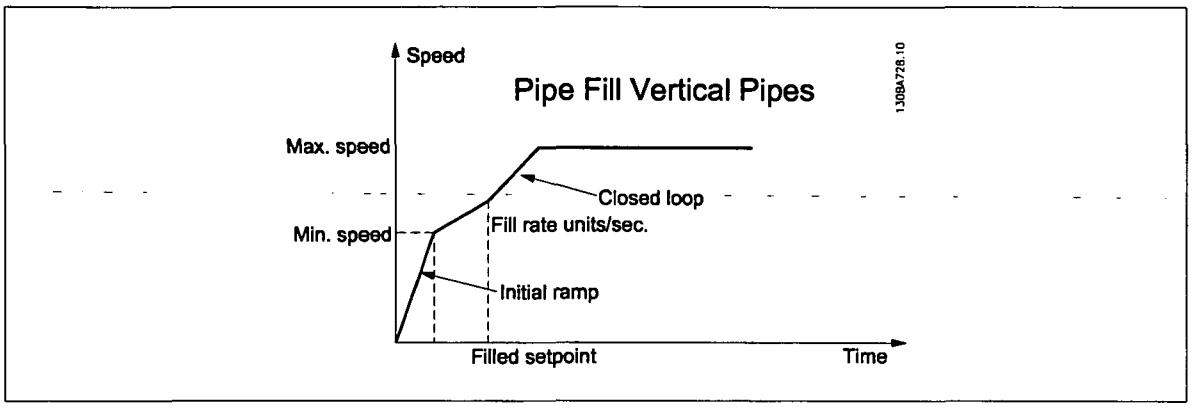
NB!
Note the analog input 2, (terminal (54) format must be set to mA. (switch 202).



Min. Reference	Par. 3-01	(30 Hz)
Max. Reference	Par. 3-02	(50/60 Hz)
Initial Ramp Up Time	Par. 3-84	(2 sec.)
Final Ramp Down Time	Par. 3-88	(2 sec.)
Normal Ramp Up Time	Par. 3-41	(8 sec. depending on size)
Normal Ramp Down Time	Par. 3-42	(8 sec. depending on size)
Motor Min. Speed	Par. 4-11	(30 Hz)
Motor Max. Speed	Par. 4-13	(50/60 Hz)

Use the "Closed Loop" wizard under "Quick Menu_Funtion_Setup", to easily set up the feedback settings in the PID controller.

Pipe Fill Mode		
Pipe Fill Enable	Par. 29-00	
Pipe Fill Rate	Par. 29-04	(Feedback units/sec.)
Filled Set Point	Par. 29-05	(Feedback units)



6

7

7. How to operate the frequency converter

7.1. Ways of Operation

7.1.1. Ways of Operation

The frequency converter can be operated in 3 ways:

1. Graphical Local Control Panel (GLCP), see 6.1.2
2. Numeric Local Control Panel (NLCP), see 6.1.3
3. RS-485 serial communication or USB, both for PC connection, see 6.1.4

If the frequency converter is fitted with fieldbus option, please refer to relevant documentation.

7.1.2. How to operate graphical LCP (GLCP)

The following instructions are valid for the GLCP (LCP 102).

The GLCP is divided into four functional groups:

1. Graphical display with Status lines.
2. Menu keys and indicator lights (LED's) - selecting mode, changing parameters and switching between display functions.
3. Navigation keys and indicator lights (LEDs).
4. Operation keys and indicator lights (LEDs).

Graphical display:
The LCD-display is back-lit with a total of 6 alpha-numeric lines. All data is displayed on the LCP which can show up to five operating variables while in [Status] mode.

Display lines:

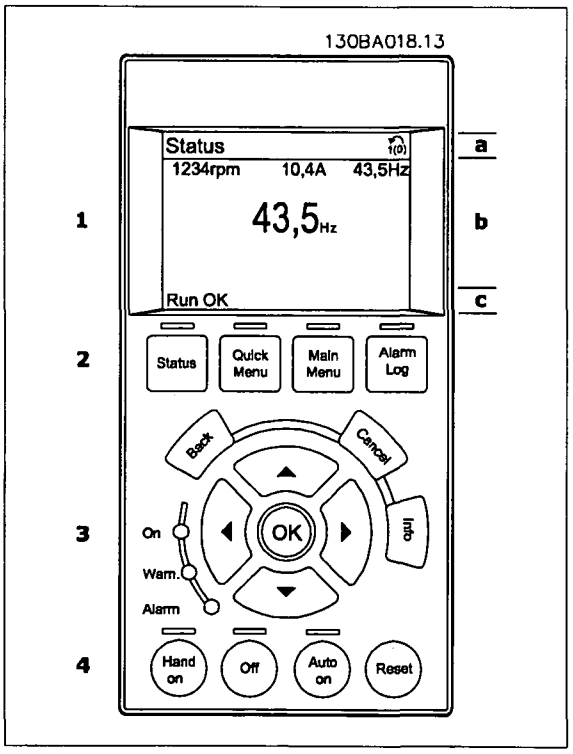
a. **Status line:** Status messages displaying icons and graphics.

b. **Line 1-2:** Operator data lines displaying data and variables defined or chosen by the user. By pressing the [Status] key, up to one extra line can be added.

c. **Status line:** Status messages displaying text.

The display is divided into 3 sections:

Top section (a)
shows the status when in status mode or up to 2 variables when not in status mode and in the case of Alarm/Warning.



The number of the Active Set-up (selected as the Active Set-up in par. 0-10) is shown. When programming in another Set-up than the Active Set-up, the number of the Set-up being programmed appears to the right in brackets.

Middle section (b)

shows up to 5 variables with related unit, regardless of status. In case of alarm/warning, the warning is shown instead of the variables.

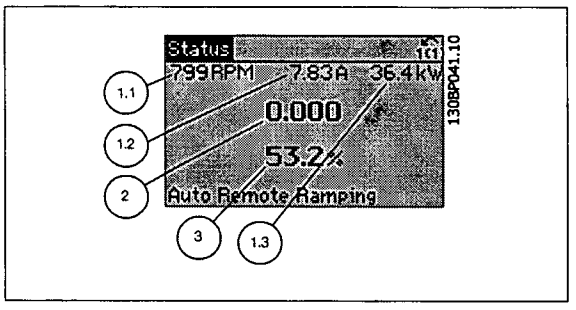
It is possible to toggle between three status read-out displays by pressing the [Status] key.
Operating variables with different formatting are shown in each status screen - see below.

Several values or measurements can be linked to each of the displayed operating variables. The values / measurements to be displayed can be defined via par. 0-20, 0-21, 0-22, 0-23, and 0-24, which can be accessed via [QUICK MENU], "Q3 Function Setups", "Q3-1 General Settings", "Q3-11 Display Settings".

Each value / measurement readout parameter selected in par. 0-20 to par. 0-24 has its own scale and number of digits after a possible decimal point. Larger numeric values are displayed with few digits after the decimal point.
Ex.: Current readout
5.25 A; 15.2 A 105 A.

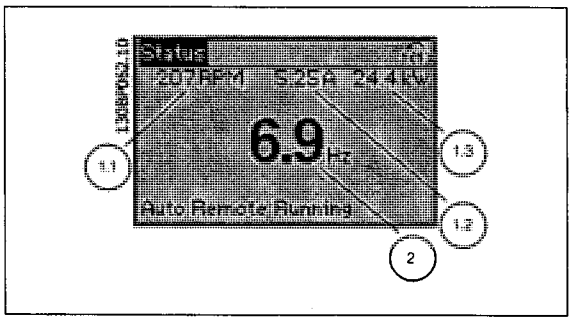
Status display I

This read-out state is standard after start-up or initialization.
Use [INFO] to obtain information about the value/measurement linked to the displayed operating variables (1.1, 1.2, 1.3, 2, and 3).
See the operating variables shown in the display in this illustration. 1.1, 1.2 and 1.3 are shown in small size. 2 and 3 are shown in medium size.



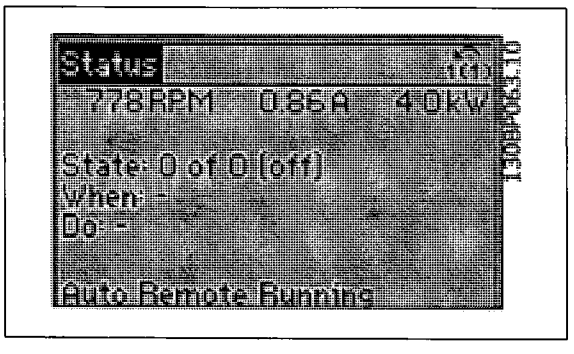
Status display II

See the operating variables (1.1, 1.2, 1.3, and 2) shown in the display in this illustration.
In the example, Speed, Motor current, Motor power and Frequency are selected as variables in the first and second lines.
1.1, 1.2 and 1.3 are shown in small size. 2 is shown in large size.

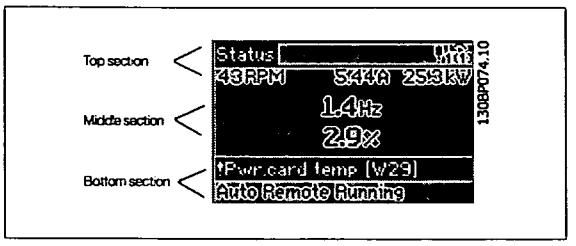


Status display III:

This state displays the event and action of the Smart Logic Control. For further information, see section *Smart Logic Control.*



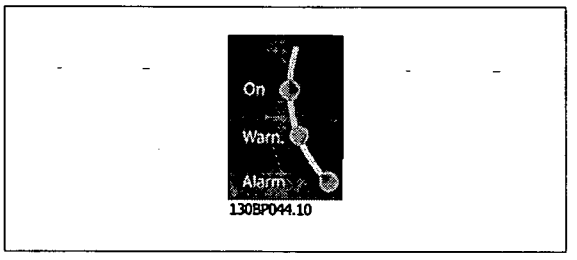
Bottom section
always shows the state of the frequency converter in Status mode.



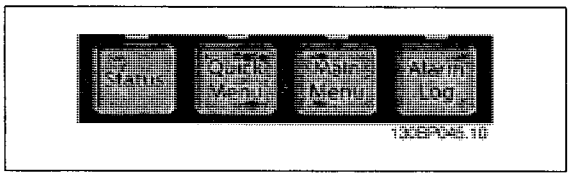
Display Contrast Adjustment
Press [status] and [▲] for darker display
Press [status] and [▼] for brighter display

Indicator lights (LEDs):
If certain threshold values are exceeded, the alarm and/or warning LED lights up. A status and alarm text appear on the control panel.
The On LED is activated when the frequency converter receives power from mains voltage, a DC bus terminal, or an external 24 V supply. At the same time, the back light is on.

- Green LED/On: Control section is working.
- Yellow LED/Warn.: Indicates a warning.
- Flashing Red LED/Alarm: Indicates an alarm.



GLCP keys
Menu keys
The menu keys are divided into functions. The keys below the display and indicator lamps are used for parameter set-up, including choice of display indication during normal operation.



[Status]
Indicates the status of the frequency converter and/or the motor. 3 different readouts can be chosen by pressing the [Status] key:
5 line readouts, 4 line readouts or Smart Logic Control.
Use **[Status]** for selecting the mode of display or for changing back to Display mode from either the Quick Menu mode, the Main Menu mode or Alarm mode. Also use the [Status] key to toggle single or double read-out mode.

[Quick Menu]
Allows quick set-up of the frequency converter. **The most common functions can be programmed here.**

The [Quick Menu] consists of:

- **Q1: My Personal Menu**
- **Q2: Quick Setup**
- **Q3: Function Setups**
- **Q5: Changes Made**
- **Q6: Loggings**

The Function set-up provides quick and easy access to all parameters required for the majority of water and wastewater applications including variable torque, constant torque, pumps, dossing pumps, well pumps, booster pumps, mixer pumps, aeration blowers and other pump and fan applications. Amongst other features it also includes parameters for selecting which variables to display on the LCP, digital preset speeds, scaling of analog references, closed loop single zone and multi-zone applications and specific functions related to water and wastewater applications.

The Quick Menu parameters can be accessed immediately unless a password has been created via par. 0-60, 0-61, 0-65 or 0-66.
It is possible to switch directly between Quick Menu mode and Main Menu mode.

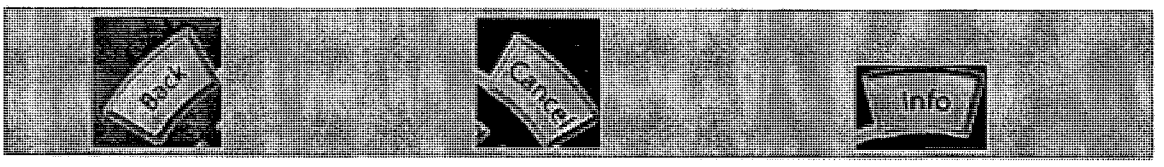
[Main Menu]
is used for programming all parameters.
The Main Menu parameters can be accessed immediately unless a password has been created via par. 0-60, 0-61, 0-65 or 0-66. For the majority of water and wastewater applications it is not necessary to access the Main Menu parameters but instead the Quick Menu, Quick Setup and Function Setups provides the simplest and quickest access to the typical required parameters.
It is possible to switch directly between Main Menu mode and Quick Menu mode.
Parameter shortcut can be carried out by pressing down the **[Main Menu]** key for 3 seconds. The parameter shortcut allows direct access to any parameter.

[Alarm Log]
displays an Alarm list of the five latest alarms (numbered A1-A5). To obtain additional details about an alarm, use the arrow keys to manoeuvre to the alarm number and press [OK]. Information is displayed about the condition of the frequency converter before it enters the alarm mode.

[Back]
reverts to the previous step or layer in the navigation structure.

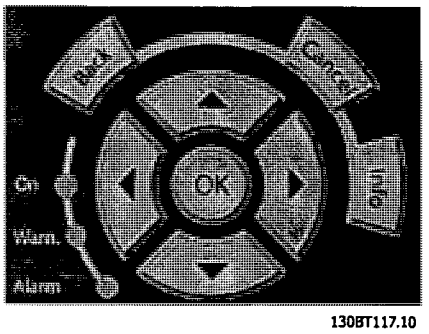
[Cancel]
last change or command will be cancelled as long as the display has not been changed.

[Info]
displays information about a command, parameter, or function in any display window. [Info] provides detailed information when needed.
Exit Info mode by pressing either [Info], [Back], or [Cancel].

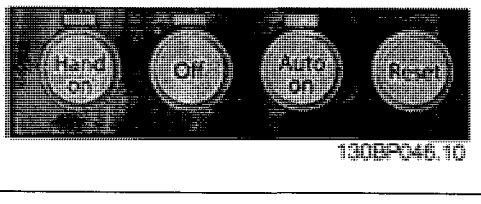


Navigation Keys
The four navigation arrows are used to navigate between the different choices available in **[Quick Menu]**, **[Main Menu]** and **[Alarm Log]**. Use the keys to move the cursor.

[OK]
is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.



Operation Keys
for local control are found at the bottom of the control panel.



[Hand On]
enables control of the frequency converter via the GLCP. [Hand on] also starts the motor, and it is now possible to give the motor speed reference by means of the arrow keys. The key can be *Enabled* [1] or *Disabled* [0] via par. *0-40 [Hand on] Key on LCP.*

The following control signals will still be active when [Hand on] is activated:

- [Hand on] - [Off] - [Auto on]
- Reset
- Coasting stop inverse (motor coasting to stop)

- Reversing
- Set-up select lsb - Set-up select msb
- Stop command from serial communication
- Quick stop
- DC brake

NB!
External stop signals activated by means of control signals or a serial bus will override a "start" command via the LCP.

[Off]
stops the connected motor. The key can be *Enabled* [1] or *Disabled* [0] via par. *0-41 [Off] key on LCP.* If no external stop function is selected and the [Off] key is inactive the motor can only be stopped by disconnecting the mains supply.

[Auto On]
enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be *Enabled* [1] or *Disabled* [0] via par. *0-42 [Auto on] key on LCP.*

NB!
An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand on] – [Auto on].

7

[Reset]
is used for resetting the frequency converter after an alarm (trip). The key can be *Enabled* [1] or *Disabled* [0] via par. 0-43 *Reset Keys on LCP.*

The parameter shortcut
can be carried out by holding down the [Main Menu] key for 3 seconds. The parameter shortcut allows direct access to any parameter.

7.1.3. How to operate numeric LCP (NLCP)

The following instructions are valid for the NLCP (LCP 101).

The control panel is divided into four functional groups:

1. Numeric display.
2. Menu key and indicator lights (LEDs) - changing parameters and switching between display functions.
3. Navigation keys and indicator lights (LEDs).
4. Operation keys and indicator lights (LEDs).

NBI
Parameter copy is not possible with Numeric Local Control Panel (LCP101).

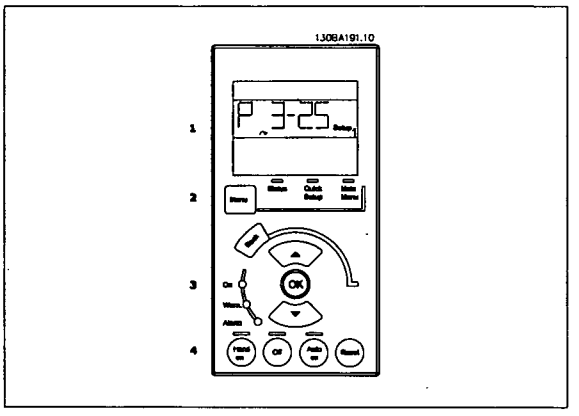


Illustration 7.1: Numerical LCP (NLCP)

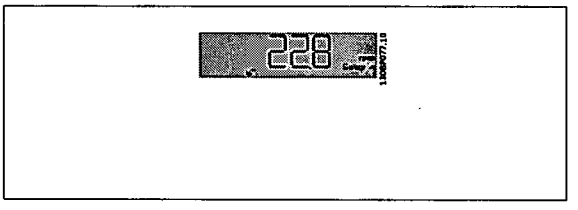


Illustration 7.2: Status display example

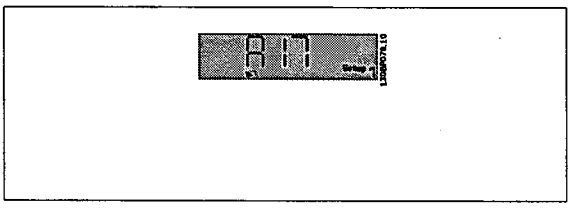


Illustration 7.3: Alarm display example

Select one of the following modes:
Status Mode: Displays the status of the frequency converter or the motor.
If an alarm occurs, the NLCP automatically switches to status mode.
A number of alarms can be displayed.

Quick Setup or Main Menu Mode: Display parameters and parameter settings.

Indicator lights (LEDs):

- Green LED/On: Indicates if control section is on.
- Yellow LED/Wm.: Indicates a warning.
- Flashing red LED/Alarm: Indicates an alarm.

Menu key
[Menu] Select one of the following modes:

- Status
- Quick Setup
- Main Menu

Main Menu
is used for programming all parameters.
The parameters can be accessed immediately unless a password has been created via par. 0-60 Main *Menu Password*, par. 0-61 Access *to Main Menu w/o Password*, par. 0-65 Personal *Menu Password* or par. 0-66 Access *to Personal Menu w/o Password*.
Quick Setup is used to set up the frequency converter using only the most essential parameters.
The parameter values can be changed using the up/down arrows when the value is flashing.
Select Main Menu by pressing the [Menu] key a number of times until the Main Menu LED is lit.
Select the parameter group [xx-__] and press [OK]
Select the parameter [__-xx] and press [OK]
If the parameter is an array parameter select the array number and press [OK]
Select the wanted data value and press [OK]

Navigation Keys

[Back]

for stepping backwards

Arrow [▲] [▼]

keys are used for manoeuvring between parameter groups, parameters and within parameters

[OK]

is used for choosing a parameter marked by the cursor and for enabling the change of a parameter.

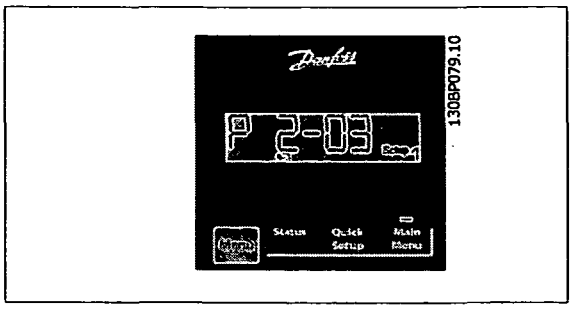


Illustration 7.4: Display example

Operation Keys

Keys for local control are found at the bottom of the control panel.

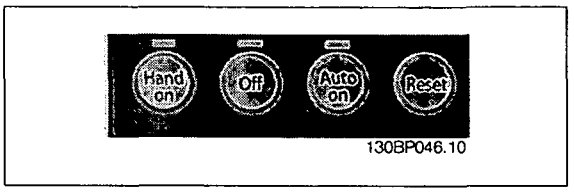


Illustration 7.5: Operation keys of the numerical LCP (NLCP)

[Hand on]

enables control of the frequency converter via the LCP. [Hand on] also starts the motor and it is now possible to enter the motor speed data by means of the arrow keys. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-40 [Hand *on] Key on LCP*.

External stop signals activated by means of control signals or a serial bus will override a 'start' command via the LCP.

The following control signals will still be active when [Hand on] is activated:

- [Hand on] - [Off] - [Auto on]
- Reset
- Coasting stop inverse
- Reversing
- Set-up select lsb - Set-up select msb
- Stop command from serial communication
- Quick stop
- DC brake

[Off]

stops the connected motor. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-41 [Off] *Key on LCP*.

If no external stop function is selected and the [Off] key is inactive the motor can be stopped by disconnecting the mains supply.

[Auto on]

enables the frequency converter to be controlled via the control terminals and/or serial communication. When a start signal is applied on the control terminals and/or the bus, the frequency converter will start. The key can be *Enabled* [1] or *Disabled* [0] via par. 0-42 [Auto *on] Key on LCP*.

NB!

An active HAND-OFF-AUTO signal via the digital inputs has higher priority than the control keys [Hand on] [Auto on].

[Reset]

is used for resetting the frequency converter after an alarm (trip). The key can be *Enabled* [1] or *Disabled* [0] via par. 0-43 [Reset] *Key on LCP*.

7.1.4. Changing Data

1. Press [Quick Menu] or [Main Menu] key.

2. Use [▲] and [▼] keys keys to find parameter group to edit.
3. Press [OK] key.
4. Use [▲] and [▼] keys to find parameter to edit.
5. Press [OK] key.
6. Use [▲] and [▼] keys to select correct parameter setting. Or, to move to digits within a number, use keys. Cursor indicates digit selected to change. [▲] key increases the value, [▼] key decreases the value.
7. Press [Cancel] key to disregard change, or press [OK] key to accept change and enter new setting.

7.1.5. Changing a Text Value

If the selected parameter is a text value, change the text value by means of the up/down navigation keys.
The up key increases the value, and the down key decreases the value. Place the cursor on the value to be saved and press [OK].

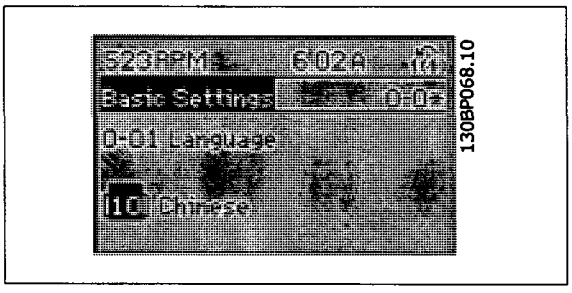


Illustration 7.6: Display example.

7.1.6. Changing a Group of Numeric Data Values

If the chosen parameter represents a numeric data value, change the chosen data value by means of the <> navigation keys as well as the up/down navigation keys. Use the <> navigation keys to move the cursor horizontally.

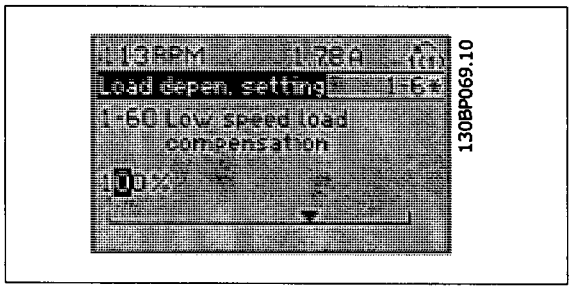


Illustration 7.7: Display example.

Use the up/down navigation keys to change the data value. The up key enlarges the data value, and the down key reduces the data value. Place the cursor on the value to be saved and press [OK].

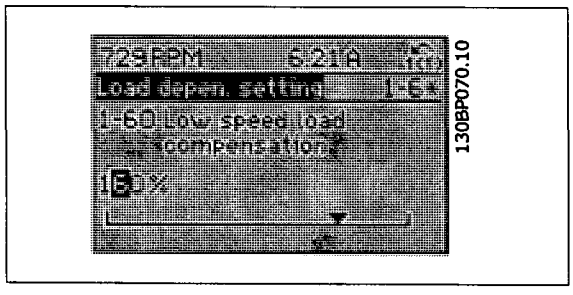


Illustration 7.8: Display example.

7.1.7. Changing of Data Value, Step-by-Step

Certain parameters can be changed step by step or infinitely variably. This applies to par. 1-20 *Motor Power [kW]*, par. 1-22 *Motor Voltage* and par. 1-23 *Motor Frequency*.
The parameters are changed both as a group of numeric data values and as numeric data values infinitely variably.

7.1.8. Read-out and Programming of Indexed Parameters

Parameters are indexed when placed in a rolling stack.
par. 15-30 Alarm *Log: Error Code* to par. 15-32 Alarm *Log: Time* contain a fault log which can be read out. Choose a parameter, press [OK], and use the up/down navigation keys to scroll through the value log.

Use par. 3-10 *Preset Reference* as another example:
Choose the parameter, press [OK], and use the up/down navigation keys keys to scroll through the indexed values. To change the parameter value, select the indexed value and press [OK]. Change the value by using the up/down keys. Press [OK] to accept the new setting. Press [Cancel] to abort. Press [Back] to leave the parameter.

7.1.9. Tips and tricks

*	For the majority of water and wastewater applications the Quick Menu, Quick Setup and Function Setups provides the simplest and quickest access to all the typical parameters required.
*	Whenever possible, performing an AMA will ensure best shaft performance
*	Contrast of the display can be adjusted by pressing [Status] and [▲] for darker display or by pressing [Status] and [▼] for brighter dispaly
*	Under [Quick Menu] and [Changes Made] all parameters that have been changed from factory settings are displayed
*	Press and hold [Main Menu] key for 3 seconds for access to any parameter
*	For service purposes it is recommended to copy all parameters to the LCP, see par. 0-50 for further information

Table 7.1: Tips and tricks

7

7.1.10. Quick Transfer of Parameter Settings when using GLCP

Once the set-up of a frequency converter is complete, it is recommended to store (backup) the parameter settings in the GLCPkeypad or on a PC via MCT 10 Set-up Software Tool.

NB!
Stop the motor before performing any of these operations.

Data storage in LCP:

1. Go to par. 0-50 LCP *Copy*
2. Press the [OK] key
3. Select "All to LCP"
4. Press the [OK] key

All parameter settings are now stored in the GLCP indicated by the progress bar. When 100% is reached, press [OK].

The GLCP can now be connected to another frequency converter and the parameter settings copied to this frequency converter.

Data transfer from LCP to Frequency converter:

1. Go to par. 0-50 LCP *Copy*
2. Press the [OK] key
3. Select "All from LCP"
4. Press the [OK] key

The parameter settings stored in the GLCP are now transferred to the frequency converter indicated by the progress bar. When 100% is reached, press [OK].

7.1.11. Initialisation to Default Settings

There are two ways to initialise the frequency converter to default: Recommended initialisation and manual initialisation.
Please be aware that they have different impact according to the below description.

Recommended initialisation (via par. 14-22 Operation *Mode*)

1. Select par. 14-22 Operation *Mode*
2. Press [OK]
3. Select "Initialisation" (for NLCP select "2")
4. Press [OK]
5. Remove power to unit and wait for display to turn off.
6. Reconnect power and the frequency converter is reset. Note that first start-up takes a few more seconds.
7. Press [Reset]

par. 14-22 Operation *Mode* initialises all except:
par. 14-50 RFI *Filter*
par.
par.
par. 8-32 Baud *Rate*
par. 8-35 Minimum *Response Delay*
par. 8-36 Maximum *Response Delay*
par. 8-37 Maximum *Inter-Char Delay*
par. 15-00 Operating *Hours* to par. 15-05 Over *Volt's*
par. 15-20 Historic *Log: Event* to par. 15-22 Historic *Log: Time*
par. 15-30 Alarm *Log: Error Code* to par. 15-32 Alarm *Log: Time*

NB!
Parameters selected in par. 0-25 My *Personal Menu*, will stay present, with default factory setting.

7

Manual initialisation

NB!
When carrying out manual initialisation, serial communication, RFI filter settings and fault log settings are reset.
Removes parameters selected in par. 0-25 My *Personal Menu*.

1. Disconnect from mains and wait until the display turns off.
2a. Press [Status] - [Main Menu] - [OK] at the same time while power up for Graphical LCP (GLCP).
2b. Press [Menu] while power up for LCP 101, Numerical Display
3. Release the keys after 5 s.
4. The frequency converter is now programmed according to default settings.

This parameter initialises all except:
par. 15-00 Operating *Hours*
par. 15-03 Power *Up's*
par. 15-04 Over *Temp's*
par. 15-05 Over *Volt's*

7.1.12. RS-485 Bus Connection

One or more frequency converters can be connected to a controller (or master) using the RS-485 standard interface. Terminal 68 is connected to the P signal (TX+, RX+), while terminal 69 is connected to the N signal (TX-,RX-).

If more than one frequency converter is connected to a master, use parallel connections.

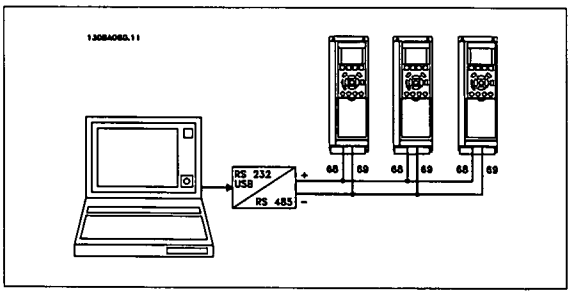


Illustration 7.9: Connection example.

In order to avoid potential equalizing currents in the screen, earth the cable screen via terminal 61, which is connected to the frame via an RC-link.

Bus termination
The RS-485 bus must be terminated by a resistor network at both ends. If the drive is the first or the last device in the RS-485 loop, set the switch S801 on the control card for ON.
For more information, see the paragraph *Switches S201, S202, and S801*.

7.1.13. How to Connect a PC to the frequency converter

To control or program the frequency converter from a PC, install the PC-based Configuration Tool MCT 10.
The PC is connected via a standard (host/device) USB cable, or via the RS-485 interface as shown in the *Design Guide, chapter How to Install > Installation of misc. connections*.

NB!
The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals. The USB connection is connected to protection earth on the frequency converter. Use only isolated laptop as PC connection to the USB connector on the frequency converter.

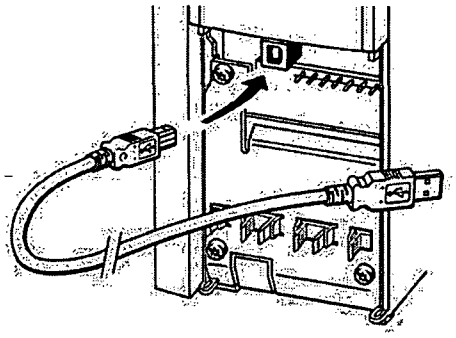


Illustration 7.10: For control cable connections, see section on *Control Terminals*.

7.1.14. PC Software tools

PC-based Configuration Tool MCT 10
All Frequency converters are equipped with a serial communication port. Danfoss provides a PC tool for communication between PC and frequency converter, PC-based Configuration Tool MCT 10. Please check the section on *Available Literature* for detailed information on this tool.

MCT 10 Set-up Software
MCT 10 has been designed as an easy to use interactive tool for setting parameters in our frequency converters. The software can be downloaded from the Danfoss internet site *http://www.Danfoss.com/BusinessAreas/DrivesSolutions/Softwaredownload/DDPC+Software+Program.htm*.
The MCT 10 Set-up software will be useful for:

- Planning a communication network off-line. MCT 10 contains a complete frequency converter database
- Commissioning frequency converters on line
- Saving settings for all frequency converters
- Replacing a frequency converter in a network
- Simple and accurate documentation of frequency converter settings after commissioning.
- Expanding an existing network
- Future developed frequency converters will be supported

MCT 10 set-up software supports Profibus DP-V1 via a Master class 2 connection. It makes it possible to on line read/write parameters in a frequency converter via the Profibus network. This will eliminate the need for an extra communication network.

Save Frequency Converter Settings:

1. Connect a PC to the unit via USB com port. (Note: Use a PC, which is isolated from the mains, in conjunction with the USB port. Failure to do so may damage equipment.)

2. Open MCT 10 Set-up Software
3. Choose "Read from drive"
4. Choose "Save as"

All parameters are now stored in the PC.

Load Frequency Converter Settings:

1. Connect a PC to the frequency converter via USB com port
2. Open MCT 10 Set-up software
3. Choose "Open"– stored files will be shown
4. Open the appropriate file
5. Choose "Write to drive"

All parameter settings are now transferred to the frequency converter.

A separate manual forMCT 10 Set-up Software is available: *MG.10.Rx.yy.*

The MCT 10 Set-up Software Modules

The following modules are included in the software package:

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	**MCT Set-up 10 Software** Setting parameters Copy to and from frequency converters Documentation and print out of parameter settings incl. diagrams
	Ext. User Interface Preventive Maintenance Schedule Clock settings Timed Action Programming Smart Logic Controller Set-up

Ordering number:

Please order the CD containing MCT 10 Set-up Software using code number 130B1000.

MCT 10 can also be downloaded from the Danfoss Internet: *WWW.DANFOSS.COM, Business Area: Motion Controls.*

8. How to programme the frequency converter

8.1. How to programme

8.1.1. Parameter Set-Up

Overview of parameter groups

Group	Title	Function
0-	Operation / Display	Parameters related to the fundamental functions of the frequency converter, function of the LCP buttons and configuration of the LCP display.
1-	Load / Motor	Parameter group for motor settings.
2-	Brakes	Parameter group for setting brake features in the frequency converter.
3-	Reference / Ramps	Parameters for reference handling, definitions of limitations, and configuration of the reaction of the frequency converter to changes.
4-	Limits / Warnings	Parameter group for configuring limits and warnings.
5-	Digital In/Out	Parameter group for configuring the digital inputs and outputs.
6-	Analog In/Out	Parameter group for configuration of the analog inputs and outputs.
8-	Communication and Options	Parameter group for configuring communications and options.
9-	Profibus	Parameter group for Profibus-specific parameters.
10-	DeviceNet Fieldbus	Parameter group for DeviceNet-specific parameters.
11-	LonWorks	Parameter group for LonWorks parameters
13-	Smart Logic	Parameter group for Smart Logic Control
14-	Special Functions	Parameter group for configuring special frequency converter functions.
15-	Drive Information	Parameter group containing frequency converter information such as operating data, hardware configuration and software versions.
16-	Data Readouts	Parameter group for data read-outs, e.g. actual references, voltages, control, alarm, warning and status words.
18-	Info and Readouts	This parameter group contains the last 10 Preventive Maintenance logs.
20-	Drive Closed Loop	This parameter group is used for configuring the closed loop PID Controller that controls the output frequency of the unit.
21-	Extended Closed Loop	Parameters for configuring the three Extended Closed Loop PID Controllers.
22-	Application Functions	These parameters monitor water applications.
23-	Time-based Functions	These parameters are for actions needed to be performed on a daily or weekly basis, e.g. different references for working hours/non-working hours.
25-	Basic Cascade Controller Functions	Parameters for configuring the Basic Cascade Controller for sequence control of multiple pumps.
26-	Analog I/O Option MCB 109	Parameters for configuring the Analog I/O Option MCB 109.
27-	Extended Cascade Control	Parameters for configuring the Extended Cascade Control
29-	Water Application Functions	Parameters for setting water specific functions.
31-	Bypass Option	Parameters for configuring the Bypass Option

Table 8.1: Parameter Groups

Parameter descriptions and selections are displayed on the graphic (GLCP) or numeric (NLCP) in the display area. (See Section 5 for details.) Access the parameters by pressing the [Quick Menu] or [Main Menu] key on the control panel. The quick menu is used primarily for commissioning the unit at start-up by providing those parameters necessary to start operation. The main menu provides access to all parameters for detailed application programming.

All digital input/output and analog input/output terminals are multifunctional. All terminals have factory default functions suitable for the majority of water applications but if other special functions are required, they must be programmed in parameter group 5 or 6.

8.1.2. Quick Menu Mode

The GLCP provides access to all parameters listed under the Quick Menus. To set parameters using the [Quick Menu] button:

Pressing [Quick Menu] the list indicates the different areas contained in the Quick menu.

Efficient Parameter Set-up for Water Applications

The parameters can easily be set up for the vast majority of the water and wastewater applications only by using the **[Quick Menu]**.

The optimum way to set parameters through the [Quick Menu] is by following the below steps:

1. Press [Quick Setup] for selecting basic motor settings, ramp times, etc.
2. Press [Function Setups] for setting up the required functionality of the frequency converter - if not already covered by the settings in [Quick Setup].
3. Choose between *General Settings*, *Open Loop Settings* and *Closed Loop Settings*.

It is recommended to do the set-up in the order listed.

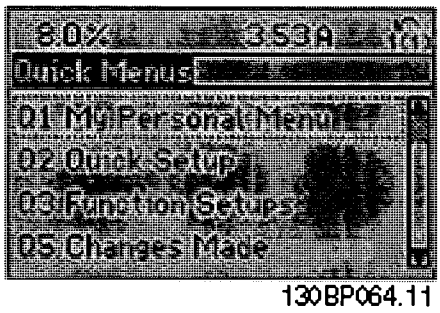

Illustration 8.1: Quick menu view.

Par.	Designation	[Units]
0-01	Language	
1-20	Motor Power	[kW]
1-22	Motor Voltage	[V]
1-23	Motor Frequency	[Hz]
1-24	Motor Current	[A]
1-25	Motor Nominal Speed	[RPM]
3-41	Ramp 1 Ramp up Time	[s]
3-42	Ramp 1 Ramp down Time	[s]
4-11	Motor Speed Low Limit	[RPM]
4-13	Motor Speed High Limit	[RPM]
1-29	Automatic Motor Adaptation (AMA)	

Table 8.2: Quick Setup parameters

If *No Operation* is selected in terminal 27 no connection to +24 V on terminal 27 is necessary to enable start.
If *Coast Inverse* (factory default value) is selected in Terminal 27, a connection to +24V is necessary to enable start.

NB!
For detailed parameter descriptions, please see the following section on *Commonly Used Parameters - Explanations.*

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8.1.3. Q1 My Personal Menu

Parameters defined by the user can be stored in Q1 My Personal Menu.

Select *My Personal Menu* to display only the parameters, which have been pre-selected and programmed as personal parameters. For example, a pump or equipment OEM may have pre-programmed these to be in My Personal Menu during factory commissioning to make on site commissioning / fine tuning simpler.. These parameters are selected in par. 0-25 *My Personal Menu.* Up to 20 different parameters can be defined in this menu.

Q1 My Personal Menu
20-21 Setpoint 1
20-93 PID Proportional Gain
20-94 PID Integral Time

8.1.4. Q2 Quick Setup

The parameters in Q2 Quick Setup are the basic parameters which are always needed to set-up the frequency converter to operation.

Q2 Quick Setup	
Parameter number and name	**Unit**
0-01 Language	
1-20 Motor Power	kW
1-22 Motor Voltage	V
1-23 Motor Frequency	Hz
1-24 Motor Current	A
1-25 Motor Nominal Speed	RPM
3-41 Ramp 1 Ramp Up Time	s
3-42 Ramp 1 Ramp Down Time	s
4-11 Motor Speed Low Limit	RPM
4-13 Motor Speed High Limit	RPM
1-29 Automatic Motor Adaptation (AMA)	

8.1.5. Q3 Function Setups

The Function Setup provides quick and easy access to all parameters required for the majority of water and wastewater applications including variable torque, constant torque, pumps, dossing pumps, well pumps, booster pumps, mixer pumps, aeration blowers and other pump and fan applications. Amongst other features it also includes parameters for selecting which variables to display on the LCP, digital preset speeds, scaling of analog references, closed loop single zone and multi-zone applications and specific functions related to water and wastewater applications.

How to access Function Set-up - example

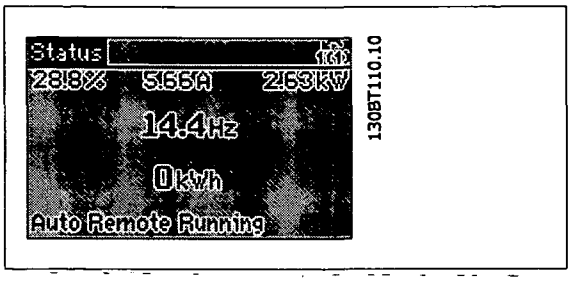

Illustration 8.2: Step 1: Turn on the frequency converter (On LED lights)

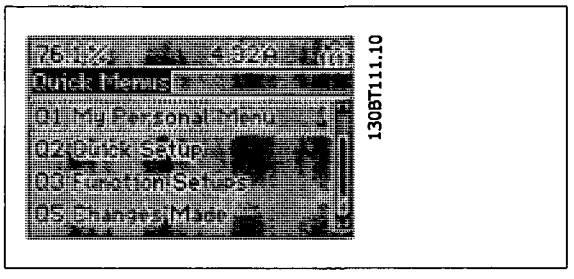

Illustration 8.3: Step 2: Press the [Quick Menus] button (Quick Menus choices appear).

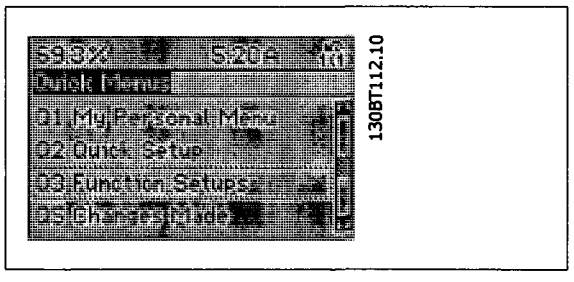

Illustration 8.4: Step 3: Use the up/down navigation keys to scroll down to Function Setups. Press [OK].

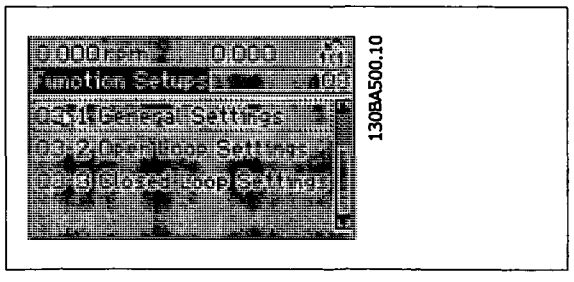

Illustration 8.5: Step 4: Function Setups choices appear. Choose 03-1 *General Settings*. Press [OK].

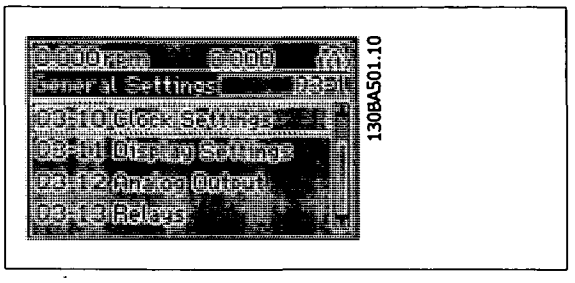

Illustration 8.6: Step 5: Use the up/down navigation keys to scroll down to i.e. 03-12 *Analog Outputs*. Press [OK].

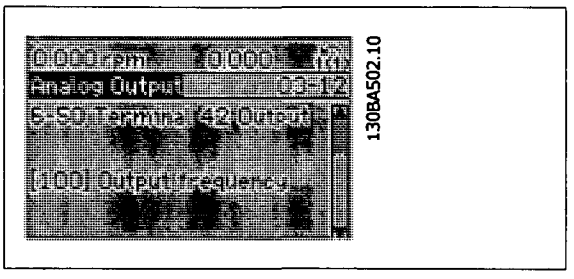

Illustration 8.7: Step 6: Choose parameter 6-50 *Terminal 42 Output*. Press [OK].

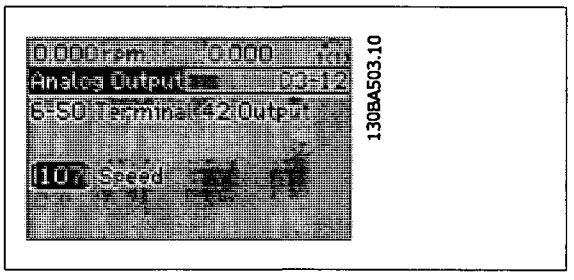

Illustration 8.8: Step 7: Use the up/down navigation keys to select between the different choices. Press [OK].

8

The Function Setup parameters are grouped in the following way:

Q3-1 General Settings

Q3-10 Clock Settings	Q3-11 Display Settings	Q3-12 Analog Output	Q3-13 Relays
0-70 Set Date and Time	0-20 Display Line 1.1 Small	6-50 Terminal 42 Output	Relay 1 ⇒ 5-40 Function Relay
0-71 Date Format	0-21 Display Line 1.2 Small	6-51 Terminal 42 Output Min Scale	Relay 2 ⇒ 5-40 Function Relay
0-72 Time Format	0-22 Display Line 1.3 Small	6-52 Terminal 42 Output Max Scale	Option relay 7 ⇒ 5-40 Function Relay
0-74 DST/Summertime	0-23 Display Line 2 Large		Option relay 8 ⇒ 5-40 Function Relay
0-76 DST/Summertime Start	0-24 Display Line 3 Large		Option relay 9 ⇒ 5-40 Function Relay
0-77 DST/Summertime End	0-37 Display Text 1		
	0-38 Display Text 2		
	0-39 Display Text 3		

Q3-2 Open Loop Settings

Q3-20 Digital Reference	Q3-21 Analog Reference
3-02 Minimum Reference	3-02 Minimum Reference
3-03 Maximum Reference	3-03 Maximum Reference
3-10 Preset Reference	6-10 Terminal 53 Low Voltage
5-13 Terminal 29 Digital Input	6-11 Terminal 53 High Voltage
5-14 Terminal 32 Digital Input	6-14 Terminal 53 Low Ref/Feedb. Value
5-15 Terminal 33 Digital Input	6-15 Terminal 53 High Ref/Feedb. Value

Q3-3 Closed Loop Settings

Q3-30 Feedback Settings	Q3-31 PID Settings
1-00 Configuration Mode	20-81 PID Normal/Inverse Control
20-12 Reference/Feedb.Unit	20-82 PID Start Speed [RPM]
3-02 Minimum Reference	20-21 Setpoint 1
3-03 Maximum Reference	20-93 PID Proportional Gain
6-20 Terminal 54 Low Voltage	20-94 PID Integral Time
6-21 Terminal 54 High Voltage	
6-24 Terminal 54 Low Ref/Feedb Value	
6-25 Terminal 54 High Ref/Feedb Value	
6-00 Live Zero Timeout Time	
6-01 Live Zero Timeout Function	

8

8.1.6. Q5 Changes Made

Q5 Changes Made can be used for fault finding.

Select *Changes made* to get information about:

- the last 10 changes. Use the up/down navigation keys to scroll between the last 10 changed parameters.
- the changes made since default setting.

Select *Loggings* to get information about the display line read-outs. The information is shown as graphs.
Only display parameters selected in par. 0-20 and par. 0-24 can be viewed. It is possible to store up to 120 samples in the memory for later reference.

Please notice that the parameters listed in the below tables for Q5 only serve as examples as they will vary depending on the programming of the particular frequency converter.

Q5-1 Last 10 Changes
20-94 PID Integral Time
20-93 PID Proportional Gain

Q5-2 Since Factory Setting
20-93 PID Proportional Gain
20-94 PID Integral Time

Q5-3 Input Assignments
Analog Input 53
Analog Input 54

8

8.1.7. Q6 Loggings

Q6 Loggings can be used for fault finding.

Please notice that the parameters listed in the below table for Q6 only serve as examples as they will vary depending on the programming of the particular frequency converter.

Q6 Loggings
Reference
Analog Input 53
Motor Current
Frequency
Feedback
Energy Log
Trending Cont Bin
Trending Timed Bin
Trending Comparison

8.1.8. Main Menu Mode

Both the GLCP and NLCP provide access to the main menu mode. Select the Main Menu mode by pressing the [Main Menu] key. Illustration 6.2 shows the resulting read-out, which appears on the display of the GLCP. Lines 2 through 5 on the display show a list of parameter groups which can be chosen by toggling the up and down buttons.

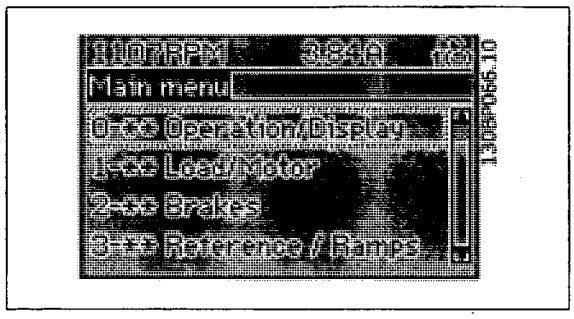

Illustration 8.9: Display example.

Each parameter has a name and number which remain the same regardless of the programming mode. In the Main Menu mode, the parameters are divided into groups. The first digit of the parameter number (from the left) indicates the parameter group number.

All parameters can be changed in the Main Menu. The configuration of the unit (par. 1-00 *Configuration Mode*) will determine other parameters available for programming. For example, selecting Closed Loop enables additional parameters related to closed loop operation. Option cards added to the unit enable additional parameters associated with the option device.

8.1.9. Parameter Selection

8

In the Main Menu mode, the parameters are divided into groups. Select a parameter group by means of the navigation keys.
The following parameter groups are accessible:

Group no.	Parameter group:
0	Operation/Display
1	Load/Motor
2	Brakes
3	References/Ramps
4	Limits/Warnings
5	Digital In/Out
6	Analog In/Out
8	Comm. and Options
9	Profibus
10	CAN Fieldbus
11	LonWorks
13	Smart Logic
14	Special Functions
15	Drive Information
16	Data Readouts
18	Data Readouts 2
20	Drive Closed Loop
21	Ext. Closed Loop
22	Application Functions
23	Time-based Functions
24	Fire Mode
25	Cascade Controller
26	Analog I/O Option MCB 109

Table 8.3: Parameter groups.

After selecting a parameter group, choose a parameter by means of the navigation keys.
The middle section on the GLCP display shows the parameter number and name as well as the selected parameter value.

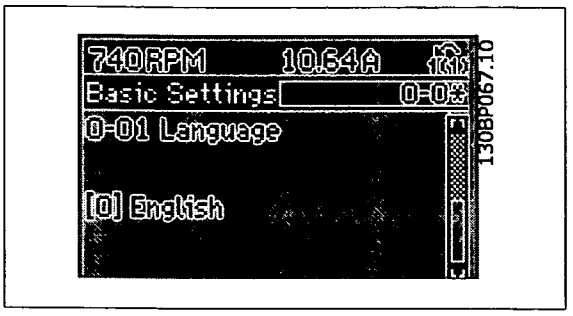

Illustration 8.10: Display example.

8.2. Commonly Used Parameters - Explanations

8.2.1. Main Menu

The Main Menu includes all available parameters in the VLT® AQUA Drive FC 200 frequency converter.
All parameters are grouped in a logic way with a group name indicating the function of the parameter group.
All parameters are listed by name and number in the section *Parameter Options* in these Operating Instructions.

All parameters included in the Quick Menus (Q1, Q2, Q3, Q5 and Q6) can be found in the following.

Some of the most used parameters for VLT® AQUA Drive applications are also explained in the following section.

8

For a detailed explanation of all parameters, please refer to the VLT® AQUA Drive Programming Guide MG.20.OX.YY which is available on www.danfoss.com or by ordering at the local Danfoss office.

8.2.2. 0-** Operation / Display

Parameters related to the fundamental functions of the frequency converter, function of the LCP buttons and configuration of the LCP display.

8

0-01 Language

Option:		Function:
		Defines the language to be used in the display. The frequency converter can be delivered with 4 different language packages. English and German are included in all packages. English cannot be erased or manipulated.
[0] *	English	Part of Language packages 1 - 4
[1]	German	Part of Language packages 1 - 4
[2]	French	Part of Language package 1
[3]	Danish	Part of Language package 1
[4]	Spanish	Part of Language package 1
[5]	Italian	Part of Language package 1
[6]	Swedish	Part of Language package 1
[7]	Dutch	Part of Language package 1
[10]	Chinese	Language package 2
[20]	Finnish	Part of Language package 1
[22]	English US	Part of Language package 4
[27]	Greek	Part of Language package 4
[28]	Portuguese	Part of Language package 4
[36]	Slovenian	Part of Language package 3
[39]	Korean	Part of Language package 2
[40]	Japanese	Part of Language package 2
[41]	Turkish	Part of Language package 4
[42]	Traditional Chinese	Part of Language package 2
[43]	Bulgarian	Part of Language package 3
[44]	Serbian	Part of Language package 3
[45]	Romanian	Part of Language package 3
[46]	Hungarian	Part of Language package 3
[47]	Czech	Part of Language package 3
[48]	Polish	Part of Language package 4
[49]	Russian	Part of Language package 3
[50]	Thai	Part of Language package 2
[51]	Bahasa Indonesian	Part of Language package 2

0-20 Display Line 1.1 Small

Option:		Function:
		Select a variable for display in line 1, left position.
[0]	None	No display value selected
[37]	Display Text 1	Present control word
[38]	Display Text 2	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[39]	Display Text 3	Enables an individual text string to be written, for display in the LCP or to be read via serial communication.
[89]	Date and Time Readout	Displays the current date and time.
[953]	Profibus Warning Word	Displays Profibus communication warnings.
[1005]	Readout Transmit Error Counter	View the number of CAN control transmission errors since the last power-up.
[1006]	Readout Receive Error Counter	View the number of CAN control receipt errors since the last power-up.
[1007]	Readout Bus Off Counter	View the number of Bus Off events since the last power-up.

[1013]	Warning Parameter	View a DeviceNet-specific warning word. One separate bit is assigned to every warning.
[1115]	LON Warning Word	Shows the LON-specific warnings.
[1117]	XIF Revision	Shows the version of the external interface file of the Neuron C chip on the LON option.
[1118]	LON Works Revision	Shows the software version of the application program of the Neuron C chip on the LON option.
[1500]	Operating Hours	View the number of running hours of the frequency converter.
[1501]	Running Hours	View the number of running hours of the motor.
[1502]	kWh Counter	View the mains power consumption in kWh.
[1600]	Control Word	View the Control Word sent from the frequency converter via the serial communication port in hex code.
[1601] *	Reference [Unit]	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in selected unit.
[1602]	Reference %	Total reference (sum of digital/analog/preset/bus/freeze ref./catch up and slow-down) in percent.
[1603]	Status Word	Present status word
[1605]	Main Actual Value [%]	One or more warnings in a Hex code
[1609]	Custom Readout	View the user-defined readouts as defined in par. 0-30, 0-31 and 0-32.
[1610]	Power [kW]	Actual power consumed by the motor in kW.
[1611]	Power [hp]	Actual power consumed by the motor in HP.
[1612]	Motor Voltage	Voltage supplied to the motor.
[1613]	Motor Frequency	Motor frequency, i.e. the output frequency from the frequency converter in Hz.
[1614]	Motor Current	Phase current of the motor measured as effective value.
[1615]	Frequency [%]	Motor frequency, i.e. the output frequency from the frequency converter in percent.
[1616]	Torque [Nm]	Present motor load as a percentage of the rated motor torque.
[1617]	Speed [RPM]	Speed in RPM (revolutions per minute) i.e. the motor shaft speed in closed loop based on the entered motor nameplate data, the output frequency and the load on the frequency converter.
[1618]	Motor Thermal	Thermal load on the motor, calculated by the ETR function. See also parameter group 1-9* Motor Temperature.
[1622]	Torque [%]	Shows the actual torque produced, in percentage.
[1630]	DC Link Voltage	Intermediate circuit voltage in the frequency converter.
[1632]	BrakeEnergy/s	Present brake power transferred to an external brake resistor. Stated as an instantaneous value.
[1633]	BrakeEnergy/2 min	Brake power transferred to an external brake resistor. The mean power is calculated continuously for the most recent 120 seconds.
[1634]	Heatsink Temp.	Present heat sink temperature of the frequency converter. The cut-out limit is 95 ±5 oC; cutting back in occurs at 70 ±5° C.
[1635]	Thermal Drive Load	Percentage load of the inverters
[1636]	Inv. Nom. Current	Nominal current of the frequency converter
[1637]	Inv. Max. Current	Maximum current of the frequency converter
[1638]	SL Control State	State of the event executed by the control
[1639]	Control Card Temp.	Temperature of the control card.
[1650]	External Reference	Sum of the external reference as a percentage, i.e. the sum of analog/pulse/bus.
[1652]	Feedback [Unit]	Signal value in units from the programmed digital input(s).
[1653]	Digi Pot Reference	View the contribution of the digital potentiometer to the actual reference Feedback.
[1654]	Feedback 1 [Unit]	View the value of Feedback 1. See also par. 20-0*.
[1655]	Feedback 2 [Unit]	View the value of Feedback 2. See also par. 20-0*.
[1656]	Feedback 3 [Unit]	View the value of Feedback 3. See also par. 20-0*.
[1660]	Digital Input	Displays the status of the 6 digital input terminals (18, 19, 27, 29, 32 and 33). Input 18 corresponds to the bit at the far left. Signal low = 0; Signal high = 1
[1661]	Terminal 53 Switch Setting	Setting of input terminal 53. Current = 0; Voltage = 1.

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[1662]	Analog Input 53	Actual value at input 53 either as a reference or protection value.
[1663]	Terminal 54 Switch Setting	Setting of input terminal 54. Current = 0; Voltage = 1.
[1664]	Analog Input 54	Actual value at input 54 either as reference or protection value.
[1665]	Analog Output 42 [mA]	Actual value at output 42 in mA. Use par. 6-50 to select the variable to be represented by output 42.
[1666]	Digital Output [bin]	Binary value of all digital outputs.
[1667]	Freq. Input #29 [Hz]	Actual value of the frequency applied at terminal 29 as a pulse input.
[1668]	Freq. Input #33 [Hz]	Actual value of the frequency applied at terminal 33 as a pulse input.
[1669]	Pulse Output #27 [Hz]	Actual value of pulses applied to terminal 27 in digital output mode.
[1670]	Pulse Output #29 [Hz]	Actual value of pulses applied to terminal 29 in digital output mode.
[1671]	Relay Output [bin]	View the setting of all relays.
[1672]	Counter A	View the present value of Counter A.
[1673]	Counter B	View the present value of Counter B.
[1675]	Analog input X30/11	Actual value of the signal on input X30/11 (General Purpose I/O Card. Option)
[1676]	Analog input X30/12	Actual value of the signal on input X30/12 (General Purpose I/O Card. Optional)
[1677]	Analog output X30/8 [mA]	Actual value at output X30/8 (General Purpose I/O Card. Optional) Use Par. 6-60 to select the variable to be shown.
[1680]	Fieldbus CTW 1	Control word (CTW) received from the Bus Master.
[1682]	Fieldbus REF 1	Main reference value sent with control word via the serial communications network e.g. from the BMS, PLC or other master controller.
[1684]	Comm. Option STW	Extended fieldbus communication option status word.
[1685]	FC Port CTW 1	Control word (CTW) received from the Bus Master.
[1686]	FC Port REF 1	Status word (STW) sent to the Bus Master.
[1690]	Alarm Word	One or more alarms in a Hex code (used for serial communications)
[1691]	Alarm Word 2	One or more alarms in a Hex code (used for serial communications)
[1692]	Warning Word	One or more warnings in a Hex code (used for serial communications)
[1693]	Warning Word 2	One or more warnings in a Hex code (used for serial communications)
[1694]	Ext. Status Word	One or more status conditions in a Hex code (used for serial communications)
[1695]	Ext. Status Word 2	One or more status conditions in a Hex code (used for serial communications)
[1696]	Maintenance Word	The bits reflect the status for the programmed Preventive Maintenance Events in parameter group 23-1*
[1830]	Analog Input X42/1	Shows the value of the signal applied to terminal X42/1 on the Analog I/O card.
[1831]	Analog Input X42/3	Shows the value of the signal applied to terminal X42/3 on the Analog I/O card.
[1832]	Analog Input X42/5	Shows the value of the signal applied to terminal X42/5 on the Analog I/O card.
[1833]	Analog Out X42/7 [V]	Shows the value of the signal applied to terminal X42/7 on the Analog I/O card.
[1834]	Analog Out X42/9 [V]	Shows the value of the signal applied to terminal X42/9 on the Analog I/O card.
[1835]	Analog Out X42/11 [V]	Shows the value of the signal applied to terminal X42/11 on the Analog I/O card.
[2117]	Ext. 1 Reference [Unit]	The value of the reference for extended Closed Loop Controller 1
[2118]	Ext. 1 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 1
[2119]	Ext. 1 Output [%]	The value of the output from extended Closed Loop Controller 1
[2137]	Ext. 2 Reference [Unit]	The value of the reference for extended Closed Loop Controller 2
[2138]	Ext. 2 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 2
[2139]	Ext. 2 Output [%]	The value of the output from extended Closed Loop Controller 2
[2157]	Ext. 3 Reference [Unit]	The value of the reference for extended Closed Loop Controller 3
[2158]	Ext. 3 Feedback [Unit]	The value of the feedback signal for extended Closed Loop Controller 3
[2159]	Ext. Output [%]	The value of the output from extended Closed Loop Controller 3
[2230]	No-Flow Power	The calculated No Flow Power for the actual operating speed
[2580]	Cascade Status	Status for the operation of the Cascade Controller

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[2581]	Pump Status	Status for the operation of each individual pump controlled by the Cascade Controller

NB!
Please consult the **VLT® AQUA Drive Programming Guide, MG.20.OX.YY** for detailed information.

0-21 Display Line 1.2 Small

Option:		Function:
		Select a variable for display in line 1, middle position.
[1662] *	Analog input 53	The options are the same as those listed for par. 0-20 *Display Line 1.1 Small*.

0-22 Display Line 1.3 Small

Option:		Function:
		Select a variable for display in line 1, right position.
[1614] *	Motor Current	The options are the same as those listed for par. 0-20 *Display Line 1.1 Small*.

0-23 Display Line 2 Large

Option:		Function:
		Select a variable for display in line 2. The options are the same as those listed for par. 0-20 *Display Line 1.1 Small*.
[1615] *	Frequency	

0-24 Display Line 3 Large

Option:		Function:
[1652] *	Feedback [Unit]	Select a variable for display in line 2. The options are the same as those listed for par. 0-20 *Display Line 1.1 Small*.

0-37 Display Text 1

Range:		Function:
0 N/A*	[0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 1 in par. 0-20 Display *Line 1.1 Small*, par. 0-21 Display *Line 1.2 Small*, par. 0-22 Display *Line 1.3 Small*, par. 0-23 Display *Line 2 Large* or par. 0-24 Display *Line 3 Large*. Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◄ and ► buttons to move the cursor. When a character is highlighted by the cursor, it can be changed. Use the ▲ or ▼ buttons on the LCP to change a character. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

0-38 Display Text 2

Range:		Function:
0 N/A*	[0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 2 in par. 0-20 Display *Line 1.1 Small*, par. 0-21 Display *Line 1.2 Small*, par. 0-22 Display *Line 1.3 Small*, par. 0-23 Display *Line 2 Large* or par. 0-24 Display *Line 3 Large*. Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◄ and ► buttons to move the cursor. When a character is highlighted by the cursor, this character can be changed. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

0-39 Display Text 3

Range:		Function:
0 N/A*	[0 - 0 N/A]	In this parameter it is possible to write an individual text string for display in the LCP or to be read via serial communication. If to be displayed permanently select Display Text 3 in par. 0-20 Display *Line 1.1 Small*, par. 0-21 Display *Line 1.2 Small*, par. 0-22 Display *Line 1.3 Small*, par. 0-23 Display *Line 2 Large* or par. 0-24 Display *Line 3 Large*. Use the ▲ or ▼ buttons on the LCP to change a character. Use the ◄ and ► buttons to move the cursor. When a character is highlighted by the cursor, this character can be changed. A character can be inserted by placing the cursor between two characters and pressing ▲ or ▼.

0-70 Set Date and Time

Range:	Function:
2000-01-01 00:00 – 2099-12-01 23:59 * [2000-01-01 00:00]	Sets the date and time of the internal clock. The format to be used is set in par. 0-71 and 0-72.

NB!
This parameter does not display the actual time. This can be read in par. 0-89. The clock will not begin counting until a setting different from default has been made.

0-71 Date Format

Option:		Function:
[0] *	YYYY-MM-DD	Sets the date format to be used in the LCP.
[1]	DD-MM-YYYY	Sets the date format to be used in the LCP.
[2]	MM/DD/YYYY	Sets the date format to be used in the LCP.

0-72 Time Format

Option:		Function:
		Sets the time format to be used in the LCP.
[0] *	24 h	
[1]	12 h	

0-74 DST/Summertime

Option:		Function:
		Choose how Daylight Saving Time/Summertime should be handled. For manual DST/Summertime enter the start date and end date in par. 0-76 *DST/Summertime Start* and par. 0-77 *DST/Summertime End*.
[0] *	Off	
[2]	Manual	

0-76 DST/Summertime Start

Range:		Function:
0 N/A*	[0 - 0 N/A]	Sets the date and time when summertime/DST starts. The date is programmed in the format selected in par. 0-71 *Date Format*.

0-77 DST/Summertime End

Range:		Function:
0 N/A*	[0 - 0 N/A]	Sets the date and time when summertime/DST ends. The date is programmed in the format selected in par. 0-71 *Date Format*.

8.2.3. General Settings, 1-0*

Define whether the frequency converter operates in open loop or closed loop.

1-00 Configuration Mode

Option:		Function:
[0] *	Open Loop	Motor speed is determined by applying a speed reference or by setting desired speed when in Hand Mode. Open Loop is also used if the frequency converter is part of a closed loop control system based on an external PID controller providing a speed reference signal as output.
[3]	Closed Loop	Motor Speed will be determined by a reference from the built-in PID controller varying the motor speed as part of a closed loop control process (e.g. constant pressure or flow). The PID controller must be configured in par. 20-** or via the Function Setups accessed by pressing the [Quick Menus] button.

NB!
This parameter cannot be changed when motor is running.

NB!
When set for Closed Loop, the commands Reversing and Start Reversing will not reverse the direction of the motor.

1-20 Motor Power [kW]

Range:	Function:
4.00 kW* [0.09 - 3000.00 kW]	Enter the nominal motor power in kW according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running. Depending on the choices made in par. 0-03 Regional Settings, either par. 1-20 Motor Power [kW] or par. 1-21 Motor Power [HP] is made invisible.

1-22 Motor Voltage

Range:	Function:
400 V* [10 - 1000 V]	Enter the nominal motor voltage according to the motor nameplate data. The default value corresponds to the nominal rated output of the unit. This parameter cannot be adjusted while the motor is running.

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1-23 Motor Frequency

Range:		Function:
50 Hz*	[20 - 1000 Hz]	Select the motor frequency value from the motor nameplate data. For 87 Hz operation with 230/400 V motors, set the nameplate data for 230 V/50 Hz. Adapt par. 4-13 Motor Speed High Limit [RPM] and par. 3-03 Maximum Reference to the 87 Hz application.

NB!
This parameter cannot be adjusted while the motor is running.

1-24 Motor Current

Range:		Function:
7.20 A*	[0.10 - 10000.00 A]	Enter the nominal motor current value from the motor nameplate data. This data is used for calculating motor torque, motor thermal protection etc.

NB!
This parameter cannot be adjusted while the motor is running.

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1-25 Motor Nominal Speed

Range:		Function:
1420 RPM*	[100 - 60000 RPM]	Enter the nominal motor speed value from the motor nameplate data. This data is used for calculating automatic motor compensations.

NB!
This parameter cannot be changed while the motor is running.

1-29 Automatic Motor Adaptation (AMA)

Option:		Function:
		The AMA function optimizes dynamic motor performance by automatically optimizing the advanced motor parameters (par. 1-30 Stator Resistance (Rs) to par. 1-35 Main Reactance (Xh)) while the motor is stationary.
[0] *	Off	No function
[1]	Enable complete AMA	performs AMA of the stator resistance R_s, the rotor resistance R_r, the stator leakage reactance X_1, the rotor leakage reactance X_2 and the main reactance X_h.
[2]	Enable reduced AMA	performs a reduced AMA of the stator resistance R_s in the system only. Select this option if an LC filter is used between the frequency converter and the motor.

Activate the AMA function by pressing [Hand on] after selecting [1] or [2]. See also the section *Automatic Motor Adaptation*. After a normal sequence, the display will read: "Press [OK] to finish AMA". After pressing the [OK] key the frequency converter is ready for operation.

Note:

- For the best adaptation of the frequency converter, run AMA on a cold motor
- AMA cannot be performed while the motor is running

NB!
It is important to set motor par. 1-2* Motor Data correctly, since these form part of the AMA algorithm. An AMA must be performed to achieve optimum dynamic motor performance. It may take up to 10 min., depending on motor power rating.

NB!
Avoid generating external torque during AMA

NB!
If one of the settings in par. 1-2* Motor Data is changed, par. 1-30 Stator *Resistance (Rs)* to par. 1-39 Motor *Poles*, the advanced motor parameters, will return to default setting.
This parameter cannot be adjusted while the motor is running

NB!
Full AMA should be run without filter only while reduced AMA should be run with filter.

See section *Automatic Motor Adaptation* - application example.

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8.2.4. 3-0* Reference Limits

Parameters for setting the reference unit, limits and ranges.

3-02 Minimum Reference

Range:

0.000 [ref. -999999.999 par. 3-03 Reference-Feed-backUnit] backUnit*

Function:

Enter the Minimum Reference. The Minimum Reference is the lowest value obtainable by summing all references. The Minimum Reference value and unit matches the configuration choice made in par. 1-00 *Configuration Mode* and par. 20-12 Reference/Feedback Unit, respectively.

NB!
This parameter is used in open loop only.

3-03 Maximum Reference

Range:

50.000 [par. 3-02 999999.999 Reference-Feed-backUnit] backUnit*

Function:

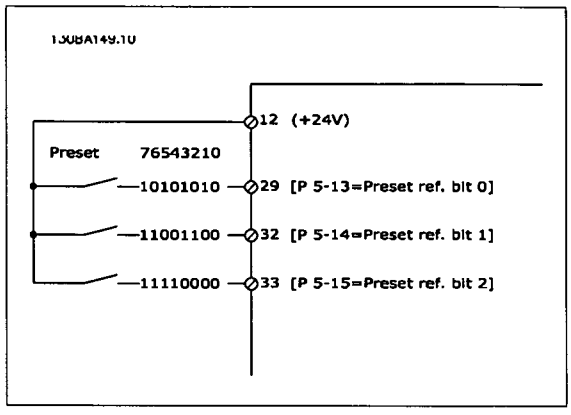
Enter the Maximum Reference. The Maximum Reference is the highest value obtainable by summing all references. The Maximum Reference value and unit matches the configuration choice made in par. 1-00 *Configuration Mode* and par. 20-12 Reference/Feedback Unit, respectively.

NB!
This parameter is used in open loop only.

3-10 Preset Reference

Array [8]

Range:	Function:
0.00 %* [-100.00 - 100.00 %]	Enter up to eight different preset references (0-7) in this parameter, using array programming. The preset reference is stated as a percentage of the value Ref_{MAX} (par. 3-03 Maximum Reference) or as a percentage of the other external references. If a Ref_{MIN} different from 0 (Par. 3-02 Minimum Reference) is programmed, the preset reference is calculated as a percentage of the full reference range, i.e. on the basis of the difference between Ref_{MAX} and Ref_{MIN}. Afterwards, the value is added to Ref_{MIN}. When using preset references, select Preset ref. bit 0, 1, 2 [16], [17], or [18] for the corresponding digital inputs in parameter group 5-1* Digital Inputs.



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3-41 Ramp 1 Ramp Up Time

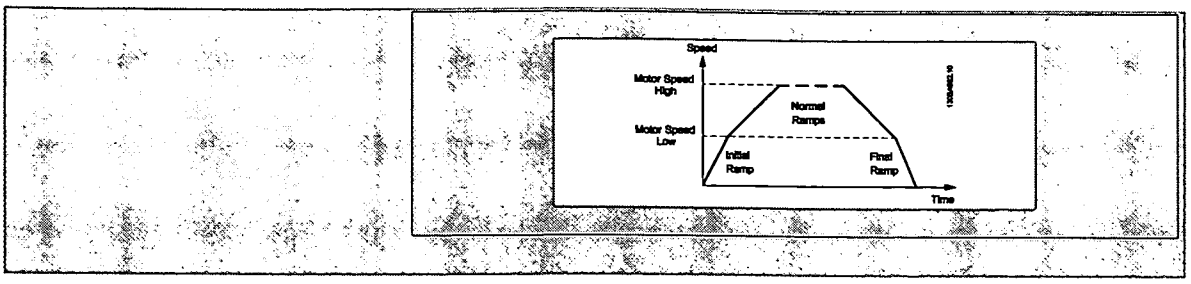
Range:	Function:
10.00 s* [1.00 - 3600.00 s]	Enter the ramp-up time, i.e. the acceleration time from 0 RPM to par. 1-25 Choose a ramp-up time such that the output current does not exceed the current limit in par. 4-18 during ramping. See ramp-down time in par. 3-42 *Ramp 1 Ramp Down Time*. $par.3-41 = \frac{tacc \times nnorm\ [par.1-25]}{ref\ [rpm]}\ [s]$ See drawing above.

3-42 Ramp 1 Ramp Down Time

Range:	Function:
20.00 s* [1.00 - 3600.00 s]	Enter the ramp-down time, i.e. the deceleration time from par. 1-25 *Motor Nominal Speed* to 0 RPM. Choose a ramp-down time such that no over-voltage arises in the inverter due to regenerative operation of the motor, and such that the generated current does not exceed the current limit set in par. 4-18 Current Limit. See ramp-up time in par. 3-41 *Ramp 1 Ramp Up Time*. $par.3-42 = \frac{tdec \times nnorm\ [par.1-25]}{ref\ [rpm]}\ [s]$

3-84 Initial Ramp Time

Range:		Function:
0 s*	[0 – 60 s]	Enter the initial ramp up time from zero speed to Motor Speed Low Limit, par. 4-11 or 4-12. Submersible deep well pumps can be damaged by running below minimum speed. A fast ramp time below minimum pump speed is recommended. This parameter may be applied as a fast ramp rate from zero speed to Motor Speed Low Limit.



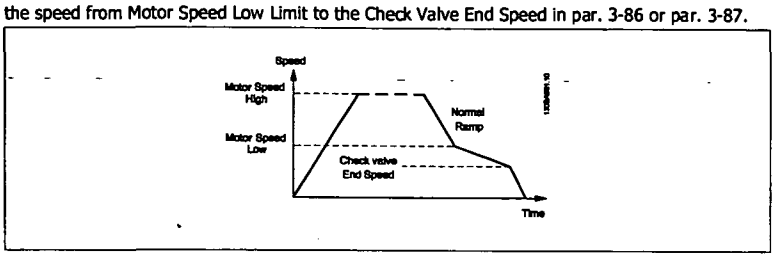
3-85 Check Valve Ramp Time

Range:

0 s* [0 – 60 s]

Function:

In order to protect ball check valves in a stop situation, the check valve ramp can be utilized as a slow ramp rate from par. 4-11 *Motor Speed Low Limit [RPM]* or par. 4-12 Motor *Speed Low Limit [Hz]*, to Check Valve Ramp End Speed, set by the user in par. 3-86 or par. 3-87. When par. 3-85 is different from 0 seconds, the Check Valve Ramp Time is effectuated and will be used to ramp down the speed from Motor Speed Low Limit to the Check Valve End Speed in par. 3-86 or par. 3-87.



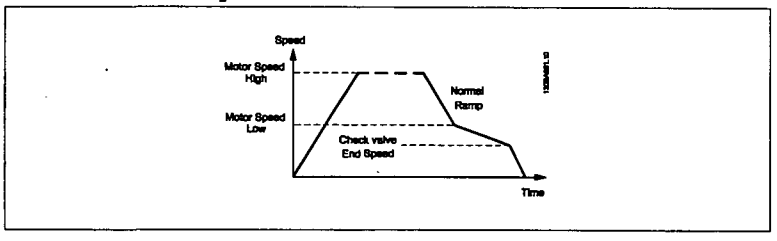
3-86 Check Valve Ramp End Speed [RPM]

Range:

0 [RPM]* [0 – Motor Speed Low Limit [RPM]]

Function:

Set the speed in [RPM] below Motor Speed Low Limit where the Check Valve is expected to be closed and the Check Valve no longer shall be active.



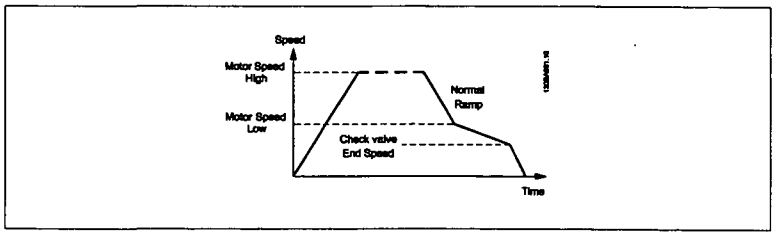
3-87 Check Valve Ramp End Speed [Hz]

Range:

0 [Hz]* [0 – Motor Speed Low Limit [Hz]]

Function:

Set the speed in [Hz] below Motor Speed Low Limit where the Check Valve Ramp will no longer be active.



3-88 Final Ramp Time

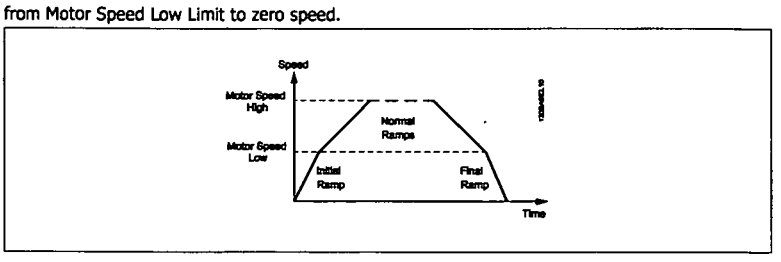
Range:

0 [s]* [0 – 60 [s]]

Function:

Enter the Final Ramp Time to be used when ramping down from Motor Speed Low Limit, par. 4-11 or 4-12, to zero speed.

Submersible deep well pumps can be damaged by running below minimum speed. A fast ramp time below minimum pump speed is recommended. This parameter may be applied as a fast ramp rate from Motor Speed Low Limit to zero speed.



8.2.5. 4-** Limits and Warnings

Parameter group for configuring limits and warnings.

4-11 Motor Speed Low Limit [RPM]

Range:	Function:
0 RPM* [0 - par. 4-13 RPM]	Enter the minimum limit for motor speed. The Motor Speed Low Limit can be set to correspond to the manufacturer's recommended minimum motor speed. The Motor Speed Low Limit must not exceed the setting in par. 4-13 *Motor Speed High Limit [RPM]*.

4-13 Motor Speed High Limit [RPM]

Range:	Function:
1500 RPM* [par. 4-11 - 60000 RPM]	Enter the maximum limit for motor speed. The Motor Speed High Limit can be set to correspond to the manufacturer's maximum rated motor. The Motor Speed High Limit must exceed the setting in par. 4-11 *Motor Speed Low Limit [RPM]*. Only par. 4-11 *Motor Speed Low Limit [RPM]* or par. 4-12 *Motor Speed Low Limit [Hz]* will be displayed depending on other parameters in the Main Menu and depending on default settings dependant on global location.

NB!
The output frequency value of the frequency convertemot exceed a value higher than 1/10 of the switching frequency.

NB!
Any changes in par. 4-13 *Motor Speed High Limit [RPM]* will reset the value in par. 4-53 Warning *Speed High* to the same value as set in par. 4-13 *Motor Speed High Limit [RPM]*.

8.2.6. 5-** Digital In/Out

Parameter group for configuring the digital input and output.

5-01 Terminal 27 Mode		
Option:		**Function:**
[0] *	Input	Defines terminal 27 as a digital input.
[1]	Output	Defines terminal 27 as a digital output.

This parameter cannot be adjusted while the motor is running.

8.2.7. 5-1* Digital Inputs

Parameters for configuring the input functions for the input terminals.

The digital inputs are used for selecting various functions in the frequency converter. All digital inputs can be set to the following functions:

Digital input function	Select	Terminal
No operation	[0]	All *term 32, 33
Reset	[1]	All
Coast inverse	[2]	All
Coast and reset inverse	[3]	All
DC-brake inverse	[5]	All
Stop inverse	[6]	All
External interlock	[7]	All
Start	[8]	All *term 18
Latched start	[9]	All
Reversing	[10]	All *term 19
Start reversing	[11]	All
Jog	[14]	All *term 29
Preset reference on	[15]	All
Preset ref bit 0	[16]	All
Preset ref bit 1	[17]	All
Preset ref bit 2	[18]	All
Freeze reference	[19]	All
Freeze output	[20]	All
Speed up	[21]	All
Speed down	[22]	All
Set-up select bit 0	[23]	All
Set-up select bit 1	[24]	All
Pulse input	[32]	term 29, 33
Ramp bit 0	[34]	All
Mains failure inverse	[36]	All
Run Permissive	[52]	
Hand start	[53]	
Auto start	[54]	
DigiPot Increase	[55]	All
DigiPot Decrease	[56]	All
DigiPot Clear	[57]	All
Counter A (up)	[60]	29, 33
Counter A (down)	[61]	29, 33
Reset Counter A	[62]	All
Counter B (up)	[63]	29, 33
Counter B (down)	[64]	29, 33
Reset Counter B	[65]	All
Sleep Mode	[66]	
Reset Maintenance Word	[78]	
Lead Pump Start	[120]	
Lead Pump Alternation	[121]	
Pump 1 Interlock	[130]	
Pump 2 Interlock	[131]	
Pump 3 Interlock	[132]	

All = Terminals 18, 19, 27, 29, 32, X30/2, X30/3, X30/4. X30/ are the terminals on MCB 101.

