

**SANCTUARY ON MOGGILL  
SEWERAGE PUMPING STATION SP316  
PRIORS POCKET ROAD, MOGGILL**

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**ELECTRICAL SWITCHBOARD  
OPERATION AND MAINTENANCE MANUAL**

Developed by:



**J & P RICHARDSON INDUSTRIES  
CAMPBELL AVENUE  
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## **1.0 INTRODUCTION**

These operating instructions cover the Sewerage Pumping Station No.SP316 electrical equipment supplied by J & P Richardson Industries Pty Ltd in mid 2010.

### **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:** ITT Water & Wastewater Ltd  
14A Devlan Street  
.Mansfield Qld 4122

Ph: (07) 3849 7477  
Fax: (07) 3849 7633

**MODEL:** NP3171.181 SH

**SERIAL No.'s:** 1026011, 1026017

**kW RATING:** 22

**MOTOR SPEED:** 2930rpm

**FULL LOAD CURRENT:** 38A

**VOLTAGE:** 415V



# Installation, Care and Maintenance

3171.091.181



# CONTENTS

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## SAFETY

This manual contains basic information on the installation, operating and maintenance and should be followed carefully. It is essential that these instructions are carefully read before installation or commissioning by both the installation crew as well as those responsible for operation or maintenance. The operating instructions should always be readily available at the location of the unit.

### Identification of safety and warning symbols



#### General Danger:

Non-observance given to safety instructions in this manual, which could cause danger to life have been specifically highlighted with this general danger symbol.



#### High Voltage:

The presence of a dangerous voltage is identified with this safety symbol.

### WARNING!

Non-observance to this warning could damage the unit or affect its function

### Qualifications of personnel

An authorized (certified) electrician and mechanic shall carry out all work.

### Safety regulations for the owner/operator

All government regulations, local health and safety codes shall be complied with.

All dangers due to electricity must be avoided (for details consult the regulations of your local electricity supply company).

### Unilateral modification and spare parts manufacturing

Modifications or changes to the unit/installation should only be carried out after consulting with Flygt.

Original spare parts and accessories authorized by the manufacturer are essential for compliance. The use of other parts can invalidate any claims for warranty or compensation.

### Dismantling and re-assembly

If the pump has been used to pump hazardous media, care must be taken that, when draining the leakage, personnel and environment are not endangered.

All waste and emissions such as used coolant must be appropriately disposed of. Coolant spills must be cleaned up and emissions to the environment must be reported.

The pumping station must be kept in good order at all times.

All government regulations shall be observed.

## NOTES FOR EX-PRODUCTS

- Only Ex-approved pumps may be used in an explosive or flammable environment.
- Do not open the pump when an explosive gas atmosphere may be present.
- Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and can not be energized. This applies to the control circuit as well.
- All mechanical work on the explosion-proof motor section must be performed by personnel authorized by Flygt.
- Electrical connection on the explosion-proof motor must be made by authorized personnel.
- Thermal contacts must be connected to protection circuit intended for that purpose according to the approval of the product.
- The pump may be used only in accordance with the approved motor data stated on the data plates.
- Intrinsically safe circuits are normally required (Ex i) for the automatic level control system by level regulator if mounted in zone 0.
- This equipment must be installed in conformity to prescriptions in international or national rules ( IEC/EN 60079-14 ).
- The maintenance operation must be made in conformity to the international or national standards ( IEC/EN 60079-17).
- The yield stress of fastener elements in the product must be in conformity with the value specified in the table for “Material of fastener” on the approval drawing or the parts specified in the part list for the product.
- According to the ATEX directive the Ex-pump must never run dry or snore. Permitted minimum water level, see dimensional drawing for the pump.  
Dry running at service and inspection is only permitted outside the Ex area.
- The user must know about the risks due the electric current and the chemical and physical characteristics of the gas and/or vapours present in hazardous areas.
- Flygt disclaims all responsibility for work done by untrained, unauthorized personnel.

## GUARANTEE

ITT Flygt undertakes to remedy faults in products sold by Flygt provided:

- that the fault is due to defects in design, materials or workmanship;
- that the faults are reported to Flygt or Flygt's representative during the guarantee period;
- that the product is used only under condition described in the Installation, Care and Maintenance manual and in applications for which it is intended;
- that the monitoring equipment incorporated in the product is correctly **connected** and **in use**;
- that all service and repair work is done by a work shop authorized by Flygt;
- that genuine Flygt parts are used.

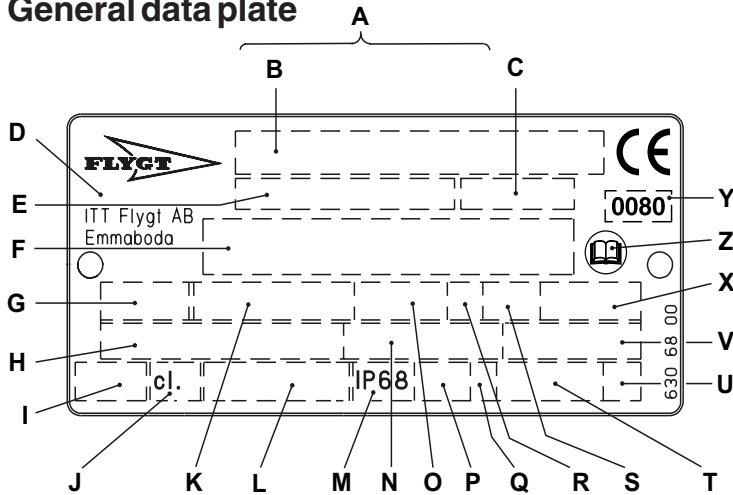
Hence, the guarantee does not cover faults caused by deficient maintenance, improper installation, incorrectly executed repair work or normal wear and tear.

Flygt assumes no liability for either bodily injuries, material damages or economic losses beyond what is stated above.

Flygt guarantees that spare parts will be kept for 15 years after that the manufacture of this product has been discontinued.

# DATA PLATE INTERPRETATION

## General data plate

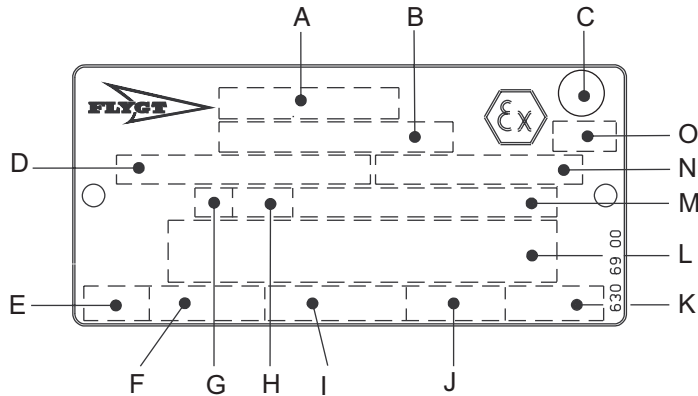


- A Serial number
- B Product code + Number
- C Curve code / Propeller code
- D Country of origin
- E Product number
- F Additional information
- G Phase; Type of current; Frequency
- H Rated voltage
- I Thermal protection
- J Thermal class
- K Rated shaft power
- L International standard
- M Degree of protection
- N Rated current
- O Rated speed
- P Max. submergence
- Q Direction of rotation: L=left, R=right
- R Duty class
- S Duty factor
- T Product weight
- U Locked rotor code letter
- V Power factor
- X Max. ambient temperature
- Y Notified body/ Only for EN-approved Ex-products
- Z Read Installation Manual

## Approval plates

These approval plates apply to an explosion-proof submersible Flygt pump. The plates are used together with the general data plate on the pump.

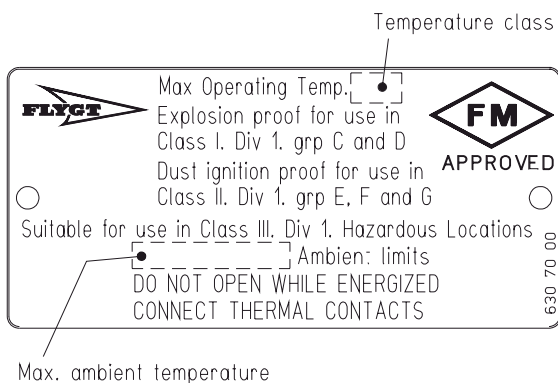
EN: European Norm  
ATEX Directive  
EN 50014, EN 50018, EN 1127-1  
Ⓔ II 2 G EEx dII B T3



- A Approval
- B Approval authority + Approval Number
- C Approval for Class I
- D Approved drive unit
- E Stall time
- F Starting current / Rated current
- G Duty class
- H Duty factor
- I Input power
- J Rated speed
- K Controller
- L Additional information
- M Max. ambient temperature
- N Serial number
- O ATEX marking

## EN approval for the Cable entry

Certificate number: INERIS 03ATEX9008 U  
Ⓔ II 2 G or IM2 EEx d IIC or EEx d I



# PRODUCT DESCRIPTION

## Introduction

Thank you for buying a submersible Flygt pump. In this Installation, Care and Maintenance manual you will find general information on how to install and service the 3171 pump to give it a long and reliable life.

## Application

This Installation, Care and Maintenance manual applies to a submersible Flygt pump. If you have bought an Ex-approved pump (please see approval plate on your pump or Parts List) special handling instructions apply as described in this document.

The pump is intended to be used for;

- pumping of waste water
- pumping of raw or clean water
- pumping of sludge

### Installation alternatives

**P** = semi permanent wet well arrangement with pump installed by means of twin guide bars with automatic connection to discharge.

**S** = transportable version with hose connection or flange for connection to discharge pipeline.

**T** = permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; vertical mounting.

**Z** = permanent dry well or in-line arrangement with flange connection to suction and discharge pipe-work; horizontal mounting.

In **T**, **Z** and **S** installations the pump must be equipped with cooling jacket.

For further information on applications, contact your nearest Flygt representative.

### Pump versions

LT = low head execution

MT = medium head execution

HT = high head execution

SH = super high head execution

**Liquid temperature:** max. 40°C (104°F)

also available in an execution for liquid temperature up to 70°C (158°F) only with cooling jacket. Higher temperatures than 40°C (104°F) are not permitted for Ex-approved pumps.

**Liquid density:** max. 1100 kg/m<sup>3</sup> (9.2 lb per US gal.)

**The pH of the pumped liquid:** 5.5—14.

**Lowest liquid level:** See illustration page 8.

**Depth of immersion:** max. 20 m (65 ft).

## Recycling

Local and/or private laws and regulations regarding recycling must be followed. If there are no laws or regulations, or the product is not accepted by an authorized recycling company, the product or it's parts can be returned to the nearest Flygt sales company or service workshop.

## Weights

Weight including connections, but without motor cable in kg (lb).

Pump type	With cooling jacket	Without cooling jacket	Discharge connection
NP 3171 LT	410 (904)	381 (840)	98 (216)
NP 3171 MT	319 (703)	290 (640)	54 (119)
NP 3171 HT	297 (639)	268 (595)	42 (93)
NP 3171 SH	346 (763)	326 (719)	42 (43)
NS 3171 LT	460 (1014)		
NS 3171 MT	352 (776)		
NS 3171 HT	317 (699)		
NS 3171 SH	366 (807)		
NT 3171 LT	525 (1157)		<sup>*)</sup> 101 (223)
NT 3171 MT	406 (895)		<sup>*)</sup> 89 (196)
NT 3171 HT	366 (807)		<sup>*)</sup> 87 (191)
NT 3171 SH	415 (915)		<sup>*)</sup> 87 (191)
NZ 3171 LT	485 (1069)		
NZ 3171 MT	384 (846)		
NZ 3171 HT	357 (787)		
NZ 3171 SH	358 (789)		

<sup>\*)</sup> Inlet elbow including stand

# MOTOR DATA

**50 Hz, 22.0 kW, 2925 r/min**

**3-phase, 2-pole**

Voltage V	Rated current A	Starting current A
230 D	67	480
380 D	41	292
400 D	38	273
400 Y	39	280
415 D	38	285
440 D	37	305
500 D	31	227
660 Y	23	169
690 Y	22	157

**50 Hz, 18.5 kW, 1460 r/min**

**3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 D	62	390
380 D	37	210
400 D	36	223
400 Y	36	225
415 D	34	210
440 D	34	225
500 D	29	179
660 Y	21	122
690 Y	21	128

**50 Hz, 15.0 kW, 1460 r/min**

**3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 D	53	325
380 D	30	167
400 D	30	178
400 Y	31	189
415 D	29	170
440 D	29	182
500 D	24	142
660 Y	17	97
690 Y	17	102

**50 Hz, 15.0 kW, 965 r/min**

**3-phase, 6-pole**

Voltage V	Rated current A	Starting current A
230 D	52	278
380 D	31	157
400 D	30	167
400 Y	30	162
415 D	28	144
440 D	28	155
500 D	24	129
660 Y	18	91
690 Y	17	96

**50 Hz, 22.0 kW, 1460 r/min**

**3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 D	73	470
380 D	42	236
400 D	41	248
400 Y	42	272
415 D	39	232
440 D	38	249
500 D	33	210
660 Y	24	137
690 Y	24	144

**60 Hz, 35hp, (26 kW) 3525 r/min  
3-phase, 2-pole**

Voltage V	Rated current A	Starting current A
230 Y//	79	585
440 D	41	294
460 D	39	273
460 YSER	40	292
575 D	31	226
600 D	30	238

**60 Hz, 30 hp, (22.0 kW) 1755 r/min  
3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 Y//	75	515
380 D	45	300
460 D	36	231
460 YSER	38	257
575 D	29	175
600 D	29	194

**60 Hz, 25 hp, (18.6 kW) 1755 r/min  
3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 Y//	61	360
380 D	37	218
460 D	31	184
460 YSER	30	180
575 D	25	147
600 D	24	154

**60 Hz, 25 hp, (18.6 kW) 1160 r/min  
3-phase, 6-pole**

Voltage V	Rated current A	Starting current A
230 Y//	64	355
380 D	38	215
460 D	31	174
460 YSER	32	177
575 D	25	134
600 D	24	141

**60 Hz, 34 hp, (25 kW) 1755 r/min  
3-phase, 4-pole**

Voltage V	Rated current A	Starting current A
230 Y//	81	560
380 D	48	310
460 D	40	256
460 YSER	40	281
575 D	32	217
600 D	32	228



# DESIGN OF THE PUMP

## Motor

Squirrel-cage 3-phase induction motor for 50 Hz or 60 Hz.

The motor is started by means of direct on-line or star delta start.

The motor can be run continuously or intermittently with a maximum of 30 evenly spaced starts per hour.

Flygt motors are tested in accordance with IEC 34-1.

The stator is insulated in accordance with class H (180° C, 355° F). The motor is designed to supply its rated output at  $\pm 10\%$  variation of the rated voltage.

Without overheating the motor,  $\pm 10\%$  variation of the rated voltage can be accepted provided that the motor does not run continuously at full load.

## Monitoring equipment

The stator incorporates three thermal contacts connected in series that activate an alarm at overtemperature.

The thermal contacts: open at 140° C (285 F°). The sensors shall be connected to Flygt's monitoring unit MiniCAS II or equivalent unit.

The monitoring equipment shall be of a design that makes automatic restart impossible.

The 3171 is supplied with inspection sensor FLS10 for sensing the presence of any liquid in the inspection chamber.

## Bearings

The support bearing of the shaft is a double row ball bearing.

The main bearing of the shaft is a double row angular contact ball bearing.

## Mechanical seal unit

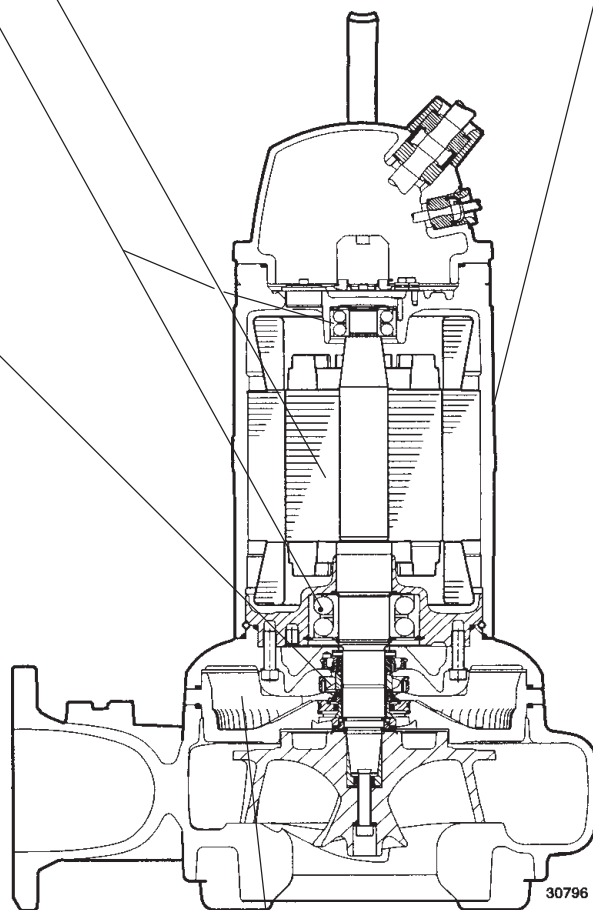
The pump has one shaft mechanical seal unit consisting of two independently operating seals:

Alt I	Inner seal:	Corrosion resistant cemented carbide WCCR/WCCR
	Outer seal:	Corrosion resistant cemented carbide WCCR/WCCR
Alt II	Inner seal:	Corrosion resistant cemented carbide WCCR/WCCR
	Outer seal:	Silicon Carbide RSiC/RSiC

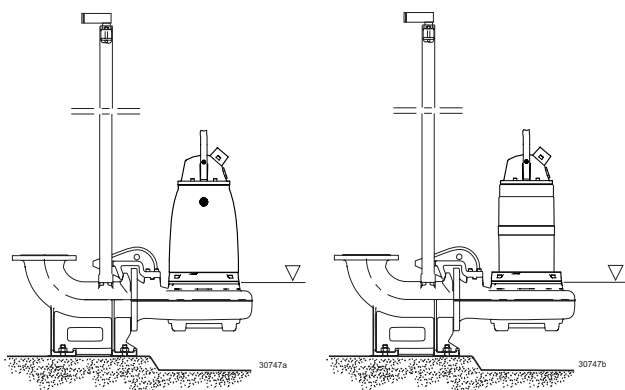
## Cooling

The pump is cooled by the ambient liquid. For lowest liquid level, see illustration below.

### Without cooling jacket



### Lowest liquid level



## Seal housing

A coolant fluid lubricates and cools the mechanical seal unit and acts as a buffer between the pumped media and the electric motor.

# DESIGN OF THE PUMP

With cooling jacket

## Inspection chamber

The inspection chamber is equipped with a FLS10 leakage sensor to prevent damages on the motor.

## Flow diffusor

Provides heat transfer from the coolant to the pumped media.

## Shaft

The shaft is delivered with the rotor as an integral part. Shaft material; stainless steel.

## Cooling

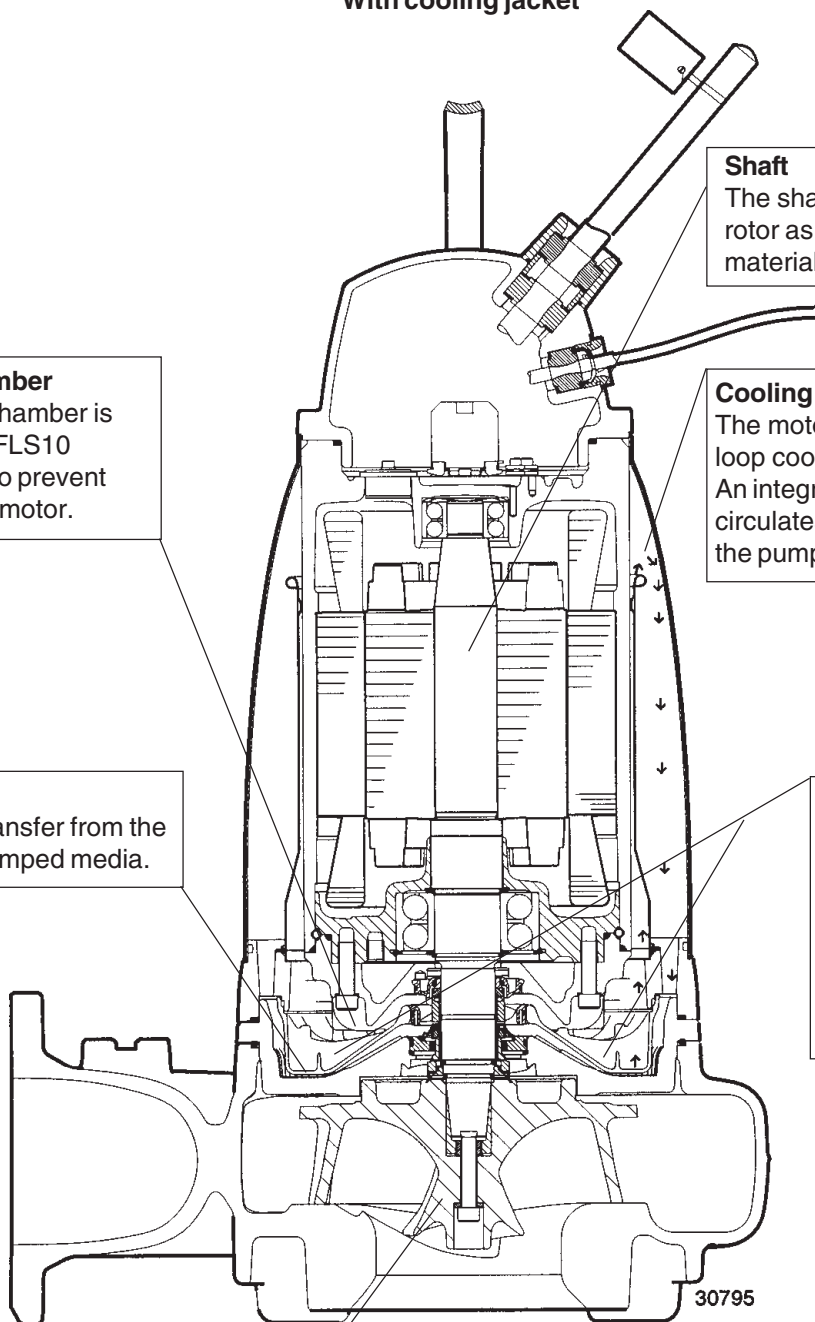
The motor is cooled by a closed loop cooling system. An integrated coolant pump circulates the coolant whenever the pump is operated.

## Seal housing

The coolant lubricates and cools the mechanical seal unit and acts as a buffer between the pumped media and the electric motor.

## Impeller

The pump is equipped with a N-impeller, a semi-open two-vane impeller.



# TRANSPORTATION AND STORAGE

The pump may be transported and stored in a vertical or horizontal position. Make sure that the pump cannot roll or fall over.

## WARNING!

Always lift the pump by its lifting handle never by the motor cable or the hose.

The pump is frostproof as long as it is operating or is immersed. If the pump is hoisted from the sump when the temperature is below the freezing point, the impeller and shaft seal may freeze.

A frozen impeller and shaft seal can be thawed by allowing the pump to stand immersed in the liquid for a short period before it is started. Never use a naked

flame to thaw the pump. The pump should be run for a few seconds after being taken up in order to expel all remaining water from the hydraulic end.

For longer periods of storage, the pump must be protected against moisture and heat. The impeller should be rotated by hand occasionally (for example every other month) to prevent the shaft seals from sticking together. If the pump is stored for more than 6 months, this rotation is mandatory.

After a long period of storage, the pump should be inspected before it is put into operation. Pay special attention to the shaft seal and the cable entry.

Follow the instructions under the heading "Before starting".

# INSTALLATION

## Handling equipment

*Always pay extra attention to safety aspects when working with lifting equipment.*

Lifting equipment is required for handling the pump. The lifting chain and the schackle should be in stainless steel and inspected every year.



- **Stay clear of suspended loads.**
- **Always lift the pump by its lifting handle – never by the motor cable or the hose.**

The minimum height between the lifting hook and the floor shall be sufficient to lift the pump out of the sump.

The lifting equipment shall be able to hoist the pump straight up and down in the sump, preferably without the need for resetting the lifting hook.

Oversized lifting equipment could cause damage if the pump should stick when being lifted.

Make sure that the lifting equipment is securely anchored and in good condition.

Check that the lifting handle and chain are in good condition.

To ensure proper installation, please see the dimensions on the dimensional drawing.



**WARNING!** The end of the cable must not be submerged. It must be above flood level, as water could penetrate through the cable into the junction box or the motor.

For automatic operation of the pump (level control), it is recommended that the level regulators should be used at low voltage. The data sheet delivered with the regulators gives the permissible voltage.

Local rules may specify otherwise.

Clean out all debris from the sump before the pump is lowered down and the station is started.

- **NOTE for Ex version page 3.**
- **Minimum stop level should be according to the dimensional drawing.**
- **The pump must never run dry.**

# INSTALLATION

## Safety precautions

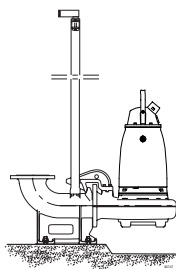
In order to minimize the risk of accidents in connection with service and installation work, the following rules should be followed:

1. Never work alone. Use a lifting harness, safety line and a respirator as required. Do not ignore the risk of drowning.
2. Make sure there are no dangerous gases within the work area.
3. Check the explosion risk before welding or using electric hand tools.
4. Before the pump is installed check that the cable and cable entry have not been damaged during the transportation.
5. Observe strict cleanliness. Do not ignore health hazards.
6. Bear in mind the risk of electrical accidents.
7. Make sure that the lifting equipment is in good condition and comply to local ordinances.
8. Provide a suitable barrier around the work area, e. a guard rail.
9. Make sure you have a clear path of retreat.
10. Use safety helmet, safety goggles and protective shoes.
11. All personnel who work with sewage systems must be vaccinated against diseases to which they may be exposed.
12. A first-aid kit must be close at hand.
13. Note that special rules apply to installation in explosive atmosphere.

Follow all health and safety rules and local codes and ordinances.

## Installation alternatives

### P- installation



In the P installation, the pump is installed on a stationary discharge connection and operates completely or partially submerged in the pumped liquid. In addition to the pump the following items are required:

**Guide bars** consisting of two hot dip galvanized or stainless steel pipes.

**Guidebar bracket** for attaching the guide bars to the access frame or the upper part of the sump.

**Level regulators** or other control equipment for start, stop and alarm.

**Cable holder** for holding the cable and regulating the height of the level regulators.

**Access frame** (with covers) to which the upper guide bar bracket and cable holder can be attached.

**Discharge connection** for connecting the pump to the discharge line. The discharge connection has a flange which fits the pump casing flange and a bracket for attaching the guide equipment.

**Bushings** for vibration damping between the guide bars and the discharge connection.

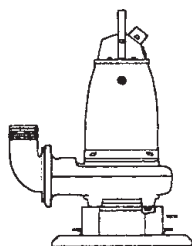
### Instructions

- Provide a barrier around the pump pit, for example a guardrail.
- Arrange for a cable between the sump and the electric control box. Make sure that the cables are not sharply bent or pinched.
- Place the access frame in position.
- Align the frame so that it is horizontal and then grout it in place.
- Grout the anchor bolts in place. Be careful when aligning and positioning the discharge connection in relation to the access frame.
- Place the discharge connection in position and tighten the nuts.
- Secure the guide bars in the bracket.
- Check that the guide bars are placed vertically by using a level or a plumb line.
- Connect the discharge pipe to the discharge connection.
- Bolt the cable holder to the access frame. Thread the level regulator cables through the holes in the cable holder and adjust the height of the level regulators.
- Protect bolts and nuts with corrosion preventive compound.
- Lower the pump along the guide bars.
- Fasten the lifting chain (stainless steel) on the access frame and the cables on the cable holder. Make sure that the cables cannot be sucked into the inlet of the pump. Support straps are required for deep installations.
- Run the cables up to the electric control box.
- Clean out debris from the sump before starting up the station.
- The pump can be hoisted up along the guide bars for inspection without any connections having to be undone.

# INSTALLATION

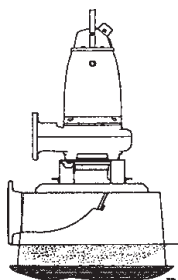
## Installation alternatives

### S- installation

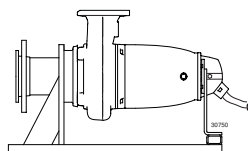


In the S- installation, the pump is transportable and intended to operate completely or partially submerged in the pumped liquid. The pump is equipped with a connection for hose or pipe, see "Parts list". The pump stands on a base stand.

### T- installation



T



Z

In the T- installation, the pump is installed in a stationary position in a dry well next to the wet sump.

In the Z- installation the pump is installed in a horizontal position on a support stand and a bell-mouth is connected to the inlet pipe.

The pump has a watertight motor and will therefore not be damaged in the event of flooding.

The pump is equipped with a cooling jacket.

In addition to the pump, the following items are required:

**Support stand** for anchoring the pump to a base.

**Shut-off valves** to permit the pump to be removed for service.

**Level regulators** or other control equipment for start, stop and alarm.

**WARNING!** The risk of freezing is particularly great at certain T or Z installations.

### Instruction

Bolt the base stand to the concrete base by means of the anchor bolts. Bolt the pump to the base stand and the suction connection.

Connect the motor cable, suction line and discharge line.

Make sure that the weight of the pump does not bear on the system piping.

# ELECTRICAL CONNECTIONS



- Before starting work on the pump, make sure that the pump and the control panel are isolated from the power supply and cannot be energized.
- If the pump is equipped with automatic level control, there is a risk of sudden restart.
- If persons are likely to come into physical contact with the pump or pumped media (liquid), e.g on construction sites and farms, the earthed (grounded) socket must have an additional earth-(ground-) fault protection device (GFI) connected.

All electrical work shall be carried out under the supervision of an authorized electrician. Local codes and regulations shall be complied with.



### NOTE for Ex version page 3.

- All electrical equipment must be earthed (grounded). This applies to both pump equipment and any monitoring equipment. Failure to heed this warning may cause a lethal accident. Make sure that the earth (ground) lead is correctly connected by testing it.

Check the data plate to determine which voltage supply is valid for your pump.

Check that the main voltage and frequency agree with the specifications on the pump data plate.

If the pump can be connected to different voltages, the connected voltage is specified by a yellow sticker.

Connect the motor cable to the starter equipment as illustrated in the wiring diagrams.

When the pump is connected to the public mains it may cause flicker of incandescent lamps when starting. In this case the supply authority should be notified before installing the pump.

#### Leads that are not in use must be isolated.

The cable should be replaced if the outer sheath is damaged. Contact a Flygt service shop.

Make sure that the cable does not have any sharp bends and is not pinched.

Under no circumstances may the starter equipment be installed in the sump.

**WARNING!** For safety reasons, the earth (ground) lead should be approx. 100 mm (4.0") longer than the phase lead. If the motor cable is jerked loose by mistake, the earth (ground) lead should be the last lead to come loose from its terminal. This applies to both ends of the cable.

The motor is convertible between different voltages as stated on the data plate. This conversion is done on the terminal board or the contactor.

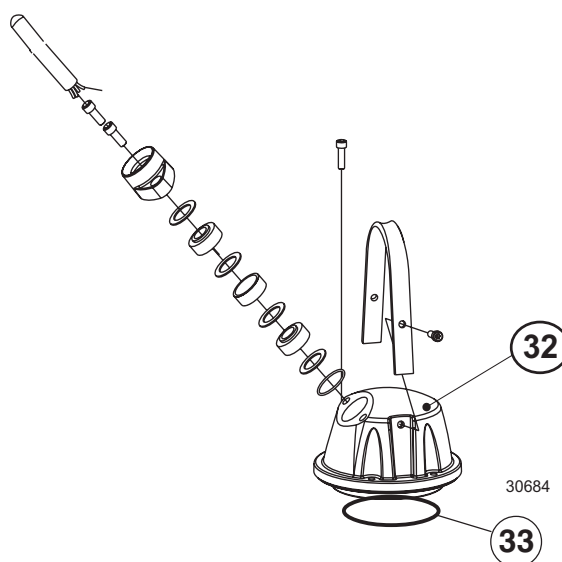


— **Bear in mind the risk of electrical shock and the risk of explosion if the electrical connections are not correctly carried out.**

When using a variable-frequency-drive (VFD) the shielded cable (type NSSHÖU.../3E+St) should be used in order to fulfil European CE requirements. Contact your Flygt representative and ask your VFD-supplier for electrical limitations. Also please see VFD-recommendation Flygt article no. 893472.

## Connection of stator and motor leads

- Check on the data plate which connection, Y, D or YD, is valid for the voltage supply. Then, depending on voltage, arrange the connection on the terminal board in accordance with Y, D or YD. See figure.
- Connect the motor cable to the connection block, U1, V1, W1 and earth (ground). Connect the leads from the motor control circuit.
- If star-delta start is used, motor cables are connected as shown in the figure. Links (jumper strips) are not used with star-delta start.
- Make sure that the pump is correctly earthed (grounded).
- Install the O-ring (33) and connection cover (32).
- Tighten the screws and the gland nut so that the cable entry unit bottoms out.
- Connect the motor cable to the starter equipment.
- Check the direction of rotation, see "Before starting".
- If the direction of rotation is wrong, transpose two of the phase leads.
- Remember that the starting surge with the direct-on line start can be up to six times higher than the rated current. Make sure that the fuses and circuit breakers are of the proper amperage.
- The incorporated **thermal contacts** (motor protection breaker) must be connected and in use. It shall be set to the motor rated current as given on the dataplate.





# CABLE CHART

## SUBCAB® 7GX

2 parallel cores connected together  
6-leads, Y

3171

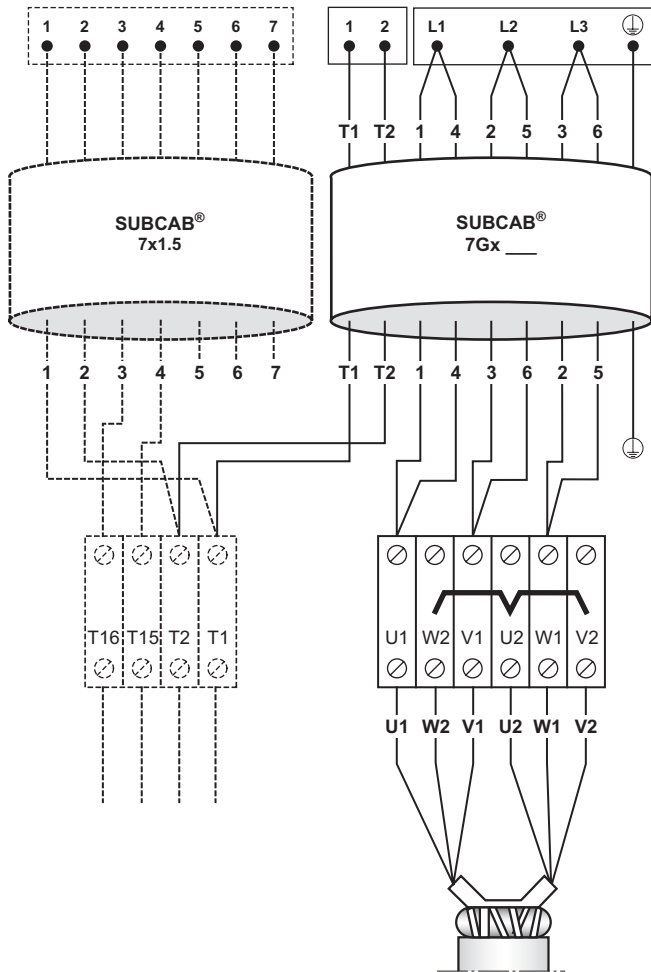


Bild 3

Mains	Lead	Terminal board
L1	1	U1
L1	4	U1
L2	2	W1
L2	5	W1
L3	3	V1
L3	6	V1
⊕	yellow/green	⊕
Control	Cable lead	Terminal board
T1	T1	T1
T2	T2	T2
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

## SUBCAB® 7GX

2 parallel cores connected together  
6-leads, D

3171

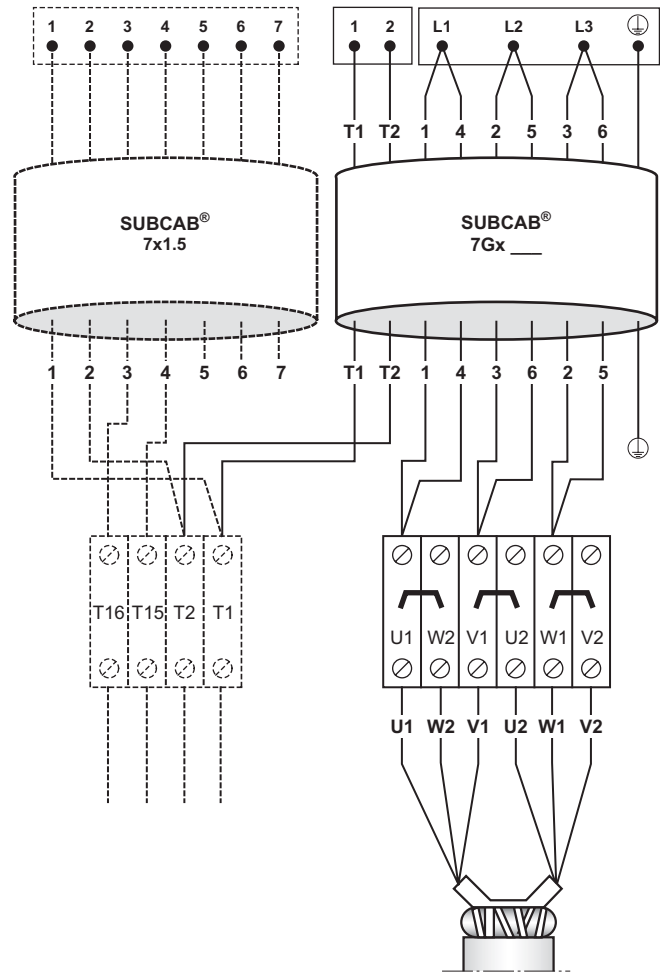


Bild 6

Mains	Lead	Terminal board
L1	1	U1
L1	4	U1
L2	2	W1
L2	5	W1
L3	3	V1
L3	6	V1
⊕	yellow/green	⊕
Control	Cable lead	Terminal board
T1	T1	T1
T2	T2	T2
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

# CABLE CHART

## SUBCAB® 4GX/SUBCAB® AWG, 6-leads, Y 3171

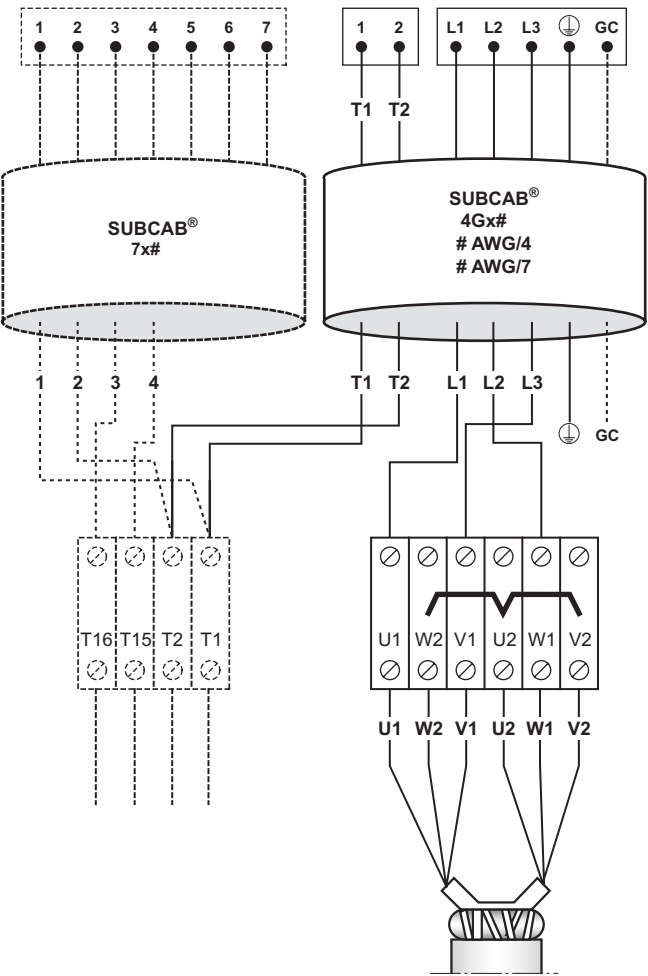


Bild 2

## SUBCAB® 4GX/SUBCAB® AWG, 6-leads, D 3171

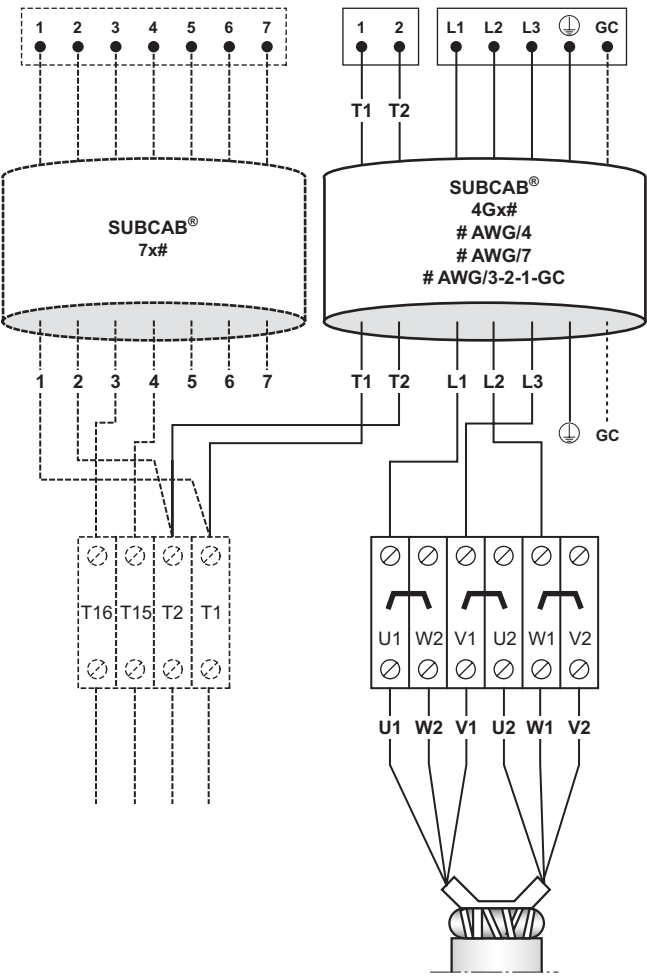


Bild 5

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⊕	yellow/green	yellow/green	⊕
Groundcheck GC		yellow	
Control	SUBCAB® Cable lead	SUBCAB® AWG Cable lead	Terminal board
T1	T1	orange	T1
T2	T2	blue	T2
Stator leads connection:			
Stator lead		Terminal board	
U1, red		U1	
W2, black		W2	
V1, brown		V1	
U2, green		U2	
W1, yellow		W1	
V2, blue		V2	

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⊕	yellow/green	yellow/green	⊕
Groundcheck GC		yellow	
Control	SUBCAB® Cable lead	SUBCAB® AWG Cable lead	Terminal board
T1	T1	orange	T1
T2	T2	blue	T2
Stator leads connection:			
Stator lead		Terminal board	
U1, red		U1	
W2, black		W2	
V1, brown		V1	
U2, green		U2	
W1, yellow		W1	
V2, blue		V2	



# CABLE CHART

## SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 9-leads, 460 V, Y ser. 3171

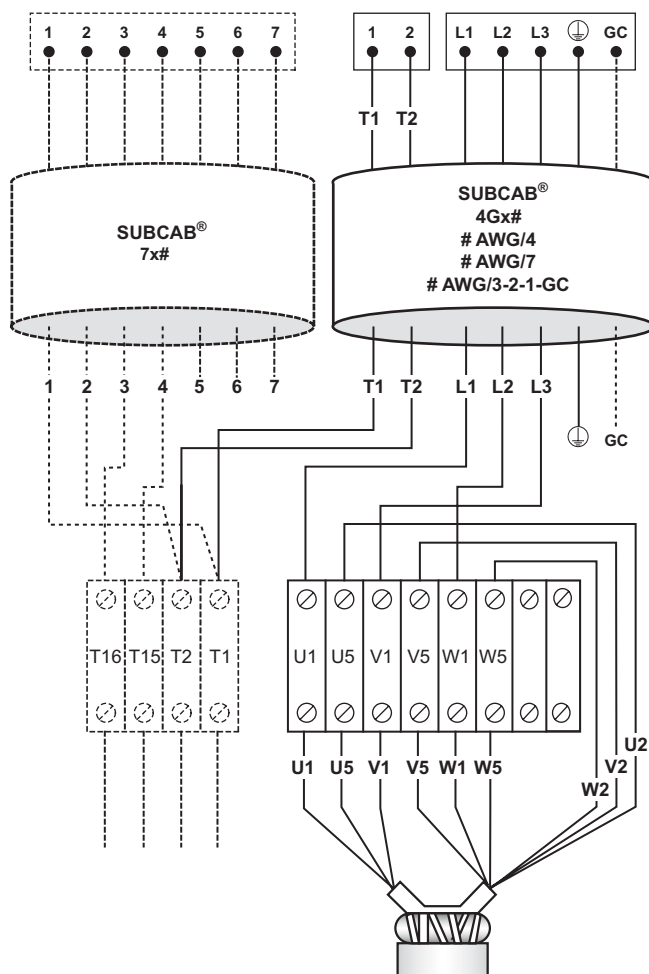


Bild 8

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⊕ Groundcheck GC	yellow/green	yellow/green yellow	⊕
Control	SUBCAB® Cable lead	SUBCAB® AWG Cable lead	Terminal board
T1	T1	orange	T1
T2	T2	blue	T2
Stator leads connection:			
Stator lead		Terminal board	
U1, red		U1	
U5, red		U5	
U2, green		U5	
V1, brown		V1	
V5, brown		V5	
V2, blue		V5	
W1, yellow		W1	
W5, yellow		W5	
W2, black		W5	

## SUBCAB® 4GX/SUBCAB® AWG, 60 Hz only, 9-leads, 230 V, Y // 3171

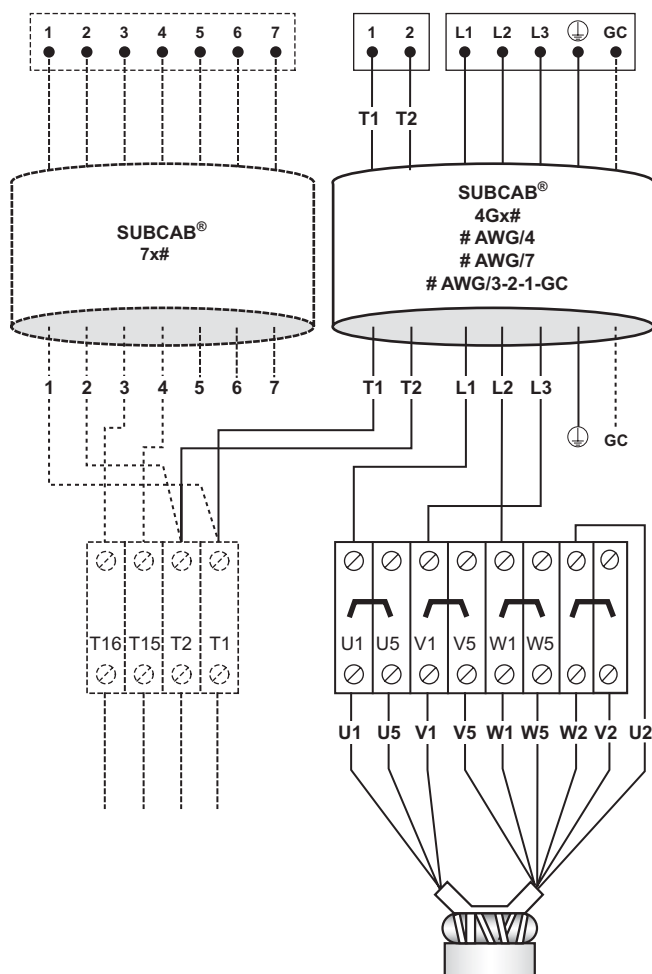


Bild 10

Mains	SUBCAB® Lead	SUBCAB® AWG Lead	Terminal board
L1	brown	red	U1
L2	black	black	W1
L3	grey	white	V1
⊕ Groundcheck GC	yellow/green	yellow/green yellow	⊕
Control	SUBCAB® Cable lead	SUBCAB® AWG Cable lead	Terminal board
T1	T1	orange	T1
T2	T2	blue	T2
Stator leads connection:			
Stator lead		Terminal board	
U1, red		U1	
U5, red		U5	
V1, brown		V1	
V5, brown		V5	
W1, yellow		W1	
W5, yellow		W5	
W2, black*			
V2, blue*			
U2, green*			

\*Connected together at terminal

# CABLE CHART

## SUBCAB® 7GX, 6-leads, Y/D 3171

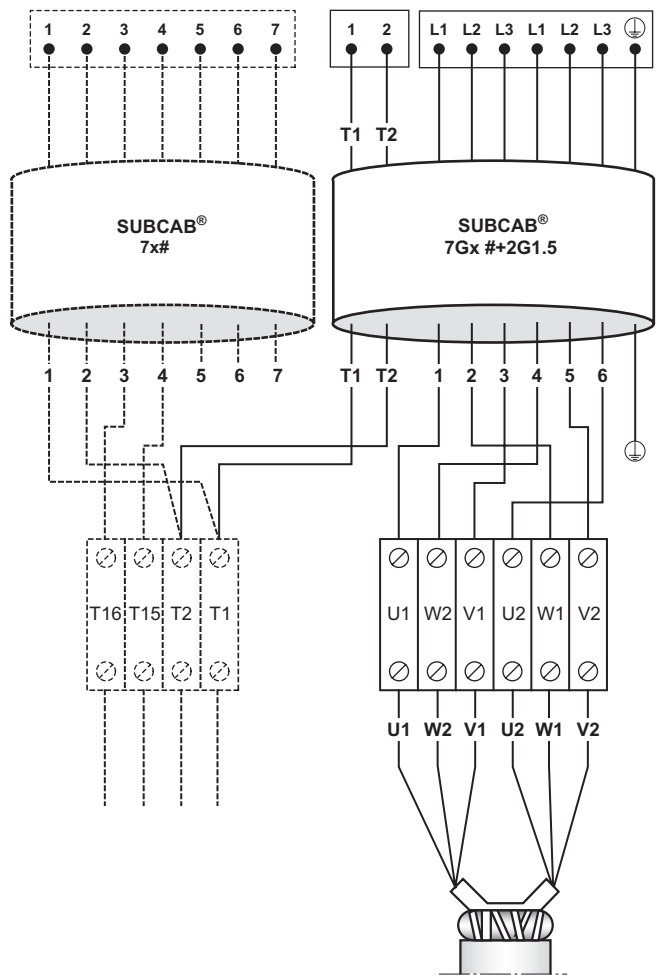


Bild 12

Mains	Lead	Lead
L1	1	U1
L2	2	W1
L3	3	V1
L1	4	W2
L2	5	V2
L3	6	U2
⊕	yellow/green	⊕
Control	Cable lead	Terminal board
T1	T1	T1
T2	T2	T2
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

# CABLE CHART

## SUBCAB® Screened, 6-leads, Y

3171

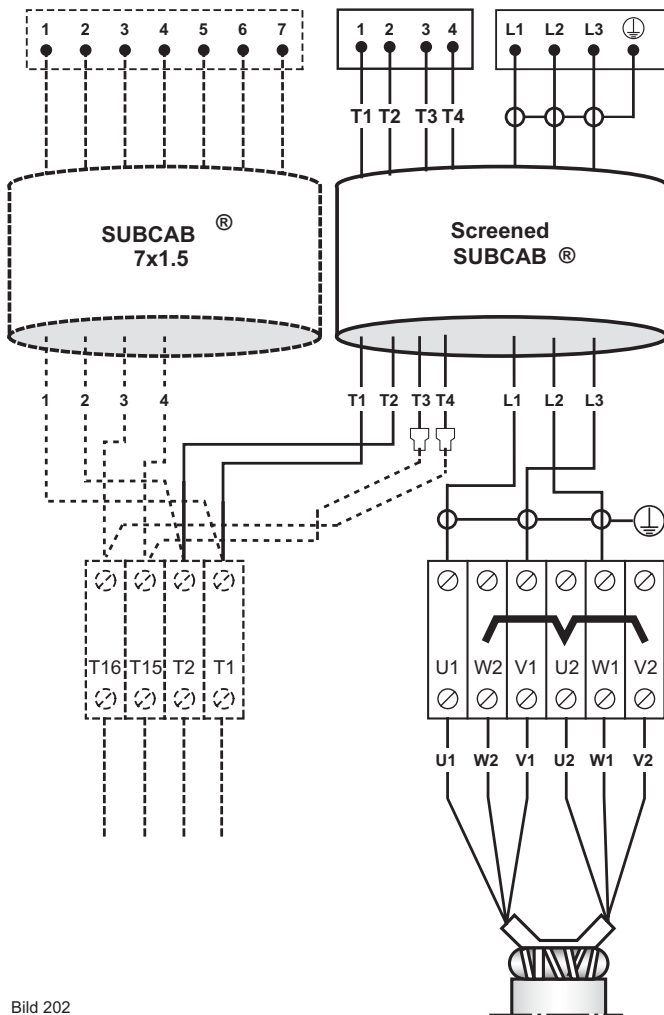


Bild 202

## SUBCAB® Screened, 6-leads, D

3171

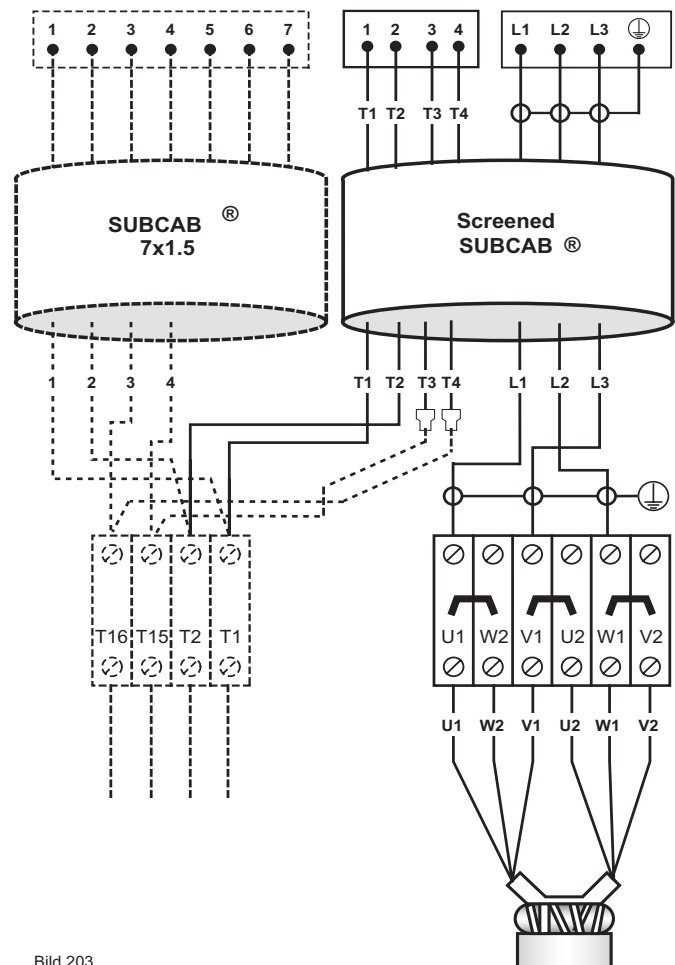


Bild 203

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⊕	Screen from leads	⊕
Control	Cable lead	Terminal board
T1	White T1	T1
T2	White T2	T2
T3	White T3	T15
T4	White T4	T16
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⊕	Screen from leads	⊕
Control	Cable lead	Terminal board
T1	White T1	T1
T2	White T2	T2
T3	White T3	T15
T4	White T4	T16
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

# CABLE CHART

## NSSHÖU ../3E+st, 6-leads, Y

3171

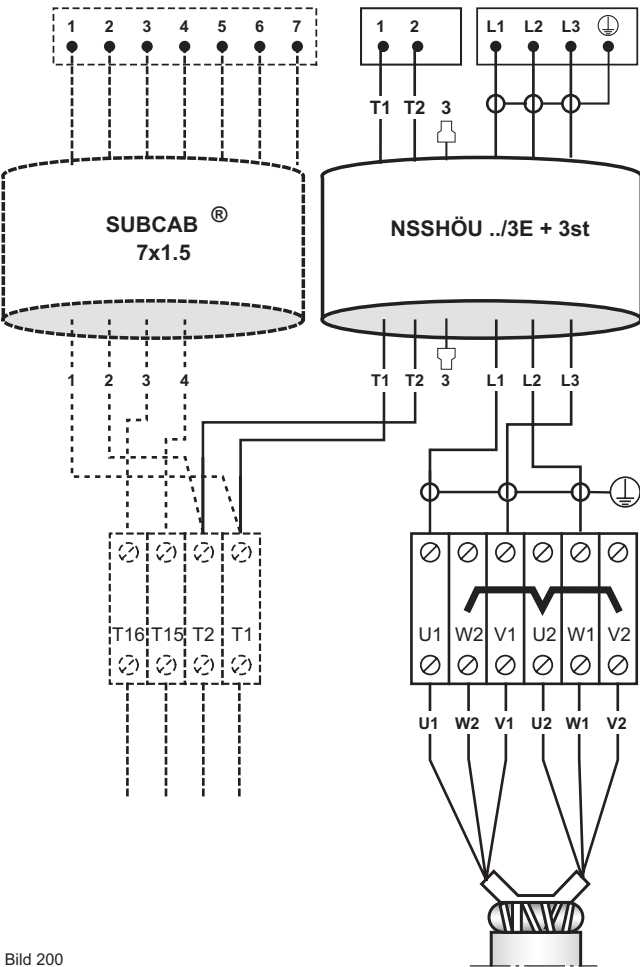


Bild 200

## NSSHÖU ../3E+st, 6-leads, D

3171

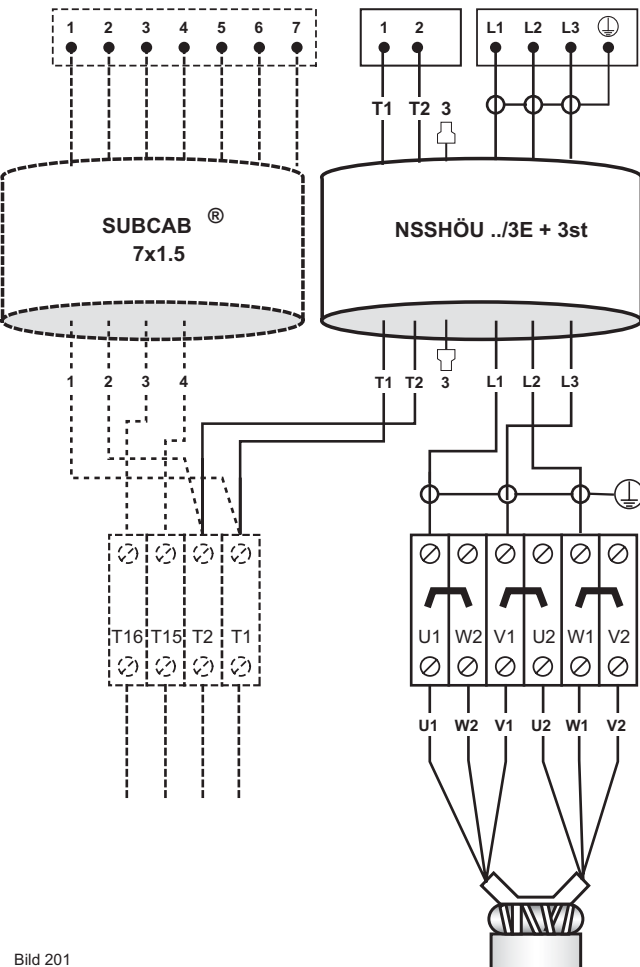


Bild 201

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	Cable lead	Terminal board
T1	Black T1/1	T1
T2	Brown T2/2	T2
T3	Grey/3	Unused
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

Mains	Lead	Lead
L1	Brown	U1
L2	Black	W1
L3	Grey	V1
⏚	Screen from leads	⏚
Control	Cable lead	Terminal board
T1	Black T1/1	T1
T2	Brown T2/2	T2
T3	Grey/3	Unused
Stator leads connection:		
Stator lead	Terminal board	
U1, red	U1	
W2, black	W2	
V1, brown	V1	
U2, green	U2	
W1, yellow	W1	
V2, blue	V2	

## Sensor connections

### Monitoring equipment

FLS10 is a small float switch and it is installed in the inspection chamber. FLS is connected to max 12 V.

Thermal switches are incorporated into the stator and are rated 250 V, 2,5 A (cos  $\varphi=1$ ) / 1,6 A (cos  $\varphi=0,6$ ).

The sensors are connected as standard to the Flygt monitoring relay MiniCAS II (see diagrams below).

In case optional sensors are used the more advanced monitoring relay MAS 711 can be used.

For a **PTC-thermistor** (PTC = Positive Temperature Coefficient), there is a significant increase in resistance at a certain temperature that can be utilized for monitoring the temperature.

PTC-thermistor

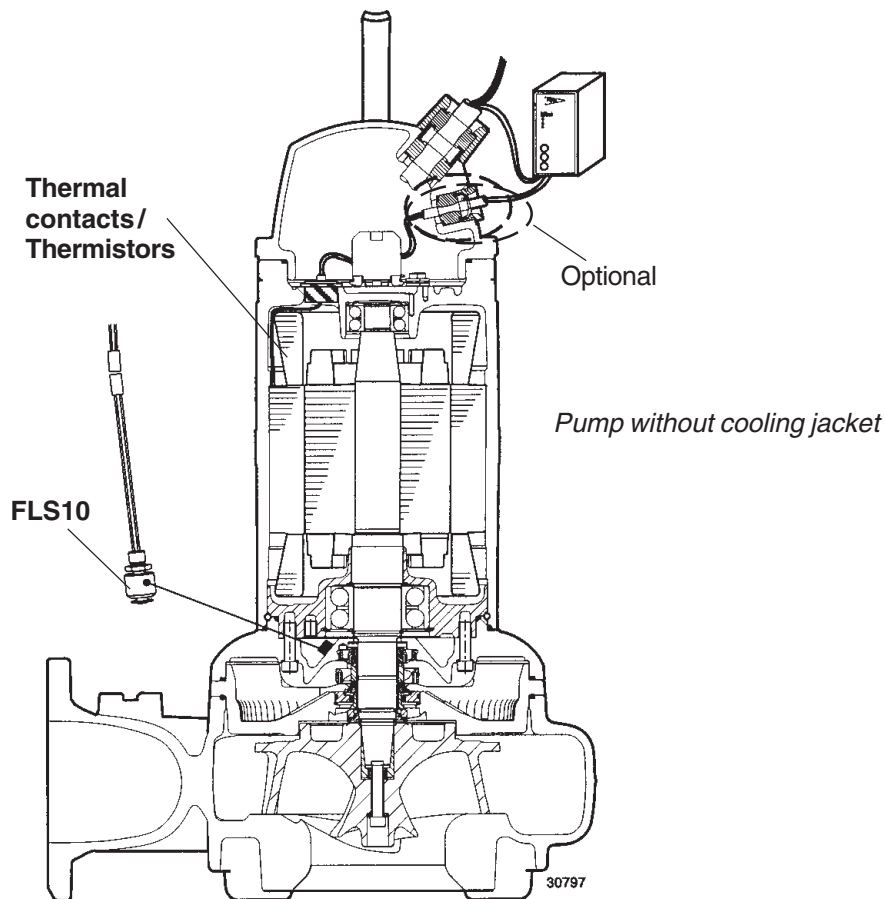
$T = 25\text{ }^{\circ}\text{C}$   $R \leq 100\text{ Ohm}$

$T = 135\text{ }^{\circ}\text{C}$  ( $T_{\text{REF}} - 5\text{ }^{\circ}\text{C}$ )  $R \leq 550\text{ Ohm}$

$T = 145\text{ }^{\circ}\text{C}$  ( $T_{\text{REF}} + 5\text{ }^{\circ}\text{C}$ )  $R \geq 1330\text{ Ohm}$

Three thermistors are connected in series and have a resistance of approx. 150-300 ohms at room temperature.

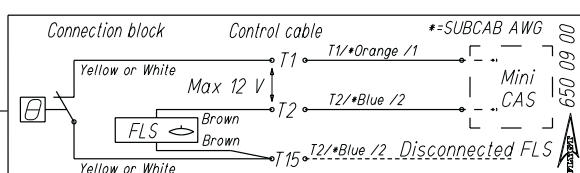
The label in the junction box shows if the pump is equipped with optional sensors.



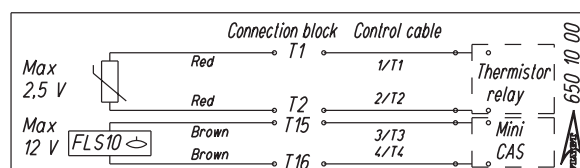
**Sensor connection for standard configuration**

The pump is as standard equipped with either thermal contacts or thermistors.

#### A) Thermal contacts



#### B) Thermistors



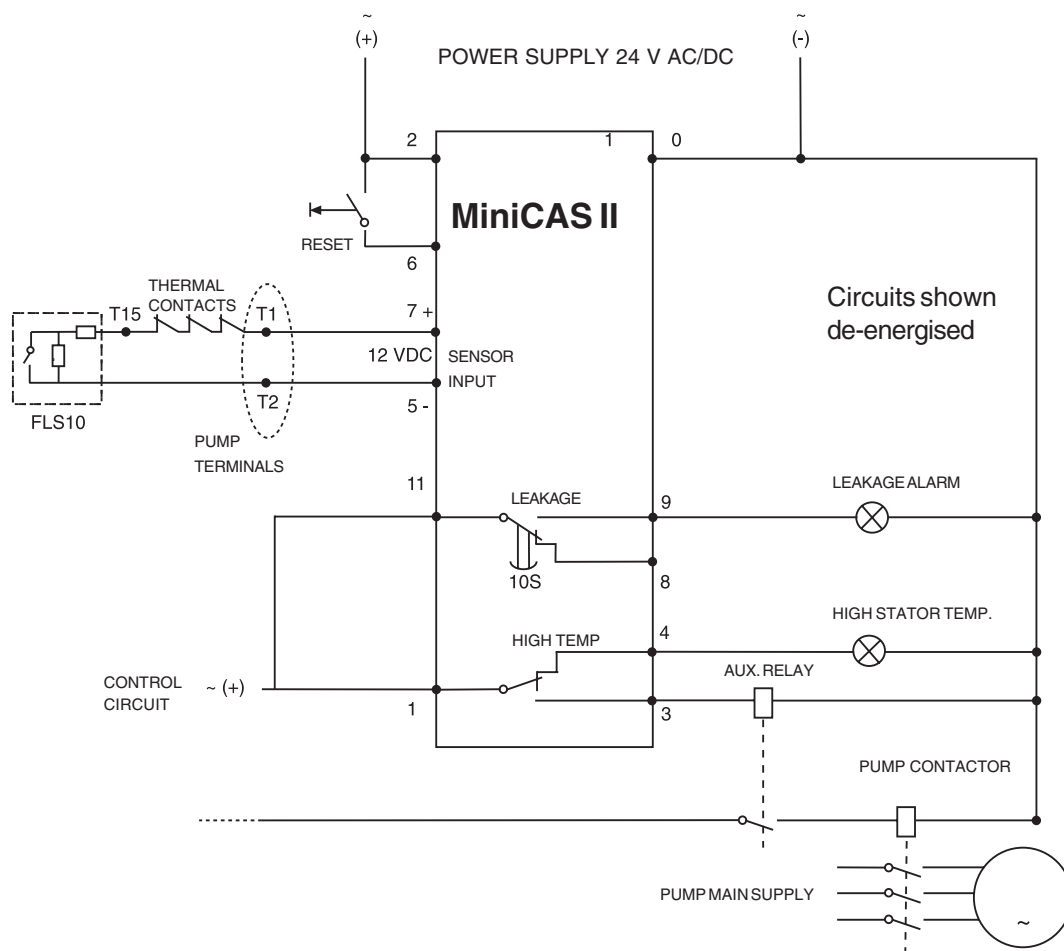
### FLS10 + thermal contacts

0 mA = *Overtemperature*

10 mA = *OK*

28 mA = *Leakage*

Tolerance 10%



### Sensor Connection Table

(For further information please contact Flygt representative.)

Sensor	Sensor lead	Thermal connection	Control cable	Connected to
Thermal contacts + FLS10	White Brown White+Brown	T1 T2 T15	T1/*Orange T2/*Blue = SubCab /* SubCabAWG	Mini CAS II Mini CAS II
Thermistors + FLS10	Red Red Brown Brown	T1 T2 T15 T16	1 2 3 4	Thermistor relay Thermistor relay Mini CAS II Mini CAS II

# OPERATION

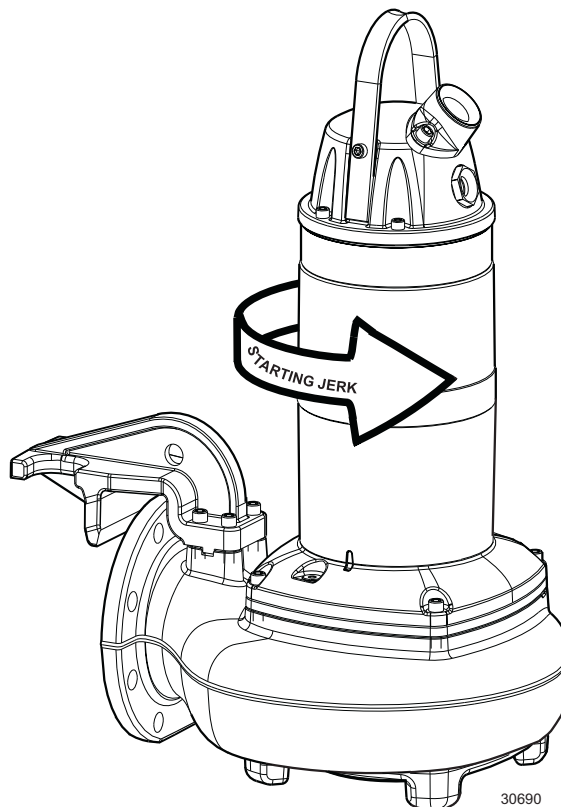
## Before starting

- Check that the visible parts of the pump and installation are undamaged and in good condition.
- Remove the fuses or open the circuit breaker and check that the impeller can be rotated freely.
- Verify that the supply voltage matches the pump data plate voltage rating.
- Conduct insulation integrity check.
- Conduct phase to phase resistance check.
- Check that the monitoring equipment works.
- Check the direction of rotation. The impeller shall rotate clockwise, as viewed from above. When started, the pump will jerk in the opposite direction to the direction in which the impeller rotates. See figure. In case of dry installation, check the direction of rotation through the inlet elbow access cover. Transpose two phase leads if the impeller rotates in the wrong direction (3 ~).



**Note for Ex version page 3.**

- **Before starting work on the pump, make sure that the pump is isolated from the power supply and cannot be energized.**
- **Make sure that the pump cannot roll or fall over and injure people or damage property.**
- **In some installations the pump surface and the surrounding liquid may be hot. Bear in mind the risk of burn injuries.**
- **In some installations and at certain operating points on the performance curve, the noise level of 70 dB or the noise level specified for the actual pump may be exceeded.**



*Watch the starting jerk which can be powerful.*

# CARE AND MAINTENANCE

## Service/Inspection

Flygt recommends a preventive maintenance program based on Intermediate and Major Services at regular intervals. For standard sewage applications where FLS10 is correctly connected and in use and the temperature of the pumped liquid is 40° C (104° F) or less an *Intermediate Service* should be performed every 8000 hours or every 2 years, whichever occurs first.

The time between *Major Service* could vary considerably depending on operating conditions and the need for a Major Service will be determined during the regular Intermediate Services.

However, a minimum of 20 000 hours of operation could be anticipated.

For applications other than sewage water or for specific operating conditions, other service intervals may be recommended.

Pump	Intermediate Service running 8 000 h or 2 years
Junction box	Check that it is clean and dry.
Terminal board	Check that the connections are properly tightened.
Insulation check	Check that the resistance between earth and phase lead is more than 5 M $\Omega$ . Conduct phase to phase resistance check.
Cable	Check that the rubber sheating (jacket) is undamaged.
Seal housing	Fill up with new coolant if necessary. Check freezing point (lower than -13°C, 9°F).
Inspection chamber	Drain all liquid if any. Check the resistance. Normal value approx. 1200 $\Omega$ , alarm approx. 430 $\Omega$ .
O-rings	Always replace the O-rings of the filling plugs and at the junction cover. Always grease new O-rings.
Thermal contacts	Check the resistance. Normally closed circuit; interval 0 – 1 $\Omega$ .
Thermistor	Check the resistance 20 – 250 $\Omega$ , (measuring voltage max 2 V DC).
Impeller	Check impeller clearance and adjust if necessary.

Lifting handle	Check the screws and the status of the lifting handle.
Rotation direction	Check the rotation of the impeller.
Lifting device	Check that local safety regulations are followed.
Voltage and amperage	Check running values.
Pumpstation	Intermediate Service running 8 000 h or 2 years
Electrical cabinets/panels	Check that they are clean and dry.
Connection to power	Check that the connections are properly tightened.
Overload and other protections	Check correct settings.
Personnel safety	Check guard rails, covers and other protections.
Level regulators	Check condition and function.
Pump	Major Service
Support and main bearing.	Replace with new bearings.
Mechanical seal unit.	Replace with new seal units.
<b>Pumpstations same as Intermediate Service.</b>	



If any indication of alarm between inspections, please see instructions below.	Actions
<p>FLS10</p> <p>Thermistor/Thermal-contact</p> <p>Overload protection</p>	<p>Drain the fluid in the inspection chamber. Fill with new coolant if necessary. Check freezing point (lower than <math>-13^{\circ}\text{C}</math> (<math>9^{\circ}\text{F}</math>)). Check the inspection chamber again after one week of operation. If leakage has occurred, drain the fluid and change the mechanical seal unit and replace with new coolant.</p> <p>Check coolant level. (pump with cooling jacket) Check start and stop levels.</p> <p>Check that the impeller can rotate freely.</p>

The following points are important in connection with work on the pump:

- Make sure that the pump cannot roll or fall over and injure people or damage property.
- Check every year that the lifting equipment is in good condition.

The pump is designed for use in liquids which can be a healthrisk. In order to prevent injury to the eyes and skin, observe the following points when working on the pump:

- Make sure that the pump has been thoroughly cleaned.
- Beware of the risk of infection.
- Follow local safety regulations.
- Always wear goggles and rubber gloves.
- Rinse the pump thoroughly with clean water before starting work.
- Rinse the components in water after dismantling.
- The coolant chamber may be under pressure. Hold a rag over the filling plug to prevent splatter.

Proceed as follows if fluids have splashed into your eyes:

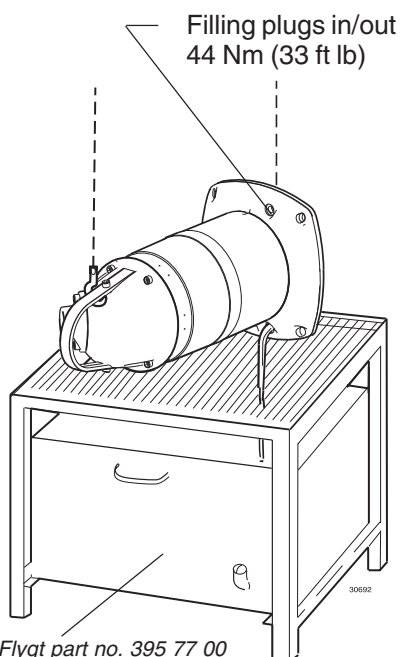
- Rinse your eyes immediately in running water for 15 minutes. Hold your eyelids apart with your fingers.
- Contact an eye specialist.

On your skin:

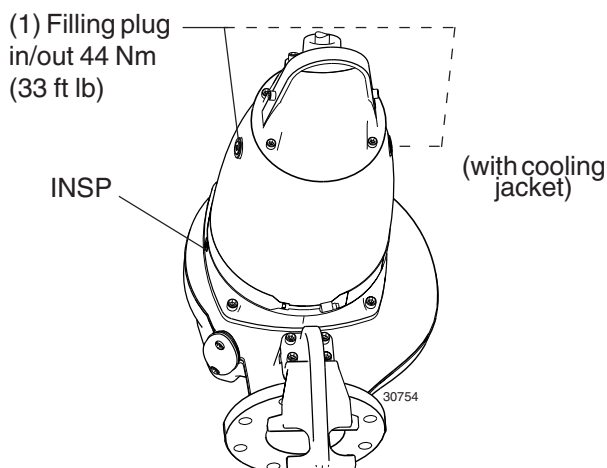
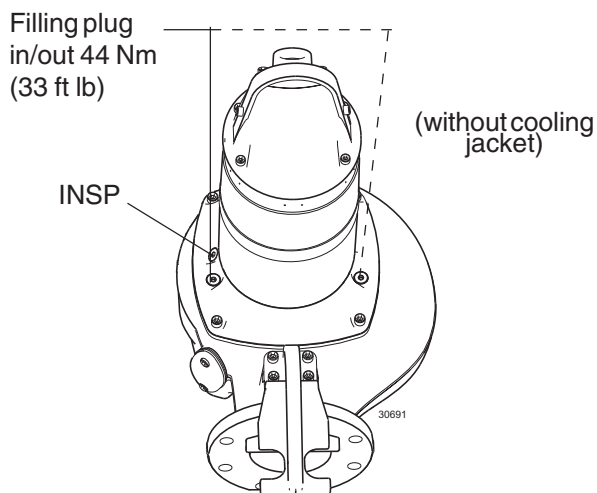
- Remove contaminated clothes.
- Wash your skin with soap and water.
- Seek medical attention, if required.

## Changing the coolant

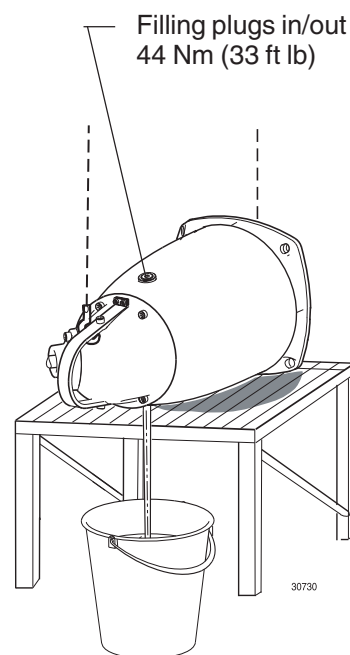
### Emptying coolant (without cooling jacket)



### Filling coolant



### Emptying coolant (with cooling jacket)



1. Lift the pump horizontally with an overhead crane and place on a relief table.
2. Turn the pump so that one of the filling plugs holes faces downwards.  
**WARNING!** If the mechanical seal unit leaks, the seal housing may be under pressure. Hold a rag over the filling plug to prevent splatter.
3. Unscrew the filling plug. It is easier to drain the water-glycol if the other filling plug is also removed.

4. **Pump without cooling jacket.** Raise the pump to an upright position. Fill with coolant to the same level as the filling plugs; approx. 4,6 litres (4.9 US quarts).

**Pump with cooling jacket;** approx. 16,7 litres (17.6 US quarts).

Coolant: a mix of water and stabilized monopropylene glycol in a mixture ratio of 70/30 % volume part.

Known trade marks of monopropylene glycol are: Dowcal N (individual components are approved by FDA), Dowcal 20. These are non-poisonous, heat-and-cold resistant and inhibiting of corrosion.

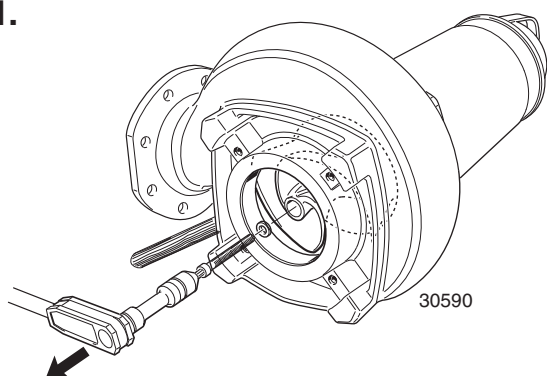
Use of other type of glycol jeopardize the function of the pump.

If there is no risk of freezing even clean water with anti-corrosive is acceptable as coolant.

5. Always replace the O-rings of the filling plugs. Put the plugs back and tighten them.

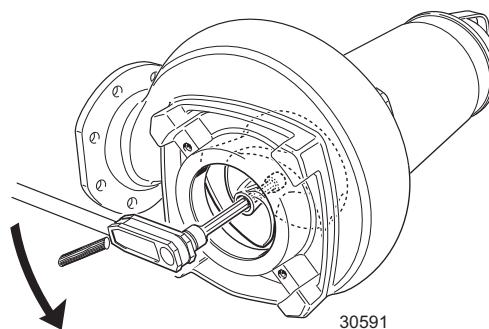
## Removing the impeller

1.



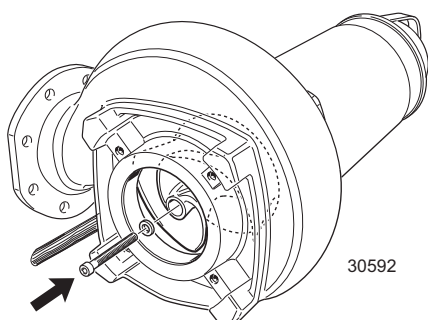
Place the pump horizontally. Remove the guide pin (if mounted). Remove the flush valve cover and its O-ring. Insert a rod (wood or plastic) through the hole and lock the impeller in place. Remove the impeller screw.

2.



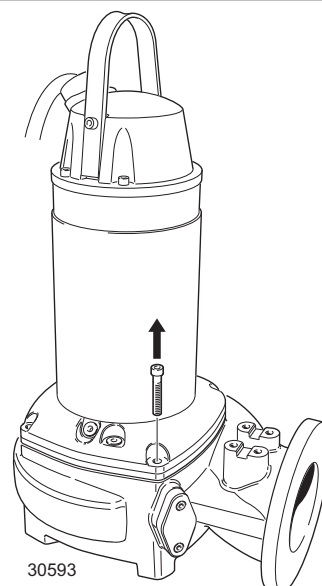
Using a 12 mm hexagon bit adaptor (allen socket) with a 100 mm (4") extension (minimum length) turn the gland screw counter clockwise until the impeller breaks free from the shaft.

3.



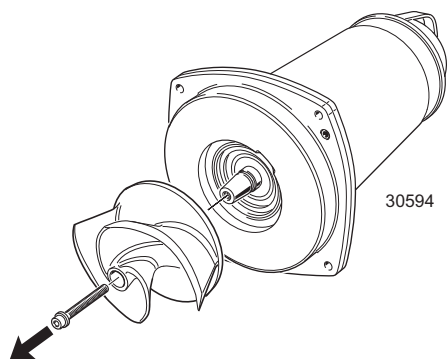
Install the impeller and screw. Tighten lightly by hand, just to prevent the impeller from falling off.

4.



Remove the rod and raise the pump. Remove the pump housing. Using a crane, lift the drive unit off the pump housing.

5.



Place the drive unit horizontally. Remove the impeller screw.



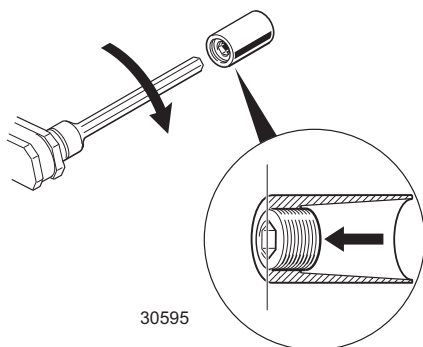
**Worn impellers can have very sharp edges. Use protective gloves!**

**WARNING!** When laying the pump on its side do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.

## Installing and setting clearance

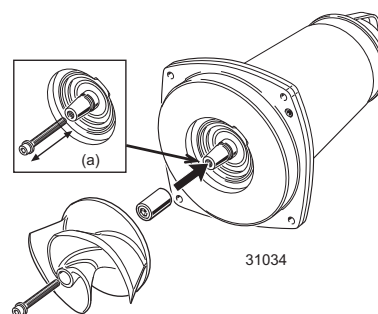
(If you fail with the impeller installation, you **must** start again from step 1)

1.



Make sure that the end of the shaft is clean and free from burrs. Polish off any flaws with fine emery cloth. Grease the end of the shaft, conical sleeve, the threads of the gland screw and the impeller screw. Align the edge of the gland screw with the edge of the conical sleeve so that they are flush.

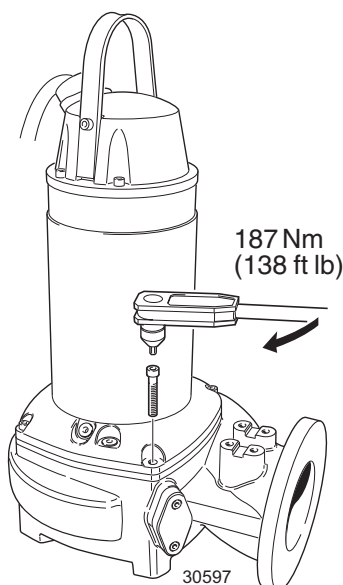
2.



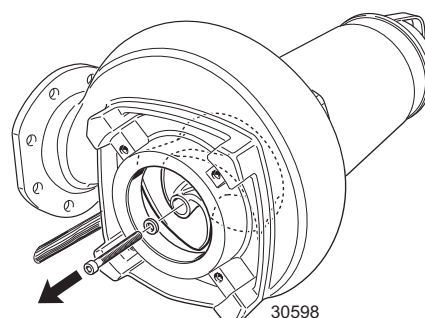
Before assembling, check that the impeller screw is clean and easy to screw into the shaft end (a). This is to prevent the shaft to rotate with the impeller. Assemble the conical sleeve and the impeller onto the shaft. Fit the impeller screw onto the shaft. Tighten the impeller screw lightly by hand, just to prevent the impeller from falling off.

3.

Fit the drive unit to the pump housing. Adjust its position so that the inspection hole is on the same side as the hole for the flush valve. Tighten the screws in diagonally opposite pairs.

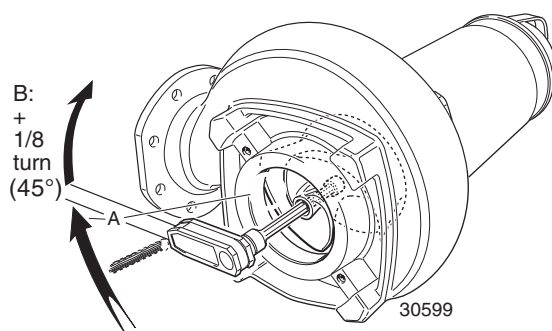


4.



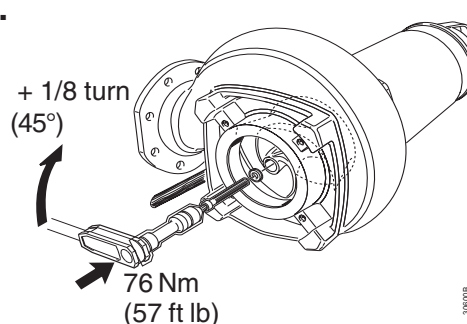
Place the pump horizontally. Remove the flush valve cover and its O-ring. Insert a rod (wood or plastic) through the hole and lock the impeller in place. Remove the impeller screw.

5.



Turn the gland screw clockwise until the impeller makes contact with the pump housing. Tighten it a further 1/8 turn, 45°. This will insure the correct clearance between the impeller and the bottom of the pump housing in the next step.

6.

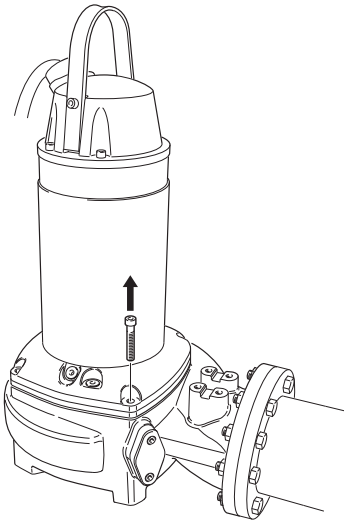


Fit the washer and the greased impeller screw and tighten, torque to 76 Nm (57 ft lb) + 1/8 turn (45°). Remove the rod used to lock the impeller. Fit the O-ring, flush valve cover and secure with screws, torque to 44 Nm (33 ft lb).

**SH-version - if applicable:** Fit the guide pin and adjust the clearance to 0,2 - 0,8 mm (0,008-0,032") between the guide pin and the impeller.

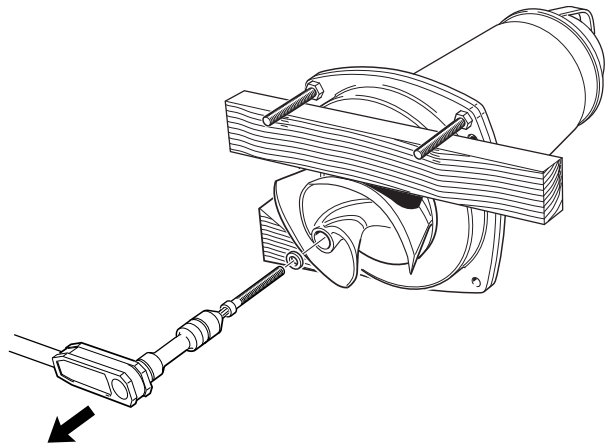
## Removing the impeller - dry installation version, NT

1.



Remove the drive unit from the pump housing.

2.



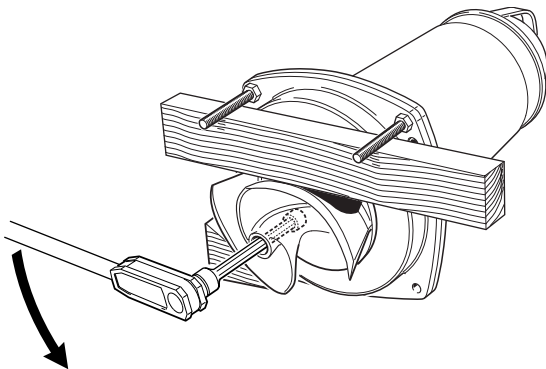
Place the drive unit horizontally. Lock the impeller in place and remove the impeller screw.

**WARNING!** When laying the pump on its side do not allow the weight of the pump to rest on any portion of the impeller. The impeller must not be allowed to make contact with the concrete floor or other hard and rough surfaces.



**Worn impellers can have very sharp edges. Use protective gloves!**

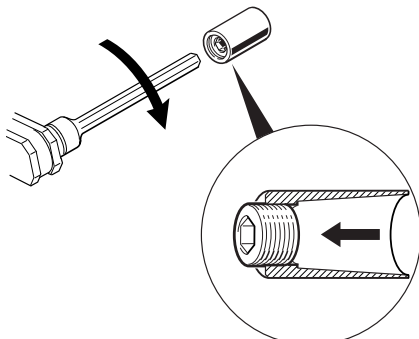
3.



Using a 12 mm hexagon bit adaptor (allen socket) with a 100 mm (4") extension (minimum length) turn the gland screw counter clockwise until the impeller breaks free from the shaft. Remove the impeller.

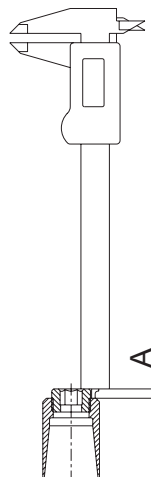
## Installing and setting clearance

1.



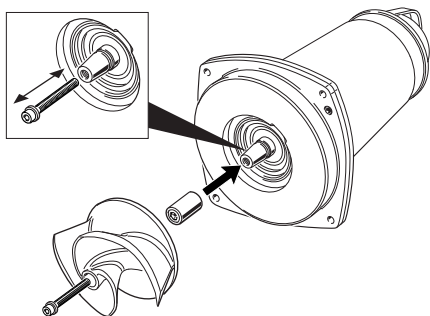
Make sure that the end of the shaft is clean and free from burrs. Polish off any flaws with fine emery cloth. Grease end of shaft, conical sleeve and the threads of the gland screw and the impeller screw. Unscrew the gland screw approximately 5 mm.

2.



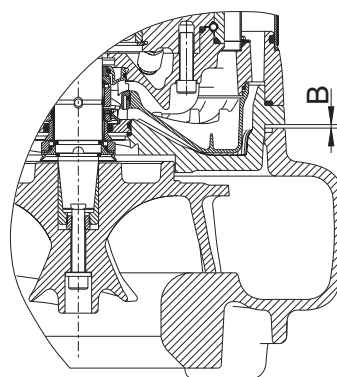
Measure and note the distance A.

3.



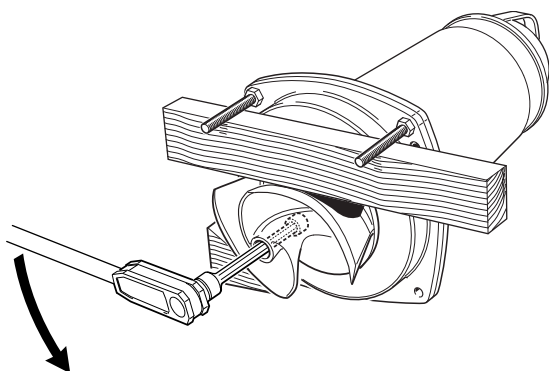
Before assembling, check that the impeller screw is clean and easy to screw into the shaft end (a). This to prevent the shaft to rotate with the impeller screw. Assemble the conical sleeve and the impeller onto the shaft. Fit the impeller screw with washer onto the shaft and tighten to 76 Nm (57 ft lb).

4.



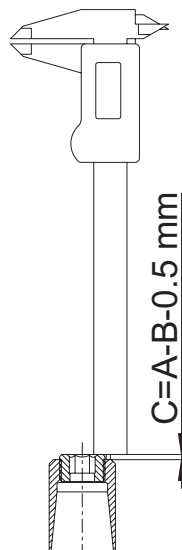
Make sure that the O-ring is removed from the seal housing cover. Place the drive unit in the pump housing. Check the distance between the seal housing cover and the pump housing with a feeler gauge. Check diametrically at four points. Note the largest measured distance, B. See fig.

5.



Lift the drive unit out of the pump housing and remove the impeller and conical sleeve.

6.

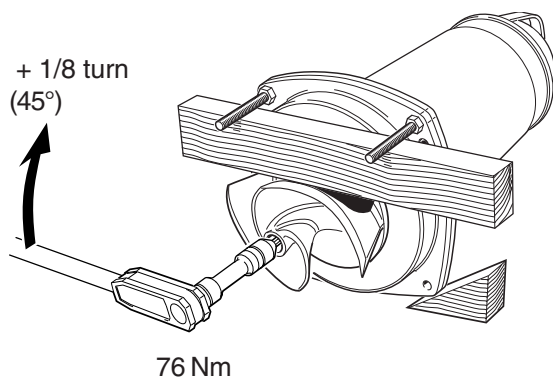


Calculate the measure C according to formula:

$$C = A - B - 0,5\text{mm}$$

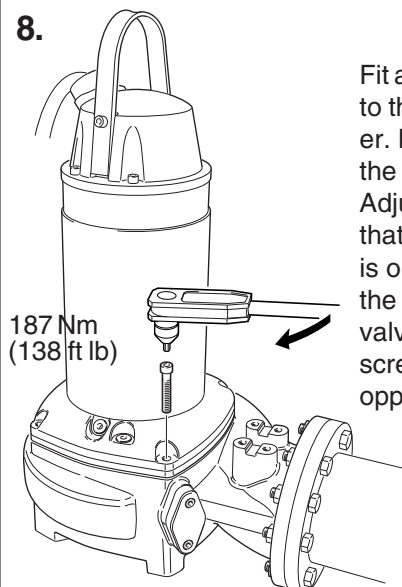
Unscrew the gland screw until C is reached.

7.



Fit the conical sleeve, impeller and impeller screw with washer and tighten to 76 Nm (57 ft lb) + 1/8 turn (45°).

8.



Fit a new greased O-ring to the seal housing cover. Fit the drive unit to the pump housing. Adjust its position so that the inspection hole is on the same side as the hole for the flush valve. Tighten the screws in diagonally opposite pairs.



# FAULT TRACING (TROUBLESHOOTING)

A universal instrument multimeter (VOM), a test lamp (continuity tester) and wiring diagram are required in order to carry out fault tracing on the electrical equipment.

Fault tracing shall be done with the power supply disconnected and locked off, except for those checks which cannot be performed without voltage.

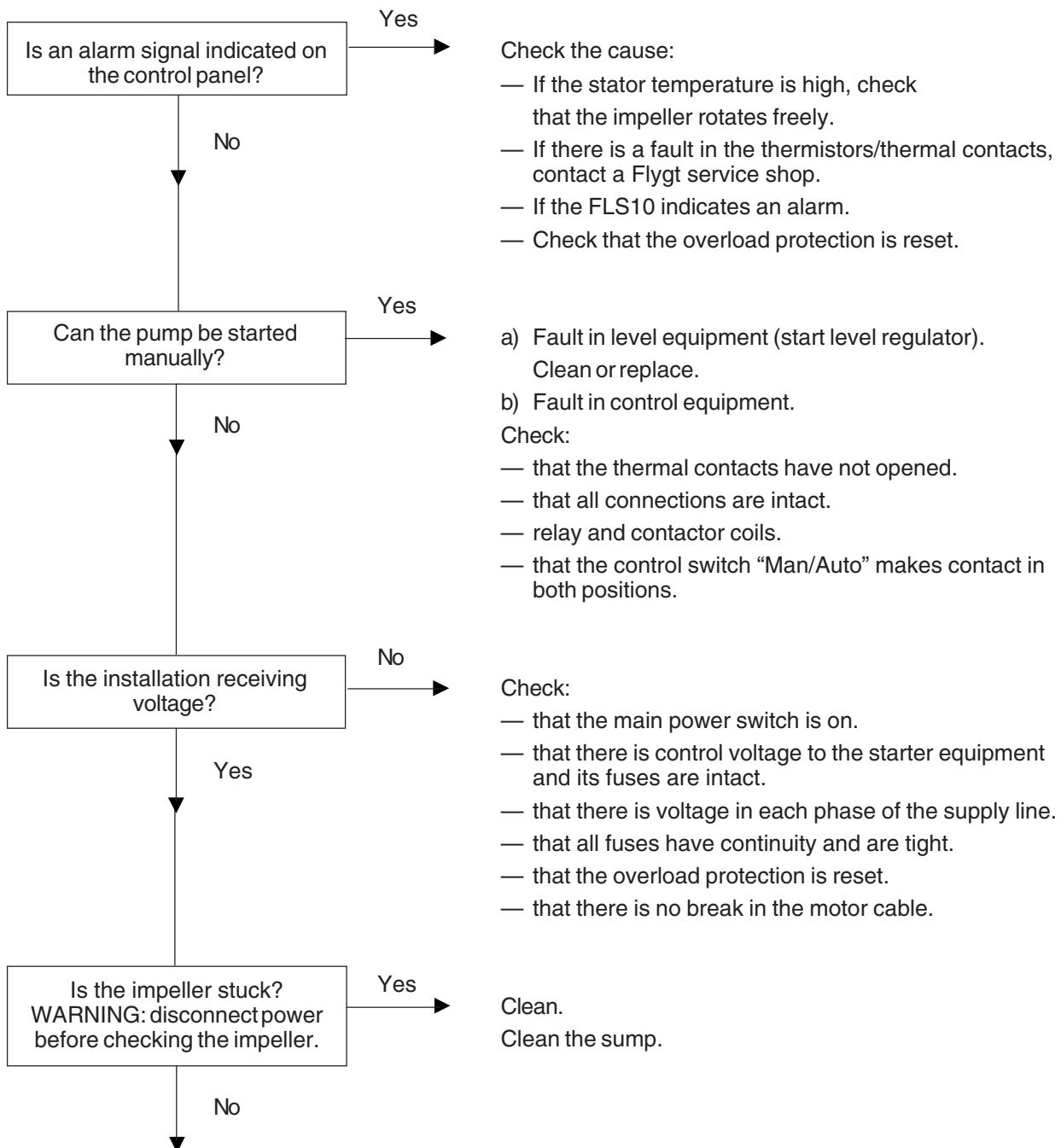
Always make sure that there is no one near the pump when the power supply is turned on.

Use the following checklist as an aid to fault tracing. It is assumed that the pump and installation have formerly functioned satisfactorily.

Electrical work shall be performed by an authorized electrician.

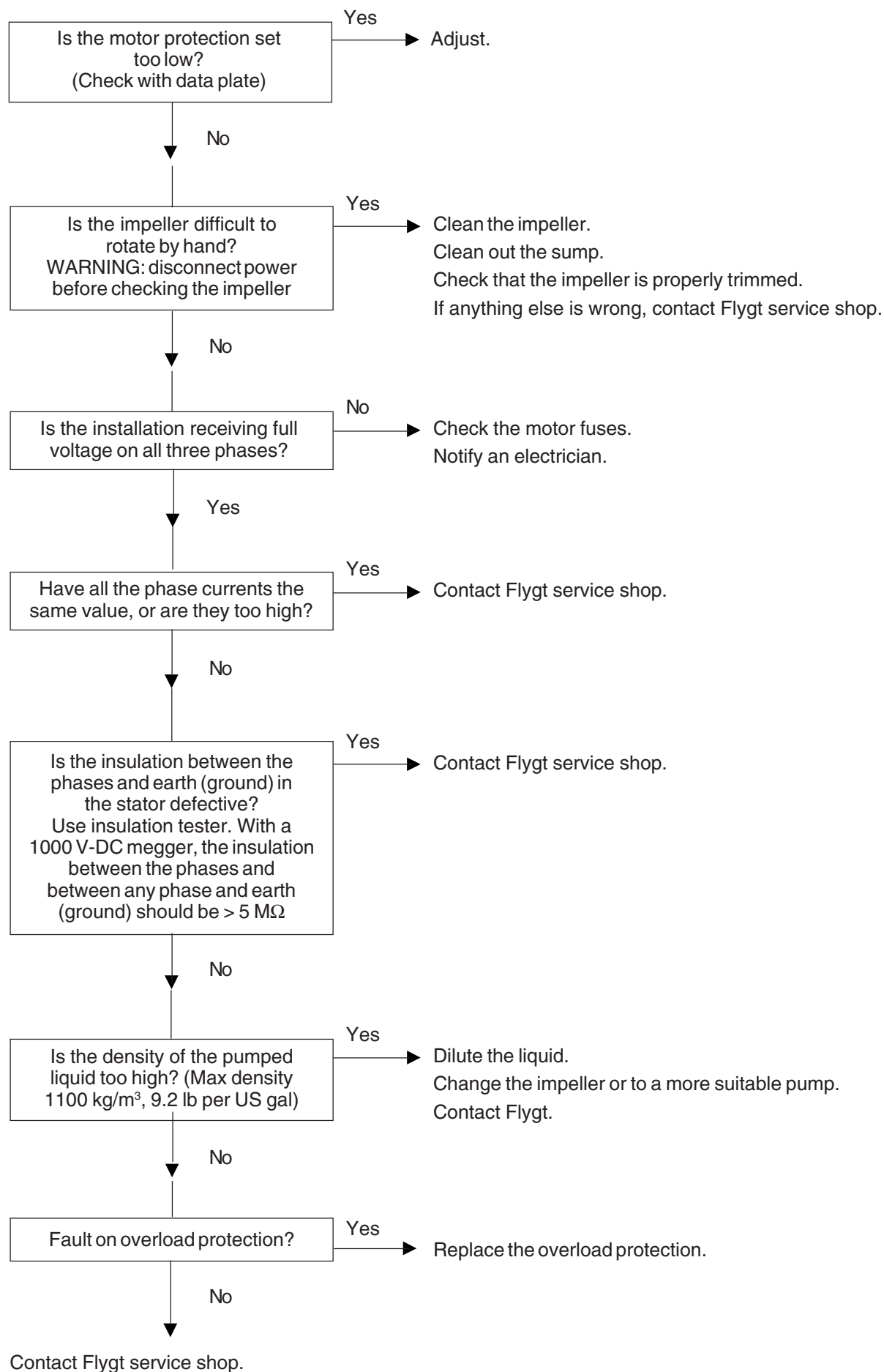
Follow local safety regulations and observe recommended safety precautions.

## 1. Pump fails to start



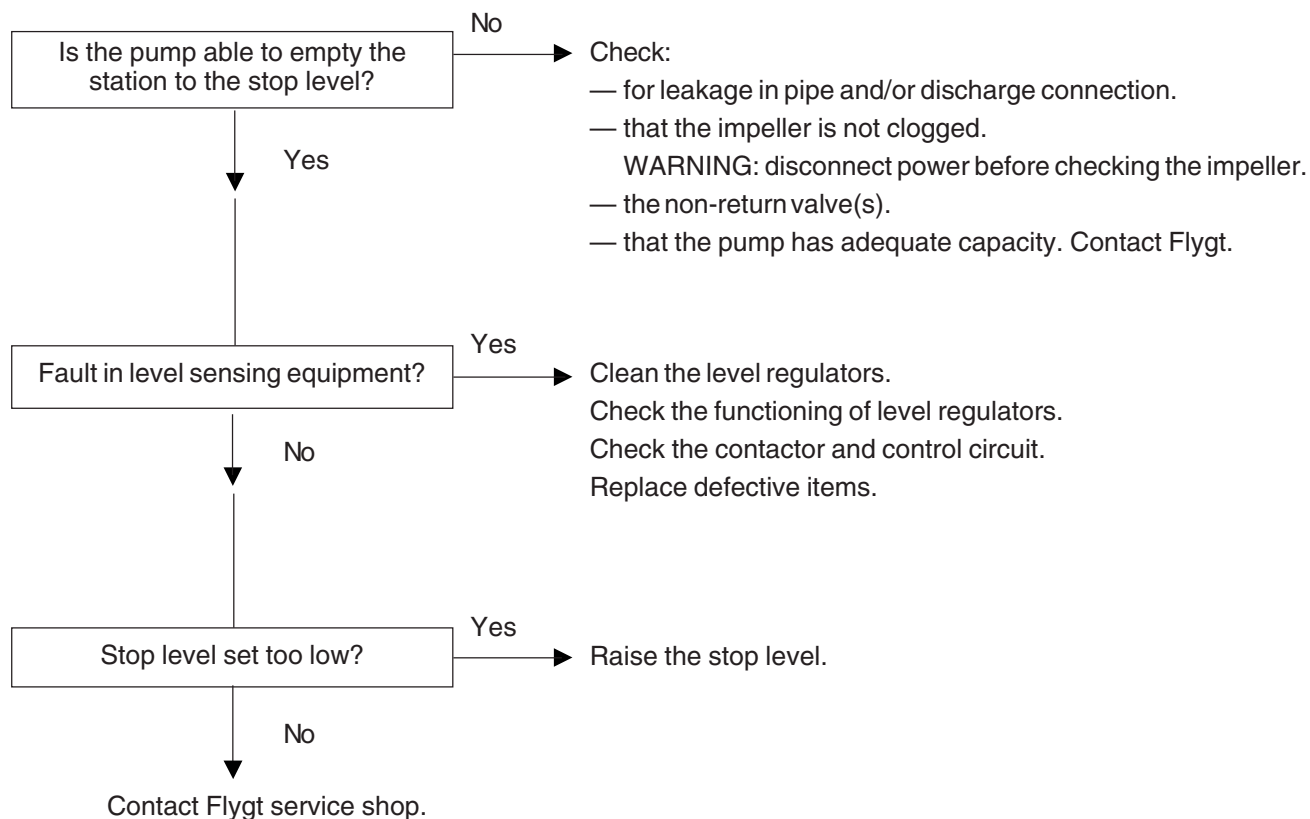
Contact Flygt service shop.

## 2. Pump starts but motor protection trips

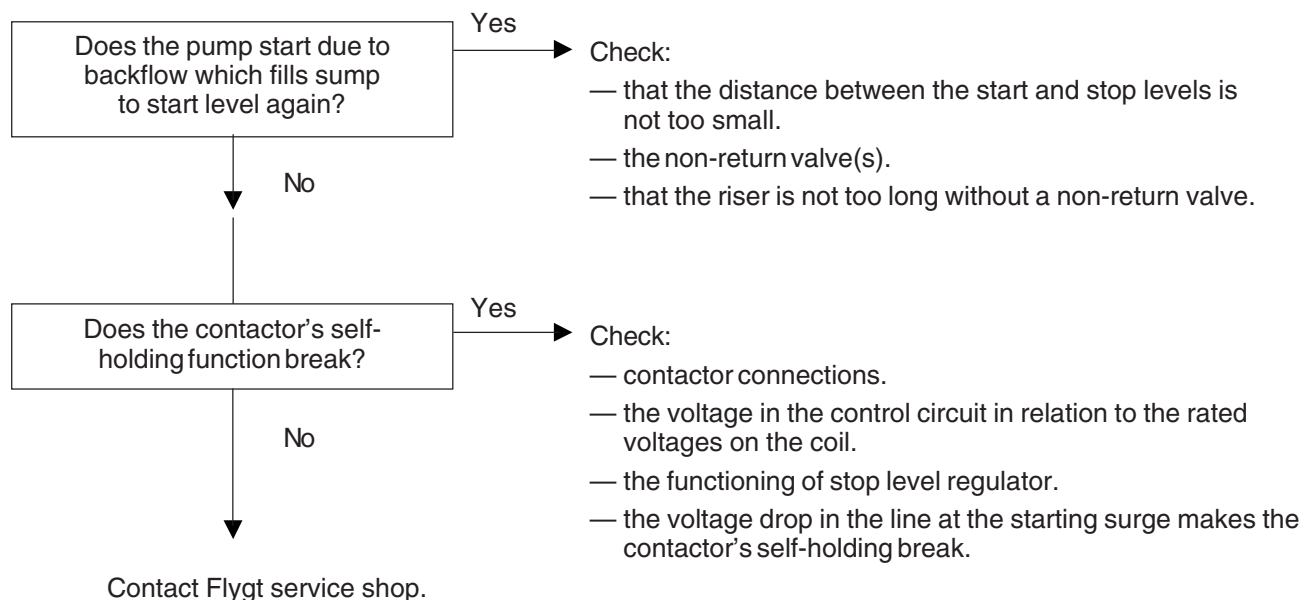




### 3. The pump does not stop (when level control is used)



### 4. The pump starts-stops-starts in rapid sequence



**Do not override the motor protection repeatedly if it has tripped.**

Most recent service date	Pump No.	Hours of operation	Remarks	Sign.



## Parts list

3171

Detaljlista

Ersatzteilliste

Liste des pièces de rechange

Lista de piezas de repuesto

Lista parti di ricambo



Flygt



ITT Industries

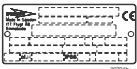
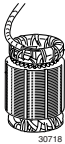
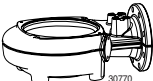
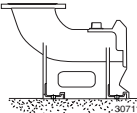
	<b>Content</b> <b>Innehåll</b> <b>Inhalt</b>	<b>Table des matières</b> <b>Contenidos</b> <b>Indice</b>	<b>3171</b>
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### 3171.091: Explosion Proof according to:

**EN:** European Norm  
ATEX Directive  
European standards EN 50014, EN 50018 and  
EN 1127-1






**FM:** Factory Mutual  
Class I Div. I Grp C and D  
Class II and III Div. I Grp E, F and G

### 3171.181: Standard

			page sida Seite pagina
Data plates Dataskyltar Datenschilder		Plaques signalétiques Placas de características Targhette segnaletiche .....	6
Motorparts Motordetaljer Motorteile		Pièces du moteur Piezas del motor ..... 16-24• Parti motore ..... 36-41	
Pump parts Pumpdetaljer Pumpenteile		Pièces de la pompe Piezas para bombas Parti pompa .....	25-27
Sump components Pumpgropsdetaljer Schachteinbauteile		Equipement du puisad Equipo para pozo negro Componenti del pozzetto .....	28-36



**Exploded views with item Nos.**  
**Sprängteckningar med pos. nr.**  
**Explosionszeichnungen mit Pos. - Nrm.**


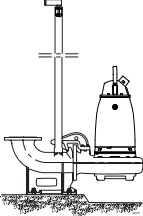
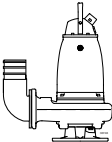
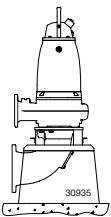
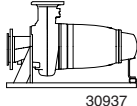
**Vues éclatées de la pompe avec N°s de repérage**  
**Despieces numeros de pos.**  
**Disegno esploso con No di posizione.**

Motor parts		.....	9-12
Hydrualic Parts		.....	13-14
Sump Components		.....	15
Recommended Spare Parts		.....	42-45
Parts for Service		.....	46

Open order quantity

\* \* \* \*

	<b>Sales codes</b> <b>Säljkoder</b> <b>Verkaufscodes</b>	<b>Codes de vente</b> <b>Código de ventas</b> <b>Codici di vendita</b>	<b>3171</b>
<div style="text-align: center; margin-bottom: 10px;"> <b>N P 3171.181 MT</b> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> HYDRAULIC PART  HYDRAULDEL  HYDRAULIKTEILE  PARTE HYDRAULIQUE  PARTE HIDRÁULICAS  PARTI IDRAULICHE </div> <div style="width: 30%;"> INSTALLATION  INSTALLATION  AUFSTELLUNGSART  INSTALLATION  INSTALACIÓN  INSTALLAZIONE </div> <div style="width: 30%;"> HEAD  TRYCK  DRUCK  PRESSION  PRESIÓN  REVALENZA </div> </div>			
<b>HYDRAULIC PART</b> <b>HYDRAULDEL</b> <b>HYDRAULIKTEILE</b>  <b>N =</b> <b>(NP, NS, NT, NZ)</b> Semi-open self-cleaning multi-vane impeller and volute with cleaning groove for pumping of raw sewage, sludge and liquid manure.  <b>(NP, NS, NT, NZ)</b> Halvöppet självrensande flerkanalhjul och pumphus med rensspår för pumpning av orenat avloppsvatten, avloppsslam och flytgödsel.  <b>(NP, NS, NT, NZ)</b> Offenes, selbstreinigendes Mehrkanalrad im Pumpengehäuse mit Entlastungsnut für kommunales und industrielles Abwasser mit hohem Faser- und Feststoffanteil.		<b>PARTE HYDRAULIQUE</b> <b>PARTE HIDRÁULICAS</b> <b>PARTI IDRAULICHE</b>  <b>(NP, NS, NT, NZ)</b> Roue à multi-canaux semi-ouverte et auto-nettoyante complétée par une volute incluant une rainure déchargeante brevetée. Recommandé pour le pompage de tous types de liquides allant de l'eau propre à ceux contenant une haute concentration de solides, tels qu'eaux d'égouts, boues, liquides fibreux et lisier.  <b>(NP, NS, NT, NZ)</b> Impulsor semi-abierto auto limpiante de dos canales y difusor con ranura limpiante para bombeo de agua residual bruta, lodos y purines líquidos.  <b>(NP, NS, NT, NZ)</b> Girante aperta bicanale autopulente, per fanghi ed acque di scarico contenenti materiali fibrosi e solidi.	
<b>HEAD</b> <b>TRYCK</b> <b>DRUCK</b>		<b>PRESSION</b> <b>PRESIÓN</b> <b>PREVALENZA</b>	
<b>MT =</b> Medium-head version Medeltrycksutförande Mitteldruckausführung Curve Nos; (50Hz: 431, 432, 433 and 434)(60 Hz: 433, 434, 435, 436 and 437)		Modèle moyenne pression Modelo de altura media de elevación Versione per media prevalenza	
<b>HT =</b> High-head version Högtrycksutförande Hochdruckausführung Curve Nos; (50Hz: 451, 452, 453, 454 and 455)(60 Hz: 451, 452, 453, 454 and 455)		Modèle haute pression Modelo de gran altura de elevación Versione per alta prevalenza	
<b>LT =</b> Low-head version Lågtrycksutförande Niederdruckausführung Curve Nos; (50Hz: 611, 612, 613 and 614)(60Hz: 613, 614, and 615)		Modèle basse pression Modelo de baja altura de elevación Versione per grande portata	
<b>SH =</b> Super high-head version Supertrycksutförande Super-Hochdruckausführung Curve Nos; (50Hz: 270, 272, 274 and 275)(60Hz: 274, 275, 277 and 278)		Version super haute pression Modelo de extremadamente alta altura de elevación Versione per altissima prevalenza	

	<b>Sales codes</b> <b>Säljkoder</b> <b>Verkaufscodes</b>	<b>Codes de vente</b> <b>Código de ventas</b> <b>Codici di vendita</b>	<b>3171</b>
	<b>INSTALLATION</b> <b>INSTALLATION</b> <b>AUFSTELLUNGSART</b>	<b>INSTALLATION</b> <b>INSTALACIÓN</b> <b>INSTALLAZIONE</b>	
	<p><b>P</b> = Semi permanent wet well arrangement with pump installed on twin guide bars with automatic connection to discharge.</p> <p>Halvstationär våt installation med pumpen fäst vid två gejdrör och med automatisk anslutning till utloppsörret.</p> <p>Stationär, nass mit schraubenlosem Kupplungssystem an Doppelführungsrohr.</p>	<p>Permanente, installation immergée. Deux barres de guidage permettent la connexion automatique sur un pied d'assise.</p> <p>Instalación fija extraíble, sumergida y con tubos guía. Acoplamiento por su propio peso a la conexión de descarga.</p> <p>Installazione semifissa in immersione, con piede di accoppiamento automatico e tubi guida.</p>	
	<p><b>S</b> = Transportable version with hose coupling or flange for connection to discharge pipeline.</p> <p>Flyttbar version med slangkoppling eller fläns för anslutning till utloppsörledning.</p> <p>Transportabel, nass mit Flanschanschluss für Rohrleitung oder mit Druckstutzen für Schlauchanschluss.</p>	<p>Version transportable avec raccord de tuyau souple ou bride pour canalisation rigide.</p> <p>Instalación transportable, con salida para manguera y colador.</p> <p>Installazione trasportabile, in immersione, con cavalletto di sostegno e attacco per tubo di mandata flessibile o rigido.</p>	
	<p><b>T</b> = Permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; vertical mounting.</p> <p>Stationär torr installation med flänsanslutningar till sug- och tryckledningarna; vertikal uppställning.</p> <p>Stationär, trocken mit Saugrohrreinheit, saug- und druckseitig fest verschraubt, vertikale Aufstellung.</p>	<p>Permanente, installation hors d'eau avec raccordement à bride à l'aspiration et au refoulement. Version verticale.</p> <p>Instalación fija, en cámara seca, sobre punto de apoyo. Aspirando de pozo húmedo con codo de aspiración. Montaje vertical.</p> <p>Installazione fissa in camera asciutta su basamento e collegamento diretto con le tubazioni di aspirazione e mandata; montaggio verticale.</p>	
	<p><b>Z</b> = Permanent dry well or in-line arrangement with flange connection to suction and discharge pipework; horizontal mounting.</p> <p>Stationär torr installation med flänsanslutningar till sug- och tryckledningarna; horisontell uppställning.</p> <p>Stationär, trocken mit Saugrohrreinheit, saug- und druckseitig fest verschraubt, horizontale Aufstellung.</p>	<p>Permanente, installation hors d'eau avec raccordement à bride à l'aspiration et au refoulement. Version horizontale.</p> <p>Instalación fija en cámara seca sobre bastidor de perfiles. Montaje horizontal.</p> <p>Installazione fissa in camera asciutta su basamento e collegamento diretto con le tubazioni di aspirazione e mandata; montaggio orizzontale.</p>	



**3171**

**Rubber Material**

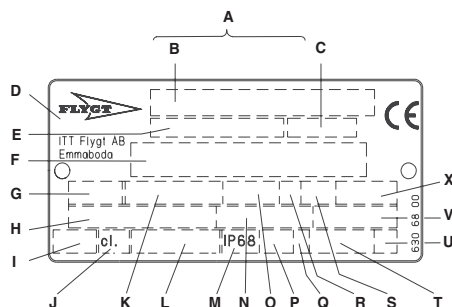
**NBR**      Nitrile rubber  
**FPM**      Fluor rubber (Hot water up to 70°C, 158°F)

**Sensores**

**FLS 10**      Flygt inspection sensor

**Sealring Material**

**WCCR**      Corrosion Resistant Cemented Carbide  
**RSiC**      Silicon Carbide

**How to read the data plate****Hur man läser dataskylten****Erläuterungen zum Datenschild****Comment lire la plaque signalétique****Interpretación de la placa de características****Come leggere la targhetta segnaletica****Data plate interpretation**

- A Serial number
- B Product code + Number
- C Curve code / Propeller code
- D Country of origin
- E Product number
- F Additional information
- G Phase; Type of current; Frequency
- H Rated voltage
- I Thermal protection
- J Thermal class
- K Rated shaft power
- L International standard
- M Degree of protection
- N Rated current
- O Rated speed
- P Max. submergence
- Q Direction of rotation: L=left, R=right
- R Duty class
- S Duty factor
- T Product weight
- U Locked rotor code letter
- V Power factor
- X Max. ambient temperature

**Légende de la plaque signalétique A**

- N° de série
- B Code de produit + N°
- C N° de courbe / Code d'hélice
- D Pays de fabrication
- E N° de produit
- F Informations complémentaires
- G Phases; Type de courant; Fréquence
- H Tension nominale
- I Protection thermique
- J Classe d'isolation
- K Puissance nominale sur l'arbre
- L Norme internationale
- M Classe de protection
- N Intensité nominale
- O Vitesse de rotation
- P Profondeur d'immersion maxi
- Q Sens de rotation: L=gauche, R=droite
- R Classe de fonctionnement
- S Facteur de marche
- T Poids de produit
- U Code alphabétique rotor verrouillé
- V Facteur de puissance
- X Température ambiante maxi

**Dataskylt inskription**

- A Seriennummer
- B Produktkod + Nummer
- C Kurv- / Propellerkod
- D Tillverkningsland
- E Produktnummer
- F Kompletterande uppgifter
- G Fastal; Strömart; Frekvens
- H Märkspänning
- I Termoskydd
- J Isolationsklass
- K Märkeffekt
- L Internationell standard
- M Skyddsklass
- N Märkström
- O Varvtal
- P Max. nedsänkingsdjup
- Q Rotationsriktning: L=vänster, R=höger
- R Driftklass
- S Driftfaktor
- T Produktvikt
- U Kodbokstav för låst rotor
- V Effektfaktor
- X Max. omgivningstemperatur

**Inscripción de la placa**

- A N° fabricación
- B Código de producto + N°
- C N° curva / Código de hélice
- D País de origen
- E N° producto
- F Información adicional
- G N° fases; Clase de corriente; Frecuencia
- H Tensión nominal
- I Protección térmica
- J Clase de aislamiento
- K Potencia de eje nominal
- L Norma internacional
- M Clase de protección
- N Intensidad de corriente nominal
- O Velocidad rotación nominal
- P Profundidad inmersión máx.
- Q Sentido de rotación: L=izq, R=dcha
- R Clase de funcionamiento
- S Factor de funcionamiento
- T Peso del producto
- U Letra de código de rotor bloqueado
- V Factor de potencia
- X Temperatura ambiente máx.


**Erläuterungen zum Datenschild**

- A Serien-Nr
- B Produktkod + Kennummer
- C Kurven-Nr / Propellerkode
- D Herstellungsland
- E Produkt-Nr
- F Komplettierende Angaben
- G Phasenzahl; Stromart; Frequenz
- H Nennspannung
- I Thermischer Schutz
- J Isolationsklasse
- K Nennwellenleistung
- L Internationale Norm
- M Schutzart
- N Nennstrom
- O Nenndrehzahl
- P Max. Eintauchtiefe
- Q Drehrichtung: L=links, R=rechts
- R Betriebsklasse
- S Relative Einschaltdauer
- T Produktgewicht
- U Kodebuchstabe für blockierten Läufer
- V Leistungsfaktor
- X Max. Umgebungstemperatur

**Descrizione targhetta segnaletica**

- A No. di matricola
- B Codice prodotto + Numero
- C No. curva / Codice elica
- D Paese di produzione
- E No. di prodotto
- F Ulteriori informazioni
- G No. di fase; Tipo di corrente; Frequenza
- H Tensione nominale di alimentazione
- I Protezione termica
- J Classe di isolamento
- K Potenza resa nominale
- L Standard internazionale
- M Classe di protezione
- N Assorbimento nominale
- O Velocità di rotazione nominale
- P Max profondità d'immersione
- Q Senso di rotazione: L=sinistra, R=destra
- R Classe di servizio
- S Fattore di utilizzazione
- T Peso del prodotto
- U Lettera codice per rotore chiuso
- V Fattore di potenza
- X Max temperatura ambiente



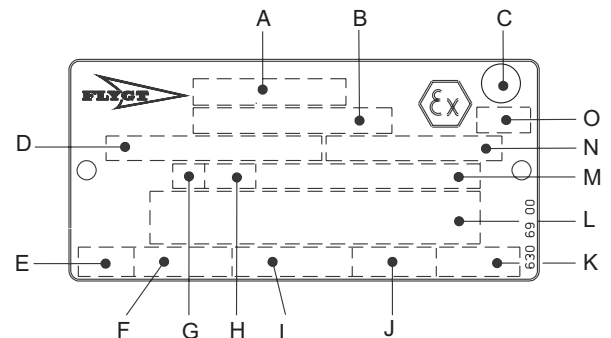
	<b>Approval plate</b> <b>Godkännandeskylt</b> <b>Prüfschild</b>	<b>Plaque d'agrément</b> <b>Placa de aprobación</b> <b>Targhetta di approvazione</b>	<b>3171</b>
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**EN:** European Norm

ATEX Directive

EN 50014, EN 50018, EN 1127-1 or EN 1127-2 ATEX,

EN 13463-1 NON ELECTRICAL EQUIPMENT

EExdI for ambient temperatures  $\leq 40^{\circ}$ EEx dIIB T3 for ambient temperatures  $\leq 40^{\circ}\text{C}$ , T4  $25^{\circ}\text{C}$ **Approval plate**

- A Approval
- B Approval authority + Approval Number
- C Approval for Class I
- D Approved drive unit
- E Stall time
- F Starting current / Rated current
- G Duty class
- H Duty factor
- I Input power
- J Rated speed
- K Controller
- L Additional information
- M Max. ambient temperature
- N Serial number
- O ATEX marking

**Plaque d'agrément**

- A Agrément
- B Organisme ayant délivré l'agrément + N° d'agrément
- C Agrément pour classe I
- D Agrément moteur
- E Temps de réaction des thermosondes
- F Intensité au démarrage / Intensité nominale
- G Classe de fonctionnement
- H Facteur de marche
- I Puissance absorbée
- J Vitesse de rotation
- K Contrôleur
- L Informations complémentaires
- M Température ambiante maxi
- N N° de série
- O Marque d' ATEX

**Godkännandeskylt**

- A Godkännande
- B Provningsmynd. + Godkännandennummer
- C Godkännande för Klass I
- D Godkänd drivenhet
- E Fastbromsningstid
- F Startström / Märkström
- G Driftklass
- H Driftfaktor
- I Inmatad effekt
- J Varvtal
- K Kontrollant
- L Kompletterande uppgifter
- M Max. omgivningstemperatur
- N Serienummer
- O ATEX märkning

**Placa de aprobación**

- A Aprobación
- B Autoridad homologadora + N° aprobación
- C Aprobación para clase I
- D Unidad de accionamiento aprobada
- E Tiempo de parada
- F Intensidad de corriente arranque/ Intensidad de corriente nominal
- G Clase de funcionamiento
- H Factor de funcionamiento
- I Potencia consumida
- J Velocidad rotación nominal
- K Controlador
- L Información adicional
- M Temperatura ambiente máx.
- N N° fabricación
- O Marcado ATEX

**Zulassungsschild**

- A Zulassung
- B Zulassungsstelle + Zulassungs-Nr
- C Zulassung für Klasse I
- D Zugelassener Antrieb
- E Abbreißezeit
- F Anlaufstrom / Nennstrom
- G Betriebsklasse
- H Relative Einschaltdauer
- I Aufgenommene Leistung
- J Nenndrehzahl
- K Kontrollstelle
- L Komplettierende Angaben
- M Max. Umgebungstemperatur
- N Serienummer
- O ATEX Markierung

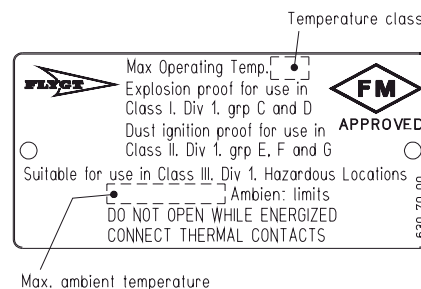
**Targhetta approvazione**


- A Approvazione
- B Autorità di approvazione + No. di approvazione
- C Classe di approvazione I
- D Motore approvato
- E Tempo di arresto
- F Corrente di spunto / Assorbimento nominale
- G Classe di servizio
- H Fattore di utilizzazione
- I Potenza assorbita
- J Velocità di rotazione nominale
- K Controllo
- L Ulteriori informazioni
- M Max temperatura ambiente
- N No. di matricola
- O Marcatura ATEX

**FM:** Factory Mutual

Class I Div. I Grp C and D

Class II and III Div. I Grp E, F and G



	<b>Ordering spare parts</b> <b>Reservdelsbeställning</b> <b>Ersatzteilbestellung</b>	<b>Commande des pièces de rechange</b> <b>Pedidos de piezas de recambio</b> <b>Ordinazione parti di ricambio</b>	<b>3171</b>
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#### Ordering spare parts

State serial number of the pump, spare part number and quantity when ordering.

Genuine Flygt parts must always be used for repairs if the pump is to fulfill requirements and obtain official approval. Only Flygt or Flygt-authorized service personnel may undertake repair work on specially approved pumps.

#### Reservdelsbeställning

Ange pumpens serienummer, reservdelsnummer och antal vid beställning.

Om pumpen skall uppfylla kraven och uppnå officiellt godkännande, måste alltid Flygt-original reservdelar användas vid service. Endast Flygt eller Flygt-auktoriserad servicepersonal får utföra servicearbete på speciellt godkända pumpar.

#### Ersatzteilbestellung

Bei Bestellung bitte die Fabrikations-Nr, Ersatzteil-Nr und Anzahl der Pumpen angeben.

Wenn die Pumpe den Erfordernissen entsprechen und offizielle Zulassung erhalten soll, müssen immer Original-Flygt-Teile für Reparaturen verwendet werden. Nur Flygt oder Flygt-autorisiertes Wartungspersonal darf Wartung an speziell zugelassenen Pumpen ausführen.

#### Commander pièces détachées

Préciser à la commande le numéro de série de la pompe, les références des pièces détachées et les quantités.

Pour que le produit demeure conforme à la réglementation et aux différents agréments, il est indispensable d'utiliser uniquement des pièces détachées Flygt. La réparation de produits possédant un agrément spécial ne doit être effectuée que par un technicien Flygt ou un atelier agréé par Flygt.

#### Orden de Repuestos

Establecer el número de serie de la bomba, numeros de cada parte de repuesto y cantidad ordenada.

En caso de reparaciones, deben ser usadas partes genuinas Flygt para conservar la garantía. Solo personal autorizado de Flygt debe efectuar reparaciones para mantener la garantía del equipo.

#### Ordine parti di ricambio

Quando ordinate le parti di ricambio, citate sempre la matricola della pompa, il codice e la quantità della parte di ricambio.

Utilizzate solo parti di ricambio originali Flygt se volete che la pompa mantenga i requisiti richiesti per l'omologazione ufficiale. Qualsiasi riparazione su pompe antideflagranti dovrà essere effettuato da tecnici autorizzati dalla Flygt; in caso contrario Flygt declina ogni responsabilità.

### Guarantee Garanti

### Garantie Garantie

### Garanzia Garantía

#### Warranty Claim

Flygt pumps are high quality products with expected reliable operation and long life. However, should the need arise for a warranty claim, please contact your Flygt representative

#### Garantianspråk

Flygt tillverkar pumpar av hög kvalitet som fungerar pålitligt och har lång livslängd. Skulle emellertid ett garantianspråk bli aktuellt, kontakta närmaste Flygt-representant för information.

#### Gewährleistung

Flygt-Pumpen sind hochwertige Produkte, die für zuverlässigen Betrieb und lange Lebensdauer gebaut sind. Falls wider Erwarten dennoch Gewährleistungsanspruch auftreten sollte, wenden Sie sich bitte an Ihre Flygt-Vertretung.

#### Garantie

Les pompes Flygt sont des produits de haute qualité, conçus pour fonctionner en toute fiabilité pendant de longues années. Toutefois, en cas de réclamation éventuelle sous le couvert de la garantie, veuillez contacter l'agence Flygt

#### Condizioni di garanzia

Le elettropompe Flygt sono prodotti di qualità per i quali è prevista una durata di esercizio lunga e affidabile. Qualora fosse necessario presentare reclamo durante il periodo di garanzia, contattare il rappresentante Flygt più vicino.

#### Reclamaciones por garantía

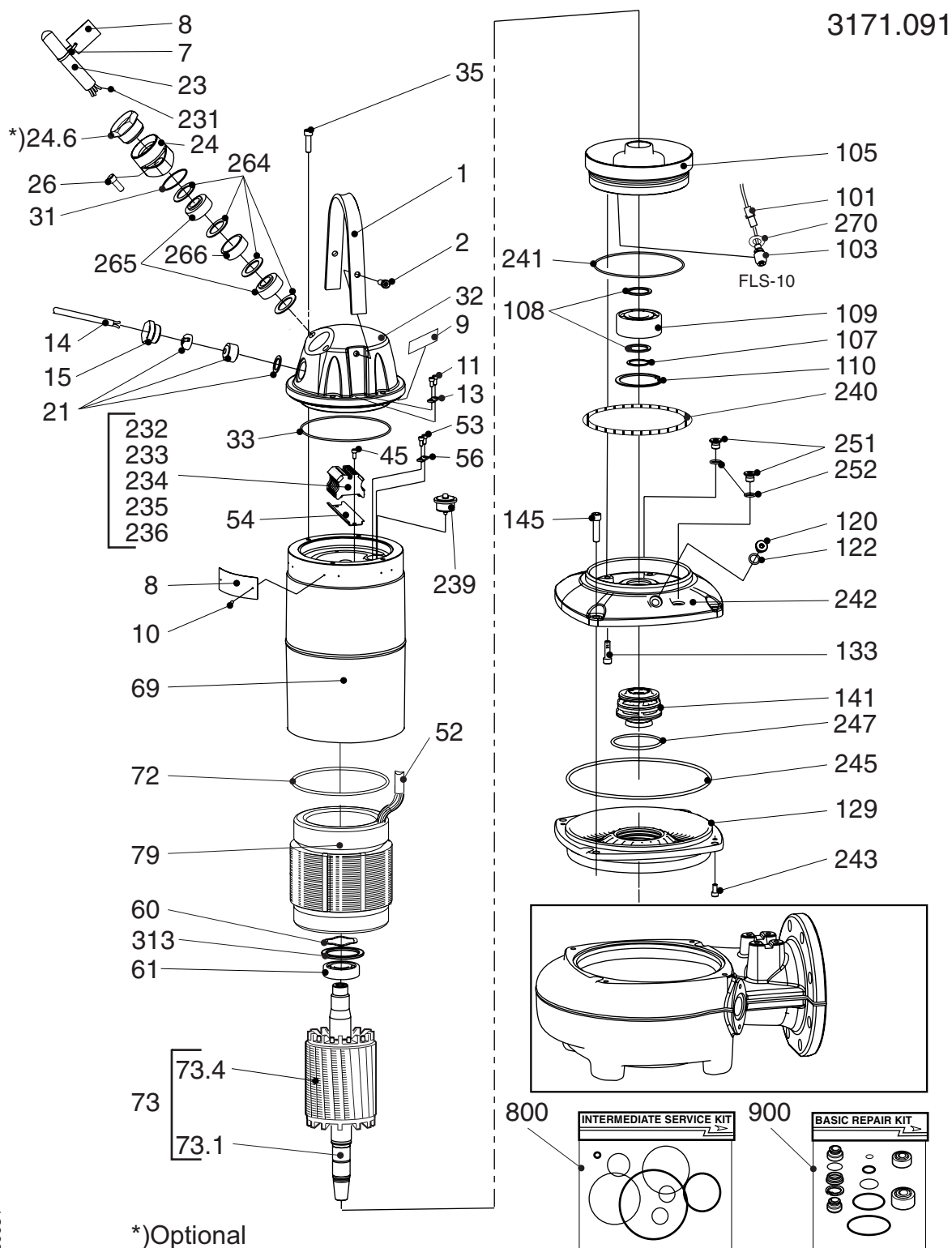
Las bombas Flygt son productos de alta calidad con un funcionamiento fiable y larga vida de servicio. Sin embargo, si hubiera motivos de reclamación por garantía, ponerse en contacto con el representante de Flygt más cercano.



