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BRISBANE CITY COUNCIL

CONTRACT BW70107-06/07

PUMP STATION SWITCHBOARD REPLACEMENT

SP 152 NUDGEE ROAD

OPERATION AND MAINTENANCE MANUALS

BRISBANE CITY COUNCIL

CONTRACT BW70107-06/07
PUMP STATION SWITCHBOARD REPLACEMENT
SP152 NUDGEE ROAD

Supply and Installation of Switchboard

Our Job No. 0720

INDEX

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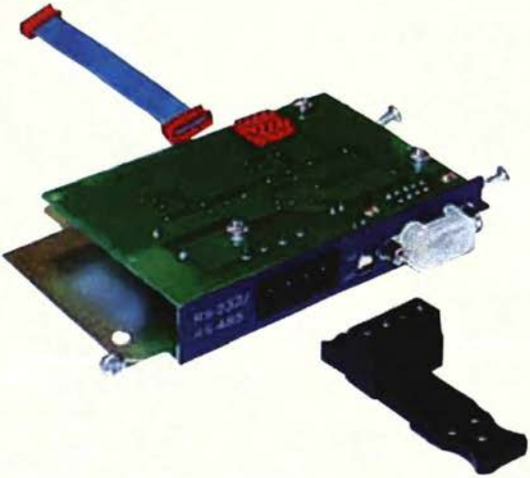
Ref:MANUAL.0720

emotron

DEDICATED DRIVE



SERIAL COMMUNICATION OPTION

INSTRUCTION MANUAL - ENGLISH

Valid for the following models:
EMOTRON Modbus RTU

Document number: 01-1989-01
Edition: r1
Date of release: 1999-10-07

SAFETY INSTRUCTIONS

Instruction manual

It is important to be familiar with the main product (softstarter/ inverter) to fully understand this instruction manual.

Technically qualified personnel

Installation, commissioning, demounting, making measurements, etc. of or on the Emotron products may only be carried out by personnel technically qualified for the task.

Installation

The installation must be made by authorised personnel and must be made according to the local standards.

Opening the frequency inverter or softstarter

DANGER! ALWAYS SWITCH OFF THE MAINS VOLTAGE BEFORE OPENING THE UNIT AND WAIT AT LEAST 5 MINUTES TO ALLOW THE BUFFER CAPACITORS TO DISCHARGE.

Always take adequate precautions before opening the frequency inverter or softstarter. Although the connections for the control signals and the jumpers are isolated from the main voltage. Always take adequate precautions before opening the inverter or softstarter.

EMC Regulations

EMC regulations must be followed to fulfill the EMC standards.

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1. GENERAL INFORMATION

1.1 Introduction

The MODBUS RTU optional card is an asynchronous serial interface for the frequency inverters of the VFB/VFX series and the softstarters of the MSF series to exchange data asynchronously with external equipment.

The protocol used for data exchange is hased on the Modhus RTU protocol, originally developed by Modicon.

Physical connection can be either RS232 or RS485.
It acts as a slave with address 1 - 247 in a master-slave configuration. The communication is half duplex. It has a standard non return to zero (NRZ) format.
Baudrates are possible from 2400 up to 38400 bits per sec.
The character frame format (always 11 bits) has:
 one start bit
 eight data bits
 one or two stop bits
 even or no parity bit
(The frequency inverters VFB/VFX have no parity).
A Cyclic Redundancy Check is included.

1.2 Description.

This instruction manual describes the installation and operation of the MODBUS RTU option card, which can be built into the following products.:
- VFB/VFX Frequency inverters:
  VFB40-004 to VFB40-046
  VFB40-018 to VFX40-1k2
  VFX50-018 to VFX50-1k2

specific information about the frequency inverters is in chapter 4. page 53.
-MSF softstarters:
  MSF-017 - MSF-1400

specific information about the sofstarters is in chapter 3. page 29.

1.3 Users

This instruction manual is intended for:
- installation engineers
- designers
- maintenance engineers
- service engineers

1.4 Safety

Because this option is a supplementary part of the frequency inverter or softstarter, the user must be aquainted with the original instruction manual of the VFB/VFX frequency inverter and the MSF softstarter. All safety instructions, warnings etc. as mentioned in these instruction manuals are to be known to the user. The following indications can appear in this manual. Always read these first and be aware of their content before continuing.

NOTE! Additional information as an aid to avoiding problems.

CAUTION ⚠ **Failure to follow these instructions can result in malfunction or damage to the softstarter or the frequency inverter.**

WARNING ⚡ **Failure to follow these instructions can result in serious injury to the user in addition to serious damage to the softstarter or the frequency inverter.**

DANGER ⚡ **The life of the user is in danger.**

1.5 Delivery and unpacking.

Check for any visible signs of damage. Inform your supplier immediately of any damage found. Do not install the option card if damage is found.

If the option card is moved from a cold storage room to the room where it is to be installed, condensation can form on it. Allow the option card to become fully acclimatised and wait until any visible condensation has evaporated before installing it in the inverter or softstarter.

2. MODBUS RTU

2.1 General

Devices communicate using a master-slave technique, in which only one device (the master) can initiate transactions (called 'queries'). The other devices (the slaves) respond by supplying the requested data to the master, or by taking the action requested in the query. Typical master devices include host processors and programming panels. Typical slaves include programmable controllers, motor controllers, load monitors etc, see Fig. 1.

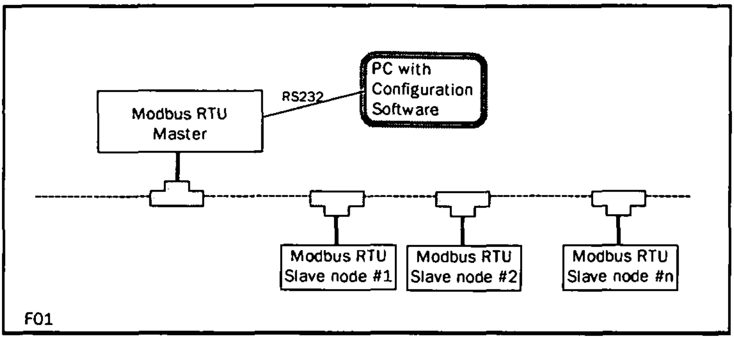


Fig. 1 Network configuration.

The master can address individual slaves. Slaves return a message (called a 'response') to queries that are addressed to them individually.

The Modbus protocol establishes the format for the master's query by placing into it the device address, a function code defining the requested action, any data to be sent, and an error checking field. The slave's response message is also constructed using Modbus protocol. It contains fields confirming the action taken, any data to be returned and an error-checking field. If an error occurred in receiving the message, or if the slave is unable to perform the requested action, the slave will construct an error message and send this as its response, see Fig. 2.

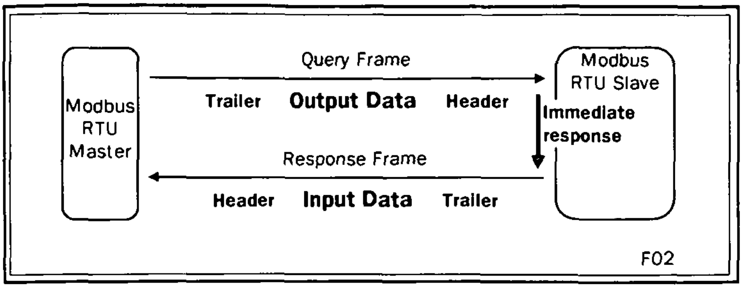


Fig. 2 Shows the MODBUS RTU data exchange.

Modbus RTU uses a binary transmission protocol.

If even parity is used, each character (8 bit data) is sent as:

Table 22 Character frame with no parity.

1	Start bit.
8	Data bits, hexadecimal 0-9,A-F, least significant bit sent first.
1	Even parity bit.
1	Stop bit.

If no parity is used each character (8 bit data) is sent as:

Table 23 Character frame with parity.

1	Start bit.
8	Data bits, hexadecimal 0-9,A-F, least significant bit sent first.
2	Stop bit.

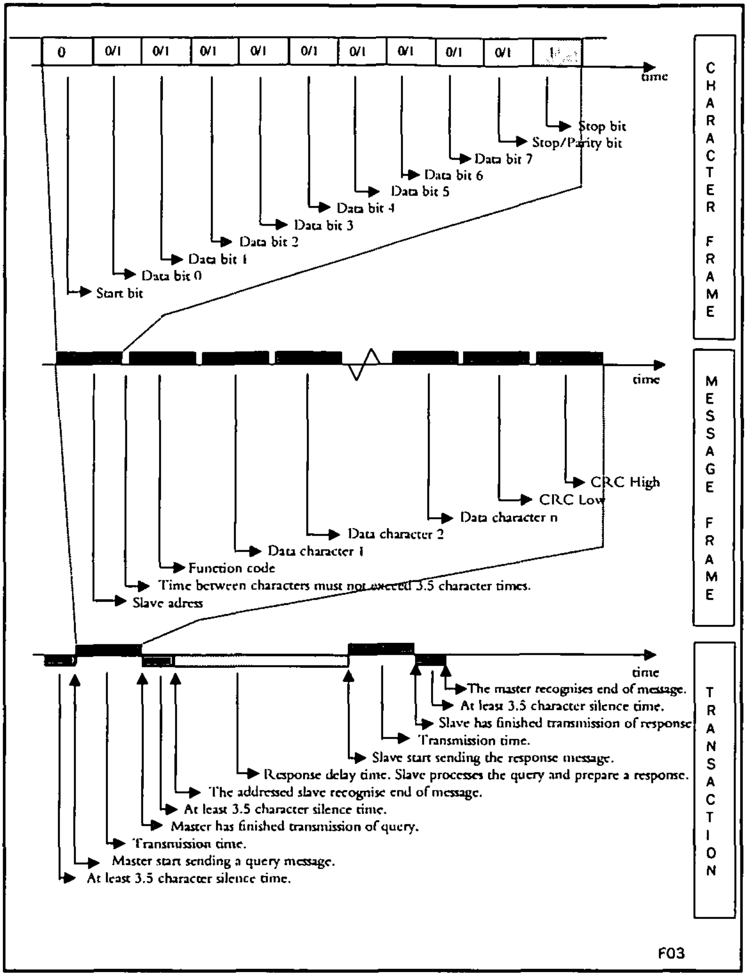


Fig. 3 Timing diagram for a transaction (query and response messages) (bottom in figure), a message frame (middle in figure) and a character frame (top in figure).

2.2 Framing

Messages start with a silent interval of at least 3.5 character times. This is easily implemented as a multiple of character times at the baud rate used on the network (shown as T1-T2-T3-T4 in the table below). The first field then transmitted is the device address.

The allowed characters transmitted for all fields are hexadecimal 0-9,A-F. Network devices monitor the network bus continuously, including during the 'silent' intervals. When the first field (the address field) is received, each device decodes it to find out if it is the addressed device.

Following the last transmitted character, a similar interval of at least 3.5 character times marks the end of the message. A new message can begin after this interval.

The entire message frame must be transmitted as a continuous stream. If a silent interval of more than 3.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes that the next byte will be the address field of a new message.

Similarly, if a new message begins earlier than 3.5 character times following a previous message, the receiving device will consider it a continuation of the previous message. This will set an error, as the value in the final CRC field will not be valid for the combined messages. A typical message frame is shown below.

Header	**START**	T1-T2-T3-T4
	ADDRESS	8 bits
	FUNCTION	8 bits
Data	**DATA**	n x 8 bits
Trailer	**CRC CHECK**	16 bits
	END	T1-T2-T3-T4

2.2.1 Address field

The address field of a message frame contains eight bits. The individual slave devices are assigned addresses in the range of 1 - 247. A master addresses a slave by placing the slave address in the address field of the message.

When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

2.2.2 Function field

The function code field of a message frame contains eight bits. Valid codes are in the range of 1 - 6, 15, 16 and 23. See 2.2, page 13.

When a message is sent from a master to a slave device, the function code field tells the slave what kind of action to perform.

Examples are:

- to read the ON/OFF states of a group of inputs;
- to read the data contents of a group of parameters;
- to read the diagnostic status of the slave;
- to write to designated coils or registers within the slave.

When the slave responds to the master, it uses the function code field to indicate either a normal (error-free) response or that some kind of error occurred (called an exception response). For a normal response, the slave simply echoes the original function code. For an exception response, the slave returns a code that is equivalent to the original function code with its most significant bit set to a logic 1.

In addition to its modification of the function code for an exception response, the slave places an unique code into the data field of the response message. This tells the master what kind of error occurred, or the reason for the exception, see 2.4.2, page 28.

The master device's application program has the responsibility of handling exception responses. Typical processes are to post subsequent retries of the message, to try diagnostic messages to the slave and to notify operators.

Additional information about function codes and exceptions comes later in this chapter.

2.2.3 Data field

The data field is constructed using sets of two hexadecimal digits (8 bits), in the range of 00 to FF hexadecimal.

The data field of messages sent from a master to slave devices contains additional information which the slave must use to take the action defined by the function code. This can include items like discrete and register addresses, the quantity of items to be handled and the count of actual data bytes in the field.

For example, if the master requests a slave to read a group of holding registers (function code 03), the data field specifies the starting register and how many registers are to be read. If the master writes to a group of registers in the slave (function code 10 hexadecimal), the data field specifies the starting register, how many registers to write, the count of data bytes to follow in the data field, and the data to be written into the registers.

If no error occurs, the data field of a response from a slave to a master contains the data requested. If an error occurs, the field contains an exception code that the master application can use to determine the next action to be taken.

2.2.4 CRC Error checking field

The error checking field contains a 16 bit value implemented as 2 bytes. The error check value is the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

The CRC field is appended to the message as the last field in the message. When this is done, the low-order byte of the field is appended first, followed by the high-order byte. The CRC high-order byte is the last byte to be sent in the message.

Additional information about CRC calculation, see chapter 5. page 78.

2.3 Functions

Emotron supports the following MODBUS function codes.

Function name	Function code
Read Coil Status	1 (01h)
Read Input Status	2 (02h)
Read Holding Registers	3 (03h)
Read Input Registers	4 (04h)
Force Single Coil	5 (05h)
Force Single Register	6 (06h)
Force Multiple Coils	15 (0Fh)
Force Multiple Registers	16 (10h)
Force/Read Multiple Holding Registers	23 (17h)

2.3.1 Read Coil Status

Read the status of digital changeable parameters.

EXAMPLE

Requesting the motor PTC input ON/OFF-state. It is ON.

PTC input:	Modbus no = 29 (1Dh)
On:	Yes = 1 coil = 0001
1 byte of data:	Byte count=01

Request message.

Field name	Hex value
Slave address	01
Function	01
Start address HI	00
Start address LO	1D
Number of Coils HI	00
Number of Coils LO	01
CRC LO	6D
CRC HI	CC

Response message.

Field name	Hex value
Slave address	01
Function	01
Byte count	01
Coil no.29 (1Dh) status	01
CRC LO	90
CRC HI	48

See 3.8, page 40 and 4.8, page 61 for all parameters readable with this function code.

2.3.2 Read Input Status

Read the status of digital read-only information.

EXAMPLE

Request the Pre-alarm status. It is no Pre-alarm. Pre-alarm status: Modbus no= 2.