Functions dedicated to only one digital input are stated in the associated parameter.

All digital inputs can be programmed to these functions:

[0]	No operation	No reaction to signals transmitted to terminal.
[1]	Reset	Resets frequency converter after a TRIP/ALARM. Not all alarms can be reset.
[2]	Coast inverse	Leaves motor in free mode. Logic '0' => coasting stop. (Default Digital input 27): Coasting stop, inverted input (NC).
[3]	Coast and reset inverse	Reset and coasting stop Inverted input (NC). Leaves motor in free mode and resets the frequency converter. Logic '0' => coasting stop and reset.
[5]	DC braking inverse	Inverted input for DC braking (NC). Stops motor by energizing it with a DC current for a certain time period. See par. 2-01 to par. 2-03. The function is only active when the value in par. 2-02 is different from 0. Logic '0' => DC braking.
[6]	Stop inverse	Stop Inverted function. Generates a stop function when the selected terminal goes from logical level '1' to '0'. The stop is performed according to the selected ramp time (par. 3-42, par. 3-52, par. 3-62, par. 3-72).
[7]	External Interlock	Same function as Coasting stop, inverse, but External Interlock generates the alarm message 'external fault' on the display, when the terminal which is programmed for Coast inverse is logic '0'. The alarm message will also be active via digital outputs and relay outputs, if programmed for External Interlock. The alarm can be reset using a digital input or the [RESET] key, if the cause for the External Interlock has been removed. A delay can be programmed in par. 22-00, External Interlock Time. After applying a signal to the input, the reaction described above will be delayed with the time set in par. 22-00.
[8]	Start	Select start for a start/stop command. Logic '1' = start, logic '0' = stop. (Default Digital input 18)
[9]	Latched start	Motor starts, if a pulse is applied for min. 2 ms. Motor stops when Stop inverse is activated
[10]	Reversing	Changes direction of motor shaft rotation. Select Logic '1' to reverse. The reversing signal only changes the direction of rotation. It does not activate the start function. Select both directions in par. 4-10 *Motor Speed Direction*. (Default Digital input 19).
[11]	Start reversing	Used for start/stop and for reversing on the same wire. Signals on start are not allowed at the same time.
[14]	Jog	Used for activating jog speed. See par. 3-11. (Default Digital input 29)
[15]	Preset reference on	Used for shifting between external reference and preset reference. It is assumed that *External/preset* [1] has been selected in par. 3-04. Logic '0' = external reference active; logic '1' = one of the eight preset references is active.
[16]	Preset ref bit 0	Enables a choice between one of the eight preset references according to the table below.
[17]	Preset ref bit 1	Enables a choice between one of the eight preset references according to the table below.
[18]	Preset ref bit 2	Enables a choice between one of the eight preset references according to the table below.

NB!
When the frequency converter is at the torque limit and has received a stop command, it may not stop by itself. To ensure that the frequency converter stops, configure a digital output to *Torque limit & stop* [27] and connect this digital output to a digital input that is configured as coast.

Preset ref. bit	2	1	0
Preset ref. 0	0	0	0
Preset ref. 1	0	0	1
Preset ref. 2	0	1	0
Preset ref. 3	0	1	1
Preset ref. 4	1	0	0
Preset ref. 5	1	0	1
Preset ref. 6	1	1	0
Preset ref. 7	1	1	1

[19]	Freeze ref	Freezes actual reference. The frozen reference is now the point of enable/condition for Speed up and Speed down to be used. If speed up/down is used, the speed change always follows ramp 2 (par. 3-51 and 3-52) in the range 0 - par. 3-03 *Maximum Reference*.

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[20]	Freeze output	Freezes actual motor frequency (Hz). The frozen motor frequency is now the point of enable/condition for Speed up and Speed down to be used. If Speed up/down is used, the speed change always follows ramp 2 (par. 3-51 and 3-52) in the range 0 - par. 1-23 *Motor Frequency*.
		NB! When Freeze output is active, the frequency converter cannot be stopped via a low 'start [13]' signal. Stop the frequency converter via a terminal programmed for Coasting inverse [2] or Coast and reset, inverse [3].
[21]	Speed up	For digital control of the up/down speed is desired (motor potentiometer). Activate this function by selecting either Freeze reference or Freeze output. When Speed up is activated for less than 400 msec. the resulting reference will be increased by 0.1 %. If Speed up is activated for more than 400 msec. the resulting reference will ramp according to Ramp 1in par. 3-41.
[22]	Speed down	Same as Speed up [21].
[23]	Set-up select bit 0	Selects one of the four set-ups. Set par. 0-10 *Active Set-up* to Multi Set-up.
[24]	Set-up select bit 1	Same as Set-up select bit 0 [23]. (Default Digital input 32)
[32]	Pulse input	Select Pulse input when using a pulse sequence as either reference or feedback. Scaling is done in par. group 5-5*
[34]	Ramp bit 0	Select which ramp to use. Logic "0" will select ramp 1 while logic "1" will select ramp 2.
[36]	Mains failure inverse	Activates par. 14-10 *Mains Failure*. Mains failure inverse is active in the Logic "0" situation.
[52]	Run Permissive	The input terminal, for which the Run permissive has been programmed must be logic "1" before a start command can be accepted. Run permissive has a logic 'AND' function related to the terminal which is programmed for *START* [8], *Jog* [14] or *Freeze Output* [20], which means that in order to start running the motor, both conditions must be fulfilled. If Run Permissive is programmed on multiple terminals, Run permissive needs only be logic '1' on one of the terminals for the function to be carried out. The digital output signal for Run Request (*Start* [8], *Jog* [14] or *Freeze output* [20]) programmed in par. 5-3* Digital outputs, or par. 5-4* Relays, will not be affected by Run Permissive.
[53]	Hand start	A signal applied will put the frequency converter into Hand mode as if button *Hand On* on the LCP has been pressed and a normal stop command will be overridden. If disconnecting the signal, the motor will stop. To make any other start commands valid, another digital input must be assign to *Auto Start* and a signal applied to this. The *Hand On* and *Auto On* buttons on the LCP has no impact. The *Off* button on the LCP will override *Hand Start* and *Auto Start*. Press either the *Hand On* or *Auto On* button to make *Hand Start* and *Auto Start* active again. If no signal on neither *Hand Start* nor *Auto Start*, the motor will stop regardless of any normal Start command applied. If signal applied to both *Hand Start* and *Auto Start*, the function will be *Auto Start*. If pressing the *Off* button on the LCP the motor will stop regardless of signals on *Hand Start* and *Auto Start*.
[54]	Auto start	A signal applied will put the frequency converter into Auto mode as if the LCP button *Auto On* has been pressed. See also *Hand Start* [53]
[55]	DigiPot Increase	Uses the input as an INCREASE signal to the Digital Potentiometer function described in parameter group 3-9*
[56]	DigiPot Decrease	Uses the input as a DECREASE signal to the Digital Potentiometer function described in parameter group 3-9*
[57]	DigiPot Clear	Uses the input to CLEAR the Digital Potentiometer reference described in parameter group 3-9*
[60]	Counter A (up)	(Terminal 29 or 33 only) Input for increment counting in the SLC counter.
[61]	Counter A (down)	(Terminal 29 or 33 only) Input for decrement counting in the SLC counter.
[62]	Reset Counter A	Input for reset of counter A.
[63]	Counter B (up)	(Terminal 29 and 33 only) Input for increment counting in the SLC counter.
[64]	Counter B (down)	(Terminal 29 and 33 only) Input for decrement counting in the SLC counter.
[65]	Reset Counter B	Input for reset of counter B.
[66]	Sleep Mode	Forces frequency converter into Sleep Mode (see par. 22-4*, Sleep Mode). Reacts on the rising edge of signal applied!
[78]	Reset Preventive Maintenance Word	Resets all data in par. 16-96, Preventive Maintenance Word, to 0.

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The below setting options are all related to the Cascade Controller. Wiring diagrams and settings for parameter, see group 25-** for more details.

[120]	Lead Pump Start	Starts/Stops the Lead Pump (controlled by the frequency converter). A start requires that also a System Start signal has been applied e.g. to one of the digital inputs set for *Start* [8]
[121]	Lead Pump Alternation	Forces alternation of the lead pump in a Cascade Controller. *Lead Pump Alternation*, par. 25-50, must be set to either *At Command* [2] or *At Staging or At Command* [3]. *Alternation Event*, par. 25-51, can be set to any of the four options.
[130] - [138]	Pump1 Interlock - Pump9 Interlock	For the above 9 setting options, par. 25-10, Pump Interlock, must be set to *On* [1]. The function will also depend on the setting in par. 25-06, Fixed Lead Pump. If set to *No* [0], then Pump1 refers to the pump controlled by relay RELAY1 etc. If set to *Yes* [1], Pump1 refers to the pump controlled by the frequency converter only (without any of the build in relays involved) and Pump2 to the pump controlled by the relay RELAY1. Variable speed pump (lead) cannot be interlocked in the Basic Cascade Controller. See below table.

Setting in Par. 5-1*	Setting in Par. 25-06	
	[0] No	[1] Yes
[130] Pump1 Interlock	Controlled by RELAY1 (only if not lead pump)	Frequency Converter controlled (cannot be interlocked)
[131] Pump2 Interlock	Controlled by RELAY2	Controlled by RELAY1
[132] Pump3 Interlock	Controlled by RELAY3	Controlled by RELAY2
[133] Pump4 Interlock	Controlled by RELAY4	Controlled by RELAY3
[134] Pump5 Interlock	Controlled by RELAY5	Controlled by RELAY4
[135] Pump6 Interlock	Controlled by RELAY6	Controlled by RELAY5
[136] Pump7 Interlock	Controlled by RELAY7	Controlled by RELAY6
[137] Pump8 Interlock	Controlled by RELAY8	Controlled by RELAY7
[138] Pump9 Interlock	Controlled by RELAY9	Controlled by RELAY8

5-13 Terminal 29 Digital Input

Option:		Function:
[0] *	No Operation	Same options and functions as par. 5-1* *Digital Inputs*.

5-14 Terminal 32 Digital Input

Option:		Function:
[0] *	No operation	Same options and functions as par. 5-1*, except for *Pulse Input*.
[1]	Reset	
[2]	Coast inverse	
[3]	Coast and reset inv	
[5]	DC-brake inverse	
[6]	Stop inverse	
[7]	External interlock	
[8]	Start	
[9]	Latched start	
[10]	Reversing	
[11]	Start reversing	
[14]	Jog	
[15]	Preset reference on	
[16]	Preset ref bit 0	
[17]	Preset ref bit 1	
[18]	Preset ref bit 2	

[19]	Freeze reference
[20]	Freeze output
[21]	Speed up
[22]	Speed down
[23]	Set-up select bit 0
[24]	Set-up select bit 1
[34]	Ramp bit 0
[36]	Mains failure inverse
[37]	Fire Mode
[52]	Run permissive
[53]	Hand start
[54]	Auto start
[55]	DigiPot Increase
[56]	DigiPot decrease
[57]	DigiPot clear
[62]	Reset Counter A
[65]	Reset Counter B
[66]	Sleep Mode
[78]	Reset Maint. Word
[120]	Lead Pump Start
[121]	Lead Pump Alternation
[130]	Pump 1 Interlock
[131]	Pump 2 Interlock
[132]	Pump 3 Interlock

5-15 Terminal 33 Digital Input

Option:	Function:
[0] *	No operation
[1]	Reset
[2]	Coast inverse
[3]	Coast and reset inv
[5]	DC-brake inverse
[6]	Stop inverse
[7]	External interlock
[8]	Start
[9]	Latched start
[10]	Reversing
[11]	Start reversing
[14]	Jog
[15]	Preset reference on
[16]	Preset ref bit 0
[17]	Preset ref bit 1
[18]	Preset ref bit 2
[19]	Freeze reference
[20]	Freeze output
[21]	Speed up
[22]	Speed down

Same options and functions as par. 5-1* Digital Inputs.

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[23]	Set-up select bit 0
[24]	Set-up select bit 1
[30]	Counter input
[32]	Pulse input
[34]	Ramp bit 0
[36]	Mains failure inverse
[37]	Fire Mode
[52]	Run permissive
[53]	Hand start
[54]	Auto start
[55]	DigiPot increase
[56]	DigiPot decrease
[57]	DigiPot clear
[60]	Counter A (up)
[61]	Counter A (down)
[62]	Reset Counter A
[63]	Counter B (up)
[64]	Counter B (down)
[65]	Reset Counter B
[66]	Sleep Mode
[78]	Reset Maint. Word
[120]	Lead Pump Start
[121]	Lead Pump Alternation
[130]	Pump 1 Interlock
[131]	Pump 2 Interlock
[132]	Pump 3 Interlock

5-30 Terminal 27 Digital Output

Option:		Function:
[0] *	No operation	Same options and functions as par. 5-3*.
[1]	Control ready	
[2]	Drive ready	
[3]	Drive rdy/rem ctrl	
[4]	Standby / no warning	
[5]	Running	
[6]	Running / no warning	
[8]	Run on ref/no warn	
[9]	Alarm	
[10]	Alarm or warning	
[11]	At torque limit	
[12]	Out of current range	
[13]	Below current, low	
[14]	Above current, high	
[15]	Out of speed range	
[16]	Below speed, low	
[17]	Above speed, high	
[18]	Out of feedb. range	

[19]	Below feedback, low
[20]	Above feedback, high
[21]	Thermal warning
[25]	Reverse
[26]	Bus OK
[27]	Torque limit & stop
[28]	Brake, no brake war.
[29]	Brake ready, no fault
[30]	Brake fault (IGBT)
[35]	External Interlock
[40]	Out of ref range
[41]	Below reference, low
[42]	Above ref, high
[45]	Bus ctrl.
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[55]	Pulse output
[60]	Comparator 0
[61]	Comparator 1
[62]	Comparator 2
[63]	Comparator 3
[64]	Comparator 4
[65]	Comparator 5
[70]	Logic rule 0
[71]	Logic rule 1
[72]	Logic rule 2
[73]	Logic rule 3
[74]	Logic rule 4
[75]	Logic rule 5
[80]	SL digital output A
[81]	SL digital output B
[82]	SL digital output C
[83]	SL digital output D
[84]	SL digital output E
[85]	SL digital output F
[160]	No alarm
[161]	Running reverse
[165]	Local ref active
[166]	Remote ref active
[167]	Start command act.
[168]	Hand mode
[169]	Auto mode
[180]	Clock Fault
[181]	Prev. Maintenance
[190]	No-Flow
[191]	Dry Pump
[192]	End Of Curve

[193]	Sleep Mode
[194]	Broken Belt
[195]	Bypass Valve Control
[196]	Fire Mode
[197]	Fire Mode was Act.
[198]	Drive Bypass
[200]	Full capacity
[201]	Pump 1 running
[202]	Pump 2 running
[203]	Pump 3 running

5-40 Function Relay

Array [8]	(Relay 1 [0], Relay 2 [1], Relay 7 [6], Relay 8 [7], Relay 9 [8])

Select options to define the function of the relays.
The selection of each mechanical relay is realised in an array parameter.

[0]	No Operation
[1]	Control Ready
[2]	Drive Ready
[3]	Drive Ready/Remote
[4]	Stand-by/No Warning
[5] *	Running
[6]	Running/No Warning
[8]	Run on Ref./No Warning
[9]	Alarm
[10]	Alarm or Warning
[11]	At Torque Limit
[12]	Out of Current Range
[13]	Below Current, low
[14]	Above Current, high
[15]	Out of Speed Range
[16]	Below Speed, low
[17]	Above Speed, high
[18]	Out of Feedb. Range
[19]	Below Feedback, low
[20]	Above Feedback, high
[21]	Thermal Warning
[25]	Reverse
[26]	Bus OK
[27]	Torque Limit & Stop
[28]	Brake, No Warning
[29]	Brake Ready, No Fault
[30]	Brake Fault (IGBT)
[35]	External Interlock
[36]	Control Word Bit 11
[37]	Control Word Bit 12

[40]	Out of Ref. Range
[41]	Below Reference, low
[42]	Above Ref. high
[45]	Bus ctrl
[46]	Bus ctrl, 1 if timeout
[47]	Bus ctrl, 0 if timeout
[60]	Comparator 0
[61]	Comparator 1
[62]	Comparator 2
[63]	Comparator 3
[64]	Comparator 4
[65]	Comparator 5
[70]	Logic Rule 0
[71]	Logic Rule 1
[72]	Logic Rule 2
[73]	Logic Rule 3
[74]	Logic Rule 4
[75]	Logic Rule 5
[80]	SL Digital Output A
[81]	SL Digital Output B
[82]	SL Digital Output C
[83]	SL Digital Output D
[84]	SL Digital Output E
[85]	SL Digital Output F
[160]	No Alarm
[161]	Running Reverse
[165]	Local Ref. Active
[166]	Remote Ref. Active
[167]	Start Cmd. Active
[168]	Drive in Hand Mode
[169]	Drive in Auto Mode
[180]	Clock Fault
[181]	Prev. Maintenance
[190]	No-Flow
[191]	Dry Pump
[192]	End of Curve
[193]	Sleep Mode
[194]	Broken Belt
[195]	Bypass Valve Control
[199]	Pipe Filling
[211]	Cascade Pump1
[212]	Cascade Pump2
[213]	Cascade Pump3
[223]	Alarm, Trip Locked
[224]	Bypass Mode Active

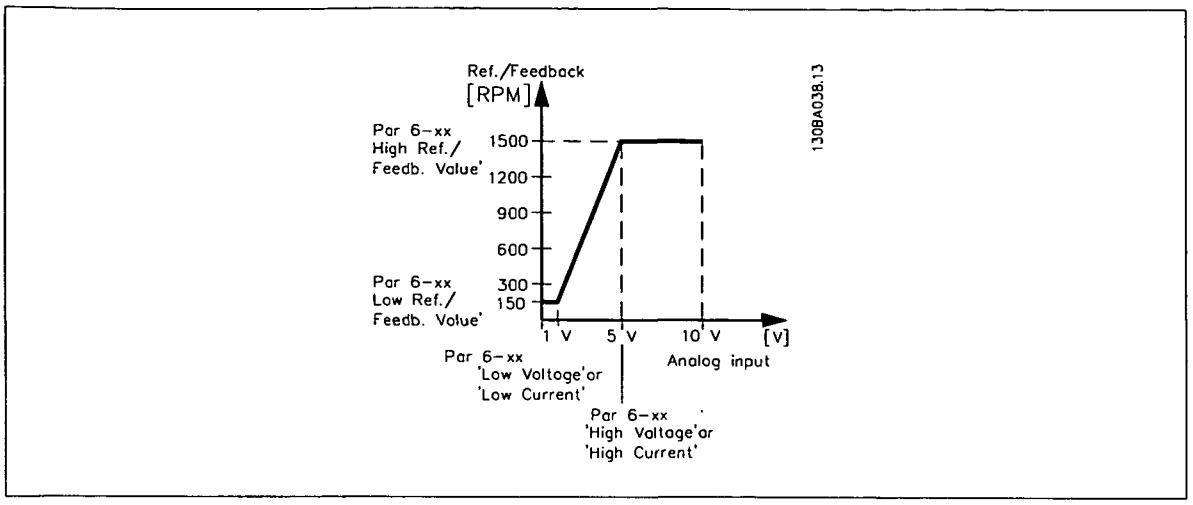
5-53 Term. 29 High Ref./Feedb. Value	
Range:	**Function:**
100.000 N* [-999999.999 - 999999.999 N/A]	Enter the high reference value [RPM] for the motor shaft speed and the high feedback value, see also par. 5-58 Term. 33 High Ref./Feedb. Value.

8.2.8. 6-** Analog In/Out

Parameter group for configuration of the analog input and output.

6-00 Live Zero Timeout Time	
Range:	**Function:**
10 s* [1 - 99 s]	Enter the Live Zero Time-out time period. Live Zero Time-out Time is active for analog inputs, i.e. terminal 53 or terminal 54, allocated to current and used as reference or feedback sources. If the reference signal value associated with the selected current input falls below 50% of the value set in par. 6-10 *Terminal 53 Low Voltage*, par. 6-12 *Terminal 53 Low Current*, par. 6-20 *Terminal 54 Low Voltage* or par. 6-22 *Terminal 54 Low Current* for a time period longer than the time set in par. 6-00 *Live Zero Timeout Time*, the function selected in par. 6-01 *Live Zero Timeout Function* will be activated.

6-01 Live Zero Timeout Function	
Option:	**Function:**
	Select the time-out function. The function set in par. 6-01 *Live Zero Timeout Function* will be activated if the input signal on terminal 53 or 54 is below 50% of the value in par. 6-10 *Terminal 53 Low Voltage*, par. 6-12 *Terminal 53 Low Current*, par. 6-20 *Terminal 54 Low Voltage* or par. 6-22 *Terminal 54 Low Current* for a time period defined in par. 6-00 *Live Zero Timeout Time*. If several time-outs occur simultaneously, the frequency converter prioritises the time-out functions as follows: 1. par. 6-01 *Live Zero Timeout Function* 2. par. 8-04 *Control Timeout Function* The output frequency of the frequency converter can be: • [1] frozen at the present value • [2] overruled to stop • [3] overruled to jog speed • [4] overruled to max. speed • [5] overruled to stop with subsequent trip If you select set-up 1-4, par. 0-10 *Active Set-up* must be set to *Multi Set-up* [9]. This parameter cannot be adjusted while the motor is running.
[0] *	Off
[1]	Freeze output
[2]	Stop
[3]	Jogging
[4]	Max. speed
[5]	Stop and trip



6-10 Terminal 53 Low Voltage

Range:	Function:
0.07 V* [0.00 - par. 6-11 V]	Enter the low voltage value. This analog input scaling value should correspond to the low reference/feedback value set in par. 6-14 *Terminal 53 Low Ref./Feedb. Value*.

6-11 Terminal 53 High Voltage

Range:	Function:
10.00 V* [par. 6-10 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. 6-15 *Terminal 53 High Ref./Feedb. Value*.

6-14 Terminal 53 Low Ref./Feedb. Value

Range:	Function:
0.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the low voltage/low current set in par. 6-10 *Terminal 53 Low Voltage* and par. 6-12 *Terminal 53 Low Current*.

6-15 Terminal 53 High Ref./Feedb. Value

Range:	Function:
50.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the high voltage/high current value set in par. 6-11 *Terminal 53 High Voltage* and par. 6-13 *Terminal 53 High Current*.

6-20 Terminal 54 Low Voltage

Range:	Function:
0.07 V* [0.00 - par. 6-21 V]	Enter the low voltage value. This analog input scaling value should correspond to the low reference/feedback value, set in par. 6-24 *Terminal 54 Low Ref./Feedb. Value*.

6-21 Terminal 54 High Voltage

Range:	Function:
10.00 V* [par. 6-20 - 10.00 V]	Enter the high voltage value. This analog input scaling value should correspond to the high reference/feedback value set in par. 6-25 *Terminal 54 High Ref./Feedb. Value*.

6-24 Terminal 54 Low Ref./Feedb. Value

Range:	Function:
0.000 N/A* [-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the low voltage/low current value set in par. 6-20 *Terminal 54 Low Voltage* and par. 6-22 *Terminal 54 Low Current*.

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6-25 Terminal 54 High Ref./Feedb. Value

Range:		Function:
100.000 N/A*	[-999999.999 - 999999.999 N/A]	Enter the analog input scaling value that corresponds to the high voltage/high current value set in par. 6-21 *Terminal 54 High Voltage* and par. 6-23 Terminal *54 High Current*.

6-50 Terminal 42 Output

Option:		Function:
		Select the function of Terminal 42 as an analog current output.
[0] *	No operation	
[100]	Output freq. 0-100	: 0 - 100 Hz
[101]	Reference Min-Max	: Minimum reference - Maximum reference
[102]	Feedback +-200%	: -200% to +200% of par. 2-14
[103]	Motor cur. 0-Imax	: 0 - Inverter Max. Current (par. 16-37)
[104]	Torque 0-Tlim	: 0 - Torque limit (par. 4-16)
[105]	Torque 0-Tnom	: 0 - Motor rated torque
[106]	Power 0-Pnom	: 0 - Motor rated power
[107]	Speed 0-HighLim	: 0 - Speed High Limit (par. 4-13 and par. 4-14)
[113]	Ext. Closed Loop 1	0 - 100%
[114]	Ext. Closed Loop 2	0 - 100%
[115]	Ext. Closed Loop 3	0 - 100%
[130]	Out frq 0-100 4-20mA	:0 - 100 Hz
[131]	Reference 4-20mA	Minimum Reference - Maximum Reference
[132]	Feedback 4-20mA	-200% to +200% of par. 2-14
[133]	Motor cur. 4-20mA	0 - Inverter Max. Current (par. 16-37 Inv. *Max. Current*)
[134]	Torq.0-lim 4-20 mA	:0 - Torque limit (par. 4-16)
[135]	Torq.0-nom 4-20mA	:0 - Motor rated torque
[136]	Power 4-20mA	0 - Motor rated power
[137]	Speed 4-20mA	0 - Speed High Limit (par. 4-13 and par. 4-14)
[139]	Bus ctrl.	0 - 100%
[140]	Bus ctrl. 4-20 mA	0 - 100%
[141]	Bus ctrl t.o.	0 - 100%
[142]	Bus ctrl t.o. 4-20mA	0 - 100%
[143]	Ext. CL 1 4-20mA	0 - 100%
[144]	Ext. CL 2 4-20mA	0 - 100%
[145]	Ext. CL 3 4-20mA	0 - 100%

NB!
Values for setting the Minimum Reference is found in par. 3-02 *Minimum Reference* and par. 20-13 Minimum *Reference/Feedb.* - values for Maximum Reference is found in par. 3-03 *Maximum Reference* and par. 20-14 Maximum *Reference/Feedb.*.

6-51 Terminal 42 Output Min Scale

Range:	Function:
0.00 %* [0.00 - 200.00 %]	Scale for the minimum output (0 or 4 mA) of the analogue signal at terminal 42. Set the value to be the **percentage** of the full range of the variable selected in par. 6-50 *Terminal 42 Output*.

6-52 Terminal 42 Output Max Scale

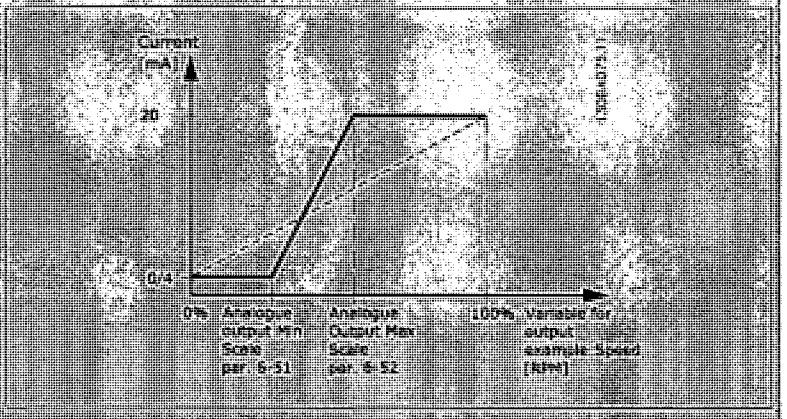
Range:

Function:

100.00 %* [0.00 - 200.00 %]

Scale for the maximum output (20 mA) of the analog signal at terminal 42.

Set the value to be the percentage of the full range of the variable selected in par. 6-50 *Terminal 42 Output*.



It is possible to get a value lower than 20 mA at full scale by programming values > 100% by using a formula as follows:

20 mA / desired maximum current x 100 %

i.e. 10 mA: $\frac{20\ mA}{10\ mA} \times 100\ \% = 200\ \%$

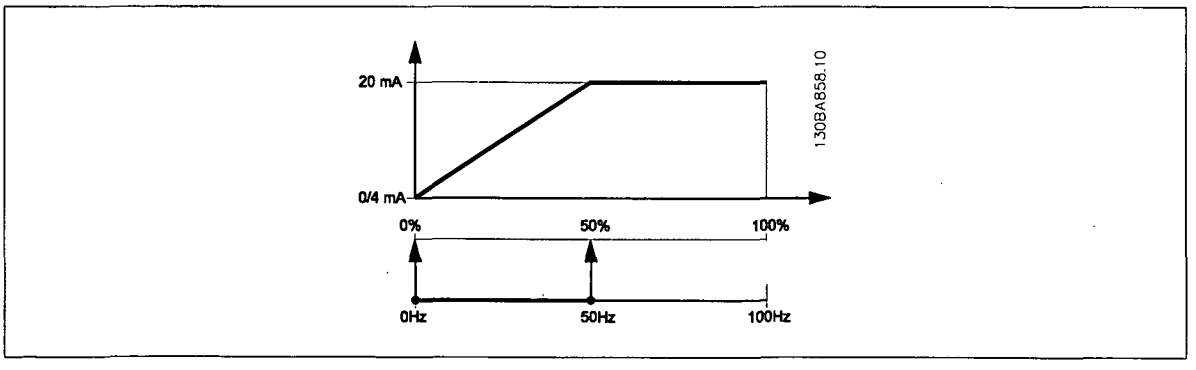
EXAMPLE 1:

Variable value= OUTPUT FREQUENCY, range = 0-100 Hz

Range needed for output = 0-50 Hz

Output signal 0 or 4 mA is needed at 0 Hz (0% of range) - set par. 6-51 *Terminal 42 Output Min Scale* to 0%

Output signal 20 mA is needed at 50 Hz (50% of range) - set par. 6-52 *Terminal 42 Output Max Scale* to 50%



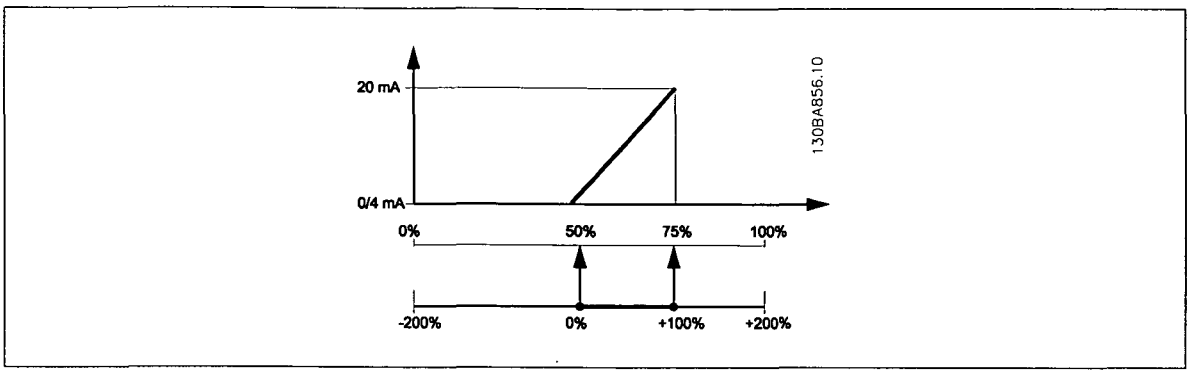
EXAMPLE 2:

Variable= FEEDBACK, range= -200% to +200%

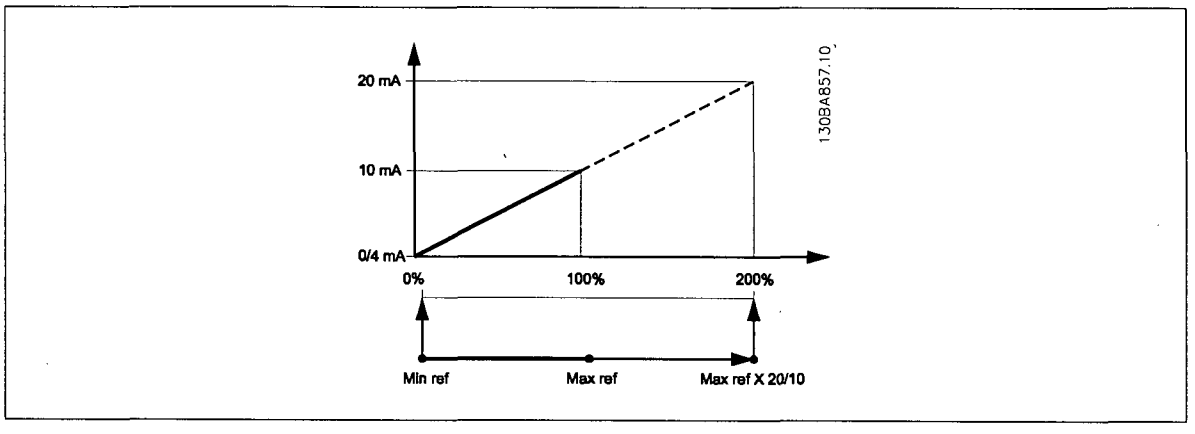
Range needed for output= 0-100%

Output signal 0 or 4 mA is needed at 0% (50% of range) - set par. 6-51 *Terminal 42 Output Min Scale* to 50%

Output signal 20 mA is needed at 100% (75% of range) - set par. 6-52 *Terminal 42 Output Max Scale* to 75%



EXAMPLE 3:
Variable value= REFERENCE, range= Min ref - Max ref
Range needed for output= Min ref (0%) - Max ref (100%), 0-10 mA
Output signal 0 or 4 mA is needed at Min ref - set par. 6-51 *Terminal 42 Output Min Scale* to 0%
Output signal 10 mA is needed at Max ref (100% of range) - set par. 6-52 *Terminal 42 Output Max Scale* to 200%
(20 mA / 10 mA x 100%=200%).



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8.2.9. Drive Closed Loop, 20-**

This parameter group is used for configuring the closed loop PID Controller, that controls the output frequency of the frequency converter.

20-12 Reference/Feedback Unit

Option:	Function:
[0]	None
[1] *	%
[5]	PPM
[10]	1/min
[11]	RPM
[12]	Pulse/s
[20]	l/s
[21]	l/min
[22]	l/h
[23]	m^3/s
[24]	m^3/min
[25]	m^3/h

[30]	kg/s
[31]	kg/min
[32]	kg/h
[33]	t/min
[34]	t/h
[40]	m/s
[41]	m/min
[45]	m
[60]	°C
[70]	mbar
[71]	bar
[72]	Pa
[73]	kPa
[74]	m WG
[75]	mm Hg
[80]	kW
[120]	GPM
[121]	gal/s
[122]	gal/min
[123]	gal/h
[124]	CFM
[125]	ft^3/s
[126]	ft^3/min
[127]	ft^3/h
[130]	lb/s
[131]	lb/min
[132]	lb/h
[140]	ft/s
[141]	ft/min
[145]	ft
[160]	°F
[170]	psi
[171]	lb/in^2
[172]	in WG
[173]	ft WG
[174]	in Hg
[180]	HP

This parameter determines the unit that is used for the setpoint reference and feedback that the PID Controller will use for controlling the output frequency of the frequency converter.

20-21 Setpoint 1

Range:

0.000 Proc... [-999999.999 - 999999.999 Proc... ess Ctrl. unit]

Function:

Setpoint 1 is used in Closed Loop Mode to enter a setpoint reference that is used by the frequency converter's PID Controller. See the description of par. 20-20 Feedback Function.

NB!

Setpoint reference entered here is added to any other references that are enabled (see par. group 3-1*).

20-81 PID Normal/Inverse Control

Option:		Function:
[0] *	Normal	
[1]	Inverse	*Normal* [0] causes the frequency converter's output frequency to decrease when the feedback is greater than the setpoint reference. This is common for pressure-controlled supply fan and pump applications. *Inverse* [1] causes the frequency converter's output frequency to increase when the feedback is greater than the setpoint reference.

20-82 PID Start Speed [RPM]

Range:		Function:
0 RPM*	[0 - par. 4-13 RPM]	When the frequency converter is first started, it initially ramps up to this output speed in Open Loop Mode, following the active Ramp Up Time. When the output speed programmed here is reached, the frequency converter will automatically switch to Closed Loop Mode and the PID Controller will begin to function. This is useful in applications in which the driven load must first quickly accelerate to a minimum speed when it is started. **NB!** This parameter will only be visible if par. 0-02 Motor *Speed Unit* is set to [0] RPM.

20-93 PID Proportional Gain

Range:		Function:
0.50 N/A*	[0.00 - 10.00 N/A]	When the difference between the feedback and the setpoint reference is less than the value of this parameter, the frequency converter's display will show "Run on Reference". This status can be communicated externally by programming the function of a digital output for *Run on Reference/No Warning* [8]. In addition, for serial communications, the On Reference status bit of the frequency converter's Status Word will be high (1). The *On Reference Bandwidth* is calculated as a percentage of the setpoint reference.

20-94 PID Integral Time

Range:		Function:
20.00 s*	[0.01 - 10000.00 s]	The integrator adds over time (integrates) the error between the feedback and the setpoint reference. This is required to ensure that the error approaches zero. Quick frequency converter speed adjustment is obtained when this value is small. However, if too small of a value is used, the frequency converter's output frequency may become unstable.

8.2.10. 22-** Miscellaneous

This group contains parameters used for monitoring water/ wastewater applications.

22-20 Low Power Auto Set-up

Option:		Function:
		When set for *Enabled*, an auto set up sequence is activated, automatically setting speed to approx. 50 and 85% of rated motor speed (par. 4-13 *Motor Speed High Limit [RPM]*, par. 4-14 Motor *Speed High Limit [Hz]*). At those two speeds, the power consumption is automatically measured and stored. Before enabling Auto Set Up: 1. Close valve(s) in order to create a no flow condition 2. The frequency converter must be set for Open Loop (par. 1-00 *Configuration Mode*). Note that it is important also to set par. 1-03 Torque *Characteristics*.
[0] *	Off	
[1]	Enabled	

NB!
Auto Set Up must be done when the system has reached normal operating temperature!

NB!
It is important that the par. 4-13 *Motor Speed High Limit [RPM]* or par. 4-14 Motor *Speed High Limit [Hz]* is set to the max. operational speed of the motor!
It is important to do the Auto Set-up before configuring the integrated PI Contoller as settings will be reset when changing from Closed to Open Loop in par. 1-00 *Configuration Mode*.

NB!
Carry out the tuning with the same settings in par. 1-03 Torque *Characteristics*, as for operation after the tuning.

22-21 Low Power Detection

Option:		Function:
[0] *	Disabled	
[1]	Enabled	If selecting Enabled, the Low Power Detection commissioning must be carried out in order to set the parameters in group 22-3* for proper operation!

22-22 Low Speed Detection

Option:		Function:
[0] *	Disabled	
[1]	Enabled	Select Enabled for detecting when the motor operates with a speed as set in par. 4-11 *Motor Speed Low Limit [RPM]* or par. 4-12 Motor *Speed Low Limit [Hz]*.

22-23 No-Flow Function

Option:		Function:
		Common actions for Low Power Detection and Low Speed Detection (individual selections not pos sible)
[0] *	Off	
[1]	Sleep Mode	
[2]	Warning	Messages in the Local Control Panel display (if mounted) and/or signal via a relay or a digital output.
[3]	Alarm	The frequency converter trips and motor stays stopped until reset.

22-24 No-Flow Delay

Range:		Function:
10 s*	[1 - 600 s]	Set the time Low Power/Low Speed must stay detected to activate signal for actions. If detection disappears before run out of the timer, the timer will be reset.

22-26 Dry Pump Function

Option:		Function:
		Low Power Detection must be Enabled (par. 22-21 *Low Power Detection*) and commissioned (using either par. 22-3*, *No Flow Power Tuning*, or par. 22-20 *Low Power Auto Set-up*) in order to use Dry Pump Detection.
[0] *	Off	
[1]	Warning	Messages in the Local Control Panel display (if mounted) and/or signal via a relay or a digital output.
[2]	Alarm	The frequency converter trips and motor stays stopped until reset.

22-27 Dry Pump Delay

Range:		Function:
10 s*	[0 - 600 s]	Defines for how long the Dry Pump condition must be active before activating Warning or Alarm

22-30 No-Flow Power

Range:		Function:
0.00 kW*	[0.00 - 0.00 kW]	Read out of calculated No Flow power at actual speed. If power drops to the display value the frequency converter will consider the condition as a No Flow situation.

22-31 Power Correction Factor

Range:		Function:
100 %*	[1 - 400 %]	Make corrections to the calculated power at par. 22-30 *No-Flow Power*. If No Flow is detected, when it should not be detected, the setting should be decreased. However, if No Flow is not detected, when it should be detected, the setting should be increased to above 100%.

22-32 Low Speed [RPM]

Range:		Function:
0 RPM*	[0 - par. 22-36 RPM]	To be used if par. 0-02 *Motor Speed Unit* has been set for RPM (parameter not visible if Hz selected). Set used speed for the 50% level. This function is used for storing values needed to tune No Flow Detection.

22-33 Low Speed [Hz]

Range:		Function:
0 Hz*	[0.0 - par. 22-37 Hz]	To be used if par. 0-02 *Motor Speed Unit* has been set for Hz (parameter not visible if RPM selected). Set used speed for the 50% level. This function is used for storing values needed to tune No Flow Detection.

22-34 Low Speed Power [kW]

Range:		Function:
0 kW*	[0.00 - 0.00 kW]	To be used if par. 0-03 *Regional Settings* has been set for International (parameter not visible if North America selected). Set power consumption at 50% speed level. This function is used for storing values needed to tune No Flow Detection.

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22-35 Low Speed Power [HP]

Range:		Function:
0 hp*	[0.00 - 0.00 hp]	To be used if par. 0-03 Regional *Settings* has been set for North America (parameter not visible if International selected). Set power consumption at 50% speed level. This function is used for storing values needed to tune No Flow Detection.

22-36 High Speed [RPM]

Range:		Function:
0 RPM*	[0 - par. 4-13 RPM]	To be used if par. 0-02 Motor Speed Unit has been set for RPM (parameter not visible if Hz selected). Set used speed for the 85% level. This function is used for storing values needed to tune No Flow Detection.

22-37 High Speed [Hz]

Range:		Function:
0.0 Hz*	[0.0 - par. 4-14 Hz]	To be used if par. 0-02 Motor Speed Unit has been set for Hz (parameter not visible if RPM selected). Set used speed for the 85% level. This function is used for storing values needed to tune No Flow Detection.

22-38 High Speed Power [kW]

Range:		Function:
0 kW*	[0.00 - 0.00 kW]	To be used if par. 0-03 Regional Settings has been set for International (parameter not visible if North America selected). Set power consumption at 85% speed level. This function is used for storing values needed to tune No Flow Detection.

22-39 High Speed Power [HP]

Range:		Function:
0 hp*	[0.00 - 0.00 hp]	To be used if par. 0-03 Regional Settings has been set for North America (parameter not visible if International selected). Set power consumption at 85% speed level. This function is used for storing values needed to tune No Flow Detection.

22-40 Minimum Run Time

Range:		Function:
10 s*	[0 - 600 s]	Set the desired minimum running time for the motor after a Start command (digital input or Bus) before entering Sleep Mode.

22-41 Minimum Sleep Time

Range:		Function:
10 s*	[0 - 600 s]	Set the desired minimum time for staying in Sleep Mode. This will override any wake up conditions.

22-42 Wake-up Speed [RPM]

Range:		Function:
0 RPM*	[par. 4-11 - par. 4-13 RPM]	To be used if par. 0-02 Motor Speed Unit has been set for RPM (parameter not visible if Hz selected). Only to be used if par. 1-00 Configuration Mode is set for Open Loop and speed reference is applied by an external controller. Set the reference speed at which the Sleep Mode should be cancelled.

8

22-43 Wake-up Speed [Hz]

Range:		Function:
0 Hz*	[par. 4-12 - par. 4-14 Hz]	To be used if par. 0-02 Motor *Speed Unit*, has been set for Hz (parameter not visible if RPM selected). Only to be used if par. 1-00 *Configuration Mode*, is set for Open Loop and speed reference is applied by an external controller controlling the pressure. Set the reference speed at which the Sleep Mode should be cancelled.

22-44 Wake-up Ref./FB Difference

Range:		Function:
10%*	[0-100%]	Only to be used if par. 1-00, *Configuration Mode*, is set for Closed Loop and the integrated PI controller is used for controlling the pressure. Set the pressure drop allowed in percentage of set point for the pressure (Pset) before cancelling the Sleep Mode.

NB!
If used in application where the integrated PI controller is set for inverse control in par. 20-71, *PID, Normal/Inverse Control*, the value set in par. 22-44 will automatically be added.

22-45 Setpoint Boost

Range:		Function:
0 %*	[-100 - 100 %]	Only to be used if par. 1-00 *Configuration Mode*, is set for Closed Loop and the integrated PI controller is used. In systems with e.g. constant pressure control, it is advantageous to increase the system pressure before the motor is stopped. This will extend the time in which the motor is stopped and help to avoid frequent start/stop. Set the desired over pressure/temperature in percentage of set point for the pressure (Pset)/temperature before entering the Sleep Mode. If setting for 5%, the boost pressure will be Pset*1.05. The negative values can be used for e.g. cooling tower control where a negative change is needed.

22-46 Maximum Boost Time

Range:		Function:
60 s*	[0 - 600 s]	Only to be used if par. 1-00 *Configuration Mode* is set for Closed Loop and the integrated PI controller is used for controlling the pressure. Set the maximum time for which boost mode will be allowed. If the set time is exceeded, Sleep Mode will be entered, not waiting for the set boost pressure to be reached.

22-50 End of Curve Function

Option:		Function:
[0]*	Off	End of Curve monitoring not active.
[1]	Warning	A warning is issued in the display [W94].
[2]	Alarm	An alarm is issued and the frequency converter trips. A message [A94] appears in the display.

NB!
Automatic restart will reset the alarm and start the system again.

22-51 End of Curve Delay

Range:		Function:
10 s*	[0 - 600 s]	When an End of Curve condition is detected, a timer is activated. When the time set in this parameter expires, and the End of Curve condition has been steady in the entire period, the function set in par. 22-50 *End of Curve Function* will be activated. If the condition disappears before the timer expires, the timer will be reset.

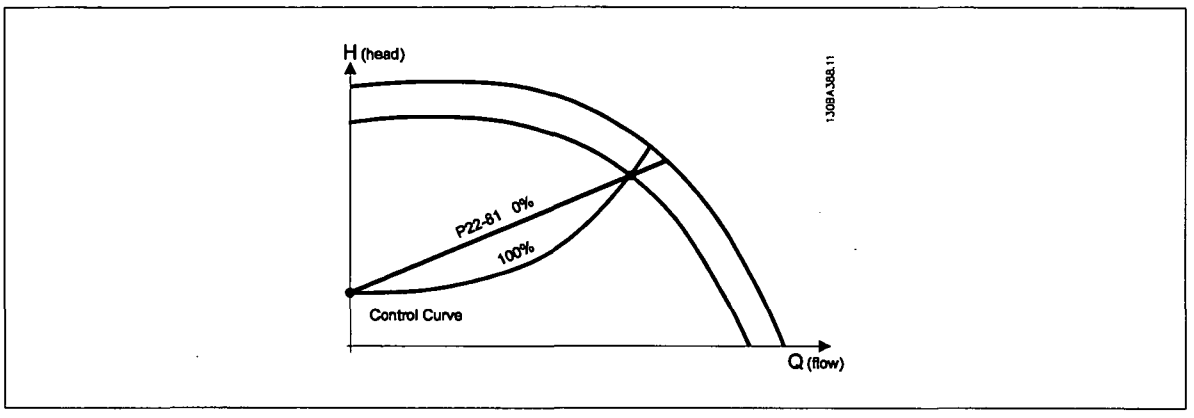
22-80 Flow Compensation

Option:		Function:
[0] *	Disabled	[0] *Disabled*: Set-Point compensation not active.
[1]	Enabled	[1] *Enabled*: Set-Point compensation is active. Enabling this parameter allows Flow Compensated Setpoint operation.

22-81 Square-linear Curve Approximation

Range:	Function:
100 %* [0 - 100 %]	Example 1: Adjustment of this parameter allows the shape of the control curve to be adjusted. 0 = Linear 100% = Ideal shape (theoretical)

NB!
Please note: Not visible when running in cascade.

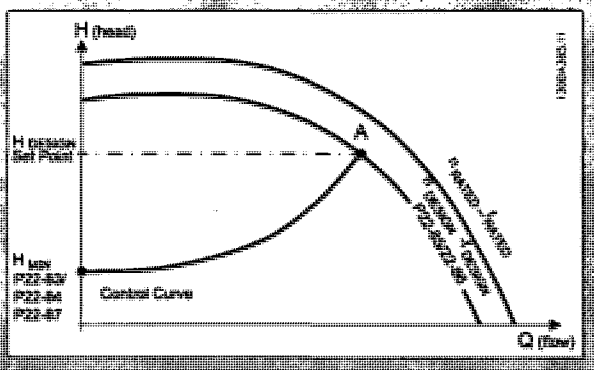


8

22-82 Work Point Calculation

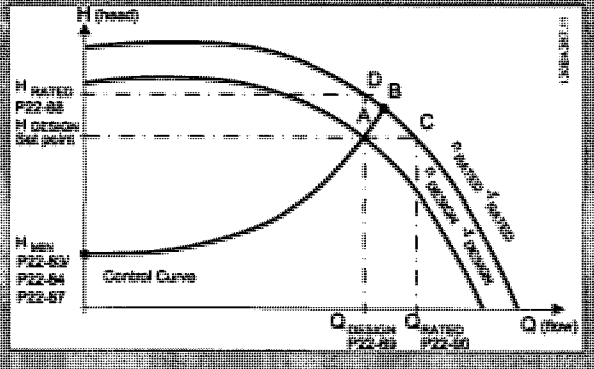
Option: **Function:**

Example 1: Speed at System Design Working Point is known:



From the data sheet showing characteristics for the specific equipment at different speeds, simply reading across from the H_{DESIGN} point and the Q_{DESIGN} point allows us to find point A, which is the System Design Working Point. The pump characteristics at this point should be identified and the associated speed programmed. Closing the valves and adjusting the speed until H_{MIN} has been achieved allows the speed at the no flow point to be identified.
Adjustment of par. 22-81 *Square-linear Curve Approximation* then allows the shape of the control curve to be adjusted infinitely.

Example 2:
Speed at System Design Working Point is not known: Where the Speed at System Design Working Point is unknown, another reference point on the control curve needs to be determined by means of the data sheet. By looking at the curve for the rated speed and plotting the design pressure (H_{DESIGN}, Point C) the flow at that pressure (Q_{RATED}) can be determined. Similarly, by plotting the design flow (Q_{DESIGN}, Point D) the pressure (H_D) at that flow can be determined. Knowing these two points on the pump curve, along with H_{MIN} as described above, allows the frequency converter to calculate the reference point B and thus to plot the control curve which will also include the System design Working Point A.



[0] *	Disabled	*Disabled [0]*: Work Point Calculation not active. To be used if speed at design point is known (see table above).
[1]	Enabled	*Enabled [1]*: Work Point Calculation is active. Enabling this parameter allows the calculation of the unknown System Design Working Point at 50/60 Hz speed, from the input data set in par. 22-83 *Speed at No-Flow [RPM]* par. 22-84 *Speed at No-Flow [Hz]* par. 22-87 *Pressure at No-Flow Speed* par. 22-88 *Pressure at Rated Speed* par. 22-89 *Flow at Design Point* and par. 22-90 *Flow at Rated Speed*.

22-84 Speed at No-Flow [Hz]

Range:	Function:
50.0 Hz* [0.0 - par. 22-86 Hz]	Resolution 0.033 Hz. The speed of the motor at which flow has effectively stopped and minimum pressure H_{MIN} is achieved should be entered here in Hz. Alternatively, the speed in RPM can be entered in par. 22-83 *Speed at No-Flow [RPM]*. If it has been decided to use Hz in par. 0-02 *Motor Speed Unit*, then par. 22-86 *Speed at Design Point [Hz]* should also be used. Closing the valves and reducing the speed until minimum pressure H_{MIN} is achieved will determine this value.

22-85 Speed at Design Point [RPM]

Range:	Function:
1500 RPM* [par. 22-83 - 60000 RPM]	Resolution 1 RPM. Only visible when par. 22-82 *Work Point Calculation* is set to *Disable*. The speed of the motor at which the System Design Working Point is achieved should be entered here in RPM. Alternatively, the speed in Hz can be entered in par. 22-86 *Speed at Design Point [Hz]*. If it has been decided to use RPM in par. 0-02 *Motor Speed Unit* then par. 22-83 *Speed at No-Flow [RPM]* should also be used.

22-86 Speed at Design Point [Hz]

Range:	Function:
50/60.0 Hz* [par. 22-84 - par. 4-19 Hz]	Resolution 0.033 Hz. Only visible when par. 22-82 *Work Point Calculation* is set to *Disable*. The speed of the motor at which the System Design Working Point is achieved should be entered here in Hz. Alternatively, the speed in RPM can be entered in par. 22-85 *Speed at Design Point [RPM]*. If it has been decided to use Hz in par. 0-02 *Motor Speed Unit*, then par. 22-83 *Speed at No-Flow [RPM]* should also be used.

22-87 Pressure at No-Flow Speed

Range:	Function:
0.000 N/A* [0.000 - par. 22-88 N/A]	Enter the pressure H_{MIN} corresponding to Speed at No Flow in Reference/Feedback Units.

22-88 Pressure at Rated Speed

Range:	Function:
999999.999 N/A* [par. 22-87 - 999999.999 N/A]	Enter the value corresponding to the Pressure at Rated Speed, in Reference/Feedback Units. This value can be defined using the pump datasheet.

22-83 Speed at No-Flow [RPM]

Range:	Function:
300 RPM* [0 - par. 22-85 RPM]	Resolution 1 RPM. The speed of the motor at which flow is zero and minimum pressure H_{MIN} is achieved should be entered here in RPM. Alternatively, the speed in Hz can be entered in par. 22-84 *Speed at No-Flow [Hz]*. If it has been decided to use RPM in par. 0-02 *Motor Speed Unit* then par. 22-85 *Speed at Design Point [RPM]* should also be used. Closing the valves and reducing the speed until minimum pressure H_{MIN} is achieved will determine this value.

22-90 Flow at Rated Speed

Range:	Function:
0.000 N/A* [0.000 - 999999.999 N/A]	Enter the value corresponding to Flow at Rated Speed. This value can be defined using the pump datasheet.

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8.2.11. Timed Actions, 23-0*

Use *Timed Actions* for actions needing to be performed on a daily or weekly basis, e.g. different references for working hours / non-working hours. Up to 10 Timed Actions can be programmed in the frequency converter. The Timed Action number is selected from the list when entering parameter group 23-0* from the Local Control Panel. par. 23-00 *ON Time* – par. 23-04 *Occurrence* then refer to the selected Timed Action number. Each Timed Action is divided into an ON time and an OFF time, in which two different actions may be performed.

NB!
The clock (parameter group 0-7*) must be correctly programmed for Timed Actions to function correctly.

NB!
When mounting an Analog I/O MCB109 option card, a battery back up of the date and time is included.

23-00 ON Time

Array [10]

Range:	Function:
0 N/A* [0 - 0 N/A]	Sets the ON time for the Timed Action.

NB!
The frequency converter has no back up of the clock function and the set date/time will reset to default (2000-01-01 00:00) after a power down unless a Real Time Clock module with back up is installed. In par. 0-79 *Clock Fault* it is possible to program for a Warning in case clock has not been set properly, e.g. after a power down.

23-01 ON Action

Arra [10]

Option:	Function:
	Select the action during ON Time. See par. 13-52 SL *Controller Action* for descriptions of the options.
[0] *	Disabled
[1]	No action
[2]	Select set-up 1
[3]	Select set-up 2
[4]	Select set-up 3
[5]	Select set-up 4
[10]	Select preset ref 0
[11]	Select preset ref 1
[12]	Select preset ref 2
[13]	Select preset ref 3
[14]	Select preset ref 4
[15]	Select preset ref 5
[16]	Select preset ref 6
[17]	Select preset ref 7
[18]	Select ramp 1
[19]	Select ramp 2
[22]	Run

[23]	Run reverse
[24]	Stop
[26]	DC Brake
[27]	Coast
[28]	Freeze output
[29]	Start timer 0
[30]	Start timer 1
[31]	Start timer 2
[32]	Set digital out A low
[33]	Set digital out B low
[34]	Set digital out C low
[35]	Set digital out D low
[36]	Set digital out E low
[37]	Set digital out F low
[38]	Set digital out A high
[39]	Set digital out B high
[40]	Set digital out C high
[41]	Set digital out D high
[42]	Set digital out E high
[43]	Set digital out F high
[60]	Reset Counter A
[61]	Reset Counter B
[70]	Start Timer 3
[71]	Start Timer 4
[72]	Start Timer 5
[73]	Start Timer 6
[74]	Start Timer 7

23-02 OFF Time

Array [10]

Range:	Function:
0 N/A*	0 - 0 N/A

Sets the OFF time for the Timed Action.

NB!
The frequency converter has no back up of the clock function and the set date/time will reset to default (2000-01-01 00:00) after a power down unless a Real Time Clock module with back up is installed. In par. 0-79 Clock Fault it is possible to program for a Warning in case clock has not been set properly, e.g. after a power down.

23-03 OFF Action

Array [10]

Option:	Function:
	Select the action during OFF Time. See par. 13-52 SL Controller Action for descriptions of the options.
[0] *	Disabled
[1]	No action
[2]	Select set-up 1
[3]	Select set-up 2

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[4]	Select set-up 3
[5]	Select set-up 4
[10]	Select preset ref 0
[11]	Select preset ref 1
[12]	Select preset ref 2
[13]	Select preset ref 3
[14]	Select preset ref 4
[15]	Select preset ref 5
[16]	Select preset ref 6
[17]	Select preset ref 7
[18]	Select ramp 1
[19]	Select ramp 2
[22]	Run
[23]	Run reverse
[24]	Stop
[26]	DC Brake
[27]	Coast
[28]	Freeze output
[29]	Start timer 0
[30]	Start timer 1
[31]	Start timer 2
[32]	Set digital out A low
[33]	Set digital out B low
[34]	Set digital out C low
[35]	Set digital out D low
[36]	Set digital out E low
[37]	Set digital out F low
[38]	Set digital out A high
[39]	Set digital out B high
[40]	Set digital out C high
[41]	Set digital out D high
[42]	Set digital out E high
[43]	Set digital out F high
[60]	Reset Counter A
[61]	Reset Counter B
[70]	Start Timer 3
[71]	Start Timer 4
[72]	Start Timer 5
[73]	Start Timer 6
[74]	Start Timer 7

23-04 Occurrence

Array [10]

Option:		Function:
		Select which day(s) the Timed Action applies to. Specify working/non-working days in par. 0-81 Working Days, par. 0-82 Additional Working Days and par. 0-83 Additional Non-Working Days.
[0] *	All days	
[1]	Working days	
[2]	Non-working days	
[3]	Monday	
[4]	Tuesday	
[5]	Wednesday	
[6]	Thursday	
[7]	Friday	
[8]	Saturday	
[9]	Sunday	

8.2.12. Water Application Functions, 29-**

The group contains parameters used for monitoring water / wastewater applications.

8

29-00 Pipe Fill Enable

Option:		Function:
[0] *	Disabled	Select Enabled to fill pipes at a user specified rate.
[1]	Enabled	Select Enabled to fill pipes with a user specified rate.

29-01 Pipe Fill Speed [RPM]

Range:		Function:
Speed Low Limit*	[Speed Low Limit - Speed High Limit]	Set the filling speed for filling horizontal pipe systems. The speed can be selected in Hz or RPM depending on the choices made in par. 4-11 / par. 4-13 (RPM) or in par. 4-12 / par. 4-14 (Hz).

29-02 Pipe Fill Speed [Hz]

Range:		Function:
Motor Speed Low Limit*	[Speed Low Limit - Speed High Limit]	Set the filling speed for filling horizontal pipe systems. The speed can be selected in Hz or RPM depending on the choices made in par. 4-11 / par. 4-13 (RPM) or in par. 4-12 / par. 4-14 (Hz).

29-03 Pipe Fill Time

Range:		Function:
0 s*	[0 - 3600 s]	Set the specified time for pipe filling of horizontal pipe systems.

29-04 Pipe Fill Rate

Range:		Function:
0.001 units/s*	[0.001 – 999999.999 units/s]	Specifies the filling rate in units/second using the PI controller. Filling rate units are feedback units/second. This function is used for filling-up vertical pipe systems but will be active when the filling-time has expired, no matter what , until the pipe fill-set-point set in par. 29-05 is reached.

29-05 Filled Setpoint

Range:		Function:
0 s*	[0 – 999999,999 s]	Specifies the Filled Set-point at which the Pipe Fill Function will be disabled and the PID controller will take control. This function can be used both for horizontal and vertical pipe systems.

8.3. Parameter Options

8.3.1. Default settings

Changes during operation:

"TRUE" means that the parameter can be changed while the frequency converter is in operation and "FALSE" means that the frequency converter must be stopped before a change can be made.

4-Set-up:

'All set-up': the parameter can be set individually in each of the four set-ups, i. e. one single parameter can have four different data values.
'1 set-up': data value will be the same in all set-ups.

SR:

Size related

N/A:

No default value available.

Conversion index:

This number refers to a conversion figure used when writing or reading by means of a frequency converter.

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Conv. index	100	67	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6
Conv. factor	1	1/60	1000000	100000	10000	1000	100	10	1	0.1	0.01	0.001	0.0001	0.00001	0.000001

Data type	Description	Type
2	Integer 8	Int8
3	Integer 16	Int16
4	Integer 32	Int32
5	Unsigned 8	Uint8
6	Unsigned 16	Uint16
7	Unsigned 32	Uint32
9	Visible String	VisStr
33	Normalized value 2 bytes	N2
35	Bit sequence of 16 boolean variables	V2
54	Time difference w/o date	TimD

8.3.2. Operation/Display 0-**

Par. No. #	Parameter description	Default value	4-set-up	FC 302 only	Change during operation	Conversion index	Type
0-0* Basic Settings							
0-01	Language	[0] English	1 set-up		TRUE	-	Uint8
0-02	Motor Speed Unit	[0] RPM	2 set-ups		FALSE	-	Uint8
0-03	Regional Settings	[0] International	2 set-ups		FALSE	-	Uint8
0-04	Operating State at Power-up	[0] Resume	All set-ups		TRUE	-	Uint8
0-05	Local Mode Unit	[0] As Motor Speed Unit	2 set-ups		FALSE	-	Uint8
0-1* Set-up Operations							
0-10	Active Set-up	[1] Set-up 1	1 set-up		TRUE	-	Uint8
0-11	Programming Set-up	[9] Active Set-up	All set-ups		TRUE	-	Uint8
0-12	This Set-up Linked to	[0] Not linked	All set-ups		FALSE	-	Uint8
0-13	Readout: Linked Set-ups	0 N/A	All set-ups		FALSE	0	Uint16
0-14	Readout: Prog. Set-ups / Channel	0 N/A	All set-ups		TRUE	0	Int32
0-2* LCP Display							
0-20	Display Line 1.1 Small	1601	All set-ups		TRUE	-	Uint16
0-21	Display Line 1.2 Small	1662	All set-ups		TRUE	-	Uint16
0-22	Display Line 1.3 Small	1614	All set-ups		TRUE	-	Uint16
0-23	Display Line 2 Large	1613	All set-ups		TRUE	-	Uint16
0-24	Display Line 3 Large	1652	All set-ups		TRUE	-	Uint16
0-25	My Personal Menu	ExpressionLimit	1 set-up		TRUE	0	Uint16
0-3* LCP Custom Readout							
0-30	Custom Readout Unit	[1] %	All set-ups		TRUE	-	Uint8
0-31	Custom Readout Min Value	ExpressionLimit	All set-ups		TRUE	-2	Int32
0-32	Custom Readout Max Value	100.00 CustomReadoutUnit	All set-ups		TRUE	-2	Int32
0-37	Display Text 1	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-38	Display Text 2	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-39	Display Text 3	0 N/A	1 set-up		TRUE	0	VisStr[25]
0-4* LCP Keypad							
0-40	[Hand on] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-41	[Off] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-42	[Auto on] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-43	[Reset] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-44	[Off/Reset] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-45	[Drive Bypass] Key on LCP	[1] Enabled	All set-ups		TRUE	-	Uint8
0-5* Copy/Save							
0-50	LCP Copy	[0] No copy	All set-ups		FALSE	-	Uint8
0-51	Set-up Copy	[0] No copy	All set-ups		FALSE	-	Uint8
0-6* Password							
0-60	Main Menu Password	100 N/A	1 set-up		TRUE	0	Uint16
0-61	Access to Main Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8
0-65	Personal Menu Password	200 N/A	1 set-up		TRUE	0	Uint16
0-66	Access to Personal Menu w/o Password	[0] Full access	1 set-up		TRUE	-	Uint8

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
0-7* Clock Settings						
0-70	Date and Time	ExpressionLimit	All set-ups	TRUE	0	TimeOfDay
0-71	Date Format	[0] YYYY-MM-DD	1 set-up	TRUE	-	Uint8
0-72	Time Format	[0] 24 h	1 set-up	TRUE	-	Uint8
0-74	DST/Summertime	[0] Off	1 set-up	TRUE	-	Uint8
0-76	DST/Summertime Start	ExpressionLimit	1 set-up	TRUE	0	TimeOfDay
0-77	DST/Summertime End	ExpressionLimit	1 set-up	TRUE	0	TimeOfDay
0-79	Clock Fault	null	1 set-up	TRUE	-	Uint8
0-81	Working Days	null	1 set-up	TRUE	-	Uint8
0-82	Additional Working Days	ExpressionLimit	1 set-up	TRUE	0	TimeOfDay
0-83	Additional Non-Working Days	ExpressionLimit	1 set-up	TRUE	0	TimeOfDay
0-89	Date and Time Readout	0 N/A	All set-ups	TRUE	0	VisStr[25]

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8.3.3. Load/Motor 1-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
1-0* General Settings						
1-00	Configuration Mode	null	All set-ups	TRUE	-	Uint8
1-01	Motor Control Principle	null	All set-ups	FALSE	-	Uint8
1-03	Torque Characteristics	[3] Auto Energy Optim. VT	All set-ups	TRUE	-	Uint8
1-1* Motor Selection						
1-10	Motor Construction	[0] Asynchron	All set-ups	FALSE	-	Uint8
1-2* Motor Data						
1-20	Motor Power [kW]	ExpressionLimit	All set-ups	FALSE	1	Uint32
1-21	Motor Power [HP]	ExpressionLimit	All set-ups	FALSE	-2	Uint32
1-22	Motor Voltage	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-23	Motor Frequency	ExpressionLimit	All set-ups	FALSE	0	Uint16
1-24	Motor Current	ExpressionLimit	All set-ups	FALSE	-2	Uint32
1-25	Motor Nominal Speed	ExpressionLimit	All set-ups	FALSE	67	Uint16
1-28	Motor Rotation Check	[0] Off	All set-ups	FALSE	-	Uint8
1-29	Automatic Motor Adaptation (AMA)	[0] Off	All set-ups	FALSE	-	Uint8
1-3* Adv. Motor Data						
1-30	Stator Resistance (Rs)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-31	Rotor Resistance (Rr)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-35	Main Reactance (Xh)	ExpressionLimit	All set-ups	FALSE	-4	Uint32
1-36	Iron Loss Resistance (Rfe)	ExpressionLimit	All set-ups	FALSE	-3	Uint32
1-39	Motor Poles	ExpressionLimit	All set-ups	FALSE	0	Uint8
1-5* Load Indep. Setting						
1-50	Motor Magnetisation at Zero Speed	100 %	All set-ups	TRUE	0	Uint16
1-51	Min Speed Normal Magnetising [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
1-52	Min Speed Normal Magnetising [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-6* Load Depen. Setting						
1-60	Low Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-61	High Speed Load Compensation	100 %	All set-ups	TRUE	0	Int16
1-62	Slip Compensation	0 %	All set-ups	TRUE	0	Int16
1-63	Slip Compensation Time Constant	ExpressionLimit	All set-ups	TRUE	-2	Uint16
1-64	Resonance Dampening	100 %	All set-ups	TRUE	0	Uint16
1-65	Resonance Dampening Time Constant	5 ms	All set-ups	TRUE	-3	Uint8
1-7* Start Adjustments						
1-71	Start Delay	0.0 s	All set-ups	TRUE	-1	Uint16
1-73	Flying Start	[0] Disabled	All set-ups	FALSE	-	Uint8
1-74	Start Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
1-75	Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-76	Start Current	0.00 A	All set-ups	TRUE	-2	Uint32
1-8* Stop Adjustments						
1-80	Function at Stop	[0] Coast	All set-ups	TRUE	-	Uint8
1-81	Min Speed for Function at Stop [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
1-82	Min Speed for Function at Stop [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
1-86	Trip Speed Low [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
1-87	Trip Speed Low [Hz]	0 Hz	All set-ups	TRUE	-1	Uint16
1-9* Motor Temperature						
1-90	Motor Thermal Protection	[4] ETR trip 1	All set-ups	TRUE	-	Uint8
1-91	Motor External Fan	[0] No	All set-ups	TRUE	-	Uint16
1-93	Thermistor Source	[0] None	All set-ups	TRUE	-	Uint8

8.3.4. Brakes 2-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
2-0* DC-Brake			All set-ups	TRUE		Uint8
2-00	DC Hold/Preheat Current	50 %	All set-ups	TRUE	0	Uint8
2-01	DC Brake Current	50 %	All set-ups	TRUE	0	Uint16
2-02	DC Braking Time	10.0 s	All set-ups	TRUE	-1	Uint16
2-03	DC Brake Cut In Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
2-04	DC Brake Cut In Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
2-1* Brake Energy Funct.						
2-10	Brake Function	[0] Off	All set-ups	TRUE	-	Uint8
2-11	Brake Resistor (ohm)	ExpressionLimit	All set-ups	TRUE	0	Uint16
2-12	Brake Power Limit (kW)	ExpressionLimit	All set-ups	TRUE	0	Uint32
2-13	Brake Power Monitoring	[0] Off	All set-ups	TRUE	-	Uint8
2-15	Brake Check	[0] Off	All set-ups	TRUE	-	Uint8
2-16	AC brake Max. Current	100.0 %	All set-ups	TRUE	-1	Uint32
2-17	Over-voltage Control	[2] Enabled	All set-ups	TRUE	-	Uint8

8.3.5. Reference / Ramps 3-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
3-0* Reference Limits						
3-02	Minimum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
3-03	Maximum Reference	ExpressionLimit	All set-ups	TRUE	-3	Int32
3-04	Reference Function	[0] Sum	All set-ups	TRUE	-	Uint8
3-1* References						
3-10	Preset Reference	0.00 %	All set-ups	TRUE	-2	Int16
3-11	Jog Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
3-13	Reference Site	[0] Linked to Hand / Auto	All set-ups	TRUE	-	Uint8
3-14	Preset Relative Reference	0.00 %	All set-ups	TRUE	-2	Int32
3-15	Reference 1 Source	[1] Analog input 53	All set-ups	TRUE	-	Uint8
3-16	Reference 2 Source	[0] No function	All set-ups	TRUE	-	Uint8
3-17	Reference 3 Source	[0] No function	All set-ups	TRUE	-	Uint8
3-19	Jog Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
3-4* Ramp 1						
3-41	Ramp 1 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-42	Ramp 1 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-5* Ramp 2						
3-51	Ramp 2 Ramp Up Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-52	Ramp 2 Ramp Down Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-8* Other Ramps						
3-80	Jog Ramp Time	ExpressionLimit	All set-ups	TRUE	-2	Uint32
3-81	Quick Stop Ramp Time	ExpressionLimit	2 set-ups	TRUE	-2	Uint32
3-84	Initial Ramp Time	0.00 s	All set-ups	TRUE	-2	Uint16
3-85	Check Valve Ramp Time	0.00 s	All set-ups	TRUE	-2	Uint16
3-86	Check Valve Ramp End Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
3-87	Check Valve Ramp End Speed [HZ]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
3-88	Final Ramp Time	0.00 s	All set-ups	TRUE	-2	Uint16
3-9* Digital Pot.Meter						
3-90	Step Size	0.10 %	All set-ups	TRUE	-2	Uint16
3-91	Ramp Time	1.00 s	All set-ups	TRUE	-2	Uint32
3-92	Power Restore	[0] Off	All set-ups	TRUE	-	Uint8
3-93	Maximum Limit	100 %	All set-ups	TRUE	0	Int16
3-94	Minimum Limit	0 %	All set-ups	TRUE	0	Int16
3-95	Ramp Delay	ExpressionLimit	All set-ups	TRUE	-3	TimD

8.3.6. Limits / Warnings 4-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
4-1* Motor Limits						
4-10	Motor Speed Direction	[0] Clockwise	All set-ups	FALSE	-	Uint8
4-11	Motor Speed Low Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-12	Motor Speed Low Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-13	Motor Speed High Limit [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-14	Motor Speed High Limit [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-16	Torque Limit Motor Mode	110.0 %	All set-ups	TRUE	-1	Uint16
4-17	Torque Limit Generator Mode	100.0 %	All set-ups	TRUE	-1	Uint16
4-18	Current Limit	ExpressionLimit	All set-ups	TRUE	-1	Uint32
4-19	Max Output Frequency	ExpressionLimit	All set-ups	FALSE	-1	Uint16
4-5* Adj. Warnings						
4-50	Warning Current Low	0.00 A	All set-ups	TRUE	-2	Uint32
4-51	Warning Current High	ImaxVLT (P1637)	All set-ups	TRUE	-2	Uint32
4-52	Warning Speed Low	0 RPM	All set-ups	TRUE	67	Uint16
4-53	Warning Speed High	outputSpeedHighLimit (P413)	All set-ups	TRUE	67	Uint16
4-54	Warning Reference Low	-999999.999 N/A	All set-ups	TRUE	-3	Int32
4-55	Warning Reference High	999999.999 N/A	All set-ups	TRUE	-3	Int32
4-56	Warning Feedback Low	-999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
4-57	Warning Feedback High	999999.999 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
4-58	Missing Motor Phase Function	[1] On	All set-ups	TRUE	-	Uint8
4-6* Speed Bypass						
4-60	Bypass Speed From [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-61	Bypass Speed From [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-62	Bypass Speed To [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
4-63	Bypass Speed To [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
4-64	Semi-Auto Bypass Set-up	[0] Off	All set-ups	FALSE	-	Uint8

8.3.7. Digital In/Out 5-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
5-0* Digital I/O mode						
5-00	Digital I/O Mode	[0] PNP - Active at 24V	All set-ups	FALSE	-	Uint8
5-01	Terminal 27 Mode	[0] Input	All set-ups	TRUE	-	Uint8
5-02	Terminal 29 Mode	[0] Input	All set-ups	TRUE	-	Uint8
5-1* Digital Inputs						
5-10	Terminal 18 Digital Input	[8] Start	All set-ups	TRUE	-	Uint8
5-11	Terminal 19 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-12	Terminal 27 Digital Input	null	All set-ups	TRUE	-	Uint8
5-13	Terminal 29 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-14	Terminal 32 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-15	Terminal 33 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-16	Terminal X30/2 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-17	Terminal X30/3 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-18	Terminal X30/4 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
5-3* Digital Outputs						
5-30	Terminal 27 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
5-31	Terminal 29 Digital Output	[0] No operation	All set-ups	TRUE	-	Uint8
5-32	Term X30/6 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	-	Uint8
5-33	Term X30/7 Digi Out (MCB 101)	[0] No operation	All set-ups	TRUE	-	Uint8
5-4* Relays						
5-40	Function Relay	null	All set-ups	TRUE	-	Uint8
5-41	On Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-42	Off Delay, Relay	0.01 s	All set-ups	TRUE	-2	Uint16
5-5* Pulse Input						
5-50	Term. 29 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-51	Term. 29 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-52	Term. 29 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
5-53	Term. 29 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
5-54	Pulse Filter Time Constant #29	100 ms	All set-ups	FALSE	-3	Uint16
5-55	Term. 33 Low Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-56	Term. 33 High Frequency	100 Hz	All set-ups	TRUE	0	Uint32
5-57	Term. 33 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
5-58	Term. 33 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
5-59	Pulse Filter Time Constant #33	100 ms	All set-ups	FALSE	-3	Uint16
5-6* Pulse Output						
5-60	Terminal 27 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-62	Pulse Output Max Freq #27	5000 Hz	All set-ups	TRUE	0	Uint32
5-63	Terminal 29 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-65	Pulse Output Max Freq #29	5000 Hz	All set-ups	TRUE	0	Uint32
5-66	Terminal X30/6 Pulse Output Variable	[0] No operation	All set-ups	TRUE	-	Uint8
5-68	Pulse Output Max Freq #X30/6	5000 Hz	All set-ups	TRUE	0	Uint32
5-9* Bus Controlled						
5-90	Digital & Relay Bus Control	0 N/A	All set-ups	TRUE	0	Uint32
5-93	Pulse Out #27 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-94	Pulse Out #27 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
5-95	Pulse Out #29 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-96	Pulse Out #29 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
5-97	Pulse Out #X30/6 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
5-98	Pulse Out #X30/6 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

8.3.8. Analog In/Out 6-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
6-0* Analog I/O Mode						
6-00	Live Zero Timeout Time	10 s	All set-ups	TRUE	0	Uint8
6-01	Live Zero Timeout Function	[0] Off	All set-ups	TRUE	-	Uint8
6-1* Analog Input 53						
6-10	Terminal 53 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-11	Terminal 53 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-12	Terminal 53 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
6-13	Terminal 53 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
6-14	Terminal 53 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-15	Terminal 53 High Ref./Feedb. Value	ExpressionLimit	All set-ups	TRUE	-3	Int32
6-16	Terminal 53 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-17	Terminal 53 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-2* Analog Input 54						
6-20	Terminal 54 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-21	Terminal 54 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-22	Terminal 54 Low Current	4.00 mA	All set-ups	TRUE	-5	Int16
6-23	Terminal 54 High Current	20.00 mA	All set-ups	TRUE	-5	Int16
6-24	Terminal 54 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-25	Terminal 54 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-26	Terminal 54 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-27	Terminal 54 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-3* Analog Input X30/11						
6-30	Terminal X30/11 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-31	Terminal X30/11 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-34	Term. X30/11 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-35	Term. X30/11 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-36	Term. X30/11 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-37	Term. X30/11 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-4* Analog Input X30/12						
6-40	Terminal X30/12 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
6-41	Terminal X30/12 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
6-44	Term. X30/12 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
6-45	Term. X30/12 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
6-46	Term. X30/12 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
6-47	Term. X30/12 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
6-5* Analog Output 42						
6-50	Terminal 42 Output	[100] Output freq. 0-100	All set-ups	TRUE	-	Uint8
6-51	Terminal 42 Output Min Scale	0.00 %	All set-ups	TRUE	-2	Int16
6-52	Terminal 42 Output Max Scale	100.00 %	All set-ups	TRUE	-2	Int16
6-53	Terminal 42 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
6-54	Terminal 42 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
6-6* Analog Output X30/8						
6-60	Terminal X30/8 Output	[0] No operation	All set-ups	TRUE	-	Uint8
6-61	Terminal X30/8 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
6-62	Terminal X30/8 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
6-63	Terminal X30/8 Output Bus Control	0.00 %	All set-ups	TRUE	-2	N2
6-64	Terminal X30/8 Output Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

8.3.9. Comm. and Options 8-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
8-0* General Settings						
8-01	Control Site	null	All set-ups	TRUE	-	Uint8
8-02	Control Source	null	All set-ups	TRUE	-	Uint8
8-03	Control Timeout Time	ExpressionLimit	1 set-up	TRUE	-1	Uint32
8-04	Control Timeout Function	[0] Off	1 set-up	TRUE	-	Uint8
8-05	End-of-Timeout Function	[1] Resume set-up	1 set-up	TRUE	-	Uint8
8-06	Reset Control Timeout	[0] Do not reset	All set-ups	TRUE	-	Uint8
8-07	Diagnosis Trigger	[0] Disable	2 set-ups	TRUE	-	Uint8
8-1* Control Settings						
8-10	Control Profile	[0] FC profile	All set-ups	TRUE	-	Uint8
8-13	Configurable Status Word STW	[1] Profile Default	All set-ups	TRUE	-	Uint8
8-14	Configurable Control Word CTW	[1] Profile default	All set-ups	TRUE	-	Uint8
8-3* FC Port Settings						
8-30	Protocol	null	1 set-up	TRUE	-	Uint8
8-31	Address	ExpressionLimit	1 set-up	TRUE	0	Uint8
8-32	Baud Rate	null	1 set-up	TRUE	-	Uint8
8-33	Parity / Stop Bits	null	1 set-up	TRUE	-	Uint8
8-35	Minimum Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
8-36	Max Response Delay	ExpressionLimit	1 set-up	TRUE	-3	Uint16
8-37	Maximum Inter-Char Delay	ExpressionLimit	1 set-up	TRUE	-5	Uint16
8-4* FC MC protocol set						
8-40	Telegram Selection	[1] Standard telegram 1	2 set-ups	TRUE	-	Uint8
8-5* Digital/Bus						
8-50	Coasting Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-52	DC Brake Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-53	Start Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-54	Reversing Select	null	All set-ups	TRUE	-	Uint8
8-55	Set-up Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-56	Preset Reference Select	[3] Logic OR	All set-ups	TRUE	-	Uint8
8-7* BACnet						
8-70	BACnet Device Instance	1 N/A	1 set-up	TRUE	0	Uint32
8-72	MS/TP Max Masters	127 N/A	1 set-up	TRUE	0	Uint8
8-73	MS/TP Max Info Frames	1 N/A	1 set-up	TRUE	0	Uint16
8-74	"I-Am" Service	[0] Send at power-up	1 set-up	TRUE	-	Uint8
8-75	Initialisation Password	ExpressionLimit	1 set-up	TRUE	0	VisStr[20]
8-8* FC Port Diagnostics						
8-80	Bus Message Count	0 N/A	All set-ups	TRUE	0	Uint32
8-81	Bus Error Count	0 N/A	All set-ups	TRUE	0	Uint32
8-82	Slave Message Rcvd	0 N/A	All set-ups	TRUE	0	Uint32
8-83	Slave Error Count	0 N/A	All set-ups	TRUE	0	Uint32
8-9* Bus Jog / Feedback						
8-90	Bus Jog 1 Speed	100 RPM	All set-ups	TRUE	67	Uint16
8-91	Bus Jog 2 Speed	200 RPM	All set-ups	TRUE	67	Uint16
8-94	Bus Feedback 1	0 N/A	1 set-up	TRUE	0	N2
8-95	Bus Feedback 2	0 N/A	1 set-up	TRUE	0	N2
8-96	Bus Feedback 3	0 N/A	1 set-up	TRUE	0	N2