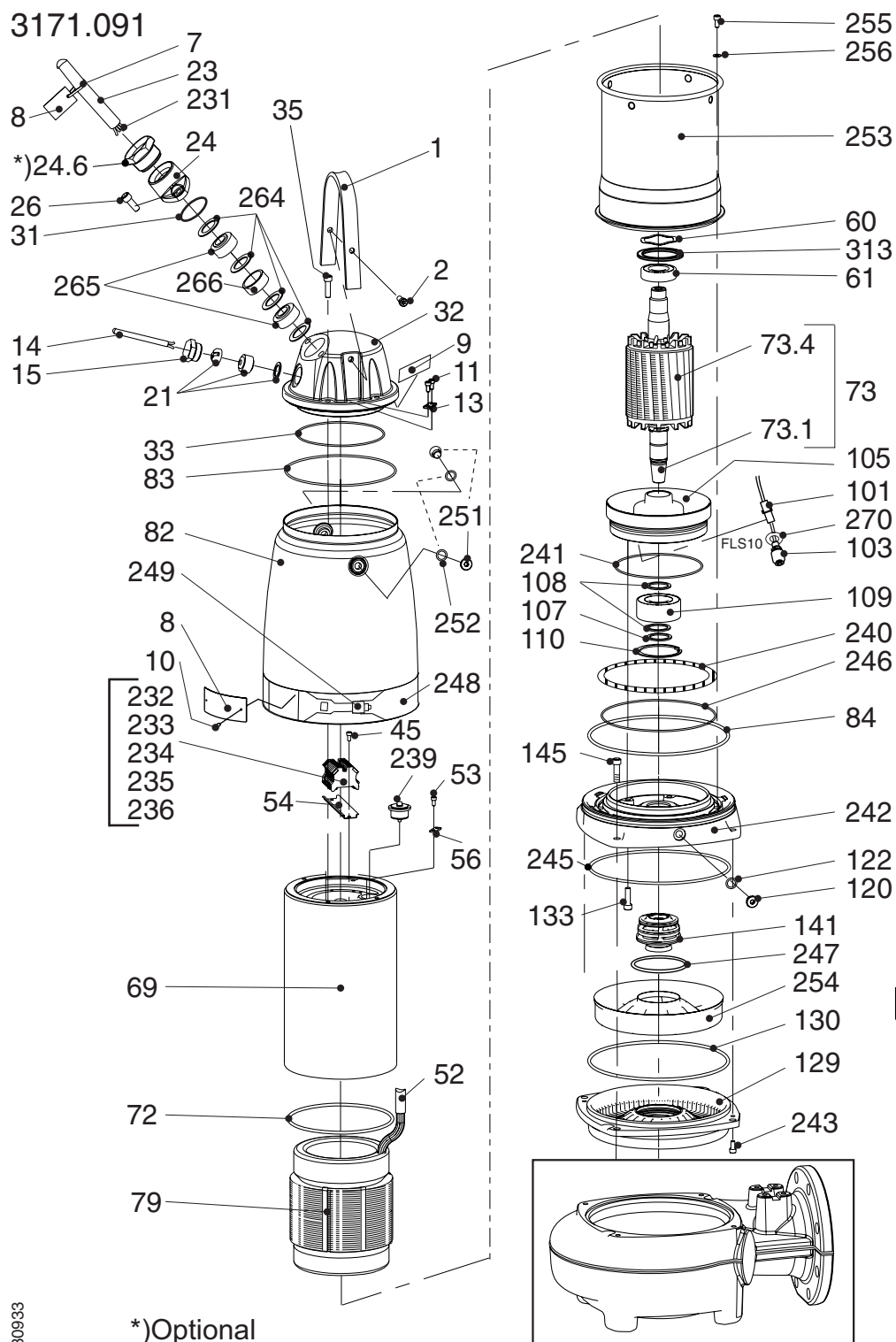
# Exploded view without cooling jacket

3171.091

Motor Parts



30934

**FLYGT****Exploded view  
with cooling jacket****3171.091**

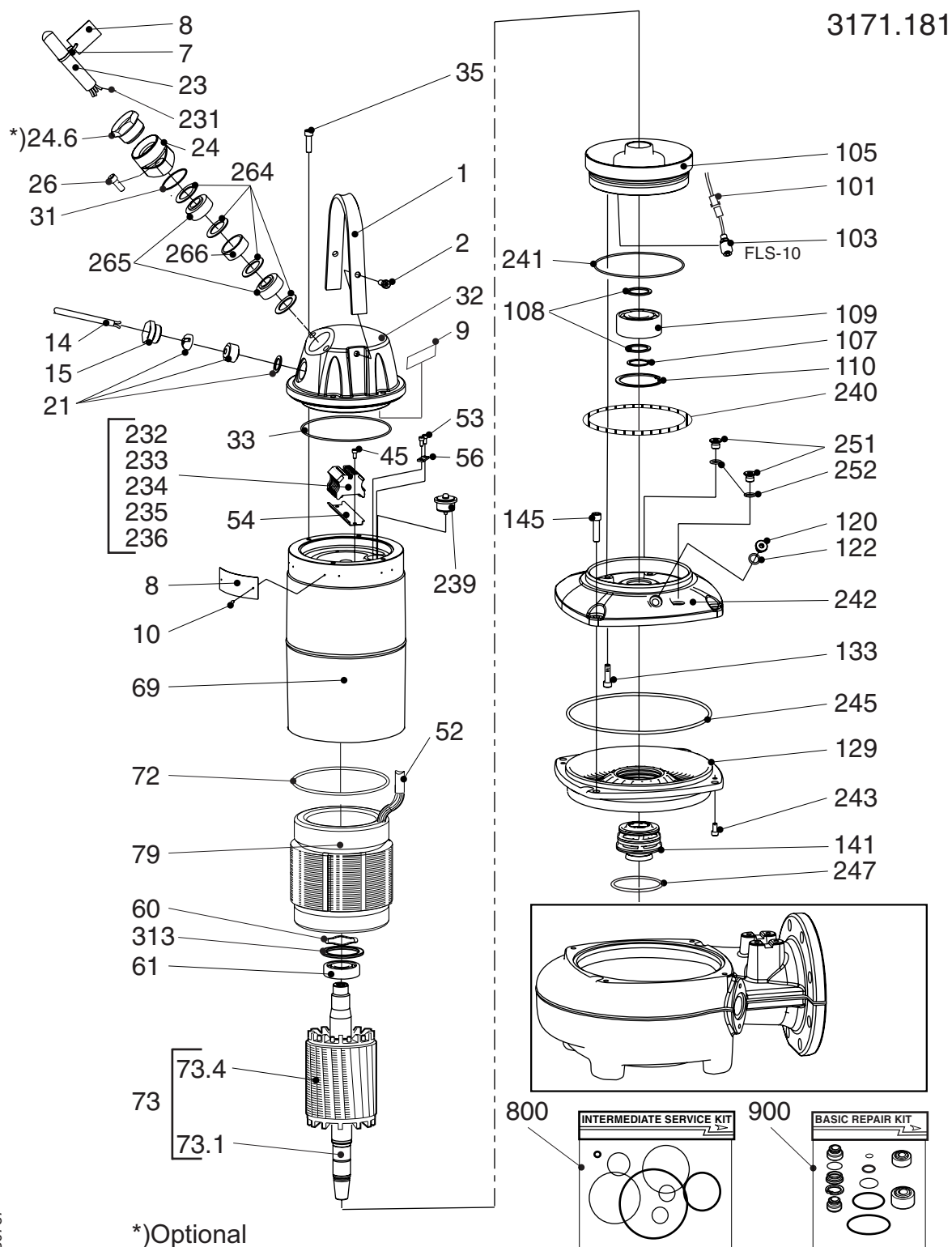
30933



# Exploded view without cooling jacket

3171.181

Motor Parts

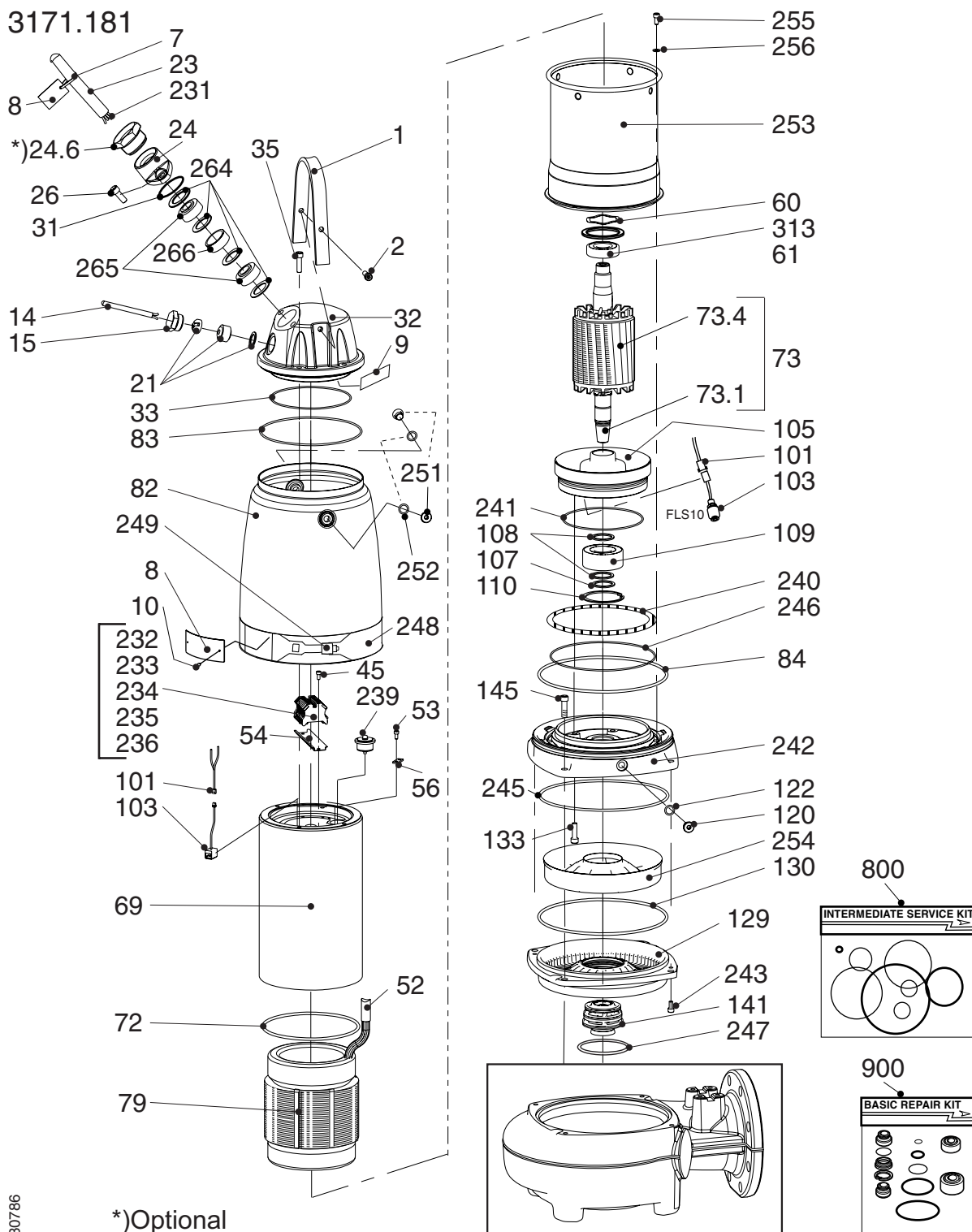


30787



# Exploded view with cooling jacket

3171.181



30786

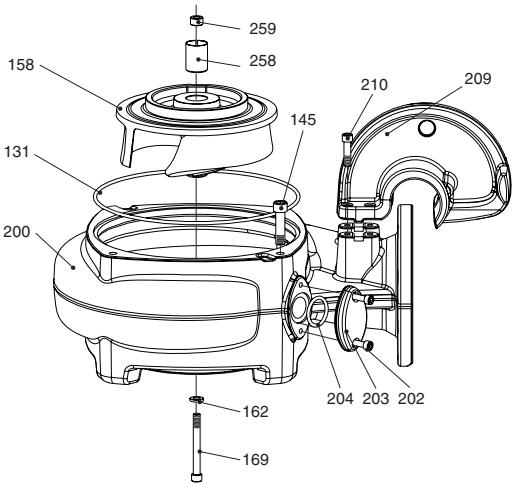


**Exploded view**  
**Pump parts, NP, NS and NT; Low head, Medium head**

**3171**

NP 3171 LT/MT

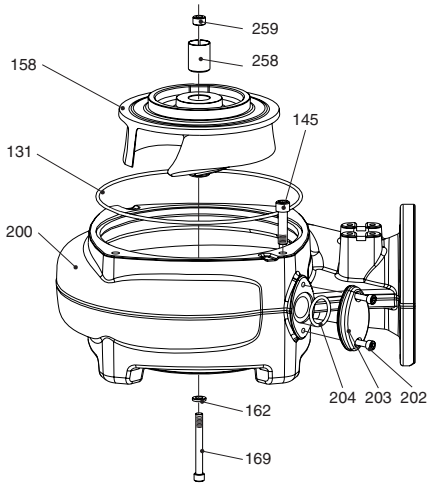
	LT	MT
Curve No	611	431
Kurva nr.	612	432
Kurve Nr.	613	433
Courbe N°	614	434
Curvas N°	615	435
No curva		436
		437



30788

N\_ 3171 LT/MT

	LT	MT
Curve No	611	431
Kurva nr.	612	432
Kurve Nr.	613	433
Courbe N°	614	434
Curvas N°	615	435
No curva		436
		437



30789

Hydraulic Parts



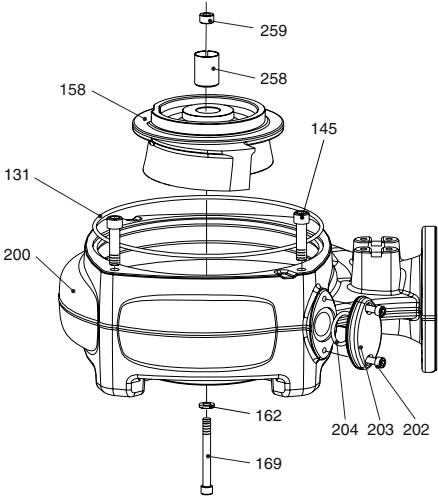
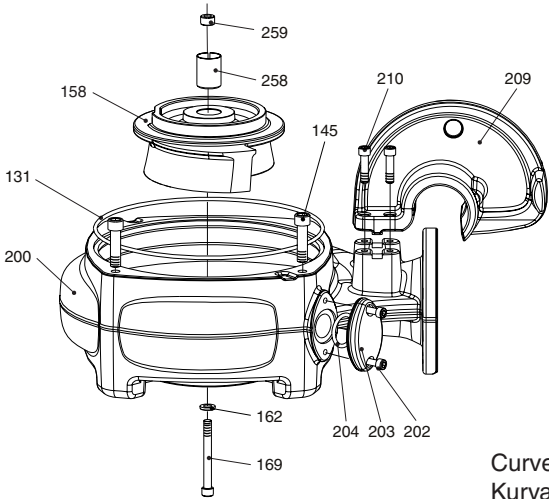


**Exploded view**  
**Pump parts, NP, NS, NT and NZ; High head/**  
**Super High head**

**3171**

NP 3171 HT

N\_3171 HT



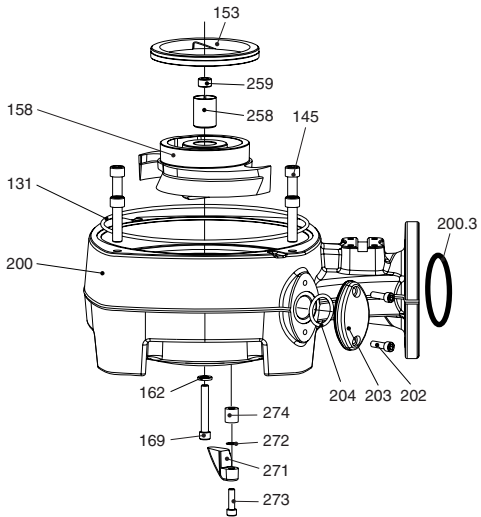
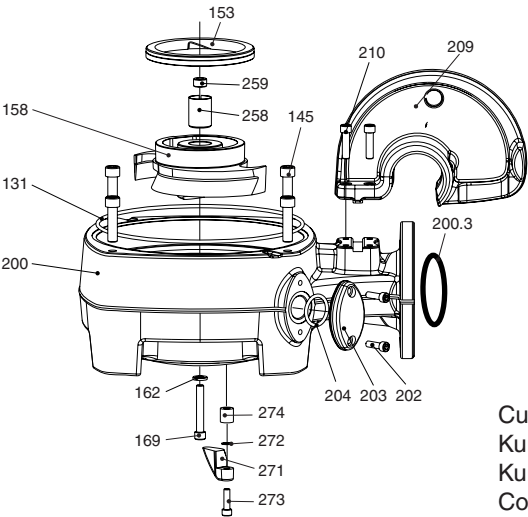
Curve No **451**  
Kurva nr. **452**  
Kurve Nr. **453**  
Courbe N° **454**  
Curvas N° **455**  
No curva

30790

30791

NP 3171 SH

NS/NT/NZ 3171 SH



Curve No **270**  
Kurva nr. **272**  
Kurve Nr. **274**  
Courbe N° **275**  
Curvas N° **277**  
No curva **278**

31189NP

31189 S, T, Z

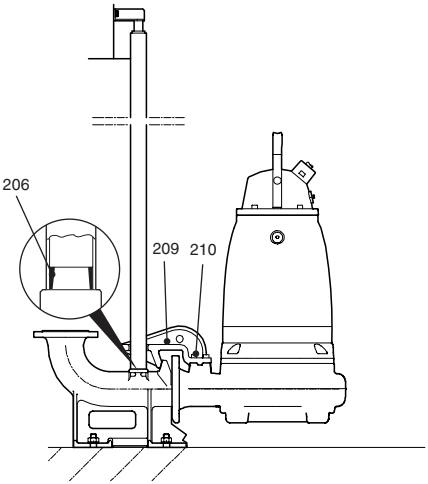




**Exploded view**  
**Sump components NP, NS, NT and NZ**

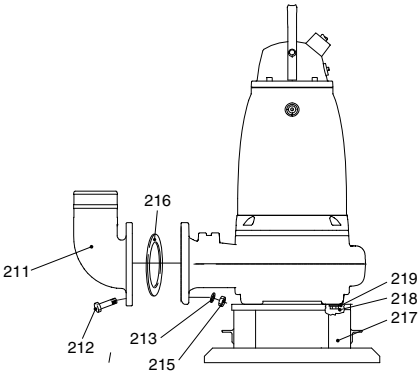
**3171**

NP 3171



30902

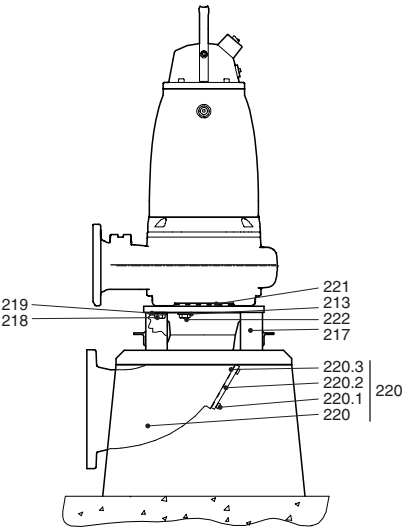
NS 3171



30903

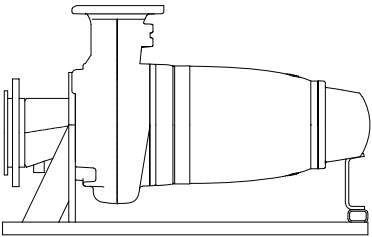


NT 3171





30904



NZ 3171





30938




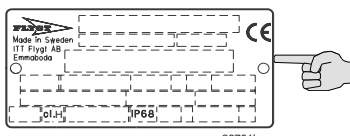
		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
1	651 05 00	LIFTING HANDLE LYFTBYGEL TRAGBÜGEL ETRIER D'ELEVER ABRAZADERA DE ELEVAR MANIGLIA SOLLEVAMEN.		1	1
2	83 04 53	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X45-A4-80	2	2
7	83 45 59	CABLE TIE BUNT BAND KABELBINDER COLLIER DE CABLE COLLAR DE CABLE COLLARE PER CAVO	200X2,4 PA 6/6 -55+105	1	1
8	630 68 00 630 69 00 630 70 00 630 76 00	DATA PLATE DATASKYLT DATENSCHILD PLAQUE SIGNALÉTIQUE PLACA DE CARACTERIST TARGA DATI	USE 6306801 AS SPARE PART EX FM APPROVED Hot water product	1 1 1 -	1 - - 1
9	650 09 00 650 10 00 650 22 00 650 23 00 657 79 00 681 58 00	CONNECTION PLATE KOPPLINGSSKYLT KUPPLUNGSSCHILD PLAQUE DE BRANCHEM. PLACA DE CONEXION PIASTRA DI COLLEG.		1 - 1 1 1 1 1	1 1 1 1 1 1 1
10	82 20 88	DRIVE SCREW DRIVSKRUV TREIBSCHRAUBE VIS FILETANTE TORNILLO VITE AUTOFILETTANTE	4X5-A2-70	2	2
11	82 00 11	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M6X12-A2-70	2	-


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
13	642 16 00	EARTHING PLATE SKYDDSLÄDARPLATTA ERDUNGSPLATTE PLAQUE DE TERRE PLACA DE TIERRA PIASTRA DI TERRA		1	-
14	94 19 22 94 19 30	CONTROL CABLE MANÖVERKABEL STEUERKABEL CABLE AUXILIAIRE CABLE AUXILIAR CAVO AUSILIARIO		* -	* 1
15	397 81 00	GLAND SCREW HYLSSKRUV VERSCHRAUBUNG ECROU DE SERRAGE TORNILLO DE CAMISA VITE DI SERRAGGIO		1	1
21.1	82 40 61	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA		2	2
21.2	84 17 90 84 17 92	SEAL SLEEVE TÄTNINGSHYLSA DICHTUNGSHÜLSE DOUILLE DE JOINT MANGUITO DE JUNTA GOMMINO ENTR.CAVO		1 1	1 1
21.3	398 98 00 398 98 03	CLAMP KLÄMMA KLEMME CRAMPON ABRAZADERA FASCETTA		1 1	1 1

		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
23		MOTOR CABLE MOTORKABEL MOTORKABEL CABLE DE MOTEUR CABLE DEL MOTOR CAVO DI POTENZA 			
	94 09 31	NSSHÖU 3X6+3X6/3E+3X1,5 max 70°C (158°F) 22 mm		*	*
	94 09 32	NSSHÖU3X16+3X16/3E+3X2,5 max 70°C (158°F) 28 mm		*	*
	94 09 37	NSSHÖU 3X2,5+3X2,5/3E+3X1,5 max 70°C (158°F) 18,5 mm		*	*
	94 20 56	SUBCAB 4G6+2X1.5mm <sup>2</sup> , max 70°C (158°F)(23) -25 mm		*	*
	94 20 57	SUBCAB 4G10+2X1.5mm <sup>2</sup> , max 70°C (158°F)(26) -28 mm		*	*
	94 20 58	SUBCAB 4G16+2X1,5 mm <sup>2</sup> , max 70°C (158°F)(26) -28 mm		*	*
	94 20 59	SUBCAB 4G2.5+2X1.5mm <sup>2</sup> , max 70°C (158°F)(17) -18 mm		*	*
	94 20 60	SUBCAB 4G4+2X1.5mm <sup>2</sup> , max 70°C (158°F)(20) -22 mm		*	*
	94 20 80	SUBCAB 7G4+2X1.5mm <sup>2</sup> , max 70°C (158°F)(22) -26 mm		*	*
	94 20 81	SUBCAB 7G6+2X1,5mm <sup>2</sup> , max 70°C (158°F)(24) -28 mm		*	*
	94 20 82	SUBCAB 7G2,5+2X1,5mm <sup>2</sup> , max 70°C (158°F)(20) -23 mm		*	*
	94 21 04	SUBCAB 12 AWG/7, max 70°C (158°F)(20) -22 mm		*	*
	94 21 06	SUBCAB 10AWG/3-2-1GC, max 70°C (158°F)(20) -22 mm		*	*
	94 21 08	SUBCAB 8AWG/3-2-1-GC, max 70°C (158°F)(27) -29 mm		*	*
	94 21 09	SUBCAB 6AWG/3-2-1-GC, max 70°C (158°F)(30) -32 mm		*	*
	94 21 10	SUBCAB 4AWG/3-2-1-GC, max 70°C (158°F)(33) -35 mm		*	*
24	597 87 01	ENTRANCE FLANGE	SS	1	1
	597 87 04	INFÖRINGSFLÄNS	ISO 228/1-G2	1	1
	597 87 08	EINFÜHRUNGSFLANSCH	2-11.5 NPT	1	1
	597 87 11	BRIDE D'ENTREE	1 1/2-11,5 NPT	1	1
	642 17 00	BRIDA DE ENTRADA	STD-version	-	1
	642 17 01	FLANGIA ENTRATA CAVO	EX-version	1	-
24.6	633 11 01	GLAND SCREW	1 1/4" ISO Intended for metalhose	1	1
	633 11 04	HYLSSKRUV	1 1/2" NPT Intended for metalhose	1	1
		VERSCHRAUBUNG			
		ECROU DE SERRAGE			
		TORNILLO DE CAMISA			
		VITE DE SERRAGGIO			
25	84 41 09	PLATE PLATTA PLATTE PLAQUE PLACA PIASTRA		1	1
26	83 04 53	HEX.SOCKET HD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X45-A4-80	2	2


		Motor parts Motordetaljer Motorteile	Pièces du moteur Piezas del motor Parti motore	3171	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
31	82 74 63 82 81 03	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	49,5x3,0 NBR 49,5x3,0 FPM	1 1	1 1
32	650 87 00 650 87 01 650 87 02 650 87 03	ENTRANCE COVER INFÖRINGSLOCK EINFÜHRUNGSDECKEL COUVERCLE D'ENTREE TAPA DE ENTRADA COPERCHIO ENTR. CAVO		- 1 - 1	1 - 1 -
33	82 74 92 82 75 24	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	194.3X5.7-NBR 194.3X5.7 FPM	1 1	1 1
35	83 04 53	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X45-A4-80	4	4
45	82 00 11	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M6X12-A2-70	2	2
49	83 42 48 83 42 49	END SLEEVE ÄNDHYLSA ENDHUELSE COSSE MANGUITO DE DETRAS CAPOCORDA	H16/24 H25/30	3 3	3 3
53	82 00 11	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M6X12-A2-70	4	4


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
54	651 04 00	RAIL SKENA SCHIENE RAIL RIEL BARRA		1	1
56	642 16 00	EARTHING PLATE SKYDDSLEDARPLATTA ERDUNGSPLATTE PLAQUE DE TERRE PLACA DE TIERRA PIASTRA DI TERRA		2	2
60	82 56 25	SPRING WASHER FJÄDERBRICKA FEDERSCHEIBE RONDELLE ELASTIQUE ARANDELA ELASTICA RONDELLA ELASTICA	71,5X59,0X6,5	1	1
61	83 30 16	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3306A-2Z/C3. UPPER BEARING	1	1
69	650 90 04 650 90 05	STATOR HOUSING STATORHUS STATORGEHÄUSE LOGEMENT DE STATOR CARCASA DE ESTATOR ALLOGGIO STATORE	STD-version EX-version	- 1	1 -
72	82 74 97 82 80 86	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	239,5X5,7-NBR 239,3X5,7 FPM	1 1	1 1


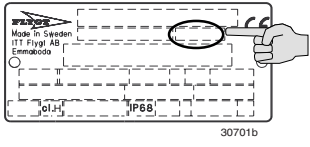
		Motor parts Motordetaljer Motorteile	Pièces du moteur Piezas del motor Parti motore	3171	
Pos.No.	Part No.	Denomination		Qty /Version	
				091	181
73		SHAFT UNIT AXELENHET WELLENEINHEIT UNITE D'ARBRE UNIDAD DE ARBOL ALBERO ROTORE	For motor För motor Für motor Pour moteur Para motor Per motore		
73	647 45 00	SHAFT UNIT	25-18-2A	1	1
	649 74 00	AXELENHET	25-18-6B	1	1
	652 46 03	WELLENEINHEIT	25-14-4A	1	1
	652 46 04	UNITE D'ARBRE	25-17-4A	1	1
	652 46 05	UNIDAD DE ARBOL ALBERO ROTORE	25-19-4A	1	1
79		STATOR ESTATOR STATORE			
		<b>3-phase, 50 Hz, 15.0 kW, 1460 r/min (25-14-4A)</b>	<b>3-phase, 60 Hz, 18.6 kW (25.0 hp), 1755 r/min(25-14-4A)</b>		
	647 25 01	690/660V Y - 400/380V D	460V D	1	1
	647 25 02	400V Y - 230V D	—	1	1
	647 25 05	415 - 440V D	—	1	1
	647 25 06	500V D	575 - 600V D	1	1
	647 25 07	—	460Y SER - 230Y //	1	1
	647 25 08	—	380V D	1	1
	657 94 05	415 - 440V D (With termistors)	—	-	1
		<b>3-phase, 50 Hz, 22.0 kW, 2930 r/min (25-18-2A)</b>	<b>3-phase, 60 Hz, 26.0 kW (35.0 hp), 3525 r/min (25-18-2A)</b>		
	647 43 01	690V Y - 400/440V D	460V D	1	1
	647 43 02	400V Y - 230V D	—	1	1
	647 43 03	660V Y - 380V D	440V D	1	1
	647 43 07	500V D	575 - 600V D	1	1
	647 43 09	—	460Y SER - 230Y //	1	1
	689 08 01	415 - 440V D (With termistors)	—	-	1
		<b>3-phase, 50 Hz, 18.5 kW, 1460 r/min (25-17-4AA)</b>	<b>3-phase, 60 Hz, 22.0 kW (30.0 hp), 1755 r/min (25-17-4AA)</b>		
	647 62 01	690/660V Y - 400/380V D	460V D	1	1
	647 62 02	400V Y - 230V D	—	1	1
	647 62 05	440 - 415V D	—	1	1
	647 62 06	500V D	575 - 600V D	1	1
	647 62 07	—	460Y SER - 230Y //	1	1
	647 62 13	—	380V D	1	1
	657 95 05	415 - 440V D (With termistors)	—	-	1


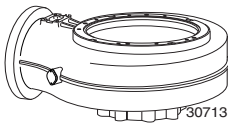











		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
79		<b>3-phase, 50 Hz, 15.0 kW,</b> <b>960 r/min (25-18-6BB)</b>	<b>3-phase, 60 Hz, 18.6 kW (25.0 hp),</b> <b>1160 r/min (25-18-6BB)</b>		
	660 06 01 660 06 02 660 06 05 660 06 06 660 06 07 660 06 08 678 83 05	690/660V Y - 400/380V D 400V Y - 230V D 440 - 415V D 500V D — — 415 - 440V D (With termistors)	460V D — — 575 - 600V D 460Y SER - 230Y // 380V D —	1 1 1 1 1 1 -	1 1 1 1 1 1 1
		<b>3-phase, 50 Hz, 22.0 kW,</b> <b>1460 r/min (25-19-4AA)</b>	<b>3-phase, 60 Hz, 25.0 kW (34.0 hp),</b> <b>1760 r/min (25-19-4AA)</b>		
	692 99 01 692 99 02 692 99 05 692 99 06 692 99 07 692 99 08 696 41 05	690/660V Y - 400/380V D 400V Y - 230V D 440 - 415V D 500V D — — 415 - 440V D (With termistors)	460V D — — 575 - 600V D 460Y SER - 230Y // 380V D —	1 1 1 1 1 1 -	1 1 1 1 1 1 1
82	650 93 00	OUTER CASING	Standard	1	1
	650 93 01	KÅPA MANTEL COIFFE CAPOTA CAMPANA	Stainless steel (ASTM 329)	1	1
83	82 74 99	O-RING	259.3X5.7 NBR	1	1
	82 81 06	O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	259,3X5,7 FPM	1	1
84	82 75 05	O-RING	339,3X5,7 NBR	1	1
	82 75 23	O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	339,3X5,7 FPM	1	1
101	650 51 00	CABLE UNIT SLADDENHET KABELEINHEIT UNITE DE CABLE UNIDAD DE CABLE UNITA' CAVO	Intended for FLS10	1	1










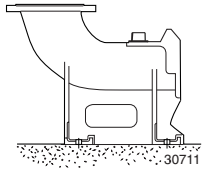
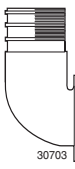
		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
103	663 04 00	LEVEL SENSOR NIVÅGIVARE SCHWIMMSCHALTER EMETTEUR DE NIVEAU EMISOR DE NIVEL SENSORE DI LIVELLO	FLS10	1	1
105	650 80 00 650 80 01	BEARING HOLDER LAGERHÅLLARE LAGERHALTER SUPPORT DE ROULEMENT SUJETADOR DE COJIN. SUPP. CUSCINETTO		- 1	1 -
107	82 59 12	RETAINING RING SPÅRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA		1	1
108	82 44 19	SUPPORTING WASHER STÖDBRICKA STUETZSCHEIBE RONDELLE DE SUPPORT ARANDELA DE SOPORTE RONDELLA DI SUPPORTO	S 55X68X3	2	2
109	83 30 21	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3311A-2Z/C3. LOWER BEARING	1	1
110	83 07 63	RETAINING RING SPÅRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA		1	1
120	642 13 00	INSPECTION SCREW INSPEKTIONSSKRUV INSPEKTIONSSCHRAUBE VIS D'INSPECTION TORNILLO DE INSPECT. VITE D'ISPEZIONE		1	1


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				181	181
122	82 76 85 82 79 15	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	17,0X3,0 NBR 17,0X3,0 FPM	1 1	1 1
129	650 78 00	SEAL HOUSING COVER TÄTNINGSHUSLOCK DICHTUNGGEH.DECKEL BOITIER DE JOINT CO. CAJA DE JUNTA TAPA ALLOGGIO TENUTA COP.		1	1
130	82 78 59	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	290,0X3,0 NBR	1	1
131	82 75 05 82 75 23	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	339,3X5,7 NBR 339,3X5,7 FPM	1 1	1 1
133	83 04 53	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X45-A4-80	6	6
141	619 64 00 619 64 01	MECHANICAL SEAL PLANTÄTNING GLEITRINGDICHTUNG JOINT MECANIQUE JUNTA MECANICA TENUTA MECCANICA	Seal material, Inner:WCCR Outer:WCCR  Inner:WCCR Outer:RSiC	1 1	1 1
145	83 04 58	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M16X60-A4-80	4	4


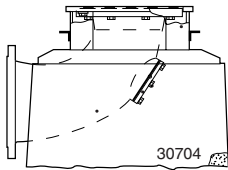


		<b>Pump parts</b> <b>Pumpdetaljer</b> <b>Pumpenteile</b>	<b>Pièces de la pompe</b> <b>Piezas para bombas</b> <b>Parti pompa</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
153	681 31 00	INSERT RING INSATSRING EINSATZRING ANNEAU DE REDRESS. ANILLO DE ENDEREZ. ANELLO DI RIPORTO		1	1
158		IMPELLER PUMPHJUL LAUFRAD ROUE IMPULSOR GIRANTE		Curve No: Kurva nr. Kurve Nr. Courbe N° Curvas N° No curva	
					
	650 96 00	N - High head	451, 50/60 Hz, 3-phase	1	1
	650 96 17	N - High head	452, 50/60 Hz, 3-phase	1	1
	650 96 34	N - High head	453, 50/60 Hz, 3-phase	1	1
	650 96 50	N - High head	454, 50/60 Hz, 3-phase	1	1
	650 96 64	N - High head	455, 50/60 Hz, 3-phase	1	1
	650 97 00	N - Medium head	431, 50 Hz, 3-phase	1	1
	650 97 12	N - Medium head	432, 50 Hz, 3-phase	1	1
	650 97 24	N - Medium head	433, 50/60 Hz, 3-phase	1	1
	650 97 35	N - Medium head	434, 50/60 Hz, 3-phase	1	1
	650 97 46	N - Medium head	435, 60 Hz, 3-phase	1	1
	650 97 56	N - Medium head	436, 60 Hz, 3-phase	1	1
	650 97 66	N - Medium head	437, 60 Hz, 3-phase	1	1
158	665 95 01	N- Low head	611, 50 Hz, 3-phase	1	1
	665 95 09	N- Low head	612, 50 Hz, 3- phase	1	1
	665 95 16	N- Low head	613, 50/60 Hz, 3-phase	1	1
	665 95 24	N- Low head	614, 50/60 Hz, 3-phase	1	1
	665 95 31	N- Low head	615, 60 Hz, 3-phase	1	1
	685 16 00	N-Super high head	270, 50 Hz, 3-phase	1	1
	685 16 19	N-Super high head	272, 50 Hz, 3-phase	1	1
	685 16 32	N-Super high head	274, 50/60 Hz, 3-phase	1	1
	685 16 50	N-Super high head	275, 50/60 Hz, 3-phase	1	1
	685 16 65	N-Super high head	277, 60 Hz, 3-phase	1	1
	685 16 80	N-Super high head	278, 60 Hz, 3-phase	1	1
162	82 37 05	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	A2-A 200	1	1

		<b>Pump parts</b> <b>Pumpdetaljer</b> <b>Pumpenteile</b>	<b>Pièces de la pompe</b> <b>Piezas para bombas</b> <b>Parti pompa</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
169	83 04 55 83 04 66	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X110-A4 80 M12X80-A4	1	1
200		PUMP HOUSING PUMPHUS PUMPENGHÄUSE CORPS DE POMPE CUERPO DE BOMBA CORPO POMPA	 For flush valve För omrörarventil Führ Rührwerkventil		
	650 98 00	"HT" High head version DN 100	 Undrilled	1	1
	650 98 01	"HT" High head version DN 100	 Drilled to EN 1092-2 Table 9	1	1
	650 98 03	"HT" High head version DN 100	 Drilled inlet for S, T, Z and zink anodes	1	1
	650 98 05	"HT" High head version DN 100	 Drilled to ANSI B16.1- Table 5	1	1
	650 99 00	"MT" Medium head version DN 150	 Undrilled	1	1
	650 99 03	"MT" Medium head version DN 150	 Drilled inlet for S, T, Z and zink anodes	1	1
	650 99 06	"MT" Medium head version DN 150	 Drilled to EN 1092-2 Table 9. ANSI B16.1-1989 Table 5	1	1
	665 94 00	"LT" Low head version DN 250	 Undrilled	1	1
	665 94 01	"LT" Low head version DN 250	 Drilled to EN 1092-2 Table 8	1	1
	665 94 03	"LT" Low head version DN 250	 Drilled inlet for S, T, Z and zink anodes	1	1
	665 94 05	"LT" Low head version DN 250	 Drilled to ANSI B16.1-89; Table 5	1	1



		<b>Pump parts</b> <b>Pumpdetaljer</b> <b>Pumpenteile</b>	<b>Pièces de la pompe</b> <b>Piezas para bombas</b> <b>Parti pompa</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
200	665 94 07	"LT" Low head version DN 250	 Drilled to EN 1092-2 Table 9	1	1
	681 30 00	"SH" Super high head version DN 100	 Undrilled	1	1
	681 30 01	"SH" Super high head version DN 100	 Drilled to EN 1092-2 Table 9	1	1
	681 30 03	"SH" Super high head version DN 100	Drilled inlet for S, T, Z and zink anodes	1	1
	681 30 05	"SH" Super high head version DN 100	 Drilled to ANSI B16.1-89 Table 5	1	1
	681 30 10	"SH" Super high head version DN 100	 Undrilled With outlet sealing	1	1
	681 30 13	"SH" Super high head version DN 100	Drilled inlet for S, T, Z and zink anodes With outlet sealing	1	1
200.3	84 90 94	SEAL RING TÄTNINGSRING DICHTUNGSRING ANNEU DE JOINT ANILLO DE JUNTA ANELLO DI TENUTA	Intended for pumphousing 681 30 10 and 681 30 13	1	1
202	83 04 56	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M10X35-A4-80	2	2
203	648 00 00	COVER LOCK DECKEL COUVERCLE TAPA COPERCHIO		1	1
204	82 81 93	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	44,2X5,7 FPM	1	1




		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
		<b>Installation</b> <b>Installation</b> <b>Aufstellungsart</b>	<b>_ P</b> <b>Installation</b> <b>Instalacion</b> <b>Installazione</b>	091	181
205	3171	DISCHARGE CON.STAT. TRYCKANSL. STATIONÄR DRUCKANSCHLUSS STAT. ORIFICE DE REF.STAT. ORIFICIO DE REC.STAT PIEDE ACCOPPIAMENTO			
		See, group.flygt.com / Intranet/GPI/Accessories Se, group.flygt.com / Intranet/GPI / Tillbehör Sehen Sie, group.flygt.com/Intranet/GPI/Zubehör Voir, group.flygt.com/ l'Intranet/GPI/ Accessoires Veda il, group.flygt.com/Intranet/GPI/Accessori Veá el, group.flygt.com/Intranet/GPI/Accesorios			
209	651 07 00 651 08 00	SLIDING BRACKET GLIDSKO GLEITKLAUE GRIFFE DE GLISSEM. GARRA DE DESLIZ. SLITTA SCORREVOLE	2" 3"	1 1	1 1
210	83 04 53	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M12X45-A4-80	4	4
		<b>Installation</b> <b>Installation</b> <b>Aufstellungsart</b>	<b>_ S</b> <b>Installation</b> <b>Instalacion</b> <b>Installazione</b>		
211		DISCHARGE CONNECTION TRYCKANSLUTNING DRUCKANSCHLUSS ORIFICE DE REFOULEM. ORIFICIO DE RECALC. ATTACCO TUBO			
	259 82 04	"SH"/"HT" Super/High head, DN 100		1	1
	259 84 05	"SH"/"HT" Super/High head, DN 100 Thread: 4-8 NPSM, outer		1	1
	259 84 06	"HT"/"HT" Super/High head, DN 100 Thread : ISO G4A outer		1	1
	295 57 00	"MT" Medium head, DN 150		1	1
	309 31 00	"MT" Medium head, DN 150, Thread : 6-8 NPSM outer		1	1
	309 31 01	"MT" Medium head, DN 150, Thread : ISO G6A outer		1	1




		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
211	379 32 00 479 26 00	"LT" Low head, DN 200 "LT" Low head, DN 250		1 1	1 1
212	84 34 07 84 34 32 84 34 34	HEXAGON HEAD BOLT SEKKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG BULLONE TESTA ESAG.	M16X60-A2-70 High head M20X70-A2-70 Medium head Low head	4 8 4	4 8 4
213	82 35 23	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	16-A2-A 140	4	4
215	82 23 61 82 23 62	HEXAGON NUT SEKKANTMUTTER MUTTER ECROU TUERCA DADO ESAGONALE	M16-A2-70 High head M20-A2-70 Medium head	4 8	4 8
216	259 83 00 295 64 00 384 45 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE	4" High head 6" Medium head 8" Low head	1 1 1	1 1 1
217	380 92 00 396 11 00	STAND COMPL. STATIV KOMPL. STATIV KOMPL. BATI COMPL. BASTIDOR COMPL. CAVALLETTO COMPL.	Intended for NS/NT; Medium head, Low head Intended for NS/NS; High head	1 1	1 1
218	84 34 03 84 34 07 84 34 30 84 34 35	HEXAGON HEAD SCREW SEKKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE M20X90-A2-70	M16X40-A2-70 NT; High head, NS; Medium/High head M16X60-A2-70 NS, NT; High head M20X60-A2-70 NT; Medium head NT; Low head	4 4 4 12	4 4 4 12




		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
219	82 35 23 82 35 26	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	16-A2-A 140 20-A2-A 140	4 8	4 8
		<b>Installation</b> <b>Installation</b> <b>Aufstellungsart</b>	<b>Installation</b> _T <b>Instalacion</b> <b>Installazione</b>		
220		SUCTION PIPE UNIT SUGRÖRSENHET SAUGROHR EINHEIT TUYAU D'ASPIRAT.UNIT TUBO DE ASPIRAC.UNID UNITA'CURVA ASPIRAZ.	 30704		
	384 74 00	"LT" Low head DN 300	 Undrilled	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1
220	384 74 01	"LT" Low head DN 300	 Drilled to EN 1092-2 Table 8	1	1







		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b> <b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination	Qty / Version	
			091	181
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA	1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE	1	1
220	384 74 05	"LT" Low head DN 300  Drilled to ANSI B16.1-89 Table 5	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA	1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE	1	1


		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
220	384 74 07	"LT" Low head DN 300	 Drilled to EN 1092-2 Table 9	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1
220	381 77 30	"MT" Medium head DN 250	 Undrilled	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1


		<b>Sump components</b> <b>Pumpgrupsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
220	381 77 31	"MT" Medium head DN 250	 Drilled to EN 1092-2 Table 8	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1
220	381 77 35	"MT" Medium head DN 250	 Drilled to ANSI B16.1-1989	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1

		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				1091	181
220	381 77 37	"MT" Medium head DN 250	 Drilled to 1092-2 Table 9	1	1
220.1	81 41 56	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M12X35-A2-70	4	4
220.2	274 45 01	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1
220	272 82 20	"SH"/"HT" Super/High head DN 200	 Undrilled	1	1
220.1	81 52 49	HEXAGON SCREW SEXKANTSKRUV SCHRAUBE VIS TORNILLO VITE ESAGONALE		4	4
220.2	274 45 00	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1


		<b>Sump components</b> <b>Pumpgropsdetaljer</b> <b>Schachteinbauteile</b>	<b>Equipment du puisard</b> <b>Equipo para pozo negro</b> <b>Componenti per versione</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
220	272 82 26	"SH"/"HT" Super/High head DN 200	 Drilled to EN 1092-2 Table 8 ANSI B16.1-1989 Table 5	1	1
220.1	81 52 49	HEXAGON SCREW SEXKANTSKRUV SCHRAUBE VIS TORNILLO VITE ESAGONALE		4	4
220.2	274 45 00	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1
220	272 82 27	"SH"/"HT" Super/High head DN 200	 Drilled to EN 1092-2 Table 9	1	1
220.1	81 52 49	HEXAGON SCREW SEXKANTSKRUV SCHRAUBE VIS TORNILLO VITE ESAGONALE		4	4
220.2	274 45 00	CLEANING DOOR RENSLUCKA REINIGUNGSDECKEL REGARD DE NETTOYAGE PUERTA DE LIMPIEZA PORTA PULITURA		1	1
220.3	274 48 00	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE		1	1


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
221	84 65 82 84 65 87 84 65 88	GASKET PACKNING PACKUNG JOINT JUNTA GUARNIZIONE	250 PN 10 Intended for Low head 150 PN10 Intended for High head 200 PN10 Intended for Medium head	1 1 1	1 1 1
222	84 34 03	HEXAGON HEAD SCREW SEXKANTSKRUV SECHSKANTSCHRAUBE VIS A TÊTE HEXAGONAL TORNILLO DE CAB.EXAG VITE TESTA ESAGONALE	M16X40-A2-70	4	4
227	83 19 34 83 19 36	COUPLING PART KOPPLINGSHALVA KUPPLUNGSHÄLFTE SEMI ACCOUPLEMENT SEMI ACOPLAMIENTO SEMI-GIUNTO	R 4" High head R 6" Medium head	1 1	1 1
229	667 40 01	STICKER DEKAL KLEBESTREIFEN RUBAN ADHESIF FRANJA ENCOLADO AUTOADESIVO		2	2
231	93 00 77 93 00 78	SHRINK HOSE KRYMPSLANG SCHRUMPFSCHLAUCH TUYAU DE FRETAGE MANGUERA DE SUNCHADO TUBO DI RIDUZIONE	ID 6,4 ID 9,5	* *	* *
232	83 53 58	TERMINAL CLAMP KOPPLINGSKLÄMMA ANSCHLUSSKLEMME BORNE DE RACCORDEM. BORNE DE CONEXION MORSETTO	WEIDMÜLLER WDU 6/10	3	3
233	83 53 17 83 53 61	TERMINAL CLAMP KOPPLINGSKLÄMMA ANSCHLUSSKLEMME BORNE DE RACCORDEM. BORNE DE CONEXION MORSETTO	WDU35/IK/ZA WDU16,1000 V	8 6	8 6


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
234	83 53 49 83 53 67 650 20 02	CROSS CONNECTION TVÄRFÖRBINDNING QUERVERBINDUNG CONNEXION TRANSVERS. CONEXION TRANSVERS. COOLEGAM.TRASVERSALE	WQW35/2 WQV 16/2	4 3 1	4 3 1
235	83 53 54	END SUPPORT ÄNDSTOPP ENDANSCHLAG ARRET DE BOUT TOPE DE DETRAS SUPPORTO FINALE	WEW 35/2	2	2
236	83 53 50	SECTION PLATE SKILJEVÄGG AUSCHLUSSPLATTE CLOISON		1	1
239	650 84 01	LEAD THROUGH UNIT GENOMFÖRINGSENHET DURCHFÜHRUNG EINHEIT PASSAGE UNITE PASO UNIDAD UNITA' PASSAGG.TERM.	For motorcables 6mm <sup>2</sup>	1	1
240	607 48 04	SPRING FJÄDER FEDER RESSORT RESORTE MOLLA		1	1
241	82 74 95 82 75 21	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	219.3X5.7-NBR 219,3X5,7-FPM	1 1	1 1
242	650 88 00 650 88 01 650 89 00 650 89 01	ADAPTER MELLANDEL ZWISCHENTEIL ADAPTEOR ADAPTOR		- 1 - 1	1 - 1 -


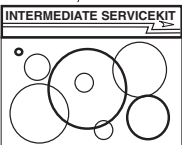
		Motor parts Motordetaljer Motorteile	Pièces du moteur Piezas del motor Parti motore	3171	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
243	83 04 61	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA		2	2
245	82 75 05	O-RING	339,3X5,7 NBR	1	1
	82 75 23	O-RING	339,3X5,7 FPM	1	1
		O-RING			
		ANNEAU TORIQUE			
		ANILLO TORICO			
		ANELLO OR			
246	82 78 59	O-RING	290,0X3,0 NBR	1	1
		O-RING			
		O-RING			
		ANNEAU TORIQUE			
		ANILLO TORICO			
		ANELLO OR			
247	82 95 70	O-RING	92,0X4,0 FPM	1	1
		O-RING			
		O-RING			
		ANNEAU TORIQUE			
		ANILLO TORICO			
		ANELLO OR			
248	608 27 01	STRIP		1	1
		BAND			
		BAND			
		BANDE			
		BANDAS			
249	82 32 50	CLAMP		1	1
		KLÄMMA			
		KLEMME			
		CRAMPON			
		ABRAZADERA			
		FASCETTA			
251	642 13 00	INSPECTION SCREW INSPEKTIONSSKRUV INSPEKTIONSSCHRAUBE VIS D'INSPECTION TORNILLO DE INSPECT. VITE D'ISPEZIONE		2	2


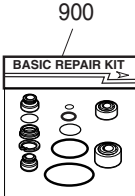



		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty /Version	
				091	181
252	82 76 85 82 79 15	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR	17,0X3,0 NBR 17,0X3,0 FPM	2 2	2 2
253	650 94 00	COOLING JACKET KYLKÅPA KUEHLMANTEL COIFFE REFROIDISSEUR CAPOTA REFRIGERANTE CAMPANA RAFFREDDAMEN	"INNER"	1	1
254	651 06 00	FLOW DIFFUSER FLÖDES DIFFUSOR STRÖMUNGSKONUS DIFFUSEUR DE COURANT DIFUSOR DE CORRIENTE DIFFUSORE CORRENTE		1	1
255	82 00 11	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M6X12-A2-70	4	4
256	608 24 00	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA		4	4
258	651 03 01	SLEEVE HYLSA HUELSE DOUILLE MANGUITO BUSSOLA		1	1
259	643 66 00	GLAND SCREW HYLSSKRUV VERSCHRAUBUNG ECROU DE SERRAGE TORNILLO DE CAMISA VITE DI SERRAGGIO		1	1


		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
264	82 40 69 82 40 81 82 40 82	PLAIN WASHER RUNDBRICKA SCHEIBE RONDELLE ARANDELA RONDELLA	35.5X52X2 (33)-35 MM (14)-20 mm (20)-32 mm	4 4 4	4 4 4
265	84 18 01 84 18 02 84 18 03 84 18 04 84 18 05 84 18 06	SEAL SLEEVE TÄTNINGSHYLSA DICHTUNGSHÜLSE DOUILLE DE JOINT MANGUITO DE JUNTA GOMMINO ENTR.CAVO	(17)-20 mm (20)-23 mm (23)-26mm (26)-29 mm (29)-32 mm (32)-35 mm	2 2 2 2 2 2	2 2 2 2 2 2
266	597 98 02	RING RING RING ANNEAU ANILLO ANELLO		1	1
270	608 31 00	LOCK WASHER LÅSBRICKA SICHERUNGSBLECH RONDELLE DE BLOCAGE ARANDELA DE CIERRE RONDELLA DI BLOCCAG.		1	-
271	689 43 00	LIP KLACK HACKEN		1	1
272	82 40 35 82 40 36	WASHER BRICKA SCHEIBE RONDELLE ARANDELA RONDELLA		3 3	3 3
273	83 04 56	SOCKET HEAD SCREW SEXKANTHÅLSKRUV SCHRAUBE VIS TORNILLO VITE A BRUGOLA	M10X35-A4-80	1	1

		<b>Motor parts</b> <b>Motordetaljer</b> <b>Motorteile</b>	<b>Pièces du moteur</b> <b>Piezas del motor</b> <b>Parti motore</b>	<b>3171</b>	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
274	689 73 00	PACING SLEEVE DISTANSHYLSA DISTANZHUELSE DOUILLE D'ECARTEMENT MANGUITO DE SEP-CION BUSSOLA DISTANZ.		1	1
313	82 71 72	O-RING O-RING O-RING ANNEAU TORIQUE ANILLO TORICO ANELLO OR		1	1
			71,2X3,0 FPM		


		Recommended spare parts		3171	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
800	82 96 96 82 96 97	IS KIT Standard 3171.090/180/091/181 IS SATS Warm liquid version up to 70°C, (158°F) 3171.090/180 IS SATZ 091/181 JEU DE IS JUEGO DE IS		*	*
	800 	I= Intermediate Service Kit; parts for inspection and maintenance I= Intermediate Service Kit; artiklar för inspektion och underhåll I= Intermediate Service Kit; Teile für Kontrolle und Wartung  I= Intermediate Service Kit; pièces pour inspection et maintenance I= Intermediate Service Kit; piezas para inspección y mantenimiento I= Intermediate Service Kit; parti per ispezione e mantenimento			
800	82 96 96	<b>Consisting of:</b>			
	82 71 72	O-RING	71,2X3,0 FPM	1	1
	82 74 01	O-RING	44,2X5,7 NBR	1	1
	82 74 63	O-RING	49,5X3,0-NBR	1	1
	82 74 92	O-RING	194,3X5,7-NBR	1	1
	82 74 95	O-RING	219,3X5,7-NBR	1	1
	82 74 97	ANNEAU TORIQUE	239,3X5,7-NBR	1	1
	82 74 99	ANILLO TORICO	259,3X5,7 NBR	1	1
	82 75 05	ANELLO OR	339,3X5,7 NBR	3	3
	82 76 85		17,0X3,0 NBR	3	3
	82 78 59		290,0X3,0 NBR	2	2
	82 95 70		92,0X4,0 FPM	1	1
	607 48 04	SPRING FJÄDER FEDER RESSORT RESORTE MOLLA		1	1

		Recommended spare parts		3171	
Pos.No.	Part No.	Denomination		Qty /Version	
				091	181
800	82 96 97	<b>Consisting of:</b>			
	82 71 72	O-RING	71,2X3,0 FPM	1	1
	82 75 21	O-RING	219,3X5,7-FPM	1	1
	82 75 23	O-RING	339,3X5,7 FPM	3	3
	82 75 24	O-RING	194,3X5,7 FPM	1	1
	82 78 59	ANNEAU TORIQUE	290,0X3,0 NBR	2	2
	82 79 15	ANILLO TORICO	17,0X3,0 FPM	3	3
	82 80 86	ANELLO OR	239,3X5,7 FPM	1	1
	82 81 03		49,5X3,0 FPM	1	1
	82 81 06		259,3X5,7 FPM	1	1
	82 81 93		44,2X5,7 FPM	1	1
	82 95 70		92,0X4,0 FPM	1	1
	607 48 04	SPRING FJÄDER FEDER RESSORT RESORTE MOLLA		1	1
900	657 17 01	BASIC REPAIR KIT	Standard	*	*
	657 17 02	GRUNDREPARATIONSSATS GRUNDREPARATURSATZ KIT PALIER JUEGO BASICO DE REP. KIT DI RIPARAZIONE	Warm liquid version up to 70°C, (158°F)	*	*
		<b>B=</b> Basic Repair Kit; parts for major overhaul <b>B=</b> Basic Repair Kit; artiklar för större genomgång <b>B=</b> Basic Repair Kit; Teile für Generalüberholung  <b>B=</b> Basic Repair Kit; pièces pour révision complète <b>B=</b> Basic Repair Kit; piezas para revisiones importantes <b>B=</b> Basic Repair Kit; parti per revisioni complete			
900	657 17 01	<b>Consisting of:</b>			
	82 56 25	SPRING WASHER FJÄDERBRICKA FEDERSCHEIBE RONDELLE ELASTIQUE ARANDELA ELASTICA RONDELLA ELASTICA	71,5X59,0X6,5	1	1

		Recommended spare parts		3171	
Pos.No.	Part No.	Denomination	Qty / Version		
			091	181	
	82 59 12	RETAINING RING SPÄRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA	1	1	
	82 96 96	IS KIT IS SATS IS SATZ JEU DE IS JUEGO DE IS	Standard 3171.090/180 1	1	
	83 07 63	RETAINING RING SPÄRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA	1	1	
	83 30 16	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3306A-2Z/C3. UPPER BEARING 1	1	
	83 30 21	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3311A-2Z/C3. LOWER BEARING 1	1	
	619 64 00	MECHANICAL SEAL PLANTÄTNING GLEITRINGDICHTUNG JOINT MECANIQUE JUNTA MECANICA TENUTA MECCANICA	Seal material, Inner:WCCR/WCCR Outer:WCCR/WCCR 1	1	

		Recommended spare parts		3171	
Pos.No.	Part No.	Denomination	Qty /Version		
			091	181	
900	657 17 02	<b>Consisting of:</b>			
	82 56 25	SPRING WASHER FJÄDERBRICKA FEDERSCHEIBE RONDELLE ELASTIQUE ARANDELA ELASTICA RONDELLA ELASTICA	71,5X59,0X6,5	1	1
	82 59 12	RETAINING RING SPÅRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA		1	1
	82 96 97	IS KIT IS SATS IS SATZ JEU DE IS JUEGO DE IS	Warm liquid version up to 70°C, (158°F) 3171.090/180/091/181	1	1
	83 07 63	RETAINING RING SPÅRRING NUTRING CIRCLIP ANILLO DE PRESION ANELLO DI SICUREZZA		1	1
	83 30 16	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3306A-2Z/C3. UPPER BEARING	1	1
	83 30 21	BALL BEARING KULLAGER KUGELLAGER ROULEMENT A BILLES COJINETE DE BOLAS CUSCINETTO A SFERE	3311A-2Z/C3. LOWER BEARING	1	1
	619 64 00	MECHANICAL SEAL PLANTÄTNING GLEITRINGDICHTUNG JOINT MECANIQUE JUNTA MECANICA TENUTA MECCANICA	Seal material, Inner:WCCR/WCCR Outer:WCCR/WCCR	1	1

Recommended spare parts

		Parts for Service		3171	
Pos.No.	Part No.	Denomination		Qty / Version	
				091	181
901	90 37 08	MONOPROPYLENE GLYCOL MONOPROPOLENEGLYKOL MONOPROLYLEN GLYKOL	Pump without cooling jacket = approx. 4,6 litres (4.9 US quarts) Pump with cooling jacket = approx. 16,7 litres (17.6 US quarts)	*	*
		<b>Tools</b>	<b>Range of use</b>		
	83 95 42	Pump	Inspection room	*	*
	84 08 02	Circlip plier (SGA 19-60 mm)	Mechanical seal unit	*	*
	84 08 11	Circlip plier (SGH 85 165 mm)	Outer bearing	*	*
	84 08 60	Crow bar (2x)	Mechanical seal unit	*	*
	84 10 16	Ratchet handle	Sockets	*	*
	84 11 40	Combination wrench	Level switch	*	*
	84 13 03	Hexagon bit adapter	Terminal's rail, earthing	*	*
	84 13 05	Hexagon bit adapter	Pugs, connection cover, lift handle	*	*
	84 13 06	Hexagon bit adapter	Impeller screw, cable entry, seal housing cover	*	*
	84 13 01	Hexagon bit adapter	Pump housing	*	*
	84 13 62	Puller	Inner bearing	*	*
	84 14 80	Hexagon bit adapter	Impeller	*	*
	84 14 89	Allen keys set (9x)	Mechanical seal unit	*	*
	84 15 55	Extension bar (L= 125 mm)	Sockets	*	*
	332 91 00	Puller	Spring	*	*
	398 57 00	Mounting socket	L=80-15/95mm Plug-in seal fitting	*	*
	608 23 01	Stand	Pump fixation 3153, 3171	*	*
	651 19 00	Bearing puller	Main bearing handling	*	*
	689 54 05	Mount.-dismount.tool	Stator	*	*



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## **4.0 VALVES**

**SUPPLIER:** TYCO NORTHGATE  
88 FREDERICK STREET  
NORTHGATE Qld 4013

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

**MODEL:** 100 DIA DF R.S SLUICE VALVE  
150 DIA DF R.S SLUICE VALVE

**SUPPLIER:** VALVECO INDUSTRIES

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

**MODEL:** 100 DIA. VALMATIC FLEX CHECK VALVE

## Resilient Seated Gate Valves - Figure 500 DN80 - DN600

**tyco**

*Flow Control*

**Tyco Water**

Figure 500 resilient seated gate valves are designed and manufactured to AS 2638-2.

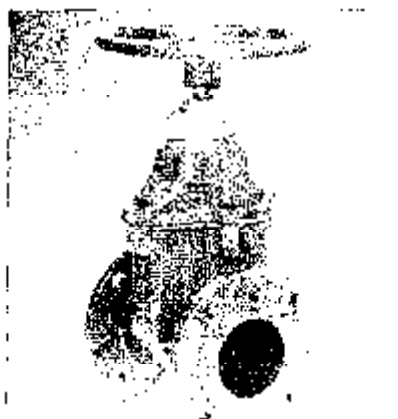
### Features

- Ductile Iron body and bonnet for high strength and impact resistance.
- Ductile Iron gate fully encapsulated in EPDM rubber to ensure drop tight sealing.
- Grade 431 Stainless Steel spindle for high strength and corrosion resistance.
- Gunmetal dezincification resistant top casting incorporating dual O-ring seats and wiper ring for long life operation.
- Back seal facility to allow for replacement of seals under full operating pressure.
- Rilsan<sup>®</sup> Nylon 11 coating for long life corrosion protection.
- Straight through full bore to avoid debris traps.
- 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, hand wheel or gearbox operation available.



### General Application

Figure 500 resilient 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.

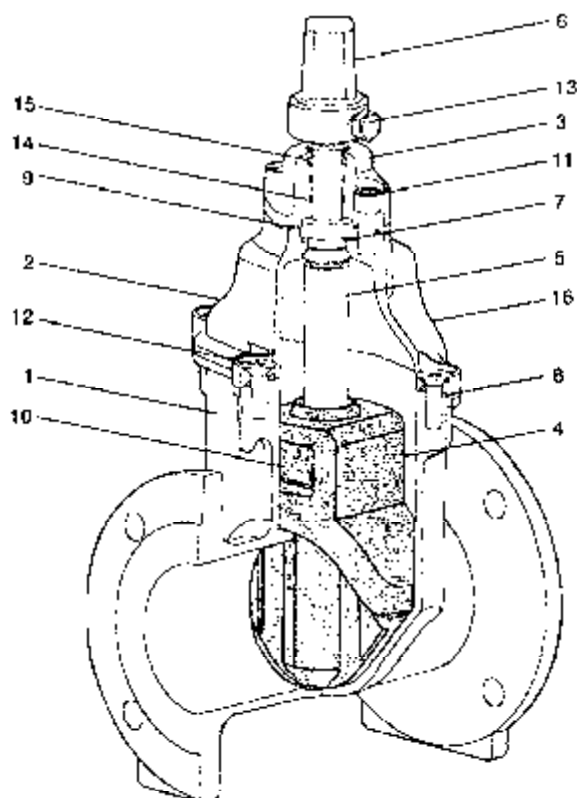


### Technical Data

**Size Range:** DN80-DN600  
**Allowable Operating Pressure:** 1600 kPa  
**Maximum Temperature:** 40°C  
**End Connections:**  
 Flanged to AS 408 / Fig B5  
 TYTON<sup>®</sup> Socket  
 Spigot to AS/NZS 2280  
 Flange - TYTON Socket  
**Approvals:**  
 WSAA Appraisal No. 98/21  
 ISC AS 2638 Product Mark  
 Registration No. PRD/R61/0412/2  
 Certified to AS 4020 -suitable for contact with drinking water.

## Resilient Seated Gate Valves - Figure 500

DN80 - DN600



### Parts List

No	Description	Material	Standard
1	Body	Ductile Iron	AS 1831 400-12
2	Bonnet	Ductile Iron	AS 1831 400-12
3	Seal Retainer	Gunmetal	AS 1565 C83600
4	Gate	Ductile Iron (EPDM Encapsulated)	AS 1831 400-12
5	Spindle	Stainless Steel	ASTM A 276 431
6	Spindle Cap	Ductile Iron	AS 1831 400-12
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	Fusion Coating	Rilsan® Nylon 11	AS/NZS 4158

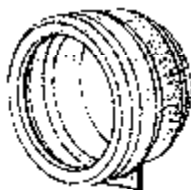
## Resilient Seated Gate Valves - Figure 500

### DN60 - DN600

#### End Connections



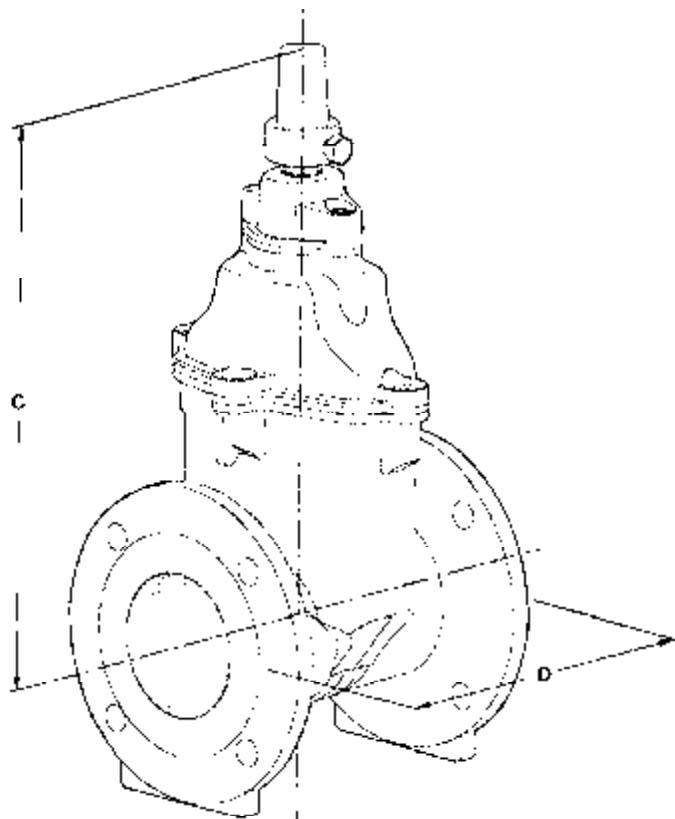
Flange



Socket



Spigot



#### Dimensions (mm)

Valve Size	C	D			Turns to Close	Torque to Seal Nm	Approx. Mass kg
		TYTON Socket	Flange AS4087 Fig B5	Spigot			
80*	367	-	203	306	20	40	18
100†	402	150	229	365	23	50	24
150†	502	170	267	380	26	75	43
200†	610	195	292	410	34	120	75
225†	649	205	305	420	38	140	85
250†	723	235	330	435	42	180	110
300	810	245	356	450	50	200	160
375	960	275	381	-	62	420	340
450	1145	-	432	-	76	500	560
500	1290	-	457	-	82	530	710
600	1467	-	508	-	98	550	940

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

\* Flange to Polydex socket available.

† Flange to TYTON socket available.

## Resilient Seated Gate Valves - Figure 500

### DN80 - DN600

#### Available Range

DN	Resilient Seated Gate Valves Inside Screw Class 16				
	Key Operated				Handwheel Operated
	FI-FI	Sc-Sc	Sp-Sp	FI-Sc	FI-FI
80	✓		✓	✓	✓
100	✓	✓	✓	✓	✓
150	✓	✓	✓	✓	✓
200	✓	✓	✓	✓	✓
225	✓	✓	✓	✓	✓
250	✓	✓	✓	✓	✓
300	✓	✓	✓	✓	✓
375	✓	✓			✓
450	✓				✓
500	✓				✓
600	✓				✓
Fig No.	500	500	500	500	500H
Coating					
Rilsan Nylon 11	✓	✓	✓	✓	✓
Options					
Anticlockwise Closing	✓	✓	✓	✓	
Clockwise Closing	✓	✓	✓	✓	✓
Gear Actuator	✓				
Flange Drilling Fig 85 (FC)	✓			✓	✓

#### Recommended Specification

- Gate valves shall be resilient seated conforming to AS2638.2.
- The allowable operating pressure shall be 1600kPa.
- 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 fully encapsulated in EPDM rubber - partially coated wedges are not 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.

# VAL-MATIC®



**EFFICIENCY &  
RELIABILITY  
THROUGH  
SIMPLICITY  
OF DESIGN**

## Swing-Flex® Check Valve





#### A. 100% FLOW AREA

For improved flow characteristics and lower head loss, the Val-Matic Swing-Flex® Check Valve provides 100% unrestricted flow area.

#### B. REINFORCED DISC

The one piece precision molded disc is steel and nylon reinforced to provide years of trouble free performance. It is backed by a 25 year warranty for the flex portion of the disc. (Tested for proof of design - see page 5.)

#### C. ONE MOVING PART

The Memory-Flex™ disc, the only moving part, assures long life with minimal maintenance. No packing or O-rings, mechanical hinges, pivot pins or bearings to wear out.

#### D. DOMED ACCESS PORT

Full size top access port allows removal of disc without removing valve from line. Access cover includes a drilled and tapped port for installation of optional Disc Position Indicator.

#### E. DROP TIGHT SEATING

The synthetic reinforced disc, with its integral O-ring type seal design assures positive seating at high and low pressures.

#### F. NON-SLAM CLOSURE

"Short Disc Stroke" combined with Memory-Flex™ Disc Action reduces potentially destructive water hammer.

#### G. BACKFLOW ACTUATOR (Not Shown)

Body is drilled and tapped for installation of optional backflow actuator (see options).

#### H. NON-CLOG DESIGN

The unrestricted full flow area combined with smooth streamlined contouring allows passage of large solids minimizing the potential for clogging.

#### I. MECHANICAL DISC POSITION INDICATOR\* (Optional)

Provides clear indication of the valve's disc position. Can also be provided with a SCADA compatible limit switch for off site monitoring (see options).

#### J. FUSION BONDED EPOXY

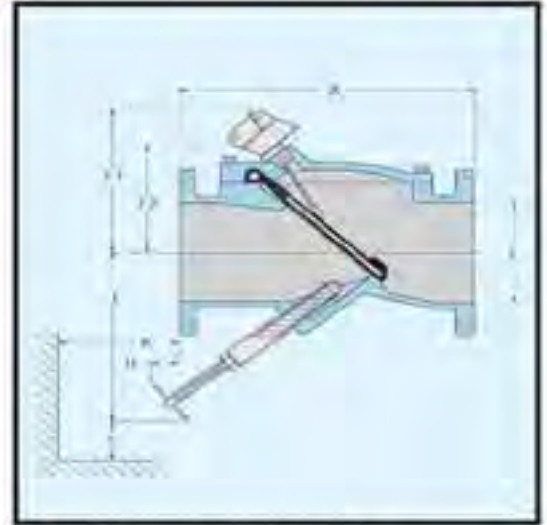
Fusion Bonded Epoxy (FBE) is provided standard on the interior and exterior of the valve. The FBE is ANSI/NSF 61 certified. Other coatings are available on request.



# INSTALLATION DIMENSIONS AND CONSTRUCTION

VALVE SIZE	MODEL #	A	E	F1	F2	H	J	K	L
2	502A	8	2	N/A	3 3/8	-1/2	6 3/4	7/8	1 1/2
2 1/2	525A	8 1/2	2 1/2	N/A	3 3/8	-1/2	7	5/8	1 1/2
3	503A	9 1/2	3	7 3/8	5 1/8	-3/8	7 1/2	3/4	1 3/8
4	504A	11 1/2	4	8 1/4	5 3/4	1 1/2	7 1/4	2 3/8	2 3/8
6	506A	15	6	9 3/8	6 7/8	2	12	6 1/4	3 1/8
8	508A	19 1/2	8	11	8 3/8	2	15 3/4	7 1/2	4 1/4
10	510A	24 1/2	10	13 3/8	10 3/4	4	20 3/8	8	5 1/4
12	512A	27 1/2	12	15	12 1/2	3 1/2	22 1/2	10	6 1/2
14	514A	31	14	17 3/8	13	4	26 1/4	11 5/8	7 1/2
16	516A	32	16	18 7/8	14 1/4	4 3/8	30	13 1/4	8 3/8
18	518A	36	18	20	15 1/4	5 1/4	33 3/4	15	9 3/4
20	520A	40	20	21 3/8	16 7/8	5 7/8	37 1/2	16 3/8	10 7/8
24	524A	48	24	23 7/8	19 1/4	7	45	20	13
30	530	56	30	27 1/8	23	-5/8	41 1/4	12	6
36	536	63	36	31	27 3/8	-6 1/8	43 1/2	8	6

Dimensions "L" and "E" represent the clearance required to remove backflow situation.



\*Dimension "E" represents nominal valve size.

Note: Flanged with surface to ANSI B16.1 Class 125.

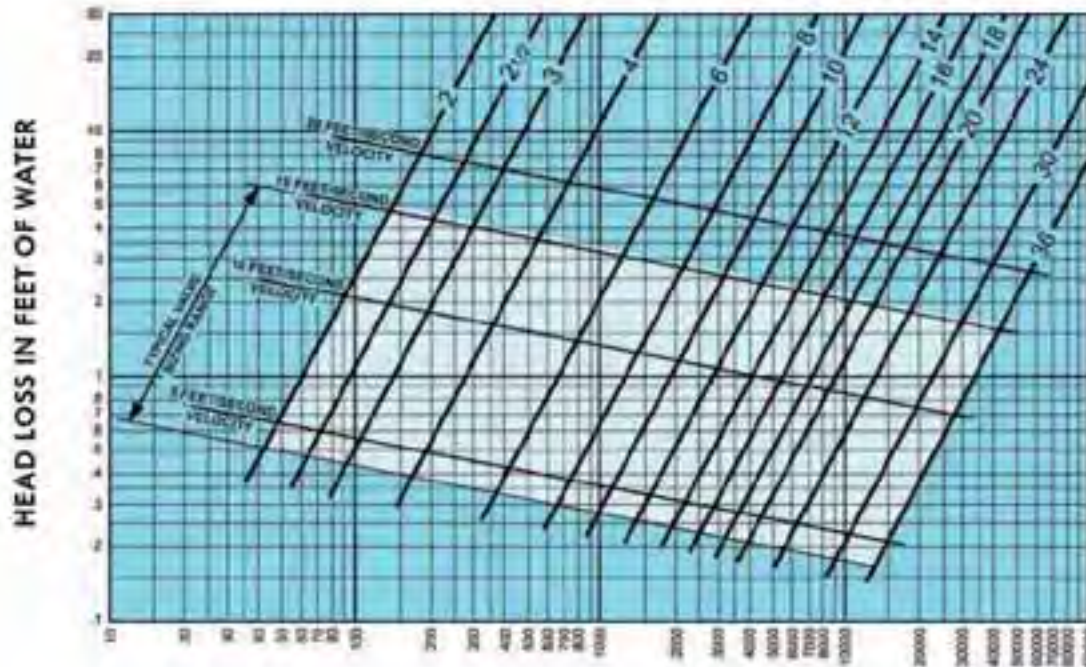
MATERIALS OF CONSTRUCTION		
Component	Standard	Optional
Body and Cover	Ductile Iron ASTM A536 Grade 65-45-12	Stainless Steel, Bronze
Disc	Buna-N (NBR), ASTM D2000-BG	Viton (FKM), ASTM D2000-HK
Coatings	Interior	Fusion Bonded Epoxy*
	Exterior	Fusion Bonded Epoxy*

\*Consult factory for additional material and coating options.

\*ANSI/NFPA 61 Certification

ANSI MAXIMUM PRESSURE-TEMPERATURE RATING		
Maximum Non-Shock Working Pressure (P.S.I.) ANSI Class 125		
Temperature °F	2" - 24"	30" - 36"
100°	250	150
150°		
200°	235	135
Hydrostatic Test Pressures	375	230

## HEAD LOSS CHART



FLOW OF WATER IN GALLONS PER MINUTE

Consult factory for Digester Gas Service

Flow Tests performed by the Utah Water Research Laboratory of Utah State University.



## SAMPLE SPECIFICATIONS

The check valve shall be of the **Swing-Flex®** full body flanged type, with a domed access cover and only one moving part - the valve disc.

The valve body shall have full flow equal to nominal pipe diameter at any point through the valve. The seating surface shall be on a 45° angle to minimize disc travel. The top access part shall be full size, allowing removal of the disc without removal of the valve from the pipeline and shall include a port for installation of an optional mechanical position indicator.

The disc shall be of one piece construction, precision molded with an integral O-ring type sealing surface and contain steel and nylon reinforcements in both the **Memory Flex™** and central disc areas. The flex portion of the disc shall be warranted for 25 years. Non-slam closing characteristic shall be provided through a short 35° disc stroke and a

**Memory-Flex™** disc return action.

A mechanical indicator shall be provided when specified to provide disc position indication on valves 3" and larger. The indicator shall have continuous contact with the disc under all operating conditions to assure accurate disc position indication.

A limit switch will be provided when specified to indicate open/closed position to a remote location. The mechanical type limit switch shall be activated by the external position indicator. The switch shall be rated for NEMA 4, 6, or 6P and shall have U.L. rated 5 amp, 125, or 250 VAC contacts.

Backflow capabilities shall be available by means of an optional screw type backflow actuator. Both the disc position indicator and backflow actuator shall be capable of installation without special tools.

The valve body and cover shall be ASTM A536 Grade 65-45-12, Class B Ductile Iron. The disc shall be Buna-N (NBR), ASTM D2000-BG.

The interior and exterior of the valve shall be coated with an ANSI/NSF 61 approved Fusion Bonded Epoxy.

The valve shall be proof of design cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

The manufacturer shall have a minimum of five years experience in the manufacture of flexible disc type check valves.

The valve shall be Val-Matic **Swing-Flex®** series 500 and shall be designed, manufactured and tested in accordance with ANSI/AWWA Standard C508.

## INDEPENDENT PROOF OF DESIGN TEST

In the case of the Val-Matic **Swing-Flex®** Check Valve, we have taken quality assurance one step further by having the valve cycle tested. Utilizing an eight-inch **Swing-Flex®** with optional signal switch, the valve was cycled over 1,000,000 (one million) times.

To place one million cycles in perspective, it would take an average of 100 cycles per day for more than 27 years

to equal the 1,000,000 cycles. Upon conclusion, PSI/Pittsburgh Testing Laboratory Division reported the following results:

1. After 1,000,000 cycles the valve's disc showed no signs of fatigue or stress cracks.
2. After 1,000,000 cycles the valve seating areas showed no signs of wear

or distortion. The valve seating remained drop tight during the low and high pressure hydrostatic tests.

3. After 1,000,000 cycles the signal switch continued to function as designed.

Copies of the PSI/Pittsburgh Testing Laboratory Division report are available upon request.

## QUALITY ASSURANCE

Val-Matic's Quality Assurance is the sum of imaginative design, solid engineering, careful manufacturing and dedicated people.

These all combine to ensure total customer satisfaction. We recognize the need for, and encourage, individual pride and the self-satisfaction, which is gained in producing reliable and quality valves.

This quality attitude permeates through the corporation from the president to our newest employee.

Testing (right) is the backbone of our quality assurance. Every **Swing-Flex®** Check Valve is 100% tested including a seat test to assure drop tight sealing and hydrostatic testing to assure the integrity of the casting.



Swing-Flex® Valve at test.



## EFFICIENCY..... RELIABILITY .....BY DESIGN!

Efficiency and reliability through simplicity of design is the key to the superior performance and long life of the Val-Matic *Swing-Flex*® Check Valve.

### ENERGY EFFICIENT BY DESIGN

The streamlined contour of the *Swing-Flex*® body provides 100% flow area with no restrictions at any point through the valve (Figure 1.) Flow tests performed by an independent laboratory have shown that this unique body design produces minimal head loss through the valve. Flow and head loss charts, developed from the test data, are shown on Page 4.

### DISC STABILIZATION BY DESIGN

In the full open position, the disc is stabilized by using body contouring to ease the direction of flow towards the disc assuring long disc life (Figure 1).

### NON-CLOGGING BY DESIGN

Clog resistant performance is achieved by maintaining an unobstructed 100% flow area, smooth streamlined body contouring and the simplicity of one moving part. The entrapment or hang-up of solids and stringy materials is minimized by the elimination of mechanical devices in the valve design. The standard 4" *Swing-Flex* is designed to pass a 3" solid.

### NON-SLAM CLOSING BY DESIGN

The non-slam closing characteristic of the *Swing-Flex*® Check Valve is achieved by utilizing a "Short Disc Stroke" in conjunction with the unique "*Memory-Flex*" action" of the valve's disc. The 35" stroke, a result of the angled seat, is less than half the typical 80" to 90" stroke of a conventional swing check valve. (Figures 1 & 2) The feature is similar to that found in high performance tilted disc check valves.

### VAL-MATIC SWING-FLEX® VALVE

Figure 1



### CONVENTIONAL SWING CHECK VALVE

Figure 2



The short disc stroke and "*Memory-Flex*" action" (Figure 1) serve to reduce the closing time of the valve. This reduced closing time minimizes flow reversal and the resultant water hammer normally associated with the sudden stoppage of reverse flow.

### RELIABILITY BY DESIGN

Operational reliability is achieved by utilizing just one moving part, the *Memory-Flex*™ disc. Extended life is —

designed into the disc by the inclusion of steel and nylon reinforcements. The steel and nylon are precision molded into the disc, providing a tough, durable disc with a 25-year warranty\*. (Figure 3)

Unlike a conventional horizontal swing check valve, the *Swing-Flex*® has no packing or O-rings, mechanical hinges, shafts, pivot pins, or bearings to wear out (Figure 3.) Upon conclusion of a 1,000,000 (one million) cycle test, an independent testing laboratory reported that the valve had no visible signs of wear and remained drop tight. (See Page 5)



Figure 3

### POSITIVE SHUT OFF BY DESIGN

The *Memory-Flex*™ disc with its integral O-ring type seal design assures drop tight seating at both high and low working pressures. Each and every valve is tested to this standard. A certified report is available upon request.

## OPTIONAL ACCESSORIES

**RUBBER LINING** — Unlike conventional swing check valves, the *Swing-Flex*® Check Valve is designed to accept synthetic or natural rubber lining. Body lining coupled with synthetic *Memory-Flex*™ discs makes the *Swing-Flex*® ideally suited for systems containing abrasive or corrosive fluids.



**DISC POSITION INDICATOR** — The cover mounted disc position indicator provides clear indication of the valve's disc position. A SCADA compatible limit switch can also be provided. Both can be provided at the time of valve purchase or for field installation at a later date.

**BACKFLOW ACTUATOR** — Available for use when manual backflow operation is required. Most commonly used for priming pumps, back flushing, draining lines, and system testing. The Val-Matic Backflow Actuator can be provided at the time of valve purchase or for field installation at a later date.



\* The Val-Matic® warranty and its operating cycle available for 25 years covering the full portion of the disc.





## Make the change to **QUALITY!** Specify **VAL-MATIC®**

Val-Matic's quality of design and meticulous workmanship has set the standards by which all others are measured. Quality design features such as Type 316 stainless steel trim as standard on Air Release, Air/Vacuum and Combination Air Valves...combined resilient/metal to metal seating for Silent Check® Valves...stabilized components that provide extended life of the Dual Disc® Check Valves...high strength and wear resistant aluminum bronze trim as standard for Tilted Disc® Check valves...unrestricted full flow area through Swing-Flex® Check Valves...heavy duty stainless steel screened inlet on Sure Seal® Foot Valves...a Cam-Centric®

Plug Valve with more requested features than any other eccentric plug valve, and the American-BFV® Butterfly Valve that provides a field replaceable seat without the need for special tools. These features coupled with our attention to detail put Val-Matic valves in a class by themselves.

Val-Matic is totally committed to providing the highest quality valves and outstanding service to our customers. Complete customer satisfaction is our goal.

# VAL-MATIC®

**VAL-MATIC VALVE AND MANUFACTURING CORP.**

905 RIVERSIDE DRIVE \* ELMHURST, IL 60126  
630/941-7600 \* FAX: 630/941-8042  
[www.valmatic.com](http://www.valmatic.com) [valve@valmatic.com](mailto:valve@valmatic.com)

*J & P Richardson Industries Pty Ltd*

---

## **5.0 FLOWMETER**

**SUPPLIER:**

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

Ph: (02) 8877 7000  
Fax: (02) 8877 7099

**MODEL:**

150 Dia. Promag 50W1F-S50A1AKABAD



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

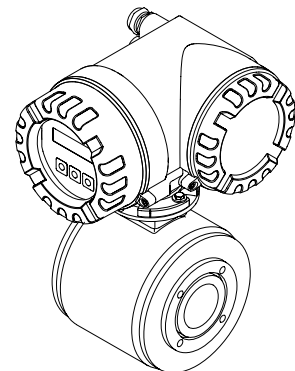
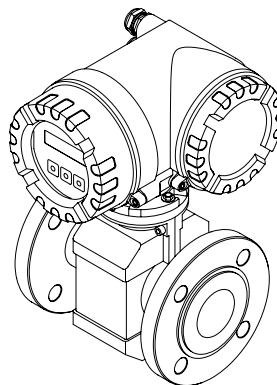
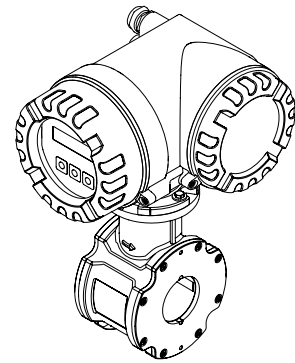
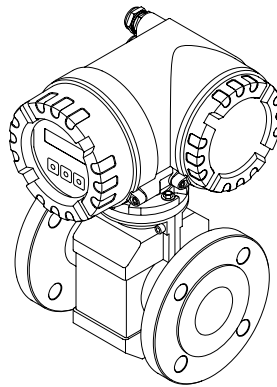


Solutions

## Operating Instructions

# Proline Promag 50

## Electromagnetic flow measuring system



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# 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  $\mu\text{S}/\text{cm}$  is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5  $\mu\text{S}/\text{cm}$ .

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 to 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.  Europe,  USA,  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

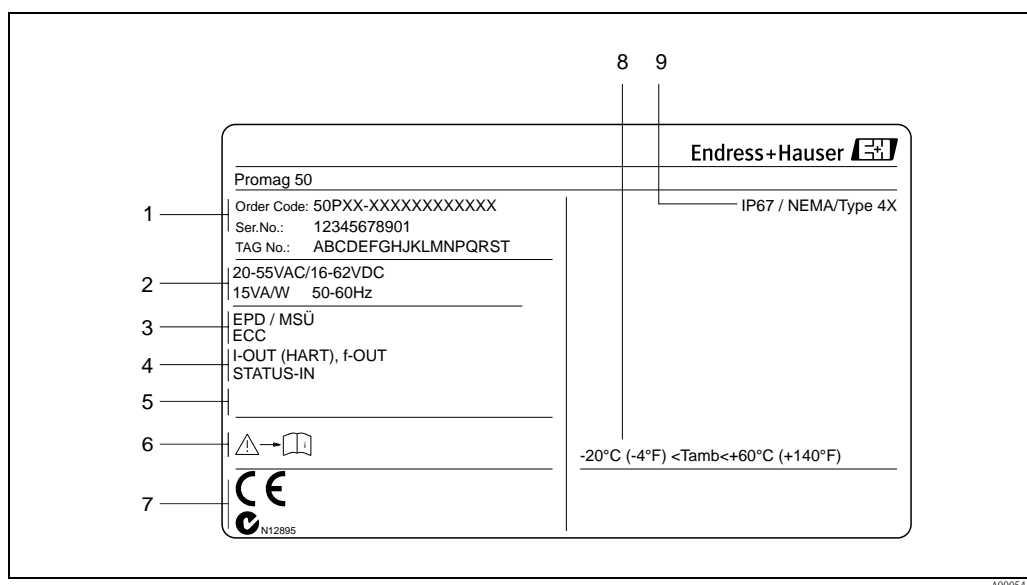


Fig. 1: Nameplate specifications for the "Promag 50" transmitter (example)

- 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

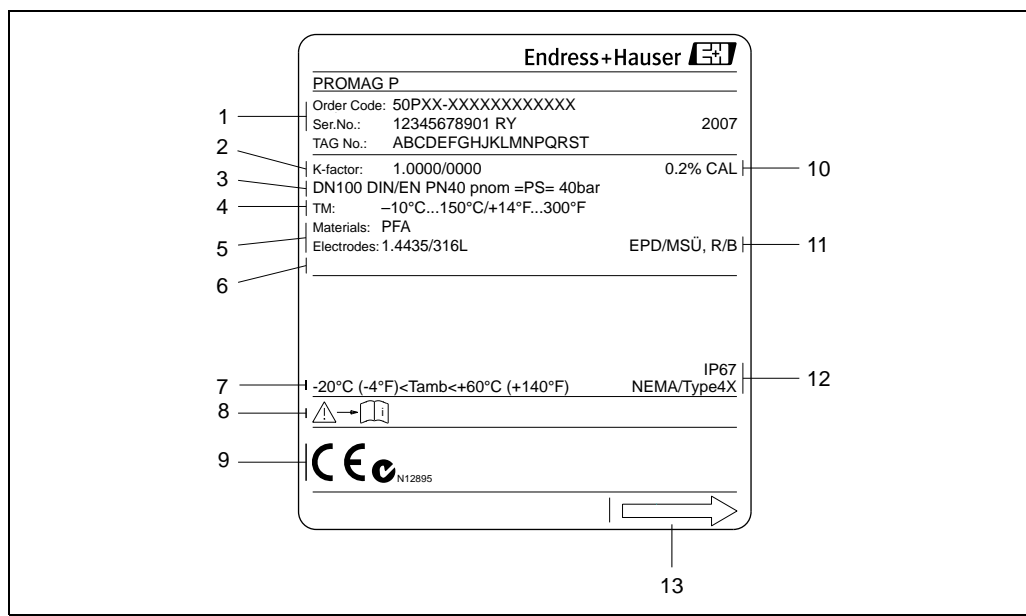


Fig. 2: Nameplate specifications for the "Promag" sensor (example)

- 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



## 2.3 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 $DN \leq 300$ ( $\leq 12''$ )*

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.

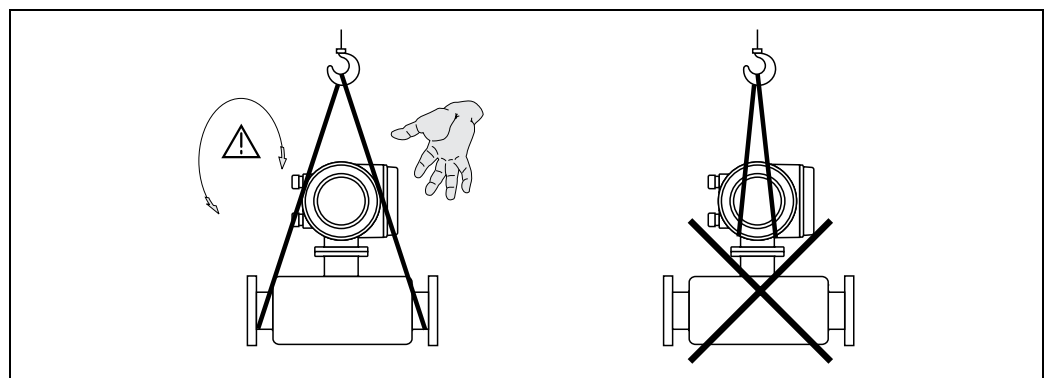


Fig. 4: Transporting sensors with  $DN \leq 300$  ( $\leq 12''$ )

a0004294

*Transporting flanged devices 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.

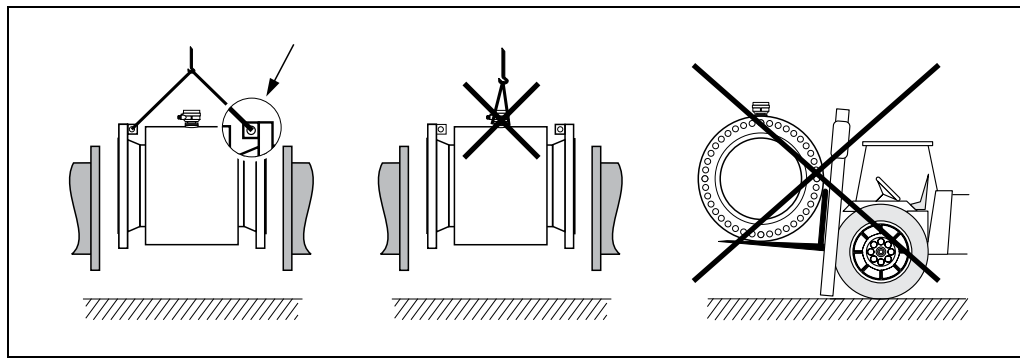


Fig. 5: Transporting sensors with DN > 300 (> 12")

### 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](http://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.

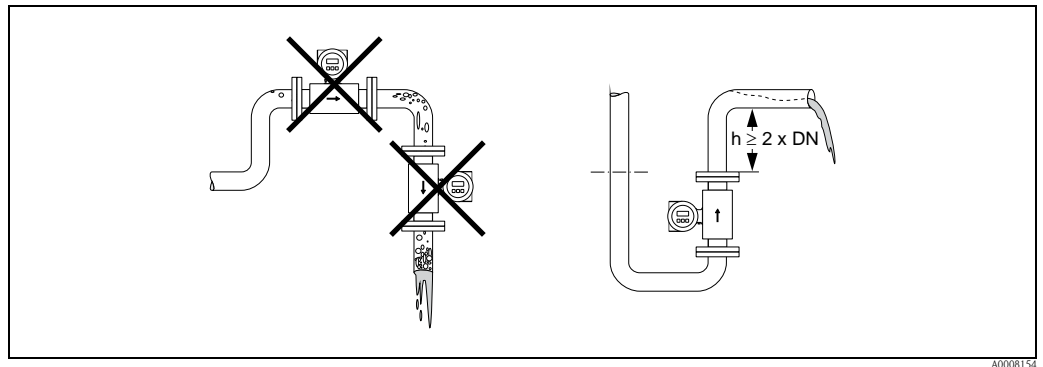


Fig. 6: Mounting location

### 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.

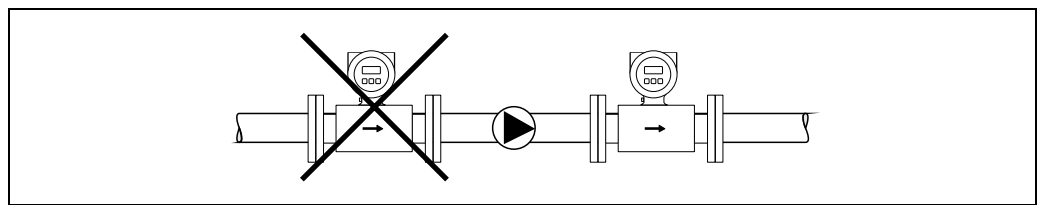


Fig. 7: Installation of pumps

### 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.

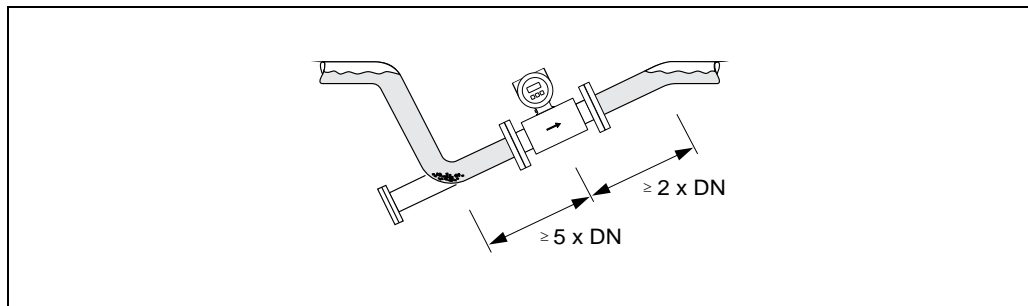


Fig. 8: Installation in a partially filled pipe

### Down pipes

Install a siphon or a vent valve downstream of the sensor in down pipes whose length  $h \geq 5$  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.

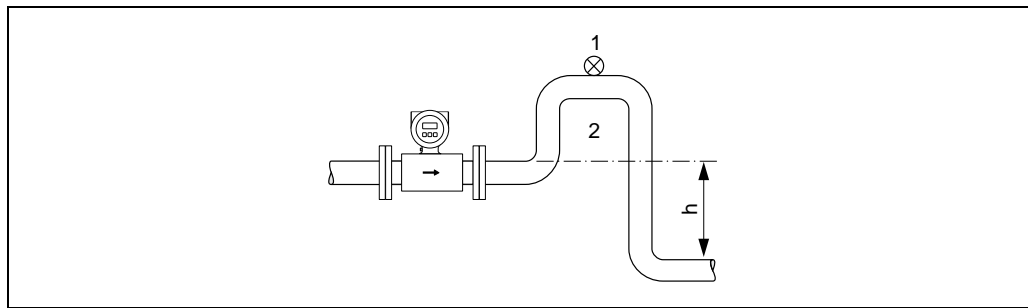


Fig. 9: Measures for installation in a down pipe

- 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.

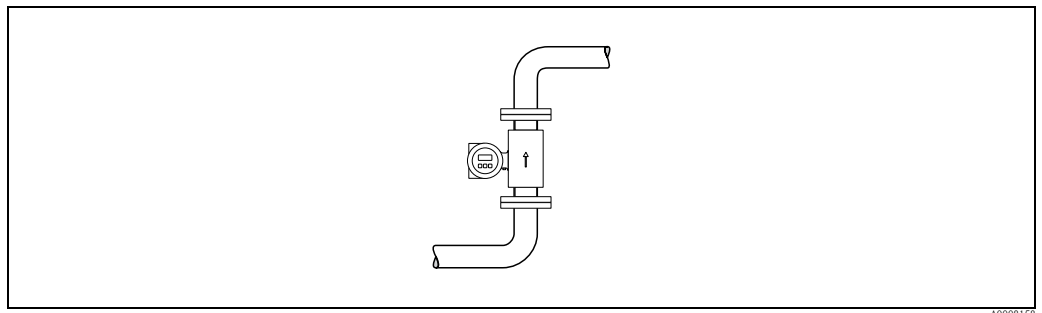


Fig. 10: Vertical orientation

#### 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.

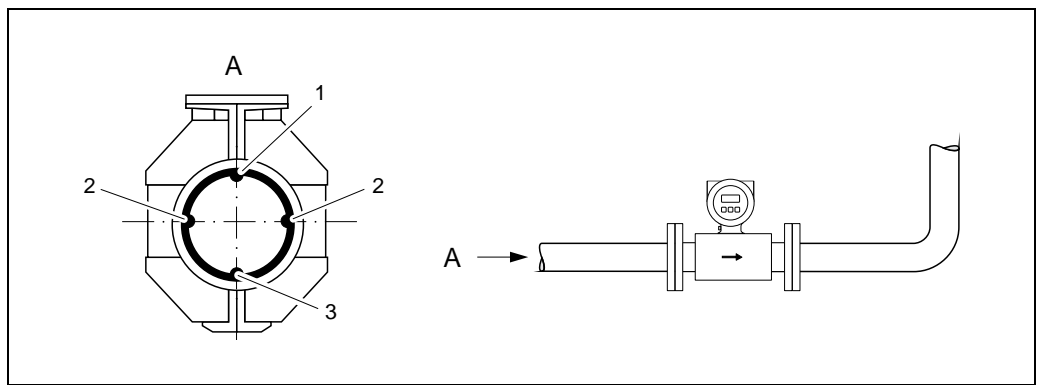


Fig. 11: Horizontal orientation

- 1 EPD electrode for the detection of empty pipes (not with Promag D and Promag H (DN 2 to 15; 1/12" to 1/2"))
- 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:  $\geq 5 \times \text{DN}$
- Outlet run:  $\geq 2 \times \text{DN}$

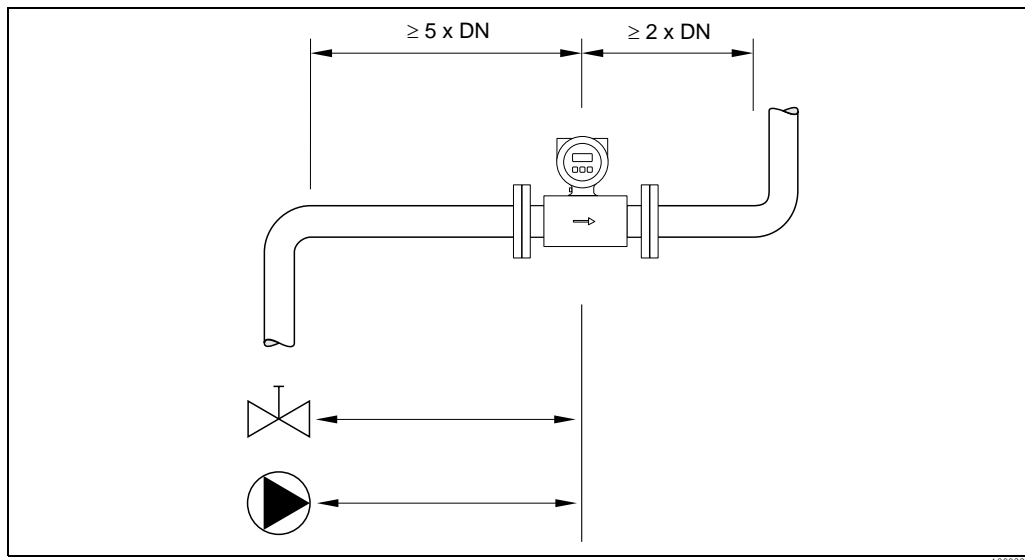


Fig. 12: Inlet and outlet runs

### 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.

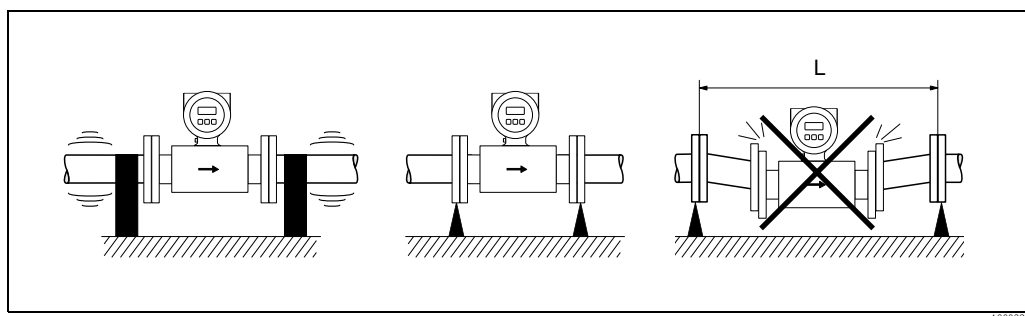


Fig. 13: Measures to prevent vibration of the device ( $L > 10 \text{ m (32.8 ft)}$ )

### 3.2.5 Foundations, supports

If the nominal diameter is  $DN \geq 350$ , 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.

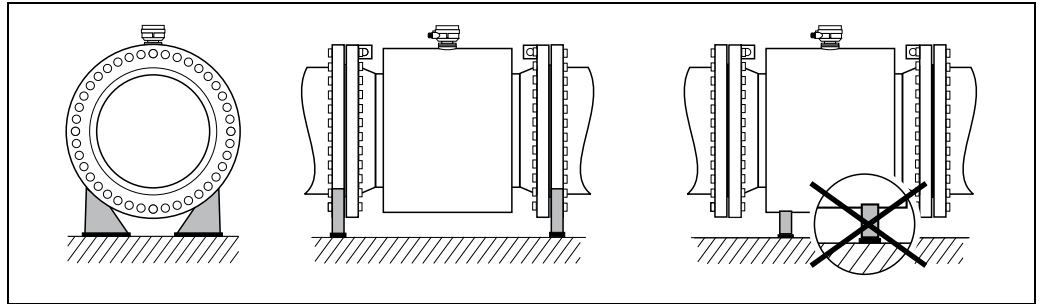


Fig. 14: Correct support for large nominal diameters ( $DN \geq 350$ )

### 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.

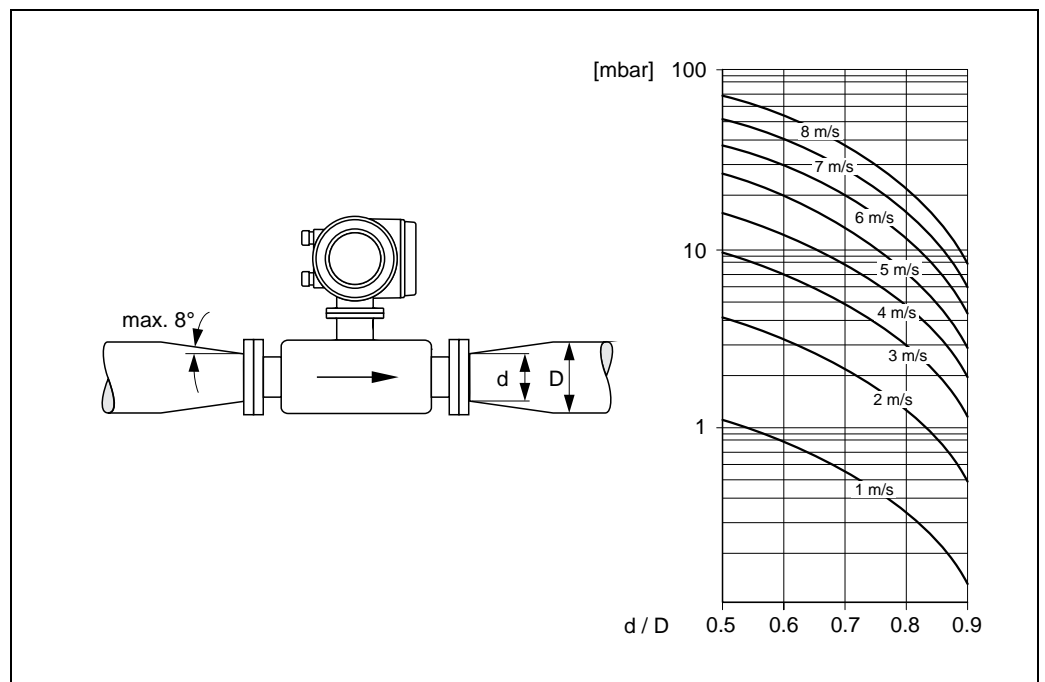


Fig. 15: Pressure loss due to adapters

### 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 ( $v \approx 0.3$ or $10$ m/s) in [dm <sup>3</sup> /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 ( $v \approx 0.3$ or $10$ m/s) in [m <sup>3</sup> /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 [inch]	Promag D	Promag L	Promag W	Promag P	Promag H
Min./max. full scale value ( $v \approx 0.3$ or $10$ m/s) in [gal/min]					
1 $\frac{1}{12}$ "	–	–	–	–	0.015 to 0.5
$\frac{5}{32}$ "	–	–	–	–	0.07 to 2
$\frac{5}{16}$ "	–	–	–	–	0.25 to 8
$\frac{1}{2}$ "	–	–	–	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 $\frac{1}{4}$ "	–	–	4 to 130	4 to 130	–
1 $\frac{1}{2}$ "	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 $\frac{1}{2}$ "	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	–	–
Min./max. full scale value ( $v \approx 0.3$ 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 ( $\rightarrow$  16). A minimum conductivity of 20  $\mu\text{S}/\text{cm}$  is required for measuring demineralized water. Most liquids can be measured as of a minimum conductivity of 5  $\mu\text{S}/\text{cm}$ .
- The maximum connecting cable length is 10 m (32.8 ft) when empty pipe detection (EPD  $\rightarrow$  74) is switched on.

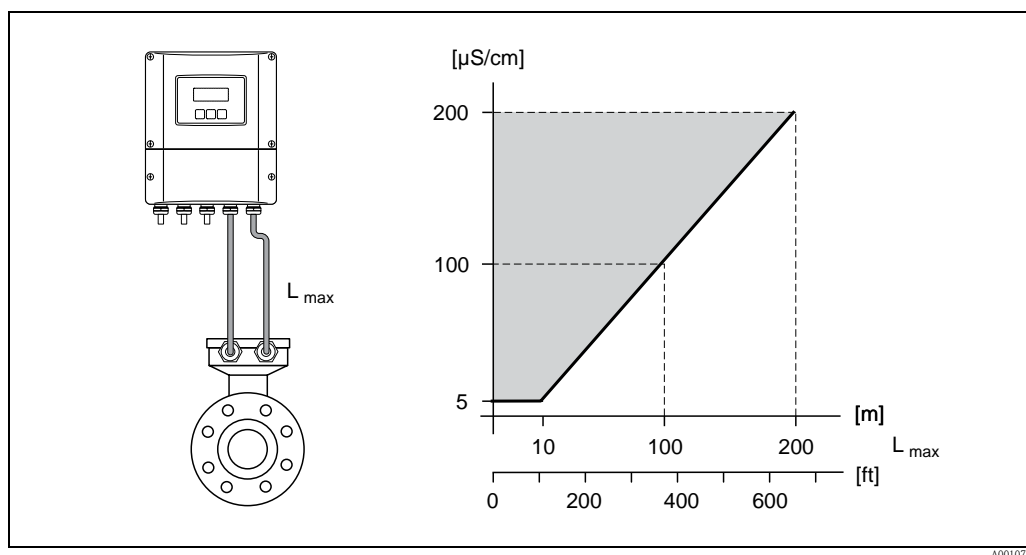


Fig. 16: Permissible cable length for the remote version

Area shaded gray = permitted range  
 $L_{\max}$  = connecting cable length in [m]  
 Fluid conductivity in [ $\mu\text{S}/\text{cm}$ ]



### 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).

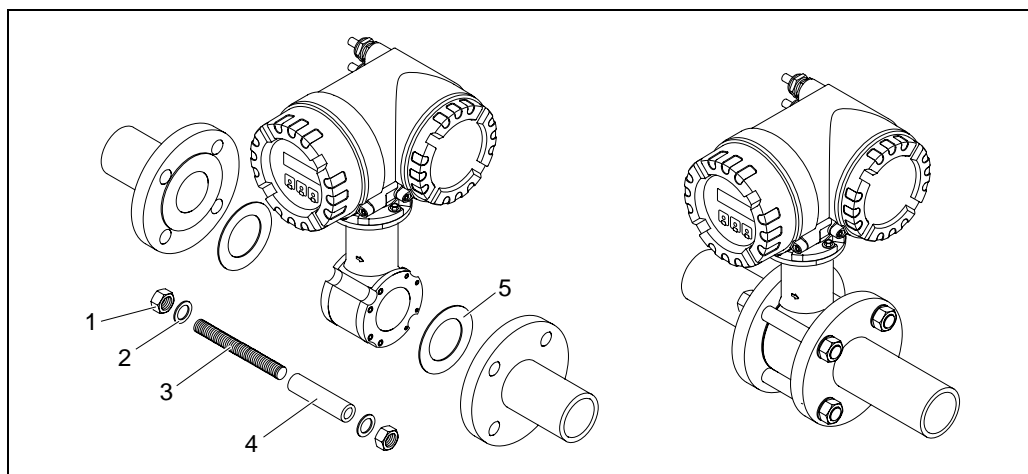


Fig. 17: Mounting the sensor

- 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.

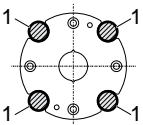
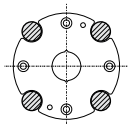
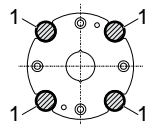
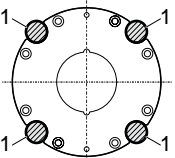
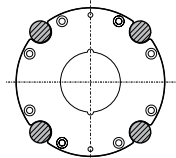
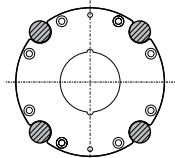
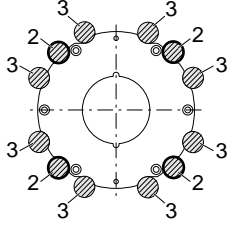
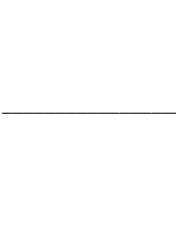
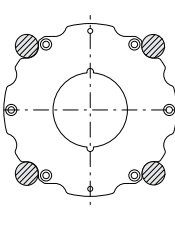
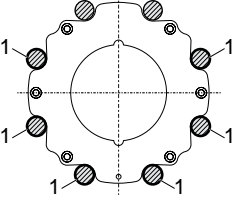
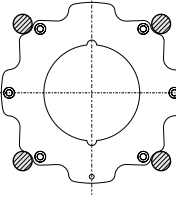
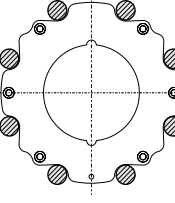
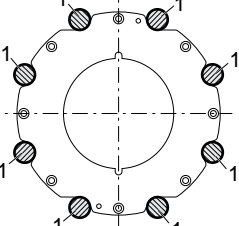
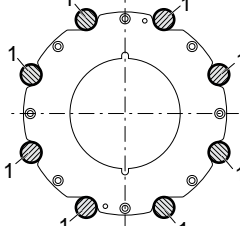
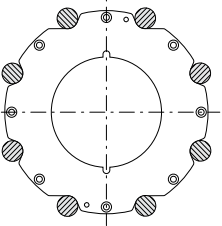


**Note!**

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 1/2")	 A0010896	 A0010824	 A0010896
DN 50 (DN 2")	 A0010897	 A0010825	 A0010825
DN 65	 A0012170	 A0010827	 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 <sup>1)</sup>	4 × M16 × 200	92	44	44
65 <sup>2)</sup>	8 × M16 × 200	– <sup>3)</sup>	29	29
80	8 × M16 × 225	116	36	36
100	8 × M16 × 260	147	40	40

<sup>1)</sup> EN (DIN) flanges: 4-hole → with centering sleeves  
<sup>2)</sup> EN (DIN) flanges: 8-hole → without centering sleeves  
<sup>3)</sup> 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 1/2"	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 concentric installation in the measuring section is required

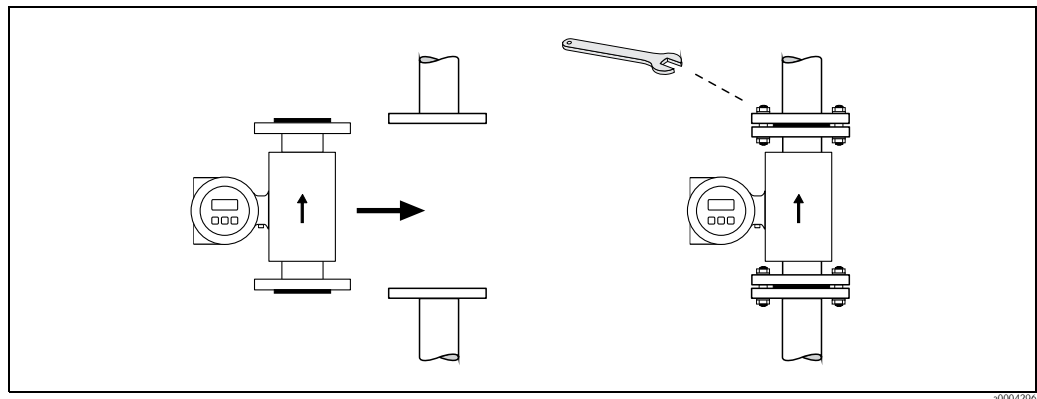


Fig. 18: Installing the Promag L sensor

#### 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]	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		ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque			
[mm]	[inch]			Polyurethane		PTFE	
				[Nm]	[lbf · ft]	[Nm]	[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 × 3/4"	45	33	90	66
200	8"	Class 150	8 × 3/4"	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

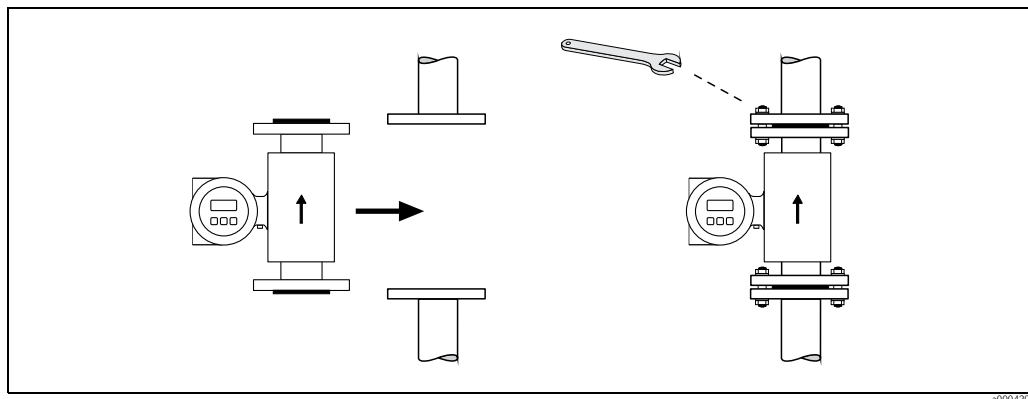


Fig. 19: Installing the Promag W sensor

#### 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)	Threaded fasteners	Max. tightening torque [Nm]	
	Pressure rating [bar]		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		ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque			
				Hard rubber		Polyurethane	
[mm]	[inch]			[Nm]	[lbf · ft]	[Nm]	[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		AWWA Pressure rating	Threaded fasteners	Max. tightening torque			
				Hard rubber		Polyurethane	
[mm]	[inch]			[Nm]	[lbf · ft]	[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

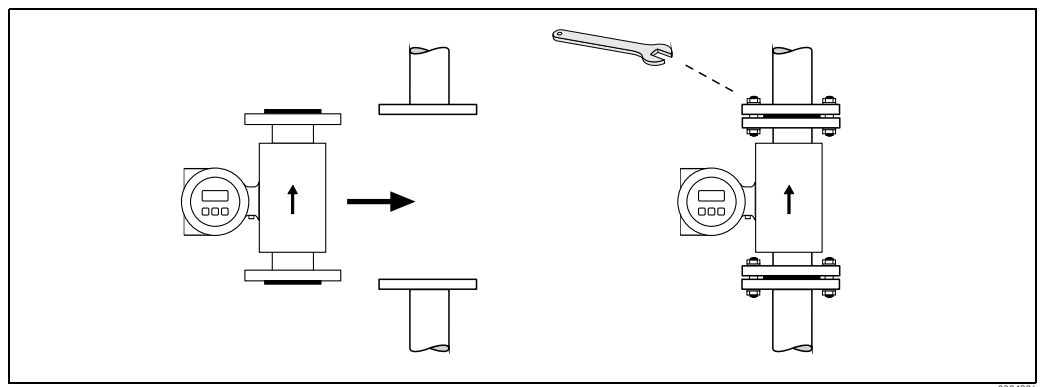


Fig. 20: Installing the Promag P sensor

### 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  $+150\text{ }^{\circ}\text{C}$ .



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.

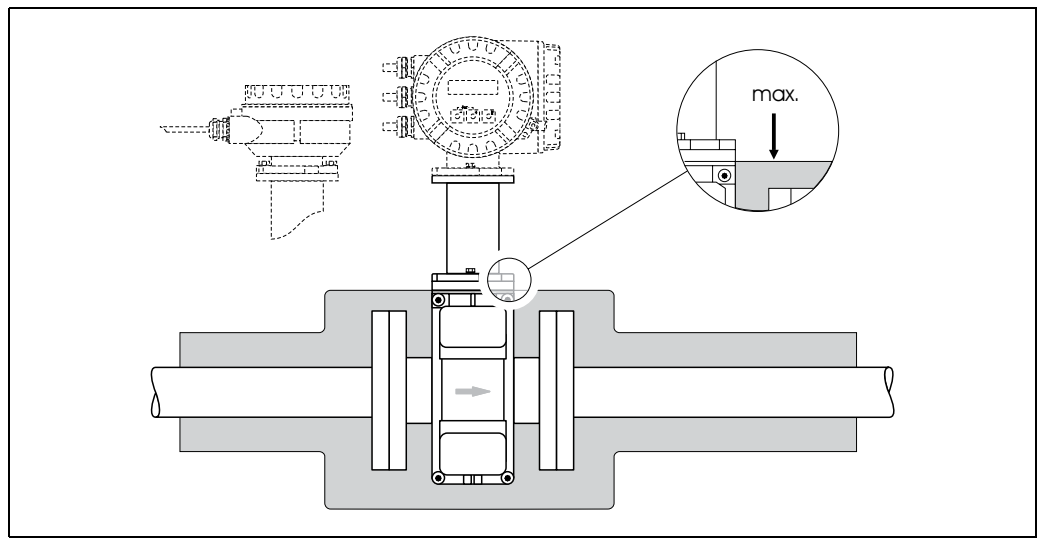


Fig. 21: Promag P (high-temperature version): Insulating the pipe

### 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		ANSI Pressure rating [lbs]	Threaded fasteners	Max. tightening torque			
[mm]	[inch]			PTFE [Nm]	[lbf · ft]	PFA [Nm]	[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).

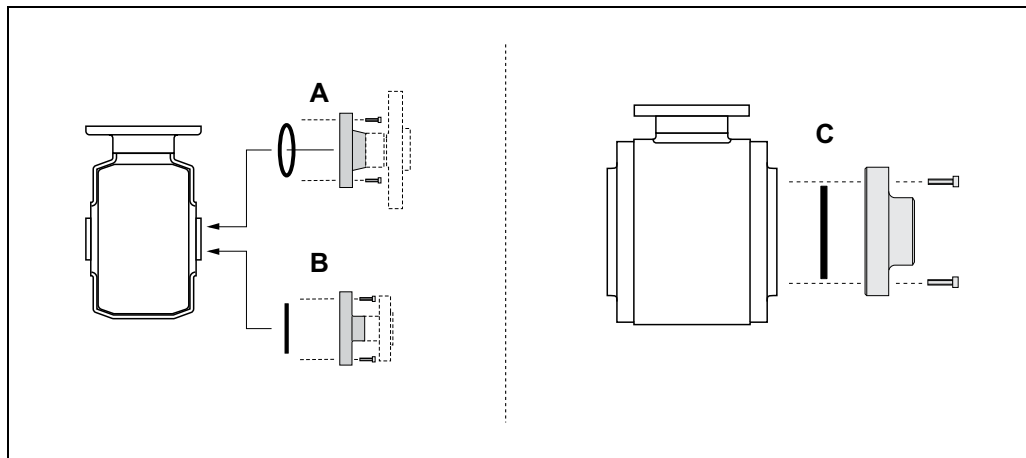


Abb. 22: Promag H process connections (DN 2...25 / DN 40...100, 1/12"...1" / DN 1½"...4")

**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 vseat**

- 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 potential 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).

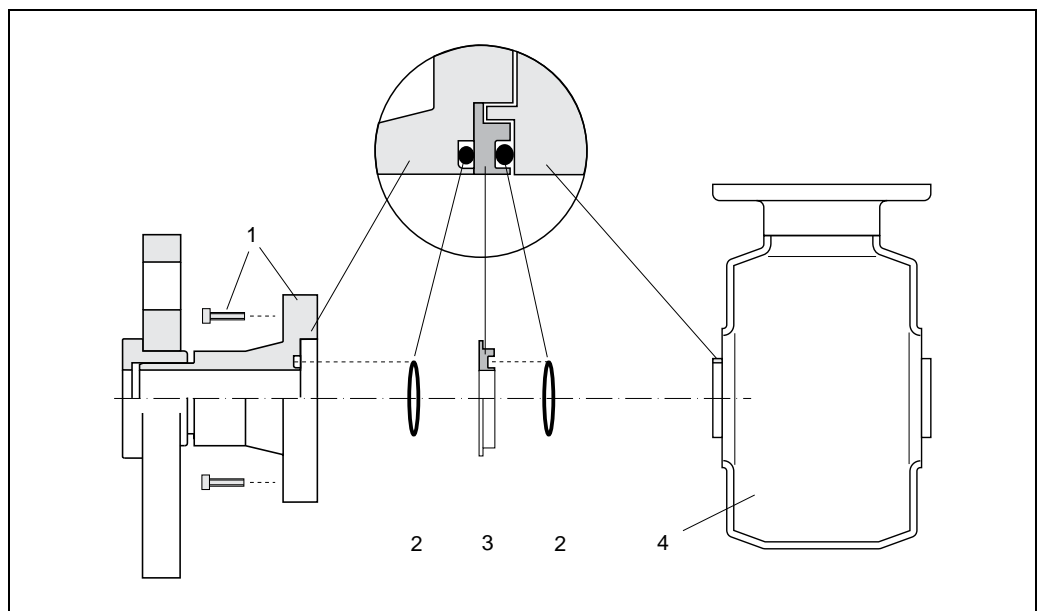


Fig. 23: Installing ground rings with Promag H (DN 2 to 25, 1/12" to 1")

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.

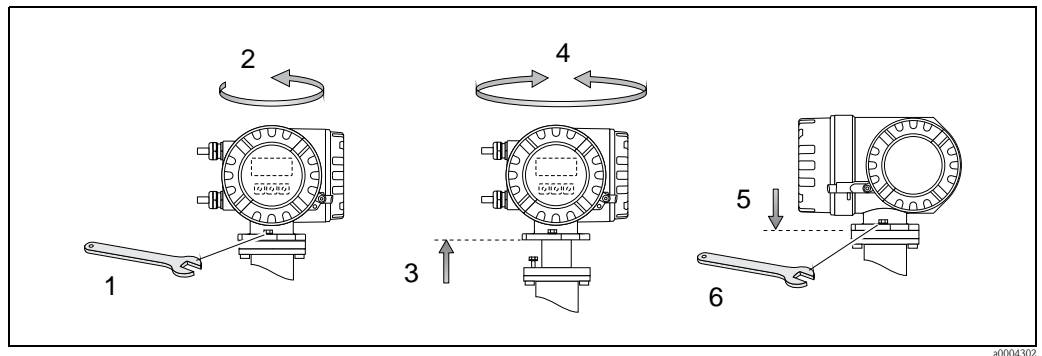


Fig. 24: Turning the transmitter housing (aluminum field housing)

#### 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.  $2 \times 90^\circ$  in either direction).
4. Lower the housing into position.
5. Retighten the two securing screws.

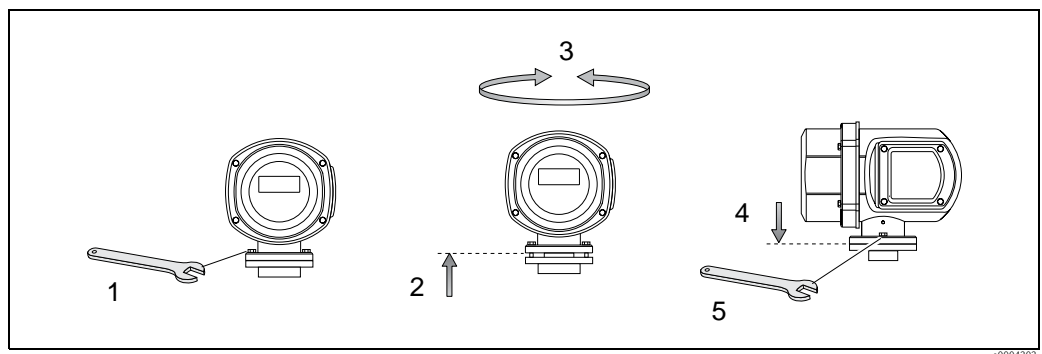


Fig. 25: Turning the transmitter housing (stainless-steel field housing)

### 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.  $4 \times 45^\circ$  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.

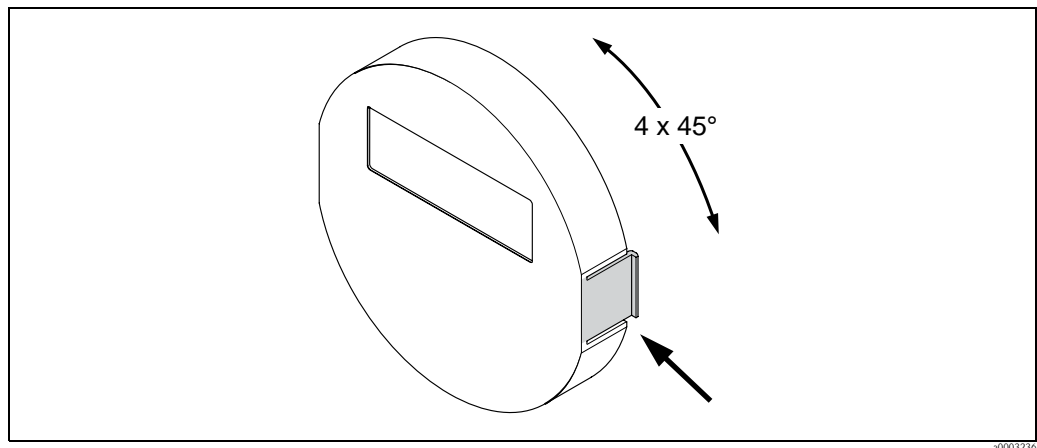


Fig. 26: Turning the local display (field housing)

### 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.

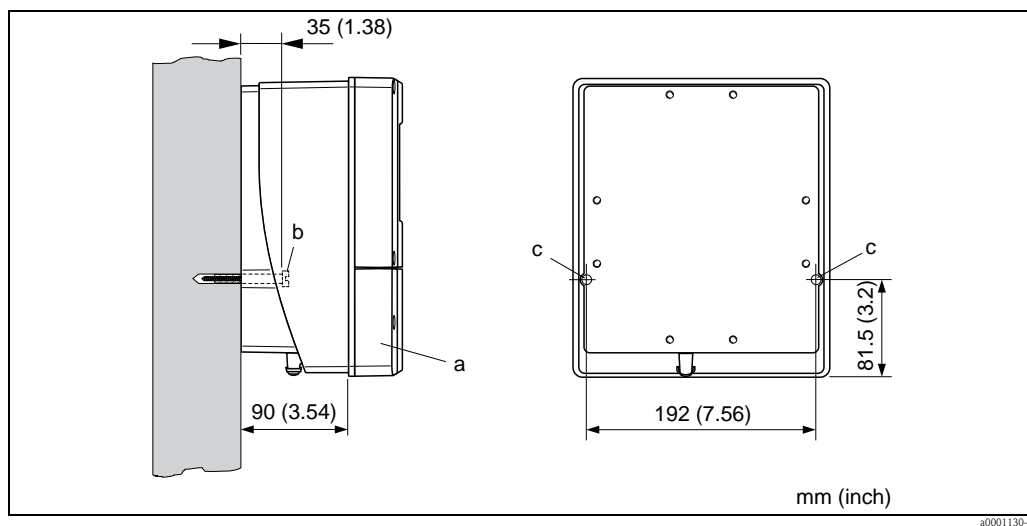


Fig. 27: Mounted directly on the wall

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### 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.

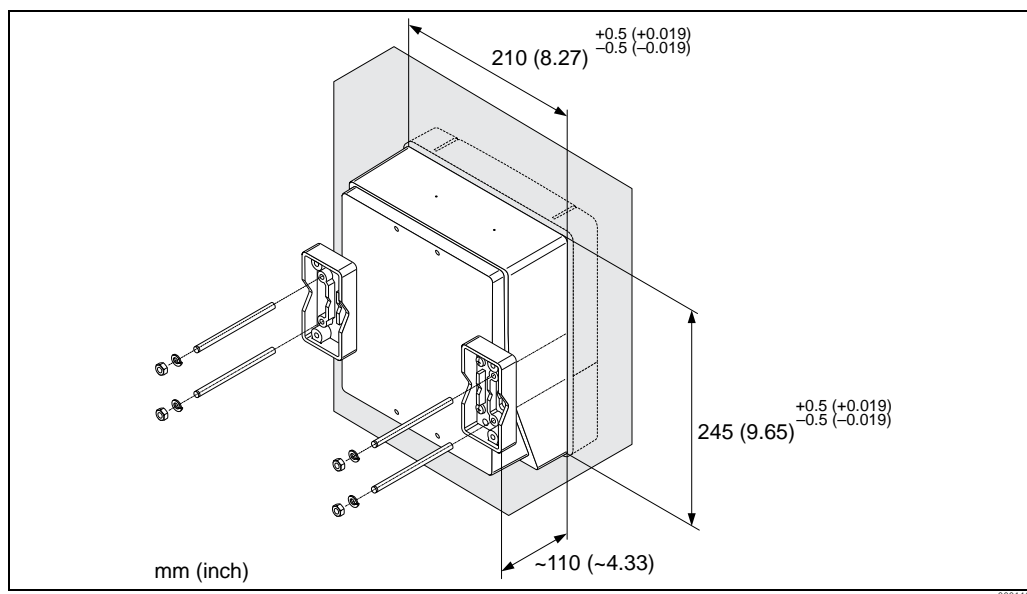


Fig. 28: Panel installation (wall-mount housing)

### 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.

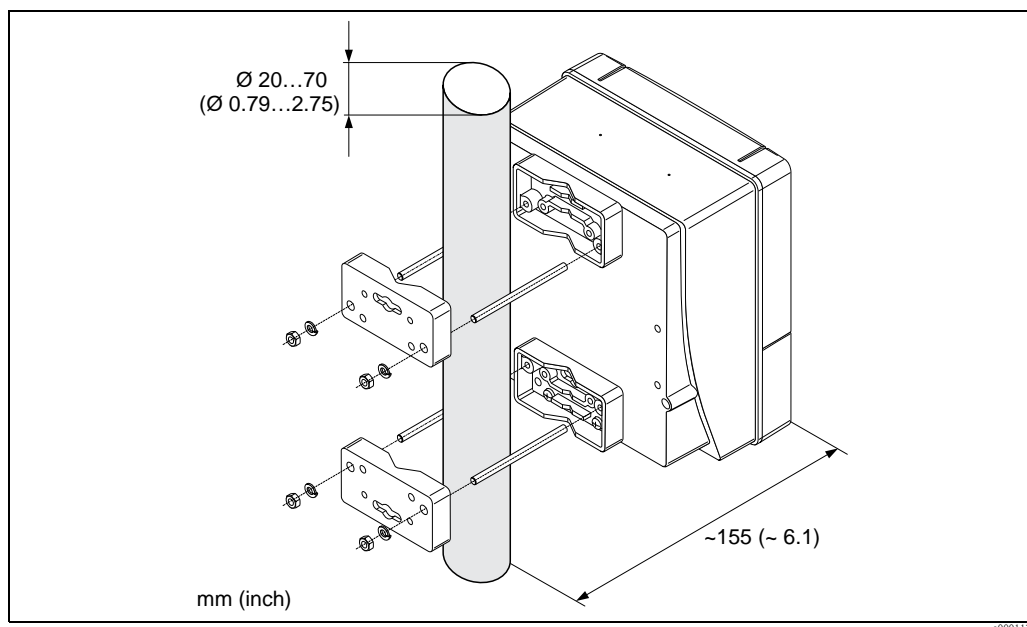


Fig. 29: Pipe mounting (wall-mount housing)

### 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 $\geq 5 \times \text{DN}$ Outlet run $\geq 2 \times \text{DN}$
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).



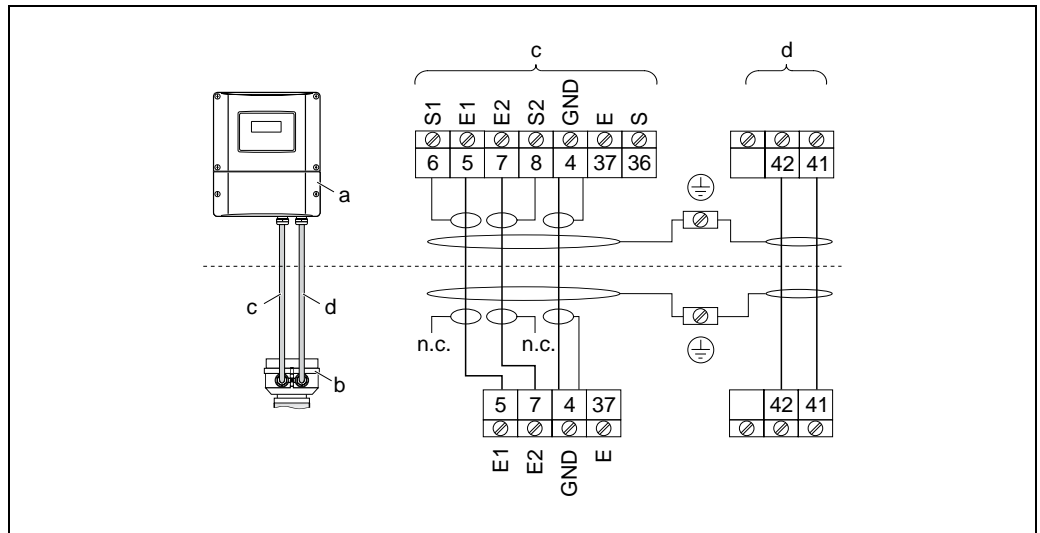
**Promag D**

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

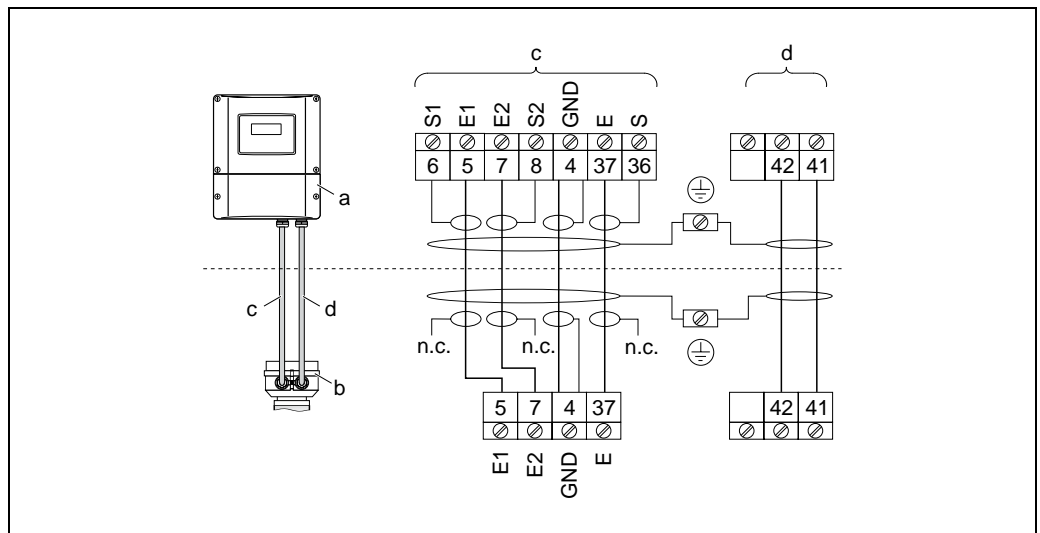
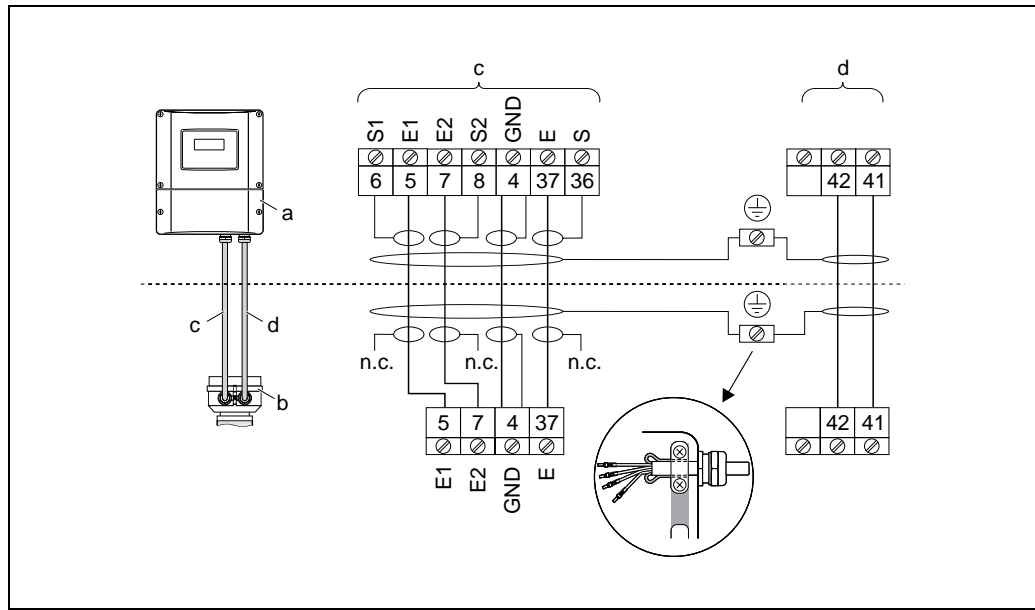
**Promag L, W, P**

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**

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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!**

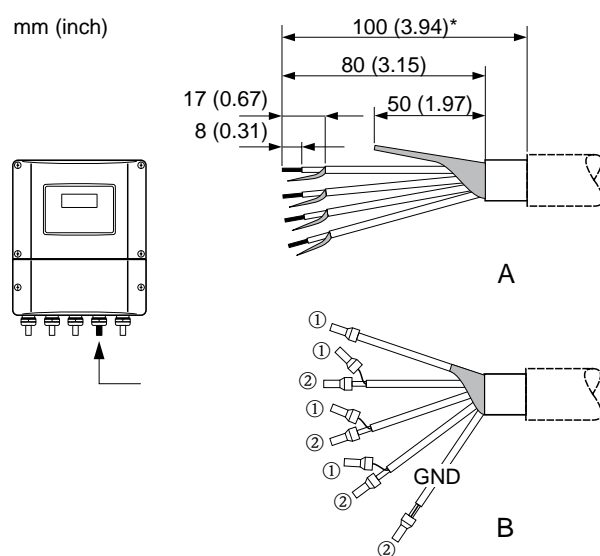
When fitting the connectors, pay attention to the following points:

- **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.

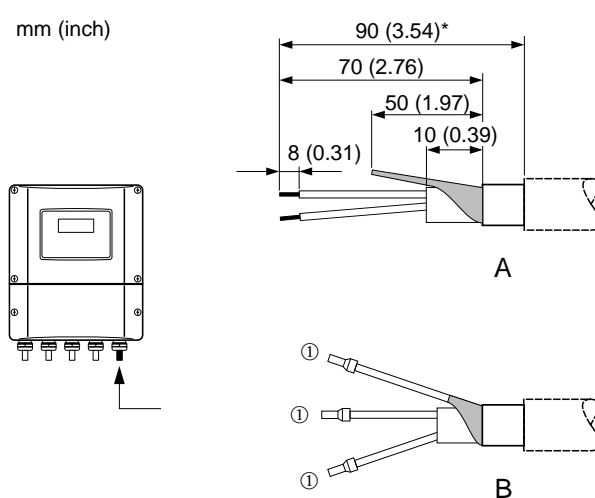
## TRANSMITTER

Signal cable

Coil current cable



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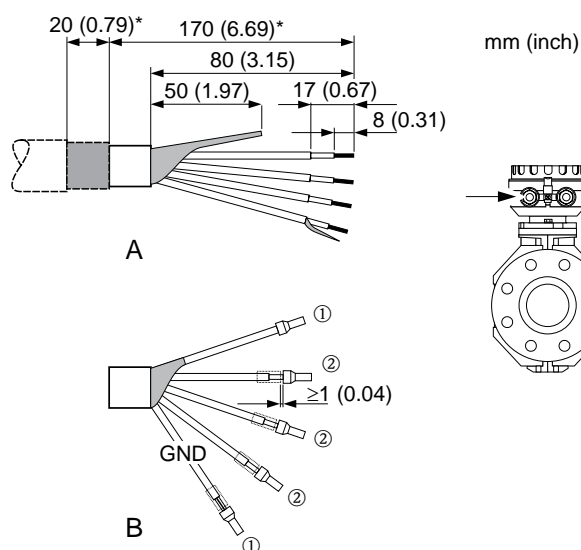


A0002688-2e

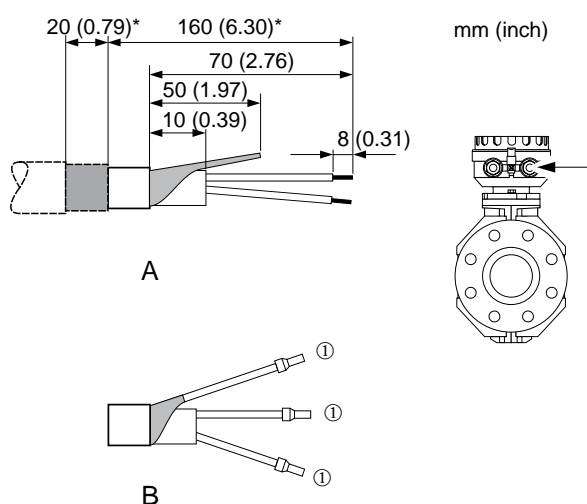
## SENSOR

Signal cable

Coil current cable



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A0002650-ae

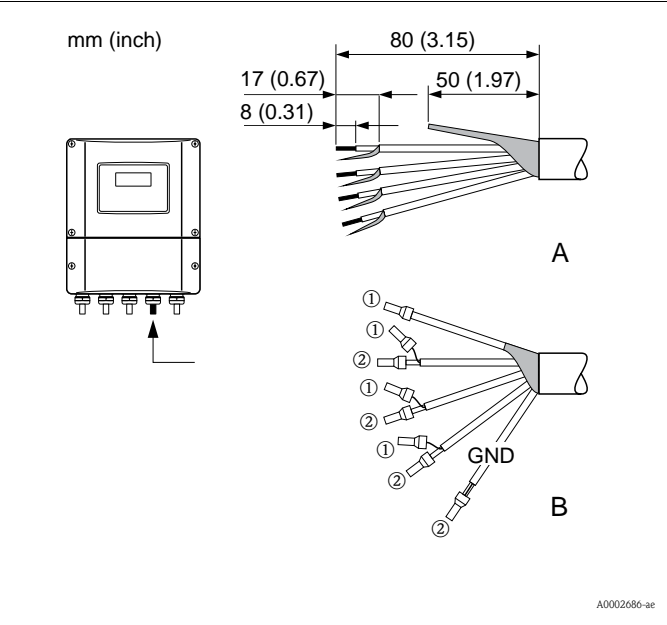
Cable termination for the remote version  
Promag H

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).

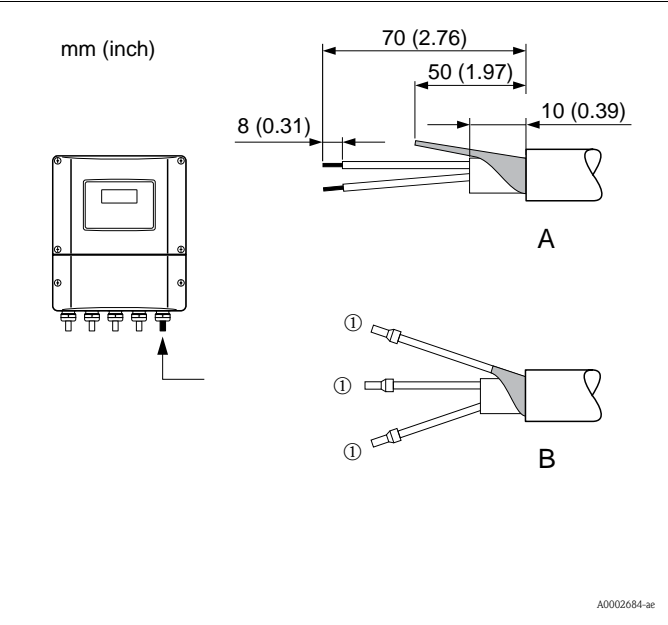
- ⚠ Caution!
- When fitting the connectors, pay attention to the following points:
- *Signal cable* → Make sure that the ferrules do not touch the wire shield on the sensor side.  
Minimum distance = 1 mm (exception "GND" = green cable).
  - *Coil current cable* → Insulate one core of the three-core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

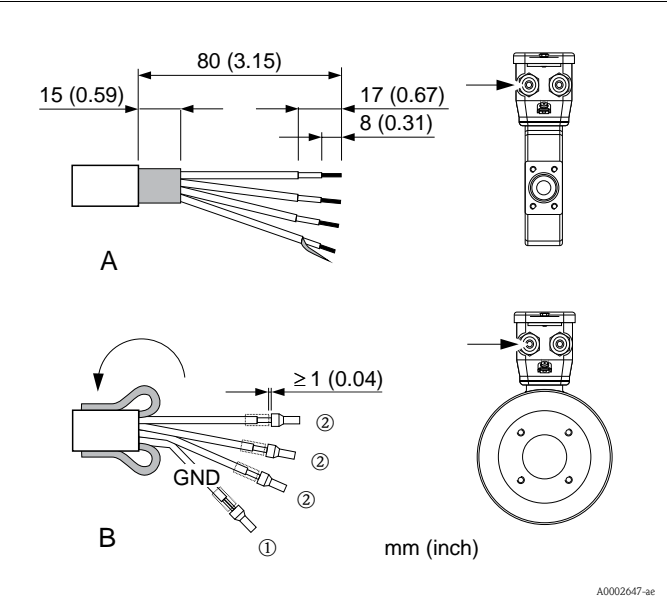


Coil current cable

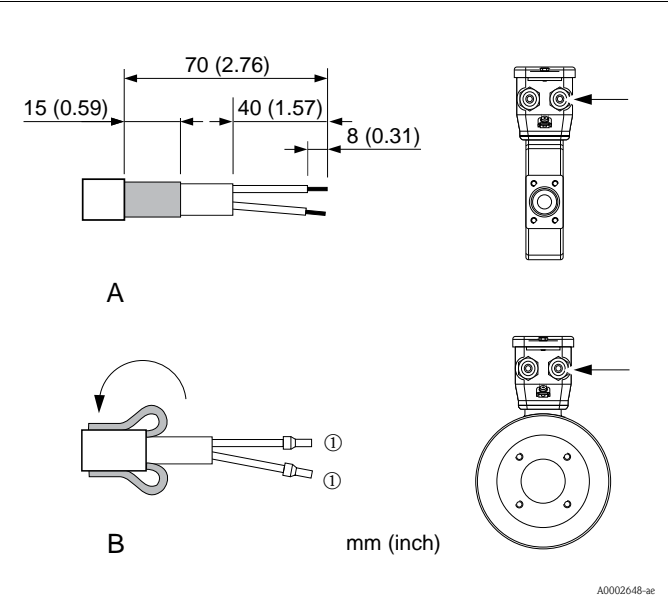


SENSOR

Signal cable



Coil current cable



## 4.1.2 Cable specifications

### Signal cable

- $3 \times 0.38 \text{ mm}^2$  PVC cable with common, braided copper shield ( $\varnothing \sim 7 \text{ mm}$ ) and individually shielded cores
- With Empty Pipe Detection (EPD):  $4 \times 0.38 \text{ mm}^2$  PVC cable with common, braided copper shield ( $\varnothing \sim 7 \text{ mm}$ ) and individually shielded cores
- Conductor resistance:  $\leq 50 \text{ } \Omega/\text{km}$
- Capacitance: core/shield:  $\leq 420 \text{ pF/m}$
- Permanent operating temperature:  $-20$  to  $+80 \text{ } ^\circ\text{C}$
- Cable cross-section: max.  $2.5 \text{ mm}^2$

### Coil cable

- $2 \times 0.75 \text{ mm}^2$  PVC cable with common, braided copper shield ( $\varnothing \sim 7 \text{ mm}$ )
- Conductor resistance:  $\leq 37 \text{ } \Omega/\text{km}$
- Capacitance: core/core, shield grounded:  $\leq 120 \text{ pF/m}$
- Operating temperature:  $-20$  to  $+80 \text{ } ^\circ\text{C}$
- Cable cross-section: max.  $2.5 \text{ mm}^2$
- Test voltage for cable insulation:  $\geq 1433 \text{ V AC r.m.s. } 50/60 \text{ Hz}$  or  $\geq 2026 \text{ V DC}$

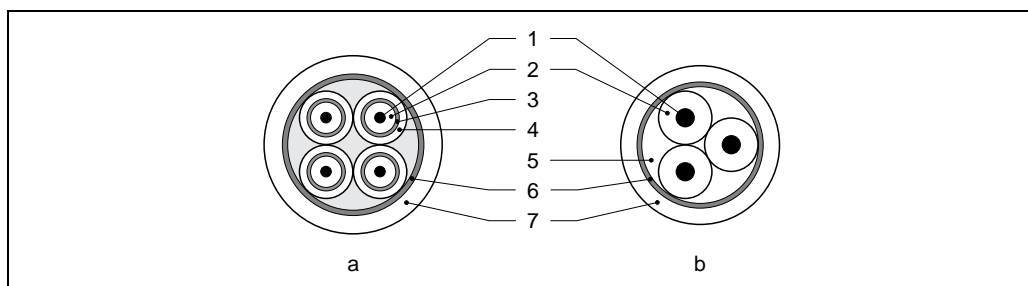


Fig. 33: Cable cross-section

- 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.