Request message.

Field name	Hex value
Slave address	01
Function	02
Start address HI	00
Start address LO	02
Number of Inputs HI	00
Number of Inputs LO	01
CRC LO	18
CRC HI	0A

Response message.

Field name	Hex value
Slave address	01
Function	02
Byte count	01
Input no.2 (02h)status	00
CRC LO	A1
CRC HI	88

See 3.9, page 41 for all digital status readable with this function code.

2.3.3 Read Holding Registers

Read the value of analogue changeable information.
Example, requesting the Nominal Motor Voltage, Nominal Motor Frequency and the Nominal Motor Current. Their values are 400.0 V, 60 Hz and 15.5 A.

400.0V, unit 0.1V - 4000 (0FA0h)
60Hz unit 1Hz - 60 (003Ch)
15.5A, unit 0.1A - 155 (009Bh)

Request message.

Field name	Hex value
Slave address	01
Function	03
Start address HI	00
Start address LO	00
Number of Registers HI	00
Number of Registers LO	03
CRC LO	05
CRC HI	CB

Response message.

Field name	Hex value
Slave address	01
Function	03
Byte count	06
Reg no. 0, (0h) data HI	0F
Reg no. 0, (0h) data LO	A0
Reg no. 1, (1h) data HI	00
Reg no. 1, (1h) data LO	3C
Reg no. 2, (2h) data HI	00
Reg no. 2, (2h) data LO	9B
CRC LO	20
CRC HI	34

See 3.11, page 45 and 4.10, page 65 for all analogue changeable parameters readable with this function code.

2.3.4 Read Input Registers

Read the contents of analogue read-only information.

EXAMPLE

Request the Shaft Torque. It is 452.0 Nm. It has a long representation, 2 registers are used.

452.0 Nm, unit 0.1 Nm - 4520 (000011A8h).

Request message.

Field name	Hex value
Slave address	01
Function	04
Start address HI	00
Start address LO	0A
Number of Registers HI	00
Number of Registers LO	02
CRC LO	51
CRC HI	C9

Response message.

Field name	Hex value
Slave address	01
Function	04
Byte count	04
Reg no. 10 (0Ah) data HI	00
Reg no. 10 (0Ah) data LO	00
Reg no. 11 (0Bh) data HI	11
Reg no. 11 (0Bh) data LO	A8
CRC LO	F6
CRC HI	6A

See 3.10, page 42 and 4.9, page 62 for all analogue read-only information readable with this function code.

2.3.5 Force Single Coil

Set the status of one changeable digital parameter.

EXAMPLE

Set the Start Command to ON. This will cause the motor to start.

Modbus no = 1 - adress LO 1 (01h)
Run = 1 - 0 Data HI 255 (0FFh), Data LO 00 (00h)

Request message.

Field name	Hex value
Slave address	01
Function	05
Start address HI	00
Start address LO	01
Data HI	FF
Data LO	00
CRC LO	DD
CRC HI	FA

Response message.

Field name	Hex value
Slave address	01
Function	05
Start address HI	00
Start address LO	01
Data HI	FF
Data LO	00
CRC LO	DD
CRC HI	FA

See 3.8, page 40 and 4.8, page 61 for all parameters changeable with this function code.

2.3.6 Force Single Register

Set the value of one analogue changeable parameter.

EXAMPLE

Set the Response Delay Max Alarm to 12.5 sec.

Modbus no 13 -> address LO (0Dh)
12.5s, unit 0.1s - 125 (7Dh)

Request message.

Field name	Hex value
Slave address	01
Function	06
Start address HI	00
Start address LO	0D
Data HI	00
Data LO	7D
CRC LO	D8
CRC HI	28

Response message.

Field name	Hex value
Slave address	01
Function	06
Start address HI	00
Start address LO	0D
Data HI	00
Data LO	7D
CRC LO	D8
CRC HI	28

See 3.11, page 45 and 4.10, page 65 for all parameters changeable with this function code.

2.3.7 Force Multiple Coil

Set the status of multiple digital changeable parameters.

EXAMPLE

Set the Alarm Reset ON and Start Command to ON. This will cause an alarm reset before the motor starts.

Coil no. = 0-1 Reset -> 1
Run = 1
->- 00000011 (03h)

Request message.

Field name	Hex value
Slave address	01
Function	0F
Start address HI	00
Start address LO	00
Number of Coils HI	00
Number of Coils LO	02
Byte count	01
Coil no. 0-1 status (0000 0011B)	03
CRC LO	9E
CRC HI	96

Response message.

Field name	Hex value
Slave address	01
Function	0F
Start address HI	00
Start address LO	00
Number of Coils HI	00
Number of Coils LO	02
CRC LO	D4
CRC HI	0A

See 3.8, page 40 and 4.8, page 61 for all parameters changeable with this function code.

2.3.8 Force Multiple Register

Set the contents of multiple changeable analogue parameters.

EXAMPLE

Set the Response Delay Min Alarm to 25.0 sec and the Min Alarm Level to 55%.

25.0 sec, unit 0.1 sec -> - 250 (00FAh)
55%, unit 1% -> 55 (0037h)

Request message.

Field name	Hex value
Slave address	01
Function	10
Start address HI	00
Start address LO	11
Number of Registers HI	00
Number of Registers LO	02
Byte count	04
Data HI reg 17 (11h)	00
Data LO reg 17 (11h)	FA
Data HI reg 18 (12h)	00
Data LO reg 18 (12h)	37
CRC LO	52
CRC HI	88

Response message.

Field name	Hex value
Slave address	01
Function	10
Start address HI	00
Start address LO	11
Number of Registers HI	00
Number of Registers LO	02
CRC LO	11
CRC HI	CD

See 3.11, page 45 and 4.10, page 65 for all parameters changeable with this function code.

2.3.9 Force/Read Multiple Register

Set and read the contents of multiple analogue changeable parameters in the same message.

EXAMPLE

Set the Parameter Set parameter to 2 and Relay 1 function to 1 and read the Nominal Motor Speed and the Nominal Motor Power. They are 1450 rpm and 17000 W.

1450 rpm, unit 1 rpm -> 1450 (05AAh)
17000 W, unit 1 W -> 17000 (4268h)

Request message.

Field name	Hex value
Slave address	01
Function	17
Start read address HI	00
Start read address LO	03
Number of read Regs HI	00
Number of read Regs LO	02
Start write address HI	00
Start write address LO	15
Number of write Regs HI	00
Number of write Regs LO	02
Byte count	04
Data HI Reg 21 (15h)	00
Data LO Reg 21 (15h)	02
Data HI Reg 22 (16h)	00
Data LO Reg 22 (16h)	01
CRC LO	62
CRC HI	77

Response message.

Field name	Hex value
Slave address	01
Function	17
Byte count	04
Reg no. 3, (3h) data HI	05
Reg no. 3, (3h) data LO	AA
Reg no. 4, (4h) data HI	42
Reg no. 4, (4h) data LO	68
CRC LO	E8
CRC HI	85

See 3.11, page 45 and 4.10, page 65 for all parameters changeable with this function code.

2.4 Errors, exception codes

Two kinds of errors are possible:
- Transmission errors.
- Operation errors.

2.4.1 Transmission errors

Transmission errors are:
- Frame error (stop bit error).
- Parity error (if parity is used).
- CRC error.
- No message at all.

These errors are caused by i.e. electrical interference from machinery or damage to the communication channel (cables, contact, I/O ports etc.). This unit will not act on or answer the master when a transmission error occurs. (Same result as if a non-existing slave is addressed). The master will eventually cause a time-out condition.

2.4.2 Operation errors

If no transmission error is detected in the master query, the message is examined. If an illegal function code, data address or data value is detected, the message is not acted upon but an answer with an exception code is sent back to the master. This unit can also send back an exception code when a set (force) function message is received during some busy operation states.

Bit 8 (most significant bit) in the function code byte is set to a '1' in the exception response message. Example with an illegal data address when reading an input register.

Exception response message.

Field name	Hex value
Slave address	01
Function	84
Exception code	02
CRC LO	C2
CRC HI	C1

Table 24 Exception codes.

Exc. code	Name	Description
01	Illegal function	This unit doesn't support the function code.
02	Illegal data address	The data address is not within its boundaries.
03	Illegal data value	The data value is not within it's boundaries.
06	Busy	The unit is unable to perform the request at this time. Retry later.

3. SOFTSTARTER MSF DATA

3.1 Installation bookshelf types

Fig. 4 shows the parts of the MODBUS RTU option.

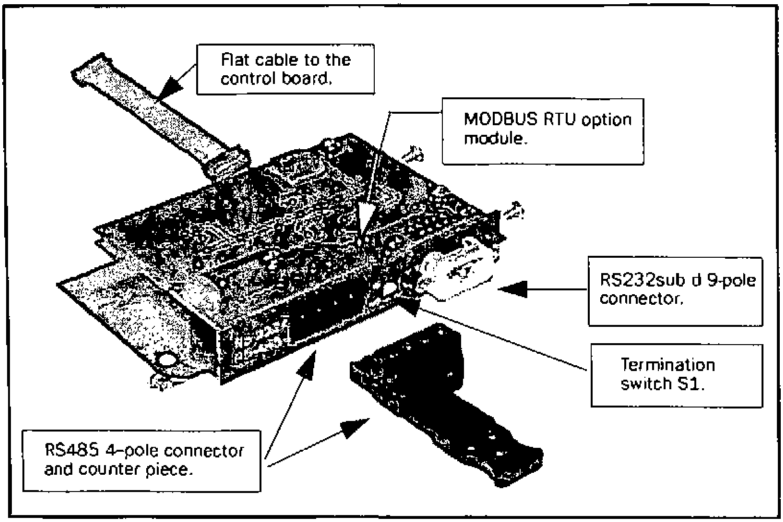
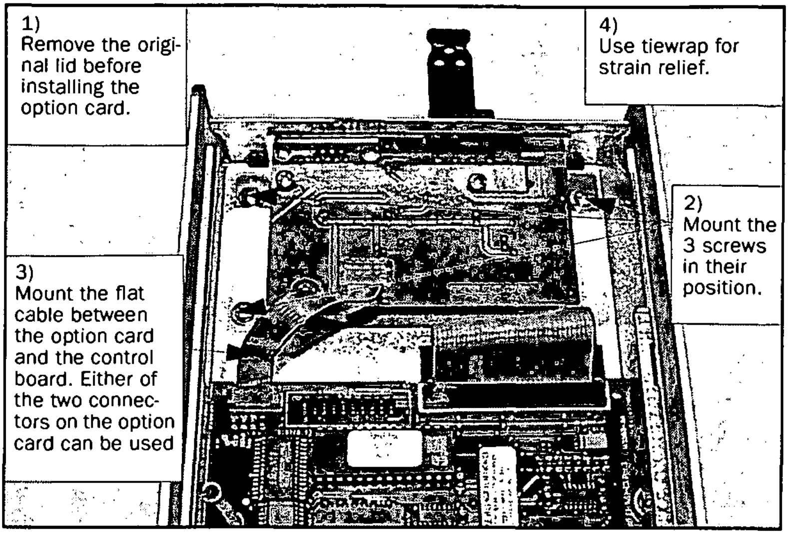


Fig. 4 MODBUS RTU option card.

WARNING! Opening the softstarter. Always switch off the mains voltage before opening the softstarter and wait at least 5 minutes to allow the buffer capacitors to discharge.

Remove first the lid on the top side of the softstarter. Mount the option card according to the sequence in Fig. 4.



1) Remove the original lid before installing the option card.

2) Mount the 3 screws in their position.

3) Mount the flat cable between the option card and the control board. Either of the two connectors on the option card can be used

4) Use tiewrap for strain relief.

Fig. 5 Installation of the option card.

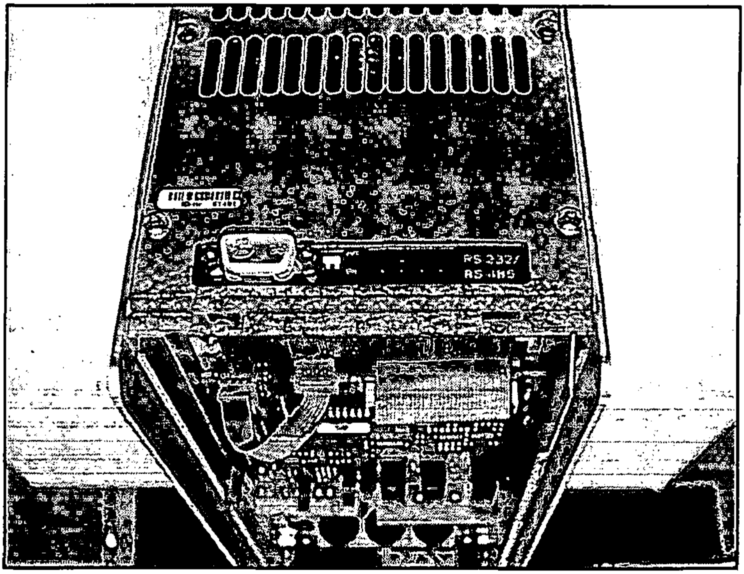


Fig. 6 Mounting of the option card seen from the top.

3.2 Installation of MSF-170 to MSF-1400

NOTE! Under construction, to be defined.

3.3 RS485 Multipoint network

The RS485 port (see Fig. 4) is used for multi point communication. A host computer (PC/PLC) can address (master) maximum 247 slave stations (nodes). See Fig. 7.

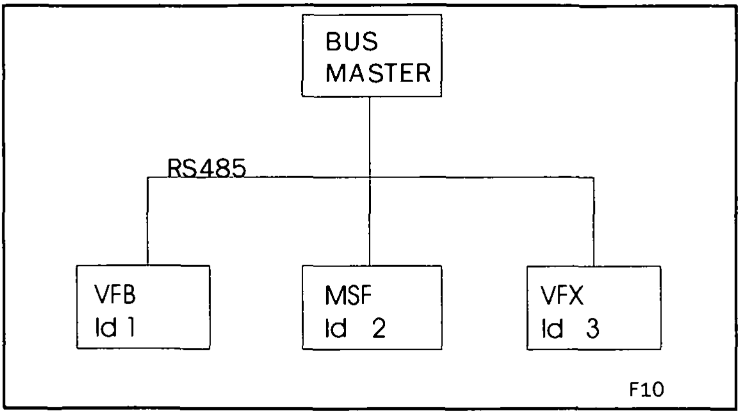


Fig. 7 RS 485 mulitpoint network

3.3.1 RS485 connection

Table 25 RS485 pinning

RS485 pin	Function
1	Ground
2	A-line
3	B-line
4	PE

The connector is a 4-pole male connector. The wiring should be done according to Fig. 8.