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8.3.10. Profibus 9-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
9-00	Setpoint	0 N/A	All set-ups	TRUE	0	Uint16
9-07	Actual Value	0 N/A	All set-ups	FALSE	0	Uint16
9-15	PCD Write Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
9-16	PCD Read Configuration	ExpressionLimit	2 set-ups	TRUE	-	Uint16
9-18	Node Address	126 N/A	1 set-up	TRUE	0	Uint8
9-22	Telegram Selection	[108] PPO 8	1 set-up	TRUE	-	Uint8
9-23	Parameters for Signals	0	All set-ups	TRUE	-	Uint16
9-27	Parameter Edit	[1] Enabled	2 set-ups	FALSE	-	Uint16
9-28	Process Control	[1] Enable cyclic master	2 set-ups	FALSE	-	Uint8
9-44	Fault Message Counter	0 N/A	All set-ups	TRUE	0	Uint16
9-45	Fault Code	0 N/A	All set-ups	TRUE	0	Uint16
9-47	Fault Number	0 N/A	All set-ups	TRUE	0	Uint16
9-52	Fault Situation Counter	0 N/A	All set-ups	TRUE	0	Uint16
9-53	Profibus Warning Word	0 N/A	All set-ups	TRUE	0	V2
9-63	Actual Baud Rate	[255] No baudrate found	All set-ups	TRUE	-	Uint8
9-64	Device Identification	0 N/A	All set-ups	TRUE	0	Uint16
9-65	Profile Number	0 N/A	All set-ups	TRUE	0	OctStr[2]
9-67	Control Word 1	0 N/A	All set-ups	TRUE	0	V2
9-68	Status Word 1	0 N/A	All set-ups	TRUE	0	V2
9-71	Profibus Save Data Values	[0] Off	All set-ups	TRUE	-	Uint8
9-72	ProfibusDriveReset	[0] No action	1 set-up	FALSE	-	Uint8
9-80	Defined Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
9-81	Defined Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
9-82	Defined Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
9-83	Defined Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
9-84	Defined Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16
9-90	Changed Parameters (1)	0 N/A	All set-ups	FALSE	0	Uint16
9-91	Changed Parameters (2)	0 N/A	All set-ups	FALSE	0	Uint16
9-92	Changed Parameters (3)	0 N/A	All set-ups	FALSE	0	Uint16
9-93	Changed Parameters (4)	0 N/A	All set-ups	FALSE	0	Uint16
9-94	Changed Parameters (5)	0 N/A	All set-ups	FALSE	0	Uint16

8.3.11. CAN Fieldbus 10-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
10-0* Common Settings						
10-00	CAN Protocol	null	2 set-ups	FALSE	-	Uint8
10-01	Baud Rate Select	null	2 set-ups	TRUE	-	Uint8
10-02	MAC ID	ExpressionLimit	2 set-ups	TRUE	0	Uint8
10-05	Readout Transmit Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-06	Readout Receive Error Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-07	Readout Bus Off Counter	0 N/A	All set-ups	TRUE	0	Uint8
10-1* DeviceNet						
10-10	Process Data Type Selection	null	All set-ups	TRUE	-	Uint8
10-11	Process Data Config Write	ExpressionLimit	2 set-ups	TRUE	-	Uint16
10-12	Process Data Config Read	ExpressionLimit	2 set-ups	TRUE	-	Uint16
10-13	Warning Parameter	0 N/A	All set-ups	TRUE	0	Uint16
10-14	Net Reference	[0] Off	2 set-ups	TRUE	-	Uint8
10-15	Net Control	[0] Off	2 set-ups	TRUE	-	Uint8
10-2* COS Filters						
10-20	COS Filter 1	0 N/A	All set-ups	FALSE	0	Uint16
10-21	COS Filter 2	0 N/A	All set-ups	FALSE	0	Uint16
10-22	COS Filter 3	0 N/A	All set-ups	FALSE	0	Uint16
10-23	COS Filter 4	0 N/A	All set-ups	FALSE	0	Uint16
10-3* Parameter Access						
10-30	Array Index	0 N/A	2 set-ups	TRUE	0	Uint8
10-31	Store Data Values	[0] Off	All set-ups	TRUE	-	Uint8
10-32	Devicenet Revision	ExpressionLimit	All set-ups	TRUE	0	Uint16
10-33	Store Always	[0] Off	1 set-up	TRUE	-	Uint8
10-34	DeviceNet Product Code	130 N/A	1 set-up	TRUE	0	Uint16
10-39	Devicenet F Parameters	0 N/A	All set-ups	TRUE	0	Uint32

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8.3.12. Smart Logic 13-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
13-0* SLC Settings						
13-00	SL Controller Mode	null	2 set-ups	TRUE	-	Uint8
13-01	Start Event	null	2 set-ups	TRUE	-	Uint8
13-02	Stop Event	null	2 set-ups	TRUE	-	Uint8
13-03	Reset SLC	[0] Do not reset SLC	All set-ups	TRUE	-	Uint8
13-1* Comparators						
13-10	Comparator Operand	null	2 set-ups	TRUE	-	Uint8
13-11	Comparator Operator	null	2 set-ups	TRUE	-	Uint8
13-12	Comparator Value	ExpressionLimit	2 set-ups	TRUE	-3	Int32
13-2* Timers						
13-20	SL Controller Timer	ExpressionLimit	1 set-up	TRUE	-3	TimD
13-4* Logic Rules						
13-40	Logic Rule Boolean 1	null	2 set-ups	TRUE	-	Uint8
13-41	Logic Rule Operator 1	null	2 set-ups	TRUE	-	Uint8
13-42	Logic Rule Boolean 2	null	2 set-ups	TRUE	-	Uint8
13-43	Logic Rule Operator 2	null	2 set-ups	TRUE	-	Uint8
13-44	Logic Rule Boolean 3	null	2 set-ups	TRUE	-	Uint8
13-5* States						
13-51	SL Controller Event	null	2 set-ups	TRUE	-	Uint8
13-52	SL Controller Action	null	2 set-ups	TRUE	-	Uint8

8.3.13. Special Functions 14-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
14-0* Inverter Switching						
14-00	Switching Pattern	null	All set-ups	TRUE	-	Uint8
14-01	Switching Frequency	null	All set-ups	TRUE	-	Uint8
14-03	Overmodulation	[1] On	All set-ups	FALSE	-	Uint8
14-04	PWM Random	[0] Off	All set-ups	TRUE	-	Uint8
14-1* Mains On/Off						
14-10	Mains Failure	[0] No function	All set-ups	FALSE	-	Uint8
14-11	Mains Voltage at Mains Fault	ExpressionLimit	All set-ups	TRUE	0	Uint16
14-12	Function at Mains Imbalance	[3] Derate	All set-ups	TRUE	-	Uint8
14-2* Reset Functions						
14-20	Reset Mode	[10] Automatic reset x 10	All set-ups	TRUE	-	Uint8
14-21	Automatic Restart Time	10 s	All set-ups	TRUE	0	Uint16
14-22	Operation Mode	[0] Normal operation	All set-ups	TRUE	-	Uint8
14-23	Typecode Setting	null	2 set-ups	FALSE	-	Uint8
14-25	Trip Delay at Torque Limit	60 s	All set-ups	TRUE	0	Uint8
14-26	Trip Delay at Inverter Fault	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-28	Production Settings	[0] No action	All set-ups	TRUE	-	Uint8
14-29	Service Code	0 N/A	All set-ups	TRUE	0	Int32
14-3* Current Limit Ctrl.						
14-30	Current Lim Ctrl, Proportional Gain	100 %	All set-ups	FALSE	0	Uint16
14-31	Current Lim Ctrl, Integration Time	0.020 s	All set-ups	FALSE	-3	Uint16
14-4* Energy Optimising						
14-40	VT Level	66 %	All set-ups	FALSE	0	Uint8
14-41	AEO Minimum Magnetisation	ExpressionLimit	All set-ups	TRUE	0	Uint8
14-42	Minimum AEO Frequency	10 Hz	All set-ups	TRUE	0	Uint8
14-43	Motor Cosphi	ExpressionLimit	All set-ups	TRUE	-2	Uint16
14-5* Environment						
14-50	RFI Filter	[1] On	1 set-up	FALSE	-	Uint8
14-52	Fan Control	[0] Auto	All set-ups	TRUE	-	Uint8
14-53	Fan Monitor	[1] Warning	All set-ups	TRUE	-	Uint8
14-55	Output Filter	[0] No Filter	1 set-up	FALSE	-	Uint8
14-59	Actual Number of Inverter Units	ExpressionLimit	1 set-up	FALSE	0	Uint8
14-6* Auto Derate						
14-60	Function at Over Temperature	[1] Derate	All set-ups	TRUE	-	Uint8
14-61	Function at Inverter Overload	[1] Derate	All set-ups	TRUE	-	Uint8
14-62	Inv. Overload Derate Current	95 %	All set-ups	TRUE	0	Uint16
14-8* Options						
14-80	Option Supplied by External 24VDC	[0] No	2 set-ups	FALSE	-	Uint8

8.3.14. FC Information 15-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
15-0* Operating Data						
15-00	Operating Hours	0 h	All set-ups	FALSE	74	Uint32
15-01	Running Hours	0 h	All set-ups	FALSE	74	Uint32
15-02	kWh Counter	0 kWh	All set-ups	FALSE	75	Uint32
15-03	Power Up's	0 N/A	All set-ups	FALSE	0	Uint32
15-04	Over Temp's	0 N/A	All set-ups	FALSE	0	Uint16
15-05	Over Volt's	0 N/A	All set-ups	FALSE	0	Uint16
15-06	Reset kWh Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
15-07	Reset Running Hours Counter	[0] Do not reset	All set-ups	TRUE	-	Uint8
15-08	Number of Starts	0 N/A	All set-ups	FALSE	0	Uint32
15-1* Data Log Settings						
15-10	Logging Source	0	2 set-ups	TRUE	-	Uint16
15-11	Logging Interval	ExpressionLimit	2 set-ups	TRUE	-3	TimD
15-12	Trigger Event	[0] False	1 set-up	TRUE	-	Uint8
15-13	Logging Mode	[0] Log always	2 set-ups	TRUE	-	Uint8
15-14	Samples Before Trigger	50 N/A	2 set-ups	TRUE	0	Uint8
15-2* Historic Log						
15-20	Historic Log: Event	0 N/A	All set-ups	FALSE	0	Uint8
15-21	Historic Log: Value	0 N/A	All set-ups	FALSE	0	Uint32
15-22	Historic Log: Time	0 ms	All set-ups	FALSE	-3	Uint32
15-23	Historic Log: Date and Time	ExpressionLimit	All set-ups	FALSE	0	TimeOfDay
15-3* Alarm Log						
15-30	Alarm Log: Error Code	0 N/A	All set-ups	FALSE	0	Uint8
15-31	Alarm Log: Value	0 N/A	All set-ups	FALSE	0	Int16
15-32	Alarm Log: Time	0 s	All set-ups	FALSE	0	Uint32
15-33	Alarm Log: Date and Time	ExpressionLimit	All set-ups	FALSE	0	TimeOfDay
15-34	Alarm Log: Setpoint	0.000 ProcessCtrlUnit	All set-ups	FALSE	-3	Int32
15-35	Alarm Log: Feedback	0.000 ProcessCtrlUnit	All set-ups	FALSE	-3	Int32
15-36	Alarm Log: Current Demand	0 %	All set-ups	FALSE	0	Uint8
15-37	Alarm Log: Process Ctrl Unit	[0]	All set-ups	FALSE	-	Uint8
15-4* Drive Identification						
15-40	FC Type	0 N/A	All set-ups	FALSE	0	VisStr[6]
15-41	Power Section	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-42	Voltage	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-43	Software Version	0 N/A	All set-ups	FALSE	0	VisStr[5]
15-44	Ordered Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-45	Actual Typecode String	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-46	Frequency Converter Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-47	Power Card Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-48	LCP Id No	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-49	SW ID Control Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-50	SW ID Power Card	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-51	Frequency Converter Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[10]
15-53	Power Card Serial Number	0 N/A	All set-ups	FALSE	0	VisStr[19]

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
15-6* Option Ident						
15-60	Option Mounted	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-61	Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-62	Option Ordering No	0 N/A	All set-ups	FALSE	0	VisStr[8]
15-63	Option Serial No	0 N/A	All set-ups	FALSE	0	VisStr[18]
15-70	Option in Slot A	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-71	Slot A Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-72	Option in Slot B	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-73	Slot B Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-74	Option in Slot C0	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-75	Slot C0 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-76	Option in Slot C1	0 N/A	All set-ups	FALSE	0	VisStr[30]
15-77	Slot C1 Option SW Version	0 N/A	All set-ups	FALSE	0	VisStr[20]
15-9* Parameter Info						
15-92	Defined Parameters	0 N/A	All set-ups	FALSE	0	Uint16
15-93	Modified Parameters	0 N/A	All set-ups	FALSE	0	Uint16
15-98	Drive Identification	0 N/A	All set-ups	FALSE	0	VisStr[40]
15-99	Parameter Metadata	0 N/A	All set-ups	FALSE	0	Uint16

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8.3.15. Data Readouts 16-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
16-0* General Status						
16-00	Control Word	0 N/A	All set-ups	TRUE	0	V2
16-01	Reference [Unit]	0.000 ReferenceFeedbackUnit	All set-ups	TRUE	-3	Int32
16-02	Reference [%]	0.0 %	All set-ups	TRUE	-1	Int16
16-03	Status Word	0 N/A	All set-ups	TRUE	0	V2
16-05	Main Actual Value [%]	0.00 %	All set-ups	TRUE	-2	N2
16-09	Custom Readout	0.00 CustomReadoutUnit	All set-ups	TRUE	-2	Int32
16-1* Motor Status						
16-10	Power [kW]	0.00 kW	All set-ups	TRUE	1	Int32
16-11	Power [hp]	0.00 hp	All set-ups	TRUE	-2	Int32
16-12	Motor Voltage	0.0 V	All set-ups	TRUE	-1	Uint16
16-13	Frequency	0.0 Hz	All set-ups	TRUE	-1	Uint16
16-14	Motor Current	0.00 A	All set-ups	TRUE	-2	Int32
16-15	Frequency [%]	0.00 %	All set-ups	TRUE	-2	N2
16-16	Torque [Nm]	0.0 Nm	All set-ups	TRUE	-1	Int32
16-17	Speed [RPM]	0 RPM	All set-ups	TRUE	67	Int32
16-18	Motor Thermal	0 %	All set-ups	TRUE	0	Uint8
16-22	Torque [%]	0 %	All set-ups	TRUE	0	Int16
16-3* Drive Status						
16-30	DC Link Voltage	0 V	All set-ups	TRUE	0	Uint16
16-32	Brake Energy /s	0.000 kW	All set-ups	TRUE	0	Uint32
16-33	Brake Energy /2 min	0.000 kW	All set-ups	TRUE	0	Uint32
16-34	Heatsink Temp.	0 °C	All set-ups	TRUE	100	Uint8
16-35	Inverter Thermal	0 %	All set-ups	TRUE	0	Uint8
16-36	Inv. Nom. Current	ExpressionLimit	All set-ups	TRUE	-2	Uint32
16-37	Inv. Max. Current	ExpressionLimit	All set-ups	TRUE	-2	Uint32
16-38	SL Controller State	0 N/A	All set-ups	TRUE	0	Uint8
16-39	Control Card Temp.	0 °C	All set-ups	TRUE	100	Uint8
16-40	Logging Buffer Full	[0] No	All set-ups	TRUE	-	Uint8
16-5* Ref. & Feedb.						
16-50	External Reference	0.0 N/A	All set-ups	TRUE	-1	Int16
16-52	Feedback [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-53	Digi Pot Reference	0.00 N/A	All set-ups	TRUE	-2	Int16
16-54	Feedback 1 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-55	Feedback 2 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-56	Feedback 3 [Unit]	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
16-58	PID Output [%]	0.0 %	All set-ups	TRUE	-1	Int16
16-59	Adjusted Setpoint	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
16-6* Inputs & Outputs						
16-60	Digital Input	0 N/A	All set-ups	TRUE	0	Uint16
16-61	Terminal 53 Switch Setting	[0] Current	All set-ups	TRUE	-3	Uint8
16-62	Analog Input 53	0.000 N/A	All set-ups	TRUE	-3	Int32
16-63	Terminal 54 Switch Setting	[0] Current	All set-ups	TRUE	-3	Uint8
16-64	Analog Input 54	0.000 N/A	All set-ups	TRUE	-3	Int32
16-65	Analog Output 42 [mA]	0.000 N/A	All set-ups	TRUE	-3	Int16
16-66	Digital Output [bin]	0 N/A	All set-ups	TRUE	0	Int16
16-67	Pulse Input #29 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-68	Pulse Input #33 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-69	Pulse Output #27 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-70	Pulse Output #29 [Hz]	0 N/A	All set-ups	TRUE	0	Int32
16-71	Relay Output [bin]	0 N/A	All set-ups	TRUE	0	Uint16
16-72	Counter A	0 N/A	All set-ups	TRUE	0	Int32
16-73	Counter B	0 N/A	All set-ups	TRUE	0	Int32
16-75	Analog In X30/11	0.000 N/A	All set-ups	TRUE	-3	Int32
16-76	Analog In X30/12	0.000 N/A	All set-ups	TRUE	-3	Int32
16-77	Analog Out X30/8 [mA]	0.000 N/A	All set-ups	TRUE	-3	Int16
16-8* Fieldbus & FC Port						
16-80	Fieldbus CTW 1	0 N/A	All set-ups	TRUE	0	V2
16-82	Fieldbus REF 1	0 N/A	All set-ups	TRUE	0	N2
16-84	Comm. Option STW	0 N/A	All set-ups	TRUE	0	V2
16-85	FC Port CTW 1	0 N/A	All set-ups	TRUE	0	V2
16-86	FC Port REF 1	0 N/A	All set-ups	TRUE	0	N2
16-9* Diagnosis Readouts						
16-90	Alarm Word	0 N/A	All set-ups	TRUE	0	Uint32
16-91	Alarm Word 2	0 N/A	All set-ups	TRUE	0	Uint32
16-92	Warning Word	0 N/A	All set-ups	TRUE	0	Uint32
16-93	Warning Word 2	0 N/A	All set-ups	TRUE	0	Uint32
16-94	Ext. Status Word	0 N/A	All set-ups	TRUE	0	Uint32
16-95	Ext. Status Word 2	0 N/A	All set-ups	TRUE	0	Uint32
16-96	Maintenance Word	0 N/A	All set-ups	TRUE	0	Uint32

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8.3.16. Data Readouts 2 18-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
18-0* Maintenance Log						
18-00	Maintenance Log: Item	0 N/A	All set-ups	FALSE	0	Uint8
18-01	Maintenance Log: Action	0 N/A	All set-ups	FALSE	0	Uint8
18-02	Maintenance Log: Time	0 s	All set-ups	FALSE	0	Uint32
18-03	Maintenance Log: Date and Time	ExpressionLimit	All set-ups	FALSE	0	TimeOfDay
18-3* Inputs & Outputs						
18-30	Analog Input X42/1	0.000 N/A	All set-ups	FALSE	-3	Int32
18-31	Analog Input X42/3	0.000 N/A	All set-ups	FALSE	-3	Int32
18-32	Analog Input X42/5	0.000 N/A	All set-ups	FALSE	-3	Int32
18-33	Analog Out X42/7 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16
18-34	Analog Out X42/9 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16
18-35	Analog Out X42/11 [V]	0.000 N/A	All set-ups	FALSE	-3	Int16

8.3.17. FC Closed Loop 20-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
20-0* Feedback						
20-00	Feedback 1 Source	[2] Analog input 54	All set-ups	TRUE	-	Uint8
20-01	Feedback 1 Conversion	[0] Linear	All set-ups	FALSE	0	Uint8
20-02	Feedback 1 Source Unit	null	All set-ups	TRUE	-	Uint8
20-03	Feedback 2 Source	[0] No function	All set-ups	TRUE	0	Uint8
20-04	Feedback 2 Conversion	[0] Linear	All set-ups	FALSE	-	Uint8
20-05	Feedback 2 Source Unit	null	All set-ups	TRUE	0	Uint8
20-06	Feedback 3 Source	[0] No function	All set-ups	TRUE	-	Uint8
20-07	Feedback 3 Conversion	[0] Linear	All set-ups	FALSE	0	Uint8
20-08	Feedback 3 Source Unit	null	All set-ups	TRUE	-	Uint8
20-12	Reference/Feedback Unit	null	All set-ups	TRUE	0	Uint8
20-2* Feedback/Setpoint						
20-20	Feedback Function	[4] Maximum	All set-ups	TRUE	0	Uint8
20-21	Setpoint 1	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-22	Setpoint 2	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-23	Setpoint 3	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
20-7* PID Autotuning						
20-70	Closed Loop Type	[0] Auto	2 set-ups	TRUE	-	Uint8
20-71	PID Performance	[0] Normal	2 set-ups	TRUE	0	Uint8
20-72	PID Output Change	0.10 N/A	2 set-ups	TRUE	-2	Uint16
20-73	Minimum Feedback Level	-999999.000 ProcessCtrlUnit	2 set-ups	TRUE	-3	Int32
20-74	Maximum Feedback Level	999999.000 ProcessCtrlUnit	2 set-ups	TRUE	-3	Int32
20-79	PID Autotuning	[0] Disabled	All set-ups	TRUE	0	Uint8
20-8* PID Basic Settings						
20-81	PID Normal/ Inverse Control	[0] Normal	All set-ups	TRUE	0	Uint8
20-82	PID Start Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
20-83	PID Start Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
20-84	On Reference Bandwidth	5 %	All set-ups	TRUE	0	Uint8
20-9* PID Controller						
20-91	PID Anti Windup	[1] On	All set-ups	TRUE	-	Uint8
20-93	PID Proportional Gain	2.00 N/A	All set-ups	TRUE	-2	Uint16
20-94	PID Integral Time	8.00 s	All set-ups	TRUE	-2	Uint32
20-95	PID Differentiation Time	0.00 s	All set-ups	TRUE	-2	Uint16
20-96	PID Diff. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

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8.3.18. Ext. Closed Loop 21-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
21-0* Ext. CL Autotuning						
21-00	Closed Loop Type	[0] Auto	2 set-ups	TRUE	-	Uint8
21-01	PID Performance	[0] Normal	2 set-ups	TRUE	-	Uint8
21-02	PID Output Change	0.10 N/A	2 set-ups	TRUE	-2	Uint16
21-03	Minimum Feedback Level	-999999.000 N/A	2 set-ups	TRUE	-3	Int32
21-04	Maximum Feedback Level	999999.000 N/A	2 set-ups	TRUE	-3	Int32
21-09	PID Auto Tuning	[0] Disabled	All set-ups	TRUE	-	Uint8
21-1* Ext. CL 1 Ref./Fb.						
21-10	Ext. 1 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-11	Ext. 1 Minimum Reference	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-12	Ext. 1 Maximum Reference	100.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-13	Ext. 1 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-14	Ext. 1 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-15	Ext. 1 Setpoint	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-17	Ext. 1 Reference [Unit]	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-18	Ext. 1 Feedback [Unit]	0.000 ExtPID1Unit	All set-ups	TRUE	-3	Int32
21-19	Ext. 1 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-2* Ext. CL 1 PID						
21-20	Ext. 1 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-21	Ext. 1 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-22	Ext. 1 Integral Time	20.00 s	All set-ups	TRUE	-2	Uint32
21-23	Ext. 1 Differentation Time	0.00 s	All set-ups	TRUE	-2	Uint16
21-24	Ext. 1 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16
21-3* Ext. CL 2 Ref./Fb.						
21-30	Ext. 2 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-31	Ext. 2 Minimum Reference	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-32	Ext. 2 Maximum Reference	100.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-33	Ext. 2 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-34	Ext. 2 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-35	Ext. 2 Setpoint	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-37	Ext. 2 Reference [Unit]	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-38	Ext. 2 Feedback [Unit]	0.000 ExtPID2Unit	All set-ups	TRUE	-3	Int32
21-39	Ext. 2 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-4* Ext. CL 2 PID						
21-40	Ext. 2 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-41	Ext. 2 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-42	Ext. 2 Integral Time	20.00 s	All set-ups	TRUE	-2	Uint32
21-43	Ext. 2 Differentation Time	0.00 s	All set-ups	TRUE	-2	Uint16
21-44	Ext. 2 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
21-5*	Ext. CL 3 Ref./Fb.					
21-50	Ext. 3 Ref./Feedback Unit	[0]	All set-ups	TRUE	-	Uint8
21-51	Ext. 3 Minimum Reference	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-52	Ext. 3 Maximum Reference	100.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-53	Ext. 3 Reference Source	[0] No function	All set-ups	TRUE	-	Uint8
21-54	Ext. 3 Feedback Source	[0] No function	All set-ups	TRUE	-	Uint8
21-55	Ext. 3 Setpoint	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-57	Ext. 3 Reference [Unit]	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-58	Ext. 3 Feedback [Unit]	0.000 ExtPID3Unit	All set-ups	TRUE	-3	Int32
21-59	Ext. 3 Output [%]	0 %	All set-ups	TRUE	0	Int32
21-6*	Ext. CL 3 PID					
21-60	Ext. 3 Normal/Inverse Control	[0] Normal	All set-ups	TRUE	-	Uint8
21-61	Ext. 3 Proportional Gain	0.50 N/A	All set-ups	TRUE	-2	Uint16
21-62	Ext. 3 Integral Time	20.00 s	All set-ups	TRUE	-2	Uint32
21-63	Ext. 3 Differentation Time	0.00 s	All set-ups	TRUE	-2	Uint16
21-64	Ext. 3 Dif. Gain Limit	5.0 N/A	All set-ups	TRUE	-1	Uint16

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8.3.19. Application Functions 22-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
22-0* Miscellaneous						
22-00	External Interlock Delay	0 s	All set-ups	TRUE	0	Uint16
22-2* No-Flow Detection						
22-20	Low Power Auto Set-up	[0] Off	All set-ups	FALSE	-	Uint8
22-21	Low Power Detection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-22	Low Speed Detection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-23	No-Flow Function	[0] Off	All set-ups	TRUE	-	Uint8
22-24	No-Flow Delay	10 s	All set-ups	TRUE	0	Uint16
22-26	Dry Pump Function	[0] Off	All set-ups	TRUE	-	Uint8
22-27	Dry Pump Delay	10 s	All set-ups	TRUE	0	Uint16
22-3* No-Flow Power Tuning						
22-30	No-Flow Power	0.00 kW	All set-ups	TRUE	1	Uint32
22-31	Power Correction Factor	100 %	All set-ups	TRUE	0	Uint16
22-32	Low Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
22-33	Low Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
22-34	Low Speed Power [kW]	ExpressionLimit	All set-ups	TRUE	1	Uint32
22-35	Low Speed Power [HP]	ExpressionLimit	All set-ups	TRUE	-2	Uint32
22-36	High Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
22-37	High Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
22-38	High Speed Power [kW]	ExpressionLimit	All set-ups	TRUE	1	Uint32
22-39	High Speed Power [HP]	ExpressionLimit	All set-ups	TRUE	-2	Uint32
22-4* Sleep Mode						
22-40	Minimum Run Time	60 s	All set-ups	TRUE	0	Uint16
22-41	Minimum Sleep Time	30 s	All set-ups	TRUE	0	Uint16
22-42	Wake-up Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
22-43	Wake-up Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
22-44	Wake-up Ref./FB Difference	10 %	All set-ups	TRUE	0	Int8
22-45	Setpoint Boost	0 %	All set-ups	TRUE	0	Int8
22-46	Maximum Boost Time	60 s	All set-ups	TRUE	0	Uint16
22-5* End of Curve						
22-50	End of Curve Function	[0] Off	All set-ups	TRUE	-	Uint8
22-51	End of Curve Delay	10 s	All set-ups	TRUE	0	Uint16
22-6* Broken Belt Detection						
22-60	Broken Belt Function	[0] Off	All set-ups	TRUE	-	Uint8
22-61	Broken Belt Torque	10 %	All set-ups	TRUE	0	Uint8
22-62	Broken Belt Delay	10 s	All set-ups	TRUE	0	Uint16
22-7* Short Cycle Protection						
22-75	Short Cycle Protection	[0] Disabled	All set-ups	TRUE	-	Uint8
22-76	Interval between Starts	start_to_start_min_on_time (P2277)	All set-ups	TRUE	0	Uint16
22-77	Minimum Run Time	0 s	All set-ups	TRUE	0	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
22-8*	Flow Compensation					
22-80	Flow Compensation	[0] Disabled	All set-ups	TRUE	-	Uint8
22-81	Square-linear Curve Approximation	100 %	All set-ups	TRUE	0	Uint8
22-82	Work Point Calculation	[0] Disabled	All set-ups	TRUE	-	Uint8
22-83	Speed at No-Flow [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
22-84	Speed at No-Flow [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
22-85	Speed at Design Point [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
22-86	Speed at Design Point [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
22-87	Pressure at No-Flow Speed	0.000 N/A	All set-ups	TRUE	-3	Int32
22-88	Pressure at Rated Speed	999999.999 N/A	All set-ups	TRUE	-3	Int32
22-89	Flow at Design Point	0.000 N/A	All set-ups	TRUE	-3	Int32
22-90	Flow at Rated Speed	0.000 N/A	All set-ups	TRUE	-3	Int32

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8.3.20. Timed Actions 23-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
23-0* Timed Actions						
23-00	ON Time	ExpressionLimit	2 set-ups	TRUE	0	TimeOfDay-WoDate
23-01	ON Action	[0] Disabled	2 set-ups	TRUE	-	Uint8
23-02	OFF Time	ExpressionLimit	2 set-ups	TRUE	0	TimeOfDay-WoDate
23-03	OFF Action	[0] Disabled	2 set-ups	TRUE	-	Uint8
23-04	Occurrence	[0] All days	2 set-ups	TRUE	-	Uint8
23-1* Maintenance						
23-10	Maintenance Item	[1] Motor bearings	1 set-up	TRUE	-	Uint8
23-11	Maintenance Action	[1] Lubricate	1 set-up	TRUE	-	Uint8
23-12	Maintenance Time Base	[0] Disabled	1 set-up	TRUE	-	Uint8
23-13	Maintenance Time Interval	1 h	1 set-up	TRUE	74	Uint32
23-14	Maintenance Date and Time	ExpressionLimit	1 set-up	TRUE	0	TimeOfDay
23-1* Maintenance Reset						
23-15	Reset Maintenance Word	[0] Do not reset	All set-ups	TRUE	-	Uint8
23-16	Maintenance Text	0 N/A	1 set-up	TRUE	0	VisStr[20]
23-5* Energy Log						
23-50	Energy Log Resolution	[5] Last 24 Hours	2 set-ups	TRUE	-	Uint8
23-51	Period Start	ExpressionLimit	2 set-ups	TRUE	0	TimeOfDay
23-53	Energy Log	0 N/A	All set-ups	TRUE	0	Uint32
23-54	Reset Energy Log	[0] Do not reset	All set-ups	TRUE	-	Uint8
23-6* Trending						
23-60	Trend Variable	[0] Power [kW]	2 set-ups	TRUE	-	Uint8
23-61	Continuous Bin Data	0 N/A	All set-ups	TRUE	0	Uint32
23-62	Timed Bin Data	0 N/A	All set-ups	TRUE	0	Uint32
23-63	Timed Period Start	ExpressionLimit	2 set-ups	TRUE	0	TimeOfDay
23-64	Timed Period Stop	ExpressionLimit	2 set-ups	TRUE	0	TimeOfDay
23-65	Minimum Bin Value	ExpressionLimit	2 set-ups	TRUE	0	Uint8
23-66	Reset Continuous Bin Data	[0] Do not reset	All set-ups	TRUE	-	Uint8
23-67	Reset Timed Bin Data	[0] Do not reset	All set-ups	TRUE	-	Uint8
23-8* Payback Counter						
23-80	Power Reference Factor	100 %	2 set-ups	TRUE	0	Uint8
23-81	Energy Cost	1.00 N/A	2 set-ups	TRUE	-2	Uint32
23-82	Investment	0 N/A	2 set-ups	TRUE	0	Uint32
23-83	Energy Savings	0 kWh	All set-ups	TRUE	75	Int32
23-84	Cost Savings	0 N/A	All set-ups	TRUE	0	Int32

8.3.21. Cascade Controller 25-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
25-0* System Settings						
25-00	Cascade Controller	null	2 set-ups	FALSE	-	Uint8
25-02	Motor Start	[0] Direct on Line	2 set-ups	FALSE	-	Uint8
25-04	Pump Cycling	null	All set-ups	TRUE	-	Uint8
25-05	Fixed Lead Pump	null	2 set-ups	FALSE	-	Uint8
25-06	Number of Pumps	2 N/A	2 set-ups	FALSE	0	Uint8
25-2* Bandwidth Settings						
25-20	Staging Bandwidth	ExpressionLimit	All set-ups	TRUE	0	Uint8
25-21	Override Bandwidth	100 %	All set-ups	TRUE	0	Uint8
25-22	Fixed Speed Bandwidth	casco_staging_bandwidth (P2520)	All set-ups	TRUE	0	Uint8
25-23	SBW Staging Delay	15 s	All set-ups	TRUE	0	Uint16
25-24	SBW Destaging Delay	15 s	All set-ups	TRUE	0	Uint16
25-25	OBW Time	10 s	All set-ups	TRUE	0	Uint16
25-26	Destage At No-Flow	[0] Disabled	All set-ups	TRUE	-	Uint8
25-27	Stage Function	null	All set-ups	TRUE	-	Uint8
25-28	Stage Function Time	15 s	All set-ups	TRUE	0	Uint16
25-29	Destage Function	null	All set-ups	TRUE	-	Uint8
25-30	Destage Function Time	15 s	All set-ups	TRUE	0	Uint16
25-4* Staging Settings						
25-40	Ramp Down Delay	10.0 s	All set-ups	TRUE	-1	Uint16
25-41	Ramp Up Delay	2.0 s	All set-ups	TRUE	-1	Uint16
25-42	Staging Threshold	ExpressionLimit	All set-ups	TRUE	0	Uint8
25-43	Destaging Threshold	ExpressionLimit	All set-ups	TRUE	0	Uint8
25-44	Staging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
25-45	Staging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16
25-46	Destaging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
25-47	Destaging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16
25-5* Alternation Settings						
25-50	Lead Pump Alternation	null	All set-ups	TRUE	-	Uint8
25-51	Alternation Event	[0] External	All set-ups	TRUE	-	Uint8
25-52	Alternation Time Interval	24 h	All set-ups	TRUE	74	Uint16
25-53	Alternation Timer Value	0 N/A	All set-ups	TRUE	0	VisStr[7]
25-54	Alternation Predefined Time	ExpressionLimit	All set-ups	TRUE	0	TimeOfDay-WoDate
25-55	Alternate if Load < 50%	[1] Enabled	All set-ups	TRUE	-	Uint8
25-56	Staging Mode at Alternation	[0] Slow	All set-ups	TRUE	-	Uint8
25-58	Run Next Pump Delay	0.1 s	All set-ups	TRUE	-1	Uint16
25-59	Run on Mains Delay	0.5 s	All set-ups	TRUE	-1	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
25-8* Status						
25-80	Cascade Status	0 N/A	All set-ups	TRUE	0	VisStr[25]
25-81	Pump Status	0 N/A	All set-ups	TRUE	0	VisStr[25]
25-82	Lead Pump	0 N/A	All set-ups	TRUE	0	Uint8
25-83	Relay Status	0 N/A	All set-ups	TRUE	0	VisStr[4]
25-84	Pump ON Time	0 h	All set-ups	TRUE	74	Uint32
25-85	Relay ON Time	0 h	All set-ups	TRUE	74	Uint32
25-86	Reset Relay Counters	[0] Do not reset	All set-ups	TRUE	-	Uint8
25-9* Service						
25-90	Pump Interlock	[0] Off	All set-ups	TRUE	-	Uint8
25-91	Manual Alternation	0 N/A	All set-ups	TRUE	0	Uint8

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8.3.22. Analog I/O Option MCB 109 26-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
26-0* Analog I/O Mode						
26-00	Terminal X42/1 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-01	Terminal X42/3 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-02	Terminal X42/5 Mode	[1] Voltage	All set-ups	TRUE	-	Uint8
26-1* Analog Input X42/1						
26-10	Terminal X42/1 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-11	Terminal X42/1 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-14	Term. X42/1 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-15	Term. X42/1 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-16	Term. X42/1 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-17	Term. X42/1 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-2* Analog Input X42/3						
26-20	Terminal X42/3 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-21	Terminal X42/3 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-24	Term. X42/3 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-25	Term. X42/3 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-26	Term. X42/3 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-27	Term. X42/3 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-3* Analog Input X42/5						
26-30	Terminal X42/5 Low Voltage	0.07 V	All set-ups	TRUE	-2	Int16
26-31	Terminal X42/5 High Voltage	10.00 V	All set-ups	TRUE	-2	Int16
26-34	Term. X42/5 Low Ref./Feedb. Value	0.000 N/A	All set-ups	TRUE	-3	Int32
26-35	Term. X42/5 High Ref./Feedb. Value	100.000 N/A	All set-ups	TRUE	-3	Int32
26-36	Term. X42/5 Filter Time Constant	0.001 s	All set-ups	TRUE	-3	Uint16
26-37	Term. X42/5 Live Zero	[1] Enabled	All set-ups	TRUE	-	Uint8
26-4* Analog Out X42/7						
26-40	Terminal X42/7 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-41	Terminal X42/7 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-42	Terminal X42/7 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-43	Terminal X42/7 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-44	Terminal X42/7 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
26-5* Analog Out X42/9						
26-50	Terminal X42/9 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-51	Terminal X42/9 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-52	Terminal X42/9 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-53	Terminal X42/9 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-54	Terminal X42/9 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16
26-6* Analog Out X42/11						
26-60	Terminal X42/11 Output	[0] No operation	All set-ups	TRUE	-	Uint8
26-61	Terminal X42/11 Min. Scale	0.00 %	All set-ups	TRUE	-2	Int16
26-62	Terminal X42/11 Max. Scale	100.00 %	All set-ups	TRUE	-2	Int16
26-63	Terminal X42/11 Bus Control	0.00 %	All set-ups	TRUE	-2	N2
26-64	Terminal X42/11 Timeout Preset	0.00 %	1 set-up	TRUE	-2	Uint16

8.3.23. Cascade CTL Option 27-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
27-0* Control & Status						
27-01	Pump Status	[0] Ready	All set-ups	TRUE	-	Uint8
27-02	Manual Pump Control	[0] No Operation	2 set-ups	TRUE	-	Uint8
27-03	Current Runtime Hours	0 h	All set-ups	TRUE	74	Uint32
27-04	Pump Total Lifetime Hours	0 h	All set-ups	TRUE	74	Uint32
27-1* Configuration						
27-10	Cascade Controller	[0] Disabled	2 set-ups	FALSE	-	Uint8
27-11	Number Of Drives	1 N/A	2 set-ups	FALSE	0	Uint8
27-12	Number Of Pumps	ExpressionLimit	2 set-ups	FALSE	0	Uint8
27-14	Pump Capacity	100 %	2 set-ups	FALSE	0	Uint16
27-16	Runtime Balancing	[0] Balanced Priority 1	2 set-ups	TRUE	-	Uint8
27-17	Motor Starters	[0] Direct Online	2 set-ups	FALSE	-	Uint8
27-18	Spin Time for Unused Pumps	ExpressionLimit	All set-ups	TRUE	0	Uint16
27-19	Reset Current Runtime Hours	[0] Do not reset	All set-ups	TRUE	-	Uint8
27-2* Bandwidth Settings						
27-20	Normal Operating Range	ExpressionLimit	All set-ups	TRUE	0	Uint8
27-21	Override Limit	100 %	All set-ups	TRUE	0	Uint8
27-22	Fixed Speed Only Operating Range	ExpressionLimit	All set-ups	TRUE	0	Uint8
27-23	Staging Delay	15 s	All set-ups	TRUE	0	Uint16
27-24	Destaging Delay	15 s	All set-ups	TRUE	0	Uint16
27-25	Override Hold Time	10 s	All set-ups	TRUE	0	Uint16
27-27	Min Speed Destage Delay	ExpressionLimit	All set-ups	TRUE	0	Uint16
27-3* Staging Speed						
27-31	Stage On Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
27-32	Stage On Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
27-33	Stage Off Speed [RPM]	ExpressionLimit	All set-ups	TRUE	67	Uint16
27-34	Stage Off Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
27-4* Staging Settings						
27-40	Auto Tune Staging Settings	[1] Enabled	All set-ups	TRUE	-	Uint8
27-41	Ramp Down Delay	10.0 s	All set-ups	TRUE	-1	Uint16
27-42	Ramp Up Delay	2.0 s	All set-ups	TRUE	-1	Uint16
27-43	Staging Threshold	ExpressionLimit	All set-ups	TRUE	0	Uint8
27-44	Destaging Threshold	ExpressionLimit	All set-ups	TRUE	0	Uint8
27-45	Staging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
27-46	Staging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16
27-47	Destaging Speed [RPM]	0 RPM	All set-ups	TRUE	67	Uint16
27-48	Destaging Speed [Hz]	0.0 Hz	All set-ups	TRUE	-1	Uint16
27-5* Alternate Settings						
27-50	Automatic Alternation	[0] Disabled	All set-ups	FALSE	-	Uint8
27-51	Alternation Event	null	All set-ups	TRUE	-	Uint8
27-52	Alternation Time Interval	0 min	All set-ups	TRUE	70	Uint16
27-53	Alternation Timer Value	0 min	All set-ups	TRUE	70	Uint16
27-54	Alternation At Time of Day	[0] Disabled	All set-ups	TRUE	-	Uint8
27-55	Alternation Predefined Time	ExpressionLimit	All set-ups	TRUE	0	TimeOfDayWoDate
27-56	Alternate Capacity is <	0 %	All set-ups	TRUE	0	Uint8
27-58	Run Next Pump Delay	0.1 s	All set-ups	TRUE	-1	Uint16

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
27-6*	Digital Inputs					
27-60	Terminal X66/1 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-61	Terminal X66/3 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-62	Terminal X66/5 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-63	Terminal X66/7 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-64	Terminal X66/9 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-65	Terminal X66/11 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-66	Terminal X66/13 Digital Input	[0] No operation	All set-ups	TRUE	-	Uint8
27-7*	Connections					
27-70	Relay	[0] Standard Relay	2 set-ups	FALSE	-	Uint8
27-9*	Readouts					
27-91	Cascade Reference	0.0 %	All set-ups	TRUE	-1	Int16
27-92	% Of Total Capacity	0 %	All set-ups	TRUE	0	Uint16
27-93	Cascade Option Status	[0] Disabled	All set-ups	TRUE	-	Uint8

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8.3.24. Water Application Functions 29-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
29-0*	Pipe Fill		2 set-ups	FALSE	-	Uint8
29-00	Pipe Fill Enable	[0] Disabled	All set-ups	TRUE	67	Uint16
29-01	Pipe Fill Speed [RPM]	ExpressionLimit	All set-ups	TRUE	-1	Uint16
29-02	Pipe Fill Speed [Hz]	ExpressionLimit	All set-ups	TRUE	-2	Uint32
29-03	Pipe Fill Time	0.00 s	All set-ups	TRUE	-3	Int32
29-04	Pipe Fill Rate	0.001 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32
29-05	Filled Setpoint	0.000 ProcessCtrlUnit	All set-ups	TRUE	-3	Int32

8.3.25. Bypass Option 31-**

Par. No. #	Parameter description	Default value	4-set-up	Change during operation	Conversion index	Type
31-00	Bypass Mode	[0] Drive	All set-ups	TRUE	-	Uint8
31-01	Bypass Start Time Delay	30 s	All set-ups	TRUE	0	Uint16
31-02	Bypass Trip Time Delay	0 s	All set-ups	TRUE	0	Uint16
31-03	Test Mode Activation	[0] Disabled	All set-ups	TRUE	-	Uint8
31-10	Bypass Status Word	0 N/A	All set-ups	FALSE	0	V2
31-11	Bypass Running Hours	0 h	All set-ups	FALSE	74	Uint32
31-19	Remote Bypass Activation	[0] Disabled	2 set-ups	TRUE	-	Uint8

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9. Troubleshooting

9.1. Alarms and warnings

A warning or an alarm is signalled by the relevant LED on the front of the frequency converter and indicated by a code on the display.

A warning remains active until its cause is no longer present. Under certain circumstances operation of the motor may still be continued. Warning messages may be critical, but are not necessarily so.

In the event of an alarm, the frequency converter will have tripped. Alarms must be reset to restart operation once their cause has been rectified.

This may be done in four ways:

1. By using the [RESET] control button on the LCP control panel.
2. Via a digital input with the "Reset" function.
3. Via serial communication/optional fieldbus.
4. By resetting automatically using the [Auto Reset] function, which is a default setting for VLT AQUA Drive. see par. 14-20 Reset Mode in **VLT AQUA Drive Programming Guide**

NB!
After a manual reset using the [RESET] button on the LCP, the [AUTO ON] or [HAND ON] button must be pressed to restart the motor.

If an alarm cannot be reset, the reason may be that its cause has not been rectified, or the alarm is trip-locked (see also table on following page).

Alarms that are trip-locked offer additional protection, means that the mains supply must be switched off before the alarm can be reset. After being switched back on, the frequency converter is no longer blocked and may be reset as described above once the cause has been rectified.

Alarms that are not trip-locked can also be reset using the automatic reset function in parameter 14-20 (Warning: automatic wake-up is possible!)

If a warning and alarm is marked against a code in the table on the following page, this means that either a warning occurs before an alarm, or it can be specified whether it is a warning or an alarm that is to be displayed for a given fault.

This is possible, for instance, in parameter 1-90 *Motor Thermal Protection*. After an alarm or trip, the motor carries on coasting, and the alarm and warning flash on the frequency converter. Once the problem has been rectified, only the alarm continues flashing.

No.	Description	Warning	Alarm/Trip	Alarm/Trip Lock	Parameter Reference
1	10 Volts low	X			
2	Live zero error	(X)	(X)		6-01
3	No motor	(X)			1-80
4	Mains phase loss	(X)	(X)	(X)	14-12
5	DC link voltage high	X			
6	DC link voltage low	X			
7	DC over voltage	X	X		
8	DC under voltage	X	X		
9	Inverter overloaded	X	X		
10	Motor ETR over temperature	(X)	(X)		1-90
11	Motor thermistor over temperature	(X)	(X)		1-90
12	Torque limit	X	X		
13	Over Current	X	X	X	
14	Earth fault	X	X	X	
15	Hardware mesh mash		X	X	
16	Short Circuit		X	X	
17	Control word timeout	(X)	(X)		8-04
25	Brake resistor short-circuited	X			
26	Brake resistor power limit	(X)	(X)		2-13
27	Brake chopper short-circuited	X	X		
28	Brake check	(X)	(X)		2-15
29	Power board over temp	X	X	X	
30	Motor phase U missing	(X)	(X)	(X)	4-58
31	Motor phase V missing	(X)	(X)	(X)	4-58
32	Motor phase W missing	(X)	(X)	(X)	4-58
33	Inrush fault		X	X	
34	Fieldbus communication fault	X	X		
38	Internal fault		X	X	
47	24 V supply low	X	X	X	
48	1.8 V supply low		X	X	
50	AMA calibration failed		X		
51	AMA check U_{nom} and I_{nom}		X		
52	AMA low I_{nom}		X		
53	AMA motor too big		X		
54	AMA motor too small		X		
55	AMA parameter out of range		X		
56	AMA interrupted by user		X		
57	AMA timeout		X		
58	AMA internal fault	X	X		
59	Current limit	X			
61	Tracking Error	(X)	(X)		4-30
62	Output Frequency at Maximum Limit	X			
64	Voltage Limit	X			
65	Control Board Over-temperature	X	X	X	
66	Heat sink Temperature Low	X			
67	Option Configuration has Changed		X		
68	Safe Stop Activated		X		
80	Drive Initialised to Default Value		X		

Table 9.1: Alarm/Warning code list

(X) Dependent on parameter

LED indication	
Warning	yellow
Alarm	flashing red
Trip locked	yellow and red

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Alarm Word and Extended Status Word					
Bit	Hex	Dec	Alarm Word	Warning Word	Extended Status Word
0	00000001	1	Brake Check	Brake Check	Ramping
1	00000002	2	Pwr. Card Temp	Pwr. Card Temp	AMA Running
2	00000004	4	Earth Fault	Earth Fault	Start CW/CCW
3	00000008	8	Ctrl.Card Temp	Ctrl.Card Temp	Slow Down
4	00000010	16	Ctrl. Word TO	Ctrl. Word TO	Catch Up
5	00000020	32	Over Current	Over Current	Feedback High
6	00000040	64	Torque Limit	Torque Limit	Feedback Low
7	00000080	128	Motor Th Over	Motor Th Over	Output Current High
8	00000100	256	Motor ETR Over	Motor ETR Over	Output Current Low
9	00000200	512	Inverter Overld.	Inverter Overld.	Output Freq High
10	00000400	1024	DC under Volt	DC under Volt	Output Freq Low
11	00000800	2048	DC over Volt	DC over Volt	Brake Check OK
12	00001000	4096	Short Circuit	DC Voltage Low	Braking Max
13	00002000	8192	Inrush Fault	DC Voltage High	Braking
14	00004000	16384	Mains ph. Loss	Mains ph. Loss	Out of Speed Range
15	00008000	32768	AMA Not OK	No Motor	OVC Active
16	00010000	65536	Live Zero Error	Live Zero Error	
17	00020000	131072	Internal Fault	10V Low	
18	00040000	262144	Brake Overload	Brake Overload	
19	00080000	524288	U phase Loss	Brake Resistor	
20	00100000	1048576	V phase Loss	Brake IGBT	
21	00200000	2097152	W phase Loss	Speed Limit	
22	00400000	4194304	Fieldbus Fault	Fieldbus Fault	
23	00800000	8388608	24 V Supply Low	24V Supply Low	
24	01000000	16777216	Mains Failure	Mains Failure	
25	02000000	33554432	1.8V Supply Low	Current Limit	
26	04000000	67108864	Brake Resistor	Low Temp	
27	08000000	134217728	Brake IGBT	Voltage Limit	
28	10000000	268435456	Option Change	Unused	
29	20000000	536870912	Drive Initialised	Unused	
30	40000000	1073741824	Safe Stop	Unused	

Table 9.2: Description of Alarm Word, Warning Word and Extended Status Word

The alarm words, warning words and extended status words can be read out via serial bus or optional fieldbus for diagnosis. See also par. 16-90, 16-92 and 16-94.

9

9.1.1. Fault messages

WARNING 1, 10 Volts low:

The 10 V voltage from terminal 50 on the control card is below 10 V. Remove some of the load from terminal 50, as the 10 V supply is overloaded. Max. 15 mA or minimum 590 Ω.

WARNING/ALARM 2, Live zero error:

The signal on terminal 53 or 54 is less than 50% of the value set in par. 6-10 *Terminal 53 Low Voltage*, par. 6-12 Terminal *53 Low Current*, par. 6-20 *Terminal 54 Low Voltage*, or par. 6-22 Terminal *54 Low Current* respectively.

WARNING/ALARM 3, No motor:

No motor has been connected to the output of the frequency converter.

WARNING/ALARM 4, Mains phase loss:

A phase is missing on the supply side, or the mains voltage imbalance is too high.

This message also appears in case of a fault in the input rectifier on the frequency converter.

Check the supply voltage and supply currents to the frequency converter.

WARNING 5, DC link voltage high:

The intermediate circuit voltage (DC) is higher than the over-voltage limit of the control system. The frequency converter is still active.

WARNING 6, DC link voltage low:

The intermediate circuit voltage (DC) is below the undervoltage limit of the control system. The frequency converter is still active.

WARNING/ALARM 7, DC over voltage:

If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.

Possible corrections:

Select **O**ver **V**oltage **C**ontrol function in par. 2-17 Over-voltage *Control*

Connect a brake resistor

Extend the ramp time

Activate functions in par. 2-10 Brake *Function*

Increase par. 14-26 Trip *Delay at Inverter Fault*

Selecting OVC function will extend the ramp times.

Alarm/warning limits:

Voltage Range	3 x 200-240 V AC [VDC]	3 x 380-500 V AC [VDC]
Undervoltage	185	373
Voltage warning low	205	410
Voltage warning high (w/o brake - w/brake)	390/405	810/840
Overvoltage	410	855

The voltages stated are the intermediate circuit voltage of the frequency converter with a tolerance of ± 5 %. The corresponding mains voltage is the intermediate circuit voltage (DC-link) divided by 1.35

WARNING/ALARM 8, DC under voltage:
If the intermediate circuit voltage (DC) drops below the "voltage warning low" limit (see table above), the frequency converter checks if 24 V back-up supply is connected.
If no 24 V backup supply is connected, the frequency converter trips after a given time depending on the unit.
To check whether the supply voltage matches the frequency converter, see *3.1 General Specifications*.

WARNING/ALARM 9, Inverter overloaded:
The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection gives a warning at 98% and trips at 100%, while giving an alarm. You cannot reset the frequency converter until the counter is below 90%.
The fault is that the frequency converter is overloaded by more than nominal current for too long.

WARNING/ALARM 10, Motor ETR over temperature:
According to the electronic thermal protection (ETR), the motor is too hot. You can choose if you want the frequency converter to give a warning or an alarm when the counter reaches 100% in par. 1-90 Motor *Thermal Protection*. The fault is that the motor is overloaded by more than nominal current for too long. Check that the motor par. 1-24 *Motor Current* is set correctly.

WARNING/ALARM 11, Motor thermistor over temp:
The thermistor or the thermistor connection is disconnected. You can choose if you want the frequency converter to give a warning or an alarm in par. 1-90 Motor *Thermal Protection*. Check that the thermistor is connected correctly between terminal 53 or 54 (analog voltage input) and terminal 50 (+ 10 Volts supply), or between terminal 18 or 19 (digital input PNP only) and terminal 50. If a KTY sensor is used, check for correct connection between terminal 54 and 55.

WARNING/ALARM 12, Torque limit:
The torque is higher than the value in par. 4-16 Torque *Limit Motor Mode* (in motor operation) or the torque is higher than the value in par. 4-17 Torque *Limit Generator Mode* (in regenerative operation).

WARNING/ALARM 13, Over Current:
The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 sec., then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter.

ALARM 14, Earth fault:
There is a discharge from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.
Turn off the frequency converter and remove the earth fault.

ALARM 15, In-complete hardware:
A fitted option is not handled by the present control board (hardware or software).

ALARM 16, Short-circuit:
There is short-circuiting in the motor or on the motor terminals.
Turn off the frequency converter and remove the short-circuit.

WARNING/ALARM 17, Control word timeout:
There is no communication to the frequency converter.
The warning will only be active when par. 8-04 Control *Timeout Function* is NOT set to *OFF*.
If par. 8-04 Control *Timeout Function* is set to *Stop* and *Trip*, a warning appears and the frequency converter ramps down to zero speed, while giving an alarm.
par. 8-03 Control *Timeout Time* could possibly be increased.

WARNING 22, Hoist Mech. Brake:
Report value will show what kind it is.

0 = The torque ref. was not reached before timeout

1 = There was no brake feedback before timeout

WARNING 23, Internal fans:
External fans have failed due to defect hardware or fans not mounted.

WARNING 24, External fan fault:
The fan warning function is an extra protection function that checks if the fan is running / mounted. The fan warning can be disabled in par. 14-53 Fan *Monitor*, [0] Disabled.

WARNING 25, Brake resistor short-circuited:
The brake resistor is monitored during operation. If it short-circuits, the brake function is disconnected and the warning appears. The frequency converter still works, but without the brake function. Turn off the frequency converter and replace the brake resistor (see par. 2-15 Brake *Check*).

ALARM/WARNING 26, Brake resistor power limit:
The power transmitted to the brake resistor is calculated as a percentage, as a mean value over the last 120 s, on the basis of the resistance value of the brake resistor (par. 2-11 Brake *Resistor (ohm)*) and the intermediate circuit voltage. The warning is active when the dissipated braking power is higher than 90%. If *Trip* [2] has been selected in par. 2-13 Brake *Power Monitoring*, the frequency converter cuts out and issues this alarm, when the dissipated braking power is higher than 100%.

WARNING/ALARM 27, Brake chopper fault:
The brake transistor is monitored during operation and if it short-circuits, the brake function disconnects and the warning comes up. The frequency converter is still able to run, but since the brake transistor has short-circuited, substantial power is transmitted to the brake resistor, even if it is inactive.
Turn off the frequency converter and remove the brake resistor.

Warning: There is a risk of substantial power being transmitted to the brake resistor if the brake transistor is short-circuited.

ALARM/WARNING 28, Brake check failed:
Brake resistor fault: the brake resistor is not connected/working.

WARNING/ALARM 29, Drive over temperature:
If the enclosure isIP00, IP20/Nema1 or IP21/TYPE 1, the cut-out temperature of the heat-sink is 95 °C ±5 °C. The temperature fault cannot be reset, until the temperature of the heatsink is below 70 °C.

The fault could be:

- Ambient temperature too high
- Too long motor cable

ALARM 30, Motor phase U missing:
Motor phase U between the frequency converter and the motor is missing.
Turn off the frequency converter and check motor phase U.

ALARM 31, Motor phase V missing:
Motor phase V between the frequency converter and the motor is missing.
Turn off the frequency converter and check motor phase V.

ALARM 32, Motor phase W missing:
Motor phase W between the frequency converter and the motor is missing.
Turn off the frequency converter and check motor phase W.

ALARM 33, Inrush fault:
Too many powerups have occured within a short time period. See the chapter *General Specifications* for the allowed number of power-ups within one minute.

WARNING/ALARM 34, Fieldbus communication fault:
The fieldbus on the communication option card is not working.

WARNING/ALARM 36, Mains failure:
This warning/alarm is only active if the supply voltage to the frequency converter is lost and parameter 14-10 is NOT set to OFF. Possible correction: check the fuses to the frequency converter

WARNING/ALARM 37, Phase Imbalance:
There is a current imbalance between the power units.

ALARM 38, Internal fault:
Contact your local Danfoss supplier.

ALARM 39, Heatsink Sensor:
No feedback from the heatsink sensor.

WARNING 40, Overload of Digital Output Terminal 27
Check the load connected to terminal 27 or remove short-circuit connection. Check parameters 5-00 and 5-01.

WARNING 41, Overload of Digital Output Terminal 29:
Check the load connected to terminal 29 or remove short-circuit connection. Check parameters 5-00 and 5-02.

WARNING 42, Overload of Digital Output On X30/6 :
Check the load connected to X30/6 or remove short-circuit connection. Check parameter 5-32.

WARNING 42, Overload of Digital Output On X30/7 :
Check the load connected to X30/7 or remove short-circuit connection. Check parameter 5-33.

ALARM 46, Pwr. card supply:
The supply on the power card is out of range.

WARNING 47, 24 V supply low:
The external 24 V DC backup power supply may be overloaded, otherwise contact your Danfoss supplier.

ALARM 48, 1.8 V supply low:
Contact your Danfoss supplier.

WARNING 49, Speed limit:
The speed has been limited by range in par. 4-11 *Motor Speed Low Limit [RPM]* and par. 4-13 *Motor Speed High Limit [RPM]*.

ALARM 50, AMA calibration failed:
Contact your Danfoss supplier.

ALARM 51, AMA check Unom and Inom:
The setting of motor voltage, motor current, and motor power is presumably wrong. Check the settings.

ALARM 52, AMA low Inom:
The motor current is too low. Check the settings.

ALARM 53, AMA motor too big:
The motor is too big for the AMA to be carried out.

ALARM 54, AMA motor too small:
The motor is too small for the AMA to be carried out.

ALARM 55, AMA par. out of range:
The par. values found from the motor are outside acceptable range.

ALARM 56, AMA interrupted by user:
The AMA has been interrupted by the user.

ALARM 57, AMA timeout:
Try to start the AMA again a number of times, until the AMA is carried out. Please note that repeated runs may heat the motor to a level where the resistance Rs and Rr are increased. In most cases, however, this is not critical.

WARNING/ALARM 58, AMA internal fault:
Contact your Danfoss supplier.

WARNING 59, Current limit:
The current is higher than the value in par. 4-18 Current *Limit*.

WARNING 60, External Interlock:
External Interlock has been activated. To resume normal operation, apply 24 VDC to the terminal programmed for External Interlock and reset the frequency converter (via Bus, Digital I/O or by pressing [Reset]).

WARNING/ALARM 61, Tracking Error:
Tracking error. Contact your supplier.

WARNING 62, Output Frequency at Maximum Limit:
The output frequency is limited by the value set in par. 4-19 Max *Output Frequency*

WARNING 64, Voltage Limit:
The load and speed combination demands a motor voltage higher than the actual DC link voltage.

WARNING/ALARM/TRIP 65, Control Card Over Temperature:
Control card over temperature: The cut-out temperature of the control card is 80° C.

WARNING 66, Heatsink Temperature Low:
The heat sink temperature is measured as 0° C. This could indicate that the temperature sensor is defective and thus the fan speed is increased to the maximum in case the power part or control card is very hot.
If the temperature is below 15° C the warning will be present.

ALARM 67, Option Configuration has Changed:
One or more options has either been added or removed since the last power-down.

ALARM 68, Safe Stop:
Safe Stop has been activated. To resume normal operation, apply 24 VDC to terminal 37 then send a Reset signal (via Bus, Digital I/O or by pressing [Reset]).

ALARM 69, Pwr. Card Temp:
Power card over temperature.

ALARM 70, Illegal Frequency Converter Configuration:
Actual combination of control board and power board is illegal.

ALARM 90, Feedback Mon.:

ALARM 91, Analogue Input 54 Wrong Settings:
Switch S202 has to be set in position OFF (voltage input), when a KTY sensor is connected to the analogue input terminal 54.

ALARM 92, NoFlow:
A no load situation has been detected for the system. See parameter group 22-2*.

ALARM 93, Dry Pump:
A no flow situation and high speed indicates that the pump has run dry. See parameter group 22-2*

ALARM 94, End of Curve:
Feed back stays lower than the set point, which may be indicates a leakage in the pipe system. See parameter group 22-5*

ALARM 95, Broken Belt:
Torque is below the torque level set for no load indicating a broken belt. See parameter group 22-6*

ALARM 96, Start Delayed:
Start of the motor has been delayed due to short cycle protection is active. See parameter group 22-7*.

ALARM 250, New Spare Part:
The power or Switch Mode Power Supply has been exchanged. The frequency converter type code must be restored in the EEPROM. Select the correct type code in Par 14-23 according to the label on unit. Remember to select 'Save to EEPROM' to complete.

ALARM 251, New Type Code:
The frequency converter has got a new type code.

9

10. Specifications

10.1. General Specifications

10

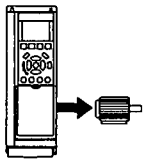
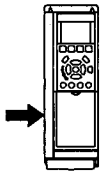
10

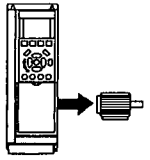
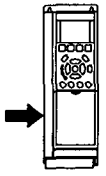
10.1.1. Mains Supply 1 x 200 - 240 VAC

Mains Supply 1 x 200 - 240 VAC - Normal overload 110% for 1 minute												
Frequency converter	P1K5		P2K2		P3K0		P4K0		P5K5		P7K5	
Typical Shaft Output [kW]	1.5		2.2		3.0		4.0		5.5		7.5	
Typical Shaft Output [HP] at 240 V	2		3		4		5		7.5		10	
IP 20/21/NEMA 1	A2		A2		A2		A2		A3		A3	
IP 55 / NEMA 12	A5		A5		A5		A5		A5		A5	
IP 66	A5		A5		A5		A5		A5		A5	
Output current												
Continuous (3 x 200-240 V) [A]	6.6		9.6		12.5		16.7		24.2		30.8	
Intermittent (3 x 200-240 V) [A]	7.3		10.6		13.8		18.4		26.6		33.4	
Continuous kVA (208 V AC) [kVA]	2.38		3.46		4.50		6.01		8.72		11.09	
Max. cable size: (mains, motor, brake) [mm²/ AWG] 2)	4/4/4 12/10/10								10/7		35/2	
Max. input current												
Continuous (1 x 200-240 V) [A]	10.6		15.4		20.0		26.7		38.7		49.3	
Intermittent (1 x 200-240 V) [A]	11.7		16.9		22.0		29.4		42.6		54.2	
Max. pre-fuses 1) [A]	16		20		32		32		63		80	
Environment												
Estimated power loss at rated max. load [W] 4)	21		29		42		54		79		104	
Weight enclosure IP 21 [kg]	4.9								12.7			
Weight enclosure IP 55 [kg]	5.3								13.5			
Weight enclosure IP 66 [kg]	5.3								13.5			
Efficiency 3)	0.96								0.98			

Mains Supply 1 x 200 - 240 VAC - Normal overload 110% for 1 minute												
Frequency converter	P11K		P15K		P18K		P22K		P30K		P37K	
Typical Shaft Output [kW]	11		15		18.5		22		30		37	
Typical Shaft Output [HP] at 240 V	15		20		25		30		40		50	
IP 20/21/NEMA 1	B1		C1		C1		C1		C2		C2	
IP 55 / NEMA 12	B1		C1		C1		C1		C2		C2	
IP 66	B1		C1		C1		C1		C2		C2	
Output current												
Continuous (3 x 200-240 V) [A]	42		59.4		74.8		88		115		143	
Intermittent (3 x 200-240 V) [A]	46.2		65.3		82.3		96.8		127		157	
Continuous kVA (208 V AC) [kVA]	15.1		21.4		27.0		31.7		41.4		51.5	
Max. cable size: (mains, motor, brake) [mm²/ AWG] 2)	35/2		50/1/0				95/4/0					
Max. input current												
Continuous (1 x 200-240 V) [A]	59		111		143		172		215		267	
Intermittent (1 x 200-240 V) [A]	64.9		122.1		157.3		189.2		236.5		293.7	
Max. pre-fuses 1) [A]	100		110		160		200		250		315	
Environment												
Estimated power loss at rated max. load [W] 4)	150		200		268		440		353		479	
Weight enclosure IP 21 [kg]	27		45				65					
Weight enclosure IP 55 [kg]	27		45				65					
Weight enclosure IP 66 [kg]	27		45				65					
Efficiency 3)	0.98						0.98					

10.1.2. Mains Supply 3 x 200 - 240 VAC

Normal overload 110% for 1 minute										
IP 20 / NEMA Chassis		A2	A2	A2	A2	A2	A2	A2	A3	A3
IP 21 / NEMA 1		A2	A2	A2	A2	A2	A2	A2	A3	A3
IP 55 / NEMA 12		A5	A5	A5	A5	A5	A5	A5	A5	A5
IP 66		A5	A5	A5	A5	A5	A5	A5	A5	A5
Mains supply 200 - 240 VAC										
Frequency converter		PK25	PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	P3K7
Typical Shaft Output [kW]		0.25	0.37	0.55	0.75	1.1	1.5	2.2	3	3.7
Typical Shaft Output [HP] at 208 V		0.25	0.37	0.55	0.75	1.5	2.0	2.9	4.0	4.9
Output current										
	Continuous (3 x 200-240 V) [A]	1.8	2.4	3.5	4.6	6.6	7.5	10.6	12.5	16.7
	Intermittent (3 x 200-240 V) [A]	1.98	2.64	3.85	5.06	7.26	8.3	11.7	13.8	18.4
	Continuous kVA (208 V AC) [kVA]	0.65	0.86	1.26	1.66	2.38	2.70	3.82	4.50	6.00
	Max. cable size: (mains, motor, brake) [mm² /AWG] [2]	0.2 - 4 mm² / 4 - 10 AWG								
Max. input current										
	Continuous (3 x 200-240 V) [A]	1.6	2.2	3.2	4.1	5.9	6.8	9.5	11.3	15.0
	Intermittent (3 x 200-240 V) [A]	1.7	2.42	3.52	4.51	6.5	7.5	10.5	12.4	16.5
	Max. pre-fuses[1] [A]	10	10	10	10	20	20	20	32	32
	Environment									
	Estimated power loss at rated max. load [W] [4]	21	29	42	54	63	82	116	155	185
	Weight enclosure IP20 [kg]	4.9	4.9	4.9	4.9	4.9	4.9	4.9	6.6	6.6
	Weight enclosure IP21 [kg]	5.5	5.5	5.5	5.5	5.5	5.5	5.5	7.5	7.5
	Weight enclosure IP55 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
	Weight enclosure IP 66 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
	Efficiency [3]	0.94	0.94	0.95	0.95	0.96	0.96	0.96	0.96	0.96

Mains supply 3 x 200 - 240 VAC - Normal overload 110% for 1 minute										
IP 20 / NEMA Chassis (B3+4 and C3+4 may be converted to IP21 using a conversion kit (Please contact Danfoss)		B3	B3	B3	B4	B4	C3	C3	C4	C4
IP 21 / NEMA 1		B1	B1	B1	B2	C1	C1	C1	C2	C2
IP 55 / NEMA 12		B1	B1	B1	B2	C1	C1	C1	C2	C2
IP 66		B1	B1	B1	B2	C1	C1	C1	C2	C2
Frequency converter		P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K
Typical Shaft Output [kW]		5.5	7.5	11	15	18.5	22	30	37	45
Typical Shaft Output [HP] at 208 V		7.5	10	15	20	25	30	40	50	60
Output current										
	Continuous (3 x 200-240 V) [A]	24.2	30.8	46.2	59.4	74.8	88.0	115	143	170
	Intermittent (3 x 200-240 V) [A]	26.6	33.9	50.8	65.3	82.3	96.8	127	157	187
	Continuous kVA (208 V AC) [kVA]	8.7	11.1	16.6	21.4	26.9	31.7	41.4	51.5	61.2
	Max. cable size: (mains, motor, brake) [mm² /AWG] [2]	10/7			35/2		50/1/0		95/4/0	120/250 MCM
Max. input current										
	Continuous (3 x 200-240 V) [A]	22.0	28.0	42.0	54.0	68.0	80.0	104.0	130.0	154.0
	Intermittent (3 x 200-240 V) [A]	24.2	30.8	46.2	59.4	74.8	88.0	114.0	143.0	169.0
	Max. pre-fuses[1] [A]	63	63	63	80	125	125	160	200	250
	Environment:									
	Estimated power loss at rated max. load [W] [4]	269	310	447	602	737	845	1140	1353	1636
	Weight enclosure IP20 [kg]	12	12	12	23.5	23.5	35	35	50	50
	Weight enclosure IP21 [kg]	23	23	23	27	45	45	65	65	65
	Weight enclosure IP55 [kg]	23	23	23	27	45	45	65	65	65
	Weight enclosure IP 66 [kg]	23	23	23	27	45	45	65	65	65
	Efficiency [3]	0.96	0.96	0.96	0.96	0.96	0.97	0.97	0.97	0.97

10.1.3. Mains Supply 1 x 380 - 480 VAC

Mains Supply 1x 380 VAC - Normal overload 110% for 1 minute

Frequency converter		P7K5	P11K	P22K	P37K
Typical Shaft Output [kW]		7.5	15	30	50
Typical Shaft Output [HP] at 460 V		10	15	30	50
IP 21 / NEMA 1		B1	B2	C1	C2
IP 55 / NEMA 12		B1	B2	C1	C2
IP 66		B1	B2	C1	C2
Output current					
	Continuous (3 x 380-440 V) [A]	16	24	44	73
	Intermittent (3 x 380-440 V) [A]	17.6	26.4	48.4	80.3
	Continuous (3 x 441-480 V) [A]	14.5	21	40	65
	Intermittent (3 x 441-480 V) [A]	15.4	23.1	44	71.5
	Continuous kVA (400 V AC) [kVA]	11.0	16.6	30.5	50.6
	Continuous kVA (460 V AC) [kVA]	11.6	16.7	31.9	51.8
	Max. cable size: (mains, motor, brake) [[mm²/ AWG] 2)]	10/7	35/2	50/1/0	120/4/0
Max. input current					
	Continuous (1 x 380-440 V.) [A]	33	48	94	151
	Intermittent (1 x 380-440 V) [A]	36	53	103	166
	Continuous (1 x 441-480 V) [A]	30	41	85	135
	Intermittent (1 x 441-480 V) [A]	33	46	93	148
	Max. pre-fuses 1) [A]	63	80	160	250
	Environment				
	Estimated power loss at rated max. load [W] 4)	300	440	880	1480
	Weight enclosure IP 21 [kg]	23	27	45	65
	Weight enclosure IP 55 [kg]	23	27	45	65
	Weight enclosure IP 66 [kg]	23	27	45	65
	Efficiency 3)	0.96	0.96	0.96	0.96

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10.1.4. Mains Supply 3 x 380 - 480 VAC

Mains Supply 3 x 380 - 480 VAC - Normal overload 110% for 1 minute											
Frequency converter	PK37	PK55	PK75	P1K1	P1K5	P2K2	P3K0	P4K0	P5K5	P7K5
Typical Shaft Output [kW]	0.37	0.55	0.75	1.1	1.5	2.2	3	4	5.5	7.5
Typical Shaft Output [HP] at 460 V	0.5	0.75	1.0	1.5	2.0	2.9	4.0	5.3	7.5	10
IP 20 / NEMA Chassis	A2	A2	A2	A2	A2	A2	A2	A2	A3	A3
IP 21 / NEMA 1										
IP 55 / NEMA 12	A5	A5	A5	A5	A5	A5	A5	A5	A5	A5
IP 66	A5	A5	A5	A5	A5	A5	A5	A5	AA	A5
Output current										
Continuous (3 x 380-440 V) [A]	1.3	1.8	2.4	3	4.1	5.6	7.2	10	13	16
Intermittent (3 x 380-440 V) [A]	1.43	1.98	2.64	3.3	4.5	6.2	7.9	11	14.3	17.6
Continuous (3 x 441-480 V) [A]	1.2	1.6	2.1	2.7	3.4	4.8	6.3	8.2	11	14.5
Intermittent (3 x 441-480 V) [A]	1.32	1.76	2.31	3.0	3.7	5.3	6.9	9.0	12.1	15.4
Continuous kVA (400 V AC) [kVA]	0.9	1.3	1.7	2.1	2.8	3.9	5.0	6.9	9.0	11.0
Continuous kVA (460 V AC) [kVA]	0.9	1.3	1.7	2.4	2.7	3.8	5.0	6.5	8.8	11.6
Max. cable size: (mains, motor, brake) [mm² / AWG] [2]	4/10									
Max. input current										
Continuous (3 x 380-440 V) [A]	1.2	1.6	2.2	2.7	3.7	5.0	6.5	9.0	11.7	14.4
Intermittent (3 x 380-440 V) [A]	1.32	1.76	2.42	3.0	4.1	5.5	7.2	9.9	12.9	15.8
Continuous (3 x 441-480 V) [A]	1.0	1.4	1.9	2.7	3.1	4.3	5.7	7.4	9.9	13.0
Intermittent (3 x 441-480 V) [A]	1.1	1.54	2.09	3.0	3.4	4.7	6.3	8.1	10.9	14.3
Max. pre-fuses [1] [A]	10	10	10	10	10	20	20	20	30	30
Environment										
Estimated power loss at rated max. load [W] [4]	35	42	46	58	62	88	116	124	187	255
Weight enclosure IP20 [kg]	4.7	4.7	4.8	4.8	4.9	4.9	4.9	4.9	6.6	6.6
Weight enclosure IP 21 [kg]										
Weight enclosure IP 55 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	14.2	14.2
Weight enclosure IP 66 [kg]	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	14.2	14.2
Efficiency [3]	0.93	0.95	0.96	0.96	0.97	0.97	0.97	0.97	0.97	0.97

Mains Supply 3 x 380 - 480 VAC - Normal overload 110% for 1 minute

Frequency converter	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical Shaft Output [kW]	11	15	18.5	22	30	37	45	55	75	90
Typical Shaft Output [HP] at 460 V	15	20	25	30	40	50	60	75	100	125
IP 20 / NEMA Chassis (B3+4 and C3+4 may be converted to IP21 using a conversion kit (Please contact Danfoss)	B3	B3	B3	B4	B4	B4	C3	C3	C4	C4
IP 21 / NEMA 1	B1	B1	B1	B2	B2	C1	C1	C1	C2	C2
IP 55 / NEMA 12	B1	B1	B1	B2	B2	C1	C1	C1	C2	-
IP 66	B1	B1	B1	B2	B2	C1	C1	C1	C2	-
Output current										
Continuous (3 x 380-440 V) [A]	24	32	37.5	44	61	73	90	106	147	177
Intermittent (3 x 380-440 V) [A]	26.4	35.2	41.3	48.4	67.1	80.3	99	117	162	195
Continuous (3 x 441-480 V) [A]	21	27	34	40	52	65	80	105	130	160
Intermittent (3 x 441-480 V) [A]	23.1	29.7	37.4	44	61.6	71.5	88	116	143	176
Continuous kVA (400 V AC) [kVA]	16.6	22.2	26	30.5	42.3	50.6	62.4	73.4	102	123
Continuous kVA (460 V AC) [kVA]	16.7	21.5	27.1	31.9	41.4	51.8	63.7	83.7	104	128
Max. cable size: (mains, motor, brake) [[mm²/ AWG] 2)		10/7			35/2			50/1/0	120/4/0	120/4/0
Max. input current										
Continuous (3 x 380-440 V) [A]	22	29	34	40	55	66	82	96	133	161
Intermittent (3 x 380-440 V) [A]	24.2	31.9	37.4	44	60.5	72.6	90.2	106	146	177
Continuous (3 x 441-480 V) [A]	19	25	31	36	47	59	73	95	118	145
Intermittent (3 x 441-480 V) [A]	20.9	27.5	34.1	39.6	51.7	64.9	80.3	105	130	160
Max. pre-fuses 1) [A]	63	63	63	63	80	100	125	160	250	250
Environment										
Estimated power loss at rated max. load [W] 4)	278	392	465	525	698	739	843	1083	1384	1474
Weight enclosure IP20 [kg]	12	12	12	23.5	23.5	23.5	35	35	50	50
Weight enclosure IP 21 [kg]	23	23	23	27	27	45	45	45	65	65
Weight enclosure IP 55 [kg]	23	23	23	27	27	45	45	45	65	65
Weight enclosure IP 66 [kg]	23	23	23	27	27	45	45	45	65	65
Efficiency 3)	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.99

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Normal overload 110% for 1 minute											
Frequency converter	P110	P132	P160	P200	P250	P315	P355	P400	P450		
Typical Shaft Output [kW]	110	132	160	200	250	315	355	400	450		
Typical Shaft Output [HP] at 460V	150	200	250	300	350	450	500	550	600		
IP 00	D3	D3	D4	D4	D4	E2	E2	E2	E2		
IP 21 / Nema 1	D1	D1	D2	D2	D2	E1	E1	E1	E1		
IP 54 / Nema 12	D1	D1	D2	D2	D2	E1	E1	E1	E1		
Output current											
Continuous (3 x 380-400 V) [A]	212	260	315	395	480	600	658	745	800		
Intermittent (3 x 380-400 V) [A]	233	286	347	435	528	660	724	820	880		
Continuous (3 x 401-480V) [A]	190	240	302	361	443	540	590	678	730		
Intermittent (3 x 401-480V) [A]	209	264	332	397	487	594	649	746	803		
Continuous kVA (400 VAC) [kVA]	147	180	218	274	333	416	456	516	554		
Continuous kVA (460 VAC) [kVA]	151	191	241	288	353	430	470	540	582		
Max. cable size:											
(mains, motor, brake) [mm²/ AWG] [2]	2x70		2x185			4x240					
	2x2/0		2x350 mcm			4x500 mcm					
Max. input current											
Continuous (3 x 380-400 V) [A]	204	251	304	381	463	590	647	733	787		
Continuous (3 x 401-480V) [A]	183	231	291	348	427	531	580	667	718		
Max. pre-fuses[1] [A]	300	350	400	500	600	700	900	900	900		
Environment											
Estimated power loss at rated max. load [W] [4]	3234	3782	4213	5119	5893	7630	7701	8879	9428		
Weight enclosure IP00 [kg]	81.9	90.5	111.8	122.9	137.7	221.4	234.1	236.4	277.3		
Weight enclosure IP 21 [kg]	95.5	104.1	125.4	136.3	151.3	263.2	270.0	272.3	313.2		
Weight enclosure IP 54 [kg]	95.5	104.1	125.4	136.3	151.3	263.2	270.0	272.3	313.2		
Efficiency [3]	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98		

[1] For type of fuse see section *Fuses*
[2] American Wire Gauge
[3] Measured using 5 m screened motor cables at rated load and rated frequency
[4] The typical power loss is at normal load conditions and expected to be within +/- 15% (tolerance relates to variety in voltage and cable conditions).
Values are based on a typical motor efficiency (eff2/eff3 border line). Lower efficiency motors will also add to the power loss in the frequency converter and vice versa.
If the switching frequency is raised from nominal the power losses may rise significantly.
LCP and typical control card power consumptions are included. Further options and customer load may add up to 30W to the losses. (Though typically only 4W extra for a fully loaded control card, or options for slot A or slot B, each).
Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (+/- 5%).