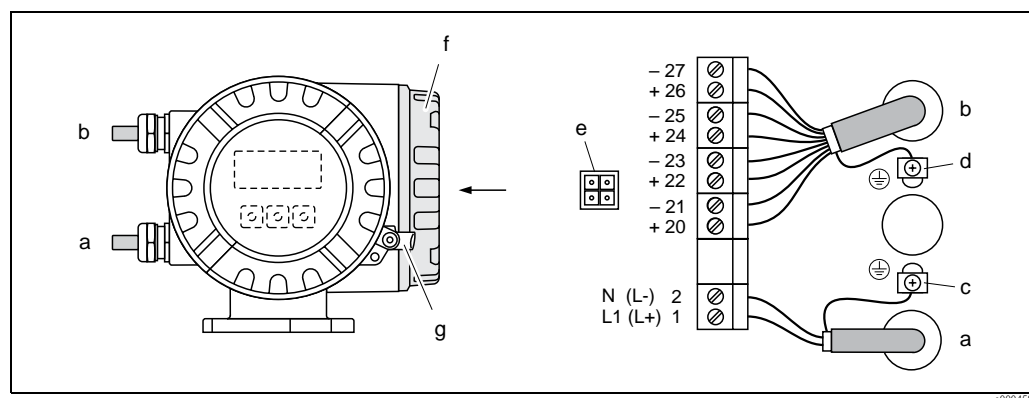


Fig. 34: Connecting the transmitter (aluminum field housing). Cable cross-section: max. 2.5 mm<sup>2</sup>

- 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

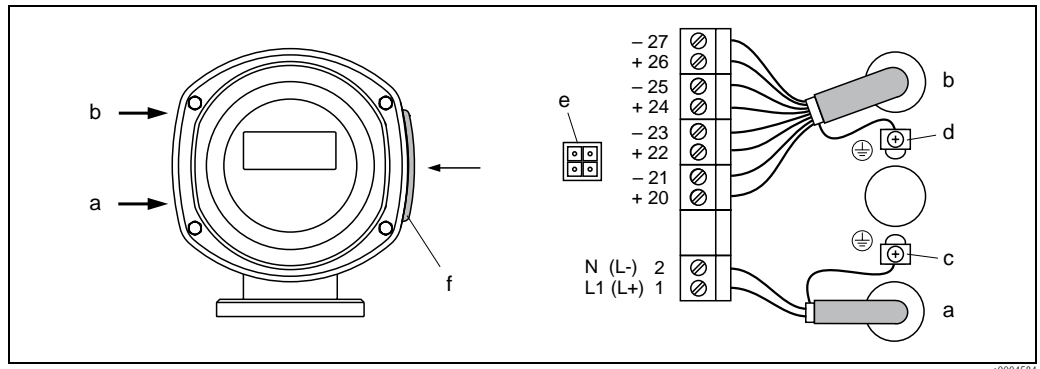


Fig. 35: Connecting the transmitter (stainless steel field housing); cable cross-section: max. 2.5 mm<sup>2</sup>

- 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

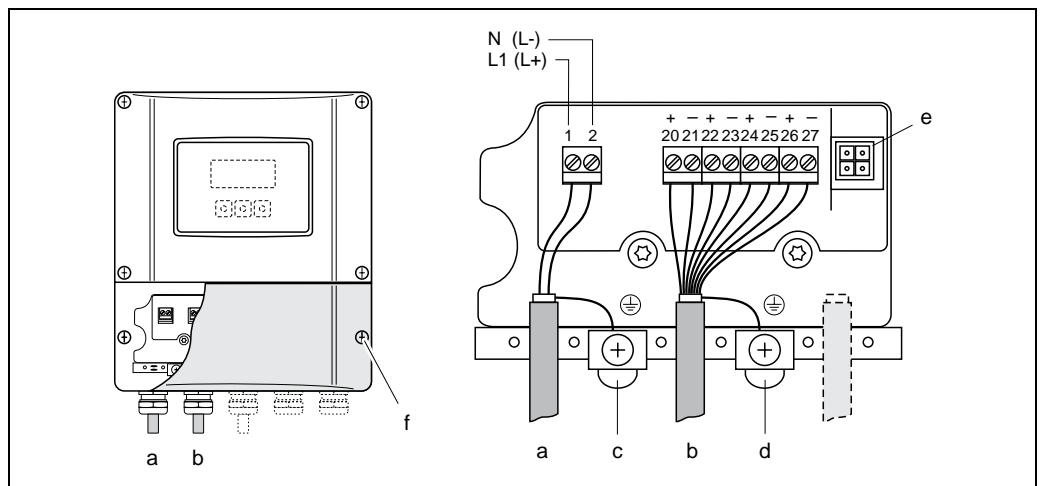


Fig. 36: Connecting the transmitter (wall-mount housing); cable cross-section: max. 2.5 mm<sup>2</sup>

- 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  $\Omega$ .
- 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".

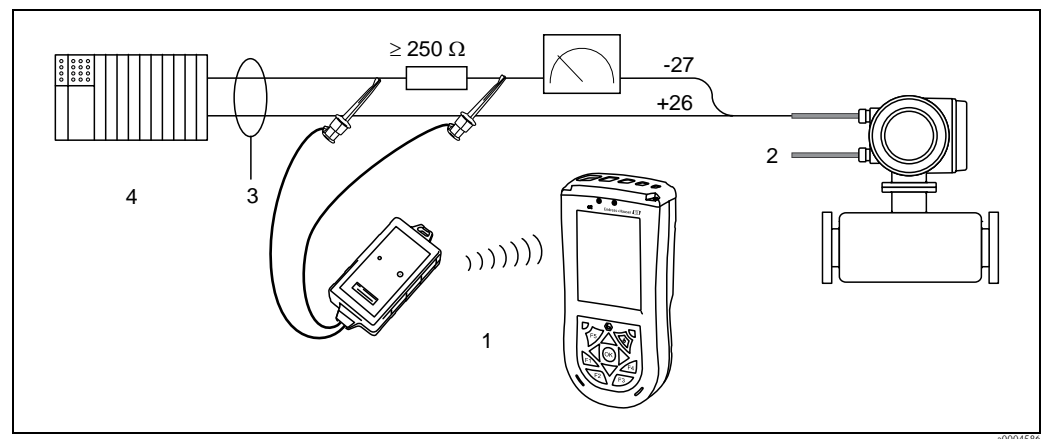


Fig. 37: Electrical connection of HART handheld Field Xpert SFX100

- 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.

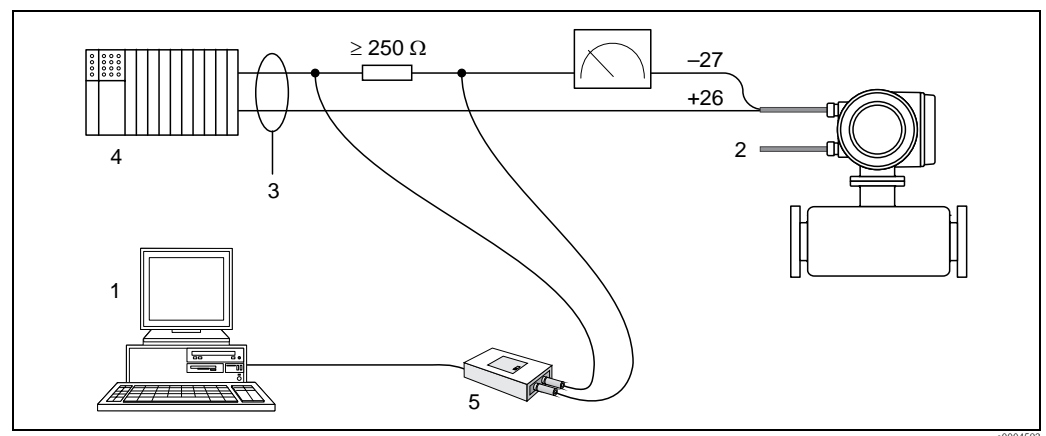


Fig. 38: Electrical connection of a PC with operating software

- 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.

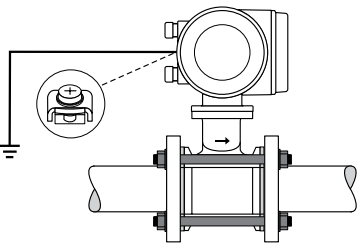


#### Caution!

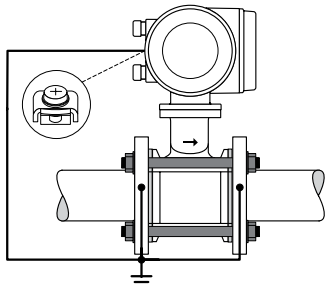
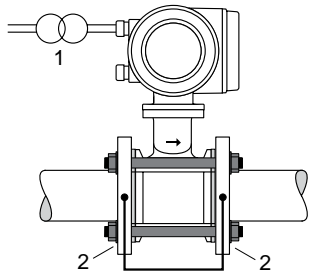
If using process connections made of a synthetic material, ground rings have to be used to ensure that potential is equalized (→ 37). The necessary ground rings can be ordered separately from Endress+Hauser as accessories (→ 77).

#### 4.3.4 Exampels for potential equalization connections for Promag D

##### Standard case


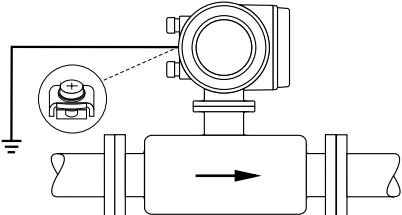
Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Metal, grounded pipe</li> <li>■ Plastic pipe</li> <li>■ Pipe with insulating lining</li> </ul> <p>Potential equalization takes place via the ground terminal of the transmitter (standard situation).</p> <p> <b>Note!</b> When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.</p>	 <p><i>Fig. 39: Via the ground terminal of the transmitter</i></p>

### Special cases


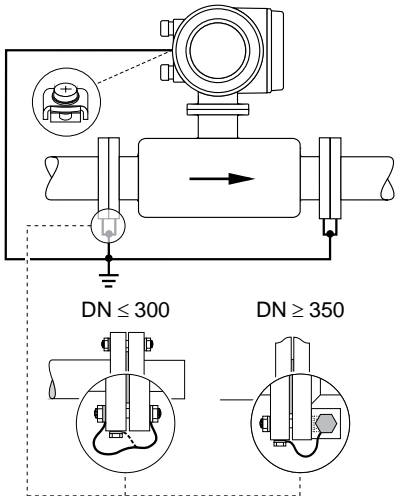
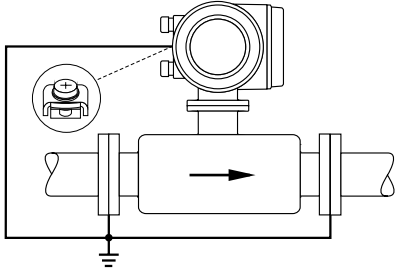
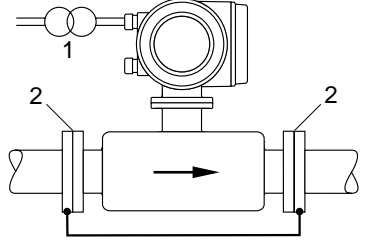
Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Metal pipe that is not grounded</li> </ul> <p>This connection method also applies in situations where:</p> <ul style="list-style-type: none"> <li>■ Customary potential equalization cannot be ensured</li> <li>■ Excessively high equalizing currents can be expected</li> </ul> <p>Potential equalization takes place via the ground terminal of the transmitter and the two pipe flanges.</p> <p>Here, the ground cable (copper wire, 6 mm<sup>2</sup> (0.0093 in<sup>2</sup>)) is mounted directly on the conductive flange coating with flange screws.</p>	 <p><i>Fig. 40: Via the ground terminal of the transmitter and the flanges of the pipe.</i></p> <p style="text-align: right;">a00012173</p>
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Pipe with a cathodic protection unit</li> </ul> <p>The device is installed potential-free in the pipe.</p> <p>Only the two flanges of the pipe are connected with a ground cable (copper wire, 6 mm<sup>2</sup> (0.0093 in<sup>2</sup>)). Here, the ground cable is mounted directly on the conductive flange coating with flange screws.</p> <p>Note the following when installing:</p> <ul style="list-style-type: none"> <li>■ The applicable regulations regarding potential-free installation must be observed.</li> <li>■ There should be <b>no</b> electrically conductive connection between the pipe and the device.</li> <li>■ The mounting material must withstand the applicable torques.</li> </ul>	 <p><i>Fig. 41: Potential equalization and cathodic protection</i></p> <p>1 Power supply isolation transformer 2 Electrically isolated</p> <p style="text-align: right;">a00012174</p>

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

#### Standard case

Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Metal, grounded pipe</li> </ul> <p>Potential equalization takes place via the ground terminal of the transmitter (standard situation).</p> <p> <b>Note!</b> When installing in metal pipes, we recommend you connect the ground terminal of the transmitter housing with the piping.</p>	 <p><i>Fig. 42: Via the ground terminal of the transmitter</i></p> <p style="text-align: right;">A0011892</p>

## Special cases

Operating conditions	Potential equalization
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Metal pipe that is not grounded</li> </ul> <p>This connection method also applies in situations where:</p> <ul style="list-style-type: none"> <li>■ Customary potential equalization cannot be ensured</li> <li>■ Excessively high equalizing currents can be expected</li> </ul> <p>Both sensor flanges are connected to the pipe flange by means of a ground cable (copper wire, 6 mm<sup>2</sup> (0.0093 in<sup>2</sup>)) and grounded. Connect the transmitter or sensor connection housing, as applicable, to ground potential by means of the ground terminal provided for the purpose.</p> <p>Ground cable installation depends on the nominal diameter:</p> <ul style="list-style-type: none"> <li>■ DN ≤ 300: The ground cable is mounted directly on the conductive flange coating with the flange screws.</li> <li>■ DN ≥ 350: The ground cable is mounted directly on the metal transport bracket.</li> </ul> <p> <b>Note!</b> The ground cable for flange-to-flange connections can be ordered separately as an accessory from Endress+Hauser.</p>	 <p>DN ≤ 300      DN ≥ 350</p> <p style="text-align: right;">A0011893</p> <p><i>Fig. 43: Via the ground terminal of the transmitter and the flanges of the pipe</i></p>
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Plastic pipe</li> <li>■ Pipe with insulating lining</li> </ul> <p>This connection method also applies in situations where:</p> <ul style="list-style-type: none"> <li>■ Customary potential equalization cannot be ensured</li> <li>■ Excessively high equalizing currents can be expected</li> </ul> <p>Potential equalization takes place using additional ground disks, which are connected to the ground terminal via a ground cable (copper wire, min. 6 mm<sup>2</sup> (0.0093 in<sup>2</sup>)). When installing the ground disks, please comply with the enclosed Installation Instructions.</p>	 <p style="text-align: right;">A0011895</p> <p><i>Fig. 44: Via the ground terminal of the transmitter</i></p>
<p>When using the measuring device in a:</p> <ul style="list-style-type: none"> <li>■ Pipe with a cathodic protection unit</li> </ul> <p>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 mm<sup>2</sup> (0.0093 in<sup>2</sup>)). Here, the ground cable is mounted directly on the conductive flange coating with flange screws.</p> <p>Note the following when installing:</p> <ul style="list-style-type: none"> <li>■ The applicable regulations regarding potential-free installation must be observed.</li> <li>■ There should be <b>no</b> electrically conductive connection between the pipe and the device.</li> <li>■ The mounting material must withstand the applicable torques.</li> </ul>	 <p style="text-align: right;">A0011896</p> <p><i>Fig. 45: Potential equalization and cathodic protection</i></p> <p>1 Power supply isolation transformer 2 Electrically isolated</p>

## 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.

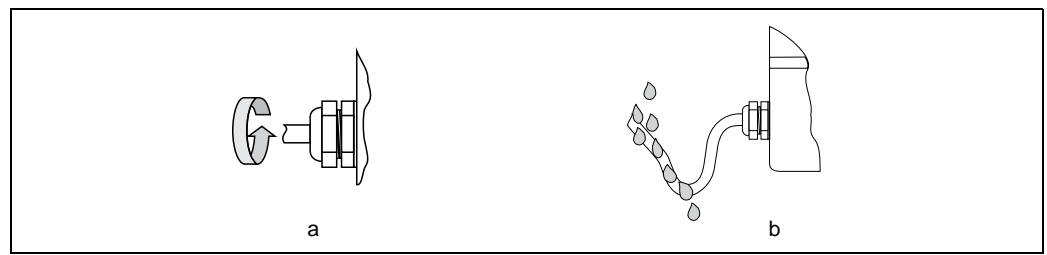


Fig. 46: Installation instructions, cable entries



### 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?	<ul style="list-style-type: none"> <li>■ 85 to 250 V AC (50 to 60 Hz)</li> <li>■ 20 to 28 V AC (50 to 60 Hz)</li> <li>11 to 40 V DC</li> </ul>
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).

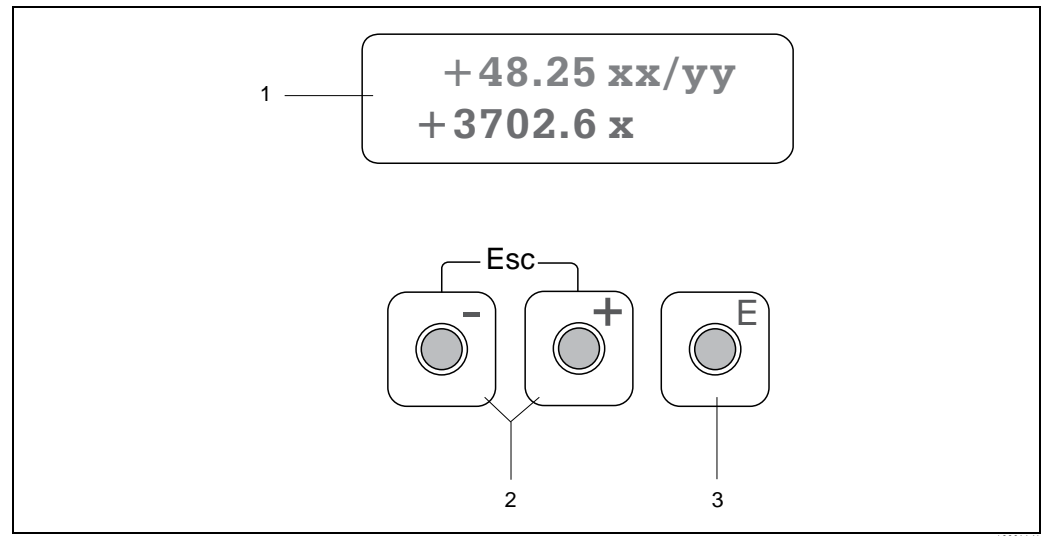


Fig. 47: Display and operating elements

**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

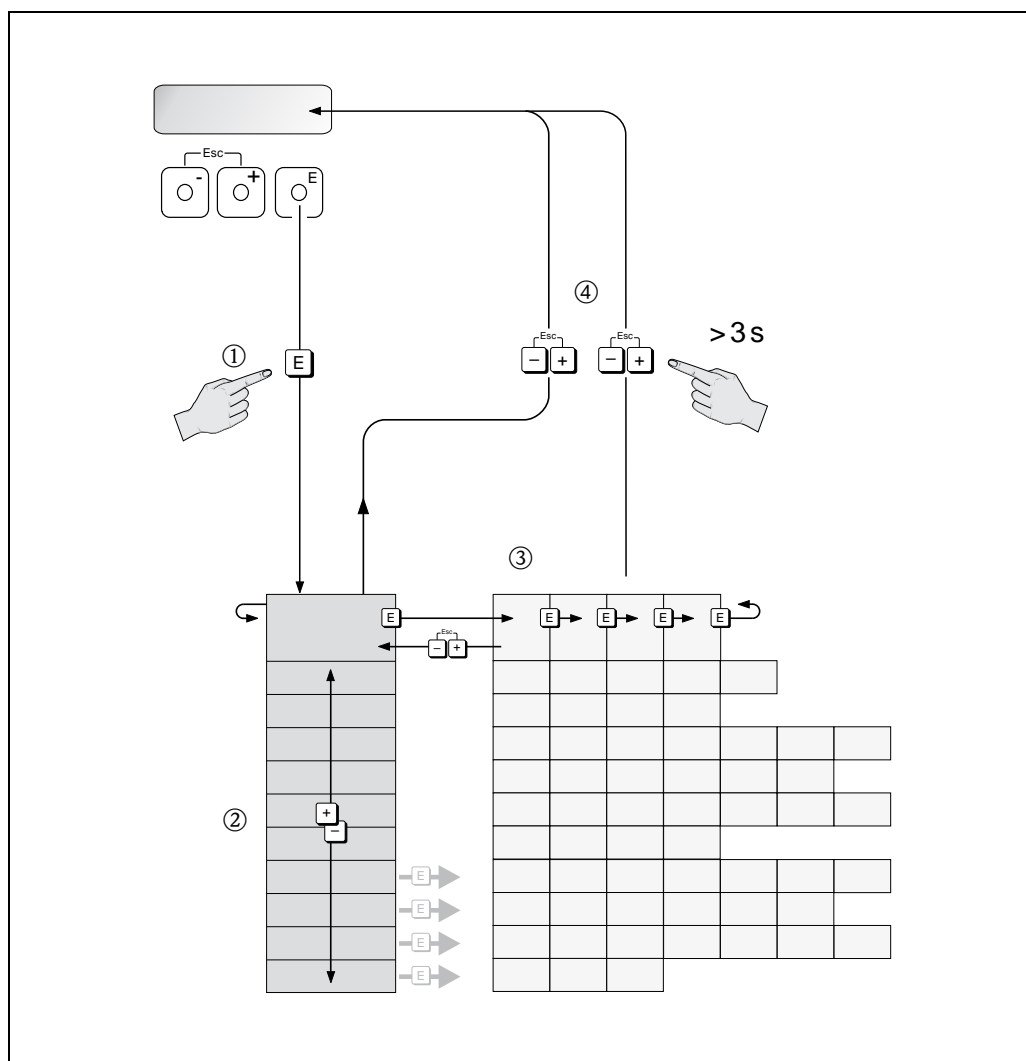



Fig. 48: Selecting functions and configuring parameters (function matrix)




A0001142



### 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  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.

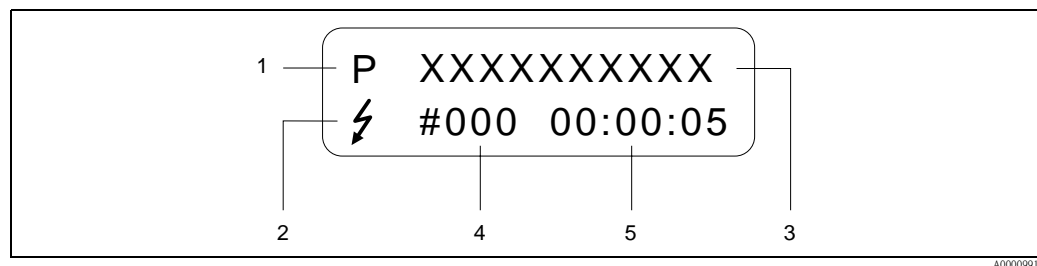


Fig. 49: Error messages on the display (example)

1 Error type:

- P = process error
- S = system error

2 Error message type:

- ⚡ = 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 (⚡)

- Displayed as → Lightning flash (⚡), 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:

<b>Valid for device software:</b>	2.03.XX	→ Function DEVICE SOFTWARE
<b>Device data HART</b>		
Manufacturer ID:	11 <sub>hex</sub> (ENDRESS+HAUSER)	→ Function MANUFACTURER ID
Device ID:	41 <sub>hex</sub>	→ Function DEVICE ID
<b>HART version data:</b>	Device Revision 6/ DD Revision 1	
<b>Software release:</b>	07.2009	
<b>Operating program:</b>	<b>Sources for obtaining device descriptions:</b>	
Handheld Field Xpert SFX100	Use update function of handheld terminal	
FieldCare / DTM	<ul style="list-style-type: none"> <li>■ www.endress.com → Download</li> <li>■ CD-ROM (Endress+Hauser order number 56004088)</li> <li>■ DVD (Endress+Hauser order number 70100690)</li> </ul>	
AMS	www.endress.com → Download	
SIMATIC PDM	www.endress.com → Download	

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

Command No. HART command / Access type		Command data (numeric data in decimal form)	Response data (numeric data in decimal form)
6	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: <ul style="list-style-type: none"> <li>– Byte 0: fixed value 254</li> <li>– Byte 1: Manufacturer ID, 17 = E+H</li> <li>– Byte 2: Device type ID, 65 = Promag 50</li> <li>– Byte 3: Number of preambles</li> <li>– Byte 4: Universal commands rev. no.</li> <li>– Byte 5: Device-specific commands rev. no.</li> <li>– Byte 6: Software revision</li> <li>– Byte 7: Hardware revision</li> <li>– Byte 8: Additional device information</li> <li>– Bytes 9-11: Device identification</li> </ul>
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	<ul style="list-style-type: none"> <li>– Bytes 0-5: TAG</li> <li>– Bytes 6-17: descriptor</li> <li>– Bytes 18-20: Date</li> </ul>  Note! You can write the TAG, descriptor and date using Command 18.
14	Read sensor information on primary process variable	none	<ul style="list-style-type: none"> <li>– Bytes 0-2: Sensor serial number</li> <li>– Byte 3: HART unit code of sensor limits and measuring range of the primary process variable</li> <li>– Bytes 4-7: Upper sensor limit</li> <li>– Bytes 8-11: Lower sensor limit</li> <li>– Bytes 12-15: Minimum span</li> </ul>  Note! <ul style="list-style-type: none"> <li>■ The data relate to the primary process variable (= volume flow).</li> <li>■ Manufacturer-specific units are represented using the HART unit code "240".</li> </ul>
15	Read output information of primary process variable Access type = read	none	<ul style="list-style-type: none"> <li>– Byte 0: Alarm selection ID</li> <li>– Byte 1: Transfer function ID</li> <li>– Byte 2: HART unit code for the set measuring range of the primary process variable</li> <li>– Bytes 3-6: upper range, value for 20 mA</li> <li>– Bytes 7-10: lower range, value for 4 mA</li> <li>– Bytes 11-14: Damping constant in [s]</li> <li>– Byte 15: Write protection ID</li> <li>– Byte 16: OEM dealer ID, 17 = E+H</li> </ul> Factory setting: Primary process variable = Volume flow  Note! <ul style="list-style-type: none"> <li>■ Manufacturer-specific units are represented using the HART unit code "240".</li> <li>■ You can change the assignment of device variables to process variables using Command 51.</li> </ul>

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)
<b>Common practice commands</b>			
34	Write damping value for primary process variable Access = write	Bytes 0-3: Damping value of the primary process variable "volume flow" in seconds  <i>Factory setting:</i> 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  <i>Factory setting:</i> Primary process variable = Volume flow   <b>Note!</b> ■ 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   <b>Note!</b> ■ 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   <b>Note!</b> 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  <i>Factory setting:</i> Primary process variable = Volume flow   <b>Note!</b> 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  <i>Factory setting:</i> Primary process variable = Volume flow   Note! <ul style="list-style-type: none"> <li>■ If the written HART unit code is not the correct one for the process variable, the device will continue with the last valid unit.</li> <li>■ If you change the unit of the primary process variable, this has a direct impact on the system units.</li> </ul>	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: <ul style="list-style-type: none"> <li>– Byte 0: Device variable code to the primary process variable</li> <li>– Byte 1: Device variable code to the second process variable</li> <li>– Byte 2: Device variable code to the third process variable</li> <li>– Byte 3: Device variable code to the fourth process variable</li> </ul> <i>Factory setting:</i> <ul style="list-style-type: none"> <li>■ Primary process variable: Code 1 for volume flow</li> <li>■ Second process variable: Code 250 for totalizer</li> <li>■ Third process variable: Code 0 for OFF (not assigned)</li> <li>■ Fourth process variable: Code 0 for OFF (not assigned)</li> </ul>
51	Write assignment of the device variables to the four process variables Access = write	Setting of the device variables to the four process variables: <ul style="list-style-type: none"> <li>– Byte 0: Device variable code to the primary process variable</li> <li>– Byte 1: Device variable code to the second process variable</li> <li>– Byte 2: Device variable code to the third process variable</li> <li>– Byte 3: Device variable code to the fourth process variable</li> </ul> <i>Factory setting:</i> <ul style="list-style-type: none"> <li>■ Primary process variable: Volume flow</li> <li>■ Second process variable: Totalizer 1</li> <li>■ Third process variable: OFF (not assigned)</li> <li>■ Fourth process variable: OFF (not assigned)</li> </ul>	The variable assignment of the process variables is displayed as a response: <ul style="list-style-type: none"> <li>– Byte 0: Device variable code to the primary process variable</li> <li>– Byte 1: Device variable code to the second process variable</li> <li>– Byte 2: Device variable code to the third process variable</li> <li>– Byte 3: Device variable code to the fourth process variable</li> </ul>
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: <ul style="list-style-type: none"> <li>– Byte 0: Device variable code</li> <li>– Byte 1: HART unit code</li> </ul> Code of the supported device variables: See information → 64   Note! <ul style="list-style-type: none"> <li>■ If the written unit is not the correct one for the device variable, the device will continue with the last valid unit.</li> <li>■ If you change the unit of the device variable, this has a direct impact on the system units.</li> </ul>	The current unit of the device variables is displayed in the device as a response: <ul style="list-style-type: none"> <li>– Byte 0: Device variable code</li> <li>– Byte 1: HART unit code</li> </ul>  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	7	347	Pulse buffer: The temporarily buffered flow portions (measuring mode for pulsating flow) could not be cleared or output within 60 seconds.
	0	348	
	1	349	
	2	350	
	3	351	Current output: Flow is out of range.
	4	352	
	5	353	
	6	354	
8	7	355	Frequency output: Flow is out of range.
	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 overshoot
	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	Simulation frequency output active
	3	621	
	4	622	
	5	623	
	6	624	Simulation pulse output active
	7	631	
16	0	632	
	1	633	
	2	634	
	3	641	Simulation status output active
	4	642	
	5	643	
	6	644	
	6	644	
17	7	671	Simulation of the status input active
18	0	672	
	1	673	
	2	674	
	3	691	
	4	692	Simulation of volume flow active

## 6 Commissioning

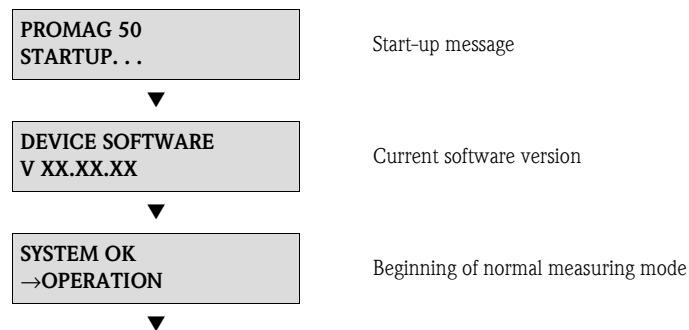
### 6.1 Function check

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:



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.

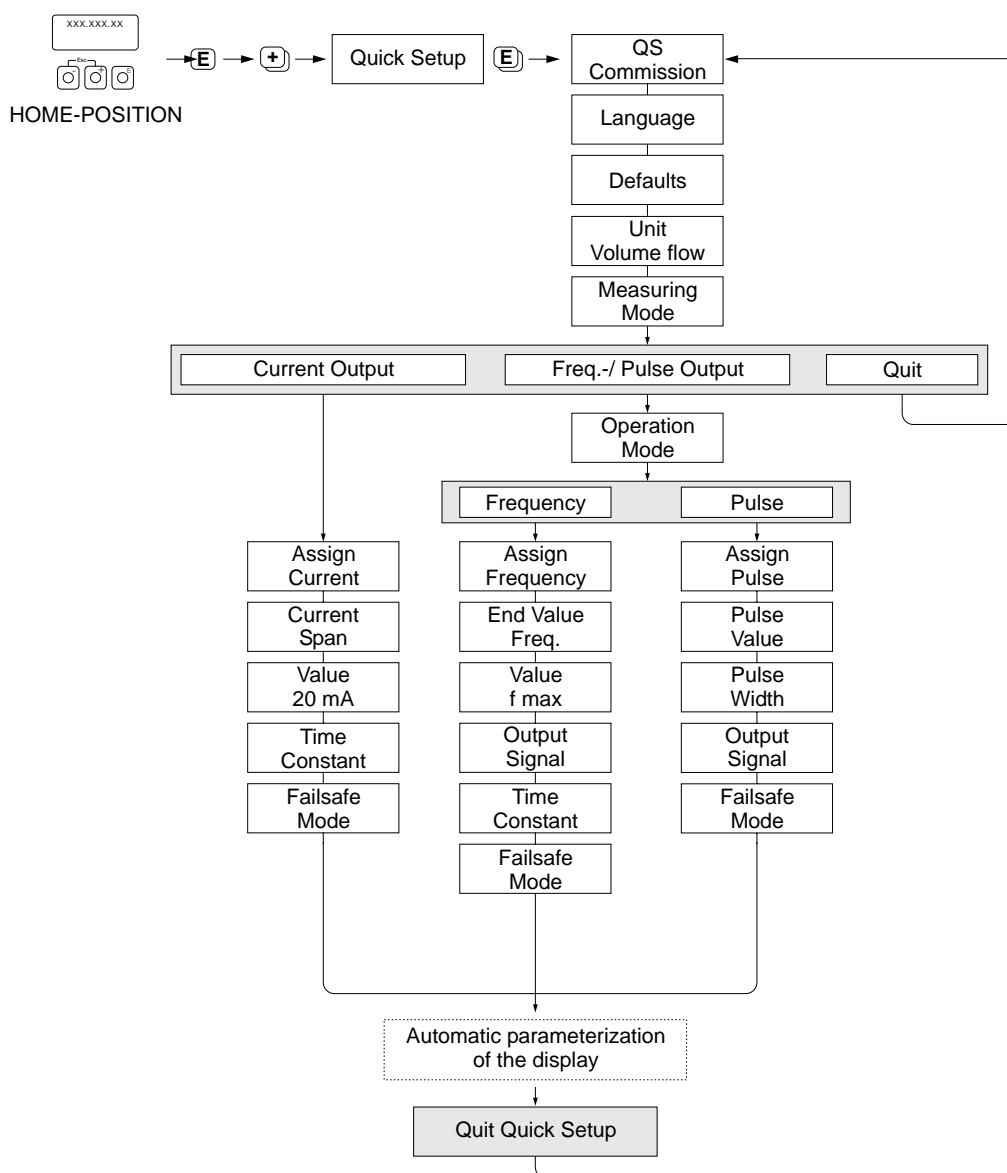
## 6.3 Quick Setup

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.



A0005413-EN

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.

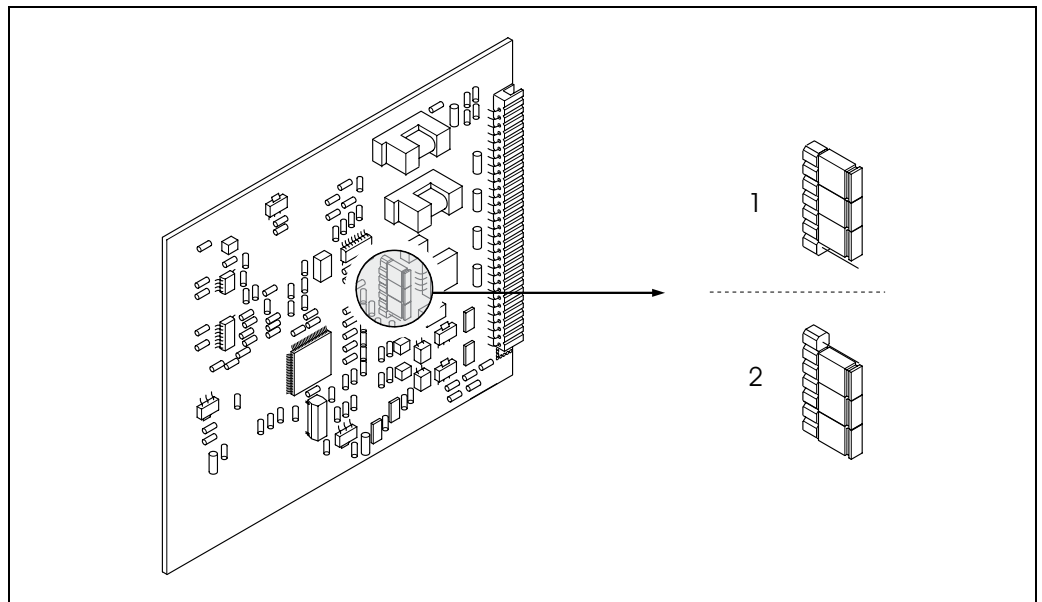


Fig. 51: Configuring current outputs using jumpers (I/O board)

- 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 → → → PROCESS PARAMETER → → → 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 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 to confirm.
6. Having completed the adjustment, select the setting "OFF" and exit the function by pressing .
7. Switch on empty pipe detection in the EPD function:
  - EPD empty pipe adjustment: Select ON STANDARD or ON SPECIAL and press to confirm
  - OED empty pipe adjustment: Select OED and confirm with .



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: <ul style="list-style-type: none"> <li>■ Approvals</li> <li>■ Degree of protection/version</li> <li>■ Cable for remote version</li> <li>■ Cable entry</li> <li>■ Display/power supply/operation</li> <li>■ Software</li> <li>■ Outputs/inputs</li> </ul>	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: <ul style="list-style-type: none"> <li>■ Wall mounting</li> <li>■ Pipe mounting</li> <li>■ Panel-mounted installation</li> </ul> Mounting set for aluminum field housing. Suitable for: <ul style="list-style-type: none"> <li>■ Pipe mounting</li> </ul>	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: <ul style="list-style-type: none"> <li>■ Mounting bolts</li> <li>■ Nuts incl. washers</li> <li>■ Flange seals</li> <li>■ Centering sleeves (if required for the flange)</li> </ul>	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: <ul style="list-style-type: none"> <li>■ 2 process connections</li> <li>■ Threaded fasteners</li> <li>■ Seals</li> </ul>	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: <ul style="list-style-type: none"> <li>■ Universal input</li> <li>■ Transmitter power supply</li> <li>■ Limit relay</li> <li>■ Analog output</li> </ul>	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: <ul style="list-style-type: none"> <li>■ 2-channel analog input (4 to 20 mA)</li> <li>■ 4 binary inputs with event counter function and frequency measurement</li> <li>■ Communication via modem, Ethernet or GSM</li> <li>■ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone</li> <li>■ Limit value monitoring with alarm by e-mail or SMS</li> <li>■ Synchronized time stamping of all measured values.</li> </ul>	FXA320 – *****
Fieldgate FXA520	Gateway for remote interrogation of HART sensors and actuators via Web browser: <ul style="list-style-type: none"> <li>■ Web server for remote monitoring of up to 30 measuring points</li> <li>■ Intrinsically safe version [EEx ia]IIC for applications in hazardous areas</li> <li>■ Communication via modem, Ethernet or GSM</li> <li>■ Visualization via Internet/Intranet in Web browser and/or WAP cellular phone</li> <li>■ Limit value monitoring with alarm by e-mail or SMS</li> <li>■ Synchronized time stamping of all measured values</li> <li>■ Remote diagnosis and remote configuration of connected HART devices</li> </ul>	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: <a href="http://www.endress.com">www.endress.com</a>
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.	<ol style="list-style-type: none"> <li>1. Check the supply voltage → terminals 1, 2</li> <li>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</li> <li>3. Measuring electronics defective → order spare parts →  77</li> </ol>
No display visible, but output signals are present.	<ol style="list-style-type: none"> <li>1. Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board →  88</li> <li>2. Display module defective → order spare parts →  77</li> <li>3. Measuring electronics defective → order spare parts →  77</li> </ol>
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	
<p>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):</p> <ul style="list-style-type: none"> <li>– Error type: <b>S</b> = system error, <b>P</b> = process error</li> <li>– Error message type: <b>f</b> = fault message, <b>!</b> = notice message</li> <li>– <b>EMPTY PIPE</b> = Type of error, e.g. measuring tube is only partly filled or completely empty</li> <li>– <b>03:00:05</b> = duration of error occurrence (in hours, minutes and seconds)</li> <li>– <b>#401</b> = error number</li> </ul> <p> Caution!</p> <ul style="list-style-type: none"> <li>■ See the information on →  62!</li> <li>■ The measuring system interprets simulations and positive zero return as system errors, but displays them as notice message only.</li> </ul>	
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 (⚡) 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 ⚡ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
No. # 0xx → Hardware error			
001	S: CRITICAL FAILURE ⚡: # 001	Serious device error	Replace the amplifier board.
011	S: AMP HW EEPROM ⚡: # 011	Amplifier: Defective EEPROM	Replace the amplifier board.
012	S: AMP SW EEPROM ⚡: # 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 occurred in a totalizer block (see error No. 111 / CHECKSUM TOTAL).
031	S: SENSOR HW DAT ⚡: # 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
032	S: SENSOR SW DAT ⚡: # 032		3. Replace measuring electronics boards if necessary. 4. Plug the S-DAT into the amplifier board.
No. # 1xx → Software error			
101	S: GAIN ERROR AMP ⚡: # 101	Gain deviation compared to reference gain > 25%.	Replace the amplifier board.
111	S: CHECKSUM TOTAL ⚡: # 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 ⚡: # 251	Internal communication fault on the amplifier board.	Replace the amplifier board.
261	S: COMMUNICATION I/O ⚡: # 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)
<b>No. # 3xx → System limits exceeded</b>			
<b>321</b>	S: TOL. COIL CURR. !: # 321	Sensor: Coil current is out of tolerance.	 <b>Warning!</b> Switch off power supply before manipulating the coil current cable, coil current cable connector or measuring electronics boards!  Remote version: <ol style="list-style-type: none"> <li>1. Check wiring of terminals 41/42 → 44</li> <li>2. Check coil current cable connector.</li> </ol> Compact and remote version: Replace measuring electronics boards if necessary
<b>339 to 342</b>	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.	<ol style="list-style-type: none"> <li>1. Change the upper or lower limit setting, as applicable.</li> <li>2. Increase or reduce flow, as applicable.</li> </ol> Recommendations in the event of fault category = FAULT MESSAGE (≠) <ul style="list-style-type: none"> <li>■ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared.</li> <li>■ Clear the temporary buffer by the measures described under Item 1.</li> </ul>
<b>343 to 346</b>	S: STACK FREQ. OUT n !: # 343 to 346		
<b>347 to 350</b>	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.	<ol style="list-style-type: none"> <li>1. Increase the setting for pulse weighting</li> <li>2. Increase the max. pulse frequency if the totalizer can handle a higher number of pulses.</li> <li>3. Increase or reduce flow, as applicable.</li> </ol> Recommendations in the event of fault category = FAULT MESSAGE (≠) <ul style="list-style-type: none"> <li>■ Configure the fault response of the output to "ACTUAL VALUE" so that the temporary buffer can be cleared.</li> <li>■ Clear the temporary buffer by the measures described under Item 1.</li> </ul>
<b>351 to 354</b>	S: CURRENT RANGE n !: # 351 to 354	Current output: flow is out of range.	<ol style="list-style-type: none"> <li>1. Change the upper or lower limit setting, as applicable.</li> <li>2. Increase or reduce flow, as applicable.</li> </ol>
<b>355 to 358</b>	S: FREQ. RANGE n !: # 355 to 358	Frequency output: flow is out of range.	<ol style="list-style-type: none"> <li>1. Change the upper or lower limit setting, as applicable.</li> <li>2. Increase or reduce flow, as applicable.</li> </ol>
<b>359 to 362</b>	S: PULSE RANGE !: # 359 to 362	Pulse output: the pulse output frequency is out of range.	<ol style="list-style-type: none"> <li>1. Increase the setting for pulse weighting</li> <li>2. When selecting the pulse width, choose a value that can still be processed by a connected counter (e.g. mechanical counter, PLC etc.).  <i>Determine the pulse width:</i> <ul style="list-style-type: none"> <li>– Variant 1: Enter the minimum duration that a pulse must be present at the connected counter to ensure its registration.</li> <li>– 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.</li> </ul>           Example: The maximum input frequency of the connected counter is 10 Hz. The pulse width to be entered is:   <math display="block">\frac{1}{2 \cdot 10 \text{ Hz}} = 50 \text{ ms}</math> </li> <li>3. Reduce flow.</li> </ol>

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No.	Error message / Type	Cause	Remedy (spare part → 87)
<b>No. # 5xx → Application error</b>			
<b>501</b>	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.
<b>502</b>	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.
<b>No. # 6xx → Simulation mode active</b>			
<b>601</b>	S: POS. ZERO-RETURN !: # 601	Positive zero return active  <b>Caution!</b> This message has the highest display priority!	Switch off positive zero return
<b>611 to 614</b>	S: SIM. CURR. OUT. n !: # 611 to 614	Simulation current output active	
<b>621 to 624</b>	S: SIM. FREQ. OUT. n !: # 621 to 624	Simulation frequency output active	Switch off simulation
<b>631 to 634</b>	S: SIM. PULSE n !: # 631 to 634	Simulation pulse output active	Switch off simulation
<b>641 to 644</b>	S: SIM. STAT. OUT n !: # 641 to 644	Simulation status output active	Switch off simulation
<b>671 to 674</b>	S: SIM. STATUS IN n !: # 671 to 674	Simulation status input active	Switch off simulation
<b>691</b>	S: SIM. FAILSAFE !: # 691	Simulation of response to error (outputs) active	Switch off simulation
<b>692</b>	S: SIM. MEASURAND !: # 692	Simulation of a measured variable active (e.g. mass flow).	Switch off simulation
<b>698</b>	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 ⚡ = Fault message (with an effect on the outputs) ! = Notice message (without an effect on the outputs)			
<b>401</b>	EMPTY PIPE ⚡: # 401	Measuring tube partially filled or empty	1. Check the process conditions of the plant 2. Fill the measuring tube
<b>461</b>	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.
<b>463</b>	FULL = EMPTY ⚡: # 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.	<ol style="list-style-type: none"> <li>1. Remote version: <ul style="list-style-type: none"> <li>– Switch off the power supply and check the wiring → 44</li> <li>– If necessary, reverse the connections at terminals 41 and 42</li> </ul> </li> <li>2. Change the setting in the "INSTALLATION DIRECTION SENSOR" function accordingly</li> </ol>
Measured-value reading fluctuates even though flow is steady.	<ol style="list-style-type: none"> <li>1. Check grounding and potential equalization → 54</li> <li>2. Check the fluid for presence of gas bubbles.</li> <li>3. In the "SYSTEM DAMPING" function → increase the value</li> </ol>
Measured-value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	<ol style="list-style-type: none"> <li>1. Check grounding and potential equalization → 54</li> <li>2. Check the fluid for presence of gas bubbles.</li> <li>3. Activate the "LOW FLOW CUTOFF" function, i.e. enter or increase the value for the switching point.</li> </ol>
Measured-value reading on display, even though measuring tube is empty.	<ol style="list-style-type: none"> <li>1. Perform empty-pipe/full-pipe adjustment and then switch on Empty Pipe detection → 74</li> <li>2. Remote version: Check the terminals of the EPD cable → 44</li> <li>3. Fill the measuring tube.</li> </ol>
The current output signal is always 4 mA, irrespective of the flow signal at any given time.	<ol style="list-style-type: none"> <li>1. Select the "BUS ADDRESS" function and change the setting to "0".</li> <li>2. Value for creepage too high. Reduce the value in the "LOW FLOW CUTOFF" function.</li> </ol>
<p>The fault cannot be rectified or some other fault not described above has arisen.</p> <p>In these instances, please contact your Endress+Hauser service organization.</p>	<p>The following options are available for tackling problems of this nature:</p> <p><b>Request the services of an Endress+Hauser service technician</b>  If you contact our service organization to have a service technician sent out, please be ready to quote the following information:</p> <ul style="list-style-type: none"> <li>– Brief description of the fault</li> <li>– Nameplate specifications (→ 7): order code, serial number</li> </ul> <p><b>Returning devices to Endress+Hauser</b>  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.</p> <p><b>Replace transmitter electronics</b>  Components in the measuring electronics defective → order spare parts → 77</p>




## 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
 <b>Caution!</b> 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	<p><i>FALLBACK VALUE</i> Signal output → 0 Hz</p> <p><i>FAILSAFE LEVEL</i> Output of the frequency specified in the <i>FAILSAFE VALUE</i> function.</p> <p><i>HOLD VALUE</i> Measured value display on the basis of the last saved value preceding occurrence of the fault.</p> <p><i>ACTUAL VALUE</i> Measured value display on the basis of the current flow measurement. The fault is ignored.</p>	Output signal corresponds to "zero flow"
Totalizer	<p><i>STOP</i> The totalizers are paused until the error is rectified.</p> <p><i>ACTUAL VALUE</i> The fault is ignored. The totalizer continues to count in accordance with the current flow value.</p> <p><i>HOLD VALUE</i> The totalizer continues to count the flow in accordance with the last valid flow value (before the error occurred).</p>	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

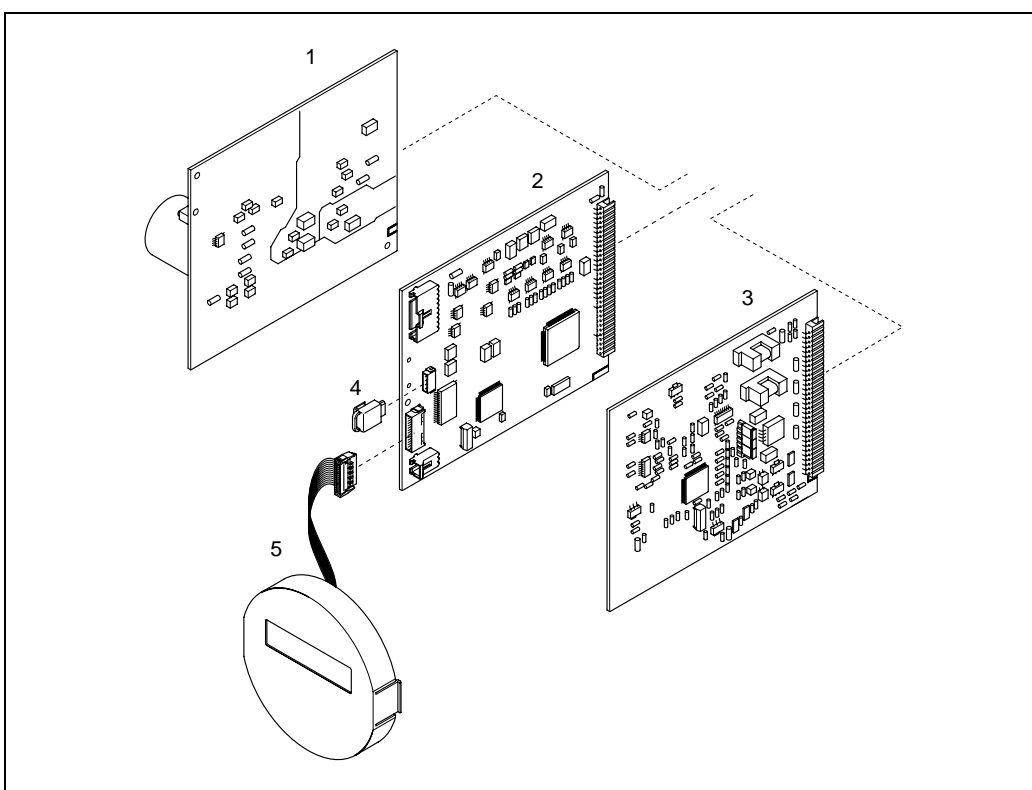


Fig. 52: Spare parts for Promag 50 transmitter (field and wall-mounted housings)

- 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.

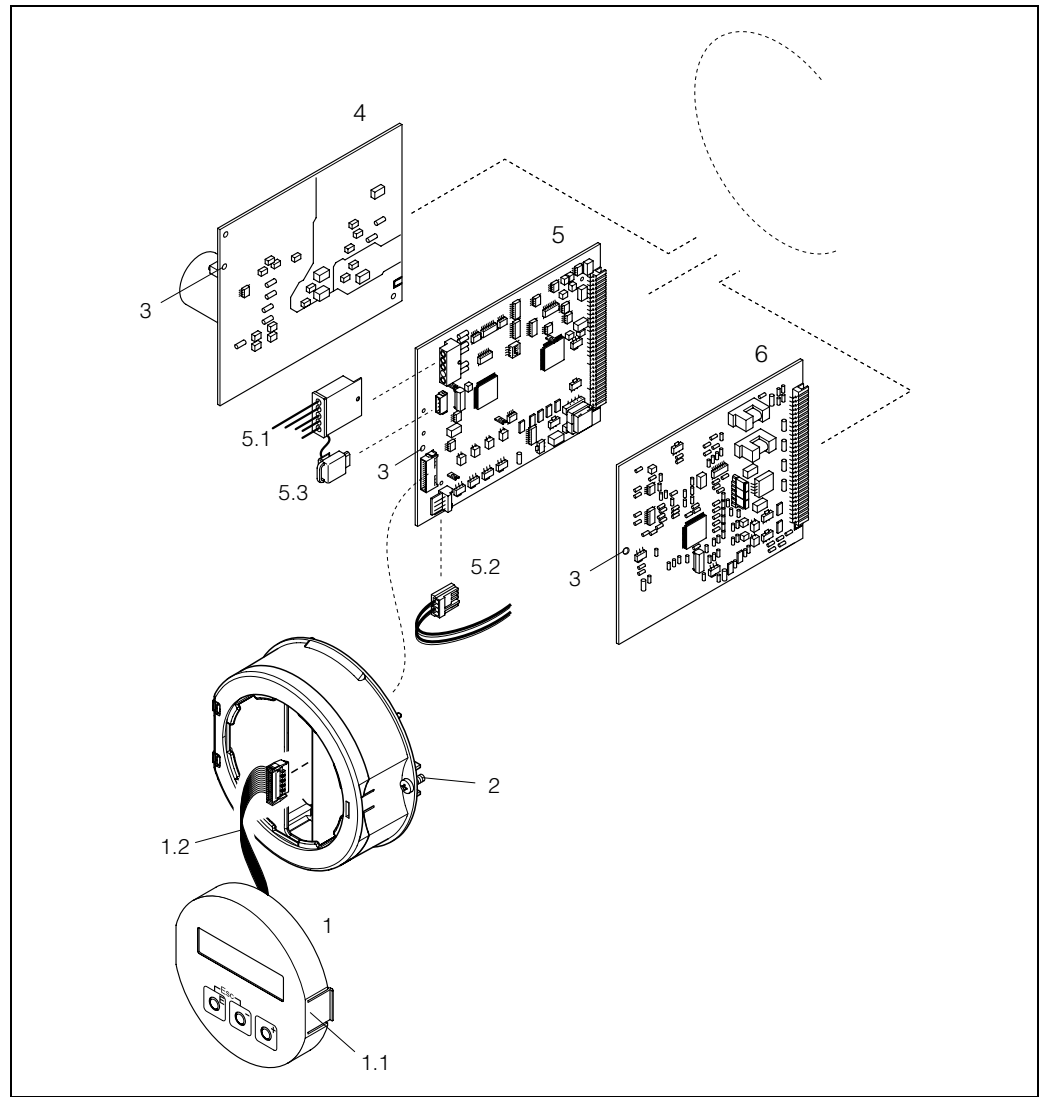


Fig. 53: Field housing: removing and installing printed circuit boards

- 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.

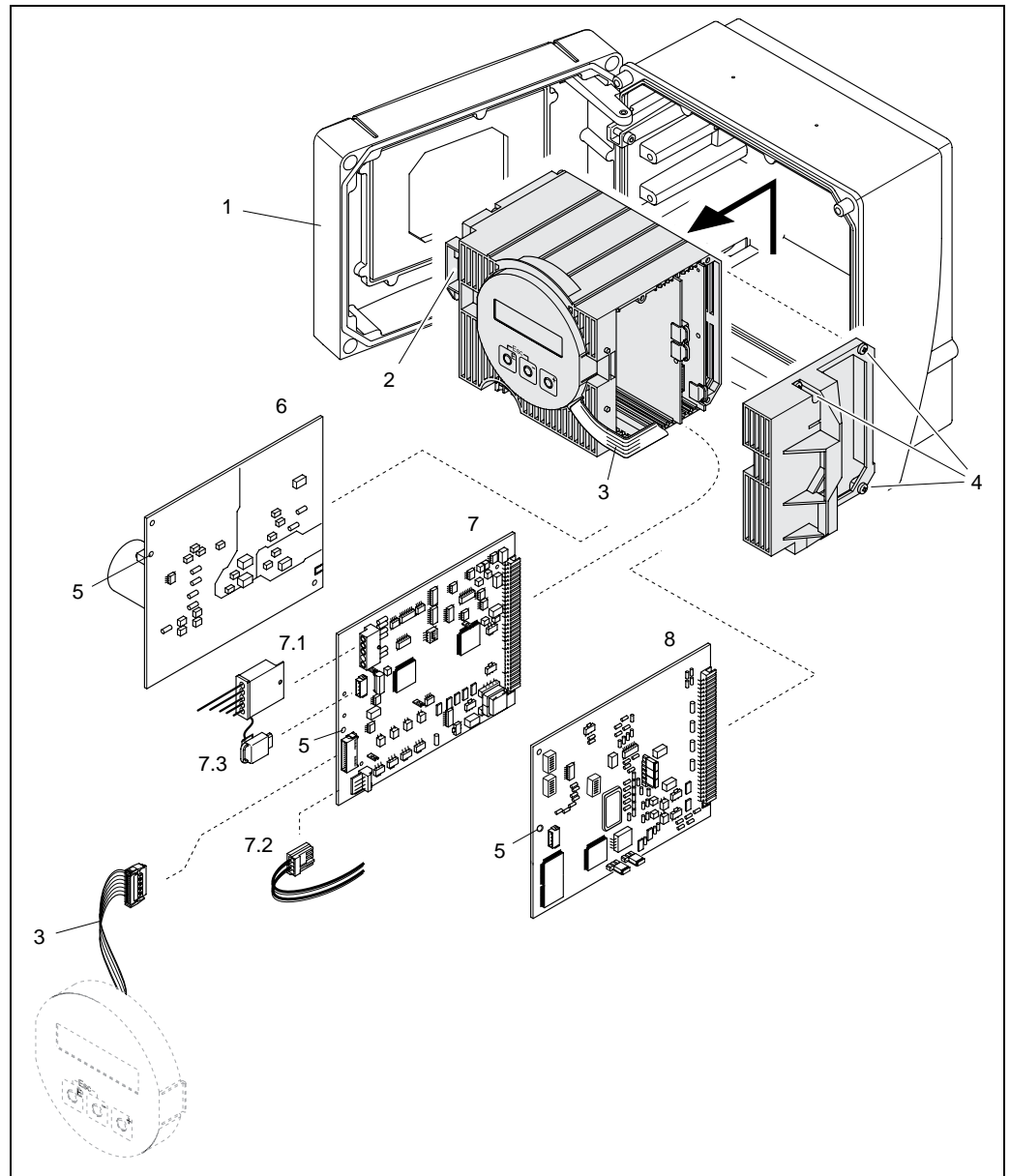


Fig. 54: Wall-mount housing: removing and installing printed circuit boards

- 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.

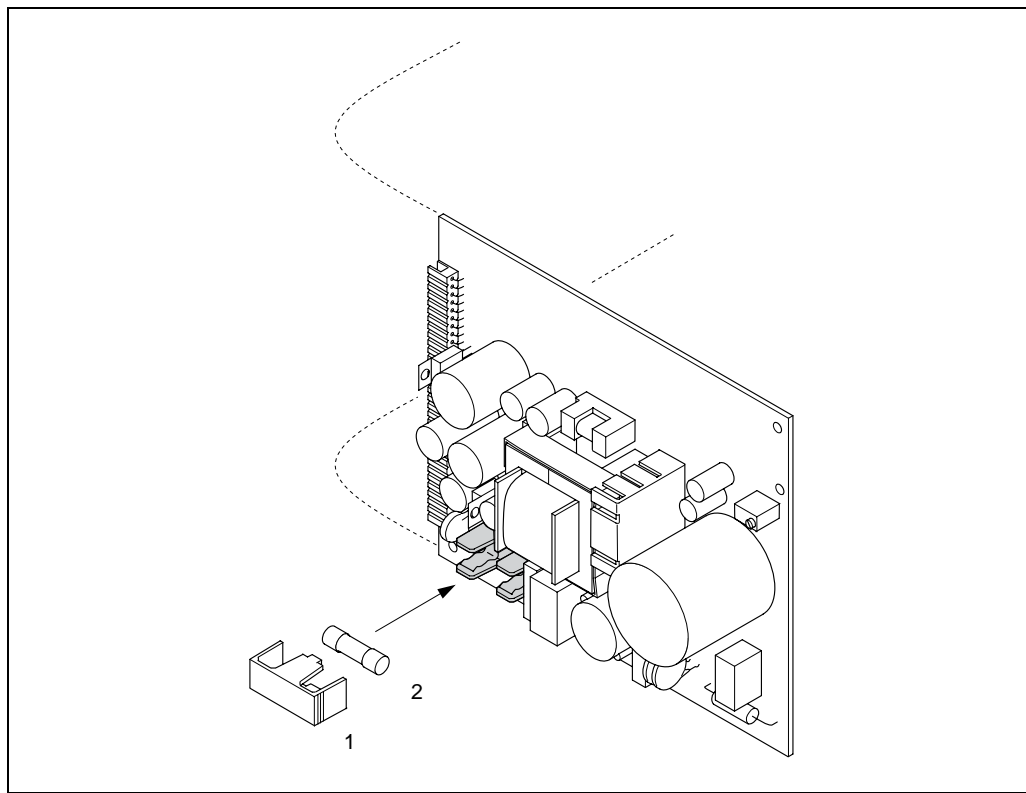


Fig. 55: Replacing the device fuse on the power supply board

- 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.

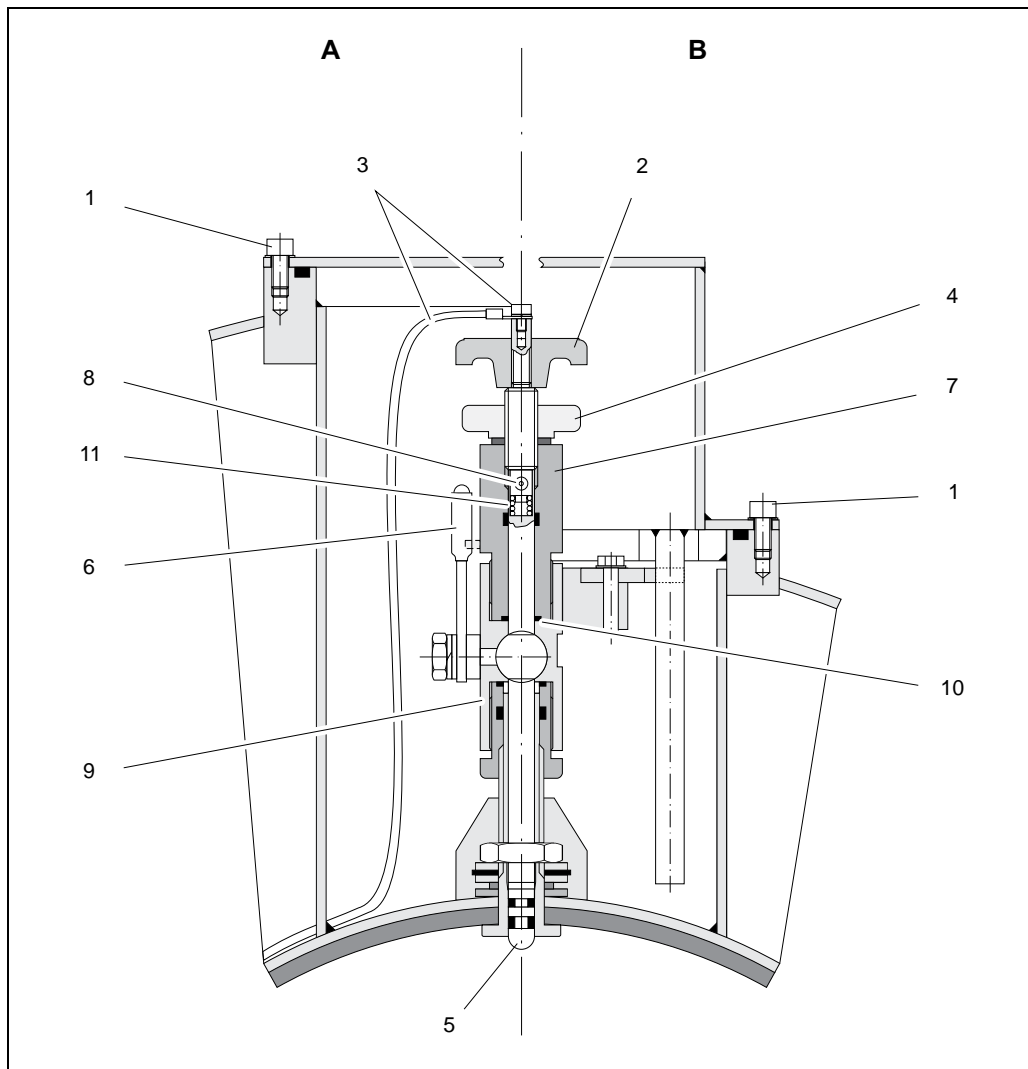







Fig. 56: Apparatus for replacing exchangeable measuring electrodes

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.  <b>Caution!</b> 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.  <b>Warning!</b> 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.  <b>Note!</b> 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.  <b>Warning!</b> 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).  <b>Caution!</b> 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: <ul style="list-style-type: none"> <li>■ Language groups</li> <li>■ Flow direction pulse output selectable</li> </ul> New functionalities: <ul style="list-style-type: none"> <li>■ Second Totalizer</li> <li>■ Adjustable backlight (display)</li> <li>■ Operation hours counter</li> <li>■ Simulation function for pulse output</li> <li>■ Counter for access code</li> <li>■ Reset function (fault history)</li> <li>■ Up-/download with FieldTool</li> </ul>	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.
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Measuring system	→ 7
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#### 10.1.3 Input

Measured variable	Flow velocity (proportional to induced voltage)
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Measuring range	Typically $v = 0.01$ to $10$ m/s ( $0.033$ to $33$ ft/s) with the specified accuracy
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Operable flow range	Over $1000 : 1$
---------------------	-----------------

Input signal	<i>Status input (auxiliary input)</i> <ul style="list-style-type: none"> <li>■ Galvanically isolated</li> <li>■ <math>U = 3</math> to <math>30</math> V DC</li> <li>■ <math>R_i = 5</math> k<math>\Omega</math></li> <li>■ Can be configured for: totalizer reset, positive zero return, error message reset.</li> </ul>
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#### 10.1.4 Output

Output signal	<i>Current output</i> <ul style="list-style-type: none"> <li>■ Galvanically isolated</li> <li>■ Active/passive can be selected: <ul style="list-style-type: none"> <li>– Active: <math>0/4</math> to <math>20</math> mA, <math>R_L &lt; 700</math> <math>\Omega</math> (HART: <math>R_L \geq 250</math> <math>\Omega</math>)</li> <li>– Passive: <math>4</math> to <math>20</math> mA, supply voltage <math>V_S</math> <math>18</math> to <math>30</math> V DC, <math>R_i \geq 150</math> <math>\Omega</math>)</li> </ul> </li> <li>■ Time constant can be selected (<math>0.01</math> to <math>100</math>s)</li> <li>■ Full scale value adjustable</li> <li>■ Temperature coefficient: typ. <math>0.005\%</math> o.f.s./<math>^{\circ}\text{C}</math>, resolution: <math>0.5</math> <math>\mu\text{A}</math></li> </ul> <p>o.f.s. = of full scale value</p>
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##### *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  $2000$  ms)
  - 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	<p><i>Current output</i></p> <p>Failsafe mode can be selected (e.g. in accordance with NAMUR Recommendation NE 43)</p> <p><i>Pulse/frequency output</i></p> <p>Failsafe mode can be selected</p> <p><i>Status output</i></p> <p>"Not conductive" in the event of fault or power supply failure</p>
Load	See "Output signal"
Switching output	<p><i>Status output</i></p> <ul style="list-style-type: none"> <li>■ Galvanically isolated</li> <li>■ Max. 30 V DC/250 mA</li> <li>■ Open collector</li> <li>■ Can be configured for: error messages, empty pipe detection (EPD), flow direction, limit values</li> </ul>
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	<p><i>To DIN EN 29104 and VDI/VDE 2641:</i></p> <ul style="list-style-type: none"> <li>■ Fluid temperature: <math>+28\text{ °C} \pm 2\text{ K}</math></li> <li>■ Ambient temperature: <math>+22\text{ °C} \pm 2\text{ K}</math></li> <li>■ Warm-up period: 30 minutes</li> </ul> <p><i>Installation:</i></p> <ul style="list-style-type: none"> <li>■ Inlet run <math>&gt;10 \times \text{DN}</math></li> <li>■ Outlet run <math>&gt; 5 \times \text{DN}</math></li> <li>■ Sensor and transmitter grounded.</li> <li>■ The sensor is centered in the pipe.</li> </ul>
Maximum measured error	<ul style="list-style-type: none"> <li>■ Current output: plus typically <math>\pm 5\text{ }\mu\text{A}</math></li> <li>■ Pulse output: <math>\pm 0.5\%</math> o.r. <math>\pm 1\text{ mm/s}</math> Option: <math>\pm 0.2\%</math> o.r. <math>\pm 2\text{ mm/s}</math> (o.r. = of reading)</li> </ul> <p>Fluctuations in the supply voltage do not have any effect within the specified range.</p> <div> </div> <p><i>Fig. 57: Max. measured error in % of reading</i></p>
Repeatability	Max. $\pm 0.1\%$ o.r. $\pm 0.5\text{ mm/s}$ (o.r. = of reading)
<b>10.1.7 Operating conditions: Installation</b>	
Installation instructions	Any orientation (vertical, horizontal), restrictions and installation instructions → 13
Inlet and outlet run	<p>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 (→ 12):</p> <ul style="list-style-type: none"> <li>■ Inlet run: <math>\geq 5 \times \text{DN}</math></li> <li>■ Outlet run: <math>\geq 2 \times \text{DN}</math></li> </ul>
Adapters	→ 17
Length of connecting cable	→ 20



### 10.1.8 Operating conditions: Environment

Ambient temperature range	<ul style="list-style-type: none"> <li>■ Transmitter:               <ul style="list-style-type: none"> <li>– Standard: –20 to +60 °C (–4 to +140 °F)</li> <li>– Optional: –40 to +60 °C (–40 to +140 °F)</li> </ul> </li> <li> Note! At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired.</li> <li>■ Sensor:               <ul style="list-style-type: none"> <li>– Flange material carbon steel: –10 to +60 °C (+14 to +140 °F)</li> <li>– Flange material stainless steel: –40 to +60 °C (–40 to +140 °F)</li> </ul> </li> <li> Caution!               <ul style="list-style-type: none"> <li>■ The permitted temperature range of the measuring tube lining may not be undershot or overshoot (→ "Operating conditions: Process" → "Medium temperature range").</li> <li>■ Install the device in a shady location. Avoid direct sunlight, particularly in warm climatic regions.</li> <li>■ The transmitter must be mounted separate from the sensor if both the ambient and fluid temperatures are high.</li> </ul> </li> </ul>
Storage temperature	<p>The storage temperature corresponds to the operating temperature range of the measuring transmitter and the appropriate measuring sensors.</p> <p> Caution!</p> <ul style="list-style-type: none"> <li>■ The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.</li> <li>■ 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.</li> </ul>
Degree of protection	<ul style="list-style-type: none"> <li>■ Standard: IP 67 (NEMA 4X) for transmitter and sensor</li> <li>■ Optional: IP 68 (NEMA 6P) for remote version of Promag L, W and P sensor. Promag L only with stainless steel flanges.</li> </ul>
Shock and vibration resistance	<p>Acceleration up to 2 g following IEC 60068-2-6 (high-temperature version: no data available)</p>
CIP cleaning	<p> Caution! The maximum fluid temperature permitted for the device may not be exceeded.</p> <p><i>CIP cleaning is possible:</i> Promag P, Promag H</p> <p><i>CIP cleaning is not possible:</i> Promag D, Promag L, Promag W</p>
SIP cleaning	<p> Caution! The maximum fluid temperature permitted for the device may not be exceeded.</p> <p><i>SIP cleaning is possible:</i> Promag H</p> <p><i>SIP cleaning is not possible:</i> Promag D, Promag L, Promag W, Promag P</p>
Electromagnetic compatibility (EMC)	<ul style="list-style-type: none"> <li>■ As per IEC/EN 61326 and NAMUR Recommendation NE 21</li> <li>■ Emission: to limit value for industry EN 55011</li> </ul>

### 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")

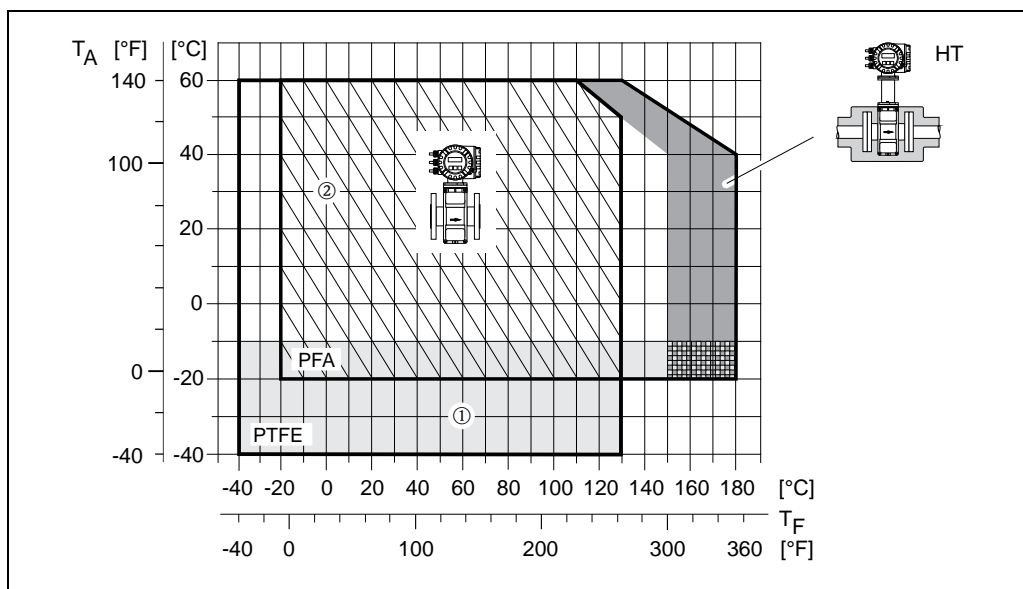


Abb. 58: Compact version Promag P (with PFA- or PTFE-lining)

$T_A$  = 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

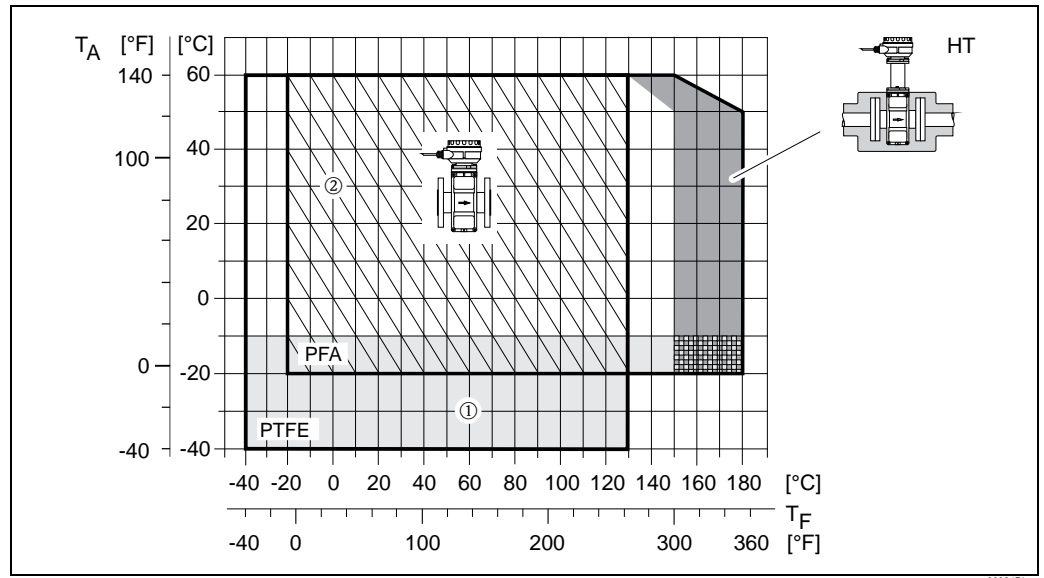


Abb. 59: Remote version Promag P (with PFA- or PTFE-lining)

$T_A$  = 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  $\geq 5$   $\mu\text{S}/\text{cm}$  ( $\geq 20$   $\mu\text{S}/\text{cm}$  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  $\leq 60\text{ °C}$  ( $\leq 140\text{ °F}$ )

*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		
[mm]	[inch]	25 °C	50 °C	80 °C
		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			
[mm]	[inch]	25 °C		90 °C	
		77 °F		194 °F	
		[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						
[mm]	[inch]		25 °C	50 °C	80 °C	100 °C	130 °C	150 °C	180 °C
			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					
[mm]	[inch]	25 °C	80 °C	100 °C	130 °C	150 °C	180 °C
		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					
[mm]	[inch]	25 °C	80 °C	100 °C	130 °C	150 °C	180 °C
		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		Resistance of measuring tube lining to partial vacuum								
Nominal diameter		Limit values for abs. pressure [mbar] ([psi]) at various fluid temperatures								
[mm]	[inch]	25 °C		80° C	100 °C		130 °C		150 °C	180 °C
		77 °F		176° F	212 °F		266 °F		302 °F	356 °F
		[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					
[mm]	[inch]	25 °C	80 °C	100 °C	130 °C	150 °C	180 °C
		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

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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](http://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)
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)							
[mm]	[inch]	EN (DIN) / AS*		JIS		ANSI / AWWA	EN (DIN) / AS*		Sensor		ANSI / AWWA	Trans-mitter		
25	1"	PN 40	7.3	10K	7.3	7.3	PN 40	5.3	10K	5.3	Class 150	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	10K	11.1	–	PN 16	10.0	10K	9.1	Class 150	6.0		
80	3"		14.0		12.5			14.0		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"	PN 10	25.5	Class 150	24.5	25.5	PN 10	23.5	10K	22.5	Class 150	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	Class 150	–	175	PN 10	113	10K	–	Class 150	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"	PN 10	235	Class 150	–	405	PN 10	233	10K	–	Class 150	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"	PN 10	575	Class 150	–	800	PN 10	573	10K	–	Class 150	798	6.0	
1000	40"		700					900				698	898	6.0
–	42"		–					1100				–	1098	6.0
1200	48"		850					1400				848	1398	6.0
–	54"	PN 6	–	Class D	–	2200	PN 6	–	10K	–	Class D	2198	6.0	
1400	–		1300					–				1298	–	6.0
–	60"		–					2700				–	2698	6.0
1600	–		1700					–				1698	–	6.0
–	66"	PN 6	–	Class D	–	3700	PN 6	–	10K	–	Class D	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)								
[mm]	[inch]	EN (DIN) / AS*		JIS		ANSI / AWWA		EN (DIN) / AS*		Sensor		ANSI / AWWA	Trans-mitter	
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	10K	11.1	Class 150	–	PN 16	10.0	10K	9.1	Class 150	–	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	10K	41.9	Class 150	45	PN 10	43	10K	39.9	Class 150	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"	PN 10	175	10K		Class 150	255	PN 10	173	10K		Class 150	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)	
[mm]	[inch]	DIN	Sensor	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)		
[mm]	[inch]			Sensor		Transmitter
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)	
[mm]	[inch]		Sensor	Transmitter
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
  - $DN \leq 300$ : stainless steel 1.4301 or 1.4306/304L; for flanges made of carbon steel with Al/Zn protective coating
  - $DN \geq 350$ : 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 ( $DN \leq 300$ : with Al/Zn protective coating;  $DN \geq 350$  with protective lacquering)
  - ANSI: A105; F316L ( $DN \leq 300$  with Al/Zn protective coating;  $DN \geq 350$  with protective lacquering)
  - AWWA: 1.0425
  - JIS: RSt37-2 (S235JRG2); HII; 1.0425/316L ( $DN \leq 300$  with Al/Zn protective coating;  $DN \geq 350$  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	<ul style="list-style-type: none"> <li>■ Liquid crystal display: illuminated, two-line, 16 characters per line</li> <li>■ Custom configurations for presenting different measured-value and status variables</li> <li>■ 2 totalizers</li> </ul>
	<p>Note!</p> <p>At ambient temperatures below –20 (–4 °F) the readability of the display may be impaired.</p>
Operating elements	<ul style="list-style-type: none"> <li>■ Local operation with three keys (◀, ▶, ⏏)</li> <li>■ "Quick Setup" menus for straightforward commissioning</li> </ul>
Language groups	<p>Language groups available for operation in different countries:</p> <ul style="list-style-type: none"> <li>■ Western Europe and America (WEA): English, German, Spanish, Italian, French, Dutch and Portuguese</li> <li>■ Eastern Europe/Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech</li> <li>■ Southeast Asia (SEA): English, Japanese, Indonesian</li> </ul>
	<p>Note!</p> <p>You can change the language group via the operating program "FieldCare".</p>
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	<p><i>Promag D, L, W and P</i></p> <p>No applicable approvals or certification</p> <p><i>Promag H</i></p> <ul style="list-style-type: none"> <li>■ 3A authorization and EHEDG-tested</li> <li>■ Seals: in conformity with FDA (except Kalrez seals)</li> </ul>
Drinking water approval	<p><i>Promag D, L and W</i></p> <ul style="list-style-type: none"> <li>■ WRAS BS 6920</li> <li>■ ACS</li> <li>■ NSF 61</li> <li>■ KTW/W270</li> </ul> <p><i>Promag P and H</i></p> <p>No drinking water approval</p>

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**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.

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**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.



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# 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] \_\_\_\_\_ [mm<sup>2</sup>/s]

**Medium and warnings**

Warnhinweise zum Medium



	Medium /concentration Medium /Konzentration	Identification CAS No.	flammable entzündlich	toxic giftig	corrosive ätzend	harmful/ irritant gesundheitsschädlich/ 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 _____	Phone number of contact person / Telefon-Nr. Ansprechpartner: _____
Address / Adresse _____	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."

 \_\_\_\_\_  
 (place, date / Ort, Datum)

 \_\_\_\_\_  
 Name, dept./ Abt. (please print / bitte Druckschrift)

 \_\_\_\_\_  
 Signature / Unterschrift

[www.endress.com/worldwide](http://www.endress.com/worldwide)

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**Endress+Hauser**   
People for Process Automation

---

*J & P Richardson Industries Pty Ltd*

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## **6.0 TEST SHEETS**

## Flow Calibration with Adjustment

40054476-2332637

52727461

Purchase order number

AU-49241218-10 / Endress+Hauser Flowtec AG

Order N°/Manufacturer

50W1F-S50A1AK4ABAD

Order code

PROMAG 50 W DN150

Transmitter/Sensor

D5011320000

Serial N°

-

Tag N°

FCP-7.1.D

Calibration rig

88.3573 l/s ( $\pm 100\%$ )

Calibrated full scale

Service interface

Calibrated output

1.0480

Calibration factor

-1

Zero point

31.2 °C

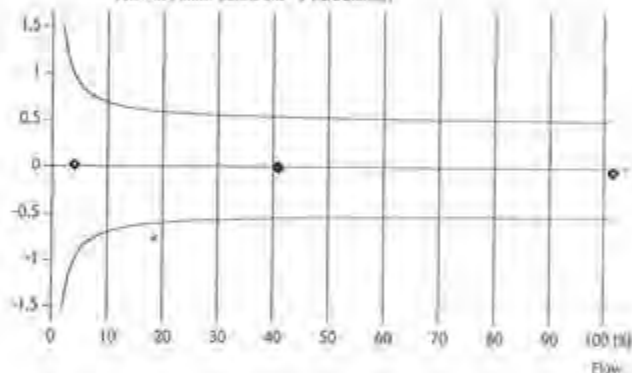
Water temperature

Flow [l/s]	Flow [l/s]	Duration [s]	V target [l]	V meas. [l]	$\Delta$ o.r.* [%]	Outp.** [mA]
4.0	3.55	80.1	284.708	284.757	0.02	4.64
40.8	36.1	60.1	2166.82	2166.90	0.00	10.53
40.9	36.1	60.1	2168.01	2167.72	-0.01	10.54
101.7	89.8	80.1	7192.77	7189.93	-0.04	20.26
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-
-	-	-	-	-	-	-

\*o.r.: of rate

\*\*Calculated value (4 - 20 mA)

Measured error % o.r.

Tolerance limits  $\pm 0.5\%$  o.r.\*  $\neq$  Zero stability

For detailed data concerning output specifications of the unit under test, see technical informations (TI), chapter Performance characteristics.

Traceability to the national standard for all test instruments used for the calibration is guaranteed.

Endress+Hauser Flowtec operates ISO/IEC 17025 accredited calibration facilities in Reinach (CH), Cernay (FR), Greenwood (USA), Aurangabad (IN) and Suzhou (CN).

07/06/2010

Date of calibration



Balaji Kallepwar

Operator

 Certified acc. to  
 ISO 9001



## Parameter Setting

#0055816-2332437

52727461

Purchase order number

49241218-10 / Endress+Hauser Flowtec AG

Order N°/Manufacturer

50W1F-S50A1AK4ABAD

Order code

D5011320000

Serial N°

PROMAG 50 W

Transmitter/Sensor

DN150

Nominal diameter

Tag N°

The below parameters are set according to your order.  
 Please refer to the Operating Manual for any parameters not mentioned.

Device software

V2.03.00

Current output 1

Value 20 mA

150 m<sup>3</sup>/hr

Current span

4-20 mA HART NAMUR

Pulse output 1

Pulse value

0.025 m<sup>3</sup>

Output signal

passive/positive

07/06/2010

Date

Endress+Hauser Flowtec (India) Pvt. Ltd.  
 M-171 - M-176, Waluj MIDC  
 Aurangabad - 431 136, India

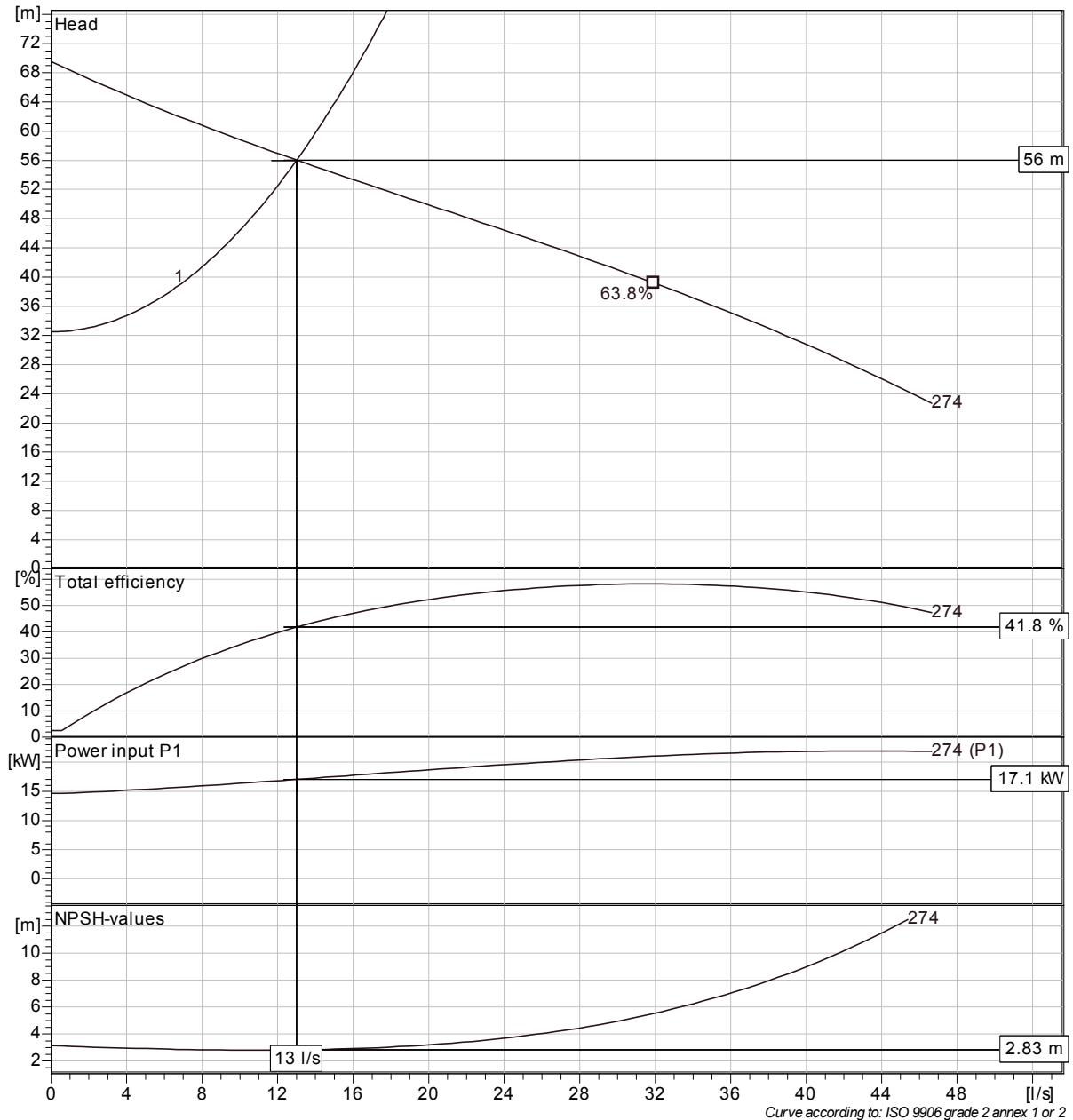
**ITT****Water & Wastewater****N 3171 SH 3~ 274 Installation: P****Performance curve****Pump**

Outlet diameter	100 mm
Inlet diameter	150 mm
Impeller diameter	213 mm
Number of blades	2
Throughlet diameter	

**Motor**

Motor #	N3171 25-18-2AA-W 22KW
Stator variant	1
Frequency	50 Hz
Rated voltage	415 V
Number of poles	2
Phases	3~
Rated power	22 kW
Rated current	38 A
Starting current	285 A
Rated speed	2930 rpm

Power factor	
1/1 Load	0.9
3/4 Load	0.86
1/2 Load	0.78
Efficiency	
1/1 Load	90.5 %
3/4 Load	91.5 %
1/2 Load	91.5 %

**Operating points**

Pumps running	Total Flow	Head	Total Power, P2	Eff.
13 l/s	56 m	15.6 kW	45.6 %	

Project	Project ID	Created by	Created on	Last update
			28.10.2009	

## **7.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION**

### **7.1 Circuit Breakers / Circuit Breaker Chassis**

### **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 Soft Starter**

### **7.8 Earth / Neutral Links**

### **7.9 Terminals / Isolators**

**7.1 CIRCUIT BREAKERS / CIRCUIT BREAKER CHASSIS**

- TERASAKI – S125GJ/63 – CIRCUIT BREAKER
- TERASAKI – E125NJ/100 – CIRCUIT BREAKER
- TERASAKI – T2F123SLNG – 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 – DTCB6325C – CIRCUIT BREAKER
- TERASAKI – DTCB6310C – CIRCUIT BREAKER
- TERASAKI – DTCB6306C – CIRCUIT BREAKER
- TERASAKI – DTCB6110C – CIRCUIT BREAKER
- TERASAKI – DTCB6106C – CIRCUIT BREAKER
- TERASAKI – DTCB6104C – CIRCUIT BREAKER
- TERASAKI – CD-2-24/18-3U – CIRCUIT BREAKER CHASSIS

## Thermal magnetic type S125GJ

### 65kA

**Current rating:** 12.5 – 125A

**Approvals and Tests:**

Standards AS/NZS 3947-2, and IEC60947-2

**Interrupting capacity:**

	Voltage	Icu	Ics
AC use	380/400	65	36
DC use	250V	40	40

**Trip unit:**

Adjustable thermal (0.63  $I_r$  to 100%  $I_r$ ) and adjustable magnetic (6  $I_m$  to 12  $I_m$ )

**Dimensions (mm)**

Poles	3	4
H	155	155
W	90	120
D (less toggle)	68	68
Toggle cut-out	Standard DIN	

Ampere Rating NRC	Adj. $I_r$ <sup>1)</sup> Min - Max.	Adj. $I_m$ <sup>1)</sup> Min - Max.	Cat. No.
20	12.5 - 20	120 - 240	<a href="#">S125 GJ 3 20</a> <a href="#">S125 GJ 4 20</a>
32	20 - 32	192 - 384	<a href="#">S125 GJ 3 32</a> <a href="#">S125 GJ 4 32</a>
50	32 - 50	300 - 600	<a href="#">S125 GJ 3 50</a> <a href="#">S125 GJ 4 50</a>
63	40 - 63	378 - 756	<a href="#">S125 GJ 3 63</a> <a href="#">S125 GJ 4 63</a>
100	63 - 100	600 - 1200	<a href="#">S125 GJ 3 100</a> <a href="#">S125 GJ 4 100</a>
125	80 - 125	750 - 1500	<a href="#">S125 GJ 3 125</a> <a href="#">S125 GJ 4 125</a>

1)	NRC: Adj. $I_r$ : Adj. $I_m$ :	Nominal rated current Adjustable thermal setting Adjustable magnetic setting
----	--------------------------------------	--

*Replaces: XH125NJ, TL100NJ, Note: check exact ratings or dimensions to suit your application requirement*



## TEMBREAK 2 MCCBs

NHP

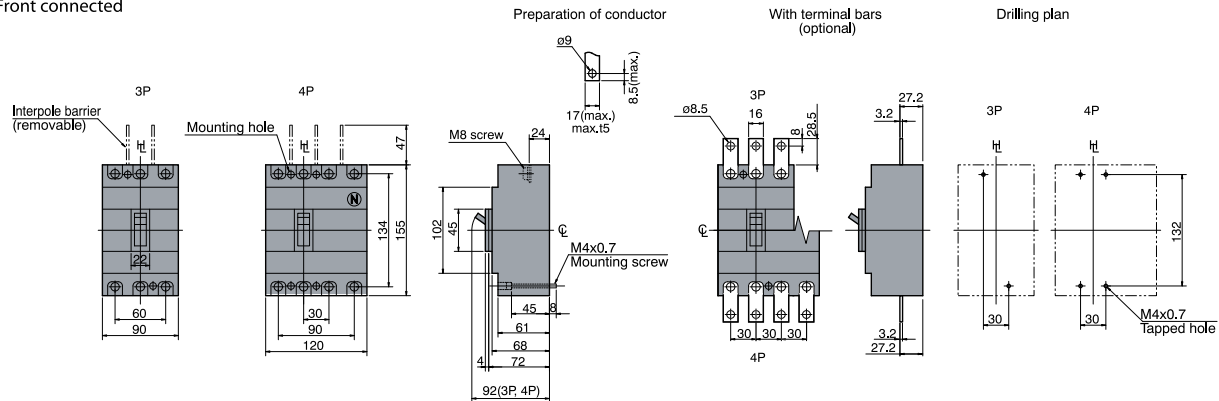
# DIMENSIONS

## E125-NJ, S125-NJ, S125-GJ

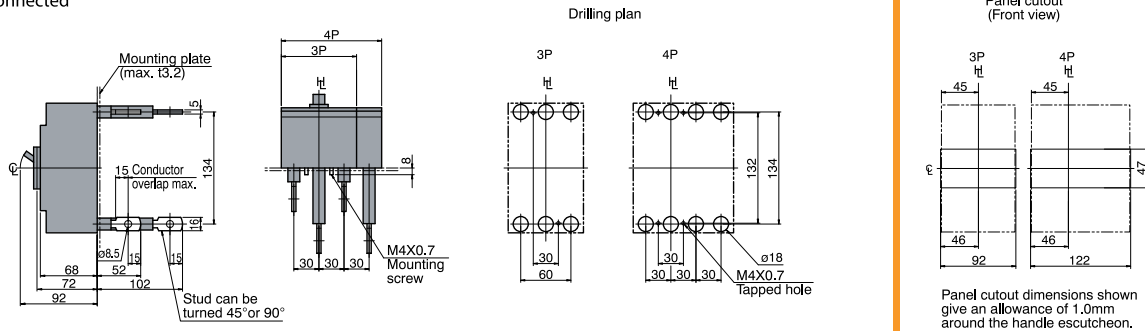
ASL: Arrangement Standard Line

HL: Handle Frame Centre Line

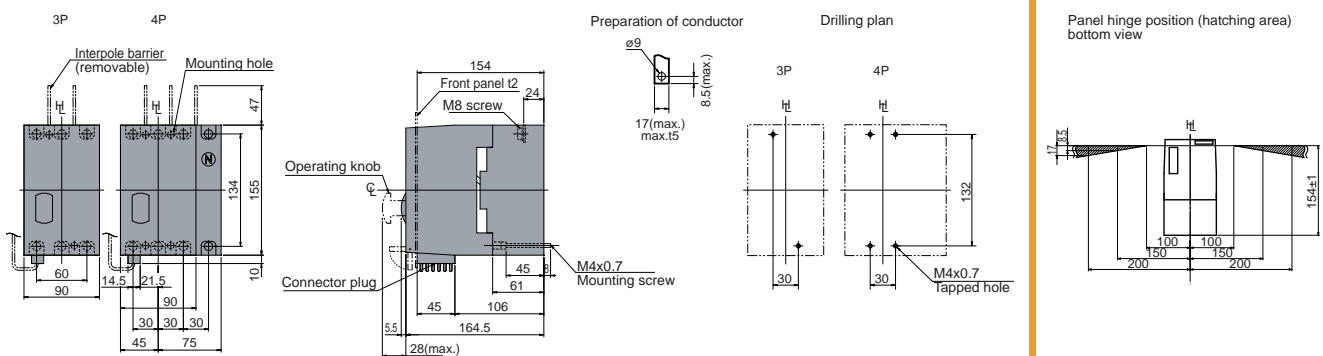
Front connected



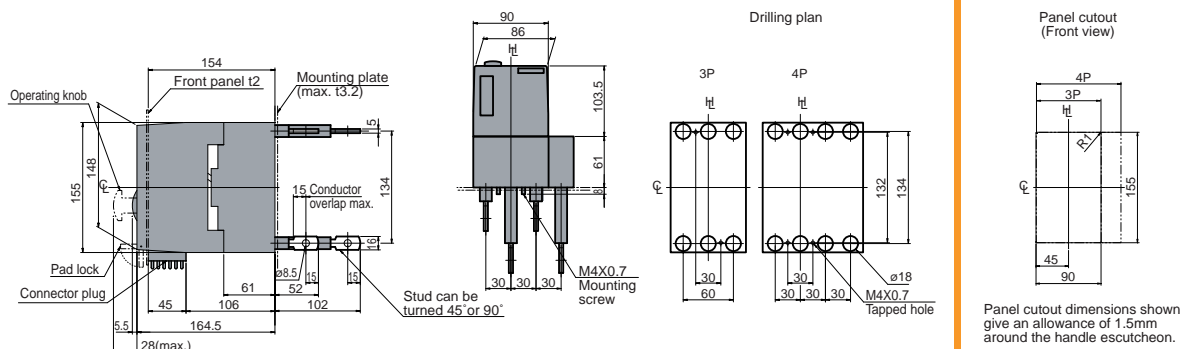
Rear connected



Front connected with Motor Operator



Rear connected with Motor Operator



SECTION 7

**NHP**

## Thermal magnetic type

### E125NJ

## 25kA

**Current rating:** 12.5 – 125A

**Approvals and Tests:**

Standards AS/NZS 3947-2, and IEC60947-2

**Interrupting capacity:**

	Voltage	Icu	Ics
AC use	380/415	25	19
DC use	250V	25	19

**Trip unit:**

Adjustable thermal (0.63 *I<sub>r</sub>* to 100% *I<sub>r</sub>*) and adjustable magnetic (6 *I<sub>m</sub>* to 12 *I<sub>m</sub>*)

**Dimensions (mm)**

Poles	3
H	155
W	90
D (less toggle)	68
Toggle cut-out	Standard DIN

**Ampere**
**Rating**
**NRC**
**Adj. *I<sub>r</sub>* 1)**

Min - Max.

**Adj. *I<sub>m</sub>* 1)**

Min - Max.

**Cat. No.**

20	12.5 - 20	120 - 240	E125 NJ 3 20
32	20 - 32	192 - 384	E125 NJ 3 32
50	32 - 50	300 - 600	E125 NJ 3 50
63	40 - 63	378 - 756	E125 NJ 3 63
100	63 - 100	600 - 1200	E125 NJ 3 100
125	80 - 125	750 - 1500	E125 NJ 3 125

1)

NRC:

Adj. *I<sub>r</sub>*:

Adj. *I<sub>m</sub>*:

Nominal rated current

Adjustable thermal setting

Adjustable magnetic setting



Replaces: XS125CJ, Note: check exact ratings or dimensions to suit your application requirement

Price Schedule T2

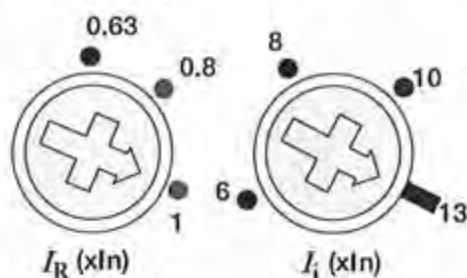
6



## OPERATING CHARACTERISTICS

### THERMAL MAGNETIC PROTECTION

#### Adjustment Dials



1.  $I_R$  is the thermal element adjustment dial and is used to set the rated current to match the conductor rating.

$I_R$  can be set between 0.63 and 1.0 times  $I_n$ .

2.  $I_i$  is the magnetic element adjustment dial and is used to set the short circuit tripping threshold to suit the application.

$I_i$  can be set between 6 and 12 times  $I_n$  on 125A and 400A frame models.

$I_i$  can be set between 6 and 13 times  $I_n$  on 250A frame models with ratings of 160A, 200A and 250A.

$I_i$  can be set between 6 and 12 times  $I_n$  on 250A frame models with ratings of 125A and less.

#### Models, Types and Rated Currents of Thermal Elements

Model	Type	Current Rating In (A)
S125	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100, 125
E125	-NJ	20, 32, 50, 63, 100, 125
S125	-NJ	20, 32, 50, 63, 100, 125
S125	-GJ	20, 32, 50, 63, 100, 125
H125	-NJ	20, 32, 50, 63, 100, 125
L125	-NJ	20, 32, 50, 63, 100, 125
S160	-NF	16, 20, 25, 32, 40, 50, 63, 80, 100, 125, 160
S160	-NJ	20, 32, 50, 63, 100, 125, 160
S160	-GJ	50, 63, 100, 125, 160
H160	-NJ	160
L160	-NJ	160
E250	-NJ	20, 32, 50, 63, 100, 125, 160, 200, 250
S250	-NJ	160, 200, 250
S250	-GJ	160, 200, 250
H250	-NJ	160, 250
L250	-NJ	160, 250
E400	-NJ	250, 400
S400	-CJ	250, 400
S400	-NJ	250, 400
S400	-GJ	250, 400
H400	-NJ	250, 400
L400	-NJ	250, 400



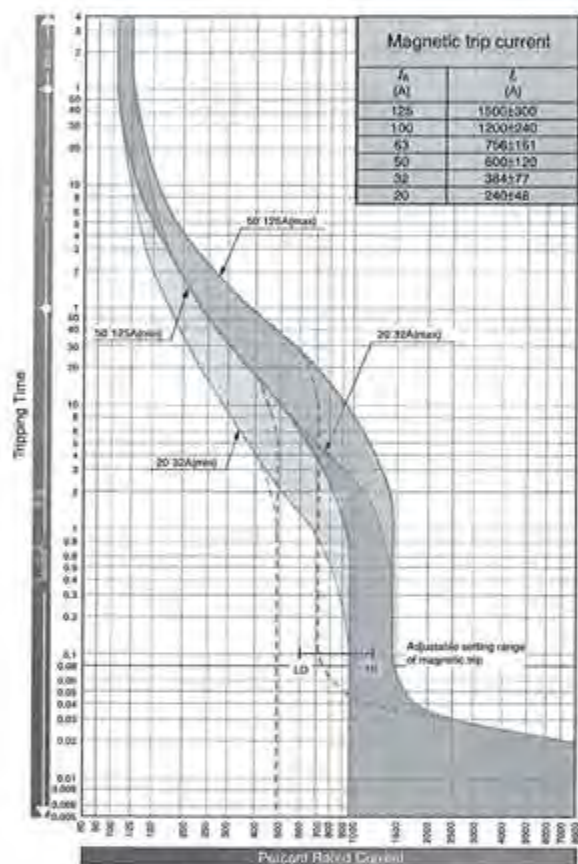
# OPERATING CHARACTERISTICS

## THERMAL MAGNETIC CHARACTERISTICS

### 125A Frame MCCBs

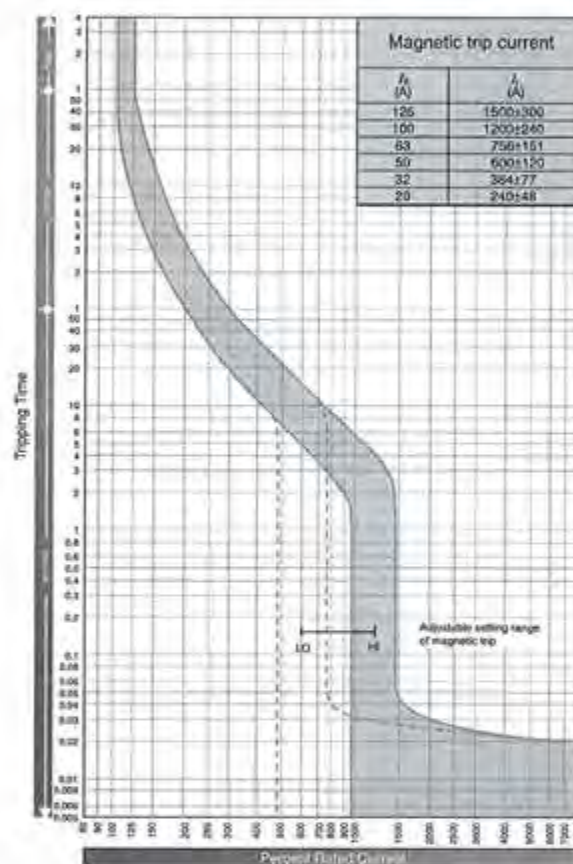
Time/current characteristic curves

E125-NJ, S125-NJ, S125-GJ



Time/current characteristic curves

H125-NJ, L125-NJ



# ACCESSORIES

## TEMBREAK 2

### MOULDED CASE CIRCUIT BREAKERS

#### 16A TO 630A

1.	Welcome to TemBreak 2	
2.	Ratings and Specifications	
3.	Operating Characteristics	
4.	Application Data	
5.	Accessories	
	• Electrical Control (Internal Accessories)	59
	• Termination of Control Wiring	64
	• Electrical Control (Motorised Operation)	65
	• Operating Handles & Locking Devices	68
	• Insulation Accessories	70
	• Dual Supply Changeover Systems	73
6.	Installation	
7.	Dimensions	



## TEMBREAK

### MOULDED CASE CIRCUIT BREAKERS

#### 630A TO 1600A

8.	TemBreak Moulded Case Circuit Breakers	
9.	Order Codes	

# ACCESSORIES

## ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Electrical control accessories for TemBreak 2 are designed with the installer in mind. Status and alarm contacts, remote tripping coils and undervoltage protection coils are of modular design and convenient to use.



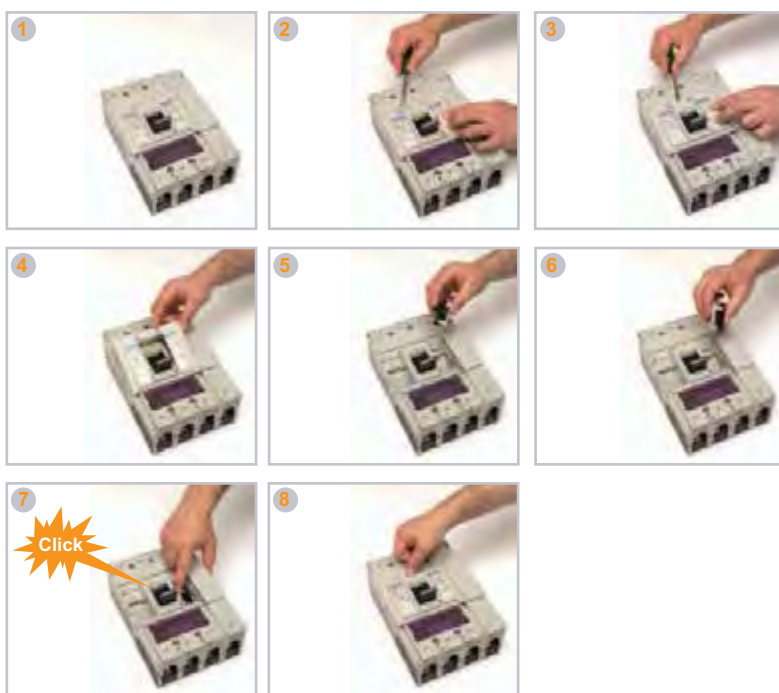
- 1) Heavy-duty auxiliary switch
- 2) Heavy-duty alarm switch
- 3) General-purpose auxiliary switch
- 4) General-purpose alarm switch
- 5) Shunt trip
- 6) Under voltage trip

- Every accessory fits every MCCB and Switch-Disconnecter in the range.
- All accessories are endurance tested to the same level as MCCBs.
- TemBreak 2 internal accessories are easily **field-installable**.
- All accessories are individually packaged and are supplied with fitting instructions.
- Control wiring is terminated on the accessory screw terminal. Alternatively a terminal block which clips to the side of the MCCB is available.



### Installing Accessories in a 4 pole S400 model

The internal accessories can be easily installed in the field without special tools or product training.



### Easy field-Installation of Accessories

- Internal accessory can be simply plugged into position
- No tools are required for this, except a screwdriver to lift the MCCB front cover clips.
- Accessories fit with a firm click when installed correctly.
- Colour coding of accessories helps identification and installation

ACCESSORIES

ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

Valid Maximum Accessory Combinations

Frame size (A):		
125	160 and 250	400 and 630

- Status indication switches mount in the left side of the MCCB. *General purpose and heavy duty status indication switches cannot be mixed in the same MCCB. Only one alarm switch can be fitted to an MCCB.*
- Shunt trips and under voltage trips mount in the right side of the MCCB.
- It is not possible to install a shunt trip and an under voltage trip in an MCCB as they occupy the same location. Under voltage trips can provide remote tripping if necessary by wiring a normally closed contact or pushbutton in series with the protected supply.
- Under voltage trips with time delays require an external time delay controller which clips to the side of the MCCB.



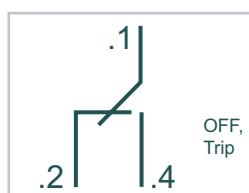
# ACCESSORIES

## ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

### Status Indication Switches



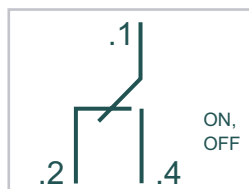
General Purpose Auxiliary Switch



Terminal Designations and Function of General Purpose Auxiliary Switch



General Purpose Alarm Switch



Terminal Designations and Function of General Purpose Alarm Switch

### General Purpose Auxiliary Switch (AX)

An auxiliary switch electrically indicates the ON or OFF status of the MCCB. The general purpose type is a changeover switch with 3 terminals.

A microcurrent version is available for switching currents as low as 1mA.

Auxiliary switches are colour coded grey. The cable capacity of the terminals is 0.5 to 1.25mm<sup>2</sup>.

The general purpose auxiliary switch meets the requirements of IEC 61058-1.

### General Purpose Alarm Switch (AL)

An alarm switch electrically indicates the TRIP status of the MCCB. The general purpose type is a changeover switch with 3 terminals.

A microcurrent version is available for switching currents as low as 1mA.

Alarm switches are colour coded grey and black. The cable capacity of the terminals is 0.5 to 1.25mm<sup>2</sup>.

The general purpose alarm switch meets the requirements of IEC 61058-1.

General purpose auxiliaries and alarm switch ratings						
Volts (V)	AC		Volts (V)	DC		Minimum Load
	Amperes (A)			Amperes (A)		
	Resistive Load	Inductive Load		Resistive Load	Inductive Load	
440	-	-	250	-	-	100mA at 15V DC.
240	3	2	125	0.4	0.05	
110	3	2	30	3	2	

Microcurrent versions		
Volts (V)	DC	
	Amperes (A)	
	Resistive Load	Minimum Load
30	0.1	1mA at 5V DC and 30V DC.

# ACCESSORIES

## ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

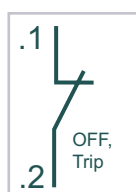
### Status Indication Switches



Heavy Duty Auxiliary Switch



*Terminal Designations and Function of Heavy Duty Auxiliary Switch, a contact*



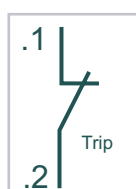
*Terminal Designations and Function of Heavy Duty Auxiliary Switch, b contact*



Heavy Duty Alarm Switch



*Terminal Designations and Function of Heavy Duty Alarm Switch, a contact*



*Terminal Designations and Function of Heavy Duty Alarm Switch, b contact*

### Heavy Duty Auxiliary Switch (AX)

The heavy duty auxiliary switch has an impulse withstand voltage (Uimp) of 6kV and is suitable for isolating safety circuits. The auxiliary switch electrically indicates the ON or OFF status of the MCCB. The heavy duty type is a bridge switch with two terminals. It is available in either normally open or normally closed configurations.

Heavy duty auxiliary switches are colour coded grey. The cable capacity of the terminals is 1.25 to 2.5mm<sup>2</sup>.

The heavy duty auxiliary switch meets the requirements of IEC 60947-5-1.

It has direct opening action, recommended by IEC 60204-1 Safety of Machinery - Electrical Equipment for Machines.



### Heavy Duty Alarm Switch (AL)

The heavy duty alarm switch has an impulse withstand voltage (Uimp) of 6kV and is suitable for isolating control circuits. The alarm switch electrically indicates the TRIP status of the MCCB. The heavy duty type is a bridge switch with two terminals. It is available in either normally open or normally closed configurations.

Heavy duty auxiliary switches are colour coded grey and black. The cable capacity of the terminals is 1.25 to 2.5mm<sup>2</sup>.

The heavy duty alarm switch meets the requirements of IEC 60947-5-1.

It has direct opening action, recommended by IEC 60204-1 Safety of Machinery - Electrical Equipment for Machines.



Ratings of Heavy Duty Auxiliary and Alarm Switches					
AC			DC		
Volts (V)	Amperes (A)		Volts (V)	Amperes (A)	
	Resistive Load	Inductive Load		Resistive Load	Inductive Load
500	1	1	-		
440	3	3	250	0.5	0.5
240	4	4	125	1	1
110	5	5	48	3	2.5
48	6	6	24	6	2.5

# ACCESSORIES

## ELECTRICAL CONTROL USING INTERNALLY MOUNTED ACCESSORIES

### Remote Tripping Devices

#### Shunt Trip (SHT)

A shunt trip allows an MCCB to be tripped remotely on the application of the rated coil voltage across the shunt trip terminals. TemBreak 2 shunt trips have **continuously rated coils** and are suitable for use in electrical interlocking applications.

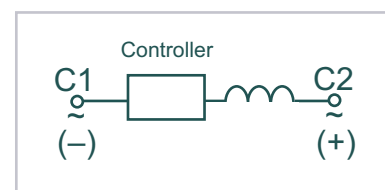
The MCCB contacts and toggle will move to the tripped position when the shunt trip is operated.

The permissible voltage range is 85% to 110% for AC or 75% to 125% for DC.

The cable capacity of the terminals is 0.5 to 1.25mm<sup>2</sup>. Shunt trips are colour coded grey.



Shunt Trips



Terminal Designations of Shunt Trips

Ratings of Shunt Trips							
Rated Voltage	Voltage AC			Voltage DC			
	100-120	200-240	380-450	24	48	100-120	200-240
Excitation Current (A)	0.014	0.014	0.0065	0.03	0.03	0.011	0.011

#### Under Voltage Trip (UVT)

An under voltage trip will trip the breaker automatically when the voltage applied to the terminals of the undervoltage coil drops to between 70% and 35% of its voltage rating. The under voltage trip prevents the circuit breaker being closed unless a voltage corresponding to at least 85% of its voltage rating is applied across the terminals of the undervoltage coil.

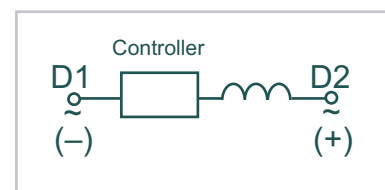
The MCCB contacts and toggle will move to the tripped position when the under-voltage trip operates.

Under voltage trips with AC operating voltages are available with 500ms time delays. Time-delay units are fitted to the outside of MCCBs.

The cable capacity of the terminals is 0.5 to 1.25mm<sup>2</sup>. Under voltage trips are colour coded grey and black.



Under Voltage Trips



Terminal Designations of Under Voltage Trips

Ratings of Under Voltage Trips						
Rated Voltage	Power supply capacity (VA)			Excitation current (mA)		
	Voltage AC			Voltage DC		
	100-120	200-240	380-450	24	100-120	200-240
Power Supply Capacity (VA)	1.4	1.4	2.28	23	10	10

# ACCESSORIES

## TERMINATION OF CONTROL WIRING

Terminal blocks are for optional use with all types of internally mounted accessory.



### Terminal Block for Plug-in MCCBs

The terminal block for a plug-in MCCB consists of:

- a male section pre-fitted with 3 cables with which clips easily to the back of the MCCB
- a female section with 3 user terminals which clips easily into the plug-in base.

Up to 4 terminal blocks can be installed on a 125A, 160A or 250A frame MCCB. Up to 5 terminal blocks can be installed on a 400A or 630A frame MCCB.



*Terminal Block for Plug-in MCCBs*

### Terminal Block for Front-Connected and Rear-Connected MCCBs (TF)

A terminal block facilitates convenient and accessible control wiring to internally mounted accessories. It allows the use of control wiring cables with larger cross-sectional area than permitted by the internal accessories themselves.

This terminal block can be clipped to either side of the MCCB. If mounted on the left incoming wiring will be fed vertically up to the terminals. If mounted on the right, the incoming wiring will be fed vertically down to the terminals. Terminal blocks are pre-fitted with outgoing wiring which can be terminated directly on each internal accessory. Note that if the terminal block is mounted on the right side of the MCCB, it is not compatible with the breaker-mounted terminal block for preferential trip alarm. The latter should be remotely-mounted in this case.

The maximum incoming cable size to the terminal block is 2.5mm<sup>2</sup>. Terminal blocks have 11 terminals.



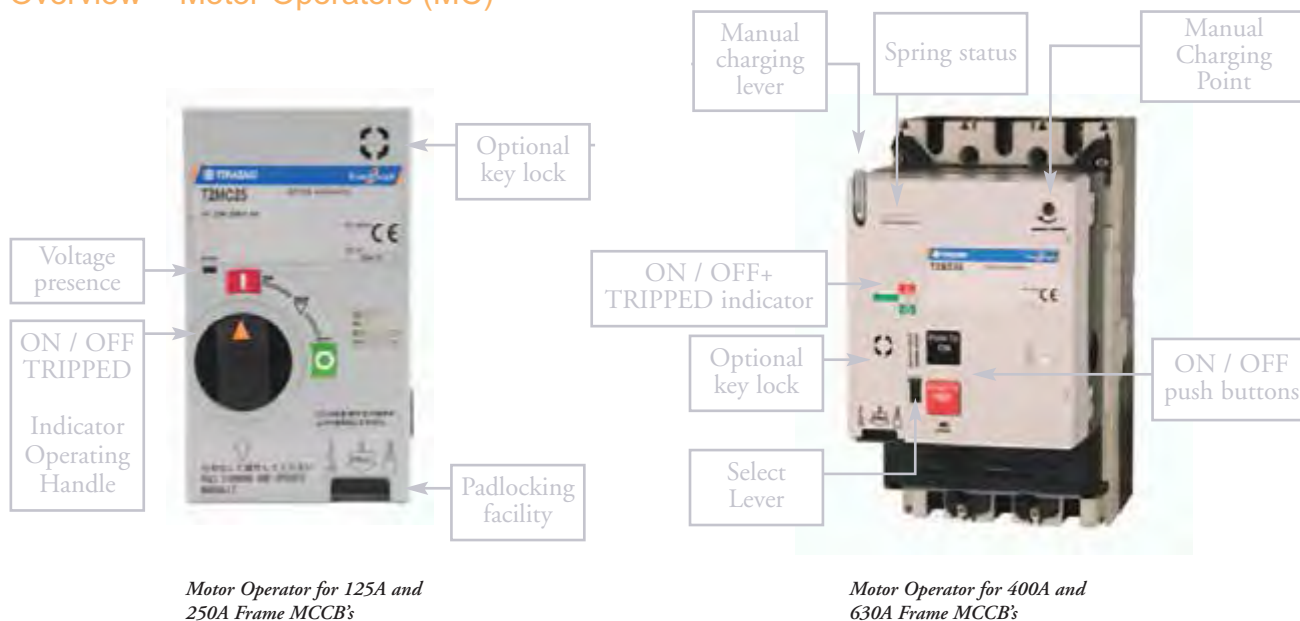
*Terminal Block for Front-Connected and Rear-Connected MCCBs*



# ACCESSORIES

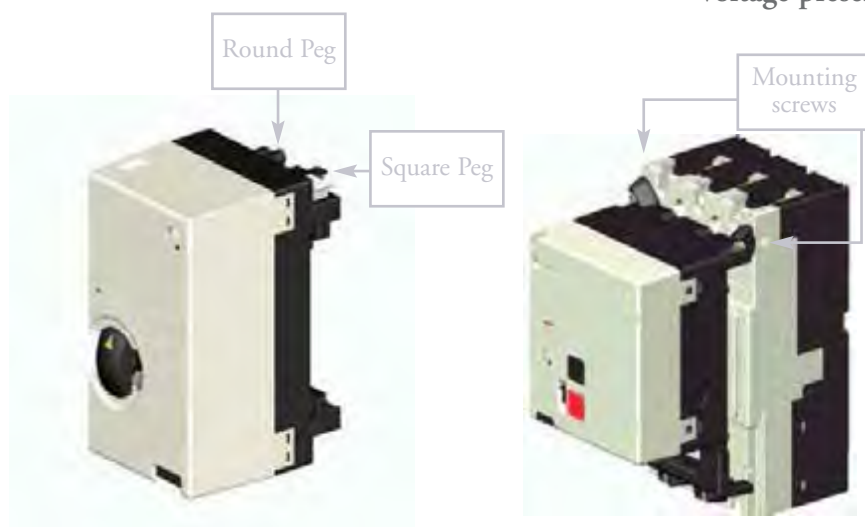
## ELECTRICAL CONTROL USING MOTORISED OPERATION

### Overview – Motor Operators (MC)



Motor operators provide the possibility of opening and closing an MCCB on application of electrical control signals. TemBreak 2 motor operators are extremely reliable, having been designed to endure the same switching duty as the host MCCB.

- Easy field-installation.
- Fast operation ( $\leq 100\text{ms}$ ).
- Positive contact indication.
- Padlocking facility as standard (Maximum 3, hasp diameter 8mm).
- Optional keylock.
- Versions available with automatic reset function.
- Voltage presence indication.



*Motor Operator for 125A and 250A frame MCCB's*

*Motor Operator for 400A and 630A frame MCCB's*

Motor operators for 125A and 250A frame are mounted on the front of the breaker. They can be rapidly fitted by locating the round pegs and square pegs on the motor into corresponding round and square holes on the breaker. It takes less than 10 seconds to secure the motor to the MCCB. Two levers securely lock the motor into position. No tools are needed to fit the motor operator.

400A frame and 630A frame motor operators are held in place with mounting screws. They can be installed easily in the field.

# ACCESSORIES

## ELECTRICAL CONTROL USING MOTORISED OPERATION

### Indication of ON, OFF or TRIPPED Status

The external operating handle of 125A and 250A frame motor operators has dual functions:

1. Indication of ON, OFF or TRIPPED status as shown in the photographs below;
2. Manual operation when external operating handle is pulled out. The supply to electrical control circuits inside the motor operator is cut when the external operating handle is pulled out.



MCCB on



MCCB off



MCCB tripped



*Motor operators for 400A and 630A frame MCCBs incorporate a mechanical flag which indicates the ON, OFF and TRIPPED status of the MCCB. They can be manually charged using the lever provided.*

### Ratings and Specifications

Frame size of host MCCB (A)		125, 160, 250	400, 630
Rated operating voltage	100-110 V AC	■	■
	200-220 V AC	■	■
	230-240 V AC	■	■
	24 V DC	■	■
	48 V DC	■	■
	100-110 V DC	■	■
Operating current/ Starting current Peak value (A)	100-110 V AC	2.5 / 5.3	ON ---/1.9; OFF, RESET 1.3/3.8
	200-220 V AC	2.9 / 5.3	ON ---/3.3; OFF, RESET 0.9/3.8
	230-240 V AC	2.8 / 5.3	ON ---/3.3; OFF, RESET 0.9/3.8
	24 V DC	9 / 18	ON ---/9.2; OFF, RESET 4.3/9.8
	48 V DC	8 / 17	ON ---/3.8; OFF, RESET 2.0/5.2
	100-110 V DC	1.3 / 4.3	ON ---/1.3; OFF, RESET 1.2/2.9
Operating method		Direct drive	Spring charging
Operating time (s)	ON	0.1	0.1
	OFF	0.1	1.5
	RESET	0.1	1.5
Operating switch rating	100V, 0.1 A, Opening voltage: 44V, current 4mA		
Power supply required	300 VA minimum		300VA minimum
Dielectric properties (1 min)	1500 V AC (1000V AC for 24V DC and 48V DC motors)		
Weight	1.4 kg		3.5kg

■ = Available

Note: Operating times shown in the above table apply only when the rated operational voltage is supplied to the motor operator. The voltage supplied to the motor operator must be within the range of 85% and 110% of the rated operating voltage.

# ACCESSORIES

## ELECTRICAL CONTROL USING MOTORISED OPERATION

### Motor Operator Control Circuits

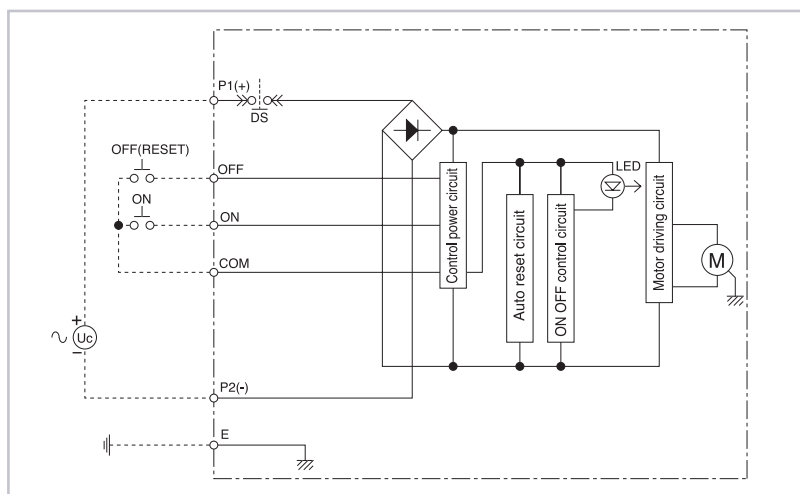


MCCB and Motor Operator Showing Control Wiring Socket

*The Control circuits for Motor Operators are connected using a simple plug and socket system.*



Control Wiring Plug



Control circuit for Motor Operators

### Operation

The motor operator incorporates a self-hold circuit for the closing and opening signals. Therefore a momentary open or close signal will ensure a complete operation.

When the breaker trips, the breaker is reset by applying a signal to the OFF terminals of the motor.

When a UVT is used with a motor operator, design the control circuit so that the UVT is energised **before** a reset or close signal is sent to the motor operator. A 40ms time delay in the reset and close signals is sufficient to allow the UVT to energise.

When a shunt trip is used with a motor operator, design the control circuit so that the shunt trip is de-energised before a reset or close signal is sent to the motor operator.

If motor operators are used with mechanically interlocked MCCBs, the motors must be electrically interlocked to ensure correct operation.

Electrical interlocking can be achieved using the 'Cable for Electrical Interlocking' accessory. This cable is wired to terminals on the top of each motor, and provides electrical interlocking without the use of other accessories or wiring. Refer to section 10 for order codes.

### Auto-reset

Two types of motor operator are available: motor operators without auto-reset and motor operators with auto-reset. The correct type of motor operator should be selected for the application. MCCB auxiliary and alarm switches do not have to be used in the control circuits for motor operators whether they have auto-reset or not, saving cost and space.

# ACCESSORIES

## OPERATING HANDLES & LOCKING DEVICES

TemBreak 2 external operating handles are extremely reliable, having been designed to endure the same switching duty as the host MCCB.

It is easy to fit the operating unit to the MCCB. Fitting involves three easy steps:

1. Align breaker toggle with operating mechanism
2. Push external operating handle into position (the handle's round pegs locate securely in the breaker's round holes and the external operating handle's\* square pegs in the breaker's square holes).
3. Twist locking screws through 45 degrees.\*

### Safety Features

- Door interlock mechanism with override facility included as standard
- IP54 as standard (door mounted version), IP3X as standard (breaker mounted version)
- IP65 optional (door mounted version), IP5X optional (breaker mounted version)
- Locks OFF with up to 3 padlocks (8mm hasps)
- Optional keylock in OFF position
- Available in black or red and yellow
- A trip test can be performed with the external operating handle fitted to the MCCB

### Orientation

To switch the breaker from OFF to ON the external operating handle is rotated through 90 degrees in a clockwise direction.

The ON (I) and OFF (O) indication of the external operating handle can be re-oriented in steps of 90 degrees with respect to the operating mechanism. This allows the indication position to remain the same whether the breaker is mounted vertically (right side up or upside down) or horizontally (on its left side or on its right side).

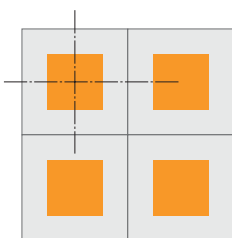
The hole cut-out dimensions for a panel or door will remain unchanged if the external operating handle is re-oriented. The external operating handle's axis of rotation is on the intersection of the centre lines of a 3P MCCB. This means that the positioning of the door cutouts is symmetrical for breakers mounted horizontally on either side of a vertical busbar system.



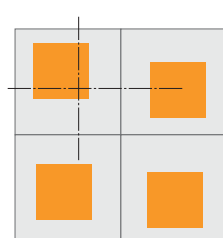
MCCB ON

MCCB ON

### Cubicle Door Cutouts



Using TemBreak 2 Operating Handles



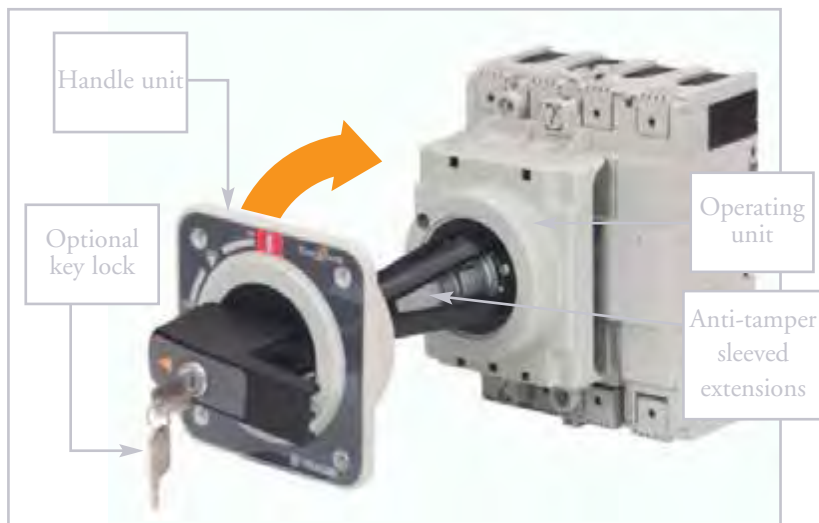
Using other MCCB Operating Handles

\*external operating handles for 400A and 630A Frame models are secured with four screws.

# ACCESSORIES

## OPERATING HANDLES & LOCKING DEVICES

### Door Mounted Handle (HP)



*Door Mounted Handle with Optional Keylock*

The door mounted handle is used to operate a circuit breaker mounted inside a cubicle from outside the door. It consists of an operating mechanism that is mounted on the breaker, an operating handle that is mounted on the door, and a shaft that transmits the turning force from the handle to the operating unit. The shaft can be cut to the required length.

### Breaker Mounted Handle (HB)



*Breaker Mounted Handle Padlocked in the OFF Position*

This external operating handle is used to operate a circuit breaker mounted just behind a compartment door with the door closed. The operating unit and the handle itself are mounted directly onto the circuit breaker. The handle protrudes through a cutout in the door. A moulded door flange is supplied with the external operating handle which covers the cutout from the front.

Padlocking and keylocking is possible in the OFF position.

### Locking Devices

Toggle locking devices allow MCCBs to be locked ON or OFF using up to three padlocks. Locking devices for 125A, 160A and 250A frame models accept padlocks with 5mm hasp diameter. Locking devices for 400A and 630A frame models accept padlocks with 8mm hasp diameter.



*S250 Locked OFF*



*S400 Locked OFF*

Fittings for Castell and Fortress locks are available. They are suitable for use on toggle-operated MCCBs, or on door mounted handles (HP) for MCCBs.

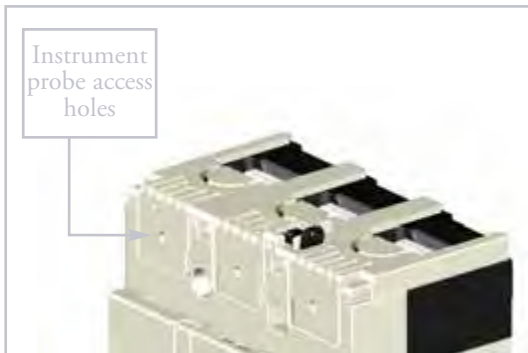


# ACCESSORIES

## INSULATION ACCESSORIES

### Terminal Covers

Terminal covers are used to prevent direct contact with live MCCB terminations. They also provide additional insulation to reduce the possibility of a short circuit between phases or to earth when large conductors are used.



### General features

- Terminal covers require no tools for installation
- All terminal covers have an IP20 ingress protection rating
- Terminal covers are ordered individually. Two terminal covers are required to cover both the line and load terminals of an MCCB. Each cover can either be fitted to the top or bottom of the MCCB
- Terminal covers have an instrument probe access hole of 4mm diameter on each phase.



*Terminal Cover Lock with Lead Seal*

### Options

- A terminal cover lock allows an anti-tampering seal to be added.
- An earth barrier can be added to terminal covers for front connection. The earth barrier provides insulation at the rear of the terminations.



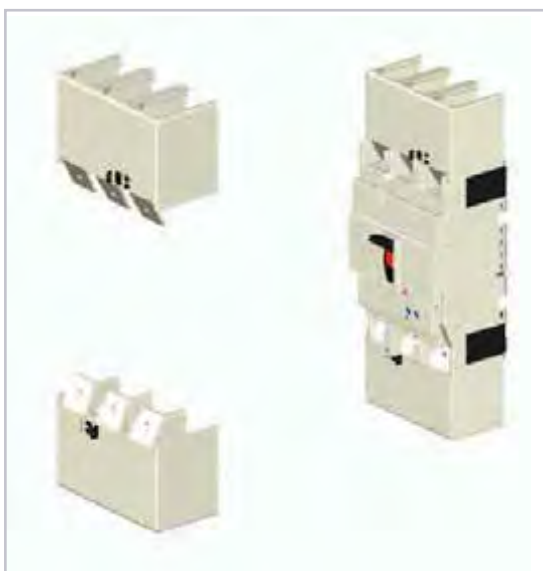
*Earth Barrier Fitted to Rear of Terminal Cover*

# ACCESSORIES

## INSULATION ACCESSORIES

### Terminal Covers for Front Connection (CF)

Terminal covers for front connection are suitable for covering the exposed live parts of conductors terminated on the MCCB.



*Terminal Covers for Front Connection*



*Flush Terminal Covers*

### Flush Terminal Covers (CS)

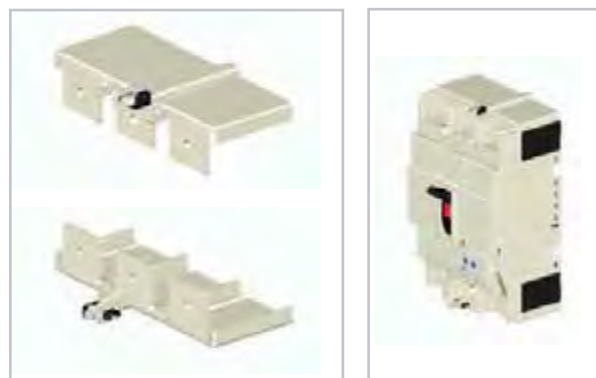
Flush terminal covers are useful for increasing the ingress protection rating at the terminals without increasing the overall length. They can be used with busbar and for direct entry of stranded cable (with solderless cable clamp terminals (FW), refer to Section 6, Installation).

Flush terminal covers are identical to rear terminal covers for 400A and 630A frame models.

The user can remove a section of the rear terminal cover using a tool to allow entry of the conductor.

### Terminal covers for Rear Connection (CR)

Terminal covers for rear connection may be used on MCCBs fitted with rear connections (RC) or plug-in connections (PM). They prevent access to the terminals from the front and top.



*Terminal Covers for Rear Connection*

# ACCESSORIES

## INSULATION ACCESSORIES

### Interpole Barriers (BA)

Interpole barriers provide maximum insulation between phases at the terminals of the MCCB. They cannot be fitted at the same time as any of the terminal covers.

Interpole barriers for use on one end of the MCCB are supplied as standard. Additional interpole barriers can be ordered individually. All interpole barriers can easily be fitted to either end of an MCCB.

MCCB moulds have been designed to accept an additional interpole barrier between two adjacent MCCBs.



*MCCB Fitted with Interpole Barriers on Both Ends*



*Interpole Barriers between Adjacent MCCBs*



# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS

Where more than one AC voltage source is available to a distribution system it is often necessary to prevent multiple sources supplying the system at one time. Interlocking accessories are used together with two MCCBs to prevent both being in the ON state simultaneously. This provides a secure mechanical means of preventing the connection of two supply sources.

An automatic changeover controller can monitor the status of two supplies and control the switching of two MCCBs according to pre-programmed parameters. When an automatic changeover controller is interfaced to a pair of interlocked MCCBs fitted with remote control accessories, a secure, fully automatic changeover system is achieved.

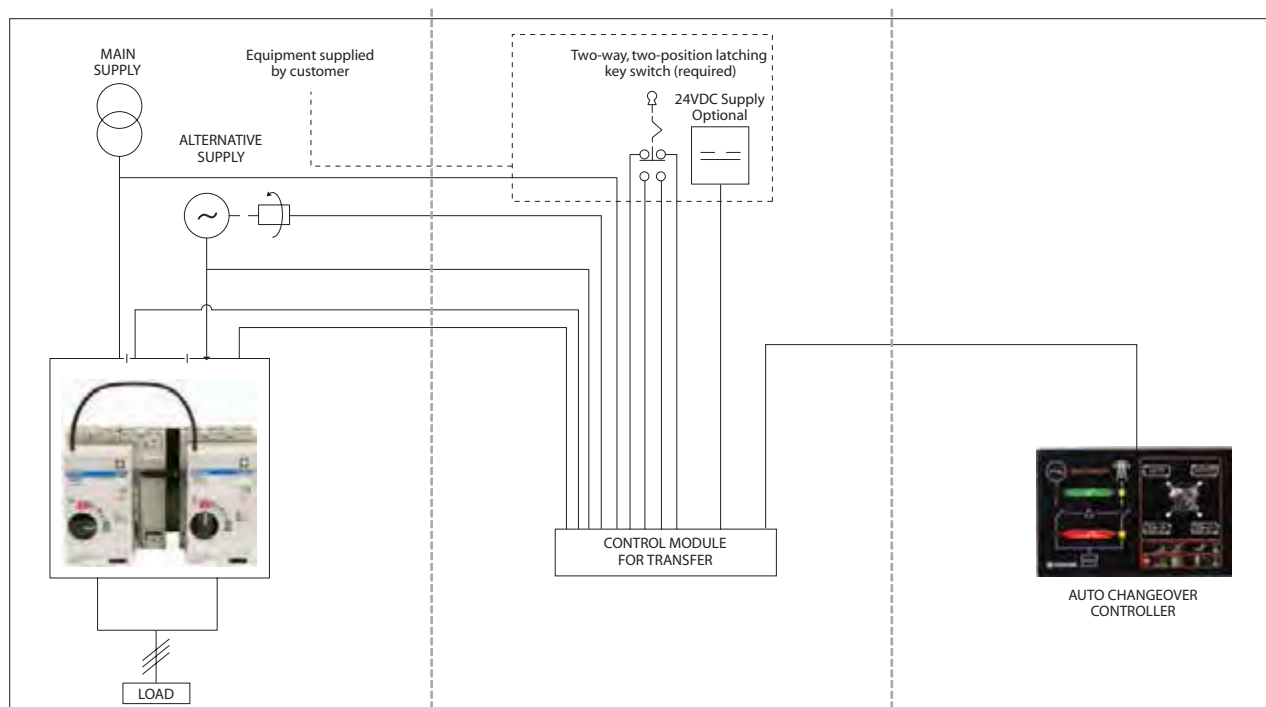
Terasaki can supply components for automatic changeover systems in one of the following three ways:

1. Terasaki provides MCCBs, mechanical interlocks and accessories individually packaged, for customer assembly. Automatic changeover controller, terminal block, control elements, all wiring and wiring diagrams are the customer's own. The requirements for the control circuit mentioned under the headings 'Electrical Control Using Motorised Operation/Operation', in this section, must be observed to ensure correct operation.
2. Terasaki provides MCCBs, mechanical interlocks, accessories, TemTransfer Automatic Changeover Controller and wiring diagram individually packaged, for customer assembly. Terminal block, control elements and all wiring are the customer's own. A two-way, two-position latching key switch is required to provide reset after faults, and to disable automatic control allowing isolation of the load.
3. Terasaki provides MCCBs, mechanical interlocks, accessories, TemTransfer Automatic Changeover Controller, wiring diagram and control module individually packaged, for customer assembly. All wiring is the customer's own. A two-way, two-position latching key switch is required to provide reset after faults, and to disable automatic control allowing isolation of the load.

# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS

The following schematic diagram illustrates an automatic changeover system employing the TemTransfer Automatic Changeover Controller.



### Mechanically and Electrically Interlocked MCCBs and Accessories

All accessories, including mechanical interlocks, can be fitted in the field.

The unique design of the interlocks means that a special mounting plate is not necessary.

Contact us for a list of the accessories required.

### Control Module for TemTransfer (Optional)

The optional control modules centralises the connections, thereby simplifying the wiring of a TemTransfer automatic changeover system.

It consists of a control element and terminal block.

The 24VDC supply is not required for normal operation, but is required for performing diagnostic or reprogramming procedures on TemTransfer in the absence of mains or alternative supplies.

Contact us for the wiring diagram.

### TemTransfer Automatic Changeover Controller (refer to p77 for details)

Terasaki can supply TemTransfer pre-programmed to your specification (contact us for details), or with an optional interface for self-programming (refer to Section 10 for order codes). Otherwise supplied with factory default settings.

# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS



*Link Interlock*



*Changeover Pair with Link Interlock and Motor Operators*



*Viewed from Below*

### Link Interlock (ML)

Link interlocks consist of a mechanism mounted to each MCCB in an adjacently mounted pair. The link between each mechanism inhibits the closure of one MCCB unless the other is in the OFF position.

Link interlocks can be used on a mixture of 3 and 4 pole breakers of the same frame size.

The TemBreak 2 link interlock is an innovative design breakthrough which will save space, time and money for switchboard builders in that:

- Installation is extremely simple. Link interlocks are field-installable and only require a screwdriver to fit.
- Link interlocks replace the accessory cover on the front of the breaker
- Motor operators and operating handles are compatible with link interlocks
- The interlock is installed on the front of the MCCB and does not therefore interfere with copperwork or cables
- No need to buy factory-built backplates with MCCBs and interlocks pre-fitted
- An automatic changeover pair consisting of an interlocked pair of MCCBs with internal control accessories and motor operators can be assembled in a few minutes!

# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS

### Wire Interlock (MW)

Wire interlocks consist of two mechanisms connected by a cable. The mechanisms are mounted on two MCCBs located at a distance from each other which is limited by the length and bend radius of the cable. The mechanisms and cable inhibit the closure of one MCCB unless the other is in the OFF position. Each mechanism is ordered separately. Cables of 1.0m or 1.5m length are also ordered as separate items.

Wire interlocks can be used on a mixture of 3 and 4 pole MCCBs of different frame sizes. This allows potential cost savings by using lower rated MCCBs for the alternative power supply. MCCBs can be mounted in different switchboard compartments or on different planes.



*Changeover Pair with Wire Interlock, Electrical Interlock and Motor Operators*



*View from above*

The TemBreak 2 wire interlock is an innovative design breakthrough which will save space, time and money for switchboard builders in that:

- Installation is extremely simple. Wire interlocks are field-installable.
- Wire interlocks replace the accessory cover on the front of the breaker.
- Motor operators and operating handles are compatible with wire interlocks.
- Interlocking of MCCBs mounted in different compartments is possible.
- No need to buy factory-built backplates with MCCBs and interlocks pre-fitted.
- An automatic changeover pair consisting of an interlocked pair of MCCBs with internal control accessories and motor operators can be assembled in a few minutes!

### Slide Interlock (MS)

Slide interlocks are manually operated toggle locking devices which can be installed between two adjacent MCCBs. Depending on the position of the slide, one or other of the MCCBs on either side of a slide interlock is inhibited from being in the ON position.

Slide interlocks can be used between MCCBs of the same number of poles and of the same frame size.

Slide interlocks can be installed in the field and are padlockable in both positions.



*Slide Interlock installed between two MCCBs*

# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS

### TemTransfer Automatic Changeover Controller

The TemTransfer is a fully configurable **Automatic Changeover Controller (ACC)**. It is designed to monitor the incoming AC mains supply (1 or 3 phases) for under/over voltage and under/over frequency. Should these fall out of limits, the module will issue a start command to the generating set controller. Once the set is available and producing an output within limits the ACC will control the transfer devices and switch the load from the mains to the generating set. Should the mains supply return to within limits the module will command a return to the mains supply and shut down the generator after a suitable cooling run. Various timing sequences are used to prevent nuisance starting and supply breaks.

TemTransfer is compatible with TemPower 2 ACBs, TemBreak 2 MCCBs and TemContact contactors.

When TemTransfer is used with a pair of TemBreak 2 MCCBs, additional control wiring and components may be necessary for some control schemes. Contact us for details.

Terasaki can supply TemTransfer pre-configured to specification, or unconfigured with an optional interface kit.

**Configuration** is by PC based software and the interface kit using an FCC68 socket on the rear of the module. This allows rapid and secure configuration of the module. The FCC68 socket also provides full real-time diagnostics on the status of the ACC, its inputs and outputs.

Configuration and connection options allow for a wide range of **higher functions** such as *'Auto start inhibit'*, *'Manual restore to mains'*, *'Load inhibit'* (both mains and gen-set), *'Lamp test'*, *'Push-button transfer control'*, *'External mains or Gen-set failure inputs'*, etc.

The four position key-switch allows for mode selection:-

- Auto Mode
- Auto mode with manual return to Mains
- Run generator off load
- Run generator on load

A clear mimic diagram with 'International' symbols and LEDs provide clear indication of supply availability and load switching status. Further LED indication is provided for *'Start delay in progress'* and *'Mains return timer active'*. Two **user configurable LED's** are provided to allow the user to display specific states (defaulted to indicate that the closing procedure of the Mains or Generator circuit breaker has been started).

Five **user configurable relays** are provided to allow control of contactors, different circuit breaker types and engine control modules and alarm systems.

The controller features a self seeking power supply which will utilise power from the Mains AC supply or the Generator AC supply. A DC supply to the module is not essential for basic operation, though some 'higher' functions require it (such as system diagnostics).

The module is mounted in a robust plastic case, connection to the module is via plug and socket connectors.



TemTransfer Automatic Changeover Controller



# ACCESSORIES

## ACCESSORIES FOR DUAL SUPPLY CHANGEOVER SYSTEMS

### TemTransfer Automatic Changeover Controller

#### Specifications

##### DC Supply

The TemTransfer is normally powered from the AC sensing supplies. It will only draw power from the DC supply if both AC supplies are not present.

DC power should be supplied from a low voltage supply between 8 to 35V continuous. It is able to operate at 0V for 50ms during cranking, providing supply was at least 10V before dropout and supply recovers to 5V. This is achieved without the need for internal batteries.

**Maximum operating current:**  
150mA @ 12V, 95mA @ 24V.

**Maximum standby current (AC powered supply)**  
34.7 mA @ 115V. 16.1mA @ 230V.

**3 Low voltage auxiliary relay contacts:**  
8Amp DC rated 1 each: NO+NC C/O  
(a and b C/O contacts)

**2 Mains rated relay contacts:**  
8Amp RMS rated 1 each NO+NC.  
(a and b contacts)

##### Dimensions:

96 x 144 x 155 DIN STANDARD.

**Operating temperature range:**  
-15 to +55°C

##### Indication LEDs:

Mains Available/On Load, Generator Available/On load, Start Delay, Mains Return Delay and 2 User Configurable.

**Operating voltage:** - Specify on ordering.

**AC Voltage Input Range (for AC Powered Operation):**

115V Version:- 88 - 160 V ac RMS

230V Version:- 176 - 305 V ac RMS

**AC Voltage Input/Adjustment Range (Sensing Operation):**

115V Version:- 55 - 152 V ac RMS

230V Version:- 110 - 304 V ac RMS

**AC Frequency Input/Adjustment Range:** 10-75 Hz

## MODULAR SIZES



All current ratings up to 630A can be supplied in 2 sizes: the 250A and 630A sizes.



The compact 125A size offers the same features and performance but with reduced dimensions and cost.



## Miniature circuit breakers


### Din-Safe MCBs (RCBO)

- Standard AS/NZS 61009
- Approval N17482
- Short circuit, overcurrent and earth leakage protection
- Handle sealable and padlockable
- DIN Rail mounting

#### Din-Safe MCB with pigtail

No of Poles	Amp rating (A)	Voltage (V)	Short circuit (kA)	Phase <sup>1)</sup>	Trip Sens. (mA)	Cat. No
2	6	110/240	10	1+N	30	DSRCB0630P
2	10	110/240	10	1+N	30	DSRCB1030P
2	16	110/240	10	1+N	30	DSRCB1630P
2	20	110/240	10	1+N	30	DSRCB2030P
2	25	110/240	10	1+N	30	DSRCB2530P
2	32	110/240	10	1+N	30	DSRCB3230P
2	40	110/240	10	1+N	30	DSRCB4030P

#### Din-Safe MCB standard terminal configuration

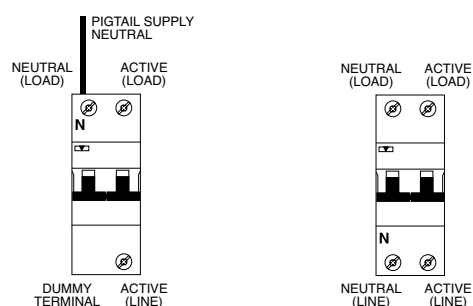
No of Poles	Amp rating (A)	Voltage (V)	Short circuit (kA)	Phase <sup>2)</sup>	Trip Sens. (mA)	Cat. No <sup>3)</sup>
2	6	110/240	10	1+N	10	 DSRCB0610A
2	6	110/240	10	1+N	30	DSRCB0630
2	10	110/240	10	1+N	10	DSRCB1010A
2	10	110/240	10	1+N	30	DSRCB1030
2	10	110/240	10	1+N	100	DSRCB10100
2	16	110/240	10	1+N	10	DSRCB1610A
2	16	110/240	10	1+N	30	DSRCB1630
2	16	110/240	10	1+N	100	DSRCB16100
2	20	110/240	10	1+N	10	DSRCB2010A
2	20	110/240	10	1+N	30	DSRCB2030
2	20	110/240	10	1+N	100	DSRCB20100
2	25	110/240	10	1+N	30	DSRCB2530
2	32	110/240	10	1+N	30	DSRCB3230
2	40	110/240	10	1+N	30	DSRCB4030

#### Application

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


Din-Safe MCBs are suitable for use in residential, commercial and light industrial applications.

#### Terminal configuration



#### Characteristics

- Width: 2 modules.
- For type AC residual currents. <sup>4)</sup>
- Rated voltage: 110/240 V/50-60 Hz.
- Tripping characteristics of MCB part: IEC 60848 - C curve.
- Short circuit capacity: 10 kA.
- Terminal capacity: 25 mm<sup>2</sup>.
- High immunity to transient current.
- Profile as per Din-T MCB.
- Test button for periodic testing.

- Notes:**
- <sup>1)</sup> Unprotected neutral, not switched.
  - <sup>2)</sup> Unprotected neutral, switched.
  - <sup>3)</sup> Fits Din-T chassis (special configuration) refer page TBA.
  - <sup>4)</sup> Some type "A" RCDs are stocked. Refer NHP.
- Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.**
-  Available on indent only.

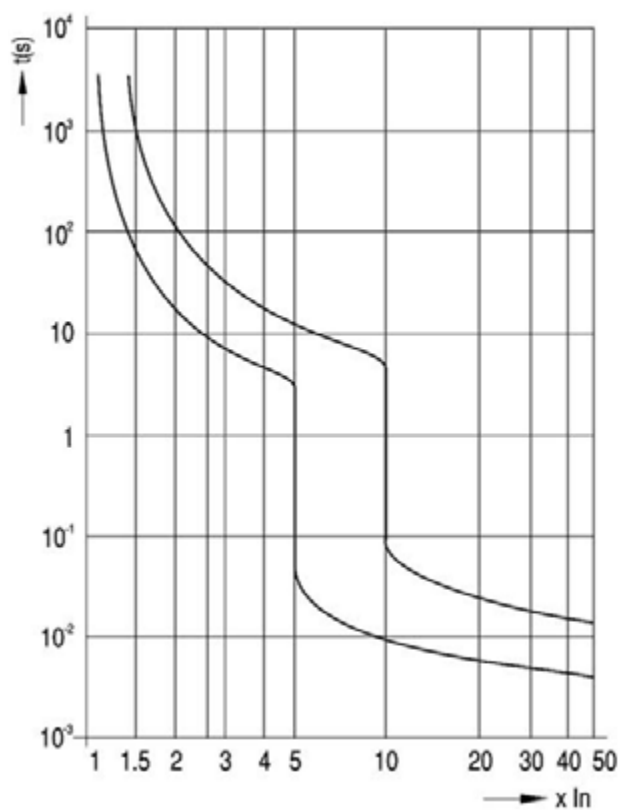


## Din-T MCBs + RCDs Technical data

### Tripping curves according to EN 60898

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

#### Curve C



## Din-T MCBs + RCDs Technical data

### What is an RCD?

3

The RCD (Residual Current Device) is a device intended to protect people against indirect contact, the exposed conductive parts of the installation being connected to an appropriate earth electrode. It may be used to provide protection against fire hazards due to a persistent earth fault current, without operation of the overcurrent protective device.

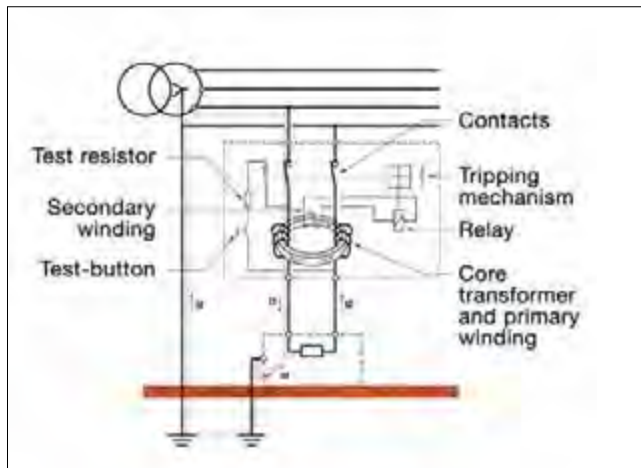
RCDs having a rated residual operating current not exceeding 30 mA are also used as a means for additional protection in case of failure of the protective means against electric shock (direct contact).

#### Working Principle

The main components of an RCD are the following:

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

The RCD constantly monitors the vectorial sum of the current passing through all the conductors. In normal conditions the vectorial sum is zero ( $I_1 + I_2 = 0$ ) but in case of an earth fault, the vectorial sum differs from zero ( $I_1 + I_2 = I_d$ ), this causes the actuation of the relay and therefore the release of the main contacts.



#### Definitions related to RCDs

**RCCB = Residual Current Circuit Breaker without overcurrent protection.**

**RCBO = Residual Current Circuit Breaker with overcurrent protection.**

#### Breaking capacity

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

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

A value of the AC component of a residual prospective current which an RCCB can make, carry for its opening time and break under specified conditions of use and behaviour.

#### Conditional residual short-circuit current ( $I_{\Delta c}$ )

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

#### Conditional short-circuit current ( $I_{nc}$ )

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

#### Residual short-circuit withstand current

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

#### Prospective current

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

#### Making capacity

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

#### Open position

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

#### Closed position

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

#### Tripping time

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

#### Residual current ( $I_{\Delta n}$ )

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

#### Residual operating current

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

#### Rated short-circuit capacity ( $I_{cn}$ )

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

#### Conventional non-tripping current ( $I_{nt}$ )

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

#### Conventional tripping current ( $I_t$ )

A specified value of current which causes the circuit breaker to trip within a specified time. (Only applicable to RCBO)

## Din-T MCBs + RCDs Technical data

### RCDs classification according to EN 61008/61009

RCDs may be classified according to:

The behaviour in the presence of DC current  
(types for general use).

■ Type AC

■ Type A

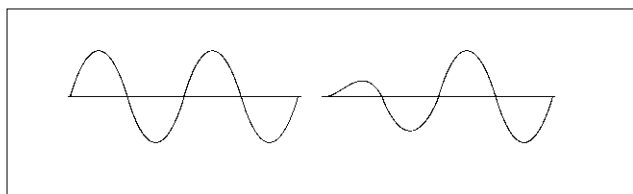
The time-delay (in the presence of residual current)

■ RCDs without time delay: type for general use

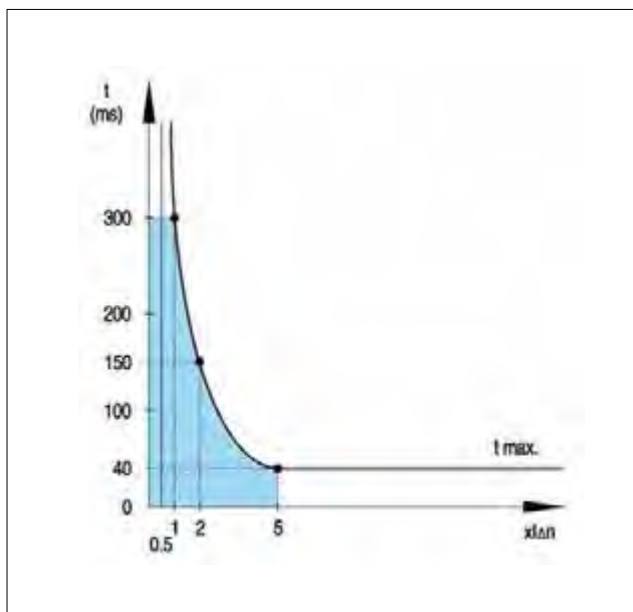
■ RCDs with time delay: type S for selectivity

**Type AC**  <sup>1)</sup> <sup>2)</sup>

The type AC RCDs are designed to release with sinusoidal residual currents which occur suddenly or slowly rise in magnitude.



Residual current	Tripping time
$0.5 \times I_{\Delta n}$	$t = \infty$
$1 \times I_{\Delta n}$	$t = <300 \text{ ms}$
$2 \times I_{\Delta n}$	$t = <150 \text{ ms}$
$5 \times I_{\Delta n}$	$t = \leq 40 \text{ ms}$



Tripping curve type AC


<sup>1)</sup> Standard in Australia

<sup>2)</sup> Type A acceptable in Australia

Tripping curve type A

<sup>3)</sup> Standard in New Zealand

<sup>4)</sup> DSRCBH is type A.

**Type A**  <sup>3)</sup> <sup>4)</sup>

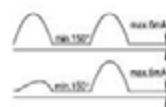
Certain devices during faults can be the source of non-sinusoidal earth leakage currents (DC components) due to the electronic components e.g. diodes, thyristors etc.

Type A RCDs are designed to ensure that under these conditions the residual current devices operate on sinusoidal residual current and also with pulsating direct current(\*) which occur suddenly or slowly rise in magnitude.

(\*) Pulsating direct current: current of pulsating wave form which assumes, in each period of the rated power frequency, the value 0 or a value not exceeding  $0.006 \text{ A DC}$  during one single interval of time, expressed in angular measure of at least  $150^\circ$ .

Residual current	Tripping time
1. For sinusoidal residual current	
$0.5 \times I_{\Delta n}$	$t = \infty$
$1 \times I_{\Delta n}$	$t = <300 \text{ ms}$
$2 \times I_{\Delta n}$	$t = <150 \text{ ms}$
$5 \times I_{\Delta n}$	$t = \leq 40 \text{ ms}$

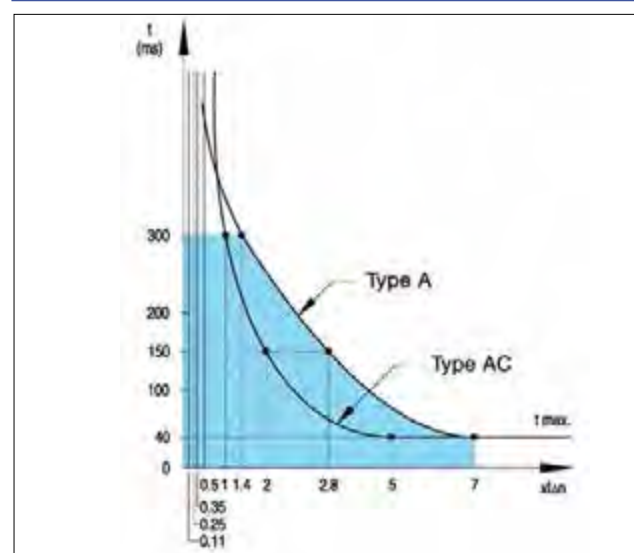
2. For residual pulsating direct current	
At point of wave $0^\circ$	
$0.35 \times I_{\Delta n}$	$t = \infty$
$1.4 \times I_{\Delta n}$	$t = <300 \text{ ms}$
$2.8 \times I_{\Delta n}$	$t = <150 \text{ ms}$
$7 \times I_{\Delta n}$	$t = \leq 40 \text{ ms}$



At point of wave $90^\circ$	
$0.25 \times I_{\Delta n}$	$t = \infty$
$1.4 \times I_{\Delta n}$	$t = <300 \text{ ms}$
$2.8 \times I_{\Delta n}$	$t = <150 \text{ ms}$
$7 \times I_{\Delta n}$	$t = \leq 40 \text{ ms}$



At point of wave $135^\circ$	
$0.11 \times I_{\Delta n}$	$t = \infty$
$1.4 \times I_{\Delta n}$	$t = <300 \text{ ms}$
$2.8 \times I_{\Delta n}$	$t = <150 \text{ ms}$
$7 \times I_{\Delta n}$	$t = \leq 40 \text{ ms}$



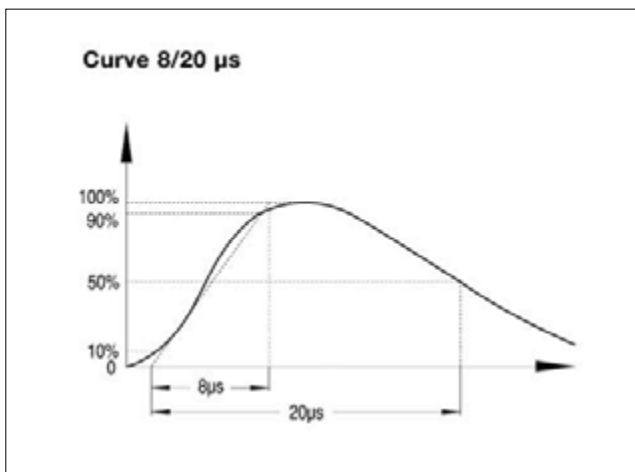
## Din-T MCBs + RCDs Technical data

### Nuisance tripping

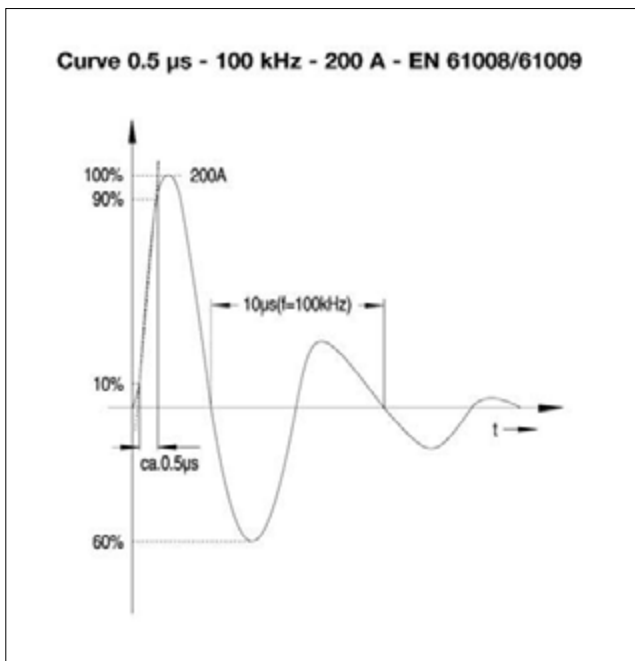
All DinSafe RCDs have a high level of immunity to transient currents, against current impulses of 8/20  $\mu$ s according to EN 61008/61009 and VDE 0664.T1.

Type A, AC.....250 A 8/20  $\mu$ s

Type S.....3000 A 8/20  $\mu$ s



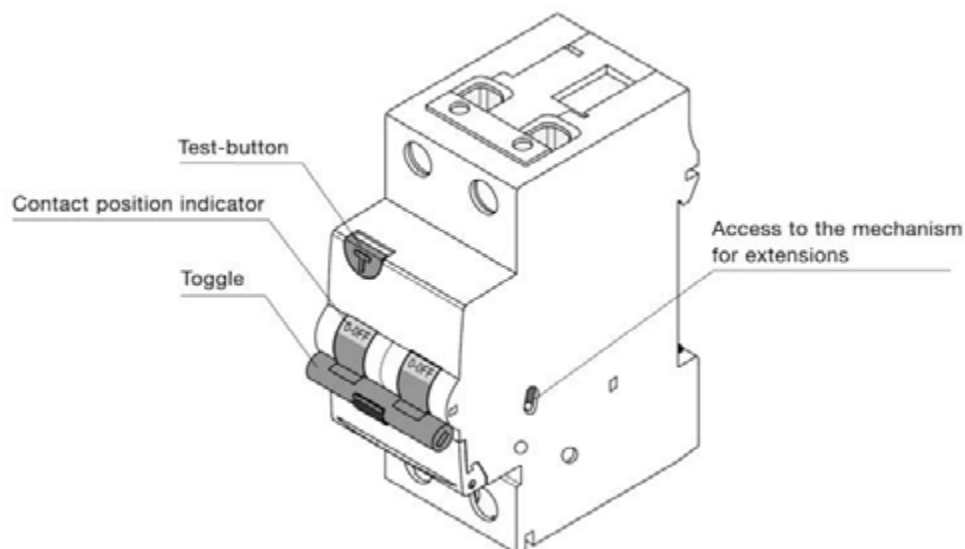
RCDs have a high level of immunity against alternating currents of high frequency according to EN 61008/61009.



## Din-T MCBs + RCDs Technical data

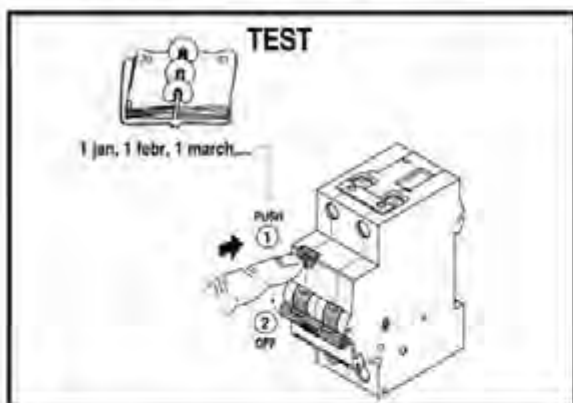
### Use of an RCBO Din-Safe (DSRCB)

3



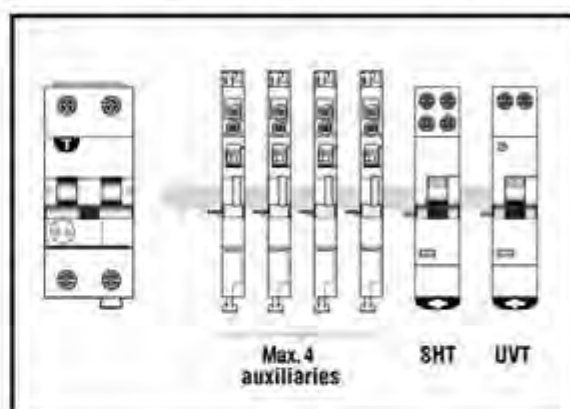
#### TEST-BUTTON

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



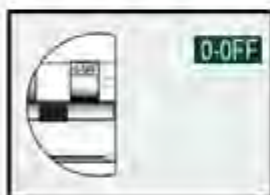
#### ACCESS TO THE MECHANISM FOR EXTENSIONS

It is possible to add an auxiliary contact, shunt trip, undervoltage release or motor operator, following the stack-on configuration of the extensions in section 4.



#### CONTACT POSITION INDICATOR

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



#### O-OFF

Contacts in open position. Ensure a distance between contacts > 4 mm.



#### I-ON

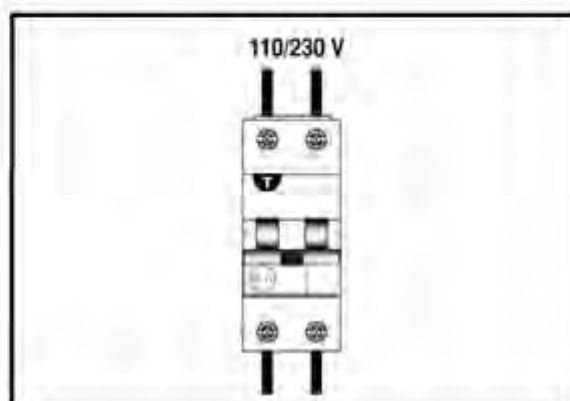
Contacts in closed position. Ensure continuity in the main circuit.

#### TOGGLE

To manually switch the RCBO ON or OFF

#### ALL CABLES MUST BE CONNECTED TO THE RCBO

All conductors, phase and neutral, that constitute the power supply of the installation to be protected, must be connected to the RCBO to either upper or lower terminals according to the following diagram.



## Din-T MCBs + RCDs Technical data

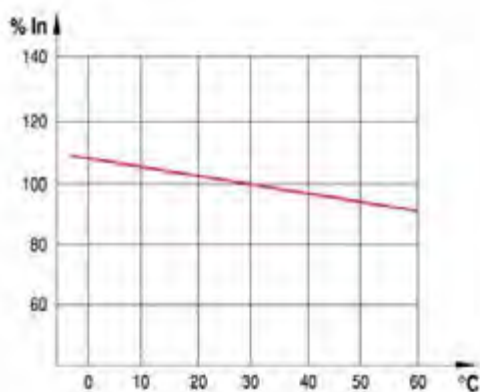
### Product related information

#### Influence of air ambient temperature on the rated current

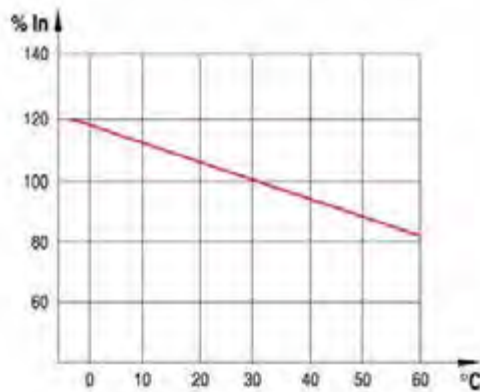
##### Influence of temperature on RCBOs (DinSafe DSRCB)

The thermal calibration of the RCBO was carried out at an ambient temperature of 30 °C. Ambient temperatures different from 30 °C influence the bimetal and this results in earlier or later thermal tripping.

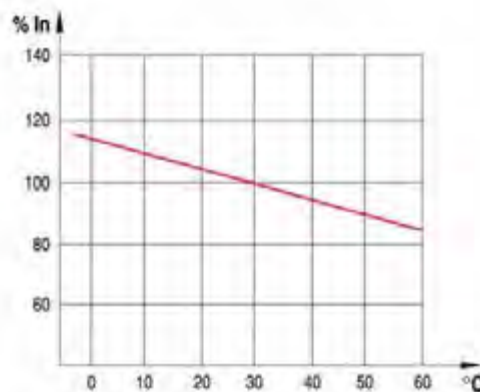
**0.5 - 6 A**



**10 A**



**16 - 40 A**



## Din-T MCBs + RCDs Technical data

### Tripping current as a function of the frequency

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

#### RCBO DSRCB <sup>3)</sup>

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

**Notes:** <sup>1)</sup> The standard NHP/Terasaki type is the "type AC" in Australia, Type "A" in New Zealand.

<sup>2)</sup> The standard NHP/Terasaki DSRCBH single pole RCBO is "type A" in Australia and New Zealand.

<sup>3)</sup> The numbers in the table above are multipliers, e.g. A "DSRCD" at 50 hz has an 0.8 multiplier.  
Therefore a 30 mA, "type AC" RCD will trip at (0.8 x 30 mA) 24 mA.

### Power losses

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

#### RCBO-DinSafe MCB DSRCB

In (A)	4	6	10	13	16	20	25	32	40
Z (mOhm)	125	53	16.5	11.9	9.8	7.1	5.6	4.7	3.6
Pw (W)	2.0	1.9	1.6	2.0	2.5	2.8	3.5	4.8	5.8



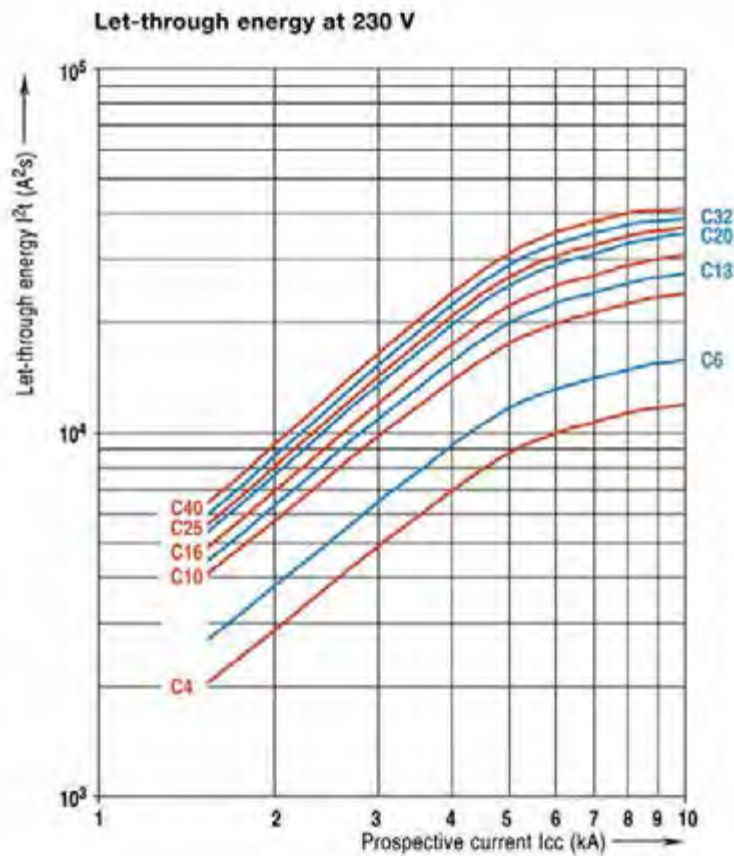
## Din-T MCBs + RCDs Technical data

### RCBO (DSRCB) let-through energy $I^2t$

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

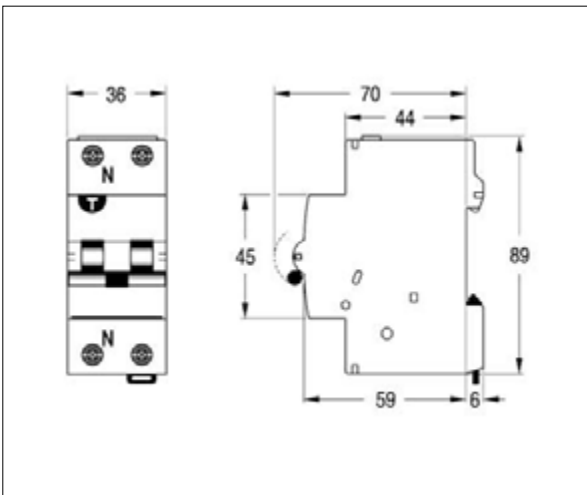
#### Din-Safe DSRCB

##### Curve C



#### RCBO - Din-Safe (DSRCB)

##### RCBO - Din-Safe (DSRCB)



Dimensions in mm



## Din-T MCBs + RCDs Technical data

### Text for specifiers

#### RCBO DinSafe (DSRCB)

- The residual making and associated MCB:
  - ☛ Din-T6 .....6000 A
  - ☛ Din-T10 .....7500 A
- According to EN 61009 standard.
- Intended to detect residual sinusoidal currents (type AC) or residual pulsating direct currents (type A).
- Resistance against nuisance tripping according to VDE 0664 T1 and EN 61009.
- Working ambient temperature from -25 °C up to +40 °C for type A and from -5 °C up to +40 °C for type AC.  
Approved by CEBEC, VDE , KEMA, IMQ, etc.
- The RCBO 1 P+N is 2 modules wide or 1 module wide.
- The neutral pole is on the left hand side. The N pole closes first of all poles and opens last of all poles.
- Nominal rated currents are: 4 up to 40 A.
- Characteristic B & C.
- Nominal residual currents are: 10, 30, 100, 300, 500, 1000 mA.
- The test circuit is protected against overloads.
- The short-circuit capacity is 10 kA, with selectivity class 3.
- The making and breaking capacity is 500 A.
- The residual making and breaking capacity is 7500 A.
- Terminal capacity from 1 up to 25 mm<sup>2</sup> rigid in the top terminals and from 1 up to 35 mm<sup>2</sup> in the bottom terminals.
- The devices 10, 30, 100 mA type A or AC always have vertical selectivity with devices 300 mA type S.
- Both incoming and outgoing terminals have a protection degree of IP 20.
- Isolator function due to Red/Green printing on the toggle.
- Auxiliary contacts can be added on the right hand side.
- RCBOs can be released by means of a shunt trip or undervoltage release.
- RCBOs can be remotely controlled by means of a motor operator.

# Din-T MCBs + RCDs Technical data

## Overview Din-Safe RCDs

### RCBO



## Device type definition

Rating/description		Cat. No.	DSRCB
Standards			IEC 61009-1
Magnetic tripping characteristics			C
Residual tripping characteristic <sup>1)</sup>			AC, A
Tripping time at I <sub>Δn</sub>	Instantaneous	ms	<300
	Selective	ms	-
Rated current		A	4, 6, 10, 13, 16, 20, 25, 32, 40
Rated residual current I <sub>Δn</sub>		mA	10, 30
Calibration temperature		°C	30
Number of poles versus modules			1
Rated voltage U <sub>n</sub>	2 P AC	V	110, 240 (1 P+N)
	3 P AC	V	-
	4 P AC	V	-
Frequency		Hz	50/60
Maximum service voltage U <sub>bmax</sub>		V	255
Minimum service voltage U <sub>bmin</sub>		V	100
Power supply			Top/Bottom
Selectivity class			3
Rated making and breaking capacity (I <sub>m</sub> )		A	-
Residual making and breaking capacity (I <sub>Δm</sub> )		A	7500
Conditional short-circuit capacity (I <sub>nc</sub> )		A	-
Conditional residual short-circuit capacity (I <sub>Δc</sub> )		A	-
Short-circuit capacity (I <sub>cn</sub> )		A	10000
Grid distance (safety distance between two devices)		mm	35
Isolator application			yes
Insulation degree	Insulation voltage	V (DC)	500
	Shock voltage (1.2/50 ms)	kV	6
	Insulation resistance	(mΩm)	1000
	Dielectric strength	V	2500
Shock resistance (in x, y, z direction)(IEC 60077/16.3)			40 g, 18 shocks 5 ms
Vibration resistance (in x, y, z direction; IEC 60068-2-6)			1.5 g, 30 min, 0...80 Hz
Endurance	electrical at U <sub>n</sub> , In		10000
	mechanical at U <sub>n</sub> , In		20000
Protection degree (outside/inside electrical enclosure)			IP 20 / IP 40
Self extinguish degree (according to UL 94)			V2
Tropicalisation (according to IEC 60068-2, DIN 40046)		°C/RH	+55/95 %
Pollution degree (acc. IEC 60947-1)			3
Operating temperature		°C	-25...+60
Storage temperature		°C	-5...+70
Terminals capacity	Rigid cable min/max (Top)	mm <sup>2</sup>	1/25
	Flexible cable min*/max (Top)	mm <sup>2</sup>	1/16
	Rigid cable min/max (bottom)	mm <sup>2</sup>	1/35
	Flexible cable min*/max (bottom)	mm <sup>2</sup>	1/25
	(*Flexible cable 0.75/1/1.5 mm <sup>2</sup> with cable lug)		
Torque	Top/Bottom	Nm	3/4
Add-on devices (side add-on)	Auxiliary contacts		yes
	UVT		yes
	Shunt trip		yes
	Motor operator		yes
	Panelboard switch		Bottom
Busbars systems	Pin		Bottom
	Fork		yes
<b>Accessories</b>			
Dimensions, weights, packaging	# Poles		1+N
	(HxDxW) 86x68xW	mm	36
	Weight/unit	g	250
	Package/unit		1/6

**Note:** <sup>1)</sup> Refer catalogue section for types.

<sup>2)</sup> Making sure that N-L and both flying leads are disconnected.



## Miniature circuit breakers

### Din-T6 series 6 kA MCB

- Standards AS/NZS 4898
- Approval No. N17481
- Current range 2-63 Amps 1, 2 and 3 pole
- Seatable and lockable handle
- Available in curve type C and D
- Mounts on CD chassis (250 A and 355 A)

DTCB6  
1 pole



#### 1 pole 1 module

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

#### 2 pole 2 modules

2	DTCB6202C
4	DTCB6204C
6	DTCB6206C
10	DTCB6210C
13	<input type="checkbox"/> DTCB6213C
16	DTCB6216C
20	DTCB6220C
25	DTCB6225C
32	DTCB6232C
40	DTCB6240C
50	DTCB6250C
63	DTCB6263C

#### 3 pole 3 modules

2	DTCB6302C
4	DTCB6304C
6	DTCB6306C
10	DTCB6310C
13	<input type="checkbox"/> DTCB6313C
16	DTCB6316C
20	DTCB6320C
25	DTCB6325C
32	DTCB6332C
40	DTCB6340C
50	DTCB6350C
63	DTCB6363C

#### Short circuit capacity 6 kA

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

DC use	1 P	2 P <sup>1)</sup>
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.

Notes: <sup>1)</sup> 2 pole MCB connected in series.  
The line side is the "OFF" (bottom) side of  
the MCB, and connects to CD chassis tee-offs.  
☐ Available on indent only.

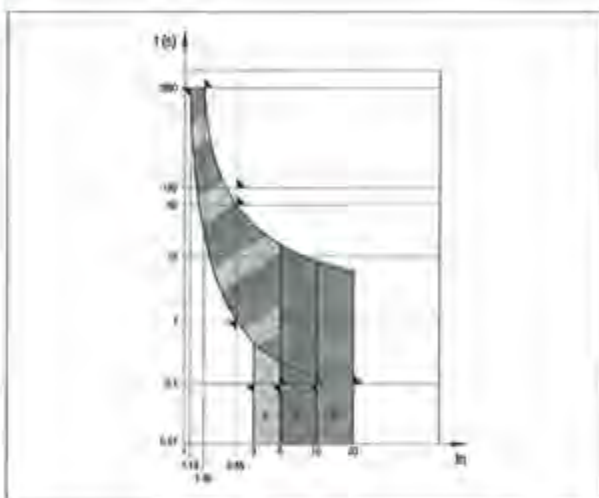
## Din-T MCBs Technical data

### Characteristics according to BS EN 60898

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

# 3

#### Tripping characteristic curves



#### Magnetic release

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

Icn (A)	Test current	Tripping time	Applications
B	3 x In	0.1 < t < 45 s (In ≤ 32 A)	Only for resistive loads eg: • electrical heating • water heater • stoves.
	5 x In	0.1 < t < 90 s (In > 32 A)	
		t < 0.1 s	
C	5 x In	0.1 < t < 15 s (In ≤ 32 A)	Usual loads such as: • lighting • socket outlets • small motors
	10 x In	0.1 < t < 30 s (In > 32 A)	
		t < 0.1 s	
D	10 x In	0.1 < t < 4 s (**) (In ≤ 32 A)	Control and protection of circuits having important transient inrush currents (large motors)
	20 x In	0.1 < t < 8 s (In > 32 A)	
		t < 0.1 s	

#### Thermal release

The release is initiated by a bimetal strip in the event of overload. The standard defines the range of releases for specific overload values. Reference ambient temperature is 30 °C.

Test current	Tripping time
1.13 x In	t ≥ 1 h (In ≤ 63 A) t ≥ 2 h (In > 63 A)
1.45 x In	t < 1 h (In ≤ 63 A) t < 2 h (In > 63 A)
2.55 x In	1 s < t < 60 s (In ≤ 32 A) 1 s < t < 120 s (In > 32 A)

#### Rated short-circuit breaking capacity (Icn)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 900 V. Moreover, the MCB shall be capable of tripping when loaded with 2.8 In within the time corresponding to 2.55 In but greater than 0.1s.

#### Service short-circuit breaking capacity (Ics)

Is the value of the short-circuit that the MCB is capable of withstanding in the following test of sequence of operations: O-t-CO-t-CO.

After the test the MCB is capable, without maintenance, to withstand a dielectric strength test at a test voltage of 1500 V. Moreover, the MCB shall not trip at a current of 0.96 In. The MCB shall trip within 1h when current is 1.6 In.

O - Represents an opening operation

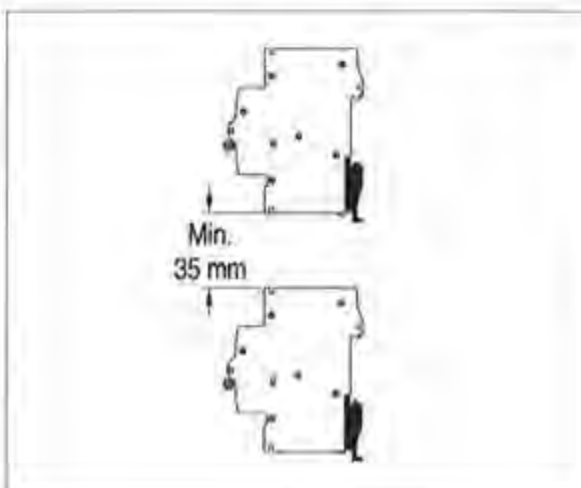
C - Represents a closing operation followed by an automatic opening.

t - Represents the time interval between two successive short-circuit operations; 3 minutes.

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

Icn (A)	Ics (A)
≤ 6000	6000
> 6000	0.75 Icn min. 6000
≤ 10000	
> 10000	0.75 Icn min. 7500

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





## Din-T MCBs Technical data

Series			Din-T6
Standards (Aust / NZ / International)			AS/NZS 4898
Tripping characteristics			C, D
Nominal current		A	C/D(0.5-63)
Calibration temperature		°C	30
Number of poles (A mod)			1/2/3/4
Neutral pole protected			yes
Nominal voltage Un	AC 1 P	V	240/415
	3 P/4 P	V	415
	DC 1 P <sup>1)</sup>	V DC	68
	2 P (in series) <sup>1)</sup>	V DC	110
Frequency		Hz	50/60
		Hz	DC: magn.trip +40%
		Hz	400: magn.trip +50%
Maximum service voltage U <sub>lmax</sub> between two wires		V	250/440; 53/120
Minimum service voltage U <sub>lmin</sub>		V	12; 12
Selectivity class (IEC 60898)			3
Isolator application			yes
Rated insulation voltage	Pollution degree 2	V	500
	Pollution degree 3	V	440
Impulse withstand test voltage		kV	6
Insulation resistance		MΩmin	10,000
Dielectric rigidity		kV	2.5
Vibration resistance (in x, y, z direction) (IEC 77/16.3)			3 g
Endurance	Electrical at Un, In		10,000
	mechanical		20,000
Utilisation category (IEC 60947-2)			A
Protection degree (outside / inside, in enclosure with door)			IP 20/IP 40
Self-extinguish degree (according to UL94)			V2
Tropicalisation (according to IEC 60068-2 / DIN 40046) °C/RH			+55 °C/95 % RH
Operating temperature		°C	-25/+55
Storage temperature		°C	-55/+55
Terminal capacity rigid cable min/max (top)		mm <sup>2</sup>	1/35
	Flexible cable min*/max (top)	mm <sup>2</sup>	0.75/25
	Rigid cable min/max (bottom)	mm <sup>2</sup>	1/35
	Flexible cable min*/max (bottom)	mm <sup>2</sup>	0.75/25
	(* Flexible cable 0.75/1/1.5 mm <sup>2</sup> with cable lug)		
	Torque	Nm	4.5
Add-on devices (side add-on)	Auxiliary contacts		yes
	LVT		yes
	Shunt trip		yes
	Motor operator		yes
	Panelboard switch		yes
Busbar systems	Pin (top/bottom)		yes/yes
	Fork (top/bottom)		-/yes
Accessories			yes
Dimensions, weights, packaging			
(HxDxW) 86x68xW		mm/mod.	18
Weight/mod.		g	120
Package		mod.	12
Short-circuit capacity AC (kA)			AS/NZS 4898
IEC 60898	I <sub>cn</sub>	1 P	230/400 V 6
		2 P	230/400 V 6
		3 P/4 P	230/400 V 6
	I <sub>cs</sub> (service)		
IEC 60947-2	I <sub>cu</sub> (ultimate)	1 P	127 V 20
			240 V 10
			415 V 3
		2 P	127 V -
			240 V 15
			415 V 10
	3 P, 4 P	240 V	15
			10
		440 V	15
			415 V 10
	440 V 6		
	I <sub>cs</sub> (service)		
NEMA AB1 (120/240V)			20
Short-circuit capacity DC (kA)			
IEC 60947-2	I <sub>cu</sub> (ultimate)	1 P	≤80 V 20
			≤220 V -
	2 P	≤125 V 25	
		≤440 V -	
	I <sub>cs</sub> (service)		

Notes: Refer pages 3 + 23, 24 for information on SAFE-T MCBs.

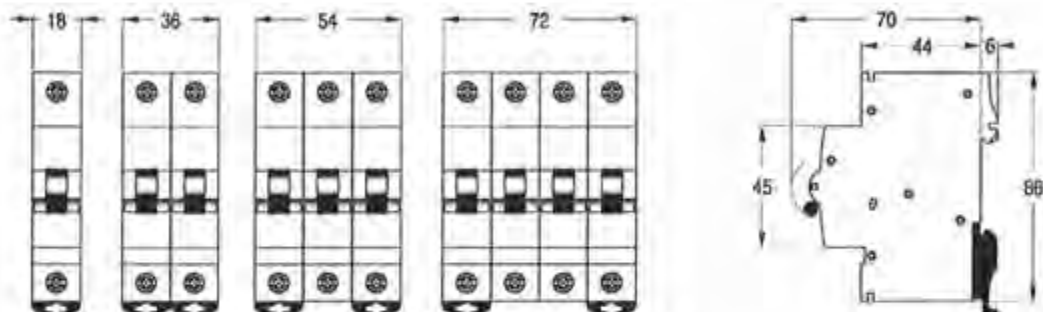
<sup>1)</sup> Preferred values of rated control supply voltage (IEC 60947-2): 24 V, 68 V, 110 V, 325 V, 250 V<sup>2)</sup> 0.5-4 A/6-25 A/33-40 A/70-63 A<sup>3)</sup> 10 (125 V DC)<sup>4)</sup> 10 (250 V AC)<sup>5)</sup> On request

## Din-T MCBs Technical data

### Miniature circuit breakers - Din-T 6

Dimensions in mm.

3



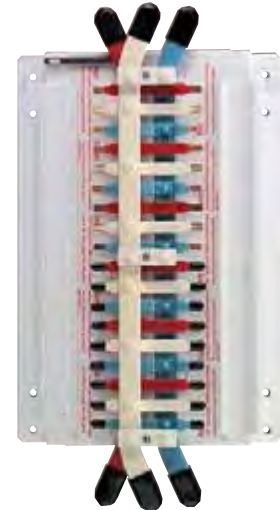
## Panelboards, loadcentres and accessories

### 2 CONCEPT•PLUS and Premier busbar chassis – Din-T

- Standards AS/NZS 3439
- Current rating 250 A
- Withstand rating 250 A/20 kA for 0.2 sec
- Splayed busbar to suit 160 A & 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 to suit Din-T MCBs (18 mm pole pitch) <sup>3)</sup>

Pole capacity	250 A Cat. No. <sup>1)</sup>
12	CD-2-12/18-3U
18	CD-2-18/18-3U
24	CD-2-24/18-3U
30	CD-2-30/18-3U
36	CD-2-36/18-3U
42	CD-2-42/18-3U
48	CD-2-48/18-3U
54	CD-2-54/18-3U
60	CD-2-60/18-3U
72	CD-2-72/18-3U
78	CD-2-78/18-3U
84	CD-2-84/18-3U
96	CD-2-96/18-3U



3 pole CD chassis to suit Din-T MCBs

- Notes:** <sup>1)</sup> 4 pole and other special configurations available to special order refer NHP.  
 '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.  
<sup>3)</sup> Not suitable for CONCEPT economy Panelboards. Contact NHP for availability.  
 Available on indent only.



#### 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

#### Technical data – CD/CT busbar chassis

Description	CD-250 A
Busbar rating (Amp)	250
Voltage rating (V)	415
Short circuit rating (kA)	20
Short circuit time (sec)	0.2
Insulation material	Polyolefin PPA-441

#### Catalogue number structure – CD/CT busbar chassis

XX	X	XX	XX	X
Type	Current rating	No. of ways	Pole pitch (mm)	No. of phases
CD Din-T	2 250 A	12	18 Din-T	2 1 P + N (red, black)
CDH Din-T10H	3 355 A	18	27 Din-T10H	3 3 P (red, white, blue)
CT Safe-T	Etc.	24	27/18 Hybrid Din-T10H/Din-T	4 3 P + N (red, white, blue, black)
		30	25 Safe-T	
		36 etc.		
		27 mm/18 mm		
		6/24		
		12/60		

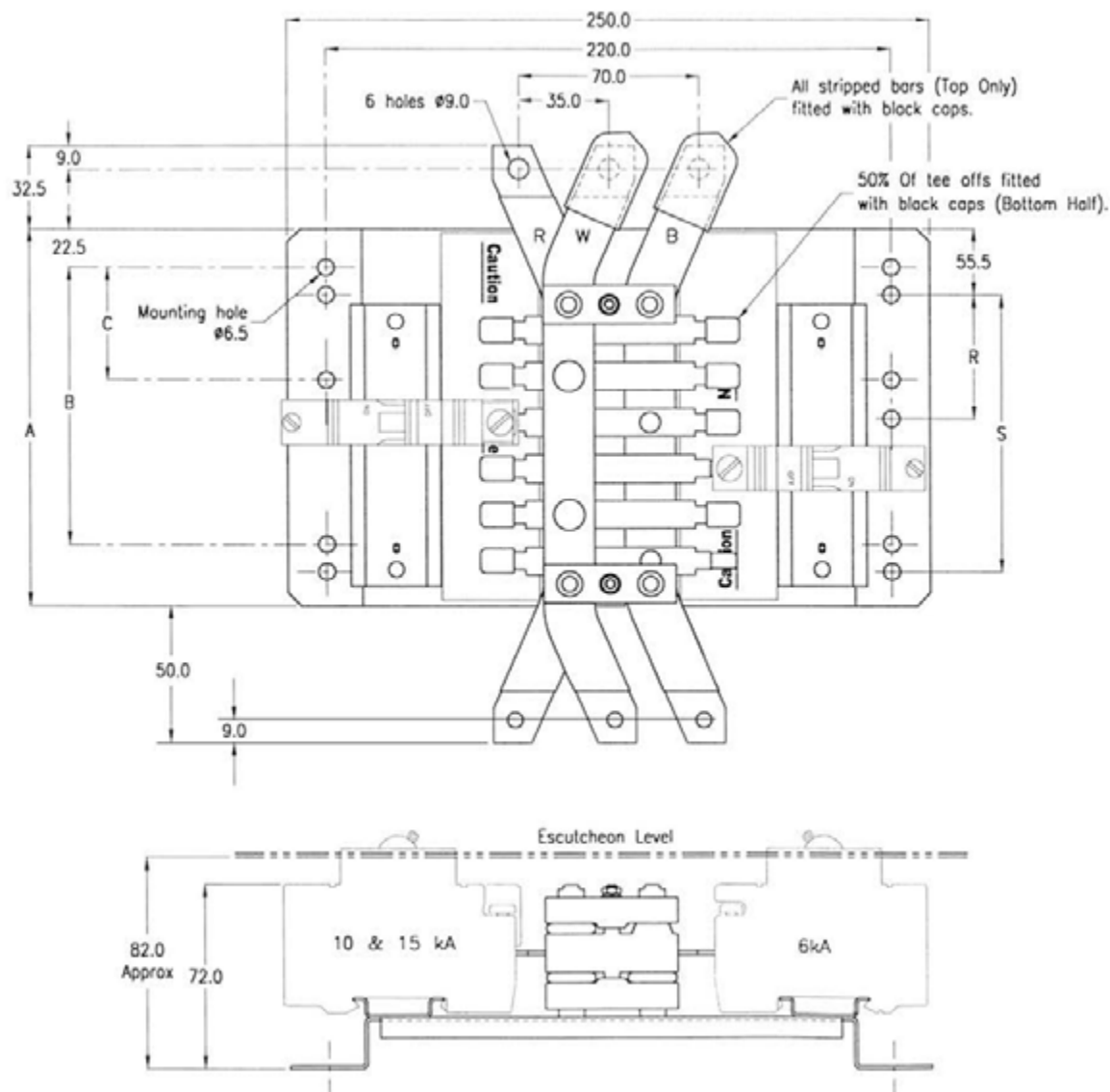


## Panelboards, loadcentres and accessories

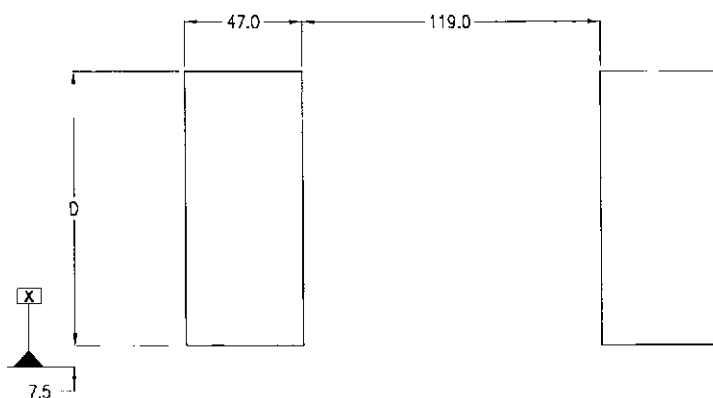
### Dimensions (mm)

2

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



Escutcheon cut-out details



Dimensions (mm)

Chassis size <sup>1)</sup>	A	B	C	D	R	S
CD-X-12/18-3U	152	100	-	110	-	100
CD-X-18/18-3U	206	100	-	164	-	100
CD-X-24/18-3U	260	100	-	218	-	100
CD-X-30/18-3U	314	200	-	272	-	200
CD-X-36/18-3U	368	300	-	326	-	300
CD-X-42/18-3U	422	300	-	280	-	300
CD-X-48/18-3U	476	400	-	434	-	400
CD-X-54/18-3U	530	400	-	488	-	400
CD-X-60/18-3U	584	500	-	542	-	500
CD-X-72/18-3U	692	600	-	650	-	600
CD-X-78/18-3U	745	700	300	704	300	700
CD-X-84/18-3U	800	700	300	758	300	700
CD-X-96/18-3U	908	800	400	866	400	800

**Notes:** <sup>1)</sup> "X" insert 2 = 250 A or 3 = 355 A, current rating does not effect above dims.  
 Maximum current rating of tee-off = 100 A.  
 'OFF' (line) side of MCB connects to chassis tee-off.  
 MCB DIN clips may be disengaged or removed when mounting onto "CD" chassis.  
 Use insulated tool provided to disengage DIN clip when removing MCB from chassis.



## **7.2 CONTROL DEVICES / GPO'S / RELAYS**

- CROMPTON INSTRUMENTS – 252-PSGW – 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 – 56C410 – 3 PHASE SWITCHED OUTLET
- CLIPSAL – 56S0310 – GENERATOR ANCILLARY POWER
- SPRECHER AND SCHUH – CA7-43-00-240V – PUMP 1,2 LINE CONTACTORS
- SPRECHER AND SCHUH – CA7-43-00-240V – PUMP 1,2 BYPASS CONTACTORS
- FLYGT – MINICASS II – PUMP 1,2 SEAL FAIL RELAYS c/w 11 PIN BASE
- MENNEKES – MEN361 – GENERATOR POWER
- IDEC – RH2B-UL-24VDC – PUMP RELAY
- IDEC – RH4B-UL-24VDC – RELAY
- MARECHAL – DS3 3134013972+51CA058 – PUMP POWER SOCKET OUTLET
- MARECHAL – PN7C 01P4060+01NA053 – PUMP CONTROL SOCKET OUTLET



# Protector Trip Relays

## Phase Balance Relay

### Application

The Crompton Protector Phase Balance module provides continuous surveillance of a 3 phase, 3 or 4 wire system and protects against:-

- ✓ Phase Loss
- ✓ Phase Reversal
- ✓ Sequence
- ✓ Phase Unbalance
- ✓ System Under Voltage

The protector de-energizes a relay should any one of the above faults occur. It is fitted with an adjustable time delay to eliminate premature operation on short duration supply fluctuations.

A red LED indicates that the supply is within limits and that the output relay is energized. N.B. the relay will not energize if the supply is connected in the wrong sequence.

The phase unbalance feature protects motors of any size, from full load to no-load for

- ✓ Excessive temperature rise due to unbalanced supplies (e.g. a 10% unbalanced supply can increase the temperature rise by 150%)
- ✓ The regenerated voltage generated during a single phase failure when running at low load.

### Principle of operation

The Protector comprises monitoring circuits for voltage phase reversal and phase unbalance. Outputs from these circuits are fed to a comparator which changes state under fault conditions.

When the comparator switches, the output relay will de-energize after a preset time delay and the red LED will also de-energize in series.

The relay and LED will automatically energize again when all the supply parameters have returned to safe and acceptable limits

Phase loss and unbalanced	Product Code
Phase loss, unbalanced and undervoltage	252-PSF
	252-PSG

### Specification

This model is U.R. and C.U.R approved.

<b>System :</b>	3 phase, 3 or 4 wire
<b>Frequency:</b>	50 or 60Hz
<b>Nominal Voltage :</b>	100, 110, 120, 220, 230, 240, 380, 400, 415 & 440V
<b>Burden:</b>	3VA
<b>Voltage Withstand:</b>	1.2 x continuously 1.5 x for 10 x 10 seconds

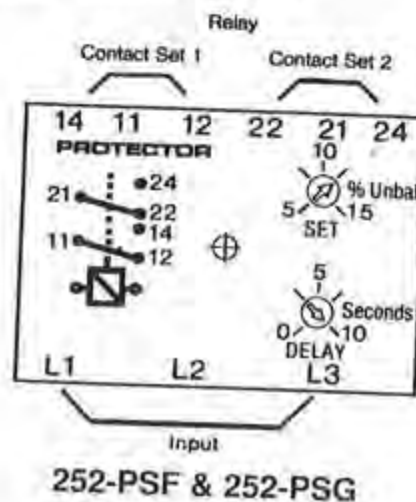
<b>Set Points</b>	
<b>Unbalance:</b>	Adjustable 5% to 15%
<b>Time Delay:</b>	Up to 10 seconds adjustable (not operative if voltage falls below 70% of the nominal voltage or set point on type 252-PSG)

### Under Voltage: (Type 252-PSG only)

Internally preset at 15% of nominal voltage (other values between 10% and 30% available on request)  
Approximately - 0.3 kg

<b>Weight:</b>	
<b>Output Relay</b>	
<b>Type:</b>	DP changeover
<b>Rating a.c.:</b>	240V, 5A non-inductive
<b>d.c.:</b>	24V, 5A resistive
<b>Operations:</b>	0.2 million at the above load
<b>Reset:</b>	Automatic

### Connection Diagram



## MTR Level Relay



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

### Safe

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

### Four sensitivities

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

### Activation delays

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

### LED indication

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

### Dipswitch programmable

All settings are easily selectable from the front panel.

### Proven reliability

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

### I.S application

Perfect for I.S application when used with an MTISB.

### Unique two-sensor operation (MTRA only)

Pump and alarm can be controlled using two or three sensors. Two-sensor operation is ideal for budget applications or where space is limited.

### DIN rail or screw mounting

### Low installed cost

## Specifications

### Mode of operation:

MTR Mode	Charge/Discharge (Fill or Empty)
MTRA Mode	Discharge ONLY

### Probe Inputs:

Sensor inputs	MTR : 2 / MTRA : 3
Sensor voltage	10/12VAC Nominal
Sensor current	0.8mA max. (per sensor)
Sensitivity	1k, 4k, 20k, 80k

### Relay Outputs:

MTR relay output	2 contact sets : 1 N/O & 1 C/O
MTR Output delay	0, 2.5, 5, 10, 20, 40, 80, 160 sec
MTRA relay output	2 relays : both N/O
MTRA Output delay	Pump: 0.5, 10; Alarm: 0.5, 15 sec
Relay contact rating	250 VAC 5A Resistive, 2A Inductive
Relay contact life	10 <sup>5</sup> Operations
Terminal size	2 x 13 AWG / 2.5mm <sup>2</sup>

### Display

LEDs:	Power On	Pump	Alarm
MTR	Green	Red	Red
MTRA	Green	Yellow	Red

### Physical Product:

Dimensions	2.7/8H x 1.3/4W x 4.1/2D (Inches) 72Hx45Wx114D (mm)
Mounting	DIN Rail or 2 x #6 Screws / 2 x M4 Screws
Enclosure	Makrolon (self-extinguishing)



### Power Supply:

Supply Voltage AC	24, 110, 240, 415VAC* - 50/60Hz
Power Consumption	3.5 Watts max *(MTR only)
Supply Voltage DC	12 or 24VDC,
Power Consumption	3 Watts max

### Environmental Range:

Centigrade	- 10 <sup>0</sup> to +60°C
Fahrenheit	+14 <sup>0</sup> to +140°F



### Available Models & Ordering Information

415VAC	MTR-1	n/a
240VAC	MTR-2	MTRA-2
110VAC	MTR-3	MTRA-3
24VAC	MTR-4	MTRA-4
24VDC	MTR-5	MTRA-5
12VDC	MTR-6	MTRA-6

**MULTITRODE**

[www.multitrode.com](http://www.multitrode.com)

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## 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.



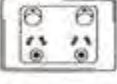





### Ordering Colours

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 2025WE.

**Refer to '2000 Series Colours' on page 12 for colour options and their corresponding codes.**



**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	 A
2025QC	116mm	76mm	31mm	84mm apart	 B
2025SM	116mm	76mm	30mm	84mm apart	 C
2025V3/30PF	290mm	116mm	13mm	See template	 D
2025	A	Twin Switched Socket Outlet, 250V/10A.			 E
2025S	A	Twin Switched Socket Outlet, 250V/10A, with safety shutters.			 F
2025N	B	Twin Switched Socket Outlet, 250V/10A, with safety shutters and neons.			 G
2025L	C	Twin Switched Socket Outlet, 250V/10A, with round earth pin.			 H
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 2.5mm<sup>2</sup> cables. 30 Series Switch Terminals accommodate 3 x 2.5mm<sup>2</sup> on the 2025XA and 2025XAN. All models have a base projection of 13mm, except for 2025QC which has a base projection of 14mm.

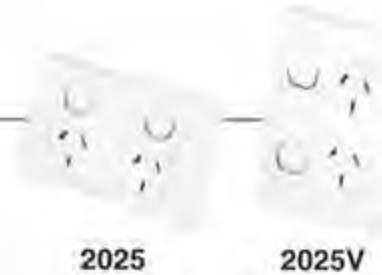
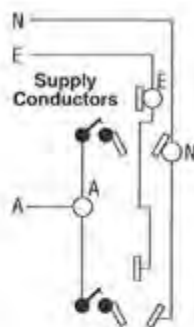
\* Refer to **Page 62** for more information on "Powertainment™".

\* Refer to **Page 53** for mounting templates.

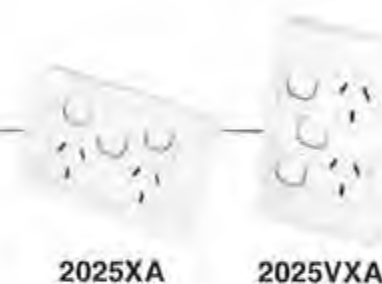
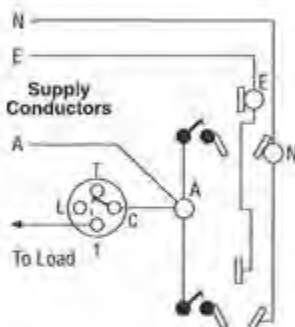


## SCHEMATIC WIRING DIAGRAMS

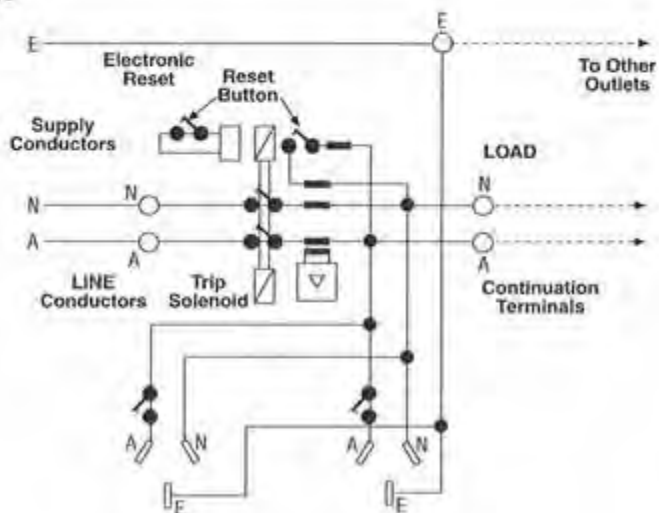
### Standard Pattern Mounting Twin Combination



### Twin Switched Sockets with Extra Switch



### Earth Leakage Protected Twin Switched Sockets



## 2000 SERIES PRODUCT LISTING

STANDARD SIZE TWIN SWITCHED SOCKET OUTLETS - HORIZONTAL MOUNTING						
Cut No	Description	Length	Width	Depth	Mounting Centres	PAGE
2025	Twin Switched Socket Outlet, 250V/10A	116mm	76mm	28mm	84mm apart	33
2025S	Twin Switched Socket Outlet, 250V/10A, with safety shutters	116mm	76mm	28mm	84mm apart	33
2025N	Twin Switched Socket Outlet, 250V/10A, with safety shutters and neons	116mm	76mm	28mm	84mm apart	33
2025L	Twin Switched Socket Outlet, 250V/10A, with round earth pin	116mm	76mm	28mm	84mm apart	33
2025QC	Twin Switched Socket Outlet, 250V/10A, Quick Connect	116mm	76mm	31mm	84mm apart	33
2025FO	Twin Socket Outlet, 250V/10A, pin and with NOT PROTECTED BY SAFETY SWITCH FRIDGE/FREEZER ONLY	116mm	76mm	28mm	84mm apart	33
2025V3/30PF	Six Switched Socket Outlets + I-type Plug TV outlet, 2000/4 surround, 250V/10A	290mm	116mm	13mm	See template	33
2025XA	Twin Switched Socket Outlet, 250V/10A, with removable extra switch	116mm	76mm	28mm	84mm apart	33
2025XAN	Twin Switched Socket Outlet, 250V/10A, safety shutters, neons, removable extra switch	116mm	76mm	28mm	84mm apart	33
2025SM	Twin Switched Socket Outlet, 250V/10A	116mm	76mm	30mm	84mm apart	33
2025XAS	Twin Switched Socket Outlet, 250V/10A, with removable extra switch and safety shutters	116mm	76mm	30mm	84mm apart	33
STANDARD SIZE SINGLE SWITCHED SOCKET OUTLETS - VERTICAL MOUNTING						
2015V	Single Switched Socket Outlet, 250V/10A (vertical)	116mm	76mm	28mm	84mm apart	34
2015VN	Single Switched Socket Outlet, 250V/10A, with safety shutter and neon (vertical)	116mm	76mm	28mm	84mm apart	34
2015V1S	Single Switched Socket Outlet, 250V/15A (vertical)	116mm	76mm	28mm	84mm apart	34
2015V1SN	Single Switched Socket Outlet, 250V/15A, with safety shutter and neon (vertical)	116mm	76mm	28mm	84mm apart	34
2015VX	Single Switched Socket Outlet, 250V/10A, with removable extra switch (vertical)	116mm	76mm	28mm	84mm apart	34
2015VXN	Single Switched Socket Outlet, 250V/10A, safety shutter, neon, removable extra switch (vertical)	116mm	76mm	28mm	84mm apart	34
2015VXX	Single Switched Socket Outlet, 250V/10A, with 2 removable switches (vertical)	116mm	76mm	28mm	84mm apart	34
2015XXN	Single Switched Socket Outlet, 250V/10A, safety shutter, neon and 2 removable extra switches	116mm	76mm	28mm	84mm apart	34
2015VD	Single Switched Socket Outlet, 250V/10A, double pole (vertical)	116mm	76mm	28mm	84mm apart	34
2015VDX	Single Switched Socket Outlet, 250V/10A, double pole with extra switch (vertical)	116mm	76mm	28mm	84mm apart	34
STANDARD SIZE TWIN SWITCHED SOCKET OUTLETS - VERTICAL MOUNTING						
2015/2V	Twin Switched Socket Outlet, 250V/10A - two piece base (vertical)	116mm	76mm	38mm	84mm apart	34
2015D2V	Twin Switched Socket Outlet, 250V/10A, double pole	116mm	76mm	38mm	84mm apart	34
2015/2VN	Twin Switched Socket Outlet, 250V/10A, with safety shutters, neons	116mm	76mm	38mm	84mm apart	34
2015/2VS	Twin Switched Socket Outlet, 250V/10A, with safety shutters	116mm	76mm	38mm	84mm apart	34
2025V	Twin Switched Socket Outlet, 250V/10A - one piece base (vertical)	116mm	76mm	28mm	84mm apart	34
2025VN	Twin Switched Socket Outlet, 250V/10A, with safety shutters, neons	116mm	76mm	28mm	84mm apart	34
2025VXA	Twin Switched Socket Outlet, 250V/10A, with removable switch	116mm	76mm	28mm	84mm apart	34
2025VXN	Twin Switched Socket Outlet, 250V/10A, with removable switch and neon	116mm	76mm	28mm	84mm apart	34
2025VXS	Twin Switched Socket Outlet, 250V/10A, with removable switch and safety shutters	116mm	76mm	28mm	84mm apart	34
PROTECTED SOCKET OUTLETS						
2025RC	Twin Switched Socket Outlet, 250V/10A, with RCD protection - 30mA	116mm	76mm	47mm	84mm apart	35
2025RC10	Twin Switched Socket Outlet, 250V/10A, with RCD protection - 10mA	116mm	76mm	47mm	84mm apart	35
2025SF	Twin Switched Socket Outlet, 250V/10A, with surge protection	116mm	76mm	45mm	84mm apart	35
UNIVERSAL SHAVER OUTLETS						
2727	Universal Shaver Outlet, Dual Voltage (240V - 115V)	116mm	76mm	57mm	84mm apart	35
2727RC30	Shaver Outlet, 250V/20A, double pole with RCD-30mA - horizontal	219mm	116mm	57mm	84mm apart (3 sets)	36
2727VRC30	Shaver Outlet, 250V/20A, double pole with RCD-30mA - vertical	219mm	116mm	57mm	84mm apart (3 sets)	36



## 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 6mm<sup>2</sup> cables are supplied with 500V models.

### Options available

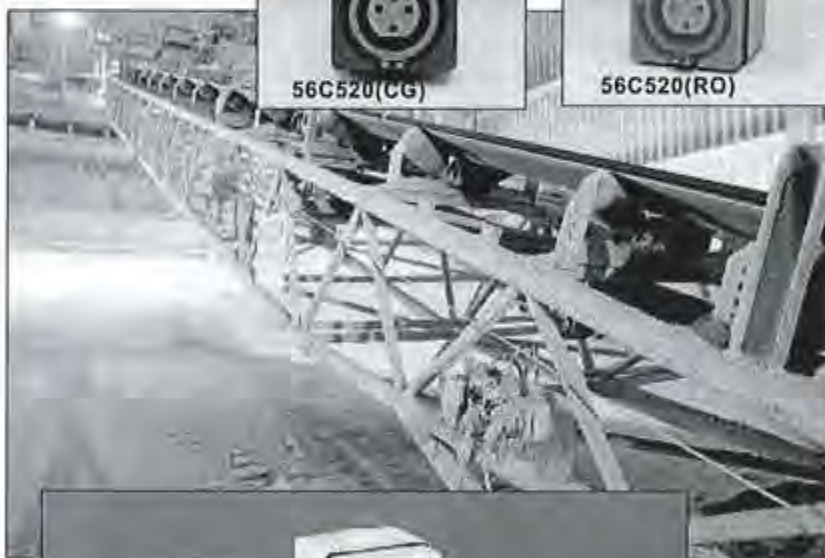
- With Neon - add N to Catalogue Number - e.g. 56C410 becomes 56C410N.
- Less Enclosure - add LE to Catalogue Number e.g. 56C410 becomes 56C410LE.
- Versions with key operated switches available to special order.
- Internal interlock facility available on three phase, one piece cover combinations - add I to Catalogue Number e.g. 56CV410 becomes 56CV410I.
- 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.



56C520(CG)



56C520(RO)



56CV420

56C532

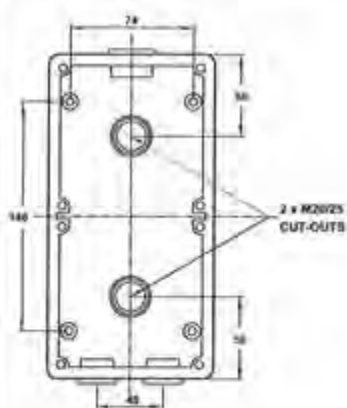
56C310

Catalogue Number	No. of swit. poles	I <sub>max</sub> (A)	UI/U <sub>e</sub> (V)
56C210	1	10	250
56C215/32	1	15	32
56C3110	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	500
56C710	3	20 cont 10	500
56C720	3	20 cont 20 20 cont	500

Catalogue Number	No. of swit. poles	I <sub>max</sub> (A)	UI/U <sub>e</sub> (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	500
56CV710	3	20 cont 10	500
56CV720	3	20 cont 20 20 cont	500



## TECHNICAL DRAWINGS

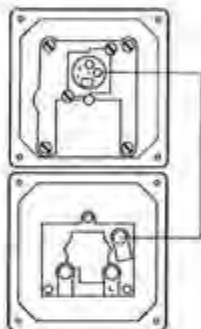


FRONT MOUNTING ENCLOSURE

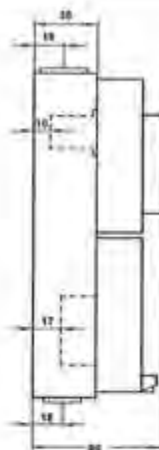
56C215/32



SWITCH IS 30 SERIES MECH

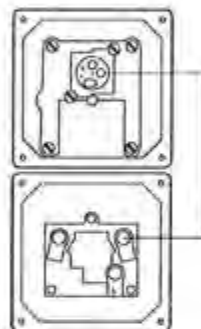


REAR MECHANISMS

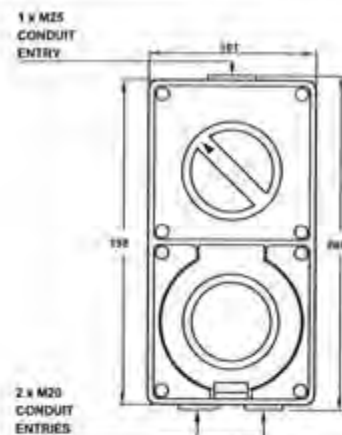


SIDE COMPLETE

56C210

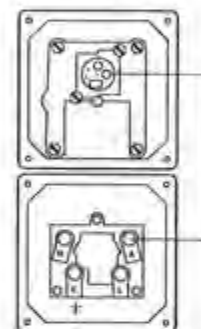


REAR MECHANISMS

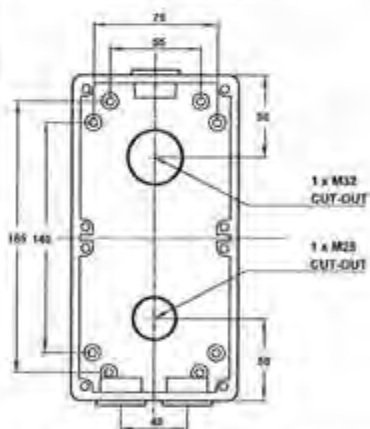


FRONT COMPLETE

56C310  
56C310L  
56C310RP  
56C315  
56C3/110

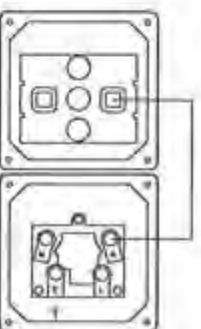


REAR MECHANISMS

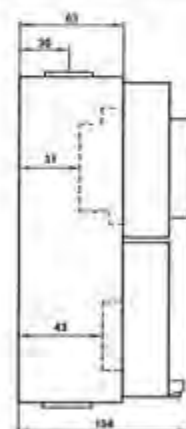


FRONT MOUNTING ENCLOSURE

56C310HD  
56C315HD

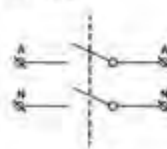


REAR MECHANISMS



SIDE COMPLETE

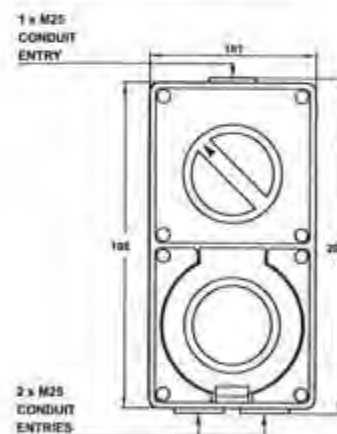
56C310D  
56C315D



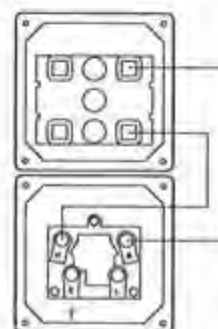
SWITCH TERMINALS  
ARE NOT IDENTIFIED

SWITCH IS  
BACKWIRED

CONDUCTOR TERMINATION  
IS PRESSURE PLATE TYPE



FRONT COMPLETE



REAR MECHANISMS

## Spare Parts Internal Socket Housings

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



Catalogue Number	$I_{enc}$ (A)	$U_i$ (V)	Number of Sockets	Cond. Term size in mm <sup>2</sup>		Socket Config.
				Min	Max/cont.	
56SO320G	20	250	3 Round	2.5	6	H
56SO332G	32	250	3 Round	6	16	I
56SO410G	10	500	4 Round	1.5	6	K
56SO416G	16	500	4 Round (unique key config.)	1.5	6	M
56SO420G	20	500	4 Round	2.5	6	L
56SO432G	32	500	4 Round	6	16	N
56SO440G	40	500	4 Round	10	16	O
56SO450G	50	500	4 Round	10	16	P
56SO510G	10	500	5 Round	1.5	6	Q
56SO520G	20	500	5 Round	2.5	6	R
56SO532G	32	500	5 Round	6	16	S
56SO540G	40	500	5 Round	10	16	T
56SO550G	50	500	5 Round	10	16	U
56SO610G	10	500	4 Round Power 2 Round Control	1.5	6/2.5	V
56SO710G	10	500	5 Round Power 2 Round Control	1.5	6/2.5	W
56SO720G	20	500	5 Round Power 2 Round Control	2.5	6/2.5	X

$I_{enc}$  - Conventional Enclosed Thermal Current

$U_i$  - Insulation Voltage

Refer to page 47 for explanation of socket configurations.

## APPLIANCE INLETS

56 Series 3 Phase Appliance Inlets feature a downward facing, angled pin housing which enables extension socket plugs to be neatly connected without bulky right angle entry.

A screwed lock ring is standard on all models to secure extension sockets and appliance connectors, and ensure IP integrity.

All mouldings are impact resistant and UV stabilised.

Note: The IP rating is only achieved on 500V appliance inlets if the screw-on cap (56PC Series) provided is fitted when not in use.



All 56AI Series Appliance Inlets are compatible with 56CSC Extension Sockets and there is no need for special reverse pin plugs.



### Options available

- All appliance inlets are available Less Enclosure - add LE to Catalogue Number e.g. 56AI420 becomes 56AI420LE.
- 56AI310 and 56AI315 versions available in Chemical Resistant Orange e.g. 56AI310 becomes 56AI310RO.

Catalogue Number	$I_{enc}$ (A)	$U_i$ (V)	Number of Pins	Conductor Terminal size in mm <sup>2</sup>		IP Rating	Matching Extension Socket	Socket Configuration	O/A* Dims. (H) x (W) x (D)
				Min.	Max.				
56AI310	10	250	3 Flat	1.5	6	66	56CSC310	A	107x101x38
56AI315	15	250	3 Flat	2.5	6	66	56CSC315	B	107x101x38
56AI320	20	250	3 Round	2.5	6	56	56CSC320	H	204x101x165
56AI332	32	250	3 Round	6	16	56	56CSC332	I	204x101x165
56AI410	10	500	4 Round	1.5	6	56	56CSC410	K	204x101x165
56AI420	20	500	4 Round	2.5	6	56	56CSC420	L	204x101x165
56AI432	32	500	4 Round	6	16	56	56CSC432	N	204x101x165
56AI440	40	500	4 Round	10	16	56	56CSC440	O	204x101x165
56AI450	50	500	4 Round	10	16	56	56CSC450	P	204x101x165
56AI510	10	500	5 Round	1.5	6	56	56CSC510	Q	204x101x165
56AI520	20	500	5 Round	2.5	6	56	56CSC520	R	204x101x165
56AI532	32	500	5 Round	6	16	56	56CSC532	S	204x101x165
56AI540	40	500	5 Round	10	16	56	56CSC540	T	204x101x165
56AI550	50	500	5 Round	10	16	56	56CSC550	U	204x101x165

$U_{enc}$  - Conventional Enclosed Thermal Current  
 $U_i$  - Rated Insulation Voltage

Refer to page 47 for explanation of pin configurations.

\* Refer rear of Catalogue for further details



## EXTENSION SOCKETS & APPLIANCE CONNECTORS

Clipsal's Three Phase Extension Socket/Appliance Connector is an important design breakthrough.

Now there is a common unit for both cord extension socket and appliance connector applications.

All connectors have impact resistant, UV stabilised mouldings.

The IP66 rating can be achieved when extension socket/connectors are used in conjunction with compatible accessories such as 56P Plugs, 56PA Plugs and 56AI Appliance Inlets.

IP66 rated units feature a hose proof cap which maintains the Interna-



56CSC532



56CSC410

tional Protection rating when the accessory is not being used.

Note: Cap not provided as standard with single phase extension sockets. Refer 56T Series for terminators to connect hose to non standard gland nut thread.

### Options available

- 56SC2 Socket Cap to suit single phase extension sockets.
- 56CSC310 and 56CSC315 available in Resistant Orange - add RO to Catalogue Number e.g. 56CSC310 becomes 56CSC310RO.

Catalogue Number	I <sub>n</sub> (A)	U <sub>i</sub> (V)	No. of Sockets	Conductor Term. size in mm <sup>2</sup>		Cable Nominal Diameter in mm		IP Rating	Matching Plug Straight	Matching Plug Angle	Socket Config.	Gland Nut Thread
				Min.	Max.	Min.	Max.					
56CSC310	10	250	3 Flat	1.0	6	6	12.5	66	56P310	56PA310	A	20mm
56CSC315	15	250	3 Flat	1.0	6	6	12.5	66	56P315	56PA315	B	20mm
56CSC320	20	250	3 Round	1.0	6	6	15.7	66	56P320	56PA320	H	23mm
56CSC332	32	250	3 Round	2.5	16	9	28	66		56PA332	I	37mm
56CSC410	10	500	4 Round	1.0	6	6	15.7	66	56P410	56PA410	K	23mm
56CSC420	20	500	4 Round	1.0	6	6	15.7	66	56P420	56PA420	L	23mm
56CSC432	32	500	4 Round	2.5	16	9	28	66	56P432	56PA432	N	37mm
56CSC440	40	500	4 Round	2.5	16	9	28	66	56P440	56PA440	O	37mm
56CSC450	50	500	4 Round	2.5	16	9	28	66	56P450	56PA450	P	37mm
56CSC510	10	500	5 Round	1.0	6	6	15.7	66	56P510	56PA510	Q	23mm
56CSC520	20	500	5 Round	1.0	6	6	15.7	66	56P520	56PA520	R	23mm
56CSC532	32	500	5 Round	2.5	16	9	28	66	56P532	56PA532	S	37mm
56CSC540	40	500	5 Round	2.5	16	9	28	66	56P540	56PA540	T	37mm
56CSC550	50	500	5 Round	2.5	16	9	28	66	56P550	56PA550	U	37mm

U<sub>i</sub> - Insulation Voltage

I<sub>n</sub> - Conventional Free Air Current

Refer to page 47 for explanation of socket configurations.

\*Refer to rear of catalogue for further details.

## PENDANT CONVERSION KITS

Clipsal 56POK and 56POKI Pendant Outlet Kits enable the three phase 56CSC Series Industrial Connectors to be easily converted to pendant outlets.

There are two models available for connectors 10A - 20A and 32A - 50A, both of which are manufactured from quality stainless steel to last and withstand loads of up to 50kg.

The 56SPOK allows easy conversion of the 56C and 56CV Series to pendant outlets.



56SPOK



56POK

56POKI

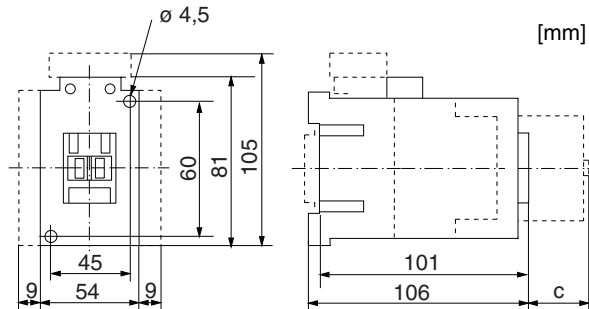
Catalogue Number	Suits
56POK	10A - 20A
56POKI	32A - 50A
56SPOK	Switched pendant outlet kit

Prior Pocket Rd 4070 SPS SP316 Electrical Switchboard Operation and Maintenance Manual (JPR)  
**Attention:** To prevent electrical shock, disconnect from power source before installing or servicing. Install in suitable enclosure. Keep free from contaminants.  
**Achtung:** Vor Installations- oder Servicearbeiten Stromversorgung unterbrechen, um Unfälle zu vermeiden. Die Geräte müssen in einem passenden Gehäuse eingebaut und gegen Verschmutzung geschützt werden.  
**Attenzione:** Per prevenire infortuni, togliere tensione prima dell'installazione o manutenzione. Installare in custodia idonea. Tenere lontano da contaminanti.  
**Attention:** Avant le montage et la mise en service, couper l'alimentation secteur afin d'éviter tout accident. Prévoir une mise en coffret ou armoire appropriée. Protéger le produit contre les environnements agressifs.  
**Atención:** Desconectar la alimentación eléctrica antes de realizar el montaje y la puesta en servicio, con el objeto de evitar accidentes. Instalado en una caja o armario apropiado. Proteger el producto de los ambientes agresivos.

...-C43 /...-43



CE A000478  
IEC 60947-1/-4-1/-5-1  
EN 60947-1/-4-1/-5-1  
UL 508; CSA 22.2 No. 14;



C [mm]	34	53	56

A1	A2		

11 mm 1 x 2,5...16 mm<sup>2</sup>  
2 x 2,5...10 mm<sup>2</sup>  
No. 14...4 AWG  
Use 75°C Cu wire only

9 mm 1 x 2,5...25 mm<sup>2</sup>  
2 x 2,5...16 mm<sup>2</sup>  
No. 14...4 AWG  
Use 75°C Cu wire only

9 mm 1 x 1...2,5 mm<sup>2</sup>  
2 x 1...2,5 mm<sup>2</sup>  
No. 16...12 AWG  
Use 75°C Cu wire only

9 mm 1 x 1...4 mm<sup>2</sup>  
2 x 1...4 mm<sup>2</sup>  
No. 16...12 AWG  
Use 75°C Cu wire only

9 mm 1 x 0,5 ... 2,5 mm<sup>2</sup>  
2 x 0,75 ... 2,5 mm<sup>2</sup>  
No. 18 ... 14 AWG  
Use 75°C Cu wire only

1 x 0,75 ... 2,5 mm<sup>2</sup>  
2 x 0,75 ... 2,5 mm<sup>2</sup>  
No. 18 ... 14 AWG  
Use 75°C Cu wire only

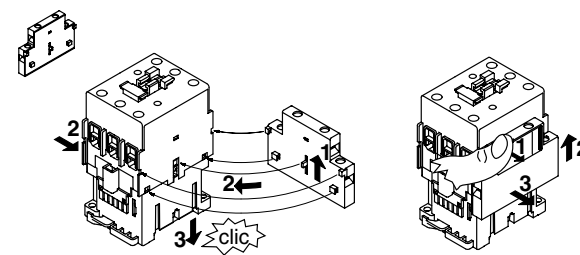
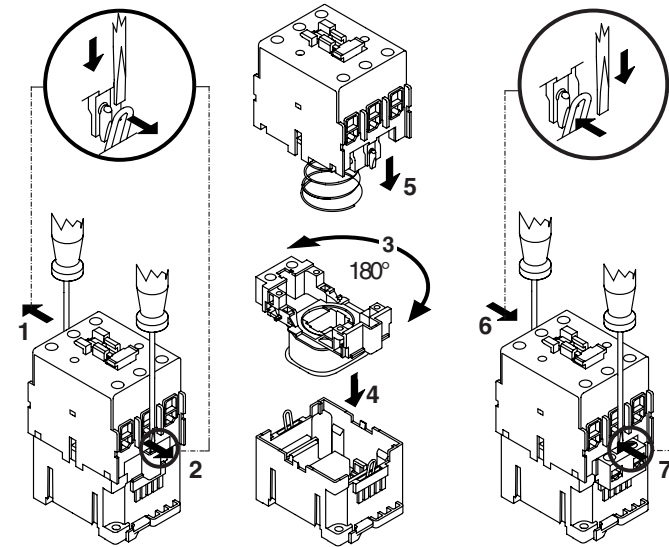
2,5...3,5 Nm  
22...31 lb-in  
No 3  
Pozidriv No 2

1...1,5 Nm  
8,9...13 lb-in  
No 3  
Pozidriv No 2

1...1,5 Nm  
8,9...13 lb-in  
No 3  
Pozidriv No 2

Q-Pulse Id: TMS536

IEC 60947-4-1 EN 60947-4-1 Ue ≤ 690 V	gG — max. Type 1	Type 2	Type 2
43	160 A	100 A	max.
IEC 60947-5-1 EN 60947-5-1	gG — max.		
10 A			



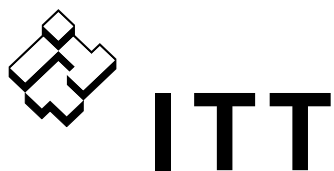
Technische Änderungen vorbehalten  
22.227.950-01 / 04. 2007  
Ausgabe 1

Active: 10/12/2013

USA/CND  
Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes

Size	Fuse	Circuit Breaker
43	600 Volts Maximum	125 A

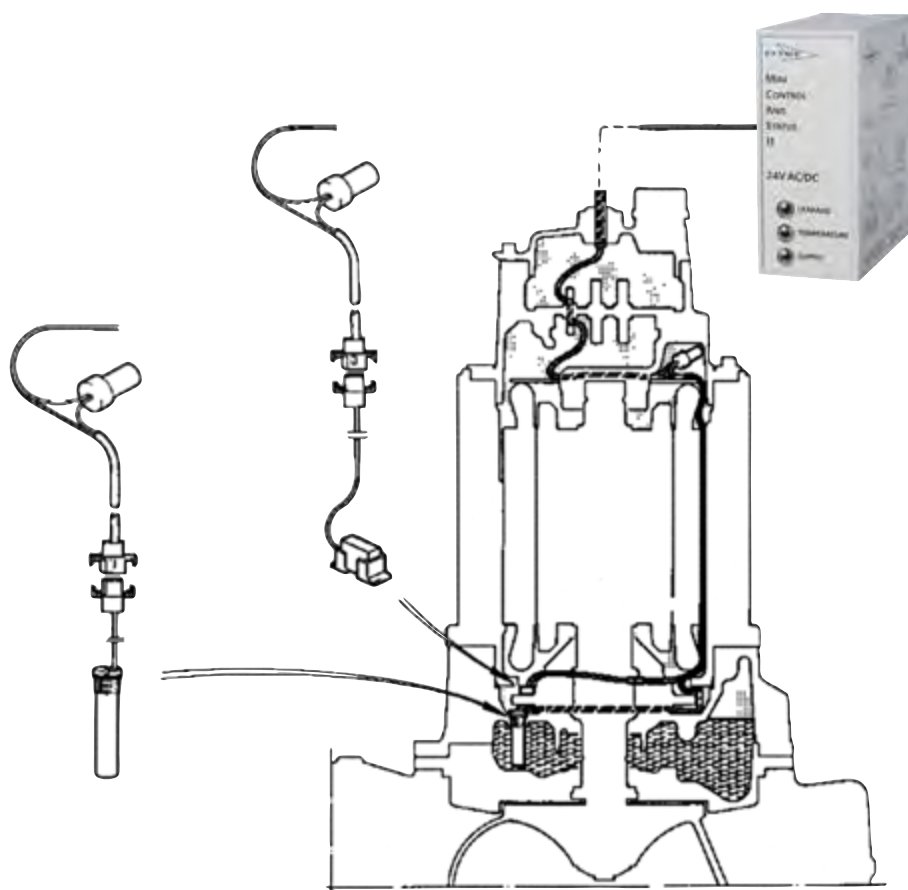
Page 280 of 537



Water & Wastewater

## Installation and application

Leakage detectors, CLS/FLS/FLS10/MiniCAS II



*Engineered for life*

# INTRODUCTION

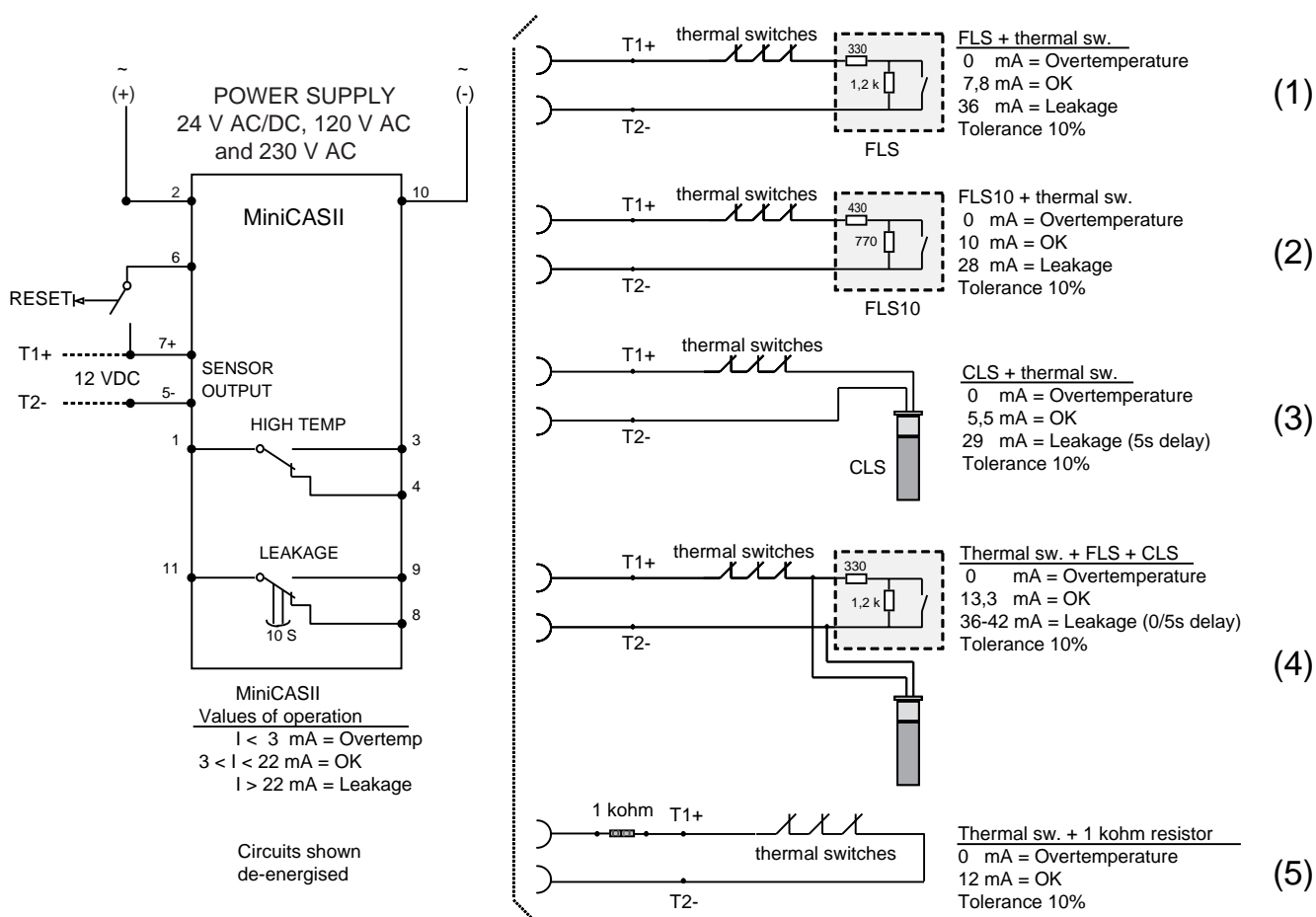
A number of condition monitoring sensors are available for the ITT FLYGT pump range.

- **Thermal switches** for stator over temperature.
- **CLS** for water in oil detection.
- **FLS** for the detection of liquid in the stator housing.
- **FLS10** for detection of liquid in the inspection chamber in the new midrange pump series, i.e. 3153, 3171, 3202 and 3301.

Any combination of these sensors can be used with the standard versions of the pumps. **Explosion proof** approved pumps are restricted to the use of the thermal switches with or without **FLS** and **FLS10** only.

The sensors are monitored by the ITT FLYGT **MiniCAS II** supervision relay, which is situated in the panel.

## BASIC SENSOR CONNECTIONS (5 alternative sensor combinations)



**Note!** MiniCASII 24 V AC/DC, RESET also possible by connecting terminals 6-2.

## NOTES

1. Amber LED indicates supply on.
  - Overtemperature relay energised when healthy.
  - Leakage relay de-energised when healthy.
  - Red overtemperature LED off when healthy.
  - Red leakage LED off when healthy.
2. MiniCAS II resets automatically after leakage fault. MiniCAS II requires resetting after overtemperature fault. Please see "Technical Data".
3. There is not a separate indication when two leakage sensors are used.



# INSTALLATION

## The monitoring connections at the panel

The **MiniCAS II** supervision relay is installed in the pump panel and simply plugs into an eleven pin relay base. Six basic sensor connections are possible.

### 1. Thermal switches with FLS

The pilot cores in the pump can be connected to the panel in either polarity.

### 2. Thermal switches with FLS10

The pilot cores in the pump can be connected to the panel in either polarity.

### 3. Thermal switches with CLS

The **CLS** sensor is diode protected. For this reason the pilot cores are required to be connected with the correct polarity (brown = +, black = -). Connected incorrectly the **MiniCAS II** supervision relay will indicate an open circuit (0 mA), i.e. with the amber supply LED and the red overtemperature LED **both** on. Connected correctly and reset, the amber LED **only** will be on.

### 4. Thermal switches with CLS + FLS

The pilot cores in the pump cable are required to be connected with the correct polarity (brown = +, black = -), however, because the **FLS** will cause the **MiniCAS II** to indicate healthy, i.e. amber LED **ON**, even when incorrectly connected **CLS**, a current reading of the monitoring circuit must be taken when installing the pump. Correct polarity will indicate 15.0 mA; incorrect polarity will indicate 7.8 mA with healthy conditions.

### 5. Thermal switches only

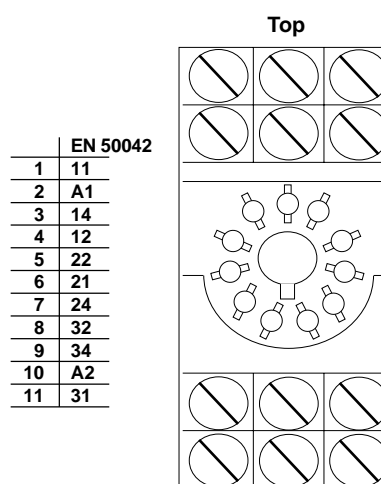
A 1000—1500 ohm resistor must be connected in series with the thermal overtemperature switches. A 1000 ohm resistor is enclosed in the package.

MiniCAS II supervision relay



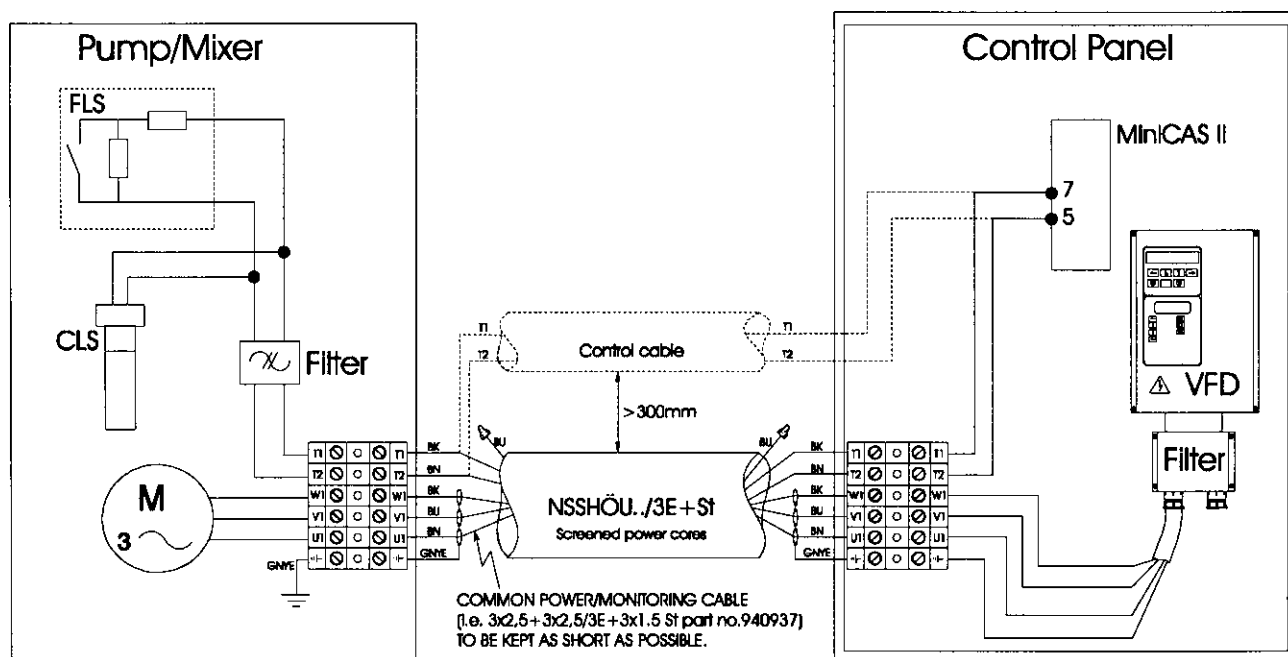
Part-nos: 83 58 57 (24 V AC/DC)  
40 501098 (120 V AC)  
40 501560 (230 V AC)

11 pin relay base



Part-no: 84 55 67

## Variable frequency inverter controlled pumps/mixers



In installations utilizing variable frequency inverters for speed control of pumps, interference from a variable frequency drive (VFD) may cause nuisance tripping of monitoring equipment and the electronic sensor CLS.

VFD-interference does not affect FLS and FLS10.

Interference occurs when the pilot cores are in close proximity to the power cores.

The interference may be suppressed by connecting a suitable filter<sup>1</sup> between the monitoring conductors (T1, T2) and ground (PE).

The filter should ideally be situated in the pump/mixer junction box.

Cables containing both power and pilot cores should be kept to a minimum length.

The power cable and control cable should be run in separate cable ducts with a distance of at least 300 mm between them.

Our pumps are CE-marked according to EMC-directive and the VFD that we buy from a subcontractor should also be CE-marked. In order to make the VFD pass the EMC-tests the interconnecting cable between pump and VFD has to be **screened**.

### <sup>1</sup>Available filter kits:

#### **Part no. 6046800**

Will fit: 3102, 3127, 4430.

#### **Part no. 6046801**

Will fit: 3085, 4410.

#### **Part no. 6046802**

Will fit: 3140, 3152, 3170, 3201, 3300.

#### **Part no. 6046804**

Will fit: 3231, 3306, 3312, 3351, 3356, 3400, 3501, 3602, 3800, 7045, 7061, 7081, 7101, 7115, 7121.

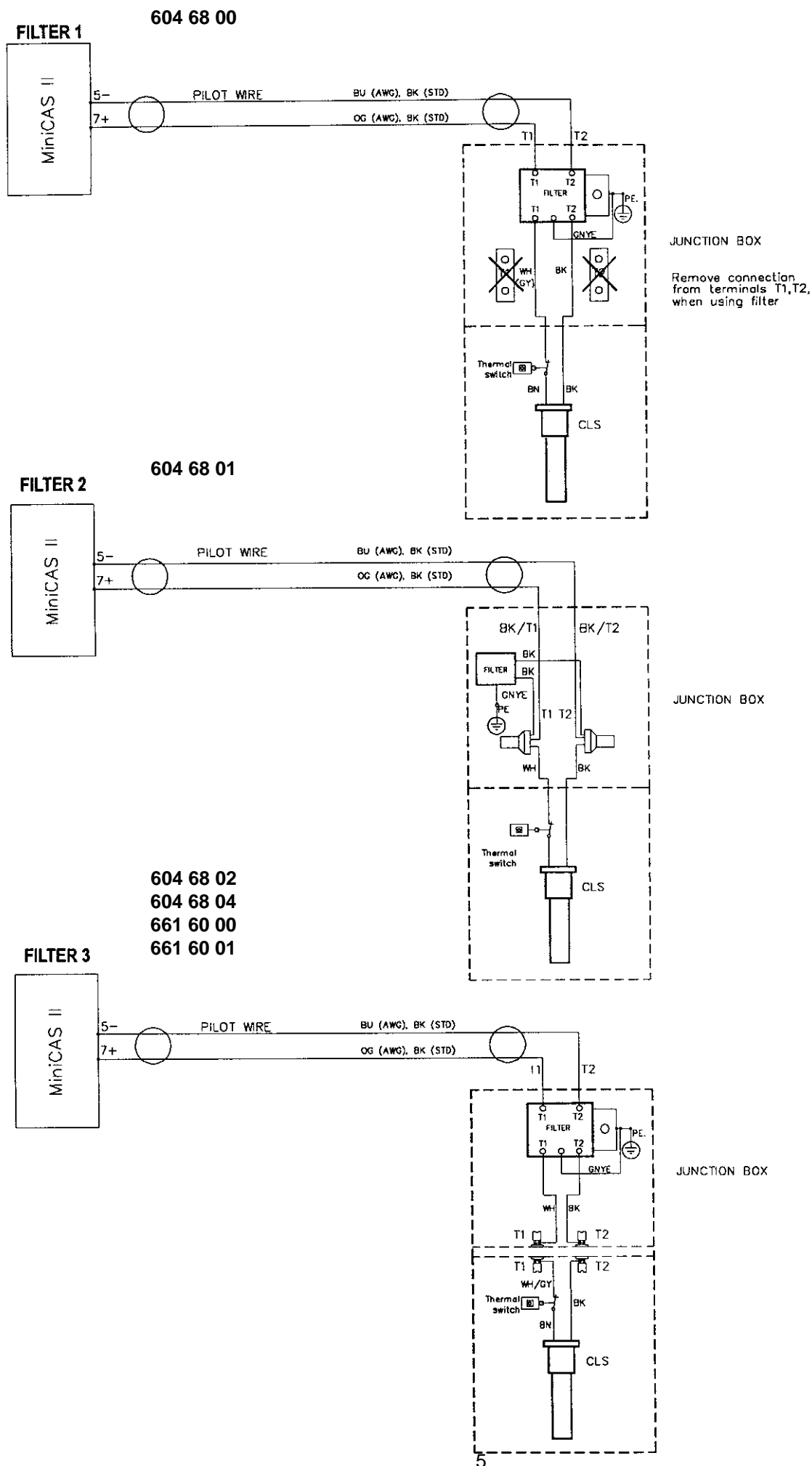
#### **Part no. 6616000**

Will fit: 4630, 4640, 4650, 4660.

#### **Part no. 6616001**

Will fit: 4670, 4680.





## Checking the sensor circuit and fault finding

Connect a multimeter in series with the sensors or use the ITT Flygt sensor tester "ST-1" (FD part no. 10-581700) to measure the current in the sensor circuit. See figures below.

"ST-1" is not yet prepared to handle the new sensor FLS10.

The figures on page 2 is used as reference to determine the status of the sensors (sensor connections).

Circuits with CLS require some extra consideration. Connected with wrong polarity the CLS draws a zero current. The CLS can then be considered not connected.

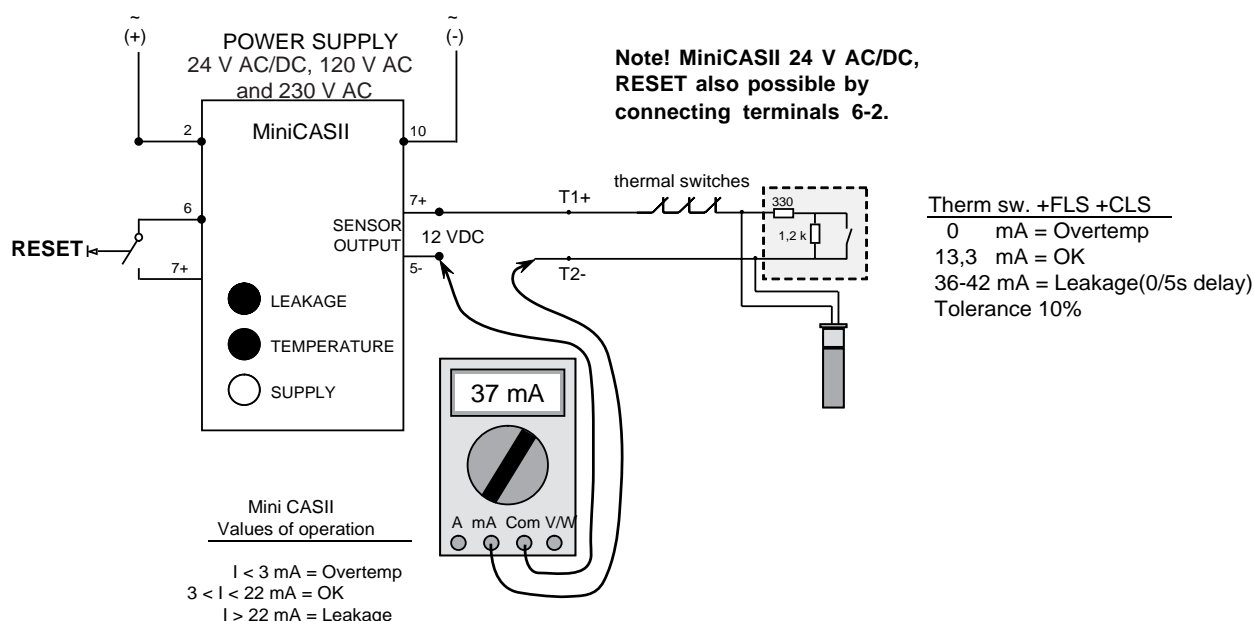
Wrong polarity results in 0 mA for circuit (3). Circuit (4) is reduced to the same as circuit (1).

As opposed to the FLS and FLS10, the CLS has a built-in alarm delay of 5 seconds.

Since the MiniCASII has only one leakage indication lamp, an alarm from the CLS or the FLS looks the same.

For circuit (4), this means that a leakage alarm can not be attributed to either of the two sensors just by looking at the MiniCASII. To make out the tripping sensor without lifting the pump, a measurement of the sensor current is necessary.

Sensor current measurement using a multimeter



### General procedure to check the status of the sensors

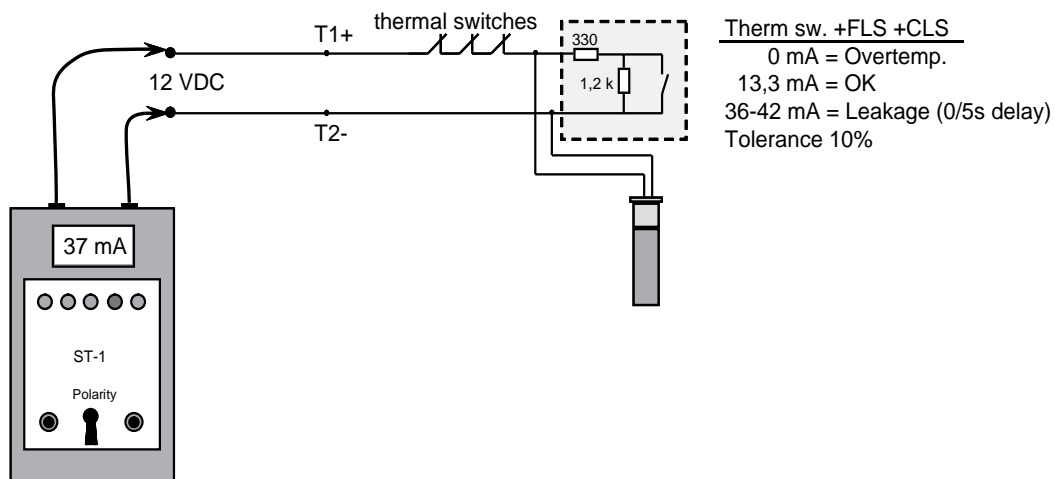
1. Close the sensor circuit by connecting the multimeter test leads according to figure above or on next page.
2. From the moment contact is made, observe the sensor current for at least 5 seconds (to await a possible CLS alarm current).
3. Switch polarity of the sensor leads (5, 7) and repeat steps 1 and 2.
4. Identify the actual sensor circuit with the help of the first page figure and analyse the sensors' status.
5. In case circuit (4) is used: By using the wrong polarity and delay properties of the CLS, it is possible to conclude if a leakage alarm is attributed to the CLS or FLS.
6. To ensure that the polarity is right after the measurement, restore the connection resulting in the largest current.

**To be noted**

A zero current may be the result of a broken sensor lead or an open thermal switch.

A leakage alarm may be caused by a short circuit due to pinched sensor leads or a correct leakage signal from FLS, FLS10 or CLS.

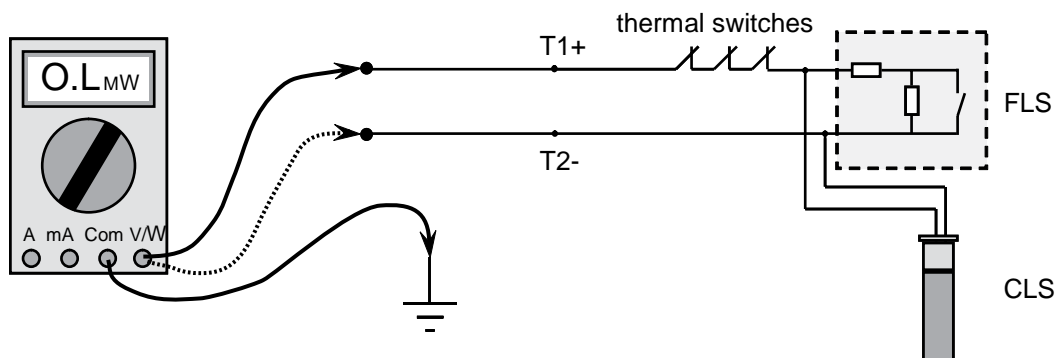
## Sensor current measurement using ST-1

**Checking earth faults**

Earth faults on the monitoring cores must be checked for and avoided as they may cause spurious seal leakage indications. Fault finding of this nature should only be carried out using a multimeter ohms scale and not an insulation tester utilising 500 V or above as a test voltage.

Measure between each sensor lead and earth. Ideally the value should be infinite but Mega ohm values are acceptable.

## Earth fault measurement



## Checking the MiniCASII

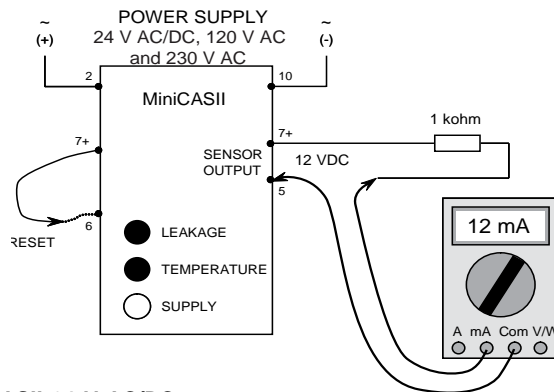
The MiniCASII can be checked by using loose sensors connected to the sensor output or by simulating the sensors using resistors.

A simple test can be performed with a resistor, for example the one enclosed in the delivery package (1 kohm):

Connect the MiniCASII input , 2 and 10 to the correct voltage, 24V AC/DC, 120V AC or 230 V AC.

### Simulating normal condition

Connect a resistor of between 1 kohm to 1,5 kohm to the 12 VDC sensor outputs 5 and 7. If a multimeter is available it can be connected in series with the resistor (see fig.) Reset the MiniCASII by shortly connecting and disconnecting a lead between outputs 6 and 7. Now, the SUPPLY lamp only should be lit.



Mini CASII Values of operation	
$I < 3 \text{ mA}$	= Overtemp
$3 < I < 22 \text{ mA}$	= OK
$I > 22 \text{ mA}$	= Leakage

**Note! MiniCASII 24 V AC/DC,**  
RESET also possible by  
connecting terminals 6-2.

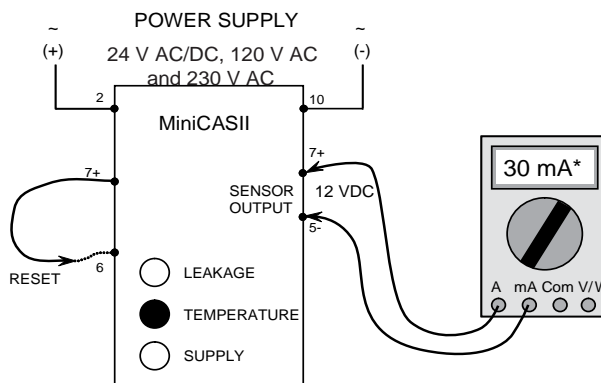
The mA reading with a 1 kohm resistor:  $12 \text{ V} / 1000 \text{ ohm} = 12 \text{ mA}$ .

### Simulating temperature alarm

If nothing is connected to the sensor outputs 5 and 7 (open circuit), the SUPPLY and TEMPERATURE lamps are both lit. The current is obviously zero mA.

### Simulating leakage alarm

The leakage condition can be checked by connecting a 500 ohm (or less) resistor to the sensor outputs 5 and 7. It is fine to short circuit the output with the multimeter or a jumper. Note that there is a 10 s delay<sup>1</sup> before the LEAKAGE lamp is lit. The TEMPERATURE lamp may or may not be lit depending on if the MiniCASII has been reset.



Mini CAS II Values of operation	
$I < 3 \text{ mA}$	= Overtemp
$3 < I < 22 \text{ mA}$	= OK
$I > 22 \text{ mA}$	= Leakage

\* At short circuit, MiniCASII limits the current to 30 mA

**Note! MiniCASII 24 V AC/DC,**  
RESET also possible by  
connecting terminals 6-2.

<sup>1</sup> The MiniCASII 24 V AC/DC has been updated at one occasion. Both versions have part no 835857 but are easily distinguished by looking at the circuit diagram on the side of the unit. Check the delay of the leakage alarm.

The original version has a 5 s delay.

The updated version has a 10 s delay. This version also has an improved noise protection. In some cases where noise, generated by a *variable frequency drive*, has made the original version fail, the new version works.

# TECHNICAL DATA

## MiniCAS II supervision relay

Operational principle:	Current Sensing		
Approvals:	CE, C-UR (covering USA and Canada) and CSA		
Environment:	-25 to 60°C (maximum 90% relative humidity)		
Supply voltage 24 V AC/DC:	20-30 V AC (50-60Hz) 23.5-30 V DC		
Supply voltage 120 V AC:	120 V AC (50-60 Hz)		
Supply voltage 230 V AC:	230 V AC (50-60 Hz)		
Relay contact rating:	250 V AC / 5A		
Voltage to sensor:	12 V DC +/-5%		
Values of operation:	3mA < I < 22 mA	=	OK condition
	I < 3 mA	=	High temperature (or interruption)
	I > 22 mA	=	Leakage (or short circuit), 10 s delay of alarm
	( I = current measured by MiniCAS II )		
Power supply required:	5 VA		

## OPERATION

Leakage:	<table> <tr> <td>Changeover contacts</td><td>11-8 Normally closed for interlock 11-9 Closes for alarm</td></tr> </table> <p>Automatic reset Red LED for indication – follows the relay Red indication lamp on: Leakage Red indication lamp off: No leakage</p>	Changeover contacts	11-8 Normally closed for interlock 11-9 Closes for alarm				
Changeover contacts	11-8 Normally closed for interlock 11-9 Closes for alarm						
Temperature:	<table> <tr> <td>Changeover contacts</td><td>1-3 Closes for interlock when energized 1-4 Normally closed for alarm</td></tr> </table> <p>Manual reset (see below) Red indication lamp on: Over temperature Red indication lamp off: Normal temperature</p>	Changeover contacts	1-3 Closes for interlock when energized 1-4 Normally closed for alarm				
Changeover contacts	1-3 Closes for interlock when energized 1-4 Normally closed for alarm						
Reset of Temperature Alarm:	<p>External reset is possible either by connecting terminals 6-7 with an external push button or by interrupting the supply voltage.</p> <p>Note, in the 24 V version, Reset is also possible between 6-2.</p>						
DIMENSIONS:	<table> <tr> <td>Width</td><td>33 mm</td></tr> <tr> <td>Height</td><td>79 mm</td></tr> <tr> <td>Depth</td><td>75 mm</td></tr> </table>	Width	33 mm	Height	79 mm	Depth	75 mm
Width	33 mm						
Height	79 mm						
Depth	75 mm						
PART NOS:	<p>83 58 57 (24 V AC/DC) 40 501098 (120 V AC) 40 501560 (230 V AC)</p>						

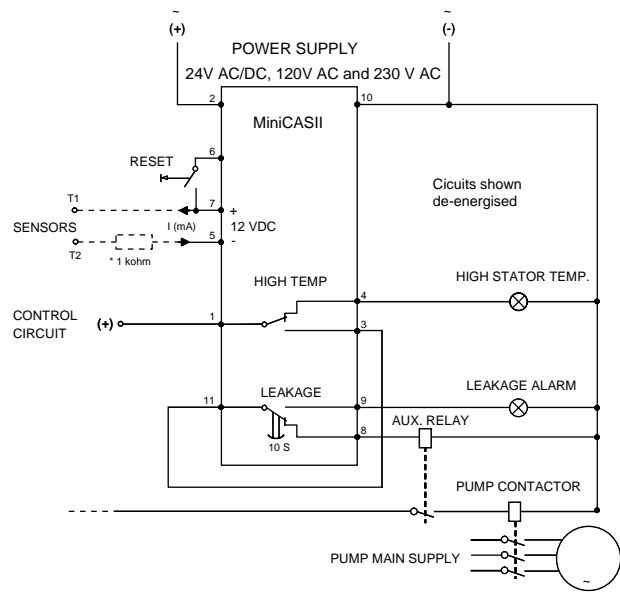
# TECHNICAL DATA

## CONNECTIONS

### Leakage alarm will stop the pump

This installation can be used if the leakage alarm shall stop the pump.

It is recommended if the FLS sensor is used. The FLS is detecting liquid in the stator housing, which is critical and requires a quick stop of the pump.



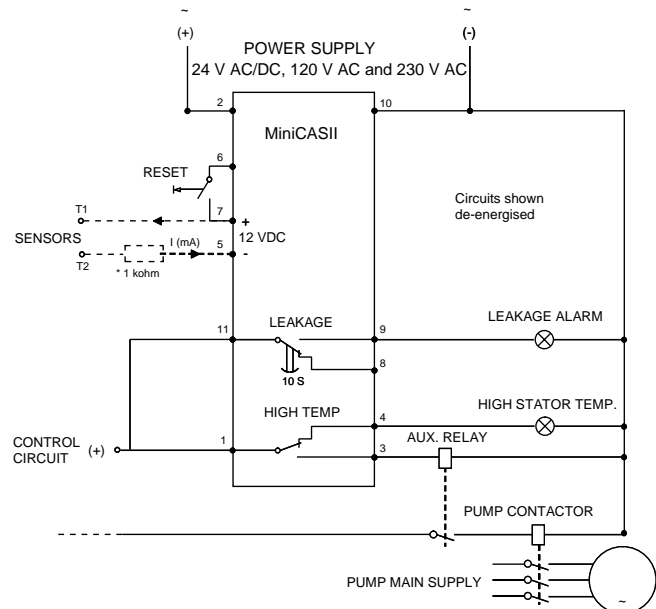
**Note! MiniCASII 24 V AC/DC, RESET also possible by connecting terminals 6-2.**

### Leakage alarm will not stop the pump (only warning)

This installation can be used if the leakage alarm shall not stop the pump but give a warning on the Mini-CASII.

It is recommended if FLS10 in inspection chamber or CLS is used. These sensors detect liquid in the inspection chamber (FLS10) and water in the oil (CLS), which is less critical than water in the stator housing.

FLS10 is used in the new midrange pump series, i.e. 3153, 3171, 3202 and 3301.



\*) Fit resistor to avoid short circuit if only thermal contacts are to be connected.

# TECHNICAL DATA

## FLS stator leakage sensor

Signal: 8 mA non-alarm current,  
36 mA alarm current

Supply voltage: 12 VDC

Max. duty temperature: 90°C

Material: Aluminium

### Physical size, sensor

Length: 27 mm

Width: 16 mm

Height: 16 mm

**Part Number** 518 89 02

## CLS water in oil sensor

Trip emulsion: 35% of water in oil

Signal: 5.5 mA non-alarm current,  
29mA alarm current  
(5 s delay of alarm)

Poles: 2 wires protected with a  
diode (wrong polarity  
connection = 0 mA)

Supply voltage: 12 VDC ( $\pm 10\%$ )  
(brown = +, black = -)

Metal parts: Acid proof stainless steel

Sensor surface: Glass

Max. pressure: 10 MPa 1h

Test pressure: 40 MPa

Duty pressure: 2 MPa

Max. temperature: 90°C, 1h

Test temperature: 115°C, 1h

Max. duty temperature 70°C

### Physical size, sensor

Length: 75 mm

Diameter: 12 mm

Thread: M16  $\times$  1.5, length 15 mm

**Part number:** 505 12 00

## FLS10 inspection chamber sensor

Signal: 10 mA non-alarm current,  
28 mA alarm current

Supply voltage: 12VDC

Max. duty temperature: 90°C

Material: Stainless steel and  
nitril rubber

### Physical size, sensor

Length: 44 mm

Diameter: 22 mm

Thread: M12  $\times$  1, length 9 mm

**Part number** 6630400

**Warning: Sensor body made of glass.  
Handle with care.**



## What can ITT Water & Wastewater do for you?

Integrated solutions for fluid handling are offered by ITT Water & Wastewater as a world leader in transport and treatment of wastewater. We provide a complete range of water, wastewater and drainage pumps, equipment for monitoring and control, units for primary and secondary biological treatment, products for filtration and disinfection, and related services. ITT Water & Wastewater, headquartered in Sweden, operates in some 140 countries across the world, with own plants in Europe, China and North and South America. The company is wholly owned by the ITT Corporation of White Plains, New York, supplier of advanced technology products and services.



**[www.ittwww.com](http://www.ittwww.com)**

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Fax +46-44-20 59 01



**RH Series — General Purpose Midget Relays****Key features of the RH series include:**

- Compact midget size saves space
- High switching capacity (10A)
- Choice of blade or PCB style terminals
- Relay options include indicator light, check button, and top mounting bracket
- DIN rail, surface, panel, and PCB type sockets available for a wide range of mounting applications



UL Recognized  
Files No. RH1 = E66043  
RH2 = E66043  
RH3 = E66043  
RH4 = E55996



CSA Certified  
File No. LR35144



File No. B020813332452



<b>Specifications</b>	<b>Contact Material</b>	Silver cadmium oxide
	<b>Contact Resistance</b>	50mΩ maximum (initial value)
	<b>Minimum Applicable Load</b>	24V DC/30mA, 5V DC/100mA (reference value)
	<b>Operating Time</b>	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	<b>Release Time</b>	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	<b>Maximum Continuous Applied Voltage (AC/DC) at 20°C</b>	110% of the rated voltage
	<b>Minimum Operating Voltage (AC/DC) at 20°C</b>	80% of the rated voltage
	<b>Drop-Out Voltage (AC)</b>	30% or more of the rated voltage
	<b>Drop-Out Voltage (DC)</b>	10% or more of the rated voltage
	<b>Power Consumption</b>	<b>SPDT (RH1):</b> DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) <b>DPDT (RH2):</b> DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) <b>3PDT (RH3):</b> DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) <b>4PDT (RH4):</b> DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
	<b>Insulation Resistance</b>	100MΩ min (measured with a 500V DC megger)
	<b>Dielectric Strength</b>	<b>SPDT (RH1)</b> Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
		<b>DPDT (RH2), 3PDT (RH3), 4PDT (RH4)</b> Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contact circuits: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
	<b>Frequency Response</b>	1,800 operations/hour
	<b>Temperature Rise</b>	Coil: 85°C maximum Contact: 65°C maximum
	<b>Vibration Resistance</b>	0 to 6G (55Hz maximum)
	<b>Shock Resistance</b>	SPDT/DPDT: 200N (approximately 20G) 3PDT/4PDT: 100N (approximately 10G)
	<b>Life Expectancy</b>	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT [RH1], 3PDT [RH3], 4PDT [RH4]) Mechanical: 50,000,000 operations
	<b>Operating Temperature</b>	−30 to +70°C
	<b>Weight</b>	SPDT: 24g, DPDT: 37g (approximately) 3PDT: 50g, 4PDT: 74g (approximately)

**Ordering Information**

Order standard voltages for fastest delivery. Allow extra delivery time for non-standard voltages.

**Basic Part No.****RH2B-U****Coil Voltage:****AC110-120V**

## Part Numbers

## Part Numbers: RH Series with Options

Termination	Contact Configuration	Basic Part No.	Indicator Light	Check Button	Indicator Light and Check Button	Top Bracket
B (blade)	SPDT	RH1B-U	RH1B-UL	RH1B-UC	RH1B-ULC	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-ULC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	RH3B-ULC	RH3B-UT
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-ULC	RH4B-UT
V2 (PCB 0.078" [2mm] wide)	SPDT	RH1V2-U	RH1V2-UL	RH1V2-UC	RH1V2-ULC	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	RH2V2-ULC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	RH3V2-ULC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	RH4V2-ULC	—

## Ratings

## Coil Ratings

Rated Voltage		Rated Current ±15% at 20°C								Coil Resistance ±15% at 20°C			
		60Hz				50Hz							
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
AC	6V	150mA	200mA	280mA	330mA	170mA	238mA	330mA	387mA	18.8Ω	9.4Ω	6.0Ω	5.4Ω
	12V	75mA	100mA	140mA	165mA	86mA	118mA	165mA	196mA	76.8Ω	39.3Ω	25.3Ω	21.2Ω
	24V	37mA	50mA	70mA	83mA	42mA	59.7mA	81mA	98mA	300Ω	153Ω	103Ω	84.5Ω
	120V*	7.5mA	11mA	14.2mA	16.5mA	8.6mA	12.9mA	16.4mA	19.5mA	7,680Ω	4,170Ω	2770Ω	2220Ω
	240V†	3.2mA	5.5mA	7.1mA	8.3mA	3.7mA	6.5mA	8.2mA	9.8mA	3,1200Ω	15,210Ω	12,100Ω	9120Ω
		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
DC	6V	128mA		150mA		240mA		250mA		47Ω	40Ω	25Ω	24Ω
	12V	64mA		75mA		120mA		125mA		188Ω	160Ω	100Ω	96Ω
	24V	32mA		36.9mA		60mA		62mA		750Ω	650Ω	400Ω	388Ω
	48V	18mA		18.5mA		30mA		31mA		2,660Ω	2,600Ω	1,600Ω	1550Ω
	110V‡	8mA		9.1mA		12.8mA		15mA		13,800Ω	12,100Ω	8,600Ω	7,340Ω

E  
Relays

\* For RH2 relays = 110/120V AC.

† For RH2 relays = 220/240V AC.

‡ For RH2 relays = 100/110V DC.

Rated Voltage		Coil Inrush				Coil Inductance							
						Energizing				De-Energizing			
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
AC	6V	250mA	340mA	520mA	620mA	0.09H	0.08H	0.05H	0.05H	0.06H	0.04H	0.03H	0.02H
	12V	120mA	170mA	260mA	310mA	0.037H	0.30H	0.22H	0.18H	0.22H	0.16H	0.12H	0.10H
	24V	56mA	85mA	130mA	165mA	1.5H	1.2H	0.9H	0.73H	0.9H	0.63H	0.5H	0.36H
	120V*	12mA	16mA	26mA	33mA	37H	33H	21H	18H	22H	15H	12H	9H
	240V†	7mA	8mA	12mA	16mA	130H	130H	84H	73H	77H	62H	47H	36H
DC		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT
	6V												
	12V												
	24V	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	48V												
	110V												



\* For RH2 relays = 110/120V AC.

† For RH2 relays = 220/240V AC.

**Ratings con't**
**Contact Ratings**

# of Poles	Max Contact Power		General Ratings		
	Resistive	Inductive	Voltage	Resistive	Inductive*
RH1	AC1540VA DC300W	AC990VA DC210W	AC110	10A	7A
			AC220	7A	4.5A
			DC30	10A	7A
RH2 RH3 RH4	AC1650VA DC300W	AC1100VA DC225W	AC110	10A	7.5A
			AC220	7.5A	5A
			DC30	10A	7.5A



\* $\cos\phi = 0.3$   
L/R - 7ms

**UL Ratings**

Voltage	Resistive			General Use			Horse Power Rating
	RH1, RH2	RH3	RH4	RH1, RH2	RH3	RH4	RH1, RH2 RH3
AC240V	10A	7.5A	7.5A	7A	6.5A	5A	1/3HP
AC120V	10A	10A	10A	7A	7.5A	7.5A	1/6HP
DC30V	10A	10A	—	7A	—	—	—
DC28V	10A	10A	10A	7A	—	—	—

**TÜV Ratings**

Voltage	RH1	RH2	RH3	RH4
AC240V	10A	10A	7.5A	7.5A
DC30V	10A	10A	10A	10A

**CSA Ratings**

Voltage	Resistive				General Use				HP Rating
	RH1	RH2	RH3	RH4	RH1	RH2	RH3	RH4	RH1, 2, 3
AC240V	10A	10A	—	7.5A	7A	7A	7A	5A	1/3HP
AC120V	10A	10A	10A	10A	7.5A	7.5A	—	7.5A	1/6HP
DC30V	10A	10A	10A	10A	7A	7.5A	—	—	—

**Applicable Sockets**
**Part Numbers: Sockets**

Relay	Standard DIN Rail Mount	Finger-Safe DIN Rail Mount	Surface Mount	Panel Mount	PCB Mount
<b>RH1B</b>	SH1B-05	SH1B-05C	—	SH1B-51	SH1B-62
<b>RH2B</b>	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62
<b>RH3B</b>	SH3B-05	SH3B-05C	—	SH3B-51	SH3B-62
<b>RH4B</b>	SH4B-05	SH4B-05C	—	SH4B-51	SH4B-62



See Section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN rail BNDN1000.

**Spring & Clips (optional)**

Part Number	Use With
SY2S-02F1③ SFA-101① SFA-202②	SH1B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH1B-51, 62
SY4S-02F1③ SFA-101① SFA-202②	SH2B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH2B-51, 62
SH3B-05F1③ SFA-101①, -202②	SH3B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH3B-51, 62
SH4B-02F1③ SFA-101①, -202②	SH4B-05, 05C
SY4S-51F1③ SFA-301① SFA-302②	SH4B-51, 62



- ① Top latch  
② Side latch  
③ Pullover spring

## Internal Circuits

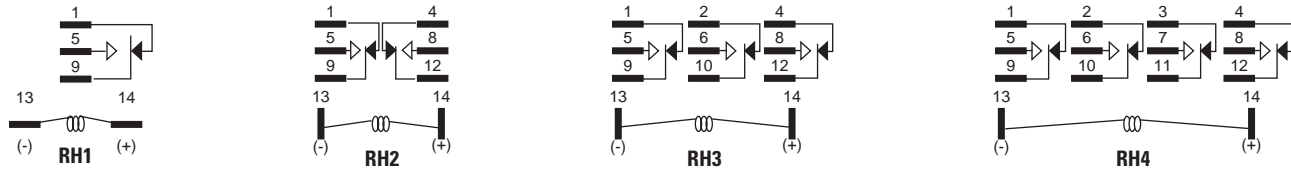
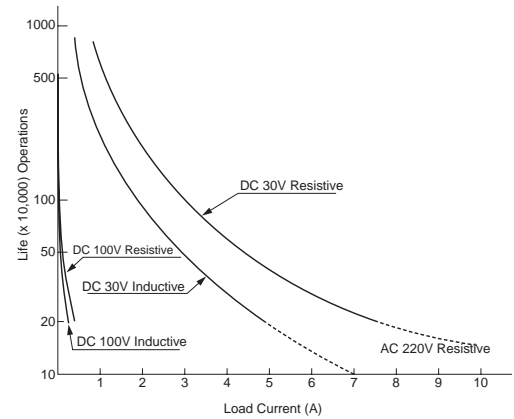
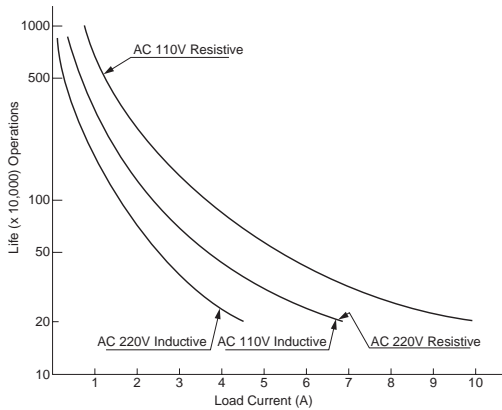


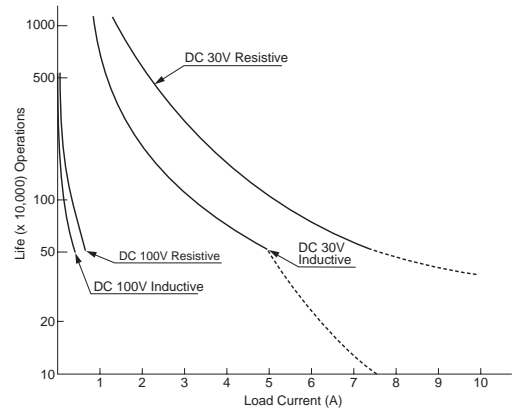
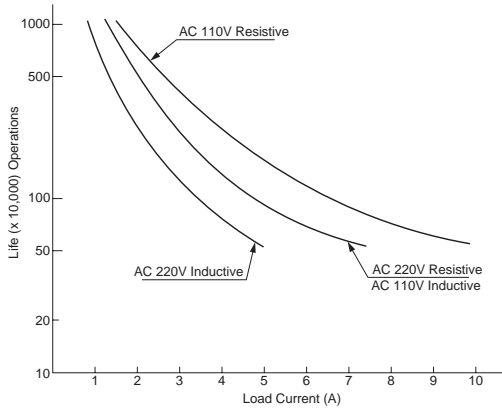
Image as viewed from bottom of relay. Refer to socket for exact wiring layout (Section F).