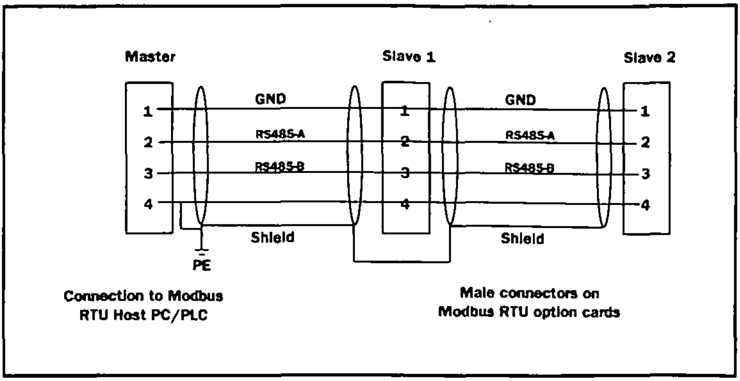


Fig. 8 RS485 wiring

3.3.2 RS485 termination.

The RS485 network must always be terminated, to avoid transmission problem. The termination must take place at the end of the network. In Fig. 8 this means that the termination must take place at the slave 2 unit.

Switch S1 (see Fig. 4) sets the termination ON or OFF as indicated in the Fig. 9 and Fig. 10.

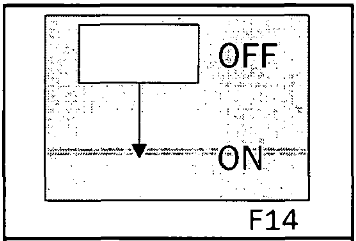


Fig. 9 Termination is OFF.

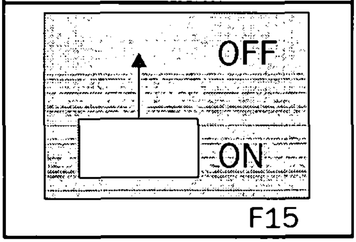


Fig. 10 Termination is ON.

NOTE! Physical connection can be either RS232 or RS485, not both on the same time.

3.4 RS232 point to point network

The RS232 port is used for point to point communication as a master slave. See fig Fig. 11.

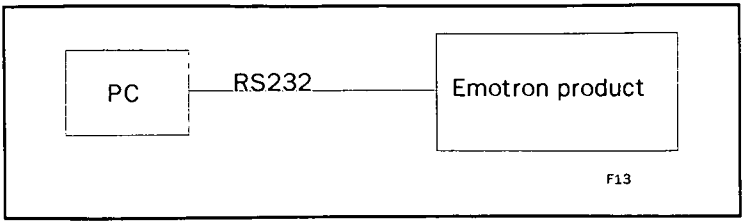


Fig. 11 RS232 point to point network

3.4.1 RS232 connection

Table 26 RS232 pinning

RS232 pin	Function
2	TX from module
3	RX to module
5	Ground

3.4.2 RS232 wiring

The RS232 port consists of a sub-D 9 pole female connector. The wiring should be done according to Fig. 11.

NOTE! Use an 1:1 cable WITHOUT a pin 2-3 crossing.

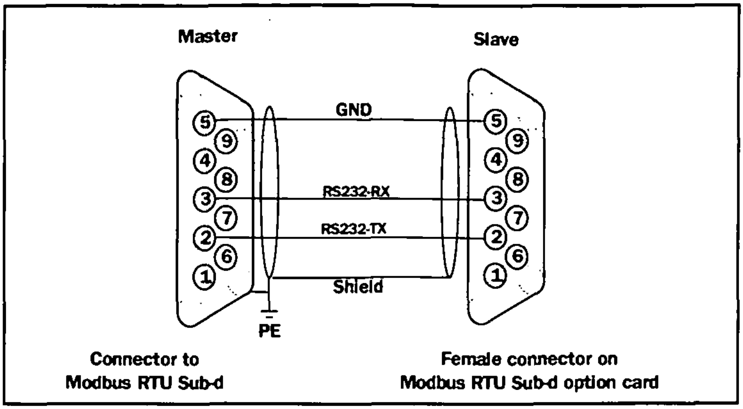


Fig. 12 RS232 wiring.

NOTE! Physical connection can be either RS232 or RS485, not both on the same time.

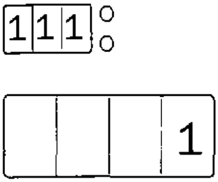
3.5 Set-up Communication Parameters for Softstarter MSF

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 3.6.1, page 38.

Serial comm. unit address[111]

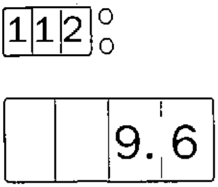


Serial comm unit address

Default:	1
Range:	1-247

This parameter will select the unit address.

Serial comm. baudrate[112]

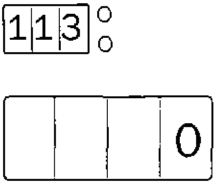


Serial comm baudrate

Default:	9.6
Range:	2.4, 4.8, 9.6, 19.2, 38.4 kBaud

This parameter will select the baudrate.

Serial comm. parity[113]



Serial comm parity

Default:	0
Range:	0.1

This parameter will select the parity.

0	No parity.
1	Even parity.

Serial comm. broken alarm[114]

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 softstarter 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 1	**Serial comm. contact interrupted**
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.	

3.6 Softstarter MSF in serial comm. control mode

The source from where operation and parameter settings are made is selected in the Control Mode para-meter menu 006. When serial communication control mode (3) is selected, it is possible to:

- Operate the soft starter only via serial comm.
- Set up parameters only via serial comm. Exceptions for the serial comm. parameters described above.
- Readout all view information and all parameters.
- Set up the control mode parameter from local MSF keyboard, but not via serial comm.
- Inspect all parameters and open the menu expansions from local MSF keyboard.

3.6.1 Selection of control mode [006]

Setting up the control mode has to be done from the local MSF keyboard.

006 2	**Selection of control mode**
Default:	2
Range:	1, 2, 3
This parameter will select the control mode (source). 1 Keyboard control. 2 Remote input control. 3 Serial communication control.	

In all control modes it is possible to read out all the information in the soft starter via serial communication, both parameters and view information.

NOTE! When Reset to factory settings is made via serial comm., the control mode will remain in serial comm. control.

See also 6.1.7 'Overview of soft starter operation and parameter set-up' in MSF instruction manual.

3.7 Parameter List

Logical number is often used to give a parameter a unique number. But it is not the logical number inside the actual MODBUS message.

The following table explains the relations between logical numbers and actual numbers inside MODBUS messages.

Table 27 Parameter types

Parameter type	Modbus logical numbers	Modbus actual numbers
Coil Status	1 - 10000	0 - 9999 (Logical-1)
Input Status	10001 - 20000	0 - 9999 (Logical-10001)
Input Registers	30001 - 40000	0 - 9999 (Logical-30001)
Holding Registers	40001 - 50000	0 - 9999 (Logical-40001)

The product MSF menu column show the menu number on the PPU (Parameter Presentation Unit) for the parameter.

For more information on any parameter/function, see Instruction Manual MasterStart MSF Softstarter.

3.8 Coil status list

Table 28 Coil status list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product MSF menu
1	0	Alarm reset	0->1 = Reset	
2	1	Run /-Stop	Stop=0, Run=1	
5	4	Auto-set monitor	0->1 = Auto-set	089
6	5	Reset power consumption	0->1 = Reset	206
26	25	Pump control	Off, on; off=0, on=1	022
27	26	Full voltage start D.O.L.	Off, on; off=0, on=1	024
28	27	By pass	Off, on; off=0, on=1	032
29	28	Power factor control PFC	Off, on; off=0, on=1	033
30	29	Motor PTC input	No, yes; no=0, yes=1	071
31	30	Run at single phase input failure	No, yes; no=0, yes=1	101
32	31	Run at current limit time-out	No, yes; no=0, yes=1	102
33	32	Jog forward from keyb. enable	No, yes; no=0, yes=1	103
34	33	Jog reverse from keyb. enable	No, yes; no=0, yes=1	104
35	34	Phase reversal alarm	Off, on; off=0, on=1	088

3.9 Input status list

Table 29 Input status list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product MSF menu
10001	0	Locked keyboard info	0=Unlocked, 1=Locked	221
10002	1	Extended start ramp time	No, yes; no=0, yes=1	S05
10003	2	Pre-Alarm status	0=No Pre-Alarm, 1=Pre-Alarm	
10004	3	Max Pre-Alarm status	0=No Pre-Alarm, 1=Pre-Alarm	
10005	4	Min Pre-Alarm status	0=No Pre-Alarm, 1=Pre-alarm	

3.10 Input register list

Table 30 Input register list

Modbus logial no	Modbus no	Function/Name	Range/Unit	Product MSF menu
30001	0	Power consumption high word	0-2E9 Wh,1Wh<->1	205
30002	1	Power consumption low word		205
30003	2	Electrical power high word	0-+-2E9 W,1 W<->1	S51
30004	3	Electrical power low word		S51
30005	4	Output shaft power high word	0-+-2E9 W,1 W<->1	203
30006	5	Output shaft power low word		203
30007	6	Operation time high word	0.1 days <->1	208
30008	7	Operation time low word	0.1 days <->1	208
30011	10	Shaft torque high word	0- +-2E8 Nm, 0.1Nm <-> 1	207
30012	11	Shaft torque low word	"	207
30017	16	Software version	r23 -> r = release, Bit 15-14 = 0,0 LB =23	
30018	17	Software variant	v001 -> HB=0, LB=01	
30019	18	Current	0-6553.5A, 0.1A<->1	005
30020	19	Phase 1 current	"	211
30021	20	Phase 2 current	"	212
30022	21	Phase 3 current	"	213
30024	23	Line main voltage	"	202
30025	24	Line main voltage 1	"	214
30026	25	Line main voltage 2	"	215
30027	26	Line main voltage 3	"	216
30028	27	Product type number	1-19 See description in 3.12.1.	
30029	28	Control start by / Control mode	1= Keyboard 2= Remote 3= Serial comm.	006
30031	30	Serial comm. unit address	1-247	111

Table 30 Input register list (continuing)

Modbus logial no	Modbus no	Function/Name	Range/Unit	Product MSF menu
30032	31	Serial comm. baudrate	2400–38400 Baud, 100 Baud <-> 1	112
30033	32	Serial comm. parity	0=No parity 1=Even parity	113
30034	33	Serial comm. contact broken	0-2 See description in 3.12.2.	114
30035	34	Actual parameter set	1-4	
30036	35	Shaft power %	-200% -+200% 1%<-> 1	090
30037	36	Cooler temperature	30.0 - 100.0°C 0.1°C <-> 1	
30041	40	Operation mode	1-7 See description in 3.12.3.	
30042	41	Operation status	1-11 See description in 3.12.4.	
30047	46	Used thermal capacity	0-150 %, 1%<->1	073
30048	47	Power factor	0.00-1.00,0.01<->1	204
30049	48	Current ratio	80 -150%, 1%<->1	
30050	49	Voltage ratio	50 -150%, 1%<->1	F12
30051	50	Phase sequence	0-2 0 = None, 1 = RST, 2 = RTS	087
30052	51	Emotron product	1=VFB/VFX, 2=MSF	
30103	102	Trip message 1	0- 16 See description in 3.12.5.	901
30106	105	Trip message 2	See trip message 1.	902
30109	108	Trip message 3	See trip message 1.	903
30112	111	Trip message 4	See trip message 1.	904

Table 30 Input register list (continuing)

Modbus logial no	Modbus no	Function/Name	Range/Unit	Product MSF menu
30115	114	Trip message 5	See trip message 1.	905
30118	117	Trip message 6	See trip message 1.	906
30121	120	Trip message 7	See trip message 1.	907
30124	123	Trip message 8	See trip message 1.	908
30127	126	Trip message 9	See trip message 1.	909
30130	129	Trip message 10	See trip message 1.	910

3.11 Holding register list

Table 31 Holding register list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product MSF menu
40001	0	Nominal motor voltage	200.0-700.0V 0.1V<->1	041
40002	1	Nominal motor frequency	50-60Hz 1Hz<->1	046
40003	2	Nominal motor current	25 %- 150% Insoft in Amp.0.1A<->1	042
40004	3	Nominal motor speed	500 - 3600 Rpm Bit15=0->1rpm<->1	044
40005	4	Nominal motor power	25% -150% Pnsoft in W; Bit15=0->1W<->1 Bit15=1->100W<->1	043
40006	5	Nominal motor cos phi	50-100, Cos phi = 1.00 <-> 100	045
40013	12	Start delay monitor	1-250sec,1sec<->1	091
40014	13	Max alarm response delay	0.1-25.0sec 0.1s->1	093
40015	14	Max alarm limit	5-200% Pn 1%<->1	092
40017	16	Max pre-alarm	5-200% Pn 1%<->1	094
40018	17	Min alarm response delay	0.1-25.0sec 0.1s<->1	099
40019	18	Min alarm limit	5-200% Pn 1%<->1	098
40020	19	Min pre-alarm response delay	0.1-25.0sec 0.1s<->1	097
40021	20	Min pre-alarm	5-200% Pn 1%<->1	096
40022	21	Parameter set	0 = External input selection 1-4 = Par. set 1-4.	061
40023	22	Relay 1	1-3 See description in 3.12.6.	051
40024	23	Relay 2	1-4 See description in 3.12.7.	052
40028	27	AnIn 1, setup	0= OFF, No remote analogue control. 1= 0-10V/0-20mA 2= 2-10V/4-20mA	023

Table 31 Holding register list (continuing)

Modbus logical no	**Modbus no**	**Function/Name**	**Range/Unit**	**Product MSF menu**
40037	36	AnOut 1, function	1 - 3 See description in 3.12.8.	055
40038	37	AnOut 1, setup	0= OFF, No analogue output. 1= 0-10V/0-20mA 2= 2-10V/4-20mA	054
40040	39	AnOut 1, scaling	5 - 150% 1% <-> 1	056
42001	2000	Initial voltage at start	25-90% U, 1% Un<->1	001
42002	2001	Start time ramp 1	1-60sec, 1 sec<->1	002
42003	2002	Step down voltage at stop	100-40% U,1% Un<->1	003
42004	2003	Stop time ramp 1	Off,1-120sec, 1s<->1	004
42005	2004	Initial voltage start ramp 2	30-90% U, 1% Un<->1	011
42006	2005	Start time ramp 2	Off,1-60sec, 1sec<->1	012
42007	2006	Step down voltage stop ramp 2	100-40% U, 1% Un<->1	013
42008	2007	Stop time ramp 2	Off,1-120sec, 1s<->1	014
42009	2008	Initial torque at start	0-200% Tn,1% Tn<->1	016
42010	2009	End torque at start	50-200% Tn, 1% Tn<->1	017
42011	2010	Torque control	Off = Torque control OFF 1 = Linear characteristic. 2 = Square characteristic.	025
42012	2011	Voltage ramp with current limit	Off, 150-500% In 1% In<->1	020
42013	2012	Current limit at start	Off, 150-500% In 1% In<->1	021
42014	2013	DC-Brake current limit	100-300% In 1% In<->1	035
42015	2014	DC-Brake active time	Off, 1-120sec, 1s<->1	034
42016	2015	Torque boost current limit	300-500% In 1% In<->1	031
42017	2016	Torque boost active time	Off, 0.1-2.0sec 0.1sec<->1	030

Table 31 Holding register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product MSF menu
42018	2017	Slow speed digital input	Off, 1-100 edges, 1 edge<->1	036
42019	2018	Slow speed torque	10-100, 10 <->10	037
42020	2019	Slow speed time at start	Off, 1-60sec, 1s<->1	038
42021	2020	Slow speed time at stop	Off, 1-60sec, 1s<->1	039
42022	2021	Slow speed DC-Brake time	Off, 1-60sec, 1s<->1	040
42023	2022	Motor thermal protection class	Off, 2-40sec, 1s<->1	072
42024	2023	Starts per hour limitation	Off, 1-90/hour, 1<->1	074
42025	2024	Locked rotor alarm	Off, 0.1-10.0sec 0.1 sec<->1	075
42026	2025	Voltage unbalance alarm	5-25% Un, 1% Un<->1	081
42027	2026	Response delay voltage unbal.	Off,1-60sec, 1sec<->1	082
42028	2027	Over voltage alarm	100-150% Un 1% Un<->1	083
42029	2028	Response delay over voltage	Off, 1-60sec, 1s<->1	084
42030	2029	Under voltage alarm	75-100% Un 1% Un<->1	085
42031	2030	Response delay under voltage	Off, 1-60sec, 1sec<->1	086
42032	2031	Reset to factory settings	No, yes; no=0, yes=1	199

3.12 Parameter description MSF

The MODBUS logical number inside brackets.