10.1.5. Mains Supply 3 x 525 - 600 VAC

Normal overload 110% for 1 minute

Size:	PK75	P1K1	P1K5	P2K2	P3K0	P3K7	P4K0	P5K5	P7K5	P11K	P15K	P18K	P22K	P30K	P37K	P45K	P55K	P75K	P90K
Typical Shaft Output [kW]	0.75	1.1	1.5	2.2	3	3.7	4	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
IP 20 / NEMA Chassis	A2	A2	A2	A2	A2	A2	A2	A3	A3	B3	B3	B3	B4	B4	B4	C3	C3	C4	C4
IP 21 / NEMA 1	A2	A2	A2	A2	A2	A2	A2	A3	A3	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
IP 55 / NEMA 12	A5	A5	A5	A5	A5	A5	A5	A5	A5	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
IP 66	A5	A5	A5	A5	A5	A5	A5	A5	A5	B1	B1	B1	B2	B2	B2	C1	C1	C2	C2
Output current																			
Continuous (3 x 525-550 V) [A]	1.8	2.6	2.9	4.1	5.2	-	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Intermittent (3 x 525-550 V) [A]		2.9	3.2	4.5	5.7	-	7.0	10.5	12.7	21	25	31	40	47	59	72	96	116	151
Continuous (3 x 525-600 V) [A]	1.7	2.4	2.7	3.9	4.9	-	6.1	9.0	11.0	18	22	27	34	41	52	62	83	100	131
Intermittent (3 x 525-600 V) [A]		2.6	3.0	4.3	5.4	-	6.7	9.9	12.1	20	24	30	37	45	57	68	91	110	144
Continuous kVA (525 V AC) [kVA]	1.7	2.5	2.8	3.9	5.0	-	6.1	9.0	11.0	18.1	21.9	26.7	34.3	41	51.4	61.9	82.9	100	130.5
Continuous kVA (575 V AC) [kVA]	1.7	2.4	2.7	3.9	4.9	-	6.1	9.0	11.0	17.9	21.9	26.9	33.9	40.8	51.8	61.7	82.7	99.6	130.5
Max. cable size (mains, motor, brake) [AWG] [2] [mm²]						-	24 - 10 AWG 0.2 - 4				6 16			2 35			1 50		3/0 95 [5]
Max. input current																			
Continuous (3 x 525-600 V) [A]	1.7	2.4	2.7	4.1	5.2	-	5.8	8.6	10.4	17.2	20.9	25.4	32.7	39	49	59	78.9	95.3	124.3
Intermittent (3 x 525-600 V) [A]		2.7	3.0	4.5	5.7	-	6.4	9.5	11.5	19	23	28	36	43	54	65	87	105	137
Max. pre-fuses [1] [A]	10	10	10	20	20	-	20	32	32										
Environment:																			
Estimated power loss at rated max. load [W] [4]	35	50	65	92	122	-	145	195	261	225	285	329							
Enclosure IP 20:																			
Weight enclosure IP20 [kg]	6.5	6.5	6.5	6.5	6.5	-	6.5	6.6	6.6	12	12	12	23.5	23.5	23.5	35	35	50	50
Efficiency [4]	0.97	0.97	0.97	0.97	0.97	-	0.97	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

Table 10.1: [5] Motor and mains cable: 300MCM/150mm²

10.1.6. Mains Supply 3 x 525 - 690 VAC

Normal overload 110% for 1 minute

Frequency converter	P45K	P55K	P75K	P90K	P110	P132	P160	P200	P250	P315	P400	P450	P500	P560	P630	P710	P800	P900	P1M0	P1M2
Typical Shaft Output [kW]	45	55	75	90	110	132	160	200	250	315	400	450	500	560	630	710	800	900	1000	1200
Typical Shaft Output [HP] at 575 V	50	60	75	100	125	150	200	250	300	350	400	450	500	600	650	750	950	1050	1150	1350
IP 00	D3	D3	D3	D3	D3	D3	D3	D4	D4	D4	D4	E2	E2	E2	E2	-	-	-	-	-
IP 21 / Nema 1	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	E1	E1	E1	E1	F1/ F3[6]	F1/ F3[6]	F1/F3[6]	F2/ F4[6]	F2/F4[6]
IP 54 / Nema 12	D1	D1	D1	D1	D1	D1	D1	D2	D2	D2	D2	E1	E1	E1	E1	F1/ F3[6]	F1/ F3[6]	F1/F3[6]	F1/ F3[6]	F1/F3[6]
Output current																				
Continuous (3 x 550 V) [A]	56	76	90	113	137	162	201	253	303	360	418	470	523	596	630	763	889	988	1108	1317
Intermittent (3 x 550 V) [A]	62	84	99	124	151	178	221	278	333	396	460	517	575	656	693	839	978	1087	1219	1449
Continuous (3 x 690V) [A]	54	73	86	108	131	155	192	242	290	344	400	450	500	570	630	730	850	945	1060	1260
Intermittent (3 x 690 V) [A]	59	80	95	119	144	171	211	266	319	378	440	495	550	627	693	803	935	1040	1166	1386
Continuous kVA (550 VAC) [kVA]	53	72	86	108	131	154	191	241	289	343	398	448	498	568	600	727	847	941	1056	1255
Continuous kVA (575 VAC) [kVA]	54	73	86	108	130	154	191	241	289	343	398	448	498	568	627	727	847	941	1056	1255
Continuous kVA (690 VACr) [kVA]	65	87	103	129	157	185	229	289	347	411	478	538	598	681	753	872	1016	1129	1267	1506
Max. cable size:																				
(Mains) [mm²/ AWG] [2]	2x70 2x2/0							2x185 2x350 mcm				4x240 4x500 mcm				8x240 8x500 mcm			8x240 8x500 mcm	
(Motor) [mm²/ AWG] [2]	2x70 2x2/0							2x185 2x350 mcm				4x240 4x500 mcm				8x150 8x300 mcm			12x150 12x300 mcm	
(Brake) [mm²/ AWG] [2]	2x70 2x2/0							2x185 2x350 mcm				2x185 2x350 mcm				4x185 4x350 mcm			6x185 6x350 mcm	
Max. input current																				
Continuous (3 x 525 V) [A]	60	77	89	110	130	158	198	299	245	299	355	453	504	574	607	743	866	962	1079	1282
Continuous (3 x 575 V) [A]	58	74	85	106	124	151	189	286	234	286	339	434	482	549	607	711	828	920	1032	1227
Continuous (3 x 690 V) [A]	50	77	87	109	128	155	197	296	240	296	352	434	482	549	607	711	828	920	1032	1227
Max. mains pre-fuses[1] [A]	125	160	200	200	250	315	350	350	400	500	550	700	700	900	900	2000	2000	2000	2000	2000
Environment:																				
Estimated power loss at rated max. load [W] [4]	1458	1717	1913	2262	2662	3114	3612	4292	5156	5821	6149	6449	7249	8727	9673					
Weight enclosure IP00 [kg]	82	82	82	82	82	82	91	112	123	138	151	221	221	236	277	-	-	-	-	-
Weight enclosure IP 21 [kg] [5]	96	96	96	96	96	96	104	125	136	151	165	263	263	272	313	1004	1004	1004	1246	1246
Weight enclosure IP 54 [kg] [5]	96	96	96	96	96	96	104	125	136	151	165	263	263	272	313	1004	1004	1004	1246	1246
Efficiency [7]	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98

[1] For type of fuse see section *Fuses*

[2] American Wire Gauge

[3] Measured using 5 m screened motor cables at rated load and rated frequency

[4] The typical power loss is at normal load conditions and expected to be within +/- 15% (tolerance relates to variety in voltage and cable conditions). Values are based on a typical motor efficiency (eff2/eff3 border line). Lower efficiency motors will also add to the power loss in the frequency converter and vice versa. If the switching frequency is raised from nominal the power losses may rise significantly. LCP and typical control card power consumptions are included. Further options and customer load may add up to 30W to the losses. (Though typically only 4W extra for a fully loaded control card, or options for slot A or slot B, each).

Although measurements are made with state of the art equipment, some measurement inaccuracy must be allowed for (+/- 5%).

[5] Adding the F enclosure option cabinet (resulting in the F1 and F3 enclosure sizes) adds 295 kg to the estimated weight.

Protection and Features:

- Electronic thermal motor protection against overload.
- Temperature monitoring of the heatsink ensures that the frequency converter trips if the temperature reaches 95 °C ± 5°C. An overload temperature cannot be reset until the temperature of the heatsink is below 70 °C ± 5°C (Guideline - these temperatures may vary for different power sizes, enclosures etc.). The frequency converter has an auto derating function to avoid it's heatsink reaching 95 deg C.
- The frequency converter is protected against short-circuits on motor terminals U, V, W.
- If a mains phase is missing, the frequency converter trips or issues a warning (depending on the load).
- Monitoring of the intermediate circuit voltage ensures that the frequency converter trips if the intermediate circuit voltage is too low or too high.
- The frequency converter is protected against earth faults on motor terminals U, V, W.

Mains supply (L1, L2, L3):	
Supply voltage	380-480 V ±10%
Supply voltage	525-690 V ±10%
Supply frequency	50/60 Hz
Max. imbalance temporary between mains phases	3.0 % of rated supply voltage
True Power Factor (λ)	≥ 0.9 nominal at rated load
Displacement Power Factor (cosφ) near unity	(> 0.98)
Switching on input supply L1, L2, L3 (power-ups) ≤ enclosure type A	maximum 2 times/min.
Switching on input supply L1, L2, L3 (power-ups) ≥ enclosure type B, C	maximum 1 time/min.
Environment according to EN60664-1	overvoltage category III/pollution degree 2

The unit is suitable for use on a circuit capable of delivering not more than 100.000 RMS symmetrical Amperes, 500/600/690 V maximum.

Motor output (U, V, W):	
Output voltage	0 - 100% of supply voltage
Output frequency	0 - 1000 Hz
Switching on output	Unlimited
Ramp times	1 - 3600 sec.

Torque characteristics:	
Starting torque (Constant torque)	maximum 110% for 1 min.*
Starting torque	maximum 135% up to 0.5 sec.*
Overload torque (Constant torque)	maximum 110% for 1 min.*

**Percentage relates to VLT AQUA Drive's nominal torque.*

Cable lengths and cross sections:	
Max. motor cable length, screened/armoured	VLT AQUA Drive: 150 m
Max. motor cable length, unscreened/unarmoured	VLT AQUA Drive: 300 m
Max. cross section to motor, mains, load sharing and brake *	
Maximum cross section to control terminals, rigid wire	1.5 mm^2/16 AWG (2 x 0.75 mm^2)
Maximum cross section to control terminals, flexible cable	1 mm^2/18 AWG
Maximum cross section to control terminals, cable with enclosed core	0.5 mm^2/20 AWG
Minimum cross section to control terminals	0.25 mm^2

** See Mains Supply tables for more information!*

Control card, RS-485 serial communication:	
Terminal number	68 (P,TX+, RX+), 69 (N,TX-, RX-)
Terminal number 61	Common for terminals 68 and 69

The RS-485 serial communication circuit is functionally separated from other central circuits and galvanically isolated from the supply voltage (PELV).

10

Digital inputs:	
Programmable digital inputs	4 (6)
Terminal number	18, 19, 27 [1], 29, 32, 33,
Logic	PNP or NPN
Voltage level	0 - 24 V DC
Voltage level, logic'0' PNP	< 5 V DC
Voltage level, logic'1' PNP	> 10 V DC
Voltage level, logic '0' NPN	> 19 V DC
Voltage level, logic '1' NPN	< 14 V DC
Maximum voltage on input	28 V DC
Input resistance, R_i	approx. 4 kΩ

All digital inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

1) Terminals 27 and 29 can also be programmed as output.

Digital output:	
Programmable digital/pulse outputs	2
Terminal number	27, 29 [1]
Voltage level at digital/frequency output	0 - 24 V
Max. output current (sink or source)	40 mA
Max. load at frequency output	1 kΩ
Max. capacitive load at frequency output	10 nF
Minimum output frequency at frequency output	0 Hz
Maximum output frequency at frequency output	32 kHz
Accuracy of frequency output	Max. error: 0.1 % of full scale
Resolution of frequency outputs	12 bit

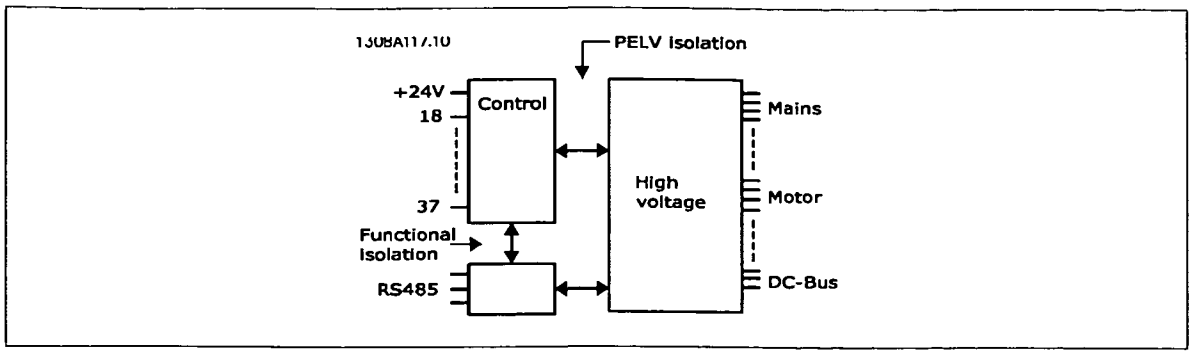
1) Terminal 27 and 29 can also be programmed as input.

The digital output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

10

Analog inputs:	
Number of analog inputs	2
Terminal number	53, 54
Modes	Voltage or current
Mode select	Switch S201 and switch S202
Voltage mode	Switch S201/switch S202 = OFF (U)
Voltage level	: 0 to + 10 V (scaleable)
Input resistance, R_i	approx. 10 kΩ
Max. voltage	± 20 V
Current mode	Switch S201/switch S202 = ON (I)
Current level	0/4 to 20 mA (scaleable)
Input resistance, R_i	approx. 200 Ω
Max. current	30 mA
Resolution for analog inputs	10 bit (+ sign)
Accuracy of analog inputs	Max. error 0.5% of full scale
Bandwidth	: 200 Hz

The analog inputs are galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.



Analog output:	
Number of programmable analog outputs	1
Terminal number	42
Current range at analog output	0/4 - 20 mA
Max. resistor load to common at analog output	500 Ω
Accuracy on analog output	Max. error: 0.8 % of full scale
Resolution on analog output	8 bit

The analog output is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control card, 24 V DC output:	
Terminal number	12, 13
Max. load	: 200 mA

The 24 V DC supply is galvanically isolated from the supply voltage (PELV), but has the same potential as the analog and digital inputs and outputs.

Relay outputs:	
Programmable relay outputs	2
Relay 01 Terminal number	1-3 (break), 1-2 (make)
Max. terminal load (AC-1)[1] on 1-3 (NC), 1-2 (NO) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)[1] (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1] on 1-2 (NO), 1-3 (NC) (Resistive load)	60 V DC, 1A
Max. terminal load (DC-13)[1] (Inductive load)	24 V DC, 0.1A
Relay 02 Terminal number	4-6 (break), 4-5 (make)
Max. terminal load (AC-1)[1] on 4-5 (NO) (Resistive load)[2][3]	400 V AC, 2 A
Max. terminal load (AC-15)[1] on 4-5 (NO) (Inductive load @ cosφ 0.4)	240 V AC, 0.2 A
Max. terminal load (DC-1)[1] on 4-5 (NO) (Resistive load)	80 V DC, 2 A
Max. terminal load (DC-13)[1] on 4-5 (NO) (Inductive load)	24 V DC, 0.1A
Max. terminal load (AC-1)[1] on 4-6 (NC) (Resistive load)	240 V AC, 2 A
Max. terminal load (AC-15)[1] on 4-6 (NC) (Inductive load @ cosφ 0.4)	240 V AC, 0.2A
Max. terminal load (DC-1)[1] on 4-6 (NC) (Resistive load)	50 V DC, 2 A
Max. terminal load (DC-13)[1] on 4-6 (NC) (Inductive load)	24 V DC, 0.1 A
Min. terminal load on 1-3 (NC), 1-2 (NO), 4-6 (NC), 4-5 (NO)	24 V DC 10 mA, 24 V AC 20 mA
Environment according to EN 60664-1	overvoltage category III/pollution degree 2

1) IEC 60947 part 4 and 5

The relay contacts are galvanically isolated from the rest of the circuit by reinforced isolation (PELV).

2) Overvoltage Category II

3) UL applications 300 V AC 2A

Control card, 10 V DC output:	
Terminal number	50
Output voltage	10.5 V ±0.5 V
Max. load	25 mA

The 10 V DC supply is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.

Control characteristics:	
Resolution of output frequency at 0 - 1000 Hz	: +/- 0.003 Hz
System response time (terminals 18, 19, 27, 29, 32, 33)	: ≤ 2 ms
Speed control range (open loop)	1:100 of synchronous speed
Speed accuracy (open loop)	30 - 4000 rpm: Maximum error of ±8 rpm

All control characteristics are based on a 4-pole asynchronous motor

Surroundings:	
Enclosure type A	IP 20/Chassis, IP 21kit/Type 1, IP55/Type12, IP 66
Enclosure type B1/B2	IP 21/Type 1, IP55/Type12, IP 66
Enclosure type B3/B4	IP20/Chassis
Enclosure type C1/C2	IP 21/Type 1, IP55/Type 12, IP66
Enclosure type C3/C4	IP20/Chassis
Enclosure type D1/D2/E1	IP21/Type 1, IP54/Type12
Enclosure type D3/D4/E2	IP00/Chassis
Enclosure kit available ≤ enclosure type A	IP21/TYPE 1/IP 4X top
Vibration test	1.0 g
Max. relative humidity	5% - 95%(IEC 721-3-3; Class 3K3 (non-condensing) during operation
Aggressive environment (IEC 721-3-3), uncoated	class 3C2
Aggressive environment (IEC 721-3-3), coated	class 3C3
Test method according to IEC 60068-2-43 H2S (10 days)	
Ambient temperature	Max. 50 °C

Derating for high ambient temperature, see section on special conditions

Minimum ambient temperature during full-scale operation	0 °C
Minimum ambient temperature at reduced performance	- 10 °C
Temperature during storage/transport	-25 - +65/70 °C
Maximum altitude above sea level without derating	1000 m
Maximum altitude above sea level with derating	3000 m

Derating for high altitude, see section on special conditions

EMC standards, Emission	EN 61800-3, EN 61000-6-3/4, EN 55011, IEC 61800-3
EMC standards, Immunity	EN 61800-3, EN 61000-6-1/2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6

See section on special conditions

Control card performance:	
Scan interval	: 5 ms

Control card, USB serial communication:	
USB standard	1.1 (Full speed)
USB plug	USB type B "device" plug

Connection to PC is carried out via a standard host/device USB cable.
The USB connection is galvanically isolated from the supply voltage (PELV) and other high-voltage terminals.
The USB connection is not galvanically isolated from protection earth. Use only isolated laptop/PC as connection to the USB connector on VLT AQUA Drive or an isolated USB cable/converter.

10

10.1.7. Efficiency

Efficiency of the frequency converter (η_{VLT})

The load on the frequency converter has little effect on its efficiency. In general, the efficiency is the same at the rated motor frequency $f_{M,N}$, even if the motor supplies 100% of the rated shaft torque or only 75%, i.e. in case of part loads.

This also means that the efficiency of the frequency converter does not change even if other U/f characteristics are chosen.
However, the U/f characteristics influence the efficiency of the motor.

The efficiency declines a little when the switching frequency is set to a value of above 5 kHz. The efficiency will also be slightly reduced if the mains voltage is 480 V, or if the motor cable is longer than 30 m.

Efficiency of the motor (η_{MOTOR})

The efficiency of a motor connected to the frequency converter depends on magnetising level. In general, the efficiency is just as good as with mains operation. The efficiency of the motor depends on the type of motor.

In the range of 75-100% of the rated torque, the efficiency of the motor is practically constant, both when it is controlled by the frequency converter and when it runs directly on mains.

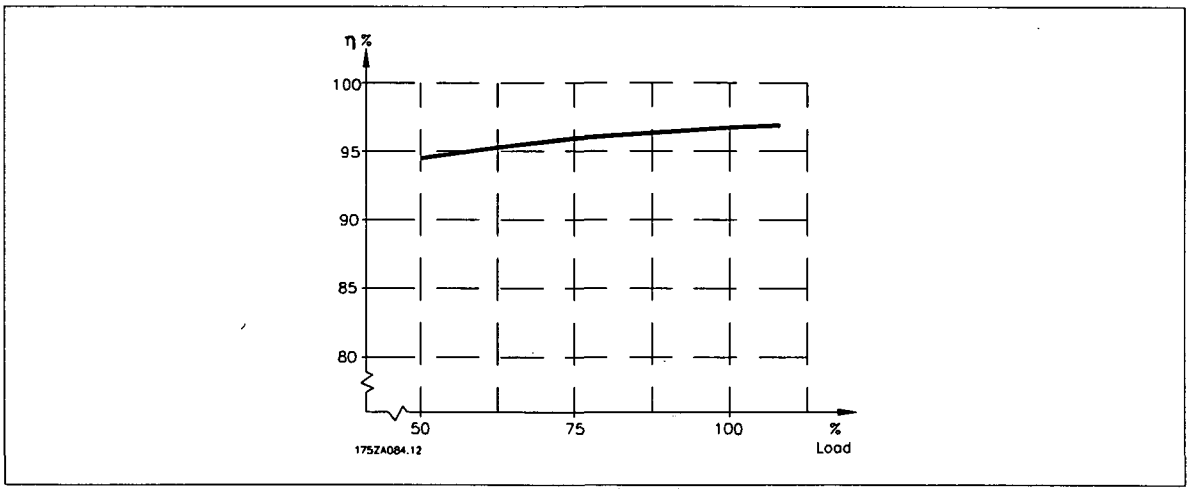
In small motors, the influence from the U/f characteristic on efficiency is marginal. However, in motors from 11 kW and up, the advantages are significant.

In general, the switching frequency does not affect the efficiency of small motors. Motors from 11 kW and up have their efficiency improved (1-2%). This is because the sine shape of the motor current is almost perfect at high switching frequency.

Efficiency of the system (η_{SYSTEM})

To calculate the system efficiency, the efficiency of the frequency converter (η_{VLT}) is multiplied by the efficiency of the motor (η_{MOTOR}):

$\eta_{SYSTEM}) = \eta_{VLT} \times \eta_{MOTOR}$



Based on the graph outlined above, it is possible to calculate the system efficiency at different speeds.

The acoustic noise from the frequency converter comes from three sources:

1. DC intermediate circuit coils.
2. Integral fan.
3. RFI filter choke.

The typical values measured at a distance of 1 m from the unit:

Enclosure	At reduced fan speed (50%) [dBA] ***	Full fan speed [dBA]
A2	51	60
A3	51	60
A5	54	63
B1	61	67
B2	58	70
B3	-	-
B4	-	-
C1	52	62
C2	55	65
C3	-	-
C4	-	-
D1+D3	74	76
D2+D4	73	74
E1/E2 *	73	74
E1/E2 **	82	83

* 315 kW, 380-480 VAC & 355 kW, 525-600 VAC only!
** Remaining E1+E2 power sizes.
*** For D and E sizes, reduced fan speed is at 87%, measured at 200 V.

When a transistor in the inverter bridge switches, the voltage across the motor increases by a du/dt ratio depending on:

- the motor cable (type, cross-section, length screened or unscreened)
- inductance

The natural induction causes an overshoot U_{PEAK} in the motor voltage before it stabilises itself at a level depending on the voltage in the intermediate circuit. The rise time and the peak voltage U_{PEAK} affect the service life of the motor. If the peak voltage is too high, especially motors without phase coil insulation are affected. If the motor cable is short (a few metres), the rise time and peak voltage are lower.
If the motor cable is long (100 m), the rise time and peak voltage are higher.

In motors without phase insulation paper or other insulation reinforcement suitable for operation with voltage supply (such as a frequency converter), fit a du/dt filter or a sine-wave filter on the output of the frequency converter.

10

10.2. Special Conditions

10.2.1. Purpose of derating

Derating must be taken into account when using the frequency converter at low air pressure (heights), at low speeds, with long motor cables, cables with a large cross section or at high ambient temperature. The required action is described in this section.

10.2.2. Derating for Ambient Temperature

The average temperature ($T_{AMB, AVG}$) measured over 24 hours must be at least 5 °C lower than the maximum allowed ambient temperature ($T_{AMB,MAX}$).

If the frequency converter is operated at high ambient temperatures, the continuous output current should be decreased.

The derating depends on the switching pattern, which can be set to 60 AVM or SFAVM in parameter 14-00.

A enclosures

60 AVM - Pulse Width Modulation

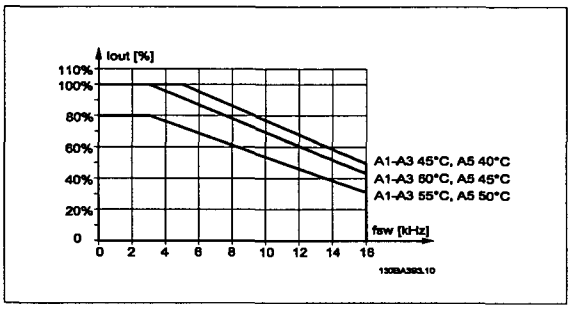


Illustration 10.1: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure A, using 60 AVM

SFAVM - Stator Frequency Asyncron Vector Modulation

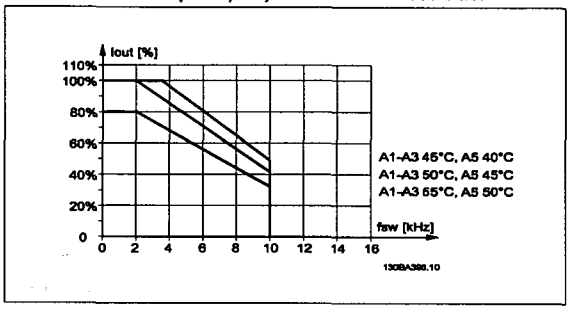


Illustration 10.2: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure A, using SFAVM

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In enclosure A, the length of the motor cable has a relatively high impact on the recommended derating. Therefore, the recommended derating for an application with max. 10 m motor cable is also shown.

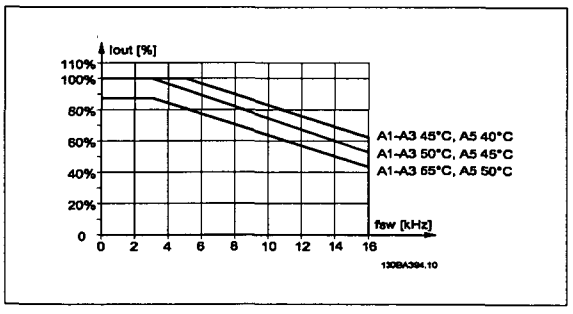

Illustration 10.3: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure A, using 60 AVM and maximum 10 m motor cable

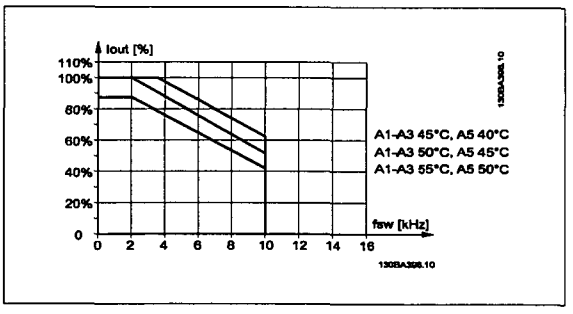

Illustration 10.4: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure A, using SFAVM and maximum 10 m motor cable

B enclosures

60 AVM - Pulse Width Modulation

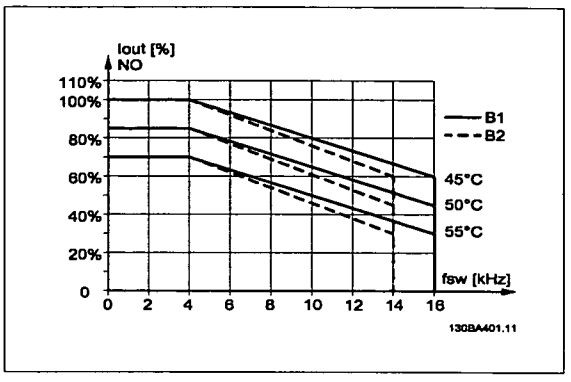

Illustration 10.5: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure B, using 60 AVM in Normal torque mode (110% over torque)

SFAVM - Stator Frequency Asyncron Vector Modulation

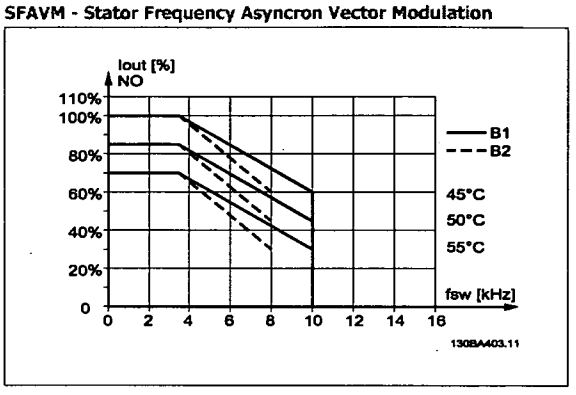

Illustration 10.6: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure B, using SFAVM in Normal torque mode (110% over torque)

C enclosures

Please note: For 90 kW in IP55 and IP66 the max. ambient temperature is 5° C lower.

60 AVM - Pulse Width Modulation

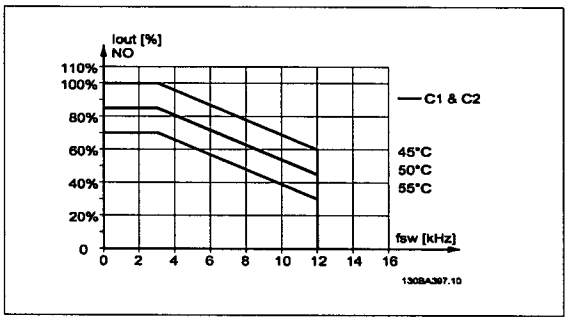

Illustration 10.7: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure C, using 60 AVM in Normal torque mode (110% over torque)

SFAVM - Stator Frequency Asyncron Vector Modulation

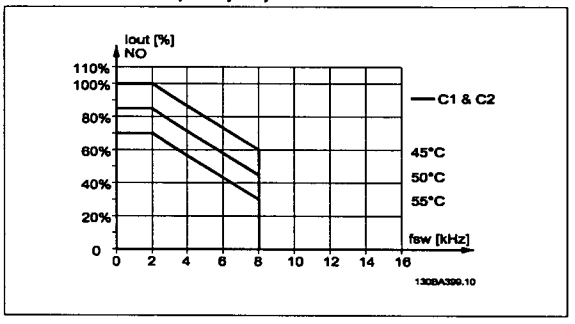

Illustration 10.8: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure C, using SFAVM in Normal torque mode (110% over torque)

D enclosures

60 AVM - Pulse Width Modulation, 380 - 480 V

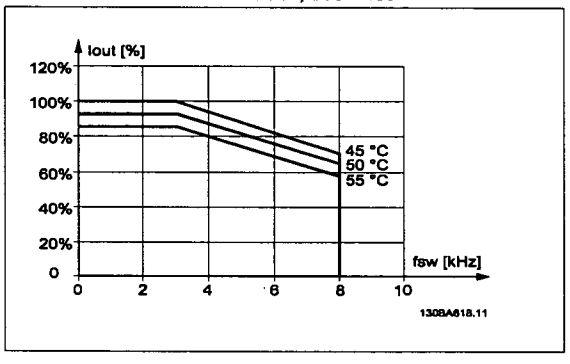

Illustration 10.9: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 480 V, using 60 AVM in Normal torque mode (110% over torque)

SFAVM - Stator Frequency Asyncron Vector Modulation

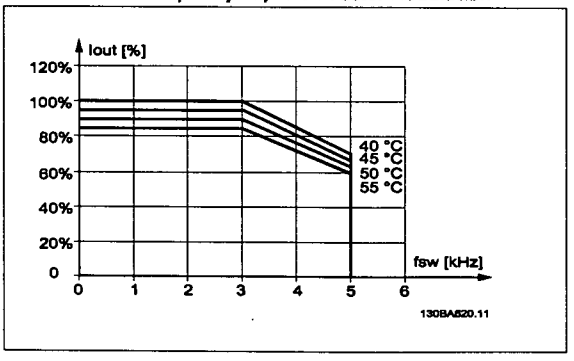

Illustration 10.10: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 480 V, using SFAVM in Normal torque mode (110% over torque)

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60 AVM - Pulse Width Modulation, 525 - 600 V (except P315)

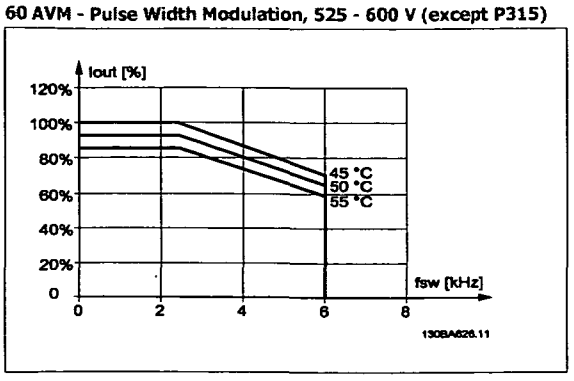


Illustration 10.11: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 600 V, using 60 AVM in Normal torque mode (110% over torque). Note: *not* valid for P315.

SFAVM - Stator Frequency Asyncron Vector Modulation

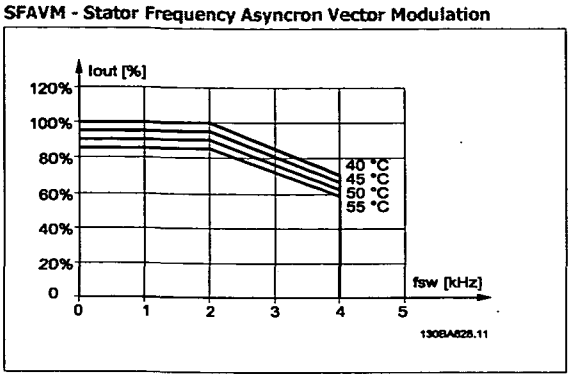


Illustration 10.12: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 600 V, using SFAVM in Normal torque mode (110% over torque). Note: *not* valid for P315.

60 AVM - Pulse Width Modulation, 525 - 600 V, P315

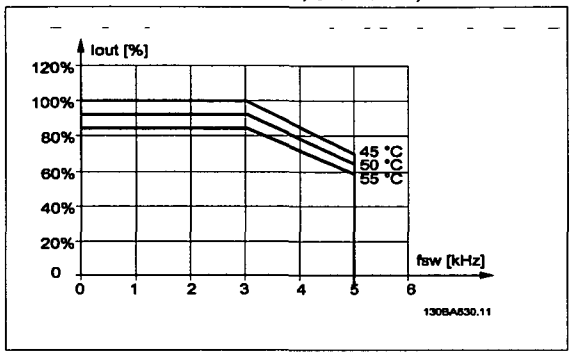


Illustration 10.13: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 600 V, using 60 AVM in Normal torque mode (110% over torque). Note: P315 *only*.

SFAVM - Stator Frequency Asyncron Vector Modulation

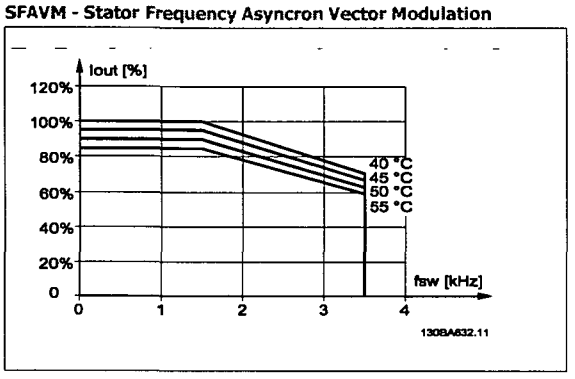


Illustration 10.14: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure D at 600 V, using SFAVM in Normal torque mode (110% over torque). Note: P315 *only*.

E enclosures

60 AVM - Pulse Width Modulation, 380 - 480 V

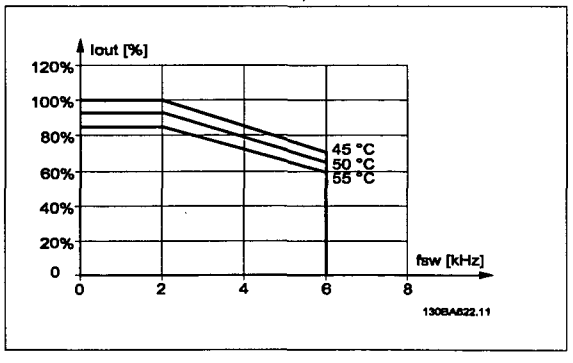


Illustration 10.15: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure E at 480 V, using 60 AVM in Normal torque mode (110% over torque)

SFAVM - Stator Frequency Asyncron Vector Modulation

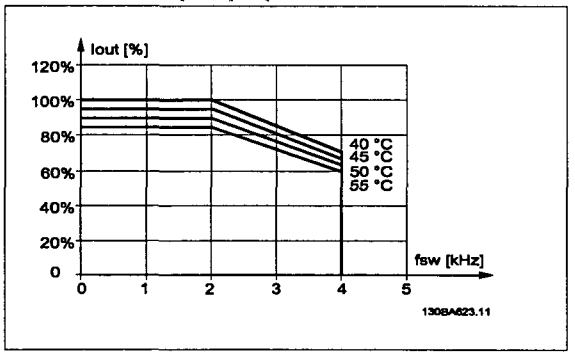


Illustration 10.16: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure E at 480 V, using SFAVM in Normal torque mode (110% over torque)

10

60 AVM - Pulse Width Modulation, 525 - 600 V

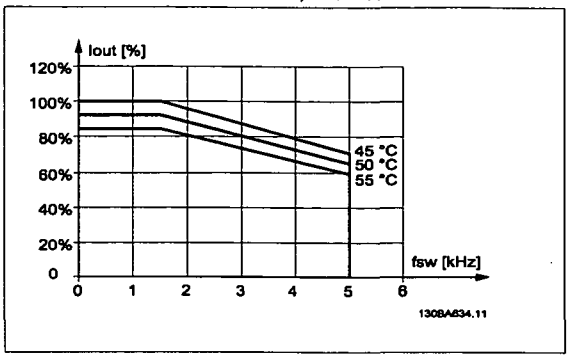


Illustration 10.17: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure E at 600 V, using 60 AVM in Normal torque mode (110% over torque).

SFAVM - Stator Frequency Asyncron Vector Modulation

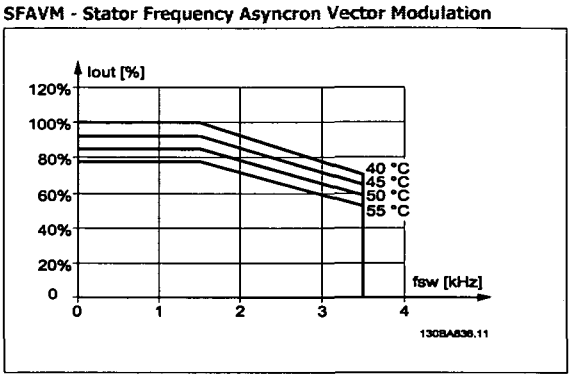


Illustration 10.18: Derating of I_{out} for different $T_{AMB, MAX}$ for enclosure E at 600 V, using SFAVM in Normal torque mode (110% over torque).

10.2.3. Derating for Low Air Pressure

The cooling capability of air is decreased at lower air pressure.

At altitudes higher than 2 km, please contact Danfoss regarding PELV.

Below 1000 m altitude no derating is necessary but above 1000 m the ambient temperature (T_{AMB}) or max. output current (I_{out}) should be derated in accordance with the shown diagram.

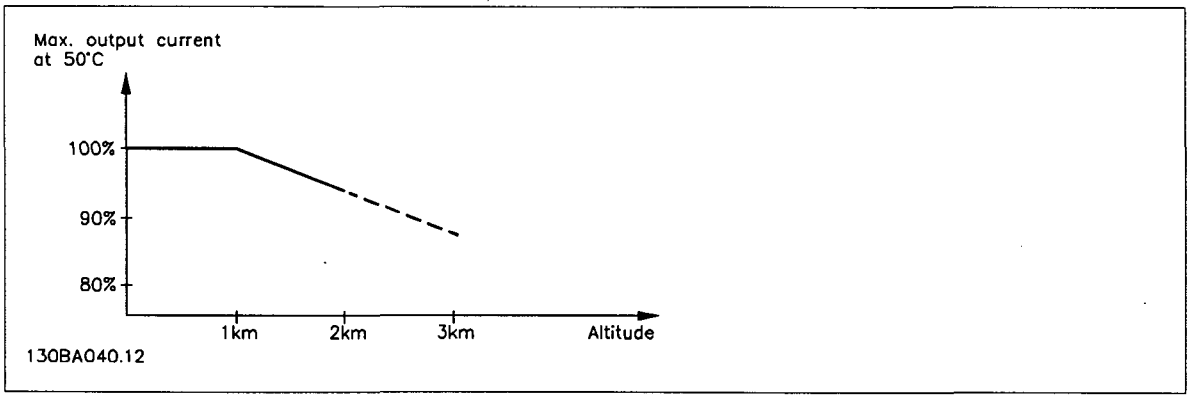


Illustration 10.19: Derating of output current versus altitude at $T_{AMB, MAX}$. By altitudes above 2 km, please contact Danfoss regarding PELV.

An alternative is to lower the ambient temperature at high altitudes and thereby ensure 100% output current at high altitudes.

10

10.2.4. Derating for Running at Low Speed

When a motor is connected to a frequency converter, it is necessary to check that the cooling of the motor is adequate.
The level of heating depends on the load on the motor, as well as the operating speed and time.

Constant torque applications (CT mode)

A problem may occur at low RPM values in constant torque applications. In a constant torque application s a motor may over-heat at low speeds due to less cooling air from the motor integral fan.
Therefore, if the motor is to be run continuously at an RPM value lower than half of the rated value, the motor must be supplied with additional air-cooling (or a motor designed for this type of operation may be used).

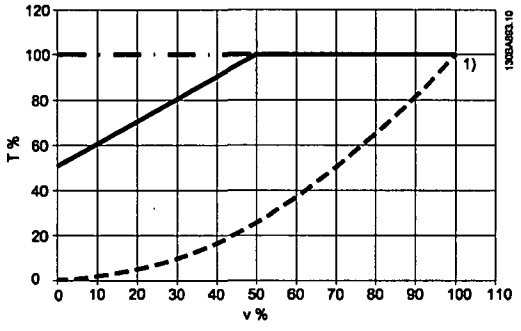
An alternative is to reduce the load level of the motor by choosing a larger motor. However, the design of the frequency converter puts a limit to the motor size.

Variable (Quadratic) torque applications (VT)

In VT applications such as centrifugal pumps and fans, where the torque is proportional to the square of the speed and the power is proportional to the cube of the speed, there is no need for additional cooling or de-rating of the motor.

In the graphs shown below, the typical VT curve is below the maximum torque with de-rating and maximum torque with forced cooling at all speeds.

Maximum Load for a Standard Motor at 40 °C driven by a frequency converter type VLT FCxxx



Legend: – – – –Typical torque at VT load —•—•—Max torque with forced cooling ——Max torque
Note 1) Over-syncronous speed operation will result in the available motor torque decreasing inversely proportional with the increase in speed. This must be considered during the design phase to avoid over-loading of the motor.

10.2.5. Derating for Installing Long Motor Cables or Cables with Larger Cross-Section

The maximum cable length for this frequency converter is 300 m unscreened and 150 m screened cable.

The frequency converter has been designed to work using a motor cable with a rated cross-section. If a cable with a larger cross-section is used, reduce the output current by 5% for every step the cross-section is increased.
(Increased cable cross-section leads to increased capacity to earth, and thus an increased earth leakage current).

10

10.2.6. Automatic adaptations to ensure performance

The frequency converter constantly checks for critical levels of internal temperature, load current, high voltage on the intermediate circuit and low motor speeds. As a response to a critical level, the frequency converter can adjust the switching frequency and / or change the switching pattern in order to ensure the performance of the frequency converter. The capability to automatically reduce the output current extends the acceptable operating conditions even further.

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7.8 EARTH / NEUTRAL LINKS

- D&L ELECTRIC – DLAH6 – MAIN NEUTRAL LINK
- D&L ELETRIC – DLAHE6 – MAIN EARTH LINK
- DORE – 165N24 – NEUTRAL LINK
- DORE – 165E24 – EARTH LINK
- CLIPSAL – L5P – SURGE DIVITER EARTH LINK
- D&L ELETRIC – DLBE12 – INSTRUMENT EARTH LINK
- CLIPSAL – L7 – FILTERED SUPPLY NEUTRAL LINK

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.

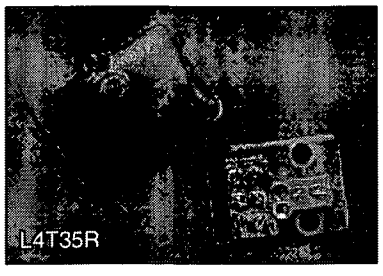
All links are available with black or red covers and bases for neutral, active or meter applications as required by local authorities.

T-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 x 46 x 43mm.
Mounting centres: 28mm. 1 tunnel 8.7mm diameter accommodate 1 x 25mm² cable.
3 tunnels 7.7mm diameter accommodate 1 x 25mm² cable.
Certificate of Suitability No. CS2252N.



Mini Links with Cover

500V 100A
2 screws per tunnel.

L5
500V 100A 5 Hole Neutral Link with two screws per tunnel. Black base and cover.

L5R
500V 100A 5 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm².
2 tunnels, 5.8mm diameter accommodate 1 x 16mm².

L5BW
500V 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 x 46 x 43mm.
Mounting centres: 46mm.
5 tunnels, 7mm diameter accommodate 1 x 25mm².
Transparent black cover, with cut outs.

L6
500V 100A 6 Hole Neutral Link with two screws per tunnel. Black base and cover.

L6R
500V 100A 6 Hole Active Link. Red base and cover.

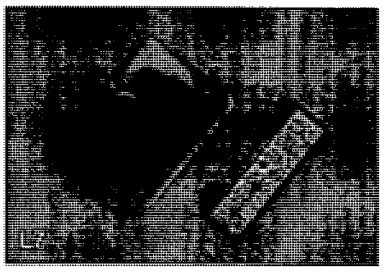
Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
3 tunnels, 5.8mm diameter accommodate 1 x 16mm² cable.

L6/25
500V 110A 6 Hole Neutral Link with 2 screws per tunnel. Black base and cover.

L6/25R
500V 110A 6 Hole Active Link. Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
2 tunnels, 7.5mm diameter accommodate 2 x 25mm² cable.
1 tunnel, 5.5mm diameter accommodates 1 x 16mm² cable.
3 tunnels, 4.7mm diameter accommodate 3 x 10mm² cable.
Transparent black cover with cut-outs.

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



L7R
500V 100A 7 Hole Active Link.
Red base and cover.

Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
4 tunnels, 5.8mm diameter accommodate 1 x 16mm² 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.

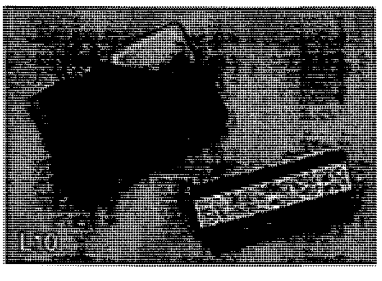
Dimensions: 65 x 46 x 43mm.
Mounting centres: 46mm.
2 tunnels, 6.3mm diameter accommodate 1 x 16mm² cables.
5 tunnels, 5.8mm diameter accommodate 1 x 16mm² cables.
Transparent black cover, with cut-outs.

L8
500V 100A 8 Hole Neutral Link with two screws per tunnel.
Black base and cover.

Dimensions: 86 x 57 x 40mm.
Mounting centres: 59 x 67mm.
3 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
5 tunnels, 5.8mm diameter accommodate 1 x 16mm² cable.
Transparent black cover with cut-outs.

L10
500V 100A 10 Hole Neutral Link with two screws per tunnel.

3 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
7 tunnels, 5.8mm diameter accommodate 1 x 16mm² cable.
Dimensions: 86 x 57 x 40mm.



L10BW
500V 100A 10 Hole Back Wiring Neutral Link with two screws per tunnel.

Dimensions: 86 x 57 x 40mm.

L12
500V 100A 12 Hole Neutral Link with two screws per tunnel.

2 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
4 tunnels, 5.5mm diameter accommodate 1 x 16mm² cable.
6 tunnels, 4.5mm diameter accommodate 1 x 10mm² cable.
Dimensions: 86 x 57 x 40mm.

L14
500V 100A 14 Hole Neutral Link with two screws in 8 tunnels and one screw in 6 tunnels.

2 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
6 tunnels, 5.5mm diameter accommodate 1 x 16mm² cable.
6 tunnels, 4.5mm diameter accommodate 1 x 16mm² cable.
Dimensions: 86 x 57 x 40mm.

L16
500V 100A 16 Hole Neutral Link with two screws in 6 tunnels and one screw in 10 tunnels.

2 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
4 tunnels, 5.5mm diameter accommodate 1 x 16mm² cable.
10 tunnels, 4.5mm diameter accommodate 1 x 10mm² cable.
Dimensions: 86 x 57 x 40mm.

L18
500V 100A 18 Hole Neutral Link with two screws in 6 tunnels and one screw in 12 tunnels.

2 tunnels, 6.3mm diameter accommodate 1 x 16mm² cable.
4 tunnels, 5.5mm diameter accommodate 1 x 16mm² cable.
12 tunnels, 4.5mm diameter accommodate 1 x 10mm² cable.
Dimensions: 86 x 57 x 40mm.

Tunnel Diameters

Catalogue Number	4.7mm for 10mm² cable	6.3mm for 16mm² cable	5.7mm for 16mm² cable	7mm for 25mm² cable
L5	-	3	2	-
L5BW	-	-	-	5
L6	-	3	3	-
L6/25	3	-	1	2
L7	-	3	4	-
L7BW	-	2	5	-

Tunnel Diameters

Catalogue Number	6.3mm for 16mm² cable	5.5mm for 16mm² cable	4.5mm for 10mm² 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

7.9 TERMINALS

- PHOENIC CONTACT – MSTB 2,5/20-ST-5,08 – DISCONNECT PLUGS
- PHOENIC CONTACT – UMSTBVK 2,5/20-G-5,08 – DISCONNECT TERMINAL BLOCKS
- PHOENIC CONTACT – UT6 – POWER TERMINALS(SHROUDED)
- PHOENIC CONTACT – UT4-HESI LED24 (5x20) – FUSED TERMINALS with LED 24V INDICATION
- PHOENIC CONTACT – UT4-MT P/P – DISCONNECT TERMINALS
- PHOENIC CONTACT – UT4-MTD-PE – EARTH TERMINALS
- PHOENIC CONTACT – UBE – GROUP MARKER CARRIER
- PHOENIC CONTACT – MPS-MT – TEST PLUG ADAPTOR
- MOORE INDUSTRIES – ECT/4-20mA/4-20mA – CHEMICAL DOSING SIGNAL ISOLATOR

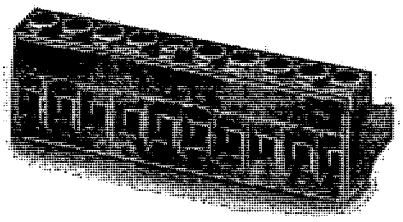
PHOENIX CONTACT

Extract from the online catalog

MSTB 2,5/20-ST

Order No.: 1754805

The figure shows a 10-position version of the product



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1754805

Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn

Product notes

WEEE/RoHS-compliant since: 01/01/2003

Commercial data	
GTIN (EAN)	4017918028978
sales group	E111
Pack	50 pcs.
Customs tariff	85366990
Weight/Piece	0.034793 KG
Catalog page information	Page 126 (CC-2005)

Technical data

Dimensions / positions

Pitch	5 mm
Dimension a	95 mm
Number of positions	20
Screw thread	M3
Tightening torque, min	0.5 Nm

MSTB 2,5/20-ST Order No.: 1754805
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1754805

Tightening torque max	0.6 Nm

Technical data

Insulating material group	I
Rated surge voltage (III/3)	4 kV
Rated surge voltage (III/2)	4 kV
Rated surge voltage (II/2)	4 kV
Rated voltage (III/2)	320 V
Rated voltage (II/2)	630 V
Connection in acc. with standard	EN-VDE
Nominal current I_N	12 A
Nominal voltage U_N	250 V
Nominal cross section	2.5 mm²
Maximum load current	12 A (with 2.5 mm² conductor cross section)
Insulating material	PA
Inflammability class acc. to UL 94	V0
Internal cylindrical gage	A3
Stripping length	7 mm
Nominal voltage, UL/CUL Use Group B	250 V
Nominal current, UL/CUL Use Group B	12 A
Nominal voltage, UL/CUL Use Group D	300 V
Nominal current, UL/CUL Use Group D	10 A

Connection data

Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section stranded min.	0.2 mm²
Conductor cross section stranded max.	2.5 mm²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

MSTB 2,5/20-ST Order No.: 1754805
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1754805

2 conductors with same cross section, solid min.	0.2 mm²
2 conductors with same cross section, solid max.	1 mm²
2 conductors with same cross section, stranded min.	0.2 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm²
Minimum AWG according to UL/CUL	30
Maximum AWG according to UL/CUL	12

Certificates / Approvals

Certification CB, CSA, CUL, GOST, UL, VDE-PZI

CSA

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	28-12

CUL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

UL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

MSTB 2,5/20-ST Order No.: 1754805
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1754805

Accessories

Item	Designation	Description
General		
1733169	EBP 2- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 2
1805615	KGS-MSTB 2,5/20	Cable housing, Pitch: 0 mm, Number of positions: 20, Dimension a: 100 mm, Color: green
Marking		
0804183	SK 5/3,8:FORTL.ZAHLEN	Marker card, printed horizontally, self-adhesive, 12 identical decades marked 1-10, 11-20 etc. up to 91-(99)100, sufficient for 120 terminal blocks
Plug/Adapter		
1734634	CP-MSTB	Keying profile, is inserted into the slot on the plug or inverted header, red insulating material
Tools		
1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Additional products

Item	Designation	Description
General		
1900028	EMSTBA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Press-in
1915042	EMSTBVA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Press-in
1762871	MDSTB 2,5/20-G1	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1763139	MDSTBV 2,5/20-G1	Header, Nominal current: 10 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering, In combination with MVSTB or FKCV plug components, both an MVSTBW (or FKCVW) and an MVSTBR plug (or FKCVR) must be used. Combination with TMSTBP plug components is not possible!
1754795	MSTB 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering

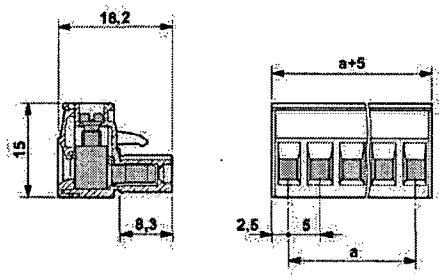
MSTB 2,5/20-ST Order No.: 1754805

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1754805

1768367	MSTB 2,5/20-G-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Assembly: Soldering
1757640	MSTBA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1770669	MSTBA 2,5/20-G-LA	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Assembly: Soldering
1753796	MSTBV 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1755684	MSTBVA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1735934	MSTBW 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1769418	SMSTB 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering
1769984	SMSTBA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Soldering

Diagrams/Drawings

Dimensioned drawing



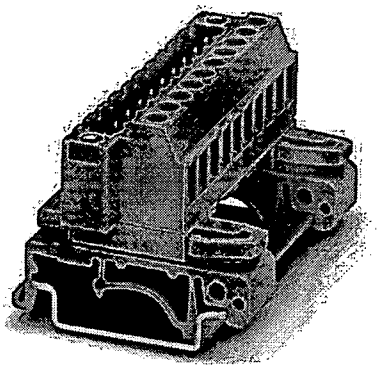
PHOENIX CONTACT

Extract from the online catalog

UMSTBVK 2,5/20-GF-5,08

Order No.: 1788101

The figure shows a 10-position version of the product



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1788101

Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Assembly: DIN rail

Commercial data	
GTIN (EAN)	4017918043162
sales group	E121
Pack	50 pcs.
Customs tariff	85366990
Weight/Piece	0.05801 KG
Catalog page information	Page 205 (CC-2005)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

Technical data

Dimensions / positions

Width	42.5 mm
Pitch	5.08 mm
Dimension a	96.52 mm
Number of positions	20
Screw thread	M3

UMSTBVK 2,5/20-GF-5,08 Order No.: 1788101

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1788101

Tightening torque, min	0.5 Nm
Tightening torque max	0.6 Nm

Technical data

Insulating material group	I
Rated surge voltage (III/3)	4 kV
Rated surge voltage (III/2)	4 kV
Rated surge voltage (II/2)	4 kV
Rated voltage (III/2)	320 V
Rated voltage (II/2)	630 V
Connection in acc. with standard	EN-VDE
Nominal current I_N	12 A
Nominal voltage U_N	320 V
Nominal cross section	2.5 mm²
Insulating material	PA
Inflammability class acc. to UL 94	V2
Internal cylindrical gage	A3
Stripping length	7 mm

Connection data

Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	2.5 mm²
Conductor cross section stranded min.	0.2 mm²
Conductor cross section stranded max.	2.5 mm²
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm²
2 conductors with same cross section, solid min.	0.2 mm²
2 conductors with same cross section, solid max.	1 mm²
2 conductors with same cross section, stranded min.	0.2 mm²
2 conductors with same cross section, stranded max.	1.5 mm²

UMSTBVK 2,5/20-GF-5,08 Order No.: 1788101
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1788101

2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	12

Certificates / Approvals

Certification CB, CSA, CUL, GOST, UL, VDE-PZI

CSA

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	28-12

CUL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

UL

Nominal voltage U_N	300 V
Nominal current I_N	10 A
AWG/kcmil	30-12

Accessories

Item	Designation	Description
Assembly		
1755477	MSTB-BL	Keying cap, for forming sections, plugs onto header pin, green insulating material

UMSTBVK 2,5/20-GF-5,08 Order No.: 1788101

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1788101

General

1733169	EBP 2- 5	Insertion bridge, fully insulated, for plug connectors with 5.0 or 5.08 mm pitch, no. of positions: 2

Marking

0804293	SK 5,08/3,8:FORTL.ZAHLEN	Marker card, printed horizontally, self-adhesive, 12 identical decades marked 1-10, 11-20 etc. up to 91-(99)100, sufficient for 120 terminal blocks

Plug/Adapter

1734401	CR-MSTB	Coding section, inserted into the recess in the header or the inverted plug, red insulating material

Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

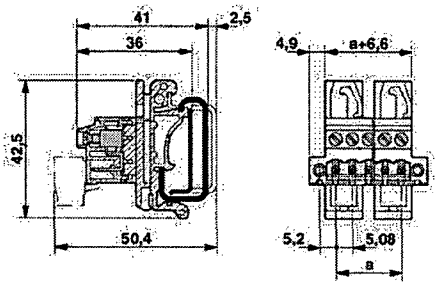
Additional products

Item	Designation	Description
General		
1777976	FRONT-MSTB 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn
1778166	MSTB 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn
1809912	MSTBC 2,5/20-STZF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn, Corresponding female crimp contacts with current [A] and conductor cross section range [mm²] data: 10A/MSTBC-MT 0,5-1,0 (3190564); 10A/MSTBC-MT 0,5-1,0 BA (3190645); 12A/MSTBC-MT 1,5-2,5 (3190551); 12A/MSTBC-MT 1,5-2,5 BA (3190658). BA = Bandkontakte
1835274	MVSTBR 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn
1835083	MVSTBW 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn

UMSTBVK 2,5/20-GF-5,08 Order No.: 1788101
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=1788101

Diagrams/Drawings

Dimensioned drawing

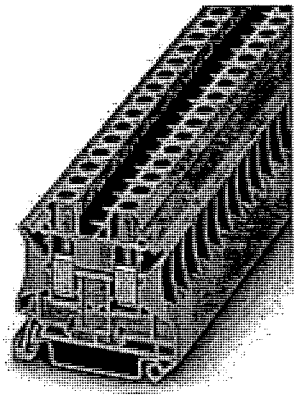


PHOENIX CONTACT

Extract from the online catalog

UT 6

Order No.: 3044131



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131

Feed-through modular terminal block, Type of connection: Screw connection, Screw connection, Cross section: 0.2 mm² - 10 mm², AWG 24 - 8, Width: 8.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15

Commercial data	
GTIN (EAN)	4017918960438
sales group	A800
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.01503 KG
Catalog page information	Page 27 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 10/26/2006

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Technical data

General

Number of levels	1
Number of connections	2
Color	gray

UT 6 Order No.: 3044131
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	8.2 mm
Length	47.7 mm
Height NS 35/7,5	47.5 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	57 A (with 10 mm² conductor cross section)
Rated surge voltage	8 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-1
Nominal current I_N	41 A
Nominal voltage U_N	1000 V
Open side panel	ja

Connection data

Conductor cross section solid min.	0.2 mm²
Conductor cross section solid max.	10 mm²
Conductor cross section stranded min.	0.2 mm²
Conductor cross section stranded max.	10 mm²
Conductor cross section AWG/kcmil min.	24
Conductor cross section AWG/kcmil max	8
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	6 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	6 mm²
2 conductors with same cross section, solid min.	0.2 mm²
2 conductors with same cross section, solid max.	2.5 mm²
2 conductors with same cross section, stranded min.	0.2 mm²

UT 6 Order No.: 3044131
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131

2 conductors with same cross section, stranded max.	2.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	4 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	10 mm
Internal cylindrical gage	A5
Screw thread	M4
Tightening torque, min	1.5 Nm
Tightening torque max	1.8 Nm

Certificates / Approvals

Certification	CB, CSA, CUL, DNV, GL, LR, UL, VDE-PZI
Certification Ex:	IECEx, KEMA-EX

CSA

Nominal voltage U_N	600 V
Nominal current I_N	50 A
AWG/kcmil	24-8

CUL

Nominal voltage U_N	600 V
Nominal current I_N	50 A
AWG/kcmil	24-8

UL

Nominal voltage U_N	600 V
Nominal current I_N	50 A
AWG/kcmil	24-8

UT 6 Order No.: 3044131
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131

Accessories

Item	Designation	Description
Assembly		
3047167	ATP-UT	Partition plate, Length: 50 mm, Width: 2 mm, Height: 48 mm, Color: gray
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
3047028	D-UT 2,5/10	End cover, Length: 47.7 mm, Width: 2.2 mm, Height: 48.4 mm, Color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030284	FBS 2-8	Plug-in bridge, Number of positions: 2, Color: red
3030297	FBS 3-8	Plug-in bridge, Number of positions: 3, Color: red
3030307	FBS 4-8	Plug-in bridge, Number of positions: 4, Color: red
3030310	FBS 5-8	Plug-in bridge, Number of positions: 5, Color: red
3032470	FBS 6-8	Plug-in bridge, Number of positions: 6, Color: red

UT 6 Order No.: 3044131
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131

3047251	RB UT 6-(2,5/4)	Reducing bridge, Number of positions: 2, Color: red

General

3047264	RB UT 6-ST(2,5/4)	Reducing bridge, Number of positions: 2, Color: red

Marking

0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1052015	ZB 8,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060896	ZB 8/WH-100:UNBEDRUCKT	Zack strip, unprinted: 10-section, for individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, terminal width: 8.2 mm, color: White
1050512	ZB 8:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements

Plug/Adapter

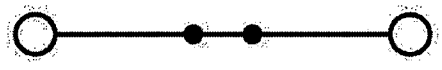
3030925	PAI-4	Test adapter, Color: gray
3031005	PS-8	Test adapter, Color: red

Tools

1205066	SZS 1,0X4,0	Screwdriver, bladed, matches all screw terminal blocks with 10 mm² and 16 mm² connection cross section, blade: 1.0 x 4.0 mm

Diagrams/Drawings

Circuit diagram

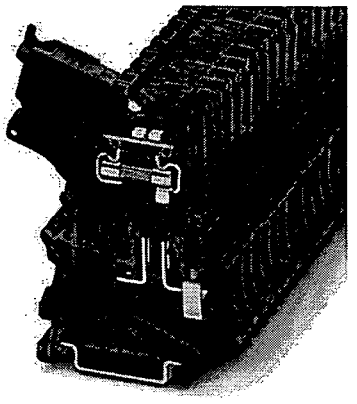


PHOENIX CONTACT

Extract from the online catalog

UT 4-HESILED 24 (5X20)

Order No.: 3046090



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090

Fuse terminal block with LED for assembly on NS 35, for 5 x 20 cartridge fuse inserts

Commercial data	
GTIN (EAN)	4017918956585
sales group	A850
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.01794 KG
Catalog page information	Page 44 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 07/01/2006

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Technical data

General

Number of levels	1
Number of connections	2
Color	black
Insulating material	PA
Inflammability class acc. to UL 94	V0

UT 4-HESILED 24 (5X20) Order No.: 3046090

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	73 mm
Height NS 35/15	80.5 mm

Technical data

Fuse	G / 5 x 20
Fuse type	Glass
LED voltage range	12 V AC/DC ... 30 V AC/DC
Rated surge voltage	6 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-3
Nominal current I_N	6.3 A (if used as disconnect terminal block. With fuse, the current is determined by the fuse used.)
Nominal voltage U_N	500 V (if used as disconnect terminal block. With fuse, the voltage is determined by the light indicator used.)
	500 V (if used as disconnect terminal block. With fuse, the voltage is determined by the light indicator used.)
Power loss	≥ 1.6 W (With single arrangement of the fuse terminal block in the event of overload)
	≥ 1.6 W (With interconnected arrangement of several fuse terminal blocks in the event of overload)
	≥ 4 W (With single arrangement of the fuse terminal block in the event of a short-circuit)
	≥ 2.5 W (With interconnected arrangement of several fuse terminal blocks in the event of a short-circuit)
LED voltage range	12 V AC/DC ... 30 V AC/DC
LED current range	1 mA ... 3 mA

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.5 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10

Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, stranded min.	0.14 mm²
2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification — CB, CSA, CUL, DNV, GL, KEMA, LR, UL

CSA

Nominal voltage U_N	24 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

UT 4-HESILED 24 (5X20) Order No.: 3046090
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090

CUL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

UL

Nominal voltage U_N	600 V
Nominal current I_N	6.3 A
AWG/kcmil	26-10

Accessories

Item	Designation	Description
Assembly		
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
3004207	VS	Connection pin, Length: 1000 mm, Color: white

UT 4-HESILED 24 (5X20) Order No.: 3046090
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090

Bridges

3030336	FBS 2-6	Plug-in bridge, Number of positions: 2, Color: red
3030242	FBS 3-6	Plug-in bridge, Number of positions: 3, Color: red
3030255	FBS 4-6	Plug-in bridge, Number of positions: 4, Color: red
3030349	FBS 5-6	Plug-in bridge, Number of positions: 5, Color: red
3030271	FBS 10-6	Plug-in bridge, Number of positions: 10, Color: red
3030365	FBS 20-6	Plug-in bridge, Number of positions: 20, Color: red
3032224	FBS 50-6	Plug-in bridge, Number of positions: 50, Color: red

Marking

0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1050004	ZB 5 :UNBEDRUCKT	Zack strip, unprinted, 10-section, for individual labeling with M-PEN, ZB-T or CMS system, pack is sufficient for 100 terminal blocks, for a terminal width of 5.2 mm, color: White
1050017	ZB 5,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
1050020	ZB 5,QR:FORTL.ZAHLEN	Zack strip, 10-section, printed vertically: with consecutive numbers, 1-10, 11-20 a.s.o. up to 991-1000, color: white
5060906	ZB 5/WH-100:UNBEDRUCKT	Zack strip, unprinted: 10-section, for individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 5.2 mm, color: White
1050295	ZB 5:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060935	ZB 6/WH-100:UNBEDRUCKT	Zack strip, unprinted: For individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 6.2 mm, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements

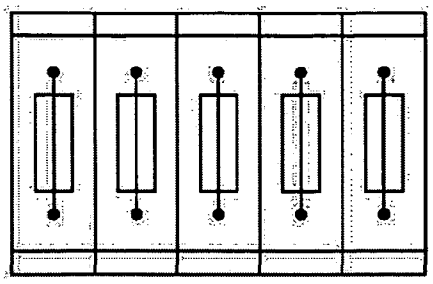
Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

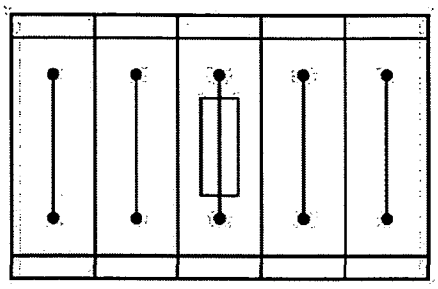
UT 4-HESILED 24 (5X20) Order No.: 3046090
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090

Diagrams/Drawings

Application drawing

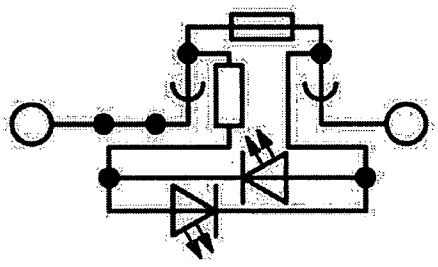


Fuse terminal blocks in interconnected arrangement,
block consisting of 5 fuse terminal blocks



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

Circuit diagram



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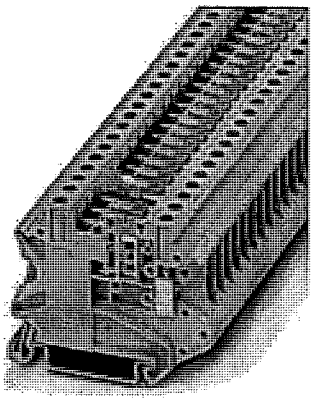
Extract from the online catalog

UT 4-MT-P/P

Order No.: 3046171



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046171

Feed-through modular terminal block, Connection type: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Nominal current: 20 A, Nominal voltage: 500 V, Length: 57.8 mm, Width: 6.2 mm, Color: gray, Assembly: NS 35/7,5, NS 35/15

Commercial data	
GTIN (EAN)	4017918975593
sales group	A840
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.014118 KG
Catalog page information	Page 50 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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Technical data

General

Number of levels	1
Number of connections	2
Color	gray

Insulating material	PA
Inflammability class acc. to UL 94	V0

Dimensions

Width	6.2 mm
Length	57.8 mm
Height NS 35/7,5	49.1 mm
Height NS 35/15	55 mm

Technical data

Maximum load current	20 A (with 6 mm² conductor cross section)
Rated surge voltage	6 kV
Pollution degree	3
Surge voltage category	III
Insulating material group	I
Connection in acc. with standard	IEC 60947-7-1
Nominal current I_N	20 A
Nominal voltage U_N	500 V
Open side panel	nein

Connection data

Conductor cross section solid min.	0.14 mm²
Conductor cross section solid max.	6 mm²
Conductor cross section stranded min.	0.14 mm²
Conductor cross section stranded max.	6 mm²
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm²
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm²
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm²
2 conductors with same cross section, solid min.	0.14 mm²
2 conductors with same cross section, solid max.	1.5 mm²
2 conductors with same cross section, stranded min.	0.14 mm²

UT 4-MT-P/P Order No.: 3046171
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046171

2 conductors with same cross section, stranded max.	1.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm²
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm²
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm²
Type of connection	Screw connection
Stripping length	9 mm
Internal cylindrical gage	A4
Screw thread	M3
Tightening torque, min	0.6 Nm
Tightening torque max	0.8 Nm

Certificates / Approvals

Certification	CSA, CUL, UL

CSA

Nominal voltage U_N	300 V
Nominal current I_N	16 A
AWG/kcmil	26-10

CUL

Nominal voltage U_N	300 V
Nominal current I_N	16 A
AWG/kcmil	26-10

UL

Nominal voltage U_N	300 V
Nominal current I_N	16 A
AWG/kcmil	26-10

UT 4-MT-P/P Order No.: 3046171
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046171

Accessories

Item	Designation	Description
Assembly		
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m
Bridges		
3030336	FBS 2-6	Plug-in bridge, Number of positions: 2, Color: red
3030242	FBS 3-6	Plug-in bridge, Number of positions: 3, Color: red
3030255	FBS 4-6	Plug-in bridge, Number of positions: 4, Color: red
3030349	FBS 5-6	Plug-in bridge, Number of positions: 5, Color: red
3030271	FBS 10-6	Plug-in bridge, Number of positions: 10, Color: red
3030365	FBS 20-6	Plug-in bridge, Number of positions: 20, Color: red
3032224	FBS 50-6	Plug-in bridge, Number of positions: 50, Color: red
3047060	RB UT 10-(2,5/4)	Reducing bridge, Number of positions: 2, Color: red

Marking

0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
5060935	ZB 6/WH-100:UNBEDRUCKT	Zack strip, unprinted: For individual labeling with M-PEN, ZB-T or CMS system, large batch, sufficient for labeling 1000 terminal blocks, for a terminal width of 6.2 mm, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements

Plug/Adapter

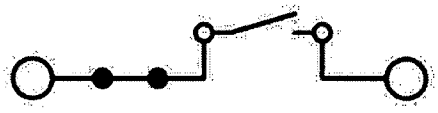
0201689	MPS-IH BU	Insulating sleeve, Color: blue
0201676	MPS-IH RD	Insulating sleeve, Color: red
0201663	MPS-IH WH	Insulating sleeve, Color: white
0201744	MPS-MT	Metal part
3030925	PAI-4	Test adapter, Color: gray
3030996	PS-6	Test adapter, Color: red

Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

Diagrams/Drawings

Circuit diagram



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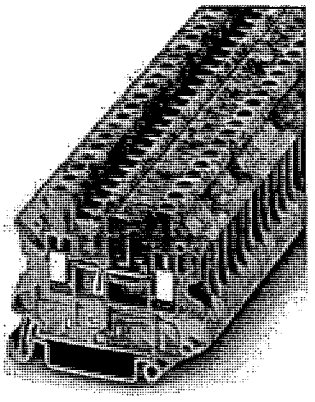
Extract from the online catalog

UT 4-MTD-PE

Order No.: 3046223



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046223

Feed-through modular terminal block, Connection type: Screw connection, Cross section: 0.14 mm² - 6 mm², AWG: 26 - 10, Length: 57.8 mm, Width: 6.2 mm, Color: green-yellow, Assembly: NS 35/7,5, NS 35/15

Commercial data	
GTIN (EAN)	4017918960995
sales group	A803
Pack	50 pcs.
Customs tariff	85369010
Weight/Piece	0.01538 KG
Catalog page information	Page 57 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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Certificates / Approvals

Certification — CB, CSA, CUL, DNV, GL, LR, UL, VDE-PZI

Certification Ex:	IECEx, KEMA-EX

CSA

AWG/kcmil	26-10

CUL

AWG/kcmil	26-10

UL

AWG/kcmil	26-10

Accessories

Item	Designation	Description
Assembly		
3022276	CLIPFIX 35-5	Snap-on end bracket, for NS 35/7.5 or NS 35/15 DIN rail, can be fitted with Zack strip ZB 5 and ZBF 5, terminal strip marker KLM 2 and KLM, parking facility for FBS...5, FBS...6, KSS 5, KSS 6, width: 5,15 mm, color: gray
3047141	D-UT 2,5/4-TWIN	End cover, Width: 2.2 mm, Color: gray
0801762	NS 35/ 7,5 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1207640	NS 35/ 7,5 PERF 755MM	NS 35 DIN rail, height 7.5 mm, length 755 mm
1207653	NS 35/ 7,5 PERF 955MM	NS35 DIN rail, height 7.5 mm, length 955 mm
1207666	NS 35/ 7,5 PERF 1155MM	NS 35 DIN rail, height 7.5 mm, length 1155 mm
0801733	NS 35/ 7,5 PERF 2000MM	DIN rail, material: Steel, galvanized and passivated with a thick layer, perforated, height 7.5 mm, width 35 mm, length: 2 m
0801681	NS 35/ 7,5 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 7.5 mm, width 35 mm, length: 2 m
1201756	NS 35/15 AL UNPERF 2000MM	DIN rail, deep-drawn, high profile, unperforated, 1.5 mm thick, material: Aluminum, height 15 mm, width 35 mm, length 2 m
1201895	NS 35/15 CU UNPERF 2000MM	DIN rail, material: Copper, unperforated, 1.5 mm thick, height 15 mm, width 35 mm, length: 2 m
1207679	NS 35/15 PERF 755MM	NS 35 DIN rail, perforated, height 15 mm, length 755 mm
1207682	NS 35/15 PERF 955MM	NS 35 DIN rail, perforated, height 15 mm, length 955 mm
1207695	NS 35/15 PERF 1155MM	NS 35 DIN rail, perforated, height 15 mm, length 1155 mm
1201730	NS 35/15 PERF 2000MM	DIN rail, material: Steel, perforated, height 15 mm, width 35 mm, length: 2 m
1201714	NS 35/15 UNPERF 2000MM	DIN rail, material: Steel, unperforated, height 15 mm, width 35 mm, length: 2 m
1201798	NS 35/15-2,3 UNPERF 2000MM	DIN rail, material: Steel, unperforated, 2.3 mm thick, height 15 mm, width 35 mm, length: 2 m

UT 4-MTD-PE Order No.: 3046223
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046223

Bridges

3030336	FBS 2-6	Plug-in bridge, Number of positions: 2, Color: red
3030242	FBS 3-6	Plug-in bridge, Number of positions: 3, Color: red
3030255	FBS 4-6	Plug-in bridge, Number of positions: 4, Color: red
3030349	FBS 5-6	Plug-in bridge, Number of positions: 5, Color: red
3030271	FBS 10-6	Plug-in bridge, Number of positions: 10, Color: red
3030365	FBS 20-6	Plug-in bridge, Number of positions: 20, Color: red
3032224	FBS 50-6	Plug-in bridge, Number of positions: 50, Color: red

Marking

1051993	B-STIFT	Marker pen, for manual labeling of unprinted Zack strips, smear-proof and waterproof, line thickness 0.5 mm
0811228	X-PEN 0,35	Marker pen without ink cartridge, for manual labeling of markers, labeling extremely wipe-proof, line thickness 0.35 mm
1051016	ZB 6,LGS:FORTL.ZAHLEN	Zack strip, 10-section, printed horizontally: with the numbers, 1-10, 11-20 etc. up to 991-1000, color: white
1051032	ZB 6,LGS:GLEICHE ZAHLEN	Zack marker strip, labeled horizontally: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: white
1051029	ZB 6,QR:FORTL.ZAHLEN	Zack strip, 10-section, printed vertically: with consecutive numbers, 1-10, 11-20 a.s.o. up to 991-1000, color: white
1051045	ZB 6,QR:GLEICHE ZAHLEN	Zack marker, labeled vertically: 10-section, with identical numbers, 1/1/1, 2/2/2 etc. up to 1000/1000/1000, color: White
1050499	ZB 6:SO/CMS	Zack strip, 10-section, divisible, special printing, marking according to customer requirements
1051003	ZB 6:UNBEDRUCKT	Zack strip, unprinted, strips with 10 labels for individual labeling with M-PEN or CMS system, for terminal block width: 6.2 mm, color: white

Plug/Adapter

0201731	MPS-IH BK	Insulating sleeve, Color: black
0201702	MPS-IH GN	Insulating sleeve, Color: green
0201676	MPS-IH RD	Insulating sleeve, Color: red
0201663	MPS-IH WH	Insulating sleeve, Color: white
0201744	MPS-MT	Metal part
3030925	PAI-4	Test adapter, Color: gray
3030996	PS-6	Test adapter, Color: red

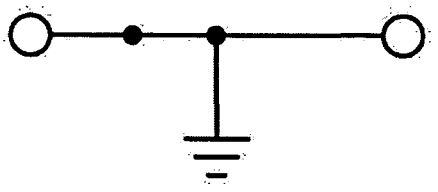
Tools

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm² connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

UT 4-MTD-PE Order No.: 3046223
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046223

Diagrams/Drawings

Circuit diagram



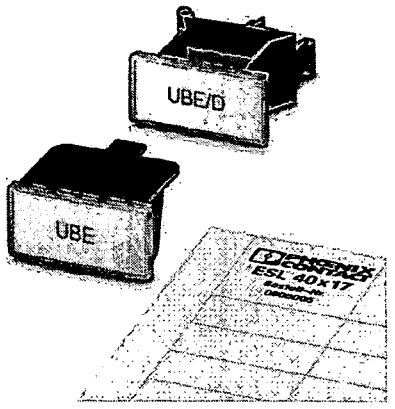
PHOENIX CONTACT

Extract from the online catalog

UBE

Order No.: 0800310

The illustration shows a combination of versions UBE/D, UBE and ESL 40 x 17



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=0800310

Terminal strip marker carriers for marking terminal groups, for end bracket E/UK or end clamp E/U, lettering field size: 40 x 17 mm

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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Commercial data

GTIN (EAN)	4017918005917
sales group	B108
Pack	10 pcs.
Customs tariff	85369010
Weight/Piece	0.00683 KG
Catalog page information	Page 699 (CL-2009)

Technical data

General

Color	gray
Inflammability class acc. to UL 94	V2
Ambient temperature (operation)	-40 °C ... 100 °C
Components	free from silicone and halogen
Material	PA

UBE Order No.: 0800310
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=0800310

Accessories

Item	Designation	Description
Marking		
0808095	ESL 40X17	Insert strip for laser printer, perforated, for terminal strip markers UBE/D or UBE, lettering field size: 40 x 17 mm, labeling with laser printer, M-PEN or CMS system, 56-section

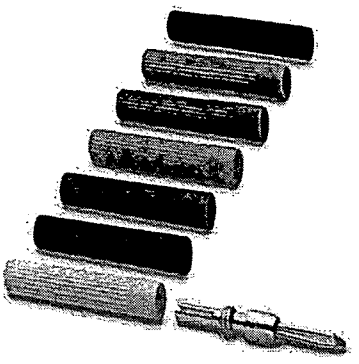
PHOENIX CONTACT

Extract from the online catalog

MPS-MT

Order No.: 0201744

The illustration shows MPS-MT test plugs and insulating sleeves



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=0201744

Metal part

Commercial data	
GTIN (EAN)	4017918098803
sales group	A092
Pack	10 pcs.
Customs tariff	85366990
Weight/Piece	0.0014 KG
Catalog page information	Page 8 (NTK-2010)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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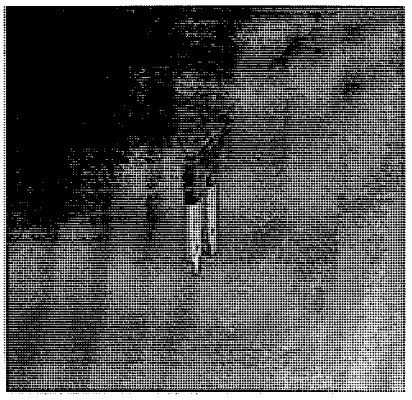
Extract from the online catalog

FBS 2-10

Order No.: 3005947



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3005947

Plug-in bridge, Number of positions: 2, Color: red

Commercial data	
GTIN (EAN)	4017918168759
sales group	A690
Pack	10 pcs.
Customs tariff	85389099
Weight/Piece	0.00707 KG
Catalog page information	Page 330 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

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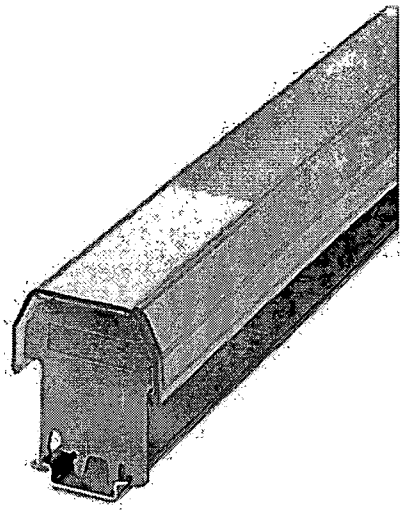
Extract from the online catalog

AP 2-TU

Order No.: 5022630



http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=5022630

Cover profile carrier for mounting on NS 32 or NS 35/7,5 DIN rail for attaching the cover profile AP 2.2 mm thick

Commercial data	
GTIN (EAN)	4017918095239
sales group	A097
Pack	50 pcs.
Customs tariff	39169010
Weight/Piece	0.005823 KG
Catalog page information	Page 703 (CL-2009)

Product notes

WEEE/RoHS-compliant since: 01/01/2003

http://www.download.phoenixcontact.com
Please note that the data given here has been taken from the online catalog. For comprehensive information and data, please refer to the user documentation. The General Terms and Conditions of Use apply to internet downloads.