## Electrical Life Curves

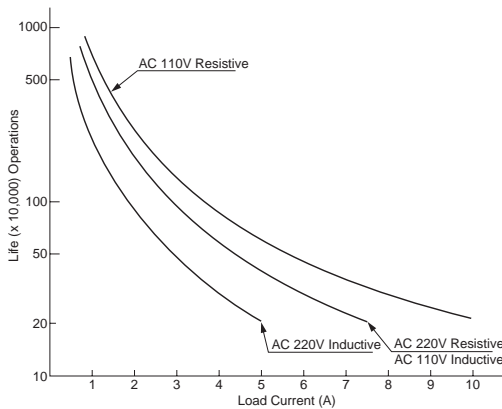
### RH1



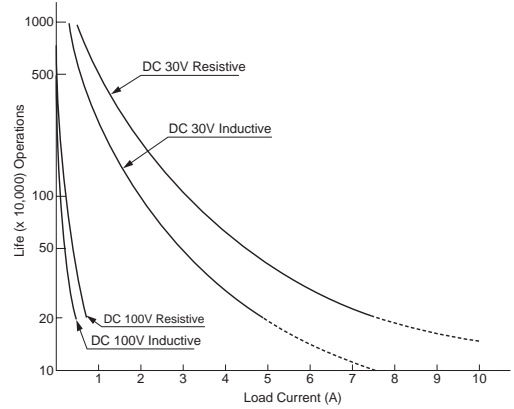
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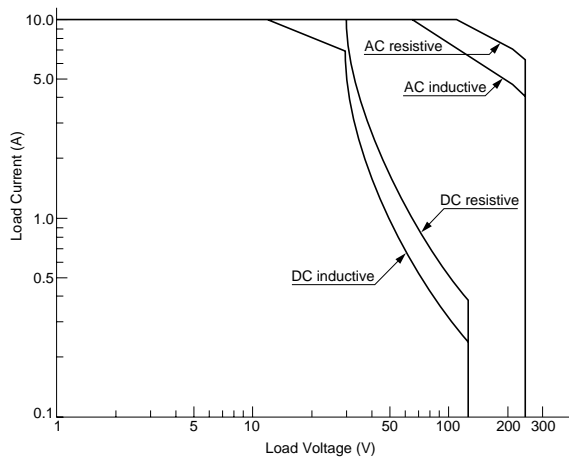
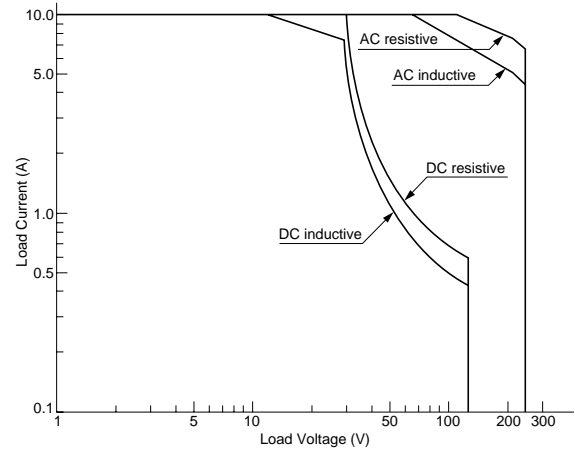
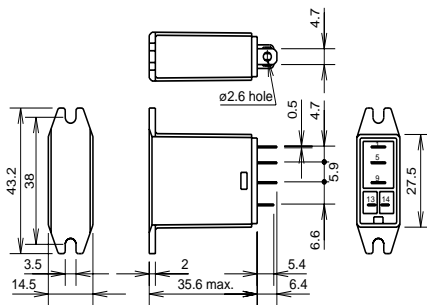
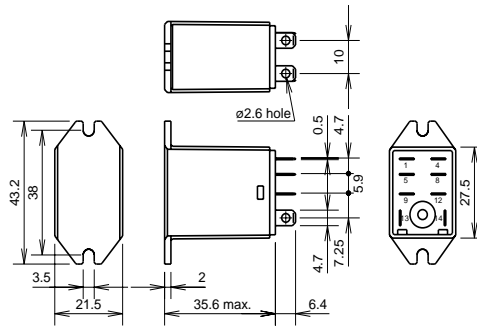
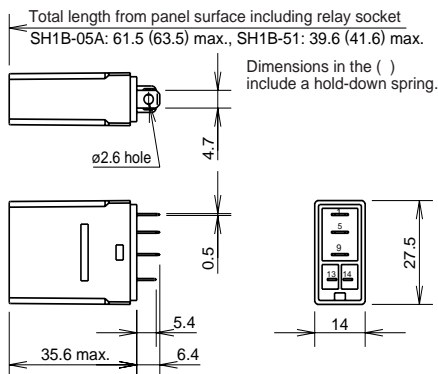
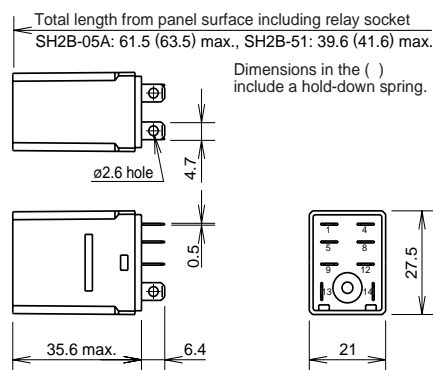


### RH3



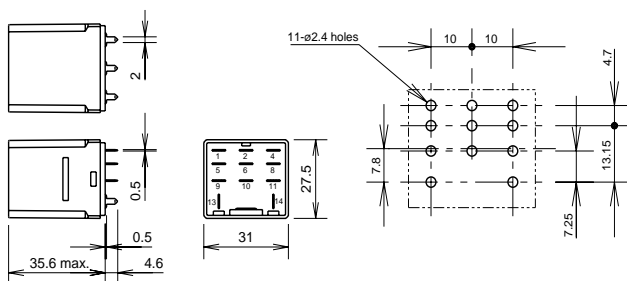
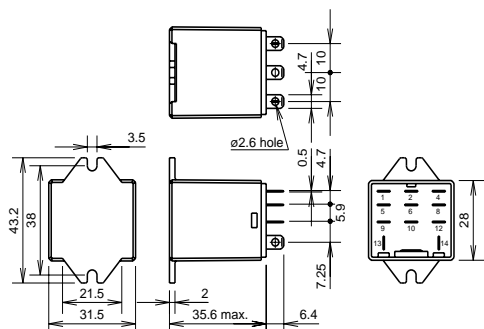
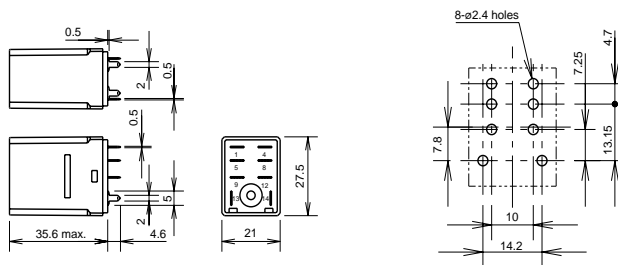
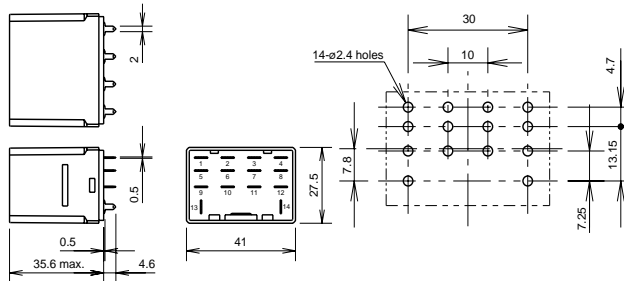
### RH4



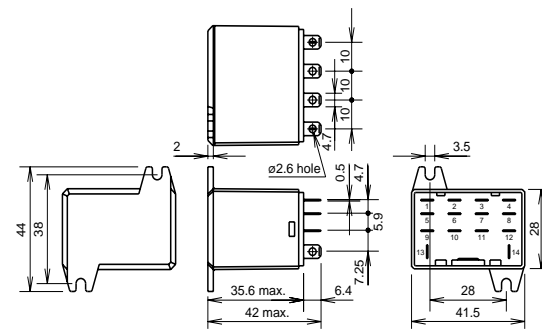
**Maximum Switching Capacity**
**RH1**

**RH2/RH3/RH4**

**Dimensions**
**Top Bracket Mounting  
Blade Terminal  
RH1B-UT**

**RH2B-UT**

**Plug-in Blade Terminal  
RH1B**

**RH2B**


All dimensions in mm.

### Plug-in Blade Terminal RH3B

**RH3B-UT****RH4B****RH4V2**

**RH4B-UT**

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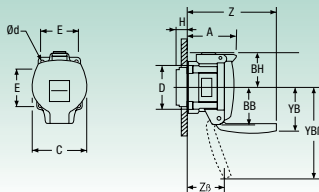
# DS range dimensions

## Socket-outlet

### + plug

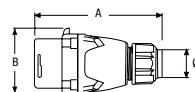
#### Socket-outlet

YB8: 180° OPENING LID



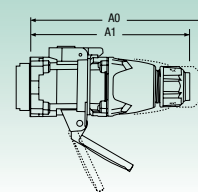
	A	BB	BH	C	D	E	H	YB	YB8	Z	ZB	Ød
DS1/DS24C	65	50	45	69	58	48	15	65	108	121	76	5
DS3/DS37C	69	55	54	80	70	55	21	100	132	121	57	5
DS6/DS7C3	76	63	60	98	80	66	27	110	152	146	87	5.5
DS9	113	75	70	113	100	81	24	137		197		6
DS2/DS7C9	110	75	92	131	118	98	38	115		213		6.5

#### Plug



	A	B	Ø
DS1/DS24C	144	70	5-21
DS3/DS37C	148	82	10-30
DS6/DS7C3	175	98	13-36
DS9	195	125	25-45
DS2/DS7C9	260	141	40-58

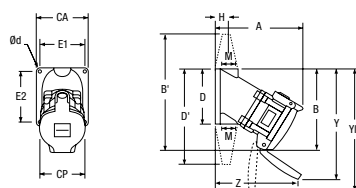
#### Plug connected (A1)/ disconnected (Ao) in a socket-outlet



	A1	Ao
DS1/DS24C	166	182
DS3/DS37C	174	190
DS6/DS7C3	197	221
DS9	246	275
DS2/DS7C9	310	341

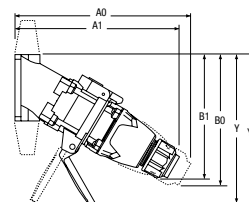
#### 30° wall mounting socket

YB: 180° OPENING LID



	A	B	B'	CA	CP	D	E1	E2	H	Y	YB	Z	Ød
DS1/DS24C	135	128		84	69	84	70	70	18	175	189	128	6
DS3/DS37C	154	151		89	80	100	77	88	24	216	216	129	6.5
DS6/DS7C3 POLY	192	185		105	98	128	89	112	31	262	269	168	7.5
DS6/DS7C3 METAL	173	151		80	98	130	105	105	28	220	239	181	7
DS9	250	188	285	138	113	285	163	116	50	279		258	7
DS2/DS7C9 (60°)	314	256	315	180	131	315	202	154	50	379		187	10

#### Plug connected (A1)/ disconnected (Ao) in a 30° wall mounting socket

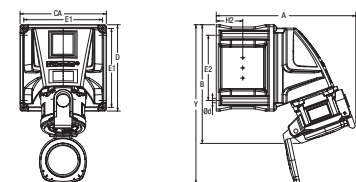


YB: 180° OPENING LID

	A1	Ao	B1	B0	Y	YB
DS1/DS24C	211	225	161	169	175	189
DS3/DS37C	232	246	184	192	216	216
DS6/DS7C3 POLY	283	304	220	232	262	269
DS6/DS7C3 METAL	268	289	193	205	220	239
DS9	355	380	243	258	279	
DS2/DS7C9 (60°)	383	399	433	460	379	

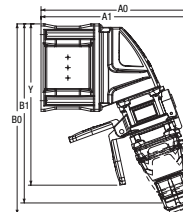
#### 70° wall mounting socket

YB: 180° OPENING LID



	A	B	CA	D	E1	E2	H2	Y	Ød
DS1/DS24C	205	175	127	127	116	96	39	234	6.5
DS3/DS37C	231	219	170	170	158	139	39	289	6.5
DS6/DS7C3 POLY	238	237	170	170	158	159	39	316	6.5

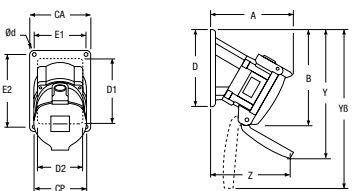
#### Plug connected (A1)/ disconnected (Ao) in a 70° wall mounting socket



	A1	Ao	B1	B0	Y
DS1/DS24C	213	219	260	276	234
DS3/DS37C	245	253	313	335	289
DS6/DS7C3 POLY	251	260	338	362	316

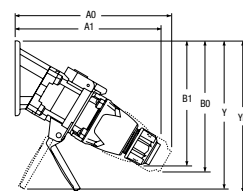
#### 30° inclined socket

YB: 180° OPENING LID



	A	B	CA	CP	D	D1	D2	E1	E2	Y	YB	Z	Ød
DS1/DS24C	116	137	76	69	107	65	62	63	95	184	198	109	5.5
DS3/DS37C	125	145	76	80	107	65	68	63	95	210	210	109	5.5
DS6/DS7C3	138	177	102	98	136	111	90	87	122	254	261	114	6.5
DS9	200	198	140	113	142	110	100	124	124	299		169	7
DS2/DS7C9 (60°)	223	249	183	131	183	150	150	165	165	380		96	7

#### Plug connected (A1)/ disconnected (Ao) in a 30° inclined socket



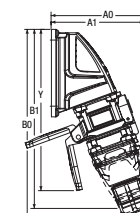
YB: 180° OPENING LID

	A1	Ao	B1	B0	Y	YB
DS1/DS24C	192	206	170	178	184	198
DS3/DS37C	203	217	178	186	210	210
DS6/DS7C3	229	250	212	224	254	261
DS9	302	327	242	257	299	
DS2/DS7C9 (60°)	292	308	347	374	293	

#### 70° inclined socket

	A	B	Ca	D	E1	Y	Ød
DS1/DS24C	127	175	127	127	116	234	4.5
DS3/DS37C	153	219	170	170	159	289	4.5
DS6/DS7C3 POLY	160	237	170	170	159	316	4.5

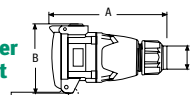
#### Plug connected (A1)/ disconnected (Ao) in a 70° inclined socket



	A1	Ao	B1	B0	Y
DS1/DS24C	135	141	260	276	234
DS3/DS37C	167	175	313	335	289
DS6/DS7C3 POLY	173	182	338	362	316

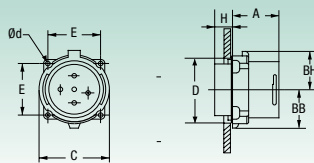
## Coupler socket + inlet

### Coupler socket



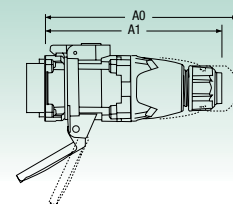
	A	B	Ø
DS1/DS24C	160	95	5-21
DS3/DS37C	165	108	10-30
DS6/DS7C3	179	123	13-36
DS9	227	145	25-45
DS2/DS7C9	291	167	40-58

### Inlet



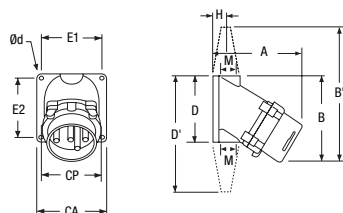
	A	BB	BH	C	D	E	H	Ød
DS1/DS24C	48	33	37	67	58	48	14	5
DS3/DS37C	52	38	45	78	70	55	18	5
DS6/DS7C3	56	45	53	92	80	66	27	5.5
DS9	71	61	64	113	100	81	26	6
DS2/DS7C9	79	73	68	130	118	98	40	6.5

### Coupler socket connected (A1)/ disconnected (Ao) in an inlet



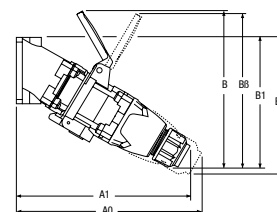
	A1	A0
DS1/DS24C	166	182
DS3/DS37C	174	190
DS6/DS7C3	197	221
DS9	246	275
DS2/DS7C9	310	341

### 30° wall mounting appliance inlet



	A	B	B'	CA	CP	D	E1	E2	H	Ød
DS1/DS24C	111	105	84	67	84	70	70	18	6	
DS3/DS37C	129	126	89	66	100	77	88	24	6.5	
DS6/DS7C3 POLY	170	158	105	92	128	89	112	31	7.5	
DS6/DS7C3 METAL	150	121	127	92	130	105	105	28	7	
DS9	203	153	320	183	113	285	163	116	50	7
DS2/DS7C9 (60°)	267	233	400	226	130	315	202	154	50	10

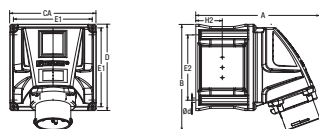
### Coupler socket connected (A1)/ disconnected (Ao) in a 30° wall mounting appliance inlet



BB: 180° OPENING LID

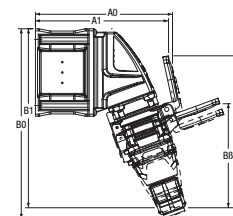
	A1	A0	B	B1	B0	Bβ
DS1/DS24C	211	225	184	161	169	199
DS3/DS37C	232	246	215	184	192	215
DS6/DS7C3 POLY	283	304	248	220	232	254
DS6/DS7C3 METAL	268	289	248	193	205	
DS9	355	380	311	243	258	
DS2/DS7C9 (60°)	383	399	427	433	460	

### 70° wall mounting appliance inlet



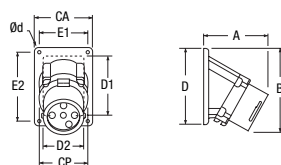
	A	B	Ca	D	E	E1	E2	H2	Ød
DS1/DS24C	182	157	127	127	116	96	39	6.5	
DS3/DS37C	208	201	170	158	159	139	39	6.5	
DS6/DS7C3 POLY	212	212	170	170	158	159	39	6.5	

### Coupler socket connected (A1)/ disconnected (Ao) in a 70° wall mounting appliance inlet



	A1	A0	B	B1	B0	Bβ
DS1/DS24C	193	199	221	260	276	151
DS3/DS37C	225	217	249	313	334	180
DS6/DS7C3 POLY	245	261	282	338	362	210

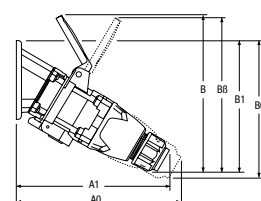
### 30° inclined appliance inlet



D1: drilling Ø

	A	B	CA	CP	D	D1	D2	E1	E2	Ød
DS1/DS24C	92	114	76	67	107	65	62	63	95	5.5
DS3/DS37C	100	120	76	66	107	65	68	63	95	5.5
DS6/DS7C3	109	146	102	92	136	111	90	87	122	6.5
DS9	153	159	140	113	142	110	100	124	124	7
DS2/DS7C9 (60°)	176	226	183	130	183	150	150	165	165	7

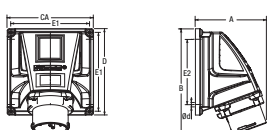
### Coupler socket connected (A1)/ disconnected (Ao) in a 30° inclined appliance inlet



BB: 180° OPENING LID

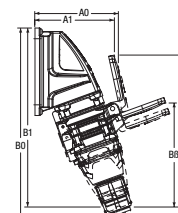
	A1	A0	B	B1	B0	Bβ
DS1/DS24C	192	206	184	170	178	199
DS3/DS37C	203	217	215	178	186	215
DS6/DS7C3	229	250	248	212	224	254
DS9	302	327	311	242	257	
DS2/DS7C9 (60°)	292	308	427	347	374	

### 70° inclined appliance inlet



	A	B	CA	D	E1	Ød
DS1/DS24C	104	157	127	127	116	4.5
DS3/DS37C	130	201	170	170	159	4.5
DS6/DS7C3	134	212	170	170	159	4.5

### Coupler socket connected (A1)/ disconnected (Ao) in a 70° inclined appliance inlet



	A1	A0	B	B1	B0	Bβ
DS1/DS24C	115	121	221	260	276	151
DS3/DS37C	139	147	249	313	334	180
DS6/DS7C3	167	183	282	338	362	210



# Plugs and socket-outlets

## 6 to 7 contacts / 16 or 25 A


**Main features:**

• (socket-outlet) IP	54 or 66/67	• Wiring (min - max) flexible	1.5 / 4 mm <sup>2</sup>
• (socket-outlet + inlet) IP	54 or 66/67	• Wiring (min - max) stranded	2.5 / 6 mm <sup>2</sup>
• IK (poly/metal)	08/09	• Keying positions	5
• Umax AC	500 V		

### **S** Socket-outlet (female)



### **I** Inlet (male)


**Main options**


Reversed interior and contacts (male socket-outlet)



Reversed interior and contacts (female inlet) with IP54 cap



Padlocking (left - Padlock not supplied) or locking by triangular screw (right)

**Accessories**


IP67 inlet cap

**Poly version**
**Metal version**

Polarity	U/I *	Part #	U/I *	Part #
5P	50/25	01 P4 <b>050</b>	50/25	09 P4 <b>050</b>
6P	50/16	01 P4 <b>060</b>	50/16	09 P4 <b>060</b>
7P	50/16	01 P4 <b>070</b>	50/16	09 P4 <b>070</b>
4P+E	500/25	01 P4 <b>041</b>	415/25	09 P4 <b>041</b>
5P+E	500/16	01 P4 <b>051</b>	415/16	09 P4 <b>051</b>
6P+E	500/16	01 P4 <b>061</b>	415/16	09 P4 <b>061</b>

\* Maximum voltage (V) / Rated current (A)

**Version with self-closing lid (IP55):**

Choose from the part numbers above and change letter P for an H.

**Socket-outlet options**

Reversed interior and contacts	Socket # + <b>001</b>
Self-returning lid *	Socket # + <b>R</b>
180°-opening lid	Socket # + <b>10</b>
180°-opening and self-returning lid *	Socket # + <b>18</b>
Padlocking (padlock 4 mm Ø) without shaft *	Socket # + <b>843</b>
Locking by triangular screw *	Socket # + <b>22</b>

\* except for IP55 version

**Poly version**
**Metal version**

Polarity	U/I *	Part #	U/I *	Part #
5P	50/25	01 P8 <b>050</b>	50/25	09 P8 <b>050</b>
6P	50/16	01 P8 <b>060</b>	50/16	09 P8 <b>060</b>
7P	50/16	01 P8 <b>070</b>	50/16	09 P8 <b>070</b>
4P+E	500/25	01 P8 <b>041</b>	415/25	09 P8 <b>041</b>
5P+E	500/16	01 P8 <b>051</b>	415/16	09 P8 <b>051</b>
6P+E	500/16	01 P8 <b>061</b>	415/16	09 P8 <b>061</b>

\* Maximum voltage (V) / Rated current (A)

**Inlet options**

Reversed interior and contacts	Inlet # + <b>137</b>
--------------------------------	----------------------

**Inlet accessories**

IP67 cap	01 NA <b>126</b>
----------	------------------



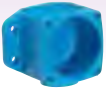
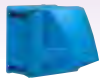

If you want to equip a socket with two or more options: call us at +33 (0) 1 45 11 60 00.

*Advantages*  
 PN12C - 5 /10 A  
 DSN24C - 5 A  
 DSN37C - 5 A  
**PN7C - 16 / 25 A**  
 DN9C - 30 A  
 DN20C - 25 A

**Also see:**





Full range of boxes page 86  
 Dimensions page 68  
 Technical Manual page 150

**Installation accessories****B Box**






					
	<b>Wall box poly 30°</b>	<b>Wall box straight metal</b>	<b>Wall box straight poly</b>	<b>Wall box poly 70°</b>	<b>Wall box metal + metal sleeve 45°</b>
<b>Entry</b>					
M20	01 NA 053	09 NA 055	01 NA 055	51 AA 058	09 NA 653
M25				51 AA 058	09 NA 653 418
M32				51 AA 058	09 NA 653 419

*The boxes are supplied without any cable gland. The 70° boxes are not drilled (drilled at extra cost)*

**Si Sleeve**

				
	<b>Inclined poly 30°</b>	<b>Inclined metal 30°</b>	<b>Inclined poly 70°</b>	<b>Inclined metal 45°</b>
	01 NA 027	09 NA 027	51 AA 757	09 2A 027

**H Handle**

					
	<b>Straight poly</b>	<b>Angled poly</b>	<b>Straight poly with poly cable gland</b>	<b>Straight metal with metal cable gland</b>	<b>Straight poly flowerpot with metric threaded entry *</b>
<b>Cable dia.</b>			<b>Cable dia.</b>	<b>Cable dia.</b>	<b>Entry</b>
8 - 18 mm	01 NA 013	01 NA 313	6 - 12 mm 01 NA 753	6 - 12 mm 09 NA 963	M20 01 NA 253 417
5 - 21 mm	61 1A 413		13 - 18 mm 01 NA 253 25P	10 - 18 mm 09 NA 953 25M	M25 01 NA 253 418
			18 - 25 mm 01 NA 253 32P	16 - 24 mm 09 NA 953 32M	M32 01 NA 253 419

*Handle for flat or steel armoured cables on request (see zoom below).*

*\* Cable gland on request.*

**Our solutions for flat or steel armoured cables**

You need a handle designed for flat or steel armoured cables?  
 Call us at 01 45 11 60 00.



**Handle for flat cables**

### **7.3 SURGE PROTECTION**

- CRITEC – TDS1100-2SR-277 – SURGE DIVERter
- CRITEC – TDF-10A-240V – 10A SURGE FILTER
- CRITEC – DAR-275V – SURGE FILTER ALARM RELAY
- GEC – RS32H c/w TIA32A – SURGE DIVERter FUSES
- NHP – NV63-FW – SURGE DIVERter FUSE

# **MOVTEC AND TDS-MOVTEC SURGE DIVERTERS**

## **INSTALLATION INSTRUCTIONS**

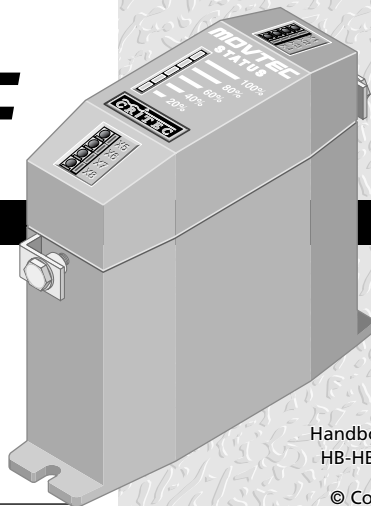
**Includes MPM Movtec Protection  
Module Instructions**

**ERICO®**

[www.erico.com](http://www.erico.com)

Q-Pulse Id: TMS536

Active: 10/12/2013



Handbook No:  
HB-HBCR-111

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ISSUE: 3  
Page 304 of 537 April 2003

INSIDE FRONT COVER

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## I. WARNINGS

- Prior to installation ensure that the Movtec is of the correct voltage and frequency, and is the type recommended for the local power distribution, and for the equipment being protected.
- Hazardous voltages may exist internally to the units. The units should be installed (and replaced) only by qualified personnel in accordance with all relevant Electricity Safety Standards.
- Do not power MPMs and three phase connected Movtecs (Ph-N) without the upstream neutral connected. Failure to do so may damage the Movtecs and/or the load.
- Where the MPMs/Movtecs are connected to an earth, this must be a low impedance earth ( $<10\ \Omega$ ) for correct operation.
- X1-X4 connections may be at phase voltages dependant upon connection method.
- If connecting to the Movtec alarm outputs do not exceed the maximum permissible ratings as damage may occur.
- Movtecs must be installed in an enclosure or panel, ensure this does not cause their environmental ratings to be exceeded.
- Do not “Megger” or “Flash Test” circuits with Movtecs installed.
- The DINLINE Surge Counter (DSC) should not be used in voltage sensing mode with TDS-Movtecs. Voltage sensing mode is not compatible with TDS-Movtecs.
- All instructions must be followed to ensure correct and safe operation.
- Diagrams are illustrative only, and should not be relied on in isolation.

## 2. INTRODUCTION

Movtecs are designed to protect mains powered equipment from the damaging effects of lightning and transients. They are ideal for point-of-entry shunt protection applications where robustness and high surge ratings are required.

The Movtec family is designed to suit many distribution systems including TN-C, TN-S, TN-C-S and TT. They can be selected for use with distribution systems with nominal voltages of 110/120V, 220/240V and 277Vrms at frequencies of 50/60 Hz.

The TDS Technology (Transient Discriminating Suppressor) units are specifically designed for distribution systems that may feature poor voltage regulation where the actual supply voltage may exceed the nominal ratings for extended periods.

This Installation Manual details the preferred procedure for the installation of the family of Critec Movtec™ Surge Diverters.

The Critec Movtec family includes:

- Critec Movtec, Single Mode, enhanced MOV technology units eg. (MT275V-135K-A)
- Critec TDS-Movtec, Single Mode, TDS technology unit featuring high over-voltage withstand for added robustness (TDS-MT-277)
- Critec TDS-Movtec, Three Mode, TDS technology unit featuring high over-voltage withstand for added robustness (TDS-MTU)

TDS-Movtec units are coloured blue for easy identification, while enhanced MOV technology units are coloured red.

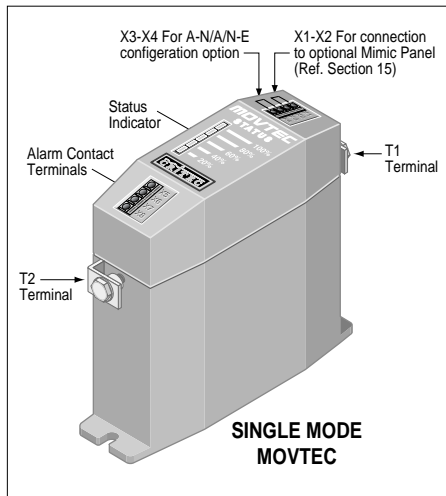
In this manual, reference to “Movtec” also includes “TDS-Movtec”.

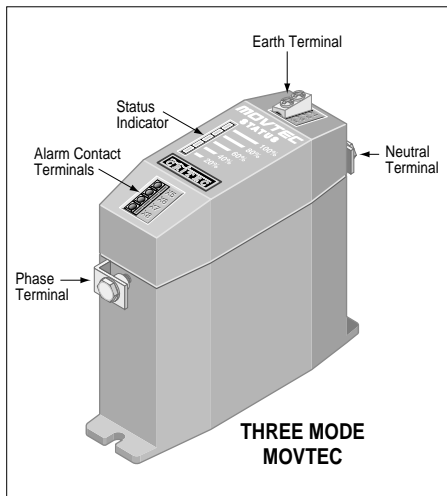


This manual also details the installation of the MPM (Movtec Protection Module). The MPM is a supplied enclosure with three Movtecs and a high energy neutral to earth protection device for three phase protection. The MPM is often used where Movtecs can not be fitted in an existing switchboard and must be mounted externally. Therefore the Movtec installation instructions are also applicable to the MPM. Section 11 gives details which are specific to the MPM.

Two standard MPMs are available:

- Critec TDS-MPM, Single Mode, TDS Technology unit (uses 3 x TDS-MT-277)
- Critec MPM-275V, Single Mode, Enhanced MOV Technology unit (uses 3 x MT275V-135K-A)

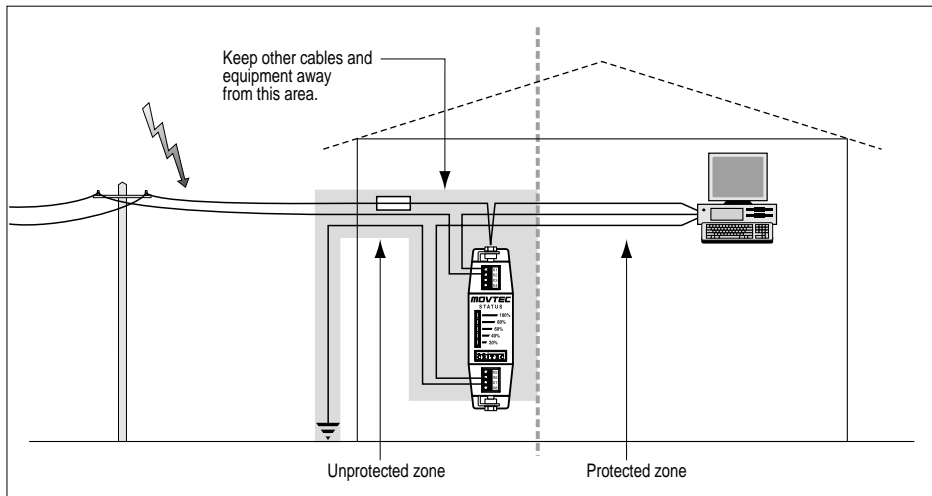




## 3. PROTECTION CONCEPTS

To optimise effectiveness of installed protection a concept of “Unprotected” and “Protected” wiring should be followed. Wiring from the transient source to the Movtec should be considered “Unprotected” and kept remote from all other wiring (approximately 300mm) where possible. Wiring on the equipment side of the Movtec should be considered “Protected”.

The separation of “Protected” from “Unprotected” wiring is recommended in order to minimise the risk of transients conducted on “Unprotected” wiring cross coupling on to “Protected” circuits, thus compromising the level of protection available from the Movtec.



## 4. MOUNTING & CAUTIONS

The performance of surge diverters can be dramatically affected by the method of connection (refer section 7). Where possible select a mounting method that allows the Movtec to be connected in the "Preferred Connection Method".

Failure of a Movtec under severe AC over-voltage, such as 11kV on 240V mains, can result in the generation of significant heat. Consideration should be given to ensure that Movtecs are not installed in close proximity to combustible materials.

Units must be installed in an enclosure or panel to provide the appropriate degree of electrical and environmental protection.

Only use enclosures that:

- Do not cause the Movtec temperature to exceed 60 deg C
- Provide adequate electrical and safety protection
- Prevent the ingress of moisture and water
- Allow Movtec Status Indication to be inspected

## 5 VOLTAGE RATINGS

The TDS (Transient Discriminating Suppressor) technology has been specifically developed to cater for abnormal over-voltage conditions that may occur on sites with poor voltage regulation, or due to wiring or distribution faults. The TDS units feature an extremely high over-voltage withstand to eliminate heat build up that can occur with standard technologies when the protection devices start to clamp on the peak of each abnormal mains cycle.

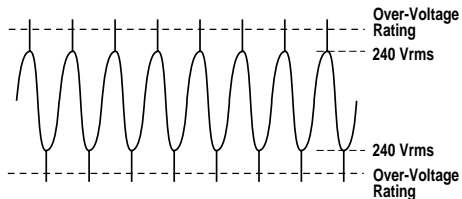
**Traditional MOV technology (eg MT-275V/135K/A) is not suitable in applications where sustained over-voltage conditions can be experienced.**

Examples of poorly regulated voltage environments include:

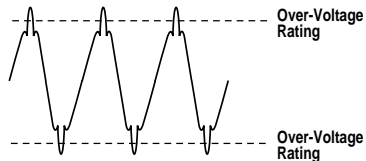
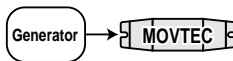
- Smaller power generation supplies
- Sites with large earth currents
- Variable motor speed control circuits
- High harmonic voltage environments (non-linear loads)

**The TDS range of Movtecs with a higher over-voltage withstand may be able to be used in these environments following advice.**

Transient protection devices are usually rated to protect against non-repetitive pulses from such sources as direct or induced lightning strikes. They are not designed to provide protection against repeated cyclic anomalies. Nor are they designed to provide protection



**Avoid repetitive voltages in excess of rating**



**Avoid high harmonic voltages**

*against sustained over-voltage conditions where the supply voltage exceeds the protection equipment's nominal rating for an extended period of time, ie continuous over-voltages from poorly regulated generators or distribution systems.*

Smaller power generation equipment (particularly capacitive excitation induction generators) does not generally conform to the same standards of voltage regulation that are in place for mains power reticulation. A large number of smaller and/or cheaper generators have a voltage waveform that is "loosely" 240Vrms (often poorly regulated), but more importantly, often contains significant higher order harmonics. These generators may exhibit a peak voltage on each half cycle far in excess of the normal 340V. The problem is usually worse when the generator is lightly loaded.

Whilst electrical equipment may tolerate this over-voltage for a period of time, the clamping elements in the power protection devices will begin to conduct on the peak of each 50Hz cycle, as their voltage threshold is reached (typically 400V peak for a traditional 275V diverter). This will cause slow degradation and ultimate failure of the clamping device (time dependent upon how poor the waveform is).

Harmonic voltages may also be present in distribution systems that do not feature generators. This is normally where non-linear loads are used, such as UPSs, rectifiers, switch mode power supplies and motor speed controls. The high harmonic voltages in certain applications may have peak voltages in excess of the protective clamping voltage causing problems as described above. Seek the manufacturer's advice before installing any

product into a circuit which features a total harmonic voltage ratio above 5%.

Model	Nominal Voltage	†Maximum Permissible Abnormal Over-Voltage
TDS-MT-277	220-277V	480V
TDS-MTU	220-277V	480V
MT275V-135K-A	220-240V	275V

Ensure that the correct voltage rating unit is installed. Exceeding the nominal rating while transient events occur may affect product life.

† *Note: Other voltage rating Movtecs are available. Refer to Movtec table for actual ratings.*

## 6. PROTECTION MODES

Movtecs are available in Three Mode and Single Mode configurations. This refers to how the internal protection is arranged and applied to the circuit to be protected.

Three Mode units provide protection between the Phase-Neutral\*, Phase-Earth\* and Neutral-Earth circuit within one Movtec.

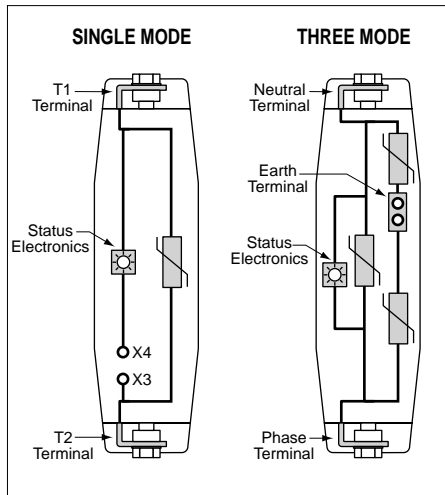
Single Mode units provide protection between two conductors connected to the terminals marked T1 and T2. These units can be connected to provide protection from Phase-Neutral\* or Phase-Earth\* or Neutral-Earth. To allow the status indication and alarm circuitry to operate, a neutral connection is required for Phase-Earth\* configured units, and a Phase\* connection is required for



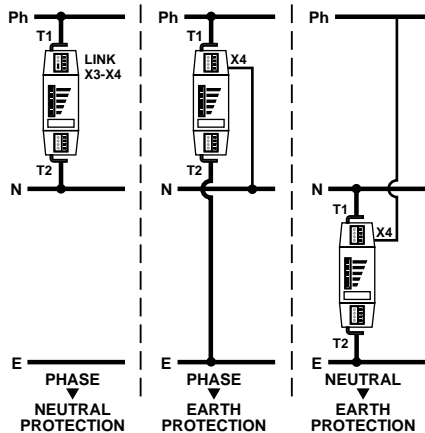
Neutral-Earth configured units. Connection details for single mode units are detailed on page 15. Warning - this connection link can be at mains potential.

\* Note. Some users may be used to the terminology “Active” or “Line”, in place of “Phase”. For consistency “Phase” is used throughout this documentation.

Model	Modes
TDS-MTU	Three Mode
TDS-MT-277	Single Mode
MT275V-135K-A	Single Mode



## SINGLE MODE CONNECTIONS OPTIONS



## 7. CONNECTION METHOD

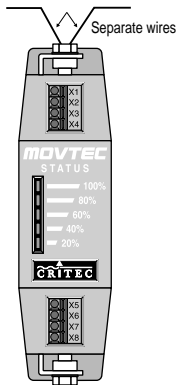
To optimise transient performance, attempt to connect the Movtects in the “Preferred” fashion as depicted on pages 16 and 17. This is recommended for cable sizes between  $6\text{mm}^2$  and  $16\text{mm}^2$ . Take care not to run the protected and unprotected wire parallel or in close proximity.

Where this is not possible due to layout or conductor size, use the “Non-preferred” “T” connection method as depicted on pages 16 to 18. With this connection method, the “T” lead should be between  $6\text{mm}^2$  and  $16\text{mm}^2$ . The connection should be as short as practicable (less than 100mm).

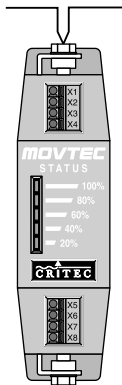
Cable sizes less than  $6\text{mm}^2$  should not be used without specialist advice.

## PREFERRED CONNECTION METHOD

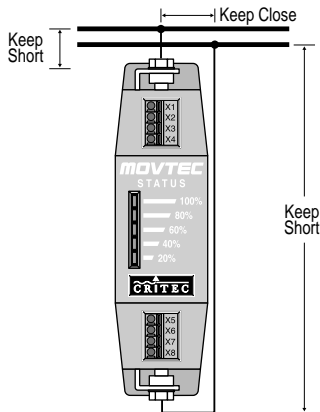
✓ **CORRECT**



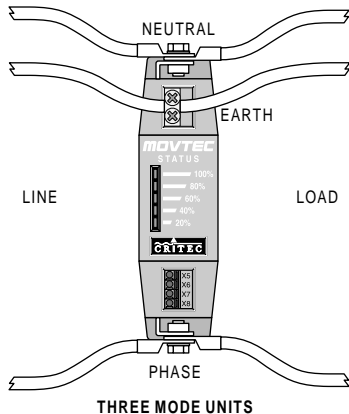
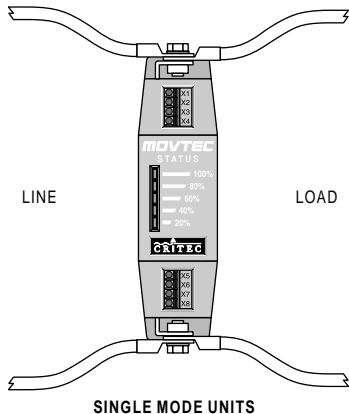
✗ **INCORRECT**



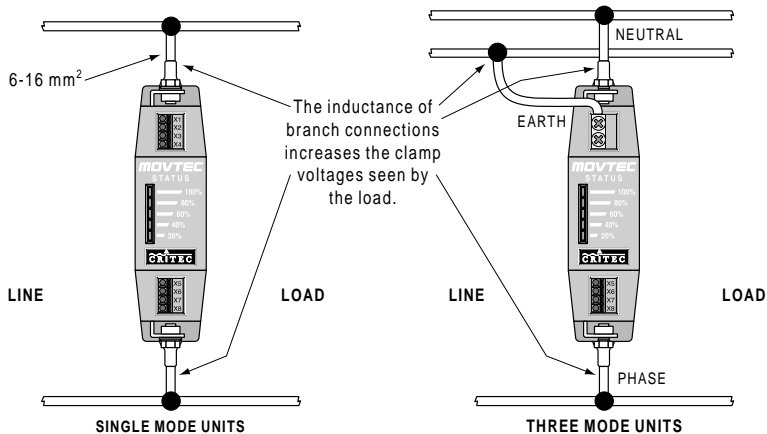
## NON-PREFERRED "T" CONNECTION METHOD

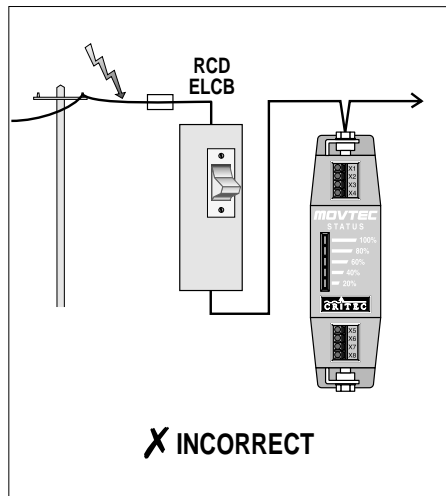
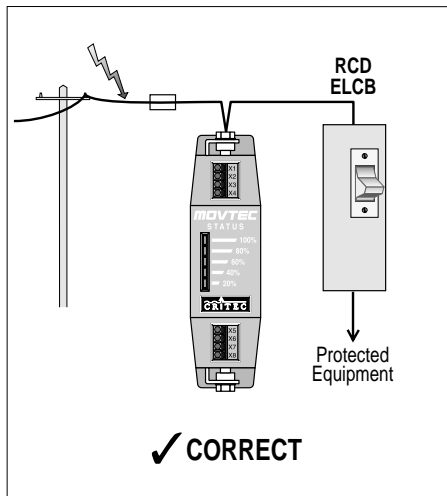


## PREFERRED CONNECTION METHOD EXAMPLES



## NON-PREFERRED "T" CONNECTION METHOD EXAMPLES





## 8. RCD, ELCB

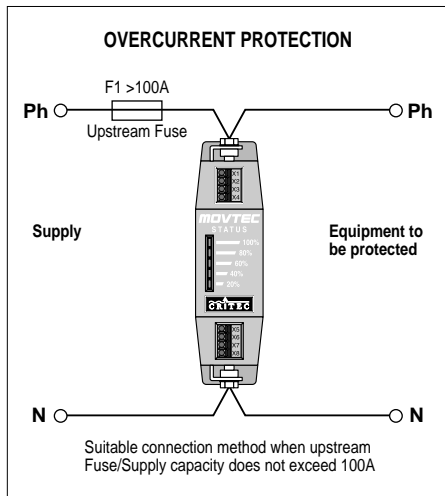
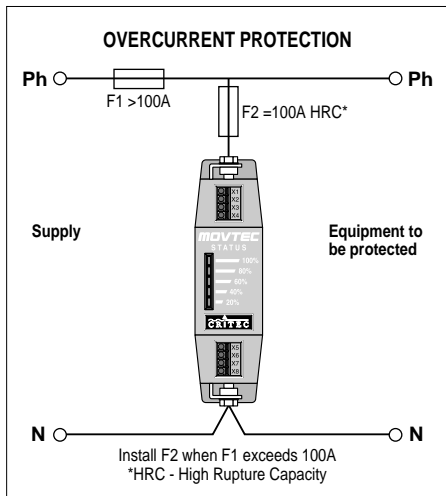
Where RCDs/ELCBs (Residual Current Devices / Earth Leakage Circuit Breakers) are fitted the Movtecs should be installed in the circuit prior to these devices (ie upstream). Where this can not be avoided and RCDs/ELCBs are installed upstream, nuisance tripping of the RCD/ELCB may occur during transient activity.

Contact your local ERICO agent for advice if upstream RCDs/ELCBs can not be avoided.

## 9. ISOLATION AND FUSING

Overcurrent and short circuit protection must be provided to protect the Movtec and associated wiring if a fault develops. The overcurrent protection should be installed in such a manner to also provide a means of isolating the Movtec module from the mains supply. This is an important safety consideration and is required in the event that any future maintenance or testing is needed.

The Movtec uses disconnection devices to isolate internal segments that have reached the end of their service life. In order for this disconnection to occur correctly, Movtecs should be only used on circuits with fuse or circuit breaker ratings of 32A or greater. (Nuisance operation of the overcurrent protection may occur during transient activity on smaller capacity circuits.)





On circuits with a capacity of greater than 100A, the Movtecs should be installed in series with a 100A HRC fuse being placed prior to the Movtec, as detailed in the diagram on page 21. This will require the Movtec to be installed in a similar manner to the non-preferred "T" connection method. Care must be taken to keep "T" connections as short and straight as possible. Note that this fuse may rupture under surge events exceeding 60kA, thereby disconnecting the protection circuit. Under such conditions it is important that suitable monitoring of the alarm contact should be carried out to detect this possible occurrence.

## 10. STATUS INDICATION AND ALARMS

A characteristic of **all** transient and surge protection devices is that they degrade in proportion to the magnitude and number of incident surges to which they have been subjected. Status indication should be periodically monitored to determine if replacement is required.

Each Movtec features 5 protection segments. The status for each of these sectors is provided by way of a 5 segment LED bar graph. If any sector is damaged due to excess surge activity, a LED will extinguish. The LEDs extinguish in a sequential order (100% LED out first, 80% LED out next etc.) irrespective of which sector has sustained damage.

When mains voltage is applied to the fully functional Movtec, the alarm contacts will be **closed**. Should the surge handling capacity fall to below the alarm threshold, these contacts will **open**. The contacts are “fail-safe” in that, if power to the unit fails, the contacts will also revert to the open condition.

#### For Single Mode units (TDS-MT-277 and MT275V-135K-A)

- The voltage free alarm contacts are activated (opened) as soon as the primary protection status displays 60% or less and indicates that the Movtec unit should be replaced.

#### For Three Mode units (TDS-MTU)

- The voltage-free alarm contacts are activated (opened) as soon as the protection status displays 80% or less. This indicates that damage has been sustained to the protection

of one of the three modes and that the TDS-Movtec unit should be replaced.

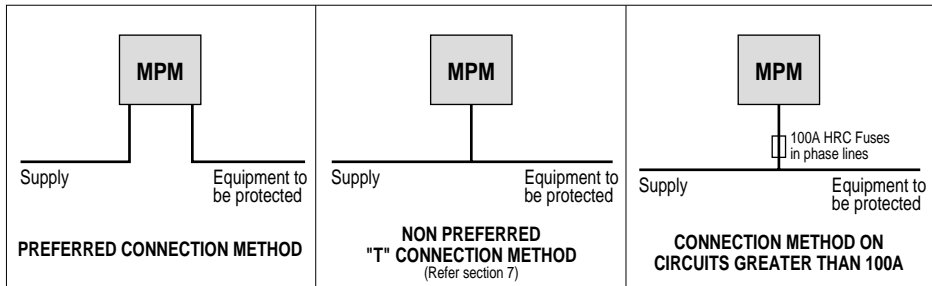
MOVTEC MODEL	TERMINALS	ALARM OPERATES WHEN
TDS-MT-277	X5 & X7	MOVTEC displayed capacity =< 60%
MT275V-135K-A	X5 & X7	MOVTEC displayed capacity = <60%
TDS-MTU	X5 & X7	MOVTEC displayed capacity = <80%
Contact Rating Contact connection	250Vac, 10A resistive, 1A inductive Multi-stranded wire with CSA not greater than 1.5mm <sup>2</sup>	

Where multiple Movtecs are used, such as in three phase distribution systems the alarm contacts may simply be connected in series to provide a common alarm output connection.

## II. MPM, MOVTEC PROTECTION MODULE

The MPM utilises a high energy Neutral to Earth spark gap to provide robust protection against earth potential rise problems. Care is required to ensure co-ordination of this device

if any other voltage limiting device is connected either upstream or downstream in the Neutral to Earth circuit. **Contact your local agent for further information if other N-E protection devices are installed and co-ordination may be affected.**



## INSTALLATION PROCEDURE FOR MPM

1. Remove the cover from the MPM.
2. Select the MPM mounting position to ensure optimum electrical connection method (refer Section 7) and in accordance with all given instructions.
3. Position and mark the mounting position of the MPM on the wall.
4. Depending on the mounting surface, prepare suitable anchoring holes for the marked position.
5. Snap the mounting spacers, supplied, into the rear of the back of the MPM as shown in Figure 1. (*see inside back cover P31*)
6. Mount the unit to the wall. To ensure the IP33 rating is preserved, the MPM should be mounted to the wall using the spacers provided and one of the fixing methods as shown in Figure 1. (*see inside back cover P31*)

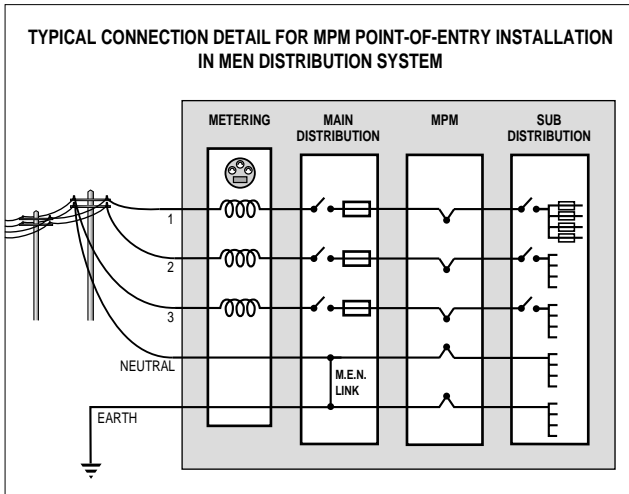
7. Prepare the appropriate cable glands. It is recommended that a nylon cable gland (typically rated at IP66) be used.
8. Install wiring, taking care to support cabling directly connecting to the MPM unit, and tighten all terminals.
9. Check that the MPM is installed in accordance with all instructions, and relevant electrical safety codes.
10. Replace MPM cover, then apply power.
11. Correct operation of the MPM unit is established by checking that all 5 LED's on each MOVTEC bar graph are lit, and that power is correctly being supplied to the load(s).

## INSTALLATION ARRANGEMENT FOR AUSTRALIAN MEN SYSTEMS

Under Australian Standards classification, MPMs are considered a piece of equipment to

be connected to the mains supply. The MPMs are not intended for use as, nor are they, a 'switch board', 'distribution board' or other equipment. As MPMs are classified as 'electrical equipment' (ie: a product), AS 3000 Wiring Regulations apply to the installation and operation of the units.

In the multiple earth neutral (MEN) distribution system, the MPM equipment should be installed as close as possible after the MEN point and after both the main disconnect switch/overcurrent protector and any metering equipment.



## 12. MAINTENANCE & TESTING

**Before removing any unit from service ensure that power to the device is isolated. Replacement of any Movtec units should only be undertaken in accordance with all relevant Electricity and Safety Standards by suitably qualified personnel.**

Movtecs should be inspected periodically, and also following any periods of lightning or transient activity. Check the status indicators and replace if in the “Alarm” condition as detailed in Section 10 -STATUS INDICATION.

For high transient exposure sites or those of a critical operational nature, it is recommended that the alarm outputs be monitored to provide an additional warning of reduced capacity (refer Section 10).

Movtecs are designed for optimum performance under severe transient activity. To provide this performance, electronic components in the Movtec are encased in a patented proprietary, shock and thermal absorbant compound. **Units cannot be serviced, they must be replaced.**

Do not attempt to open or tamper with the units in any way as this may compromise performance and will void warranty.

Do not “Megger” or perform other types of electrical tests that apply voltages greater than the nominal operating voltage of the Movtec. The Movtec will attempt to limit these voltages thereby affecting the test result. Where these tests must be performed, remove the Movtec from circuit first.

### 13. EXTENDED WARRANTY

This product has a limited warranty to be free from defects in materials and workmanship for a period of five (5) years from the date of dispatch from the Manufacturer. The Purchaser acknowledges that lightning is a natural event with statistical variation in behaviour and energy levels which may exceed product ratings, and 100 % protection is not offered and cannot be provided for. Therefore the Manufacturer's liability is limited to the repair or replacement of the product (at the Manufacturer's sole option) which in its judgement has not been abused, misused, interfered with by any person not authorised by the Manufacturer, or exposed to energy or transient levels exceeding the Manufacturer's specifications for the product. The product must be installed and earthed (where applicable) in strict accordance with the Manufacturer's specifications and all relevant national Electricity and Safety Standards. The Manufacturer and the

Purchaser mutually acknowledge that the product, by its nature, may be subject to degradation as a consequence of the number and severity of surges and transients that it experiences in normal use, and that this warranty excludes such gradual or sudden degradation. This warranty does not indemnify the Purchaser of the product for any consequential claim for damages or loss of operations or service or profits. Customers should contact their nearest manufacturer's agent to obtain a Product Repair Authorisation Number prior to making any claim under this warranty. This is only a summary of the warranty given by the Manufacturer. The full text of the warranty is set out in the Manufacturer's Conditions of Quotation and Sale. The above limited warranty is additional to rights which arise in respect of the sale of industrial and technical products and services to knowledgeable buyers under the Australian Trade Practices Act 1974 as amended.

## 14. SIX POINT PLAN

Critec Movtec surge diverters form an important part of the much larger ERICO lightning, surge and transient protection philosophy (ERICO Lightning Technologies "Six Point Plan"). The level of protection and the degree of attention dedicated to each of the six points will require careful consideration for each site. The degree of protection required is determined by the individual site location/exposure with the aid of risk management principals.

For further advice on your protection needs please contact your local representative.

### ERICO LIGHTNING TECHNOLOGIES' SIX POINT PROTECTION PLAN



**1**  
Capture the  
lightning strike



**4**  
Eliminate earth  
loops and  
differentials



**2**  
Conduct the strike  
to ground safely



**5**  
Protect equipment  
from surges on  
power lines



**3**  
Dissipate the energy  
through a low  
impedance earth  
system



**6**  
Protect equipment  
from transients on  
telecommunication  
and signal lines

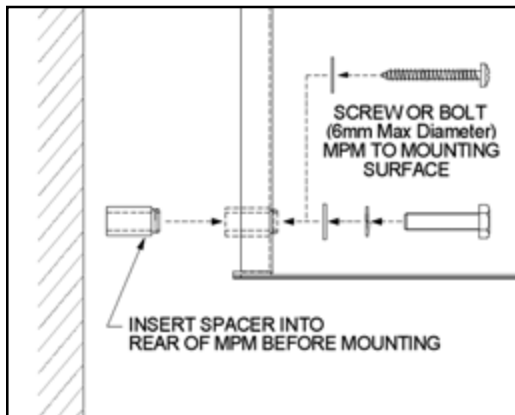


## 15. USE OF MIMIC PANELS

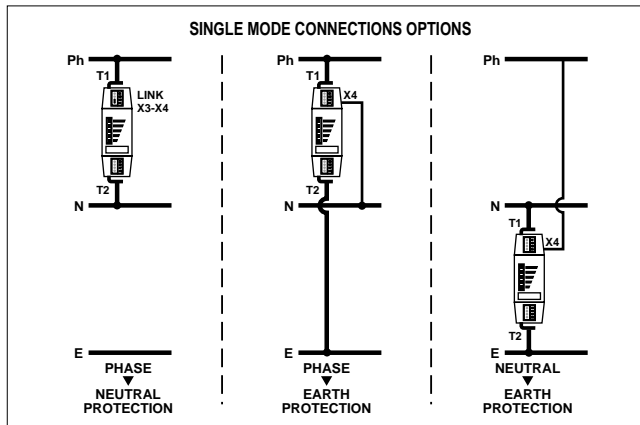
Movtecs are used in the Proline range of Surge Reduction Filters where superior protection is required for critical or sensitive electronic equipment. Some models of SRF use an electronic mimic panel to display in the

front door the status of the internal Movtecs. The X1-X4 terminals on the Movtec are used for this purpose. If this Movtec is to be used with a mimic panel (possibly as a replacement for an existing Movtec in a SRF) please ensure compatibility as below.

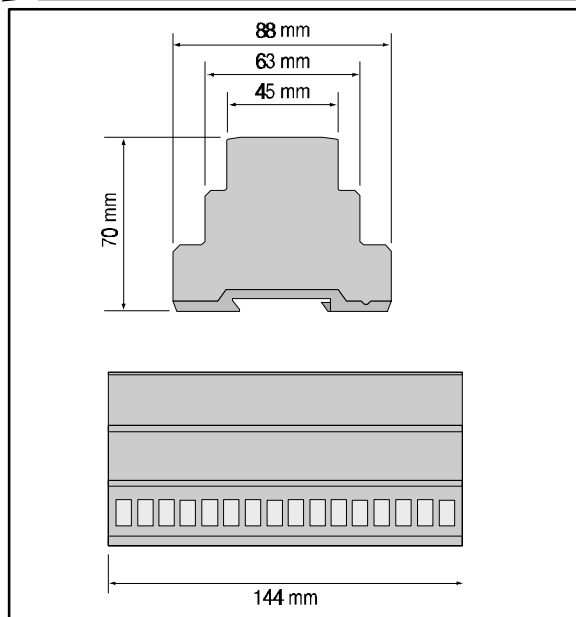
MOVTEC & MIMIC COMPATIBILITY			
Movtec Version	Mimic Version		
	TDS-Mimic #300732 EA-SRFP-117 EA-117	Hybrid Mimic #300731 EA-SRFP-115 EA-115	Discrete Mimic #300730 EA-SRFP-104 EA-104
TDS-MT-277	Yes	Note 1	No
MT-275V/135K/A #300867	Yes	Yes	Note 2
MT-275V/135K/A #300865/300866	Yes	Yes	Yes
Note 1	Mimic will operate for supply voltages up to 275Vrms		
Note 2	Request Product Update 44 for further details		



*Figure 1. MPM mounting spacers.*



**ERICO<sup>®</sup>**



## 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 communications, 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 convenience 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

# 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 8/20 $\mu$ s
Protection modes	L-N, L-G and N-G
Max surge current/mode L-N	20kA 8/20 $\mu$ s
L-G	20kA 8/20 $\mu$ s
N-G	10kA 8/20 $\mu$ s

### 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, 8/20 $\mu$ s	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 70mm

Weight 750g (approx)

Enclosure material Flame Retardant UL94V-O

Connection means Screw terminals

Wire size 1.0mm<sup>2</sup> - 6.0mm<sup>2</sup>

Mounting method DIN T35 Rail

Enclosure style DIN 43880

Environmental rating IP20

Operating temperature -30°C to +55°C

Humidity 0-90%

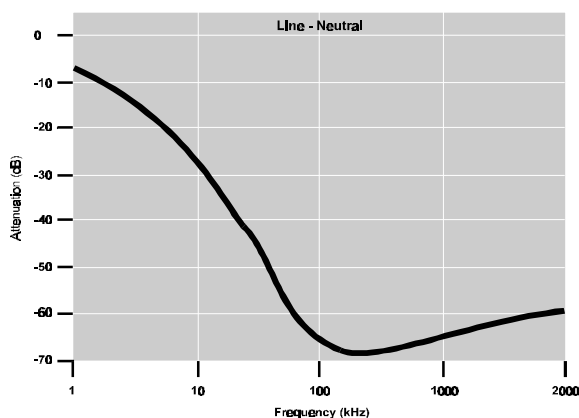
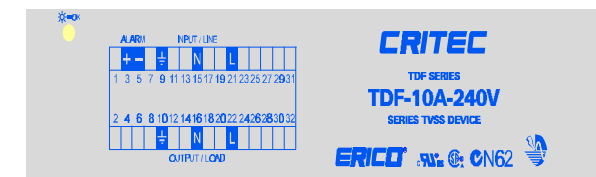
Surface finish Spark eroded finish

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. © Copyright 1999

### Part Number Description

TDF-10A-120V	120V 1 phase, 50kA 8/20 $\mu$ s, 10A series TVSS protector
TDF-10A-240V	240V 1 phase, 50kA 8/20 $\mu$ s, 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

# CRITEC® DDI/DAR/TDS SC

Asia/Australia  
Europe  
Latin America

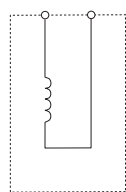
## DIN Decoupling Inductor/ DINLINE Alarm Relay & Surge Counter



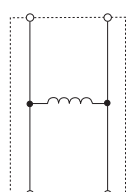
- Use for decoupling of spark gaps and MOVs – allows correct coordination of different SPD technologies
- 35 mm<sup>2</sup> tunnel terminals – accepts large cable size
- 63A model features top and bottom terminals – flexible installation
- The DINLINE Alarm Relay (DAR) is used with TDF products where 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.

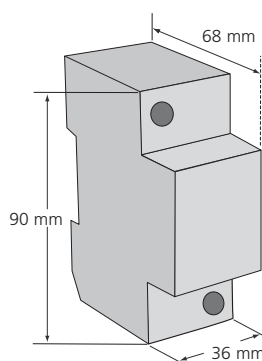
The DAR (DINLINE Alarm Relay) can be connected to TDF units to provide potential free change-over alarm contacts. The TDS SC (Surge Counter) unit is designed to provide visual indication of the number of surges registered. It uses a current transformer through which the ground conductor connecting to 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.



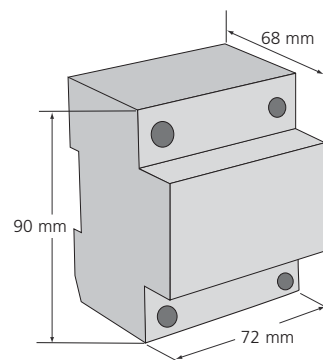
DDI 35



DDI 63



DDI 35



DDI 63

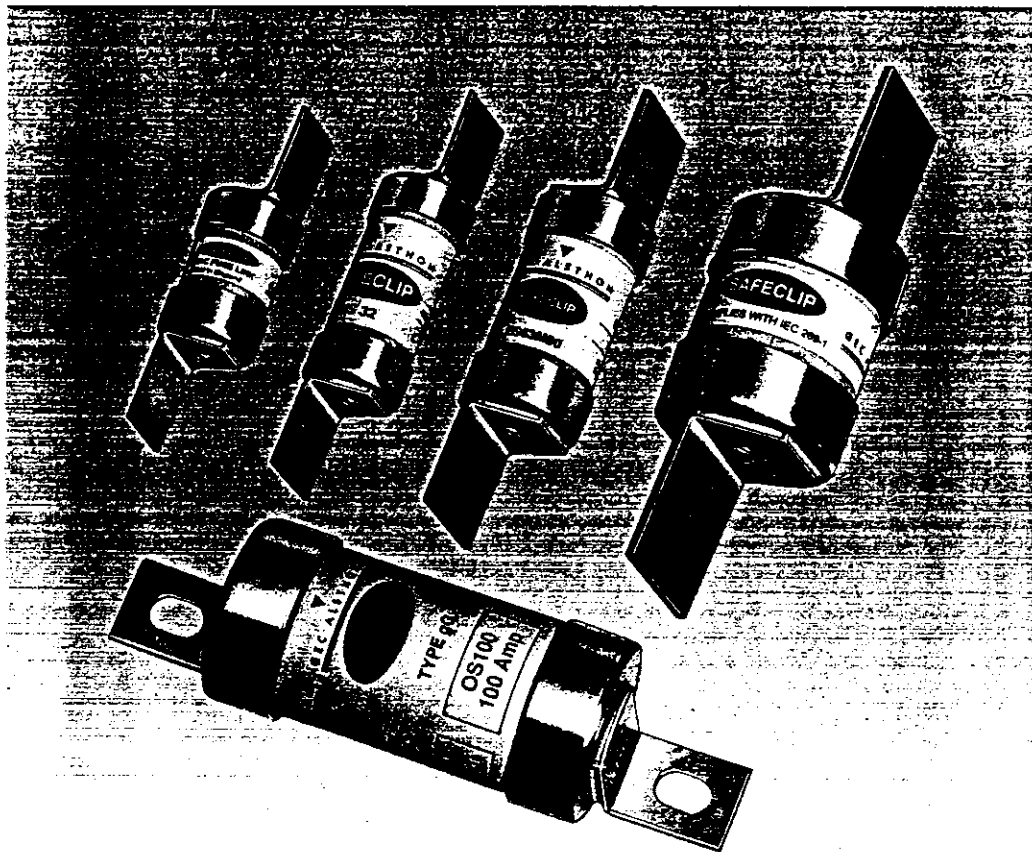
Model	DDI 35	DDI 63	DAR275V	TDS SC
Item Number for Europe	700465	700475	700900	701250
Nominal Voltage U <sub>n</sub>	-	-	20-110V---, 100-240V~	–
System Compatibility(1)	-	-	TN-C, TN-S, TN-C-S & TT	
Max. Cont. Operating Voltage U <sub>c</sub>	500V~ 200V---		275V	-
Stand-off Voltage	-	-	275V	-
Operating Current @ U <sub>n</sub>	-	-	20mA	-
Frequency	0 to 60Hz			-
Max. Line Current I <sub>l</sub>	35A @ 40°C	63A @ 40°C	-	-
Temperature Increase	45° C @ max line current (I <sub>l</sub> )		-	-
Inductance	7.5μH	15μH	-	-
Resistance	4.5mΩ	1.7mΩ	-	-
Technology	-	-	CT - trip threshold 300A 8/20μs	
Status	-	-	Red/Green LEDs Change-over contact <sup>(1)</sup>	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 mm <sup>2</sup> (#2AWG) solid ≤25 mm <sup>2</sup> (#4AWG) stranded		1 mm <sup>2</sup> to 6 mm <sup>2</sup> (#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 mm<sup>2</sup> to 6 mm<sup>2</sup> (#18AWG to #10AWG) connecting wire



177-781 → 788

# Compact Fuse Links



  
G E C A L S T H O M

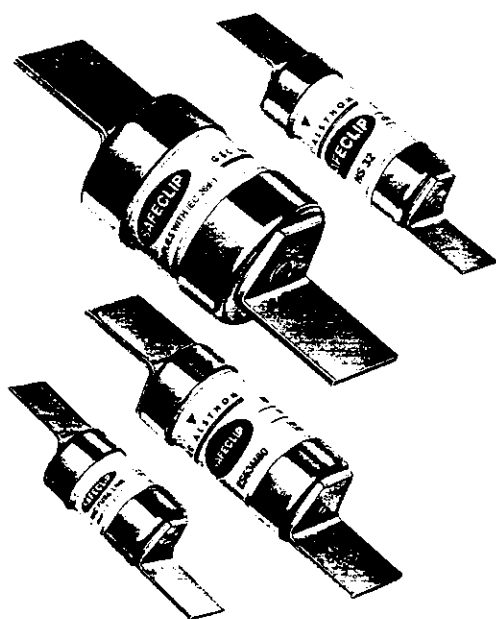
LOW VOLTAGE EQUIPMENT

**'SAFECLIP'**

Compact fuse links to  
BS 88:Part 1 or 6:1988  
for use in 'SAFECLIP'  
fuse holders and  
fuse switches

**2/2**

Contents	Page
Performance Data & Application Notes	2/2
List Numbers and Dimensions	2/3
Motor Circuit Protection	2/4
Characteristics	2/5

**Performance Data****A.C. performance**

The standard ratings are ASTA 20 certified at 80kA, 440 Volt\* to BS 88:Part 1 or Part 6:1988.

\*SS types are certified at 16.5kA, 240 Volt, and the NS32M40, ES63M80 and XS125 at 80kA, 415 Volt.

**Protection of PVC insulated cables**

Standard 'gG' ratings of 'SAFECLIP' fuse links provide complete protection to PVC insulated cables when applied in accordance with rule 433-02 of 16th Edition, IEE Wiring Regulations (ie. when their current ratings are equal to, or less than, those of the cables).

**Discrimination**

'SAFECLIP' fuse links will discriminate with each other at fault levels up to their rated a.c. performance when the ratio between 'major' and 'minor' current ratings is 2:1 (See Application Notes).

**Protection against electric shock**

The values of maximum earth loop impedance ( $Z_s$ ) given in Table 41D(a) of 16th Edition, IEE Wiring Regulations are applicable to circuits protected by 'SAFECLIP' fuse links, to give good protection against electric shock in fixed installations.

**Energy conservation**

All 'SAFECLIP' fuse links have low power loss values, well within the limits specified in BS 88:1988.

**Motor starting ability**

All 'SAFECLIP' fuse links are suitable for use in motor circuits and have superior motor starting ability (See page 2/4).

**Approvals**

Manufactured to BS 5750:Part 1:1987, 'Quality systems: design/development, production, installation and servicing', and approved by leading independent authorities.

**Application Notes****Short circuit energy limitation and discrimination**

The designers of electrical equipment such as switches and contactors have to prove their products under the worst possible conditions (ie. at maximum breaking capacity, at 110% rated voltage, very low power factor, and with faults initiated at the most onerous points on the voltage wave), and they require relevant data from the fuse link manufacturer. This is given in the cut-off current characteristics and  $I^2t$  Values on pages 2/5, 2/6 and 2/7.

However, in service the short circuit fault conditions are usually less exacting than those produced in proving tests. In particular, the circuits are usually three-phase with relatively high power factor. In practice, therefore, the  $I^2t$  values of 'SAFECLIP' fuse links are significantly less than those tabulated and they will discriminate with each other if the ratio between 'major' and 'minor' fuse links in series is 2:1. Where 'SAFECLIP' fuse links are used as the minor rating in series with a 'RED SPOT' range fuse link as the major rating then discrimination at 415/240 Volt will generally be achieved with a ratio of 1.6:1.



## Applications

Equipment	Refer to Publication number for details	Fuse link type accommodated in equipment				
		SS	NS	ES	XS	OS
'SAFECLIP' HRC Fuse holders and Fuse banks	IEF/402	•	•	•	•	•
'SAFECLIP' Distribution Fuse boards	IEF/403	•	•	•	•	•
'SAFECLIP' Fuse Combination Units – Type MSS	IEF/498		•	•	•	•
'SAFECLIP' Wall Mounting Fuse Combination Units – Type WMS	IEF/503		•	•	•	•
'SAFECLIP' Panel boards	IEF/450		•	•	•	•
Type MST100 Fuse switch	IEF/404					•
Type WM1003N Wall Mounting Fuse Switch	IEF/503					•

## List Numbers and Dimensions

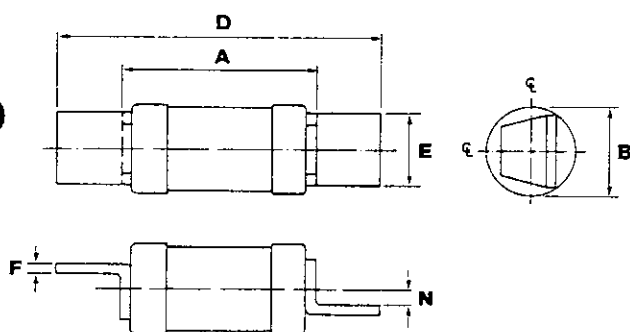


Figure 1

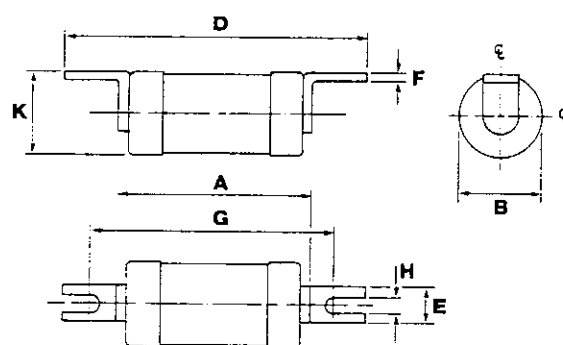


Figure 2

List number prefix	Current rating  Amp	Figure number	Dimensions in millimetres						
			A max	B max	D max	E	F	N	
SS	2*, 4*, 6, 10, 16, 20	1	25	14.5	51	11	0.8	3.6	
NS	2, 4, 6, 10, 16, 20, 25, 32, 32M40*	1	35.5	14.5	62	11	0.8	3.6	
ES	40, 50, 63, 63M80*	1	39	17.5	69	15	1.25	3.6	
XS†	20*, 32*, 63*, 80*, 100*, 125*	1	39	26.4	80	19	1.6	3.6	
OS	80*, 100*, 100M125*	2	A	B	D	E	F	G	H
			58	26.4	90.5	12.7	1.2	73	5.2
									K
									27.8

\* These types are ASTA Certified to BS 88:Part 1:1988

† Intermediate and minor rating are also available down to 2 Amp.

## Motor Circuit Protection

Select HRC fuse links to protect 3-phase motor circuits as follows:

- 1) Obtain motor full load current from Table 1.
- 2) The following motor starting conditions are assumed:  
 Direct-On-Line:  
 Up to 1 kW: 5 x FLC for 5 secs.  
 1.1 to 7.5 kW: 6 x FLC for 10 secs.  
 7.6 to 55 kW: 7 x FLC for 10 secs.  
 Assisted Start:  
 Up to 1 kW: 2.5 x FLC for 20 secs.  
 Greater than 1 kW: 3.5 x FLC for 20 secs.
- 3) Choose the recommended fuse link for the motor FLC and starting condition from Table 2 (DOL start) or Table 3 (assisted start).
- 4) Ensure voltage rating of fuse link is adequate for the application (See page 2/2).

The recommended fuse link ratings apply for up to 8 starts per hour under stated starting conditions. They may need to be adjusted if any of the following conditions occur singly or in combination:

- a) Starting currents in excess of assumed values.
- b) Longer starting times than those stated.
- c) Large number of starts per operating cycle.
- d) High enclosure temperature.

Table 1 Full load currents of typical 3-phase induction motors at voltages shown

Motor rating		Voltage			
kW	HP	220	380	415	440
0.37	0.5	2.0	1.15	1.05	1.0
0.55	0.75	2.7	1.6	1.5	1.4
0.75	1	3.9	2.3	2.0	1.9
1.1	1.5	4.7	2.8	2.5	2.4
1.5	2	6.5	3.8	3.5	3.3
2.2	3	9.3	5.4	5.0	4.7
3	4	12	7.1	6.5	6.1
4	5.5	15.4	9.0	8.4	7.9
5.5	7.5	20.7	11.9	11	10.3
7.5	10	28	16.1	14.4	14
11	15	39.1	23 <sup>2</sup>	21	19.8
15	20	52.8	30.5	28	26.4
18.5	25	66	38 <sup>2</sup>	35	33
22	30	77	45	41	39
30	40	103	60	55	52
37	50	-	75	69	65
45	60	-	87	80	75
55	75	-	107	98	92

Table 2 Direct-on-line starting

Motor FLC		Fuse Current Rating	Fuse Type
From	to	Amp	
0	0.7	2	NS <sub>3</sub>
0.8	1.4	4	
1.5	2.0	6	
2.1	3.0	10	
3.1	6.1	16	
6.2	9.0	20	
9.1	11	25	
11.1	14.4	32	ES <sub>3</sub>
14.5	18	40 <sup>1</sup>	
18.1	22	50	
22.1	28	63	XS
28.1	38	80 <sup>2</sup>	
38.1	53	100	
53.1	72	125	OS
72.1	80	125	
80.1	100	100	
100.1	125	125	

- 1) NS32M40 is alternative fuse type if FLC does not exceed 32 Amp & voltage is 415 Volt or less.
- 2) ES63M80 is alternative fuse type at 415 Volt or less.
- 3) XS fuse links are also available in minor ratings below 80 Amp.

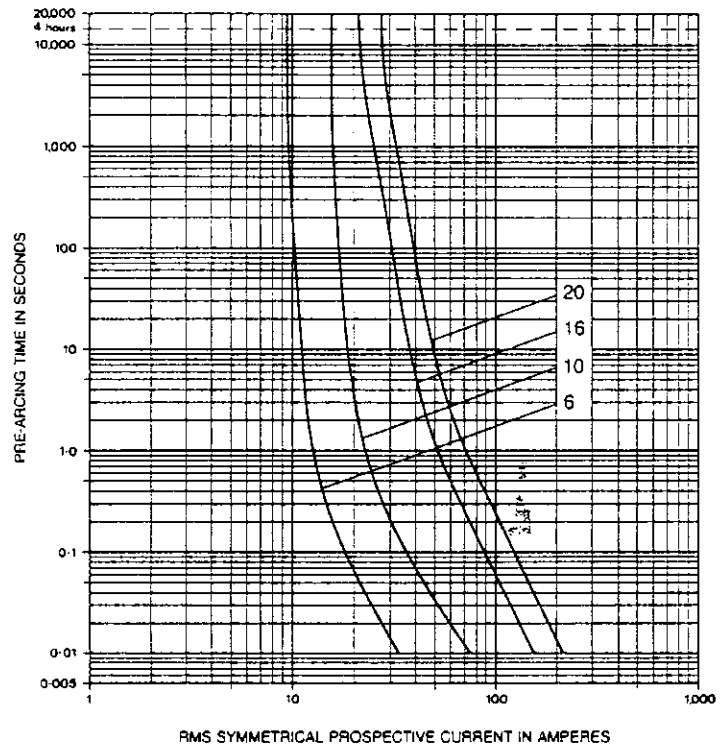
Table 3 Assisted starting (star/delta, etc.)\*

Motor FLC		Fuse Current Rating	Fuse Type
From	to	Amp	
0	1.4	2	NS <sub>3</sub>
1.5	2.1	4	
2.2	3.1	6	
3.2	5.5	10	
5.6	10	16	
10.1	14	20	
14.1	18	25	
18.1	22	32	ES <sub>3</sub>
22.1	32	40 <sup>1</sup>	
32.1	40	50	
40.1	51	63	OS or XS
51.1	80	80 <sup>2</sup>	
80.1	100	100	
100.1	125	125	XS

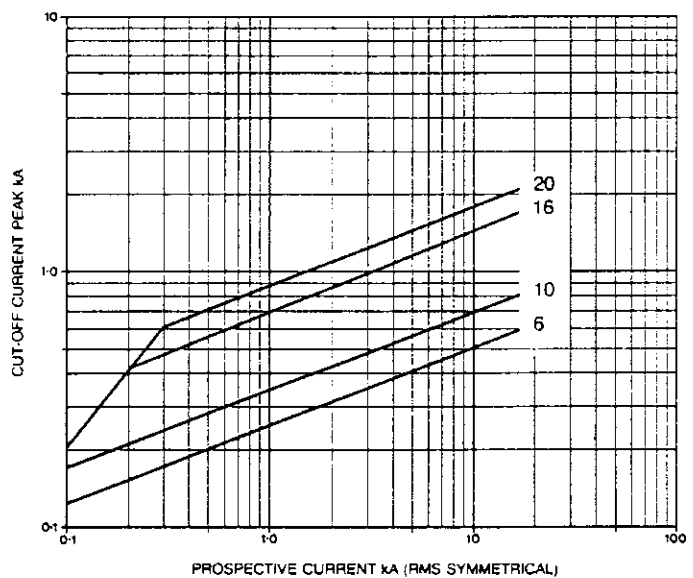
\* The assisted starting recommendations apply for ambient temperatures up to 35°C. At higher temperatures, some ratings may need to be derated. Consult GEC ALSTHOM Low Voltage Equipment Limited for further information.

## Characteristics

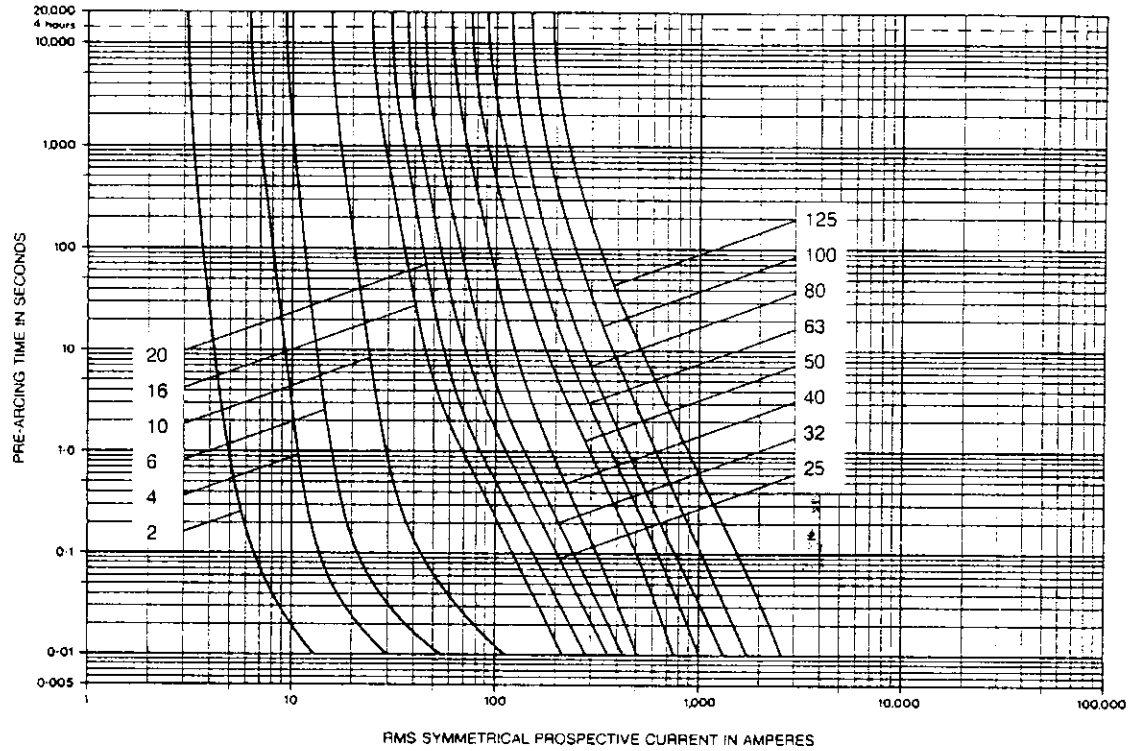
'SAFECLIP'  
Type SS  
Time/Current Characteristics  
6-20 Amp



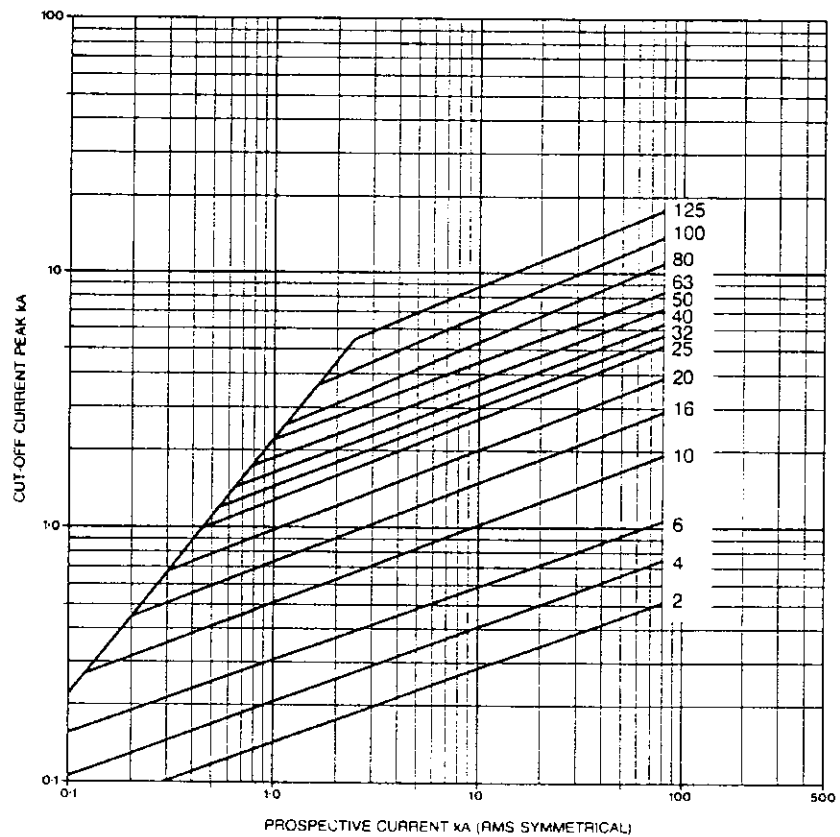
'SAFECLIP'  
Type SS  
Cut-off Current Characteristics  
6-20 Amp



'SAFECLIP'  
Types NS, ES & XS  
Time/Current  
Characteristics  
2-125 Amp



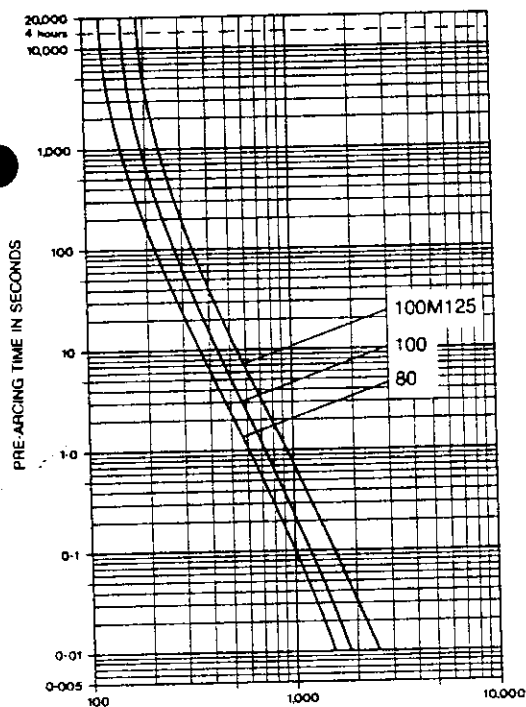
'SAFECLIP'  
Types NS, ES & XS  
Cut-off Current Characteristics  
2-125 Amp



'SAFECLIP'  
Types NS, ES & XS  
 $I^2t$  Values\*

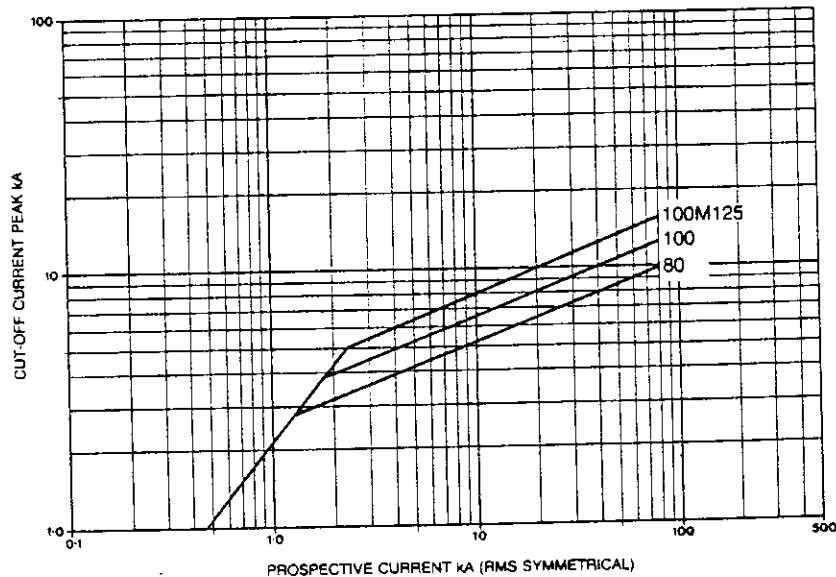
Current Rating Amp	Pre-Arcing $I^2t$ (A <sup>2</sup> Sec)	Total $I^2t$ (A <sup>2</sup> Sec)
2	1.5	16
4	7.0	75
6	22	200
10	90	440
16	300	1300
20	520	2200
25	900	3000
32	1100	4000
40	2400	12000
50	3200	15000
63	5400	25000
80	8000	45000
100	15000	68000
125	32000	145000

Type OS  
Time/Current Characteristics  
80-125 Amp



\*  $I^2t$  values at 440 Volt when tested under BS88 conditions. XS125 at 415 Volt.

Type OS  
Cut-off Current Characteristics  
80-125 Amp



Type OS  
 $I^2t$  Values\*

Current Rating Amp	Pre-Arcing $I^2t$ (A <sup>2</sup> Sec)	Total $I^2t$ (A <sup>2</sup> Sec)
80	14000	40000
100	17000	60000
100M125	32000	128000

**NHP**  
**COMPACT****Compact fuses**  
**BS type****NHP**

Refer Catalogue NF

- Ratings from 2 to 1250A
- Reduced dimensions
- Superior short circuit protection
- Complies with BS88
- Low watts loss

**NVCB8**

Rating (A)	BS 88 Ref	Cat. No.
<b>Clip-in offset tags</b>		
2	F1	NNS 2
4	F1	NNS 4
6	F1	NNS 6
10	F1	NNS 10
16	F1	NNS 16
20	F1	NNS 20
25	F1	NNS 25
32	F1	NNS 32
20M25	F1	NNS 20M25
20M32	F1	NNS 20M32
20	F2	NES 20
25	F2	NES 25
32	F2	NES 32
40	F2	NES 40
50	F2	NES 50
63	F2	NES 63

**Note:** M in catalogue No. denotes motor starting type.**NNS**  
**NES****NNIT****NTIA****BS solid links**

Type	To suit fuse holder	Cat. No.
Clip-in	NV32	32CLK
Clip-in	NV63	63CLK
Bolt-in	N20	20MFNL
Bolt-in	N32	32MFNL
Bolt-in	N63	63MFNL
Bolt-in	N100	100MFNL
Bolt-in	N200	200MFNL

**8 way comb busbar**

- Suits NV20FW/NV32FW fuses

**Cat. No.**8 way comb busbar **NVCB8**

Rating (A)	BS 88 Ref	Cat. No.
<b>Bolted pattern offset tags</b>		
2	A1	NNIT 2
4	A1	NNIT 4
6	A1	NNIT 6
10	A1	NNIT 10
16	A1	NNIT 16
20	A1	NNIT 20
25	A1	NNIT 25
32	A1	NNIT 32
20M25	A1	NNIT 20M25
20M32	A1	NNIT 20M32
32M40	A1	NNIT 32M40
32M50	A1	NNIT 32M50
32M63	A1	NNIT 32M63
2	A2	NTIA 2
4	A2	NTIA 4
6	A2	NTIA 6
10	A2	NTIA 10
16	A2	NTIA 16
20	A2	NTIA 20
25	A2	NTIA 25
32	A2	NTIA 32
32M40	A2	NTIA 32M40
32M50	A2	NTIA 32M50
32M63	A2	NTIA 32M63



# Fuse replacement chart

Refer Catalogue NF

This chart is designed to help choose the correct fuse to fit a particular Strömberg switch fuse (or vice versa) and to help choose the correct replacement fuse. Some data is from other manufacturers publications and as such cannot be guaranteed by NHP. Beware that some motor start fuses are in a larger body size than a normal fuse. It is wise to consult the fuse manufacturers data to determine their particular fuse sizes (ie. A2-C3).

## Fuse manufacturers part numbers - Australian/British standard

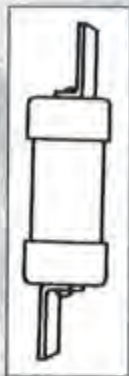
BS Ref.	Amps	NHP COMPACT FUSES	Alstrom	Holec	GEC	Dorman Smith	Federal	Brush	Siemens
F1	2...32	NNS	SN2	NS	NS	NSD	20/32C	F06	3NW NS
F2	20...63	NES	SP	NES	ES	ESD	-	-	3NW ES
A1	2...32	NNIT	SA2	NIT	NIT	NITD	20/32B	F21	3NW NIT
A2	2...32	NTIA	SB3	TIA	TIA	AAO	32B	H07	3NW TIA
A3	35...63	NTIS	SB4	TIS	TIS	BAO	63B	K07	3NW TIS
-	80...100	NOS	SO	-	OS	OSD	-	K07R	3NW OS
A4	80...100	NTCP	SD5	TCP	TCP	CEO	100B	L14	3NW TCP
Hybrid (A4)	125...200	NTFP <sup>1)</sup>	SD6	TFP	TFP	DEO	-	M14	3NW TFP
-	2...32	NTB	SE3	TB	TB	AC	-	K08	-
B1	2...32	NTBC	SF3	TBC	TBC	AD	-	K09	3NW TBC
-	40...63	NTB	SE4	TB	TB	BC	-	K08	3NW TB
B1	40...63	NTBC	SF4	TBC	TBC	BD	63B/C	K09	3NW TBC
B1	80...100	NTC	SF5	TC	TC	CD	100B/C	L09	3NW TC
B2	125...200	NTF	SF6	TF	TF	DD	200B/C	M09	3NW TF
B3	250...315	NTKF	SF7	TKF	TKF	ED	315B/C	N09	3NW TKF
-	250...315	NTKM	SG7	TKM	TKM	-	-	N11	3NW TKM
B4	355...400	NTMF	SF8	TMF	TMF	ED	400B/C	P09	3NW TMF
C1	355...400	NTM	SH8	TM	TM	EF	404B/C	P11	3NW TM
C2	450...630	NTTM	SH9	TTM	TTM	FF	504B/C	R11	3NW TTM
-	450...630	NTT	SY9	-	TT	FG	-	R12	-
C3	710...800	NTLM	SH10	TLM	TLM	GF	804B/C	S12	3NW TLM
-	710...800	NTLT	SY10	-	TLT	GG	-	S12	3NW TLT
D1	1000...1250	NTXU	SJ11	-	TXU	GH	-	U44	-
<b>Din pattern</b>									
00	6...160	N00	7999	P851.00	NHG-00	-	-	-	3NA5
1	25...250	N1	8001	P851.1	NHG-1	-	-	-	3NA4 144
2	80...400	N2	8002	P851.2	NHG-2	-	-	-	3NA4 260
3	315...630	N3	8003	P851.3	NHG-3	-	-	-	3NA1
<b>Fuse holders</b>									
Clip in	20A	NV20FW	V20FW	J2011	SC20				3NW CM20F
	32A	NV32FW	V32FW	-	SC32				3NW 32NNSF
Front wired	20A	N20FW	20MFB	-	RS20H				-
	32A	N32FW	32MFB	J3211	RS32H				3NW CM32F
	63A	N63FW	63MFB	J6311	RS63H				3NW CM63F
	100A	N100FW	100MFB	J9911	RS100H				3NW CM100F
	200A	N200FW	200MFB	J1991	RS200H				3NW 200DF
Stud/ front wired	20A	N20SFW	20MFD	-	RS20PH				-
	32A	N32SFW	32MFD	-	RS32PH				-
	63A	N63SFW	63MFD	-	RS63PH				-
	100A	N100SFW	100MFD	-	RS100PH				-
	200A	N200SFW	200MFD	-	RS200PH				3NW 200DFB

**Note:** <sup>1)</sup> This hybrid type fuse is actually an A4 size fuse, but as it is over 100 amps it cannot be called an A4 fuse to AS 2005.

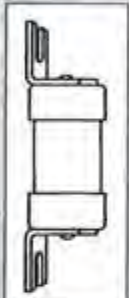


**NHP  
COMPACT**

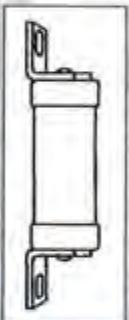
# HRC cartridge fuse-links

*Cross reference guide***NNS-Type staggered contacts breaking capacity 80kA at 415V AC to BS 88: Part 6: 1988 Ref. F1**

Current rating A		Overall length mm	Overall dia. mm	NHP Cat No.	MEM	GEC/Lawson	Siemens	Brush/Hawker	Bussman/Dorman Smith
Normal	Motor								
2	-	60	14	NNS2	2SN2	NS2	3NW NS2	2F06	NSD2
4	-			NNS4	4SN2	NS4	3NW NS4	4F06	NSD4
6	-			NNS6	6SN2	NS6	3NW NS6	6F06	NSD6
10	-			NNS10	10SN2	NS10	3NW NS10	10F06	NSD10
16	-			NNS16	16SN2	NS16	3NW NS16	16F06	NSD16
20	-			NNS20	20SN2	NS20	3NW NS20	20F06	NSD20
20	25			NNS 20M25	20SN2M25	NS20M25	3NW M25	20M25F06	NSD20M25
20	32			NNS 20M32	20SN2M32	NS20M32	3NW M32	20M32F06	NSD20M32
25	-			NNS25	25SN2	NS25	3NW NS25	25F06	NSD25
32	-			NNS32	32SN2	NS32	3NW NS32	32F06	NSD32

**NES-Type staggered contacts breaking capacity 80kA at 415V AC to ASTA certified to BS 88: Part 6: 1988**

20	-	68	17	NES20	20SP	-	-	-	ESD20
25	-			NES25	25SP	-	-	-	ESD25
32	-			NES32	32SP	-	-	-	ESD32
40	-			NES40	40SP	40ES	3NWES40	40G05	3SD40
50	-			NES50	50SP	50ES	3NWES50	50G05	ESD50
63	-			NES63	63SP	63ES	3NWES63	63G05	ESD63

**Industrial bolted pattern. Offset contacts ASTA certified to BS 88: Part 2: 1988.  
Complies with IEC 269 Parts 1 and 2. Tested to 80kA at 415V AC**

Current rating A		Fixing centres	BS88 ref	NHP Cat No.	MEM	GEC/Lawson	Siemens	Brush/Hawker	Bussman/Dorman Smith
Normal	Motor								
2	-	44.5	A1	NNIT2	2SA2	NIT2	3NWNIT2	2F21	NITD2
4	-			NNIT4	4SA2	NIT4	3NWNIT4	4F21	NITD4
6	-			NNIT6	6SA2	NIT6	3NWNIT6	6F21	NITD6
10	-			NNIT10	10SA2	NIT10	3NWNIT10	10F21	NITD10
16	-			NNIT16	16SA2	NIT16	3NW NIT16	16F21	NITD16
20	-			NNIT20	20SA2	NIT20	3NWNIT20	20F21	NITD20
20	25			NNIT20M25	20SA2M25	NIT20M25	3NWNIT20M25	20M25F21	NITD20M25
20	32			NNIT20M32	20SA2M32	NIT20M32	3NWNIT20M32	20M32F21	NITD20M32
25	-			NNIT25	25SA2	-	3NWNIT25	25F21	NITD25
32	-			NNIT32	32SA2	-	3NWNIT32	32F21	NITD32
32	40	73	A2	NNIT32M40	32SA2M40	-	3NWNIT32M40	-	-
32	50			NNIT32M50	32SA2M50	-	3NWNIT32M50	-	-
32	63			NNIT32M63	32SA2M63	-	3NWNIT32M63	-	-
2	-			NTIA2	2SB3	TIA2	3NWTIA2	2H07	AA02
4	-			NTIA4	4SB3	TIA4	3NWTIA4	4H07	AA04
6	-			NTIA6	6SB3	TIA6	3NWTIA6	6H07	AA06
10	-			NTIA10	10SB3	TIA10	3NWTIA10	10H07	AA010
16	-			NTIA16	16SB3	TIA16	3NWTIA16	16H07	AA016
20	-			NTIA20	20SB3	TIA20	3NWTIA20	20H07	AA020
25	-			NTIA25	25SB3	TIA25	3NWTIA25	25H07	AA025
32	-			NTIA32	32SB3	TIA32	3NWTIA32	32H07	AA032
32	40			NTIA32M40	32SB3M40	TIA32M40	3NWTIA32M40	32M40H07	AA032M40
32	50			NTIA32M50	32SB3M50	TIA32M50	3NWTIA32M50	32M50H07	AA032M50
32	63			NTIA32M63	32SB3M63	TIA32M63	3NWTIA32M63	32M63H07	AA032M63
35	-	73	A3	NTIS35	35SB4	TIS35	3NWTIS35	35K07	BA035
40	-			NTIS40	40SB4	TIS40	3NWTIS40	40K07	BA040
50	-			NTIS50	50SB4	TIS50	3NWTIS50	50K07	BA050
63	-			NTIS63	63SB4	TIS63	3NWTIS63	63K07	BA063
63	80			NTIS63M80	63SB4M80	TIS63M80	3NWTIS63M80	63M80K07	BA063M80
63	100			NTIS63M100	63SB4M100	TIS63M100	3NWTIS63M100	63M100K07	BA063M100
80	-			NOS80	80SO	OS80	3NWTIS80	80K07R	OSD80
100	-			NOS100	100SO	OS100	3NWTIS100	100K07R	OSD100
100	125			NOS100M125	-	OS100M125	-	100M125K07R	OSD100M125
100	160			NOS100M160	-	OS100M160	-	100M160K07R	OSD100M160
80	-	94	A4	NTCP80	80SD5	TCP80	3NWTCP80	80L14	CE080
100	-			NTCP100	100SD5	TCP100	3NWTCP100	100L14	CE0100
100	125			NTCP100M125	100SD5M125	TCP100M125	3NWTCP100M125	100M125L14	CE0100M125
100	160			NTCP100M160	100SD5M160	TCP100M160	3NWTCP100M160	100M160L14	CE0100M160
125	-			NTFP125	125SD6	TFP125	3NWTFP125	125M14	DE0125
160	-			NTFP160	160SD6	TFP160	3NWTFP160	160M14	DE0160
200	-			NTFP200	200SD6	TFP200	3NWTFP200	200M14	DE0200
200	250			NTFP200M250	200SD6M250	TFP200M250	-	200M250M14	DE0200M250





#### **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
- AMALGAMATED INSTRUMENT – PM6-LP-4C% - INDICATOR
- TERASAKI – S250PE3125 – MAIN SWITCH
- TERASAKI – T2HS25RSGM – HANDLE
- TERSAKI – T2ML2SRA - INTERLOCK

## D7 Control and indication products 22.5 mm

### Complete panel mounted standard operators

2

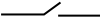
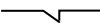
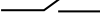
#### Non-Illuminated momentary pushbuttons



D7P-F3-PX10

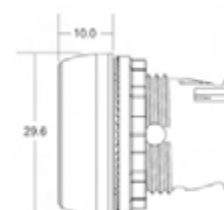
- Metal or plastic options
- Improved momentary action for fast response
- Low mounting depth from panel

#### Pushbuttons

Description	Contact	Plastic body Cat. No. <sup>1)</sup>	Price \$	Metal body Cat. No. <sup>1)</sup>	Price \$
With Green insert		D7P-F3-PX10		D7M-F3-MX10	
With Red insert		D7P-F4-PX01		D7M-F4-MX01	
With Blue insert		D7P-F6-PX10		D7M-F6-MX10	



D7M-F4-MX01





Dimensions in (mm)



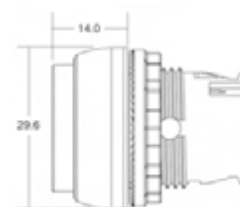
D7P-E4-PX01

#### Extended pushbutton

Description	Contact	Plastic body Cat. No. <sup>1)</sup>	Price \$	Metal body Cat. No. <sup>1)</sup>	Price \$
With Red insert		D7P-E4-PX01		D7M-E4-MX01	
With Red insert labelled "stop"		D7P-E402-PX01		D7M-E402-MX01	



D7P-E402-PX01

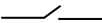
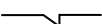
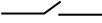


Dimensions in (mm)

#### Non-Illuminated momentary pushbuttons with labelled inserts

- Laser etched markings for improved abrasion resistance

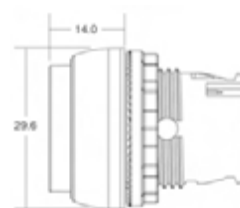
#### Pushbuttons

Description	Contact	Plastic body Cat. No. <sup>1)</sup>	Price \$	Metal body Cat. No. <sup>1)</sup>	Price \$
With Green insert labelled "Start"		D7P-F301-PX10		D7M-F301-MX10	
With Red insert labelled "Stop"		D7P-F402-PX01		D7M-F402-MX01	
With Blue insert labelled "Reset"		D7P-F607-PX10		D7M-F607-MX10	



D7M-F301-MX10

**Note:** <sup>1)</sup> Add suffix "bx" for special box/hang-sell packaging eg: D7P-F3-PX10bx



Dimensions in (mm)

#### Price Schedule 'A2'

## D7 Control and indication products 22.5 mm

### Rotary selector switches - short lever, 2 pos



D7M-SL22



D7P-LSM26


#### Panel mounted front and rear elements

- D7PS** ■ Non-illuminated short handle 2 position plastic rotary selector switch operators
- D7PLS** ■ Illuminated short handle 2 position plastic rotary selector switch operators
- D7MS** ■ Non-illuminated short handle 2 position metal rotary selector switch operators
- D7MLS** ■ Illuminated short handle 2 position metal rotary selector switch operators

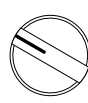
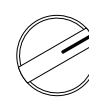
- Protection class IP 66
- Individually packaged
- 2 part ordering

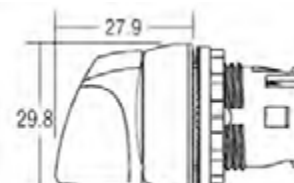
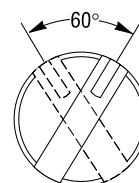


#### 1 Operators

Description		Non-illuminated Plastic Cat. No.	Price \$	Non-illuminated Metal Cat. No.	Price \$	Illuminated Plastic Cat. No. <sup>1)</sup>	Price \$	Illuminated Metal Cat. No. <sup>1)</sup>	Price \$
Stayput 60°		D7P-SM22		D7M-SM22		D7P-LSM2		D7M-LSM2	
Spring return from Left 60°		D7P-SL22		D7M-SL22		D7P-LSL2		D7M-LSL2	
Spring return from Right 60°		D7P-SR22		D7M-SR22		D7P-LSR2		D7M-LSR2	

#### Contact Development Table

X = closed O = open	<b>Mounting Position on Latch</b>		
<b>Contact Type</b>			
NO	All slots	O	X
NC	All slots	X	O



- D7PX / D7PQ** ■ Pre-assembled clip-on rear elements with plastic coupling plate
- D7MX / D7MQ** ■ Pre-assembled clip-on rear elements with metal coupling plate

#### 2 Contact/lamp blocks <sup>4)</sup>

Description	Plastic coupling screw terminal Cat. No.	Price \$	Plastic coupling spring clamp terminal Cat. No.	Price \$	Metal coupling screw terminal Cat. No.	Price \$	Metal coupling spring clamp terminal Cat. No.	Price \$
1 N/O contact block	D7PX10		D7PQ10		D7MX10		D7MQ10	
1 N/C contact block	D7PX01		D7PQ01		D7MX01		D7MQ01	
1 N/O and 1 N/C contact block	D7PX11		D7PQ11		D7MX11		D7MQ11	
1 N/O and 1 N/C contact block and integrated LED lamp block	D7PN <sup>2)</sup> <sup>3)</sup> X11		D7PQ <sup>2)</sup> <sup>3)</sup> Q11		D7MN <sup>2)</sup> <sup>3)</sup> X11		D7MQ <sup>2)</sup> <sup>3)</sup> Q11	

**Notes:** <sup>1)</sup> Illuminated operators available in a choice of five different knob colours, eg: Green = 3, Red = 4, Yellow = 5, Blue = 6, Clear = 7.

**Example D7P-LSM24 = Red Knob**

<sup>2)</sup> LED Module required for illumination. Incandescent lamp block cannot be used.  
Enter voltage 24V AC/DC = 3, 120V AC = 5, 240V AC = 7

<sup>3)</sup> enter lamp colour C = clear (incandescent), R = Red LED, G = Green LED, Y = Yellow LED, W = White LED, B = Blue LED - Example D7PN3RX11 = 24 V AC/DC RED integrated LED lamp block

<sup>4)</sup> Up to 6 contact blocks (3 across / 2 high) can be attached. Additional contact blocks refer page 2-34

#### Price Schedule 'A2'

## D7 Control and indication products 22.5 mm

### Complete emergency stop operators - panel & enclosed type

#### Emergency stop operators

- Choice of "Auto Break" or standard normally closed contacts
- 30, 40 or 60 mm mushroom head
- Extra security key release









#### Pushbutton & Key operated types

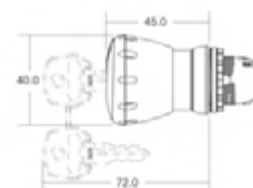


D7P-MT64-PX01S



D7M-MK44-MX01S

Description	Contact	Plastic body Cat. No. <sup>1)</sup>	Price \$	Metal body Cat. No. <sup>1)</sup>	Price \$
Twist To Reset/Standard contact blocks					
30 mm Operator		D7P-MT34-PX01		D7M-MT34-MX01	
40 mm Operator		D7P-MT44-PX01		D7M-MT44-MX01	
60 mm Operator		D7P-MT64-PX01		D7M-MT64-MX01	
Key To Reset/Standard contact blocks					
40 mm Operator		D7P-MK44-PX01		D7M-MK44-MX01	
Twist To Reset/"Auto Break" Safety contact blocks					
30 mm Operator		D7P-MT34-PX01S		D7M-MT34-MX01S	
40 mm Operator		D7P-MT44-PX01S		D7M-MT44-MX01S	
60 mm Operator		D7P-MT64-PX01S		D7M-MT64-MX01S	
Key To Reset/"Auto Break" Safety contact blocks					
40 mm Operator		D7P-MK44-PX01S		D7M-MK44-MX01S	



Dimensions in (mm)

#### Enclosed emergency stop operators





- Modern low profile enclosures
- Supplied complete
- Metric cable entry 20 mm
- Plastic or Metal enclosures



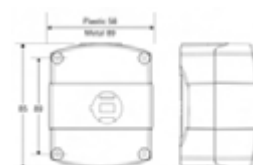
D71YM1



D71MM1

Description	Contact	Cat. No.	Price \$
Plastic enclosures with emergency stop "Twist To Reset" operator			
Yellow enclosure 40 mm plastic operator		D71YM1	
Plastic enclosures with emergency stop "Twist Key To Reset" operator			
Yellow enclosure 40 mm plastic operator		D71YM4	
Metal enclosures with emergency stop "Twist To Reset" operator			
Grey enclosure 40 mm metal operator		D71MM1	
Metal enclosures with emergency stop "Twist Key To Reset" operator			
Grey enclosure 40 mm metal operator		D71MM4	

**Note:** <sup>1)</sup> Add suffix "bx" for special box/hang-sell packaging eg: D7P-MT34-PX01bx



#### Price Schedule 'A2'

## Electronic type

## S250PE

**70kA****Current rating:** 50 – 250A**Approvals and Tests:**

Standards AS/NZS 3947-2, and IEC60947-2

**Interrupting capacity:**

	Voltage	I <sub>cu</sub>	I <sub>cs</sub>
AC use	380/415	70	70

**Over Current Relay:**

- Electronic, for general & selectivity applications
- 7 dial selectable characteristic curves suited for a variety of applications
- Base current  $I_R$  is adjustable from 40% - 100% of the nominal rated current  $I_n$ .
- STD setting 2.5 – 10 ( $\times I_R$ )<sup>2)</sup>
- INST setting 13 – 14 ( $\times I_R$ )<sup>2)</sup>

**OCR Options:**

- Neutral Pole protection for 4 pole MCCBs only (AN)
- Pre-Trip Alarm (AP)

**Dimensions (mm)**

Poles	3	4
H	165	165
W	105	140
D (less toggle)	103	103
Toggle cut-out	Standard DIN	

**Ampere****Rating****NRC****I<sub>R</sub> Adjustment**

Min - Max.

**Cat. No.** <sup>1)</sup>

125	50 - 125	<b>S250 PE _ 125</b>
250	100 - 250	<b>S250 PE _ 250</b>

**Price Adder** - if OCR options are required, add the selected OCR option price below to the above MCCB price to calculate the total MCCB cost.

3 P OCR options: PTA <sup>3)</sup> **S250 PE 3 AP #**

4 P OCR options: PTA <sup>3)</sup> **S250 PE 4 AP #**  
 AP <sup>3)</sup> **S250 PE 4 AN #**  
 PTA + NP <sup>3)</sup> **S250 PE 4 APN #**

- Add poles to complete MCCB catalogue number. Eg: 3 pole 250A: S250PE 3 250. “#” add OCR trip unit rating where shown.
- The STD and Instantaneous pickup currents ( $I_{sd}$  &  $I_i$ ) settings are not individually adjustable, however by selecting different curve types and different  $I_R$  settings the values will vary. Curve 1 & 2  $I_{sd} = 2.5 \times I_R$ , curve 3  $I_{sd} = 5 \times I_R$ , curve 4 - 7  $I_{sd} = 10 \times I_R$ .  $I_R$  dial setting 0.4 – 0.9  $I_i = 14 \times I_R$  and  $I_R$  dial setting 0.95 – 1.0  $I_i = 13 \times I_R$ . Refer curve examples & setting data on pages 18 to 30.  
  
**NRC = Nominal rated current,  $I_R$  = Current adjustment dial setting, STD = Short Time Delay, INST = instantaneous**
- To order a MCCB with the above options insert the required option after the pole to make up the cat. number. Eg: S250PE 4 **APN** 250 is a S250PE 4 Pole 250A MCCB c/w Pre-trip Alarm and Neutral Protection.



## H125-NJ, L125-NJ, H160-NJ, L160-NJ, S250-PE, H250-NJ, H250-NE, L250-NJ. Plug-in Versions

H : Handle Frame Centre Line

Technical drawings of the 24VDC power supply unit showing front and side views with dimensions and labels.

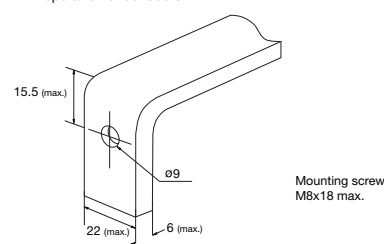
**Front View Dimensions:**

- Overall width: 175 mm
- Overall height: 180 mm
- Mounting hole diameter:  $\varnothing 4$
- Terminal block width: 105 mm (3P) and 140 mm (4P)
- Terminal block height: 165 mm
- Terminal block pitch: 22 mm
- Terminal block type: 3P and 4P
- Terminal block material: Mounting hole
- Terminal block symbol: (N)

**Side View Dimensions:**

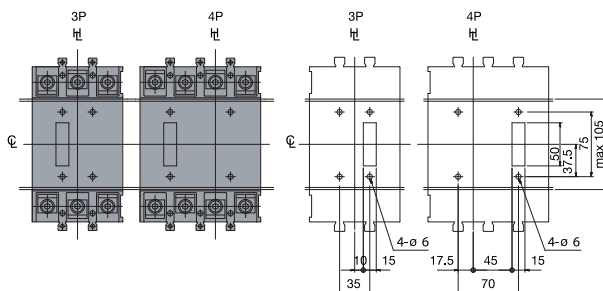
- Overall depth: 175 mm
- Mounting screw length: 27 mm
- Mounting screw diameter: M5x0.8
- Mounting screw type: Mounting screw
- Mounting screw material: Support or rail
- Mounting screw pitch: 102 mm
- Mounting screw hole diameter:  $\varnothing 4.5$
- Mounting screw hole position: 151 mm
- Mounting screw hole offset: 155 mm
- Mounting screw hole distance: 165 mm
- Mounting screw hole diameter:  $\varnothing 10$
- Mounting screw hole position: 108 mm
- Mounting screw hole offset: 180 mm
- Mounting screw hole distance: (96) mm

### Preparation of conductor

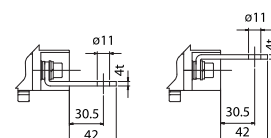
[illegible]

(rear view)

Drilling plan(front view)



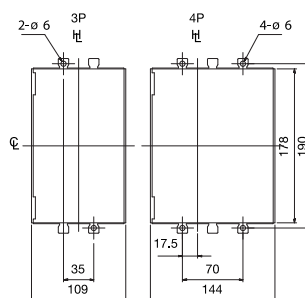
Detail of connecting part  
Oriented for rear access



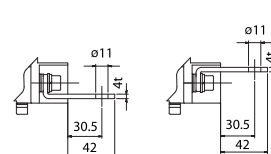
Terminal bars should be connected alternately on adjacent poles.

(rear view)

Drilling plan(front view)



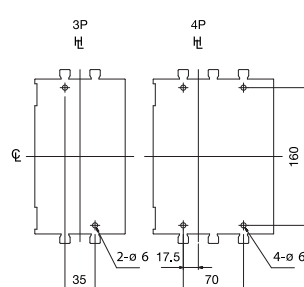
Detail of connecting part  
Oriented for rear access



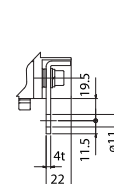
Terminal bars should be connected alternately on adjacent poles.

(rear view)

Drilling plan(front view)



Detail of connecting part  
Oriented for front access



## **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	Indefinite, 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 24V for 24V 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		OUTPUT POWER
	VDC	I <sub>LOAD</sub>	
PB251-12CM	13.8V	16A	220W
PB251-12CM-H	13.8V	20A	275W
PB251-24CM	27.6V	11A	300W
PB251-24CM-H	27.6V	12A	330W
PB251-12RML	13.8V	20A	275W
PB251-12B	13.8V	20A	275W
PB251-24RML	27.6V	12A	330W

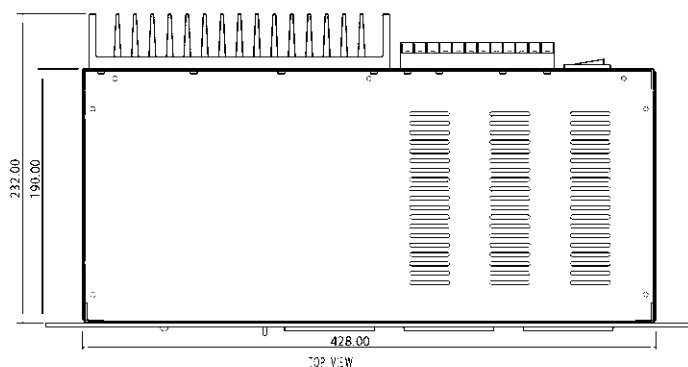
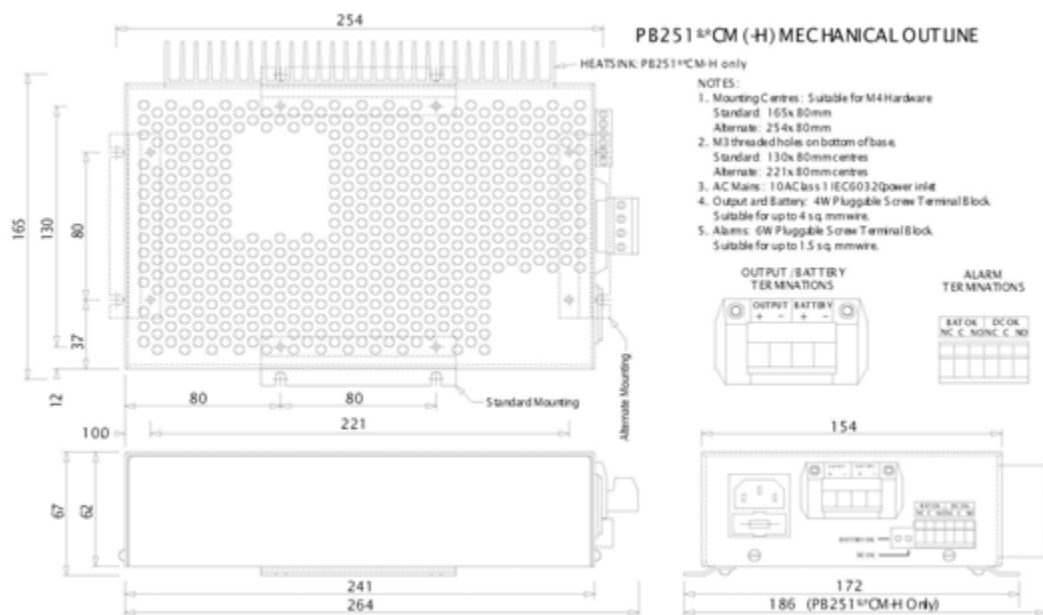
Note: Non standard battery charging current available on request. ie PB251-12CM-H-10 for 10A.



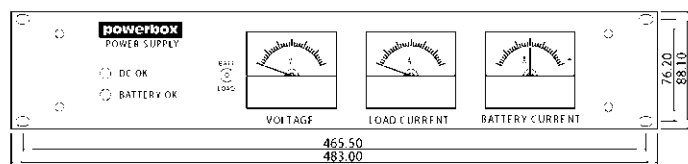
# PB251 Series

275-330 WATTS DC UPS

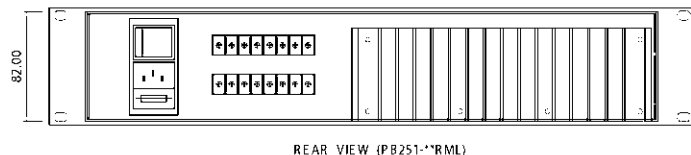
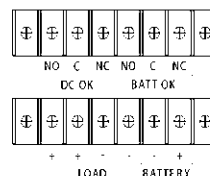
## Technical Illustrations



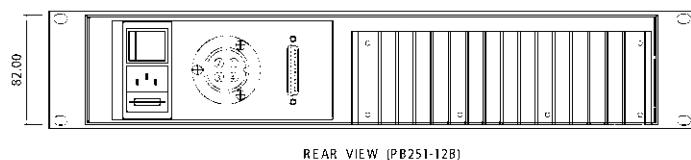
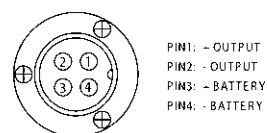
- NOTES:
1. 2RU x 19" rack enclosure per IEC 297
  2. Mounting slots are suitable for M6 hardware.
  3. Input connector is a 10A Class 1 IEC 60320 inlet.
  4. 2 meter IEC mains cord with Australian plug is supplied with unit.
  5. PB251-12B alarm terminal is DB25 female.
  6. PB251-12B output and battery 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



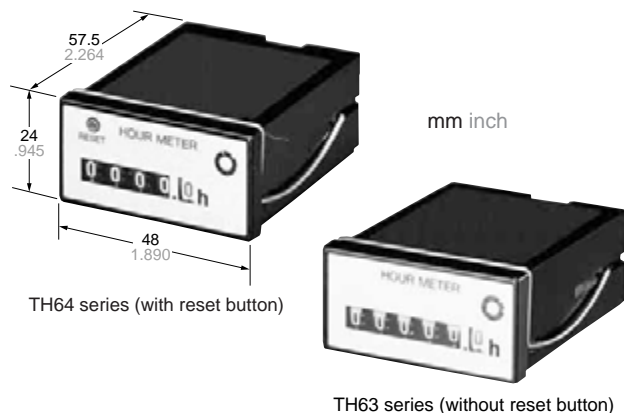
PB251-12B ALARM CONNECTOR



## **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 TRANSMITTER
- POWERBOX – PBIH-2412J-CC – RADIO 24V/13.8VDC CONVERTER
- TRIO – DR900-07A02-00 – RADIO
- LOGICA – MD331EAL/27ID-0-7 – TELEMTRY UNIT
- WAVECOM – FASTRACK SUPREME – GSM MODEM
- RF INDUSTRIES – TLA2000 – GSM CELLULAR TRANSIT ANTENNA
- RF INDUSTRIES – ANDREW CNT400 – EXTERNAL COAX CABLE

UL File No.: E42876  
CSA File No.: LR39291



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.

#### 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.

### 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/s <sup>2</sup> {10 G} (4 times on 3 axes)
	Destructive	Min 980 m/s <sup>2</sup> {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

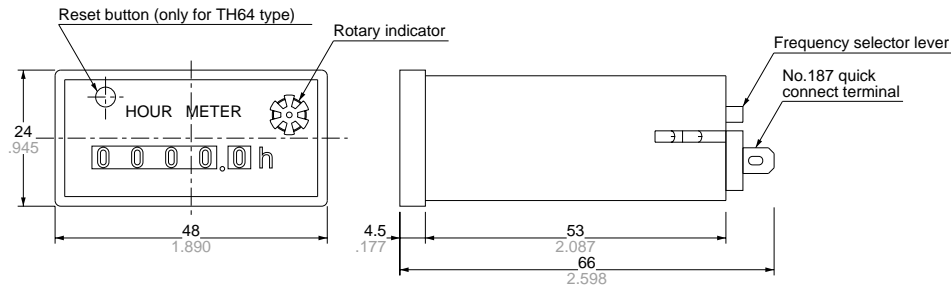
Notes) 1. Only the metallic-looking (silver) panel mounting type is available.

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 Noise terminal voltage (EMS)EN61000-6-2 Static discharge immunity  RF electromagnetic field immunity  EFT/B immunity Surge immunity Conductivity noise immunity Power frequency magnetic field immunity Voltage dip/Instantaneous stop/Voltage fluctuation immunity	EN55011 Group1 ClassA EN55011 Group1 ClassA  EN61000-4-2 4 kV contact 8 kV air EN61000-4-3 10 V/m AM modulation (80 MHz to 1 GHz) 10 V/m pulse modulation (895 MHz to 905 MHz) EN61000-4-4 2 kV (power supply line) EN61000-4-5 1 kV (power line) EN61000-4-6 10 V/m AM modulation (0.15 MHz to 80 MHz) EN61000-4-8 30 A/m (50 Hz) 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



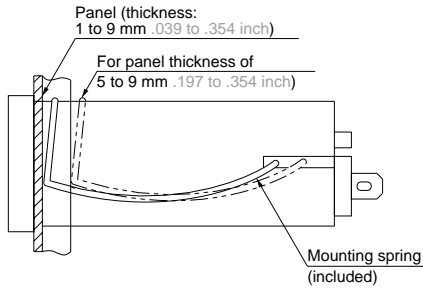
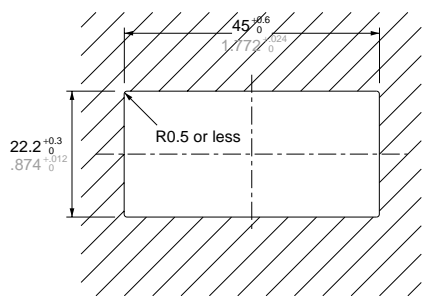
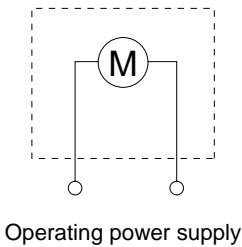
mm inch

General tolerance:  $\pm 0.5 \pm .020$

Wiring diagram

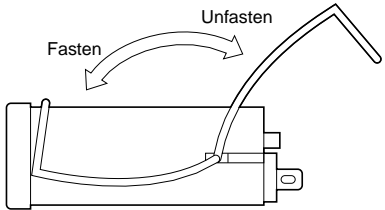
mm inch

• Panel cutout dimensions



Mounting

1. Cut a  $22.2^{+0.3}_{-0} \times 45^{+0.6}_{-0}$  mm ( $.874^{+0.12}_{-0} \times 1.772^{+0.024}_{-0}$  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.



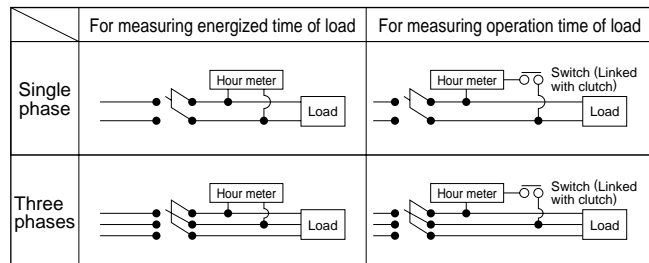
# PRECAUTIONS IN USING THE HOUR METERS

## 1. Frequency setting

Frequency is specified for AC motor-driven hour meters. Before installing, be sure to check your local power frequency.

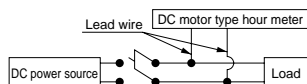
## 2. Connections

### • TH13,23,14,24,40,50,63,64



Note) Make the connection with the accompanying flat connector first and then with the hour meter's terminal (#187). In such case, be sure to cover the connection with the accompanying insulating sleeve.

### • TH70, TH8



Note) Solder the lead wires in position.

## 3. Safety precautions

Do not use the hour meters in the following places.

- Where ambient temperature is below  $-10^{\circ}\text{C}$  or above  $+50^{\circ}\text{C}$
- In wet, dusty or gaseous environments
- Where exposed to vibrations and shocks
- Outdoors, or where exposed to rain or direct sunlight

## 4. Compliant with CE.

### • LH2H

Ambient conditions:

Overvoltage category III, contamination factor 2, indoor use.

Ambient temperature and humidity  $-10$  and  $+55^{\circ}\text{C}$  and 35% to 85%RH respectively.

### • TH13, 23, 14, 24, 40, 50, 63, 64

Ambient conditions:

Overvoltage category II, contamination factor 2, indoor use.

Ambient temperature and humidity  $-10$  and  $+50^{\circ}\text{C}$  and below 85%RH respectively.

## 5. Reset-type hour meter

### • Precautions for use

If the number indications are off before use, press the reset button and confirm that all zeroes ("0") are displayed.

### • Resetting caution

Exercise due caution as an insufficient amount of pressure on the reset button may result in abnormal readings.

## 6. Acquisition of CE marking

Please abide by the conditions below when using in applications that comply with EN 61010-1/IEC 61010-1

### 1) Ambient conditions

- Overvoltage category II, pollution level 2
- Indoor use
- Acceptable temperature and humidity range:  $-10$  to  $+55^{\circ}\text{C}$ , 35 to 85%RH (with no condensation at  $20^{\circ}\text{C}$ )
- Under 2000 m elevation

### 2) Use the main unit in a location that matches the following conditions.

- There is minimal dust and no corrosive gas.
- There is no combustible or explosive gas.
- There is no mechanical vibration or impacts.
- There is no exposure to direct sunlight.
- Located away from large-volume electromagnetic switches and power lines with large electrical currents.

### 3) Connect a breaker that conforms to EN60947-1 or EN60947-3 to the voltage input section.

### 4) Applied voltage should be protected with an overcurrent protection device (example: T 1A, 250 V AC time lag fuse) that conforms to the EN/IEC standards. (Free voltage input type)



Tel +1 (717) 767-6511  
Fax +1 (717) 764-0839  
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



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

- 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 RS-422/485 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  $\pm 20\%$  SUPPLY
- RESISTIVE ANALOG TOUCHSCREEN

### 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 <sup>5</sup>	G3CF064M
	256 MB CompactFlash Card <sup>5</sup>	G3CF256M
	512 MB CompactFlash Card <sup>5</sup>	G3CF512M
G3RS	RS232/485 Optional Communications Cards	G3RS0000
G3CN	CANopen Optional Communications Cards	G3CN0000
PSDR7	DIN Rail Power Supply	PSDR7000
SFCRM2	Crimson 2.0 <sup>2</sup>	SFCRM200
CBL	RS-232 Programming Cable	CBLPROG0
	USB Cable	CBLUSB00
	Communications Cables <sup>1</sup>	CBLxxxxx
DR	DIN Rail Mountable Adapter Products <sup>3</sup>	DRxxxxxx
	Replacement Battery <sup>4</sup>	BAL3R004
G3FILM	Protective Films	G3FILM06

<sup>1</sup> Contact your Red Lion distributor or visit our website for complete selection.

<sup>2</sup> 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](http://www.redlion.net).

<sup>3</sup> Red Lion offers RJ modular jack adapters. Refer to the DR literature for complete details.

<sup>4</sup> Battery type is lithium coin type CR2025.

<sup>5</sup> 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  $\pm 20\%$

Typical Power<sup>1</sup>: 8 W

Maximum Power<sup>2</sup>: 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 <sup>2</sup>
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
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Note:

1. Criterion A: Normal operation within specified limits.

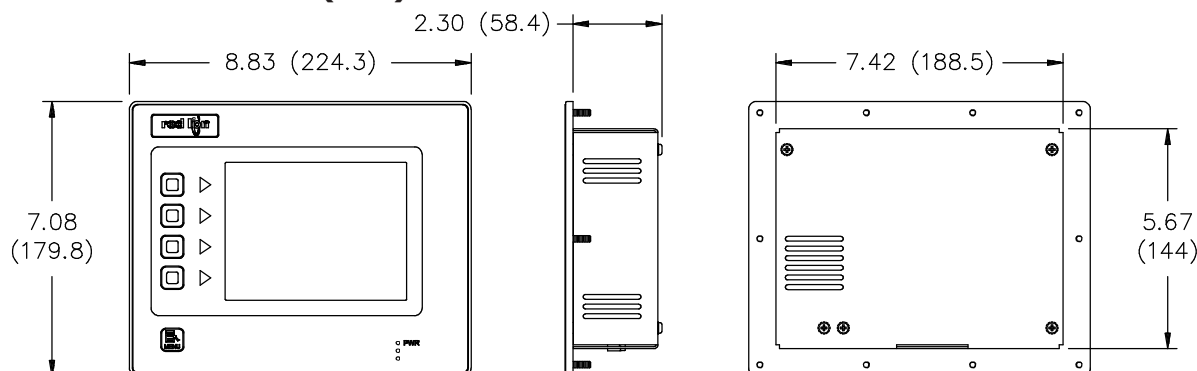
## 10. CONSTRUCTION: Steel rear metal enclosure with NEMA 4X/IP66 aluminum front plate for indoor use only when correctly fitted with the gasket provided. Installation Category II, Pollution Degree 2.

## 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)

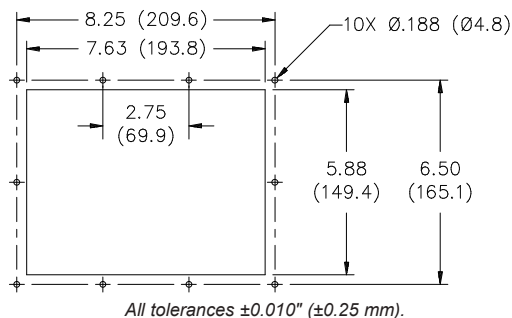


# INSTALLING AND POWERING THE G306

## 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 keps provided and tighten evenly for uniform gasket compression.

*Note: Tightening the keps beyond a maximum of 17 inch-pounds (1.92 N-m) may cause damage to the front panel.*



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).

# 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.

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.<sup>1</sup>

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.

## 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.

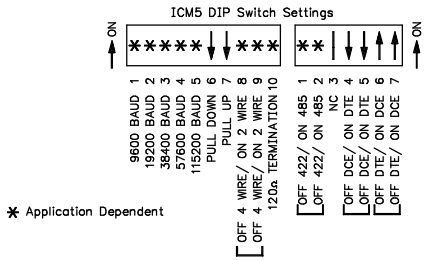
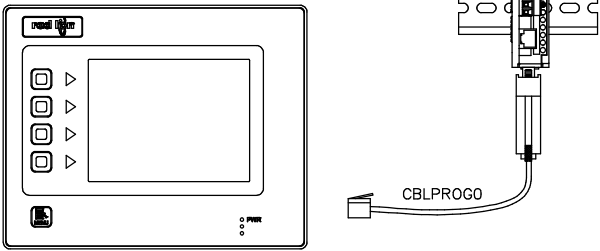
The RS232 ports can be used for either master or slave protocols with any G306 configuration.

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<sup>1</sup>, CBLRLC01<sup>2</sup>, or CBLRC02<sup>3</sup>.

G3 RS232 to a PC

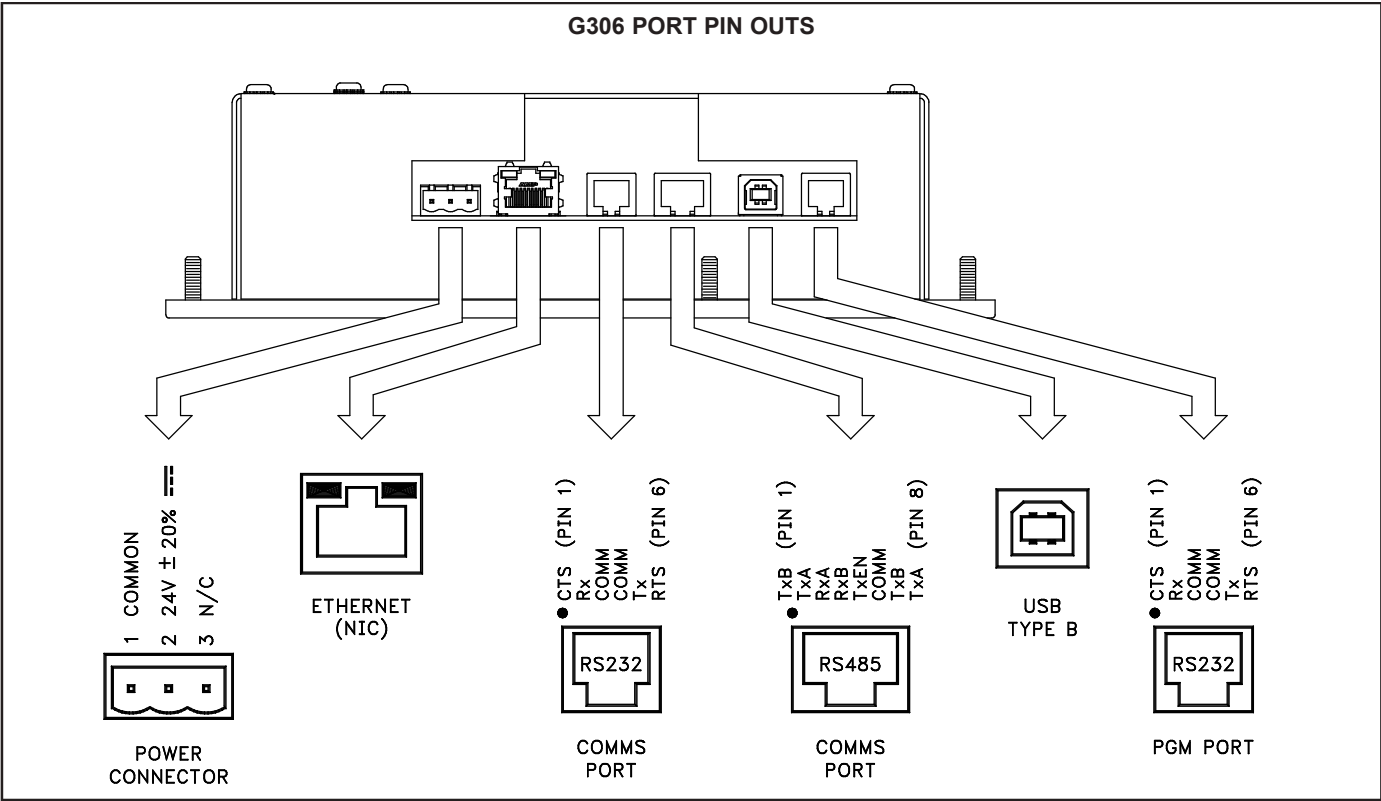
Connections			
G3: RJ12	Name	PC: DB9	Name
4	COMM	1	DCD
5	Tx	2	Rx
2	Rx	3	Tx
	N/C	4	DTR
3	COM	5	GND
	N/C	6	DSR
1	CTS	7	RTS
6	RTS	8	CTS
	N/C	9	RI

CONNECTING A G306 OPERATOR INTERFACE TO AN ICM5



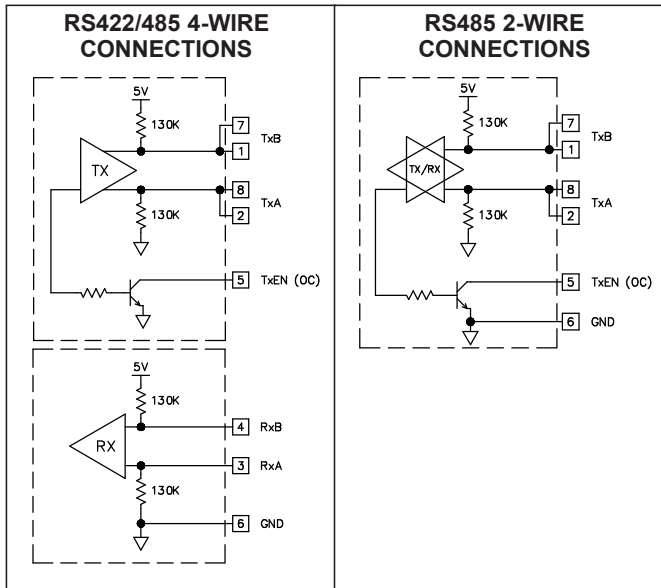
<sup>1</sup> CBLPROG0 can also be used to communicate with either a PC or an ICM5.  
<sup>2</sup> DB9 adapter not included, 1 foot long.  
<sup>3</sup> DB9 adapter not included, 10 foot long.

G306 PORT PIN OUTS



## 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](http://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
<b>RED (TOP, LABELED "PWR")</b>	
FLASHING	Unit is in the boot loader, no valid configuration is loaded. <sup>1</sup>
STEADY	Unit is powered and running an application.
<b>YELLOW (MIDDLE)</b>	
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. <sup>2</sup>
FLASHING SLOWLY	Incorrectly formatted CompactFlash card present.
<b>GREEN (BOTTOM)</b>	
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](mailto: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.



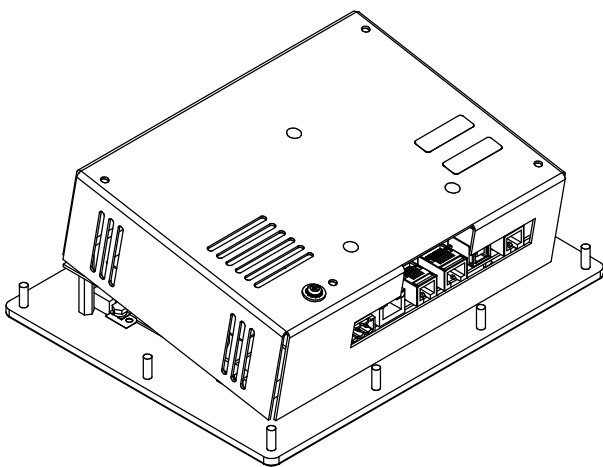
### CAUTION: RISK OF ELECTRIC SHOCK

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.