For more information on any parameter/function, see Instruction Manual MasterStart MSF Softstarter.

3.12.1 Softstarter type (30028).

Table 32 Softstarter type

1 MSF-017	2 MSF-030	3 MSF-045	4 MSF-060	5 MSF-075	6 MSF-085
7 MSF-110	8 MSF-145	9 MSF-170	10 MSF-210	11 MSF-250	12 MSF-310
13 MSF-370	14 MSF-450	15 MSF-570	16 MSF-710	17 MSF-835	18 MSF-1000
19 MSF-1400					

3.12.2 Serial comm. contact broken (30034).

Table 33 Serial comm. contact broken

0	No action when communication is lost.
1	Stop and alarm after 15 sec. when communication is lost.
2	Continue and alarm after 15 sec. when communication is lost.

Communication is considered lost if no request is made to this unit within 15 sec.

3.12.3 Operation mode (30041).

1	Voltage control.
2	Torque control.
3	Current limit control.
4	Ramp with current limit control.
5	Pump application.
6	Analogue input voltage control.
7	Direct On Line start.

3.12.4 Operation status (30042).

1	Stopped.
2	Stopped with alarm condition.
3	Run with alarm condition.
4	Run acceleration.
5	Run full voltage.
6	Run deceleration.
7	Run by passed.
8	Run power factor control.
9	Run DC brake.
10	Run at slow speed forward.
11	Run at slow speed reverse.

3.12.5 Alarm (30103).

1	Phase input failure	F1
2	Motor protection, overload	F2
3	Soft start overheated	F3
4	Current limit timeout	F4
5	Locked rotor	F5
6	Above max power limit	F6
7	Below min power limit	F7
8	Voltage unbalance	F8
9	Over voltage	F9
10	Under voltage	F10
11	Starts/hour exceeded	F11
12	Shorted thyristor	F12
13	Open thyristor	F13
14	Motor terminal open	F14
15	Serial comm. broken	F15
16	Phase reversal alarm	F16

3.12.6 Relay indication K1 (40023).

1	Indicates 'Operation'.
2	Indicates 'Full voltage'.
3	Indicates 'Pre alarm'.

3.12.7 Relay indication K2 (40024).

1	Indicates 'Operation'.
2	Indicates 'Full voltage'.
3	Indicates 'Pre alarm'.
4	Indicates 'DC-brake function is chosen'.

3.12.8 Analogue output value (40037).

1	RMS current (range 0 - 5(In).
2	Main input RMS voltage (range 0 - 532V).
3	Output shaft power (range 0 - 2(Pn).

3.12.9 Reset to factory setings (42032)

Reset to factory settings from serial communication will have the same effect as if it was done from the PPU keyboard, except for one parameter. The control mode (menu 006) will remain in 3 (serial comm. control) instead of being set to the default value 2 (remote control).

3.13 Performance

It is important to configure the communication master according to the slave performance/restrictions. The total message size must not exceed 64 bytes.

Max number of registers at a time is limited to 25 (both for read and write).

Max 2 requests per sec. to reduce system disturbance.

Min 1 request per 15 sec. to avoid serial comm. contact broken alarm.

3.13.1 MSF response delay

The read function codes (1 - 4), will have a maximum delay of 250 ms.

Table 34 Response delay table for setting (forcing) registers

Modbus logical nr	Parameter	Response delay/ recommended time out
40001-40006	Nominal motor data	500 ms/data
42032	Reset to factory settings	3.5 sec
	Other registers	250 ms

4. INVERTER VFB/VFX DATA

4.1 Installation bookshelf types

Fig. 13 shows the parts of the MODBUS RTU option.

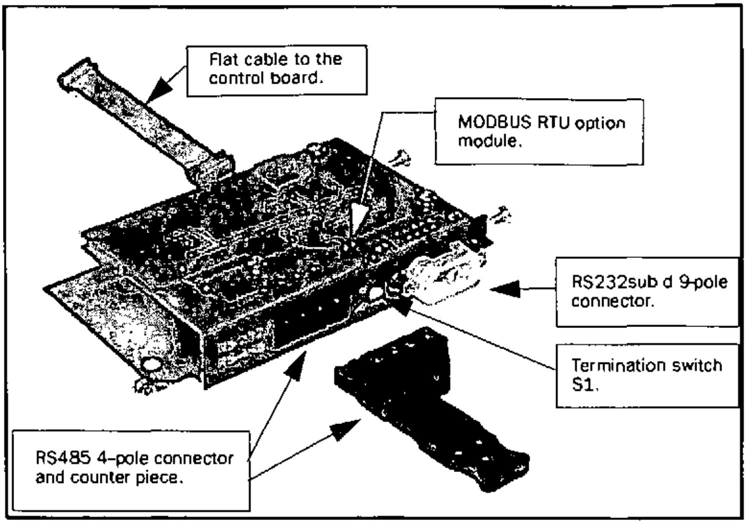
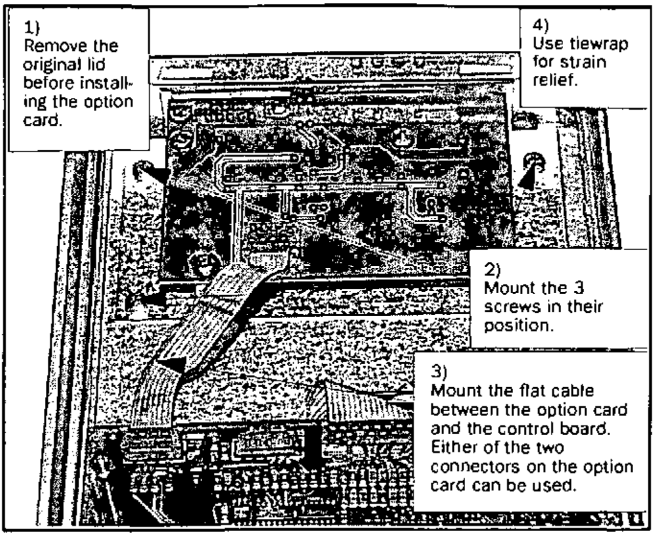


Fig. 13 MODBUS RTU option card.

WARNING! Opening the inverter. Always switch off the mains voltage before opening the inverter and wait at least 5 minutes to allow the buffer capacitors to discharge.

Remove first the lid on the top side of the inverter. Mount the option card according to the sequence in Fig. 14.

4.1.1 Mounting option card



1) Remove the original lid before installing the option card.

4) Use tiewrap for strain relief.

2) Mount the 3 screws in their position.

3) Mount the flat cable between the option card and the control board. Either of the two connectors on the option card can be used.

Fig. 14 Installation of the option card in VFB.

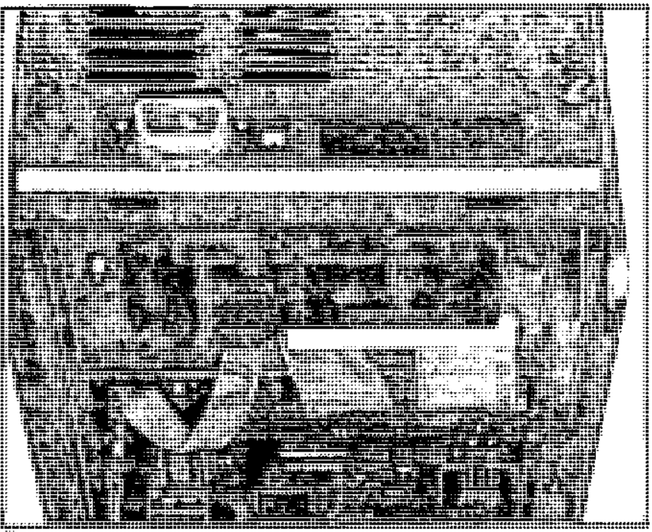


Fig. 15 Mounting of option card from above in VFB.

4.2 Installation of VFX types

NOTE! Pictures are under construction, to be defined.

4.3 RS485 Multipoint network

The RS485 port (see Fig. 13) is used for multi point communication. A host computer (PC/PLC) can address (master) maximum 247 slave stations (nodes). See Fig. 16.

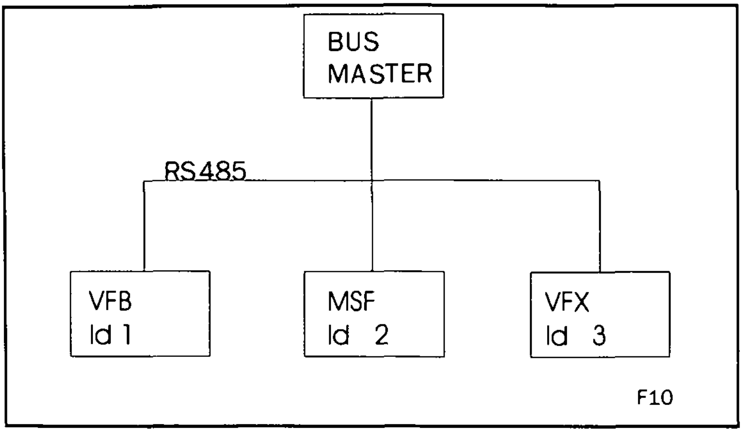


Fig. 16 RS 485 multipoint network

4.3.1 RS485 connection

Table 35 RS485 pinning

RS485 pin	Function
1	Ground
2	A-line
3	B-line
4	PE

The connector is a 4-pole male connector. The wiring should be done according to Fig. 17.

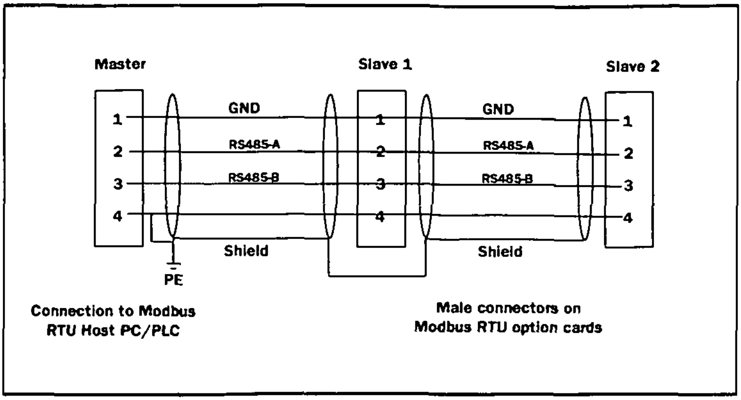


Fig. 17 RS485 wiring

4.3.2 RS485 termination.

The RS485 network must always be terminated, to avoid transmission problem. The termination must take place at the end of the network. In finure 5 this means that the termination must take place at the slave 2 unit.

Switch S1 (see Fig. 4) sets the termination ON or OFF as indicated in the Fig. 18 and Fig. 19.

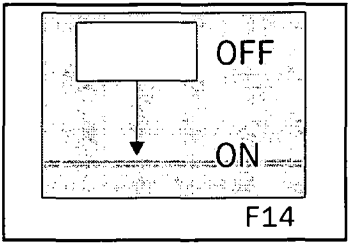


Fig. 18 Termination is OFF

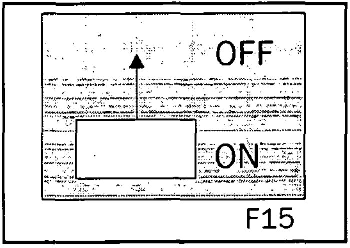


Fig. 19 Termination is ON

NOTE! Physical connection can be either RS232 or RS485, not both on the same time.

4.4 RS232 point to point network

The RS232 port is used for point to point communication as a master slave. See fig Fig. 20.

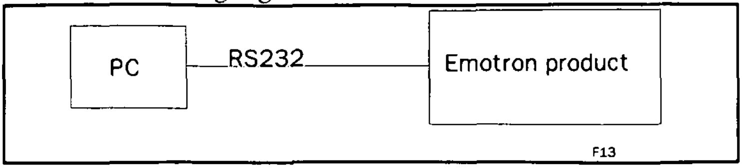


Fig. 20 RS232 point to point network

4.4.1 RS232 connection

Table 36 RS232 pinning

RS232 pin	Function
2	TX from module
3	RX to module
5	Ground

4.4.2 RS232 wiring

The RS232 port consists of a sub-D 9 pole female connector. The wiring should be done acc. to Fig. 20.

NOTE! Use an 1:1 cable WITHOUT a pin 2-3 crossing.

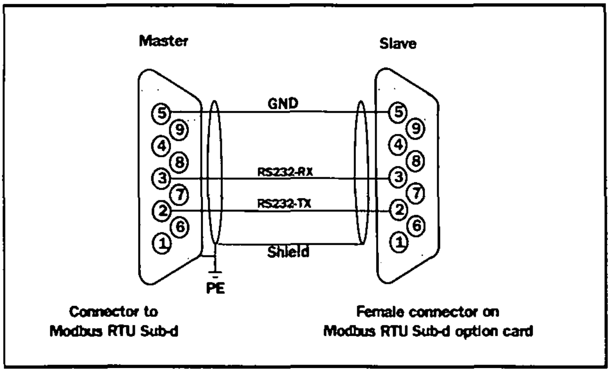


Fig. 21 RS232 wiring

NOTE! Physical connection can be either RS232 or RS485, not both on the same time.

4.5 Set-up Communication Parameters for frequency inverter VFB/VFX

The following parameters have to be set-up:

- Unit address.
- Baud rate.

Serial comm. unit address[262]

	262 Address Stp 1
Default:	1
Range	1-247
This parameter will select the unit address.	

Serial comm. baud rate[261]

	261 Baudrate Stp 9600
Default:	9600
Range	2400, 4800, 9600, 19200, 38400
This parameter will select the baudrate.	

4.6 Frequency inverter VFB/VFX in serial comm Control Mode

The serial comm link will have access to all parameters in the VFB/VFX inverter. If a valid setting for a parameter is received over the serial link that parameter will be accepted and changed. This means that the control panel and serial comm can be used in parallel. There are some limitations of writing data when the inverter is started, see manual for further information. The only parameters that can't be used in parallell is start/stop and reference values, see 4.5.