Technical data

General

Length (b)	55.6 mm
Height	68.5 mm

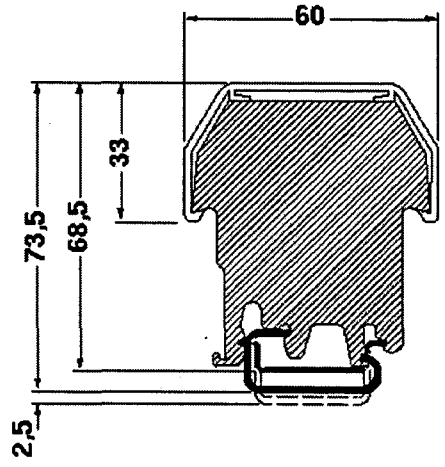
AP 2-TU Order No.: 5022630

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=5022630

Width (a)	2.1 mm
Color	gray
Inflammability class acc. to UL 94	V2
Material	PA

Diagrams/Drawings

Dimensioned drawing



MOORE INDUSTRIES WORLDWIDE

ECT-DIN

Signal Isolator, Converter, Repeater, Booster and Splitter

June 2009

Description

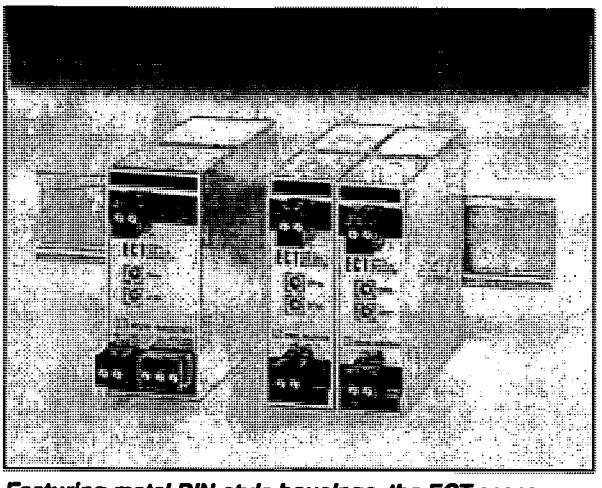
ECT DIN-style signal isolators, converters, repeaters, boosters and splitters feature solid metal housings that stand up to the continuous, daily rigors of process control and factory automation applications.

Rugged and reliable, the ECT is available in 2-wire (loop) and 4-wire (line/mains) powered models. The complete family delivers economical solutions for an expansive range of signal interface applications.

- **Isolate Signals** to stop erratic measurements caused by ground loops.
- **Convert Signals** so field instruments can interface directly with an indicator, recorder, DCS, PLC or PC-based SCADA system.
- **Split One Signal** to allow one primary measurement to be sent to two separate systems.
- **Get two isolators in one.** The ECT is available in dual channel I/O models that provide application flexibility while reducing space requirements and costs.
- **Protect Equipment and Signals (Area Isolation)** by eliminating common electrical paths.
- **Amplify (Boost) Signals** so that more instruments can be added to an overburdened loop.
- **Solve "Bucking" Power Supplies** by stopping a conflict caused by a 4-wire transmitter and a DCS both trying to power the same process loop.
- **Step Down Dangerous,** high voltage signals to safer levels to protect plant personnel.
- **Solve DCS Start-Up Problems** caused by non-isolated transmitters by installing an ECT in each troublesome loop.

To choose the right ECT for your application, first determine the power supply characteristics:

Power Supply Type	Page
2-Wire, Output-Loop Powered (12-42Vdc)	2-3
2-Wire, Input-Loop Powered (5.5Vlp)	4-5
4-Wire, Line/Mains Powered (117Vac, 230Vac, 24Vdc)	6-7



***Featuring metal DIN-style housings, the ECT** snaps securely onto standard G-type and Top Hat rails.*

Features

- **Current and voltage inputs.** Available models handle Current and Voltage Signals.
- **2-wire (loop) and 4-wire (line/mains) powered.** Versatile choices allow you to match the ECT to the type of AC or DC power available at each location.
- **Superior signal isolation (up to 1500Vrms).** Industrial-strength protection stops ground loops, motor noise, and other electrical interferences from affecting process signals.
- **RFI/EMI protection.** The ECT provides an effective barrier against the unpredictable, harmful effects of radio frequency and electromagnetic interference. When ordered with the -RF option, the ECT delivers enhanced protection for especially noisy environments.

Certifications

Underwriter's Laboratories: General Location*

CE: Conformant to EMC 89/336/EEC EN 61326

*Certification not applicable to ECT-DIN models equipped with the RF option.

208-710-09F

ECT-DIN

Signal Isolator, Converter,
Repeater, Booster and Splitter

2-Wire, Output-Loop Powered Models

This ECT model derives operating power from its output side where loop power is typically made available by the receiving device, such as a DCS.

Stop Ground Loop Noise

Differences in potential between a grounded transmitter and a grounded receiving device may result in unpredictable ground loop problems, which can lead to signal drift. Use the ECT to break the galvanic path between the field instrument and receiving device (Figure 1).

Convert Signals

The ECT takes one process signal type (such as 1-5V) and converts it to a standard, isolated 4-20mA, allowing devices with incompatible signal types to interface with one another (Figure 1).

Divert and Protect (Area Isolation) Signals

Using the ECT, you can send the output from one transmitter to a second location; protect expensive monitoring/control equipment by eliminating common electrical paths; or create a buffer between devices to allow interruption of one leg of a loop without impacting the other (Figure 2).

Amplify (Boost) Signals

If you need to add an instrument to an overloaded loop, use the ECT. It features a high drive capability of 600 ohms (with a 24V power supply) and a low input impedance of just 50 ohms (Figure 3).

Solve "Bucking" Power Supplies

When two devices (such as a 4-wire transmitter and a DCS) are trying to source power to a loop, the result is a non-functioning loop. When neither of the devices can be eliminated, the solution is the ECT. It can operate with powered inputs from both sides, thus restoring normal operations to the loop (Figure 4).

Figure 1. *Input/output loop isolation and signal conversion.*

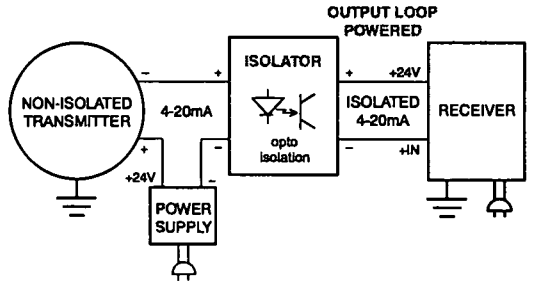


Figure 2. *Divert a process signal, or protect expensive equipment by eliminating a common electrical path.*

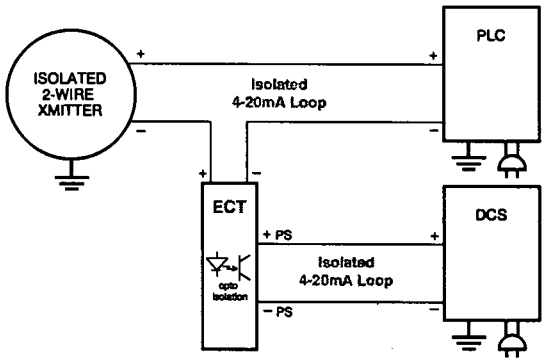


Figure 3. *Boost process signals to allow another instrument to be added to an otherwise overloaded loop.*

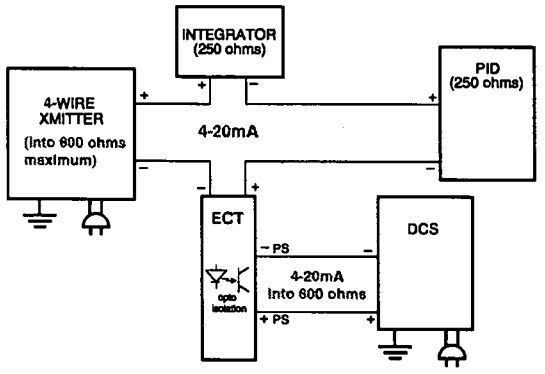
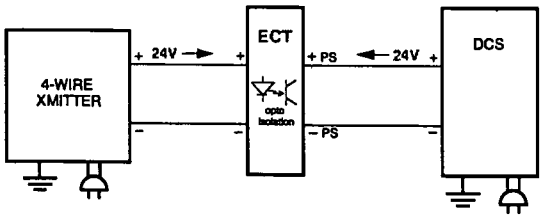


Figure 4. *Restore a loop experiencing "bucking" power supplies to normal operation.*



ECT-DIN

Signal Isolator, Converter, Repeater, Booster and Splitter

Specifications

Performance

Accuracy: ±0.1% of span (±0.2% for 0-150 AC inputs)
Stability: ±0.2% of reading per year
Isolation: WITHOUT -RF OPTION: 1500Vrms between input and output; WITH -RF OPTION: 500Vrms between input and output
Output Response Time: DC Inputs, 100msec to 99% of output maximum; AC Inputs, 400msec to 99% of output
Ripple: 10mV peak-to-peak maximum measured across a 250 ohm resistor
Over-Voltage Protection: 48V, maximum on output; 48V reverse polarity protection on output

Performance (continued)

Maximum Input Overrange: Current Inputs 250% of full scale; DC Voltage Inputs, 150% of full scale
Burden: 1V maximum with 4-20mA input; 0.01V maximum with 0-5A input
Load Capability:

$$\frac{Vs - 12Vdc}{0.02A} = \text{ohms}$$

Output Current Limiting: 25mA typical; 30mA maximum

Ambient Conditions

Operating Range: -40°C to +85°C (-40°F to +185°F)
Storage Range: -40°C to +85°C (-40°F to +185°F)

Ambient Conditions (Continued)

Ambient Temperature Effect: ±0.007% of span/°C typical; ±0.015% of span/°C maximum
Relative Humidity: 0-95% non-condensing
RFI/EMI Protection: Less than ±0.1% of span error when tested at 10V/m@ 20-1000MHz WITH -RF OPTION: Less than ±0.1% of span error when tested at 30V/m@ 20-1000MHz
Common Mode Rejection: Exceeds 95dB@60Hz with a limit of 1500Vrms

Adjustments

Type: Front panel pots
Span: ±10%
Zero: ±5% (non-interactive when span is set first)

Weight 145g (5 oz)

Ordering Information

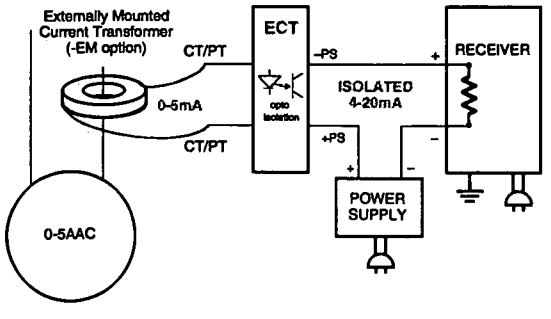
Unit	Input	Output	Power	Options	Housing
ECT 2-wire (Output-Loop Powered) Isolator/Converter	**4-20MA** into 50 ohms **1-5V** into 1 Mohm **0-10V** into 1 Mohm **0-150AC** into 100 kohms **0-5AAC** into 0.002 ohms	**4-20MA** into 600 ohms with 24Vdc power supply	**12-42DC**	**-RF** Enhanced RFI/EMI filtering provides 30V/m @ 20-1000MHz protection with less than ±0.1% of span error **-EM** Externally-mounted input transformer for current input (available with 0-5Aac input type only)	**DIN** Aluminum DIN-style housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails **FLB2** Externally-mounted flange provides a secure mount and ensures resistance to vibration

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: ECT / 4-20MA / 4-20MA / 12-42DC / -RF [DIN]

Step Down Unsafe High Level Signals

To protect plant personnel, the ECT comes with an optional external input transformer (-EM option) to step down high level AC current inputs to a low level signal. This permits safer servicing without opening the secondary of a current transformer (Figure 5).

Figure 5. To protect plant personnel, step down potentially dangerous high level AC current signals to lower level signals.



ECT-DIN

Signal Isolator, Converter,
Repeater, Booster and Splitter

2-Wire, Input-Loop Powered Models

The 2-wire, input-loop powered ECT derives its operating power from the input side of the process loop (Figure 6). This model provides loop isolation when line power or output-loop power is not available. Its simple hook-up method provides a cost-effective interface between field signals and a computer, DCS or other multiple-input system.

IMPORTANT NOTE: When choosing this type of isolator, notice the total load imposed on the input loop. Because it derives all operating power from the input loop, that loop must be able to handle the isolator's input impedance and output load (maximum output load is 250 ohms).

Figure 6. The input-loop powered ECT provides loop isolation when line power or output-loop power is not available.

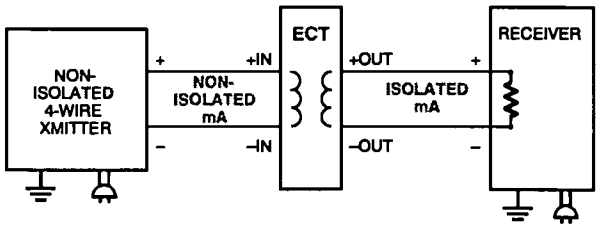
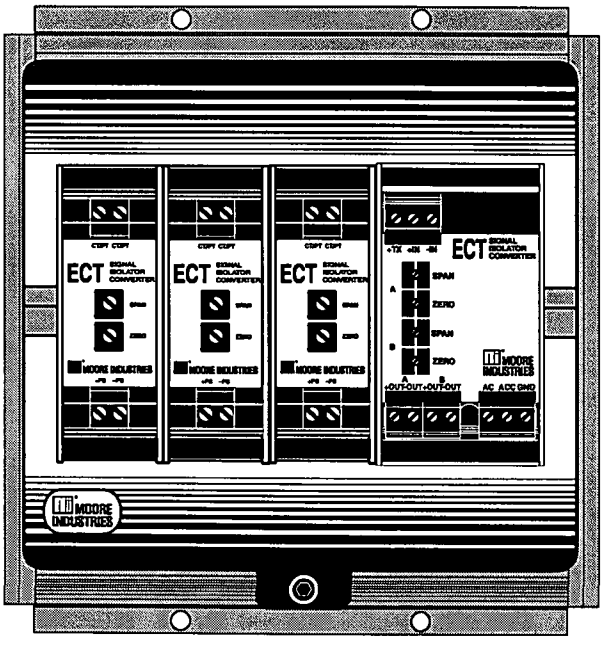


Figure 7. Available in a variety of widths, our R-BOX field-mount instrument enclosure is designed to protect DIN-rail instruments in even the most rugged environments.



Single and Multiple Unit Instrument Enclosures

Designed to meet NEMA 4X and IP66 ratings, the *R-BOX* is the perfect solution for protecting the ECT in field and control room applications. Rugged and versatile, it delivers a high impact structure and resistance to ultraviolet rays and chemicals.

The *R-BOX* mounts on a pipe, panel or surface, and comes in a variety of widths to economically accommodate just one, or up to 10, ECTs. It features a pre-installed mounting rail; customizable conduit entry options; a clear cover; and a secure locking mechanism.

For more information, see the *R-BOX* Field-Mount Enclosure for DIN Instruments data sheet.

ECT-DIN

Signal Isolator, Converter,
Repeater, Booster and Splitter

Specifications

Performance	**Accuracy:** ±0.075% of span **Stability:** ±0.2% of reading per year **Isolation:** 500Vrms between input and output **Output Response:** 20msec maximum to 99% of output **Ripple:** 10mV peak-to-peak maximum measured across a 250 ohm resistor **Over-Voltage Protection:** 48V, maximum on output; 48V, reverse polarity protection on output **Maximum Input Overrange:** 200% of full scale ***Burden:*** 5.5V when outputs are shorted for 4-20mA inputs, 10.5V with 250 ohm load (Output load voltage is reflected on input. Output should be trimmed for anticipated output load) **Output Current Limiting:** 30mA with 250 ohm output load	**Ambient Conditions**	**Operating Range:** -29°C to +82°C -20°F to +180°F **Storage Range:** -40°C to +85°C (-40°F to +185°F)	**Ambient Conditions (Continued)**	**Ambient Temperature Effect:** ±0.018% of span/°C; ±0.005% of span/°C gain change **Relative Humidity:** 0-95% non-condensing **RFI/EMI Protection:** Less than ±0.1% of span error when tested at 10V/m @ 20-1000MHz WITH -RF OPTION: Less than ±0.1% of span error when tested at 30V/m@20-1000MHz **Common Mode Rejection:** Exceeds 95dB @ 60Hz with a limit of 1500Vrms
				Adjustments	**Type:** Front panel pots **Trim:** ±1%
				Weight	145g (5 oz)

Ordering Information

Unit	Input	Output	Power	Options	Housing
ECT 2-wire (Input-Loop Powered) Isolator/ Converter	**4-20MA** into 275 ohms	**4-20MA** into 0-250 ohms	Current Loop Excitation at 4mA: **5.5VLP** 5.5 volts loop powered with 4-20mA (plus voltage across output load)	**-RF** Enhanced RFI/EMI filtering provides 30V/m @ 20-1000MHz protection with less than ±0.1% of span error	**DIN** Aluminum DIN-style housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails **FLB2** Externally-mounted flange provides a secure mount and ensures resistance to vibration

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: ECT / 4-20MA / 4-20MA / 5.5VLP / -RF [DIN]

Need Enhanced Features?

PC-Programmable Universal Interface
Our model SIY signal isolator, converter, and repeater is the ideal plant standard. This 2-wire (loop-powered), microprocessor-based instrument programs in less than a minute to handle a wide range of current and voltage inputs. It even allows creation of custom input linearization curves. For detailed information, see the SIY data sheet.

Unusual Input and Outputs
We have instruments that handle a wide array of non-standard inputs and outputs.

Custom Signal Isolators
We have engineers on hand to modify our instrument to meet your unique needs.

RTD, T/C, mV, Potentiometer, I/P, P/I, Strain Gage, and Frequency Signals
We are the Interface Solution Experts. When you need to interface field processes with computer-based systems, readout equipment, and other instrumentation... our technology, services, and experience help you do it efficiently, safely, and cost-effectively.

ECT-DIN

Signal Isolator, Converter,
Repeater, Booster and Splitter

4-Wire, Line/Mains Powered Models

These ECT models are powered by standard 117Vac, 230Vac, and 24Vdc power supplies (Figure 8). They are designed for applications where line/mains power is readily available, such as the back of a panel or in a control room.

Step Down Unsafe, High Level Signals

To protect plant personnel, the 4-wire ECT comes with an optional external input transformer (-EM option) to step down high level AC current inputs to a low level signal. This permits safer servicing without opening the secondary of a current transformer (Figure 9).

Power a 2-Wire Transmitter

With the -TX option, our 4-wire ECTs provide 24V power to a 2-wire, output-loop powered instrument. This eliminates the need for an additional power supply (Figure 10). ***IMPORTANT:*** Our 2X4-20MA dual input model provides a transmitter excitation of 16V. Refer to Figure 12 for an illustration of dual input model operation.

"Sharing" or "Splitting" a Process Signal

The ECT with dual outputs will take one input and deliver two identical, completely isolated outputs to two separate monitoring or control devices (Figure 11). This is valuable for viewing one process variable at two locations, such as in custody transfer, where two parties require identical information for accountability or billing purposes. Maintenance of one system does not disturb the information being collected at the second location. In addition, a failure at one receiver will not affect the second loop.

One Isolator Does the Work of Two

When ordered with dual input and output channels, the ECT will perform the functions of two isolators (Figure 12). Each of the ECT's two input-to-output channels is independent and completely isolated from the other.

Figure 8. *4-wire ECT models are ideal for use where line (mains) power is readily available.*

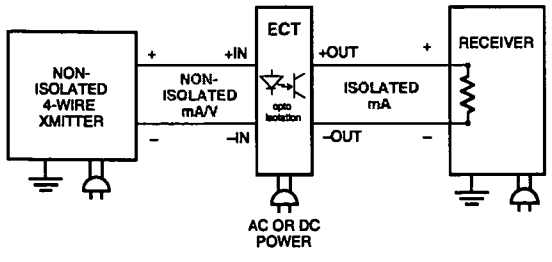


Figure 9. *When ordered with the -EM option, the ECT comes with an externally-mounted current transformer to "step down" high level signals.*

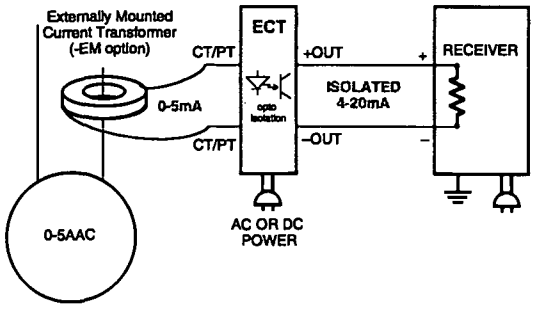


Figure 10. *With the -TX Transmitter Excitation option, the ECT will supply loop power to a 2-wire transmitter.*

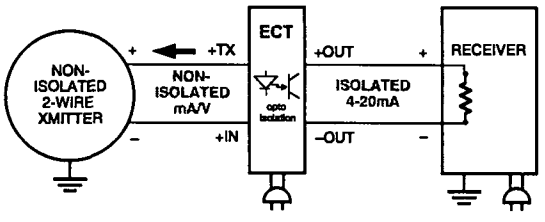


Figure 11. *The ECT takes one process input and delivers two completely isolated signal outputs.*

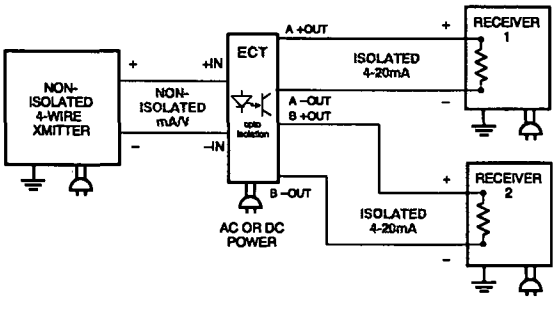
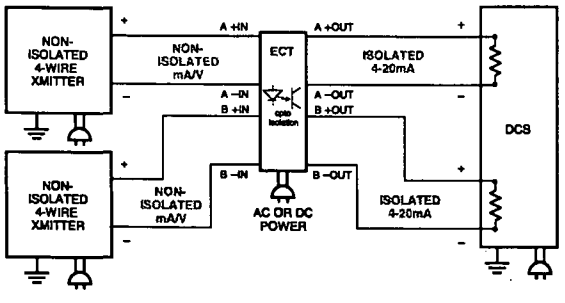


Figure 12. *The ECT takes two process inputs and delivers two completely isolated signal outputs.*



NOTE: ONLY 16V TX EXCITATION PROVIDED ON 2X4-20MA DUAL INPUT MODEL

ECT-DIN

Signal Isolator, Converter, Repeater, Booster and Splitter

Specifications

Performance	**Accuracy:** ±0.1% of span **Stability:** ±0.2% of reading per year **Isolation:** WITHOUT -RF OPTION: 1500Vrms between input and ouput and power; WITH -RF OPTION: 500Vrms between input and output, 1500Vrms power terminals; DUAL I/O WITHOUT -RF OPTION: 1500Vrms **Output Response Time:** DC Input: 100msec, maximum to 99% of output; AC Input: 400msec, maximum, from 0-99% of output **DC Input Resistance:** 50 ohms **Ripple:** 10mV peak-to-peak maximum measured across 250 ohm resistor **Load Effect:** 0.01% of span from 0-100% of rated output (current only)
Performance (continued)	**Power Supply Rejection:** Exceeds 90dB for current input unit **Maximum Input Overrange:** Current inputs, 250% of full scale DC Voltage inputs 150% of full scale **Burden:** 1V maximum with 4-20mA input; 0.01V maximum with 0-5A input **Output Current Limiting:** 25mA, typical; 30mA, maximum
Ambient Conditions	**Operating Range:** -40°C to +85°C -40°F to +185°F **Storage Range:** -40°C to +85°C (-40°F to +185°F) **Ambient Temperature Effect:** ±0.007% of span/°C, typical; ±0.015% of span/°C, maximum **Relative Humidity:** 0-95% non-condensing
Ambient Conditions (Continued)	**RFI/EMI Protection:** Less than ±0.1% of span error when tested at 10V/m@20-1000MHz WITH -RF OPTION: Less than ±0.1% of span error when tested at 30V/m@20-1000MHz; DUAL I/O WITHOUT -RF OPTION: Output unaffected by more than ±0.5% of span@10V/M 20-1000MHz **Common Mode Rejection:** Exceeds 95dB@60Hz with a limit of 1500Vrms
Adjustments	Front panel pots **Span:** ±10% **Zero:** ±5% (non-interactive when span is set first)
Weight	**Single I/O Channel:** 384g (13.7 oz) **Dual I/O Channels:** 431g (15.4 oz)

Ordering Information

Unit	Input	Output	Power	Options	Housing
ECT **4-Wire (Line/Mains) Powered** Isolator/ Converter	SINGLE INPUT CHANNEL: **4-20MA** into 50 ohms **1-5V** into 1 Mohm **0-10V** into 1 Mohm **0-150AC** into 100 kohms **0-5AAC** into 0.002 ohms DUAL INPUT CHANNELS: **2X4-20MA** into 25 ohms **2x1-5V** into 1 Mohm **2X0-10V** into 1 Mohm (Other AC ranges also available)	SINGLE OUTPUT CHANNEL: **4-20MA** into 1000 ohms **0-10V** into 5 kohms minimum DUAL OUTPUT CHANNELS: 600 ohms **2X1-5V** into 5 kohms minimum **2X0-10V** into 5 kohms minimum DUAL OUTPUT CHANNELS (Signal Splitter): **2X4-20MA** into 600 ohms (available with 4-20mA input only)	**24DC,** ±10% **117AC,** 50/60Hz, ±10% **230AC,** 50/60Hz, ±10% (3 watts maximum for single channel models; 5 watts maximum for dual output channel models)	**-EM** Externally-mounted input transformer for current input (available with 0-5AAC input only) **-TX** 24V transmitter excitation (16V for 2X4-20MA DUAL INPUT model) for powering a 2-wire transmitter (available on 4-20mA input models only; standard on models with 2X4-20mA output) **-RF** Enhanced RFI/EMI filtering provides 30V/m@ 20-1000MHz protection with less than ±0.1% of span error (-EM option required for AC current input) **-EP** External power, output stage powered by external source (only available on signal splitter in DIN housing)	**DIN** Aluminum DIN-style housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails **FLB2** Externally-mounted flange provides a secure mount and ensures resistance to vibration

When ordering, specify: Unit / Input / Output / Power / Options [Housing]
Model number example: ECT / 1-5V / 4-20MA / 117AC / -RF [DIN]

ECT-DIN

Signal Isolator, Converter, Repeater, Booster and Splitter

Figure 13. *Dimensions for 2-Wire and 4-Wire ECT-DIN models*

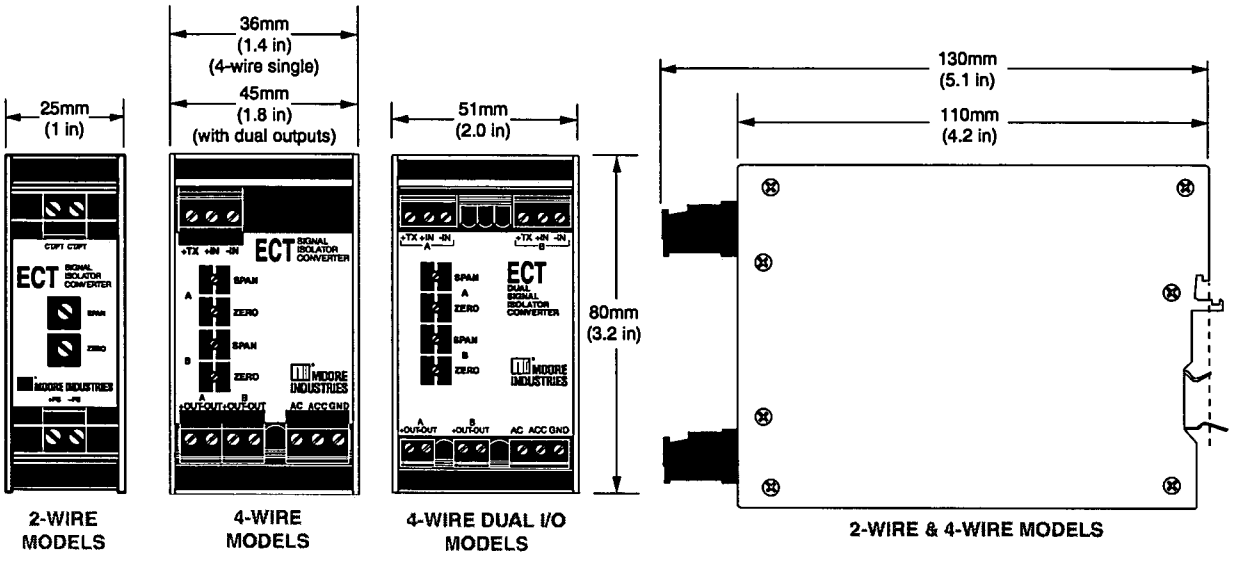


Table 1. *Terminal Designations for 2-Wire Units*

2-Wire Output-Loop Powered Models	Top Terminals (left to right)		Bottom Terminals (left to right)	
Output-Loop Powered	+IN	-IN	+PS	-PS
Output-Loop Powered with -EM Option	CT/PT	CT/PT	+PS	-PS
2-Wire Input-Loop Powered Models	**Top Terminals (left to right)**			
Input-Loop Powered	+IN	-IN	+OUT	-OUT

Table 4. *Key to Table Abbreviations*

Key	Definition
A	Channel 1 on dual output models
B	Channel 2 on dual output models
AC	AC line power input
ACC	AC line power return (neutral)
CT/PT	Current Transformer/Potential Transformer input
DC	+DC power input
DCC	-DC power input
GND	Ground
IN	Input signal (+ or -)
OUT	Output signal (+ or -)
-TX	Transmitter excitation for powering 2-wire transmitter

Table 2. *Terminal Designations for 4-Wire Units*

4-Wire (Line/Mains-Powered) Models	Top Terminals (left to right)			Bottom Terminals (left to right)							
	T1	T2	T3	B1	B2	B3	B4	B5	B6	B7	B8
AC Power Single Input/Dual Outputs & -TX	+TX	+IN	-IN	A +OUT	A -OUT	B +OUT	B -OUT		AC	ACC	GND
DC Power Single Input/Dual Outputs & -TX	+TX	+IN	-IN	A +OUT	A -OUT	B +OUT	B -OUT		DC	DCC	GND
	T1	T2	T3	B1	B2	B3	B4	B5	B6		
Power with AC Inputs or -EM Option		CT/PT	CT/PT	+OUT	-OUT		AC	ACC	GND		
AC Power with -TX Option	+TX	+IN	-IN	+OUT	-OUT		AC	ACC	GND		
Power with DC Inputs or -EM Option		CT/PT	CT/PT	+OUT	-OUT		DC	DCC	GND		
DC Power with -TX Option	+TX	+IN	-IN	+OUT	-OUT		DC	DCC	GND		

Table 3. *Terminal Designations for 4-Wire Dual I/O Units*

4-Wire (Line/Mains-Powered) Dual I/O Models	Top Terminals (left to right)									Bottom Terminals (left to right)								
	T1	T2	T3	T4	T5	T6	T7	T8	T9	B1	B2	B3	B4	B5	B6	B7	B8	B9
AC Power & Dual Inputs/Dual Outputs	A +TX	A +IN	A -IN				B +TX	B +IN	B -IN	A +OUT	A -OUT		B +OUT	B -OUT		AC	ACC	GND
DC Power & Dual Inputs/Dual Outputs	A +TX	A +IN	A -IN				B +TX	B +IN	B -IN	A +OUT	A -OUT		B +OUT	B -OUT		DC	DCC	GND

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E-mail: jpr@jpr.com.au

SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

Customer Name:	BMD		
Project:	AXIS PLACE Pump Station SP315		
JPR Job No:	M 41900	**Item:**	Pump Disconnect Box
Constructed by:	D McTaggart	**Tested by:**	E Ensor **Date:** 24/11/10

Item check list:		*To comply with Drawings, Documents & Specification*						
Main Functional Unit/s	Qty		Size		Settings			
Fuse Fittings	Qty		Size		Fuse Size			
Circuit Breakers	Qty		Size		Settings			
Motor Protection C.B.	Rating		Setting		Function			
Neutral	Reqd		Size		ID			
Equipment Earthing	Checked	✓	Size					
C.T.s	Qty		Rating		Pri Inject.			
Meters	Qty		Rating		Function			
Contactors	Qty		Rating		Voltage			
Overloads	Qty		Rating		Function			
Relays	Qty		Rating		Voltage			
Timers	Qty		Rating		Voltage			
Control Switches	Qty		Rating		Function			
Push Buttons	Qty		Rating		Function			
Pilot Lights	Qty		Rating		Voltage			
Transformers	Qty		Rating		Voltage			
ATT/VFD/Soft Starter	Qty		Rating		Function			
DC Supply	Qty		Rating		Voltage			
Terminals	Qty	✓	Size	✓	ID			
Engraving	Qty	✓	Size	✓	ID	✓		
Cabling	Type		Size		ID			
Busbars	Type	✓	Size	✓	ID	✓		
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓		
S.A. Metering CTs	Qty		Rating					
S.A Metering Links	Type							
S.A. Meters	Type		Size					
JPR Label	Fitted		Stamped		Safety Stkr	✓		
Legend Card	Qty		Correct					
PLC/Telemetry	Qty		Size					
Power Monitor Relay	Qty		Rating		Function			

General Check List:								
IP Sealing	Rating	✓						
Door Latches/Hinges	Qty	✓	Type	✓	Operation	✓		
Ventilation	Required	✓	Type	✓	Operation			
Circuit Schedule	Markup		Checked		Supplied			
Terminal Tightness	Power	✓	Control		Result	✓		
Busbar System	Clearances		Joints		ID			
Earth Continuity	Body to E	✓	Doors to E		Panels to E			
Cubicle Cleaned		✓						
Paint Finish Intact								
Polarity Check	R - R		W - W		B - B			
Function	Power		Control		PLC/Telem			
Continuity Check	R - R		W - W		B - B		N - N	

Comments:

J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

Form No. F1017/3

SWITCHBOARD & SHEETMETAL INSPECTION REPORT

Customer Name: BMD
Job No: S41900 M41900
Item: SP315 AXIS PLACE FIELD DISCONNECTION BOX
Drawing No: 486/5/7-0070-000 E10-C41900 / A3

TASK	PRODUCT DETAIL	INSPECTED BY	DATE	PASS / FAIL	CORRECTIVE ACTION REQUEST OR COMMENTS
Design	Documents	BJ	30-9-10	✓	
Drafting	Documents				
Sheetmetal (Refer F1018 for details)	Switchboard				
	Doors		1-10-10	P	
	Cell/Panels				
Painting		N/A			
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior					
Colour Internal					
Colour Panels					
Cubicle Erection					
Electrical Fitout (In accordance with drawings)	D. McTaggart				
Inspection & Test (Refer to F1019)		E Ensor	29/11/10		
		S. Toegel	03/12/10		
Packing					

Comments: TRENT + NATHAN

Tix Status Here: -

Yellow	Awaiting Inspection
Green	Inspection & Test Passed
Red	Inspection & Test Failed, Awaiting Rectification

Form No. F1018/3

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Ph: (07) 3271 2911 - Fax: (07) 3271 3623
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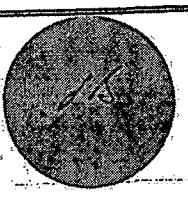
SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CLIENT: BMD				**JOB NO:** 541900	
PRODUCT DESCRIPTION: SP315 AXIS PLACE FIELD DISCONNECTION BOX				**DRAWING & SCHEDULE NUMBERS** LA61517-00-70 Rev E10-C41900 A3	
CONSTRUCTION	**QUALITY**		**COMPLIANCE WITH DRAWINGS**		**REMARKS OR ACTION**
	GOOD	**POOR**	**YES**	**NO**	
1. Folds			✓		
2. Welds			✓		
3. Edges / File			✓		
4. Gauge			✓		
5. Material			✓		
6. Ventilation Openings / Filter Bracket			✓	✓	
7. Water Ingress Test				✓	
8. Equipment Mounting Arrangement			✓		
9. Doors Stiffened				✓	
10. Escutcheons and Lexan Covers			✓		
11. Cable Saddles				✓	
12. Grinding			✓		
13. Door Stays Fitted			✓		
14. Earth Studs			✓	✓	
15. Rubber Retainer					
16. Drawing Holder				✓	
17. Hat Sections				✓	
18. Locking Bars Fitted			✓		
19. External Crevice Welded and Ground			✓		
20. Legend Cards				✓	
21. General Conditions Satisfactory			✓		
22. Cabinet Clean			✓		
23. Job Name and Number Marked			✓		
INSPECTED BY:			**DATE:** 19-10-10		

AFFIX STATUS HERE

Yellow — Awaiting Inspection
Green — Inspected/Tested Passed
Red — Inspected/Tested Awaiting Rectification



JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: *Eric McCulloch (WHSO)*

LOCATION: WACOL WORKSHOP DATE: 3./12./10

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☑ YES
		• Insulating work gloves in test	☑ YES
		• Insulating mats / covers in test	☑ YES
		• Switchboard rescue kit in test	☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☑ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☑ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
	• Approved dedicated power supply only used for testing.	☑ YES
	• Approved dedicated power supply in current test	☑ YES
OPTION	(A) RCD protected outputs used at power supply	☑ YES
	> RCD protection checked daily prior to use	☑ YES
	> Safety Observer is / is not required	☑ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1. E W Eno	2.	3.	4.	5.

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 7./12./0.

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☑ YES
		• Insulating work gloves in test	☑ YES
		• Insulating mats / covers in test	☑ YES
		• Switchboard rescue kit in test	☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☑ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☑ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
	• Approved dedicated power supply only used for testing.	☑ YES
	• Approved dedicated power supply in current test	☑ YES
OPTION	(A) RCD protected outputs used at power supply	☑ YES
	> RCD protection checked daily prior to use	☑ YES
	> Safety Observer ~~is~~ / is not required	☑ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

JOB SAFETY ANALYSIS

LIVE LOW VOLTAGE WORK

TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 8.1.13/10

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
• Authorisation from person in charge (Signature)	☑ YES	• Long cotton clothing	☑ YES
		• Insulating work gloves in test	☑ YES
		• Insulating mats / covers in test	☑ YES
		• Switchboard rescue kit in test	☑ YES

TASK		
LIVE LOW VOLTAGE WORK	• Isolation points identified and accessible	☑ YES
	• Work area clear of obstructions	☑ YES
	• Unauthorised access prevented to work area	☑ YES
	• P.P.E. is fit for purpose	☑ YES
	• Test equipment is fit for purpose	☑ YES
	• Written authority to proceed has been obtained from a person in charge	☑ YES
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	• JPR authorisation to conduct live work is current	☑ YES
	• Approved dedicated power supply only used for testing.	☑ YES
	• Approved dedicated power supply in current test	☑ YES
OPTION	(A) RCD protected outputs used at power supply	☑ YES
	> RCD protection checked daily prior to use	☑ YES
	> Safety Observer ~~is~~ / is not required	☑ YES
OPTION	(B) Non RCD protected outputs used at power supply	☐ YES
	> Supervisor consulted prior to use	☐ YES
	> Safety Observer is in attendance	☐ YES

I understand and am fully aware of the requirements of this job safety analysis.

Signatures:	1.	2.	3.	4.	5.

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
VFD & SOFT STARTER SETUP

Customer Name: BMD			
Project: Urban Utilities - Axis Place - SPS - SP315			
JPR Job No: M 41900	**Item:** Pump 1 + 2	**Drive:**	
Constructed by: R Hompenbons	**Tested by:** E Ensor	**Date:** 13/12/10	
Drive Type:			
Drive Rating:			
Drive Setup Details:			

Parameter	*Setting*	*Function*
6		
15	0 Hz	
25	50 Hz	
14		
20	Manual Reset	
0		
51	Copy to Setup 2	
0		
11	Setup 2	
12	Setup 1	
6		
14	0 Hz	
15	50 Hz	
25	0 Hz	
0		
11	Active Setup	

All other parameters are default settings.

Comments:

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
VFD & SOFT STARTER SETUP

Customer Name: BMD			
Project: Urban Utilities - Axis Place - SPS - SP315			
JPR Job No: NA 41900	**Item:** Pump 1+2	**Drive:**	
Constructed by: R Hompenhuns	**Tested by:** E Ensor	**Date:** 13/12/10	
Drive Type:			
Drive Rating:			
Drive Setup Details:			

Parameter		*Setting*		*Function*
0 02		Hz		
10		Multisetup		
11		Setup 1		
12		Setup 2		
40		Disable		
41		Disable		
1				
20		73 KW		
22		415 V		
23		50 Hz		
24		129 A		
90		Thermistor Trip		
93		Digital Input 33		
3				
3 02		0 Hz		Min Ref
03		50 Hz		Max Ref
04	(1)	Ext/Preset		
10		100%		Preset Reference 0
13	(0)	Linked to Hand/Auto		
15	(2)	A/Input 54 4-20mA		
16	(1)	A/Input 53 0-10V		
41		15 Sec		
42		15 Sec		
4				
10		clockwise		
12		0 Hz		
14		50 Hz		
5				
11	(1)	Reset		
12	(2)	Coasting Stop		
13	(15)	Preset reference on		
14	(23)	Setup Select bit 0		
40	relay 1	Running		
	relay 2	Drive Ready/Auto Mode.	(3)	

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
INDIVIDUAL DRIVES

Customer Name:	BMD							
Project:	Urban Utilities - Axis Place - SPS - SP315							
JPR Job No:	M 41900		**Item:**	Common Control				
Constructed by:	R Hompenhans		**Tested by:**	E Ensor		**Date:**	13/12/10	
Item check list:	***To comply with Drawings, Documents & Specification***							
Main Functional Unit/s:	Qty		Size		Settings			
Fuse Fittings	Qty		Size		Fuse Size			
Circuit Breakers	Qty		Size		Settings			
Motor Protection CB	Rating		Setting		Function			
Neutral	Reqd	✓	Size	✓	ID	✓		
Equipment Earthing	Checked	✓	Size	✓				
C.T.s	Qty		Rating		Pri Inject			
Torroid	Qty		Rating		Function			
Meters	Qty		Rating		Function			
Contactors	Qty		Rating		Voltage			
Overloads	Qty		Rating		Function			
Relays	Qty	✓	Rating	✓	Voltage	✓		
Timers	Qty	✓	Rating	✓	Voltage	✓		
Control Switches	Qty	✓	Rating	✓	Function	✓		
Push Buttons	Qty	✓	Rating	✓	Function	✓		
Pilot Lights	Qty	✓	Rating	✓	Voltage	✓		
Transformer	Qty	✓	Rating	✓	Voltage	✓		
DC Supply	Qty		Rating		Voltage			
ATT	Qty		Rating		Function			
VFD	Qty		Rating		Function			
Soft Starter	Qty		Rating		Function			
Terminals	Qty	✓	Size	✓	ID	✓		
Engraving	Qty	✓	Size	✓	ID	✓		
Cabling	Type	✓	Size	✓	ID	✓		
Busbars	Type		Size		ID			
Escutcheons / Shrouds	Type		Label		IP rating			
JPR Safety Guide	Fitted		Cell Clean					
Earth Leakage Unit	Qty		Size		Function			
Remote I/O Unit	Qty		Size		Function			
General Check List:								
IP Sealing	Rating	✓						
Door Latches	Qty	✓	Type	✓	Operation	✓		
Ventilation	Required		Type		Operation			
Circuit Schedule	Markup	✓	Checked		Supplied			
Terminal Tightness	Power	✓	Control	✓	Result	✓		
Polarity Check	R - R		W - W		B - B			
Continuity Check	R - R		W - W		B - B		N - N	
Earth Continuity	Body to E	✓	Door to E	✓	Panel to E	✓		
Insulation Test	R to E	W to E	B to E	R to W	R to B	W to B	N to E	
1000V Test (MΩ)								
Partially Checked Circuits - Point to Point								
Comments:								

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
INDIVIDUAL DRIVES

Customer Name: BMD							
Project: Urban Utilities - Axis Place SPS - SP315							
JPR Job No: MM 41900			**Item:** RTU				
Constructed by: R Hompenhaus			**Tested by:** E Ensor			**Date:** 13/12/10	
Item check list:		*To comply with Drawings, Documents & Specification*					
Main Functional Unit/s:	Qty		Size		Settings		
Fuse Fittings	Qty	✓	Size	✓	Fuse Size	✓	
Circuit Breakers	Qty		Size		Settings		
Motor Protection CB	Rating		Setting		Function		
Neutral	Reqd		Size		ID		
Equipment Earthing	Checked	✓	Size	✓			
C.T.s	Qty		Rating		Pri Inject		
Torroid	Qty		Rating		Function		
Meters	Qty		Rating		Function		
Contactors	Qty		Rating		Voltage		
Overloads	Qty		Rating		Function		
Relays	Qty		Rating		Voltage		
Timers	Qty		Rating		Voltage		
Control Switches	Qty		Rating		Function		
Push Buttons	Qty		Rating		Function		
Pilot Lights	Qty		Rating		Voltage		
Transformer	Qty		Rating		Voltage		
DC Supply	Qty	✓	Rating	✓	Voltage	✓	
ATT	Qty		Rating		Function		
VFD	Qty		Rating		Function		
Soft Starter	Qty		Rating		Function		
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type		Label		IP rating		
JPR Safety Guide	Fitted		Cell Clean				
Earth Leakage Unit	Qty		Size		Function		
Remote I/O Unit	Qty		Size		Function		
General Check List:							
IP Sealing	Rating	✓					
Door Latches	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required		Type		Operation		
Circuit Schedule	Markup	✓	Checked		Supplied		
Terminal Tightness	Power	✓	Control	✓	Result	✓	
Polarity Check	R - R		W - W		B - B		
Continuity Check	R - R		W - W		B - B	N - N	
Earth Continuity	Body to E	✓	Door to E	✓	Panel to E	✓	
Insulation Test	R to E	W to E	B to E	R to W	R to B	W to B	N to E
1000V Test (MΩ)							
Partially Checked Circuits - Point to Point							
Comments:							

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
INDIVIDUAL DRIVES

Customer Name:	BMD						
Project:	Urban Utilities - Axis Place - SPS - SP315						
JPR Job No:	N 41900		**Item:**	Pump No 2 VSD + Control			
Constructed by:	R Kompenhans		**Tested by:**	E Ensor		**Date:**	13/12/10
Item Check List:			***To comply with Drawings, Documents & Specification***				
Main Functional Unit/s:	Qty	✓	Size	✓	Settings	✓	
Fuse Fittings	Qty		Size		Fuse Size		
Circuit Breakers	Qty	✓	Size	✓	Settings		
Motor Protection CB	Rating		Setting		Function		
Neutral	Reqd.	✓	Size	✓	ID	✓	
Equipment Earthing	Checked	✓	Size	✓			
C.T.s	Qty		Rating		Pri Inject		
Torroid	Qty		Rating		Function		
Meters	Qty		Rating		Function		
Contactors	Qty	✓	Rating	✓	Voltage	✓	
Overloads	Qty		Rating		Function		
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty		Rating		Voltage		
Control Switches	Qty		Rating		Function		
Push Buttons	Qty		Rating		Function		
Pilot Lights	Qty		Rating		Voltage		
Transformer	Qty		Rating		Voltage		
DC Supply	Qty		Rating		Voltage		
ATT	Qty		Rating		Function		
VFD	Qty	✓	Rating	✓	Function	✓	
Soft Starter	Qty		Rating		Function		
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓	
JPR Safety Guide	Fitted		Cell Clean				
Earth Leakage Unit	Qty		Size		Function		
Remote I/O Unit	Qty		Size		Function		
General Check List:							
IP Sealing	Rating	✓					
Door Latches	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required	✓	Type	✓	Operation	✓	
Circuit Schedule	Markup	✓	Checked		Supplied		
Terminal Tightness	Power	✓	Control	✓	Result	✓	
Polarity Check	R - R	✓	W - W	✓	B - B	✓	
Continuity Check	R - R	✓	W - W	✓	B - B	✓	N - N
Earth Continuity	Body to E	✓	Door to E	✓	Panel to E	✓	
Insulation Test	R to E	W to E	B to E	R to W	R to B	W to B	N to E
1000V Test (MΩ)							
Partially Checked Circuits - Point to Point							
Comments:							

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
INDIVIDUAL DRIVES

Customer Name:	BMD						
Project:	Urban Utilities – Axis Place – SPS – SP315						
JPR Job No:	M41900		**Item:**	Pump No1 VSD + Control			
Constructed by:	R Kompenhans		**Tested by:**	E Ensor		**Date:**	13/12/10
Item check list:	***To comply with Drawings, Documents & Specification***						
Main Functional Unit/s:	Qty	✓	Size	✓	Settings	✓	
Fuse Fittings	Qty		Size		Fuse Size		
Circuit Breakers	Qty	✓	Size	✓	Settings		
Motor Protection CB	Rating		Setting		Function		
Neutral	Reqd	✓	Size	✓	ID	✓	
Equipment Earthing	Checked	✓	Size	✓			
C.T.s	Qty		Rating		Pri Inject		
Torroid	Qty		Rating		Function		
Meters	Qty		Rating		Function		
Contactors	Qty		Rating		Voltage		
Overloads	Qty		Rating		Function		
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty		Rating		Voltage		
Control Switches	Qty		Rating		Function		
Push Buttons	Qty		Rating		Function		
Pilot Lights	Qty		Rating		Voltage		
Transformer	Qty		Rating		Voltage		
DC Supply	Qty		Rating		Voltage		
ATT	Qty		Rating		Function		
VFD	Qty	✓	Rating	✓	Function	✓	
Soft Starter	Qty		Rating		Function		
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓	
JPR Safety Guide	Fitted		Cell Clean				
Earth Leakage Unit	Qty		Size		Function		
Remote I/O Unit	Qty		Size		Function		
General Check List:							
IP Sealing	Rating	✓					
Door Latches	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required	✓	Type	✓	Operation	✓	
Circuit Schedule	Markup	✓	Checked		Supplied		
Terminal Tightness	Power	✓	Control	✓	Result	✓	
Polarity Check	R - R	✓	W - W	✓	B - B	✓	
Continuity Check	R - R	✓	W - W	✓	B - B	✓	N - N
Earth Continuity	Body to E	✓	Door to E		Panel to E		
Insulation Test	R to E	W to E	B to E	R to W	R to B	W to B	N to E
1000V Test (MΩ)							
Partially Checked Circuits - Point to Point							
Comments:							

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
INDIVIDUAL DRIVES

Customer Name:	BMD							
Project:	Urban Utilities - Axis Place - SPS - SP315							
JPR Job No:	JN 41900			**Item:**	Distribution Board			
Constructed by:	R Kompenhans			**Tested by:**	E Ensor		**Date:**	13/12/10
Item check list:	***To comply with Drawings, Documents & Specification***							
Main Functional Unit/s:	Qty	✓		Size	✓	Settings	✓	
Fuse Fittings	Qty			Size		Fuse Size		
Circuit Breakers	Qty	✓		Size	✓	Settings		
Motor Protection CB	Rating			Setting		Function		
Neutral	Reqd	✓		Size	✓	ID	✓	
Equipment Earthing	Checked	✓		Size	✓			
C.T.s	Qty			Rating		Pri Inject		
Torroid	Qty			Rating		Function		
Meters	Qty			Rating		Function		
Contactors	Qty			Rating		Voltage		
Overloads	Qty			Rating		Function		
Relays	Qty			Rating		Voltage		
Timers	Qty			Rating		Voltage		
Control Switches	Qty			Rating		Function		
Push Buttons	Qty			Rating		Function		
Pilot Lights	Qty			Rating		Voltage		
Transformer	Qty			Rating		Voltage		
DC Supply	Qty			Rating		Voltage		
ATT	Qty			Rating		Function		
VFD	Qty			Rating		Function		
Soft Starter	Qty			Rating		Function		
Terminals	Qty			Size		ID		
Engraving	Qty	✓		Size	✓	ID	✓	
Cabling	Type	✓		Size	✓	ID	✓	
Busbars	Type			Size		ID		
Escutcheons / Shrouds	Type	✓		Label		IP rating		
JPR Safety Guide	Fitted			Cell Clean				
Earth Leakage Unit	Qty			Size		Function		
Remote I/O Unit	Qty			Size		Function		
General Check List:								
IP Sealing	Rating	✓						
Door Latches	Qty	✓		Type	✓	Operation	✓	
Ventilation	Required			Type		Operation		
Circuit Schedule	Markup	✓		Checked		Supplied		
Terminal Tightness	Power	✓		Control	✓	Result	✓	
Polarity Check	R - R	✓		W - W	✓	B - B	✓	
Continuity Check	R - R	✓		W - W	✓	B - B	✓	N - N
Earth Continuity	Body to E	✓		Door to E	✓	Panel to E	✓	
Insulation Test	R to E	W to E		B to E	R to W	R to B	W to B	N to E
1000V Test (MΩ)								
Partially Checked Circuits -	Point to Point							
Comments:								

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
EARTH LEAKAGE TEST

Customer Name:	BMD			
JPR Job No:	NN 41900	**Item:**	Axis Place SPS - SP315	
Constructed by:	R Kamponhans	**Tested by:**	E Ensor	**Date:** 3/12/10
Test Unit	Megger RCDT330	✓	**Other**	

Circuit Breaker	Phase	Rated Current (mA)		Trip Current (mA)		Trip Time (mS)	Comments
	R	30		23		22	
Q11	W	30		23		20.2	
	B	30		23		20.2	
Q12		30		25		28.3	
Q13		30		23		28.6	
Q16		30		25		33	
Q19		30		25		28.6	
Q21		30		25		28.6	

Comments:-

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SWITCHBOARD CONTINUITY & INSULATION TEST REPORT

Customer Name:	BMD		
Project:	Urban Utilities - Axis Place Sewage Pumping Station		
JPR Job No:	JN 41900	**Switchboard:**	SP 315
Constructed by:	R Kompenhaus	**Tested by:**	E Ensor
		Date:	3/12/10

CONTINUITY TEST

From	To	Red	White	Blue	Neutral

Sketch:

INSULATION TESTS TO SECTION 8 OF AS3439.1

Designation	1000 V Test (MΩ)	2.5 kV Test (1min)	1000 V Test (MΩ)
Red to Earth	500		500
White to Earth	500		500
Blue to Earth	500		500
Neutral to Earth			
Red to White	500		500
Red to Blue	500		500
White to Blue	500		500
Comments:	Mains Supply		Gen Supply

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SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

Customer Name: BMD

Project: Urban Utilities - AXIS Place Sewage Pumping Station

JPR Job No: M 41900 **Item:** SP315

Constructed by: R Kompeonhans **Tested by:** E Ensor **Date:** 13/12/10

Item check list:		*To comply with Drawings, Documents & Specification*					
Main Functional Unit/s	Qty	✓	Size	✓	Settings	✓	
Fuse Fittings	Qty		Size		Fuse Size		
Circuit Breakers	Qty	✓	Size	✓	Settings	✓	
Motor Protection C.B.	Rating		Setting		Function		
Neutral	Reqd	✓	Size	✓	ID	✓	
Equipment Earthing	Checked	✓	Size	✓			
C.T.s	Qty		Rating		Pri Inject.		
Meters	Qty		Rating		Function		
Contactors	Qty	✓	Rating	✓	Voltage	✓	
Overloads	Qty		Rating		Function		
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty	✓	Rating	✓	Voltage	✓	
Control Switches	Qty	✓	Rating	✓	Function	✓	
Push Buttons	Qty	✓	Rating	✓	Function	✓	
Pilot Lights	Qty	✓	Rating	✓	Voltage	✓	
Transformers	Qty	✓	Rating	✓	Voltage	✓	
ATT/VFD/Soft Starter	Qty	✓	Rating	✓	Function	✓	
DC Supply	Qty	✓	Rating	✓	Voltage	✓	
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID	✓	
Cabling	Type	✓	Size	✓	ID	✓	
Busbars	Type	✓	Size	✓	ID	✓	
Escutcheons / Shrouds	Type	✓	Label	✓	IP rating	✓	
S.A. Metering CTs	Qty		Rating				
S.A Metering Links	Type	✓					
S.A. Meters	Type		Size				
JPR Label	Fitted	✓	Stamped	✓	Safety Stkr	✓	
Legend Card	Qty	✓	Correct	✓			
PLC/Telemetry	Qty	✓	Size	✓			
Power Monitor Relay	Qty		Rating		Function		

General Check List:								
IP Sealing	Rating	✓						
Door Latches/Hinges	Qty	✓	Type	✓	Operation	✓		
Ventilation	Required	✓	Type	✓	Operation	✓		
Circuit Schedule	Markup	✓	Checked		Supplied			
Terminal Tightness	Power	✓	Control	✓	Result	✓		
Busbar System	Clearances	✓	Joints	✓	ID	✓		
Earth Continuity	Body to E	✓	Doors to E	✓	Panels to E	✓		
Cubicle Cleaned		✓						
Paint Finish Intact		✓						
Polarity Check	R - R	✓	W - W	✓	B - B	✓		
Function	Power	✓	Control	✓	PLC/Telem	✓		
Continuity Check	R - R	✓	W - W	✓	B - B	✓	N - N	✓

Comments:

Form No. F1018/3

J. & P. RICHARDSON INDUSTRIES PTY. LTD.
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CLIENT: BMD				JOB NO: 541400	
PRODUCT DESCRIPTION: SP315 AXIS PLACE SEWAGE PUMP STATION				DRAWING & SCHEDULE NUMBERS 146/517-0070-000 R10 C41400 A0 — A1	
CONSTRUCTION	QUALITY		COMPLIANCE WITH DRAWINGS		REMARKS OR ACTION
	GOOD	POOR	YES	NO	
1. Folds			✓		
2. Welds			✓		
3. Edges / File			✓		
4. Gauge			✓		
5. Material			✓		
6. Ventilation Openings / Filter Bracket			✓		
7. Water Ingress Test			✓		
8. Equipment Mounting Arrangement			✓		
9. Doors Stiffened			✓		
10. Escutcheons and Lexan Covers			✓		
11. Cable Saddles			✓		
12. Grinding			✓		
13. Door Stays Fitted			✓		
14. Earth Studs			✓		
15. Rubber Retainer				✓	
16. Drawing Holder			✓		
17. Hat Sections			✓		
18. Locking Bars Fitted			✓		
19. External Crevice Welded and Ground			✓		
20. Legend Cards			✓		
21. General Conditions Satisfactory			✓		
22. Cabinet Clean			✓		
23. Job Name and Number Marked			✓		
INSPECTED BY: JBat			DATE: 20-10-10		

AFFIX STATUS HERE

Yellow — Awaiting Inspection
Green — Inspected/Tested Passed
Red — Inspected/Tested Awaiting Rectification

J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

Form No. F1017/3

SWITCHBOARD & SHEETMETAL INSPECTION REPORT

Customer Name: BMD
Item: SP315 AXIS PLACE SEWAGE PUMP SWITCHBOARD
Job No: 541900 M41900
Drawing No: 486/5/7-0070-000 E1D-C41900-A0,A1

TASK	PRODUCT DETAIL	INSPECTED BY	DATE	PASS / FAIL	CORRECTIVE ACTION REQUEST OR COMMENTS
Design	Documents	BJ	30-9-10	✓	
Drafting	Documents				
Sheetmetal (Refer F1018 for details)	Switchboard		20-10-10	P	
	Doors				
	Cell/Panels			P	
Painting					
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior					
Colour Internal			25/10/10	PASS	
Colour Panels					
Cubicle Erection					
Electrical Fitout (In accordance with drawings)	Re-Completion				
Inspection & Test (Refer to F1019)		EEnsor	20/12/10	Pass	
		TCraig	20/12/10	Pass	
Packing					

Comments:

All Req Are Done 25/10/10 DAVE

Fix Status Here: -

Yellow	Awaiting Inspection
Green	Inspection & Test Passed
Red	Inspection & Test Failed, Awaiting Rectification

8.0 SWITCHBOARD WORKS TEST RESULTS

9.0 "AS CONSTRUCTED" DRAWINGS

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12

NAME of SIGNATORY: Rob Miotti

RPEQ No. or LICENCE: 19972

COMPANY NAME: JPR

START DATE: FINISH DATE: 1.5.12

QUEENSLAND Urban Utilities

SP315 AXIS PLACE SEWAGE PUMPING STATION

SITE COVER SHEET

ELECTRICAL DRAWINGS INDEX

DWG N°.	TITLE	SHEET	REVISIONS
486/5/7-0070-000	SITE COVER SHEET	00	P1 0 A B
486/5/7-0070-001	POWER DISTRIBUTION SCHEMATIC DIAGRAM	01	P1 0 A B
486/5/7-0070-002	PUMP 01 SCHEMATIC DIAGRAM	02	P1 0 A B
486/5/7-0070-003	PUMP 02 SCHEMATIC DIAGRAM	03	P1 0 A B
486/5/7-0070-004	*RESERVED (SUMP PUMP)*	04	
486/5/7-0070-005	*RESERVED (GENERATOR CONTROL)*	05	
486/5/7-0070-006	COMMON CONTROLS SCHEMATIC DIAGRAM	06	P1 0 A B
486/5/7-0070-007	COMMON RTU I/O SCHEMATIC DIAGRAM	07	P1 0 A B
486/5/7-0070-008	RTU POWER DISTRIBUTION SCHEMATIC DIAGRAM	08	P1 0 A B
486/5/7-0070-009	RTU DIGITAL INPUTS TERMINATION DIAGRAM	09	P1 0 A B
486/5/7-0070-010	RTU DIGITAL INPUTS TERMINATION DIAGRAM	10	P1 0 A B
486/5/7-0070-011	RTU DIGITAL OUTPUTS TERMINATION DIAGRAM	11	P1 0 A B
486/5/7-0070-012	RTU ANALOGS & MISCELLANEOUS TERMINATION DIAGRAM	12	P1 0 A B
486/5/7-0070-013	*RESERVED (COMMON CONTROLS TERMINATION DIAGRAM)*	13	
486/5/7-0070-014	EQUIPMENT LIST	14	P1 0 A B
486/5/7-0070-015	CABLE SCHEDULE	15	P1 0 A B
486/5/7-0070-016	SWITCHBOARD LABEL SCHEDULE	16	P1 0 A B
486/5/7-0070-017	SWITCHBOARD CONSTRUCTION DETAILS	17	P1 0 A B
486/5/7-0070-018	SWITCHBOARD CONSTRUCTION DETAILS	18	P1 0 A B
486/5/7-0070-019	LEVEL PROBES AND PRESSURE TRANSMITTER INSTALLATION DETAILS	19	P1 0 A B
486/5/7-0070-020	CATHODIC PROTECTION UNIT - CONSTRUCTION AND WIRING DETAILS	20	P1 0 A B
486/5/7-0070-021	FIELD DISCONNECTION BOX	21	P1 0 A B
486/5/7-0070-022	SWITCHBOARD GENERAL ARRANGEMENT ELEVATIONS - DOUBLE SIDED	22	P1 0 A B
486/5/7-0070-023	SWITCHBOARD GENERAL ARRANGEMENT SECTIONS - DOUBLE SIDED	23	P1 0 A B
486/5/7-0070-024	*RESERVED (GENERATOR EXTERNAL CONNECTION BOX)*	24	
486/5/7-0070-025	SLAB & CONDUIT DETAILS	25	P1 0 A B

STANDARD VARIABLES

DESCRIPTION	VALUES
CT METERING ISOLATOR	400A SLB 400 3P
NORMAL SUPPLY MAIN SWITCH	400A S400GE/3400
GENERATOR SUPPLY MAIN SWITCH	400A S400GE/3400
PUMP1 CIRCUIT BREAKER	250A S250GJ/3250
PUMP2 CIRCUIT BREAKER	250A S250GJ/3250
DRY WELL SUMP PUMP CIRCUIT BREAKER	*NOT APPLICABLE*
PUMP VSD SIZE	FC202P75 75kW
PUMP RATING	73kW 129A
PUMP EM.STOP CONTACTOR	CA6-140
PUMP SUPPLY CABLE	50mm²
PUMP MOTOR CABLE	2x35mm²
VSD 3 PHASE SUPPLY CABLE	50mm²
SUMP PUMP RATING	*NOT APPLICABLE*
SUMP PUMP CONTACTOR & TOL	*NOT APPLICABLE*
WET WELL LEVEL TRANSMITTER	FMX21.AA.2.2.1H.G.D.11.A.POPS 10m
EMERGENCY STORAGE WELL LEVEL TRANSMITTER	*NOT APPLICABLE*
DELIVERY PRESSURE TRANSMITTER	BR52XXGG1FHPMAS, L=100 50m
WET WELL ULTRASONIC LEVEL SENSOR	*NOT APPLICABLE*
FLOWMETER RANGE	150l/s
RADIO	DR900-06A02-D0
EMERGENCY PUMPING TIME	tbasec
No of SINGLE POINT PROBES.	3
INCOMING MAINS SUPPLY CABLE	tbamm²
MAIN EARTHING CABLE	35mm²
INCOMING GENERATOR SUPPLY CABLE	*NOT APPLICABLE*

STANDARD DESIGN OPTIONS

OPTION	DESCRIPTION	FITTED
A	INDIVIDUAL PUMP MOISTURE IN OIL (MIO) SENSOR AND FAULT RELAY	YES ☒
B	*INDIVIDUAL PUMP MOTOR AUX PROTECTION SENSORS AND FAULT RELAYS*	☒ NO
C	*INDIVIDUAL PUMP REFLUX VALVE MICROSWITCH*	☒ NO
D	*STATION MANHOLE SURCHARGE IMMINENT*	☒ NO
E	*STATION DRY WELL SUMP PUMP AND LEVEL INDICATION SENSORS AND RELAYS*	☒ NO
F	*STATION PERMANENT GENERATOR - ATS AND CONTROL CONNECTIONS*	☒ NO
G	*STATION EMERGENCY STORAGE LEVEL SENSOR*	☒ NO
H	STATION DELIVERY FLOWMETER - 24vDC ENDRESS & HAUSER	YES ☒
I	BACKUP COMMUNICATION - GSM	YES ☒
J	PUMP CONNECTION (Via Field Disconnect Box)	YES ☒
K	CATHODIC PROTECTION	YES ☒
L	MOTOR THERMISTORS (Via Field Disconnect Box)	YES ☒
M	*ODOUR CONTROL*	☒ NO
N	CURRENT TRANSFORMER (CT) METERING	YES ☒
O	*PUMPS ELECTRICAL INTERLOCK*	☒ NO
P	WET WELL WASHER	YES ☒
Q	VALVE PIT SUMP PUMP AND LEVEL PROBE	YES ☒
R	TELEMETRY RADIO	YES ☒
S	*WET WELL ULTRASONIC LEVEL SENSOR*	☒ NO
T	DOUBLE SIDED SWITCHBOARD	YES ☒
U	DELIVERY PRESSURE TRANSMITTER	YES ☒
V	*CHEMICAL DOSING*	☒ NO

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 756
	ELECTRICIAN - DATE: 27.04.12

No.	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE		
DRAFTING CHECK	A.WITTHOFT		
CAD FILE	57-0070set_C		
B.C.C. FILE No.			

Original Signed by A.WITTHOFT	8695	21-04-08	Original Signed by K.VAHEESAN		24-04-08
DESIGN	R.P.E.Q. No.	DATE	PRINCIPAL DESIGN MANAGER		DATE
Original signed by R.JANFADA	5192	21-04-08	Original Signed by P.SHERRIFF		22-04-08
DESIGN CHECK	R.P.E.Q. No.	DATE	CLIENT DELEGATE		DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 009 852 325 114 CAMPBELL AVE. BROOK. QLD 4076

JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE: SP315 AXIS PLACE SEWAGE PUMP STATION

TITLE: SITE COVER SHEET

Sheet 00

AS INSTALLED

SHEET No. 0

Queensland Urban Utilities DRAWING No. 486/5/7-0070-000

AMEND. C

STD TEMPLATE SP-3P-150-ATU Ver1.0

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NOTES

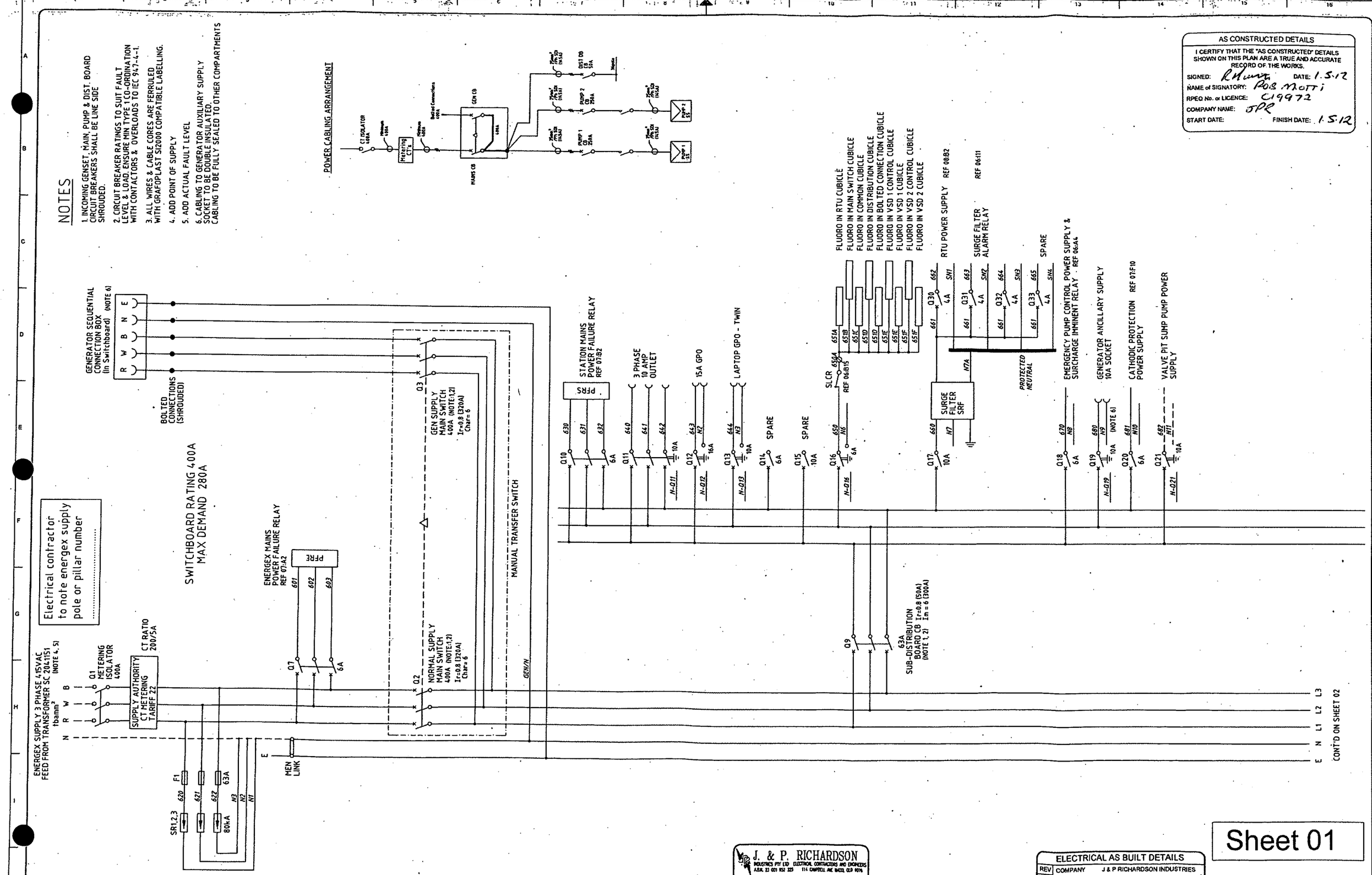
1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD. ENSURE MIN TYPE 1 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. ADD POINT OF SUPPLY
5. ADD ACTUAL FAULT LEVEL
6. CABLING TO GENERATOR AUXILIARY SUPPLY SOCKET TO BE DOUBLE INSULATED CABLING TO BE FULLY SEALED TO OTHER COMPARTMENTS

POWER CABLING ARRANGEMENT

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: R Hunt DATE: 1.5.12
NAME of SIGNATORY: Rob Motti
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12



Sheet 01

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-JP-V02-RTB Ver1.0

DRAFTED	P.HAGUE	B.C.C. FILE No.	
DRAFTING CHECK	A.WITTHOFT		
CAD FILE	67-0070set_C		

Original Signed by A.WITTHOFT	6895	21-04-08	Original Signed by K.VAHEESAN	24-04-08
DESIGN	R.P.E.Q. No.	DATE	PRINCIPAL DESIGN MANAGER	DATE
Original signed by R.JANFADA	5192	21-04-08	Original Signed by P.SHERRIFF	22-04-08
DESIGN CHECK	R.P.E.Q. No.	DATE	CLIENT DELEGATE	DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 852 325 114 CAMPBELL AVE BACCI, QLD 4076
PH. (07) 3271 3511 FAX (07) 3271 3523 Email: jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 758
	ELECTRICIAN - DATE: 27.04.12

TITLE
POWER DISTRIBUTION
SCHEMATIC DIAGRAM

SHEET No. 1

Queensland Urban Utilities DRAWING No. 486/5/7-0070-001 AMEND. C

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CONT'D FROM SHEET 01

E N R W B

Q4 250A
Ir=0.63(157.5A) Char=6 Note 1
1K1
100
Q4-1 6A

FIELD DISCONNECT BOX
EARTH RAIL
NOTE 5

DANFOSS FC202P75 75kW VSD 1U1
91 92 93 95(PE)
96 97 98 (PE) 99
SUBMERSIBLE PUMP No1 73kW 129AMPS
NOTE 5
MOTOR THERMISTORS
In FDB
50 33
130 131
100 101

SPEED ADJ. 1kΩ 1W 1Turn
Scn R Bl Gr
120 121 122
50 53 55
S201 OFF ON 0-10V

110 1K20 EMG1 REF 06:B5
OFF ON 1S5 EM.START
110 1K23 EMG1 REF 06:B5
1K21
S10 LOC REM
112 113 114 115
18 RUN COMMAND
29 RUN @ MAX SPEED
19 FAULT RESET
12 COMMON
27 COASTING STOP
32 SETUP 2

S202 OFF ON 0-20mA
54 55
AO00B AO00C
VSD SPEED REFERENCE 4-20mA
REF 02:H14

42 39
AI00+ AI00-
VSD SPEED FEEDBACK 4-20mA
REF 02:G14

READY/ AUTO 4 5
DI06+ DI06
VSD READY/ IN AUTO
REF 02:C12

103 1 RUNNING 2 104
1K3
VSD RUNNING
REF 02:C12, 02:E5

MODBUS 68 69
FROM GRAPHIC DISPLAY REF 08:I11
RS485A+ RS485A- Cable 17
RS485B+ RS485B- Cable 18
TO VSD 2 REF 03:E5

101 1S3 E/STOP
103
1K1
PUMP E.STOP CONTACTOR
REF 02:A3
1K3
107 HRM1
HOURS RUN METER

1FC Thermostat 30°C
108
CUBICLE FAN

101 1K2
CONTROL CCT 'POWER ON' RELAY
REF 02:B12

100N

CONT'D ON SHEET 03

24 VDC POWER SUPPLY
REFER SHEET 08:I7
J17- J17+

1K7
GRUNDFOS IO 111 MODULE
113R1 R1
1K21 116R2 R2
1S4 RESET
RESET
ALARM 1K7
T1 T2
1 = Healthy, 0 = Fault
J17+A 1K7A
CONTROL CCT 'POWER ON' RELAY
REF 02:C12

PUMP CASING
Br 200 102 140 P4 +
Wh 201 103 141 P5 -
SENSOR
MOISTURE IN OIL PROBE
1 2 3 4 5 6 7 8 9 10
MOISTURE IN OIL

RTU DIGITAL INPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 08:C7

2A 1 J6+ J6- DI1-COM 2 DI1-COM P1-19 CM
DI1-24V

DI00	1K2	P1-01	0	DI-00	CONTROL POWER
DI01	1S1	P1-02	1	DI-01	START PUSHBUTTON
DI02	1S2	P1-03	2	DI-02	STOP PUSHBUTTON
DI03	1S3	P1-04	3	DI-03	E/STOP PUSHBUTTON
DI04	1S4	P1-05	4	DI-04	RESET PUSHBUTTON
DI05	1K3	P1-06	5	DI-05	RUNNING
DI06	READY/AUTO 4 5 / 1K7A	P1-07	6	DI-06	STARTER HEALTHY
DI07		P1-08	7	DI-07	MOISTURE IN OIL 0 = Healthy, 1 = Fault
DI08		P1-09	8	DI-08	SPARE
DI09		P1-10	9	DI-09	SPARE

CONT'D ON SHEET 07 | CONT'D ON SHEET 07

RTU DIGITAL OUTPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 08:C7

DO1+24V CM P4-01 DO1+24V 2A 105 J6+ J6- 106 DO1-COM

DO-00	0 NO	DO00	P4-02	107	1K20	RUN COMMAND REF 02:B4
DO-01	1 NO	DO01	P4-03	109	1K21	FAULT RESET REF 02:D4, 02:H5
DO-02	2 NO	DO02	P4-04	111	1K22	EMERGENCY MODE INTERRUPT REF 06:C4
DO-03	3 NO	DO03	P4-05	113	1K23	RUN AT MAX REF 02:C4

CONT'D ON SHEET 07 | CONT'D ON SHEET 07

RTU ANALOG INPUTS

AI-02 2+ AI02+ P5-05 500mA 153 AI02A VSD 42 39 REF 02:C8
2- AI02- P5-06 154
VSD SPEED FEEDBACK 4-20mA

RTU ANALOG OUTPUTS

AO-00 0+ AO00+ P6-01 500mA 167 AO00A 1LI OUT IN AO00B VSD 54 55 REF 02:C8
0- AO00- P6-02 168 AO00C
VSD SPEED REFERENCE 4-20mA

LEGEND:

- ⌀ SWITCHBOARD CONTROL TERM
- ▣ FIELD TERMINAL
- ◪ RTU TERMINAL
- ■ VSD TERMINAL
- ● RTU MARSH. FUSE TERMINAL
- ○ RTU MARSH. LINK TERMINAL

DI1-02 RTU DIGITAL INPUT
DO1-02 RTU DIGITAL OUTPUT
AI1-02 RTU ANALOGUE INPUT
AO1-02 RTU ANALOGUE OUTPUT

NOTES

1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD ENSURE MIN TYPE 1 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. FAULT LEVEL OF 20kA AT 415V FOR 0.2sec.
5. USE CABLE CLAMPS TO MAINTAIN CONTINUITY OF CABLE SCREENING THROUGH FIELD DISCONNECT BOX. DO NOT USE PIGTAILS: SEE SHEET 18 DETAIL L1 & L2

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.
SIGNED: RMiotti DATE: 1.5.12
NAME of SIGNATORY: ROB MIOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12.