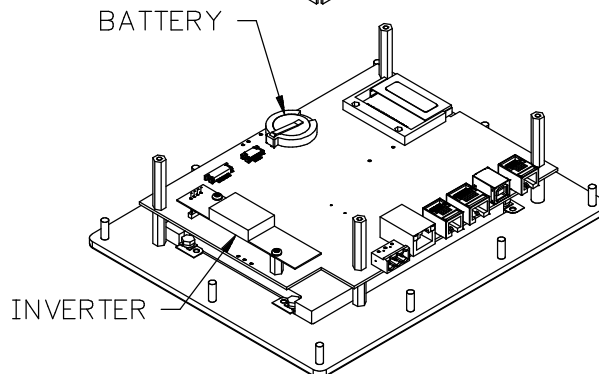
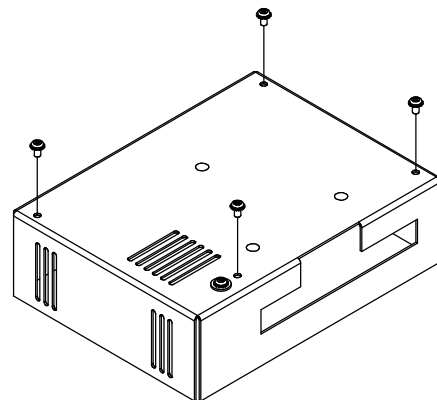
To change the battery of a G306, remove power, cabling, and then the rear cover of the unit. To remove the cover, remove the four screws designated by the arrows on the rear of the unit. Then, by lifting the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of 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

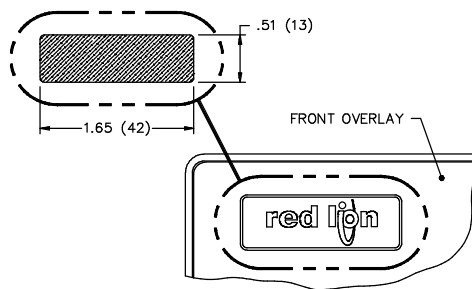
## OPTIONAL COMMUNICATION CARD

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

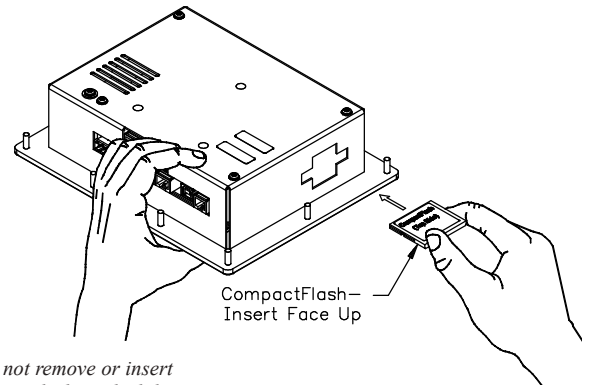
Each G3 operator interface has an embossed area containing the Red Lion logo. Red Lion can provide custom logos to apply to this area. Contact your distributor for additional information and pricing.



## 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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Tel +1 (717) 767-6511  
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Red Lion Controls BV  
Basicweg 11b  
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31, Kaki Bukit Road 3,  
#06-04/05 TechLink  
Singapore 417818  
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Fax +65 6743-3360

## VEGABAR 52



### Pressure transmitter with CERTEC® measuring cell

#### Application area

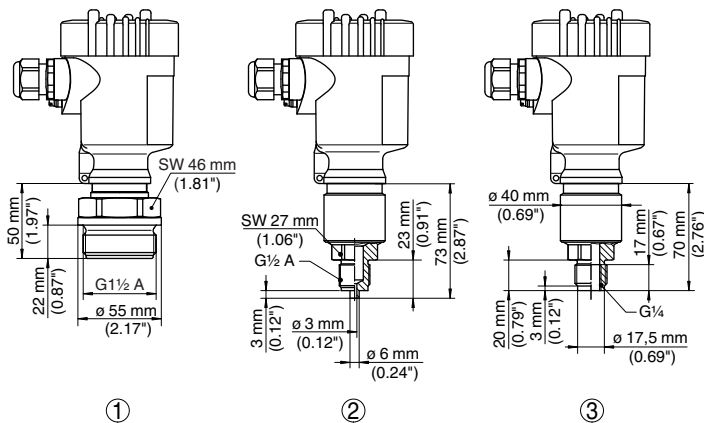
VEGABAR 52 is a pressure transmitter for measurement of gauge pressure and absolute pressure. Products to be measured are gases, vapours and liquids.

#### Advantages

Dry, ceramic-capacitive sensor element  
High measuring accuracy  
Maximum overload and vacuum resistance  
Smallest measuring ranges

#### Function

Sensor element is the CERTEC® measuring cell with rugged ceramic diaphragm. The process pressure causes a capacitance change in the measuring cell. This change is converted into an appropriate output signal and outputted as measured value. The CERTEC® measuring cell is also equipped with a temperature sensor. The temperature value can be displayed via the indicating and adjustment module or processed via the signal output.



- 1 Threaded version G $\frac{1}{2}$  A, manometer connection EN 837
- 2 Threaded version G $\frac{1}{2}$  A, inner G $\frac{1}{4}$  A
- 3 Threaded version G $\frac{1}{2}$  A, inner G $\frac{1}{4}$  A, PVDF

You will find further process fittings and options under [www.vega.com/configurator](http://www.vega.com/configurator)

You will find further drawings and charts under [www.vega.com/downloads](http://www.vega.com/downloads)

You will find mounting accessory and welded sockets in chapter "Information"

**Approval**

<b>XX</b>	w ithout .....
<b>XM</b>	Ship approval .....
<b>CX</b>	ATEX II 1G, 1/2G, 2G Ex ia IIC T6 .....
<b>CM</b>	ATEX II 1G, 1/2G, 2G Ex ia IIC T6 + Ship approval .....
<b>CI</b>	Zone 0, 0/1, 1 Ex ia IIC T6 .....
<b>GX</b>	ATEX II 1/2D, 2D Ex tD IP66 T.. .....

**Process fitting / Material**

<b>GV</b>	G½A, manometer connection EN837 PN160 / 316L .....
<b>GP</b>	G½A, inner G¼A, PN160 / 316L .....
<b>GS</b>	G½A, inner G¼A, PN10 / PVDF .....
<b>GG</b>	Thread G1½A PN60 / 316L .....
<b>GW</b>	Thread G1½A PN10 / PVDF .....
<b>GN</b>	Thread 1½NPT PN60 / 316L .....
<b>GN</b>	½NPT, inner ¼NPT, PN160 / 316L .....
<b>CA</b>	Tri-Clamp 2" PN16 / 316L .....
<b>LA</b>	Hyg. fitting w ith compression nut F40 PN40 / 316L .....
<b>TA</b>	Varivent N50-40 PN25 / 316L .....
<b>RB</b>	Bolting DN50PN25 DIN11851 / 316L .....
<b>RD</b>	Bolting DN50PN25 Form A DIN11864 / 316L .....
<b>AA</b>	DRD PN40 / 316L .....
<b>BB</b>	M44x1.25; pressure screw PN60 / 316L .....
<b>FW</b>	Flange DN50PN16 / PVDF .....
<b>FB</b>	Flange DN50PN40 Form C, DIN2501 / 316L .....
<b>FE</b>	Flange DN80PN40 Form C, DIN2501 / 316L .....
<b>FH</b>	Flange 2" 150lb RF, ANSI B16.5 / 316L .....
<b>FI</b>	Flange 3" 150lb RF, ANSI B16.5 / 316L .....

**Seal measuring cell / Process temperature**

<b>1</b>	FKM (A+P 70.16) / -40...120°C .....
<b>3</b>	EPDM (A+P 75.5/KW75F) / -40...120°C .....
<b>M</b>	FFKM (Perlast G75B) / -15...120°C .....

**Pressure / Measuring range**

<b>A</b>	rel. / 0...0.1bar (0...10kPa) .....
<b>C</b>	rel. / 0...0.4bar (0...40kPa) .....
<b>E</b>	rel. / 0...2.5bar (0...250kPa) .....
<b>F</b>	rel. / 0...5.0bar (0...500kPa) .....
<b>P</b>	rel. / -1...0.0bar (-100...0kPa) .....
<b>Q</b>	rel. / -1...1.5bar (-100...150kPa) .....
<b>R</b>	rel. / -1...5.0bar (-100...500kPa) .....
<b>S</b>	rel. / -1...10.0bar (-100...1000kPa) .....
<b>H</b>	rel. / -1...25.0bar (-100...2500kPa) .....
<b>V</b>	rel. / -1...60.0bar (-100...6000kPa) .....
<b>K</b>	rel. / -0.05...0.05bar (-5...5kPa) .....
<b>L</b>	rel. / -0.1...0.1bar (-10...10kPa) .....
<b>M</b>	rel. / -0.2...0.2bar (-20...20kPa) .....
<b>O</b>	rel. / -0.5...0.5bar (-50...50kPa) .....
<b>1</b>	abs. / 0 ... 1.0bar (0 ... 100kPa) .....
<b>2</b>	abs. / 0 ... 2.5bar (0 ... 250kPa) .....
<b>3</b>	abs. / 0 ... 5.0bar (0 ... 500kPa) .....

**Electronics**

<b>Z</b>	4...20mA .....
<b>H</b>	4...20mA/HART® .....
<b>P</b>	Profibus PA .....
<b>F</b>	Foundation Fieldbus .....

**Housing / Protection**

<b>K</b>	Plastic / IP 66/IP 67 .....
<b>A</b>	Aluminium / IP 66/IP 67 .....
<b>D</b>	Aluminium double chamber / IP 66/IP 67 .....
<b>8</b>	StSt (electropolished) 316L / IP 66/IP 67 .....
<b>P</b>	PUR cable axial IP 68, ext. housing plastic IP 65 .....
<b>W</b>	StSt double chamber / IP 66/IP 67 .....
<b>R</b>	Plastic 2-chamber / IP 66/IP 67 .....

**Cable entry / Plug connection**

<b>M</b>	M20x1.5 / w ithout .....
<b>N</b>	½NPT / w ithout .....

**Indicating/adjustment module (PLICSCOM)**

<b>X</b>	Without .....
<b>A</b>	Top mounted .....

**Accuracy class**

<b>M</b>	0.075 % .....
<b>E</b>	0.10% .....
<b>S</b>	0.20% .....

BR52.

# PBIH Series

## 15-150 WATTS DC/DC SINGLE OUTPUT

### Features

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



### Specifications

#### INPUT

Input voltage	12VDC (9.2–16) 24VDC (19–32) 48VDC (38–63) 110VDC (85–140)
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Inrush current	20A max. for 110V only
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#### OUTPUT

Output voltage	See table
Voltage adjustment	±10%, ±5% for PBIH-F
Output current	See table
Ripple & noise	Output Volts x 1% + 50mV to -100mV pk-pk
Line regulation	0.8% over input range
Load regulation	0.9%, 0%–100% load
Temperature coefficient	0°C to 50°C, 0.03% per °C
Overvoltage protection	O.V. clamp, PBIH-F Output shutdown, PBIH-G, J, M, R – input must be switched off for at least 30S to reactivate
Overcurrent protection	Fold back – PBIH-F Current limiting, PBIH-G, J, M, R (PBIH-R series is adjustable); PBIH110xxR models are not adjustable
Drift	Output V x 0.5% + 15(mV) per 8 hrs after 1 hr warm-up
Rise Time	200mS max. – PBIH-F, M, R 100mS max. – PBIH-G, J (at 25°C)
Holdup time	10mS (only 110V input)
Remote sense	PBIH-R Series only

### OPERATING

Efficiency	70%–89%
Safety isolation (1 minute)	Type – 12, 24, 48V input Input – Output: 1500VAC Input– Case: 1500VAC Output– Case: 500VAC Type– 110V input Input– Output: 2000VAC Input– Case: 2000VAC Output– Case: 500VAC
Insulation resistance	50M (500VDC) Input – Case
Parallel operation	Consult sales office for details
Remote control	PBIH-R Series: Open link: output normal Short link: output off

### ENVIRONMENTAL

Operating temperature	0°C to 50°C full load
Cooling	Convection cooled
Storage temperature	-20°C to +85°C
Humidity	85%
Shock	30G, PBIH-F, G and J
Vibration	(5Hz–10Hz, 10mm), (10Hz–50Hz) 2G, PBIH-F, G and J

### STANDARDS AND APPROVALS

Safety	Designed to UL1950
C-tick	AS/NZS CISPR11 Group 1, Class A

### MECHANICAL

Weight	PBIH-F : 250g PBIH-G : 380g PBIH-J : 410g PBIH-M : 800g PBIH-R : 1.4kg
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# PBIH Series

## 15-150 WATTS DC/DC SINGLE OUTPUT

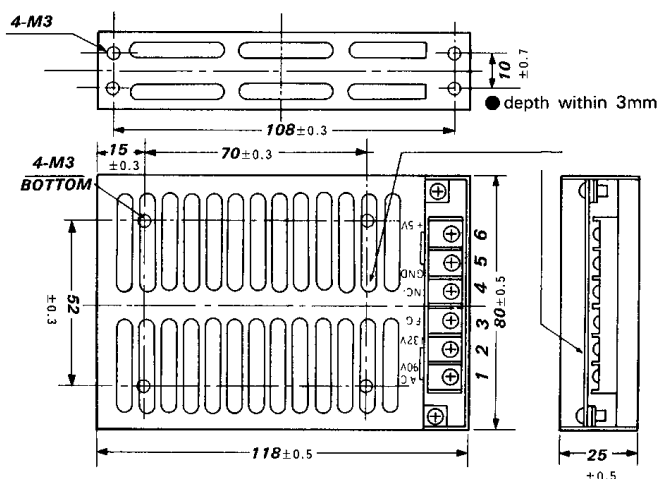
### Selection Table

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

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

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

### PBIH-F



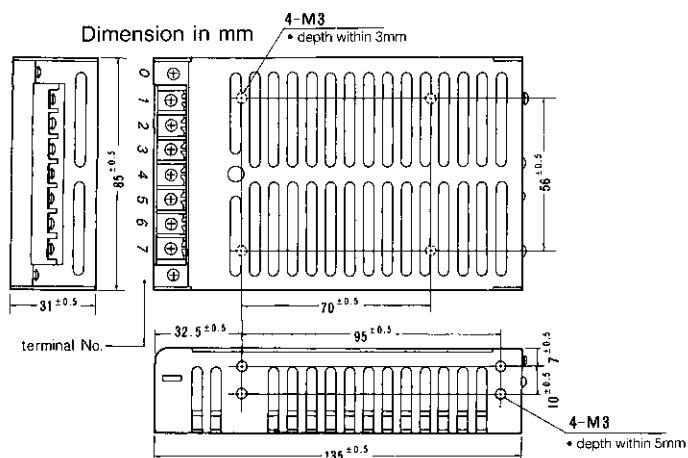
• Dimensions in mm

terminal No.	
1	0 V (DC in)
2	+ V (DC in)
3	FG
4	NO Connection
5	- V out
6	+ V out

# PBIH Series

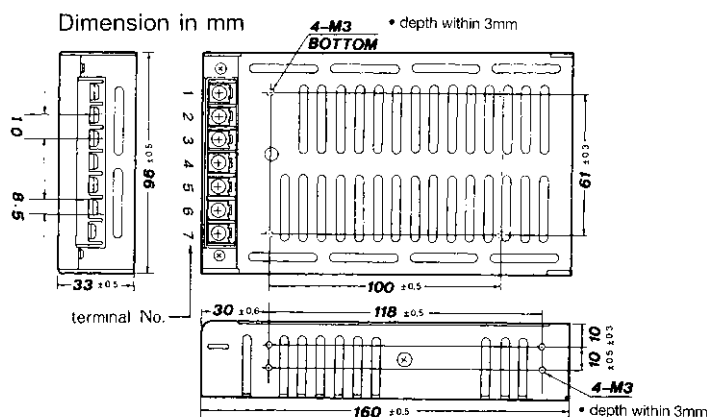
## 15-150 WATTS SINGLE OUTPUT

### PBIH-G



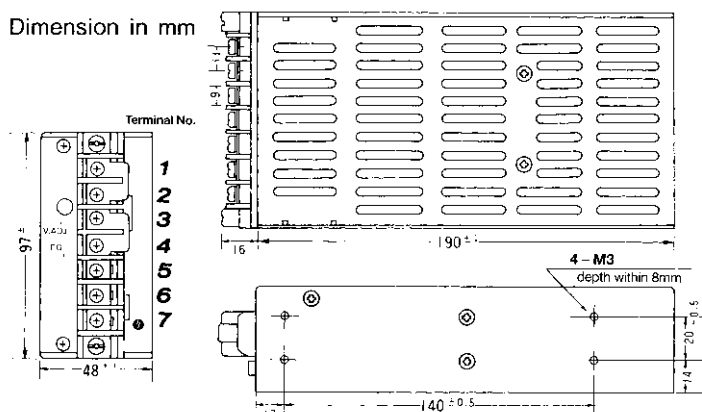
Terminal	Connection
0	FG
1	DC +V in
2	0V in
3	LFG
4	NO
5	NO
6	-V out
7	+V out

### PBIH-J



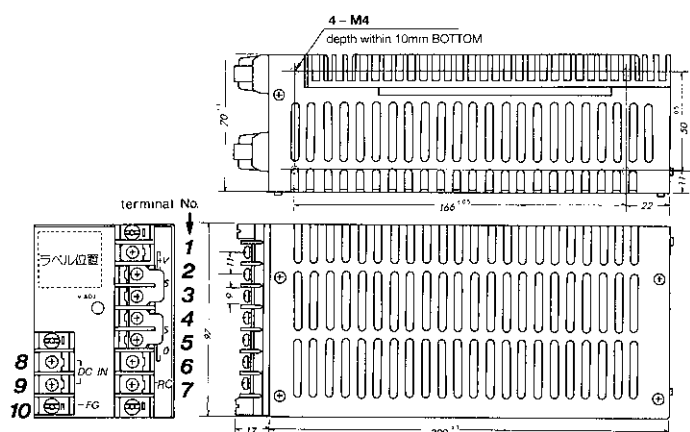
Terminal	Connection
1	FG
2	DC +V in
3	0V in
4	LFG
5	-V out
6	+V out
7	NC

### PBIH-M



Terminal	Connection
1	+V out
2	+V out
3	-V out
4	-V out
5	FG
6	-V in
7	+V in

### PBIH-R



Terminal	Connection
1, 2	+V out
3	+S
4	-S
5, 6	-V out
7	Remote Control
8	DC +V in
9	DC 0V in
10	FG

# WMOD2B Dual Band 900/1800 MHz GSM Modem

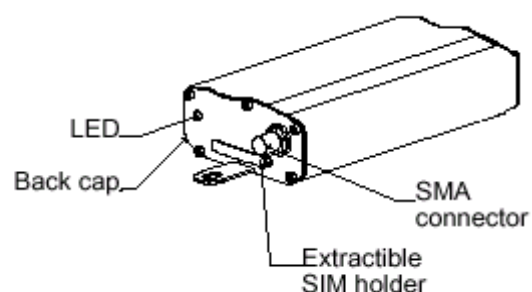
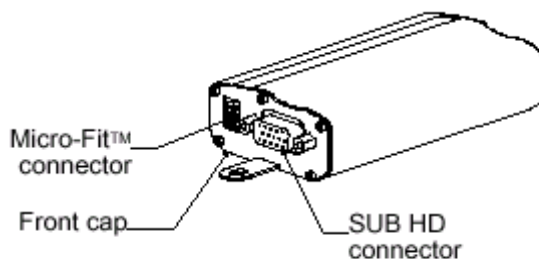
- Transmit or Receive Voice , Fax, Data and SMS Text Messages
- Dual Band - Operates on Cellnet, Vodafone, 1 to 1 or Orange networks
- Mains or 5-32 vDC power supply
- Small, lightweight, robust construction



## Specification

Standard	Dual Band Extended GSM 900 MHz Class 4 (2W) and GSM 1800 MHz Class1 (1W)
Interface	Serial interface RS232 V.24/V.28 Autobauding function AT command set based on V.25ter and GSM 07.05 & 07.07
SMS	Mobile Originated (MO) and Mobile Terminated (MT). Mode Text & PDU point to point. Cell broadcast. In accordance with GSM 07.05.
Data	Asynchronous 2400, 4800, 9600 and 14400 bits/s. Transparent and Non Transparent mode . In Non Transparent Mode only: 300, 1200, 1200/75 bauds. Mode 3.1 KHz (PSTN) and V110 (ISDN).
Fax	2400/4800/7200/9600 bits/s GSM teleservice 62 in Transparent Mode. Class 2. Groupe 3 compatible.
Audio	Half Rate / Full Rate / Enhanced Full Rate. Accessories (options): handset and car-kit.

Dimensions	98x54x25 mm (excluding connectors)
Overall dimensions	110x54x25 mm
Weight	< 130 grams
Volume	13.23 cm <sup>3</sup>
Housing	Aluminium profiled



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Western Australia, 6902

# D Series

## Data Radio Modem

### DR900 - Digital Radios

Trio DataCom's **D Series** are high performance cost effective data radio modems designed as an alternative to hard wired data transport. Transmit your data over radio with a fully integrated data radio modem designed for fixed point-to-point and point-to-multipoint applications.

The **D Series** is available as either a half duplex or a full duplex\* 853-929 MHz +/- 5MHz radio, including a fully integrated 4800 / 9600 bps data modem. These units operate equally well in either a stand-alone configuration, or as part of a large communication system.

This complete package forms an attractively priced product for the transmission of data over radio in fixed applications thus providing a viable alternative to costly networks of buried media.



#### Features:

- ❖ Fully integrated half and full duplex\* radio and modem
- ❖ Transparent and non-intrusive remote diagnostic facilities (Optional)
- ❖ Inbuilt data routing and multiplexing capabilities, multi-port operation
- ❖ Simultaneous delivery of multiple protocols using Trio DataCom's unique MultiStream™ technology
- ❖ Digital Signal Processing (DSP) modem
- ❖ Selectable 300-19,200 bps asynchronous RS232 user interface
- ❖ Built-in antenna diplexer\*
- ❖ Integrated supervisory data channel
- ❖ Unique collision avoidance facility, for unsolicited report-by-exception
- ❖ Software selectable configuration parameters
- ❖ Internal repeater operation
- ❖ Housed in an attractive yet robust metal enclosure
- ❖ Range of ancillary equipment - full duplex base / repeater stations and hot-standby base station

#### Radio

The **D Series** radio has been designed to meet worldwide regulatory guidelines, including FCC, and has adjustable power output up to 5 Watts. This fully synthesised radio is programmable in 6.25/7.5 kHz increments to accommodate various worldwide channel spacings. The receiver section has a wide tuning range with an excellent signal-to-noise ratio. Exceptional frequency stability is achieved by intelligent microprocessor controlled temperature compensation. An extended operating temperature range of -30 to 60°C makes the unit ideal for commercial and industrial applications.

#### Modem

The in-built modem includes a custom DSP developed for data communications over narrow band radio systems.

This system offers minimum occupied bandwidth and optimal data integrity (using the standard HDLC protocol with CCITT CRC error detection) inhibiting the transfer of any rogue unwanted data caused by interference or squelch headers / tails.

The Trio DataCom DSP provides:

- the interface between the asynchronous RS232 user communication and the synchronous radio link layer.
- an inbuilt multiplexer / router which allows for simultaneous transportation of multiple protocols over the one radio network.

#### Applications

The **D Series** is ideal for use in a variety of sophisticated and critical SCADA and Distributed Information Systems, where complex routing of multiple data protocols and remote diagnostics and wireless network management are important factors.

Remote units and a number of full duplex base station / repeater models, suitable for a variety of requirements, make up the **D Series**. At the top of the range, the DH model is a genuine, duplicated hot standby base for systems where nothing short of ultra reliability is acceptable.

**Telemetry Systems** - Utilities (Gas, Water, Electricity), Railways, Mining, Telecommunications, Industry. Where network status, system control, data collection and fault conditions are required.

**Transaction Processing** - Point of Sale Credit Terminals, Stock Control, Direct Order, Banks, Building Societies, Stock Brokers, Gambling Organizations, etc, where Point of Sale, inventory, credit, or transaction data requires collection and distribution.

**Common Carrier Data Services** - The high speed, low cost and spectrum efficiency of this device make it well suited to all forms of common carrier data networking.

**Alarm Monitoring** - Fire, Power, Intrusion & Essential Services Alarm Reporting.

## D Series - Data Radio Modem

### DR900 - Digital Radios

#### Configuration

Configuration using Trio's **D Series** programming software (DRProg) is completely Windows® based for all parameters, such as; frequency, transmitter power, digital mute level, PTT timer, system configurations, port settings.

#### Network Management & Diagnostic (Optional)

A large distributed network, or even a simple point-to-point link, requires comprehensive fault reporting and diagnostics to ensure a high level of availability. Trio **D Series** data radio modem products offer sophisticated in-built diagnostics using the optional **TView™** software. This capability allows the customer to remotely monitor and maintain their system, minimising the likelihood of failures, by pointing out component degradation and decreasing the time to diagnose and repair. There is no necessity to visit the master station or interfere with the host data integrity, other than additional data transfer. For further details, consult the **TView** data sheet.

#### Specifications:

RADIO	
Frequency Range**	853-929 MHz +/- 5MHz
Channel Selection	Fully programmable
Frequency Splits	76 MHz Tx/Rx frequency split available including simplex
Frequency Stability	±1ppm (-10 to 60°C ambient, opt. -30 to 70°C) Higher frequency stability options are available due to intelligent processor controlled temperature compensation
Aging	<= 1ppm/annum
Half / Full Duplex	half duplex or full duplex*
Data Rate (rf)	4800 / 9600 bps
Configuration	All configuration via Windows software
TRANSMITTER	
Tx Power	5 W (+37 dBm) or 1 W* (+30 dBm) (software programmable)
Modulation	Narrow band digital filtering binary GMSK
Occupied Bandwidth	Meets various international regulatory guidelines for point-to-point and point-to-multipoint
Tx Attach Time	< 1 mSecond
Timeout Timer	Programmable 1-255 seconds
Tx Spurious	<= -65 dBm
RECEIVER	
Sensitivity	-115 dBm for 12 dB SINAB
Blocking	> 75 dB (EIA)
Intermodulation	<= 70 dB (EIA)
Spurious Response	<= 70 dB (EIA)
Select. and Desense	70 dB (EIA)
AFC Tracking	±3 kHz tracking @ -90 dBm/attack time <10 mS
Mute	Programmable digital mute

#### Collision Avoidance

A unique fully integrated, yet independent, low speed supervisory data channel embedded within the primary bit-stream provides collision avoidance facilities which are transparent to the user. The use of this feature makes this product ideally suited for reliable, error free data transmissions between stations in high density point-to-multipoint data networks.

The benefits include:

- Multiple asynchronous applications operating on the one radio channel.
- Enhanced performance of report-by-exception networks.

#### Related Products

- ❖ Base Stations (DB900)
- ❖ Hot Standby Base Station (DH900)
- ❖ 9 Port Stream Router Multiplexer (MSR)
- ❖ Network Management and Diagnostic Software (TView™)
- ❖ D Series Programming Software (DRProg™)

CONNECTIONS	
User Data Port	2 x DB9 RS232 female ports
Antenna	SMA female bulkhead (optional N)
Power	2 pin locking. Mating connector supplied
MODEM	
Data Serial Port #1	Full duplex, DB9 RS232, DCE (modem), 300-19,200 bps asynchronous, hardware/software handshaking
Data Serial Port #2	Full duplex, DB9 RS232, 300-9600 bps asynchronous, software handshaking
Data Storage	On-board RAM
Channel Data Rate	4800 / 9600 bps, full duplex
Bit Error Rate	< 1x10 <sup>-6</sup> @ -108 dBm (4800 bps) < 1x10 <sup>-6</sup> @ -105 dBm (9600 bps)
Collision Avoidance	Trio DataCom's unique supervisory channel C/DSMA collision avoidance system
MultiStream™	Trio DataCom's unique simultaneous delivery of multiple data streams (protocols)
GENERAL	
Power Supply	13.8 Vdc nominal (11-16 Vdc)
Transmit Current	600 mA max. @ 1 W 1700 mA max. @ 5 W
Receive Current	175 mA
Dimensions	260 x 161 x 65 mm (robust metal enclosure)
Weight	1.3 kg

\* Available for DR900 full duplex 1 W version (853 ± 5 MHz / 929 ± 5 MHz)

\*\* Various sub-frequency bands available.

Note: Model codes previously known as xxxDR are now depicted as DRxxx.

designs products & *solutions*

Local regulatory conditions may determine the 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. Information subject to change without notice.

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# Cellular Transit Antenna

The TLA2000 is an ideal antenna solution for GSM data applications in both fixed and mobile situations. Designed to offer true dual band performance the TLA2000 is ready for use with the latest GSM (GPRS) modems. With a high impact resistant vacuum formed ABS radome and neoprene mounting gasket, the TLA2000 can be used for indoor or outdoor applications.

- Applications include public vending machines, ATM kiosks and industrial automotive use
- Designed for use on conductive or nonconductive surfaces
- TLA3000 model incorporates integrated GPS antenna

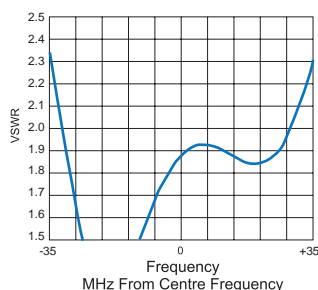
890-960 MHz  
1710-1880 MHz

**TLA2000**  
**TLA3000**

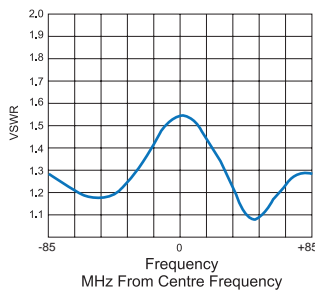


TLA2000/3000

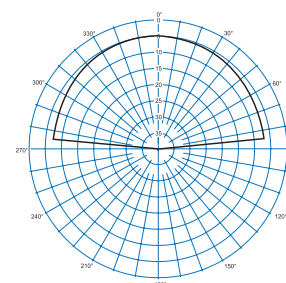
Typical VSWR response GSM900



Typical VSWR response GSM1800



Typical E-Plane response @ 890MHz



## Electrical

Model No.	TLA2000/3000
Gain dBi	2
Frequency MHz	890 - 960 / 1710 - 1880
Power W	10
Tuned Bandwidth	Entire specified band @ <2.5:1 VSWR
Tuning	Pre-tuned





## Mechanical







Model No.	TLA2000	TLA3000
Construction	White Gelyo ASA radome	
Diameter mm	135	
Height mm	61 (including gasket)	
Mounting	M4 hardware (not included)	
Cable and Connector	500mm low loss 9014 RG58 type	Cellular: 5m 9014 RG58 type - FME connector GPS: 5m low loss RG174 type - MCX connector

## GPS Specifications

Fo	1575.42 MHz
Operation Temperature	-40 to +85°C
Storage Temperature	-40 to +100°C
System Gain at Fo	28dBi including cable and filter losses
Impedance	50 Ohm
Polarization	RHCP
VSWR at Fo	1.5:1
Noise Figure at Fo	<1.8 dB max.
Power Input	+2.5Vdc to +12Vdc input, Auto Switching
Power Consumption	11mA to 13mA (max)
Power Input	Reverse Polarity Short Circuit Shutdown
Over-Current	Thermal over-current shutdown > +150°C

# 50 Ohm Braided Coaxial Cables

Cable Type	RFI Part No.	Jacket O.D. mm	Construction					Impedance Ohms	Nominal Velocity %	Type of Jacket
			Dielectric	Centre Conductor	Shield					
					No.	Type	Coverage			
 RG213	8213	10.3	Solid Polyethylene	7 x BC 2.75mm	1	BC Braid	96%	50	66	Black PVC Non Contaminating UV stabilised
 RG8 Style	CNT400	10.3	Foam Polyethylene	1 x CCA 2.75mm	2	Al Foil TC Braid	100%	50	87	Black Polyethylene UV stabilised
 RG214/U	8214	10.8	Solid Polyethylene	7 x SC 2.26mm	2	SC Braids	98%	50	66	Black PVC Non Contaminating UV stabilised
 10DFB Style	9005	13.0	Cellular Polyethylene (Foam)	1 x BC 3.5mm	2	TC Braid & Al foil on plastic tape	100%	50	80	Black Polyethylene UV stabilised

Cable Type	RFI Part No.	Jacket O.D. mm	Construction					Impedance Ohms	Nominal Velocity %	Type of Jacket
			Dielectric	Centre Conductor	Shield					
					No.	Type	Coverage			
 RG179	8179	2.54	Solid PTFE	7 x SC 0.03mm	1	SC Braid	95%	75	69.5	Tinted Brown FEP
 RG59B/U	8059	6.15	Solid Polyethylene	1 x CCS 0.57mm	1	BC Braid	95%	75	66	Black PVC Non Contaminating UV stabilised
 RG59B/U	9008	6.15	Solid Polyethylene	1 x CCS 0.57mm	1	BC Braid	95%	75	66	Black Polyethylene UV stabilised
 RG62A/U	8062	6.15	Polyethylene Helix Spiral	1 x CCS 0.64mm	1	BC Braid	93%	93	84	Black PVC Non Contaminating UV stabilised
 RG11A/U	8011	10.3	Solid Polyethylene	7 x BC 0.4mm	1	BC Braid	96%	75	66	Black PVC Non Contaminating UV stabilised
 RG11/U	9011	10.3	Foam Polyethylene	1 x BC 1.62mm	1	BC Braid	97%	75	84	Black Polyethylene UV stabilised

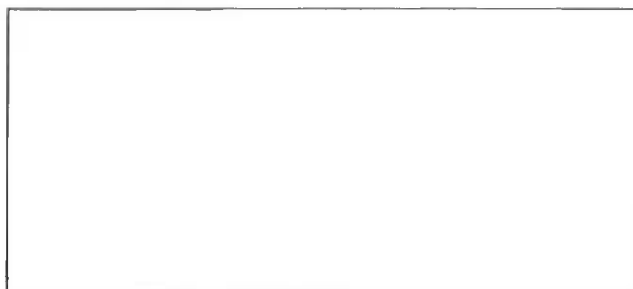


## **7.7    *SOFT STARTER***

- EMOTRON – MSF-045 + MODBUS COMMS – PUMP SOFT STARTER
- EMOTRON – 01-3060-00 – EXTERNAL KEYPAD KIT



Valid for the following Soft starter Models:  
MSF-017 to MSF-1400



## **MSF SOFT STARTER INSTRUCTION MANUAL**

Document number: 01-1363-01

Edition: r3

Date of release: 2003-02-03

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### 3. HOW TO GET STARTED

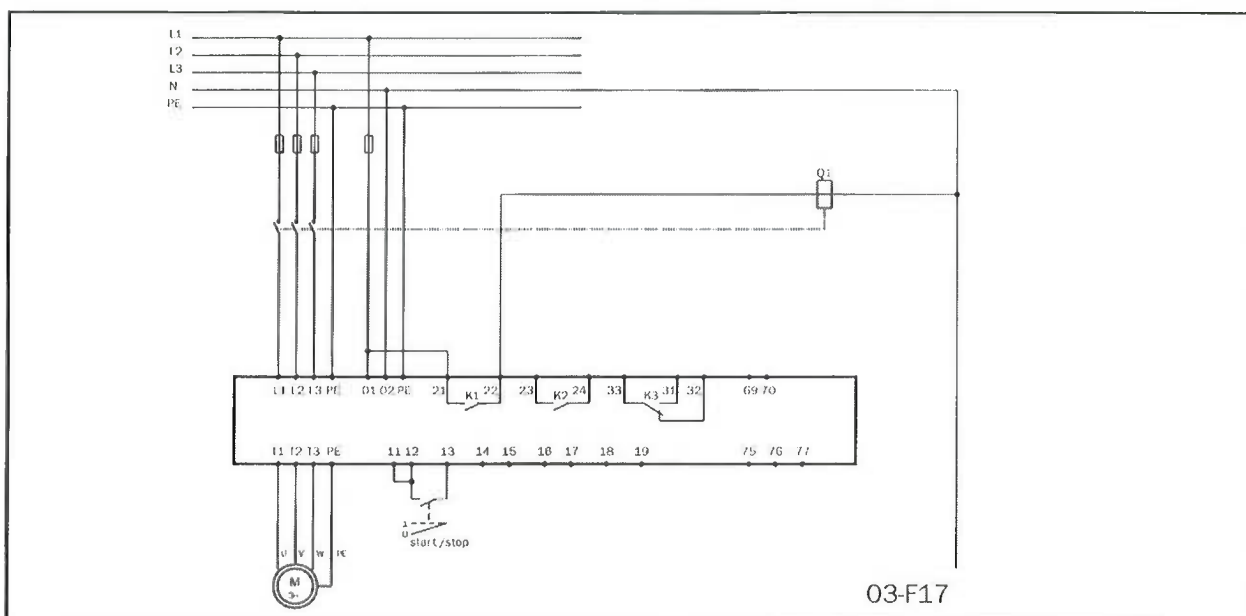


Fig. 6 Standard wiring.

This chapter describes briefly the set-up for basic soft start and soft stop by using the default “Voltage Ramp” function.



**WARNING!** Mounting, wiring and setting the device into operation must be carried out by properly trained personnel. Before set-up, make sure that the installation is according to chapter 6, page 24 and the Checklist below.

#### 3.1 Checklist

- Mount the soft starter in accordance with chapter 6, page 24.
- Consider the power loss at rated current when dimensioning a cabinet, max. ambient temperature is 40°C (see chapter 12, page 74).
- Connect the motor circuit according to Fig. 6.
- Connect the protective earth.
- Connect the control voltage to terminals 01 and 02 (100 – 240 VAC or 380–500 VAC).
- Connect relay K1 (PCB terminals 21 and 22) to the contactor – the soft starter then controls the contactor.
- Connect PCB terminals 12 and 13 to, e.g., a 2-way switch (closing non-return) or a PLC, etc., to obtain control of soft start/soft stop.<sup>1)</sup>
- Check that the motor and supply voltage corresponds to values on the soft starter’s rating plate.
- Ensure the installation complies with the appropriate local regulations.

1) The menu 006 must be put to 01 for start/stop command from keyboard.

#### 3.2 Main functions/Applications



**WARNING!** Make sure that all safety measures have been taken before switching on the supply.

Switch on the control voltage (normally 1 x 230 V), all segments in the display and the two LED’s will be illuminated for a few seconds. Then the display will show menu 001. An illuminated display indicates there is supply voltage on the PCB. Check that you have mains voltage on the mains contactor or on the thyristors. The settings are carried out according to following:

The first step in the settings is to set menu 007 and 008 to “ON” to reach the main functions 020–025 and motor data 041–046.

**NOTE!** The main function is chosen according to the application. The tables in the applications and functions selection (table 1, page 15), gives the information to choose the proper main function.

#### 3.3 Motor Data

Set the data, according to the motor type plate to obtain optimal settings for starting, stopping and motor protection.

**NOTE!** The default settings are for a standard 4-pole motor acc. to the nominal power of the soft-starter. The soft starter will run even if no specific motor data is selected, but the performance will not be optimal.

041 <sup>o</sup>	
Nominal motor voltage	
4 0 0	
Default:	400 V
Range:	200-700 V

046 <sup>o</sup>	
Nominal frequency	
5 0	
Default:	50 Hz
Range:	50/60 Hz

**NOTE! Now go back to menu 007 and set it to "oFF" and then to menu 001.**

042 <sup>o</sup>	
Nominal motor current	
4 5	
Default:	Nominal current soft starter
Range:	25% - 150% of $I_{n\text{soft}}$ in Amp

043 <sup>o</sup>	
Nominal motor power	
2 2	
Default:	Nominal power soft starter
Range:	25% - 300% of $P_{n\text{soft}}$ in kW

044 <sup>o</sup>	
Nominal motor speed	
1 4 5 0	
Default:	Nominal speed soft starter
Range:	500-3600 rpm

045 <sup>o</sup>	
Nominal motor cos phi	
. 8 6	
Default:	0.86
Range:	0.50-1.00

### 3.4 Setting of the start and stop ramps

The menu's 002 and 003 can now be set to adjust the start ramp up time and the stop ramp down time.

002 <sup>o</sup>	
Start time ramp 1	
1 0	
Default:	10 sec
Range:	1-60 sec

Estimate the starting-time for the motor/machine. Set "ramp up time" at start (1-60 sec).

Key "ENTER ↵" to confirm new value.

Key "NEXT →", "PREV ←" to change menu.

004 <sup>o</sup>	
Stop time ramp 1	
o F F	
Default:	oFF
Range:	oFF, 2-120 sec

Set "ramp down time" at stop (2-120 s).

"oFF" if only soft start requires.

### 3.5 Setting the start command

As default the start command is set for remote operation via terminal 11, 12 and 13. For easy commissioning it is possible to set the start command on the start key on the keyboards. This is set with menu 006.

006	
Selection of control mode	
2	
Default:	2
Range:	1,2,3

Menu 006 must be set to 1 to be able to operate from keyboard.

**NOTE! Factory default setting is remote control (2).**

To start and stop from the keyboard, the “START/STOP” key is used.

To reset from the keyboard, the “ENTER ↵ / RESET” key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset by the keyboard will not start or stop the motor.

### 3.6 Viewing the motor current

Set the display to menu 005. Now the Motor current can be viewed on the display.

005	
RMS current read-out	
0.0	
Default:	-
Range:	0.0-9999 Amp.

**NOTE! The menu 005 can be selected at any time when the motor is running.**

### 3.7 Starting



**WARNING! Make sure that all safety measures have been taken before starting the motor in order to avoid personal injury.**

Start the motor by pressing the “START/STOP” key on the keyboard or through the remote control, PCB terminal 11, 12 and 13. When the start command is given, the mains contactor will be activated by relay K1 (PCB terminal 21 and 22), and the motor then starts softly.

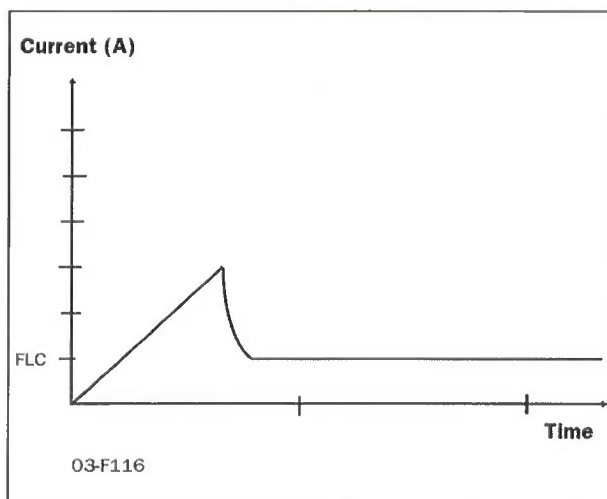


Fig. 7 Example of start ramp with main function voltage ramp.

## 4. APPLICATIONS AND FUNCTIONS SELECTION

This chapter is a guide to select the correct soft starter rating and the selection of the Main function and additional functions for each different application.

To make the right choice the following tools are used:

- **The norm AC53a.**  
This norm helps selecting the soft starter rating with regard to duty cycle, starts per hour and maximum starting current.
- **The Application Rating List.**  
With this list the soft starter rating can be selected depending on the kind of application used. The list use 2 levels of the AC53a norm. See table 1, page 15.
- **The Application Function List.**  
This table gives an complete overview of most common applications and duties. For each applications the menu's that can be used are given. See table 2, page 17.
- **Function and Combination matrix.**  
With these tables it is easy to see which combinations of Main and additional functions are possible, see table 3, page 19 and table 4, page 19.

### 4.1 Soft starter rating according to AC53a

The IEC947-4-2 standard for electronic starters defines AC53a as a norm for dimensioning of a soft starter.

The MSF soft starter is designed for continuous running. In the Applications table (table 1, page 15) two levels of AC53a are given. This is also given in the technical data tables (see chapter 12, page 74).

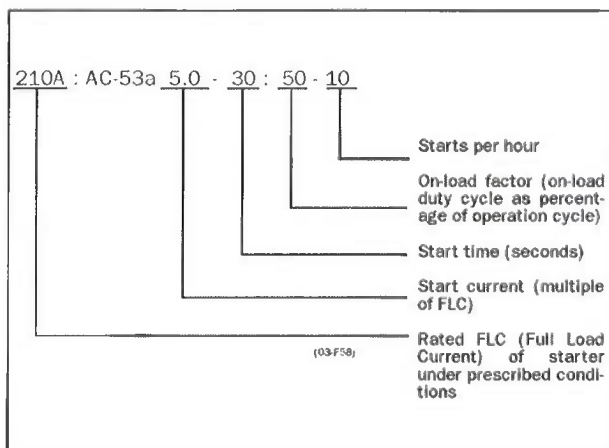


Fig. 8 Rating example AC53a.

The above example indicates a current rating of 210 Amps with a start current ratio of 5.0 x FLC (1050A) for 30 seconds with a 50% duty cycle and 10 starts per hour.

**NOTE!** If more than 10 starts/hour or other duty cycles are needed, please contact your supplier.

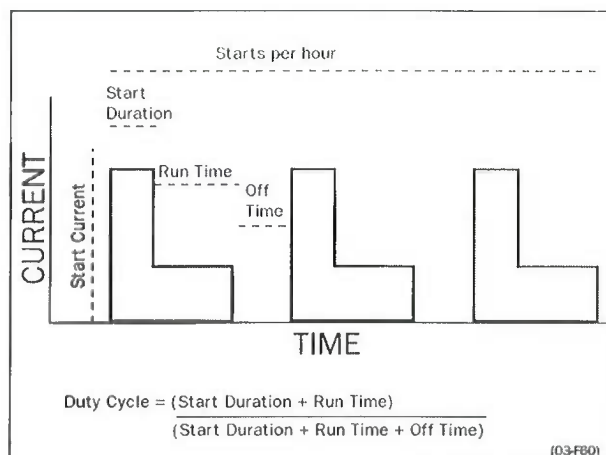


Fig. 9 Duty cycle, non bypass.

### 4.2 Soft starter rating according to AC53b

This norm is made for Bypass operation. Because the MSF soft starter is designed for continuous operation this norm is not used in the selection tables in this chapter.

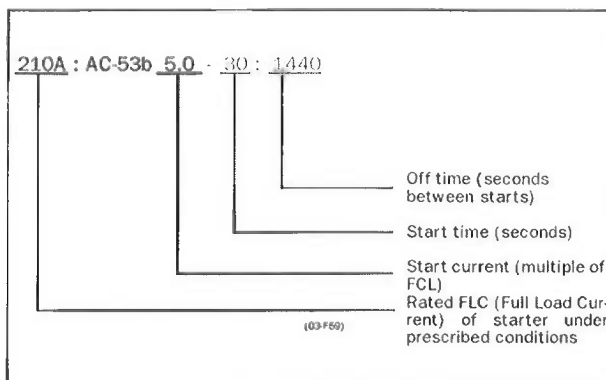


Fig. 10 Rating example AC53b.

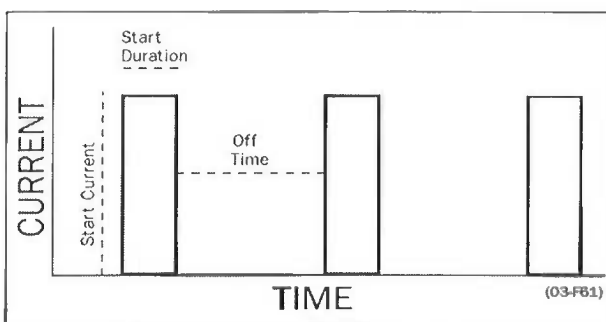


Fig. 11 Duty cycle, bypassed

The above example indicates a current rating of 210 Amps with a start current ratio of 5.0 x FLC (1050A) for 30 seconds with a 24-minute period between starts.



### 4.3 MSF Soft starter ratings

According to the norms AC53a and AC53b a soft starter can have many current ratings.

**NOTE!** Because the MSF soft starter is designed for continuous operation the norm AC53b is not used in the application rating list.

With help of the Application Rating List with typical starting currents and categories in the AC53a level (see table 1, page 15 and table 2, page 17) it is easy to select the proper soft starter rating with the application.

The Application Rating List uses two levels for the AC53a norm:

- **AC53a 5.0-30:50-10 (heavy duty)**  
This level will be able to start all applications and follows directly the type number of the soft starter.  
Example: MSF 370 is 370 Amps FLC and then 5 time this current in starting.
- **AC 53a 3.0-30:50-10 (normal/light duty)**  
This level is for a bit lighter applications and here the MSF can manage a higher FLC.  
Example: MSF 370 in this norm manage 450 Amps FLC and the 3 times this current in starting

**NOTE!** To compare Soft Starters It's important to ensure that not only FLC (Full Load Current) is compared but also that the operating parameters are identical.

### 4.4 The Application Ratings List

Table 1 gives the Application Ratings List. With this list the rating for the soft starter and Main Function menu can be selected.

Description and use of the table:

- **Applications.**  
This column gives the various applications. If the machine or application is not in this list, try to identify a similar machine or application. If in doubt please contact your supplier.
- **AC53a ratings.**  
The rating according to AC53a norm is here classified in 2 ratings. The first for normal/light duty (3.0-30:50-10) and the second for heavy duty (5.0-30:50-10)
- **Typical Starting current.**  
Gives the typical starting current for each application
- **Main Function menu.**  
The Main Function menu is advised here.  
"25;=1", means: program selection 1 in menu 25.
- **Stop function.**  
Gives a possible Stop function if applicable.  
"36;=1 / 38-40", means: program selection 1 in menu 36, also menus 38 to 40 can be selected.

#### EXAMPLE:

Roller Mill:

- This is an application for heavy duty,
- Typical starting current of 450%.
- Main function Torque ramp start (menu 25) will give the best results.
- Stop function Dynamic Brake (menu 36, selection 1) can be used.
- As well as the Slow Speed at start and stop (menu 38-40) can be used for better start and stop performance.

Table 1 Applications Rating List

Applications	AC53a 3.0-30:50-10 (normal/light)	AC 53a 5.0-30:50-10 (heavy)	Typical starting current %	Main function Menu nr.	Stop function Menu nr.
<b>General &amp; Water</b>					
Centrifugal Pump	x		300	22	22
Submersible Pump	x		300	22	22
Conveyor		x	300-400	25;=1	36;=1 / 38-40
Compressor: Screw	x		300	25	-
Compressor, Reciprocating	x		400	25;=1	-
Fan	x		300	25;=2	-
Mixer		x	400-450	25;=1	-
Agitator		x	400	25;=1	-
<b>Metals &amp; Mining</b>					
Belt Conveyor		x	400	25;=1	36;=1 / 38-40
Dust Collector	x		350	25;=1	-
Grinder	x		300	25;=1	36;=1
Hammer Mill		x	450	25;=1	36;=2
Rock Crusher		x	400	25;=1	-
Roller Conveyor	x	x	350	25;=1	36;=1 / 38-40
Roller Mill		x	450	25;=1	36;=1 or 2
Tumbler		x	400	25;=1	-
Wire Draw Machine		x	450	25;=1	36;=1 or 2
<b>Food Processing</b>					
Bottle Washer	x		300	25;=2	
Centrifuge		x	400	25;=1	36;=1 or 2
Dryer		x	400	25;=2	
Mill		x	450	25;=1	36;=1 or 2
Palletiser		x	450	25;=1	
Separator		x	450	25;=1	36;=1 or 2
Slicer	x		300	25;=1	
<b>Pulp and Paper</b>					
Re-Pulper		x	450	25;=1	
Shredder		x	450	25;=1	
Trolley		x	450	25;=1	
<b>Petrochemical</b>					
Ball Mill		x	450	25;=1	
Centrifuge		x	400	25;=1	36;=1 or 2
Extruder		x	500	25;=1	
Screw Conveyor		x	400	25;=1	
<b>Transport &amp; Machine Tool</b>					
Ball Mill		x	450	25;=1	
Grinder		x	350	25;=1	36;=1
Material Conveyor		x	400	25;=1	36;=1 / 38-40
Palletiser		x	450	25;=1	
Press		x	350	25;=1	
Roller Mill		x	450	25;=1	
Rotary Table		x	400	25;=1	36;=1 / 38-40
Trolley		x	450	25;=1	
Escalator		x	300-400	25;=1	
<b>Lumber &amp; Wood Products</b>					
Bandsaw		x	450	25;=1	36;=1 or 2
Chipper		x	450	25;=1	36;=1 or 2
Circular Saw		x	350	25;=1	36;=1 or 2
Debarker		x	350	25;=1	36;=1 or 2
Planer		x	350	25;=1	36;=1 or 2
Sander		x	400	25;=1	36;=1 or 2

## 4.5 The Application Functions List

This list gives an overview of many different applications/duties and a possible solution with one of the many MSF functions.

Description and use of the table:

- **Application /Duty.**  
This column gives the various applications and level of duty. If the machine or application is not in this list, try to identify a similar machine or application. If in doubt please contact your supplier.
- **Problem.**  
This column describes possible problems that are familiar for this kind of application.
- **Solution MSF.**  
Gives the possible solution for the problem using one of the MSF functions.
- **Menus.**  
Gives the menu numbers and selection for the MSF function.  
"25;=1", means: program selection 1 in menu 25.  
"36;=1 / 34,35", means: program selection 1 in menu 36, menus 34 and 35 are related to this function.



## 5. OPERATION OF THE SOFT STARTER



Fig. 12 MSF soft starter models.

### 5.2 PPU unit

#### 5.1 General description of user interface



**WARNING!** Never operate the soft starter with removed front cover.

To obtain the required operation, a number of parameters must be set in the soft starter.

Setting/configuration is done either from the built-in keyboard or by a computer/control system through the serial interface or bus (option). Controlling the motor i.e. start/stop, selection of parameter set, is done either from the keyboard, through the remote control inputs or through the serial interface (option).

#### Setting



**WARNING!** Make sure that all safety measures have been taken before switching on the supply.

Switch on the supply (normally 1 x 230 V), all segments in the display will light up for a few seconds. Then the display will show menu 001. An illuminated display indicates there is supply voltage on the PCB.

Check that you have voltage on the mains contactor or on the thyristors. To be able to use all extended functions and optimize of the performance, program the motor data.

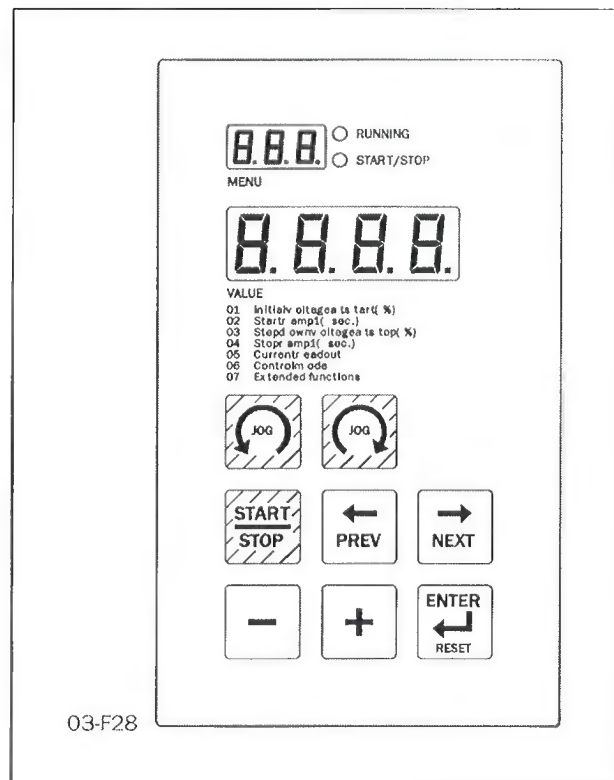


Fig. 13 PPU unit.

The programming and presentation unit (PPU) is a build-in operator panel with two light emitting diodes, three + four seven-segment LED-displays and a keyboard.

### 5.3 LED display

The two light emitting diodes indicates start/stop and running motor/machine. When a start command is given either from the PPU, through the serial interface (option) or through the remote control inputs, the start/stop-LED will be illuminated.

At a stop command the start/stop-LED will switch off. When the motor is running, the running-LED is flashing during ramp up and down and is illuminated continuously at full motor voltage.

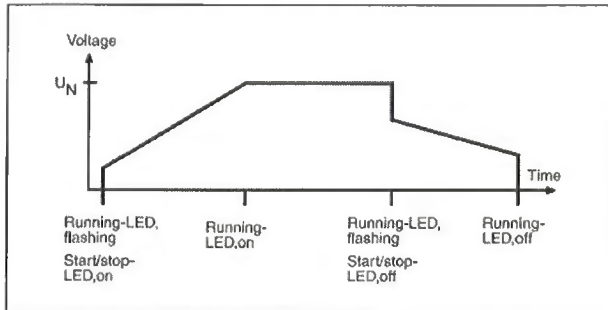


Fig. 14 LED indication at different operation situation.

### 5.4 The Menu Structure

The menus are organised in a simple one level structure with the possibility to limit the number of menus that are reachable by setting the value in menu 007 to "oFF" (factory setting). With this setting only the basic menus 001, 002, 003, 004, 005, 006 and 007 can be reached.

This to simplify the setting when only voltage start/stop ramps are used.

If menu 007 is in "on" and menu 008 "oFF" it is possible to reach all viewing menus and alarm lists as well.

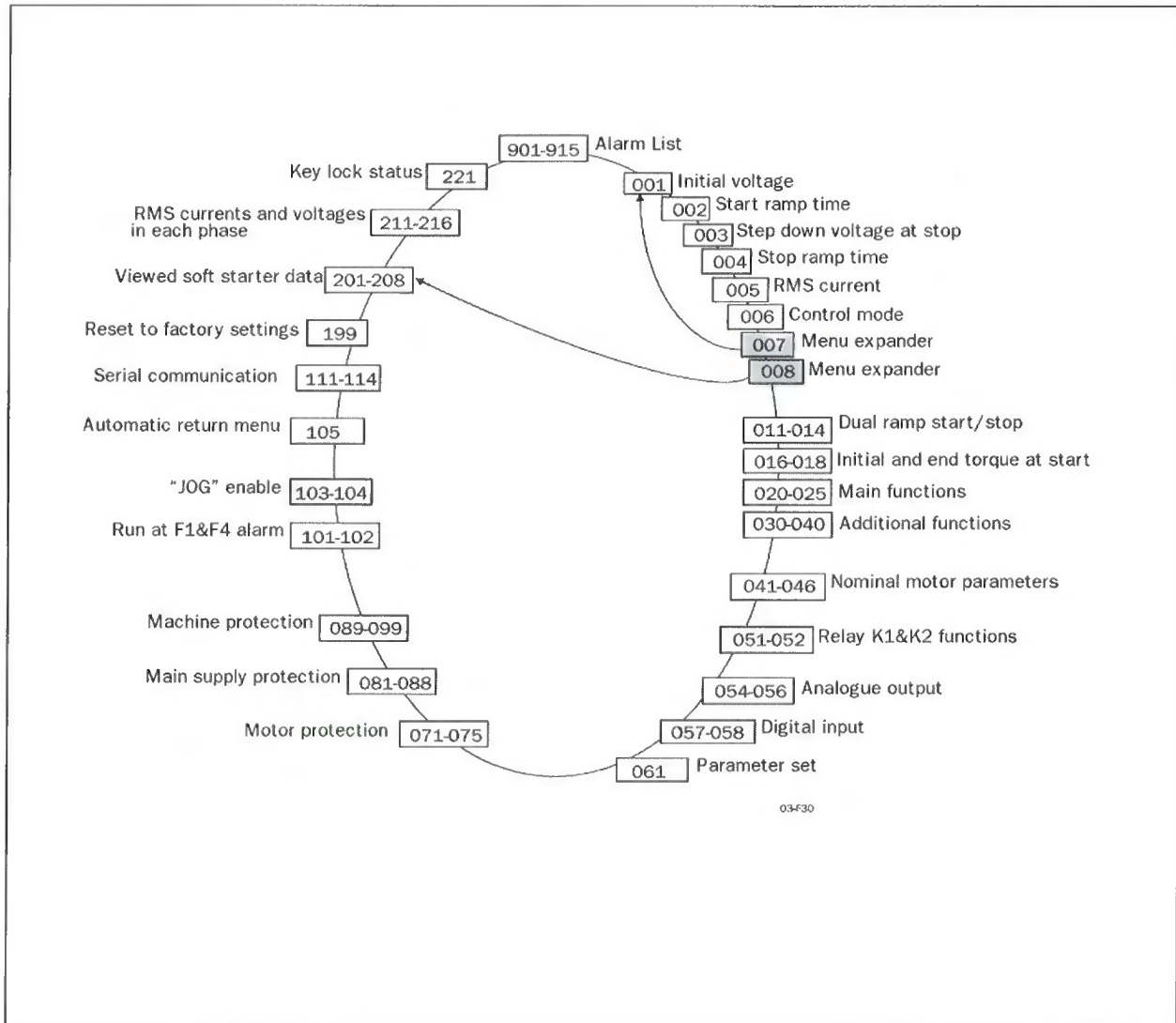


Fig. 15 Menu structure.

## 5.5 The keys

The function of the keyboard are based on a few simple rules. At power up menu 001 is shown automatically. Use the "NEXT →" and "PREV ←" keys to move between menus. To scroll through menu numbers, press and hold either the "NEXT →" or the "PREV ←" key. The "+" and "-" keys are used to increase respectively decrease the value of setting. The value is flashing during setting. The "ENTER ↵" key confirms the setting just made, and the value will go from flashing to stable. The "START/STOP" key is only used to start and stop the motor/machine.



The  and  keys are only used for JOG from the keyboard. Please note one has to select enable in menu 103 or 104, see § 7.25, page 61.

Table 5 The keys









Start/stop motor operation.	
Display previous menu.	
Display next menu.	
Decrease value of setting.	
Increase value of setting.	
Confirm setting just made. Alarm reset.	
JOG Reverse	
JOG Forward	

Table 6 Control modes

Operation/ Set-up		Start/Stop	JOG fwd/rev	Alarm reset	Setting of parameters	
					Parameter set with external selection Menu 061=0	Parameter set with internal selection Menu 061=1-4
<b>Keyboard</b> Menu 006=1	Unlocked keyboard	Keyboard	Keyboard	Keyboard	-----	Keyboard
	Locked keyboard	-----	-----	-----	-----	-----
<b>Remote</b> Menu 006=2	Unlocked keyboard	Remote	Remote	Remote and keyboard	Remote	Keyboard
	Locked keyboard	Remote	Remote	Remote	Remote	-----
<b>Serial comm.</b> Menu 006=3	Unlocked keyboard	Serial comm	Serial comm	Serial comm. and keyboard	-----	Serial comm
	Locked keyboard	Serial comm	Serial comm	Serial comm	-----	Serial comm

## 5.6 Keyboard lock

The keyboard can be locked to prohibit operation and parameter setting by an unauthorised. Lock keyboard by pressing both keys "NEXT →" and "ENTER ↵" for at least 2 sec. The message '- Loc' will display when locked. To unlock keyboard press the same 2 keys "NEXT →" and "ENTER ↵" for at least 2 sec. The message 'unlo' will display when unlocked.

In locked mode it is possible to view all parameters and read-out, but it is forbidden to set parameters and to operate the soft starter from the keyboard.

The message '-Loc' will display if trying to set a parameter or operate the soft starter in locked mode.

The key lock status can be read out in menu 221.

221 <sup>o</sup>	
Locked keyboard Info	
n o	
Default:	no
Range:	no, YES
no	Keyboard is not locked
YES	Keyboard is locked

## 5.7 Overview of soft starter operation and parameter set-up.

Table with the possibilities to operate and set parameters in soft starter.

Control mode is selected in menu 006 and Parameter set is selected in menu 061. For the keyboard lock function, see § 7.30, page 65.

## 6. INSTALLATION AND CONNECTION

Mounting, wiring and setting the device into operation must be carried out by trained personnel (electricians specialised in heavy current technology):

- In accordance with the local safety regulations of the electricity supply company.
- In accordance with DIN VDE 0100 for setting up heavy current plants.

Care must be taken to ensure that personnel do not come into contact with live circuit components.



**WARNING! Never operate the soft starter with removed front cover.**

### 6.1 Installation of the soft starter in a cabinet

When installing the soft starter:

- Ensure that the cabinet will be sufficiently ventilated, after the installation.
- Keep the minimum free space, see the tables on page 25.
- Ensure that air can flow freely from the bottom to the top.

**NOTE! When installing the soft starter, make sure it does not come into contact with live components. The heat generated must be dispersed via the cooling fins to prevent damage to the thyristors (free circulation of air).**

MSF-017 to MSF-835 soft starters are all delivered as enclosed versions with front opening. The units have bottom entry for cables etc. see Fig. 25 on page 29 and Fig. 27 on page 31. MSF-1000 and MSF-1400 are delivered as open chassis.

**NOTE! The soft starter should be wired with shielded control cable to fulfill EMC regulations acc. to § 1.5, page 6.**

**NOTE! For UL-approval use 75°C Copper wire only.**

#### MSF-017 to MSF-250

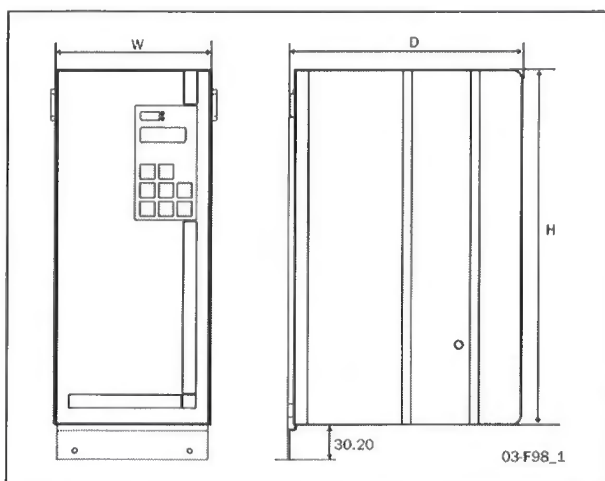


Fig. 16 MSF-017 to MSF-250 dimensions.

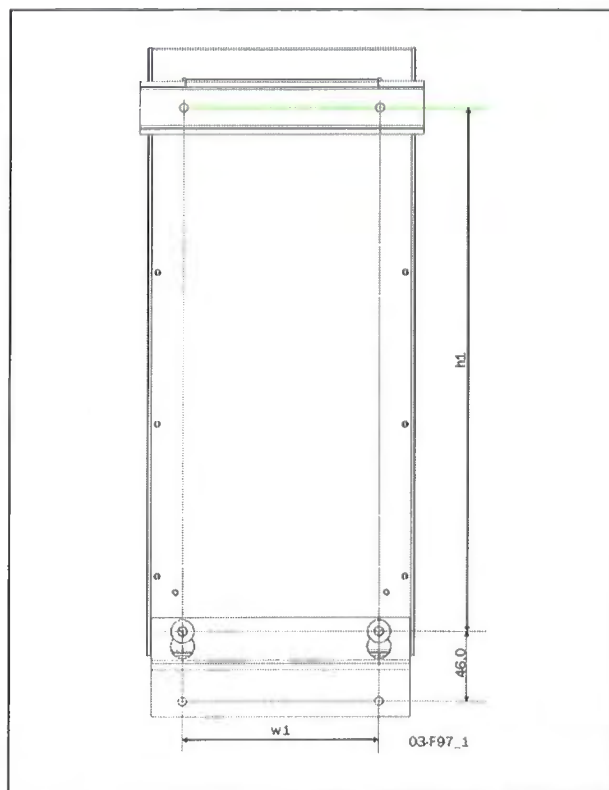


Fig. 17 Hole pattern for MSF-017 to MSF-250 (backside view).

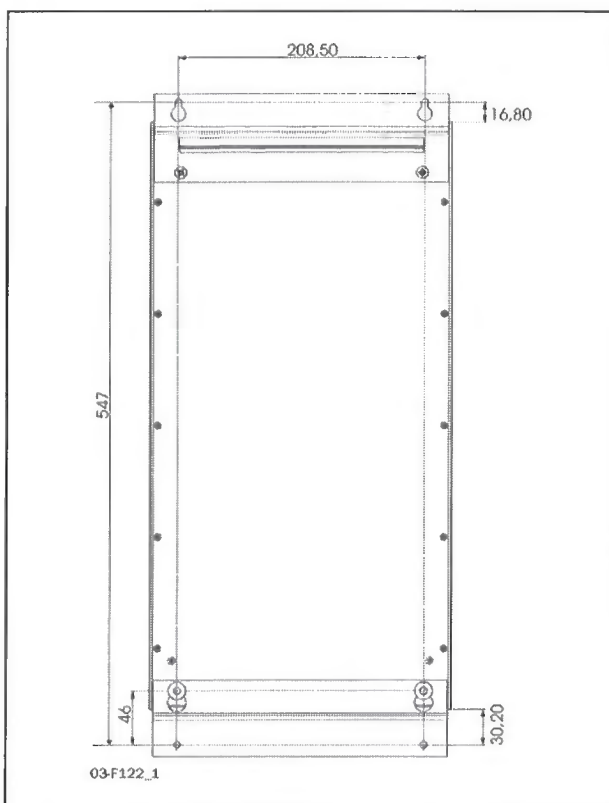


Fig. 18 Hole pattern for MSF-170 to MSF-250 with upper mounting bracket instead of DIN-rail.



**MSF-017 to MSF-250**

Table 7 MSF-017 to MSF-250.

MSF model	Class	Connection	Conv./ Fan	Dimension HxWxD (mm)	Hole dist. w1 (mm)	Hole dist. h1 (mm)	Diam./ screw	Weight (kg)
-017, -030	IP 20	Busbars	Convection	320x126x260	78.5	265	5.5/M5	6.7
-045, -060, -075, -085	IP 20	Busbars	Fan	320x126x260	78.5	265	5.5/M5	6.9
-110, -145	IP 20	Busbars	Fan	400x176x260	128.5	345	5.5/M5	12.0
-170, -210, -250	IP 20	Busbars	Fan	500x260x260	208.5	445	5.5/M5	20

Table 8 MSF-017 to MSF-250

MSF model	Minimum free space (mm):			Dimension Connection busbars Cu	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-017, -030, -045	100	100	0	15x4 (M6), PE (M6)	8	8	0.6
-060, -075, -085	100	100	0	15x4 (M8), PE (M6)	12	8	0.6
-110, -145	100	100	0	20x4 (M10), PE (M8)	20	12	0.6
-170, -210, -250	100	100	0	30x4 (M10), PE (M8)	20	12	0.6
1) Above: wall-soft starter or soft starter-soft starter							

**MSF-310 to MSF-1400**

Table 9 MSF-310 to MSF-1400 see Fig. 20 on page 26.

MSF model	Class	Connection	Conv./ Fan	Dimension HxWxD (mm)	Hole dist. w1 (mm)	Hole dist. h1 (mm)	Diam./ screw	Weight (kg)
-310	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	42
-370, -450	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	46
-570	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	64
-710	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	78
-835	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	80
-1000, -1400	IP00	Busbar	Fan	900x875x336	Fig. 23		8.5/M8	175

Table 10 MSF-310 to MSF-1400.

MSF model	Minimum free space (mm):			Dimension Connection, busbars Al	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-310, -370, -450	100	100	0	40x8 (M12)	50	12	0.6
-570, -710, -835	100	100	0	40x10 (M12)	50	12	0.6
-1000, -1400	100	100	100	75x10 (M12)	50	12	0.6
1) Above: Wall-soft starter or soft starter-soft starter							

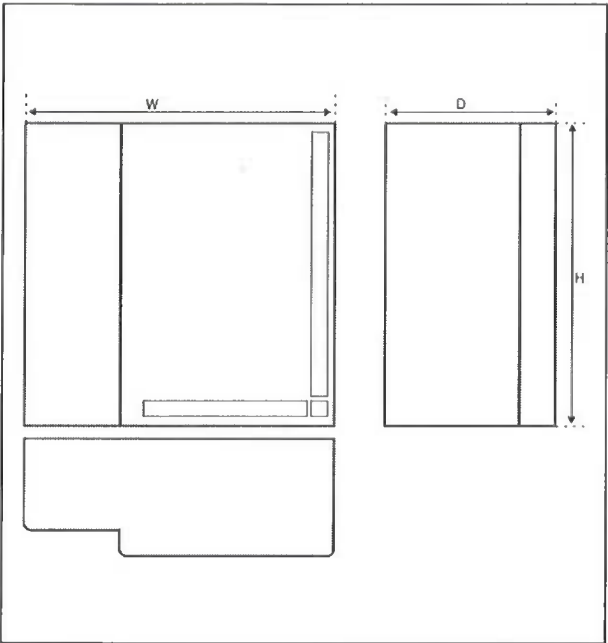


Fig. 19 MSF -310 to MSF -835.

MSF	e	f
-310 to -450	44	39
-570 to -835	45.5	39

Observe that the two supplied mounting hooks (see § 1.8, page 7 and Fig. 2 on page 7 must be used for mounting the soft starter as upper support (only MSF-310 to MSF-835).

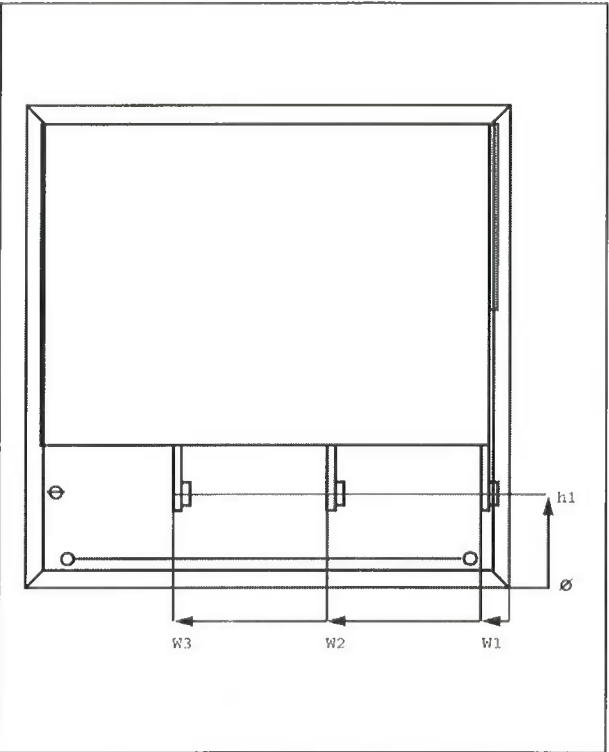


Fig. 21 Busbar distances MSF -310 to MSF -835.

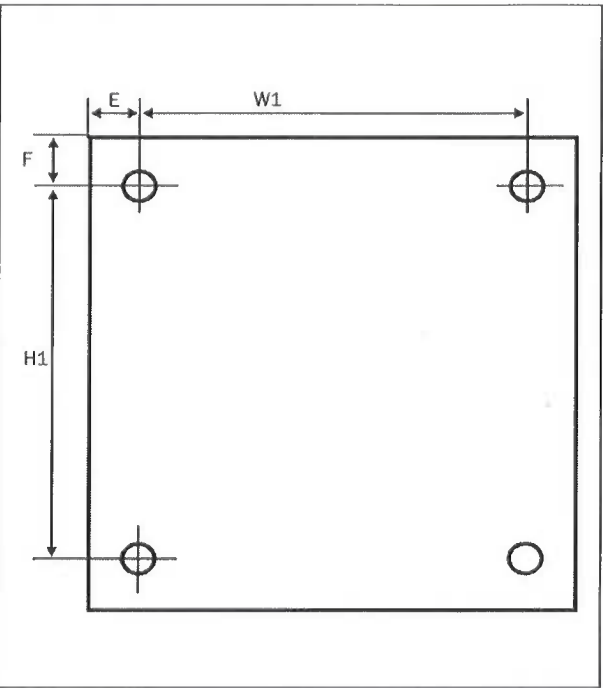


Fig. 20 Hole pattern for screw attachment, MSF-310 to MSF-835. Hole distance (mm).

Table 11 Busbar distances

MSF model	Dist. h1 (mm)	Dist. w1 (mm)	Dist. w2 (mm)	Dist. w3 (mm)
-310 to -450	104	33	206	379
-570 to -835	129	35	239.5	444
-1000 -1400		55	322.5	590.5

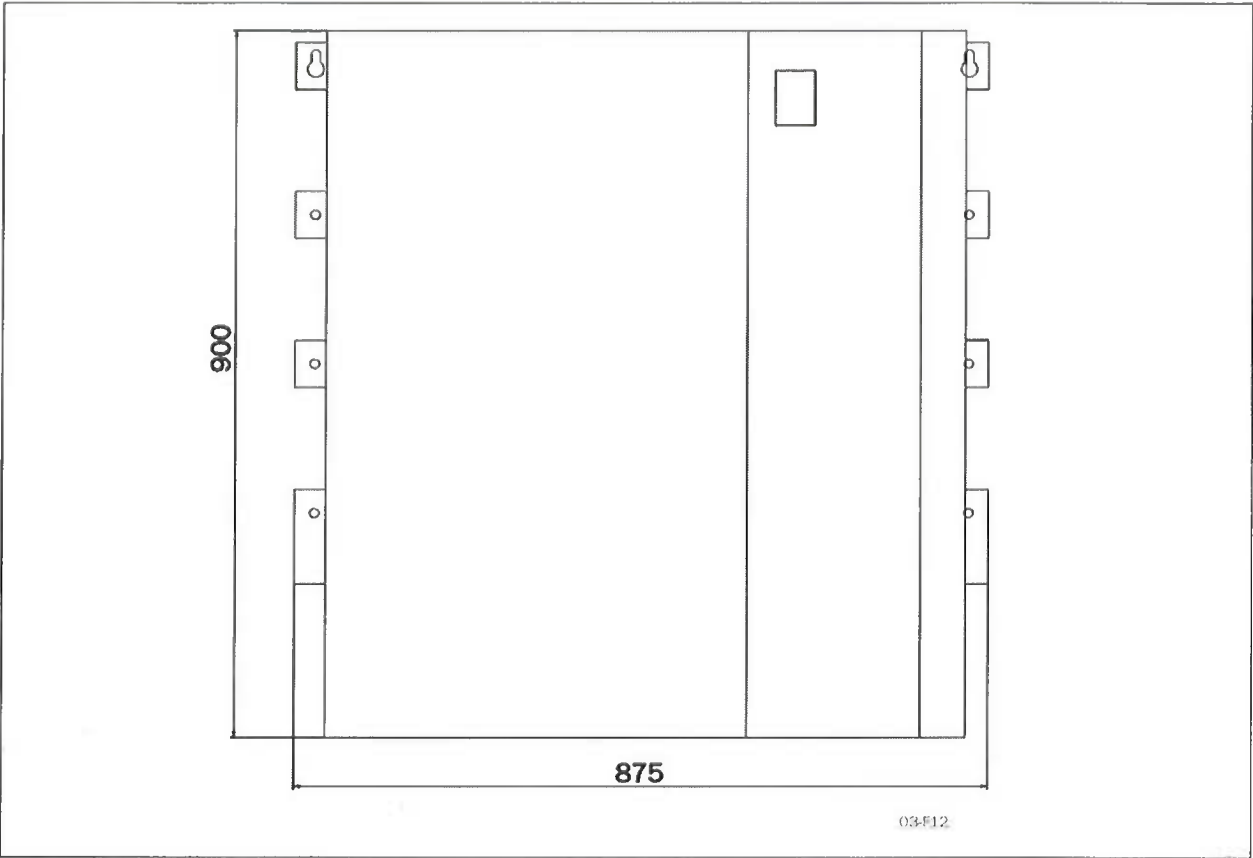


Fig. 22 MSF -1000 to -1400

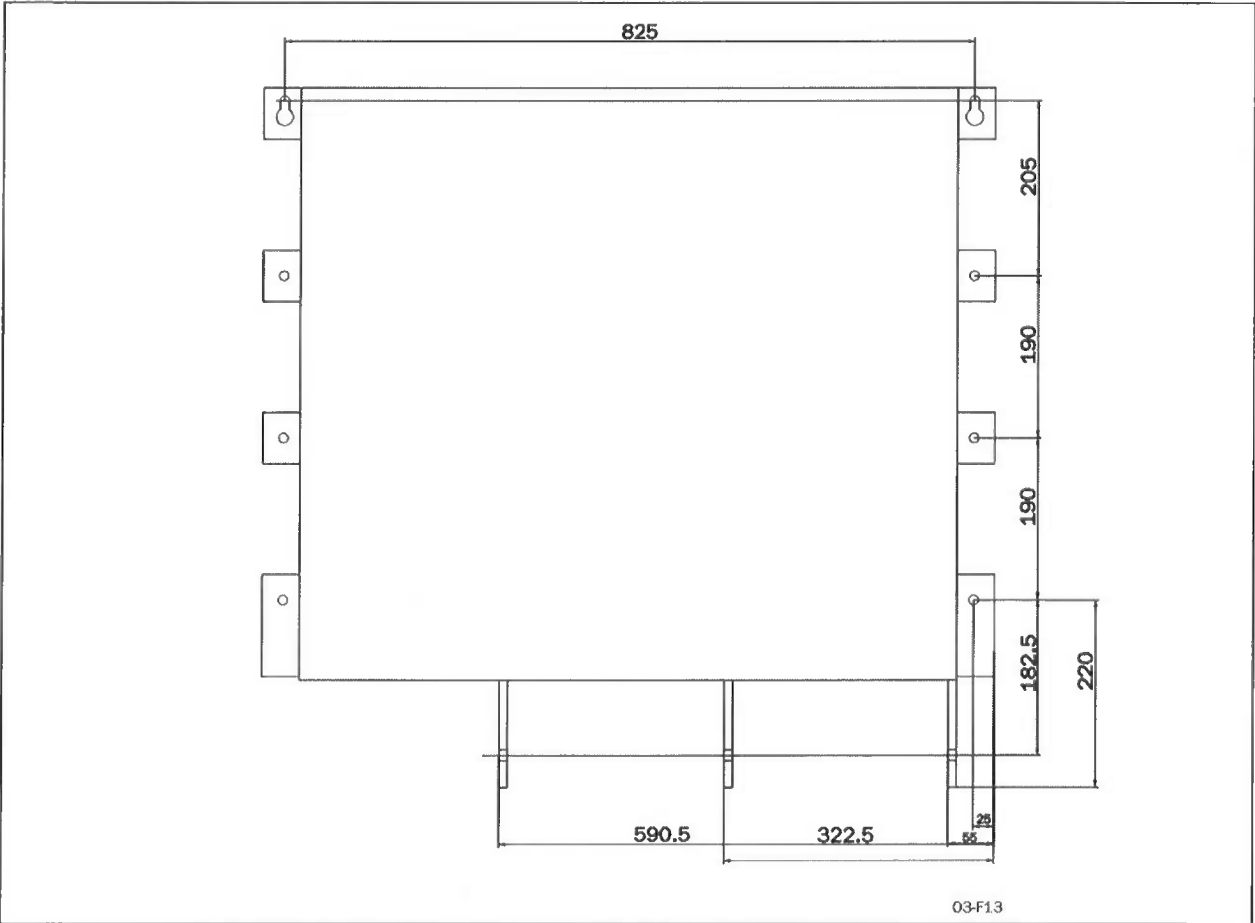


Fig. 23 Hole pattern busbar MSF -1000 to -1400.

## 6.2 Connections

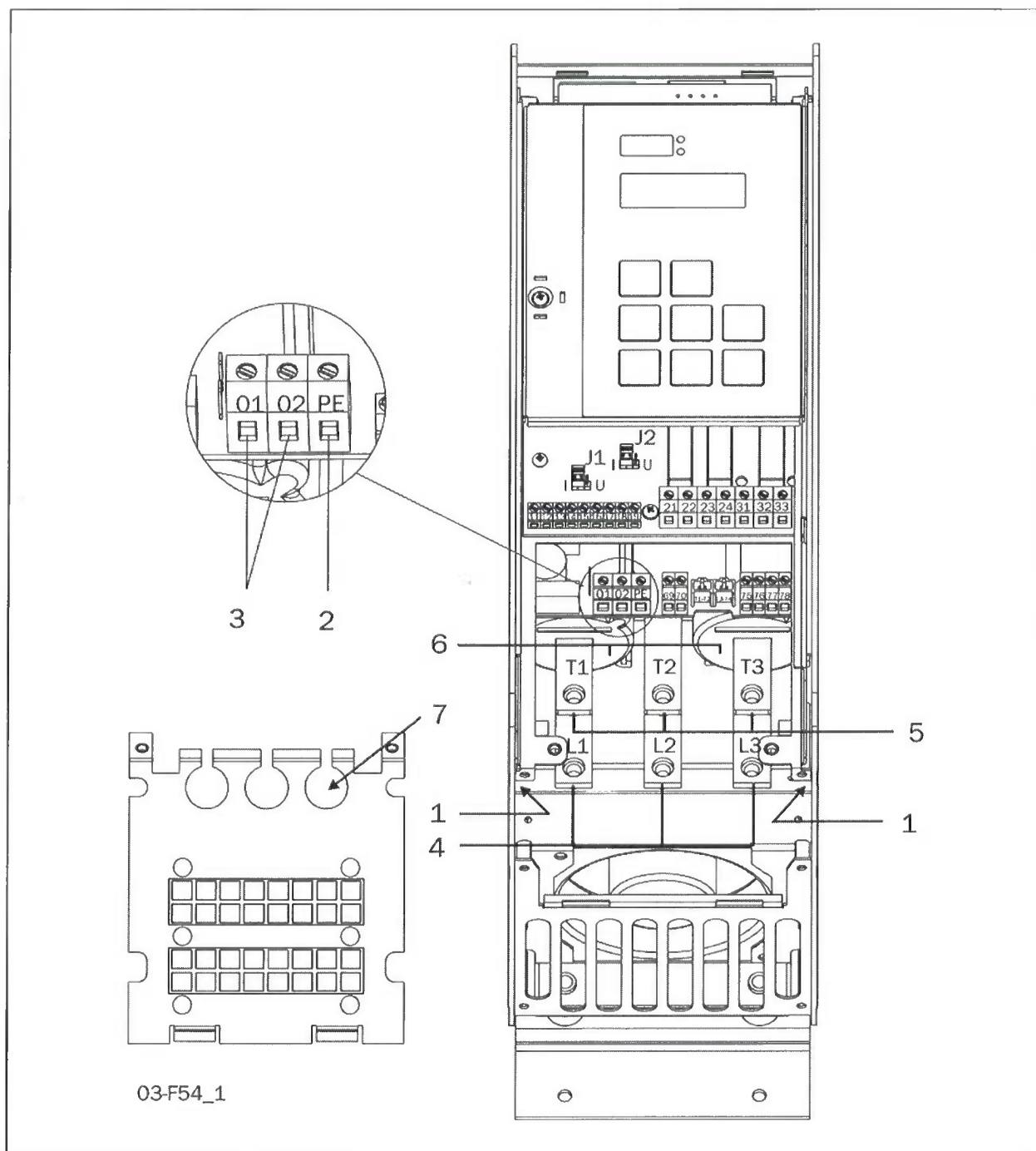


Fig. 24 Connection of MSF-017 to MSF-085.

### Connection of MSF-017 to MSF-085

#### Device connections

1. Protective earth,  $\perp$  (PE), Mains supply, Motor (on the right and left inside of the cabinet)
2. Protective earth,  $\perp$  (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables



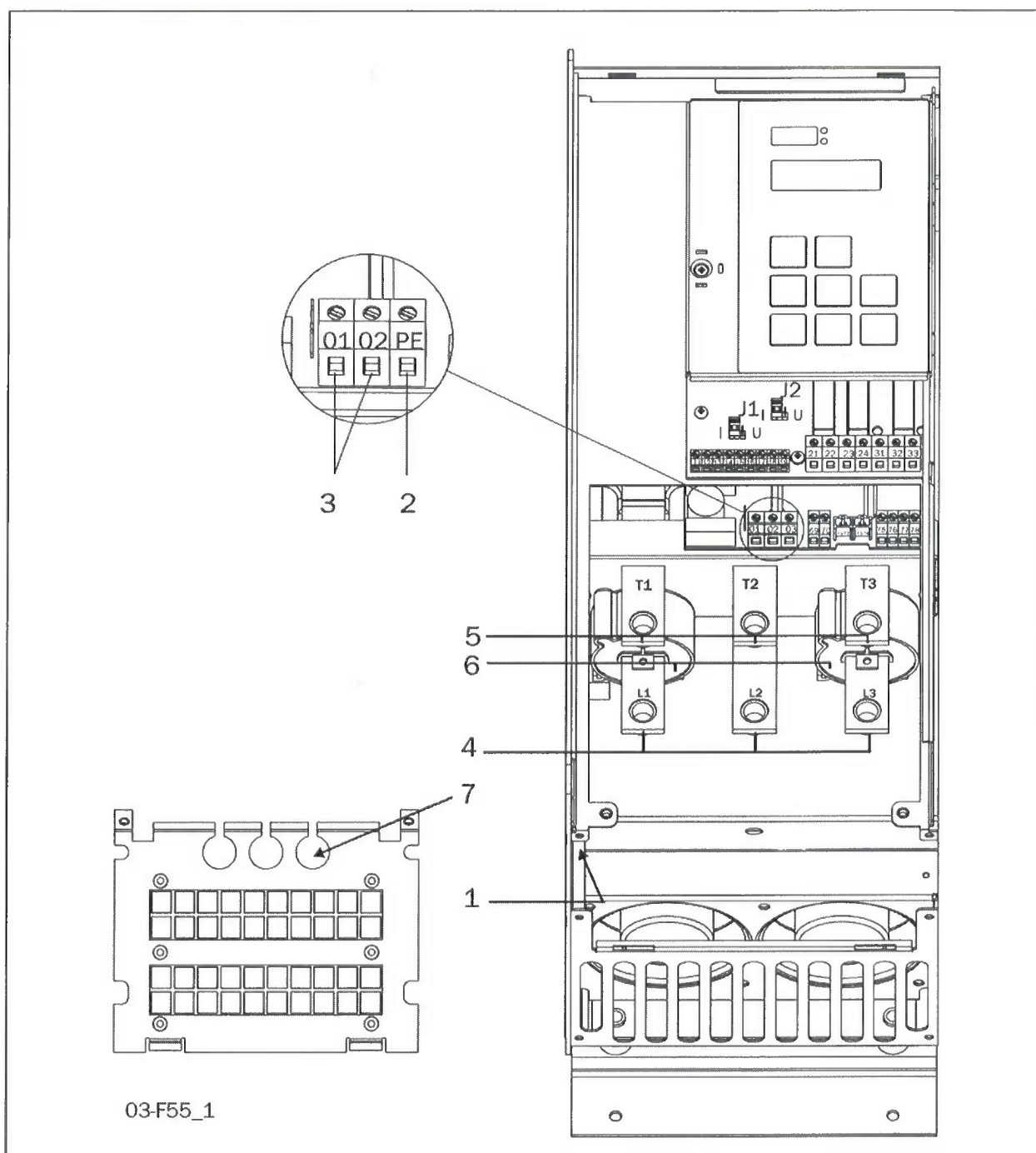


Fig. 25 Connection of MSF-110 to MSF-145.

## Connection of MSF-110 to MSF-145

### Device connections

1. Protective earth,  $\perp$  (PE), Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth  $\perp$  (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

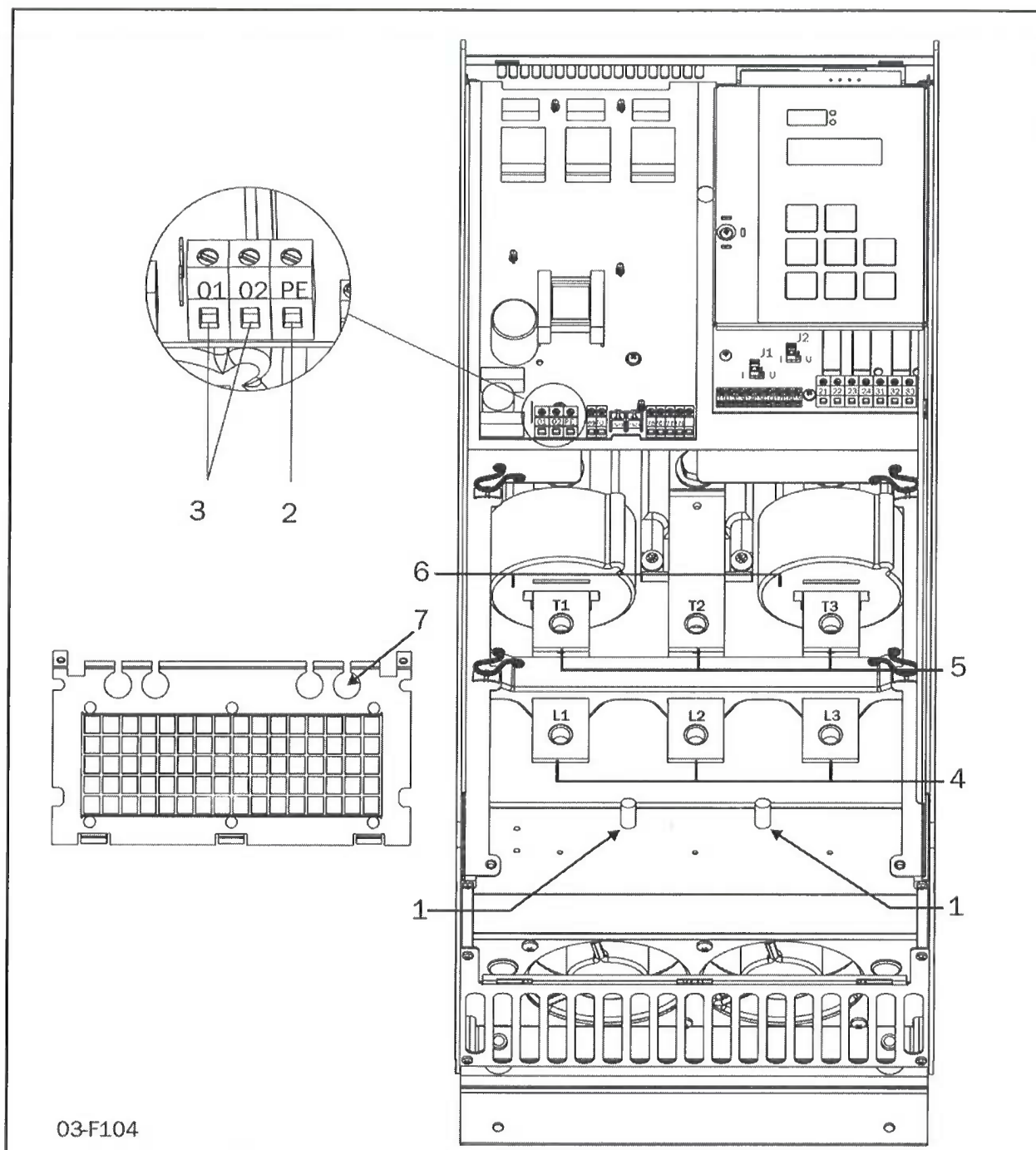


Fig. 26 Connection of MSF-170 to MSF-250

## Connection of MSF-170 to MSF-250

### Device connections

1. Protective earth,  $\perp$  (PE), Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth  $\perp$  (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

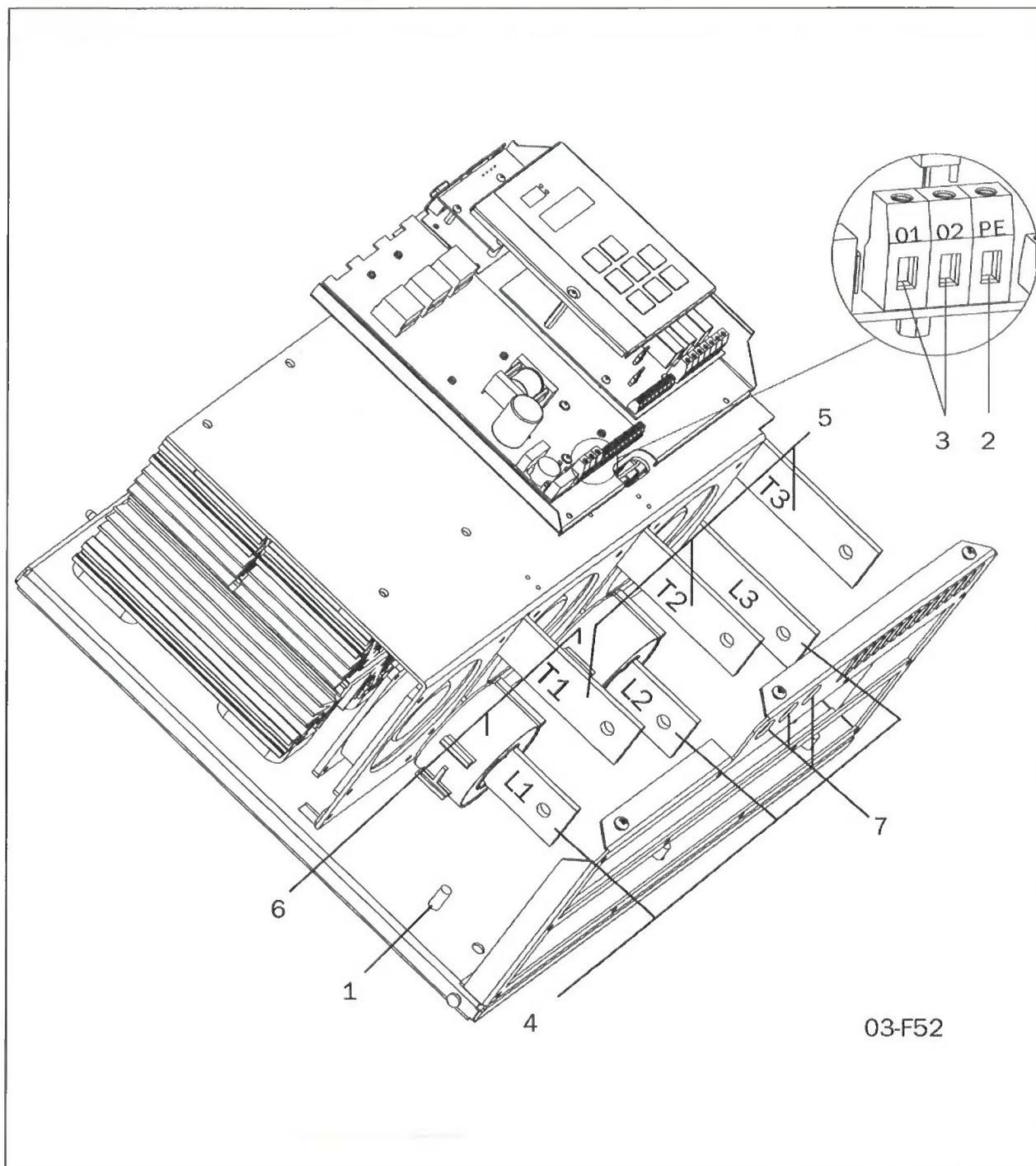


Fig. 27 Connection of MSF-170 to MSF-1400.

### Connection of MSF-310 to MSF-1400

#### Device connections

1. Protective earth,  $\perp$  (PE), Mains supply and Motor
2. Protective earth,  $\perp$  (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

### 6.3 Connection and setting on the PCB control card

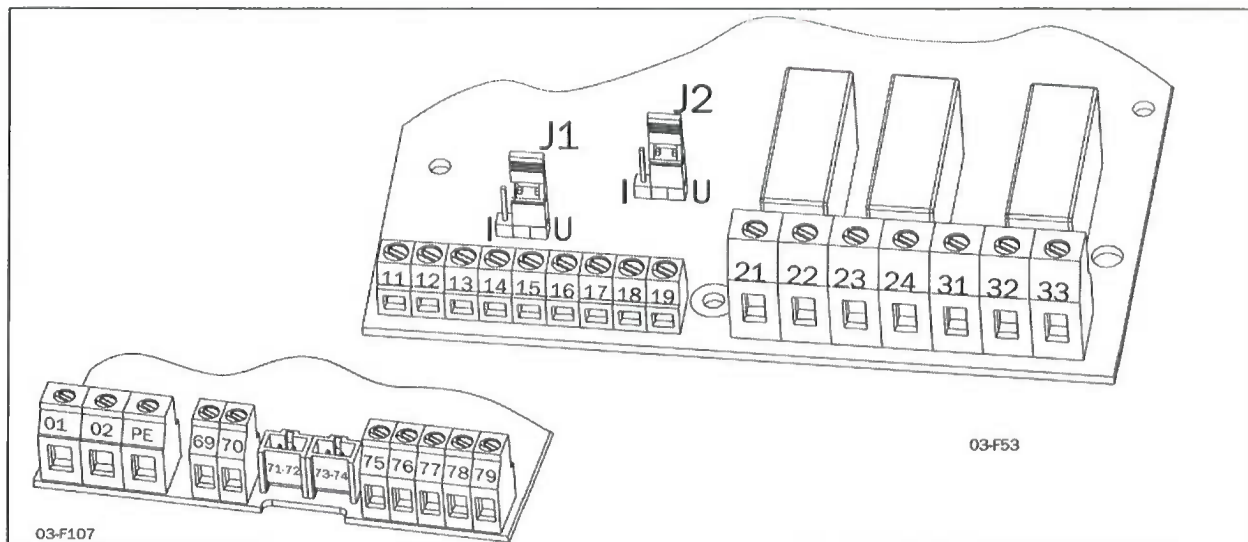


Fig. 28 Connections on the PCB, control card.

Table 12 PCB Terminals

Terminal	Function	Electrical characteristics
01	Supply voltage	100-240 VAC $\pm 10\%$ /380-500 VAC $\pm 10\%$
02		
PE	Gnd	$\perp$
11	Digital inputs for start/stop and reset.	0-3 V $\rightarrow$ 0; 8-27 V $\rightarrow$ 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 k $\Omega$ .
12		
13	Supply/control voltage to PCB terminal 11 and 12, 10 k $\Omega$ potentiometer, etc.	+12 VDC $\pm 5\%$ . Max. current from +12 VDC: 50mA. Short circuit proof.
14	Remote analogue input control, 0-10 V, 2-10 V, 0-20 mA and 4-20 mA/digital input.	Impedance to terminal 15 (0 VDC) voltage signal: 125 k $\Omega$ , current signal: 100 $\Omega$ .
15	GND (common)	0 VDC
16	Digital inputs for selection of parameter set.	0-3 V $\rightarrow$ 0; 8-27 V $\rightarrow$ 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 k $\Omega$ .
17		
18	Supply/control voltage to PCB terminal 16 and 17, 10 k $\Omega$ potentiometer, etc.	+12 VDC $\pm 5\%$ . Max. current from +12 VDC = 50mA. Short circuit proof.
19	Remote analogue output control	Analogue Output contact: 0-10V, 2-10V; min load impedance 700 $\Omega$ 0-20mA and 4-20mA; max load impedance 750 $\Omega$
21	Programmable relay K1. Factory setting is "Operation" indication by closing terminal 21 - 22.	1-pole closing contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
22		
23	Programmable relay K2. Factory setting is "Full voltage" indication by closing terminal 23-24.	1-pole closing contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
24		
31	Alarm relay K3, closed to 33 at alarm.	1-pole change over contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
32	Alarm relay K3, opened at alarm.	
33	Alarm relay K3, common terminal.	
69-70	PTC Thermistor input	Alarm level 2.4 k $\Omega$ Switch back level 2.2 k $\Omega$ .
71-72*	Clickson thermistor	Controlling soft starter cooling fine temperature MSF-310 - MSF-1400
73-74*	NTC thermistor	Temperature measuring of soft starter cooling fine
75	Current transformer input, cable S1 (blue)	Connection of L1 or T1 phase current transformer
76	Current transformer input, cable S1 (blue)	Connection of L3, T3 phase (MSF 017 - MSF 250) or L2, T2 phase (MSF 310 - MSF 1400)
77	Current transformer input, cable S2 (brown)	Common connection for terminal 75 and 76
78*	Fan connection	24 VDC
79*	Fan connection	0 VDC

\*Internal connection, no customer use.



## 6.4 Minimum wiring

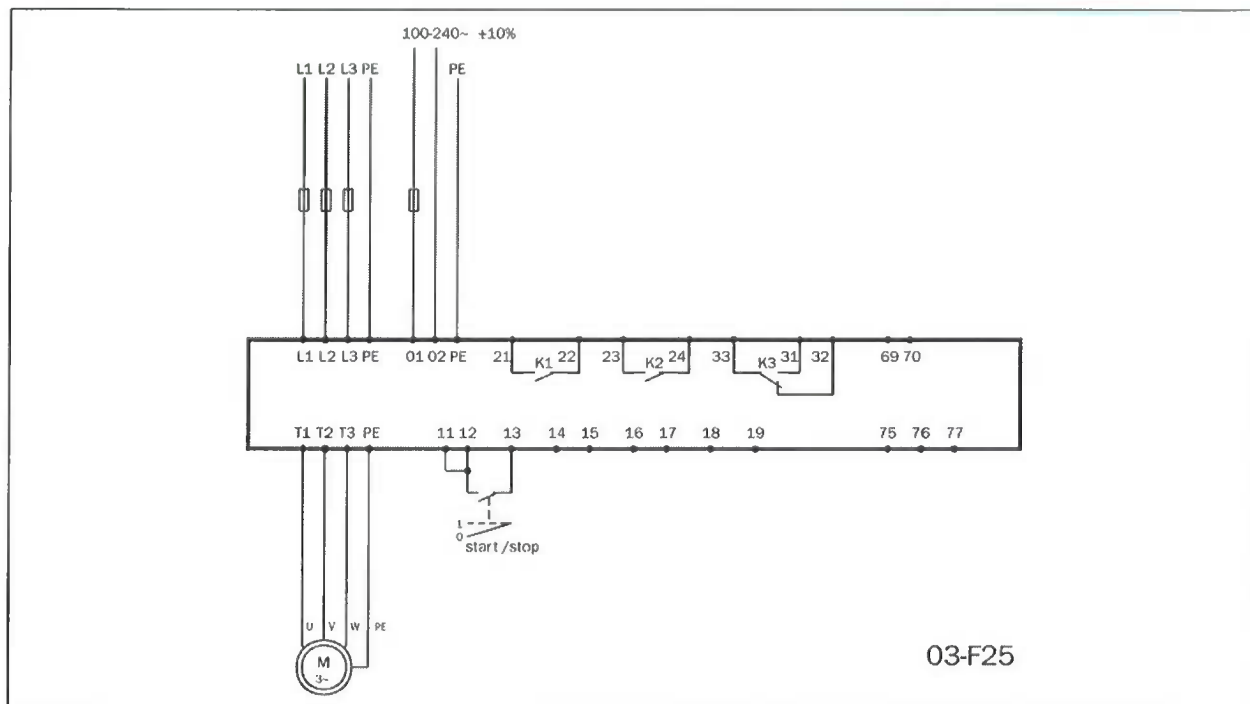


Fig. 29 Wiring circuit, "Minimum wiring".

The figure above shows the "minimum wiring". See § 6.1, page 24, for tightening torque for bolts etc.

1. Connect Protective Earth (PE) to earth screw marked  $\perp$  (PE).
2. Connect the soft starter between the 3-phase mains supply and the motor. On the soft starter the mains side is marked L1, L2 and L3 and the motor side with T1, T2 and T3.
3. Connect the control voltage (100-240 VAC) for the control card at terminal 01 and 02.
4. Connect relay K1 (terminals 21 and 22) to the control circuit.
5. Connect PCB terminal 12 and 13 (PCB terminal 11-12 must be linked) to, e.g. a 2-position switch (on/off) or a PLC, etc., to obtain control of soft start/stop. (For start/stop command from keyboard menu 006 must be set to 01).
6. Ensure the installation complies with the appropriate local regulations.

**NOTE!** The soft starter should be wired with shielded control cable to fulfill EMC regulations acc. to § 1.5, page 6.

**NOTE!** If local regulations say that a mains contactor should be used, the K1 then controls it. Always use standard commercial, slow blow fuses, e.g. type gI, gG to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if preferred. The normal guarantee is valid even if superfast semiconductor fuses are not used. All signal inputs and outputs are galvanically insulated from the mains supply.

## 6.5 Wiring examples

Fig. 30 gives an wiring example with the following functions.

- Analogue input control, see § 7.7, page 40
- Parameter set selection, see § 7.20, page 54
- Analogue output, see § 7.18, page 52
- PTC input, see § 7.21, page 55

For more information see § 6.3, page 32.

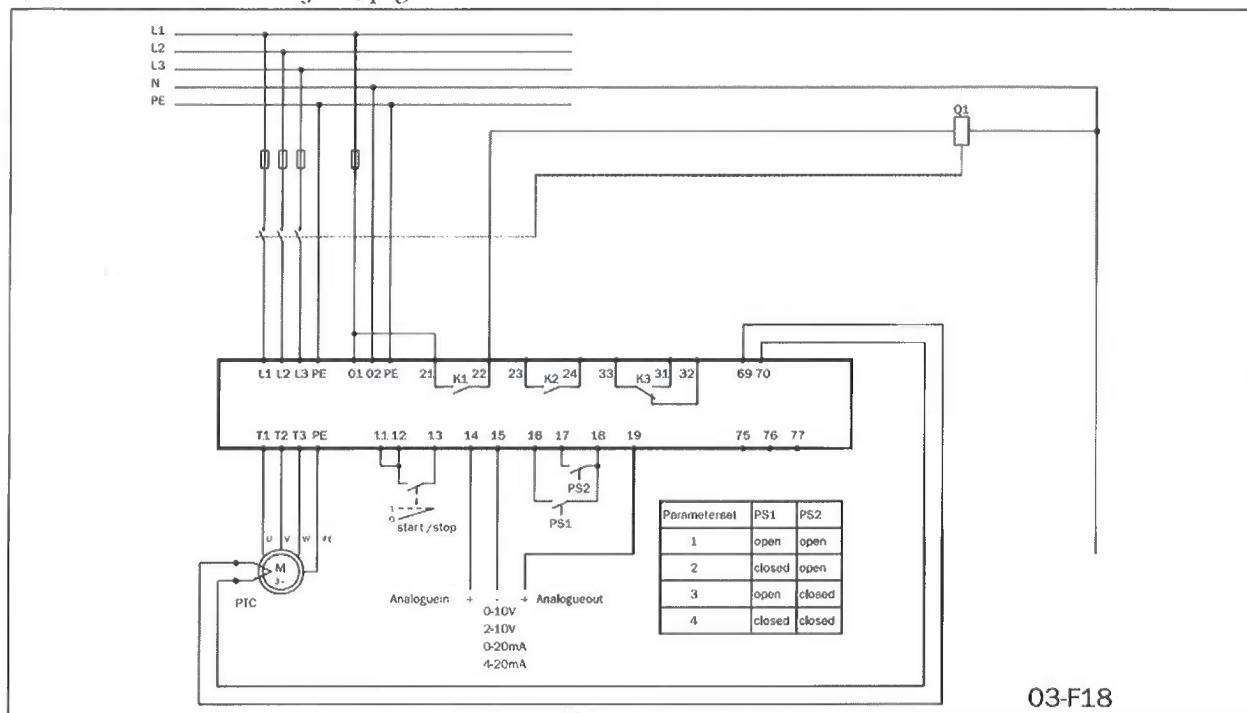


Fig. 30 Analogue input control, parameter set, analogue output and PTC input.

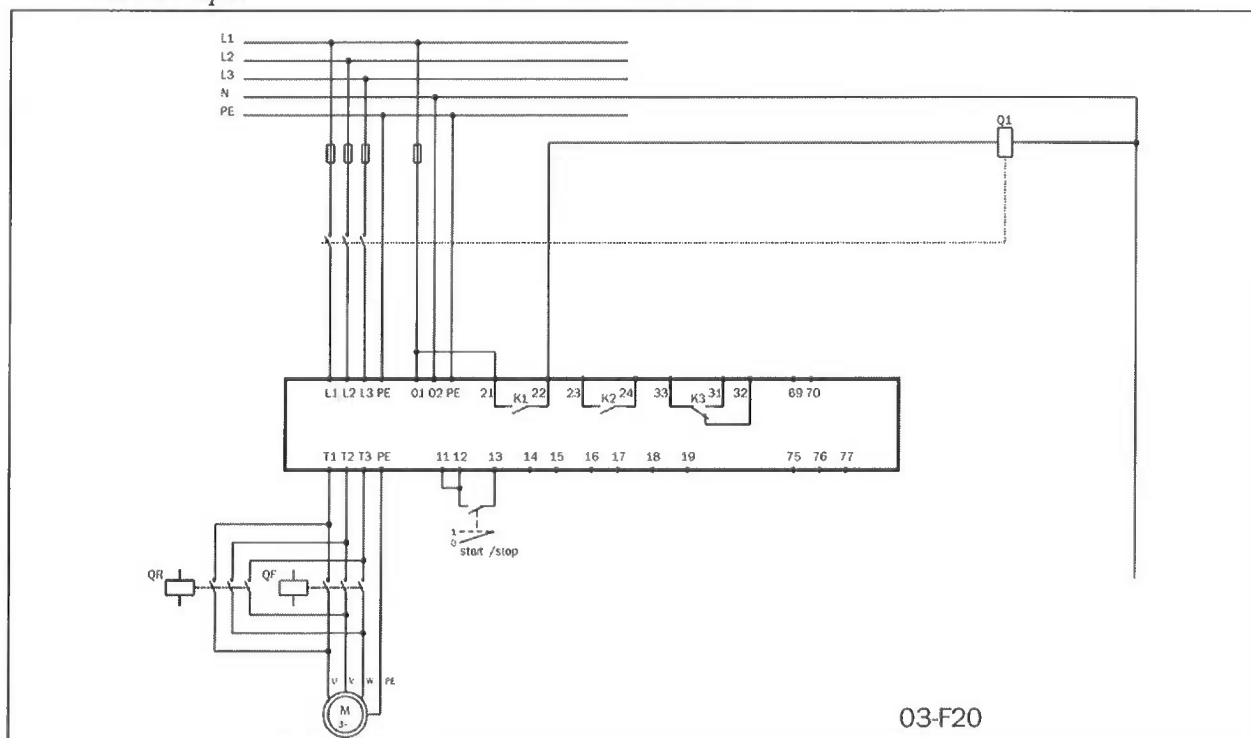


Fig. 31 Forward/reverse wiring circuit.

## 7. FUNCTIONAL DESCRIPTION SET-UP MENU

This chapter describes all the parameters and functions in numerical order as they appear in the MSE Table 13 gives an overview of the menus, see also Chapter 13, page 79 (set-up menu list).

Table 13 Set-up Menu overview

	Menu number	Parameter group		Menu numbers	See §
<b>Basic functions</b>	001-008	Basic	Ramp up/down parameters	001-005	7.1
			Start/Stop/Reset command	006	7.2
			Menu Expansion	007-008	7.3
<b>Extended functions</b>	011-199	Voltage control dual ramp		011-014	7.4
		Torque control parameters		016-018	7.5
		Main functions		020-025	7.6 - 7.10
		Additional functions		030-036	7.11 - 7.14
		Slow speed and Jog functions		037-040, 57-58, 103-104	7.15, 7.19, 7.25
		Motor Data Setting		041-046	7.16
		Outputs	Relays	051-052	7.17
			Analogue output	054-056	7.18
		Input	Digital input	057-058	7.19
		Parameter set selection		061	7.20
			Motor protection	071-075	7.21
			Main protection	081-088	7.22
			Application protection	089-099	7.23
			Resume alarms	101, 102	7.24
		Auto return menu		105	7.26
		Factory defaults		199	7.28
<b>View functions</b>	201-915	Main view		201-208	7.29
		RMS current per phase		211-213	7.29
		RMS voltage per phase		214-216	7.29
		Keyboard lock status		221	7.30
		Alarm list		901-915	7.31

## 7.1 Ramp up/down parameters

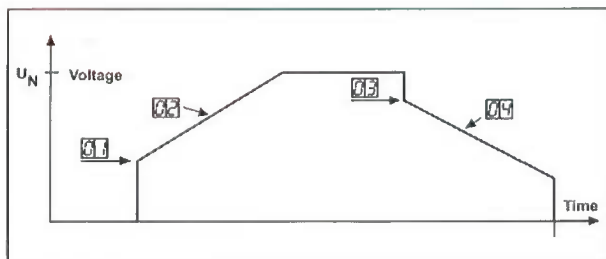


Fig. 32 Menu numbers for start/stop ramps, initial voltage at start and step down voltage at stop.

Determine the starting time for the motor/machine. When setting the ramp times for starting and stopping, initial voltage at start and step down voltage at stop, proceed as follow:

001 <sup>o</sup>			
Setting the initial voltage at start ramp 1			
		3	0
Default:	30%		
Range:	25 - 90% $U_n$		
Set the initial voltage. Normally the factory setting, 30% of $U_n$ , is a suitable choice.			

002 <sup>o</sup>			
Setting of start ramp 1			
		1	0
Default:	10 sec		
Range:	1-60 sec		
Set "Ramp up time" at start.			

003 <sup>o</sup>			
Setting of step down voltage stop ramp 1			
	1	0	0
Default:	100%		
Range:	100-40% of $U_n$		
Step down voltage at stop can be used to stop smoothly.			

004 <sup>o</sup>			
Setting of stop ramp 1			
		o	F F
Default:	oFF		
Range:	oFF, 2-120 sec		
oFF	Stop ramp disabled		
2-120	Set "Ramp down time" at stop		

### 7.1.1 RMS current [005]

005 <sup>o</sup>			
RMS current			
		0.	0
Default:	----		
Range:	0.0-9999Amp		
Read-out of the RMS motor current.			

**NOTE!** This is the same read-out as function 201, see § 7.28, page 63.



## 7.2 Start/stop/reset command

Start/stop of the motor and reset of alarm is done either from the keyboard, through the remote control inputs or through the serial interface (option). The remote control inputs start/stop/reset (PCB terminals 11, 12 and 13) can be connected for 2-wire or 3-wire control.

<div>006<sup>0</sup></div> <div> <div></div> <div></div> <div></div> <div>2</div> </div>		<b>Selection of control mode</b>	
Default:		2	
Range:		1,2,3	
1		START/STOP/RESET command via the keyboard. - Press the "START/STOP" key on the keyboard to start and stop the soft starter. - Press "ENTER/RESET" key to reset a trip condition.	
2		Via Remote control. START/STOP/RESET commands. The following control methods are possible: - 2-wire start/stop with automatic reset, see § 7.2.1, page 37. - 2-wire start/stop with separate reset, see § 7.2.2, page 37. - 3-wire start/stop with automatic reset at start, see § 7.2.3, page 37.  <b>WARNING! The motor will start if terminals 11, 12, 13 is in start position.</b>	
3		START/STOP/RESET commands via serial interface option. Read the operating instruction supplied with this option.	

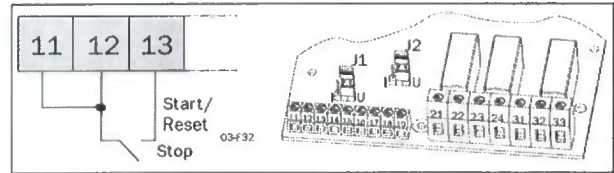
**NOTE! A reset via the keyboard will not start or stop the motor.**

**NOTE! Factory default setting is 2, remote control.**

To start and stop from the keyboard, the "START/STOP" key is used.

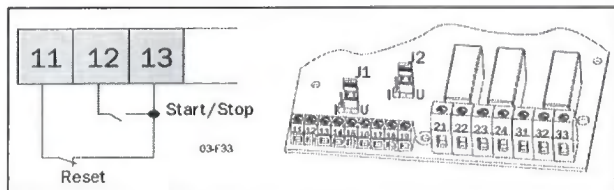
To reset from the keyboard, the "ENTER / RESET" key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset from the keyboard will not start or stop the motor.

### 7.2.1 2-wire start/stop with automatic reset at start



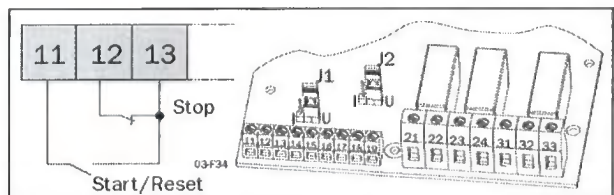
Closing PCB terminals 12 and 13, and a jumper between terminal 11 and 12, will give a start command. Opening the terminals will give a stop. If PCB terminals 12 and 13 is closed at power up a start command is given (automatic start at power up). When a start command is given there will automatically be a reset.

### 7.2.2 2-wire start/stop with separate reset



Closing PCB terminals 11, 12 and 13 will give a start and opening the terminals 12 and 13 will give a stop. If PCB terminals 12 and 13 are closed at power up a start command is given (automatic start at power up). When PCB terminals 11 and 13 are opened and closed again a reset is given. A reset can be given both when the motor is running and stopped and doesn't affect the start/stop.

### 7.2.3 3-wire start/stop with automatic reset at start.



PCB terminal 12 and 13 are normally closed and PCB terminal 11 and 13 are normally open. A start command is given by momentarily closing PCB terminal 11 and 13. To stop, PCB terminal 12 and 13 are momentarily opened.

When a start command is given there will automatically be a reset. There will not be an automatic start at power up.

### 7.3 Menu expansion setting.

In order to use the viewing menus and/or the extended functions menu 007 must be set to "On", then one reach read out of the viewing menus 201-915. To be able to set any extended functions in the menus 011-199 menu 008 must be set to "on" as well.

007 <sup>o</sup>	
<div> <div>o</div> <div>F</div> <div>F</div> </div>	
<b>Selecting of extended functions and viewing functions</b>	
Default:	oFF
Range:	oFF, on
<b>oFF</b>	Only function 1-7 are visible
<b>on</b>	<ul style="list-style-type: none"> <li>- View functions 201-915 are visible</li> <li>- Extended functions (menu 008) selectable</li> </ul>

008 <sup>o</sup>	
<div> <div>o</div> <div>F</div> <div>F</div> </div>	
<b>Selecting of extended functions</b>	
Default:	oFF
Range:	oFF, on
<b>oFF</b>	Only view function 201-915 are visible.
<b>on</b>	All the function menus are visible

**NOTE!** Menu 007 must be "on".

### 7.4 Voltage control dual ramp

To achieve even smoother ramps at start and or stop, a dual ramp can be used.

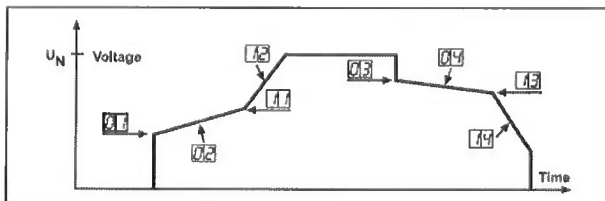


Fig. 33 Menu numbers for dual voltage ramp at start/stop, initial voltage at start and step down-voltage at stop.

The settings are carried out by beginning with the settings in menus 001-004 and 007-008 and proceed with the following steps:

011 <sup>o</sup>	
<div> <div>9</div> <div>0</div> </div>	
<b>Setting the Initial voltage at start ramp 2</b>	
Default:	90%
Range:	30-90% $U_n$
Set the start voltage for start ramp 2. The initial voltage for start ramp 2 is limited to the initial voltage at start (menu 001), see § 7.1, page 36.	

012 <sup>o</sup>	
<div> <div>o</div> <div>F</div> <div>F</div> </div>	
<b>Setting of start ramp 2</b>	
Default:	oFF
Range:	oFF, 1-60 sec
<b>oFF</b>	Start ramp 2 disabled
<b>1-60</b>	Set the start ramp 2 time. A dual voltage ramp is active.

013 <sup>o</sup>	
<div> <div>4</div> <div>0</div> </div>	
<b>Setting of step down voltage in stop ramp 2</b>	
Default:	40%
Range:	100-40% $U_n$
Set the step down voltage for stop ramp 2. The step down voltage for stop ramp 2 is limited to the step down voltage at stop (menu 003).	

014 <sup>o</sup>	
<div> <div>o</div> <div>F</div> <div>F</div> </div>	
<b>Setting of stop ramp time 2</b>	
Default:	oFF
Range:	oFF, 2-120 sec
<b>oFF</b>	Stop ramp 2 disabled
<b>1-60</b>	Set the stop ramp 2 time. A dual voltage stop ramp is active.

## 7.5 Torque control parameters

See also § 7.10, page 42 and chapter 4, page 13 for more information on the Torque control setting.

016°				Initial torque at start
		1	0	
Default:	10			
Range:	0 - 250% of T <sub>n</sub>			
Insert initial torque at start in percent of nominal shaft torque (T <sub>n</sub> ), see chapter 13, page 79.				

017°				End torque at start
	1	5	0	
Default:	150			
Range:	50 - 250% of T <sub>n</sub>			
Insert end torque at start in percent of nominal shaft torque.				

018°				End torque at stop
			0	
Default:	0			
Range:	0 - 100% of T <sub>n</sub>			
Insert end torque at stop in percent of the nominal motor torque.				

## 7.6 Current limit (Main Function)

The Current Limit function is used to limit the current drawn when starting (150 - 500% of I<sub>n</sub>). This means that current limit is only achieved during set start-up time.

Two kinds of current limit starts are available.

- **Voltage ramp with a limited current.**  
If current is below set current limit, this start will act exactly as a voltage ramp start.
- **Current limit start.**  
The soft starter will control the current up to set current limit immediately at start, and keep it there until the start is completed or the set start-up time expires.

See Fig. 34 Current limit.

**NOTE! Make sure that nominal motor current in menu 042 is correctly inserted.**

### 7.6.1 Voltage ramp with current limit

The settings are carried out in three steps:

1. Estimate starting-time for the motor/machine and select that time in menu 002 (see § 7.1, page 36).
2. Estimate the initial voltage and select this voltage in menu 001 (see § 7.1, page 36).
3. Set the current limit to a suitable value e.g. 300% of I<sub>n</sub> in menu 020.

020°				Voltage ramp with current limit at start
	o	F	F	
Default:	oFF			
Range:	oFF, 150 - 500% I <sub>n</sub>			
<b>oFF</b>	Voltage Ramp mode with current limit disabled. Voltage Ramp enabled.			
<b>150-500</b>	Current limit level in Voltage ramp mode.			

**NOTE! Only possible when Voltage Ramp mode is enabled. Menus 021-025 must be "oFF".**

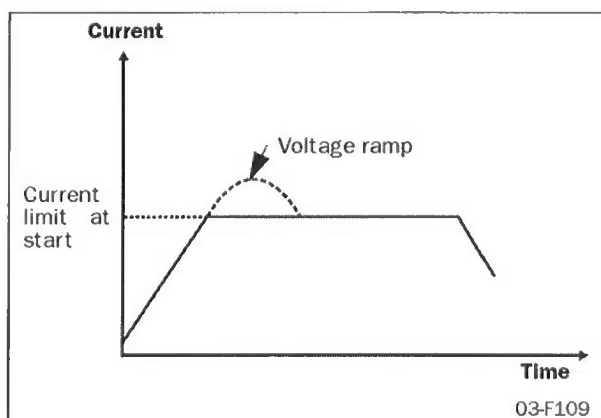


Fig. 34 Current limit

### 7.6.2 Current limit

The settings are carried out in two steps:

1. Estimate starting time for the motor/machine and select that time in menu 002 (see § 7.1, page 36).
2. Set the current limit to a suitable value e.g. 300% of In in menu 021.

021 <sup>o</sup>	
Current limit at start	
o F F	
Default:	oFF
Range:	oFF, 150 - 500% In
oFF	Current limit mode disabled. Voltage Ramp enabled.
150-500	Current limit level in current limit mode.

**NOTE!** Only possible when Voltage Ramp mode is enabled. Menus 020, 022-025 must be "oFF".

**NOTE!** Even though the current limit can be set as low as 150% of the nominal motor current value, this minimum value cannot be used generally. Considerations must be given to the starting torque and the motor before setting the appropriate current limit. "Real start time" can be longer or shorter than the set values depending on the load conditions. This applies to both current limit methods.

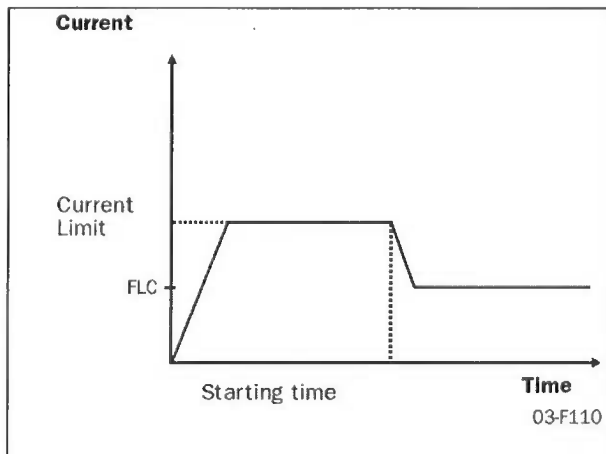


Fig. 35 Current limit

If the starting time is exceeded and the soft starter is still operating at current level, an alarm will be activated. It is possible to let the soft starter to either stop operation or to continue. Note that the current will rise uncontrolled if the operation continues (see § 7.24.2, page 61).

### 7.7 Pump control (Main Function)

By choosing pump control you will automatically get a stop ramp set to 15 sec. The optimising parameters for this main function are start and stop time; initial torque at start and end torque at start and stop. End torque at stop is used to let go of the pump when it's no longer producing pressure/flow, which can vary on different pumps. See Fig. 36.

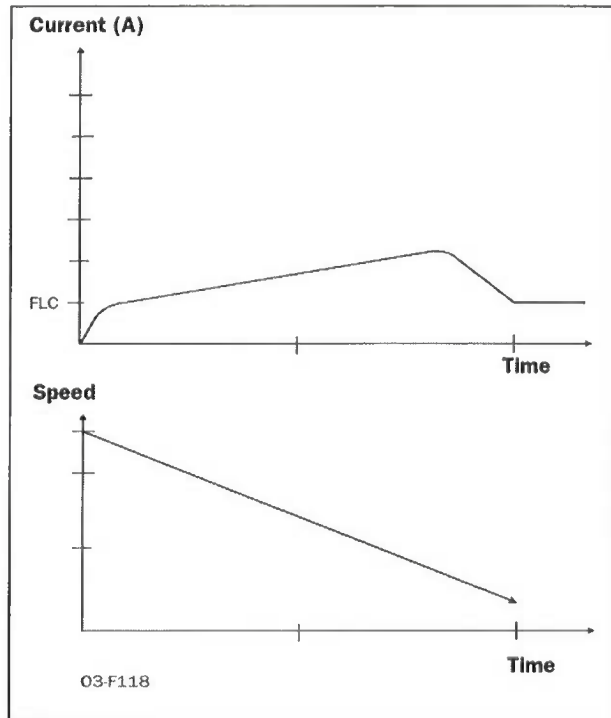


Fig. 36 Pump control

#### Pump application

The pump application is using Torque ramps for quadratic load. This gives lowest possible current and linear start and stop ramps. Related menus are 2, 4 (see § 7.1, page 36), 16, 17 and 18 (see § 7.5, page 39).

022 <sup>o</sup>	
Setting of pump control	
o F F	
Default:	oFF
Range:	oFF, on
oFF	Pump control disabled. Voltage Ramp enabled.
on	Pump control application is enabled.

**NOTE!** Only possible when Voltage Ramp mode is enabled. Menu 020-021, 023-025 must be "oFF".



## 7.8 Analogue Input Control (Main Function)

Soft starting and soft stopping can also be controlled via the Analogue Input Control (0-10 V, 2-10 V, 0-20 mA and 4-20 mA). This control makes it possible to connect optional ramp generators or regulators.

After the start command, the motor voltage is controlled through the remote analogue input.



**WARNING!** The remote analogue control may not be used for continuous speed regulation of standard motors. With this type of operation the increase in the temperature of the motor must be taken into consideration.

To install the analogue input control, proceed by:

1. Connect the ramp generator or regulator to terminal 14 (+) and 15 (-).

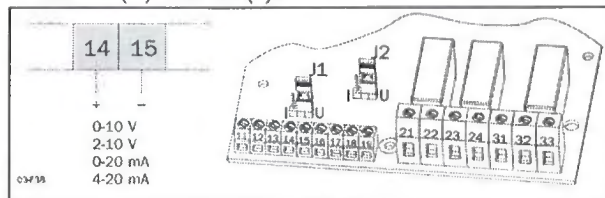


Fig. 37 Wiring for analogue input.

2. Set Jumper J1 on the PCB control card to voltage (U) or current control (I) signal position, see Fig. 38 and Fig. 24 on page 28. Factory setting is voltage (U).

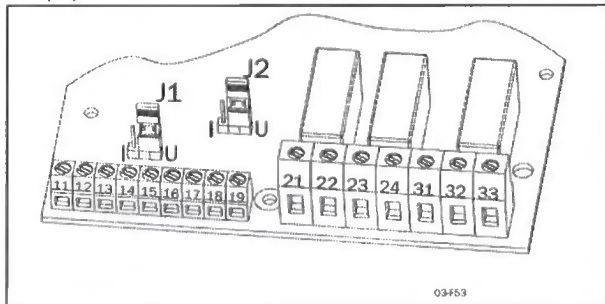


Fig. 38 Setting voltage or current for analogue input.

023 <sup>o</sup>			
o F F			
Selection of Analogue Input control			
Default:	oFF		
Range:	oFF, 1, 2		
oFF	Analogue input disabled. Voltage Ramp enabled.		
1	Analogue input is set for 0-10V/ 0-20mA control signal		
2	Analogue input is set for 2-10V/ 4-20mA control signal.		

**NOTE!** Only possible when Voltage Ramp mode is enabled. Menu 020-022, 024, 025 must be "oFF"

## 7.9 Full voltage start, D.O.L. (Main Function)

The motor can be accelerated as if it was connected directly to the mains. For this type of operation:

Check whether the motor can accelerate the required load (D.O.L.-start, Direct On Line start). This function can be used even with shorted thyristors.

024 <sup>o</sup>			
o F F			
Setting of D.O.L. start			
Default:	oFF		
Range:	oFF, on		
oFF	D.O.L. start disabled. Voltage Ramp enabled.		
on	D.O.L. start enabled		

**NOTE!** Only possible when Voltage Ramp mode is enabled. Menu 020-023, 025 must be "oFF".

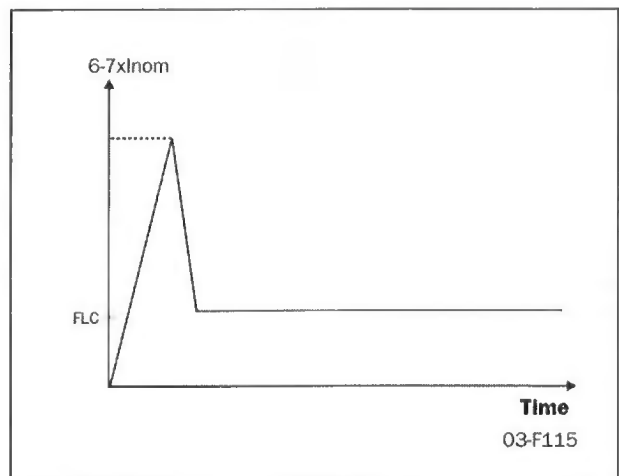


Fig. 39 Full voltage start.

## 7.10 Torque control (Main function)

This main function can be used to make a start according to a pre-defined torque reference curve. Two different load characteristics, linear and square, are possible to select.

At start/stop the torque controller will follow the selected characteristic.

A torque start/stop behaviour can be seen in Fig. 40.

A perfect start and stop with torque ramps have a good linearity of current. To optimise this, use the setting of initial torque (menu 16) and end torque (menu 18). See also § 7.5, page 39.

### Example:

Default for initial torque is 10% so if starting a more heavy load this will result in a small current peak in beginning of ramp. By increasing this value to 30/70% the current peak will not appear.

The end torque is increased mainly if the application has a high inertial load, like planers, saws and centrifuges. A current peak will appear in the end of ramp because the load is pushing the speed more or less by itself. By increasing this level to 150-250% the current will be linear and low.

025 <sup>0</sup>	
Torque control at start/stop	
OFF	
Default:	oFF
Range:	oFF, 1, 2
oFF	Torque control is disabled Voltage Ramp enabled.
1	Torque control with linear torque characteristic
2	Torque control with square torque characteristic

**NOTE!** Torque control mode is only possible when Voltage Ramp mode is enabled (menu 020-024 are "oFF").

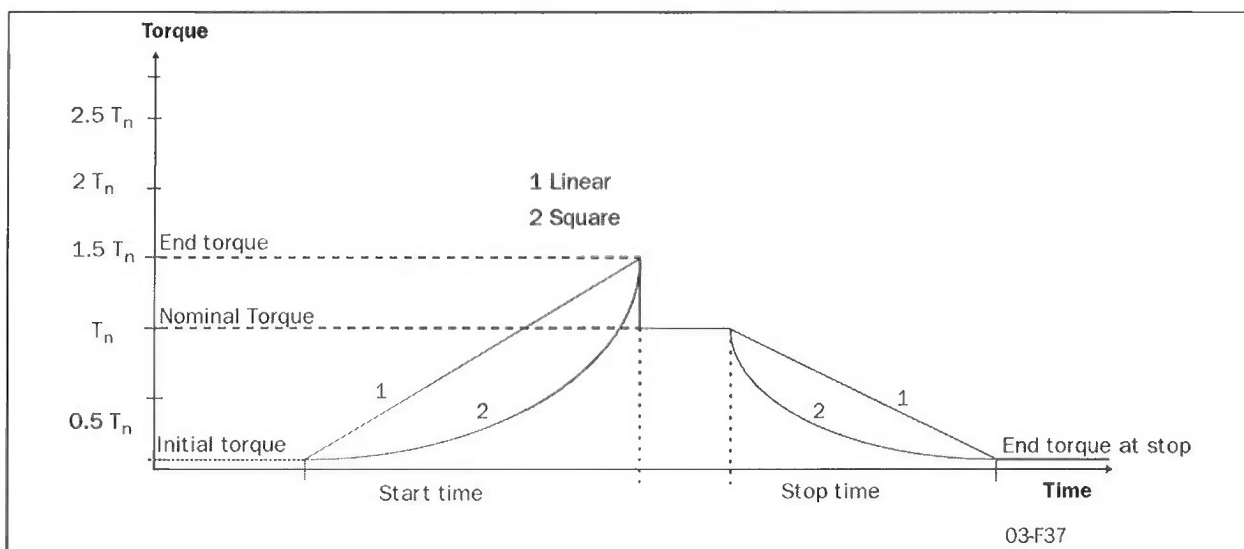


Fig. 40 Torque control at start/stop.

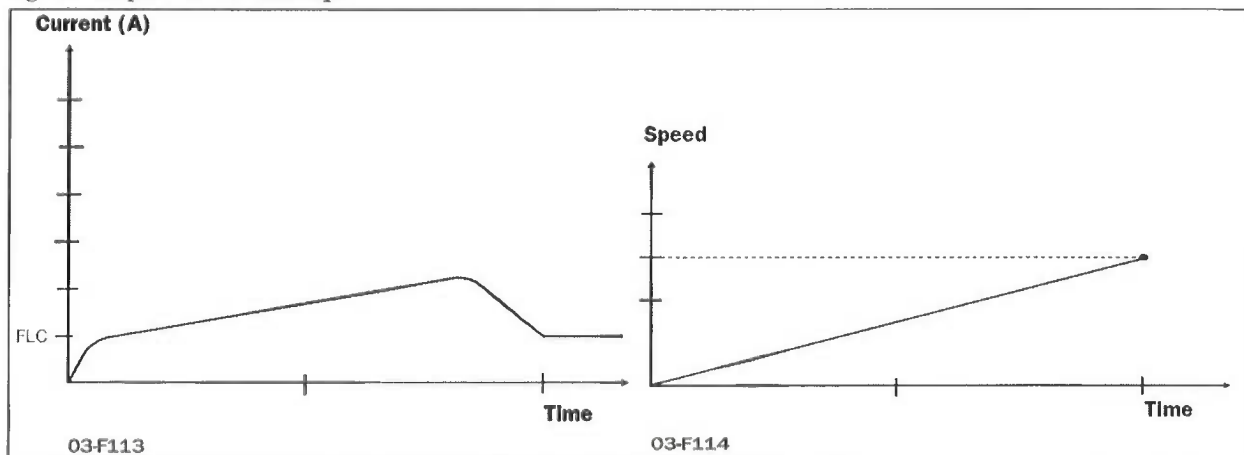


Fig. 41 Current and speed in torque control.

## 7.11 Torque boost

The Torque Booster enables a high torque to be obtained by providing a high current during 0.1 – 2 sec at start. This enables a soft start of the motor even if the break away torque is high at start. For example in crushing mills applications etc.

When the torque booster function has finished, starting continues according to the selected start mode.

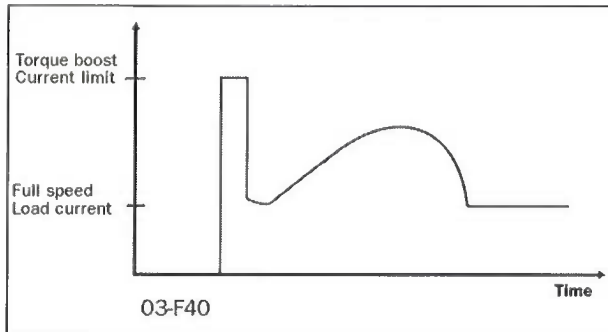


Fig. 42 The principle of the Torque Booster when starting the motor in voltage ramp mode.

See § 4.6, page 19, which main function that can be used with the torque boost.

030 <sup>o</sup>			
Torque boost active time			
o F F			
Default:	oFF		
Range:	oFF, 0.1 - 2 sec		
oFF	Torque boost disabled		
0.1-2.0	Set the Torque boost time.		

031 <sup>o</sup>			
Torque boost current limit			
3 0 0			
Default:	300		
Range:	300 - 700% of I <sub>n</sub>		
The Torque boost current controller use selected value as the motor current reference.			

**NOTE!** Check whether the motor can accelerate the load with "Torque booster", without any harmful mechanical stress.

## 7.12 Bypass

In cases of high ambient temperatures or other reason it may sometimes be necessary to use a by-pass contactor to minimize the power loss at nominal speed (see Technical Data). By using the built-in Full Voltage Relay function an external contactor can be used to Bypass the soft starter when operating at nominal speed.

Bypass contactor can also be used if soft stop is required. Normally a Bypass contactor is not necessary as the device is designed for continues running conditions, see Fig. 29 on page 33 for wiring example.

**NOTE!** If one like to use the alarm functions, the extended functions or the viewing functions the 2-pcs current transformers must be mounted outside the soft start as shown in Fig. 44 and Fig. 45 on page 45. For this purpose an optional extension cable for the current transformers is available. Code No 01-2020-00.

032 <sup>o</sup>			
Setting of Bypass			
o F F			
Default:	oFF		
Range:	oFF, on		
oFF	Bypass disabled		
on	Bypass enabled. Program either relay K1 or K2 to function 2 to control the bypass contactor, see menu 51/52.		



**CAUTION!** If the current transformers are not mounted as in Fig. 43 on page 44 and § 6.2, page 28, the alarm and viewing functions will not work. Do not forget to set menu 032 to ON, otherwise there will be an F12 alarm and at the stop command will be a freewheeling stop.

For further information see chapter 6.2 page 28.

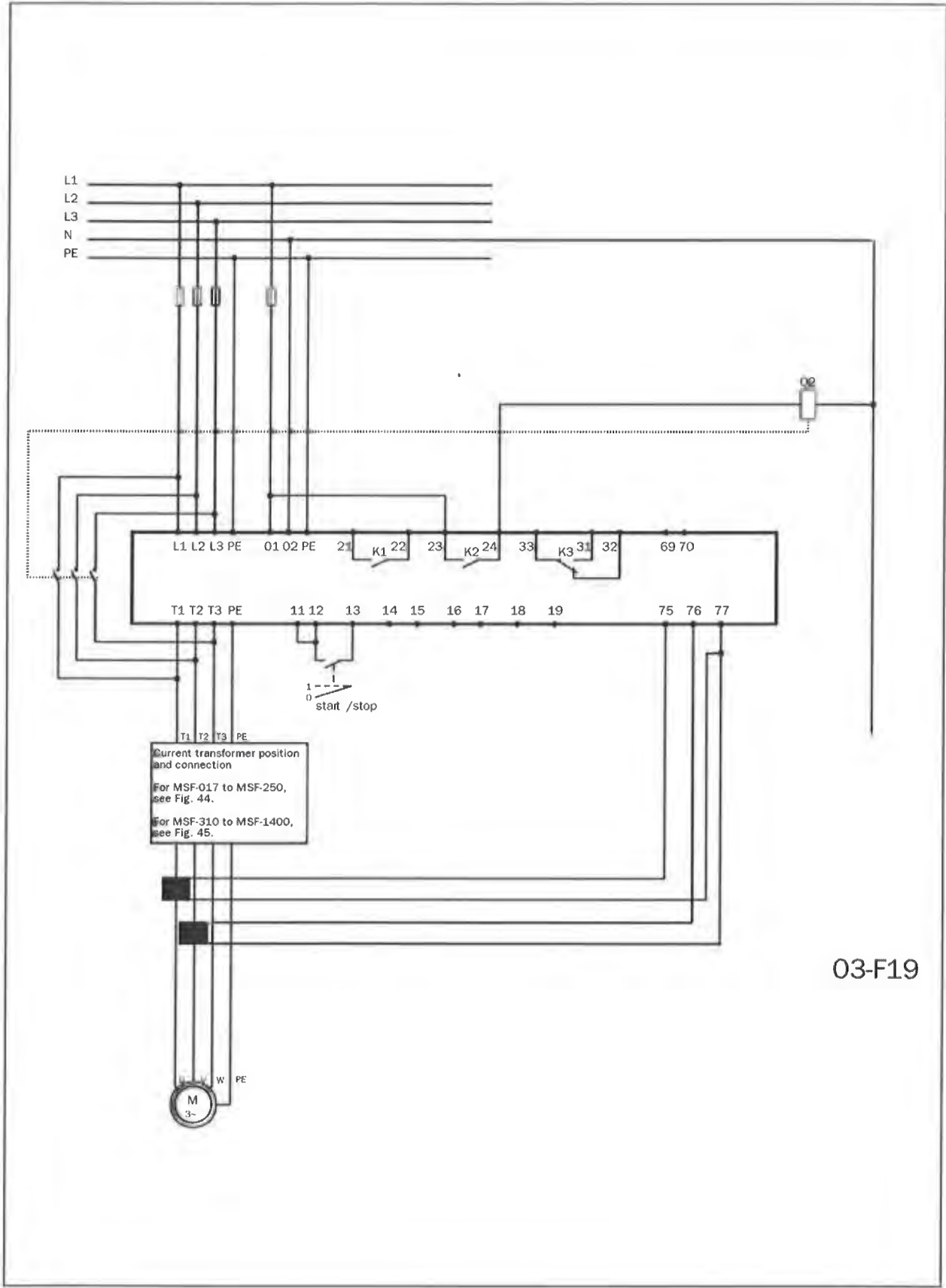


Fig. 43 Bypass wiring example MSF 310-1400.