Ref control

To be able to use the serial comm as a source for the speed or torque reference menu 212 has to be set to Comm or Comm/DigIn1. See Instruction Manual VFB/VFX for further description.

	212 Ref Control Stp Comm
Default:	Remote
Range	Remote, keyboard, Comm, Rem/ DigIn1,or Comm/DigIn1
This parameter will select reference source	

Run/Stp ctrl

To be able to use the serial comm as a source for starting and stopping the inverter menu 213 has to be set to Comm or Comm/DigIn1. See Instruction Manual VFB/VFX for further description.

	213 Run/Stp Ctrl Stp Comm
Default:	Remote
Range	Remote, keyboard, Comm, Rem/ DigIn1, or Comm/DigIn1
This parameter will select run/stop source	

4.7 Parameter List

Logical number is often used to give a parameter a unique number. But it is not the logical number inside the actual MODBUS message.

The following table explains the relations between logical numbers and actual numbers inside MODBUS messages.

Table 37 Parameter type

Parameter type	Modbus logical numbers	Modbus actual numbers
Coil Status	1 - 10000	0 - 9999 (Logical-1)
Input Registers	30001 - 40000	0 - 9999 (Logical-30001)
Holding Registers	40001 - 50000	0 - 9999 (Logical-40001)

The product VFB/VFX menu column show the menu number on the control panel for the parameters.

For more information on any parameter/function, see Instruction Manual VFB/VFX.

4.8 Coil status list

Table 38 Coil status list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
1	0	Alarm reset	0->1 = Reset	
2	1	Run /-Stop	Stop=0, Run=1	
3	2	Run Right	1=Run R	
4	3	Run Left	1=Run L	
5	4	Auto-set monitor	0->1 = Auto-set	815
6	5	Reset power consumption	0->1 = Reset	6F1
7	6	Reset Run-Time	0->1 = Reset	6D1
8	7	Reset Trip Log	0->1 = Reset	7B0
10	9	Auto-restart, Overtemp trip	Off, on; off=0, on=1	242
11	10	Auto-restart, I^2t	Off, on; off=0, on=1	243
12	11	Auto-restart, Overvolt D	Off, on; off=0, on=1	244
13	12	Auto-restart, Overvolt G	Off, on; off=0, on=1	245
14	13	Auto-restart, Overvolt L	Off, on; off=0, on=1	246
15	14	Auto-restart, PTC	Off, on; off=0, on=1	247
16	15	Auto-restart, External trip	Off, on; off=0, on=1	248
17	16	Auto-restart, Phase loss motor	Off, on; off=0, on=1	249
18	17	Auto-restart, Alarm	Off, on; off=0, on=1	24A
19	18	Auto-restart, Locked rotor	Off, on; off=0, on=1	24B
20	19	Auto-restart, Power fault	Off, on; off=0, on=1	24C
30	29	Motor PTC input	no, yes; no=0, yes=1	271

4.9 Input register list

Table 39 Input register list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
30001	0	Power consumption high word	0-2E9 Wh, 1 Wh<->1	6F0
30002	1	Power consumption low word		6F0
30003	2	Electrical power high word	0 -+ -2E9 W, 1 W<->1	640
30004	3	Electrical power low word		640
30005	4	Output shaft power high word	0 - + - 2E9 W, 1 W<->1	630
30006	5	Output shaft power low word		630
30007	6	Operation time high word	0 - 65535 h, 1 h<->1	6D0
30008	7	Operation time low word	0 - 59 Min, 1 min<->1	6D0
30009	8	Mains time hour	0 - 65535 h, 1 h<->1	6E0
30010	9	Mains time min	0 - 59 Min, 1 min<->1	6E0
30011	10	Shaft torque high word	0- +-2E8 Nm, 0.1Nm <->1	620
30012	11	Shaft torque low word	"	620
30013	12	Process speed high word	1 - + - 2E8 Rpm, 1 rpm<->1000	6G0
30014	13	Process speed low word	"	6G0
30015	14	Shaft speed high word	0-2E8 rpm,1 rpm<->1	610
30016	15	Shaft speed low word	"	610
30017	16	Software version	V1.23 -> Release Bit 15-14= 0,0 Bit 13-8=1, LB =23 See 4.11.	920
30018	17	Option/variant version	OPT V2.34 -> HB = 2, LB =34	920
30019	18	Current	0-6553.5 A, 0.1A <-> 1	650
30023	22	Output voltage	0-6553.5 V, 0.1V<->1	660
30028	27	Product type number	See description in 4.11.	910

Table 39 Input register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
30029	28	Control start by / Control mode	0=Remote, 1=Keyboard, 2=Serial comm	
30030	29	Control ref by	0=Remote 1=Keyboard 2=Serial comm	
30031	30	Serial comm. unit address	1-247	262
30032	31	Serial comm. baudrate	1=2400, 4=19200, 2=4800 5=38400 3=9600,	261
30035	34	Actual parameter set	0-3; 0= A, 2=C, 1=B 3=D	3XX
30036	35	Shaft torque %	-400%-+400% 1%<->1	620
30037	36	Cooler temperature	-40.0-+100.0°C, 0.1°C<->1	690
30038	37	Frequency	0-2000.0Hz, 0.1Hz<->1	670
30039	38	DC-link voltage	0-1000V, 0.1V<->1	680
30040	39	Warning	0-31 See description in 4.11.3.	6H0
30043	42	Digital input status	See description in 4.11.6.	6B0
30044	43	Analog input status 1	-100 -+100%, 1%<->1	6C0
30045	44	Analog input status 2	-100 -+100%, 1%<->1	6C0
30046	45	Param_version	For internal use	
30052	51	Emotron product	1=VFB/VFX, 2=MSF	
30101	100	Trip time 1 h	0-65535 h, 1h<->1	710
30102	101	Trip time 1 min	0-59 Min, 1 min<->1	710
30103	102	Trip message 1	0-31 See description in 4.11.3.	710
30104	103	Trip time 2 h	0-65535 h, 1h<->1	720
30105	104	Trip time 2 min	0-59 Min, 1 min<->1	720

Table 39 Input register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
30106	105	Trip message 2	See trip message 1.	720
30107	106	Trip time 3 h	0-65535 h, 1h<->1	730
30108	107	Trip time 3 min	0-59 Min, 1 min<->1	730
30109	108	Trip message 3	See trip message 1.	730
30110	109	Trip time 4 h	0-65535 h, 1h<->1	740
30111	110	Trip time 4 min	0-59 Min, 1 min<->1	740
30112	111	Trip message 4	See trip message 1.	740
30113	112	Trip time 5 h	0-65535 h, 1h<->1	750
30114	113	Trip time 5 min	0-59 Min, 1 min<->1	750
30115	114	Trip message 5	See trip message 1.	750
30116	115	Trip time 6 h	0-65535 h, 1h<->1	760
30117	116	Trip time 6 min	0-59 Min, 1 min<->1	760
30118	117	Trip message 6	See trip message 1.	760
30119	118	Trip time 7 h	0-65535 h, 1h<->1	770
30120	119	Trip time 7 min	0-59 Min, 1 min<->1	770
30121	120	Trip message 7	See trip message 1.	770
30122	121	Trip time 8 h	0-65535 h, 1h<->1	780
30123	122	Trip time 8 min	0-59 Min, 1 min<->1	780
30124	123	Trip message 8	See trip message 1.	780
30125	124	Trip time 9 h	0-65535 h, 1h<->1	790
30126	125	Trip time 9 min	0-59 Min, 1 min<->1	790
30127	126	Trip message 9	See trip message 1.	790
30128	127	Trip time 10 h	0-65535 h, 1h<->1	7A0
30129	128	Trip time 10 min	0-59 Min, 1 min<->1	7A0
30130	129	Trip message 10	See trip message 1.	7A0

4.10 Holding register list

Table 40 Holding register list

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
40001	0	Nominal motor voltage	100.0-700.0V	222
40002	1	Nominal motor frequency	50-300Hz	223
40003	2	Nominal motor current	25% I_nom-3200.0A	224
40004	3	Nominal motor speed	100-18000 rpm Bit15=0->1rpm<->1 Bit15=1->100rpm<->1	225
40005	4	Nominal motor power	1-3276700W Bit15=0->1W<->1 Bit15=1->100W<->1	221
40006	5	Nominal motor cos phi	50-100, cos phi =1.00<->100	226
40007	6	Motor ventilation	0=Off, 1=Self, 2=Forced	227
40008	7	Remote input level edge	0=Level, 1=Edge	215
40009	8	Encoder pulses	5-32767 pulses/rev	252
40010	9	Encoder enable	0=Off 1=On	251
40011	10	Aarm select	0=Off, 1=Max, 2=Min, 3=Min+max	811
40012	11	Ramp enable	0=Off, 1=On	812
40013	12	Start delay monitor	0-3600sec	813
40014	13	Max alarm response delay	0.1- 90.0sec	814
40015	14	Max alarm limit	0-400% Tn	816
40017	16	Max pre-alarm	0-400% Tn	817
40018	17	Min alarm response delay	40014 is used for all delays	
40019	18	Min alarm limit	0-400% Tn	818
40020	19	Min pre-alarm response delay	40014 is used for all delays	
40021	20	Min pre-alarm	0-400% Tn	819

Table 40 Holding register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
40022	21	Parameter set	0=A, 4=DI3, 1=B, 5=DI3+4, 2=C, 6=Comm 3=D,	234
40023	22	Relay 1	0-21 See description in 4.11.4.	451
40024	23	Relay 2	0-21 See description in 4.11.4.	452
40025	24	Relay 3	Not defined yet.	
40026	25	Relay 4	Not defined yet.	
40027	26	AnIn 1, function	0=Off, 1=Speed, 2=Torque	411
40028	27	AnIn 1, setup	0=0-10V/0-20mA 1=2-10V/4-20mA 2=User defined	412
40029	28	AnIn 1, offset	-100% - +100% 1% <-> 1	413
40030	29	AnIn 1, gain	-4.00 - +4.00, 0.01 <-> 1	414
40031	30	AnIn 1, bipolar	0=Off, 1=On	415
40032	31	AnIn 2, function	0=Off, 1=Speed, 2=Torque	416
40033	32	AnIn 2, setup	0=0-10V/0-20mA, 1=2-10V/4-20mA, 2=User defined	417
40034	33	AnIn 2, offset	-100% - +100% 1% <-> 1	418
40036	35	AnIn 2, bipolar	0=Off, 1=On	41A
40037	36	AnOut 1, function	0=Torque, 1=Speed, 4=Current, 2=Shaft power, 5=El.power, 3=Frequency, 6=Outp.voltage	431
40038	37	AnOut 1, setup	0=0-10V/0-20mA 1=2-10V/4-20mA 2=User defined	432
40039	38	AnOut 1, offset	-100% - +100% 1% <-> 1	433
40040	39	AnOut 1, gain	-4.00 - +4.00 0.01 <-> 1	434

Table 40 Holding register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
40041	40	AnOut 1, bipolar	0=Off, 1=On	435
40042	41	AnOut 2, function	0=Torque, 4=Current, 1=Speed, 5=El.power, 2=Shaft power, 6=Outp. voltage 3=Frequency,	436
40043	42	AnOut 2, setup	0=0-10V/0-20mA, 1=2-10V/4-20mA, 2=User defined	437
40044	43	AnOut 2, offset	-100% - +100% 1% <-> 1	438
40045	44	AnOut 2, gain	-4.00 - +4.00, 0.01 <-> 1	439
40046	45	AnOut 2, bipolar	0=Off, 1=On	43A
40047	46	AnOut 3, function	0=Torque, 4=Current, 1=Speed, 5=El.power, 2=Shaft power, 6=Outp voltage 3=Frequency,	
40048	47	AnOut 3, setup	0=0-10V/0-20mA, 1=2-10V/4-20mA, 2=User defined	
40049	48	AnOut 3,offset	-100% - +100% 1% <-> 1	
40050	49	AnOut 3, gain	-4.00 - +4.00, 0.01 <-> 1	
40051	50	AnOut 3, bipolar	0=Off, 1=On	
40052	51	AnOut 4, function	0=Torque, 4=Current, 1=Speed, 5=El.power, 2=Shaft power, 6=Outp voltage 3=Frequency,	
40053	52	AnOut 4, setup	0=0-10V/0-20mA, 1=2-10V/4-20mA, 2=User defined	
40054	53	AnOut 4, offset	-100% - +100% 1% <-> 1	
40055	54	AnOut 4, gain	-4.00 - +4.00, 0.01 <-> 1	
40057	56	AnOut 5, function	0=Torque, 4=Current, 1=Speed, 5=El.power, 2=Shaft power, 6=Outp voltage 3=Frequency,	
40058	57	AnOut 5, setup	0=0-10V/0-20mA, 1=2-10V/4-20mA, 2=User defined	

Table 40 Holding register list (continuing)

Modbus logical no	Modbus no	Function/Name	Range/Unit	Product VFB/VFX menu
40059	58	AnOut 5, offset	-100% - +100% 1% <-> 1	
40060	59	AnOut 5, gain	-4.00 - +4.00, 0.01 <-> 1	
40061	60	AnOut 5, bipolar	0=Off, 1=On	
41001	1000	Comm, ref	100% <-> 0x2000	
41002	1001	Operation.drive mode	0=Speed, 1=Torque, 2=V/Hz	211
41003	1002	Operation.ref ctrl	0=Remote, 1=Keyboard, 2=Comm	212
41004	1003	Operation.run stop ctrl	0=Remote, 3=Rem/digin1, 1=Keyboard, 4=Comm/ digin1 2=Comm,	213
41005	1004	Operation.rotation	0=R+L, 1=R, 2=L	214
41006	1005	Utility.auto restart mask	16-bit mask	
41007	1006	Utility.auto restart	0-10	241
41008	1007	DigIn 1	0-11 See description in 4.11.6.	421
41009	1008	DigIn 2	0-11 See description in 4.11.6.	422
41010	1009	DigIn 3	0-11 See description in 4.11.6.	423
41011	1010	DigIn 4	0-11 See description in 4.11.6.	424
41014	1013	DigOut 1	0-21 See description in 4.11.4.	441
41015	1014	DigOut 2	0-21 See description in 4.11.4.	442
41018	1017	Crio enable	0=Off, 1=On	281
41019	1018	Crio control	0=4-Speed, 1=3-pos, 2=Analogue	282

Table 40 Holding register list (continuing)

Modbus logical no	**Modbus no**	**Function/Name**	**Range/Unit**	**Product VFB/VFX menu**
41020	1019	Crio relay 1	0-21 See description in 4.11.4.	283
41021	1020	Crio relay 2	0-21 See description in 4.11.4.	284
41022	1021	Process unit	0=None, 3=m/s, 1=rpm, 4=/min, 2=%, 5=/hr	6G1
41023	1022	Process scale	0-10.000, 0.0001 <=> 1	6G2
41024	1023	Multiple display 1	0=Speed, 6=Frequency, 1=Torque, 7=DC voltage, 2=Shaft power,8=Temp, 3=El power, 9=Drive 4=Current, status, 5=Voltage, 10=Process speed	110
41025	1024	Multiple display 2	See 41024	120
41026	1025	Utility language	0=English, 3=Dutch, 1=German, 4=French 2=Swedish,	231
41027	1026	Utility keyboard locked	0=Unlocked, 1=Locked	232
41028	1027	Serial com. address	1-247	262
41029	1028	Serial com. Baud-rate	1=2400, 4=19200, 2=4800 5=38400 3=9600,	261
41030	1029	Serial com. parity	0=None	
41032	1031	MVB card on/off	0=Off, 1=On	291