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES CONTRACTOR LICENCE No. 756 ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-SP-VSD-RTU Ver1.0

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT 8895 21-04-08	Original Signed by K.VAHEESAN 24-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No. DATE	PRINCIPAL DESIGN MANAGER DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192 21-04-08	Original Signed by P.SHERRIFF 22-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No. DATE	CLIENT DELEGATE DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 001 952 325 114 CAMPBELL AVE WOOL QLD 4076
JPR Project No.: E10-C41900

Queensland Urban Utilities

SITE: SP315 AXIS PLACE SEWAGE PUMP STATION

TITLE: PUMP No1 SCHEMATIC DIAGRAM

SHEET No. 2
Queensland Urban Utilities DRAWING No. 486/5/7-0070-002
AMEND. C

Sheet 02
AS INSTALLED

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CONT'D FROM SHEET 02

E N R W B

Q5 250A
Ir=0.63(157.5A) Char= 6 Note 1
2K1
200
Q5-1 6A

SPEED ADJ. 1kΩ 1W 1Turn
Scn R Bl Gr
220 221 222
50 53 55
S201 OFF ON 0-10V

FIELD DISCONNECT BOX
EARTH RAIL
NOTE 5

DANFOSS FC202P75 75kW VSD 2U1
91 92 93 95(PE)
96 97 98 (PE) 99

SUBMERSIBLE PUMP No2 73kW 129AMPS
NOTE 5
MOTOR THERMISTORS
50 230 200
33 231 201
In FDB

210 2K20 EMG2 OFF ON REF 06:C6
210 2S5 EM.START
2K23 EMG2 REF 06:C6
2K21
212 18 RUN COMMAND
213 29 RUN @ MAX SPEED
214 19 FAULT RESET
210 12 COMMON
27 COASTING STOP
215 32 SETUP 2
LOC REM S10

S202 OFF ON 0-20mA
54 AO01B VSD SPEED REFERENCE 4-20mA
55 AO01C REF 03:G14
42 A103+ VSD SPEED FEEDBACK 4-20mA
39 A103- REF 03:G14

READY/ AUTO 4 5
DI22+ DI22 VSD READY/ IN AUTO REF 03:C12

203 1 RUNNING 2 204 2K3 VSD RUNNING REF 03:C12, 03:E5

MODBUS 68 69
FROM VSD 1 REF 02:E5
RS485B+ RS485B- Cable 18

201 2S3 E/STOP
203 2K1 PUMP E.STOP CONTACTOR REF 03:A3
2K3 207 HRM2 HOURS RUN METER

2FC Thermostat 30°C
208 CUBICLE FAN

201 2K2 CONTROL CCT 'POWER ON' RELAY REF 03:B12

200N

24VDC POWER SUPPLY REFER SHEET 08:17
J18- J18+
2K7 GRUNDFOS IO 111 MODULE
213R1 R1 RESET
2K21 214R2 R2
2S4 RESET
ALARM 2K7 T1 T2
1 = Healthy, 0 = Fault
J18+A 2K7A CONTROL CCT 'POWER ON' RELAY REF 03:C12
PUMP CASING
Br 200 202 240 P4 +
Wh 201 203 241 P5 -
SENSOR
MOISTURE IN OIL PROBE
MOISTURE IN OIL

RTU DIGITAL INPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 08:C7

2A 36 J6+ J6- DI2-COM 37 DI2-COM P2-19 CM
DI2-24V
DI16+ 38 2K2 DI16 39 DI16 P2-01 DI16 16 DI-16 CONTROL POWER
DI17+ 40 1S1 DI17 41 DI17 P2-02 DI17 17 DI-17 START PUSHBUTTON
DI18+ 42 1S2 DI18 43 DI18 P2-03 DI18 18 DI-18 STOP PUSHBUTTON
DI19+ 44 2S3 DI19 45 DI19 P2-04 DI19 19 DI-19 E/STOP PUSHBUTTON
DI20+ 46 1S4 DI20 47 DI20 P2-05 DI20 20 DI-20 RESET PUSHBUTTON
DI21+ 48 2K3 DI21 49 DI21 P2-06 DI21 21 DI-21 RUNNING
DI22+ 50 READY/AUTO 4 5 2K7A DI22 51 DI22 P2-07 DI22 22 DI-22 STARTER HEALTHY
DI23+ 52 DI23 53 DI23 P2-08 DI23 23 DI-23 MOISTURE IN OIL 0 = Healthy, 1 = Fault
54 DI24 55 DI24 P2-09 DI24 24 DI-24 SPARE
56 DI25+ 57 DI25 P2-10 DI25 25 DI-25 SPARE
58 DI25-

CONT'D ON SHEET 07 | CONT'D ON SHEET 07

RTU DIGITAL OUTPUTS

+ 24VDC POWER SUPPLY - REFER SHEET 08:C7

CM DO2+24V P4-11 DO2+24V 2A 123 J6+ J6- 124 DO2-COM
DO-08 8 NO DO08 P4-12 DO08 125 2K20 DO8- 126 RUN COMMAND REF 03:B4
DO-09 9 NO DO09 P4-13 DO09 127 2K21 DO9- 128 FAULT RESET REF 03:D4, 03:H5
DO-10 10 NO DO10 P4-14 DO10 129 2K22 DO10- 130 EMERGENCY MODE INTERRUPT REF 06:D4
DO-11 11 NO DO11 P4-15 DO11 131 2K23 DO11- 132 RUN AT MAX REF 03:C4

CONT'D ON SHEET 07 | CONT'D ON SHEET 07

RTU ANALOG INPUTS

AI-03 3+ AI03+ P5-07 AI03+ 500mA 155 AI03A VSD 42 39 REF 03:C8 VSD SPEED FEEDBACK 4-20mA
3- AI03- P5-08 AI03- 156 AI03-

RTU ANALOG OUTPUTS

AO-01 1+ AO01+ P6-03 AO01+ 500mA 169 AO01A 2L1 OUT IN AO01B VSD 54 55 REF 03:C8 VSD SPEED REFERENCE 4-20mA
1- AO01- P6-04 AO01- 170 AO01C

LEGEND:

- ⌀ SWITCHBOARD CONTROL TERM
- ✱ FIELD TERMINAL
- ◪ RTU TERMINAL
- ■ VSD TERMINAL
- ● RTU MARSH. FUSE TERMINAL
- ○ RTU MARSH. LINK TERMINAL
- DI1-02 RTU DIGITAL INPUT
- DO1-02 RTU DIGITAL OUTPUT
- AI1-02 RTU ANALOGUE INPUT
- AO1-02 RTU ANALOGUE OUTPUT

NOTES

1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD ENSURE MIN TYPE 1 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. FAULT LEVEL OF 20kA AT 415V FOR 0.2sec.
5. USE CABLE CLAMPS TO MAINTAIN CONTINUITY OF CABLE SCREENING THROUGH FIELD DISCONNECT BOX. DO NOT USE PIGTAILS. SEE SHEET 18 DETAIL L1 & L2

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.
SIGNED: RMiotti DATE: 1.5.12
NAME of SIGNATORY: ROB MIOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

ELECTRICAL AS BUILT DETAILS
REV C | COMPANY J & P RICHARDSON INDUSTRIES | CONTRACTOR LICENCE No. 756 | ELECTRICIAN - | DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED P.HAGUE
DRAFTING CHECK A.WITTHOFT
CAD FILE 57-0070set_C
B.C.C. FILE No.

Original Signed by A.WITTHOFT 21-04-08 DESIGN
Original signed by R.JANFADA 5192 21-04-08 DESIGN CHECK
Original Signed by K.VAHEESA8895 24-04-08 PRINCIPAL DESIGN MANAGER
Original Signed by P.SHERRIFF 22-04-08 CLIENT DELEGATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 001 952 325 114 CHAPSELL RD WOOL QLD 4676
JPR Project No.: E10-C41900

QUEENSLAND UrbanUtilities

SITE SP315 AXIS PLACE SEWAGE PUMP STATION

TITLE PUMP No2 SCHEMATIC DIAGRAM

SHEET No. 3
Queensland Urban Utilities DRAWING No. 486/5/7-0070-003
AMEND. C

Sheet 03
AS INSTALLED

STD TEMPLATE SP-2P-V50-A10 Rev L12
J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by dos_ba on Friday, 27 April 2012 11:26:28 AM

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: R Motti DATE: 1.5.12

NAME of SIGNATORY: ROB MOTTI

RPEQ No. or LICENCE: 19972

COMPANY NAME: JPR

START DATE: FINISH DATE: 1.5.12

RESERVED FOR DRY WELL SUMP PUMP

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 756
	ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT 21-04-08	Original Signed by K.VAHEESAB895 24-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No. DATE	PRINCIPAL DESIGN MANAGER DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192 21-04-08	Original Signed by P.SHERRIFF 22-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No. DATE	CLIENT DELEGATE DATE

STD TEMPLATE SP-JP-YSO-BTU Ver1/2

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325 114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 3611 FAX. (07) 3271 3622 EMAIL. jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
DRY WELL SUMP PUMP
SCHEMATIC DIAGRAM

Sheet 04

AS INSTALLED

SHEET No. 4

Queensland Urban Utilities DRAWING No. 486/5/7-0070-004

AMEND. C

J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by des_ba on Friday, 27 April 2012 11:28:28 AM

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: R Mutton DATE: 1-5-12

NAME of SIGNATORY: ROB MOTT

RPEQ No. or LICENCE: 9932

COMPANY NAME: JPR

START DATE: FINISH DATE: 1-5-12

RESERVED FOR GENERATOR ATS

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES CONTRACTOR LICENCE No. 756 ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT	21-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No.	DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA	5192 21-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No.	DATE

Original Signed by K.VAHEESAN	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 325 114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 3911 FAX (07) 3271 3933 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
GENERATOR CONTROL
SCHEMATIC DIAGRAM

Sheet 05

AS INSTALLED

SHEET No. 5

Queensland Urban Utilities DRAWING No. 486/5/7-0070-005

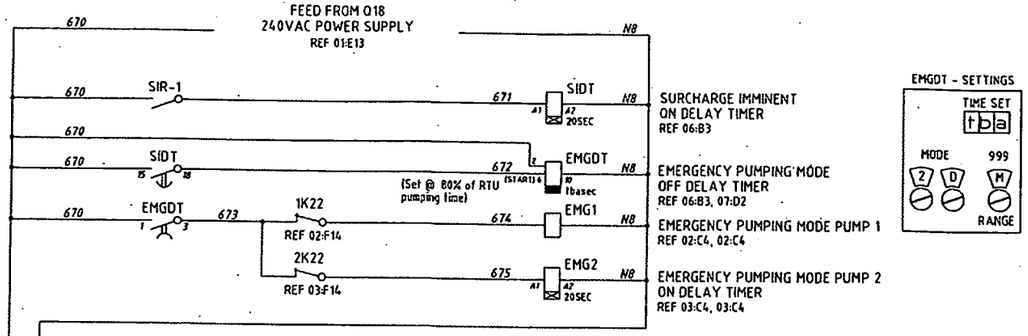
AMEND. C

STD TDPLATE SP-JP-PSD-ATS Ver1.0

J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by dee_ba on Friday, 27 April 2012 11:26:26 AM

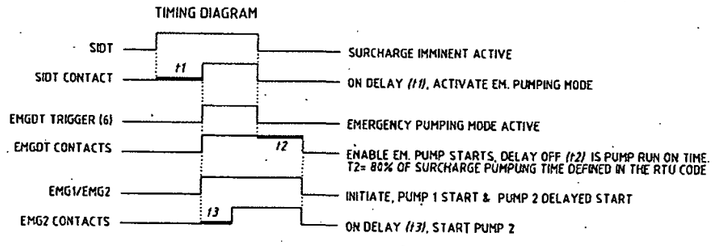
COMMON CONTROL SECTION

EMERGENCY PUMPING MODE (240VAC)



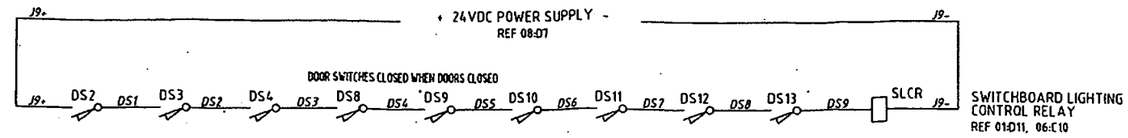
EMGDT - SETTINGS

TIMING DIAGRAM

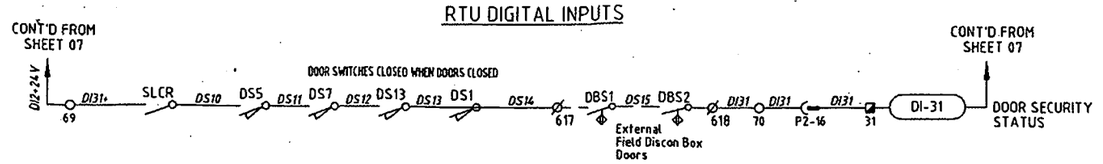


COMMON CONTROL SECTION

SWITCHBOARD INTERNAL LIGHTING



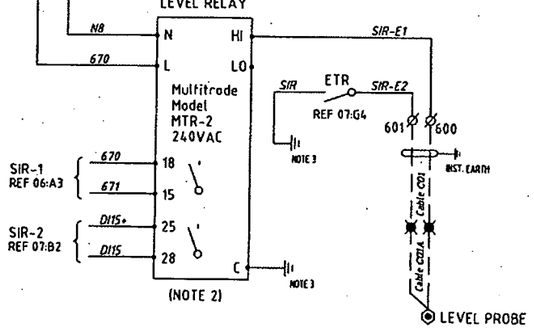
RTU DIGITAL INPUTS



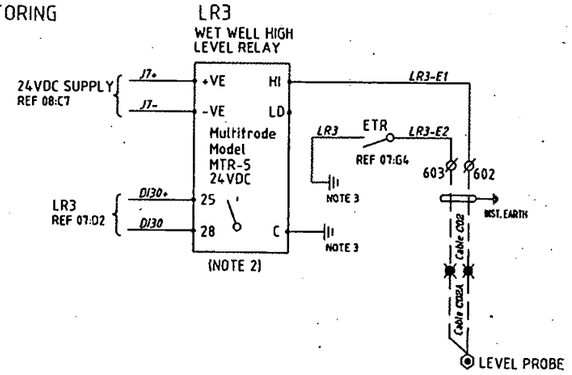
COMMON CONTROL SECTION

LEVEL MONITORING

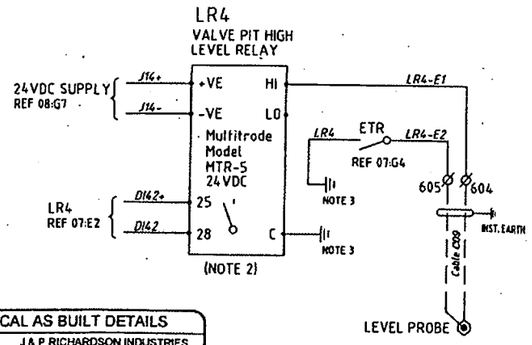
SIR
SURCHARGE IMMINENT LEVEL RELAY



LR3
WET WELL HIGH LEVEL RELAY

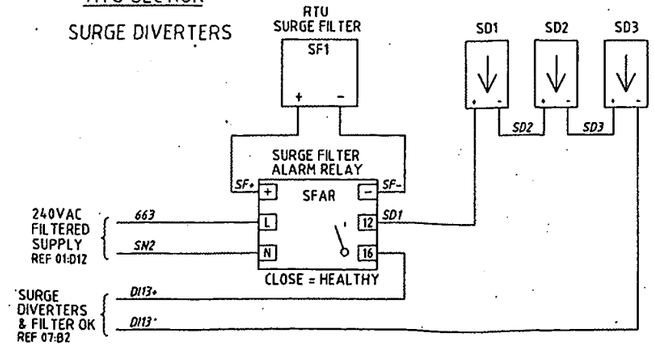


LR4
VALVE PIT HIGH LEVEL RELAY



ATS SECTION

SURGE DIVERTERS



ELECTRICAL AS BUILT DETAILS		
REV	COMPANY J & P RICHARDSON INDUSTRIES	
C	CONTRACTOR LICENCE No. 756	
	ELECTRICIAN -	DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFF	21-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No.	DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192	21-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No.	DATE

Original Signed by K.VAHEESABB95	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 071 852 325 114 CAMPBELL AVE WACOL QLD 4076
PH: (07) 3271 3911 FAX: (07) 3271 3925 EMAIL: jpr@jpr.com.au
JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE: SP315 AXIS PLACE SEWAGE PUMP STATION

TITLE: COMMON CONTROLS SCHEMATIC DIAGRAM

SHEET No. 6

Queensland Urban Utilities DRAWING No.: 486/5/7-0070-006

AMEND.: C

J:\OWG\C41900 QUU\ST-0070set_C.dwg Last Saved by dos_be on Friday, 27 April 2012 08:18 AM

STD TEMPLATE SP-SP-VSD-RTU Ver1.12

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

Sheet 06

AS INSTALLED

RTU DIGITAL INPUTS

CONT'D FROM SHEET 02

DI1+24V	24		25	DI10	P1-11	DI10	10	DI-10	SPARE	
	26	DI11+ PFRE	27	DI11	P1-12	DI11	11	DI-11	ENERGEX MAINS POWER	REF 01:F4
	28	DI12+ PFRS	29	DI12	P1-13	DI12	12	DI-12	STATION MAINS POWER	REF 01:D7
	30	DI13+ SFAR SD1,2&3	31	DI13	P1-14	DI13	13	DI-13	SURGE DIVERTERS OK	REF 06:J11
	32	DI14+ LOC REM S10	33	DI14	P1-15	DI14	14	DI-14	STATION LOCAL/REMOTE SWITCH	
	34	DI15+ SIR-2	35	DI15	P1-16	DI15	15	DI-15	SURCHARGE IMMINENT	REF 06:G2

CONT'D FROM SHEET 03

DI2+24V	59		60	DI26	P2-11	DI26	26	DI-26	SPARE	
	61	DI27+ BOK	62	DI27	P2-12	DI27	27	DI-27	RTU BATTERY OK	REF 08:C4
	63	DI28+ RTU	64	DI28	P2-13	DI28	28	DI-28	RTU CONTROL POWER	REF 08:C4
	65	DI29+ EMGDT 9 11	66	DI29	P2-14	DI29	29	DI-29	EMERGENCY PUMPING MODE	REF 06:B3
	67	DI30+ LR3	68	DI30	P2-15	DI30	30	DI-30	WET WELL HIGH LEVEL	REF 06:F6

CONT'D ON SHEET 06

+ 24VDC POWER SUPPLY - REFER SHEET 08:C7

DI3-24V	2A 71	J6+	72	DI3-COM	P3-19	DI3-COM CM				
	73	DI32+ Q2 REF 01:H6	74	DI32	P3-01	DI32	32	DI-32	NORMAL SUPPLY CB CLOSED	
	75		76	DI33	P3-02	DI33	33	DI-33	DI33 TO DI41 SPARES RESERVED FOR GENERATOR CONTROL	
	91		92	DI41	P3-10	DI41	41	DI-41		
	93	DI42+ LR4	94	DI42	P3-11	DI42	42	DI-42	VALVE PIT HIGH LEVEL	REF 06:I2
	95	DI43+ RESET 5 6	96	DI43	P3-12	DI43	43	DI-43	CATHODIC PROTECTION FAULT RESET	REF 20:A5
	97		98	DI44	P3-13	DI44	44	DI-44	DI44 TO DI47 SPARES RESERVED FOR DRY WELL SUMP PUMP	
	103		104	DI47	P3-16	DI47	47	DI-47		

RTU DIGITAL OUTPUTS

CONT'D FROM SHEET 02

DO1+24V	DO-04	4 NO	DO04	P4-06	115	ETR	DO04-	116	ELECTRODE TEST RELAY	REF 06:F4, 06:F8, 06:H4
	DO-05	5 NO	DO05	P4-07	117	WWR	DO05-	118	WETWELL WASHER AUX RELAY	REF 11:E9
	DO-06	6 NO	DO06	P4-08	119			120	SPARE - RESERVED FOR DRY WELL ALARM STROBE	
	DO-07	7 NO	DO07	P4-09	121			122	SPARE - RESERVED FOR ODOUR CONTROL UNIT	

CONT'D FROM SHEET 03

DO2+24V	DO-12	12 NO	DO12	P4-16	133			134	SPARE - RESERVED FOR GEN. CONTROL	
	DO-13	13 NO	DO13	P4-17	135	K1 7 2	DO13-	136	CATHODIC PROTECTION REMOTE INTERRUPT	REF 20:A3
	DO-14	14 NO	DO14	P4-18	137	H3 3 4	DO14-	138	CATHODIC PROTECTION FAULT INDICATION	REF 20:A4
	DO-15	15 NO	DO15	P4-19	139			140	SPARE	

RTU ANALOG INPUTS

24VDC SUPPLY REF 08:C7

J6- 142	J6+ 2A 141	AI1+24V	143	AI00A 610	AI00B 608	TERMINAL HOUSING FMX21 TRANSMITTER 609	AI00C 500mA	149	AI00+ P5-01 0+ AI00	PRIMARY WET WELL LEVEL
AI1-COM	AI1+24V	AI1-COM	150				AI00-		P5-02 0-	
		AI1+24V	144	ADJ. UNIT TRANSMITTER AI01A		AI01B 500mA	151	AI01+ P5-03 1+ AI01	DELIVERY PRESSURE
		AI1-COM	152				AI01-		P5-04 1-
		AI1+24V	145	VSD 1 42 39		AI02A 500mA	153	AI02+ P5-05 2+ AI02	VSD 1 SPEED COMMAND 4-20mA REF 02:C8
			154			AI02-		P5-06 2-	
		AI1+24V	146	VSD 2 42 39		AI03A 500mA	155	AI03+ P5-07 3+ AI03	VSD 2 SPEED COMMAND 4-20mA REF 02:C8
			156			AI03-		P5-08 3-	
		AI1+24V	147				157	AI04+ P5-09 4+ AI04	RESERVED FOR GENERATOR FUEL LEVEL
			158				AI04-		P5-10 4-
		AI1+24V	148				159	AI05+ P5-11 5+ AI05	RESERVED FOR SECONARY WET WELL LEVEL
			160				AI05-		P5-12 5-

CATHODIC PROTECTION UNIT TRANSDUCER

240VAC SUPPLY REF 01:E14 — 681 N10 — A N E — 10 11 13 14 — REF 20:B9

AI06A 500mA	161	AI06+ P5-13	6+ AI06	RECTIFIER CURRENT		
AI06-	162	P5-14	6-			

E+H PROMATIC 50 FLOWMETER SENSOR — 5-E1, 7-E2, 4-GND, 31-E, E, 41, 42

E+H PROMATIC 50 FLOWMETER Tx — 6-S1, 5-E1, 7-E2, 8-S2, 4-GND, 37-E, 36-S, E, 41, 42

26+ AI07A 500mA	163	AI07+ P5-15	7+ AI07	DELIVERY FLOWMETER		
27- AI07-	164	P5-16	7-			

1, 2 — J13+, J13- — 24VDC SUPPLY REF 08:F7

FLOWMETER PIT

RTU ANALOG OUTPUTS

RESERVED FOR CHEMICAL DOSING PUMP SPEED REFERENCE

AO-03	3+ AO03+	P6-07	AO03+ 500mA	173	
	3- AO03-	P6-08	AO03-	174	

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: R.Martin DATE: 1.5.12
NAME of SIGNATORY: ROB MIOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.

LEGEND:

- ▲ SWITCHBOARD POWER TERMINAL
- ⌀ SWITCHBOARD CONTROL TERMINAL
- □ SWITCHBOARD GENERATOR TERM.
- ✖ FIELD TERMINAL
- ◧ PLC TERMINAL
- ◪ RTU TERMINAL
- ■ VSD TERMINAL
- ● PLC/RTU MARSH. FUSE TERMINAL
- ○ PLC/RTU MARSH. LINK TERMINAL
- TO RTU —○— DISCONNECT PLUG
- DI1-02 RTU DIGITAL INPUT
- DO1-02 RTU DIGITAL OUTPUT
- AI1-02 RTU ANALOGUE INPUT
- AO1-02 RTU ANALOGUE OUTPUT

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

S:\D ED\PLATE SP-SP-VSD-RTU Ver1.12

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT	21-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No.	DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192	21-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No.	DATE
		Original Signed by K.VAHEESABBS	24-04-08
		PRINCIPAL DESIGN MANAGER	DATE
		Original Signed by P.SHERRUFF	22-04-08
		CLIENT DELEGATE	DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 33 001 852 225 114 CARROLL AVE MACKAY, QLD 4740
PH. (07) 4951 1611 FAX. (07) 4951 3023 EMAIL: jpr@jpr.com.au
JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE: SP315 AXIS PLACE SEWAGE PUMP STATION

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

TITLE: COMMON RTU I/O SCHEMATIC DIAGRAM

Sheet 07

AS INSTALLED

SHEET No. 7

Queensland Urban Utilities DRAWING No. 486/5/7-0070-007 AMEND. C

J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by des_be on Friday, 27 April 2012 11:25:28 AM

POWERBOX
PB251-24CM-CC-T

SHROUD
240VAC FILTERED SUPPLY
REF 01:D12
620
621
662
SN1
COMMON CONTROLS SECTION

PS1
LOAD
BATT
BOK
RTU
10AMP
BATTERY OK
REF 07:C2
0 = Fault, 1 = Healthy
POWER ON
REF 07:C2
0 = Fault, 1 = Healthy
TEMPERATURE PROBE LOCATED AT BATTERIES

RTU POWER SUPPLY
10A 24VDC

Rx TBA
Tx TBA
VSD
24V DC / 13.8V DC
RADIO
BLACKBOX - EON12H-2M-MF-LC

PIN-OUT FOR RADIO CONNECTION

RADIO	MD3311
DB9-M-1	DB9-F-1
DB9-M-2	DB9-F-2
DB9-M-3	DB9-F-3
DB9-M-4	DB9-F-4
DB9-M-5	DB9-F-5
DB9-M-6	DB9-F-6
DB9-M-7	DB9-F-7
DB9-M-8	DB9-F-8
DB9-M-9	DB9-F-9

DISCONNECT PLUG 6
P6-20 RS485-
P6-19 RS485+ Cable 16
P6-18
TO GRAPHIC DISPLAY REF 08:110

GSM ANTENNA
GSM MODEM
SUB MD15
11A+ 8.8AMP 11+
20+ 20-
11-
24VDC SUPPLY REF 08:F8
TERMINALS "20" MOUNTED ADJACENT TO GSM MODEM

BLACKBOX - CONNX 2965

DISCONNECT PLUG 6
P6-13
P6-14

NOT AVAILABLE CONFIGURED FOR RS232
NOT AVAILABLE CONFIGURED FOR RS485
RS485- RS485+
P3 P2 P1

REFER TO SHEET 12
"0" "1" "2" "3" "4" "5" "6" "7" E4
ANALOGUE INPUTS

PIN-OUT FOR GSM CONNECTION

MODEM	MD3311
HD15-1	DB9-F-1
HD15-2	DB9-F-2
HD15-3	DB9-F-3
HD15-4	DB9-F-4
HD15-5	DB9-F-5
HD15-6	DB9-F-6
HD15-7	DB9-F-7
HD15-8	DB9-F-8
HD15-9	DB9-F-9
HD15-10	
HD15-11	
HD15-12	
HD15-13	
HD15-14	
HD15-15	

ON/OFF SWITCH
TB1 + E3 -
POWER SUPPLY CONNECTOR
TB2 - + NC - + NC TB3
P2 P1
RS 485 PORTS
RS 232 PORTS
EXTERNAL I/O BOARD CONNECTOR

RTU
LOGICA CMG - MD3311E 24VDC - MOTHER BOARD

DIGITAL INPUTS (MODULE No. 1)
E1 COM 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
REFER TO SHEET 09

DIGITAL OUTPUTS (MODULE No. 1)
E2 7 6 5 4 3 2 1 0 COM
REFER TO SHEET 11

REFER TO SHEET 10
32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 COM E7
DIGITAL INPUTS (MODULE No. 3)

REFER TO SHEET 12
0 1 2 3 COM E8
ANALOGUE OUTPUTS

RTU
LOGICA CMG - MD3311E 24VDC - EXTENSION BOARD
EXTERNAL I/O BOARD CONNECTOR

DIGITAL INPUTS (MODULE No. 2)
E5 COM 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16
REFER TO SHEET 10

DIGITAL OUTPUTS (MODULE No. 2)
E6 15 14 13 12 11 10 9 8 COM
REFER TO SHEET 11

GRAPHIC DISPLAY
REDLION G306A000
RJ45 1 8 E
J10+ J10-
FROM RTU REF 08:A13 RS485+ RS485- Cable 16
RS485A+ RS485A- Cable 17
TO VSD 1 REF 02:E5

LOGICA CMG - MD3311E 24VDC
ETHERNET BOARD
PORT 1 → CONFIGURED FOR LAPTOP CONNECTION
PORT 2

RTU
GRAPHIC DISPLAY
VSD 1
VSD 2
TB2 P2 + -
RJ45 1 8
Do Not Earth
TERMINALS
PLUG 6 18 19 20
RS485 68 69
120Ω
RS485- Bk
RS485- W Cable 16
RS485A+ Cable 17
RS485B- Bk
RS485B+ W Cable 18
Use 120ohm Impedence Twisted Pair Cable

MODBUS CONNECTIONS

5AMP
J3+ / J3- 24V DC / 13.8V DC J4+ / J4- 5AMP J4A+ / J4A-
J5+ / J5-
J6+ / J6- RTU 24VDC CARD SUPPLY REF 02:A12
J7+ / J7- WET WELL HIGH LEVEL RELAY LR3 REF 06:F7
SPARE RESERVED FOR DRY WELL LEVEL RELAY LR2
J9+ / J9- COMMON CONTROLS REF 05:H10, 06:B12
J10+ / J10-
J11+ / J11- MODEM REF 08:B15
J13+ / J13- FLOWMETER - ENDRES+HAUSER REF 07:H11
J14+ / J14- VALVE PIT HIGH LEVEL RELAY LR4 REF 06:H2
SPARE RESERVED FOR ULTRASONIC WET WELL LEVEL
J16+ / J16- WETWELL WASHER REF 11:E8
SPARE RESERVED FOR STATION MANHOLE SURCHARGE IMMINENT
J17+ / J17- PUMP 1 SUPERVISION RELAY 1K7 REF 02:G5
J18+ / J18- PUMP 2 SUPERVISION RELAY 2K7 REF 03:G5

LEGEND:
- ▲ SWITCHBOARD POWER TERMINAL
- ⌀ SWITCHBOARD CONTROL TERMINAL
- □ SWITCHBOARD GENERATOR TERM.
- FIELD TERMINAL
- PLC TERMINAL
- RTU TERMINAL
- ■ VSD TERMINAL
- ● PLC/RTU MARSH. FUSE TERMINAL
- ○ PLC/RTU MARSH. LINK TERMINAL
- TO RTU → DISCONNECT PLUG
- DI1-02 RTU DIGITAL INPUT
- DO1-02 RTU DIGITAL OUTPUT
- AI1-02 RTU ANALOGUE INPUT
- AO1-02 RTU ANALOGUE OUTPUT

AS CONSTRUCTED DETAILS
I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.
SIGNED: DATE: 1.5.12
NAME of SIGNATORY: Rob Miotti
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

NOTES
1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT 21-04-08 DESIGN R.P.E.Q. No. DATE
Original signed by R.JANFADA 5192 21-04-08 DESIGN CHECK R.P.E.Q. No. DATE
Original Signed by K.VAHEESABBS 24-04-08 PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 22-04-08 CLIENT DELEGATE DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 33 001 952 325 114 CHERMSIDE AVE BRCDL QLD 4076
JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

ELECTRICAL AS BUILT DETAILS
REV C
COMPANY J & P RICHARDSON INDUSTRIES
CONTRACTOR LICENCE No. 756
ELECTRICIAN - DATE: 27.04.12

TITLE
RTU POWER DISTRIBUTION SCHEMATIC DIAGRAM

Sheet 08
AS INSTALLED

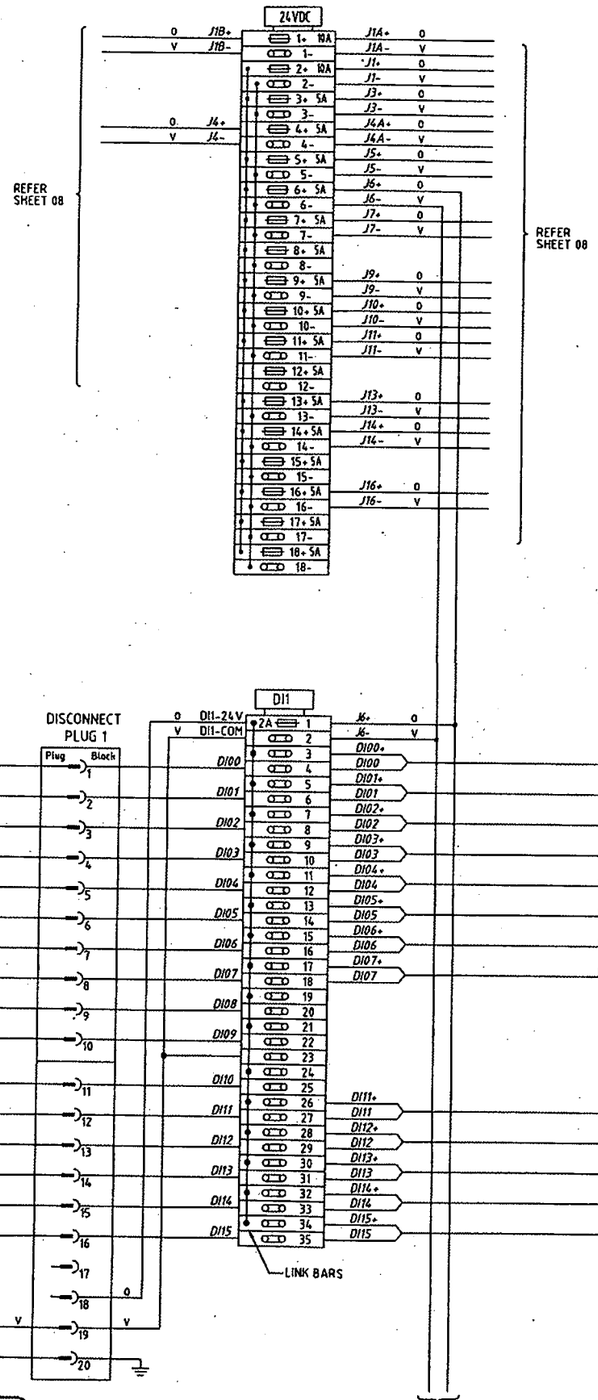
SHEET No. 8
Queensland Urban Utilities DRAWING No. 486/5/7-0070-008
AMEND. C

S:\SI DISPLAY\ SP-2P-VSD-RTU Ver4.12
J:\DWG\C41000 QUU\57-0070set_C.dwg Last Saved by des_be on Friday, 27 April 2012 11:26:28 AM

RTU COMPARTMENT

MITS RTU
MD3311 EA

RTU POWER SUPPLIES

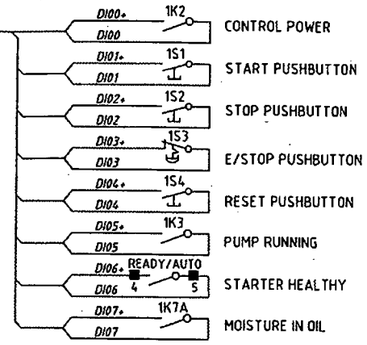


16 CHANNEL DIGITAL INPUT MODULE 1

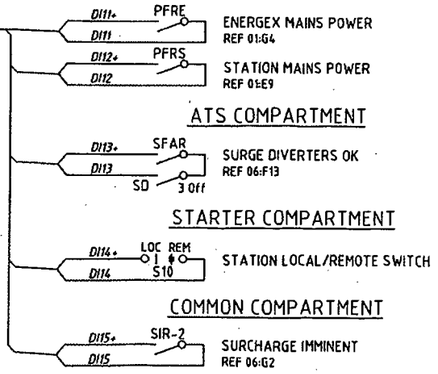
STARTER COMPARTMENT

PUMP 1

REFER SHEET 02



COMMON COMPARTMENT



ATS COMPARTMENT

STARTER COMPARTMENT

COMMON COMPARTMENT

SWITCHBOARD

FIELD

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MIOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

LEGEND:

- C?? — CABLE IDENTIFIER
- TO RTU — DISCONNECT PLUG
- 5 — FUSE TERMINAL
- 5 — DISCONNECT LINK TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 756
	ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-3P-150-ATU Ver1.2

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFF	21-04-08
DRAFTING CHECK	A.WITTHOFF	DESIGN R.P.E.Q. No.	DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192	21-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No.	DATE

Original Signed by K.VAHEESABBS	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

Queensland Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 33 001 852 325 114 CAMPBELL AVE BACOL QLD 4076
PH. (07) 3271 2511 FAX (07) 3271 3533 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

TITLE
RTU DIGITAL INPUTS
TERMINATION DIAGRAM

SHEET No. 9

Queensland Urban Utilities DRAWING No. 486/5/7-0070-009

AMEND. C

Sheet 09

AS INSTALLED

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RTU COMPARTMENT

MITS RTU
MD3311 EA

16 CHANNEL DIGITAL INPUT MODULE 2

DISCONNECT PLUG 2

DI2

CONT ON SHEET 09

DI16	16	DI16	Plug 1	DI16	36
DI17	17	DI17	2	DI17	38
DI18	18	DI18	3	DI18	40
DI19	19	DI19	4	DI19	42
DI20	20	DI20	5	DI20	44
DI21	21	DI21	6	DI21	46
DI22	22	DI22	7	DI22	48
DI23	23	DI23	8	DI23	50
DI24	24	DI24	9	DI24	52
DI25	25	DI25	10	DI25	54
DI26	26	DI26	11	DI26	56
DI27	27	DI27	12	DI27	59
DI28	28	DI28	13	DI28	61
DI29	29	DI29	14	DI29	63
DI30	30	DI30	15	DI30	65
DI31	31	DI31	16	DI31	67
COM		DI2-COM V	17		69
E5		E	18		70
			19 V		
			20		

DI2-24V V, DI2-COM V, 0 V

LINK BARS

Gy

CONT ON SHEET 11

STARTER COMPARTMENT

PUMP 2

REFER SHEET 03

DI16	2K2	CONTROL POWER
DI17	2S1	START PUSHBUTTON
DI18	2S2	STOP PUSHBUTTON
DI19	2S3	E/STOP PUSHBUTTON
DI20	2S4	RESET PUSHBUTTON
DI21	2K3	PUMP RUNNING
DI22	READY/AUTO 4 5	STARTER HEALTHY
DI23	2K7A	MOISTURE IN OIL

SWITCHBOARD

FIELD

RTU COMPARTMENT

DI27	BOK	RTU BATTERY OK REF 08:C3
DI28	RTU	RTU CONTROL POWER REF 08:C3

COMMON COMPARTMENT

DI29	EMGDT	EMERGENCY PUMPING MODE REF 06:C6
DI30	LR3	WET WELL HIGH LEVEL REFER 06:G7
DI31	SLCR	DOOR SECURITY STATUS REF 06:C15

DS 4 Off — 617 DSE — 618 Field D/Box

16 CHANNEL DIGITAL INPUT MODULE 3

DISCONNECT PLUG 3

DI3

DI32	32	DI32	Plug 1	DI32	71
DI33	33	DI33	2	DI33	73
DI34	34	DI34	3	DI34	75
DI35	35	DI35	4	DI35	77
DI36	36	DI36	5	DI36	79
DI37	37	DI37	6	DI37	81
DI38	38	DI38	7	DI38	83
DI39	39	DI39	8	DI39	85
DI40	40	DI40	9	DI40	87
DI41	41	DI41	10	DI41	89
DI42	42	DI42	11	DI42	91
DI43	43	DI43	12	DI43	93
DI44	44	DI44	13	DI44	95
DI45	45	DI45	14	DI45	97
DI46	46	DI46	15	DI46	99
DI47	47	DI47	16	DI47	101
COM		DI3-COM V	17		102
E7		E	18		103
			19 V		104
			20		

DI3+24V V, DI3-COM V, 0 V

LINK BARS

DI32	Q2	NORMAL SUPPLY CB CLOSED
DI42	LR4	VALVE PIT HIGH LEVEL REF 06:I3

CATHODIC PROTECTION UNIT

DI43	5 S2 6	FAULT RESET REF 07:F2

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 15.12
NAME of SIGNATORY: ROB MIOTTI
RPEQ No. or LICENCE: 6199 72
COMPANY NAME: JPR
START DATE: FINISH DATE: 15.12

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 071 952 225 114 CAMPBELL ST. BOWEN, QLD 4805
PH. (07) 4771 2911 FAX. (07) 4771 2022 EMAIL jprbtp@bigpond.com

JPR Project No.: E10-C41900

LEGEND:

- C?? CABLE IDENTIFIER
- TO RTU DISCONNECT PLUG
- 5 FUSE TERMINAL
- 5 DISCONNECT LINK TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 10

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-SP-V50-A1U Ver1.2

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

Original Signed by A.WITTHOFF			21-04-08
DESIGN	R.P.E.Q. No.		DATE
Original signed by R.JANFADA	5192		21-04-08
DESIGN CHECK	R.P.E.Q. No.		DATE

Original Signed by K.VAHEESAB895		24-04-08
PRINCIPAL DESIGN MANAGER		DATE
Original Signed by P.SHERRIFF		22-04-08
CLIENT DELEGATE		DATE

Queensland Urban Utilities

SITE: SP315 AXIS PLACE SEWAGE PUMP STATION

TITLE: RTU DIGITAL INPUTS TERMINATION DIAGRAM

SHEET No. 10

Queensland Urban Utilities DRAWING No. 486/5/7-0070-010 AMEND. C

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RTU COMPARTMENT

MITS RTU
MD3311 EA

CONT ON SHEET 15

SWITCHBOARD

FIELD

8 CHANNEL DIGITAL OUTPUT MODULE 1

DO1

DO00	00	COM	DO1+24V	0	Plug	Block	0	DO1+24V	2A	105	J6+ 0
DO01	01	NC				1		DO1-COM		106	J6- V
		NO	DO00			2		DO00		107	DO00
DO02	02	NC								108	DO00-
		NO	DO01			3		DO01		109	DO01
DO03	03	NC								110	DO01-
		NO	DO02			4		DO02		111	DO02
DO04	04	NC								112	DO02-
		NO	DO03			5		DO03		113	DO03
DO05	05	NC								114	DO03-
		NO	DO04			6		DO04		115	DO04
DO06	06	NC								116	DO04-
		NO	DO05			7		DO05		117	DO05
DO07	07	NC								118	DO05-
		NO	DO06			8		DO06		119	
										120	
			DO07			9		DO07		121	
		E2	E			10	V			122	

DISCONNECT PLUG 4

LINK BARS

Gy

STARTER COMPARTMENT

DO00 / DO00-	1K20	PUMP 1 RUN COMMAND REFER 02:E14
DO01 / DO01-	1K21	PUMP 1 FAULT RESET REFER 02:F14
DO02 / DO02-	1K22	PUMP 1 EMERGENCY MODE INTERRUPT REFER 02:F14
DO03 / DO03-	1K23	PUMP 1 RUN AT MAXIMUM SPEED REFER 02:F14

COMMON COMPARTMENT

DO04 / DO04-	ETR	ELECTRODE TEST RELAY REFER 07:G4
DO05 / DO05-	WWR	WETWELL WASHER AUX RELAY REFER 07:G4

24VDC SUPPLY REF 08:H7 — J16+ / J16- — 613 / 614 — J16A / J16- — C11 — J16A / J16- — WASH — WET WELL WASHER SOLENOID

8 CHANNEL DIGITAL OUTPUT MODULE 2

DO2

DO08	08	COM	DO2+24V	0	Plug	Block	0	DO2+24V	2A	123	J6+ 0
DO09	09	NC				11				124	J6- V
		NO	DO08			12		DO08		125	DO08
DO10	10	NC								126	DO08-
		NO	DO09			13		DO09		127	DO09
DO11	11	NC								128	DO09-
		NO	DO10			14		DO10		129	DO10
DO12	12	NC								130	DO10-
		NO	DO11			15		DO11		131	DO11
DO13	13	NC								132	DO11-
		NO	DO12			16		DO12		133	
DO14	14	NC								134	
		NO	DO13			17		DO13		135	DO13
DO15	15	NC								136	DO13-
		NO	DO14			18		DO14		137	DO14
										138	DO14-
			DO15			19		DO15		139	
		E6	E			20				140	

DISCONNECT PLUG 4

LINK BARS

Gy

STARTER COMPARTMENT

DO08 / DO08-	2K20	PUMP 2 RUN COMMAND REFER 03:F14
DO09 / DO09-	2K21	PUMP 2 FAULT RESET REFER 03:F14
DO10 / DO10-	2K22	PUMP 2 EMERGENCY MODE INTERRUPT REFER 03:F14
DO11 / DO11-	2K23	PUMP 2 RUN AT MAXIMUM SPEED REFER 03:F14

COMMON COMPARTMENT

CATHODIC PROTECTION UNIT

DO13 / DO13-	K1	REMOTE INTERRUPT REFER 07:I4
DO14 / DO14-	H3	FAULT INDICATION REFER 07:I4

CONT ON SHEET 12

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: Rob Miotti
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

LEGEND:

- C?? — CABLE IDENTIFIER
- TO RTU — DISCONNECT PLUG
- Ø — SWITCHBOARD CONTROL TERMINAL
- 5 — FUSE TERMINAL
- 5 — DISCONNECT LINK TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

No	DATE	AMENDMENT	P.H.	G.A.
A	07.10	RE-ISSUED FOR CONSTRUCTION		
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT	21-04-08	Original Signed by K.VAHEESABBS	24-04-08
DESIGN	R.P.E.Q. No. DATE	PRINCIPAL DESIGN MANAGER	DATE
Original signed by R.JANFADA	5192 21-04-08	Original Signed by P.SHERRIFF	22-04-08
DESIGN CHECK	R.P.E.Q. No. DATE	CLIENT DELEGATE	DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 001 952 225 114 CHERMSIDE RD BRACKEN RIDGE QLD 4017
PH. (07) 3271 3911 FAX. (07) 3271 3922 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
RTU DIGITAL OUTPUTS
TERMINATION DIAGRAM

SHEET No. 11

Queensland Urban Utilities DRAWING No. 486/5/7-0070-011

AMEND. C

Sheet 11

AS INSTALLED

STD TEMPLATE SP-JP-MSD-RTU Ver1.0

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RTU COMPARTMENT

MITS RTU
MD3311 EA

SWITCHBOARD

FIELD

CONT ON SHEET 11

USE SCREENED CABLES

COMMON COMPARTMENT

ANALOG LEVEL METER

8 CHANNEL ANALOG INPUT MODULE 1

DISCONNECT PLUG 5

TO INSULATED INSTRUMENT EARTH

NOTE 2

FIELD DISCONNECTION BOX
TERMINAL HOUSING
Breather

PRIMARY WET WELL LEVEL TRANSMITTER

ADJ. UNIT - VEGADIS 12

DELIVERY PRESSURE TRANSMITTER

INST. EARTH

VSD COMPARTMENT

PUMP 1 VFD

PUMP 1 VFD RUNNING SPEED
REFER 02:G12

PUMP 2 VFD

PUMP 2 VFD RUNNING SPEED
REFER 03:G12

CATHODIC PROTECTION UNIT

240VAC SUPPLY
REF 01:E15

CATHODIC PROTECTION PROBES

E+H PROMATIC 50 FLOWMETER Tx

24VDC SUPPLY
REF 08:F7

FLOWMETER SENSOR

FLOWMETER PIT

8 CHANNEL ANALOG OUTPUT MODULE 1

DISCONNECT PLUG 6

TO INSULATED INSTRUMENT EARTH

RTU TB1
POWER SUPPLY
REF 08:B11

RTU TB2
COMMS PORT2
REF 08:A11

PUMP 1 VSD
REF 02:E6

VSD COMPARTMENT

USE SCREENED CABLES

LINE ISOLATOR

PUMP 1 VFD SPEED REFERENCE
REFER 02:C8

PUMP 2 VFD SPEED REFERENCE
REFER 03:C8

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

LEGEND:

- C?? CABLE IDENTIFIER
- TO RTU — DISCONNECT PLUG
- 5 FUSE TERMINAL
- 5 DISCONNECT LINK TERMINAL
- 5 EARTH TERMINAL

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 756
	ELECTRICIAN DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE	B.C.C. FILE No.	
DRAFTING CHECK	A.WITTHOFT		
CAD FILE	57-0070set_C		

Original Signed by A.WITTHOFT	21-04-08	Original Signed by K.VAHEESABEEB	24-04-08
DESIGN R.P.E.Q. No.	DATE	PRINCIPAL DESIGN MANAGER	DATE
Original signed by R.JANFADA	5192 21-04-08	Original Signed by P.SHERRIFF	22-04-08
DESIGN CHECK R.P.E.Q. No.	DATE	CLIENT DELEGATE	DATE

Queensland Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
RTU ANALOGS & MISCELLANEOUS TERMINATION DIAGRAM

SHEET No. 12
Queensland Urban Utilities DRAWING No. 486/5/7-0070-012
AMEND. C

J & P RICHARDSON
INDUSTRIES PTY LTD. ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 952 225 114 CAMPBELL AVE WOOL QLD 4076
PH. (07) 3271 3911 FAX. (07) 3271 3823 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

Sheet 12

AS INSTALLED

STD TEMPLATE SP-JP-1920-RTU Ver1.02

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AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12

NAME of SIGNATORY: ROB MIOTTI

RPEQ No. or LICENCE: C12972

COMPANY NAME: JPR

START DATE: FINISH DATE: 1.5.12

RESERVED FOR GENERATOR ATS TERMINALS

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES CONTRACTOR LICENCE No. 756 ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-ZP-V10-RTU Ver12

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
S.C.C. FILE No.	

Original Signed by A.WITTHOFT		21-04-08
DESIGN	R.P.E.Q. No.	DATE
Original signed by R.JANFADA	5192	21-04-08
DESIGN CHECK	R.P.E.Q. No.	DATE

Original Signed by K.VAHEESAB895	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 33 071 852 325 116 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 3911 FAX. (07) 3271 3922 EMAIL: jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND UrbanUtilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
COMMON CONTROLS
TERMINATION DIAGRAM

Sheet 13

AS INSTALLED

SHEET No. 13

Queensland Urban Utilities DRAWING No. 486/5/7-0070-013

AMEND. C

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ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
1	1	Q1 METERING ISOLATOR + 2of Shrouds, 2of Phase Barriers	SOCOMEC	SLB 400 3P+2694 3951, 2993 0913	N	
2	1	Q2/Q3 MANUAL TRANSFER SWITCH + TZHS Handle, Shrouds	TERASAKI	MTSS4GE40033+TZHSA085GH,TZCF403SLMG		Set Ir=0.8 (320A) Char=6
3	2	- AUX TO SUIT MAIN SWITCHES Q2 & Q3 S400GE/3400	TERASAKI	T2AX80M3STA	F	
4	1	Q4 PUMP1 CIRCUIT BREAKER + TZHS Handle, Shrouds	TERASAKI	S250GJ/3250+TZHS250SGH,TZCF253SLMG		Set Ir=0.63(157.5A) Im=6
5	1	Q5 PUMP2 CIRCUIT BREAKER + TZHS Handle, Shrouds	TERASAKI	S250GJ/3250+TZHS250SGH,TZCF253SLMG		Set Ir=0.63(157.5A) Im=6
6					E	
7	1	Q7 EMERGEX PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCBF1530C	-	
8					F	
9	1	Q9 SUB-D/B CIRCUIT BREAKER + TZHS Handle, Shrouds	TERASAKI	S125NJ/350 +TZHS1250SGH,TZCF123SLMG		Set Ir=0.8 (50A) Im=6 (300A)
10	1	Q10 STATION MAINS PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCB6306C	-	
11	1	Q11 3 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	DTCB6319C	-	PLUS DSRCH-32-30-3PN
12	1	Q12 15A GPO CIRCUIT BREAKER	TERASAKI	DSRCBH-16-30A	-	
13	1	Q13 RTU LAPTOP GPO CIRCUIT BREAKER	TERASAKI	DSRCBH-10-30A	-	
14	1	Q14 SPARE	TERASAKI	DTCB6106C	E	
15	1	Q15 SPARE	TERASAKI	DTCB6110C	E	
16	1	Q16 SW/BD INTERNAL LIGHTING CIRCUIT BREAKER	TERASAKI	DSRCBH-6-30A	-	
17	1	Q17 SURGE FILTER CIRCUIT BREAKER	TERASAKI	DTCB6110C	-	
18	1	Q18 EM PUMP CNTRL & SURCHARGE IMMINENT CB	TERASAKI	DTCB6106C	-	
19	1	Q19 GENERATOR AUXILLARY SUPPLY CIRCUIT BREAKER	TERASAKI	DSRCBH-10-30A	-	
20	1	Q20 CATHODIC PROTECTION POWER SUPPLY	TERASAKI	DTCB6106C	K	
21	1	Q21 VALVE PIT SUMP PUMP POWER SUPPLY	TERASAKI	DSRCBH-10-30A	Q	
22					E	
23					H	
24					V	
25						
26	1	Q30 RTU POWER SUPPLY CIRCUIT BREAKER	TERASAKI	DTCB6104C	-	
27	1	Q31 SURGE FILTER ALARM RELAY CIRCUIT BREAKER	TERASAKI	DTCB6104C	-	
28	1	Q32 SPARE	TERASAKI	DTCB6104C	H	
29	1	Q33 SPARE	TERASAKI	DTCB6104C	-	
30		NOT USED				
31	1	Q4-1 PUMP1 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB6106C	-	
32	1	Q5-1 PUMP2 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB6106C	-	
33					E	
34					F	
35					F	
36	1	DISTRIBUTION BOARD CHASSIS	TERASAKI	CD-2-30/18-3U	-	
37	3	F1 - SURGE DIVERTER CIRCUIT FUSES	NHP	63AMP 63MS	-	FUSES & HOLDERS
38	3	SURGE DIVERTER	CRITEC	TDS1100-2SR-277	-	
39	1	SURGE FILTER ALARM RELAY - SFAR	CRITEC	DAR-275V	-	
40	1	SURGE REDUCTION FILTER - SRF	CRITEC	TOF-10A-240V	-	
41	1	ENERGEX MAINS PHASE FAILURE RELAY - PFRE	CARLO GAVAZZI	DPB-01-C-M28	-	
42						
43	1	STATION MAINS PHASE FAILURE RELAY - PFRS	CARLO GAVAZZI	DPB-01-C-M28	-	
44	1	MAIN NEUTRAL LINK	D&L ELEC.	DLAH6	-	INSULATED
45	1	MAIN EARTH LINK	D&L ELEC.	DLAHE6	-	
46	1	DIST. BD NEUTRAL LINK	DORE	165N24	-	INSULATED
47	1	DIST. BD EARTH LINK	DORE	165E24	-	
48	1	SURGE DIVERTER NEUTRAL LINK	CLIPSAL	L5A	-	
49	1	INSTRUMENT EARTH LINK	D&L ELEC.	DLBE12	-	INSULATED
50	1	FILTERED SUPPLY NEUTRAL LINK	CLIPSAL	L7	-	INSULATED
51	1	3 PHASE SWITCHED OUTLET	CLIPSAL	56C410	-	USE ENCLOSURE AS SHROUD
52	1	1 PHASE OUTLET 15A	CLIPSAL	2015+90B (SHROUD)	-	
53	1	LAPTOP GPO - TWIN 10A	CLIPSAL	2025+449A+449AP	-	
54	1	1 PHASE OUTLET - GENERATOR ANCILLARY POWER	CLIPSAL	56SO310	F	IP56
55	1	1 SET - 1 PHASE INLET SOCKET - GENERATOR POWER	POWERLOCK-NRG	PBX-SL-PO-AU-400	F	Sequential Connection Box
56	2	FIELD DISCONNECT BOX - DOOR PROXIMITY SWITCH	PEPPERL & FUCHS	NCB5-18GM40-Z0	J	
57						
58	13	SW/BD DOOR MICRO SWITCHES	CAMSCO	SM202	-	13 OFF N/O
59	9	SW/BD 8W INTERNAL FLURO LIGHTS	THORN	880108	-	
60	2	PUMP VARIABLE SPEED DRIVES	DANFOSS	Model No: FC202P0T5T4E2H1xGCxxxSxxxxAxBPCxxxxDx		
61	2	REMOTE KEYPAD MOUNTING KIT	DANFOSS	130B1107	-	
62	2	SPEED POTENTIOMETERS 1kΩ 1W 1 Turn	NHP	DTP-POT3		c/w 1kΩ 1W 1 Turn POT.
63	2	PUMP E/STOP CONTACTOR - K1	SPRECHER & SCHUH	CA6-140-EI-11-240VAC		
64	2	PUMP CONTROL CCT POWER ON RELAY - K2	IDEC	RH2B-UL-240VAC	-	+SH2B-05C

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
65	2	VSD RUNNING RELAY - K3	IDEC	RH4B-UL-240VAC	-	+SH4B-05C
66	2	MOISTURE IN OIL SLAVE RELAY - K7A	IDEC	RH2B-UL-24VDC	O	+SH2B-05C
67					C	
68					E	
69	2	PUMP MOISTURE IN OIL RELAY - K7	GRUNDFOSS	IO 111 + ZPD11	A	--FREE ISSUE WITH PUMPS--
70					B	
71					B	
72		NOT USED				
73		NOT USED				
74	2	PUMP RUN COMMAND RELAY - K20	IDEC	RH2B-UL-24VDC	-	+SH2B-05C
75	2	PUMP FAULT RESET RELAY - K21	IDEC	RH2B-UL-24VDC	-	+SH2B-05C
76	2	PUMP EMERGENCY MODE INTERRUPT RELAY - K22	IDEC	RH2B-UL-24VDC	-	+SH2B-05C
77	2	PUMP 'RUN AT MAX' RELAY - K23	IDEC	RH2B-UL-24VDC	-	+SH2B-05C
78	2	PUMP START PUSHBUTTON - S1	SPRECHER & SCHUH	DTP-F301-PX10	-	
79	2	PUMP STOP PUSHBUTTON - S2	SPRECHER & SCHUH	DTP-F402-PX01 + DT-PX10	-	
80	2	PUMP EM/STOP PUSHBUTTON - S3	SPRECHER & SCHUH	DTP-MT34-PX02S + DT15YE112, DTPX01S		
81	2	PUMP RESET PUSHBUTTON - S4	SPRECHER & SCHUH	DTP-F607-PX10	-	
82	2	PUMP HOUR RUN METER	NATIONAL	TH639	-	
83		NOT USED				
84					E	
85					E	
86					E	
87					E	
88					E	
89					E	
90					E	
91	1	LR3- WET WELL HIGH LEVEL RELAY	MULTITRODE	MTR-5	-	24VDC
92	1	LR4- VALVE PIT HIGH LEVEL RELAY	MULTITRODE	MTR-5	Q	24VDC
93					D	
94	1	SIR - SURCHARGE IMMINENT LEVEL RELAY	MULTITRODE	MTR-2	-	240VAC
95	3	SINGLE POINT PROBES	MULTITRODE	3 off - 020138FSP-Shield	-	
96	1	EMERGENCY PUMPING MODE RELAY PUMP1 - EMG1	IDEC	RH2B-UL-240VAC	-	+SH2B-05C
97	1	SURCHARGE IMMINENT DELAY TIMER - SIDT	SPRECHER & SCHUH	RZ7-FSA 3E - U23	-	ON DELAY 0.05-60sec
98	1	EMERGENCY PUMPING MODE TIMER - EMGDT	IDEC	GT3D-4-AF20 + SR3P-05C	-	DIGITAL MULTI-FUNCTION TIMER
99	1	EMERGENCY PUMPING MODE TIMER PUMP2- EMG2	SPRECHER & SCHUH	RZ7-FSA 4U - U23	-	ON DELAY 0.05-60hr
100	2	EMERGENCY PUMPING MODE SWITCH - S5	SPRECHER & SCHUH	D7P-LSM25-PX20	-	ENGRAVE 'OFF ON'
101	2	LEGEND PLATE + HOLDER	SPRECHER & SCHUH	D7-17-8E165 + D7-110		
102					F	
103					F	
104					F	
105					F	
106					F	
107					F	
108					F	
109					F	
110					F	
111					F	
112			IDEC	RH4B-UL-24VDC	F	+SH4B-05C
113					F	
114	1	GRAPHIC DISPLAY - FREE ISSUE	REDLION	G306A000	-	--FREE ISSUE--
115	1	SW/BD LIGHTING CONTROL RELAY - SLCR	IDEC	RH2B-UL-24VDC	-	+SH2B-05C
116	1	STATION LOCAL/REMOTE SWITCH - S10	KRAUS & MAIMER	CAD11-A720-600-FT2-F758	-	ENGRAVE 'LOCAL REMOTE'
117	1	ELECTRODES TEST RELAY - ETR	IDEC	RH4B-UL-24VDC	-	+SH4B-05C
118	1	WETWELL WASHER AUX RELAY - WWR	IDEC	RH2B-UL-24VDC	P	+SH2B-05C
119	1	WET WELL LEVEL INDICATOR	CROMPTON INSTRUMENTS	244-80KG-HG-4P-SR 4-20mA	-	0-100% ADJ RED POINTER
120	2	VSD CUBICLE VENT FAN	COSMOTEC	GKV30A2220	-	
121	2	CUBICLE FAN THERMOSTAT	NHP	FZK01100	-	10 - +60°C
122	4	VSD CUBICLE VENT	COSMOTEC	GKF30		
123						
124						
125						
127					S	
128					S	
129	1	CATHODIC PROTECTION UNIT	DRAWING No	SHEET 20	K	

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
130	1	ANODE - FREE ISSUE			K	Installed by BW
131		NOT USED				
132	1	FLOWMETER - FREE ISSUE	ENDRESS+HAUSER	PROMATIC 50	H	RANGE = 1501/s
133	1	WET WELL LEVEL TRANSMITTER	ENDRESS+HAUSER	FMX21AA2.2.1H.G.D.TLA.POPS	-	RANGE = 10m
134	1	WET WELL LEVEL TRANSMITTER TERMINAL HOUSING	ENDRESS+HAUSER	(Part of Item 133)	-	
135					G	
136						
137	1	DELIVERY PRESSURE TRANSMITTER	VEGA VEGABAR14	B1B2KXGG1FHPMAS, L=100	U	RANGE = 50m
138	1	DELIVERY PRESSURE ADJUSTMENT UNIT	VEGA VEGA DIS12	VEGADIS12xBxx	U	
139	1	RTU POWER SUPPLY 24VDC	POWERBOX	PB251-24CM-CC-T	-	
140	1	RADIO 24V/13.8VDC CONVERTER	POWERBOX	VTB12SC24	R	
141					I	
142	2	BATTERIES - EXCLUDING SPILL TRAYS	YUASA	UXH50-12	-	
143	1	RADIO	TRIO	DR900-06A02-D0	R	--FREE ISSUE--
144	1	ANTENNA	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/2710-0-7	-	--FREE ISSUE--
147	1	GSM MODEM	WAVECOM	FASTRACK Supreme	I	
148	1	GSM CELLULAR TRANSIT ANTENNA	RF INDUSTRIES	TLA2000	I	
149	6	DISCONNECT PLUGS	PHOENIX CONTACT	MSTB 2,5/20-ST-5.08	-	1757190
150	6	DISCONNECT TERMINAL BLOCKS	PHOENIX CONTACT	UMSTBVK2,5/20-G-5.08	-	1788295
151	6	CABLE HOUSING	PHOENIX CONTACT	KGS-MSTB2.5/20	-	1805615
152	2	CORROSION INHIBITOR	CORTEC	VPCI-110 OR 111	-	FROM AP CONTROLS
153	2	SIGNAL ISOLATORS - 2 WIRE INPUT LOOP POWERED	MOORE INDUSTRIES	ECT/4-20mA/4-20mA	-	
155	1	CODING PINS	PHOENIX CONTACT	CP-MSTB + CR-MSTB	-	
156	1	ANTENNA MAST	SWBD BUILDER	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
159	2	COAX PLUG (For CNT400 cable)	PULSE	N-203HS	R	Straight plug crimp
160	1	U CLAMPS	R.F. INDUSTRIES	UNV	R	
		SWITCHBOARD TERMINALS				
164.1	30	POWER TERMINALS - SHROUDED	PHOENIX CONTACT	UT6	-	3044131
164.2	40	FUSED TERMINALS with LED 24V INDICATION	PHOENIX CONTACT	UT4-HESI LED24 (5x20)	-	3046090
164.3	2	FUSE CARTRIDGES 10A 5x20mm				
164.4	16	FUSE CARTRIDGES 4A 5x20mm				
164.5	7	FUSE CARTRIDGES 2A 5x20mm				
164.6	12	FUSE CARTRIDGES 50mA 5x20mm			-	
164.7	180	DISCONNECT TERMINALS	PHOENIX CONTACT	UT4-MT P/P	-	3046171
164.8	18	EARTH TERMINALS	PHOENIX CONTACT	UT4-MTO-PE	-	3046207
164.9	10	GROUP MARKER CARRIER	PHOENIX CONTACT	UBE	-	0880316
164.10	2	TEST PLUG ADAPTOR	PHOENIX CONTACT	MPS-MT+ PS-6	-	0201744+3030996
164.11	4	PLUG-IN BRIDGE	PHOENIX CONTACT	FBS-20-4	-	0880310
164.12	4	PLUG-IN BRIDGE	PHOENIX CONTACT	FBS-50-6	-	3038930
164.13	5	END COVERS	PHOENIX CONTACT	D-UT2S/10		3047028
164.14	10	END COVERS	PHOENIX CONTACT	D-UT2S/4		3047141
164.15	3	COVER FOR TERMINALS	PHOENIX CONTACT			5022889
164.16	6	CARRIER PLATES	PHOENIX CONTACT			5022630
164.17	2	PARTITION PLATE	PHOENIX CONTACT	ATP-UK		3003274
164.18	14	UK6N TEST SOCKET	PHOENIX CONTACT	PSB		3030299
164.19	1	TERMINAL NUMBERS	PHOENIX CONTACT	ZB6UGSFORTLZAHLEN		1051016
165	6	CP PROBE TERMINALS	PHOENIX CONTACT	UK16	-	3036043
166	14	CP TEST TERMINALS	PHOENIX CONTACT	UK6N + PSB4	-	3036574
		MISCELLANEOUS				
170	2	ENERGEX PADLOCK - 45mm brass pin tumbler	H.A. REED LOCKSMITHS	KEY No 325 & S/S Shackle		c/w 2 keys
171	Lot	WET WELL CONDUIT SEALING BUNGS	RUBBER	TO SUIT CONDUITS		Detail 'W'
172	Lot	S/STEEL FITTINGS AS DETAILED FOR PRESSURE TX	FITTINGS	STAINLESS STEEL		Sheet 19
173	1	EARTH ROD CONNECTION BOX	NESCO	ERB1		
174	1	LINE TAP - BONDING TO EARTHING ROD	CLIPSAL	BP26		
175	1	EARTHING ROD	COPPER ROD	13mm Diameter		
176	1	IP67 JUNCTION BOX - FOR VALVE PIT SUMP PUMP	CLIPSAL	To Suit Installation		

REV	DATE	AMENDMENT	P.H.	G.A.
A	07.10	RE-ISSUED FOR CONSTRUCTION		
C	04.12	AS INSTALLED		
B	03.12	AS CONSTRUCTED		
No	DATE	AMENDMENT	DRN.	APD.

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT	21-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No.	DATE
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Original Signed by K.VAHEESAN8895	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

Queensland Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
EQUIPMENT LIST

ELECTRICAL AS BUILT DETAILS
REV C
COMPANY J & P RICHARDSON INDUSTRIES
CONTRACTOR LICENCE No. 756
ELECTRICIAN - DATE: 27.04.12

Sheet 14
AS INSTALLED

SHEET No. 14
Queensland Urban Utilities DRAWING No. 486/5/7-0070-014
AMEND. C

STD TEMPLATE SP-3P-VSD-RTU Ver1.2

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CABLE No.	STATUS	SIZE	CORES	TYPE	LENGTH (m) Note 1	FROM	TO	CABLE FUNCTION	NOTES
P01	NEW	2x95mm²	4C	PVC/CU/PVC Notes 1 & 2		ENERGEX Supply Pillar	Switchboard	Incoming Mains Supply	Refer Notes 1 & 2
E01	NEW	120mm²	1C	Building Wire Note 1		Switchboard	Earth stake	Main Earth	
E02	NEW		1C	Building Wire Note 1		Switchboard	Field Disconnection Box	Field Disconnection Box Earth	
E03	NEW	6mm²	1C	Building Wire Note 1		Switchboard	Wet Well Reinforcing Earth Bond	Equipotential Bond	
P04									
P05	NEW	50mm²	3C+3E	Screened Flexible VSD		Switchboard	Field Disconnection Box	Pump 1 Motor Feed	
P06	NEW	2x35mm²	3C+3E	Screened Flexible (Submersible)		Field Disconnection Box	Pump No1	Pump 1 Motor Feed -Thermistors	Maintain Continuity of Screen
P08	NEW	50mm²	3C+3E	Screened Flexible VSD		Switchboard	Field Disconnection Box	Pump 2 Motor Feed	
P09	NEW	2x35mm²	3C+3E	Screened Flexible (Submersible)		Field Disconnection Box	Pump No2	Pump 2 Motor Feed -Thermistors	Maintain Continuity of Screen
P11		-							
P11A		-							
P12		-							
P13		-							
P13A		-							
P14	NEW	2.5mm²	2C+E	PVC/CU/PVC		Switchboard	Valve Pit Sump Pump Junction Box	Valve Pit Sump Pump Motor	
P14A	NEW	2.5mm²	2C+E	Vendor		Valve Pit Sump Pump Junction Box	Valve Pit Sump Pump	Valve Pit Sump Pump Motor	
P15		-							
P16		-							
P18									
P19									
P20									
C100	NEW	1.5mm²	7C	PVC Screened		Switchboard	Field Disconnection Box Aux Terminals	Pump 1 Motor Thermistors	
C101	NEW	2.5mm²	7C	Screened Flexible (Submersible)		Field Disconnection Box Aux Terminals	Pump No1	Pump 1 Motor Thermistors	
C102	NEW	1.5mm²	1C	PVC/CU/PVC		Switchboard	Pump 1	Pump 1 Moisture in Oil Probe	
C103		-							
C104		-							
C105		-							
C106		-							
C200	NEW	1.5mm²	7C	PVC Screened		Switchboard	Field Disconnection Box Aux Terminals	Pump 2 Motor Thermistors	
C201	NEW	1.5mm²	7C	Screened Flexible (Submersible)		Field Disconnection Box Aux Terminals	Pump No2	Pump 2 Motor Thermistors	
C202	NEW	1.5mm²	1C	PVC/CU/PVC		Switchboard	Pump 2	Pump 2 Moisture in Oil Probe	
C203		-							
C204		-							
C205		-							
C206		-							
E01	NEW	1.5mm²	2C	PVC/PVC		Switchboard	Field Disconnection Box	Surcharge Imminent Signal (SIR)	
E01A	NEW		2C	Vendor-020130FSP-Shield		Field Disconnection Box	Surcharge Imminent Probe	Surcharge Imminent Signal (SIR)	
E02	NEW	1.5mm²	2C	PVC/PVC		Switchboard	Field Disconnection Box	Wet Well High Level Signal (LR3)	
E02A	NEW		2C	Vendor-020130FSP-Shield		Field Disconnection Box	Wet Well High Level Probe	Wet Well Level Signal (LR3)	
E03		-							
E04		-							
E05		-							
E06		-							
E07									
E08									
E09	NEW	1.5mm²	2C	Vendor-020130FSP-Shield		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LR4)	
E10	NEW	1.5mm²	2C	PVC/CU/PVC		Switchboard	Wet Well Solenoid Valve	Wet Well Washer	
E11	NEW	1.5mm²	2C	PVC/CU/PVC		Switchboard	Wet Well Washer		
E12		-							
E13		-							
E14		-							
E15	NEW	1.5mm²	2Pr	Instrolex		Switchboard	Field Disconnect Box	Field Disconnect Box Door Status	
E16									
I01	NEW	1.5mm²	1Pr	Instrolex		Switchboard	Field Disconnection Box	Primary Wet Well Level	
I01A	NEW			Vendor		Field Disconnection Box	Wet Well level Sensor	Primary Wet Well Level	• Excess Length for Probe Removal
I02	NEW			Vendor		Switchboard	Delivery Pressure transmitter	Delivery Pressure	Located in Valve Pit
I03		-							
I04	NEW			Vendor		Switchboard	Delivery Flowmeter	Flowmeter Sensor Power Supply	
I04A	NEW			Vendor		Switchboard	Delivery Flowmeter	Flowmeter Signals	
I05									
I06	NEW	0.5mm²	1 Pr	120 ohm Twisted Pair		Switchboard - Graphic Display	Switchboard - RTU	RS485 Comms	Overall Screened Twisted Pair
I07	NEW	0.5mm²	1 Pr	120 ohm Twisted Pair		Switchboard - Pump 1 VSD	Switchboard - Graphic Display	RS485 Comms	Overall Screened Twisted Pair
I08	NEW	0.5mm²	1 Pr	120 ohm Twisted Pair		Switchboard - Pump 2 VSD	Switchboard - Pump 1 VSD	RS485 Comms	Overall Screened Twisted Pair
I09									
I10		-							
I11									
X01	NEW			Vendor		Switchboard - Radio	Aerial Coax Surge Protector	Radio Communications	
X02	NEW			Vendor		Aerial Coax Surge Protector	Aerial	Radio Communications	

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12

NAME of SIGNATORY: ROB MIOTTI

RPEQ No. or LICENCE: C19972

COMPANY NAME: JPR.

START DATE: FINISH DATE: 1.5.12

NOTE:

1. THE CONTRACTOR IS RESPONSIBLE IN DETERMINING THE ACTUAL CABLE SIZE AND LENGTHS REQUIRED ON SITE.

2. PROTECT THE MAINS CABLE USING PVC SHEATHED FLEXIBLE METAL CONDUIT SUCH AS 'ADAPTAFLEX' FROM 150mm Min WITHIN THE PVC MAINS CONDUIT CAST IN THE SLAB UP TO THE GLAND PLATE. TERMINATE USING PROPRIETARY GLAND. SEAL AROUND CABLE AT EXIT POINT OF CONDUIT TO PREVENT INGRESS OF VERMIN.
PROVIDE ADEQUATE EXCESS FOR RE-TERMINATION.

3. ALLOW SUFFICIENT LENGTH ON CABLE TO ALLOW FOR REMOVAL OF PROBE AND CONDUIT. EXCESS LENGTH TO BE STORED IN ELECTRODE BOX

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 33 051 652 325 \ 114 CAMPBELL ARC BRCDL QLD 4078
PH. (07) 3271 2911 FAX. (07) 3271 2923 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	750
	ELECTRICIAN -	DATE: 27.04.12

Sheet 15

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

S:\SYSTEMPLATE SP-SP-VSD-RTU Ver1.0

DRAFTED	P.HAGUE	B.C.C. FILE No.	
DRAFTING CHECK	A.WITTHOFT		
CAD FILE	57-0070set_C		

Original Signed by A.WITTHOFT 21-04-08
DESIGN R.P.E.Q. No. DATE

Original signed by R.JANFADA 5192 21-04-08
DESIGN CHECK R.P.E.Q. No. DATE

Original Signed by K.VAHEESAS895 24-04-08
PRINCIPAL DESIGN MANAGER DATE

Original Signed by P.SHERRIFF 22-04-08
CLIENT DELEGATE DATE

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
CABLE SCHEDULE

SHEET No. 15

Queensland Urban Utilities DRAWING No. 486/5/7-0070-015

AMEND. C

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ITEM #	OPT.	DESCRIPTION - INTERNAL LABEL	LABEL 1	LABELS 2 & 3 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / TEXT
01	N	METERING ISOLATOR	CT METERING ISOLATOR ONLY 400A		8mm 4mm	ABS PLASTIC B/W
02		EXERGEX SUPPLY	NORMAL SUPPLY MAIN SWITCH 400A		8mm 4mm	ABS PLASTIC B/W
03		GENERATOR SUPPLY	GENERATOR SUPPLY MAIN SWITCH 400A		8mm 4mm	ABS PLASTIC B/W
04/05		PUMP CIRCUIT BREAKER	PUMP No1 250A	PUMP No2 250A	6mm 4mm	ABS PLASTIC W/B
07		PHASE FAILURE CIRCUIT BREAKER	EXERGEX PHASE FAILURE RELAY Q7	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	ABS PLASTIC W/B - R/W
08						
09		SUB-DISTRIBUTION BOARD CB	SUB-DISTRIBUTION BOARD 63A	Mounted On Escutcheon	6mm 4mm	ABS PLASTIC W/B
10		PHASE FAILURE CIRCUIT BREAKER	STATION PHASE FAILURE RELAY Q10		4mm 4mm	ABS PLASTIC W/B
11		3 PHASE OUTLET CIRCUIT BREAKER	3Φ OUTLET Q11		4mm 4mm	ABS PLASTIC W/B
12		1 PHASE OUTLET CIRCUIT BREAKER	1Φ GPO Q12		4mm 4mm	ABS PLASTIC W/B
13		RTU LAPTOP CIRCUIT BREAKER	RTU LAPTOP GPO Q13		4mm 4mm	ABS PLASTIC W/B
16		SWITCHBOARD LIGHTING CIRCUIT BREAKER	SWITCHBOARD LIGHTING Q16		4mm 4mm	ABS PLASTIC W/B
17		SURGE FILTER CIRCUIT BREAKER	SURGE FILTER Q17		4mm 4mm	ABS PLASTIC W/B
18		EM PUMP CONTROL & SIR CIRCUIT BREAKER	EM PUMPING CCT & SIR Q18		4mm 4mm	ABS PLASTIC W/B
19		GENERATOR ANCILLARY SUPPLY CB	GENERATOR ANCILLARY SUPPLY Q19		4mm 4mm	ABS PLASTIC W/B
20	K	CATHODIC PROTECTION POWER SUPPLY CB	CATHODIC PROTECTION Q20		4mm 4mm	ABS PLASTIC W/B
21	Q	VALVE PIT SUMP PUMP POWER SUPPLY CB	VALVE PIT SUMP PUMP Q21		4mm 4mm	ABS PLASTIC W/B
26		RTU POWER SUPPLY CIRCUIT BREAKER	RTU POWER SUPPLY Q30		4mm 4mm	ABS PLASTIC W/B
27		SURGE FILTER ALARM RELAY CIRCUIT BREAKER	SURGE FILTER ALARM RELAY Q31		4mm 4mm	ABS PLASTIC W/B
29		SPARE CIRCUIT BREAKER	SPARE Q33		4mm 4mm	ABS PLASTIC W/B
31/32		PUMP CONTROL CIRCUIT BREAKER	PUMP No1 Q4-1	PUMP No2 Q5-1	4mm 4mm	ABS PLASTIC W/B
37		SURGE DIVERTER FUSES	SURGE DIVERTER FUSES 63A	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	ABS PLASTIC W/B - R/W
38		SURGE DIVERTERS	SURGE DIVERTERS	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	ABS PLASTIC W/B - R/W
39		SURGE FILTER ALARM RELAY	SFAR		4mm 4mm	ABS PLASTIC W/B
40		SURGE REDUCTION FILTER	SURGE REDUCTION FILTER		4mm 4mm	ABS PLASTIC W/B
41		PHASE FAILURE RELAY	ENERGEX MAINS POWER FAIL - PFRE	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	ABS PLASTIC W/B - R/W
43		PHASE FAILURE RELAY	STATION MAINS POWER FAIL - PFRS		4mm 4mm	ABS PLASTIC W/B
44		MAIN NEUTRAL LINK	MAIN NEUTRAL		4mm	ABS PLASTIC W/B
45		MAIN EARTH LINK	MAIN EARTH		4mm	ABS PLASTIC W/B
46		SUB-BOARD NEUTRAL LINK	NEUTRAL		4mm	ABS PLASTIC W/B
47		SUB-BOARD EARTH LINK	EARTH		4mm	ABS PLASTIC W/B
48		SURGE DIVERTER NEUTRAL LINK	SURGE DIVERTER NEUTRAL		4mm	ABS PLASTIC W/B
49		INSTRUMENT EARTH LINK	INSTRUMENT EARTH		4mm	ABS PLASTIC W/B
51		FILTERED SUPPLY NEUTRAL LINK	FILTERED SUPPLY NEUTRAL		4mm 4mm	ABS PLASTIC W/B
54		LAPTOP GPO	LAPTOP GPO		4mm	ABS PLASTIC W/B
55	M	GENERATOR 240VAC CONNECTION SOCKET	GENERATOR ANCILLARY SUPPLY		4mm 4mm	ABS PLASTIC W/B
56	M	GENERATOR POWER CONNECTION BOX	GENERATOR CONNECTION		6mm 5mm	ABS PLASTIC W/B
60		PUMP VARIABLE SPEED DRIVE	PUMP No1 1U1	PUMP No2 2U1	6mm 4mm	ABS PLASTIC W/B
61		PUMP VSD KEYPAD	PUMP No1	PUMP No2	6mm	ABS PLASTIC W/B
62		PUMP MANUAL SPEED CONTROL	VSD SPEED	VSD SPEED	6mm	ABS PLASTIC W/B
63		E/STOP CONTACTOR	1K1	2K1	4mm	ABS PLASTIC W/B
64		PUMP CONTROL CCT POWER ON RELAY	1K2	2K2	4mm	ABS PLASTIC W/B
65		VSD RUNNING RELAY	1K3	2K3	4mm	ABS PLASTIC W/B
66						
67						
69	A	PUMP MOISTURE IN OIL	1K7	2K7	4mm	ABS PLASTIC W/B

ITEM #	OPT.	DESCRIPTION - INTERNAL LABEL	LABEL 1	LABELS 2 & 3 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / TEXT
74		PUMP RUN COMMAND RELAY	1K20	2K20	4mm	ABS PLASTIC W/B
75		PUMP FAULT RESET RELAY	1K21	2K21	4mm	ABS PLASTIC W/B
76		PUMP EMERGENCY MODE INTERRUPT RELAY	1K22	2K22	4mm	ABS PLASTIC W/B
77		PUMP "RUN AT MAX" RELAY	1K23	2K23	4mm	ABS PLASTIC W/B
78		PUMP START PUSHBUTTON	START	START	4mm	ABS PLASTIC W/B
79		PUMP STOP PUSHBUTTON	STOP	STOP	4mm	ABS PLASTIC W/B
80		PUMP E/STOP PUSHBUTTON	(use label supplied with P/Button)	(use label supplied with P/Button)		Y/B
81		PUMP RESET PUSHBUTTON	FAULT RESET	FAULT RESET	4mm	ABS PLASTIC W/B
82		PUMP HOURS RUN METER	HOURS RUN	HOURS RUN	4mm	ABS PLASTIC W/B
91		WET WELL HIGH LEVEL RELAY	WET WELL HIGH LEVEL - LR3		4mm 4mm	ABS PLASTIC W/B
92	Q	VALVE PIT LEVEL RELAY	VALVE PIT HIGH LEVEL - LR6		4mm 4mm	ABS PLASTIC W/B
94		SURCHARGE IMMINENT LEVEL RELAY	WET WELL SURCHARGE IMMINENT - SIR		4mm 4mm	ABS PLASTIC W/B
96		EMERGENCY PUMPING MODE PUMP 1 RELAY	EMG1		4mm	ABS PLASTIC W/B
97		SURCHARGE IMMINENT ON DELAY TIMER	SIDT		4mm	ABS PLASTIC W/B
98		EMERGENCY PUMPING MODE OFF DELAY TIMER	EMGDT		4mm	ABS PLASTIC W/B
99		EMERGENCY PUMPING MODE PUMP 2 TIMER	EMG2		4mm	ABS PLASTIC W/B
100		EMERGENCY PUMPING MODE START SWITCH	EMERGENCY PUMPING MODE	EMERGENCY PUMPING MODE	4mm 4mm	ABS PLASTIC W/B
117		SWITCHBOARD LIGHTING CONTROL RELAY	SLCR		4mm	ABS PLASTIC W/B
118		STATION LOCAL/REMOTE SELECTOR SWITCH	STATION CONTROL MODE		4mm	ABS PLASTIC W/B
119		ELECTRODES TEST RELAY	ETR		4mm	ABS PLASTIC W/B
116	P	WETWELL WASHER AUX RELAY	WWR		4mm	ABS PLASTIC W/B
121		WET WELL LEVEL INDICATOR	WET WELL LEVEL		4mm	ABS PLASTIC W/B
124		VENT FAN THERMOSTAT	VFC	2VFC	4mm	ABS PLASTIC W/B
129	K	CATHODIC PROTECTION UNIT	CATHODIC PROTECTION UNIT		4mm	ABS PLASTIC W/B
132	H	DELIVERY FLOWMETER TRANSMITTER	DELIVERY FLOWMETER		4mm	ABS PLASTIC W/B
134		WET WELL LEVEL ADJ. UNIT	PRIMARY WET WELL LEVEL (Located in FOB1)	PRIMARY WET WELL LEVEL (Located in FOB1)	4mm 4mm	ABS PLASTIC W/B
138	U	DELIVERY PRESSURE ADJ. UNIT	DELIVERY PRESSURE		4mm 4mm	ABS PLASTIC W/B
139		RTU 240VAC/24VDC POWER SUPPLY	RTU 24VDC POWER SUPPLY		4mm 4mm	ABS PLASTIC W/B
140	R	RADIO 24V/13.8VDC CONVERTER	24/12 VDC CONVERTER - RADIO		4mm 4mm	ABS PLASTIC W/B
143	R	RADIO	RADIO		4mm	ABS PLASTIC W/B
145	R	RADIO COAX SURGE PROTECTION	RADIO SURGE PROTECTION		4mm	ABS PLASTIC W/B
146		TELEMETRY UNIT	RTU		4mm	ABS PLASTIC W/B
147	I	MODEM	MODEM		4mm	ABS PLASTIC W/B
149		RTU DISCONNECT PLUG	PLUG No??		4mm	ABS PLASTIC W/B
150		RTU DISCONNECT TERMINAL BLOCKS	PLUG No??		4mm	ABS PLASTIC W/B

ITEM #	OPT.	DESCRIPTION - INTERNAL LABEL	LABEL 1	LABELS 2 & 3 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / TEXT
153		SIGNAL ISOLATOR	ZL1	ZL1	4mm	ABS PLASTIC W/B
		TERMINAL HEADER	RTU POWER SUPPLIES		4mm 4mm	ABS PLASTIC W/B
		TERMINAL HEADER	DIGITAL INPUTS DI1	DIGITAL INPUTS DI2 DI3	4mm 4mm	ABS PLASTIC W/B
		TERMINAL HEADER	DIGITAL OUTPUTS DO1	DIGITAL OUTPUTS DO2	4mm 4mm	ABS PLASTIC W/B
		TERMINAL HEADER	ANALOG INPUTS AI1	ANALOG OUTPUTS AO1	4mm 4mm	ABS PLASTIC W/B
		HEADER LABELS (Above Circuit Breakers)	NON FILTERED SUPPLY	FILTERED SUPPLY	6mm 6mm	ABS PLASTIC W/B
		HEADER LABEL (Screener Section)	MEN BEHIND		6mm	ABS PLASTIC W/B
		HEADER LABEL (Over Terminals 600-613)	LEVEL TX AND LEVEL PROBES		4mm 4mm	ABS PLASTIC W/B
		HEADER LABEL (Over Shrouded Terminals)	WARNING 240VAC		4mm 4mm	ABS PLASTIC R/W
200						
201						
203	F2	GENERATOR BOLTED CONNECTIONS	BUSBAR LIVE WHEN SWITCHBOARD ENERGISED FROM GENERATOR		4mm 4mm	ABS PLASTIC R/W
204	K1	CATHODIC PROTECTION CONNECTIONS	CATHODIC PROTECTION		4mm 4mm	ABS PLASTIC W/B
205						
206		INSPECTION PLATE LABELS - 2 OFF	INSPECTION PLATE DO NOT INSTALL GLANDS	FIX BY GLUEING ONLY	6mm 6mm	ABS PLASTIC W/B
207						
208						

EXTERNAL LABEL LIST

LABEL	TEXT	TEXT HEIGHT	PAINT FILL LETTERING	SIZE	QTY	OPT
A	SP315	25mm	Black	100x35	1	
B	RTU	10mm	Black	50x20	1	
C	PUMP CONTROL	10mm	Black	120x20	2	
D	WARNING THIS SITE IS MONITORED BY THE CONTROL ROOM. PLEASE INFORM THE OPERATOR BEFORE ISOLATING PUMPS OR STATION	8mm	Black	250x80	2	
E	PLEASE CHECK THAT THE STATION IS IN REMOTE MODE BEFORE LEAVING SITE	8mm	Black	210x40	1	
F	COMMON CONTROL	10mm	Black	120x20	1	
G	SUPPLY AUTHORITY METERING ISOLATOR	10mm	Black	150x50	1	N
H	METERING CT's	10mm	Black	100x20	1	N
I	MAIN SWITCHES	10mm	Black	120x20	1	
J	DISTRIBUTION BOARD	10mm	Black	150x20	1	
L	GENERATOR BUSBAR CONNECTIONS	10mm	Black	210x20	1	F
M	PUMP ? VSD	10mm	Black	80x20	2	
N	GENERATOR PLUG CONNECTIONS	10mm	Black	210x20	1	F
O	BATTERIES	10mm	Black	80x20	1	
P	SUPPLY AUTHORITY METERING	10mm	Black	200x20	1	
Q	DANGER 415V	10mm	Black	100x20	3	
R	DANGER - 2 SOURSES OF SUPPLY	10mm	Red	220x20	2	
T	SURGE DIVERTERS	10mm	Black	110x20	1	
Z	DANGER - ELECTRICAL EQUIPMENT Queensland Urban Utilities Phone 34078414 NOTE: THIS LABEL IS FREE ISSUE BY BRISBANE WATER			280x190	2	

EXTERNAL LABELS 1mm THICK. 316 GRADE STAINLESS STEEL. FIXED WITH M3 316 STAINLESS STEEL METAL THREADS.