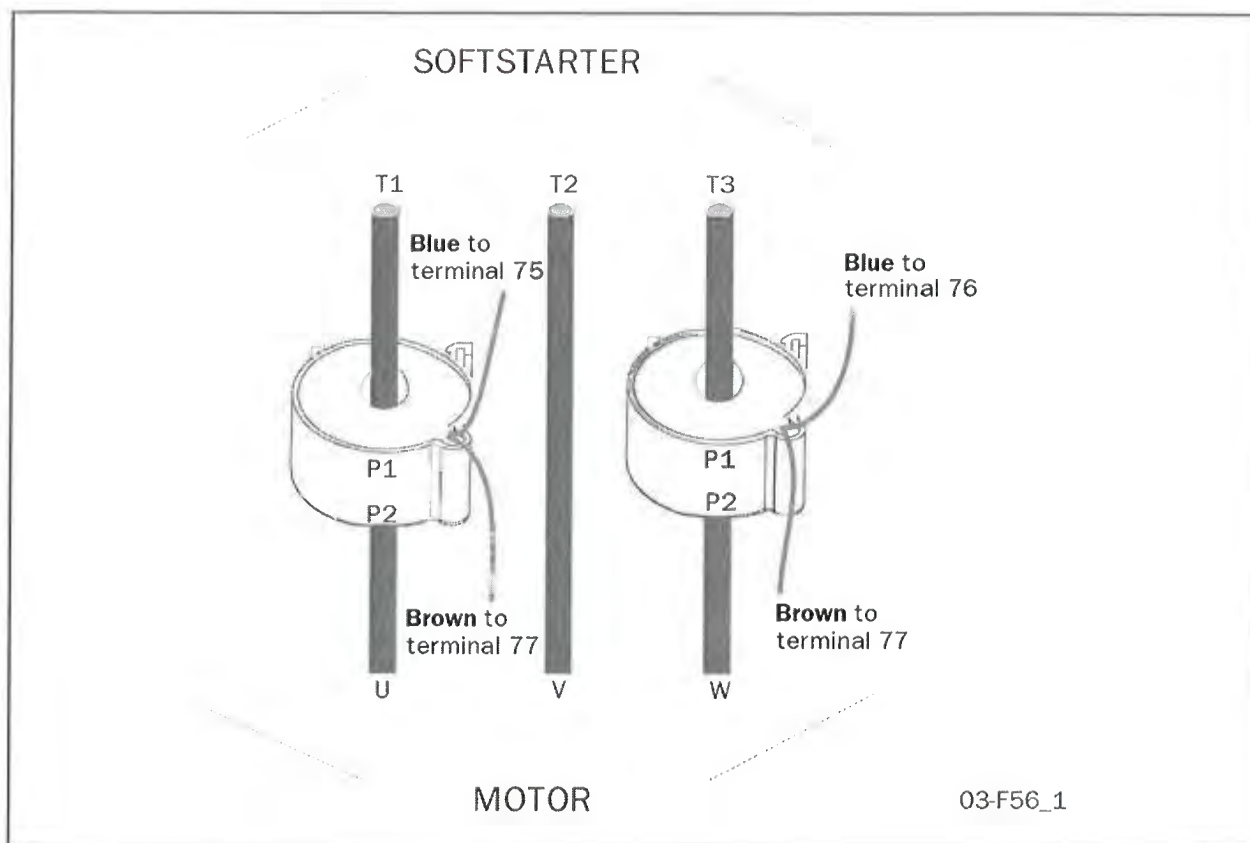


Fig. 44 Current transformer position when Bypass MSF-017 to MSF-250.

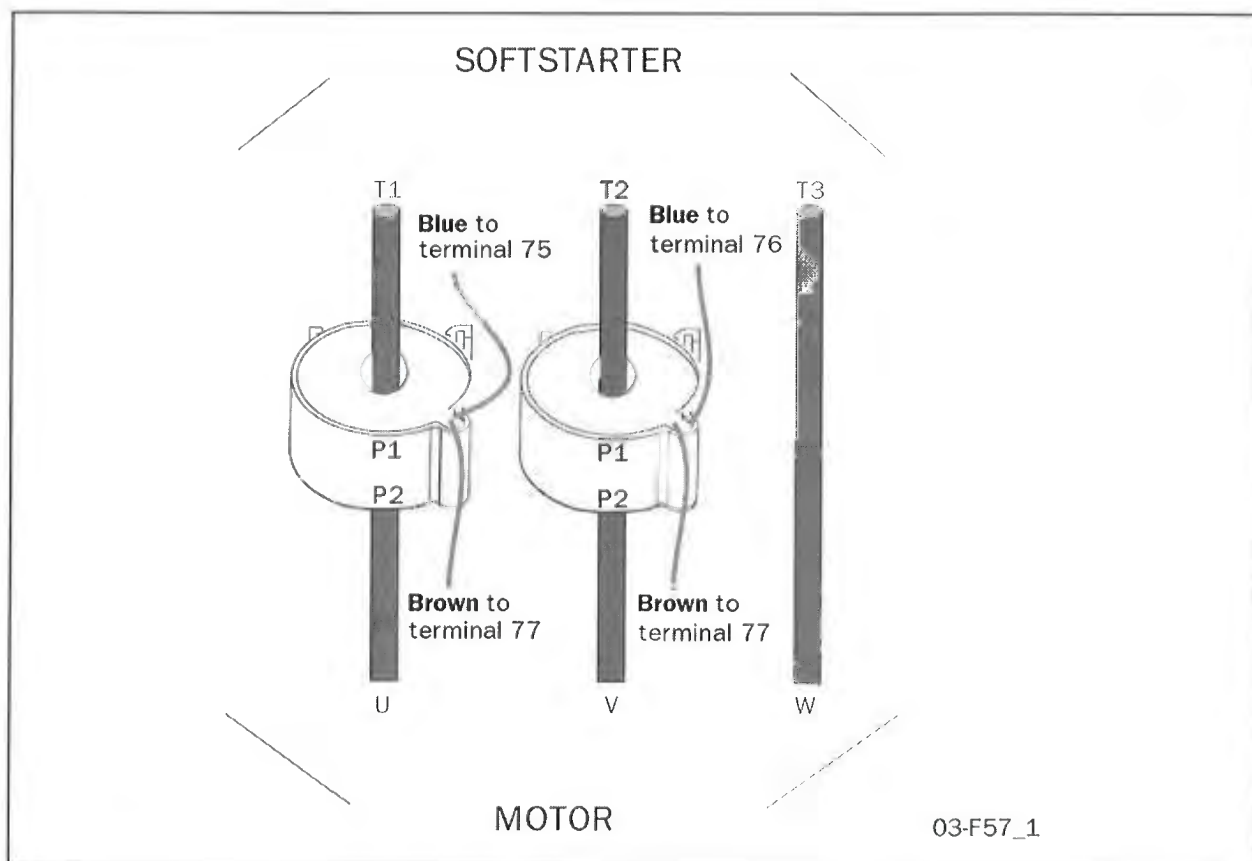


Fig. 45 Current transformer position when Bypass MSF-310 to MSF-1400.

### 7.13 Power Factor Control

During operation, the soft starter continuously monitors the load on the motor. Particularly when idling or when only partially loaded, it is sometimes desirable to improve the power factor. If Power factor control (PFC) is selected, the soft starter reduces the motor voltage when the load is lower. Power consumption is reduced and the degree of efficiency improved.

033 <sup>o</sup>	
Setting of PFC	
OFF	
Default:	oFF
Range:	oFF, on
oFF	PFC disabled
on	PFC enabled. The Full voltage relay function does not work.

**NOTE!** If the PFC is used the EMC-directive is not fulfilled.

### 7.14 Brake functions

There are two built in braking methods for applications where the normal stop ramp is not enough.

- **Dynamic DC-brake**  
Increases the braking torque by decreasing speed.
- **Soft brake**  
Gives a high torque at the start of the braking and then also increasing torque by decreasing speed.

In both methods the MSF detects when the motor is standing still, so rotating in wrong direction is avoided.

#### Dynamic Vector Brake

- Possible to stop motors with high inertia loads from close to synchronous speed.
- At 70% of the nominal speed a DC-brake is activated until the motor is standing still or the selected Braking Time has expired (see menu 34, next page).
- No contactor needed.
- For extra safety, the soft starter has a digital input signal for monitoring standstill so that at real motor standstill will stop the output voltage immediately (see § 7.19, page 53).

#### Soft brake

- Even very high inertia loads can be stopped
- The Soft brake is a controlled reversing of the motor as the MSF measures the speed during braking.
- Two contactors are needed which can be placed on the in- or output of the soft starter. On the input the first contactor is connected to relay K1 which is also used as a mains contactor.
- At 30% of the nominal speed a DC-brake is activated until the motor is standing still or the selected Braking Time has expired (menu 34, next page).

- For extra safety, the soft starter has a digital input signal for monitoring standstill. So that the output voltage is stopped immediately (see menu 57-58, § 7.19, page 53).

See Fig. 47 on page 47 for the following set-up sequence:

- Soft brake is activated if menu 36=2 and menu 34 has a time selected (see next page).
- Menu 51 and 52 are automatically set to 5 and 4 to get the correct relay functions on K1 and K2 (see § 7.17, page 51).
- Relay K1 should be used to connect a contactor for supply L1, L2, L3 to MSF or motor.
- Relay K2 is used to connect phase shifting contactor to change L1, L2 and L3 to MSF or motor.
- At start K1 is activated and connects L1, L2, L3 then the motor starts. At stop K1 opens and disconnects L1, L2, and L3 and after 1s K2 connects with the other phase sequence and the braking of the motor is active.

**NOTE!** Soft brake uses both programmable relays. For other functions, see also the function table in chapter 7. page 35.

**NOTE!** For several start/stops it is recommend to use the PTC Input.



**WARNING!** If the Soft Brake function has been selected once and after that the Bypass function is selected, then the relay functions on K1 and K2 remain in the Soft Brake functionality. Therefore it is necessary to change the relay functions in menu 51-52 manually to the Bypass functions (see § 7.17, page 51) or reset to default in menu 199 (see § 7.28, page 63) and select the Bypass function again.

034 <sup>o</sup>	
Braking time	
OFF	
Default:	oFF
Range:	oFF, 1 - 120 sec
oFF	Brake function disabled
1-120	Brake time

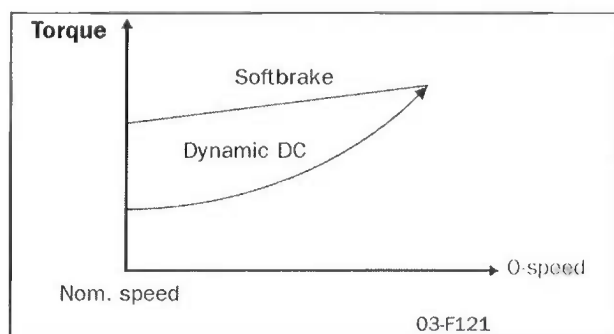


Fig. 46 Braking time

035 <sup>o</sup>			
Braking Strength			
1 0 0			
Default:	100		
Range:	100 - 500%		

036 <sup>o</sup>			
Brake method			
1			
Default:	1		
Range:	1, 2		
1	Dynamic vector brake, active		
2	Soft brake active		

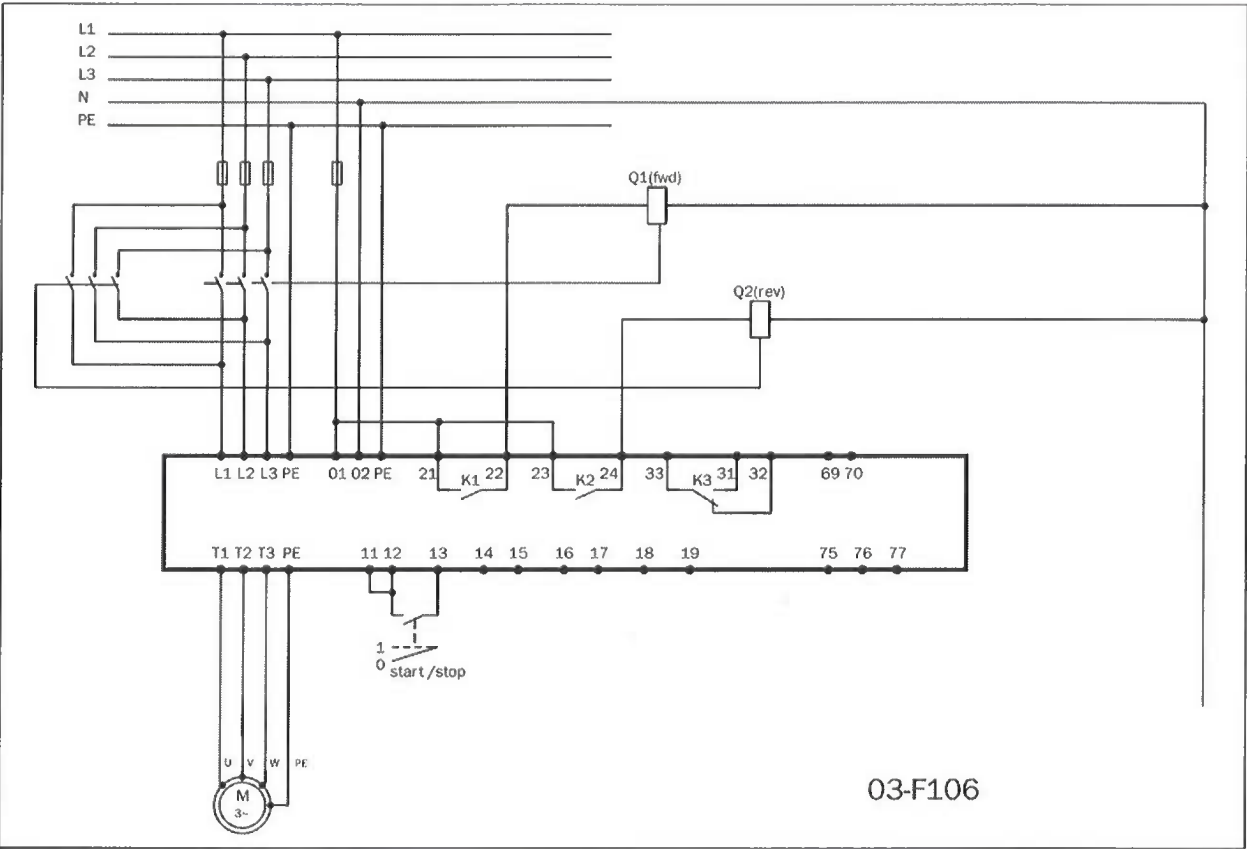


Fig. 47 Soft brake wiring example.

## 7.15 Slow speed and Jog functions

The soft starter is able to run the motor at a fixed slow speed for a limited period of time.

The slow speed will be about 14% of the full speed in the forward direction and 9% in the reverse direction.

The following functions are possible:

- **Slow speed controlled by an external signal.**  
The digital input is used to run at slow speed at a start or stop command for a selected number of pulses (edges) generated by an external sensor (photo cell, micro switch, etc.). See § 7.19, page 53 for more instructions.
- **Slow Speed during a selected time period.**  
The slow speed will be active after a stop command for a selected time period. See § 7.19, page 53 for more instructions.
- **Slow Speed using the "JOG"-commands.**  
The slow Speed can be activated via the JOG keys on the keyboard or externally via the analogue input. See § 7.25, page 61 for more instructions.

### 7.15.1 Slow speed controlled by an external signal.

With these setting it is possible to have an external pulse or edge signal controlling the time that the Slow Speed is active either after a Start command or a Stop command or at both commands. The following menu's are involved:

Menu	Function	See page
57	Digital input selection	page 53
58	Pulse selection	page 53
37	Slow speed torque	page 49
38	Slow speed time at start	page 49
39	Slow speed time at stop	page 49
40	DC-Brake at slow speed	page 49

Installation is as follows:

1. Set the analogue input selection for Slow Speed operation. Menu 57=2. See § 7.19, page 53. See Fig. 37 on page 41 for a wiring example.
2. Select in menu 38 (see § 7.15.2, page 49) the Slow Speed at Start time. This time will now be the absolute maximum time for Slow Speed to be active after a start command, in case the external signal will not appear.
3. Select in menu 39 (see § 7.15.2, page 49) the Slow Speed at Stop time. This time will now be the absolute maximum time for Slow Speed to be active after a stop command, in case the external signal will not appear.
4. Select in menu 57 (see § 7.19, page 53) the number of edges to be ignored by the Slow Speed input, before a start or stop is executed at slow speed. The edges are generated by an external sensor (photo cell, micro switch, etc.).

The Slow Speed torque (menu 37) and DC-Brake after Slow Speed (menu 40) can be selected if needed. (see § 7.15.4, page 49).

When the number of edges exceeds or the time expire, a start according to selected main function is made.

At stop, the motor will ramp down (if selected) and DC brake (if selected) before a slow speed forward at stop will begin. Slow speed will last as long as the number of edges on the external input is below parameter value in menu 036 and the max duration time doesn't expires. When the number of edges exceeds or the time expire, a stop is made.

In Fig. 48 on page 48 the selected number of edges are 4. It is recommended to select DC-brake (see § 7.14, page 46) before a slow speed at stop if it is a high inertia load. See Fig. 29 on page 33 for wiring diagram. In case one use DC-brake, see § 7.15.4, page 49.

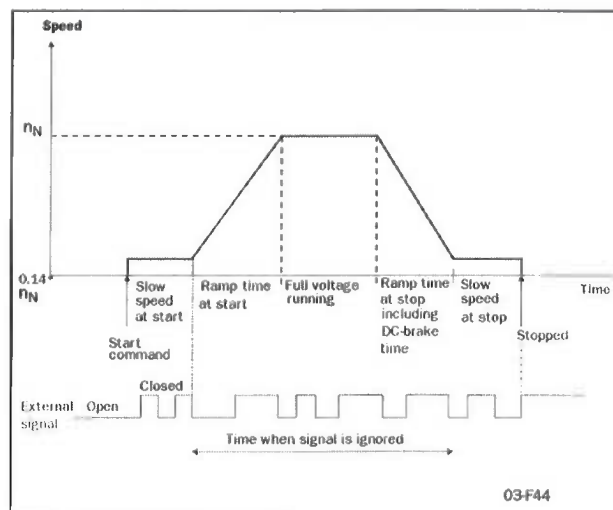


Fig. 48 Slow speed controlled by an external signal.

This additional function can be used together with most of the main functions (see § 4.6, page 19).

037 <sup>o</sup>		Slow speed torque
10		
Default:	10	
Range:	10-100	
Select the magnitude of the slow speed torque.		



### 7.15.2 Slow speed during a selected time

It is possible to have a slow speed in forward direction before a start and after a stop. The duration of the slow speed is selectable in menus 038 and 039.

It is recommended to select DC brake (see § 7.14, page 46) before a slow speed at stop if it is a high inertia load. This slow speed function is possible in all control modes, keyboard, remote and serial communication.

038 <sup>o</sup>	
Slow speed time at start	
o F F	
Default:	oFF
Range:	oFF, 1 - 60 sec
oFF	Slow speed at start is disabled
1-60	Set slow speed time at start.

039 <sup>o</sup>	
Slow speed time at stop	
o F F	
Default:	oFF
Range:	oFF, 1 - 60 sec
oFF	Slow speed at stop is disabled
1-60	Set slow speed time at stop.

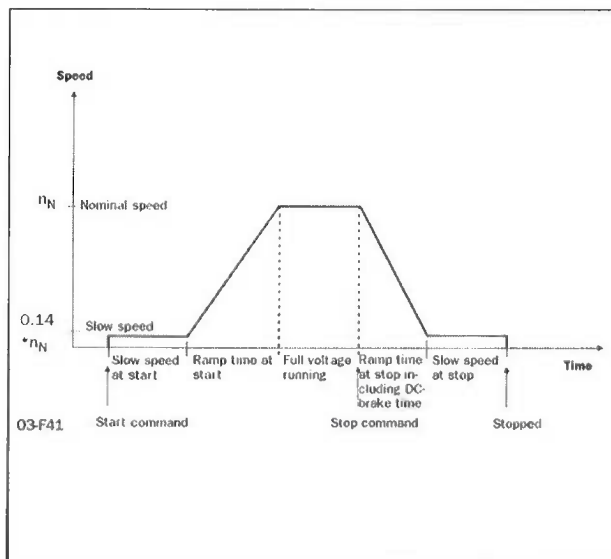


Fig. 49 Slow speed at start/stop during a selected time.

The Slow speed torque (menu 37) and the DC-Brake after Slow speed (menu 40, § 7.15.4, page 49) can be selected if needed.

### 7.15.3 Jog Functions

The Jog commands can be used to let the motor run at a Slow speed (forward or reverse) as long as the Jog command is active.

The Jog commands can be activated in 2 different ways:

- **Jog keys**

The Jog-Forward and Jog-reverse keys on the control panel. The keys can be programmed separate for each function. See § 7.25, page 61 for more instructions

- **External Jog command**

The external command is given via terminal 14 at the digital input. Only 1 function (forward or reverse) can be programmed to the digital input at the time. See § 7.19, page 53 for more instructions.

### 7.15.4 DC-brake after slow speed at stop [040]

A DC-brake after a slow speed at stop is possible to have, i.e. for a high inertia load or for a precise stop.

The current is controlled and the reference value for the normal DC-brake function is used (see § 7.15.4, page 49).

The duration for the DC-brake is possible to select.

This DC-brake function is not applied when the "JOG  " and "JOG  " keys are used.

040 <sup>o</sup>	
DC-Brake at slow speed	
o F F	
Default:	oFF
Range:	oFF, 1-60
oFF	DC-brake after slow speed at stop disabled.
1-60	DC-brake duration time after slow speed at stop.

## 7.16 Motor data setting

The first step in the settings is to set menu 007 and 008 to "on" to be able to reach the menus 041-046 and enter the motor data.

**NOTE! The default factory settings are for a standard 4-pole motor acc. to the nominal current and power of the soft starter. The soft starter will run even if no specific motor data is selected, but the performance will not be optimal.**

041 <sup>o</sup>	
Nominal motor voltage	
4 0 0	
Default:	400 V
Range:	200-700 V
Make sure the soft starters maximum voltage rating is suitable for chosen motor voltage.	

042 <sup>o</sup>	
Nominal motor current	
1 7	
Default:	Nominal soft starter current
Range:	25% - 150% of Insoft in Amp.

043 <sup>o</sup>	
Nominal motor power	
7. 5	
Default:	Nominal soft starter power
Range:	25% - 300% of Pnsoft in kW

044 <sup>o</sup>	
Nominal motor speed	
1 4 5 0	
Default:	Nnsoft in rpm
Range:	500-3600 rpm

045 <sup>o</sup>	
Nominal motor cos phi	
0. 8 6	
Default:	0.86
Range:	0.50-1.00

046 <sup>o</sup>	
Nominal frequency	
5 0	
Default:	50 Hz
Range:	50/60 Hz

**NOTE! Now go back to menu 007, 008 and set it to "oFF" and then to menu 001.**

7.17 Programmable relay K1 and K2

The soft starter has three built-in auxiliary relays, K3 (change over contacts), is always used as an alarm relay. The other two relays, K1 and K2 (closing contacts), are programmable.

K1 and K2 can be set to either “Operation”, “Full Voltage” or “Pre-alarm” indication. If DC-brake is chosen the relay K2 will be dedicated to this function.

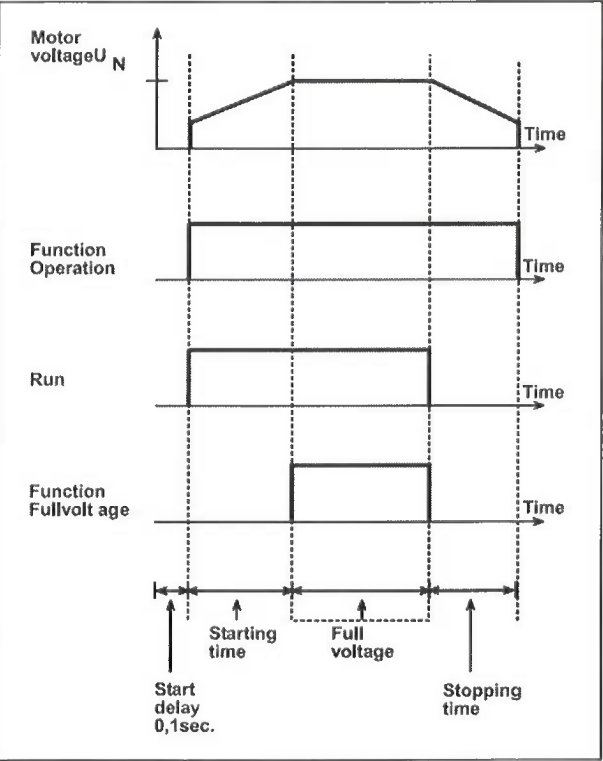


Fig. 50 Start/stop sequence and relay function “Operation” and “Full voltage”.

051 <sup>o</sup>	
Setting of K1 Indication	
1	
Default:	1
Range:	1, 2, 3, 4, 5
1	K1 is set for “Operation”
2	K1 is set for “Full Voltage”
3	K1 is set for “Power pre-alarm”
4	No function
5	K1 is set for “Run”

052 <sup>o</sup>	
Setting of K2 Indication	
2	
Default:	2
Range:	1, 2, 3, 4, 5
1	K2 is set for “Operation”
2	K2 is set for “Full Voltage”
3	K2 is set for “Power pre-alarm”
4	K2 is set for “Softbrake”
5	K2 is set for “Run”



**WARNING!** If the Soft Brake function has been selected once and after that the Bypass function is selected, then the relay functions on K1 and K2 remain in the Soft Brake functionality. Therefore it is necessary to change the relay functions in menu 51-52 manually to the Bypass functions (see § 7.12, page 43) or reset to default in menu 199 (see § 7.28, page 63) and select the Bypass function again.

## 7.18 Analogue output

The soft starter can present current, voltage and power on an analogue output terminal, for connection to a recording instrument or a PLC. The output can be configured in 4 different ways, 0-10V, 2-10V, 0-20mA or 4-20 mA. To install the instrument proceed as follows:

1. Connect the instrument to terminal 19 (+) and 15 (-).

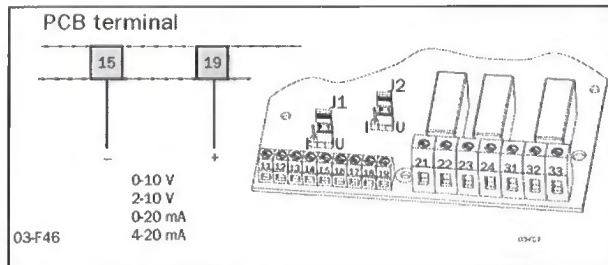


Fig. 51 Wiring for analogue output.

2. Set Jumper J2 on the PCB board to voltage (U) or current (I) signal position. Factory setting is voltage (U). See Fig. 52 on page 52 and Fig. 24 on page 28.

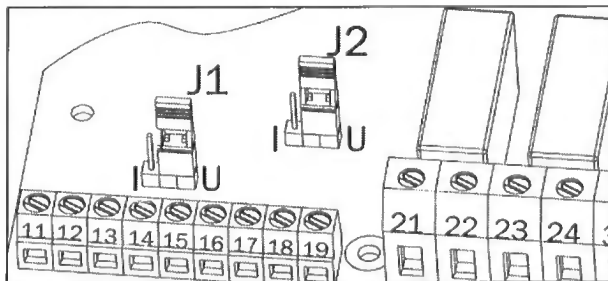


Fig. 52 Setting of current or voltage output.

3. Set the parameter in menu 054.

054 <sup>o</sup>			
o F F			
Analogue output			
Default:	oFF		
Range:	oFF, 1, 2		
oFF	Analogue output is disabled		
1	Analogue output is set to 0-10V/0-20mA		
2	Analogue output is set to 0-10V/4-20mA		

4. Choose a read-out value in menu 055

055 <sup>o</sup>			
1			
Analogue output value			
Default:	1		
Range:	1, 2, 3		
1	RMS current, default range 0-5xI <sub>n</sub>		
2	Line input RMS voltage, default range 0-720V		
3	Output shaft power, default range 0-2xP <sub>n</sub>		

5. Set analogue output gain to adjust the range of chosen analogue output value in menu 056.

056 <sup>o</sup>			
1 0 0			
Analogue output gain			
Default:	100%		
Range:	5-150%		

Example on settings:

Set value	I <sub>scale</sub>	U <sub>scale</sub>	P <sub>scale</sub>
100%	0-5xI <sub>n</sub>	0-720V	0-2xP <sub>n</sub>
50%	0-2.5xI <sub>n</sub>	0-360V	0-P <sub>n</sub>



## 7.19 Digital input selection

The analogue input can be used as a digital input. This is programmed in Menu 57. There are 4 different functions:

- Rotation sensor input for braking functions. See § 7.14, page 46.
- Slow speed external controlled. See § 7.15.1, page 48.
- Jog functions forward or reverse enabled. See § 7.25, page 61.

Fig. 53 shows how to set the input for voltage or current control, with jumper J1 the control board. The default setting for J1 is voltage control.

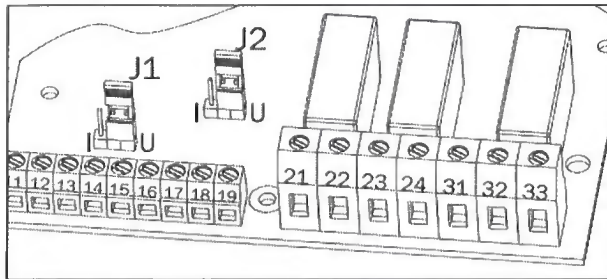


Fig. 53 Setting of J1 for current or voltage control.

Fig. 54 shows a wiring example for the analogue input as it is used for digital input.

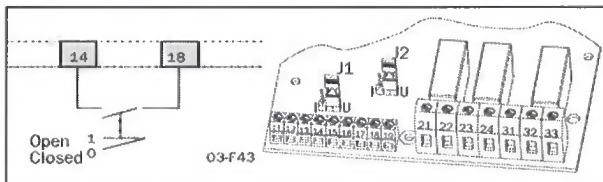


Fig. 54 Wiring for slow speed external input.

**NOTE!** If the Main Function Analogue control is programmed (see § 7.8, page 41) the analogue input can not be used for digital signal input. The menu 57 is then automatically set to OFF.

057°			
Digital Input selection			
OFF			
Default:	oFF		
Range:	oFF, 1-4		
<b>oFF</b>	No digital input control		
<b>1</b>	Rotation sensor for brake functions		
<b>2</b>	Slow speed function		
<b>3</b>	Jog forward command		
<b>4</b>	Jog reverse command		

**NOTE!** Jog forward, reverse has to be enabled, see § 7.25, page 61.

Depending on the selection made in menu 57, menu 58 is used to program the number of the edges. The edges can be generated by an external sensor (photo cell, micro switch etc.).

058°			
Digital Input pulses			
			1
Default:		1	
Range:		1-100	
If Menu 57=1.			
A positive or negative edge at analogue input from a rotation sensor will give a signal to stop the braking voltage.			
If Menu 57=2			
The number of edges to be ignored by the slow speed input, before a start or stop is executed at slow speed.			

## 7.20 Parameter Set

Parameter Set, an important function which can be handy when using one soft starter to switch in and start different motors, or working under variable load conditions. For example; starting and stopping conveyor belts with different weight on the goods from time to time.

For sets of parameters can be controlled either from the keyboard, the external control inputs or the serial interface (option). Up to 51 different parameters can be set for each Parameter Set.

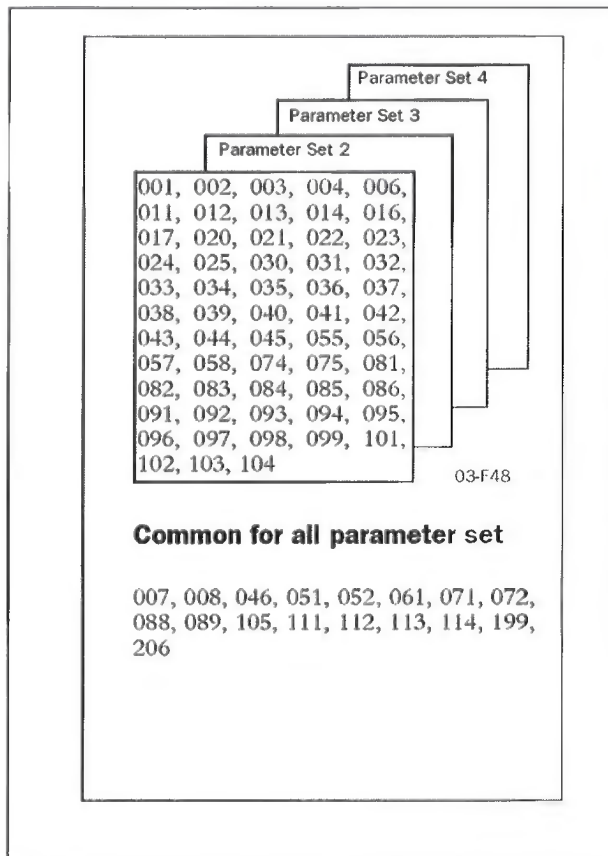


Fig. 55 Parameter overview

When 'Parameter set' in menu 061 is set to 0 (external selection), only parameters in menu 006 (Control mode) and 061 (Parameter set) can be changed. All other parameters are not allowed to change.

It is possible to change parameter set at stop and at full voltage running.

061	Parameter set
1	
Default:	1
Range:	0, 1, 2, 3, 4
0	Parameter set are selected by the external input 16 and 17 (see below).
1, 2, 3, 4	Selection of parameter set 1-4.

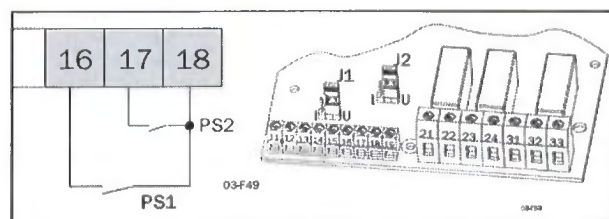


Fig. 56 Connection of external control inputs.

Parameter Set	PS1 (16-18)	PS2 (17-18)
1	Open	Open
2	Closed	Open
3	Open	Closed
4	Closed	Closed

## 7.21 Motor protection, overload (F2 alarm)

In many cases it is convenient to have a complete starter. The soft starter have a possibility to use either an input PTC signal from the motor, an internal thermal model of the motor for thermal protection or both together at the same time. Slight overload for long time and several overloads of short duration will be detected with both methods.

071 <sup>o</sup>	
<div> <div></div> <div></div> <div>n</div> <div>o</div> </div>	
Motor PTC Input	
Default:	no
Range:	no, YES
no	Motor PTC input is disabled
YES	Motor PTC input is activated: - Connect the PTC to terminals 69 and 70, see table 12, page 32 and § Fig. 30, page 34. - A to hot motor will give an F2 alarm. The alarm can only be reset after cooling down of the motor.

**NOTE!** Open terminals will give an F2 alarm immediately. Make sure the PTC is always connected or the terminals are shorted.

**NOTE!** The internal motor thermal protection will still generate an alarm if it is not selected oFF.

072 <sup>o</sup>	
<div> <div></div> <div></div> <div>1</div> <div>0</div> </div>	
Internal motor thermal protection	
Default:	10
Range:	oFF, 2-40 sec
oFF	Internal motor protection is disabled.
2-40	Selection of the thermal curve according to Fig. 57 - Check that menu 042 is set to the proper motor current (see § 7.16, page 50). - If the current exceeds the 100% level an F2 alarm is activated. - The motor model thermal capacity must cool down to 95% before reset can be accepted. - Used thermal capacity in menu 073 in § 7.21, page 55.

**NOTE!** If 'Bypass' is used check that the current transformers are placed and connected correctly (see Fig. 43 on page 44).



**CAUTION!** Used thermal capacity is set to 0 if the control board loses its supply (terminal 01 and 02). This means that the internal thermal model starts with a 'cold' motor, which perhaps in reality is not the case. This means that the motor can be overheated.

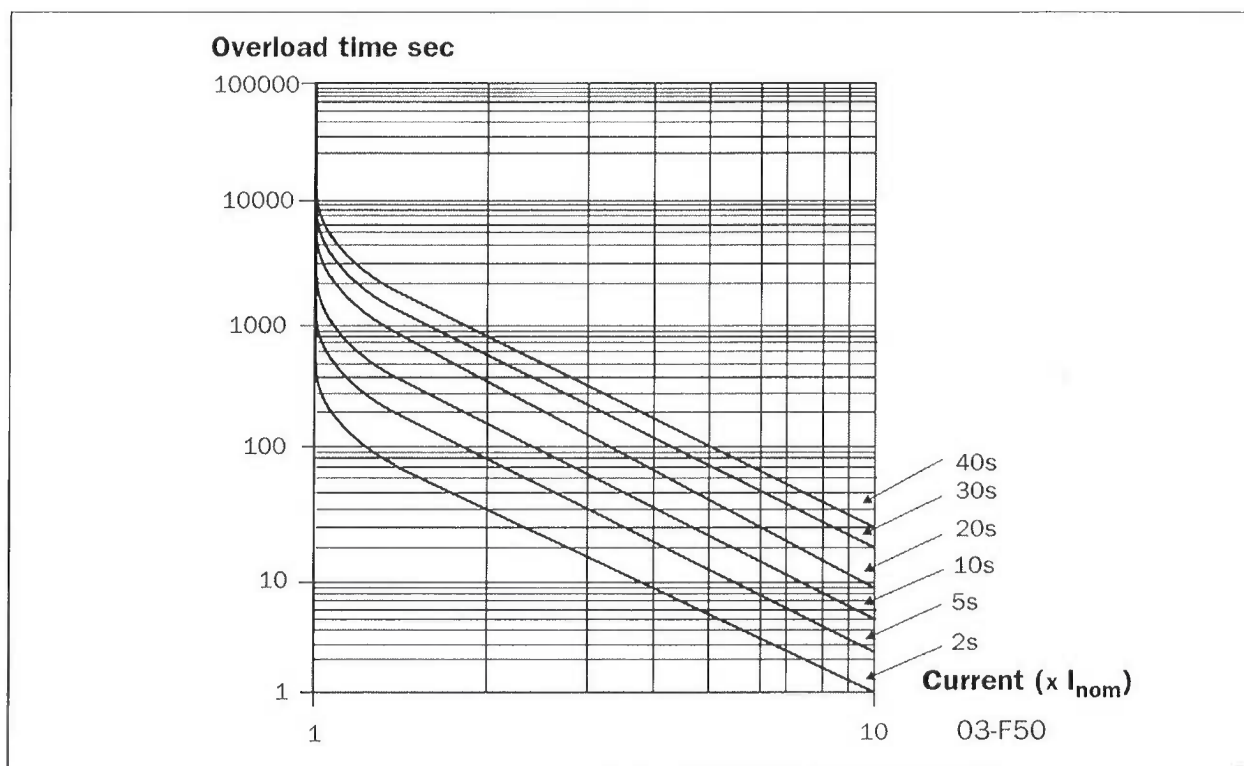


Fig. 57 The thermal curve

## 7.22 Mains protection

073 <sup>o</sup>	
Used thermal capacity	
<div> <div></div> <div></div> <div></div> <div>0</div> </div>	
Default:	-
Range:	0-150%
Read-out of the used thermal capacity. If menu 072 'Internal motor thermal protection' is selected oFF, the capacity is shown as if the default class 10 was selected.	

081 <sup>o</sup>	
Voltage unbalance alarm	
<div> <div></div> <div></div> <div>1</div> <div>0</div> </div>	
Default:	10
Range:	2 -25% U <sub>n</sub>
Insert limit in % of nominal motor voltage. Max unbalance in voltage between the 3 input phases is compared with the selected value. This is a category 2 alarm.	

074 <sup>o</sup>	
Starts per hour limitation	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1-99/hour
<b>oFF</b>	Starts per hour limitation is disabled.
<b>1-99</b>	Sets the start per hour limitation alarm. If the selected number is exceeded, alarm F11 occurs.

082 <sup>o</sup>	
Response delay voltage unbalance alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1-60 sec
<b>oFF</b>	Unbalance voltage alarm is disabled
<b>1-60</b>	Set the response delay time for unbalanced voltage alarm F8.

075 <sup>o</sup>	
Locked rotor alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1.0-10.0 sec
<b>oFF</b>	Locked rotor alarm is disabled
<b>1.0-10.0</b>	An F5 alarm is given when the rotor locks. The alarm is active during starting and running.

083 <sup>o</sup>	
Over voltage alarm	
<div> <div></div> <div>1</div> <div>1</div> <div>5</div> </div>	
Default:	115
Range:	100 -150% U <sub>n</sub>
Insert limit in % of nominal motor voltage. Max voltage of the 3 input phases is compared with the selected value. This is a category 2 alarm.	

084 <sup>o</sup>	
Response delay over voltage alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1-60 sec
<b>oFF</b>	Overvoltage alarm is disabled
<b>1-60</b>	Set the response delay time for over voltage alarm F9.



085 <sup>o</sup>	
Under voltage alarm	
o F F	
Default:	85
Range:	75-100 U <sub>n</sub>
Insert limit in % of nominal motor voltage. Min voltage of the 3 input phases is compared with the selected value. This is a category 2 alarm.	

086 <sup>o</sup>	
Response delay under voltage alarm	
o F F	
Default:	oFF
Range:	oFF, 1-60 sec
oFF	Under voltage alarm is disabled
1-60	Set the response delay time for under voltage alarm F10

087 <sup>o</sup>	
Phase sequence	
- - - -	
Default:	-
Range:	L123, L321
L123 is the direct phase sequence. L321 is the reverse phase sequence.	

088 <sup>o</sup>	
Phase reversal alarm	
o F F	
Default:	oFF
Range:	oFF, on
oFF	Phase reversal alarm is disabled
on	Sets the phase reversal Alarm. - Switch on the power supply first. The phase sequence is stored as the correct sequence. - Sets the menu 088 to "on". - Any reversal of phase sequence will cause alarm F16.

**NOTE!** The actual phase sequence can be viewed in menu 87.

## 7.23 Application protection (load monitor)

### 7.23.1 Load monitor max and min/protection (F6 and F7 alarms)

MSF has a built in load monitor based on the output shaftpower. This is a unique and important function which enables protection of machines and processes driven by the motor connected to the soft starter. Both a Min and Max limit is possible to select.

In combination with the pre-alarm function, see § 7.23.2, page 58, this create a powerful protection. An auto set function is also included for an automatic setting of the alarm limits. A start-up delay time can be selected to avoid undesired alarms at start-up, see Fig. 58 on page 60.

**NOTE!** The load monitor alarms are all disabled during a stop ramp.

089 <sup>o</sup>	
Auto set power limits	
n o	
Default:	no
Range:	no, YES
no	Auto set is disabled
YES	Auto set is activated if ENTER is pressed.

090 <sup>o</sup>	
Output shaftpower in %	
0	
Default:	-
Range:	0-200%
Measured output shaftpower in % of nominal motor power.	

**NOTE!** System must be in full voltage running before an auto set is permitted.

The actual power is regarded as 1.00xPact.

The set levels are:

Power max alarm limit[092]:	1.15xP actual
Power max pre-alarm limit[094]:	1.10xP actual
Power min pre-alarm limit[096]:	0.90xP actual
Power min alarm limit[098]:	0.85xP actual

A successful auto set shows a message 'Set' for 3 s and if something goes wrong a message 'no' will be showed.

091 <sup>o</sup>	
Start delay power limits	
10	
Default:	10 sec
Range:	1-250 sec
From start command during selected delay time, all power load monitor alarms and pre-alarms are disabled.	

092 <sup>o</sup>	
Max power alarm limit	
115	
Default:	115
Range:	5-200% Pn
Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power exceeds selected limit, an F6-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect this limit even if the alarm is set "oFF" in menu 093. This is a category 1 alarm.	

093 <sup>o</sup>	
Response delay max alarm	
oFF	
Default:	oFF
Range:	oFF, 0.1-25.0 sec
oFF	Max Alarm is disabled.
0.1-25.0	Sets the response delay of the Max Alarm level.

### 7.23.2 Pre-alarm

It could be useful to know if the load is changing towards a load alarm limit. It is possible to insert both a Max and Min pre-alarm limit based on the motor output shaft power. If the load exceeds one of these limits, a pre-alarm condition occurs.

It should be noted that it is not normal alarms. They will not be inserted in the alarm list, not activating the alarm relay output, not displayed on the display and they will not stop operation. But it is possible to activate relay K1 or K2 if a pre-alarm condition occurs. To have pre-alarm status on any of these relays, select value 3 in menu 051 or 052 (see § 7.17, page 51).

A start-up delay time can be selected in menu 091 to avoid undesired pre-alarms at start-up. Note that this time is also shared with power Max and Min alarms.

**NOTE! The pre-alarm status is always available on the serial communication.**

094 <sup>o</sup>	
Max power pre-alarm limit	
110	
Default:	110
Range:	5 -200% Pn
Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power exceeds selected limit, a pre-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect selected limit even if the pre-alarm is set "oFF" in menu 095.	

095 <sup>o</sup>	
Max pre-alarm response delay	
oFF	
Default:	oFF
Range:	oFF, 0.1 - 25.0 sec
oFF	Max Pre-Alarm is disabled.
0.1-25.0	Sets the response delay of the Max Pre-Alarm level.

096 <sup>o</sup>					
Min power pre-alarm limit					
<table border="1"> <tr> <td></td> <td></td> <td>9</td> <td>0</td> </tr> </table>				9	0
		9	0		
Default:	90%				
Range:	5 -200% Pn				
<p>Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power goes below selected limit, a pre-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect selected limit even if the pre-alarm is set "oFF" in menu 097.</p>					

099 <sup>o</sup>						
Min alarm response delay						
<table border="1"> <tr> <td></td> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>				o	F	F
		o	F	F		
Default:	oFF					
Range:	oFF, 0.1-25.0 sec					
<b>oFF</b>	Min Alarm is disabled					
<b>0.1-25.0</b>	Sets the response delay of the Min Alarm level. The Min alarm is disabled during a stop ramp down.					

097 <sup>o</sup>						
Min pre-alarm response delay						
<table border="1"> <tr> <td></td> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>				o	F	F
		o	F	F		
Default:	oFF					
Range:	oFF, 0.1 - 25.0 sec					
<b>oFF</b>	Min Pre-Alarm is disabled.					
<b>0.1-25.0</b>	Sets the response delay of the Min Pre-Alarm level. The Min Pre-alarm is disabled during a stop ramp down.					

098 <sup>o</sup>					
Min power alarm limit					
<table border="1"> <tr> <td></td> <td></td> <td>8</td> <td>5</td> </tr> </table>				8	5
		8	5		
Default:	85				
Range:	5-200% Pn				
<p>Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power goes below selected limit, an F7-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect this limit even if the alarm is set 'oFF' in menu 099. This is a category 1 alarm.</p>					

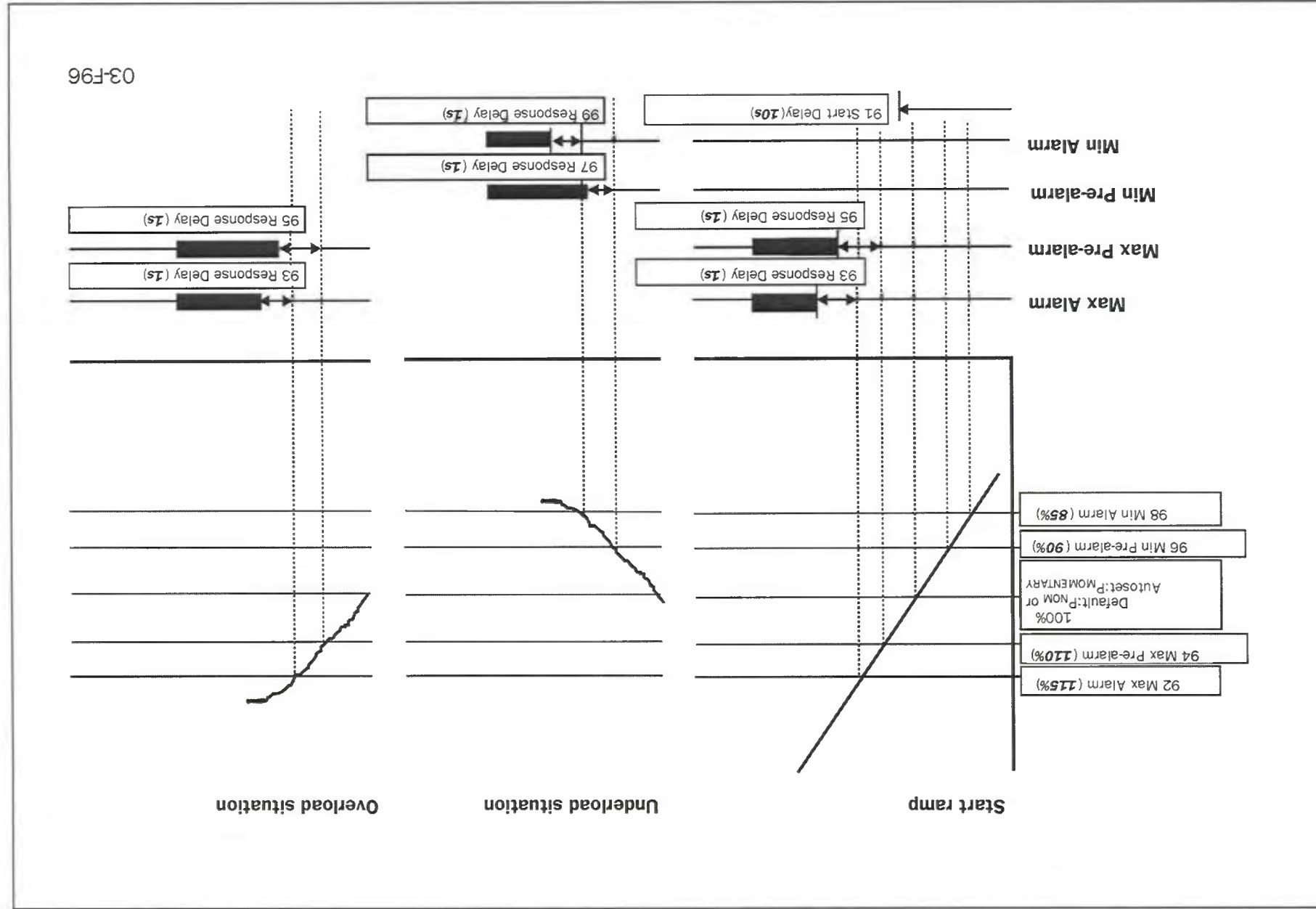


Fig. 58 Load monitor alarm functions.



## 7.24 Resume alarms

### 7.24.1 Phase Input failure F1

- **Multiple phase failure.**  
Shorter failure than 100ms is ignored. If failure duration time is between 100 ms and 2 s, operation is temporary stopped and a soft start is made if the failure disappears before 2 s. If failure duration time is longer than 2 s, an F1 alarm is given in cat. 2.
- **Single phase failure.**  
During start up (acceleration) the behaviour is like multiple phase failure below. When full voltage running there is a possibility to select the behaviour.

101 <sup>o</sup>	
Run at single phase loss	
n o	
Default:	no
Range:	no, YES
no	Soft starter trips if a single phase loss is detected. Alarm F1 (category 2) will appear after 2 sec.
YES	Soft starter continues to run after a single phase loss. - Alarm F1 appears after 2 sec. - If the loose phase is reconnect the alarm is reset automatically. - If running on 2 phases, a stop command will give a Direct on line stop (freewheel)

#### 7.24.2 Run at current limit time-out F4

In modes 'Current limit at start' and 'Voltage ramp with current limit at start' an alarm is activated if still operating at current limit level when selected ramp time exceeds. If an alarm occurs there is a possibility to select the behaviour.

102 <sup>o</sup>	
Run at current limit time-out	
n o	
Default:	no
Range:	no, YES
no	Soft starter trips if the current limit time-out is exceeded. Alarm F4 (category 2) appears.
YES	Soft starter continues to run after the current limit time-out has exceeded: - Alarm F4 appears - The current is no longer controlled and the soft starters ramps up to full voltage with a 6s ramp time. - Reset the alarm with either ENTER/RESET key or by giving a stop command.

## 7.25 Slow speed with JOG

Slow speed with "JOG" is possible from the "JOG" keys, but also from terminals, see menu 57 page 53 and serial comm. The "JOG" is ignored if the soft starter is running. The slow speed "JOG" function has to be enabled for both forward and reverse directions in menus 103 and 104, see below.

**NOTE! The enable functions is for all control modes.**

103 <sup>o</sup>	
JOG forward enable	
o F F	
Default:	oFF
Range:	oFF, on
oFF	JOG forward disabled
on	JOG forward enabled

104 <sup>o</sup>	
JOG reverse enable	
o F F	
Default:	oFF
Range:	oFF, on
oFF	JOG reverse disabled
on	JOG reverse enabled

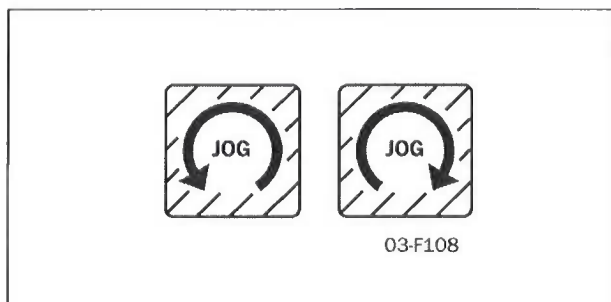


Fig. 59 The 2 Jog keys.

## 7.26 Automatic return menu

Often it is desirable to have a specific menu on the display during operation, i.e. RMS current or power consumption. The Automatic return menu function gives the possibility to select any menu in the menu system.

The menu selected will come up on the display after 60 sec. if no keyboard activity. The alarm messages (F1-F16) have a priority over menu 105 (as they have for all menus).

105°			
<div> <div>o</div> <div>F</div> <div>F</div> </div> <b>Automatic return menu</b>			
Default:	oFF		
Range:	oFF, 1-999		
1-999	Pressing "+" / "-" will lead through the menu system.		

## 7.27 Communication option, related Parameters

The following parameters have to be set-up:

- Unit address.
- Baud rate.
- Parity
- Behaviour when contact broken.

Setting up the communication parameter must be made in local 'Keyboard control' mode. See § 7.2, page 37.

111°			
<div> <div></div> <div></div> <div></div> <div>1</div> </div> <b>Serial comm unit address</b>			
Default:	1		
Range:	1-247		
This parameter will select the unit address.			

112°			
<div> <div></div> <div></div> <div>9.</div> <div>6</div> </div> <b>Serial comm baudrate</b>			
Default:	9.6		
Range:	2.4, 4.8, 9.6, 19.2, 38.4 kBaud		
This parameter will select the baudrate.			

113°			
<div> <div></div> <div></div> <div></div> <div>0</div> </div> <b>Serial comm parity</b>			
Default:	0		
Range:	0.1		
This parameter will select the parity.			
0 No parity.			
1 Even parity.			

### Serial comm. broken alarm

If control mode is 'Serial comm. control' and no contact is established or contact is broken the Soft starter consider the contact to be broken after 15 sec, the soft starter can act in three different ways:

- 1 Continue without any action at all.
- 2 Stop and alarm after 15 sec.
- 3 Continue and alarm after 15 sec.

If an alarm occurs, it is automatically reset if the communication is re-established. It is also possible to reset the alarm from the soft starter keyboard.

114°			
<div> <div></div> <div></div> <div></div> <div>1</div> </div> <b>Serial comm. contact interrupted</b>			
Default:	1		
Range:	oFF, 1, 2		
This parameter will control the behaviour in the soft starter when the serial comm. is interrupted.			
oFF No alarm and continue operation.			
1 Alarm and stop operation.			
2 Alarm and continue operation.			

## 7.28 Reset to factory setting [199]

When selecting reset to factory settings:

- All parameters in all parameter sets will have default factory settings.
- Menu 001 will appear on the display.
- Note that the alarm list, the power consumption and the operation time will **not** have default settings.

199 <sup>o</sup>			
Reset to factory settings			
no		o	
Default:	no		
Range:	no, YES		
no	No reset		
YES	Reset all functions to the factory defaults incl. all 4 Parameter Sets.		

**NOTE!** Reset to factory settings is not allowed at run.

## 7.29 View operation

### General

The soft start includes as standard a numerous metering functions which eliminates the need of additional transducers and meters.

### Measured values

- Current RMS 3-phase current and per phase
- Voltage RMS 3-phase voltage and per phase
- Output shaft power /torque kW/Nm
- Power factor
- Power consumption in kWh
- Operation time in hours

### Viewing of the measured values

After setting motor data and extended functions one can set menu 008 in oFF and will then automatically move to menu 201, the first menu viewing the measured values and thus eliminate to scroll through menu 011 to menu 199.

201 <sup>o</sup>			
RMS current			
0.0			
Default:	-		
Range:	0.0 - 9999Amp		
Read-out of the RMS motor current.			

**NOTE!** This is the same read-out as menu 005 see § 7.1.1, page 36.

202 <sup>o</sup>			
RMS main voltage			
0.0			
Default:	-		
Range:	0-720V		
The RMS input main voltage.			

203 <sup>o</sup>			
Output motor shaftpower			
0.0			
Default:	-		
Range:	-9999 +9999kW		
Viewing will show negative value if generator mode.			

204 <sup>o</sup>			
Power factor			
0.0			
Default:	-		
Range:	0.00-1		
View the actual power factor.			

**NOTE!** The power factor viewing will not work at bypass even if the current transformers are mounted outside the soft start.

205 <sup>o</sup>			
Total power consumption			
0.0		0.0	
Default:	-		
Range:	0.000 -2000MWh		
View the total power consumption.			

206 <sup>o</sup>	
Reset of power consumption	
no	
Default:	no
Range:	no, YES
no	No reset of power consumption.
YES	Reset power consumption in menu 205 to 0.000.

207 <sup>o</sup>	
Motor shaft torque	
0.0	
Default:	-
Range:	-9999 - + 9999Nm
Viewing will show negative value if generator mode.	

208 <sup>o</sup>	
Operation time	
0.0	
Default:	-
Range:	Hours
Operation time is calculated when the soft starter is in RUN mode. After 9999 hours the display will show two values.	
Example: 12467 hours shows    1            1 sec 2467        5sec	

211 <sup>o</sup>	
RMS current in phase L1	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L1.	

212 <sup>o</sup>	
RMS current in phase L2	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L2.	

213 <sup>o</sup>	
RMS current in phase L3	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L3.	

214 <sup>o</sup>	
Main voltage L1-L2	
0	
Default:	-
Range:	0-720V
View main voltage L1-L2.	

215 <sup>o</sup>	
Main voltage L1-L3	
0	
Default:	-
Range:	0 - 720V
View main voltage L1-L3.	

216 <sup>o</sup>	
Main voltage L2-L3	
0	
Default:	-
Range:	0 - 720V
View main voltage L2-L3.	

### 7.30 Keyboard lock

The keyboard can be locked to prohibit operation and parameter setting by an unauthorised. Lock keyboard by pressing both keys "NEXT →" and "ENTER ↵" for at least 2 sec. The message '- Loc' will display when locked. To unlock keyboard press the same 2 keys "NEXT →" and "ENTER ↵" for at least 2 sec. The message 'unlo' will display when unlocked.

In locked mode it is possible to view all parameters and read-out, but it is forbidden to set parameters and to operate the soft starter from the keyboard.

The message '-Loc' will display if trying to set a parameter or operate the soft starter in locked mode.

The key lock status can be read out in menu 221.

221 <sup>o</sup>					
Locked keyboard Info					
<table border="1"> <tr> <td></td> <td></td> <td>n</td> <td>o</td> </tr> </table>				n	o
		n	o		
Default:	no				
Range:	no, YES				
<b>no</b>	Keyboard is not locked				
<b>YES</b>	Keyboard is locked				

### 7.31 Alarm list

The alarm list is generated automatically. It shows the latest 15 alarms (F1 - F16). The alarm list can be useful when tracing a failure in the soft starter or its control circuit. Press key "NEXT →" or "PREV ←" to reach the alarm list in menus 901-915 (menu 007 has to be ON).

901 <sup>o</sup>					
Alarm					
<table border="1"> <tr> <td></td> <td></td> <td>F</td> <td>1</td> </tr> </table>				F	1
		F	1		
Default:	-				
Range:	F1-F16				
View actual alarm					



## 8. PROTECTION AND ALARM

The soft starter is equipped with a protection system for the motor, the machine and for the soft starter itself.

Three categories of alarm are available:

### **Category 1**

Alarm that stops the motor and need a separate reset before a new start can be accepted.

### **Category 2**

Alarm that stops the motor and accepts a new start command without any separate reset.

### **Category 3**

Alarm that continues to run the motor.

All alarm, except pre-alarm, will activate the alarm relay output K3, flash a red fault number on the display and it will also be placed in the alarm list. As long as the alarm is active, the display is locked in the alarm indication.

The relay output K3 can be used in the control circuit for actions needed when alarm occurs.

If more than one alarm is active, it is the last alarm that is presented on the display.

## 8.1 Alarm description

### 8.1.1 Alarm with stop and requiring a separate reset

Operation will stop for a category 1 alarm. A separate reset is needed before a new start command is accepted. It is possible to reset from keyboard (pushing "ENTER/RESET") regardless of selected control mode. It is also possible to reset the alarm from the actual control mode (i.e. if control mode is serial communication, a reset is possible to do from serial communication).

A reset is accepted first when the alarm source goes back to normal.

When a reset is made, the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

After a reset is made the system is ready for a new start command.

### 8.1.2 Alarm with stop and requiring only a new start command

Operation will stop for a category 2 alarm. A restart can be done and at the same time the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

It is still possible to reset the alarm in the same way as for category 1 alarms (see 8.1.1), if a start is not required at the time.

### 8.1.3 Alarm with continue run

Operation will continue run for a category 3 alarm. Some different reset behaviour is possible (see remarks for the specific alarms in § 8.2, page 67).

- Automatic reset when the alarm source goes back to normal.
- Automatic reset when a stop command is given.
- Manual reset during run.

When the reset occurs, the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

## 8.2 Alarm overview

Display Indication	Protective function	Alarm category	Remark
F1	Phase input failure.	Cat 3. Run with auto reset.	Single phase failure when full voltage running if menu 101 'Run at phase loss' = YES. If the fault phase comes back, an automatic reset is made.
		Cat 2. Stop with reset in start.	Multiple phase failure or single phase failure when not full voltage running or if menu 101 'Run at phase loss' = no.
F2	Motor protection, overload.	Cat 1. Stop with manual reset.	If menu 071 'Motor PTC input' = YES, cool down the motor. If menu 071 'Motor PTC input' = no, the internal model has to 'cool' down.
F3	Soft start overheated	Cat 1. Stop with manual reset.	If not cooled down, a reset will not be accepted.
F4	Full speed not reached at set current limit and start time.	If menu 102 'Run at current limit time-out' = no. Cat 2. Stop with reset in start.	The current limit start is not completed.
		If menu 102 'Run at current limit time-out' = YES. Cat 3. Run with manual reset.	When start time expired, a 6 sec ramp is used to reach full voltage, without control of the current. Reset the alarm with either a manual reset or a stop command.
F5	Locked rotor.	Cat 1. Stop with manual reset.	Motor and/or machine protection.
F6	Above max power limit.	Cat 1. Stop with manual reset.	Machine protection.
F7	Below min power limit.	Cat 1. Stop with manual reset.	Machine protection.
F8	Voltage unbalance.	Cat 2. Stop with reset in start.	Motor protection.
F9	Over voltage.	Cat 2. Stop with reset in start.	Motor protection.
F10	Under voltage.	Cat 2. Stop with reset in start.	Motor protection.
F11	Starts / hour exceeded.	Cat 2. Stop with reset in start.	Motor and/or machine protection.
F12	Shorted thyristor.	Cat 3. Run with manual reset.	When stop command comes, the stop will be a 'Direct On Line' stop, and the soft starter will be resetted. After this fault it is possible to start only in 'Direct On Line' mode. One or more thyristors probably damaged.
F13	Open thyristor.	Cat 1. Stop with manual reset.	One or more thyristors probably damaged.
F14	Motor terminal open.	Cat 1. Stop with manual reset.	Motor not correctly connected.
F15	Serial communication broken.	If menu 114 Serial comm. contact broken = 1. Cat 2. Stop with reset in start.	Serial communication broken will stop operation. Run from keyboard if necessary.
		If menu 114 Serial comm. contact broken = 2. Cat 3. Run with auto reset.	Serial communication broken will not stop operation. Stop from keyboard if necessary.
F16	Phase reversal alarm.	Cat 1. Stop with manual reset.	Incorrect phase order on main voltage input.

## 9. TROUBLE SHOOTING

### 9.1 Fault, cause and solution

Observation	Fault Indication	Cause	Solution
The display is not illuminated.	None	No control voltage.	Switch on the control voltage.
The motor does not run.	F1 (Phase input failure)	Fuse defective.	Renew the fuse.
		No mains supply.	Switch the main supply on.
	F2 (Motor protection, overload)	Perhaps PTC connection. Perhaps incorrect nominal motor current inserted (menu 042).	Check the PTC input if PTC protection is used. If internal protection is used, perhaps an other class could be used (menu 072). Cool down the motor and make a reset.
	F3 (Soft start overheated)	Ambient temperature too high. soft starter duty cycle exceeded. Perhaps fan failure.	Check ventilation of cabinet. Check the size of the cabinet. Clean the cooling fins. If the fan(s) is not working correct, contact your local MSF sales outlet.
	F4 (Full speed not reached at set current limit and start time)	Current limit parameters are perhaps not matched to the load and motor.	Increase the starting time and/or the current limit level.
	F5 (Locked rotor)	Something stuck in the machine or perhaps motor bearing failure.	Check the machine and motor bearings. Perhaps the alarm delay time can be set longer (menu 075).
	F6 (Above max power limit)	Overload	Over load. Check the machine. Perhaps the alarm delay time can be set longer (menu 093).
	F7 (Below min power limit)	Underload	Under load. Check the machine. Perhaps the alarm delay time can be set longer (menu 099).
	F8 (Voltage unbalance)	Main supply voltage unbalance.	Check mains supply.
	F9 (Over voltage)	Main supply over voltage.	Check mains supply.
	F10 (Under voltage)	Main supply under voltage.	Check mains supply.
	F11 (Starts / hour exceeded)	Number of starts exceeded according to menu 074.	Wait and make a new start. Perhaps the number of starts / hour could be increased in menu 074.
	F13 (Open thyristor)	Perhaps a damaged thyristor.	Make a reset and a restart. If the same alarm appears immediately, contact your local MSF sales outlet.
	F14 (Motor terminal open)	Open motor contact, cable or motor winding.	If the fault is not found, reset the alarm and inspect the alarm list. If alarm F12 is found, a thyristor is probably shorted. Make a restart. If alarm F14 appears immediately, contact your local MSF sales outlet.



Observation	Fault Indication	Cause	Solution
The motor does not run.	F15 (Serial communication broken)	Serial communication broken.	Make a reset and try to establish contact. Check contacts, cables and option board. Verify - System address (menu 111). - Baudrate (menu 112). - Parity (menu 113). If the fault is not found, run the motor with keyboard control if urgent (set menu 006 to "1"). See also manual for serial communication.
	F16 (Phase reversal)	Incorrect phase sequence on main supply.	Switch L2 and L3 input phases.
	----	Start command comes perhaps from incorrect control source. (I.e. start from keyboard when remote control is selected).	Give start command from correct source (menu 006).
	-Loc	System in keyboard lock.	Unlock keyboard by pressing the keys 'NEXT' and 'ENTER' for at least 3 sec.
The motor is running but an alarm is given.	F1 (Phase input failure)	Failure in one phase. Perhaps fuse defective.	Check fuses and mains supply. Deselect 'Run at single phase input failure' in menu 101, if stop is desired at single phase loss.
	F4 (Full speed not reached at set current limit and start time)	Current limit parameters are perhaps not matched to the load and motor.	Increase the starting time and/or the current limit level. Deselect 'Run at current limit time-out' in menu 102, if stop is desired at current limit time-out.
	F12 (Shorted thyristor)	Perhaps a damaged thyristor.	When stop command is given, a free wheel stop is made. Make a reset and a restart. If alarm F14 appears immediately, contact your local MSF sales outlet. If it is urgent to start the motor, set soft starter in 'Direct On Line' (menu 024). It is possible to start in this mode.
		By pass contactor is used but menu 032 'Bypass' is not set to "on".	Set menu 032 'Bypass' to "on".
	F15 (Serial communication broken)	Serial communication broken.	Make a reset and try to establish contact. Check contacts, cables and option board. Verify - System address (menu 111). - Baudrate (menu 112). - Parity (menu 113). If the fault is not found, run the motor with keyboard control if urgent, see also manual for serial communication.

Observation	Fault indication	Cause	Solution
The motor jerks etc.	When starting, motor reaches full speed but it jerks or vibrates.	If 'Torque control' or 'Pump control' is selected, it is necessary to input motor data into the system.	Input nominal motor data in menus 041-046. Select the proper load characteristic in menu 025. Select a correct initial- and end torque at start in menus 016 and 017. If 'Bypass' is selected, check that the current transformers are correct connected.
		Starting time too short.	Increase starting time.
		Starting voltage incorrectly set.	Adjust starting voltage.
		Motor too small in relation to rated current of soft starter.	Use a smaller model of the soft starter.
		Motor too large in relation to load of soft starter.	Use larger model of soft starter.
		Starting voltage not set correctly	Readjust the start ramp. Select the current limit function.
	Starting or stopping time too long, soft does not work.	Ramp times not set correctly.	Readjust the start and/or stop ramp time.
		Motor too large or too small in relation to load.	Change to another motor size.
The monitor function does not work.	No alarm or pre-alarm	It is necessary to input nominal motor data for this function. Incorrect alarm levels.	Input nominal motor data in menus 041-046. Adjust alarm levels in menus 091 - 099. If 'Bypass' is selected, check that the current transformers are correct connected.
Unexplainable alarm.	F5, F6, F7, F8, F9, F10	Alarm delay time is too short.	Adjust the response delay times for the alarms in menus 075, 082, 084, 086, 093 and 099.
The system seems locked in an alarm.	F2 (Motor protection, overload)	PTC input terminal could be open. Motor could still be too warm. If internal motor protection is used, the cooling in the internal model take some time.	PTC input terminal should be short circuit if not used. Wait until motor PTC gives an OK (not overheated) signal. Wait until the internal cooling is done. Try to reset the alarm after a while.
	F3 (Soft start overheated)	Ambient temperature too high. Perhaps fan failure.	Check that cables from power part are connected in terminals 073, 074, 071 and 072. MSF-017 to MSF-145 should have a short circuit between 071 and 072. Check also that the fan(s) is rotating.
Parameter will not be accepted.	----	If the menu number is one of 020 - 025, only one can be selected. In other words only one main mode is possible at a time.	Deselect the other main mode before selecting the new one.
		If menu 061, 'Parameter set' is set to "0", the system is in a remote parameter selection mode. It is now impossible to change most of the parameters.	Set the menu 061, 'Parameter set' to a value between "1" - "4" and then it is possible to change any parameter.
		During acceleration, deceleration, slow speed, DC brake and Power factor control mode, it is impossible to change parameters.	Set parameters during stop or full voltage running.
		If control source is serial comm., it is impossible to change parameters from keyboard and vice versa.	Change parameters from the actual control source.
		Some menus include only read out values and not parameters.	Read-out values can not be altered. In table 13, page 35, read-out menus has '---' in the factory setting column.
	-Loc	Keyboard is locked.	Unlock keyboard by pressing the keys 'NEXT' and 'ENTER' for at least 3 sec.

## 10. MAINTENANCE

In general the soft starter is maintenance free. There are however some things which should be checked regularly. Especially if the surroundings are dusty the unit should be cleaned regularly.



**WARNING!** Do not touch parts inside the enclosure of the unit when the control and motor voltage is switched on.

### Regular maintenance

- Check that nothing in the soft starter has been damaged by vibration (loose screws or connections).
- Check external wiring, connections and control signals. Tighten terminal screws and busbar bolts if necessary.
- Check that PCB boards, thyristors and cooling fin are free from dust. Clean with compressed air if necessary. Make sure the PCB boards and thyristors are undamaged.
- Check for signs of overheating (changes in colour on PCB boards, oxidation of solder points etc.). Check that the temperature is within permissible limits.
- Check that the cooling fan/s permit free air flow. Clean any external air filters if necessary.

In the event of fault or if a fault cannot be cured by using the fault-tracing table in chapter 9, page 68.

## 11. OPTIONS

The following option are available. Please contact your supplier for more detailed information.

### 11.1 Serial communication

For serial communication the MODBUS RTU (RS232/RS485) option card is available order number: 01-1733-00.



Fig. 60 Option RS232/485

### 11.2 Field bus systems

Various option cards are available for the following bus systems:

- PROFIBUS DP order number: 01-1734-01
- Device NET, order number: 01-1736-01
- LONWORKS: 01-1737-01
- FIP IO: 01-1738-01
- INTERBUS-S: 01-1735-01

Each system has his own card. The option is delivered with an instruction manual containing the all details for the set-up of the card and the protocol for programming.



Fig. 61 Option Profibus

### 11.3 External PPU.

The external PPU option is used to move the PPU (keyboard) from the soft starter to the front of a panel door or control cabinet.

The maximum distance between the soft starter and the external PPU is 3 m.

The option can be factory mounted (01-2138-01) or it can be built in later (01-2138-00). For both versions instruction /data sheet are available.

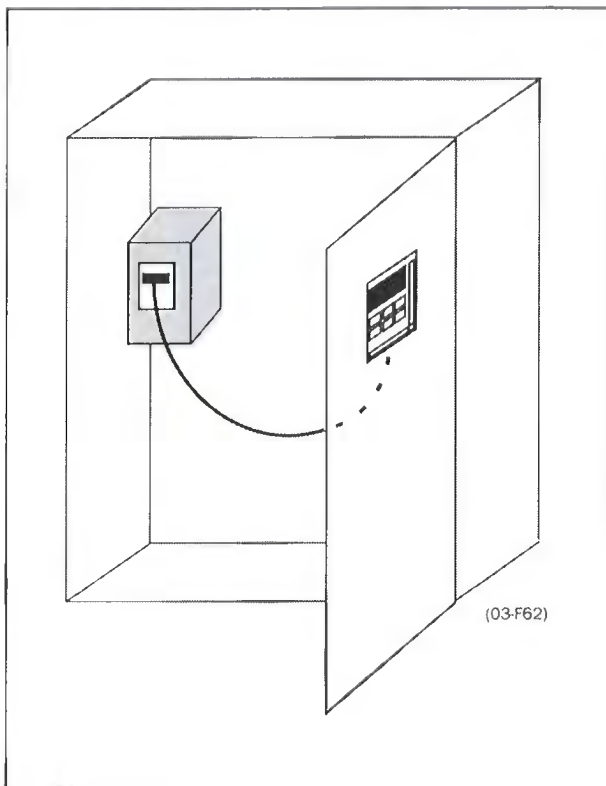


Fig. 62 Shows an example of the External PPU after it has been built in.

#### 11.3.1 Cable kit for external current transformers

This kit is used for the bypass function, to connect the external current transformers more easy. order number: 01-2020-00.

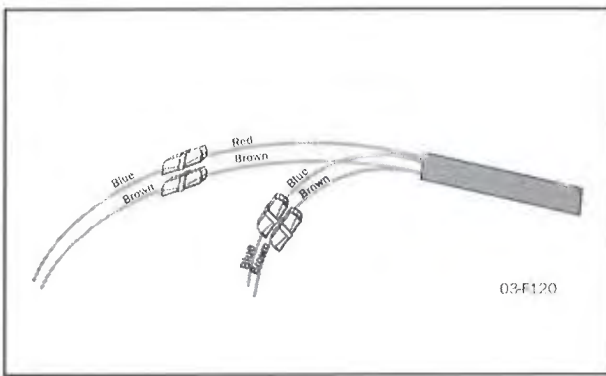


Fig. 63 Cable kit

## 11.4 Terminal clamp

Data: Single cables, Cu or Al

Cables 95-300 mm<sup>2</sup>

MSF type Cu Cable 310

Bolt for connection to busbar M10

Dimensions in mm 33x84x47 mm

Order No. single 9350

Data: Parallel cables, Cu or Al

Cables 2x95-300 mm<sup>2</sup>

MSF type and Cu Cable 310 to -835

Bolt for connection to busbar M10

Dimensions in mm 35x87x65

Order No. parallel 9351

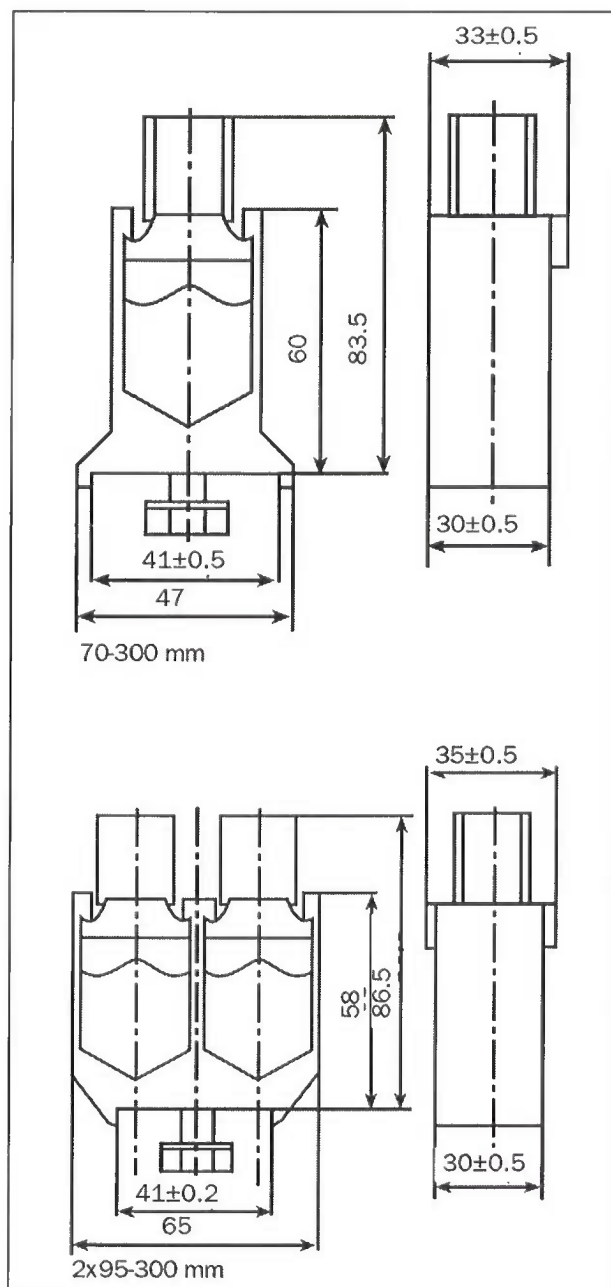


Fig. 64 The terminal clamp.



## 12. TECHNICAL DATA

3x200–525 V 50/60 Hz Model	MSF-017		MSF-030		MSF-045		MSF-060	
Soft starter rating according to AC35a, see chapter 4. page 13	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light
Rated current of soft starter (A)	17	22	30	37	45	60	60	72
Recommended motor size (kW) for 400 V	7.5	11	15	18.5	22	30	30	37
Recommended motor size (kW) for 525 V	11	15	18.5	22	30	37	37	45
Order number: supply voltage (100-240V)	01-1301-01		01-1302-01		01-1303-01		01-1304-01	
Order number: supply voltage (380-500V)	01-1301-02		01-1302-02		01-1303-02		01-1304-02	
3x200-690V 50/60Hz Model	MSF-017		MSF-030		MSF-045		MSF-060	
Rated current of soft starter (A)	17	22	30	37	45	60	60	72
Motor power for 690V	15	18.5	22	30	37	55	55	75*
Order number: supply voltage (100-240V)	01-1321-01		01-1322-01		01-1323-01		01-1324-01	
Order number: supply voltage (380-500V)	01-1321-02		01-1322-02		01-1323-02		01-1324-02	
Electrical Data								
Recommended wiring fuse (A) 1)	25/50	32	35/80	50	50/125	80	63/160	100
Semi-conductor fuses, if required	80 A		125 A		160 A		200 A	
Power loss at rated motor load (W)	50	70	90	120	140	180	180	215
Power consumption control card	20 VA		20 VA		25 VA		25 VA	
Mechanical Data								
Dimensions in mm HxWxD	320x126x260		320x126x260		320x126x260		320x126x260	
Mounting position (Vertical/Horizontal)	Vertical		Vertical		Vert. or Horiz.		Vert. or Horiz.	
Weight (kg)	6.7		6.7		6.9		6.9	
Connection busbars Cu, (bolt)	15x4 (M6)		15x4 (M6)		15x4 (M6)		15x4 (M8)	
Cooling system	Convection		Convection		Fan		Fan	
General Electrical Data								
Number of fully controlled phases	3							
Voltage tolerance control	Control +/- 10%							
Voltage tolerance motor	Motor 200-525 +/- 10%/200-690 + 5%, -10%							
Recommended fuse for control card (A)	Max 10 A							
Frequency	50/60 Hz							
Frequency tolerance	+/- 10%							
Relay contacts	3 x 8A, 250 V resistive load, 3A 250VAC inductive (PF=0.4)							
Type of protection/insulation								
Type of casing protection	IP 20							
Other General Data								
Ambient temperatures								
In operation	0 - 40 °C							
Max. e.g. at 80% IN	50 °C							
In storage	(-25) - (+70) °C							
Relative air humidity	95%, non-condensing							
Max. altitude without derating	(See separate: Technical information 151) 1000 m							
Norms/Standards, Conform to:	IEC 947-4-2, EN 292, EN 60204-1, UL508							
EMC, Emission	EN 50081-2, (EN 50081-1 with bypass contactor)							
EMC, Immunity	EN 50082-2							
1) Recommended wiring fuses for: <b>Heavy</b> (first column): ramp/direct start <b>Normal/Light</b> (second column): ramp start								
<b>NOTE! Short circuit withstand MSF017-060 5000 rms A when used with K5 or RK5 fuses.</b>								

\* 2-pole motor

3x200–525 V 50/60 Hz Model	MSF-075		MSF-085		MSF-110		MSF-145	
Soft starter rating according to AC35a, see chapter 4, page 13	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light
Rated current of soft starter (A)	75	85	85	96	110	134	145	156
Recommended motor size (kW) for 400 V	37	45	45	55*	55	75	75	
Recommended motor size (kW) for 525 V	45	55	55	75*	75	90	90	110
Order number for supply voltage (100-240 V)	01-1305-01		01-1306-01		01-1307-01		01-1308-01	
Order number for supply voltage (380-550 V)	01-1305-02		01-1306-02		01-1307-02		01-1308-02	
3x200–690 V 50/60 Hz Model	MSF-075		MSF-085		MSF-110		MSF-145	
Rated current of soft starter (A)	75	85	85	90	110	134	145	156
Motor power for 690V	55	75	75	90	90	110	132	160*
Order number for supply voltage (100-240 V)	01-1325-01		01-1326-01		01-1327-01		01-1328-01	
Order number for supply voltage (380-550 V)	01-1325-02		01-1326-02		01-1327-02		01-1328-02	
Electrical Data								
Recommended wiring fuse (A) 1)	80/200	100	100/250	125	125/315	180	160/400	200
Semi-conductor fuses, if required	250 A		315 A		350 A		450 A	
Power loss at rated motor load (W)	230	260	260	290	330	400	440	470
Power consumption control card	25 VA		25 VA		25 VA		25 VA	
Mechanical Data								
Dimensions in mm HxWxD	320x126x260		320x126x260		400x176x260		400x176x260	
Mounting position (Vertical/Horizontal)	Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.	
Weight (kg)	6.9		6.9		12		12	
Connection, busbars Cu, (bolt)	15x4 (M8)		15x4 (M8)		20x4 (M10)		20x4 (M10)	
Cooling system	Fan		Fan		Fan		Fan	
General Electrical Data								
Number of fully controlled phases	3							
Voltage tolerance control	Control +/- 10%							
Voltage tolerance motor	Motor 200-525 +/- 10%/200-690 + 5%, -10%							
Recommended fuse for control card (A)	Max 10 A							
Frequency	50/60 Hz							
Frequency tolerance	+/- 10%							
Relay contacts	8A, 250 V resistive load, 3A, 250 V inductive load (PF=0.4)							
Type of protection/insulation								
Type of casing protection	IP 20							
Other General Data								
Ambient temperatures in operation	0 - 40 °C							
Max. e.g. at 80% I <sub>N</sub>	50 °C							
In storage	(-25) - (+70) °C							
Relative air humidity	95%, non-condensing							
Max. altitude without derating	(See separate: Technical information 151) 1000 m							
Norms/Standards, Conform to:	IEC 947-4-2, EN 292, EN 60204-1, UL508							
EMC, Emission	EN 50081-2, (EN 50081-1 with bypass contactor)							
EMC, Immunity	EN 50082-2							
1) Recommended wiring fuses for: Heavy (first column): ramp/direct start Normal/Light (second column): ramp start								
NOTE! Short circuit withstand MSF075-145 10000 rms A when used with K5 or RK5 fuses.								

\* 2-pole motor

3x200–525 V 50/60 Hz Model	MSF-170		MSF-210		MSF-250		MSF-310		MSF-370	
Soft starter rating according to AC35a, see chapter 4, page 13	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light
Rated current of soft starter (A)	170	210	210	250	250	262	310	370	370	450
Recommended motor size (kW) for 400 V	90	110	110	132	132	160*	160	200	200	250
Recommended motor size (kW) for 525 V	110	132	132	160	160	200*	200	250	250	315
Order no. for supply voltage (100-240V)	01-1309-11		01-1310-11		01-1311-11		01-1312-01		01-1313-01	
Order no. for supply voltage (380-550V)	01-1309-12		01-1310-12		01-1311-12		01-1312-02		01-1313-02	
3x200–690 V 50/60 Hz Model	MSF-170		MSF-210		MSF-250		MSF-310		MSF-370	
Rated current of soft starter (A)	170	210	210	250	250	262	310	370	370	450
Motor power for 690 V	160	200	200	250	250	250	315	355	355	400
Order no. for supply voltage (100-240V)	01-1329-01		01-1330-01		01-1331-01		01-1332-01		01-1333-01	
Order no. for supply voltage (380-550V)	01-1329-02		01-1330-02		01-1331-02		01-1332-02		01-1333-02	
<b>Electrical Data</b>										
Recommended wiring fuse (A) 1)	200/400	200	250/400	315	250/500	315	315/630	400	400/800	500
Semi-conductor fuses, if required	700 A		700 A		700 A		800 A		1000 A	
Power loss at rated motor load (W)	510	630	630	750	750 W		930	1100	1100	1535
Power consumption control card	35 VA		35 VA		35 VA		35 VA		35 VA	
<b>Mechanical Data</b>										
Dimensions mm HxWxD incl. brackets	500x260x260		500x260x260		500x260x260		532x547x278		532x547x278	
Mounting position (Vertical/Horizontal)	Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.	
Weight (kg)	20		20		20		42		46	
Connection, Busbars Al/Cu (bolt)	30x4 (M10)		30x4 (M10)		30x4 (M10)		40x8 (M12)		40x8 (M12)	
Cooling system	Fan		Fan		Fan		Fan		Fan	
<b>General Electrical Data</b>										
Number of fully controlled phases	3									
Voltage tolerance control	Control +/- 10%									
Voltage tolerance motor	Motor 200-525 +/- 10%/200-690 + 5%, -10%									
Recommended fuse for control card (A)	Max 10 A									
Frequency	50/60 Hz									
Frequency tolerance	+/- 10%									
Relay contacts	8A, 250 V resistive load, 3A, 250 V inductive load (PF=0.4)									
<b>Type of protection/Insulation</b>										
Type of casing protection	IP 20									
<b>Other General Data</b>										
Ambient temperatures in operation	0 - 40 °C									
Max. e.g. at 80% I <sub>N</sub>	50 °C									
In storage	(-25) - (+70) °C									
Relative air humidity	95%, non-condensing									
Max. altitude without derating	(See separate: Technical information 151) 1000 m									
<b>Norms/Standards, Conform to:</b>	IEC 947-4-2, EN 292, EN 60204-1, (UL508, only MSF-170 to MSF-250)									
EMC, Emission	EN 50081-2, (EN 50081-1 with bypass contactor)									
EMC, Immunity	EN 50082-2									
1) Recommended wiring fuses for:	<b>Heavy</b> (first column): ramp/direct start <b>Normal/Light</b> (second column): ramp start									
<b>NOTE! Short circuit withstand MSF170-250 18000 rms A when used with K5 or RK5 fuses.</b>										

\* 2-pole motor



3x200–525V 50/60Hz Model	MSF-450		MSF-570		MSF-710		MSF-835		MSF-1000		MSF-1400	
Soft starter rating according to AC35a, see chapter 4, page 13	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light	5.0-30: 50-10 heavy	3.0-30: 50-10 normal/light
Rated current of soft starter (A)	450	549	570	710	710	835	835	960	1000	1125	1400	1650
Recommended motor size (kW) for 400 V	250	315	315	400	400	450	450	560	560	630	800	930
Recommended motor size (kW) for 525 V	315	400	400	500	500	560	600	630	660	710	1000	1250
Order no. for supply voltage (100-240V)	01-1341-01		01-1315-01		01-1316-01		01-1317-01		01-1318-01		01-1319-01	
Order no. for supply voltage (380-550V)	01-1314-02		01-1315-02		01-1316-02		01-1317-02		01-1318-02		01-1319-02	
3x200–690V 50/60Hz Model	MSF-450		MSF-570		MSF-710		MSF-835		MSF-1000		MSF-1400	
Rated current of soft starter (A)	450	549	570	640	710	835	835	880	1000	1125	1400	1524
Motor power for 690 V	400	560	560	630	710	800	800		1000	1120	1400	1600
Order no. for supply voltage (100-240V)	01-1334-01		01-1335-01		01-1336-01		01-1337-01		01-1338-01		01-1339-01	
Order no. for supply voltage (380-550V)	01-1334-02		01-1335-02		01-1336-02		01-1337-02		01-1338-02		01-1339-02	
Electrical Data												
Recommended wiring fuse (A 1)	500/1 k	630	630/1 k	800	800/1 k	1 k	1 k/1.2 k	1 k	1k/1.4 k	1.2 k	1.4 k/1.8 k	1.8 k
Semi-conductor fuses, if required	1250 A		1250 A		1800 A		2500 A		3200 A		4000 A	
Power loss at rated motor load (W)	1400	1730	1700	2100	2100	2500	2500	2875	3000	3375	4200	4950
Power consumption control card	35 VA		35 VA		35 VA		35 VA		35 VA		35 VA	
Mechanical Data												
Dimensions mm HxWxD incl. brackets	532x547x278		687x640x302		687x640x302		687x640x302		900x875x336		900x875x336	
Mounting position (Vertical/Horizontal)	Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.		Vert. or Horiz.	
Weight (kg)	46		64		78		80		175		175	
Connection, Busbars Al (bolt)	40x8 (M12)		40x10 (M12)		40x10 (M12)		40x10 (M12)		75x10 (M12)		75x10 (M12)	
Cooling system	Fan		Fan		Fan		Fan		Fan		Fan	
General Electrical Data												
Number of fully controlled phases	3											
Voltage tolerance control	Control +/- 10%											
Voltage tolerance motor	Motor 200-525 +/- 10%/200-690 + 5%, -10%											
Recommended fuse for control card (A)	Max 10 A											
Frequency	50/60 Hz											
Frequency tolerance	+/- 10%											
Relay contacts	8A, 250 V resistive load, 3A, 250 V inductive load (PF=0.4)											
Type of protection/insulation												
Type of casing protection	IP 20								IPO0			
Other General Data												
Ambient temperatures in operation	0 - 40 °C											
Max. e.g. at 80% I <sub>N</sub>	50 °C											
In storage	(-25) - (+70) °C											
Relative air humidity	95%, non-condensing											
Max. altitude without derating	(See separate: Technical information 151) 1000 m											
Norms/Standards, Conform to:	IEC 947-4-2, EN 292, EN 60204-1											
EMC, Emission	EN 50081-2, (EN 50081-1 with bypass contactor)											
EMC, Immunity	EN 50082-2											
1) Recommended wiring fuses for:	Heavy (first column): ramp/direct start Normal/Light (second column): ramp start											

## Semi-conductor fuses

Always use standard commercial fuses to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if preferred (e.g. Bussmann type FWP or similar, see table below).

The normal guarantee is valid even if superfast semiconductor fuses are not used.

Type	FWP Bussmann fuse	
	A	$I^2t$ (fuse) x 1000
MSF-017	80	2.4
MSF-030	125	7.3
MSF-045	150	11.7
MSF-060	200	22
MSF-075	250	42.5
MSF-085	300	71.2
MSF-110	350	95.6
MSF-145	450	137
MSF-170B	700	300
MSF-210B	700	300
MSF-250B	800	450
MSF-310	800	450
MSF-370	1000	600
MSF-450	1200	2100
MSF-570	1400	2700
MSF-710	1800	5300
MSF-835	2000	
MSF-1000	2500	
MSF-1400	3500	

## 13. SET-UP MENU LIST

Menu number	Function/Parameter	Range	Par.set	Factory setting	Value	Page
001	Initial voltage at start	25 - 90% of U	1 - 4	30		page 36
002	Start time ramp 1	1 - 60 sec	1 - 4	10		page 36
003	Step down voltage at stop	100 - 40% U	1 - 4	100		page 36
004	Stop time ramp 1	oFF, 2 - 120 sec	1 - 4	oFF		page 36
005	Current	0.0 - 9999 Amp	-----	-----		page 36
006	Control mode	1, 2, 3	1 - 4	2		page 37
007	Extended functions & metering	oFF, on	-----	oFF		page 38
008	Extended functions	oFF, on	-----	oFF		page 38
011	Initial voltage start ramp 2	30 - 90% U	1 - 4	90		page 38
012	Start time ramp 2	oFF, 1 - 60 sec	1 - 4	oFF		page 38
013	Step down voltage stop ramp 2	100 - 40% U	1 - 4	40		page 38
014	Stop time ramp 2	oFF, 2 - 120 sec	1 - 4	oFF		page 38
016	Initial torque at start	0 - 250% T <sub>n</sub>	1 - 4	10		page 39
017	End torque at start	50 - 250% T <sub>n</sub>	1 - 4	150		page 39
018	End torque at stop	0-100% T <sub>n</sub>	1 - 4	0		page 39
020	Voltage ramp with current limit at start	oFF, 150 - 500% I <sub>n</sub>	1 - 4	oFF		page 39
021	Current limit at start	oFF, 150 - 500% I <sub>n</sub>	1 - 4	oFF		page 40
022	Pump control	oFF, on	1 - 4	oFF		page 40
023	Remote analogue control	oFF, 1, 2	1 - 4	oFF		page 41
024	Full voltage start D.O.L	oFF, on	1 - 4	oFF		page 41
025	Torque control	oFF, 1, 2	1 - 4	oFF		page 42
030	Torque boost active time	oFF, 0.1 - 2.0 sec	1 - 4	oFF		page 43
031	Torque boost current limit	300 - 700% I <sub>n</sub>	1 - 4	300		page 43
032	Bypass	oFF, on	1 - 4	oFF		page 43
033	Power Factor Control PFC	oFF, on	1 - 4	oFF		page 46
034	Brake active time	oFF, 1 - 120 sec	1 - 4	oFF		page 47
035	Braking strength	100 - 500%	1 - 4	100		page 47
036	Braking methods	1, 2	1 - 4	1		page 47
037	Slow speed torque	10 - 100	1 - 4	10		page 49
038	Slow speed time at start	oFF, 1 - 60 sec	1 - 4	oFF		page 49
039	Slow speed time at stop	oFF, 1 - 60 sec	1 - 4	oFF		page 49
040	DC-Brake at slow speed	oFF, 1-60 sec	1 - 4	oFF		page 49
041	Nominal motor voltage	200 - 700 V	1 - 4	400		page 50
042	Nominal motor current	25-150% I <sub>nsoft</sub> in Amp	1 - 4	I <sub>nsoft</sub> in Amp		page 50
043	Nominal motor power	25 - 300% of P <sub>nsoft</sub> in kW	1 - 4	P <sub>nsoft</sub> in kW		page 50
044	Nominal speed	500 - 3600 rpm	1 - 4	N <sub>nsoft</sub> in rpm		page 50
045	Nominal power factor	0.50 - 1.00	1 - 4	0.86		page 50
046	Nominal frequency	50, 60 Hz	-----	50		page 50

Menu number	Function/Parameter	Range	Par.set	Factory setting	Value	Page
051	Programmable relay K1	1, 2, 3, (4), 5		1		page 51
052	Programmable relay K2	1, 2, 3, 4, 5	-----	2		page 51
054	Analogue output	oFF, 1, 2	1 - 4	oFF		page 52
055	Analogue output value	1, 2, 3	1 - 4	1		page 52
056	Scaling analogue output	5 - 150%	1 - 4	100		page 52
057	Digital input selection	oFF, 1, 2, 3, 4	1 - 4	oFF		page 53
058	Digital input pulses	1-100	1 - 4	1		page 53
061	Parameter set	0, 1, 2, 3, 4	-----	1		page 54
071	Motor PTC input	no, YES	-----	no		page 55
072	Internal motor thermal protection class	oFF, 2 - 40 sec	-----	10		page 55
073	Used thermal capacity	0 - 150%	-----	-----		page 55
074	Starts per hour limitation	oFF, 1 - 99/hour	1 - 4	oFF		page 55
075	Locked rotor alarm	oFF, 1.0 - 10.0 sec	1 - 4	oFF		page 55
081	Voltage unbalance alarm	2 - 25% $U_n$	1 - 4	10		page 56
082	Response delay voltage unbalance alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 56
083	Over voltage alarm	100 - 150% $U_n$	1 - 4	115		page 56
084	Response delay over voltage alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 56
085	Under voltage alarm	75 - 100% $U_n$	1 - 4	85		page 57
086	Response delay under voltage alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 57
087	Phase sequence	L123, L321	-----	-----		page 57
088	Phase reversal alarm	oFF, on	-----	oFF		page 57
089	Auto set power limits	no, YES	-----	no		page 57
090	Output shaft power	0.0 - 200.0% $P_n$	-----	-----		page 57
091	Start delay power limits	1 - 250 sec	1 - 4	10		page 58
092	Max power alarm limit	5 - 200% $P_n$	1 - 4	115		page 58
093	Max alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 58
094	Max power pre-alarm limit	5 - 200% $P_n$	1 - 4	110		page 58
095	Max pre-alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 58
096	Min pre-alarm power limit	5 - 200% $P_n$	1 - 4	90		page 58
097	Min pre-alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 59
098	Min power alarm limit	5 - 200% $P_n$	1 - 4	85		page 59
099	Min alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 59
101	Run at single phase input failure	no, YES	1 - 4	no		page 61
102	Run at current limit time-out	no, YES	1 - 4	no		page 61
103	Jog forward enable	oFF, on	1 - 4	oFF		page 61
104	Jog reverse enable	oFF, on	1 - 4	oFF		page 61
105	Automatic return menu	oFF, 1-999	-----	oFF		page 62
111	Serial comm. unit address	1 - 247	-----	1		page 62
112	Serial comm. baudrate	2.4 - 38.4 kBaud	-----	9.6		page 62

Menu number	Function/Parameter	Range	Par.set	Factory setting	Value	Page
113	Serial comm. parity	0, 1	-----	0		page 62
114	Serial comm. contact broken	oFF, 1, 2	-----	1		page 62
199	Reset to factory settings	no, YES	-----	no		page 63
201	Current	0.0 - 9999 Amp	-----	-----		page 63
202	Line main voltage	0 - 720 V	-----	-----		page 63
203	Output shaft power	-9999 - 9999 kW	-----	-----		page 63
204	Power factor	0.00 - 1.00	-----	-----		page 63
205	Power consumption	0.000 - 2000 MWh	-----	-----		page 63
206	Reset power consumption	no, YES	-----	no		page 64
207	Shaft torque	-9999 - 9999 Nm	-----	-----		page 64
208	Operation time	Hours	-----	-----		page 64
211	Current phase L1	0.0 - 9999 Amp	-----	-----		page 64
212	Current phase L2	0.0 - 9999 Amp	-----	-----		page 64
213	Current phase L3	0.0 - 9999 Amp	-----	-----		page 64
214	Line main voltage L1 - L2	0 - 720 V	-----	-----		page 64
215	Line main voltage L1 - L3	0 - 720 V	-----	-----		page 64
216	Line main voltage L2 - L3	0 - 720 V	-----	-----		page 64
221	Locked keyboard info	no, YES	-----	no		page 65
901	Alarm list, Latest error	F1 - F16	-----	-----		page 65
902 -915	Alarm list, Older error in chronological order	F1 - F16	-----	-----		page 65

Explanation of units:

U	Input line voltage
Un	Nominal motor voltage.
In	Nominal motor current.
Pn	Nominal motor power.
Nn	Nominal motor speed.
Tn	Nominal shaft torque.
Insoft	Nominal current soft starter.
Pnsoft	Nominal power soft starter.
Nnsoft	Nominal speed soft starter.

Calculation shaft torque

$$T_n = \frac{P_n}{\left(\frac{N_n}{60} \times 2\pi\right)}$$

**NOTE! The six main functions for motor control, menus 020–025, can only be selected one at a time.**



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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 – L5A – SURGE DIVITER NEUTRAL 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 25mm<sup>2</sup> cable.

3 tunnels 7.7mm diameter accommodate 1 x 25mm<sup>2</sup> cable.

Certificate of Suitability No. CS2252N.



L4T35R

### 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 16mm<sup>2</sup>.

2 tunnels, 5.8mm diameter accommodate 1 x 16mm<sup>2</sup>.

#### 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 25mm<sup>2</sup>.

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 16mm<sup>2</sup> cable.

3 tunnels, 5.8mm diameter accommodate 1 x 16mm<sup>2</sup> 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 25mm<sup>2</sup> cable.

1 tunnel, 5.5mm diameter accommodates 1 x 16mm<sup>2</sup> cable.

3 tunnels, 4.7mm diameter accommodate 3 x 10mm<sup>2</sup> cable.

Transparent black cover with cut-outs.

#### L7

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



L7

**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 16mm<sup>2</sup> cable.  
4 tunnels, 5.8mm diameter  
accommodate 1 x 16mm<sup>2</sup> 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 16mm<sup>2</sup> cables.  
5 tunnels, 5.8mm diameter  
accommodate 1 x 16mm<sup>2</sup> 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 16mm<sup>2</sup> cable.  
5 tunnels, 5.8mm diameter  
accommodate 1 x 16mm<sup>2</sup> 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 16mm<sup>2</sup> cable.  
7 tunnels, 5.8mm diameter  
accommodate 1 x 16mm<sup>2</sup> cable.  
Dimensions: 86 x 57 x 40mm.



L10

**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 16mm<sup>2</sup> cable.  
4 tunnels, 5.5mm diameter  
accommodate 1 x 16mm<sup>2</sup> cable.  
6 tunnels, 4.5mm diameter  
accommodate 1 x 10mm<sup>2</sup> 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 16mm<sup>2</sup> cable.  
6 tunnels, 5.5mm diameter  
accommodate 1 x 16mm<sup>2</sup> cable.  
6 tunnels, 4.5mm diameter  
accommodate 1 x 16mm<sup>2</sup> 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 16mm<sup>2</sup> cable.  
4 tunnels, 5.5mm diameter  
accommodate 1 x 16mm<sup>2</sup> cable.  
10 tunnels, 4.5mm diameter  
accommodate 1 x 10mm<sup>2</sup> 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 16mm<sup>2</sup> cable.  
4 tunnels, 5.5mm diameter  
accommodate 1 x 16mm<sup>2</sup> cable.  
12 tunnels, 4.5mm diameter  
accommodate 1 x 10mm<sup>2</sup> cable.  
Dimensions: 86 x 57 x 40mm.

**Tunnel Diameters**

Catalogue Number	4.7mm for 10mm <sup>2</sup> cable	6.3mm for 16mm <sup>2</sup> cable	5.7mm for 16mm <sup>2</sup> cable	7mm for 25mm <sup>2</sup> 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 16mm <sup>2</sup> cable	5.5mm for 16mm <sup>2</sup> cable	4.5mm for 10mm <sup>2</sup> 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

**TRADE PRICE LIST 2007 – 2008****DORE ELECTRICS**

Industrial Electrical Components Suppliers

Tel: 61-7-3549-5300

Email: sales@doreelec.com.au

Fax: 61-7-3349-5344

Web: www.doreelec.com.au

**Buzzers - IP44**

SCHEDULE 1

Part No.	Type	Dia.	dB	Price
BZ22R12AC/DC	Flush-Red	22mm	80	\$24.20
BZ22R24AC/DC	Flush-Red	22mm	80	\$24.20
BZ22R240	Flush-Red	22mm	80	\$24.20
BZ30DC24	Flush	30mm	75	\$48.40
BZ30AC24	Flush	30mm	75	\$48.40
BZ30AC110	Flush	30mm	75	\$48.40
BZ30AC240	Flush	30mm	75	\$48.40
BZ80DC24	Flush	80mm	85	\$48.40
BZ80AC24	Flush	80mm	85	\$48.40
BZ80AC240	Flush	80mm	85	\$48.40
BZ82AC12	Surface	82mm	85	\$48.40
BZ82DC12	Surface	82mm	85	\$48.40
BZ82DC24	Surface	82mm	85	\$48.40
BZ82AC24	Surface	82mm	85	\$48.40
BZ82AC240	Surface	82mm	85	\$48.40

**BZ22****BZ30****BZ80****BZ82****Sirens & Hooters**

SCHEDULE 1

SCZDC24	Siren	100mm	105	\$58.08
TCZAC230	Siren	75mm	105	\$82.28
TSDAC220	Siren	123mm	120	\$165.00
TCZDC24	Hooter	135mm	105	\$136.73
TCZAC240	Hooter	135mm	105	\$136.73

**Siren****Hooter****Earth & Neutral Bars – 165 Amp**

SCHEDULE 1

- Earth Links = 2 Main Screws for 165 Amp Cable – 2 Screws per Tunnel for 16mm Cable.

**Earth Links**

No. of Holes	Part No.	Price
6	165E6	\$7.75
12	165E12	\$9.50
18	165E18	\$12.21
24	165E24	\$17.50
30	165E30	\$23.13
36	165E36	\$26.25
42	165E42	\$28.13
48	165E48	\$30.00
54	165E54	\$38.63
60	165E60	\$41.25
72	165E72	\$46.25
80	165E80	\$49.25
84	165E84	\$49.25
96	165E96	\$68.50
108	165E108	\$87.50

**Mounting Feet**

- Fits all sizes up to 165 Amp

Part No.	Price Each
E/NFEET	\$1.29



## **7.9 TERMINALS / ISOLATORS**

- 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 – M205 – FUSED CARTRIDGES
- 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
- PHOENIC CONTACT – FBS – PLUG-IN BRIDGE STRIP
- PHOENIC CONTACT – AP-2 + AP2-TU – COVER PROFILE (SHROUDING) + CARRIER PLATE
- MOORE INDUSTRIES – ECT/4-20mA/4-20mA – CHEMICAL DOSING SIGNAL ISOLATOR



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

### 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)

### 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

#### 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 mm <sup>2</sup>
Maximum load current	12 A (with 2.5 mm <sup>2</sup> 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 mm <sup>2</sup>
Conductor cross section solid max.	2.5 mm <sup>2</sup>
Conductor cross section stranded min.	0.2 mm <sup>2</sup>
Conductor cross section stranded max.	2.5 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm <sup>2</sup>
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 mm <sup>2</sup>
2 conductors with same cross section, solid max.	1 mm <sup>2</sup>
2 conductors with same cross section, stranded min.	0.2 mm <sup>2</sup>
2 conductors with same cross section, stranded max.	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm <sup>2</sup>
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
<b>General</b>		
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
<b>Marking</b>		
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
<b>Plug/Adapter</b>		
1734634	CP-MSTB	Keying profile, is inserted into the slot on the plug or inverted header, red insulating material
<b>Tools</b>		
1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm <sup>2</sup> connection cross section, blade: 0.6 x 3.5 mm, without VDE approval

**Additional products**

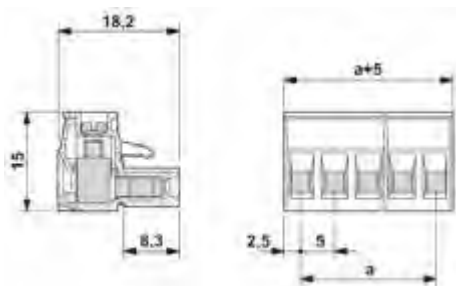
Item	Designation	Description
<b>General</b>		
1900028	EMSTBA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: green, Metal surface: Sn, Assembly: Press-in
1915042	EMSTBVA 2,5/20-G	Header, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5 mm, Color: 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





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



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### 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 mm <sup>2</sup>
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 mm <sup>2</sup>
Conductor cross section solid max.	2.5 mm <sup>2</sup>
Conductor cross section stranded min.	0.2 mm <sup>2</sup>
Conductor cross section stranded max.	2.5 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve min.	0.25 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve max.	2.5 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve max.	2.5 mm <sup>2</sup>
2 conductors with same cross section, solid min.	0.2 mm <sup>2</sup>
2 conductors with same cross section, solid max.	1 mm <sup>2</sup>
2 conductors with same cross section, stranded min.	0.2 mm <sup>2</sup>
2 conductors with same cross section, stranded max.	1.5 mm <sup>2</sup>

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 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	1.5 mm <sup>2</sup>
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
<b>Assembly</b>		
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
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**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
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**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 mm <sup>2</sup> connection cross section, blade: 0.6 x 3.5 mm, without VDE approval
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**Additional products**

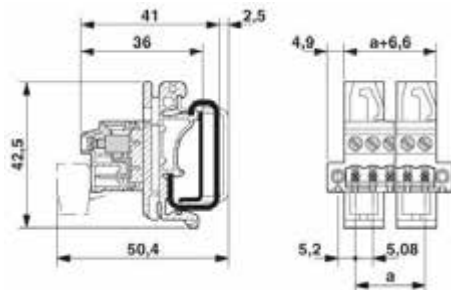
Item	Designation	Description
<b>General</b>		
1777976	FRONT-MSTB 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 5.08 mm, Color: green, Metal surface: Sn
1778166	MSTB 2,5/20-STF-5,08	Plug component, Nominal current: 12 A, Rated voltage (III/2): 320 V, Pitch: 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 [mm <sup>2</sup> ] 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





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 mm<sup>2</sup> - 10 mm<sup>2</sup>, AWG 24 - 8, Width: 8.2 mm, Color: gray, Mounting type: NS 35/7,5, NS 35/15



### Product notes

WEEE/RoHS-compliant since:  
10/26/2006



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### 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)

### 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 mm <sup>2</sup> 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 <sub>N</sub>	41 A
Nominal voltage U <sub>N</sub>	1000 V
Open side panel	ja

**Connection data**

Conductor cross section solid min.	0.2 mm <sup>2</sup>
Conductor cross section solid max.	10 mm <sup>2</sup>
Conductor cross section stranded min.	0.2 mm <sup>2</sup>
Conductor cross section stranded max.	10 mm <sup>2</sup>
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 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve max.	6 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.25 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve max.	6 mm <sup>2</sup>
2 conductors with same cross section, solid min.	0.2 mm <sup>2</sup>
2 conductors with same cross section, solid max.	2.5 mm <sup>2</sup>
2 conductors with same cross section, stranded min.	0.2 mm <sup>2</sup>

UT 6 Order No.: 3044131

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3044131>

2 conductors with same cross section, stranded max.	2.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	4 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.25 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm <sup>2</sup>
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
<b>Assembly</b>		
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
<b>Bridges</b>		
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
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**General**

3047264	RB UT 6-ST(2,5/4)	Reducing bridge, Number of positions: 2, Color: red
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**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 mm <sup>2</sup> and 16 mm <sup>2</sup> connection cross section, blade: 1.0 x 4.0 mm
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**Diagrams/Drawings**

Circuit diagram





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	$\geq 1.6$ W (With single arrangement of the fuse terminal block in the event of overload)
	$\geq 1.6$ W (With interconnected arrangement of several fuse terminal blocks in the event of overload)
	$\geq 4$ W (With single arrangement of the fuse terminal block in the event of a short-circuit)
	$\geq 2.5$ 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 mm <sup>2</sup>
Conductor cross section solid max.	6 mm <sup>2</sup>
Conductor cross section stranded min.	0.5 mm <sup>2</sup>
Conductor cross section stranded max.	6 mm <sup>2</sup>
Conductor cross section AWG/kcmil min.	26
Conductor cross section AWG/kcmil max	10

**UT 4-HESILED 24 (5X20) Order No.: 3046090**
<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090>

Conductor cross section stranded, with ferrule without plastic sleeve min.	0.14 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm <sup>2</sup>
2 conductors with same cross section, solid min.	0.14 mm <sup>2</sup>
2 conductors with same cross section, solid max.	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded min.	0.14 mm <sup>2</sup>
2 conductors with same cross section, stranded max.	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm <sup>2</sup>
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
<b>Assembly</b>		
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

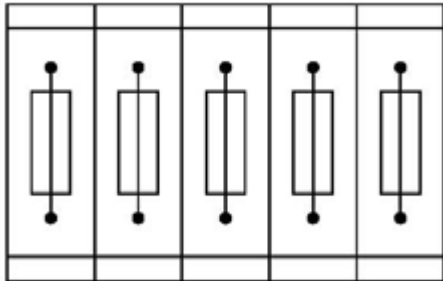
**Tools**

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm <sup>2</sup> connection cross section, blade: 0.6 x 3.5 mm, without VDE approval
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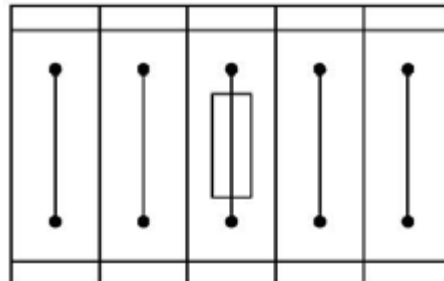
UT 4-HESILED 24 (5X20) Order No.: 3046090  
<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046090>

## Diagrams/Drawings

### Application drawing

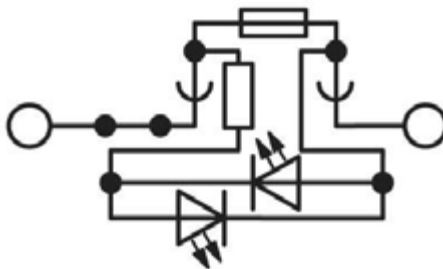


Fuse terminal blocks in interconnected arrangement, block consisting of 5 fuse terminal blocks



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

### Circuit diagram





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 mm<sup>2</sup> - 6 mm<sup>2</sup>, 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

UT 4-MT-P/P Order No.: 3046171

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046171>

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 mm <sup>2</sup> 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 <sub>N</sub>	20 A
Nominal voltage U <sub>N</sub>	500 V
Open side panel	nein

**Connection data**

Conductor cross section solid min.	0.14 mm <sup>2</sup>
Conductor cross section solid max.	6 mm <sup>2</sup>
Conductor cross section stranded min.	0.14 mm <sup>2</sup>
Conductor cross section stranded max.	6 mm <sup>2</sup>
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 mm <sup>2</sup>
Conductor cross section stranded, with ferrule without plastic sleeve max.	4 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve min.	0.14 mm <sup>2</sup>
Conductor cross section stranded, with ferrule with plastic sleeve max.	4 mm <sup>2</sup>
2 conductors with same cross section, solid min.	0.14 mm <sup>2</sup>
2 conductors with same cross section, solid max.	1.5 mm <sup>2</sup>
2 conductors with same cross section, stranded min.	0.14 mm <sup>2</sup>

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 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, min.	0.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, TWIN ferrules with plastic sleeve, max.	2.5 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, min.	0.14 mm <sup>2</sup>
2 conductors with same cross section, stranded, ferrules without plastic sleeve, max.	1.5 mm <sup>2</sup>
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
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**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

UT 4-MT-P/P Order No.: 3046171

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046171>**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**

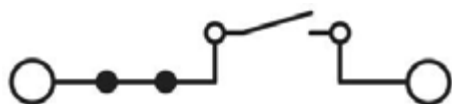
0201689	MPS-IH BU	Insulating sleeve, Color: blue
0201676	MPS-IH RD	Insulating sleeve, Color: red
0201663	MPS-IH WH	Insulating sleeve, Color: white
0201744	MPS-MT	Metal part
3030925	PAI-4	Test adapter, Color: gray
3030996	PS-6	Test adapter, Color: red

**Tools**

1205053	SZS 0,6X3,5	Screwdriver, bladed, matches all screw terminal blocks up to 4.0 mm <sup>2</sup> connection cross section, blade: 0.6 x 3.5 mm, without VDE approval
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**Diagrams/Drawings**

Circuit diagram





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 mm<sup>2</sup> - 6 mm<sup>2</sup>, 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



UT 4-MTD-PE Order No.: 3046223

<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046223>

Certification Ex:

IECEEx, KEMA-EX

**CSA**

AWG/kcmil	26-10
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**CUL**

AWG/kcmil	26-10
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**UL**

AWG/kcmil	26-10
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**Accessories**

Item	Designation	Description
<b>Assembly</b>		
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 mm <sup>2</sup> connection cross section, blade: 0.6 x 3.5 mm, without VDE approval
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UT 4-MTD-PE Order No.: 3046223

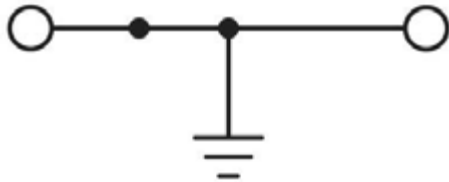
<http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=3046223>

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## Diagrams/Drawings

### Circuit diagram

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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

### 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)

### Product notes

WEEE/RoHS-compliant since:  
01/01/2003



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### 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>

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**Accessories**

Item	Designation	Description
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**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
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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

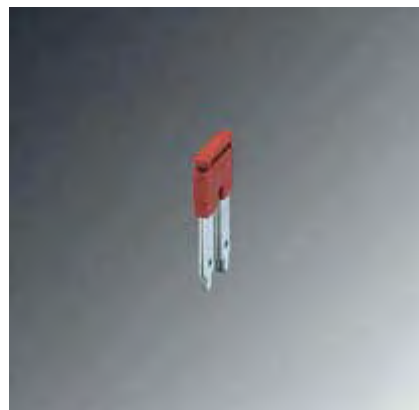
<http://www.download.phoenixcontact.com>  
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catalog

## 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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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



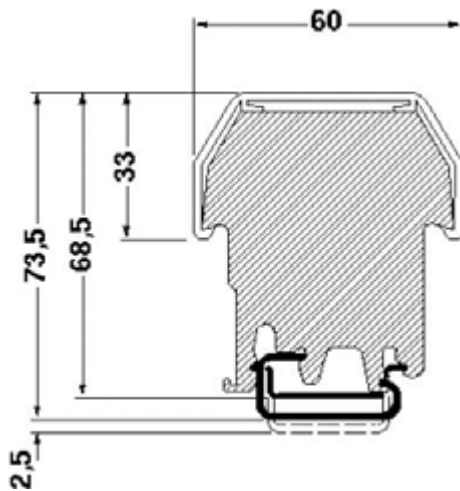
AP 2-TU Order No.: 5022630

<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



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, <b>Output-Loop</b> Powered (12-42Vdc)	2-3
2-Wire, <b>Input-Loop</b> Powered (5.5Vlp)	4-5
4-Wire, <b>Line/Mains</b> 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.

# 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).

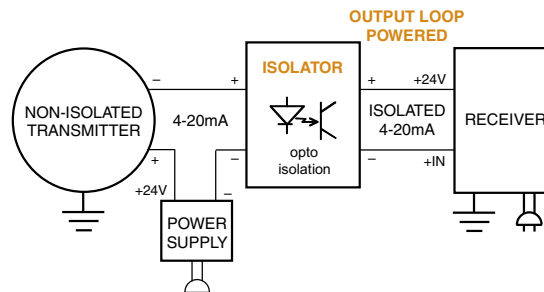
### Amplify (Boost) Signals

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).

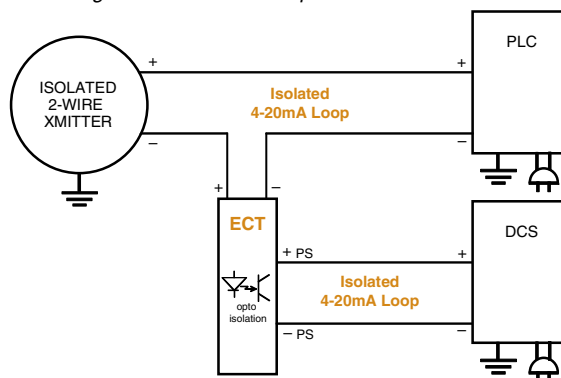
### Solve “Bucking” Power Supplies

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).

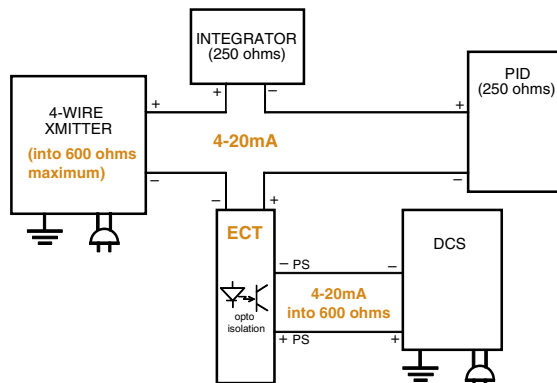
**Figure 1.** Input/output loop isolation and signal conversion.



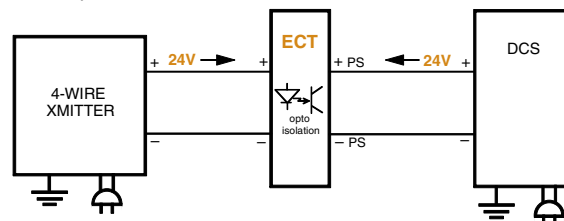
**Figure 2.** Divert a process signal, or protect expensive equipment by eliminating a common electrical path.



**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

<p><b>Performance</b></p> <p><b>Accuracy:</b> <math>\pm 0.1\%</math> of span (<math>\pm 0.2\%</math> for 0-150 AC inputs)</p> <p><b>Stability:</b> <math>\pm 0.2\%</math> of reading per year</p> <p><b>Isolation:</b> WITHOUT -RF OPTION: 1500Vrms between input and output; WITH -RF OPTION: 500Vrms between input and output</p> <p><b>Output Response Time:</b> DC Inputs, 100msec to 99% of output maximum; AC Inputs, 400msec to 99% of output</p> <p><b>Ripple:</b> 10mV peak-to-peak maximum measured across a 250 ohm resistor</p> <p><b>Over-Voltage Protection:</b> 48V, maximum on output; 48V reverse polarity protection on output</p>	<p><b>Performance (continued)</b></p> <p><b>Maximum Input Overrange:</b> Current Inputs 250% of full scale; DC Voltage Inputs, 150% of full scale</p> <p><b>Burden:</b> 1V maximum with 4-20mA input; 0.01V maximum with 0-5A input</p> <p><b>Load Capability:</b>  <math display="block">\frac{V_s - 12V_{dc}}{0.02A} = \text{ohms}</math></p> <p><b>Output Current Limiting:</b> 25mA typical; 30mA maximum</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -40°C to +85°C (-40°F to +185°F)</p> <p><b>Storage Range:</b> -40°C to +85°C (-40°F to +185°F)</p>	<p><b>Ambient Conditions (Continued)</b></p> <p><b>Ambient Temperature Effect:</b> <math>\pm 0.007\%</math> of span/°C typical; <math>\pm 0.015\%</math> of span/°C maximum</p> <p><b>Relative Humidity:</b> 0-95% non-condensing</p> <p><b>RFI/EMI Protection:</b> Less than <math>\pm 0.1\%</math> of span error when tested at 10V/m @ 20-1000MHz WITH -RF OPTION: Less than <math>\pm 0.1\%</math> of span error when tested at 30V/m @ 20-1000MHz</p> <p><b>Common Mode Rejection:</b> Exceeds 95dB @ 60Hz with a limit of 1500Vrms</p> <p><b>Adjustments</b></p> <p><b>Type:</b> Front panel pots</p> <p><b>Span:</b> <math>\pm 10\%</math></p> <p><b>Zero:</b> <math>\pm 5\%</math> (non-interactive when span is set first)</p> <p><b>Weight</b> 145g (5 oz)</p>
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## 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 $\pm 0.1\%$ 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

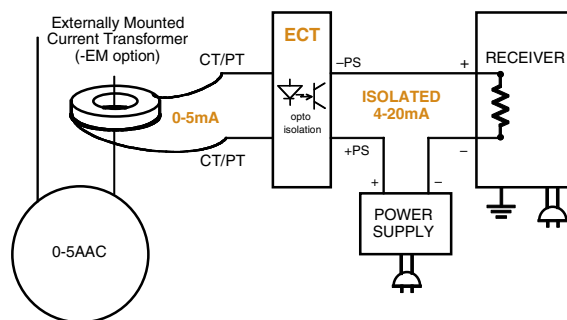
**When ordering, specify:** Unit / Input / Output / Power / Options [Housing]

**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).

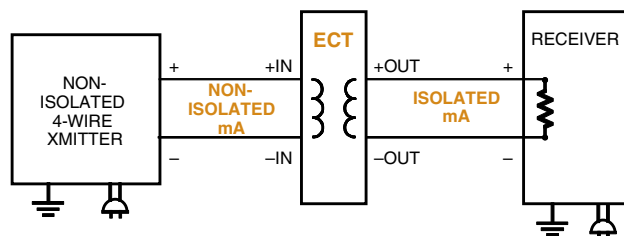
## Single and Multiple Unit Instrument Enclosures

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.

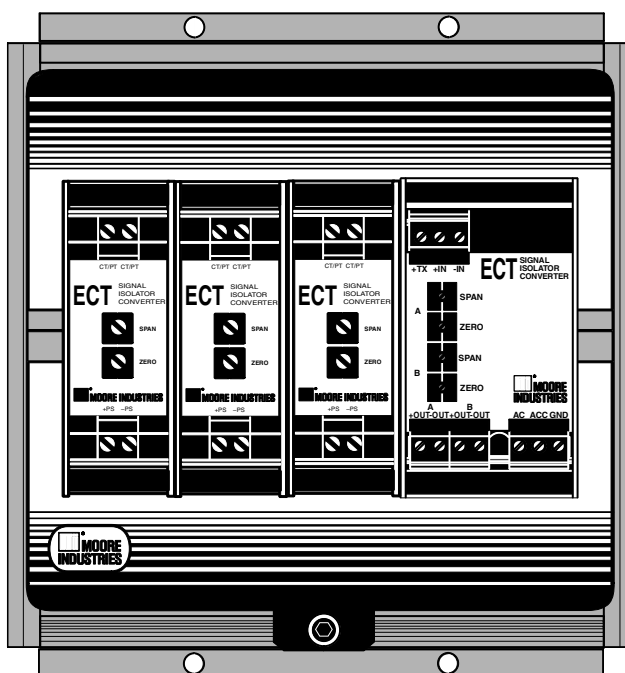
The *R-BOX* mounts on a pipe, panel or surface, and comes in a variety of widths to economically accommodate just one, or up to 10, ECTs. It features a pre-installed mounting rail; customizable conduit entry options; a clear cover; and a secure locking mechanism.

For more information, see the *R-BOX* Field-Mount Enclosure for DIN Instruments data sheet.

**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.



# ECT-DIN

Signal Isolator, Converter,  
Repeater, Booster and Splitter

## Specifications

<p><b>Performance</b></p> <p><b>Accuracy:</b> <math>\pm 0.075\%</math> of span</p> <p><b>Stability:</b> <math>\pm 0.2\%</math> of reading per year</p> <p><b>Isolation:</b> 500Vrms between input and output</p> <p><b>Output Response:</b> 20msec maximum to 99% of output</p> <p><b>Ripple:</b> 10mV peak-to-peak maximum measured across a 250 ohm resistor</p> <p><b>Over-Voltage Protection:</b> 48V, maximum on output; 48V, reverse polarity protection on output</p> <p><b>Maximum Input Overrange:</b> 200% of full scale</p> <p><b>Burden:</b> 5.5V when out-</p>	<p><b>Performance (continued)</b></p> <p>puts 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)</p> <p><b>Output Current Limiting:</b> 30mA with 250 ohm output load</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -29°C to +82°C -20°F to +180°F</p> <p><b>Storage Range:</b> -40°C to +85°C (-40°F to +185°F)</p>	<p><b>Ambient Conditions (Continued)</b></p> <p><b>Ambient Temperature Effect:</b> <math>\pm 0.018\%</math> of span/°C; <math>\pm 0.005\%</math> of span/°C gain change</p> <p><b>Relative Humidity:</b> 0-95% non-condensing</p> <p><b>RFI/EMI Protection:</b> Less than <math>\pm 0.1\%</math> of span error when tested at 10V/m @ 20-1000MHz WITH -RF OPTION: Less than <math>\pm 0.1\%</math> of span error when tested at 30V/m @ 20-1000MHz</p> <p><b>Common Mode Rejection:</b> Exceeds 95dB @ 60Hz with a limit of 1500Vrms</p> <p><b>Adjustments</b></p> <p><b>Type:</b> Front panel pots</p> <p><b>Trim:</b> <math>\pm 1\%</math></p> <p><b>Weight</b> 145g (5 oz)</p>
---	--	---

## Ordering Information

Unit	Input	Output	Power	Options	Housing
<b>ECT 2-wire (Input-Loop Powered)</b> Isolator/Converter	<b>4-20mA</b> into 275 ohms	<b>4-20mA</b> into 0-250 ohms	Current Loop Excitation at 4mA: <b>5.5VLP</b> 5.5 volts loop powered with 4-20mA (plus voltage across output load)	<b>-RF</b> Enhanced RFI/EMI filtering provides 30V/m @ 20-1000MHz protection with less than $\pm 0.1\%$ of span error	<b>DIN</b> Aluminum DIN-style housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails <b>FLB2</b> 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.

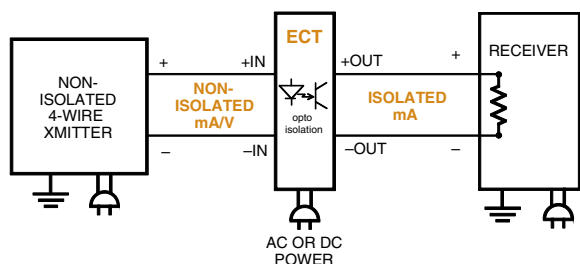
### “Sharing” or “Splitting” a Process Signal

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.

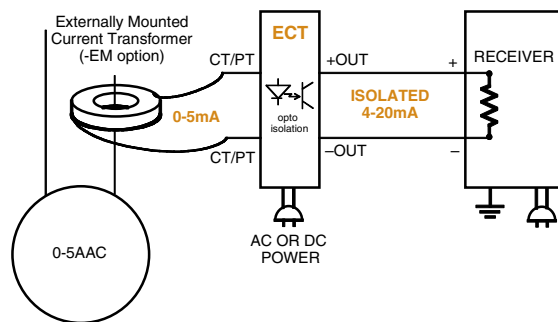
### One Isolator Does the Work of Two

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.

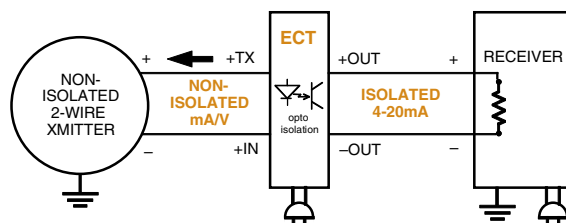
**Figure 8.** 4-wire ECT models are ideal for use where line (mains) power is readily available.



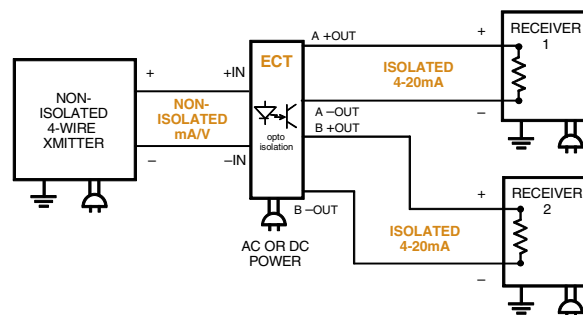
**Figure 9.** When ordered with the -EM option, the ECT comes with an externally-mounted current transformer to “step down” high level signals.



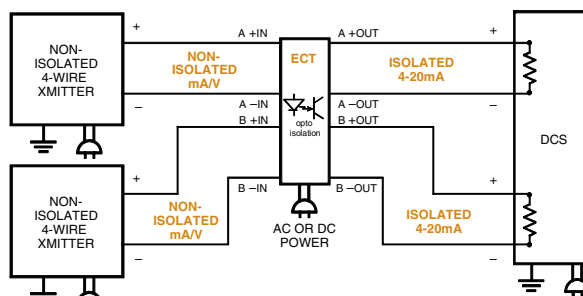
**Figure 10.** With the -TX Transmitter Excitation option, the ECT will supply loop power to a 2-wire transmitter.



**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

<p><b>Performance</b></p> <p><b>Accuracy:</b> <math>\pm 0.1\%</math> of span</p> <p><b>Stability:</b> <math>\pm 0.2\%</math> of reading per year</p> <p><b>Isolation:</b> WITHOUT -RF OPTION: 1500Vrms between input and output and power; WITH -RF OPTION: 500Vrms between input and output, 1500Vrms power terminals; DUAL I/O WITHOUT -RF OPTION: 1500Vrms</p> <p><b>Output Response Time:</b> DC Input: 100msec, maximum to 99% of output; AC Input: 400msec, maximum, from 0-99% of output</p> <p><b>DC Input Resistance:</b> 50 ohms</p> <p><b>Ripple:</b> 10mV peak-to-peak maximum measured across 250 ohm resistor</p> <p><b>Load Effect:</b> 0.01% of span from 0-100% of rated output (current only)</p>	<p><b>Performance (continued)</b></p> <p><b>Power Supply Rejection:</b> Exceeds 90dB for current input unit</p> <p><b>Maximum Input Overrange:</b> Current inputs, 250% of full scale DC Voltage inputs 150% of full scale</p> <p><b>Burden:</b> 1V maximum with 4-20mA input; 0.01V maximum with 0-5A input</p> <p><b>Output Current Limiting:</b> 25mA, typical; 30mA, maximum</p> <p><b>Ambient Conditions</b></p> <p><b>Operating Range:</b> -40°C to +85°C -40°F to +185°F</p> <p><b>Storage Range:</b> -40°C to +85°C (-40°F to +185°F)</p> <p><b>Ambient Temperature Effect:</b> <math>\pm 0.007\%</math> of span/°C, typical; <math>\pm 0.015\%</math> of span/°C, maximum</p> <p><b>Relative Humidity:</b> 0-95% non-condensing</p>	<p><b>Ambient Conditions (Continued)</b></p> <p><b>RFI/EMI Protection:</b> Less than <math>\pm 0.1\%</math> of span error when tested at 10V/m@20-1000MHz WITH -RF OPTION: Less than <math>\pm 0.1\%</math> of span error when tested at 30V/m@20-1000MHz; DUAL I/O WITHOUT -RF OPTION: Output unaffected by more than <math>\pm 0.5\%</math> of span@10V/M 20-1000MHz</p> <p><b>Common Mode Rejection:</b> Exceeds 95dB@60Hz with a limit of 1500Vrms</p> <p><b>Adjustments</b></p> <p>Front panel pots</p> <p><b>Span:</b> <math>\pm 10\%</math></p> <p><b>Zero:</b> <math>\pm 5\%</math> (non-interactive when span is set first)</p> <p><b>Weight</b></p> <p><b>Single I/O Channel:</b> 384g (13.7 oz)</p> <p><b>Dual I/O Channels:</b> 431g (15.4 oz)</p>
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## Ordering Information

Unit	Input	Output	Power	Options	Housing
<b>ECT</b> <b>4-Wire</b> <b>(Line/Mains)</b> <b>Powered</b> Isolator/ Converter	<b>SINGLE INPUT CHANNEL:</b> <b>4-20MA</b> into 50 ohms <b>1-5V</b> into 1 Mohm <b>0-10V</b> into 1 Mohm <b>0-150AC</b> into 100 kohms <b>0-5AAC</b> into 0.002 ohms  <b>DUAL INPUT CHANNELS:</b> <b>2X4-20MA</b> into 25 ohms <b>2x1-5V</b> into 1 Mohm <b>2X0-10V</b> into 1 Mohm (Other AC ranges also available)	<b>SINGLE OUTPUT CHANNEL:</b> <b>4-20MA</b> into 1000 ohms <b>0-10V</b> into 5 kohms minimum  <b>DUAL OUTPUT CHANNELS:</b> 600 ohms <b>2X1-5V</b> into 5 kohms minimum <b>2X0-10V</b> into 5 kohms minimum  <b>DUAL OUTPUT CHANNELS (Signal Splitter):</b> <b>2X4-20MA</b> into 600 ohms (available with 4-20mA input only)	<b>24DC</b> , $\pm 10\%$ <b>117AC</b> , 50/60Hz, $\pm 10\%$ <b>230AC</b> , 50/60Hz, $\pm 10\%$ (3 watts maximum for single channel models; 5 watts maximum for dual output channel models)	<b>-EM</b> Externally-mounted input transformer for current input (available with 0-5AAC input only) <b>-TX</b> 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) <b>-RF</b> Enhanced RFI/EMI filtering provides 30V/m@20-1000MHz protection with less than $\pm 0.1\%$ of span error (-EM option required for AC current input) <b>-EP</b> External power, output stage powered by external source (only available on signal splitter in DIN housing)	<b>DIN</b> Aluminum DIN-style housing mounts on 32mm G-type (EN50035) and 35mm Top Hat (EN50022) rails <b>FLB2</b> Externally-mounted flange provides a secure mount and ensures resistance to vibration

**When ordering, specify:** Unit / Input / Output / Power / Options [Housing]

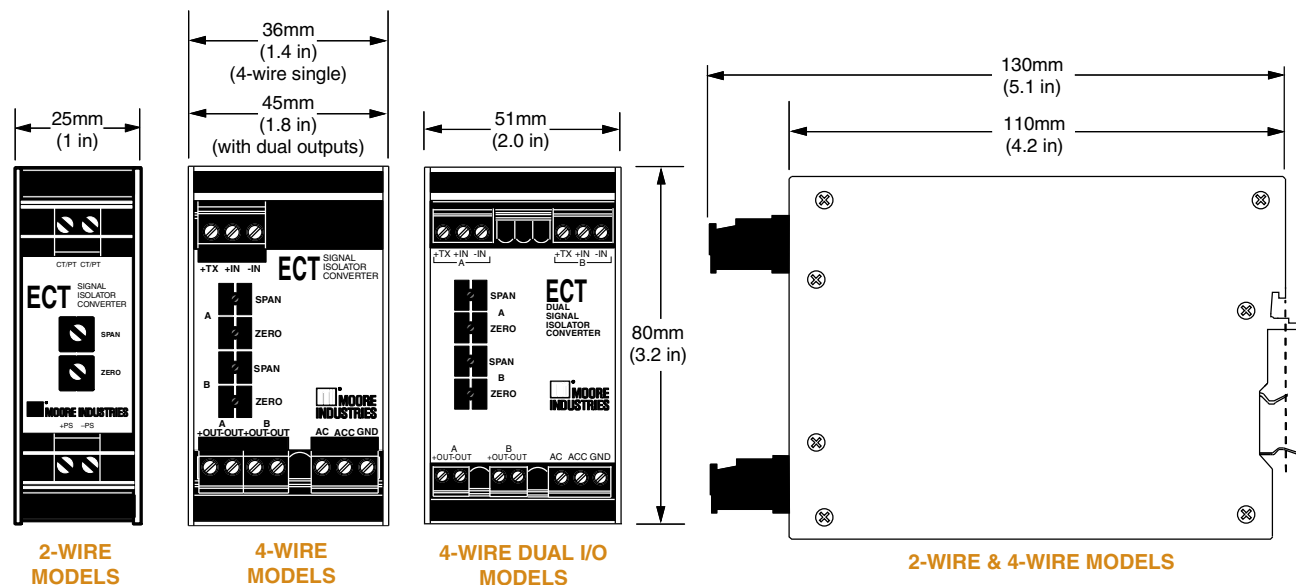
**Model number example:** ECT / 1-5V / 4-20MA / 117AC / -RF [DIN]



# 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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*J & P Richardson Industries Pty Ltd*

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## **8.0 SWITCHBOARD WORKS TEST RESULTS**



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J. &amp; 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: <b>GOLDING CONSTRUCTION</b>			Job No: <b>S41000 M41000</b>		
Item: <b>SP316 SANCTUARY ON MOGGILL SEWAGE PUMP STATION</b>			Drawing No: <b>486/5/7-0099-000-to 027</b>		
TASK	PRODUCT DETAIL	INSPECTED BY	DATE	PASS / FAIL	CORRECTIVE ACTION REQUEST OR COMMENTS
Design	Documents	B.J	28-5-10	✓	
Drafting	Documents				
Sheetmetal (Refer F1018 for details)	Switchboard			P	
	Doors		22-6-10		
	Cell/Panels				
Painting					
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior					
Colour Internal					
Colour Panels					
Cubicle Erection					
Electrical Fitout (In accordance with drawings)					
Inspection & Test (Refer to F1019)					
Packing					
		E Enser	20/8/10	Pass	
		J.T. Clegg	23/7/10	Pass	

Comments:

all prep are done! H/W 28/06/10

NOTE: Manufacture is not to proceed to the next process until the item has passed inspection.