Table 41 Parameter set A

***	***	**VFB/VFX Parameter set A**	***	***
41101	1100	Acceleration time	0.00-3600.00 See description in 4.11.7	311
41102	1101	Deceleration time	0.00-3600.00 See description in 4.11.7	313
41103	1102	Q-stop time	0.00-3600.00 See description in 4.11.7	31B
41104	1103	Acceleration shape	0=Linear, 1=S-curve	312
41105	1104	Deceleration shape	0=Linear, 1=S-curve	314
41106	1105	Q-stop shape	0=Linear	
41111	1110	Wait before brake time	0.00-3.00, 0.01s<->1	319
41112	1111	Vector brake	0=Off, 1=On	31A
41113	1112	Spinstart	0=Off, 1=On	31C
41114	1113	Motor pot function	0=Volatile, 1=Non-volatile	325
41115	1114	Minspeed mode	0=Scale, 1=Limit, 2=Stop	323
41116	1115	Minimum speed	0- Maximum speed, see description in 4.11.7	321
41117	1116	Maximum speed	Minimum speed-2*motor sync speed, see description in 4.11.7	322
41118	1117	Preset speed 1	0-2*Motor sync speed, see description in 4.11.7	326
41119	1118	Preset speed 2	0-2*Motor sync speed, see description in 4.11.7	327
41120	1119	Preset speed 3	0-2*Motor sync speed, see description in 4.11.7	328
41121	1120	Preset speed 4	0-2*Motor sync speed, see description in 4.11.7	329
41122	1121	Preset speed 5	0-2*Motor sync speed, see description in 4.11.7	32A
41123	1122	Preset speed 6	0-2*Motor sync speed, see description in 4.11.7	32B
41124	1123	Preset speed 7	0-2*Motor sync speed, see description in 4.11.7	32C

Table 41 Parameter set A (continuing)

***	***	**VFB/VFX Parameter set A**	***	***
41125	1124	Skip speed 1 Low	0-2*Motor sync speed, see description in 4.11.7	32D
41126	1125	Skip speed 1 High	0-2*Motor sync speed, see description in 4.11.7	32E
41127	1126	Skip speed 2 Low	0-2*Motor sync speed, see description in 4.11.7	32F
41128	1127	Skip speed 2 High	0-2*Motor sync speed, see description in 4.11.7	32G
41129	1128	Jog speed	0-±2*Motor sync speed, see description in 4.11.7	32F
41130	1129	Maximum torque	0-400%, 1%<-> 1 or I_max/motor In	331
41131	1130	Speed P gain	0.1-30.0, 0.1<->1	342
41132	1131	Speed I time	0.01-10.00s, 0.01s<->1	343
41133	1132	Flux optimization	0=Off, 1=On	344
41134	1133	PID-controller	0=Off, 1=On, 2=Invert	345
41135	1134	PID-controller P gain	0.1-30.0, 0.1<->1	346
41136	1135	PID-controller I time	0.01-300.00s, 0.01s<->1	347
41137	1136	PID-controller D time	0.01-30.00s, 0.01s<->1	348
41138	1137	Low voltage override	0=Off, 1=On	351
41139	1138	Rotor locked	0=Off, 1=On	352
41140	1139	Motor lost	0=Off, 1=Resume, 2=Trip	353
41141	1140	Motor I2t type	0=Off, 1=Trip, 2=Limit	354
41142	1141	Motor I2t current	0-150% inverter i_nom, 0.1A<->1	355
41143	1142	Speed direction	0=R, 1=L, 2=R+L	324
41144	1143	Start speed	0 - + -2*Motor sync speed, see description i 4.11.7, page 76.	321

Table 42 Parameter set B, C and D

***	***	**VFB/VFX Parameter set B**	***	***
41201- 41299	1200-1298	/* Parameter set B */		
***	***	**VFB/VFX Parameter set C**	***	***
41301- 41399	1300-1398	/* Parameter set C */		
***	***	**VFB/VFX Parameter set D**	***	***
41401- 41499	1400-1498	/* Parameter set D */		

4.11 Parameter description VFB/VFX

The MODBUS logical number inside brackets.

For more information on any parameter/function, see Instruction Manual Vectorflux VFB/VFX.

4.11.1 Inverter software version (30017).

MSB	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	LSB

Bit F,E	**Release Type:**	00	Release (V)
		01	Pre release (P)
		10	Beta (B)
		11	Alpha (A)
Bit D-8	**Major version**	000000	0
		000001	1
		111110	62
		111111	63
Bit 7-0	**Minor version**	00000000	0
		00000001	1
		11111110	254
		11111111	255
		3508h ->	
(**5.08**			

4.11.2 Inverter type (30028).

MSB	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	LSB

Bit F,E,D,C,B	**Reserved for future use**		
Bit A	**Option:**	0	w/o Brake chopper
		1	with Brake chopper
Bit 9,8	**Type:**	10	FDB
		11	FDX
Bit 7,6,5	**Size:**	000	Reserved
		001	Size 1
		010	Size 2
		011	Size 3
		100	Size 4 and 8
		101	Size 5 and 10
		110	Reserved
		111	Size 15 and 20
Bit 4,3,2	**Power:**	000	Reserved
		001	1st Power in size
		010	2nd Power in size
		011	3rd Power in size
		100	4th Power in size
		101	5th Power in size
		110	6th Power in size
		111	7th Power in size
Bit 1,0	**Voltage class:**	00	230V
		01	400V
		10	500V
		11	690V

4.11.3 Warning, Tripmessage 1-10 (30040, 30103, 30106, 30109, 30112, 30115, 30118, 30121, 30124, 30127,30130).

0=No warning	1=Overtemp	2=Overcurrent	3=Overvolt D
4=Overvolt G	5=Overvolt L	6=Motor Temp	7=Ext Trip
8=Spare	9=Max Alarm	10=Locked Rotor	11=Power Fault
12=Int Error	13=Spare	14=Spare	15=Spare
16=Overvoltage	17=Low Voltage	18=Overtemp	19=Motor lost
20=Max Pre-Alrm	21=Min Pre-Alrm	22=Overcurrent	23=Spare
24=Spare	25=Spare	26=Spare	27=Overvolt L
28=Min Alarm	29=Spare	30=Spare	31=Spare

4.11.4 Relay, Digout and CRIO relay (40023,40024,41014,41015,41020, 41021).

0=Run	1=Stop	2=Acc/Dec	3=At speed
4=At max speed	5=No Trip	6=Trip	7=Autorst Trip
8=Limit	9=Warning	10=Ready	11=T=Tlim
12=I>Inom	13=Brake	14=Sgnl<Offset	15=Alarm
16=Pre Alarm	17=Max Alarm	18=Max Pre-Alrm	19=Min Alrm
20=Min Pre-Alrm	21=Deviation		

4.11.5 5.x.x Auto restart mask (41006)

MSB	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	LSB

Bit 12-15	Spare	
Bit 11	INT_ERROR	0x0800
Bit 10	POWER_FAULT	0x0400
Bit 9	LOCKED_ROTOR	0x0200
Bit 8	MON_ALARM	0x0100
Bit 7	MOTOR_LOST	0x0080
Bit 6	EXT_TRIP	0x0040
Bit 5	MOTOR_TEMP	0x0020
Bit 4	OVER_VOLT_L	0x0010
Bit 3	OVER_VOLT_G	0x0008
Bit 2	OVER_VOLT_D	0x0004
Bit 1	IIT	0x0002
Bit 0	OVER_TEMP	0x0001

The corresponding bits should be set to activate the autoreset function. To enable auto reset for Int error (bit 11) and locked rotor (Bit 9) the value 0x0A00 should be written to the register.

If the value 0x0123 was read, it indicates that MON_ALARM, MOTOR_TEMP, IIT and OVER_TEMP are in auto reset mode and all other functions are swithced off.

4.11.6 DigIn (41008,41009).

0=Off	1=Lim Switch+	2=Lim Switch -	3=Ext. Trip
4=AnIn Select	5=Preset Ref 1	6=Preset Ref 2	7=Preset Ref 4
8=Quick Stop	9=Jog	10=MotPot Up	11=MotPot Down
12=PS selected!			

4.11.7 Representation of speed.

Bit15=0<->1rpm<->1

Bit15=1<->100rpm<->1

4.12 Performance

It is important to configure the communication master according to the slave performance/restrictions.

The total message size must not exceed 64 bytes.

Max number of registers at a time is limited to 25 (both for read and write).

4.12.1 VFB/VFX response delay

The response delay for the VFB/VFX will be maximum 8 ms.

5. CRC GENERATION

The CRC is started by first pre-loading a 16-bit register to all 1's. Then a process begins of applying successive eight-bit bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC. Start and stop bits, and the parity bit, do not apply to the CRC.

During generation of the CRC, each eight-bit character is exclusive ORed with the register contents. The result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register is then exclusive OR-ed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place.

This process is repeated until eight shifts have been performed. After the last (eighth) shift, the next eight-bit character is exclusive OR-ed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the characters of the message have been applied, is the CRC value.

Generation in steps:

- **Step 1** Load a 16-bit register with 0xFFFF (all 1's). Call this the CRC register.
- **Step 2** Exclusive OR the first eight-bit byte of the message with the low order byte of the 16-bit CRC register, putting the result in the CRC register.
- **Step 3** Shift the CRC register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
- **Step 4** If the LSB is 0, repeat Step 3 (another shift). If the LSB is 1, Exclusive OR the CRC register with the polynomial value 0xA001 (1010 0000 0000 0001) .
- **Step 5** Repeat Steps 3 and 4 until eight shifts have been performed. When this is done, a complete eight-bit byte will have been processed.

- **Step 6** Repeat Steps 2 ... 5 for the next eight-bit byte of the message. Continue doing this until all bytes have been processed.
  Result The final contents of the CRC register is the CRC value.
- **Step 7** When the CRC is placed into the message, its upper and lower bytes must be swapped as described below.
- Placing the CRC into the Message
  When the 16-bit CRC (two eight-bit bytes) is transmitted in the message, the low order byte will be transmitted first, followed by the high order byte - e.g., if the CRC value is 0x1241.

Message	
CRC LO	41
CRC HI	12

Example of CRC Generation Function

An example of a C language function performing CRC generation is shown on this page.
The function takes two arguments:

- Unsigned char *puchMsg; A pointer to the message buffer containing binary data to be used for generating the CRC.
- Unsigned int usDataLen; The quantity of bytes in the message buffer.

The function returns the CRC as a type unsigned int.

- Unsigned int CRC16 (unsigned int usDataLen, unsigned char *puchMsg)

```
#define CRC_POLYNOMIAL    0xA001
  unsigned int crc_reg;
  unsigned char i,k;
  crc_reg = 0xFFFF;
  for (i=0 ; i<usDataLen ; i++)
  {
    crc_reg ^= *puchMsg++;
    for (k=0 ; k<8 ; k++)
    {
      if (crc_reg & 0x0001)
      {
        crc_reg >>= 1;
        crc_reg ^= CRC_POLYNOMIAL;
      }
      else
        crc_reg >>= 1;
    }
  }
  return crc_reg;
```

Fig. 22 CRC example.

DEDICATED DRIVE

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Ref: f:\office\2007\word\070917.doc

17 September 2007

Brisbane City Council
GPO Box 2567
BRISBANE QLD 4000

ATTENTION: Mike Tomlinson

Dear Mike,

RE: <u>CONTRACT NO. BW70107-06/07</u>
<u>SEWAGE PUMP STATION 152 – NUDGEE ROAD</u>

Please find attached one (1) copy of the operation and maintenance manual for the above contract.

If you have any queries please contact me.

Yours faithfully,

Vince Whelan
WHELAN ELECTRICAL SERVICES
1 HARVEST STREET, YANDINA QLD 4561

Water & Sewerage Pumping Specialists Electrical Contractors Switchboard Manufacturing Engineering Contractors

emotron
DEDICATED DRIVE

MASTERSTART™ MSF SOFTSTARTERS

INSTRUCTION MANUAL

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

Safety

The soft starter should be installed in a cabinet or in an electrical control room.

- The device must be installed by trained personnel.
- Disconnect all power sources before servicing.
- Always use standard commercial fuses, slow blow e.g. type gl, 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.

Operating and maintenance personnel

1. Read the whole Instruction Manual before installing and putting the equipment into operation.
2. During all work (operation, maintenance, repairs, etc.) observe the switch-off procedures given in this instruction as well as any other operating instruction for the driven machine or system. See Emergency below.
3. The operator must avoid any working methods which reduce the safety of the device.
4. The operator must do what he can to ensure that no unauthorised person is working on the device.
5. The operator must immediately report any changes to the device which reduce its safety to the user.
6. The user must undertake all necessary measures to operate the device in perfect condition only.

Installation of spare parts

We expressly point out that any spare parts and accessories not supplied by us have also not been tested or approved by us.

Installing and/or using such products can have a negative effect on the characteristics designed for your device. The manufacturer is not liable for damage arising as a result of using non-original parts and accessories.

Emergency

You can switch the device off at any time with the mains switch connected in front of the soft starter (both motor and control voltage must be switched off).

Dismantling and scrapping

The enclosure of the soft starter is made of recyclable material as aluminium, iron and plastic. Legal requirements for disposal and recycling of these materials must be complied with.

The soft starter contains a number of components demanding special treatment, as for example thyristors. The circuit board contain small amounts of tin and lead. Legal requirements for disposal and recycling of these materials must be complied with.

CONTENTS

List of tables

List of figures

1. GENERAL INFORMATION

1.1 Integrated safety systems

The device is fitted with a protection system which reacts to:

- Over temperature.
- Voltage unbalance.
- Over- and under voltage.
- Phase reversal
- Phase loss
- Motor overload protection thermal and PTC.
- Motor load monitor, protecting machine or process max or min alarm
- Starts per hour limitation

The soft starter is fitted with a connection for protective earth ⏚ (PE).

MSF soft starters are all enclosed IP 20, except MSF-1000 and MSF-1400 which are delivered as open chassi IP00.

1.2 Safety measures

These instructions are a constituent part of the device and must be:

- Available to competent personnel at all times.
- Read prior to installation of the device.
- Observed with regard to safety, warnings and information given.

The tasks in these instructions are described so that they can be understood by people trained in electrical engineering. Such personnel must have appropriate tools and testing instruments available. Such personnel must have been trained in safe working methods.

The safety measures laid down in DIN norm VDE 0100 must be guaranteed.

The user must obtain any general and local operating permits and meet any requirements regarding:

- Safety of personnel.
- Product disposal.
- Environmental protection.

NOTE! The safety measures must remain in force at all times. Should questions or uncertainties arise, please contact your local sales outlet.

1.3 Notes to the Instruction Manual

⚠ **WARNING! Warnings are marked with a warning triangle.**

Serial number

The information given in these instructions only applies to the device with the serial number given on the label on the front page. A plate with the serial number is fixed to the device.