FIELD LABEL LIST

LABEL	TEXT	TEXT HEIGHT	PAINT FILL LETTERING	SIZE	QTY
AA	MAIN EARTH CONDUCTOR - DO NOT DISCONNECT (On Main Earth Electrode)	5mm			1
AH	PUMP ? AUX TERMINALS (Mounted in Field Disconnect Box)	5mm	ABS PLASTIC - W/B	120x20	2
AJ	THIS DOOR IS ALARMED - PLEASE CONTACT CONTROL ROOM ON 34078414 (Mount Label inside Meter Panel)	5mm	ABS PLASTIC - W/B	90x30	1

DETAIL Q

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES CONTRACTOR LICENCE No. 756 ELECTRICIAN DATE: 27.04.12

Sheet 16

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT 21-04-08
DESIGN R.P.E.Q. No. DATE
Original signed by R.JANFADA 5192 21-04-08
DESIGN CHECK R.P.E.Q. No. DATE

Original Signed by K.VAHEESABBEY 24-04-08
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 22-04-08
CLIENT DELEGATE DATE

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
LABEL SCHEDULE

SHEET No. 16
Queensland Urban Utilities DRAWING No. 486/5/7-0070-016
AMEND. C

STD TEMPLATE SP-SP-VSD-RTU Ver1.2

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CONSTRUCTION - EXTERNAL SWITCHBOARD

Cubicle construction 3mm Marine grade Aluminium (5251).
Plinth construction 200x60 channel 6061 T6 Grade Aluminium.
Folded, "Pulse MIG" & "TIG welded with all visible seams and joints fully welded, free from splatter and ground smooth where needed.
External doors and covers fitted with Emka 1011-207 self grip seal.
Stainless Steel "D" Handles fitted where indicated on the drawings.
M6 Earth studs fixed to the interior of all doors and hinged escutcheons and on adjacent cubicle interior surfaces. Fit dedicated earth stud adjacent main earth bar for switchboard earth.
Door stiffeners, door stays, cable straps, and document holders etc fitted where shown on the drawings.
Door stay arms to be S/Steel and of sufficent strength to prevent being deformed when subjected to reasonable loads. Minimum 3mm S/Steel.
Lift-off covers and mounting panels fixed with M8 studs & stainless steel dome nuts.
Gland plates manufactured from 3mm aluminium, unless otherwise shown.
Inspection/Access plates manufactured from 3mm aluminium.
Gland/Inspect/Access plate openings fitted with M6x1.0 flat head closed end rivet nuts. (Detail F)
Cable glands to be fitted with compression side installed within cubicle. (Detail G)
Gland/Inspection/Access plates to be fitted with seals attached to cubicle.
Gland/Inspection/Access plate fixings at 100mm.
Gland/Inspection/Access plates to maintain a 50mm clearance from section dividers.
Gland/Inspection/Access plates are NOT to be split.
Inspection/Access plates are NOT to be earthed.
Provide Shrouding to all live parts to IP20 where required.
Hinges (external) Selectrix HIB650ss-316. Stainless steel.
Star washers fitted under all hinge screws. Stainless steel.
Hinged escutcheons fixed with Emka 1/4 turn 1000-U142
All equipment to be removable via front access.
Install switchboard with non-hydroscopic material between plinth and concrete slab. (Detail E1)
All escutcheons to open a minimum of 90°
All sheet metal edging to be de-burred.

Locks Doors 1-4, 6-13
DORE ELECTRICS - Swing Handle SHKSS Universal Locking - 92268
DORE ELECTRICS - 3 point lock rod set - TLR24
Half Profile Cylinder
Key Codes RC496A, RC496AB, RC496ABC refer to each door for clarification.

Locks Door 5
DORE ELECTRICS - Swing Handle SHPSS Padlockable - 316
DORE ELECTRICS - 3 point lock rod set - TLR24
ENERGEX padlock, S/Steel Shackle, 45mm brass pin tumbler.
Energex Key No325. c/w 2 keys.

OPERATING PARAMETERS

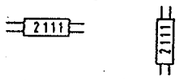
Standard	AS 3439.1
Current & Frequency	AC 50Hz
Rated Operational Voltage Ue	415 VAC
Rated Insulation Voltage Ui	660 V
Rated Auxiliary Voltage	240 VAC / 24 VDC
Rated Current (Main Bus)	300 AMPS
Short Circuit Current Isc	20 kA
Duration of Isc	.2 sec
Degree of Protection	IP 56 to AS 1939
Measure of Protection by barriers and enclosures.	
Service Conditions	Outdoors
Mass	Not exceeding 2000kg
Forms of Segregation	Form 1

PAINTING

Aluminium Surface Preparation.
Finish smooth all exposed welds, clean, descale, and degrease all surfaces.
Surfaces pretreatment in accordance with AS 1580 & AS 3715 using Novox LF acid etch cleaner, Novacoat 12 conversion coating, & clean water rinses.
Apply DULUX ALPHATECH 3000 powder coat to manufacturer's recommendations.
CUBICLE & EXTERNAL COMPONENTS :- DULUX Mist Green (36648) matt finish.
INTERIOR ITEMS (mounting panels, escutcheons, etc.) :- DULUX Bright White (32166)
Minimum Dry Film Thickness all surfaces 50 microns.

WIRING

All wiring to be PVC V90 HT 0.6/1Kv Grade with tinned conductor.
Control and instrumentation wiring has flexible copper conductors, and is colour coded as detailed below, numbered each end, and terminated by the use of appropriate pre-insulated crimp lugs or pins.
Separate lugs or pins shall be used for each conductor. A proprietary double pin lug may be used to terminate two conductors.
Use proprietary bridging links when required to common up terminals.
Not more than two wires shall be connected to any terminal.
Not more than one wire shall be connected on one side of any tunnel type terminal.
Where multiple connections are required on tunnel terminals, proprietary terminal link bars shall be used.
Power wiring to be minimum 2.5sqmm stranded copper conductors, phase colour coded as detailed below.
Control wiring to be minimum 1.0sqmm flexible copper conductors, colour coded as detailed below.
Low level control signals to be minimum 0.5sqmm flexible copper conductors. colour coded as detailed below.
Wiring between RTU terminals & RTU disconnect plugs to be multicore cable with 0.5sqmm flexible copper conductors.
4-20mA analog signals (internal & external) wired in shielded pair minimum size 0.5sqmm, and earthed at one end only. (Switchboard end for external signals)
All 240VAC wiring in the RTU or PLC sections shall be double insulated and all terminals shall be shrouded and labelled- 'Danger 240VAC'
Earth cables minimum 2.5sqmm flexible.
Doors and hinged escutcheons bonded with flexible tinned copper braiding.
Disconnection zone door to be bonded with flexible copper B/Wire. Heat shrink at lugs.
Switchboard to have dedicated earthing cable bonding directly to main earth bar.
Ensure minimum clearance of 100mm is maintained between cable ducting & gland plates.
Wire numbering will be equal to Grafoplast SI2000 system.
Terminal strips to be mounted 30mm off equipment panel to aid termination.
Wire numbers are readable left to right,bottom to top as shown.



Refer to sheet 17 for coding details for RTU disconnection plugs.
Coding pins must be fitted to both the disconnect plug and terminal block.
Supply spare 'RTU fuse terminal' fuses seperately. 2x10A, 2x5A 4x2A, 6x.5A

COLOUR CODE

Phase wiring (A,B &C)	Red, White, Blue	2.5sqmm (min)
Potential Metering (240/415 VAC)	Red, White, Blue, Black	1.5sqmm
Current Metering (Secondary)	Red, White, Blue, Grey	2.5sqmm
240 VAC Control Active	Red	1.0sqmm
240 VAC Neutral	Black	1.0sqmm
Extra Low VDC Positive supplies	Orange	1.0sqmm
Extra Low VDC Negative supplies	Violet	1.0sqmm
General Extra Low VDC Wiring	Grey	1.0sqmm
RTU & PLC Wiring	Grey	0.5sqmm
Electrode Wiring	Salmon	1.0sqmm
Intrinsically safe wiring	Light Blue	1.5sqmm
Earth	Green/Yellow	2.5sqmm (min)
Door & Escutcheon Earth Bonds	Green/Yellow	4 sqmm

LABELS

Internal labels W/B engraved ABS PLASTIC to label schedule.
Warning labels R/W engraved ABS PLASTIC to label schedule.
E/Stop labels Y/B engraved ABS PLASTIC to label schedule.
First letter = Background colour, Second letter = Lettering colour.

Main switch labels	MAIN SWITCH 400A	10mm / 4mm	Material ABS PLASTIC Colour B/W
Pump CB labels	PUMP No1 250A	6mm / 4mm	Material ABS PLASTIC Colour W/B
Compartment labels	RTU	10mm	Material Stainless Steel
E/Stop labels	EMERGENCY STOP	4mm	Material ABS PLASTIC Colour Y/B
Warning labels	DANGER 415V ISOLATE ELSE WHERE	7mm / 5mm	Material ABS PLASTIC Colour R/W

Internal labels secured by M3 chrome plated metal threads. CB's to be identified with individual labels as per label schedule Labels obstructed by switchboard wiring are relocated to adjacent duct lid. Labels secured by M3 nylon threads. The duct lid is secured by a single cable tie at one corner. External labels secured by M3 316 stainless steel metal threads. All internal and external labels are to have bevelled edges.

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.
SIGNED: R Mott DATE: 1.5.12
NAME of SIGNATORY: Rob Mcott
RPEQ No. or LICENCE: 9972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

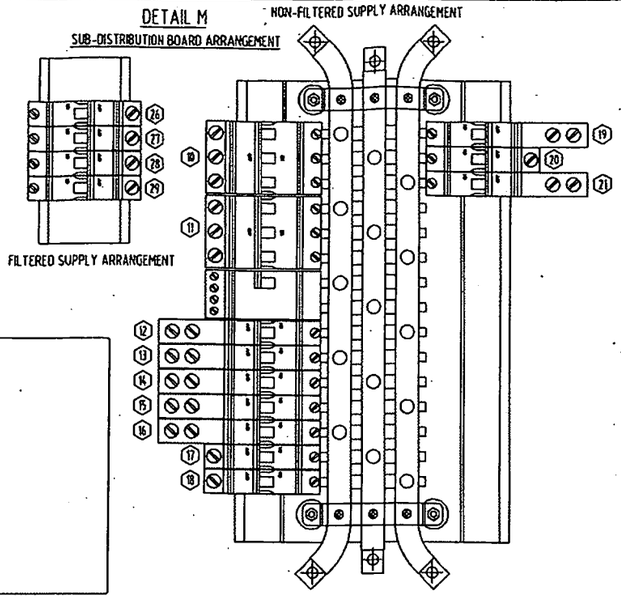
ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 004 857 325 114 CAMPBELL AVE BROOK, QLD 4076
PH. (07) 3271 2911 FAX. (07) 3271 2933 EMAIL: jpr@jpr.com.au
JPR Project No.: E10-C41900

DETAIL M

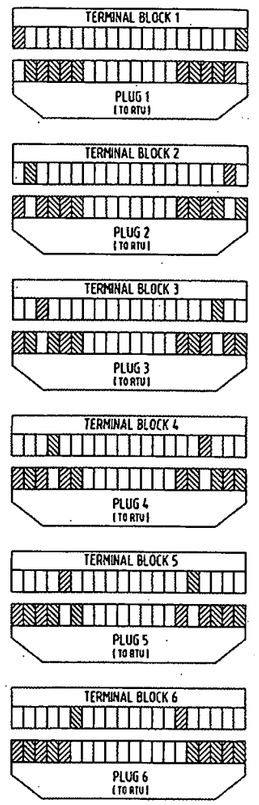
NON-FILTERED SUPPLY ARRANGEMENT
SUB-DISTRIBUTION BOARD ARRANGEMENT

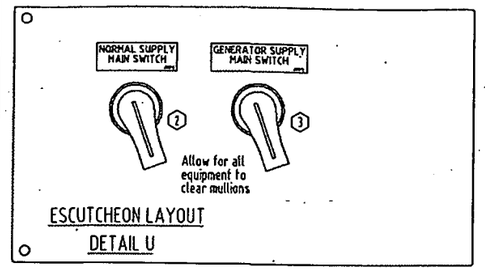


FILTERED SUPPLY ARRANGEMENT

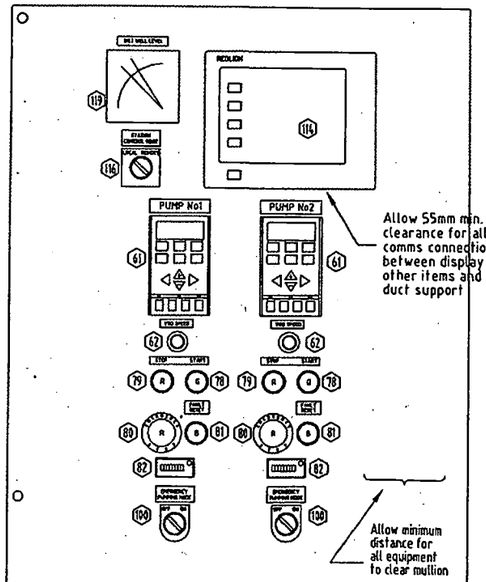
RTU DISCONNECT PLUGS

CODING DETAILS . CODING PIN

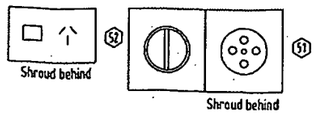


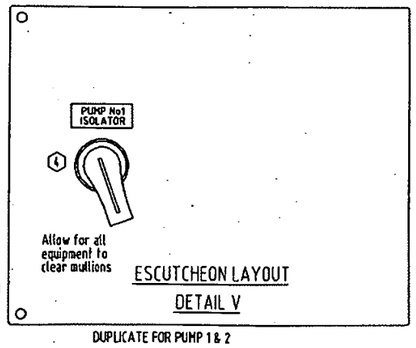


ESCUTCHEON LAYOUT
DETAIL U



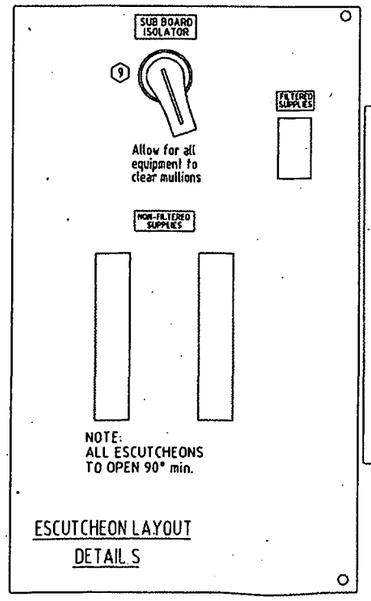
ENSURE ALL EQUIPMENT CLEARS MULLION WHEN HINGED PANEL IS FULLY OPEN
DOOR LAYOUT
DETAIL R



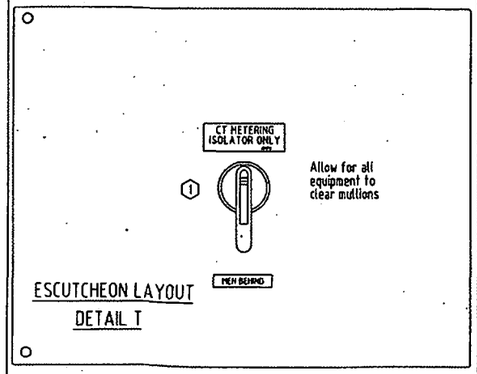


ESCUTCHEON LAYOUT
DETAIL V

DUPLICATE FOR PUMP 1 & 2



ESCUTCHEON LAYOUT
DETAIL S



ESCUTCHEON LAYOUT
DETAIL T

Sheet 17

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED P.HAGUE
DRAFTING CHECK A.WITTHOFT
CAD FILE 57-0070set_C
B.C.C. FILE No.

Original Signed by A.WITTHOFT	21-04-08	Original Signed by K.VAHEESAN895	24-04-08
DESIGN R.P.E.Q. No.	DATE	PRINCIPAL DESIGN MANAGER	DATE
Original signed by R.JANFADA 5192	21-04-08	Original Signed by P.SHERRIFF	22-04-08
DESIGN CHECK R.P.E.Q. No.	DATE	CLIENT DELEGATE	DATE

Queensland Urban Utilities

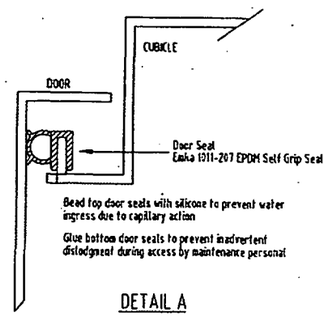
SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
CONSTRUCTION DETAILS

SHEET No. 17
Queensland Urban Utilities DRAWING No.
486/5/7-0070-017
AMEND. C

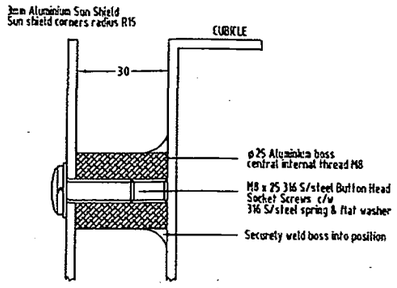
STD TEMPLATE SP-ZP-V50-ATW Ver1.2

J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by des_ba on Friday, 27 April 2012 11:26:28 AM



DETAIL A

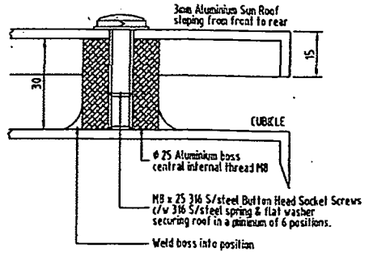
DOOR SEAL
EXTERNAL SWITCHBOARD



Notes: Screws are not to penetrate cubicle metalwork.
Boss for sunshields to be 30mm.

DETAIL B

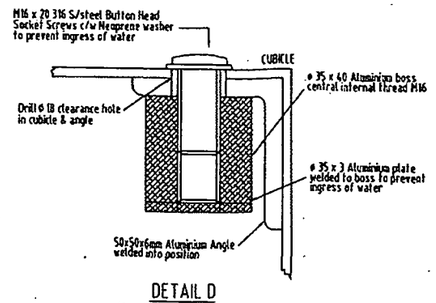
(SUN SHIELD MOUNTING TO ENDS, REAR AND DOORS)



Note: Screws are not to penetrate cubicle metalwork

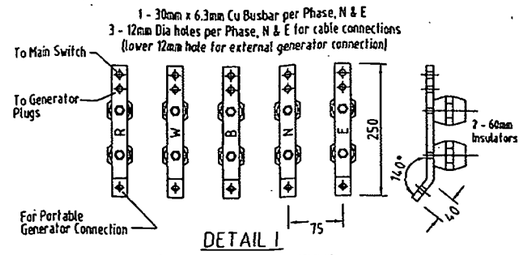
DETAIL C

(SUN ROOF FIXING DETAIL)



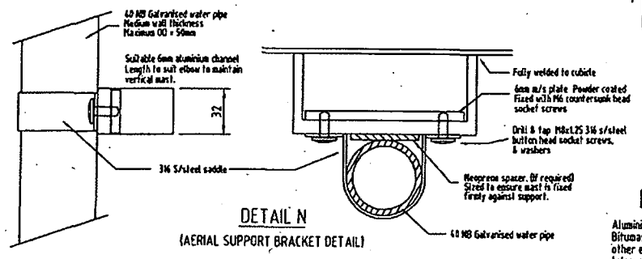
DETAIL D

(EYE BOLT FIXING DETAIL)



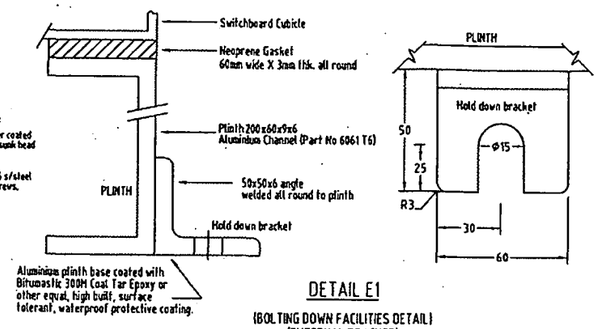
DETAIL I

(GENERATOR BOLTED CONNECTION)
(FIT SHROUD AND LABEL)



DETAIL N

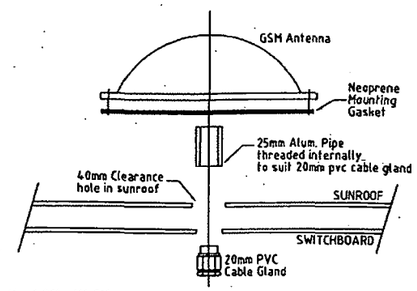
(AERIAL SUPPORT BRACKET DETAIL)

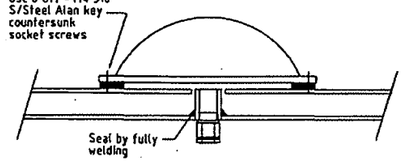


DETAIL E1

(BOLTING DOWN FACILITIES DETAIL)
(EXTERNAL BRACKET)

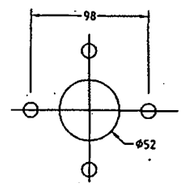
SET UP CUBICLE TO BE LEVEL & PLUMB BEFORE BOLTING TO CONCRETE PLINTH USING M12 S/STEEL CHEMICAL ANCHORS.
MINIMUM ANCHORAGE 110mm.
FILL WITH NON-SHRINK GROUT WHERE REQUIRED.





DETAIL X

(GSM ANTENNA MOUNTING DETAIL)

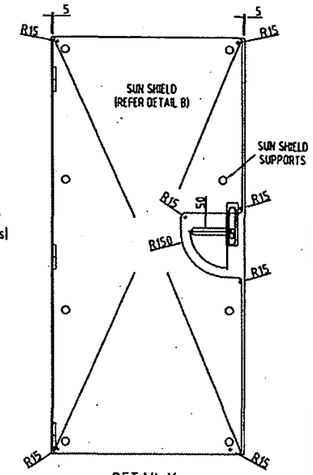


(Fit 3mm neoprene gasket between plinth & flange)
(Fixings 316 s/steel botts, nuts, flat & spring washers)

DETAIL P

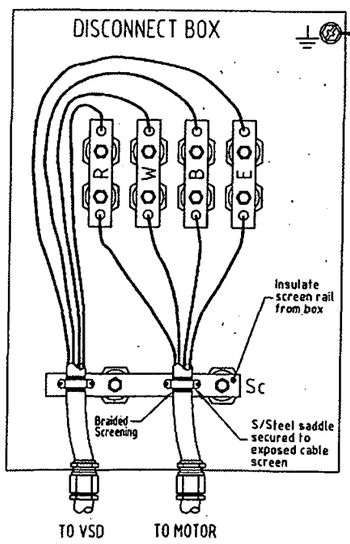
(AERIAL FLANGE MOUNTING DETAIL)

NOTE:
DOORS MUST BE ARRANGED ON MULLIONS TO ALLOW FOR ALL DOORS TO OPEN THE FULL 105°.
A FULLY OPEN DOOR MUST NOT PREVENT AN ADJACENT DOOR FROM BEING OPENNED OR CLOSED.



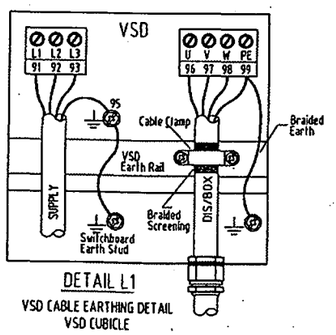
DETAIL K

(DOOR SUN SHIELD DETAIL)



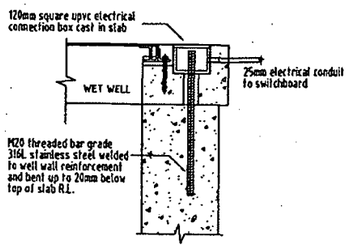
DETAIL L2

VSD CABLE EARTHING DETAIL
DISCONNECT BOX



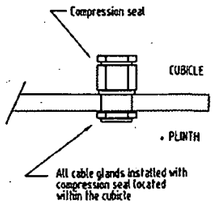
DETAIL L1

VSD CABLE EARTHING DETAIL
VSD CUBICLE



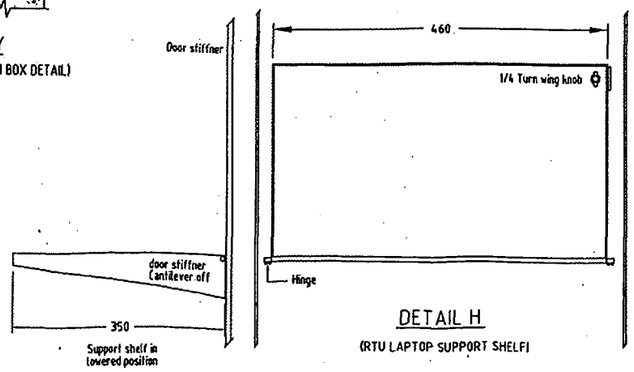
DETAIL Y

(REINFORCING CONNECTION BOX DETAIL)



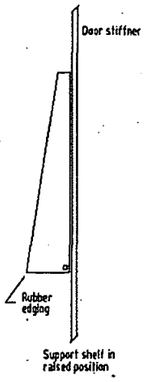
DETAIL G

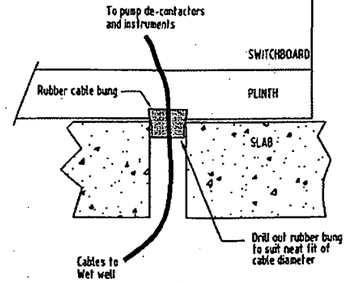
(CABLE GLAND INSTALLATION DETAIL)



DETAIL H

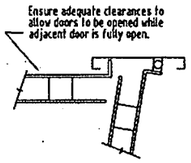
(RTU LAPTOP SUPPORT SHELF)



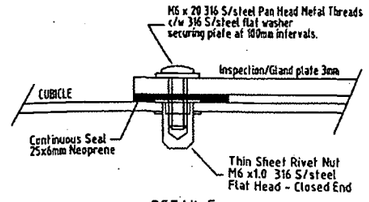


DETAIL W

(WET WELL CONDUIT SEALING DETAIL)



DOOR CLEARANCES



DETAIL F

(GLAND/INSPECTION PLATE FIXING DETAIL)

REV	COMPANY	J & P RICHARDSON INDUSTRIES
C	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

ELECTRICAL AS BUILT DETAILS

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-2P-V10-8TU Ver1.0

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT		21-04-08
DESIGN	R.P.E.Q. No.	DATE
Original signed by R.JANFADA	5192	21-04-08
DESIGN CHECK	R.P.E.Q. No.	DATE

Original Signed by K.VAHEESABBS	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
CONSTRUCTION DETAILS

SHEET No. 18

Queensland Urban Utilities DRAWING No.
486/5/7-0070-018

AMEND.
C

J & P RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 009 859 323 144 CAMPBELL ST BOWEN QLD 4805
PH. (07) 4771 2911 FAX (07) 4771 2823 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

Sheet 18

AS INSTALLED

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J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by dos_be on Friday, 27 April 2012 11:20:28 AM

NORTHERN SURVEY MARKER No.???
mAHD = ????

CONDUIT TO FIELD DISCONNECTION BOX

TOP OF SLAB LEVEL (SITE SURVEY LEVEL)
mAHD =

TOP OF LEVEL PROBE BRACKET
mAHD =

ALLOW SUFFICIENT LENGTH ON CABLE TO ALLOW FOR REMOVAL OF PROBE AND CONDUIT ASSEMBLY. EXCESS LENGTH TO BE STORED IN ELECTRODE BOX.

HANGING HOOK

CABLE TIES

?? mtrs Note 4

SURCHARGE LEVEL
mAHD =

SURCHARGE IMMINENT LEVEL
mAHD =

MEASUREMENT POINT

SURCHARGE IMMINENT LEVEL PROBE

CABLE CLAMP SUSPENSION EYELET

25mm NYLON CABLE GLAND Note 3

END CAP (No Glue)

?? mtrs Note 4

200

HIGH LEVEL
mAHD =

MEASUREMENT POINT

HIGH LEVEL PROBE

40mm PVC CONDUIT

?? mtrs Note 4

DRILLED 6mm HOLES AT 300mm INTERVALS ALONG THE LENGTH OF THE CONDUIT Note 1

?? mtrs

PUMP A START
mAHD =

PUMP A STOP
mAHD =

REFER TO 'RED LION' DISPLAY FOR CURRENT SITE LEVELS

Note 2

LEVEL PROBE
mAHD =

HYDROSTATIC LEVEL PROBE
RANGE = 10m

MEASUREMENT POINT

BOTTOM OF WELL
mAHD =

	QTY	MATERIALS LIST
1	1	LENGTH OF HEAVY DUTY ORANGE PVC CONDUIT 40mm
2	1	CONDUIT END CAP
3	2	25mm NYLON CABLE GLAND
4	3	CABLE CLAMP SUSPENSION EYELET

LEVEL PROBE INSTALLATION NOTES

1. Drill 4 x 6mm holes, 150mm from each end and every 300mm of the cut length, prior to installation.
2. Install so that the conduit rests on the shoulder of the probe. Do Not glue the conduit to the end cap.
3. Install a 25mm nylon cable gland. Apply no compression to cable.
4. Measurements are to be taken from top of the Level Probe box (slab level) to 'measurement points' on probes

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: RMA DATE: 1.5.12
NAME of SIGNATORY: Rob M. Offi
RPEQ No. or LICENCE: C1997Z
COMPANY NAME: JPR.
START DATE: FINISH DATE: 1.5.12

Qu to confirm probe mounting HEIGHT.

IP68 RATED "VEGABAR 74 " PRESSURE SENSOR WITH DN40 (11/2") BSP THREADED MALE END. MODEL TO SUIT PRESSURE RANGE AND CABLE LENGTH FOR EACH INDIVIDUAL SITE. EXAMPLE MODEL "BR74XXGGI?HA2X"

PRESSURE RANGE

CABLE TO REMOTE "VEGABAR DIS12XBAX" ELECTRONICS IN PUMPING STATION SWITCHBOARD

DN40 (11/2") BSP TO DN32 (11/4") BSP STAINLESS STEEL REDUCING SOCKET

DN32 (11/4") BSP STAINLESS STEEL 90° EQUAL MALE BEND.

DETAILS OF NON PREFERRED INSTALLATION TO BE USED WHERE SPACE IS LIMITED

DN40 (11/2") BSP TO DN32 (11/4") BSP STAINLESS STEEL REDUCING SOCKET

DN32 (11/4") BSP STAINLESS STEEL NIPPLE.

REDUCE TO SUIT EXISTING PRESSURE POINT STOP COCK

DN32 STAINLESS STEEL UNION WITH DN32 (11/4") BSP FEMALE ENDS AND INSTALLED WITH FEMALE SECTION OF UNION ADJACENT TO VALVE

DN32 (11/4") BSP STAINLESS STEEL NIPPLE. NOTE, ADDITIONAL FITTINGS MAY BE REQUIRED.

B-B TO BE INSTALLED ON SITE

A-A EXISTING ON SITE

PRESSURE POINT STOP COCK

TAPPING BAND

HORIZONTAL

26 MIN 121°

DETAILS OF PREFERRED INSTALLATION

Electrical contractor to supply and fit all fitting necessary to plumb pressure transducer into existing isolation valve.

PRESSURE TRANSMITTER INSTALLATION NOTES

1. Material: All stainless steel fittings to be grade 316.
2. Galling: All stainless steel threads to be lubricated with approved anti galling grease and thread tape where applicable.
3. Install as per 'prefered' detail unless space limitations prevents this method.

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	67-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT	6695	21-04-08	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by R.JANFADA	5192	21-04-08	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by K.VAHEESAN	24-04-08
PRINCIPAL DESIGN MANAGER	DATE
Original Signed by P.SHERRIFF	22-04-08
CLIENT DELEGATE	DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 27 001 852 325 114 CAMPBELL AVE BROOL QLD 4078
PH. (07) 3271 3911 FAX (07) 3271 3925 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND UrbanUtilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
LEVEL PROBES
AND PRESSURE TRANSMITTER
INSTALLATION DETAILS

SHEET No. 19
Queensland Urban Utilities DRAWING No. 486/5/7-0070-019
AMEND. C

Sheet 19

AS INSTALLED

STD TEMPLATE SP-3P-V50-RTO Ver12

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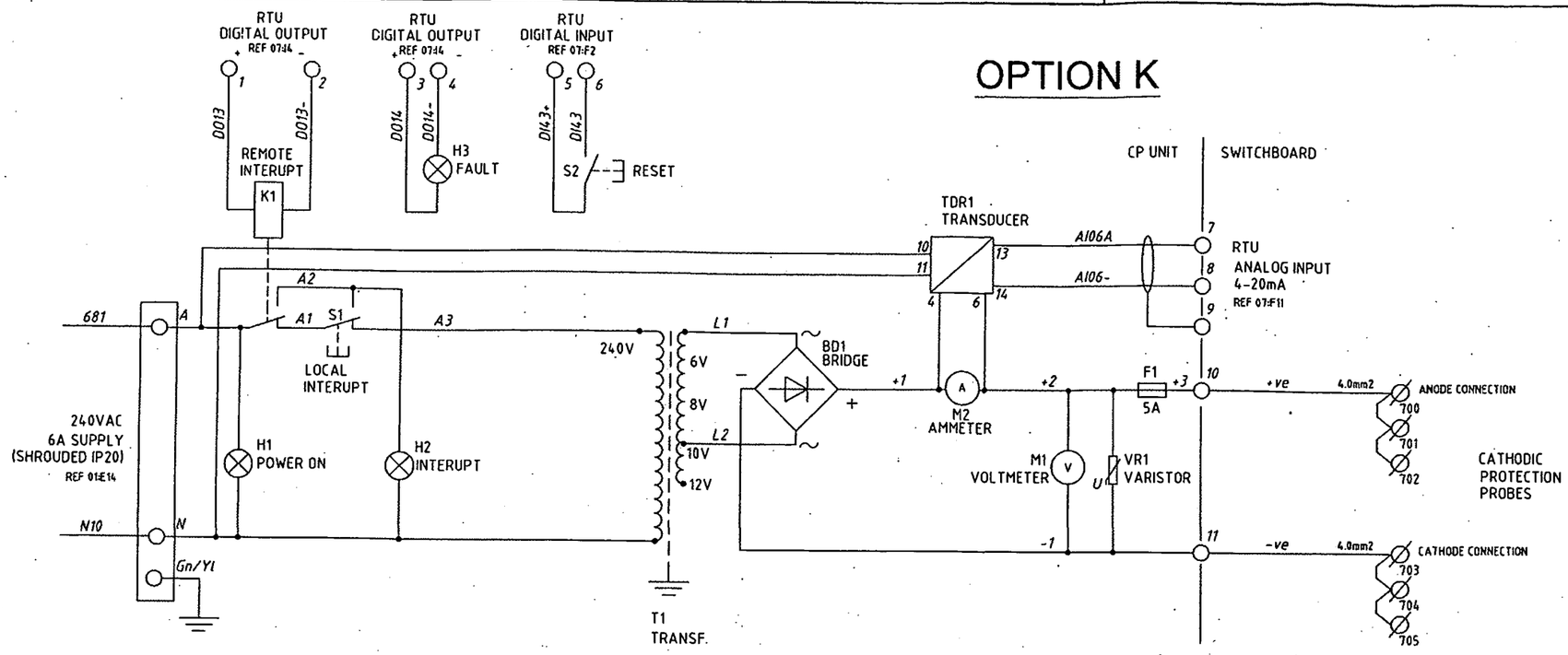
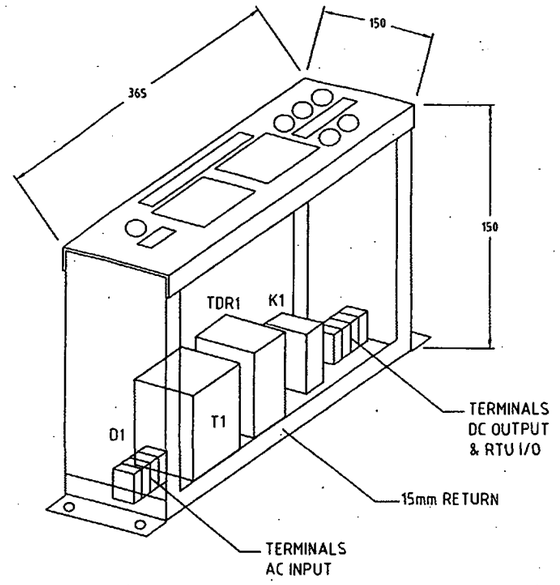
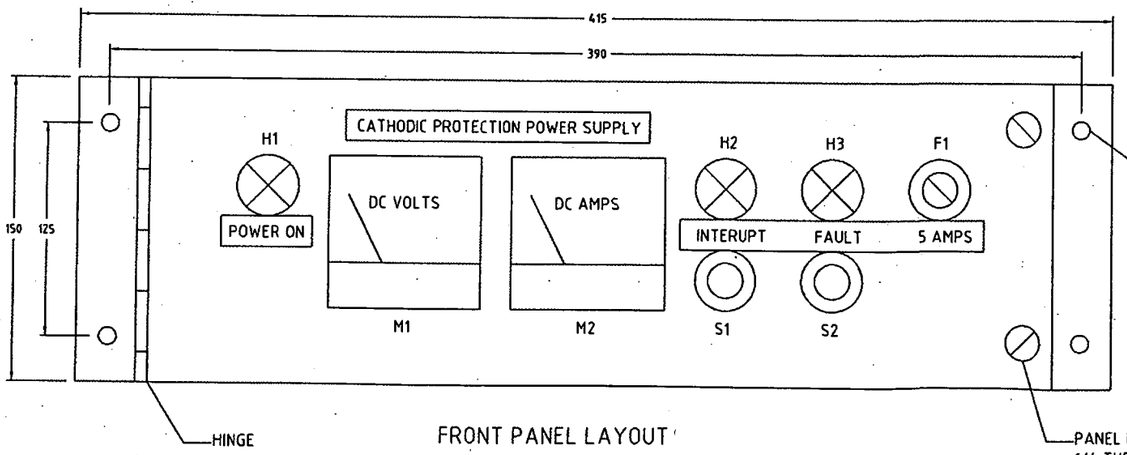
OPTION K







FRONT PANEL LAYOUT
NTS

ITEM	QTY	DESCRIPTION (RS _____ = RS COMPONENTS PART NUMBER)
BD1	1	DIODE BRIDGE SINGLE PHASE 35A 600V ISOLATED METAL BASE. RS2278772
F1	1	DC OUTPUT FUSE - PANEL MTG 5x20 FUSE HOLDER c/w 5A FUSE
H1	1	POWER ON INDICATOR 240VAC NEON RED RS576608
H2	1	INTERUPT INDICATOR 240VAC NEON WHITE RS576620
H3	1	FAULT INDICATOR 28VDC LED ARRAY AMBER RS576563
K1	1	REMOTE INTERUPT - RELAY 24VDC 2A 2POLE CHANGEOVER + FW BASE
M1	1	VOLTMETER 0-15 V 69x53 RS259577
M2	1	AMMETER 0-5 A 69x53 RS259511 (28 mOhms)
S1	1	LOCAL INTERUPT - MOMENTERY PUSH BUTTON SWITCH 240V2A CHANGEOVER - RED
S2	1	FAULT RESET - MOMENTERY PUSH BUTTON SWITCH 240V2A CHANGEOVER - BLUE
TDR1	1	TRANSDUCER - MANN INDUSTRIES FTXOMV 0-150mV/4-20mA/240vAC
T1	1	TRANSFORMER - 240VAC PRIM/6,8,10,12VAC SEC 60VA
VR1	1	VARISTOR - SURGE SUPPRESSOR RS649150 (CLAMP 76V10Ap) (31VDC CONTINUOUS)
-	14	TERMINALS 4.0mm RAIL MTG + END COVERS & STOPS

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

ELECTRICAL AS BUILT DETAILS

REV | COMPANY J & P RICHARDSON INDUSTRIES
C | CONTRACTOR LICENCE No. 756
ELECTRICIAN - DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED P.HAGUE
DRAFTING CHECK A.WITTHOFT
CAD FILE 57-0070set_C
B.C.C. FILE No.

Original Signed by A.WITTHOFT 8695 21-04-08 DESIGN R.P.E.Q. No. DATE
Original signed by R.JANFADA 5192 21-04-08 DESIGN CHECK R.P.E.Q. No. DATE
Original Signed by K.VAHEESAN 24-04-08 PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 22-04-08 CLIENT DELEGATE DATE

J. & P. RICHARDSON INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS A.B.N. 23 001 952 325 114 CAMPBELL AVE BROOK QLD 4076
JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

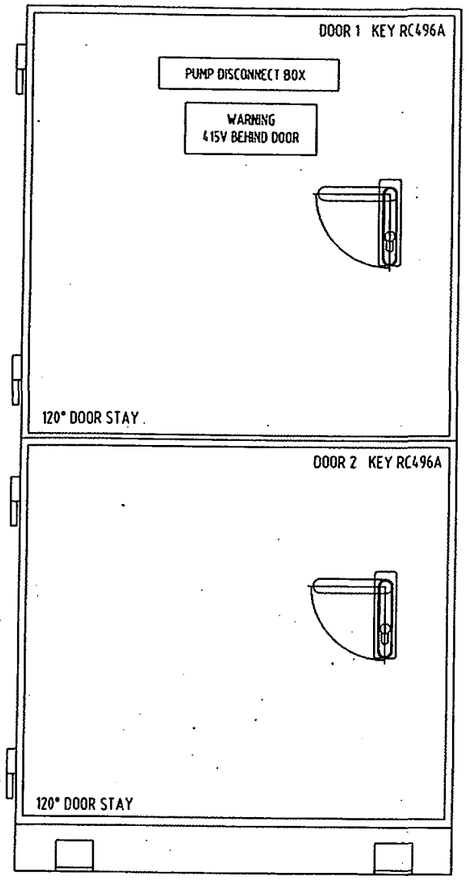
TITLE
CATHODIC PROTECTION UNIT
CONSTRUCTION & WIRING DIAGRAM

SHEET No. 20
Queensland Urban Utilities DRAWING No. 486/5/7-0070-020
AMEND. C

J:\DWG\C41900 QUU\57-0070set_C.dwg Last Saved by des_ba on Friday, 27 April 2012 11:26:28 AM

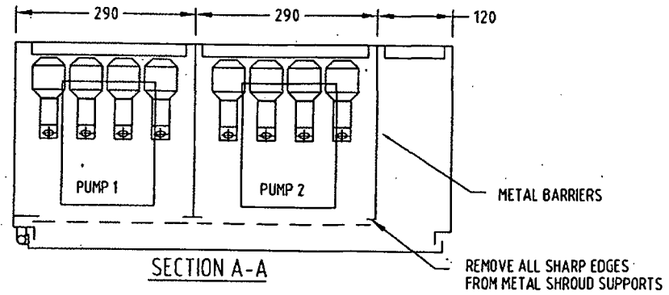
Sheet 20

AS INSTALLED

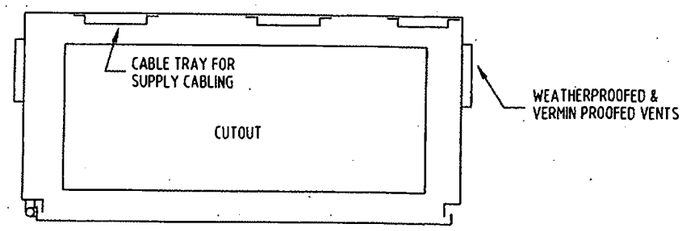


FRONT VIEW

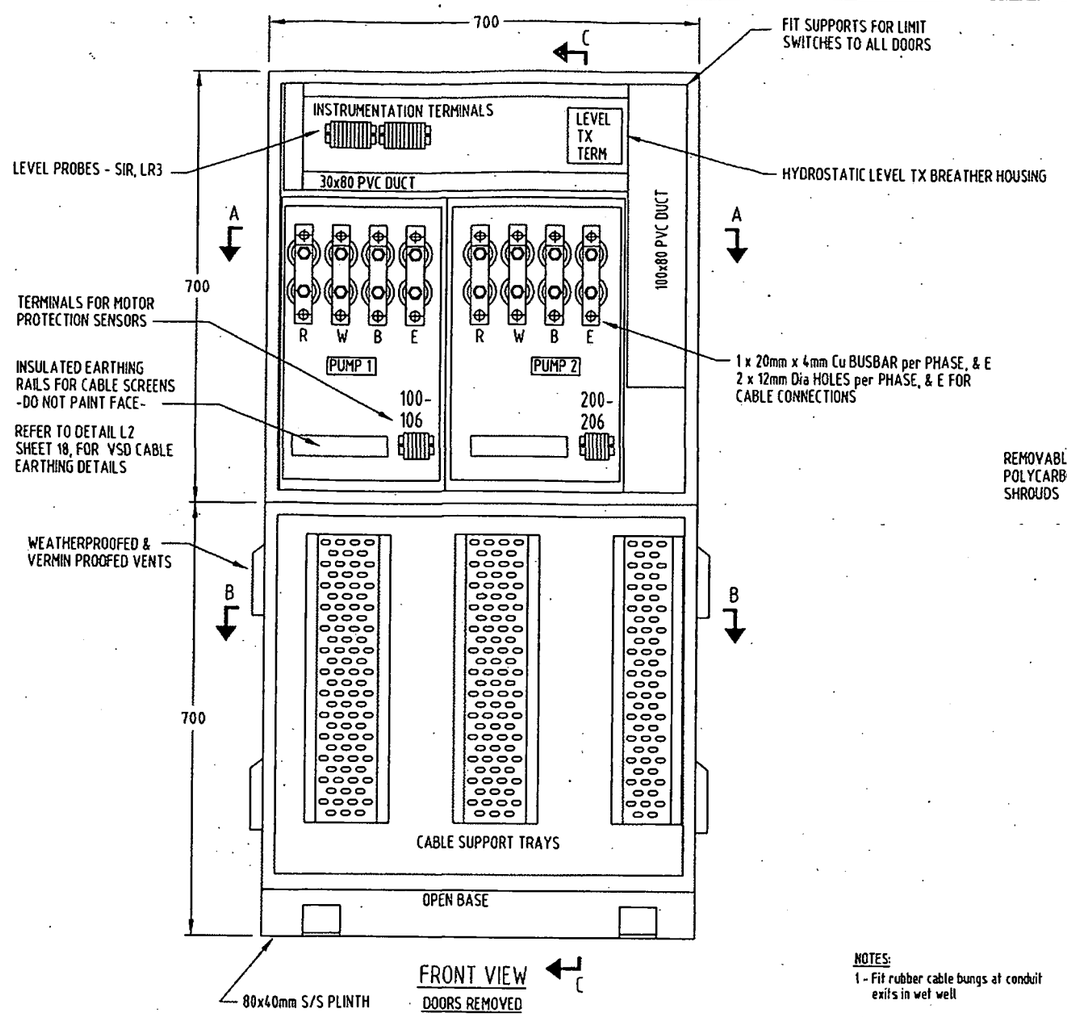
HOLD DOWN TAGS (REFER DETAIL E1)



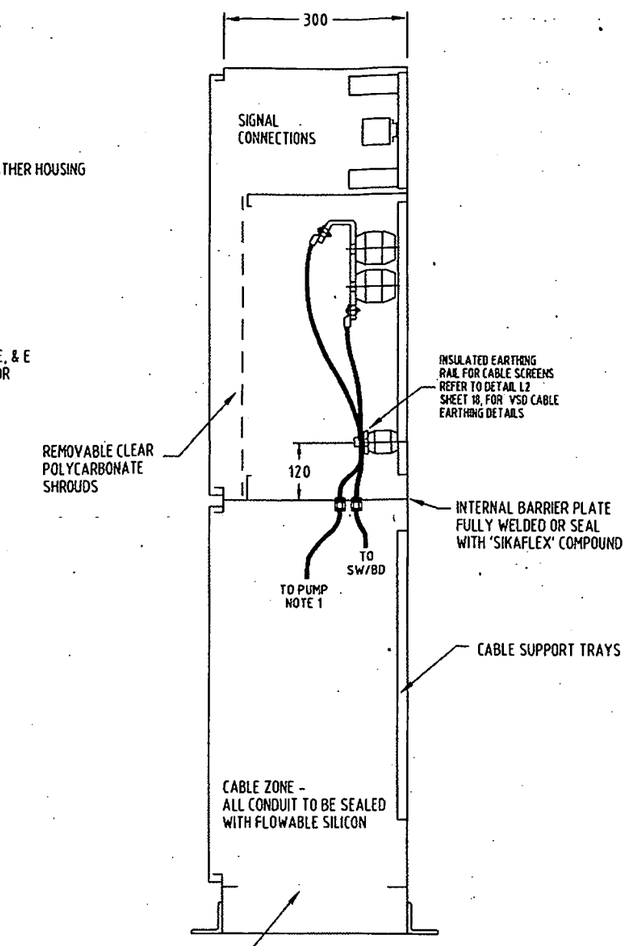
SECTION A-A



SECTION B-B



FRONT VIEW
DOORS REMOVED



SECTION C-C

HOLD DOWN TAGS (REFER DETAIL E1)

NOTES:
1 - Fit rubber cable bungs at conduit exits in wet well

FIELD CONNECTION BOX LABEL LIST

TEXT	TEXT HEIGHT	MATERIAL / COLOUR	SIZE	QTY
PUMP DISCONNECT BOX (EXTERNAL)	20mm	S/STEEL - Black Text	280x35	1
WARNING 415V BEHIND DOOR (EXTERNAL)	10mm	S/STEEL - Red Text	160x40	1
PUMP No?	10mm	ABS PLASTIC - W/B	70x20	2
INSTRUMENTATION	6mm	ABS PLASTIC - W/B	80x15	1
LEVEL TRANSMITTER	6mm	ABS PLASTIC - W/B	80x15	1
EXTERNAL LABELS 1mm THICK. 316 GRADE STAINLESS STEEL. FIXED WITH M3 316 STAINLESS STEEL METAL THREADS.				

CONSTRUCTION

Cubicle construction 2mm 316 Stainless Steel.

Plinth construction 80x40 channel 316 Stainless Steel.

Folded, "Pulse MIG" & "TIG welded with all visible seams and joints fully welded, free from splatter and ground smooth where needed.

External doors and covers fitted with Emka 1011-207 self grip seal.

M6 Earth studs fixed to the interior of all doors and hinged escutcheons and on adjacent cubicle interior surfaces.

Door stiffeners to be of sufficent strength to prevent being deformed when subjected to reasonable loads.

Provide Shrouding as shown on drawing to all busbars to IP20

Hinges (external) Selectrix HB650ss-316. Stainless Steel

Star washers fitted under all hinge screws.

Locks Door 1 & 2

DORE ELECTRICS - Swing Handle SHKSS Universal Locking - 92268
DORE ELECTRICS - 3 point lock rod set - TLR22SS (all S/Steel)
Lockwood Barrel Lock,
Key Code RC496A

Finish

Stainless Steel 2b Finish.

OPERATING PARAMETERS

Standard	AS 3439.1
Current & Frequency	AC 50Hz
Rated Operational Voltage Ue	415 VAC
Rated Insulation Voltage Ui	660 V
Rated Auxiliary Voltage	240 VAC / 24 VDC
Rated Current (Busbars)	200 AMPS
Short Circuit Current Isc	20 kA
Duration of Isc	.2 sec
Degree of Protection	IP 56 to AS 1939
Service Conditions	Outdoors

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MOTTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0070set_C
B.C.C. FILE No.	

Original Signed by A.WITTHOFT 8895 21-04-08
DESIGN R.P.E.Q. No. DATE
Original signed by R.JANFADA 5192 21-04-08
DESIGN CHECK R.P.E.Q. No. DATE

Original Signed by K.VAHEESAN 24-04-08
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 22-04-08
CLIENT DELEGATE DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 852 325 114 CHERMSIDE RD BOOX, QLD 4016
PH. (07) 3271 3111 FAX. (07) 3271 3523 Email: jpr@jpr.com.au

JPR Project No.: E10-C41900

QUEENSLAND UrbanUtilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN	DATE: 27.04.12

TITLE
SWITCHBOARD
GENERAL ARRANGEMENT
ELEVATIONS

Sheet 21

AS INSTALLED

SHEET No. 21

Queensland Urban Utilities DRAWING No. 486/5/7-0070-021 AMEND. C

STD TEMPLATE SP-JP-VSD-RTU Ver1.0

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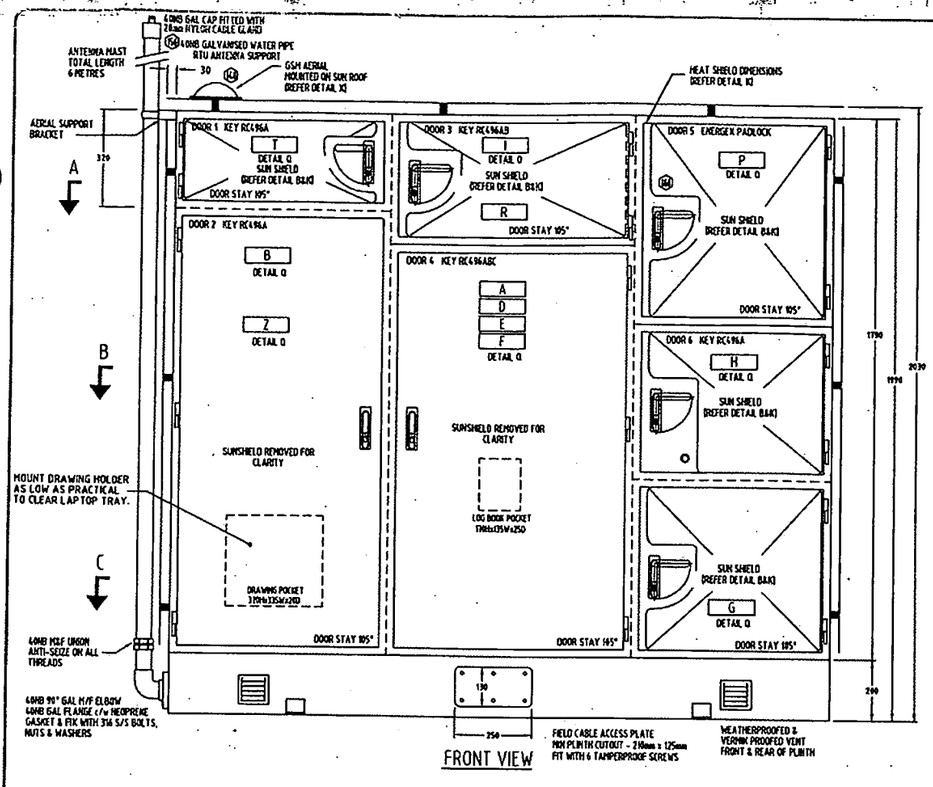
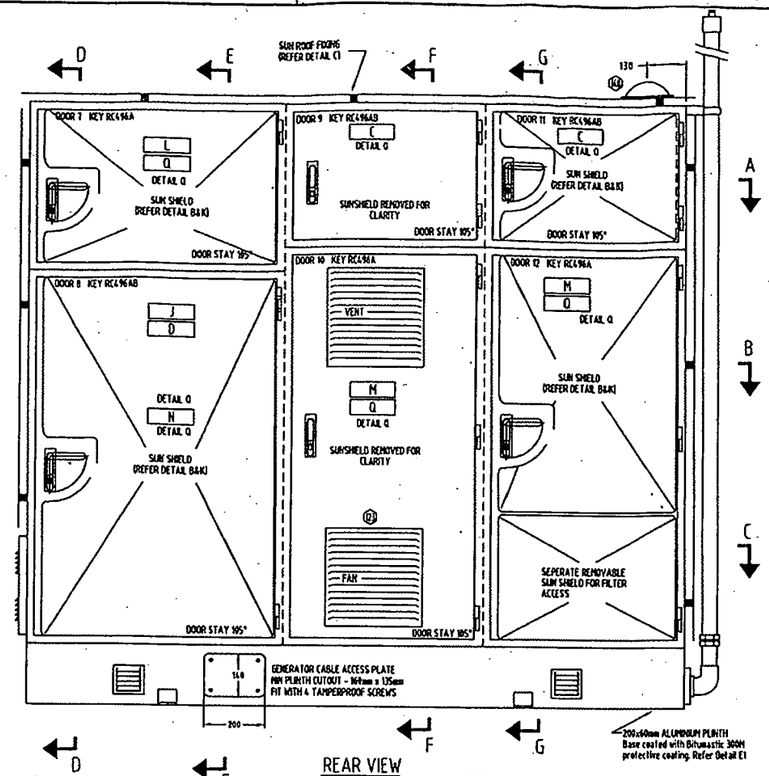
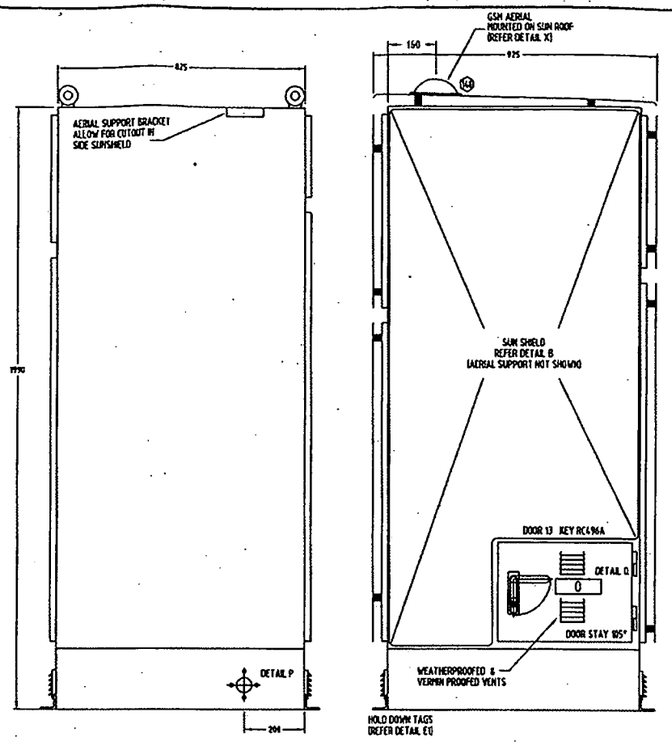


FRONT VIEW

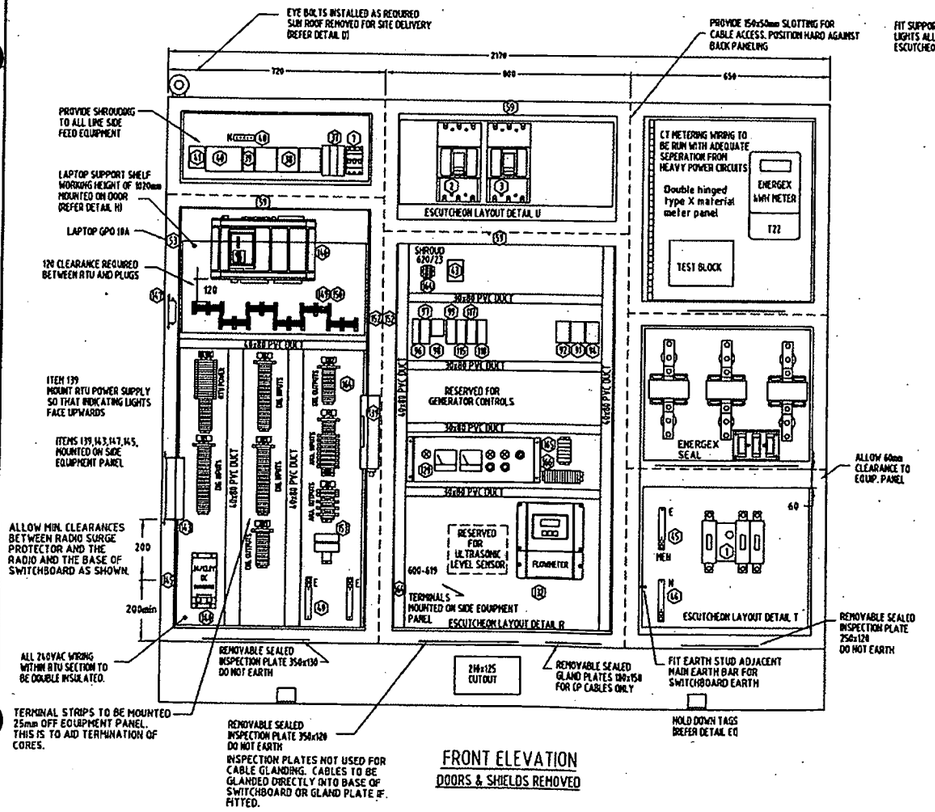


REAR VIEW

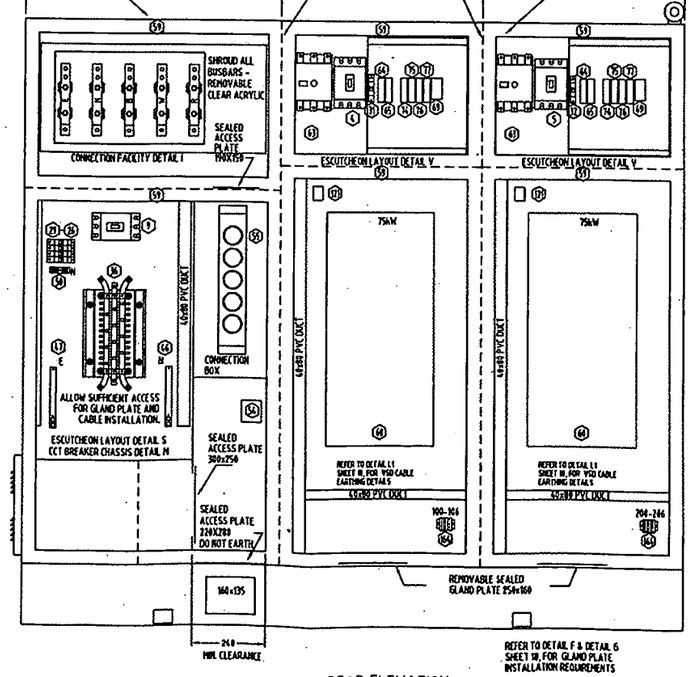


LEFT HAND ELEVATION
SHIELDS REMOVED

RIGHT HAND VIEW



FRONT ELEVATION
DOORS & SHIELDS REMOVED



REAR ELEVATION
DOORS & SHIELDS REMOVED

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12

NAME of SIGNATORY: ROB MOTTI

RPEQ No. or LICENCE: 19977

COMPANY NAME: JPR.

START DATE: FINISH DATE: 1.5.12

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 33 001 852 325 114 CAMPBELL AVE WOOL QLD 4076
PH. (07) 3271 2511 FAX. (07) 3271 2633 EMAIL: jpr@jpr.com.au

JPR Project No.: E10-C41900

ELECTRICAL AS BUILT DETAILS

REV	
C	COMPANY J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No. 756
	ELECTRICIAN - DATE: 27.04.12

Sheet 22

AS INSTALLED

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT 8895 21-04-08	DESIGN R.P.E.Q. No. DATE
DRAFTING CHECK	A.WITTHOFT	Original signed by R.JANFADA 5192 21-04-08	DESIGN CHECK R.P.E.Q. No. DATE
CAD FILE	57-0070set_C	Original Signed by K.VAHEESAN 24-04-08	PRINCIPAL DESIGN MANAGER DATE
B.C.C. FILE No.		Original Signed by P.SHERRIFF 22-04-08	CLIENT DELEGATE DATE

STD TEMPLATE SP-3P-V50-03U Ver1.0

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
GENERAL ARRANGEMENT
ELEVATIONS

SHEET No. 22

Queensland Urban Utilities DRAWING No. 486/5/7-0070-022

AMEND. C

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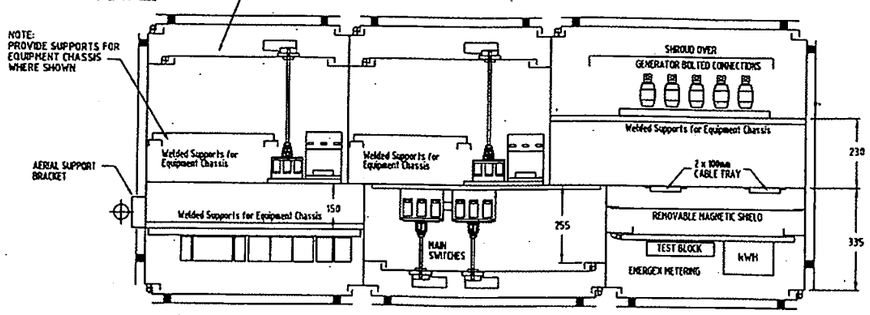
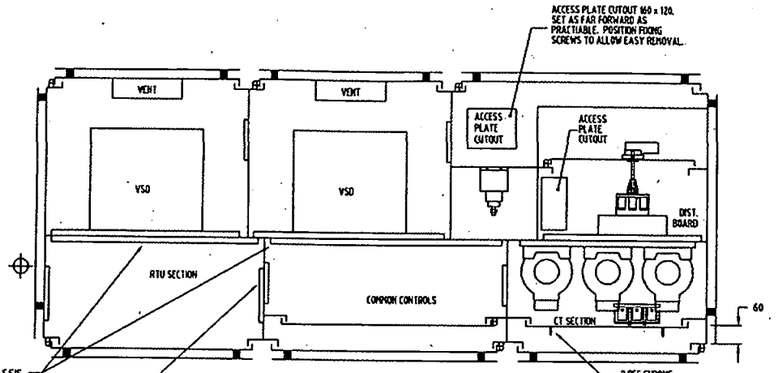
NOTE:
ALL ESCUTCHEONS TO OPEN 90° min.

NOTE:
PROVIDE SUPPORTS FOR EQUIPMENT CHASSIS WHERE SHOWN



SECTION A-A

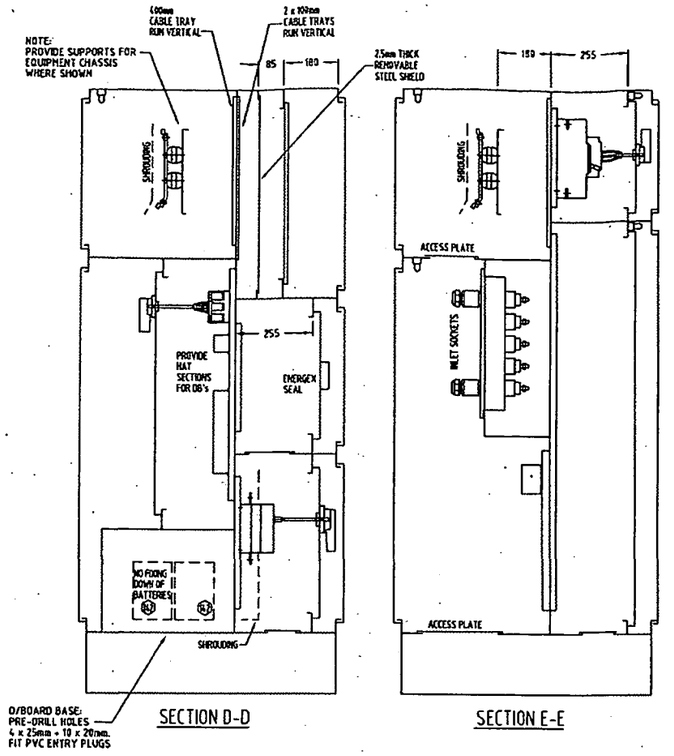


NOTE:
MAKE EQUIPMENT CHASSIS MAXIMUM WIDTH

FULL LENGTH EQUIPMENT PANELS ON SIDE WALLS IN RTU & COMMON SECTIONS (AS WIDE AS PRACTICAL AND AS FAR FORWARD AS POSSIBLE)

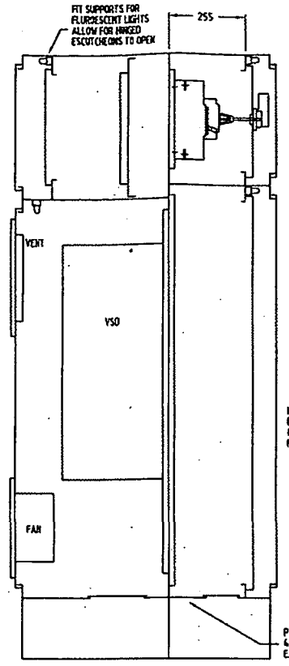
2 OFF CHROME LIFT OFF HANDLES

SECTION B-B

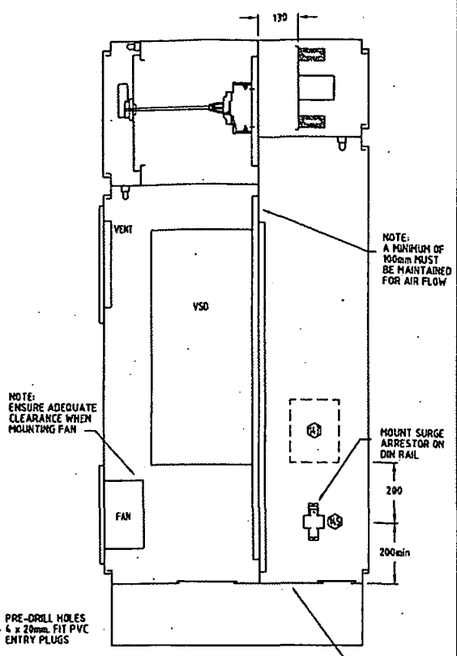


SECTION D-D

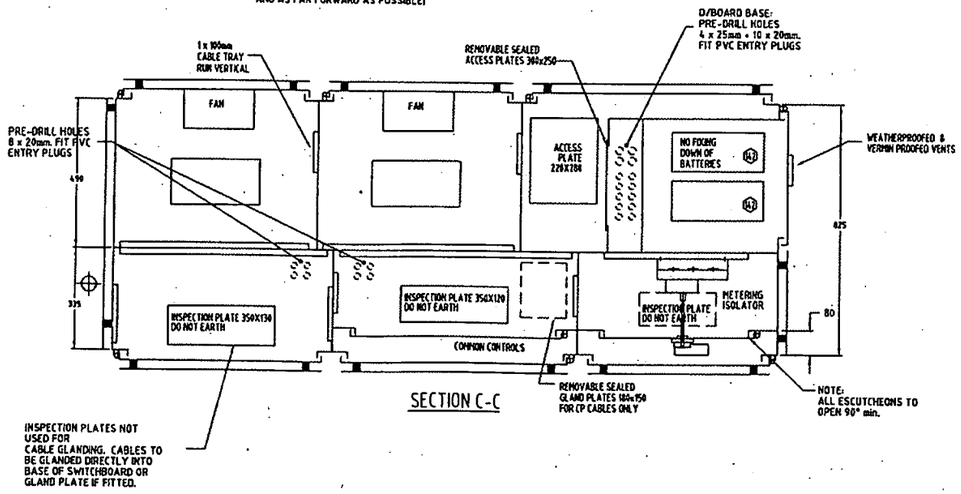
SECTION E-E



SECTION F-F

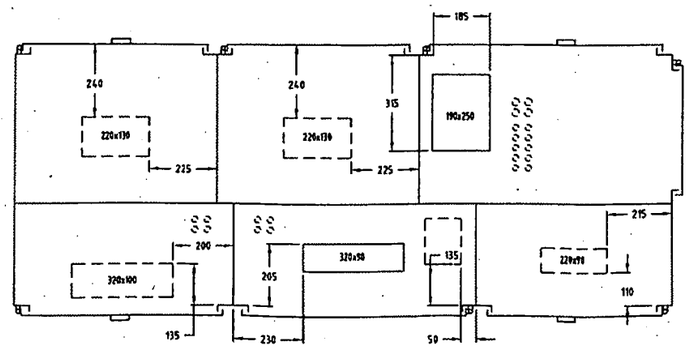


SECTION G-G



SECTION C-C

INSPECTION PLATES NOT USED FOR CABLE GLANDING. CABLES TO BE GLANDED DIRECTLY INTO BASE OF SWITCHBOARD OR GLAND PLATE IF FITTED.



GLAND/INSPECTION PLATE CUTOUTS

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MICITTI
RPEQ No. or LICENCE: C19972
COMPANY NAME: JPR.
START DATE: FINISH DATE: 1.5.12

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 009 853 325 114 CAMPBELL ARC WACOL QLD 4076
PH. (07) 3271 2611 FAX (07) 3271 2622 EMAIL jpr@jpr.com.au

JPR Project No.: E10-C41900

Sheet 23

AS INSTALLED

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No:	756
	ELECTRICIAN	DATE: 27.04.12

A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.	DRAFTED	P.HAGUE	
C	04.12	AS INSTALLED	B.A.	R.M.	DRAFTING CHECK	A.WITTHOFT	
B	03.12	AS CONSTRUCTED	R.B.	B.J.	CAD FILE	57-0070set_C	
No.	DATE	AMENDMENT	DRN.	APD.	B.C.C. FILE No.		

Original Signed by A.WITTHOFT	8895	21-04-08	
DESIGN	R.P.E.Q. No.	DATE	
Original signed by R.JANFADA	5192	21-04-08	
DESIGN CHECK	R.P.E.Q. No.	DATE	

Original Signed by K.VAHEESAN		24-04-08
PRINCIPAL DESIGN MANAGER		DATE
Original Signed by P.SHERRIFF		22-04-08
CLIENT DELEGATE		DATE

Queensland Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
GENERAL ARRANGEMENT
SECTIONS

SHEET No. 23

Queensland Urban Utilities DRAWING No.
486/5/7-0070-023

AMEND.
C

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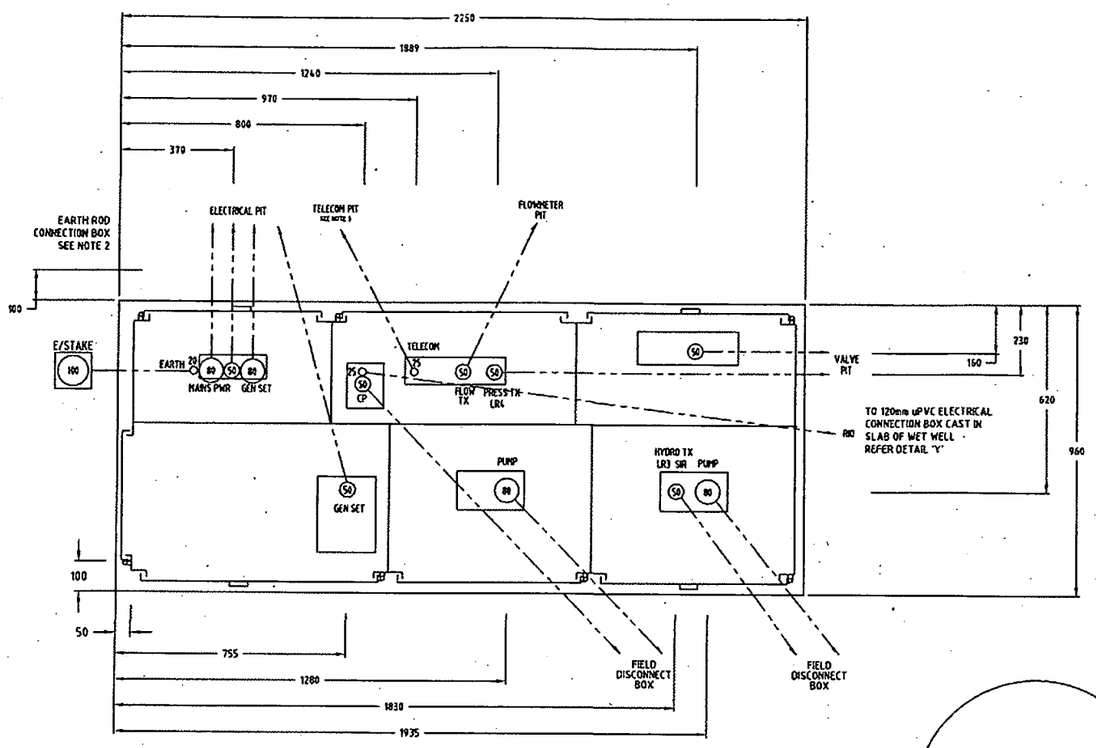
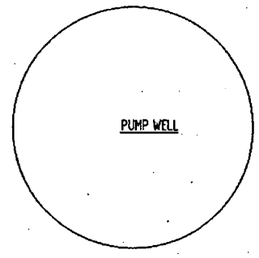


NEW SWITCHBOARD AND CONDUIT LOCATIONS
SCLAE 1:20



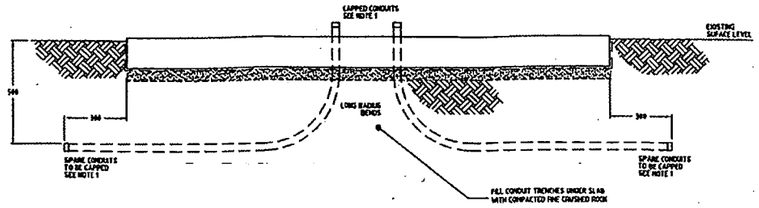
CONCRETE SLAB & CONDUITS

ALL DIMENSIONS TO BE CONFIRMED ON SITE

AS CONSTRUCTED DETAILS

I CERTIFY THAT THE "AS CONSTRUCTED" DETAILS SHOWN ON THIS PLAN ARE A TRUE AND ACCURATE RECORD OF THE WORKS.

SIGNED: DATE: 1.5.12
NAME of SIGNATORY: ROB MOTTI
RPEQ No. or LICENCE: 19972
COMPANY NAME: JPR
START DATE: FINISH DATE: 1.5.12



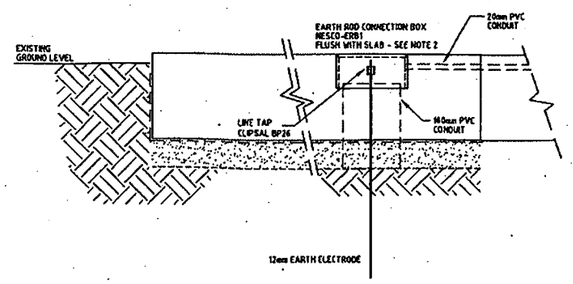
TYPICAL CONDUIT INSTALLATION
(NOT ALL CONDUITS SHOWN)
N.T.S.