Fix Status Here: -

Yellow

Green

Red

Awaiting Inspection

Inspection &amp; Test Passed

Inspection &amp; Test Failed, 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

**SWITCHBOARD / SHEETMETAL**  
**INSPECTION CHECKLIST**

CLIENT: <u>GOLDING CONSTRUCTION</u>				JOB NO: <u>541000</u>	
PRODUCT DESCRIPTION: <u>SP316 SANCTUARY</u> <u>ON MOBILE SEWAGE PUMP STATION</u>				DRAWING & SCHEDULE NUMBERS <u>486/5/1-0099-000-70-027</u>	
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: <u>[Signature]</u>				DATE: <u>25-6-10</u>	

AFFIX STATUS HERE

Yellow  
Green  
Red

Awaiting Inspection  
Inspected/Tested Passed  
Inspected/Tested Awaiting Rectification





## J. &amp; 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 ELECTRICAL INSPECTION &amp; TEST REPORT

Customer Name: Golding ConstructionProject: Urban Utilities SP316 Sanctuary on Maggill SPSJPR Job No: M41000Item: SP316Constructed by: R StangerwayTested by: E EnricDate: 20/8/10

## Item check list:

To comply with Drawings, Documents &amp; Specification

Main Functional Unit/s	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	Settings	<input checked="" type="checkbox"/>
Fuse Fittings	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	Fuse Size	<input checked="" type="checkbox"/>
Circuit Breakers	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	Settings	<input checked="" type="checkbox"/>
Motor Protection C.B.	Rating	<input checked="" type="checkbox"/>	Setting	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
Neutral	Reqd	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Equipment Earthing	Checked	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
C.T.s	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Pri Inject.	<input checked="" type="checkbox"/>
Meters	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
Contactors	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
Overloads	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
Relays	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
Timers	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
Control Switches	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
Push Buttons	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
Pilot Lights	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
Transformers	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
ATT/VFD/Soft Starter	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>
DC Supply	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Voltage	<input checked="" type="checkbox"/>
Terminals	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Engraving	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Cabling	Type	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Busbars	Type	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Escutcheons / Shrouds	Type	<input checked="" type="checkbox"/>	Label	<input checked="" type="checkbox"/>	IP rating	<input checked="" type="checkbox"/>
S.A. Metering CTs	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
S.A. Metering Links	Type	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
S.A. Meters	Type	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
JPR Label	Fitted	<input checked="" type="checkbox"/>	Stamped	<input checked="" type="checkbox"/>	Safety Strk	<input checked="" type="checkbox"/>
Legend Card	Qty	<input checked="" type="checkbox"/>	Correct	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
PLC/Telemetry	Qty	<input checked="" type="checkbox"/>	Size	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Power Monitor Relay	Qty	<input checked="" type="checkbox"/>	Rating	<input checked="" type="checkbox"/>	Function	<input checked="" type="checkbox"/>

## General Check List:

IP Sealing	Rating	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Door Latches/Hinges	Qty	<input checked="" type="checkbox"/>	Type	<input checked="" type="checkbox"/>	Operation	<input checked="" type="checkbox"/>
Ventilation	Required	<input checked="" type="checkbox"/>	Type	<input checked="" type="checkbox"/>	Operation	<input checked="" type="checkbox"/>
Circuit Schedule	Markup	<input checked="" type="checkbox"/>	Checked	<input checked="" type="checkbox"/>	Supplied	<input checked="" type="checkbox"/>
Terminal Tightness	Power	<input checked="" type="checkbox"/>	Control	<input checked="" type="checkbox"/>	Result	<input checked="" type="checkbox"/>
Busbar System	Clearances	<input checked="" type="checkbox"/>	Joints	<input checked="" type="checkbox"/>	ID	<input checked="" type="checkbox"/>
Earth Continuity	Body to E	<input checked="" type="checkbox"/>	Doors to E	<input checked="" type="checkbox"/>	Panels to E	<input checked="" type="checkbox"/>
Cubicle Cleaned		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Paint Finish Intact		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Polarity Check	R - R	<input checked="" type="checkbox"/>	W - W	<input checked="" type="checkbox"/>	B - B	<input checked="" type="checkbox"/>
Function	Power	<input checked="" type="checkbox"/>	Control	<input checked="" type="checkbox"/>	PLC/Telem	<input checked="" type="checkbox"/>
Continuity Check	R - R	<input checked="" type="checkbox"/>	W - W	<input checked="" type="checkbox"/>	B - B	<input checked="" type="checkbox"/>
					N - N	<input checked="" type="checkbox"/>

## Comments:



Customer Name:	Golding Construction		
Project:	Urban Utilities Sanctuary on McGill SPS		
JPR Job No:	M41000	Switchboard:	SP 316
Constructed by:	R Stanaway	Tested by:	E Ensor
		Date:	12/8/10

[illegible]

Sketch:

Designation	1000 V Test (M $\Omega$ )	2.5 kV Test ( Imin )	1000 V Test (M $\Omega$ )
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
-----------	--------------	------------





Page 508 of 537

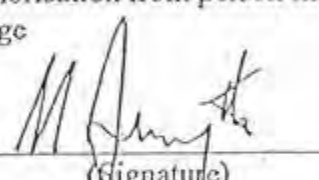


TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP

DATE: 12.12.11

AUTHORISATIONS	PERSONAL PROTECTIVE EQUIPMENT
<ul style="list-style-type: none"> <li>• Authorisation from person in charge <input checked="" type="checkbox"/> YES</li> </ul>  (Signature)	<ul style="list-style-type: none"> <li>• Long cotton clothing <input checked="" type="checkbox"/> YES</li> <li>• Insulating work gloves in test <input checked="" type="checkbox"/> YES</li> <li>• Insulating mats / covers in test <input checked="" type="checkbox"/> YES</li> <li>• Switchboard rescue kit in test <input checked="" type="checkbox"/> YES</li> </ul>

TASK		
LIVE LOW VOLTAGE WORK	<ul style="list-style-type: none"> <li>• Isolation points identified and accessible</li> <li>• Work area clear of obstructions</li> <li>• Unauthorised access prevented to work area</li> <li>• P.P.E. is fit for purpose</li> <li>• Test equipment is fit for purpose</li> <li>• Written authority to proceed has been obtained from a person in charge</li> <li>• JPR authorisation to conduct live work is current</li> <li>• Approved dedicated power supply only used for testing.</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> </ul>
TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	OPTION (A) RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; RCD protection checked daily prior to use</li> <li>&gt; Safety Observer <del>is</del> / is not required</li> </ul>	<ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> <li><input checked="" type="checkbox"/> YES</li> </ul>
	OPTION (B) Non RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; Supervisor consulted prior to use</li> <li>&gt; Safety Observer is in attendance</li> </ul>	<ul style="list-style-type: none"> <li><input type="checkbox"/> YES</li> <li><input type="checkbox"/> YES</li> <li><input type="checkbox"/> YES</li> </ul>

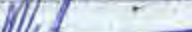
I understand and am fully aware of the requirements of this job safety analysis.

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)

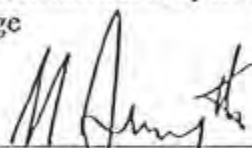

LOCATION: WACOL WORKSHOP

DATE: 13/12/19

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT			
<ul style="list-style-type: none"> <li>• Authorisation from person in charge</li> </ul>  <p>(Signature)</p>	<input checked="" type="checkbox"/> YES	<ul style="list-style-type: none"> <li>• Long cotton clothing</li> <li>• Insulating work gloves in test</li> <li>• Insulating mats / covers in test</li> <li>• Switchboard rescue kit in test</li> </ul>	<input type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES		
<b>TASK</b>  <b>LIVE LOW VOLTAGE WORK</b>  <b>TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES</b>	<ul style="list-style-type: none"> <li>• Isolation points identified and accessible</li> <li>• Work area clear of obstructions</li> <li>• Unauthorised access prevented to work area</li> <li>• P.P.E. is fit for purpose</li> <li>• Test equipment is fit for purpose</li> <li>• Written authority to proceed has been obtained from a person in charge</li> <li>• JPR authorisation to conduct live work is current</li> <li>• Approved dedicated power supply only used for testing.</li> <li>• Approved dedicated power supply in current test</li> </ul>	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES		
<b>OPTION (A)</b> RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; RCD protection checked daily prior to use</li> <li>&gt; Safety Observer is / is not required</li> </ul>	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES		
<b>OPTION (B)</b> Non RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; Supervisor consulted prior to use</li> <li>&gt; Safety Observer is in attendance</li> </ul>	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES		
I understand and am fully aware of the requirements of this job safety analysis.					
Signatures:	1. 	2.	3.	4.	5.

### TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

DATE: 10/21/10

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT	
<ul style="list-style-type: none"> <li>• Authorisation from person in charge</li> </ul>  (Signature)	<input checked="" type="checkbox"/> YES	<ul style="list-style-type: none"> <li>• Long cotton clothing</li> <li>• Insulating work gloves in test</li> <li>• Insulating mats / covers in test</li> <li>• Switchboard rescue kit in test</li> </ul>	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES
<b>TASK</b>  <b>LIVE LOW VOLTAGE WORK</b>  <b>TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES</b>	<ul style="list-style-type: none"> <li>• Isolation points identified and accessible</li> <li>• Work area clear of obstructions</li> <li>• Unauthorised access prevented to work area</li> <li>• P.P.E. is fit for purpose</li> <li>• Test equipment is fit for purpose</li> <li>• Written authority to proceed has been obtained from a person in charge</li> <li>• JPR authorisation to conduct live work is current</li> <li>• Approved dedicated power supply only used for testing.</li> </ul>	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES
<b>OPTION</b> (A) RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; RCD protection checked daily prior to use</li> <li>&gt; Safety Observer is / is not required</li> </ul>	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES
<b>OPTION</b> (B) Non RCD protected outputs used at power supply <ul style="list-style-type: none"> <li>&gt; Supervisor consulted prior to use</li> <li>&gt; Safety Observer is in attendance</li> </ul>	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES
I understand and am fully aware of the requirements of this job safety analysis.			
Signatures: 1.  2. 3. 4. 5.			



**DAILY RISK ASSESSMENT**  
**FOR**  
**LIVE LOW VOLTAGE WORK**

**TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN JPR MANUFACTURING PREMISES BY**  
**AN INDEPENDENT BODY**

DATE: 27.12.10

AUTHORISATIONS	MINIMUM PERSONAL PROTECTIVE EQUIPMENT
<ul style="list-style-type: none"> <li>• JPR induction completed <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Authorisation from JPR person in control to perform live work <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Independent body employee Qualifications in accordance with requirements of Electrical Safety Act. <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> </ul> <p style="text-align: center;"><i>[Signature]</i> (Signature) JPR Person in Control</p>	<ul style="list-style-type: none"> <li>• Long cotton clothing <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Insulating work gloves in test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Insulating mats / covers in test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Switchboard rescue kit in test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> </ul> <p>Note:- Items 2,3,4 are to be supplied by the independent body and submitted to JPR for inspection prior to initial use</p>
HAZARDS	CONTROL MEASURES
<ul style="list-style-type: none"> <li>• CONTACT WITH LIVE LOW VOLTAGE</li> <li>• ELECTRIC SHOCK</li> <li>• BURNS</li> </ul>	<ul style="list-style-type: none"> <li>• Isolation points identified and accessible <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Work area clear of obstructions <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Unauthorised access prevented to work area Barriers and signage provided by independent body <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• P.P.E. is fit for purpose and in test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Test equipment is fit for purpose and in test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Authority to proceed has been obtained from JPR person in control <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Independent body authorisation to conduct live work is current (documentation required to support evidence) <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Approved dedicated power supply only used for testing. (JPR supplied) <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> <li>• Approved dedicated power supply in current test <span style="float: right;"><input checked="" type="checkbox"/> YES</span></li> </ul> <p><b>OPTION</b></p> <p><b>(A) RCD protected outputs used at power supply</b> <span style="float: right;"><input checked="" type="checkbox"/> YES</span></p> <p>&gt; RCD protection checked daily prior to use <span style="float: right;"><input checked="" type="checkbox"/> YES</span></p> <p>&gt; Safety Observer <del>is</del> / is not required (Competent safety observer supplied by independent body for duration of live work, documentation required to support evidence) <span style="float: right;"><input checked="" type="checkbox"/> YES</span></p> <p><b>OPTION</b></p> <p><b>(B) Non RCD protected outputs used at power supply</b> <span style="float: right;"><input type="checkbox"/> YES</span></p> <p>&gt; JPR person in control prior to use <span style="float: right;"><input type="checkbox"/> YES</span></p> <p>&gt; Safety Observer is in attendance (Competent safety observer supplied by independent body for duration of live work, documentation required to support evidence) <span style="float: right;"><input type="checkbox"/> YES</span></p>

I understand and am fully aware of the requirements of this job safety analysis.

**ALL INDEPENDENT BODY EMPLOYEES ON SITE PERFORMING LIVE WORK TO SIGN**

Signatures:	<i>[Signature]</i>				
Name Printed:	John Clayton				
Date:	27/8/10				



CA17a - Factory Inspection Tests

Major Projects & Commercial Services  
SQUV SP Reliability Improvement - Stage 2

G. Non-Conformances and Unauthorised Modifications

G.1	RANGE 2 COLLOIDAL HYDROLYSIS TO 5 mg/L
G.2	Shielded PROBS of Pie, Rem "96"
G.3	<del>ENTER CASE</del> <u>Pastork</u>
G.4	
G.5	Final No.2 Control. should be fixed from white, phase
G.6	
G.7	Station PFR failed change both -
G.8	
G.9	Phase wires loose for PU1 + PU2 Flap Poles
G.10	Open 15 p & 15 g cross phase 1 Cable 15 p

Contractor's Tester Signature

..... Date .....

Queensland Urban Utilities Electrical Inspector

....John Clayton ... Date ...27/08/10

Doc Id: CA-17a

Printed: 27/08/2010

Note: Printed copies of this document should be verified for currency against the published electronic copy.

Rev: 5  
Owner: Alfonso Chavez

Queensland Urban Utilities Confidential  
Page 16 of 17

*J & P Richardson Industries Pty Ltd*

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## **9.0 “AS CONSTRUCTED” DRAWINGS**



EST  
INSTRUCTION  
Albome 6.3.10

SP316 SANCTUARY ON MOGGILL  
SEWAGE PUMPING STATION  
SITE COVER SHEET

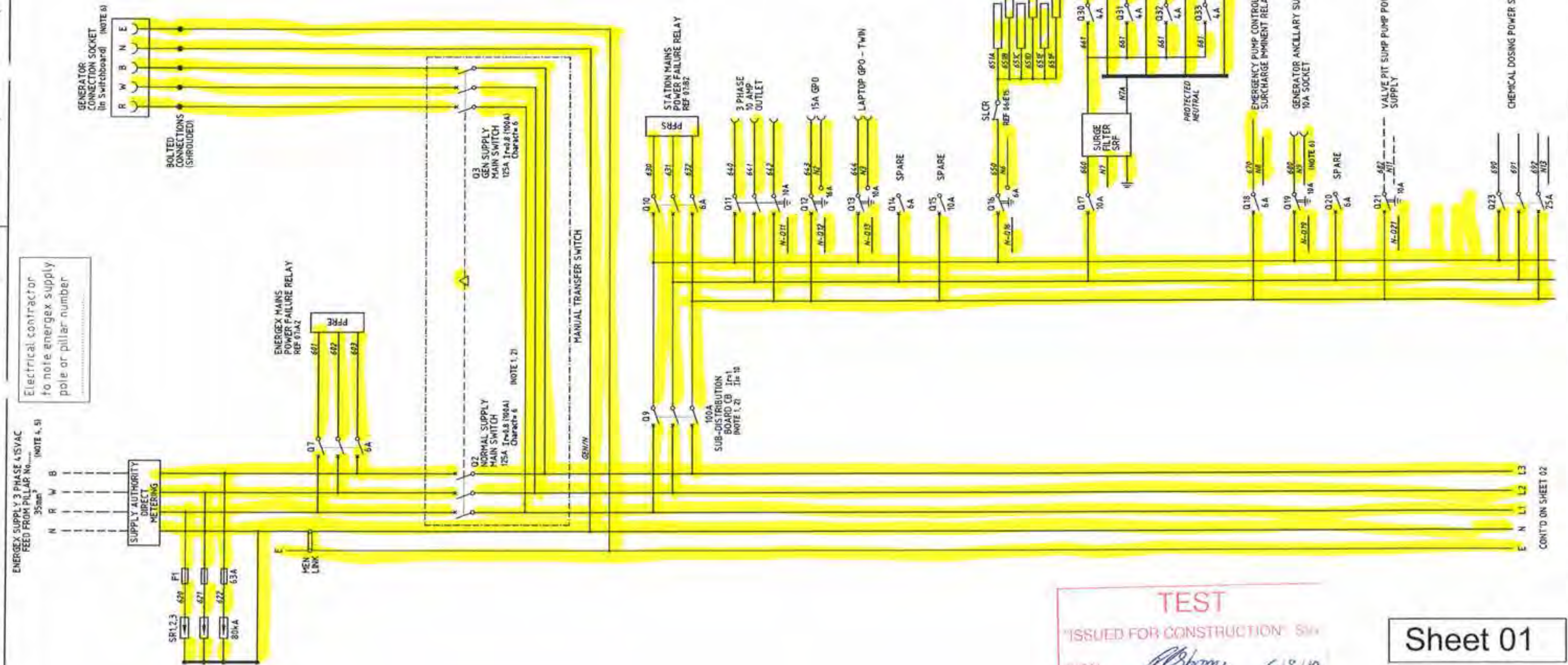
STANDARD DESIGN OPTIONS		
OPTION	DESCRIPTION	FITTED
A	INDIVIDUAL PUMP MOISTURE IN OIL (MIO) SENSOR AND FAULT RELAY	YES <input checked="" type="checkbox"/>
B	INDIVIDUAL PUMP MOTOR AUX PROTECTION SENSORS AND FAULT RELAYS	YES <input checked="" type="checkbox"/>
C		<input checked="" type="checkbox"/> NO
D	STATION MANHOLE SURCHARGE IMMINENT	YES <input checked="" type="checkbox"/>
E		<input checked="" type="checkbox"/> NO
F		<input checked="" type="checkbox"/> NO
G		<input checked="" type="checkbox"/> NO
H	STATION DELIVERY FLOWMETER - 24vDC ENDRESS & HAUSER	YES <input checked="" type="checkbox"/>
I	BACKUP COMMUNICATION - GSM	YES <input checked="" type="checkbox"/>
J	PUMP CONNECTION (Via De-contacts)	YES <input checked="" type="checkbox"/>
K		<input checked="" type="checkbox"/> NO
L	MOTOR THERMISTORS (Via De-contacts)	YES <input checked="" type="checkbox"/>
M		<input checked="" type="checkbox"/> NO
N		<input checked="" type="checkbox"/> NO
O	PUMPS ELECTRICAL INTERLOCK (Mains & Generator)	YES <input checked="" type="checkbox"/>
P	WET WELL WASHER	YES <input checked="" type="checkbox"/>
Q	VALVE PIT SUMP PUMP AND LEVEL PROBE	YES <input checked="" type="checkbox"/>
R	TELEMETRY RADIO	YES <input checked="" type="checkbox"/>
S		<input checked="" type="checkbox"/> NO
T	DOUBLE SIDED SWITCHBOARD	YES <input checked="" type="checkbox"/>
U	DELIVERY PRESSURE TRANSMITTER	YES <input checked="" type="checkbox"/>
V	CHEMICAL DOSING	YES <input checked="" type="checkbox"/>

				DRY TED	P.HAGUE	Original Signed by P.HAGUE	12-03-10	Original Signed by K.VAHEESAN	12-03-10	 <b>Urban Utilities</b> <small>— Division of the City of San Jose —</small>	<b>SITE</b> <b>SP316</b> <b>SANCTUARY ON MOGGILL</b> <b>SEWAGE PUMP STATION</b>	<b>TITLE</b> <b>SITE COVER SHEET</b>	<b>SHEET No. 0</b> <small>Quantities Urban Utilities DRAWING No</small> <b>486/5/7-0099-000</b>		<small>ASB#1</small> <b>0</b>		
D	03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITTHOFT	DESIGN	R.P.E. & No.	DATE							PRINCIPAL DESIGN/MANAGER	DATE
R2	12.08	ISSUED FOR REVIEW	P.H.	A.W.	CAD/KME	57-0099-001_0	Original signed by A.WITTHOFT	8885	12-03-10							Original Signed by P.D.H. REFF	12-05-10
NO	DATE	AMENDMENT	DRN	APD	S.C.C. FILE No		DESIGN CHECK	R.P.E. & No.	DATE							CLIENT DELEGATE	DATE



# 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 52000 COMPATIBLE LABELLING.
4. ADD POINT OF SUPPLY
5. ADD ACTUAL FAULT LEVEL
6. CABLEING TO GENERATOR CONNECTION SOCKET AND AUXILIARY SUPPLY SOCKET TO BE DOUBLE INSULATED. CABLEING TO BE FULLY SEALED TO OTHER COMPARTMENTS



TEST  
"ISSUED FOR CONSTRUCTION" SW  
SIGN *[Signature]* 6/8/10

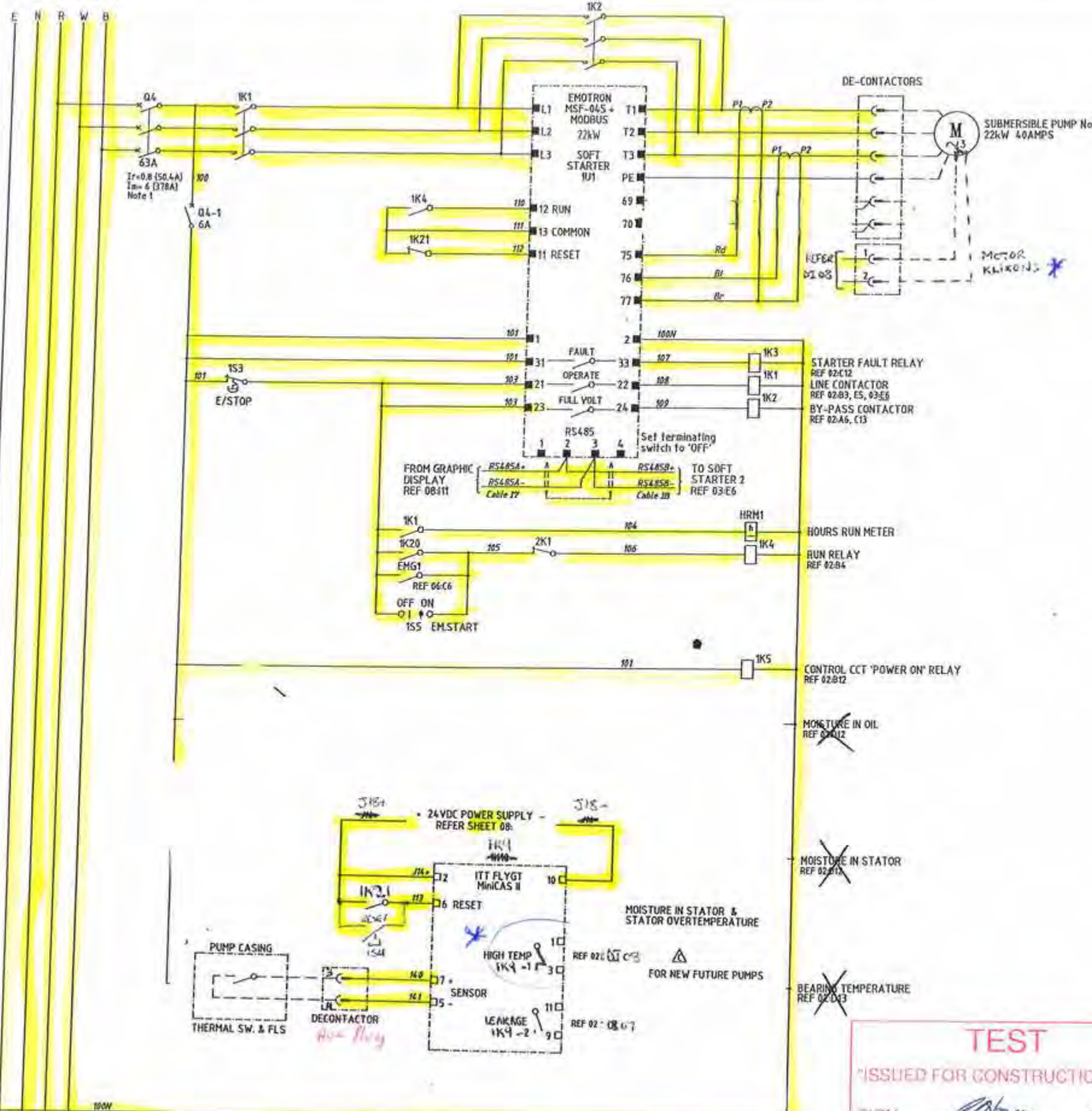
Sheet 01

FOR CONSTRUCTION

Q3.10	ISSUED FOR CONSTRUCTION	P.H. A.W.	DRAFTING CHECK	A.WITTHOFF	Original Signed by P.HAGUE	12-03-10	Original Signed by K.VAHESSAN	12-03-10		SITE SP316 SANCTUARY ON MOGGILL SEWAGE PUMP STATION	TITLE POWER DISTRIBUTION SCHEMATIC DIAGRAM	SHEET No. 1 Queensland Urban Utilities DRAWING No. 486/5/7-0099-001	AMEND O
P2	ISSUED FOR REVIEW	P.H. A.W.	CAD FILE	57-0099001_O	Original signed by A.WITTHOFF	12-03-10	Original Signed by P.BREKID	12-03-10					
No	DATE	AMENDMENT	DRN	APD	R.P.C. FILE No		CLIENT DELEGATE						

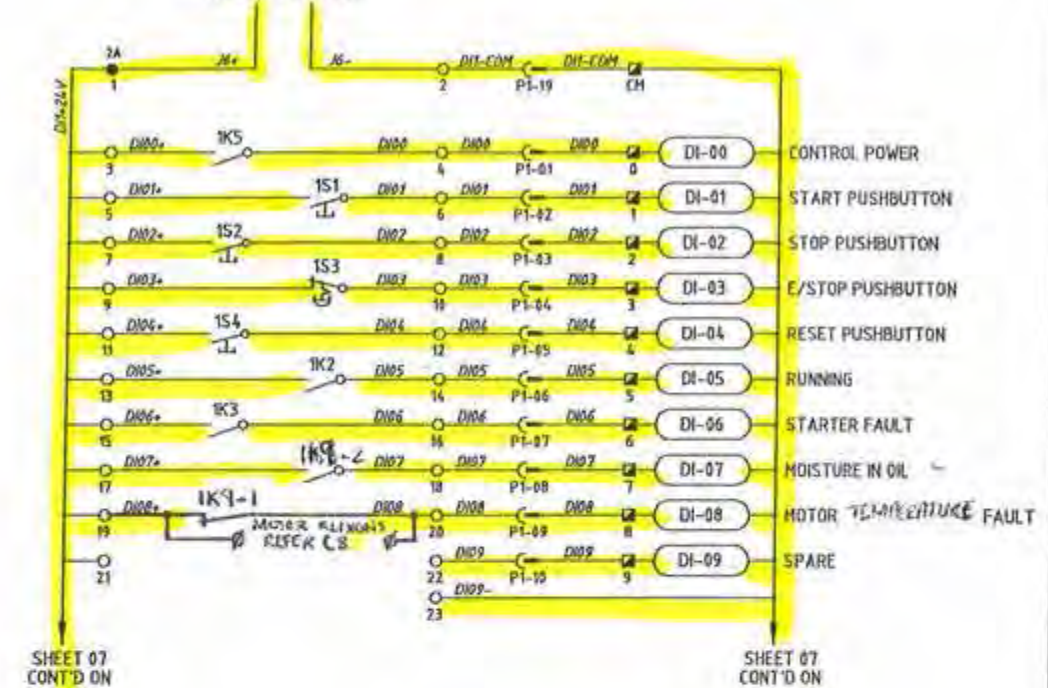


CONT'D FROM SHEET 01



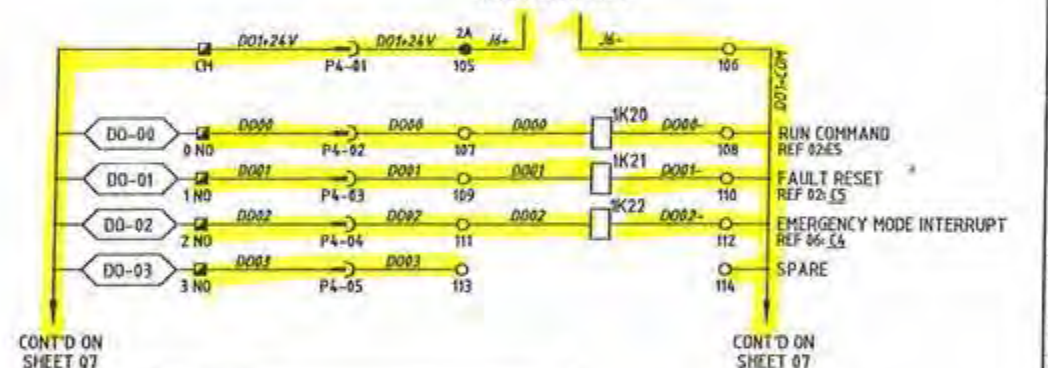
### RTU DIGITAL INPUTS

24VDC POWER SUPPLY - REFER SHEET 08-C7



### RTU DIGITAL OUTPUTS

24VDC POWER SUPPLY - REFER SHEET 08-C7



### LEGEND:

- ▲ SWITCHBOARD POWER TERMINAL
- ◊ SWITCHBOARD CONTROL TERMINAL
- SWITCHBOARD GENERATOR TERM.
- ✕ FIELD TERMINAL
- PLC TERMINAL
- ▣ RTU TERMINAL
- SS TERMINAL
- PLC/RTU MARSH. FUSE TERMINAL
- PLC/RTU MARSH. LINK TERMINAL
- DISCONNECT PLUG
- DI-01 RTU DIGITAL INPUT
- DO-01 RTU DIGITAL OUTPUT
- AI-01 RTU ANALOGUE INPUT
- AO-01 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 FURLED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING.
4. FAULT LEVEL OF 20KA AT 415V FOR 0.2sec.

TEST

"ISSUED FOR CONSTRUCTION" S97

SIGN *[Signature]* 6/8/10

Sheet 02

FOR CONSTRUCTION

03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITHOFT	Original Signed by P.HAGUE	12-03-10	Original Signed by KVAHEESAN	12-03-10
12.08	ISSUED FOR REVIEW	P.H.	A.W.	CAD FILE	57-0099-002	DESIGN	R.P.E.Q. No. DATE	PRINCIPAL DESIGN MANAGER	DATE
No.	DATE	AMENDMENT	DRN	APD	B.C.C. FILE No.	DESIGN CHECK	R.P.E.Q. No. DATE	Original Signed by P.SHERIFF	12-03-10
								CLIENT DELEGATE	DATE

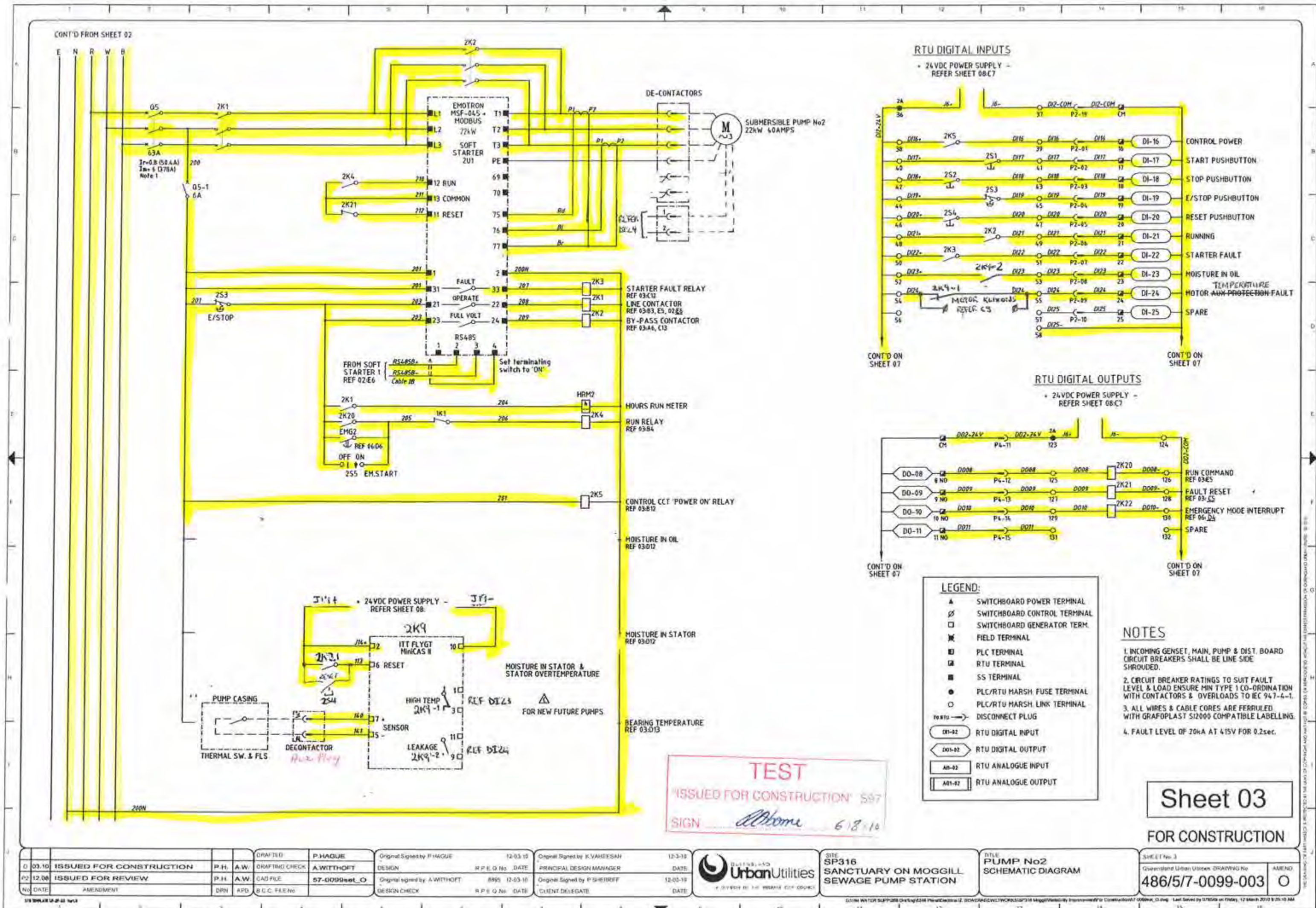


SP316  
SANCTUARY ON MOGGILL  
SEWAGE PUMP STATION

TITLE  
PUMP No1  
SCHEMATIC DIAGRAM

SHEET No. 2  
Queensland Urban Utilities DRAWING No.  
486/5/7-0099-002

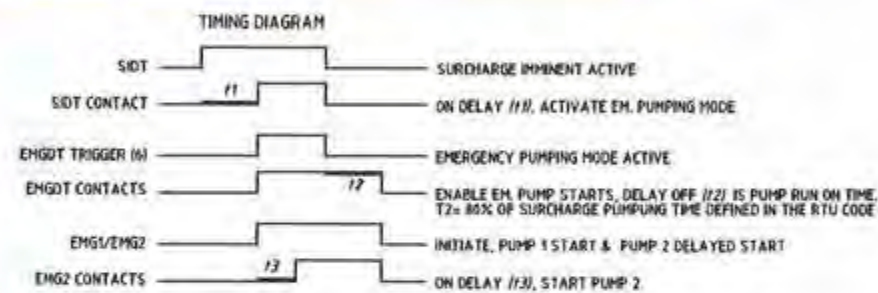
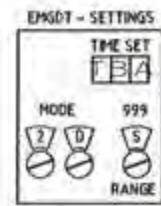
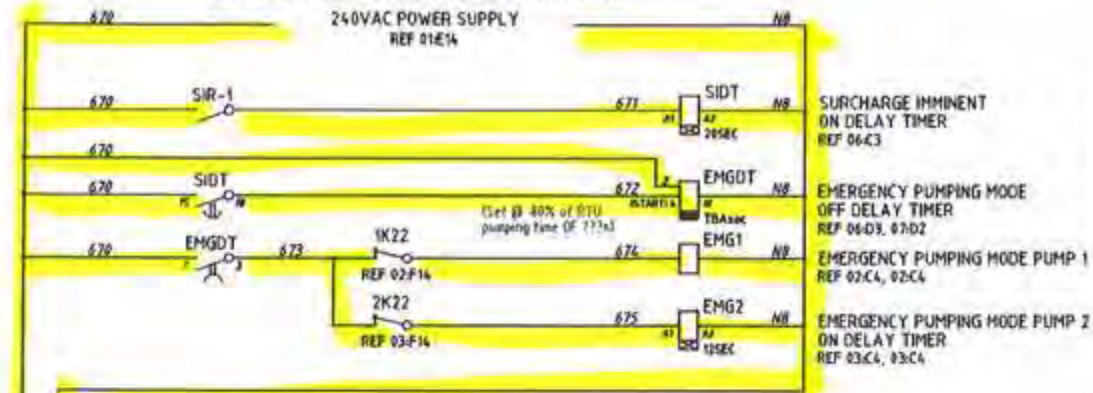






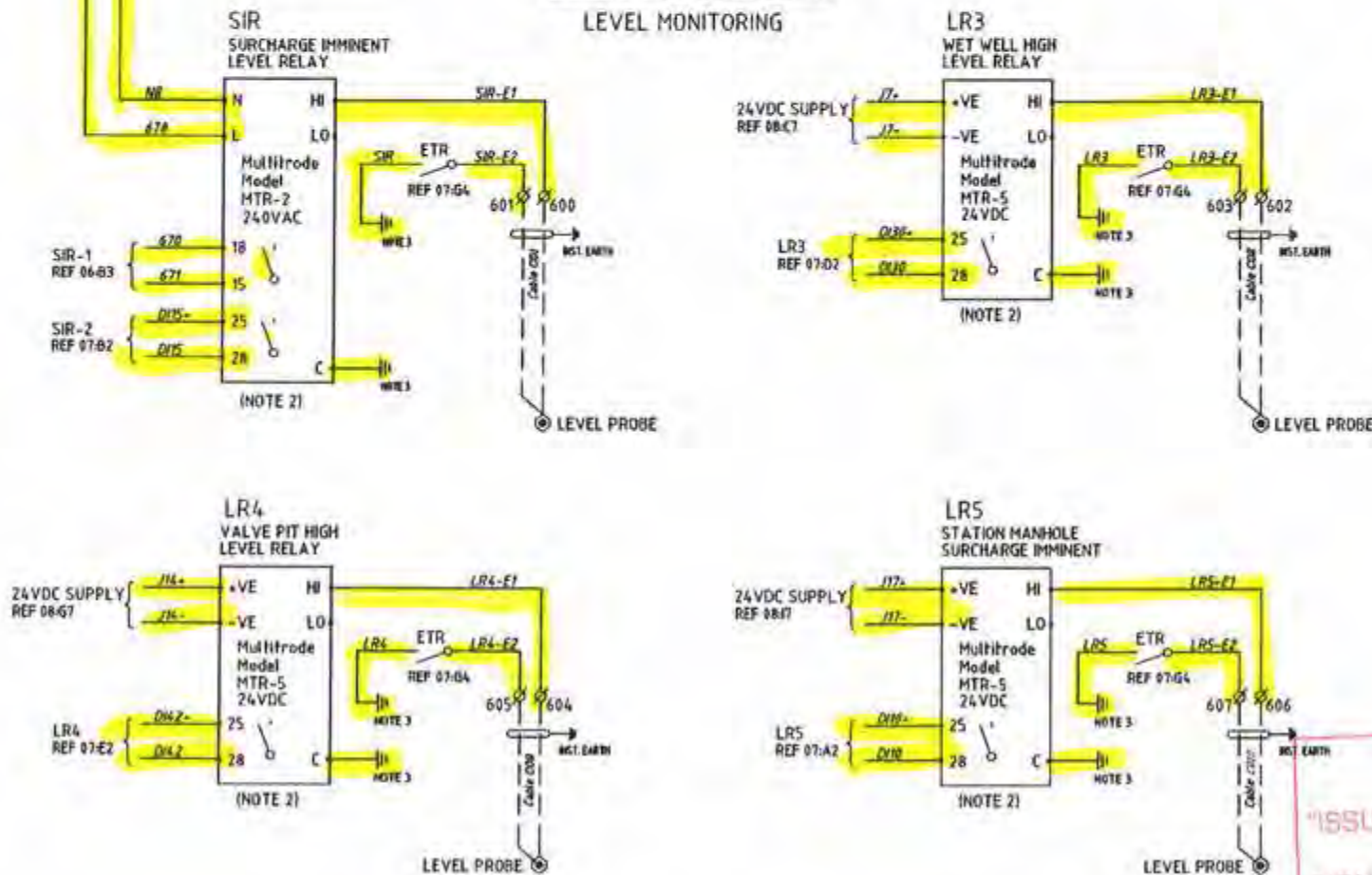
## COMMON CONTROL SECTION

## EMERGENCY PUMPING MODE (240VAC)



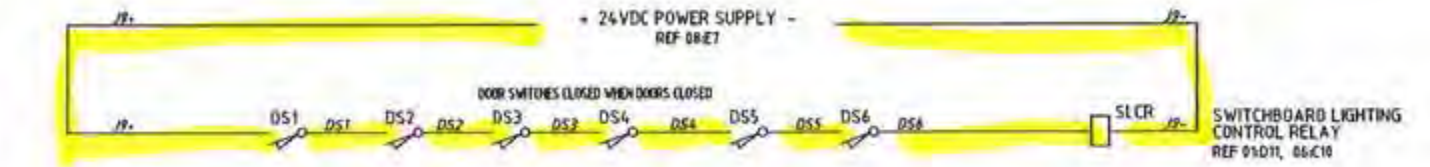
## COMMON CONTROL SECTION

## LEVEL MONITORING

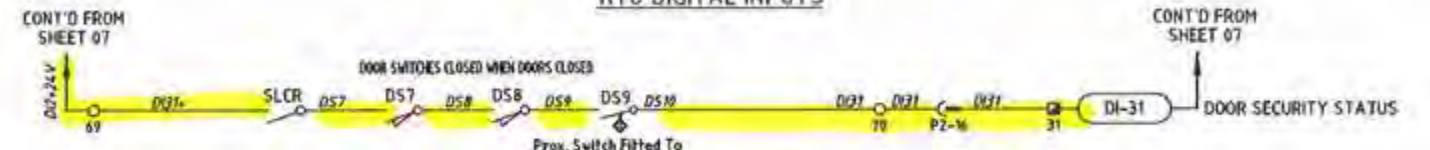


## COMMON CONTROL SECTION

## SWITCHBOARD INTERNAL LIGHTING

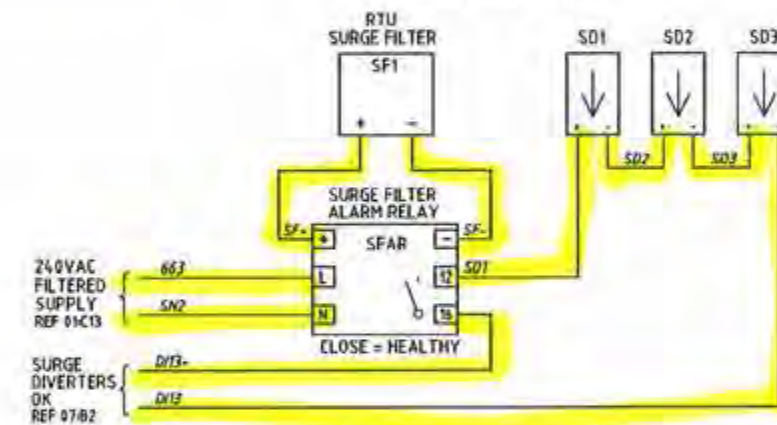


## RTU DIGITAL INPUTS



## ATS SECTION

## SURGE DIVERSERS



## LEGEND:

- ▲ SWITCHBOARD POWER TERMINAL
- ◻ SWITCHBOARD CONTROL TERMINAL
- ◻ SWITCHBOARD GENERATOR TERM.
- ✕ FIELD TERMINAL
- PLC TERMINAL
- ▣ RTU TERMINAL
- SS TERMINAL
- PLC/RTU MARSH. FUSE TERMINAL
- PLC/RTU MARSH. LINK TERMINAL
- RTU → DISCONNECT PLUG
- 001-02 RTU DIGITAL INPUT
- 001-02 RTU DIGITAL OUTPUT
- 001-02 RTU ANALOGUE INPUT
- 001-02 RTU ANALOGUE OUTPUT

## NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING.
2. SET DIPSWITCH TO 'DISCHARGE' MODE.
3. RUN SEPARATE DEDICATED EARTH CONDUCTOR TO EARTH BAR.

**TEST**  
"ISSUED FOR CONSTRUCTION" 507  
SIGN *[Signature]* 6/8/10

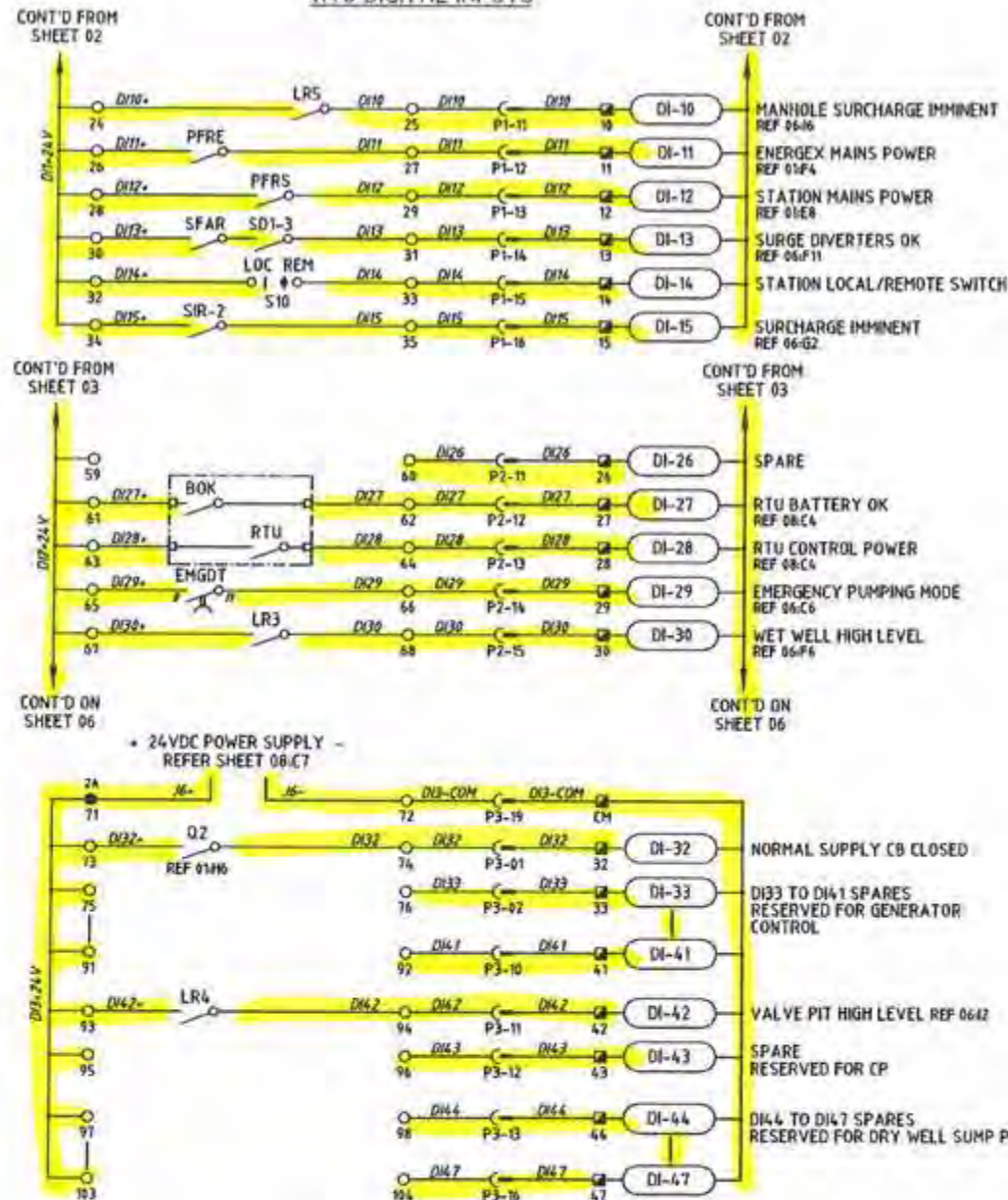
**Sheet 06**

FOR CONSTRUCTION

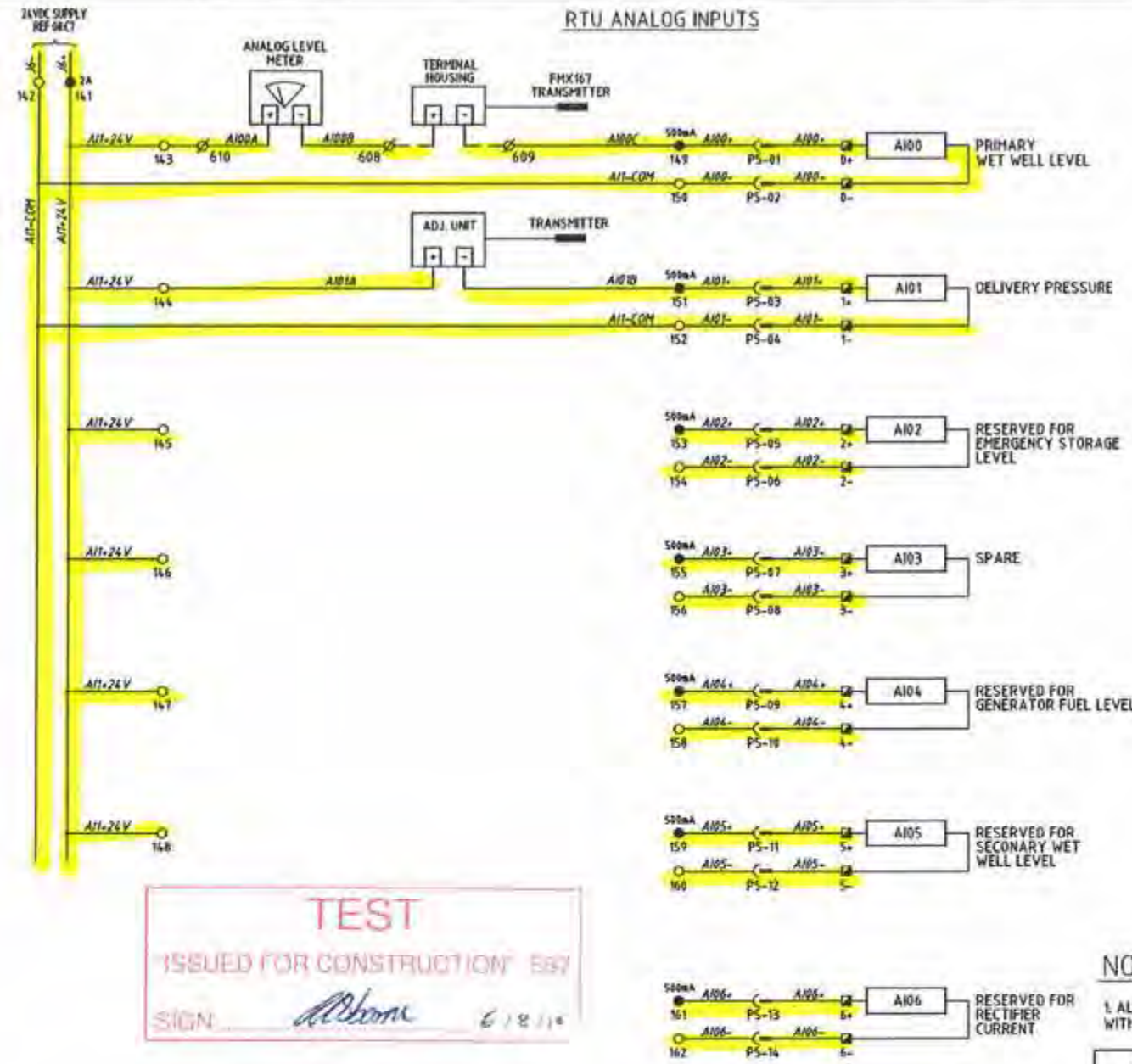
03.10	ISSUED FOR CONSTRUCTION	P.H. A.W.	DRAFTING CHECK	A.WITTHOFT	Original Signed by P.HAGUE	12-03-10	Original Signed by K.VAHEESAN	12-3-10		SITE SP316 SANCTUARY ON MOGGILL SEWAGE PUMP STATION	TITLE COMMON CONTROLS SCHEMATIC DIAGRAM	SHEET No 0 486/517-0099-006 O
12.08	ISSUED FOR REVIEW	P.H. A.W.	CAD FILE	57-0099-006	Original signed by A.WITTHOFT	8895 12-03-10	Original Signed by P.SHERIFF	12-03-10				
01.01	AMENDMENT	DIV. APD.	B.C.D. FILE NO		DESIGN CHECK	R.P.E. Q. No. DATE	CLIENT DELEGATE	DATE				
01.01	AMENDMENT	DIV. APD.	B.C.D. FILE NO		DESIGN CHECK	R.P.E. Q. No. DATE	CLIENT DELEGATE	DATE				



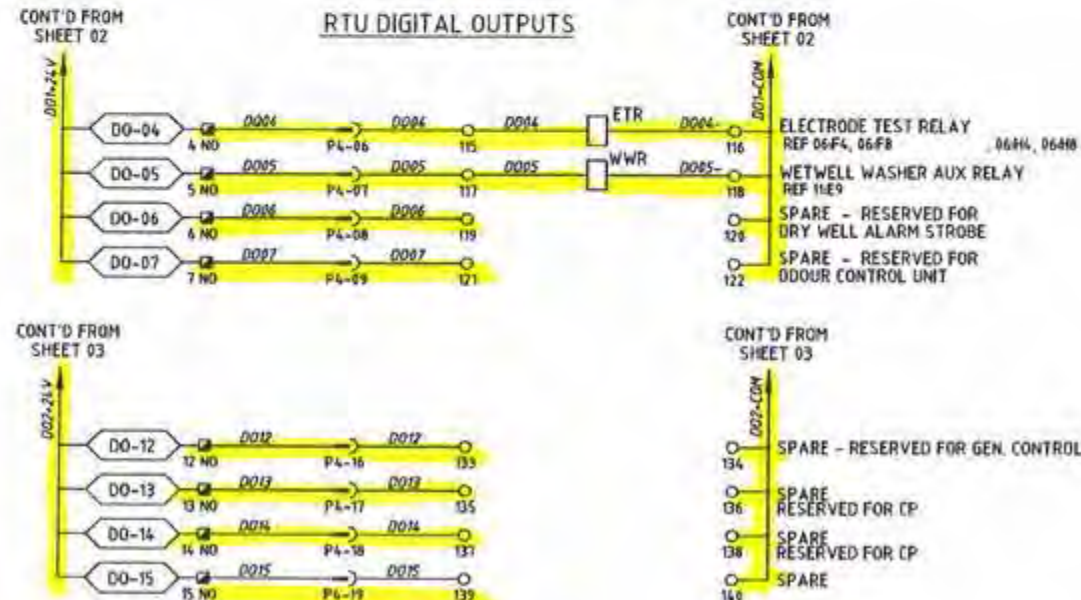
# RTU DIGITAL INPUTS



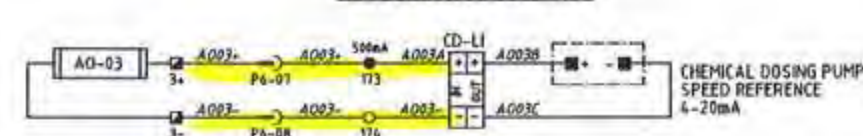
# RTU ANALOG INPUTS



# RTU DIGITAL OUTPUTS



# RTU ANALOG OUTPUTS



**TEST**  
ISSUED FOR CONSTRUCTION 6/8/14  
SIGN: *[Signature]*

# NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST 512000 COMPATIBLE LABELLING

# LEGEND:

- ▲ SWITCHBOARD POWER TERMINAL
- ◻ SWITCHBOARD CONTROL TERMINAL
- ◻ SWITCHBOARD GENERATOR TERM.
- FIELD TERMINAL
- PLC TERMINAL
- RTU TERMINAL
- SS TERMINAL
- PLC/RTU MARSH FUSE TERMINAL
- PLC/RTU MARSH LINK TERMINAL
- TO RTU → DISCONNECT PLUG
- DI-01 RTU DIGITAL INPUT
- DO-01 RTU DIGITAL OUTPUT
- AI-01 RTU ANALOGUE INPUT
- AO-01 RTU ANALOGUE OUTPUT

**Sheet 07**  
FOR CONSTRUCTION

03.10	ISSUED FOR CONSTRUCTION	P.H. A.W.	DRAFTING CHECK	A.WITTHOFT	Original Signed by P.HAGUE	12-03-10	Original Signed by V.VAHEESAN	12-3-10
12.08	ISSUED FOR REVIEW	P.H. A.W.	CAD FILE	57-0099007	DESIGN	R.F.E.D. No. DATE	PRINCIPAL DESIGN MANAGER	DATE
12.08	AMENDMENT	ORH	APD	B.C.C. FILE No.	DESIGN CHECK	R.F.E.D. No. DATE	Original Signed by P.SHERIFF	12-03-10
							CLIENT DELEGATE	DATE

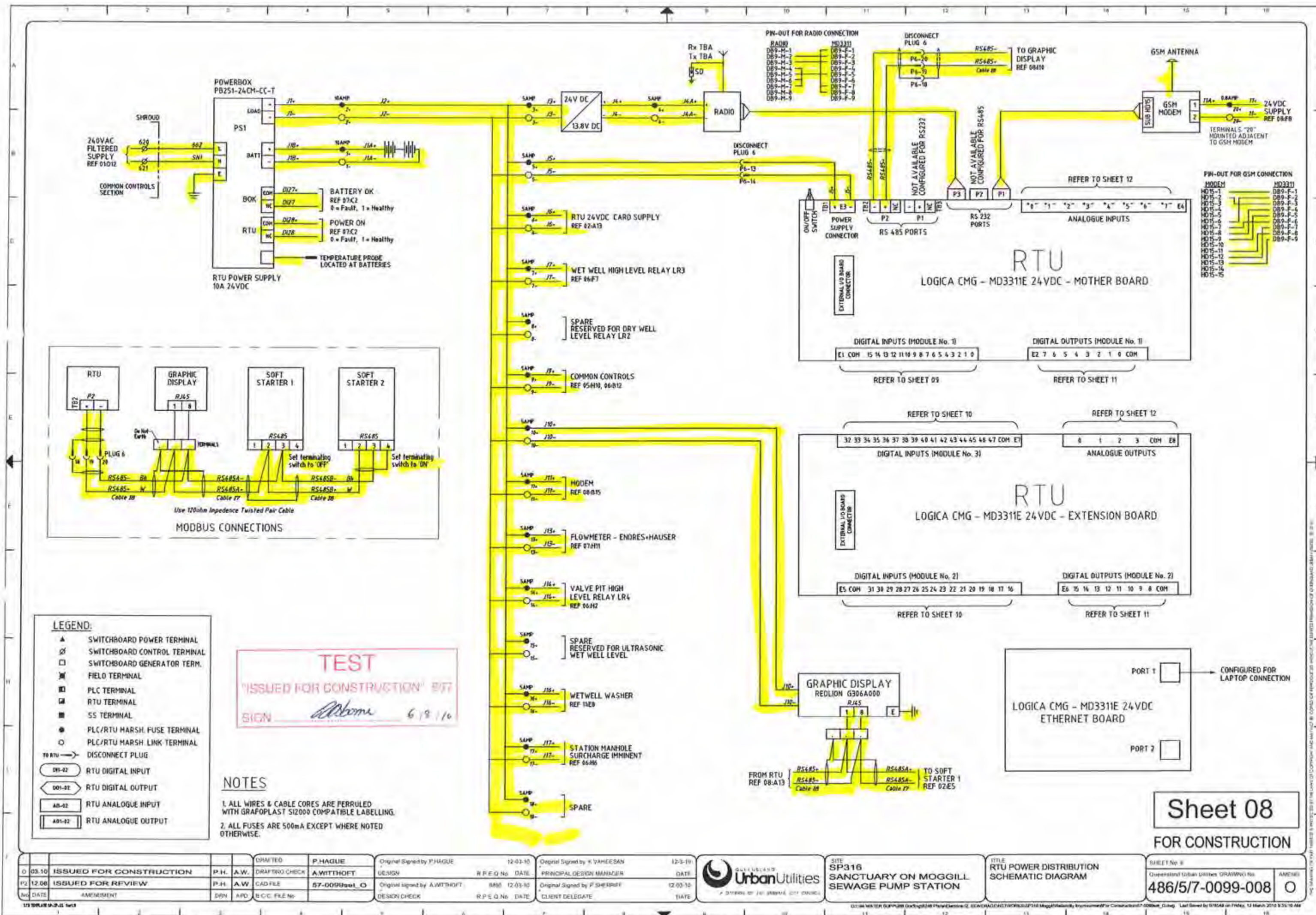


SP316  
SANCTUARY ON MOGGILL  
SEWAGE PUMP STATION

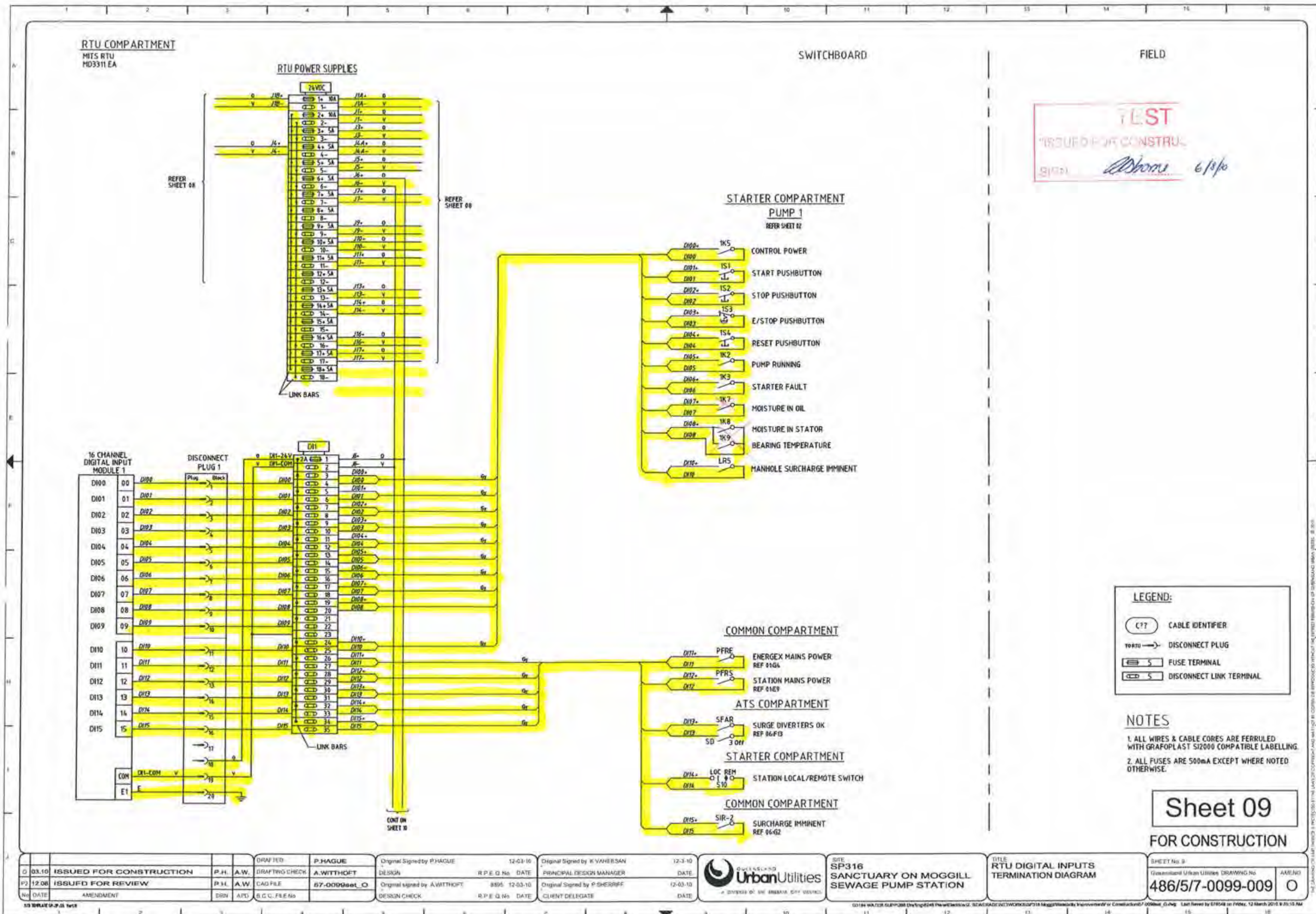
TITLE  
COMMON RTU I/O  
SCHEMATIC DIAGRAM

SHEET No. 7  
Quintessence Urban Utilities DRAWING No.  
486/5/7-0099-007  
AMEND

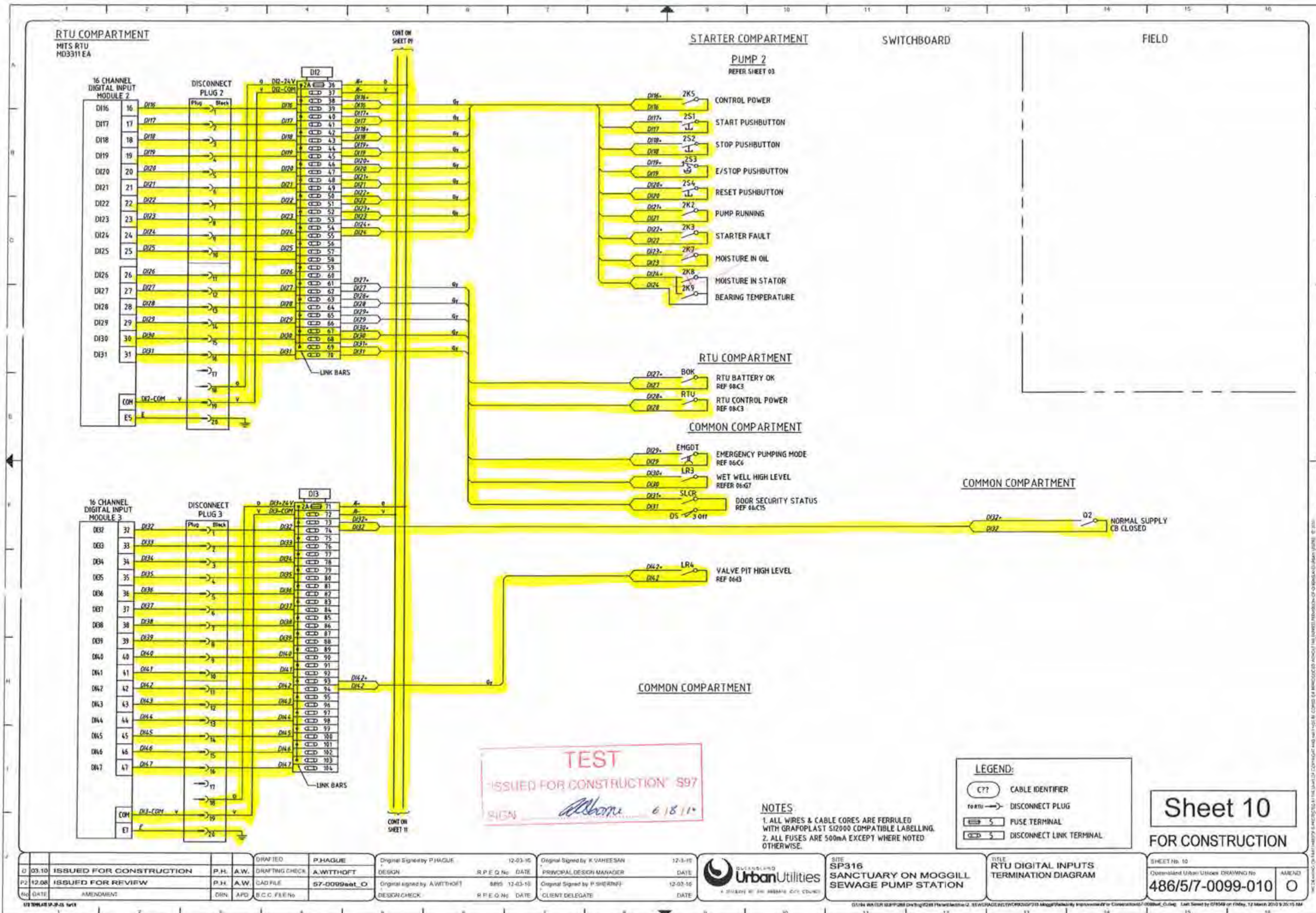




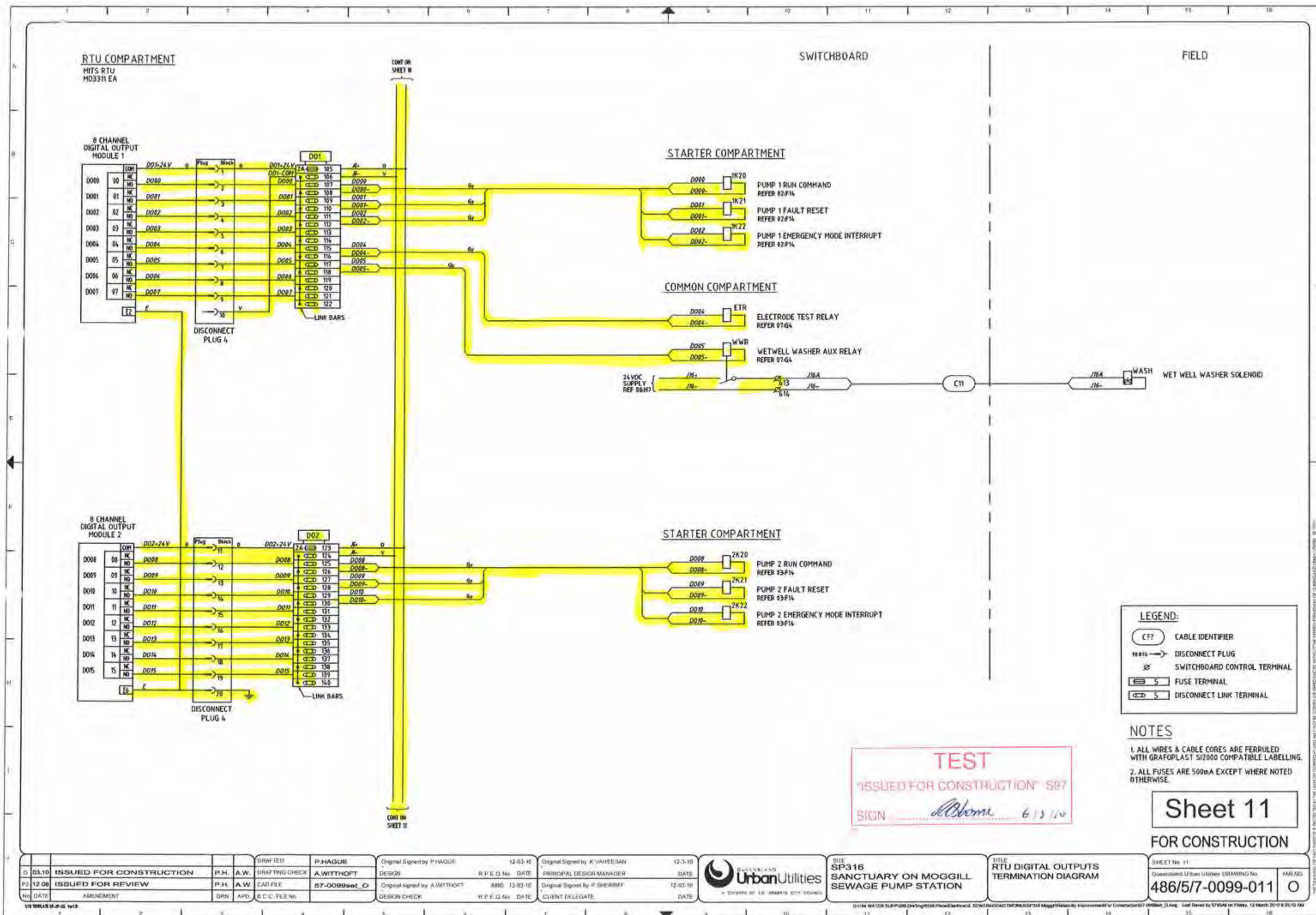






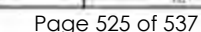








FIELD





ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	QTY	REMARKS	ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	QTY	REMARKS	ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	QTY	REMARKS	
1					H		45	2	PUMP FAULT RELAY - KJ	IEC	RH2B-UL-24VAC	-		129					K		
2	1	HANDL TRANSFER SWITCH	TERASAKI	WISS2PE12C33	F	Set Invol (100A) Charis	46	1	PUMP1 RUN RELAY - KA	IEC	RH2B-UL-24VAC	-		130					K		
3		- TO SPLIT MAIN SWITCHES B2 & B3	TERASAKI	40 RTED WITH W/AN AIR CONTACT	F		47	1	PUMP7 RUN RELAY - 2KA	IEC	RH2B-UL-24VAC	B		131		NOT USED					
4	1	B4 PUMP1 CIRCUIT BREAKER + 120S Handle	TERASAKI	S125G163	-	Set Invol (50.0A) Nov (370A)	48	2	PUMP CONTROL C/T POWER ON RELAY - KS	IEC	RH2B-UL-24VAC	-		132	1	PLUMETER - FREE ISSUE	ENDRESS+HAUSER	PROMATE 50	H	RANGE = 500/s	
5	1	B5 PUMP2 CIRCUIT BREAKER + 120S Handle	TERASAKI	S125G163	-	Set Invol (50.0A) Nov (370A)	49					E		133	1	WET WELL LEVEL TRANSMITTER	ENDRESS+HAUSER	PROX2AA.2.2.WL.GD.TU.A.PMS	-	RANGE = 5m	
6					E		50					E		134	1	WET WELL LEVEL TRANSMITTER TERMINAL HOUSING	ENDRESS+HAUSER	(Part of Item 133)	-		
7	1	B7 EMEREX PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCB33AC	-		51	2	PUMP MOISTURE IN OIL RELAY - K7	PEPPER & FUCHS	KFA4-ER-1A	A		135					G		
8					F		52	2	PUMP MOISTURE IN STATOR RELAY - K8	PEPPER & FUCHS	KFA4-ER-1A	B		136							
9	1	B9 SUB-DISTRIBUTION BOARD CIRCUIT BREAKER	TERASAKI	E25M1100	-	Set Invol Invol 10	53	2	PUMP BEARING TEMPERATURE RELAY- K1	AS PER PUMP MANUFACTURE RECOMMENDATION		B		137	1	DELIVERY PRESSURE TRANSMITTER	VEGA	VEGA8176	8074X0605H2X	U	RANGE = 100m
10	1	B10 STATION MAINS PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		54	2	PUMP RUN COMMAND RELAY - K20	IEC	RH2B-UL-24VDC	-		138	1	DELIVERY PRESSURE ADJUSTMENT UNIT	VEGA	VEGA D512	VEGA0512000	U	
11	1	B11 3 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	DTCB43AC	-	PLUS DISCHN-32-30-3FN	55	2	PUMP FAULT RESET RELAY - K21	IEC	RH2B-UL-24VDC	-		139	1	RTU POWER SUPPLY 24VDC	POWERBOX	PB251-24VDC-CE-1	-		
12	1	B12 15A GPO CIRCUIT BREAKER	TERASAKI	DSRCN-10-30A	-		56	2	PUMP EMERGENCY MODE INTERRUPT RELAY - K22	IEC	RH2B-UL-24VDC	-		140	1	RTU POWER SUPPLY 24VDC	POWERBOX	PB251-24VDC-CE-1	-		
13	1	B13 RTU LAPTOP GPO CIRCUIT BREAKER	TERASAKI	DSRCN-10-30A	-		57	2	PUMP START PUSHBUTTON - S1	SPRECHER & SCHUH	D7P-F3-PXN	-		141	1	RADIO 24V/13.8VDC CONVERTER	POWERBOX	PB01-24VDC-CC	H		
14	1	B14 SPARE	TERASAKI	DTCB43AC	E		58	2	PUMP STOP PUSHBUTTON - S2	SPRECHER & SCHUH	D7P-F4-PXN	-		142	1				I		
15	1	B15 SPARE	TERASAKI	DTCB43AC	E		59	2	PUMP EM/STOP PUSHBUTTON - S3	SPRECHER & SCHUH	D7P-M13A-PXN25	-	U/v Main E/Stop Ring - Label	143	2	BATTERIES - INCLUDING SPILL TRAYS	YUASA	UDX50-12	-		
16	1	B16 SW/DO INTERNAL LIGHTING CIRCUIT BREAKER	TERASAKI	DSRCN-10-30A	-		60	2	PUMP RESET PUSHBUTTON - S4	SPRECHER & SCHUH	D7P-F4-PXN	-		144	1						
17	1	B17 SURGE FILTER CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		61	2	PUMP HOUR RUN METER	NATIONAL	TH039	-		145	1	RADIO	THO	CG900-RTA2-00	B		
18	1	B18 EM PUMP CTRL & SURCHARGE IMMINENT CB	TERASAKI	DTCB43AC	-		62	2	PUMP POWER SOCKET OUTLET + INCLINE SLEEVE	HARECHAL	DS3 30440972 + 51CA458	-		146	1	RADIO ANTENNA	THO	YAG ANT13AL	B	5 ELEMENT 5MB ALUM	
19	1	B19 GENERATOR AUXILIARY SUPPLY CIRCUIT BREAKER	TERASAKI	DSRCN-10-30A	-		63	2	PUMP POWER INLET PLUG + HANDLE	HARECHAL	DS3 30440972 + 33A493	-		147	1	RADIO COAX SURGE PROTECTION UNIT	POLYMERSE CORPORATION	IS-500P-C2	B	Mounted on Din Rail	
20	1	B20 SPARE	TERASAKI	DTCB43AC	K		64	2	PUMP CONTROL SOCKET OUTLET + INCLINE SLEEVE	HARECHAL	PWTC 0P0400 + 01NA453	-		148	1	TELEMETRY UNIT - FREE ISSUE	LOGICA ONE	HD331EAL/27B1-0-7	-	FREE ISSUE	
21	1	B21 VALVE PIT SUMP PUMP POWER SUPPLY	TERASAKI	DSRCN-10-30A	Q		65					F		149	1	ISM MODEN	WAVECOM	FASTRACK Supreme	I	U/v 5 H Cable	
22					H		66					E		150	1	ISM CELLULAR TRANSIT ANTENNA	RF INDUSTRIES	TLA2400	I		
23	1	B23 CHEMICAL DOSING SUPPLY CIRCUIT BREAKER	TERASAKI	DTCB33AC	V		67					E		151	4	DISCONNECT PLUGS	PHOENIX CONTACT	MS1B 2.5/20-5T-50A	-		
24		NOT USED					68					E		152	4	DISCONNECT TERMINAL BLOCKS	PHOENIX CONTACT	UM510VX7.5/20-6-50A	-		
25		NOT USED					69					E		153	4	CABLE HOUSING	PHOENIX CONTACT	HGS-MS1025/20	-		
26	1	B26 RTU POWER SUPPLY CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		70					E		154	1	COORING PINS	PHOENIX CONTACT	CP-MS1B + CP-MS1B	-		
27	1	B27 SURGE FILTER ALARM RELAY CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		71					E		155	1	CHEMICAL DOSING SERIAL ISOLATOR - CO-LI	MOORE INDUSTRIES	ECT/4-20mA/4-20mA	-	2 WIRE LOOP POWERED	
28	1		TERASAKI	DTCB43AC	H		72					E		156	1	ANTENNA MAST U/v 20mm NYLON CABLE GLAND	SWBO BUILDER	SHEET 22	B	LENGTH = 6 MTRS	
29	1	B29 SPARE	TERASAKI	DTCB43AC	-		73	1	LR3- WET WELL HIGH LEVEL RELAY	MULTITRIDE	HTB-5	-	24VDC	157	1	INTERNAL COAX CABLE (Radio to Lightning Arrester)	THO	TH0 - SHAM/WHVTL23	B	Cable No X01	
30		NOT USED					74	1	LR4- VALVE PIT HIGH LEVEL RELAY	MULTITRIDE	HTB-5	B	24VDC	158	1	EXTERNAL COAX CABLE (Lightning Arrester to Aerial)	R.F. INDUSTRIES	ANGREW - ONT400	B	Cable No X02	
31	1	B31 PUMP1 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		75	1	LR5- MAINLINE SURCHARGE IMMINENT LEVEL RELAY	MULTITRIDE	HTB-5	D	24VDC	159	2	COAX PLUG (For ONT400 cable)	PULSE	N-20305	B	Straight cable plug crimp	
32	1	B32 PUMP2 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB43AC	-		76	1	SR - SURCHARGE IMMINENT LEVEL RELAY	MULTITRIDE	HTB-2	-	24VAC	160	1	U CLAMPS	R.F. INDUSTRIES	URY	B		
33					E		77	4	SINGLE POINT PROBES	MULTITRIDE	4 off - 0240852-1264	-		161							
34					F		78	1	EMERGENCY PUMPING MODE RELAY PUMP1 - ENG1	IEC	RH2B-UL-24VAC	-	24VAC	162	-	SWITCHBOARD TERMINALS					
35					F		79	1	SURCHARGE IMMINENT DELAY TIMER - SBT	SPRECHER & SCHUH	R77-F5A 3E103	-	ON DELAY	163	1	POWER TERMINALS - SHROUDED	PHOENIX CONTACT	UT6	-		
36	1	DISTRIBUTION BOARD CHASSIS	TERASAKI	CB-7-24/10-20	-		80	1	EMERGENCY PUMPING MODE TIMER - ENG01	IEC	GT30-4-AF29 + IEC BASE	-	ON DELAY	164	1	FUSED TERMINALS WITH LED 24V INDICATION	PHOENIX CONTACT	UT6-MESH LED24 (5x20)	-		
37	3	F1 - SURGE OVERTER CIRCUIT FUSES	NBP	43AMP 10KMS	-	FUSES & HOLDERS	81	1	EMERGENCY PUMPING MODE TIMER PUMP2 - ENG2	SPRECHER & SCHUH	R77-F5A 3E103	-	ON DELAY	165	1	FUSE CARTRIDGES	PHOENIX CONTACT	H225	-	RATINGS AS REQUIRED	
38	3	SURGE OVERTER	CRITEC	TD5100-250-277	-		82	1	EMERGENCY PUMPING MODE SWITCH - S5	SPRECHER & SCHUH	D7P-L5025-PX10	-	ENGRAVE 'OFF ON'	166	1	DISCONNECT TERMINALS	PHOENIX CONTACT	UT6-MT P/P	-		
39	1	SURGE FILTER ALARM RELAY - SPAR	CRITEC	QAR-275V	-		83					F		167	1	EARTH TERMINALS	PHOENIX CONTACT	UT6-MTD-PE	-		
40	1	SURGE PROTECTION FILTER - SPT	CRITEC	TDF-18A-240V	-		84					F		168	1	GROUP MARKER CARRIER	PHOENIX CONTACT	USE	-		
41	1	EMEREX MAINS PHASE FAILURE RELAY - PPRE	CRIMPTON INSTRUMENTS	252-PSGW	-		85					F		169	2	TEST PLUG ADAPTOR	PHOENIX CONTACT	NPS-MT-PS-6	-		
42		NOT USED					86					F		170	1	PLUG-IN BRIDGING STOP	PHOENIX CONTACT	FBS	-	AS REQUIRED	
43	1	STATION MAINS PHASE FAILURE RELAY - PPRS	CRIMPTON INSTRUMENTS	252-PSGW	-		87					F		171	1	COVER PROFILE TSHROUDED + CARRIER PLATE	PHOENIX CONTACT	AP-2 + AP2-TU	-	AS REQUIRED	
44		NOT USED					88					F		172							
45	1	MAIN NEUTRAL LINK	DAL ELEC	DLAN6	-	INSULATED	89					F		173							
46	1	MAIN EARTH LINK	DAL ELEC	DLAN6A	-		90					F		174							
47	1	DIST. BD NEUTRAL LINK	DAL ELEC	DLAN6B	-	INSULATED	91					F		175	1	EMEREX PADLOCK - 16mm brass pin handle	N.A. REED LOCKSMITHS	KEY No 375 & S/S Shackle	-	U/v 1 KEY	
48	1	DIST. BD EARTH LINK	DAL ELEC	DLAN6B	-		92					F		176	1	WET WELL CONDUIT SEALING BUNGS	RUBBER	TO SUIT CONDUITS	-	Detail 'W'	
49	1	SURGE OVERTER NEUTRAL LINK	CLIPSAL	L5A	-	INSULATED	93					F		177	1	S/STEEL FITTINGS AS DETAILD FOR PRESSURE TX	FITTINGS	STAINLESS STEEL	U	Sheet 15	
50	1	INSTRUMENT EARTH LINK	DAL ELEC	DLN612	-	INSULATED	94					F		178	1	EARTH ROD CONNECTION BOX	NESCO	ERB1	-		
51	1	FILTERED SUPPLY NEUTRAL LINK	CLIPSAL	LT	-	INSULATED	95					F		179	1	LINE TAP - BOWLING TO EARTHING ROD	CLIPSAL	BP26	-		
52	1	3 PHASE SWITCHED OUTLET	CLIPSAL	56410	-	USE ENCLOSURE AS SHOWN	96					F		180	1	EARTHING ROD	COPPER ROD	6mm Diameter	-		
53	1	1 PHASE OUTLET 15A	CLIPSAL	57/65/900 (SHROUDED)	-		97					F		181							
54	1	LAPTOP GPO - TWIN 10A	CLIPSAL	25+44A+44AMP	-		98					F		182							
55	1	1 PHASE OUTLET - GENERATOR AUXILIARY POWER	CLIPSAL	565030	F	15A	99					F		183	2	CORROSION INHIBITOR	CONTEC	VPC-10 IN 11	-	FROM AP CONTROLS	
56	1	3 PHASE NEE APPLIANCE INLET - GENERATOR POWER	HENDRICKS	HEND61	F	U/v PROTECTIVE CAP 40787	100					F									
57		NOT USED					101					F									
58		NOT USED					102					F									
59	1	PUMP SOFT STARTER	EMOTRON HSF2.0																		

Sheet 14  
FOR CONSTRUCTION

DATE	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITHOFT	Original Signed by P.HAGUE	12-03-10	Original Signed by H. WAHREMAN	12-03-10	DATE	ISSUED FOR REVIEW	P.H.	A.W.	CAO FILE	07-00000001	Original Signed by A.WITHOFT	08-05-12-03-10	Original Signed by P.HAGUE	12-03-10	DATE
DATE	AMENDMENT	DWN	APD	B.C.C. FILE No		DESIGN CHECK	H.P.E. Q. No	CHIEF DELEGATE		DATE										




ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
1	1	N/O AUX SWITCH	TERASAKI	TERASAKI 5250E3125	K	
2	1	HANDL TRANSFER SWITCH	TERASAKI	TERASAKI 5250E3125	F	Set In-0.8 (100A) Char-6
3	1	TO SUIT MAIN SWITCHES 02 & 03 5250E/05	TERASAKI	TERASAKI 5250E3125	F	
4	1	Q4 PUMP1 CIRCUIT BREAKER - THIS RUND	TERASAKI	TERASAKI 5250E3125	-	Set In-0.8 (50A) In-4 (20A)
5	1	Q5 PUMP2 CIRCUIT BREAKER - THIS RUND	TERASAKI	TERASAKI 5250E3125	-	Set In-0.8 (50A) In-4 (20A)
6	3	1250 MAINS	TERASAKI	TERASAKI 5250E3125	E	
7	1	Q7 EMERGENCY PHASE FAILURE CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
8	1	Q9 SUB-DISTRIBUTION BOARD CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	Set In-1 In-10
9	1	Q10 STATION MAINS PHASE FAILURE CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
10	1	Q11 3 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	PLUS DISCH-37-30-3FN
11	1	Q12 15A GPO CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
12	1	Q13 RTU LAPTOP GPO CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
13	1	Q14 SPARE	TERASAKI	TERASAKI 5250E3125	E	
14	1	Q15 SPARE	TERASAKI	TERASAKI 5250E3125	E	
15	1	Q16 SW/BO INTERNAL LIGHTING CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
16	1	Q17 SURGE FILTER CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
17	1	Q18 EM PUMP CTRL & SURCHARGE IMBENT CB	TERASAKI	TERASAKI 5250E3125	-	
18	1	Q19 GENERATOR AUXILIARY SUPPLY CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
19	1	Q20 SPARE	TERASAKI	TERASAKI 5250E3125	K	
20	1	Q21 VALVE PIT SUMP PUMP POWER SUPPLY	TERASAKI	TERASAKI 5250E3125	Q	
21	2	25A SHROUDS	TERASAKI	TERASAKI 5250E3125	H	
22	1	Q23 CHEMICAL DOSING SUPPLY CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	V	
23	1	Q24 CRITICAL SUPPLY PANEL	TERASAKI	TERASAKI 5250E3125	-	
24	3	125A SHROUDS	TERASAKI	TERASAKI 5250E3125	E	
25	1	Q25 RTU POWER SUPPLY CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
26	1	Q26 SURGE FILTER ALARM RELAY CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
27	1	Q27 SPARE	TERASAKI	TERASAKI 5250E3125	H	
28	1	Q28 SPARE	TERASAKI	TERASAKI 5250E3125	-	
29	1	Q29 SPARE	TERASAKI	TERASAKI 5250E3125	-	
30	1	Q30 PUMP1 CONTROL CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
31	1	Q31 PUMP2 CONTROL CIRCUIT BREAKER	TERASAKI	TERASAKI 5250E3125	-	
32	1	Q32 SPARE	TERASAKI	TERASAKI 5250E3125	E	
33	1	Q33 SPARE	TERASAKI	TERASAKI 5250E3125	F	
34	1	Q34 SPARE	TERASAKI	TERASAKI 5250E3125	-	
35	1	Q35 SPARE	TERASAKI	TERASAKI 5250E3125	-	
36	1	Q36 SPARE	TERASAKI	TERASAKI 5250E3125	-	
37	1	Q37 SPARE	TERASAKI	TERASAKI 5250E3125	-	
38	1	Q38 SPARE	TERASAKI	TERASAKI 5250E3125	-	
39	1	Q39 SPARE	TERASAKI	TERASAKI 5250E3125	-	
40	1	Q40 SPARE	TERASAKI	TERASAKI 5250E3125	-	
41	1	Q41 SPARE	TERASAKI	TERASAKI 5250E3125	-	
42	1	Q42 SPARE	TERASAKI	TERASAKI 5250E3125	-	
43	1	Q43 SPARE	TERASAKI	TERASAKI 5250E3125	-	
44	1	Q44 SPARE	TERASAKI	TERASAKI 5250E3125	-	
45	1	Q45 SPARE	TERASAKI	TERASAKI 5250E3125	-	
46	1	Q46 SPARE	TERASAKI	TERASAKI 5250E3125	-	
47	1	Q47 SPARE	TERASAKI	TERASAKI 5250E3125	-	
48	1	Q48 SPARE	TERASAKI	TERASAKI 5250E3125	-	
49	1	Q49 SPARE	TERASAKI	TERASAKI 5250E3125	-	
50	1	Q50 SPARE	TERASAKI	TERASAKI 5250E3125	-	
51	1	Q51 SPARE	TERASAKI	TERASAKI 5250E3125	-	
52	1	Q52 SPARE	TERASAKI	TERASAKI 5250E3125	-	
53	1	Q53 SPARE	TERASAKI	TERASAKI 5250E3125	-	
54	1	Q54 SPARE	TERASAKI	TERASAKI 5250E3125	-	
55	1	Q55 SPARE	TERASAKI	TERASAKI 5250E3125	-	
56	1	Q56 SPARE	TERASAKI	TERASAKI 5250E3125	-	
57	1	Q57 SPARE	TERASAKI	TERASAKI 5250E3125	-	
58	1	Q58 SPARE	TERASAKI	TERASAKI 5250E3125	-	
59	1	Q59 SPARE	TERASAKI	TERASAKI 5250E3125	-	
60	1	Q60 SPARE	TERASAKI	TERASAKI 5250E3125	-	
61	1	Q61 SPARE	TERASAKI	TERASAKI 5250E3125	-	
62	1	Q62 SPARE	TERASAKI	TERASAKI 5250E3125	-	
63	1	Q63 SPARE	TERASAKI	TERASAKI 5250E3125	-	
64	1	Q64 SPARE	TERASAKI	TERASAKI 5250E3125	-	
65	1	Q65 SPARE	TERASAKI	TERASAKI 5250E3125	-	
66	1	Q66 SPARE	TERASAKI	TERASAKI 5250E3125	-	
67	1	Q67 SPARE	TERASAKI	TERASAKI 5250E3125	-	
68	1	Q68 SPARE	TERASAKI	TERASAKI 5250E3125	-	
69	1	Q69 SPARE	TERASAKI	TERASAKI 5250E3125	-	
70	1	Q70 SPARE	TERASAKI	TERASAKI 5250E3125	-	
71	1	Q71 SPARE	TERASAKI	TERASAKI 5250E3125	-	
72	1	Q72 SPARE	TERASAKI	TERASAKI 5250E3125	-	
73	1	Q73 SPARE	TERASAKI	TERASAKI 5250E3125	-	
74	1	Q74 SPARE	TERASAKI	TERASAKI 5250E3125	-	
75	1	Q75 SPARE	TERASAKI	TERASAKI 5250E3125	-	
76	1	Q76 SPARE	TERASAKI	TERASAKI 5250E3125	-	
77	1	Q77 SPARE	TERASAKI	TERASAKI 5250E3125	-	
78	1	Q78 SPARE	TERASAKI	TERASAKI 5250E3125	-	
79	1	Q79 SPARE	TERASAKI	TERASAKI 5250E3125	-	
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81	1	Q81 SPARE	TERASAKI	TERASAKI 5250E3125	-	
82	1	Q82 SPARE	TERASAKI	TERASAKI 5250E3125	-	
83	1	Q83 SPARE	TERASAKI	TERASAKI 5250E3125	-	
84	1	Q84 SPARE	TERASAKI	TERASAKI 5250E3125	-	
85	1	Q85 SPARE	TERASAKI	TERASAKI 5250E3125	-	
86	1	Q86 SPARE	TERASAKI	TERASAKI 5250E3125	-	
87	1	Q87 SPARE	TERASAKI	TERASAKI 5250E3125	-	
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89	1	Q89 SPARE	TERASAKI	TERASAKI 5250E3125	-	
90	1	Q90 SPARE	TERASAKI	TERASAKI 5250E3125	-	
91	1	Q91 SPARE	TERASAKI	TERASAKI 5250E3125	-	
92	1	Q92 SPARE	TERASAKI	TERASAKI 5250E3125	-	
93	1	Q93 SPARE	TERASAKI	TERASAKI 5250E3125	-	
94	1	Q94 SPARE	TERASAKI	TERASAKI 5250E3125	-	
95	1	Q95 SPARE	TERASAKI	TERASAKI 5250E3125	-	
96	1	Q96 SPARE	TERASAKI	TERASAKI 5250E3125	-	
97	1	Q97 SPARE	TERASAKI	TERASAKI 5250E3125	-	
98	1	Q98 SPARE	TERASAKI	TERASAKI 5250E3125	-	
99	1	Q99 SPARE	TERASAKI	TERASAKI 5250E3125	-	
100	1	Q100 SPARE	TERASAKI	TERASAKI 5250E3125	-	
101	1	Q101 SPARE	TERASAKI	TERASAKI 5250E3125	-	
102	1	Q102 SPARE	TERASAKI	TERASAKI 5250E3125	-	
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104	1	Q104 SPARE	TERASAKI	TERASAKI 5250E3125	-	
105	1	Q105 SPARE	TERASAKI	TERASAKI 5250E3125	-	
106	1	Q106 SPARE	TERASAKI	TERASAKI 5250E3125	-	
107	1	Q107 SPARE	TERASAKI	TERASAKI 5250E3125	-	
108	1	Q108 SPARE	TERASAKI	TERASAKI 5250E3125	-	
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110	1	Q110 SPARE	TERASAKI	TERASAKI 5250E3125	-	
111	1	Q111 SPARE	TERASAKI	TERASAKI 5250E3125	-	
112	1	Q112 SPARE	TERASAKI	TERASAKI 5250E3125	-	
113	1	Q113 SPARE	TERASAKI	TERASAKI 5250E3125	-	
114	1	Q114 SPARE	TERASAKI	TERASAKI 5250E3125	-	
115	1	Q115 SPARE	TERASAKI	TERASAKI 5250E3125	-	
116	1	Q116 SPARE	TERASAKI	TERASAKI 5250E3125	-	
117	1	Q117 SPARE	TERASAKI	TERASAKI 5250E3125	-	
118	1	Q118 SPARE	TERASAKI	TERASAKI 5250E3125	-	
119	1	Q119 SPARE	TERASAKI	TERASAKI 5250E3125	-	
120	1	Q120 SPARE	TERASAKI	TERASAKI 5250E3125	-	
121	1	Q121 SPARE	TERASAKI	TERASAKI 5250E3125	-	
122	1	Q122 SPARE	TERASAKI	TERASAKI 5250E3125	-	
123	1	Q123 SPARE	TERASAKI	TERASAKI 5250E3125	-	
124	1	Q124 SPARE	TERASAKI	TERASAKI 5250E3125	-	
125	1	Q125 SPARE	TERASAKI	TERASAKI 5250E3125	-	
126	1	Q126 SPARE	TERASAKI	TERASAKI 5250E3125	-	
127	1	Q127 SPARE	TERASAKI	TERASAKI 5250E3125	-	
128	1	Q128 SPARE	TERASAKI	TERASAKI 5250E3125	-	
129	1	Q129 SPARE	TERASAKI	TERASAKI 5250E3125	-	
130	1	Q130 SPARE	TERASAKI	TERASAKI 5250E3125	-	
131	1	Q131 SPARE	TERASAKI	TERASAKI 5250E3125	-	
132	1	Q132 SPARE	TERASAKI	TERASAKI 5250E3125	-	
133	1	Q133 SPARE	TERASAKI	TERASAKI 5250E3125	-	
134	1	Q134 SPARE	TERASAKI	TERASAKI 5250E3125	-	
135	1	Q135 SPARE	TERASAKI	TERASAKI 5250E3125	-	
136	1	Q136 SPARE	TERASAKI	TERASAKI 5250E3125	-	
137	1	Q137 SPARE	TERASAKI	TERASAKI 5250E3125	-	
138	1	Q138 SPARE	TERASAKI	TERASAKI 5250E3125	-	
139	1	Q139 SPARE	TERASAKI	TERASAKI 5250E3125	-	
140	1	Q140 SPARE	TERASAKI	TERASAKI 5250E3125	-	
141	1	Q141 SPARE	TERASAKI	TERASAKI 5250E3125	-	
142	1	Q142 SPARE	TERASAKI	TERASAKI 5250E3125	-	
143	1	Q143 SPARE	TERASAKI	TERASAKI 5250E3125	-	
144	1	Q144 SPARE	TERASAKI	TERASAKI 5250E3125	-	
145	1	Q145 SPARE	TERASAKI	TERASAKI 5250E3125	-	
146	1	Q146 SPARE	TERASAKI	TERASAKI 5250E3125	-	
147	1	Q147 SPARE	TERASAKI	TERASAKI 5250E3125	-	
148	1	Q148 SPARE	TERASAKI	TERASAKI 5250E3125	-	
149	1	Q149 SPARE	TERASAKI	TERASAKI 5250E3125	-	
150	1	Q150 SPARE	TERASAKI	TERASAKI 5250E3125	-	
151	1	Q151 SPARE	TERASAKI	TERASAKI 5250E3125	-	
152	1	Q152 SPARE	TERASAKI	TERASAKI 5250E3125	-	
153	1	Q153 SPARE	TERASAKI	TERASAKI 5250E3125	-	
154	1	Q154 SPARE	TERASAKI	TERASAKI 5250E3125	-	
155	1	Q155 SPARE	TERASAKI	TERASAKI 5250E3125	-	
156	1	Q156 SPARE	TERASAKI	TERASAKI 5250E3125	-	
157	1	Q157 SPARE	TERASAKI	TERASAKI 5250E3125	-	
158	1	Q158 SPARE	TERASAKI	TERASAKI 5250E3125	-	
159	1	Q159 SPARE	TERASAKI	TERASAKI 5250E3125	-	
160	1	Q160 SPARE	TERASAKI	TERASAKI 5250E3125	-	
161	1	Q161 SPARE	TERASAKI	TERASAKI 5250E3125	-	
162	1	Q162 SPARE	TERASAKI	TERASAKI 5250E3125	-	
163	1	Q163 SPARE	TERASAKI	TERASAKI 5250E3125	-	
164	1	Q164 SPARE	TERASAKI	TERASAKI 5250E3125	-	
165	1	Q165 SPARE	TERASAKI	TERASAKI 5250E3125	-	
166	1	Q166 SPARE	TERASAKI	TERASAKI 5250E3125	-	
167	1	Q167 SPARE	TERASAKI	TERASAKI 5250E3125	-	
168	1	Q168 SPARE	TERASAKI	TERASAKI 5250E3125	-	
169	1	Q169 SPARE	TERASAKI	TERASAKI 5250E3125	-	
170	1	Q170 SPARE	TERASAKI	TERASAKI 5250E3125	-	
171	1	Q171 SPARE	TERASAKI	TERASAKI 5250E3125	-	
172	1	Q172 SPARE	TERASAKI	TERASAKI 5250E3125	-	
173	1	Q173 SPARE	TERASAKI	TERASAKI 5250E3125	-	
174	1	Q174 SPARE	TERASAKI	TERASAKI 5250E3125	-	
175	1	Q175 SPARE	TERASAKI	TERASAKI 5250E3125	-	
176	1	Q176 SPARE	TERASAKI	TERASAKI 5250E3125	-	
177	1	Q177 SPARE	TERASAKI	TERASAKI 5250E3125	-	
178	1	Q178 SPARE	TERASAKI	TERASAKI 5250E3125	-	
179	1	Q179 SPARE	TERASAKI	TERASAKI 5250E3125	-	
180	1	Q180 SPARE	TERASAKI	TERASAKI 5250E3125	-	
181	1	Q181 SPARE	TERASAKI	TERASAKI 5250E3125	-	
182	1	Q182 SPARE	TERASAKI	TERASAKI 5250E3125	-	
183	1	Q183 SPARE	TERASAKI	TERASAKI 5250E3125	-	
184	1	Q184 SPARE	TERASAKI	TERASAKI 5250E3125	-	
185	1	Q185 SPARE	TERASAKI	TERASAKI 5250E3125	-	
186	1	Q186 SPARE	TERASAKI	TERASAKI 5250E3125	-	

5 ENVOIES D UT 2.5/10 304702E  
10 ENVOIES D UT 2.5/4-hen 3047141  
1 ZBG LGS FORTL ZAHLEN WISACH  
TECHNICAL SERVICES

Sheet 14

FOR CONSTRUCTION

O	03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITHOFF	Original Signed by P.HAGUE DESIGN R.P.E.Q. No. DATE	12-03-10	Original signed by K.VAHEESAN PRINCIPAL DESIGN MANAGER DATE	12-03-10
P2	12.08	ISSUED FOR REVIEW	P.H.	A.W.	CAD FILE	57-0099-014	Original signed by A WITHOFF DESIGN CHECK R.P.E.Q. No. DATE	08-05-10	Original Signed by PLUMBERIFF CLIENT DELEGATE DATE	12-03-10
No.	DATE	AMENDMENT	DRW.	APD.	B.C.C. FILE NO.					



SITE  
**SP316**

**SANCTUARY ON MOGGILL SEWAGE PUMP STATION**

TITLE  
**EQUIPMENT LIST**

SHEET No. 14

Queensland Urban Utilities DRAWING No:  
**486/5/7-0099-014**

AMEND:

**0**



CABLE No.	STATUS	SIZE	CORES	TYPE	LENGTH (m) Note 1	FROM	TO	CABLE FUNCTION	NOTES
P01	NEW	35mm <sup>2</sup>	4C	PVC/CU/PVC Nite2		ENERGET Supply Pillar/Pole	Switchboard	Incoming Mains Supply	Refer Note 2 for Cable Protection
E01	NEW	10mm <sup>2</sup>	2C	Building Wire		Switchboard	Earth stake	Main Earth	
E02	NEW	10mm <sup>2</sup>	2C	Building Wire		Switchboard	Wet Well Reinforcing Earth Bond	Epoxihetical Bond	
P04	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No1	Pump 1 Motor Feed +Thermistors	
P05	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P06	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P08	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P09	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P10	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P11	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P12	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P13	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P14	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P15	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P16	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P17	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P18	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P19	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
P20	NEW	10mm <sup>2</sup>	3C+E-2Pilot	Flexible (Schermidale)		Switchboard - Pump De-Contactor	Pump No2	Pump 2 Motor Feed +Thermistors	
C00	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard - Pump Aux Plug	Pump No1	Pump 1 Motor Thermistors + Aux Protection	
C04	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Pump 1	Pump 1 Bearing Temperature RTD	
C05	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Pump 2	Pump 2 Bearing Temperature RTD	
C06	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Surcharge Inlet/Outlet Probe	Surcharge Inlet/Outlet Signal (SRI)	
C07	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C08	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C09	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C10	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C11	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C12	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C13	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C14	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C15	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C16	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C17	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C18	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C19	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C20	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C21	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C22	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C23	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C24	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C25	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C26	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C27	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C28	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C29	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C30	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C31	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C32	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C33	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C34	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C35	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C36	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C37	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C38	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C39	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C40	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C41	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C42	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C43	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C44	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C45	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C46	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C47	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C48	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C49	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C50	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C51	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C52	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C53	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C54	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C55	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C56	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C57	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C58	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C59	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C60	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C61	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C62	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C63	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C64	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C65	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C66	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C67	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C68	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C69	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C70	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C71	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C72	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C73	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C74	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C75	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C76	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C77	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C78	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C79	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C80	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C81	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C82	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C83	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C84	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C85	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C86	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C87	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C88	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C89	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C90	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C91	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C92	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C93	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C94	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C95	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	
C96	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Chemical Dosing Unit	Chemical Dosing Unit - Controls	
C97	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well High Level Probe	Wet Well High Level Signal (LBS)	
C98	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Valve Pit High Level Probe	Valve Pit High Level Signal (LBS)	
C99	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Station Mainline Surcharge Inlet/Outlet Probe	Mainline Surcharge Inlet/Outlet Signal (LBS)	
C100	NEW	15mm <sup>2</sup>	4C	RTD cable		Switchboard	Wet Well Washer Solenoid Valve	Wet Well Washer	

### VOLTAGE DROP Mains Cable

$$V_d = L \times (I \times R) \times V_c / 1000$$

$$35mm^2 = (1.1mV/A \cdot m)$$

$$75mtrs \times 95A \times 1.1 / 1000$$

$$\text{Voltage Drop} = 7.9\text{volts to Main Switch}$$

Based on 100A supply fuses

### NOTE:

1. THE CONTRACTOR IS RESPONSIBLE IN DETERMINING THE ACTUAL CABLE LENGTHS REQUIRED ON SITE.
2. PROTECT THE MAINS CABLE USING PVC SHEATHED FLEXIBLE METAL CONDUIT SUCH AS 'ADAPTA FLEX' 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.
4. MAXIMUM ROUTE LENGTH OF MAINS CABLE RUN TO BE 75 MTRS. RE-SIZE CABLE IF POINT OF CONNECTION IS GREATER THAN 75MTRS. MAXIMUM DEMAND IS 95AMPS.

# Sheet 15

## FOR CONSTRUCTION

03.10	ISSUED FOR CONSTRUCTION	R.H.	A.W.	DRAFTING CHECK	P.HAGUE
12.08	ISSUED FOR REVIEW	R.H.	A.W.	CAD FILE	57-0099001_0
DATE	AMENDMENT	DRN	APD	B.C.C. FILE No	

Original Signed by P.HAGUE	12-03-10	Original Signed by K.VAHEEDAN	12-03-10
DESIGN	R.P.E.G. No. DATE	PRINCIPAL DESIGN MANAGER	DATE
Original Signed by A.WITTHOFF	12-03-10	Original Signed by P.SHERREFF	12-03-10
DESIGN CHECK	R.P.E.G. No. DATE	CLIENT DELEGATE	DATE



SITE  
SP316  
SANCTUARY ON MOGGILL  
SEWAGE PUMP STATION

TITLE  
CABLE SCHEDULE

PROJECT No. 58  
Drawn and Issued by Urban Utilities DRAWING No.  
486/5/7-0099-015  
AMEND  
O

ITEM #	QTY.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOR
		TERMINAL HEADER	RTU POWER SUPPLIES		1/16"	ABS PLASTIC W/PA
		TERMINAL HEADER	DIGITAL INPUTS	DIGITAL INPUTS	1/16"	ABS PLASTIC W/PA
		TERMINAL HEADER	DIGITAL INPUTS	DIGITAL INPUTS	1/16"	ABS PLASTIC W/PA
		TERMINAL HEADER	ANALOG INPUTS	ANALOG INPUTS	1/16"	ABS PLASTIC W/PA
		TERMINAL HEADER	ANALOG INPUTS	ANALOG INPUTS	1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Above Circuit Breakers)	NON PA TIEBARS		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Above Circuit Breakers)	SUPPLY		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Above Circuit Breakers)	PULSER(S)		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Below Section)	SUPPLY		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Below Section)	HIGH BEHIND		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Over Terminals 600-610)	LEVEL TX AND LEVEL PROBES		1/16"	ABS PLASTIC W/PA
		HEADER LABEL (Over Unshielded Terminals)	WARNING		1/16"	ABS PLASTIC W/PA
200						
201						
202	M	GENERATOR INTERFACE TERMINALS	GENERATOR INTERFACE		1/16"	ABS PLASTIC W/PA
203	F2	GENERATOR BOLTED CONNECTIONS	BUSBAR LINE WHEN SWITCHBOARD ENERGIZED FROM GENERATOR		1/16"	ABS PLASTIC W/PA
204						
205						
206		METER PANEL WARNING SIGN	1/DUPPLICATE LABELS 1/4" X 1/4" FROM EXTERNAL LABEL LIST / INSPECTION PLATE	1/DO NOT ASSEY METER BOX ADJACENT METERS / FIX BY GROUNDING ONLY	1/16"	ABS PLASTIC W/PA
207		INSPECTION PLATE LABELS - 2 OFF	DO NOT INSTALL GRANDS		1/16"	ABS PLASTIC W/PA
208						
209						

[illegible]

LABEL	TEXT	TEXT HEIGHT	PARTIAL LETTERING	SIZE	QTY
AA	HAN/EARTH CONDUCTOR - DO NOT DISCONNECT Via Main Earth Electrode	Small			1

FOR CONSTRUCTION

SUBJECT No. 18 Queensland Urban Utilities DRAWINGS No. <b>486/5/7-0099-016</b>		AMEND <b>O</b>
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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 1011-287 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. Fill 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 stiffeners to be S/Steel and of sufficient 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/Inspection/Access plate openings fitted with M6x10 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 spilt.  
Inspection/Access plates are NOT to be earthed.  
Provide Shrouding to all live parts to IP20 where required.  
Hinges (external) Selectrix H08650ss-316. Stainless steel.  
Star washers fitted under all hinge screws.  
Hinged escutcheons fixed with Emka 1/4 turn 1000-U162.  
All equipment to be removable via front access.  
Install switchboard with non-hydroscopic material between plinth and concrete slab. (Detail E)  
All escutcheons to open a minimum of 90°.  
All sheet metal edging to be de-burrl.

**Locks Doors 1 - 6 & 8**

DORE ELECTRICS - Swing Handle SHK55 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 9**

DORE ELECTRICS - Swing Handle SHK55 Universal Locking - 92268  
DORE ELECTRICS - 3 point lock rod set - TLR2255 (all S/Steel)  
Lockwood Barrel Lock, Key Code RC496AB

**Locks Door 7**

DORE ELECTRICS - Swing Handle SHP55 Padlockable - 316  
DORE ELECTRICS - 3 point lock rod set - TLR24  
ENERGEX padlock, S/Steel Shackle, 45mm brass pin tumblers.  
Energes Key No325. (1/w) key

**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 (3664R) matt finish.  
INTERIOR ITEMS (mounting panels, escutcheons, etc.) - DULUX Bright White (3216A)  
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, each individual wire shall be 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 funnel type terminal.  
Where multiple connections are required on funnel 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 Grapofast SIZ600 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 separately. 2x10A, 2x5A 4x2A, 6x5A

**COLOUR CODE**

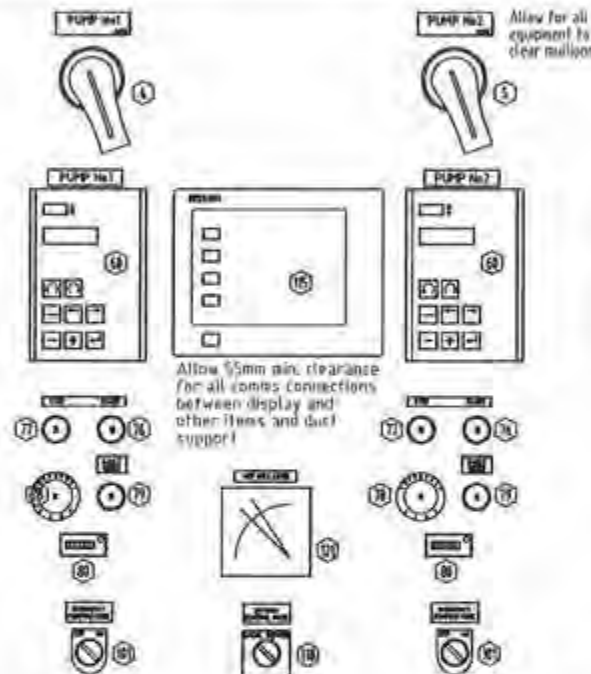
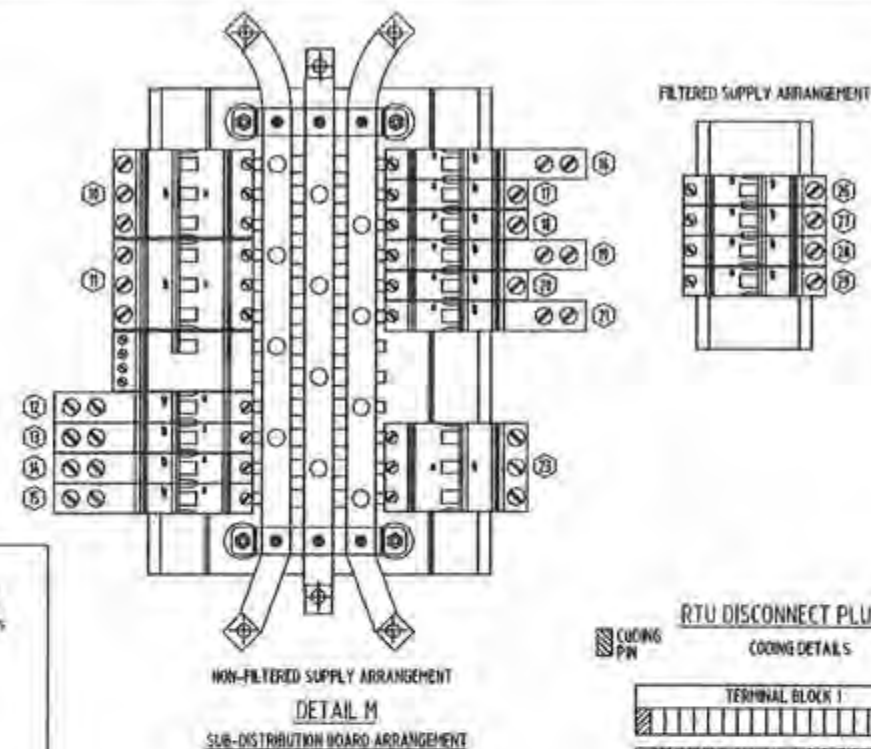
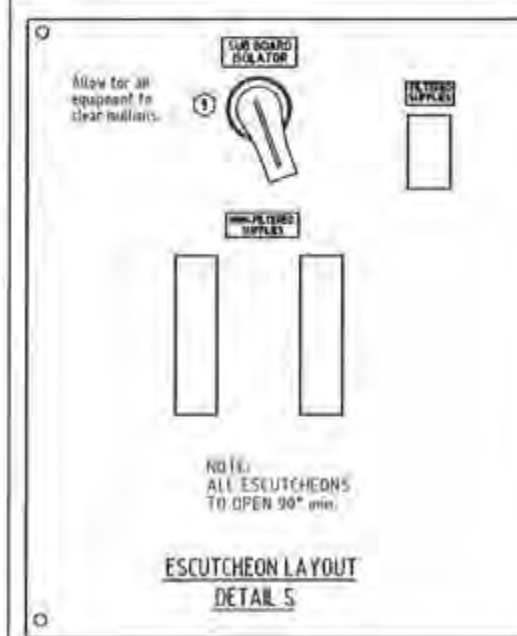
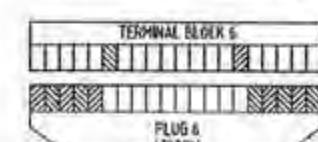
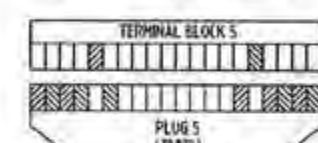
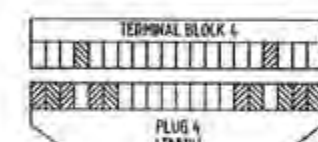
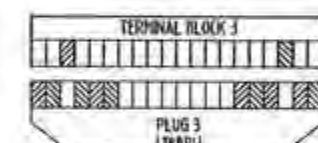
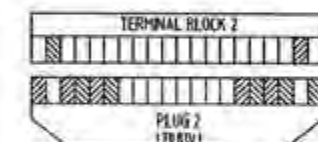
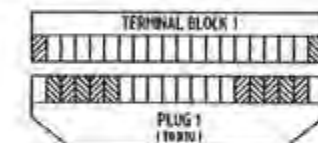
Phase wiring (A,B,C)	Red, White, Blue	2.5sqmm (min)
Potential Metering (240/415 VAC)	Red, White, Blue, Black	1.5sqmm
Current Metering (Secondary)	Red, White, Blue, Grey	2.5sqmm
240 VAC Control Active	Red	1.0sqmm
240 VAC Neutral	Black	1.0sqmm
Extra Low VDC Positive supplies	Orange	1.0sqmm
Extra Low VDC 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 label	MAIN SWITCH 400A	9mm 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 and secured by M3 nylon threads. Lid to be secured by a single cable tie at one corner.  
External labels 1mm thick 316 grade s/steel secured by M3 316 s/steel metal threads.  
All internal and external labels are to have bevelled edges.

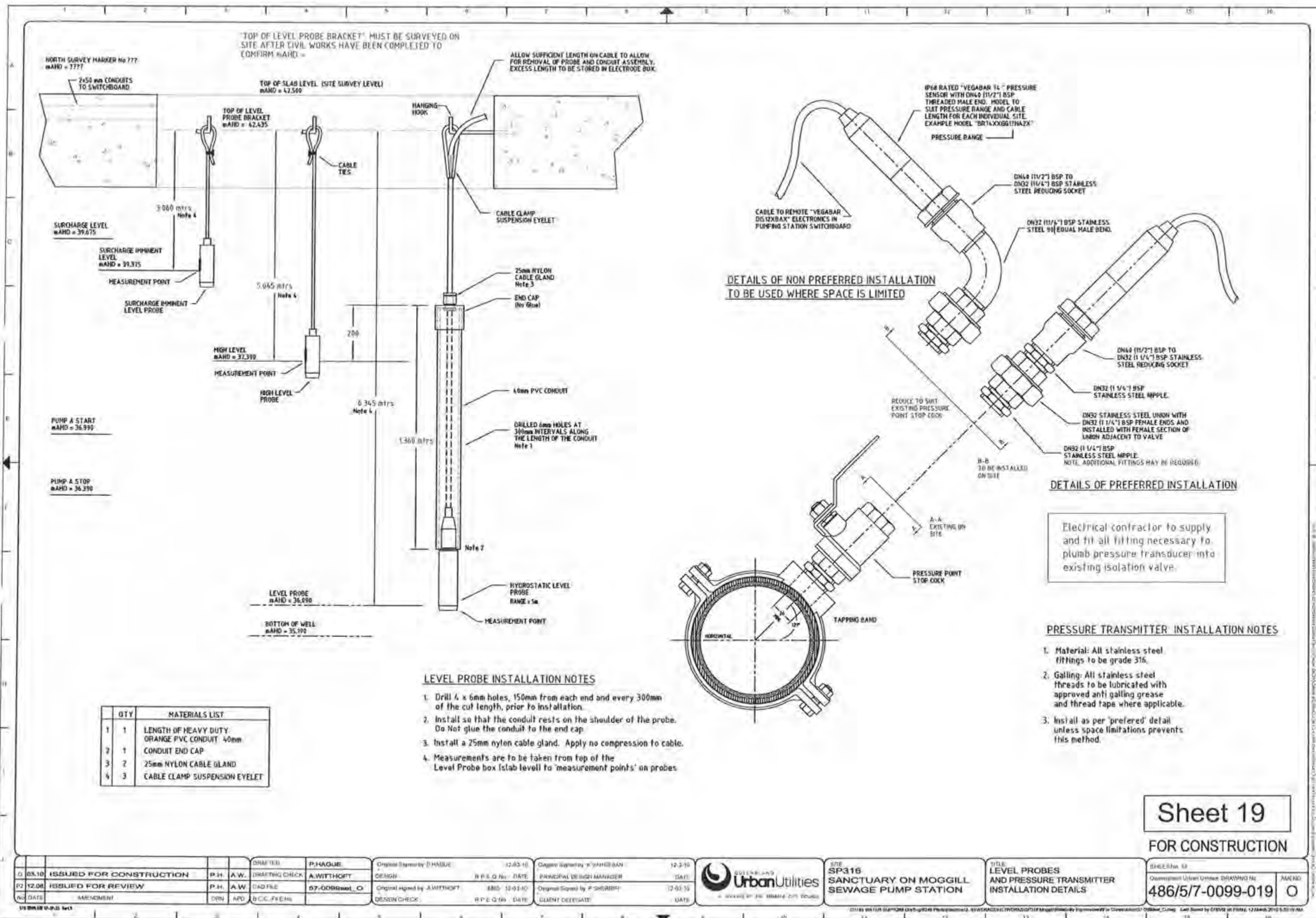
**ESCUTCHEON LAYOUT  
DETAIL U****ESCUTCHEON LAYOUT  
DETAIL R****NON-FILTERED SUPPLY ARRANGEMENT  
DETAIL M  
SUB-DISTRIBUTION BOARD ARRANGEMENT****RTU DISCONNECT PLUGS  
CODING DETAIL S****ESCUTCHEON LAYOUT  
DETAIL S****Sheet 17****FOR CONSTRUCTION**

ISSUED FOR CONSTRUCTION	P.H. A.W.	DRAFTING/CHECK	A.WITHOFT	DESIGN	W.P.B. Q. No. DATE	PRINCIPAL DESIGN MANAGER	DATE	SITE SP316 SANCTUARY ON MOGGILL SEWAGE PUMP STATION	TITLE SWITCHBOARD CONSTRUCTION DETAILS	DRAWN BY 486/5/7-0099-017	AMEND
ISSUED FOR REVIEW	P.H. A.W.	CAD FILE	57-0099-017	DESIGN CHECK	R.P.E. Q. No. DATE	CLIENT RELEASE	DATE				

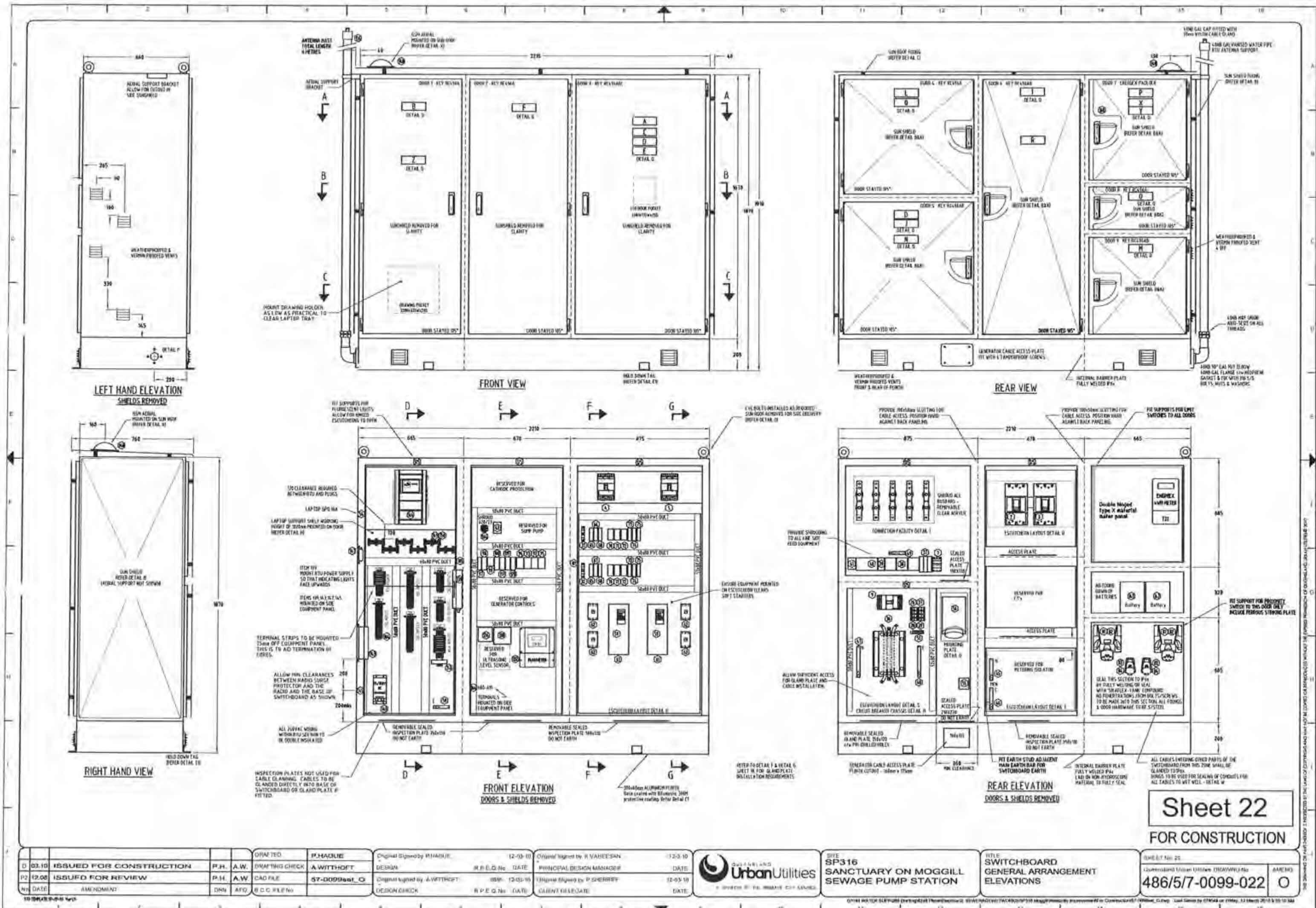


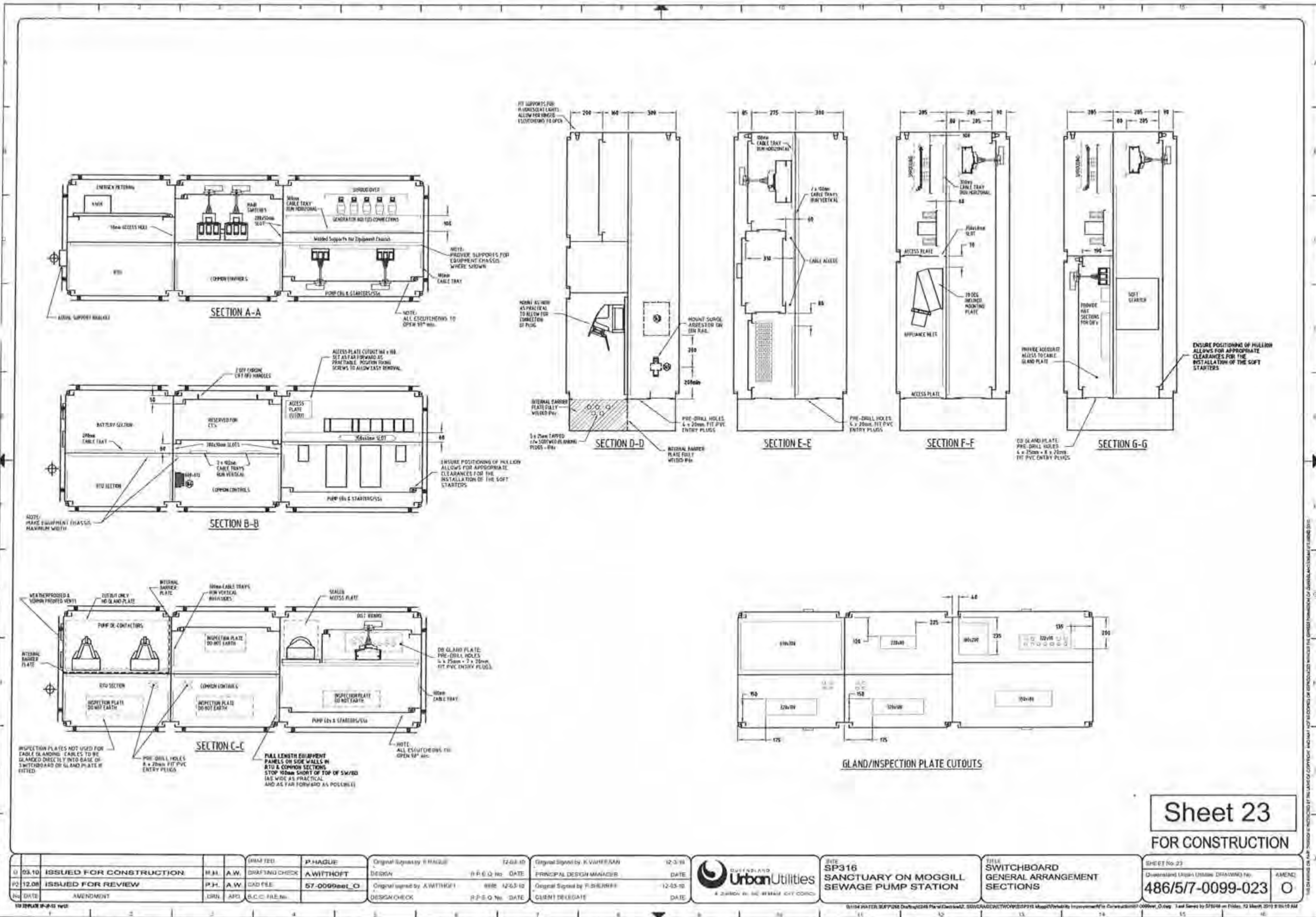
					GRAFTER	P.HAGUE	Original Signed by P.HAGUE	12-03-10	Original Signed by K.VAITEBAN	12-03-10	 <b>Urban Utilities</b> <small>A DIVISION OF THE GOVERNMENT OF SASKATCHEWAN</small>	<b>SITE</b> <b>SP316</b> <b>SANCTUARY ON MOGGILL</b> <b>SEWAGE PUMP STATION</b>	<b>TITLE</b> <b>SWITCHBOARD</b> <b>CONSTRUCTION DETAILS</b>	<b>SHEET No. 16</b> Drawn by Urban Utilities DWM/FG No. <b>486/5/7-0099-018</b> <b>486/5/7-0099-018</b>	<b>ASHEET</b> <b>0</b>
0	03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITTHOFT	DESIGN	R.P.P. Q No. DATE	Original Signed by P.HAGUE	12-03-10					
P2	12.08	ISSUED FOR REVIEW	P.H.	A.W.	CAD FILE	57-00099-018_D	DESIGN CHECK	R.P.P. Q No. DATE	Original Signed by A.WITTHOFT	12-03-10					

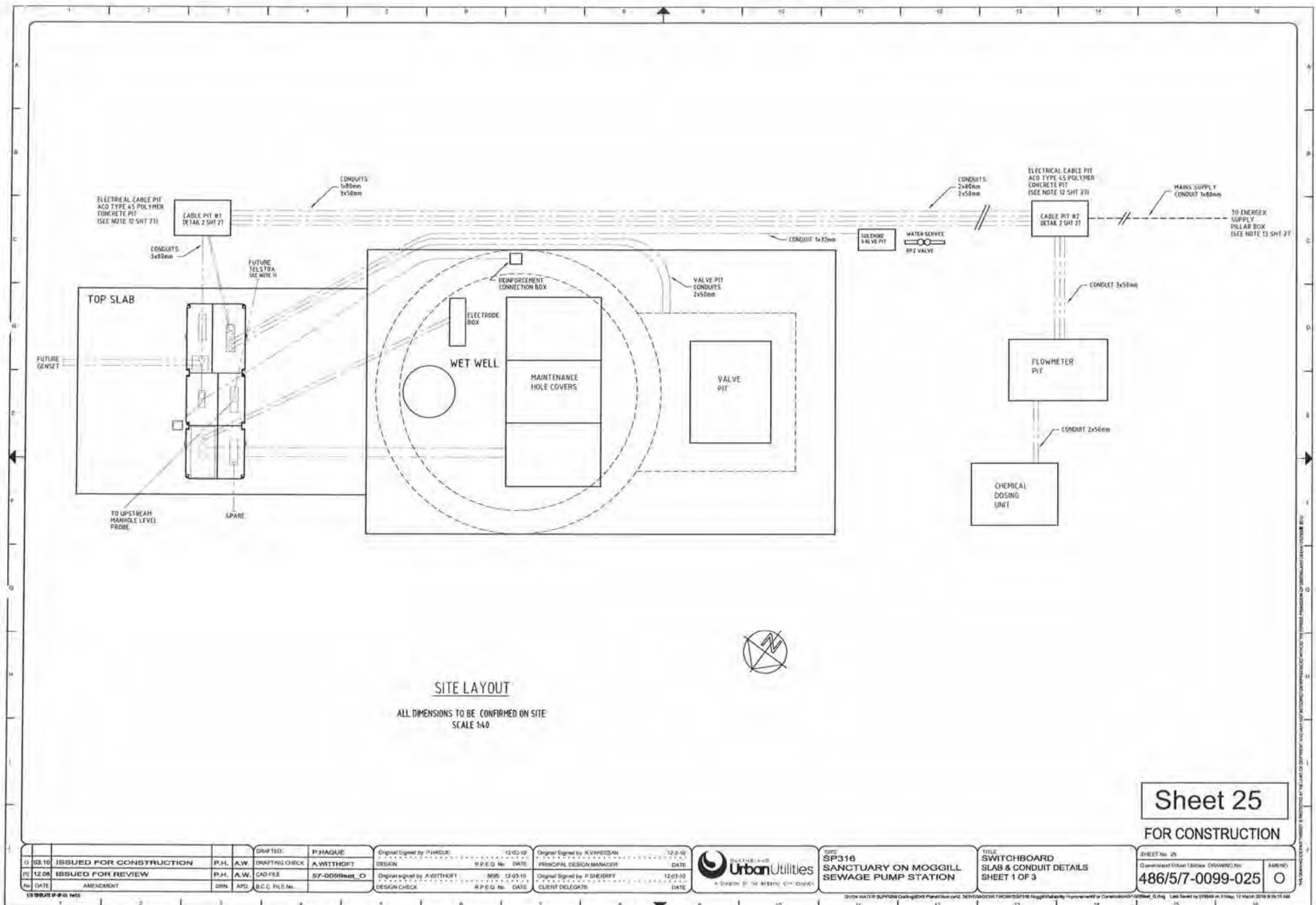




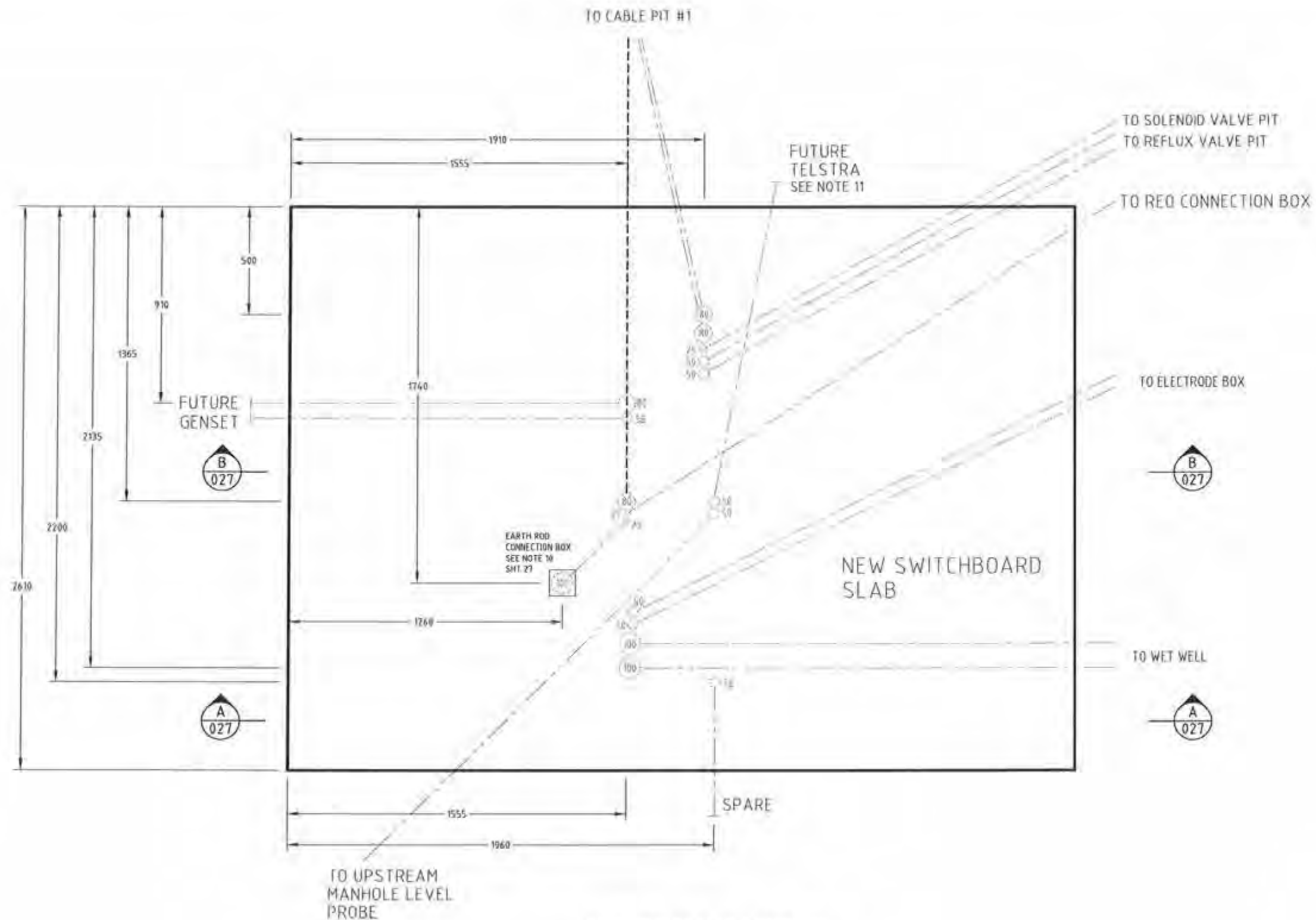











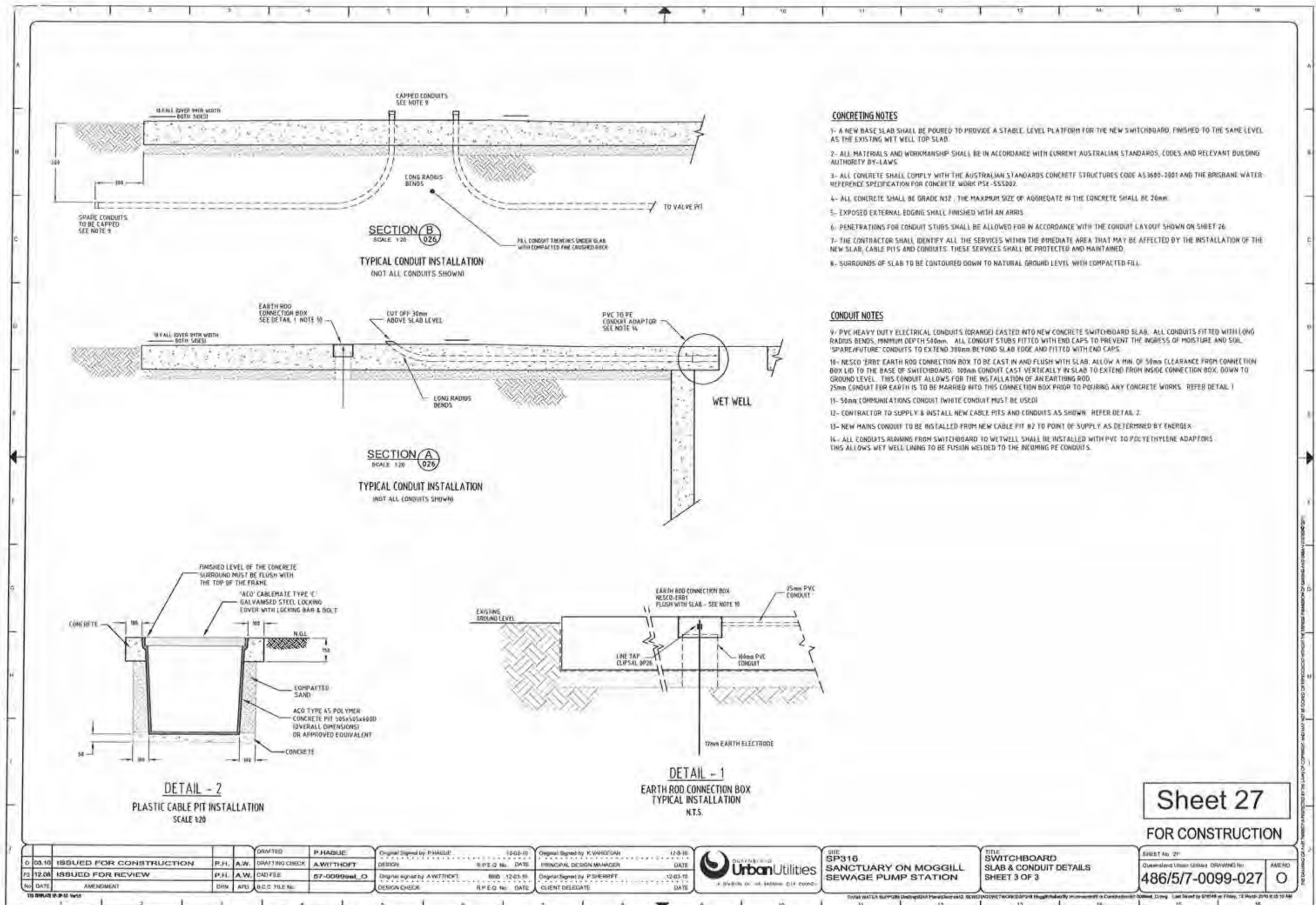


SWITCHBOARD SLAB & CONDUITS  
ALL DIMENSIONS TO BE CONFIRMED ON SITE  
SCALE 1:20

Sheet 26

FOR CONSTRUCTION

					DRAFTED	P.HAGUE	Original Signed by P.HAGUE	12-08-16	Original Signed by K.VARESAN	12-03-10	 QUEENSLAND <b>UrbanUtilities</b> A DIVISION OF THE SPERAL CITY COUNCIL	BITE SP316 SANCTUARY ON MOGGILL SEWAGE PUMP STATION	TITLE SWITCHBOARD SLAB & CONDUIT DETAILS SHEET 2 OF 3	SHEET No. 26	Queensland Urban Utilities DRAWING No.	AMEND	
C	03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	A.WITHOFT	DESIGN	R.P.E.Q. No.	DATE	PRINCIPAL DESIGN MANAGER							
P2	12.00	ISSUED FOR REVIEW	P.H.	A.W.	CAD FILE	57-009Bnet_O	Original signed by A.WITHOFT	ASQS	12-03-10	Original Signed by P.SHERIFF		12-03-10					
No	DATE	AMENDMENT	ORN	APD	B.C.C. FILE No.		DESIGN CHECK	R.P.E.Q. No.	DATE	CLIENT DELEGATE							



Sheet 27

FOR CONSTRUCTION

03.10	ISSUED FOR CONSTRUCTION	P.H.	A.W.	DRAFTING CHECK	P.HAGUE	Original Signed by P.HAGUE	12-03-10	Original Signed by K.WARD/DAH	12-03-10
PS 12.08	ISSUED FOR REVIEW	P.H.	A.W.	CAD FILE	57-008999-0	Original Signed by A.WITTHOFT	888 12-03-10	Principal Design Manager	DATE
No	DATE	AMENDMENT	DRN	APD	B.C.C. FILE No.	DESIGN CHECK	R.P.E.Q. No.	CLIENT DELEGATE	DATE



SITE  
SP316  
SANCTUARY ON MOGGILL  
SEWAGE PUMP STATION

TITLE  
SWITCHBOARD  
SLAB & CONDUIT DETAILS  
SHEET 3 OF 3

SHEET No. 27  
Queensland Urban Utilities DRAWING No.  
486/5/7-0099-027  
A/E/NO