Important

For all enquiries and spare parts orders, please quote the correct name of the device and serial number to ensure that your inquiry or order is dealt with correctly and swiftly.

NOTE! These instructions only apply to the soft starters having the serial number given on the front page, and not for all models.

1.4 How to use the Instruction Manual

This instruction manual tells you how to install and operate the MSF soft starter. Read the whole Instruction Manual before installing and putting the unit into operation. For simple start-up, read chapter 2. page 8 to chapter 3. page 10.

Once you are familiar with the soft starter, you can operate it from the keyboard by referring to the chapter 13. page 79. This chapter describes all the functions and possible setting.

1.5 Standards

The device is manufactured in accordance with these regulations.

- IEC 947-4-2
- EN 60204-1 Electrical equipment of machines, part 1, General requirements and VDE 0113.
- EN 50081-2, EMC Emission
- EN 50081-1, EMC Emission with bypass
- EN 50082-2, EMC Immunity
- GOST
- UL508

1.6 Tests in accordance with norm EN60204

Before leaving the factory, the device was subjected to the following tests:

- Through connection of earthing system;
  a) visual inspection.
  b) check that earthing wire is firmly connected.
- Insulation
- Voltage
- Function

1.7 Inspection at delivery

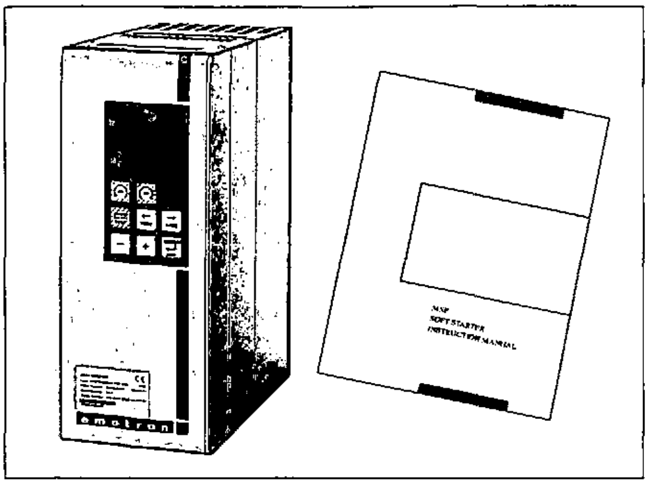


Fig. 1 Scope of delivery.

1.7.1 Transport and packing

The device is packed in a carton or plywood box for delivery. The outer packaging can be returned. The devices are carefully checked and packed before dispatch, but transport damage cannot be ruled out.

Check on receipt:

- Check that the goods are complete as listed on the delivery note, see type no. etc. on the rating plate.

Is the packaging damaged?

- Check the goods for damage (visual check).

If you have cause for complaint

If the goods have been damaged in transport:

- Contact the transport company or the supplier immediately.
- Keep the packaging (for inspection by the transport company or for returning the device).

Packaging for returning the device

- Pack the device so that it is shock-resistant.

Intermediate storage

After delivery or after it has been dismounted, the device can be stored before further use in a dry room.

1.8 Unpacking of MSF-310 and larger types

The soft starter is attached to the plywood box/loading stool by screws, and the soft starter must be unpacked as follows:

1. Open only the securing plates at the bottom of the box (bend downwards). Then lift up the box from the loading stool, both top and sides in one piece.
2. Loosen the three (3 pcs) screws on the front cover of the soft starter, down by the lower logo.
3. Push up the front cover about 20 mm so that the front cover can be removed.
4. Remove the two (2 pcs) mounting screws at the bottom of the soft starter.
5. Lift up the soft starter at the bottom about 10 mm and then push backwards about 20 mm so that the soft starter can be removed from the mounting hooks* at the top. The hooks are placed under the bottom plate and cannot be removed until the soft starter is pulled out.
6. Loosen the screws (2 pcs) for the mounting hooks and remove the hooks.
7. The hooks are used as an upper support for mounting the soft starter.

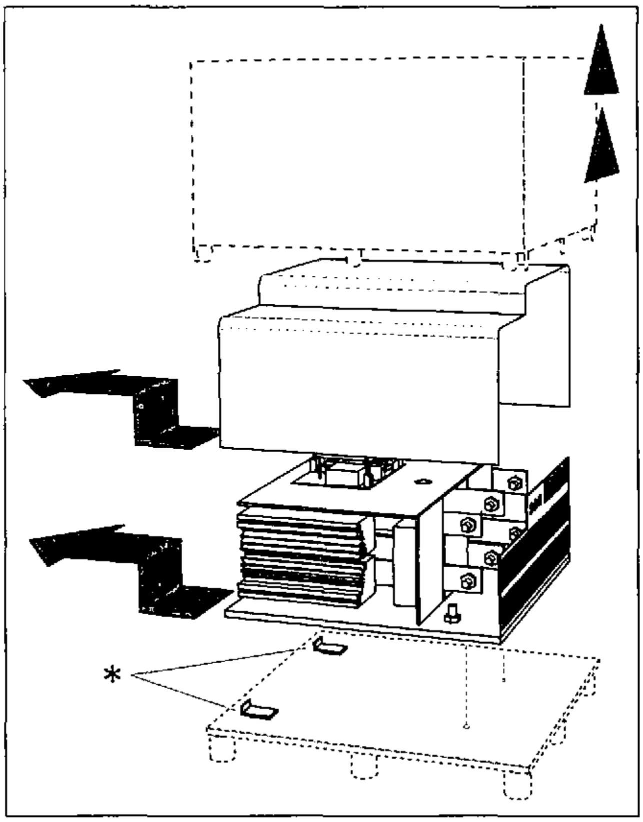
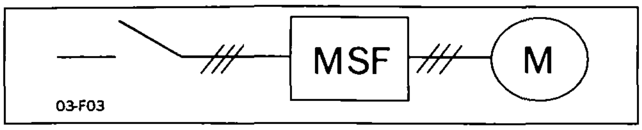


Fig. 2 Unpacking of MSF-310 and larger models.

2. DESCRIPTION

2.1 General

The MSF is installed directly between the mains and the supply cable to the motor. If a mains contactor is used it can be activated by the integrated K1 relay.



The MSF is developed for soft starting, stopping and braking three-phase motors.

There are 3 different kinds of soft starting control methods:

- **Control method 1-Phase**
  The single phase controlled soft starters provide only a reduction in starting torque no control of current or torque. These starters need a main and bypass contactor as well as external motor protections. This is a open loop voltage controller. These starters are mainly in the power up to 7.5 kW.
- **Control method 2-Phase**
  The two phase starters can start a motor without a mains contactor, but in that case voltage still is present at the motor when it´s stopped. These starters are mainly in the power up to 22 kW.
- **Control method 3-Phase**
  In the three phase Soft Starters there are different technologies:
  - Voltage control
  - Current control
  - Torque control

Voltage control

This method is the most used control method. The starter gives a smooth start but doesn't get any feedback on current or torque. The typical settings to optimize a voltage ramp are: Initial voltage, ramp time, dual ramp time.

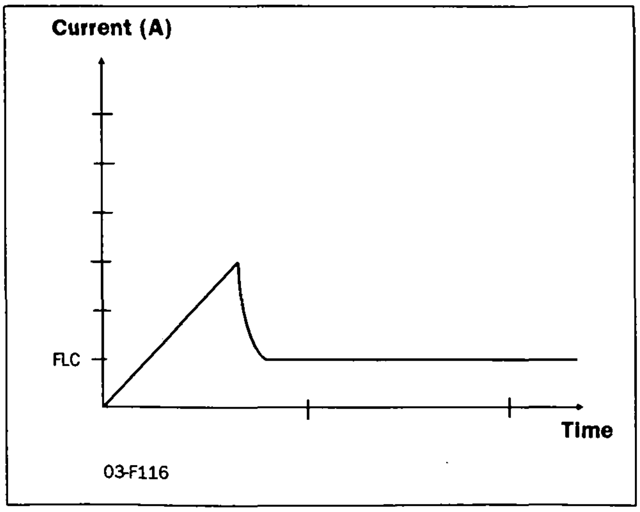


Fig. 3 Voltage control

Current control

The voltage ramp can be used with a current limit which stops the voltage ramp when the set maximum current level is reached. The maximum current level is the main setting and must be set by the user depending the maximum current allowed for the application.

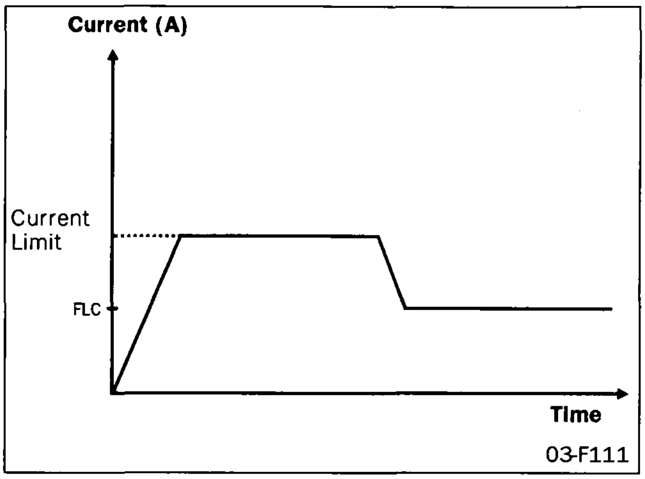


Fig. 4 Current control

Torque control

Is the most sufficient way of starting motors. Unlike voltage and current based systems the soft starter monitors the torque need and allows to start with the lowest possible current. Using a closed loop torque controller also linear ramps are possible. The voltage ramp can not hold back the motor starting torque this results in a current peak and unlinear ramps. In the current ramp there will be no peak current, but a higher current for a longer period of time during the start compared to torque control. Current starting doesn't give linear ramps. The linear ramps are very important in many applications. For an example, to stop a pump with an unlinear ramp will give water hammer. Soft starters which doesn't monitor the torque, will start and stop to fast if the load is lighter than the setting of current or ramp time.

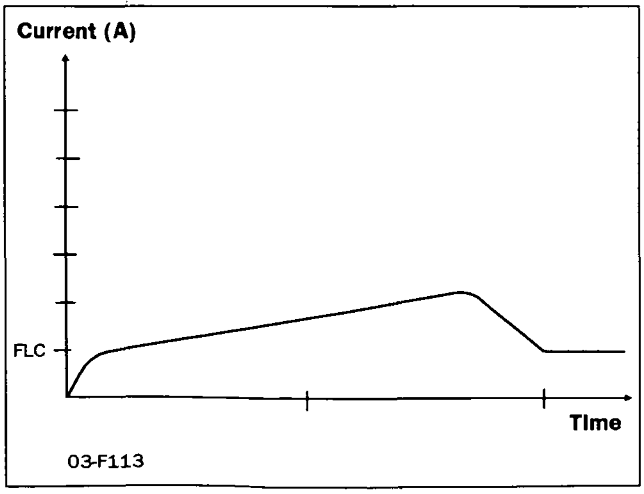


Fig. 5 Torque control

2.2 MSF control methods

MSF Soft Starters control all three phases supplied to the motor. It manages all the 3 possible starting methods where the closed loop Torque control is the most efficient way of starting and stopping motors.

2.2.1 General features

As mentioned above soft starters offer you several features and the following functions are available:

- Torque controlled start and stop
- Current limit control at start
- Application "Pump"
- External analogue input control
- Torque booster at start
- Full voltage start (D.O.L)
- Dual voltage ramp at start and stop
- Bypass
- Dynamic DC-brake or Softbrake
- Slow speed at start and stop
- Jogging forward and reverse
- Four parameter sets
- Analogue output indicating current, power or voltage
- Viewing of current, voltage, power, torque, power consumption, elapsed time etc.
- Integrated safety system acc. to § 1.1, page 6, with an alarm list.

3. HOW TO GET STARTED

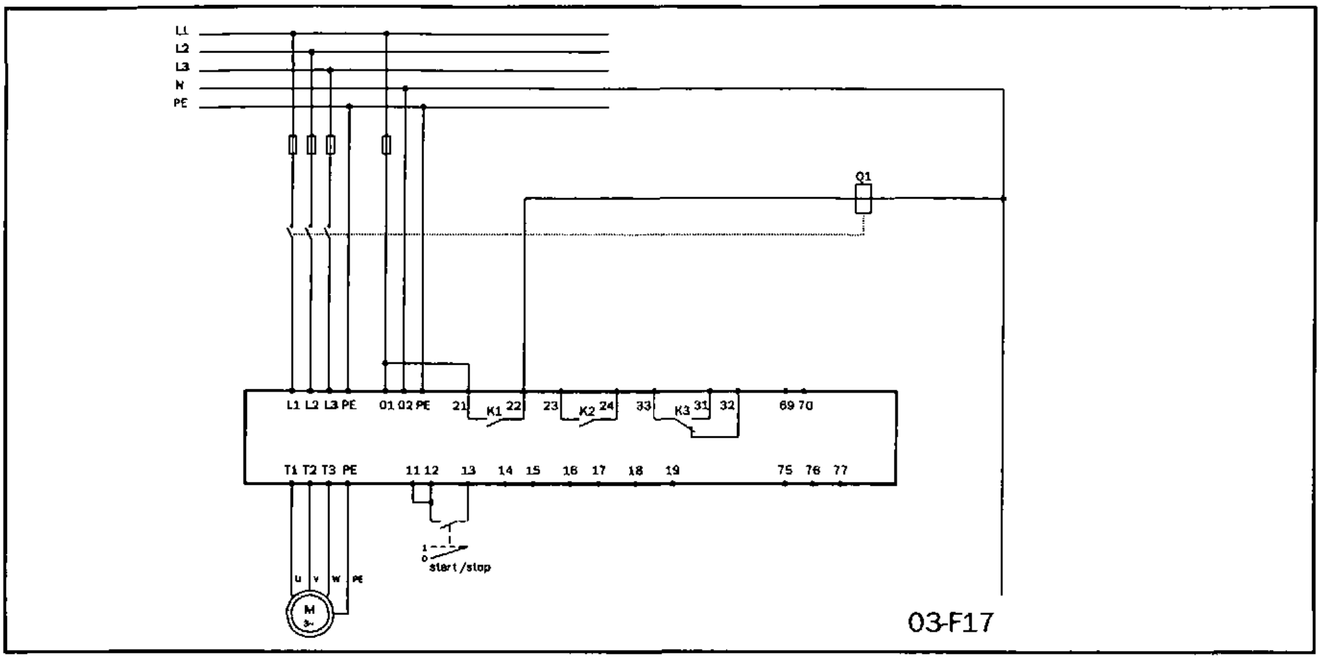


Fig. 6 Standard wiring.

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.[1])
- 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.

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.

---

[1]) The menu 006 must be put to 01 for start/stop command from keyboard.

041

400 **Nominal motor voltage**

Default:	400 V
Range:	200-700 V

042

45 **Nominal motor current**

Default:	Nominal current soft starter
Range:	25% - 150% of In_{soft} in Amp

043

22 **Nominal motor power**

Default:	Nominal power soft starter
Range:	25% - 300% of Pn_{soft} in kW

044

1450 **Nominal motor speed**

Default:	Nominal speed soft starter
Range:	500-3600 rpm

045

.86 **Nominal motor cos phi**

Default:	0.86
Range:	0.50-1.00

046

50 **Nominal frequency**

Default:	50 Hz
Range:	50/60 Hz

NOTE! Now go back to menu 007 and set it to "oFF" and then to menu 001.