CONDUIT NOTES

1- PVC HEAVY DUTY ELECTRICAL CONDUITS (ORANGE) CASTED INTO NEW CONCRETE SWITCHBOARD SLAB. ALL CONDUITS FITTED WITH LONG RADIUS BENDS, MINIMUM DEPTH 500mm. ALL CONDUIT STUBS FITTED WITH END CAPS TO PREVENT THE INGRESS OF MOISTURE AND SOIL. 'SPARE' OR 'FUTURE' CONDUITS TO EXTEND 300mm BEYOND SLAB EDGE AND FITTED WITH END CAPS.

2- NESCO 'ERB1' EARTH ROD CONNECTION BOX TO BE CAST IN AND FLUSH WITH SLAB. ALLOW A MIN. OF 20mm CLEARANCE FROM CONNECTION BOX LID TO THE BASE OF SWITCHBOARD. 100mm CONDUIT CAST VERTICALLY IN SLAB TO EXTEND FROM INSIDE CONNECTION BOX, DOWN TO GROUND LEVEL. THIS CONDUIT ALLOWS FOR THE INSTALLATION OF AN EARTHING ROD. 20mm CONDUIT FOR EARTH IS TO BE MARRIED INTO THIS CONNECTION BOX PRIOR TO POURING ANY CONCRETE WORKS. REFER DETAIL 1

3- 50mm COMMUNICATIONS CONDUIT (WHITE CONDUIT MUST BE USED)



DETAIL - 1
EARTH ROD CONNECTION BOX
TYPICAL INSTALLATION
N.T.S.

ELECTRICAL AS BUILT DETAILS

REV		
C	COMPANY	J & P RICHARDSON INDUSTRIES
	CONTRACTOR LICENCE No.	756
	ELECTRICIAN -	DATE: 27.04.12

No	DATE	AMENDMENT	DRN.	APD.
A	07.10	RE-ISSUED FOR CONSTRUCTION	P.H.	G.A.
C	04.12	AS INSTALLED	B.A.	R.M.
B	03.12	AS CONSTRUCTED	R.B.	B.J.

STD TEMPLATE SP-3P-SS Ver2.4

DRAFTED	P.HAGUE	Original Signed by A.WITTHOFT 8895 21-04-08	Original Signed by F.FORNASIER 24-04-08
DRAFTING CHECK	A.WITTHOFT	DESIGN R.P.E.Q. No. DATE	PRINCIPAL DESIGN MANAGER DATE
CAD FILE	57-0070set_C	Original signed by R.JANFADA 5192 21-04-08	Original Signed by P.SHERRIFF 22-04-08
B.C.C. FILE No.		DESIGN CHECK R.P.E.Q. No. DATE	CLIENT DELEGATE DATE

J. & P. RICHARDSON
INDUSTRIES PTY LTD ELECTRICAL CONTRACTORS AND ENGINEERS
A.B.N. 23 001 892 325 114 CAMPBELL AVE WACOL QLD 4076
PH. (07) 3271 2511 FAX (07) 3271 2533 EMAIL jpr@jpr.com.au
JPR Project No.: E10-C41900

QUEENSLAND Urban Utilities

SITE
SP315
AXIS PLACE
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
SLAB & CONDUIT DETAILS

Sheet 25
AS INSTALLED

SHEET No. 25
Queensland Urban Utilities DRAWING No. 486/5/7-0070-025
AMEND. C

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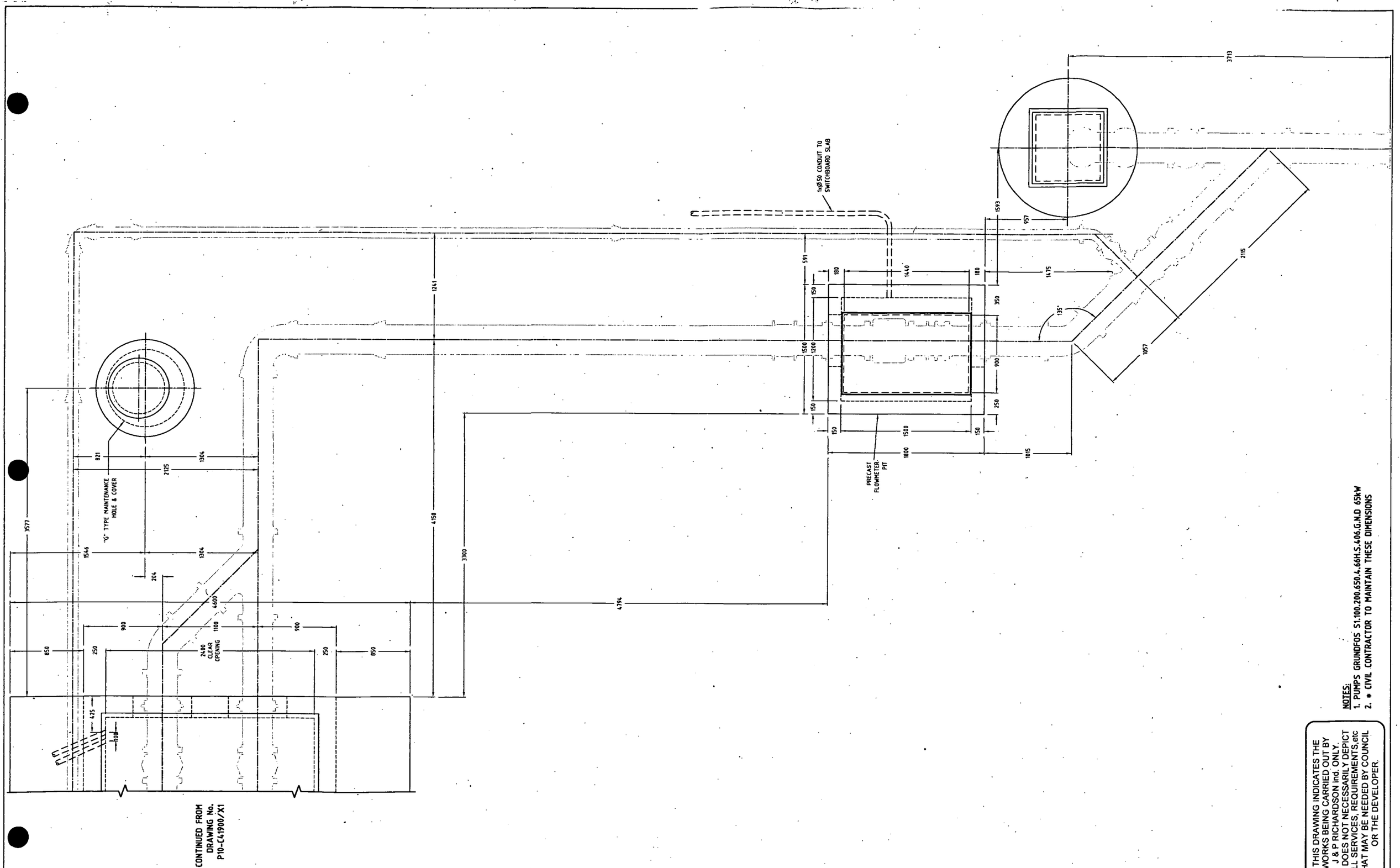


NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. IT DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS, etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.

FILE NAME: Q Pulse Id TMS775

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	AS CONSTRUCTED	13-3-12	P.H.	
A	DRAWING UPDATED TO SUIT AMENDED SLUICE VALVE LENGTHS	20-12-10	P.H.	P.H. 20-12-10

Active 29/01/2014

SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.:	

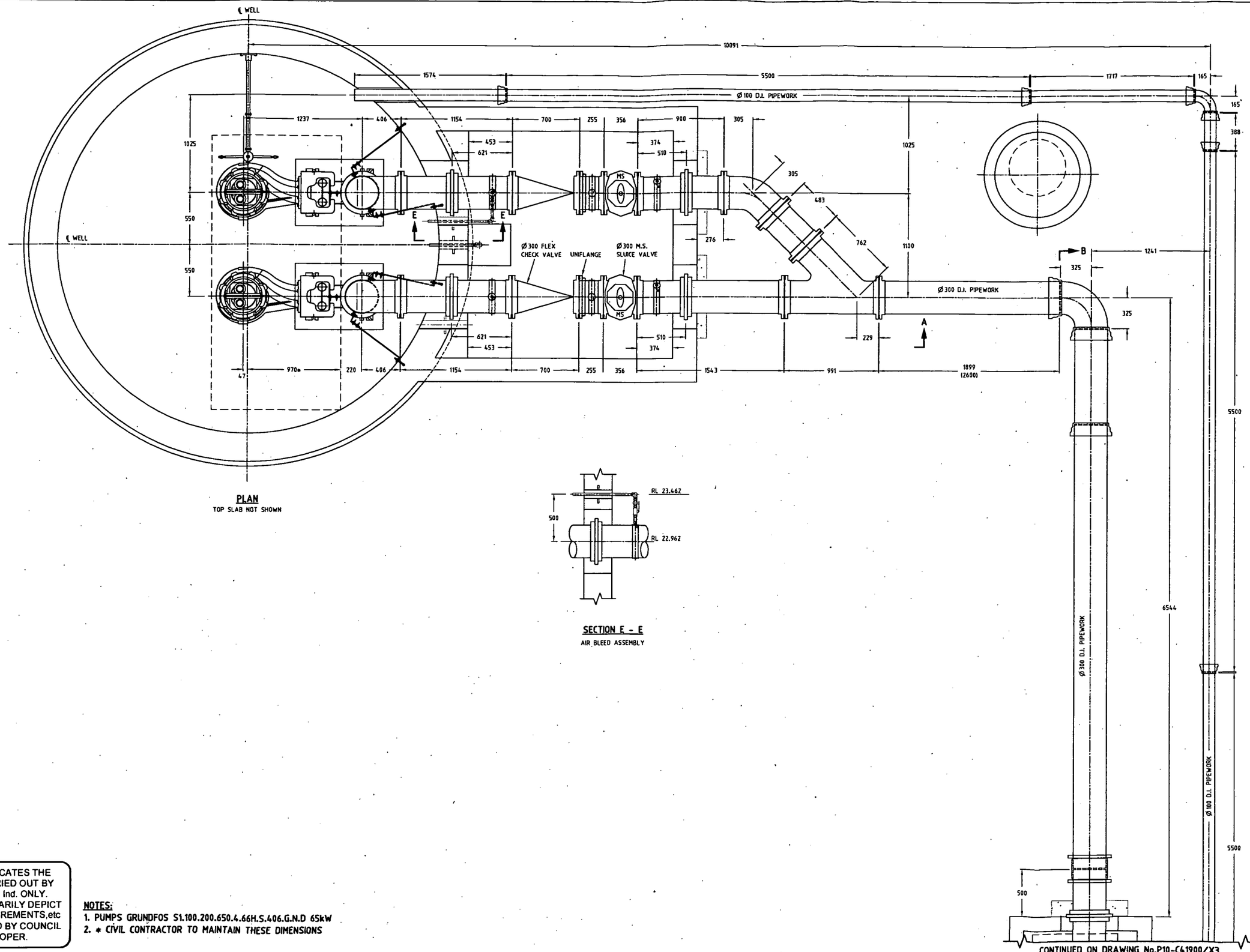
J. & P. RICHARDSON

INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION TOP SLAB LAYOUT

DRAWING No: P10-C41900/X2

AMENDMENT: B



PLAN
TOP SLAB NOT SHOWN

SECTION E - E
AIR BLEED ASSEMBLY

CONTINUED ON DRAWING No.P10-C41900/X3

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS,etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.

NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME: Q-Pulse Id TMS775

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
D	AS CONSTRUCTED	13-3-12	P.H.	
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	P.H. 20-12-10
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

Active 29/01/2014

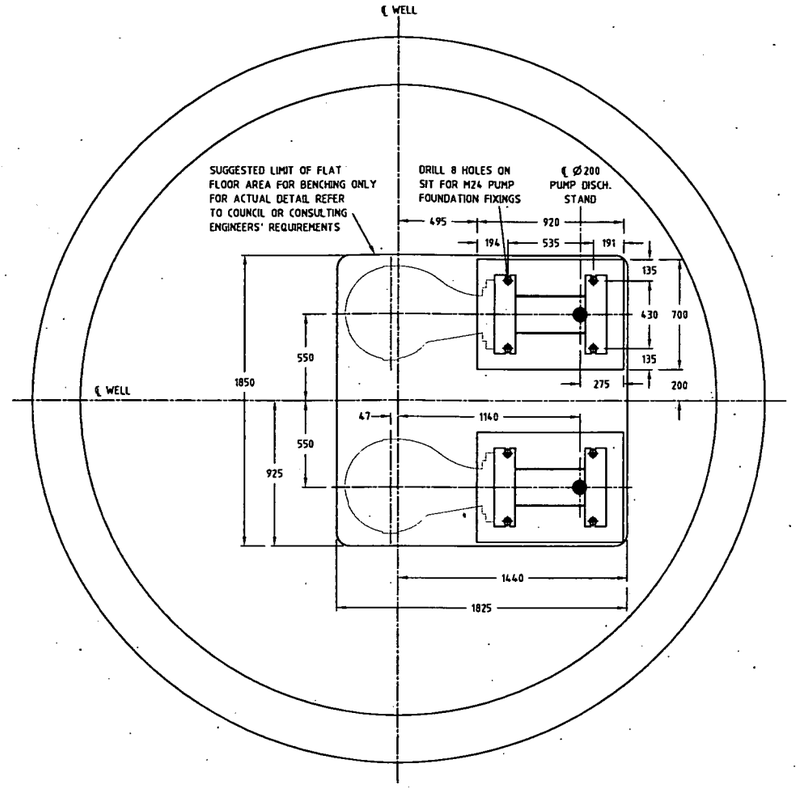
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

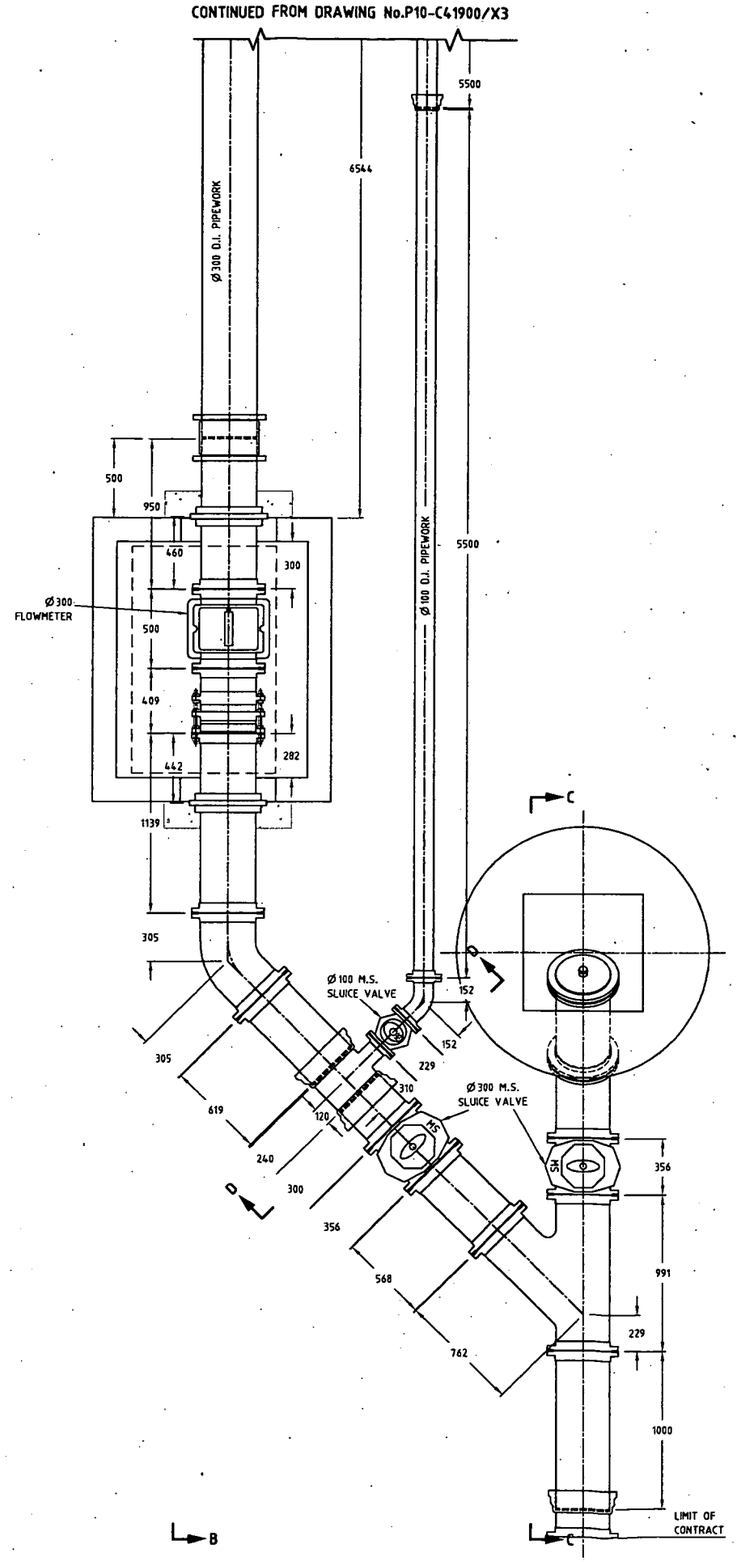
DRAWING No
P10-C41900/X3

AMENDMENT D



FOUNDATION DETAIL

CONTINUED FROM DRAWING No.P10-C41900/X3



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NOTES:
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2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME: Q Pulse Id TMS775

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
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LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
D	AS CONSTRUCTED	13-3-12	P.H.	
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	P.H. 20-12-10
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

Active 29/01/2014

SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON

INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
Ph(07)3271 2911 Fax(07)3271 3823 Email JPR@JPR.COM.AU

TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P10-C41900/X4

AMENDMENT D

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. IT DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS,etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.

NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

SECTION A - A

FILE NAME: Q-Pulse Id TMS775

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
D	AS CONSTRUCTED	13-3-12	P.H.	
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	P.H. 20-12-10
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

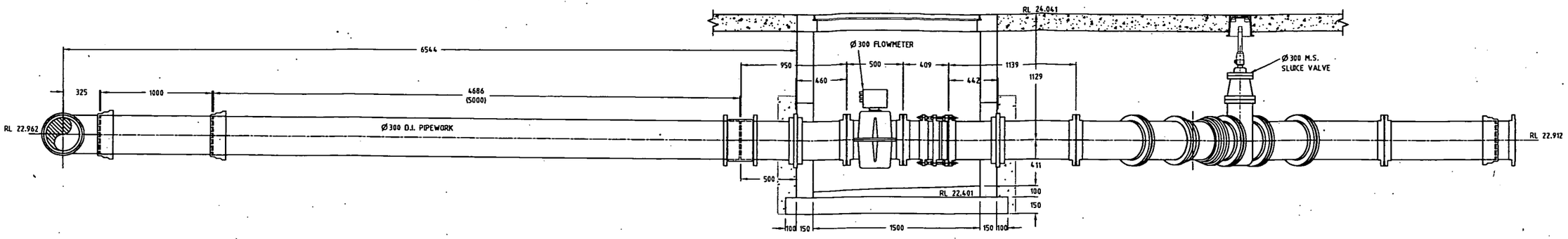
J. & P. RICHARDSON

INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
Ph(07)3271 2911 Fax(07)3271 3823 Email JPR@JPR.COM.AU

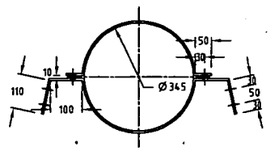
TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION PIPEWORK LAYOUT

DRAWING No: P10-C41900/X5

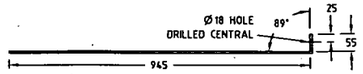
AMENDMENT: D



SECTION B - B



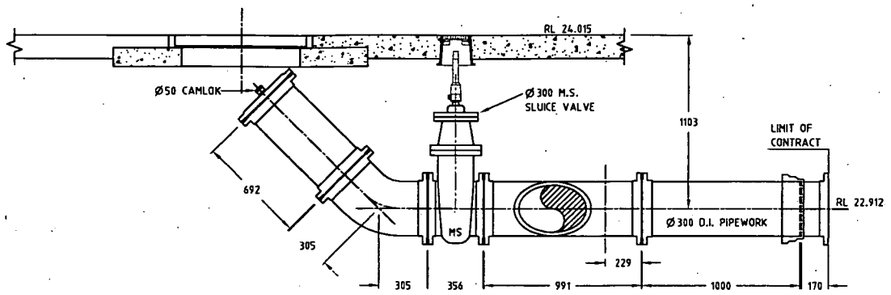
PIPE FIXING BRACKET
1 REQUIRED PER SET
ALL HOLES Ø14, DRILLED CENTRAL



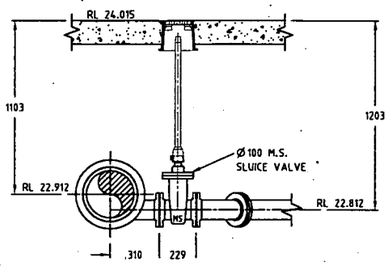
WALL FIXING BRACKET
2 REQUIRED PER SET

DETAIL 1
PIPE SUPPORT BRACKET

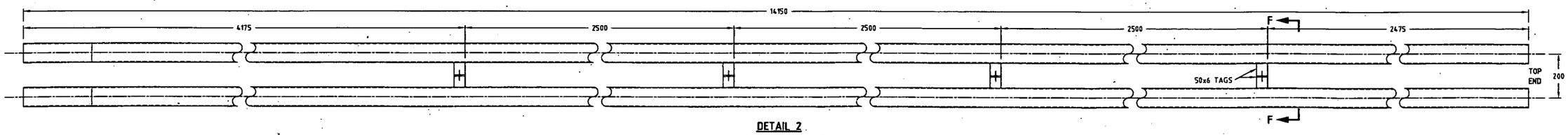
SCALE: 1:10 AT A1
MATERIAL: 50x6 316SS FLAT
No. REQUIRED: 8 SETS



SECTION C - C

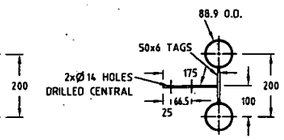


SECTION D - D

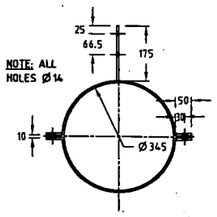


DETAIL 2
PUMP GUIDE RAILS

No. REQUIRED: 2 SETS
MATERIAL: 88.9 O.D. SCH.10S 316SS PIPE



SECTION F - F



DETAIL 3
GUIDE RAIL SUPPORT BRACKET

SCALE: 1:10 AT A1
MATERIAL: 50x6 316SS FLAT
No. REQUIRED: 8

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NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME: Q-Pulse Id TMS775

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
D	AS CONSTRUCTED	13-3-12	P.H.	
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	P.H. 20-12-10
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

Active 29/01/2014

SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

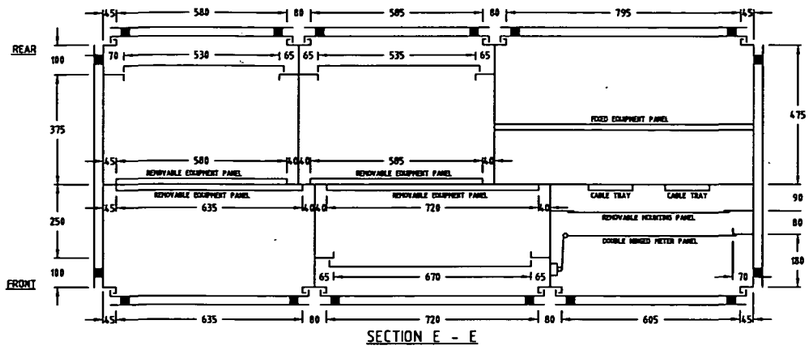
J. & P. RICHARDSON

INDUSTRIES PTY LTD — 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

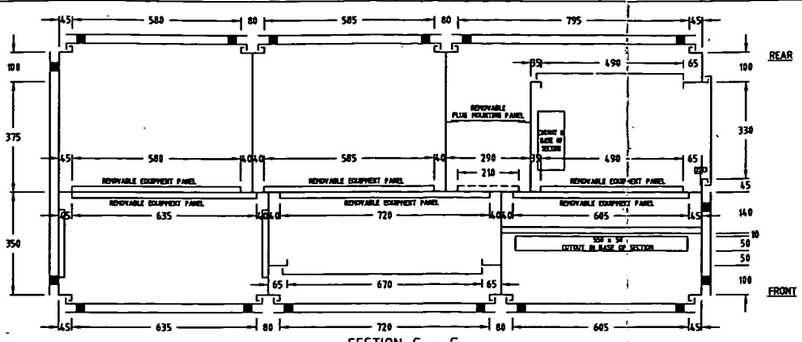
TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P10-C41900/X6

AMENDMENT D



SECTION E - E



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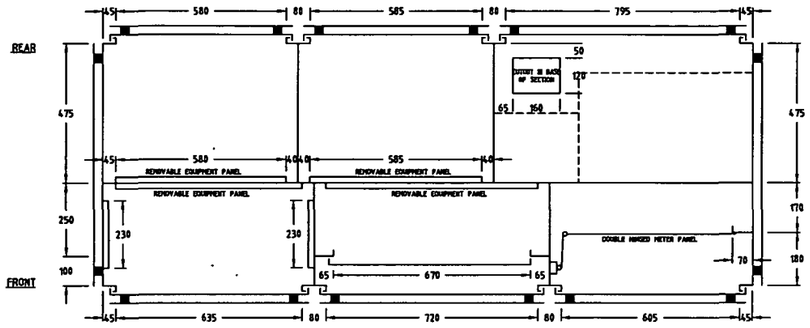

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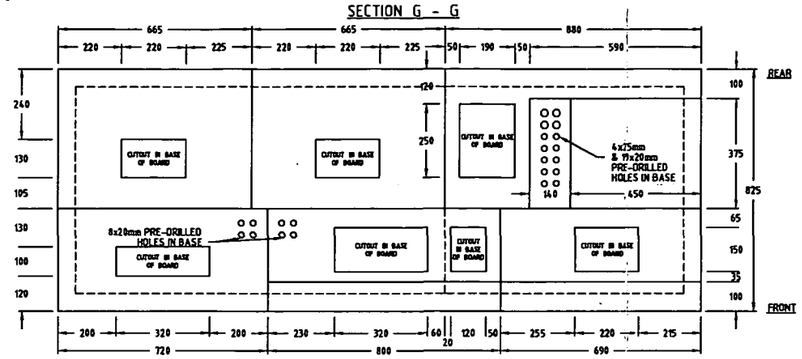
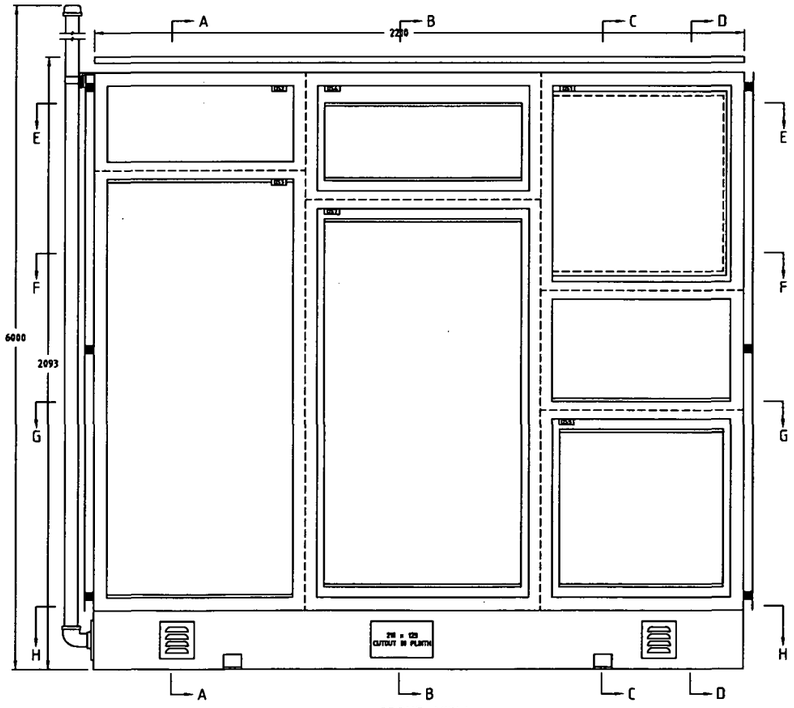
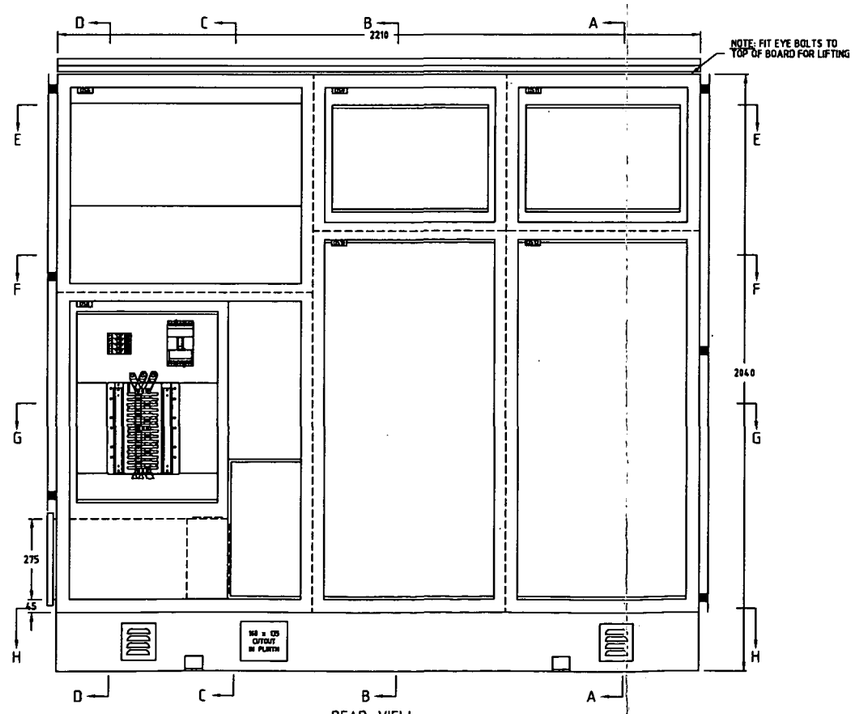


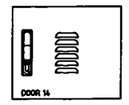
SECTION H - H



FRONT VIEW
DOORS & HINGED PANELS NOT SHOWN



REAR VIEW
DOORS & HINGED PANELS NOT SHOWN



SIDE DOOR

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	AS CONSTRUCTED	26-10-10	L.P.	
A	ISSUED FOR CONSTRUCTION	14-9-10	L.P.	B.J. 14-9-10

SCALE	N.T.S.
DESIGNED	B.J.
TRACED	L.P.
CHECKED	B.J. 17-6-10
DATE	17-6-10
APPROVED	
CLIENT NAME	BMO
JOB No.	C41900

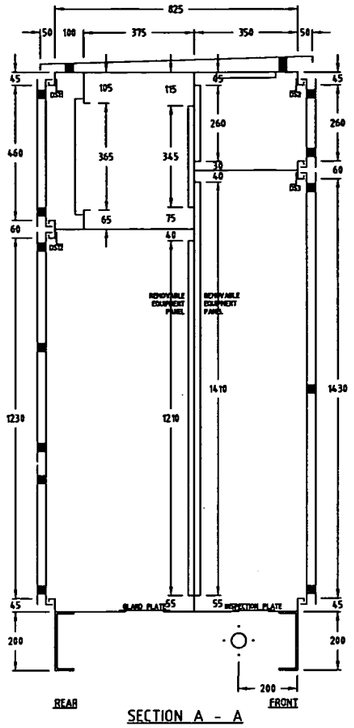
J. & P. RICHARDSON

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3823 Email JPR@JPR.COM.AU

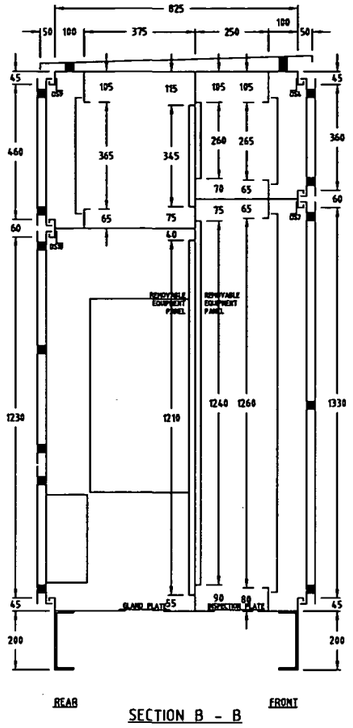
TITLE
QUEENSLAND URBAN UTILITIES
AXIS PLACE
SEWAGE PUMP STATION SP315
SWITCHBOARD
GENERAL ARRANGEMENT

DRAWING No
E10-C41900/A0

AMENDMENT B



SECTION A - A



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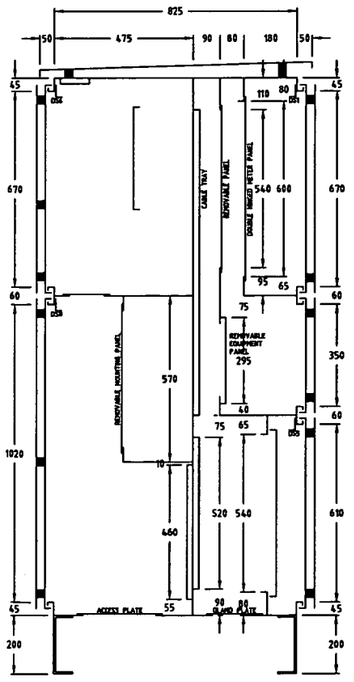

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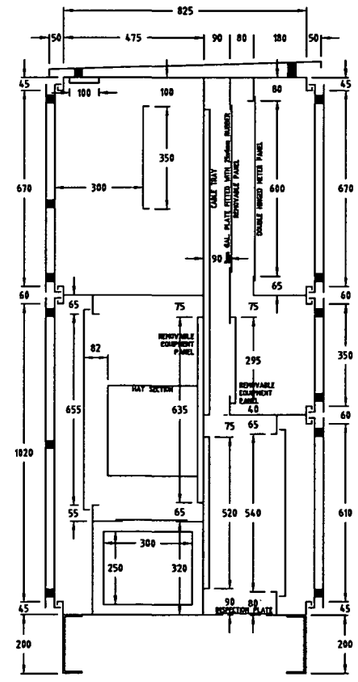
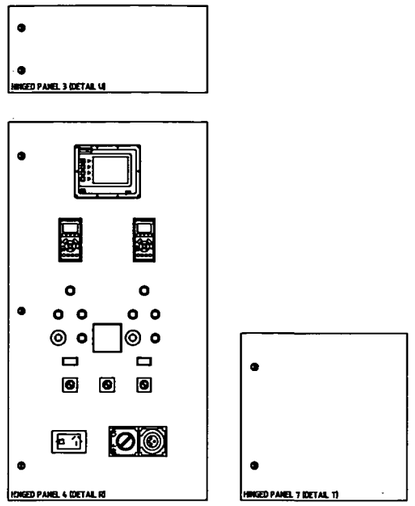
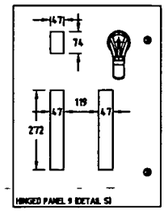
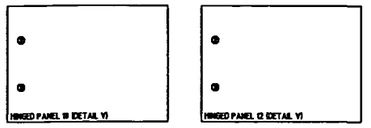


SECTION D - D

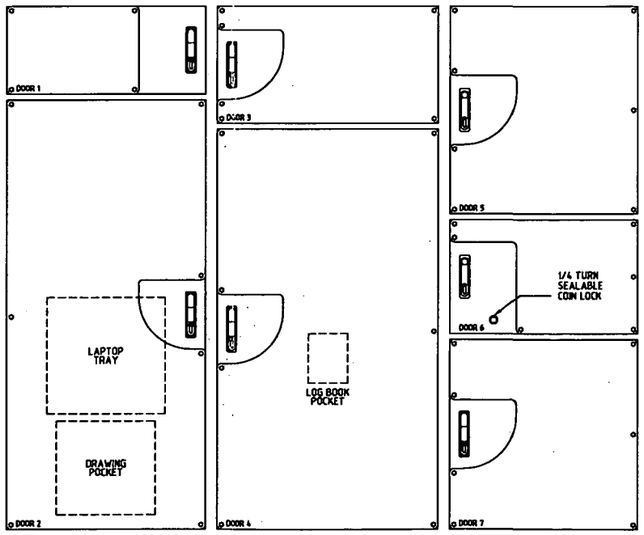


FRONT HINGED PANELS

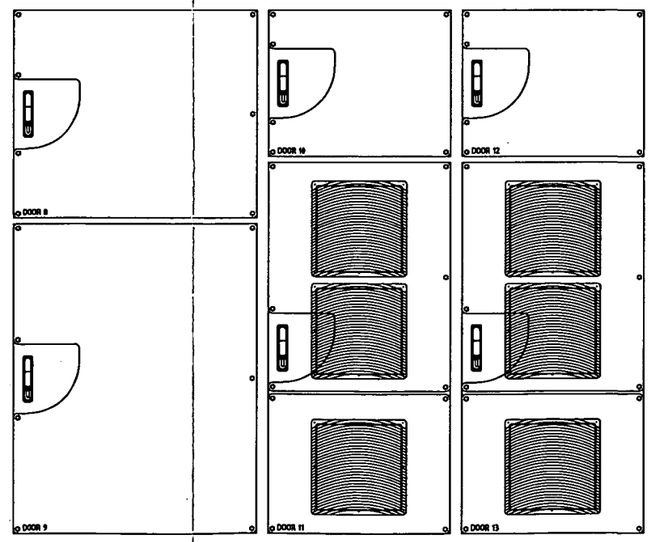




REAR HINGED PANELS



FRONT DOORS



REAR DOORS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	AS CONSTRUCTED	26-10-10	L.P.	
A	ISSUED FOR CONSTRUCTION	14-9-10	L.P.	B.J. 14-9-10

SCALE	N.T.S.
DESIGNED	B.J.
TRACED	L.P.
CHECKED	B.J. 17-6-10
DATE	17-6-10
APPROVED	
CLIENT NAME	BMD
JOB No.	C41900

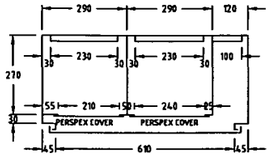
J. & P. RICHARDSON

INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

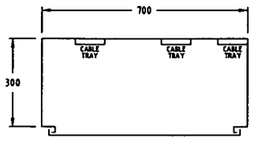
TITLE
QUEENSLAND URBAN UTILITIES
AXIS PLACE
SEWAGE PUMP STATION SP315
SWITCHBOARD
GENERAL ARRANGEMENT

DRAWING No
E10-C41900/A1

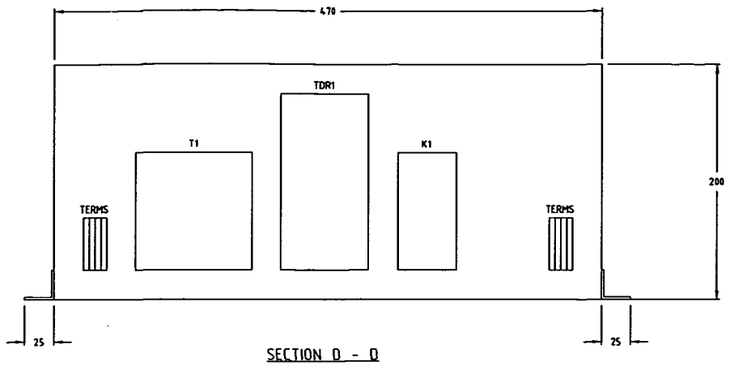
AMENDMENT B



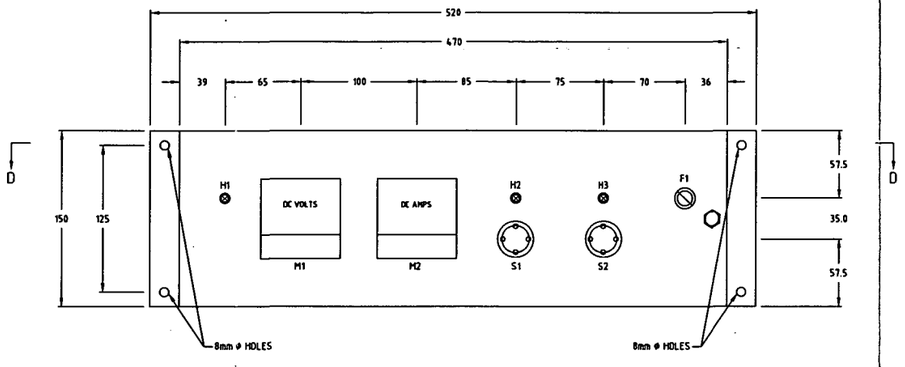
SECTION B - B



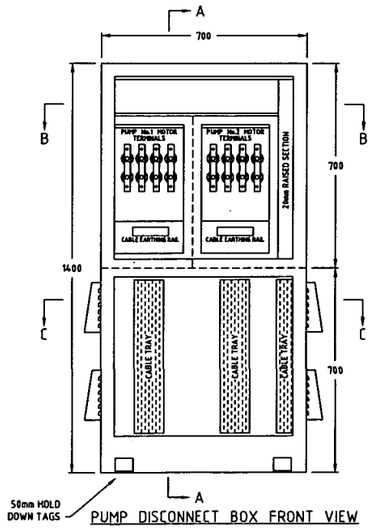
SECTION C - C



SECTION D - D

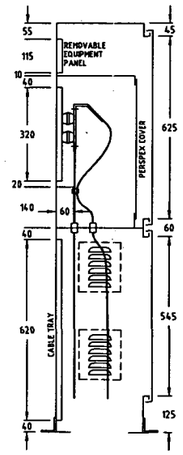


CATHODIC PROTECTION UNIT FRONT PANEL LAYOUT

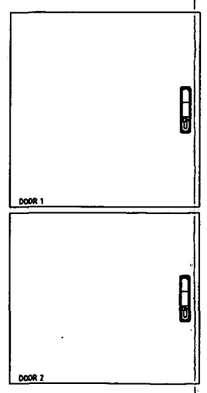


PUMP DISCONNECT BOX FRONT VIEW

DOORS & HINGED PANELS NOT SHOWN



SECTION A - A



PUMP DISCONNECT BOX DOOR LAYOUTS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
A	AMENDED SHEETMETAL	01-10-10	B.A.	

SCALE	N.T.S.
DESIGNED	B.J.
TRACED	L.P.
CHECKED	B.J. 22-09-10
DATE	22-9-10
APPROVED	
CLIENT NAME	BMD
JOB No.	E41900

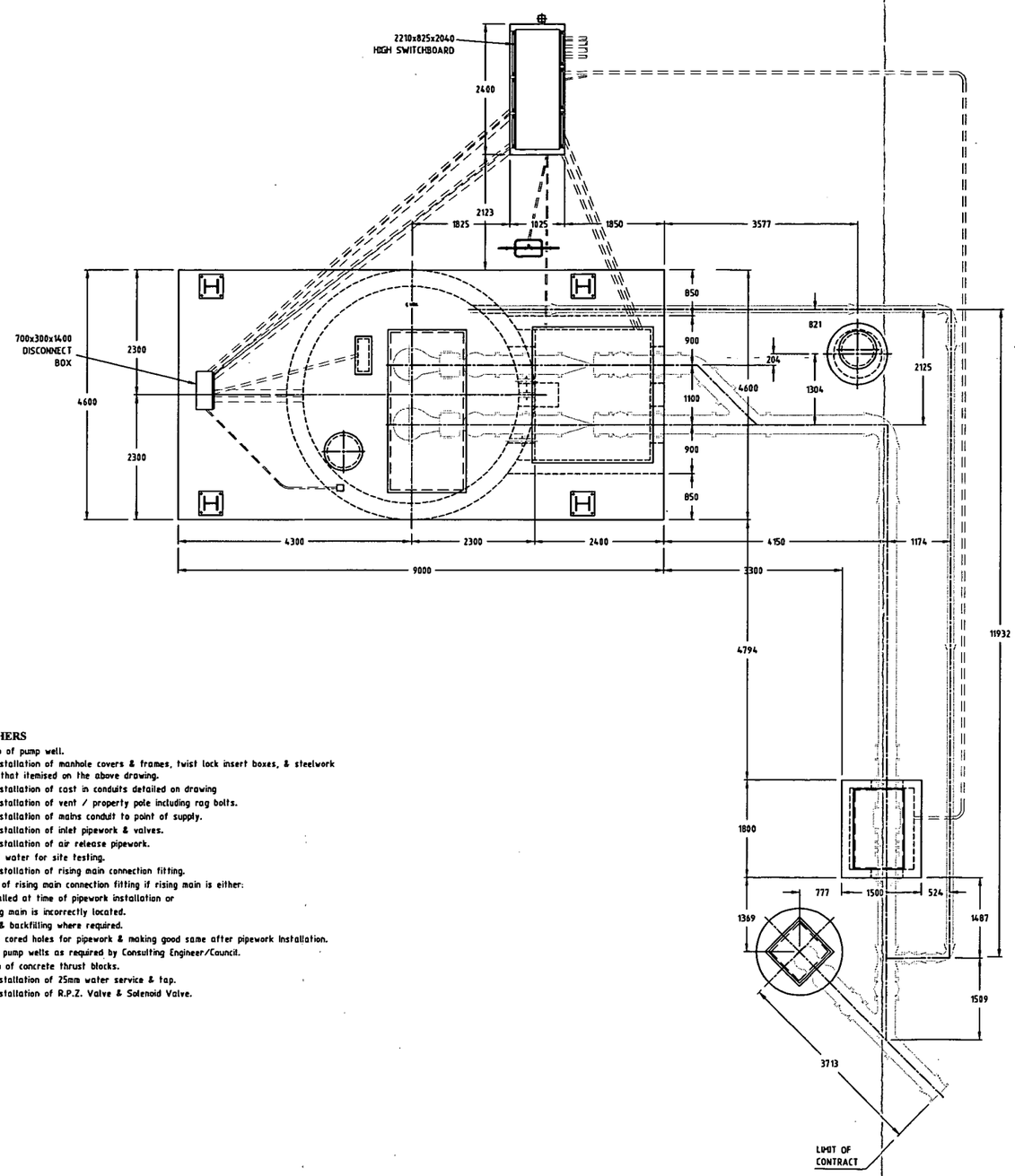
J. & P. RICHARDSON

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE: QUEENSLAND URBAN UTILITIES
AXIS PLACE PUMP STATION SP315
CATHODIC PROTECTION UNIT
& PUMP DISCONNECT BOX
GENERAL ARRANGEMENT

DRAWING No: E10-E41900/A2

AMENDMENT: A



JOB NOTES

WORK BY PUMP CONTRACTOR

1. Supply & Installation of all equipment detailed on drawing numbers P10-C41900/X0-6.
2. Supply & Installation of control cubicle & associated wiring for pump station.
3. Pipework & fittings 100 & 300 dia. Class 16 AS.4087 Fig.B5
   Externally & Internally F.B.E. coated.
4. All bolts, nuts, & washers in wet well grade 316SS.
5. All flanges to be AS2129 Table "E" / AS4087 Fig.B5.
6. Supply & Installation of Consumers Mains cabling for a route length of 20m.
7. Supply & Installation of Ø300 Flowmeter.
8. Supply & Installation of Auto Well Washers.

WORK BY OTHERS

1. Construction of pump well.
2. Supply & Installation of manhole covers & frames, twist lock insert boxes, & steelwork other than that itemised on the above drawing.
3. Supply & Installation of cast in conduits detailed on drawing
4. Supply & Installation of vent / property pole including rag bolts.
5. Supply & Installation of mains conduit to point of supply.
6. Supply & Installation of inlet pipework & valves.
7. Supply & Installation of air release pipework.
8. Provision of water for site testing.
9. Supply & Installation of rising main connection fitting.
10. Installation of rising main connection fitting if rising main is either:
    a. Not installed at time of pipework installation or
    b. The rising main is incorrectly located.
11. Excavation & backfilling where required.
12. Provision of cored holes for pipework & making good same after pipework installation.
13. Benching of pump wells as required by Consulting Engineer/Council.
14. Construction of concrete thrust blocks.
15. Supply & Installation of 25mm water service & tap.
16. Supply & Installation of R.P.Z. Valve & Solenoid Valve.

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. IT DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS,etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.

NOTES:

1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	DRAWING UPDATED TO SUIT AMENDED SLUICE VALVE LENGTHS	20-12-10	P.H.	
A	SWITCHBOARD SIZE AMENDED & SLAB CHANGED TO SUIT	27-9-10	P.H.	P.H. 27-9-10

SCALE	1:50 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	

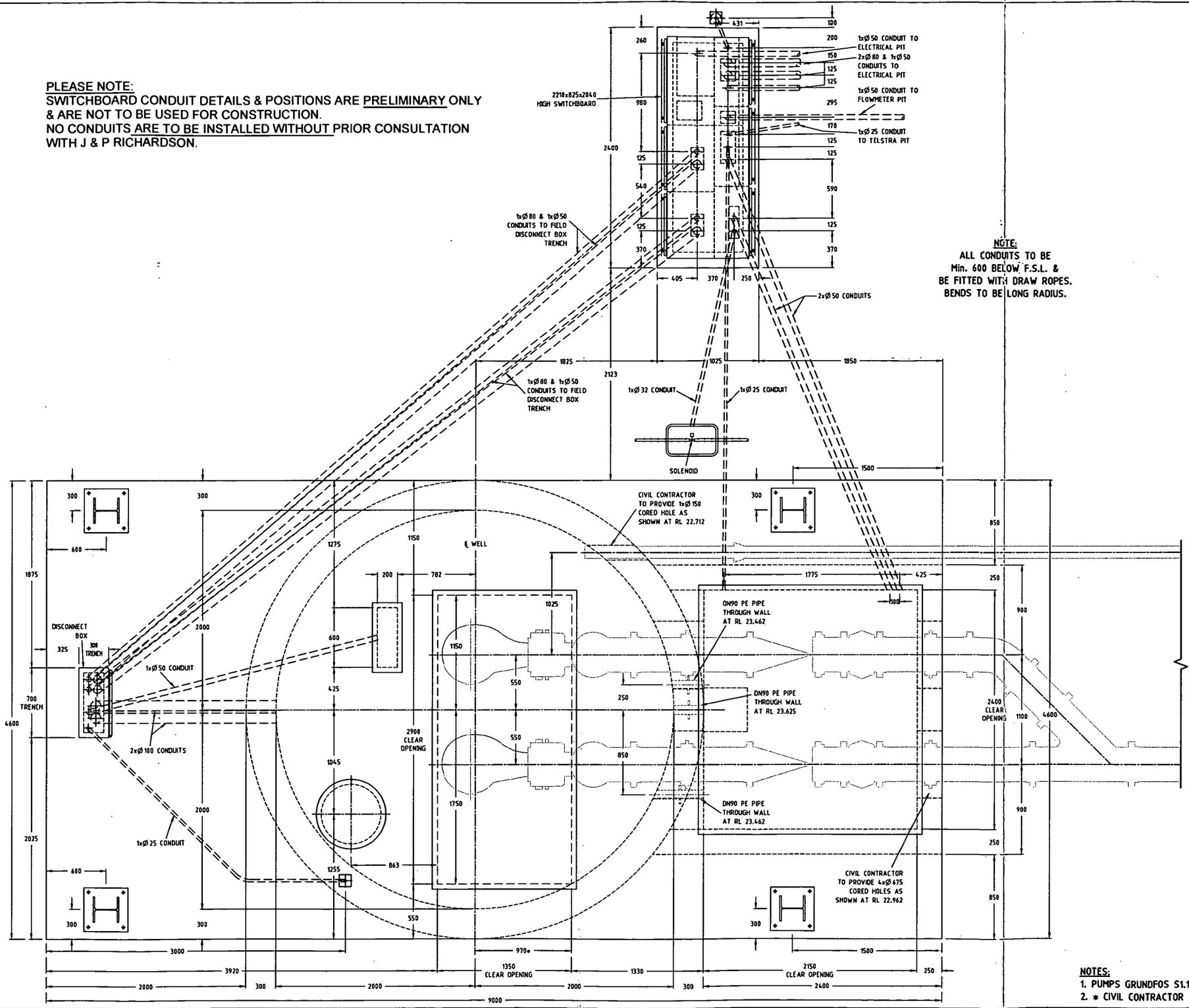
J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
OVERALL LAYOUT

DRAWING No
P10-C41900/X0

AMENDMENT
B

PLEASE NOTE:
SWITCHBOARD CONDUIT DETAILS & POSITIONS ARE PRELIMINARY ONLY & ARE NOT TO BE USED FOR CONSTRUCTION.
NO CONDUITS ARE TO BE INSTALLED WITHOUT PRIOR CONSULTATION WITH J & P RICHARDSON.



NOTE:
ALL CONDUITS TO BE Min. 600 BELOW F.S.L. & BE FITTED WITH DRAW ROPES. BENDS TO BE LONG RADIUS.

NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

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FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	DRAWING UPDATED TO SUIT AMENDED SLUICE VALVE LENGTHS	20-12-10	P.H.	
A	SWITCHBOARD SIZE AMENDED & SLAB CHANGED TO SUIT	27-9-10	P.H.	P.H. 27-9-10

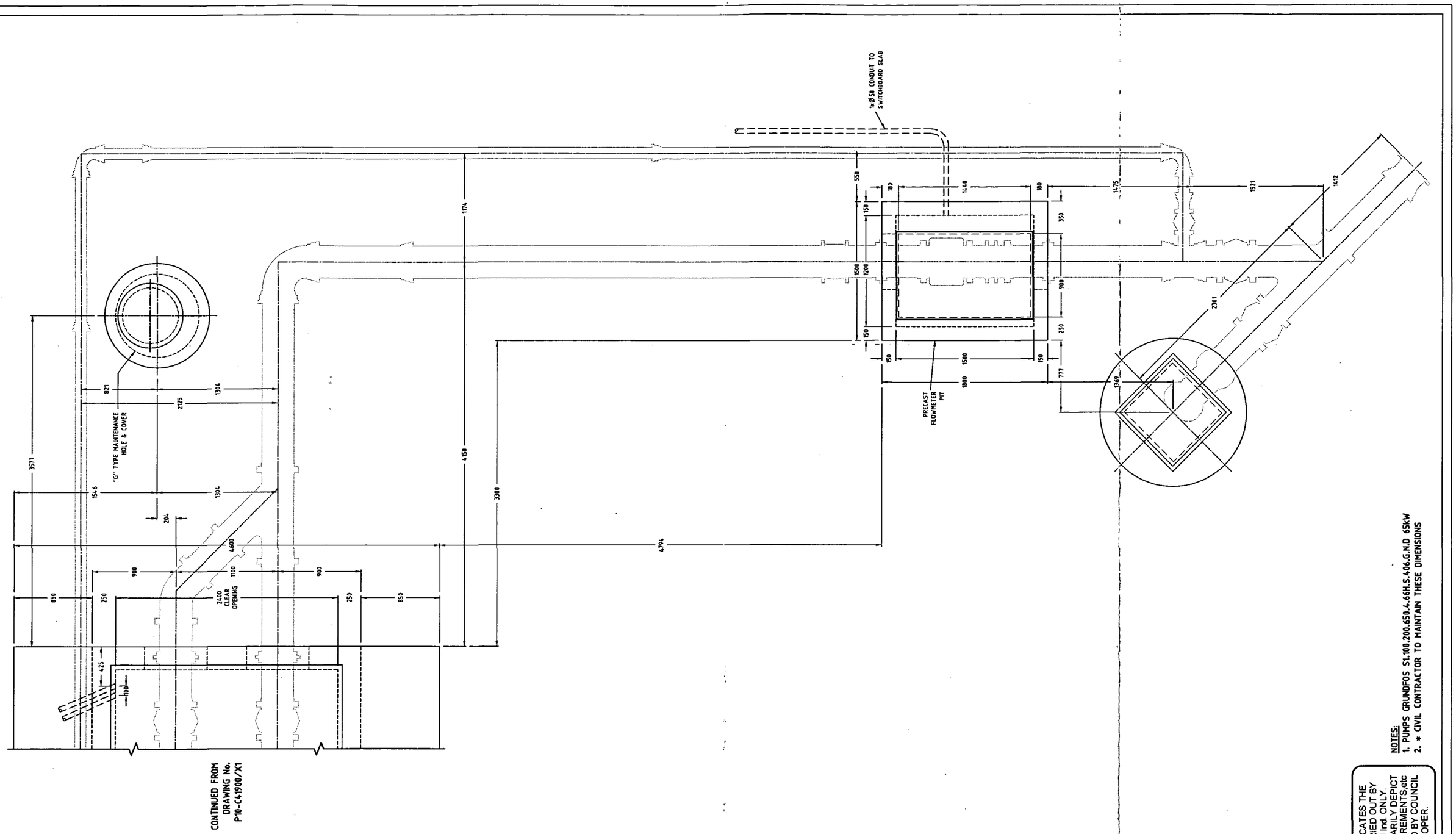
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	

J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION TOP SLAB LAYOUT

DRAWING No: P10-C41900/X1

AMENDMENT: B



NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

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FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE
FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
A	DRAWING UPDATED TO SUIT AMENDED SLUICE VALVE LENGTHS	20-12-10	P.H.	

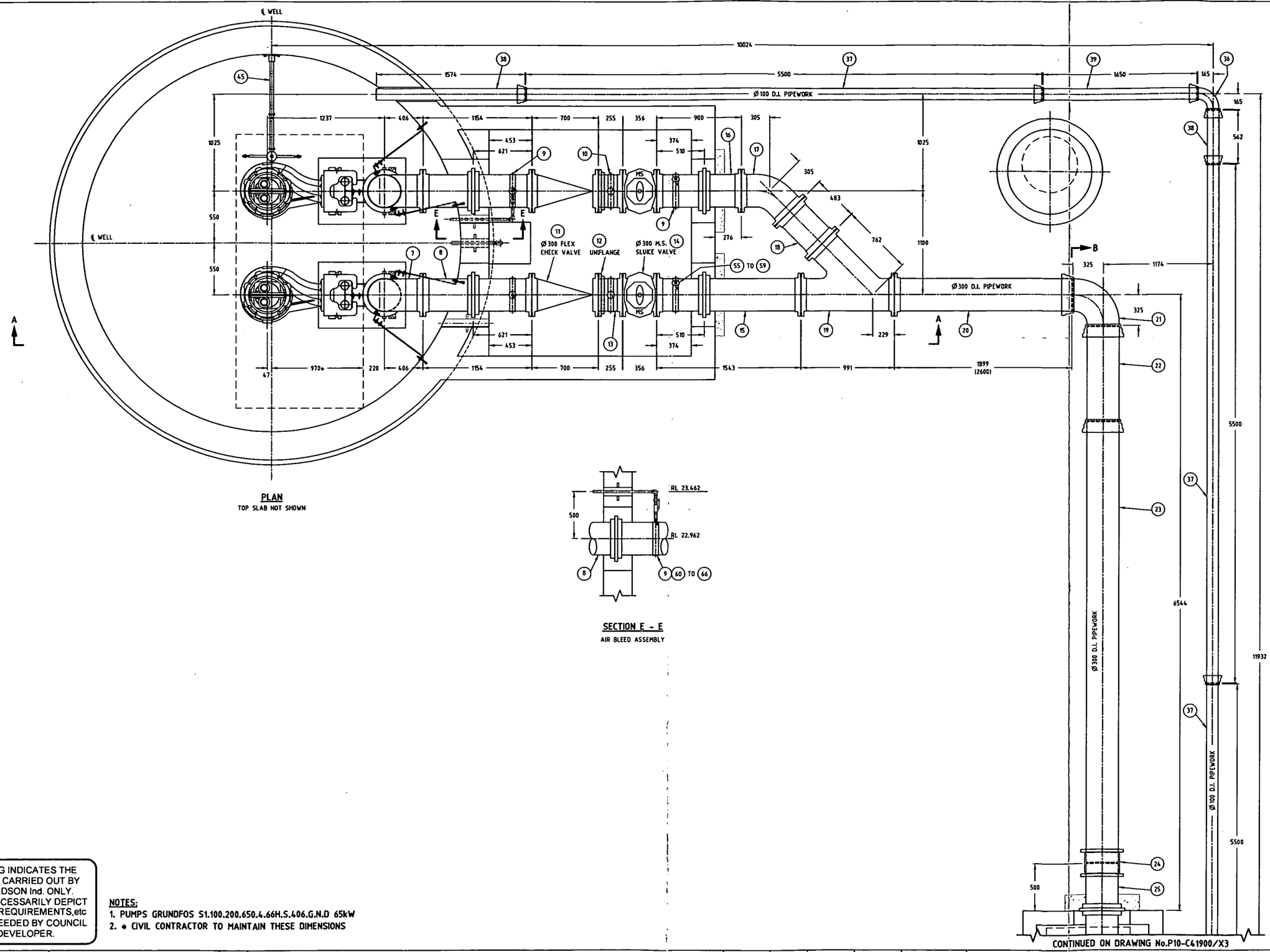
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	

J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION TOP SLAB LAYOUT

DRAWING No: P10-C41900/X2

AMENDMENT: A



PLAN
TOP SLAB NOT SHOWN

SECTION E - E
AIR BLEED ASSEMBLY

CONTINUED ON DRAWING No.P10-C41900/X3

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NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

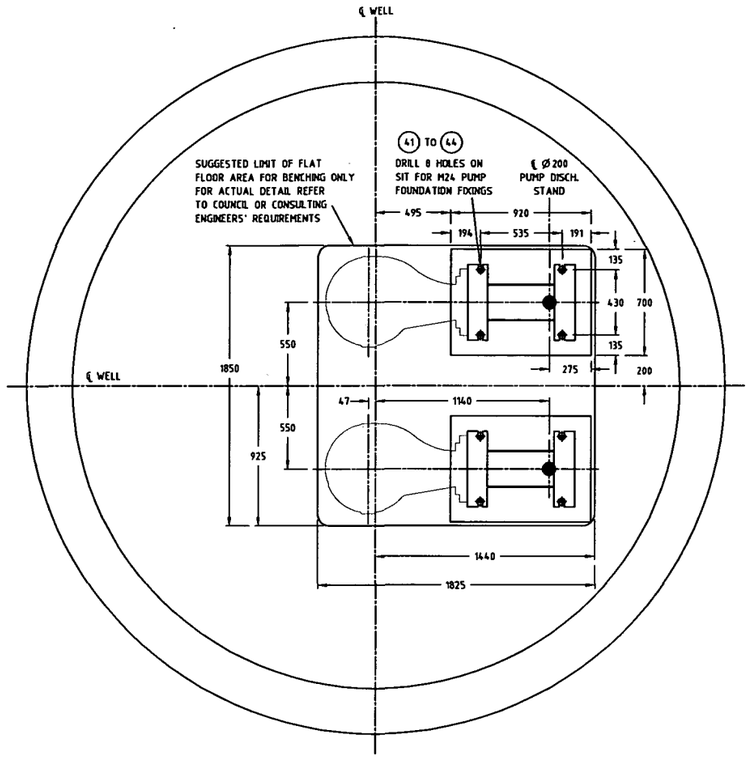
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

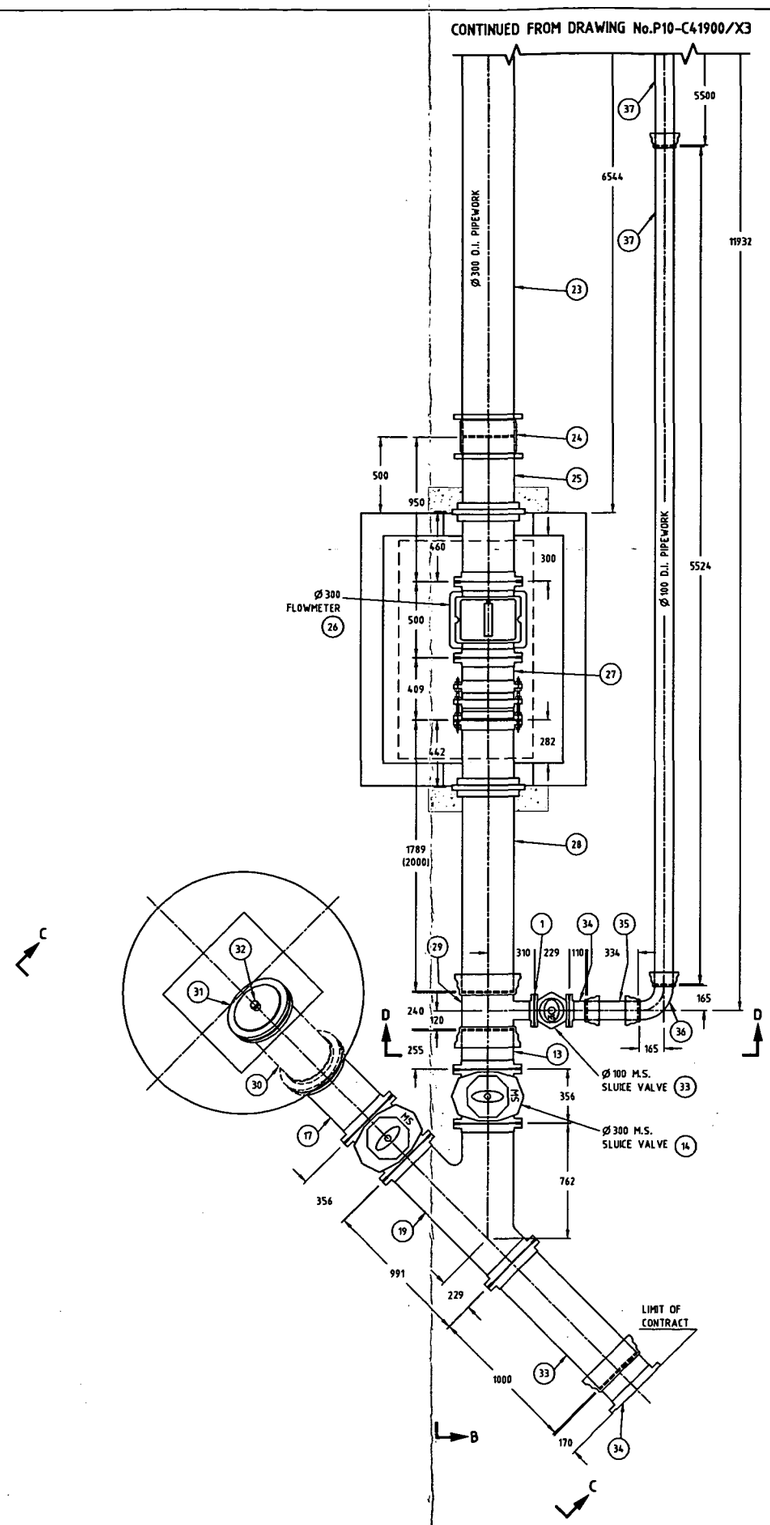
TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P10-C41900/X3

AMENDMENT C



FOUNDATION DETAIL



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NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
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LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

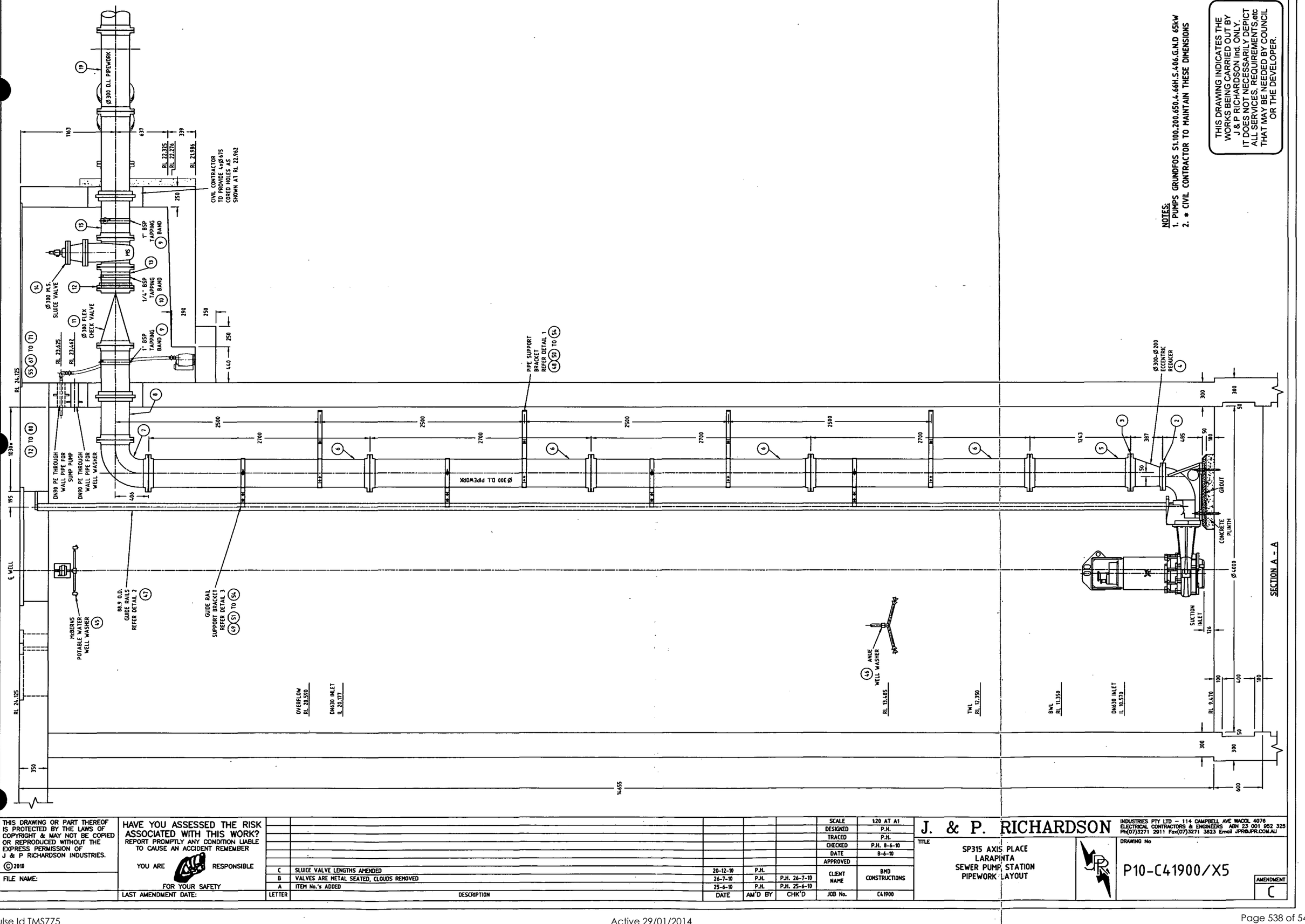
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON
INDUSTRIES PTY LTD — 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
PH(07)3271 2911 Fax(07)3271 3823 Email JPRBUPR.COM.AU

TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION PIPEWORK LAYOUT

DRAWING No: P10-C41900/X4

AMENDMENT: C



NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

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FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

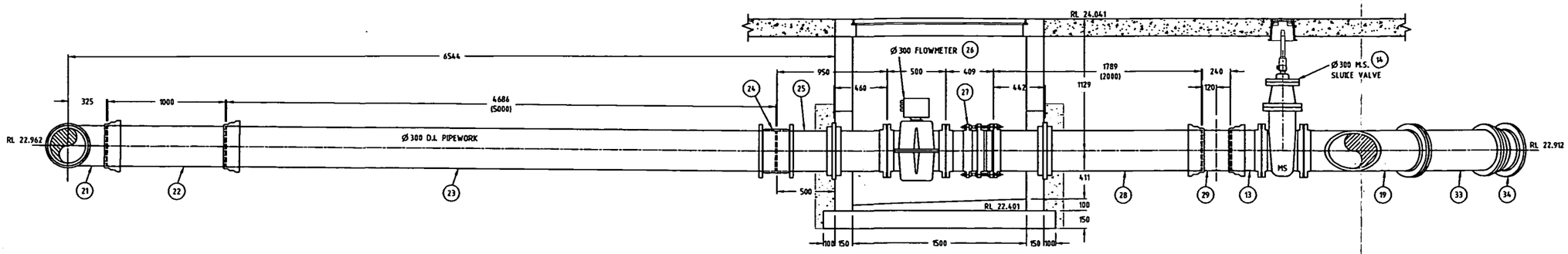
SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON
INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

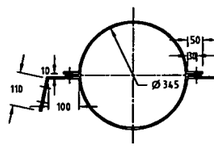
TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P10-C41900/X5

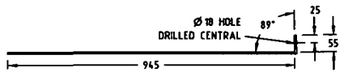
AMENDMENT C



SECTION B - B



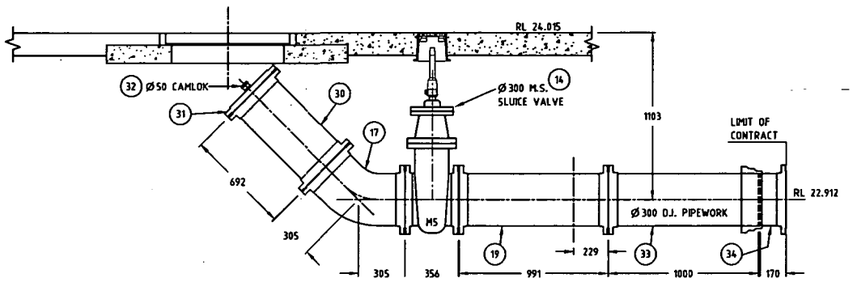
PIPE FIXING BRACKET
1 REQUIREQ PER SET
ALL HOLES Ø 14, DRILLED CENTRAL



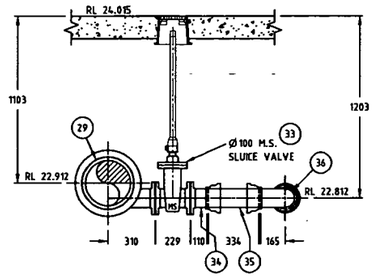
WALL FIXING BRACKET
2 REQUIRED PER SET

DETAIL 1
PIPE SUPPORT BRACKET

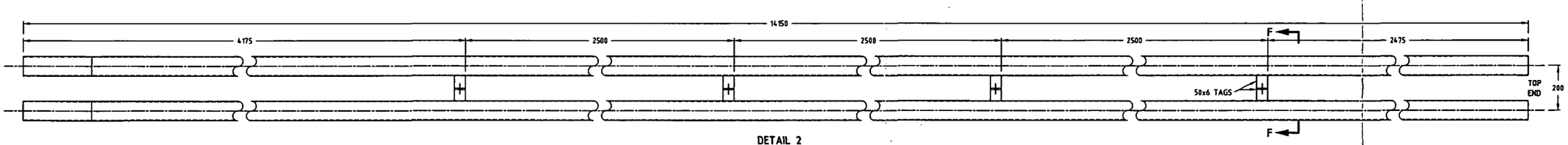
SCALE: 1:10 AT A1
MATERIAL: 50x6 316SS FLAT
No. REQUIRED: 8 SETS
(48) (50) TO (54)



SECTION C - C

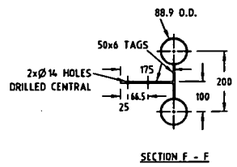


SECTION D - D

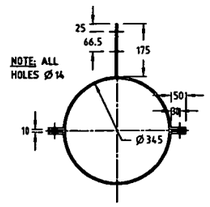


DETAIL 2
PUMP GUIDE RAILS

No. REQUIRED: 2 SETS
MATERIAL: 88.9 O.D. SCH.10S 316SS PIPE
(47)



SECTION F - F



DETAIL 3
GUIDE RAIL SUPPORT BRACKET

SCALE: 1:10 AT A1
MATERIAL: 50x6 316SS FLAT
No. REQUIRED: 8
(49) (51) TO (54)

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NOTES:
1. PUMPS GRUNDFOS S1.100.200.650.4.66H.S.406.G.N.D 65kW
2. * CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
C	SLUICE VALVE LENGTHS AMENDED	20-12-10	P.H.	
B	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10
A	ITEM No.'s ADDED	25-6-10	P.H.	P.H. 25-6-10

SCALE	1:20 AT A1
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

J. & P. RICHARDSON

INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 852 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
SP315 AXIS PLACE
LARAPINTA
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P10-C41900/X6

AMENDMENT
C

Item	Qty	Make & Number
1	2	100dia. BNWG SET 316SS TABLE "C"
2	2	200dia. BNWG SET 316SS TABLE "C"
3	34	300dia. BNWG SET 316SS TABLE "C"
4	2	300dia. - 200dia. DF ECCENTRIC TAPER
5	2	300dia. DF PIPE 1243Lg
6	8	300dia. DF PIPE 2700Lg
7	2	300dia. DF 90deg. BEND
8	2	300dia. DF PIPE 1154Lg c/w WEEP AT 621 FROM 1 END
9	4	300dia. 1" BSP TAPPING BAND
10	2	300dia. 1/4" BSP TAPPING BAND
11	2	300dia. DF FLEX CHECK VALVE
12	2	300dia. UNIFLANGE
13	3	300dia. FL/SP CONNECTOR
14	4	300dia. DF M.S. SLUICE VALVE ACC.
15	1	300dia. DF PIPE 1543Lg c/w WEEP AT 510 FROM FL
16	1	300dia. DF PIPE 900Lg c/w WEEP AT 510 FROM FL
17	2	300dia. DF 45deg. BEND
18	1	300dia. DF PIPE 483Lg
19	2	300dia. ALL FL WYE BRANCH
20	1	300dia. FL/SP PIPE 2600Lg C.O.S.
21	1	300dia. SOC/SOC 90deg. BEND
22	1	300dia. SOC/SP PIPE 1000Lg
23	1	300dia. SP/SP PIPE 5000Lg C.O.S.
24	1	300dia. GIBAULT JOINT
25	1	300dia. FL/SP PIPE 950Lg c/w WEEP AT 460 FROM FL
26	1	300dia. ENDRESS & HAUSER FLOWMETER
27	1	300dia. THRUST DISMANTLING JOINT
28	1	300dia. FL/SP PIPE 2000Lg c/w WEEP AT 442 FROM FL C.O.S.
29	1	300dia. - 100dia. SOC/FL SCOUR TEE
30	1	300dia. DF PIPE 692Lg
31	1	300dia. BLANK FLANGE WITH 2"BSP HOLE TAPPED CENTRAL
32	1	50dia. THREADED CAMLOK
33	1	100dia. DF M.S. SLUICE VALVE ACC.
34	1	100dia. FL/SOC CONNECTOR
35	1	100dia. SP/SP PIPE 334Lg
36	2	100dia. SOC/SOC 90deg. BEND
37	3	100dia. SOC/SP PIPE 5500Lg
38	1	100dia. SP/SP PIPE 3000Lg C.O.S.
39	1	100dia. SOC/SP PIPE 1650Lg
40	0	SPARE
41	3m	M24-316SS BROOKER ROD
42	24	M24-316SS NUTS
43	8	24mm-316SS FLAT WASHERS
44	16	24mm GALV. SQUARE WASHERS
45	1	McBERNS WALL MOUNT AUTO WELL WASHER
46	1	ANUE RECYCLED EFFLUENT WELL WASHER
47	2	88.9 O.D. SCHED.10 316SS GUIDE RAIL ASSEMBLIES
48	8	PIPE SUPPORT BRACKET TO DETAIL 1
49	8	GUIDE RAIL SUPPORT BRACKET TO DETAIL 3
50	16	M16x100 SS STUD ANCHORS
51	48	M12x40-316SS SET SCREWS
52	32	M12x50-316SS SET SCREWS
53	80	M12-316SS NUTS
54	80	M12x316SS FLAT WASHERS
55	10	1 1/4" BSP 316SS NIPPLE
56	4	1 1/4" BSP M/M 316SS 90deg. ELBOW
57	4	1 1/4" BSP F/F FULL BORE 316SS BALL VALVE
58	4	1 1/4" BSP F/F 316SS UNION
59	4	1 1/2" - 1 1/4"BSP 316SS REDUCING SOCKET
60	3	1" BSP 316SS TOE NIPPLES
61	5	1" BSP 316SS HEX NIPPLES
62	2	1" BSP 316SS F/F 90deg. ELBOWS
63	2	1" BSP 316SS F/F UNION
64	1	1" BSP 316SS THREADED SOCKET
65	1	1" BSP 316SS F/F BALL VALVES
66	1	1" N.B. SCH.40S 316SS PIPE 1000Lg
67	1	1 1/4" BSP 316SS TOE NIPPLE
68	1	1 1/4" BSP 316SS F/F 90deg. ELBOW
69	1	1 1/4" N.B. SCH.40S 316SS PIPE 500Lg
70	2	1 1/4" BSP BRASS HOSE TAILS
71	1	GRUNDFOS KP 150 AV 1 SUMP PUMP
72	4	12mm x 100-316SS STUD ANCHORS
73	4	12mm GALV. SQUARE WASHERS
74	4	M10-316SS HOOKS
75	4	M10-316SS NUTS
76	4	M10 SS DROP IN ANCHORS
77	2	13mm S/S LIFTING CHAINS 14300Lg c/w RINGS AT 1300crs. S.W.L. 2500kg
78	2	22mm S/S BOW SHACKLES S.W.L. 4750kg
79	2	19mm S/S BOW SHACKLES S.W.L. 3200kg
80	2	KULAK SF019 (0-25mm CABLE) S/S CABLE STOCKINGS

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. IT DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS,etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
B	DRAWING UPDATED TO SUIT AMENDED SLUICE VALVE LENGTHS	20-12-10	P.H.	
A	VALVES ARE METAL SEATED, CLOUDS REMOVED	26-7-10	P.H.	P.H. 26-7-10

SCALE	N.T.S.
DESIGNED	P.H.
TRACED	P.H.
CHECKED	P.H. 8-6-10
DATE	8-6-10
APPROVED	
CLIENT NAME	BMD CONSTRUCTIONS
JOB No.	C41900

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TITLE: SP315 AXIS PLACE LARAPINTA SEWER PUMP STATION MATERIAL LIST

DRAWING No: P10-C41900/X7

AMENDMENT: B