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

10 **Start time ramp 1**

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

oFF **Stop time ramp 1**

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	
2	**Selection of control mode**
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	
0.0	**RMS current read-out**
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.

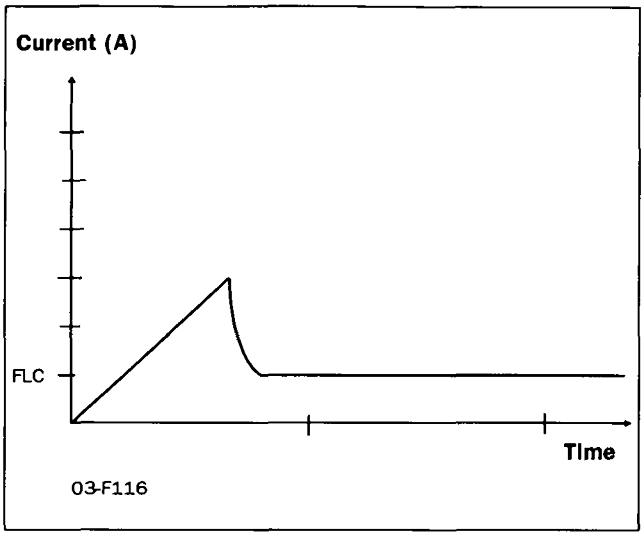


Fig. 7 Example of start ramp with main function voltage ramp.

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).

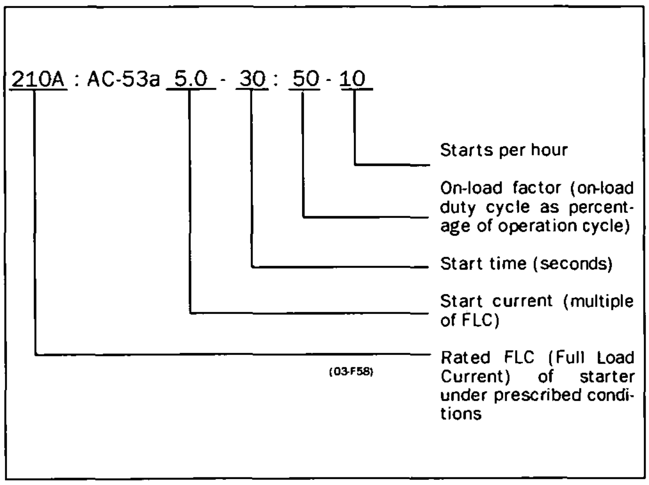


Fig. 8 Rating example AC53a.

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.

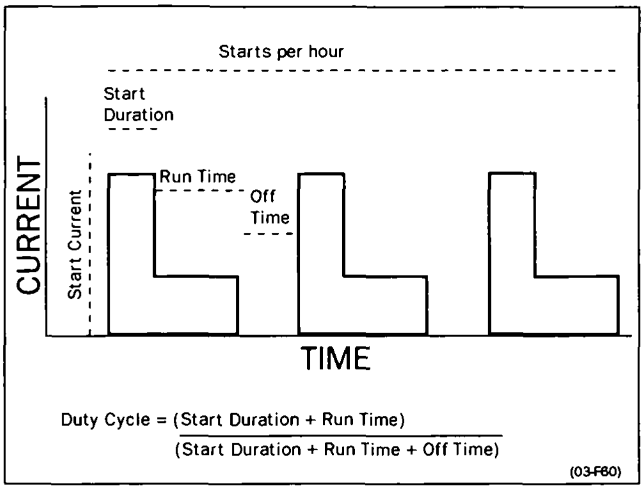


Fig. 9 Duty cycle, non bypass.

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.

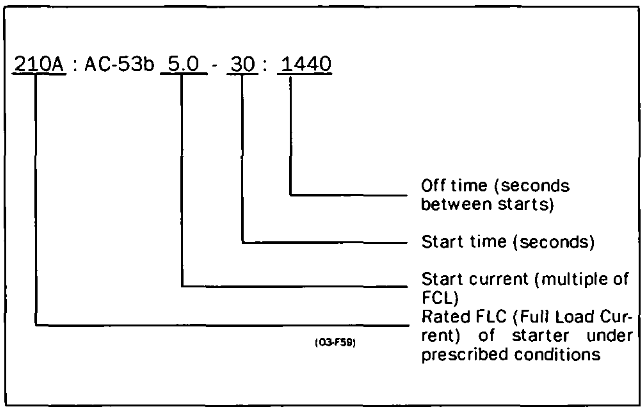


Fig. 10 Rating example AC53b.

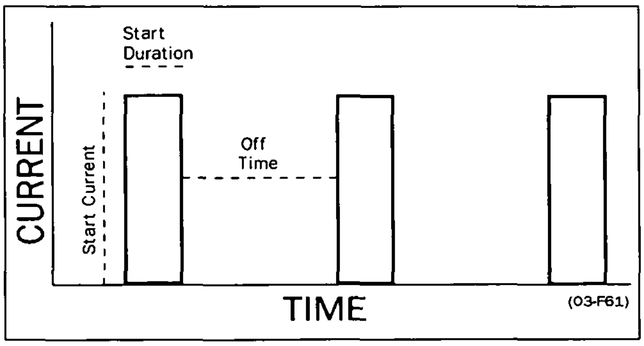


Fig. 11 Duty cycle, bypassed

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 pleas 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.**
General & Water					
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	-
Metals & Mining					
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
Food Processing					
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	
Pulp and Paper					
Re-Pulper		x	450	25;=1	
Shredder		x	450	25;=1	
Trolley		x	450	25;=1	
Petrochemical					
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	
Transport & Machine Tool					
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	
Lumber & Wood Products					
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 pleas 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 the MSF function.
- **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.

Table 2 Application Function List

Application/ Duty	Problem	Solution MSF	Menus
PUMP Normal	Too fast start and stops	MSF Pump application with following start/stop features:	22
	Non linear ramps	Linear ramps without tacho.	
	Water hammer	Torque ramps for quadratic load	
	High current and peaks during starts.		
	Pump is going in wrong direction	Phase reversal alarm	88
	Dry running	Shaft power underload	96-99
	High load due to dirt in pump	Shaft power overload	92-95
COMPRESSOR Normal	Mechanical shock for compressor, motor and transmissions	Linear Torque ramp or current limit start.	25;=1 or 20,21
	Small fuses and low current available.		
	Screw compressor going in wrong direction	Phase sequence alarm	88
	Damaged compressor if liquid ammonia enters the compressor screw.	Shaft power overload	92-95
	Energy consumption due to compressor is running unloaded	Shaft power underload	96-99
CONVEYOR Normal/Heavy	Mechanical shocks for transmissions and transported goods.	Linear Torque ramp	25;=1
	Filling or unloading conveyors	Slow speed and accurate position control.	37-40,57,58
	Conveyor jammed	Shaft power overload	92-95
	Conveyor belt or chain is off but the motor is still running	Shaft power underload	96-99
	Starting after screw conveyor have stopped due to overload.	Jogging in reverse direction and then starting in forward.	
	Conveyor blocked when starting	Locked rotor function	75
FAN Normal	High starting current in end of ramps	Torque ramp for quadratic need	25;=2
	Slivering belts.		
	Fan is going in wrong direction when starting.	Catches the motor and going easy to zero speed and then starting in right direction.	
	Belt or coupling broken	Shaft power underload	96-99
	Blocked filter or closed damper.		
PLANER Heavy	High inertia load with high demands on torque and current control.	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
	Need to stop quick both by emergency and production efficiency reasons.	Dynamic DC brake without Contactor for medium loads and controlled sensor less soft brake with reversing contactor for heavy loads.	36;=1,34,35 36;=2,34,35
	High speed lines	Conveyor speed set from planer shaft power analog output.	54-56
	Worn out tool	Shaft power overload	92-95
	Broken coupling	Shaft power underload	96-99
ROCK CRUSHER Heavy	High enertia	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
	Heavy load when starting with material	Torque boost	30,31
	Low power if a diesel powered generator is used.		
	Wrong material in crusher	Shaft power overload	92-95
	Vibrations during stop	Dynamic DC brake without Contactor	36;=1,34,35
BANDSAW Heavy	High inertia load with high demands on torque and current control.	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
	Need to stop quick both by emergency and production efficiency reasons.	Dynamic DC brake without Contactor for medium loads and controlled sensor less soft brake with reversing contactor for heavy loads.	36;=1,34,35 36;=2,34,35
	High speed lines	Conveyor speed set from band saw shaft power analog output.	54-56
	Worn out saw blade	Shaft power overload	
	Broken coupling, saw blade or belt	Shaft power underload	
CENTRIFUGE Heavy	High inertia load	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
	To high load or unbalanced centrifuge	Shaft power overload	
	Controlled stop	Dynamic DC brake without Contactor for medium loads and controlled sensor less soft brake with reversing contactor for heavy loads.	36;=1,34,35 36;=2,34,35
	Need to open centrifuge in a certain position.	Braking down to slow speed and then positioning control.	37-40,57,58

Table 2 Application Function List

Application/ Duty	Problem	Solution MSF	Menus
MIXER Heavy	Different materials	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
	Need to control material viscosity	Shaft power analog output	54-56
	Broken or damaged blades	Shaft power overload	92-95
		Shaft power underload	96-99
HAMMER MILL Heavy	Heavy load with high breakaway torque	Linear Torque ramp gives linear acceleration and lowest possible starting current.	25;=1
		Torque boost in beginning of ramp.	30,31
	Jamming	Shaft power overload	92-95
	Fast stop	Controlled sensor less soft brake with reversing contactor for heavy loads.	36;=2,34,35
	Motor blocked	Locked rotor function	75

EXAMPLE:

Hammer Mill:

- This is an application for heavy duty,
- Main function Torque ramp start (menu 25) will give the best results.
- Torque boost to overcome high breakaway torque (menu 30 and 31)
- Overload alarm function for jamming protection (menu 92 and 95)
- Stop function Soft Brake (menu 36, selection 2) can be used. Menu 34 and 35 to set the brake time and strength.

4.6 Function and combination matrix

Table 3 gives an overview of all possible functions and combination of functions.

1. Select function in the horizontal "Main Function" column. Only one function can be selected in this column, at a time.
2. In the vertical column "Additional Functions" you will find all possible function that can be used together with your selected main function.

Table 3 Combination matrix

Main Functions / **Additional functions**	Dual ramp start	Dual ramp stop	Bypass (032)	Power factor control (033)	Torque boost (030)	Jogging with keyboard/terminal	Timer controlled slow speed	External controlled slow speed	Complete protection	Parameter sets (061)	Dynamic Vector Brake (036-1)	Softbrake (036-2)
Voltage ramp start/stop (default)	X	X	X	X	X	X	X	X	X	X	X	
Torque control start/stop (menu 025)			X	X	X	X	X	X	X	X	X	
Voltage ramp with current limit (menu 020)		X	X	X	X	X	X	X	X	X	X	X
Current limit start (menu 021)		X	X	X	X	X	X	X	X	X	X	X
Pump control (menu 022)			X						X	X		
Analog input (menu 023)									X	X		
Direct on line start (menu 024)			X						X	X		

By using one parameter set, the following start/stop table is given.

NOTE! Voltage and torque ramp for starting only with softbrake.

Table 4 Start/stop combination.

START FUNCTION / **STOP FUNCTION**	Voltage ramp stop	Torque control stop	Pump control	Analog input	Direct on line stop	Dynamic Vector Brake	Softbrake
Voltage ramp start	X				X	X	X
Torque control start		X			X	X	X
Current limit start	X				X	X	X
Voltage ramp with current limit	X				X	X	X
Pump control			X		X		
Analog input				X	X		
Direct on line start					X		

By using different parameter sets for start and stop, it is possible to combine all start and stop functions.

4.7 Special condition

4.7.1 Small motor or low load

The minimum load current for the soft starter is 10% of the rated current of the soft starter. Except for the MSE-017 there the min. current is 2 A. Example MSE-210, rated current = 210 A. Min. Current 21 A. Please note that this is "min. load current" and not min. rated motor current.

4.7.2 Ambient temperature below 0°C

For ambient temperatures below 0°C e.g. an electrical heater must be installed in the cabinet. The soft starter can also be mounted in some other place, due to that the distance between the motor and the soft starter is not critical.

4.7.3 Phase compensation capacitor

If a phase compensation capacitor is to be used, it must be connected at the inlet of the soft starter, not between the motor and the soft starter.

4.7.4 Pole-changing contactor and two speed motor

The switching device must be connected between the output of the soft starter and the motor.

4.7.5 Shielded motor cable

It is not necessary to use shielded wires together with soft starters. This is due to the very low radiated emissions.

NOTE! The soft starter should be wired with shielded control cable to fulfill EMC regulations acc. to § 1.5, page 6.

4.7.6 Slip ring motors

Slip ring motors can not be used together with the soft starter. Unless the motor is rewinded (as a squirrel cage motor). Or keep the resistors in, please contact your supplier.

4.7.7 Pump control with soft starter and frequency inverter together

It is possible e.g. in a pump station with two or more pumps to use one frequency inverter on one pump and soft starters on each of the other pumps. The flow of the pumps can then be controlled by one common control unit.

4.7.8 Starting with counter clockwise rotating loads

It is possible to start a motor clockwise, even if the load and motor is rotating counter clockwise e.g. fans. Depending on the speed and the load "in the wrong direction" the current can be very high.

4.7.9 Running motors in parallel

When starting and running motors in parallel the total amount of the motor current must be equal or lower than the connected soft starter. Please note that it is not possible to make individual settings for each motor. The start ramp can only be set for an average starting ramp for all the connected motors. This applies that the start time may differ from motor to motor. This is also even if the motors are mechanically linked, depending on the load etc.

4.7.10 How to calculate heat dissipation in cabinets

See chapter 12. page 74 "Technical Data", "Power loss at rated motor load (I_N)", "Power consumption control card" and "Power consumption fan". For further calculations please contact your local supplier of cabinets, e.g. Rittal.

4.7.11 Insulation test on motor

When testing the motor with high voltage e.g. insulation test the soft starter must be disconnected from the motor. This is due to the fact that the thyristors will be seriously damage by the high peak voltage.

4.7.12 Operation above 1000 m

All ratings are stated at 1000 m over sea level.
If a MSF is placed for example at 3000 m it must be derated unless that the ambient temperature is lower than 40 C and compensate for this higher pressure.

To get information about motors and drives at higher altitudes please contact your supplier to get technical information nr 151.

4.7.13 Reversing

Motor reversing is always possible. See Fig. 31 on page 34 for the advised connection of the reverse contactors.

At the moment that the mains voltage is switched on, the phase sequence is monitored by the control board. This information is used for the Phase Reverse Alarm (menu 88, see § 7.22, page 56).

However if this alarm is not used (factory default), it is also possible to have the phase reversal contactors in the input of the soft starter.

5. OPERATION OF THE SOFT STARTER

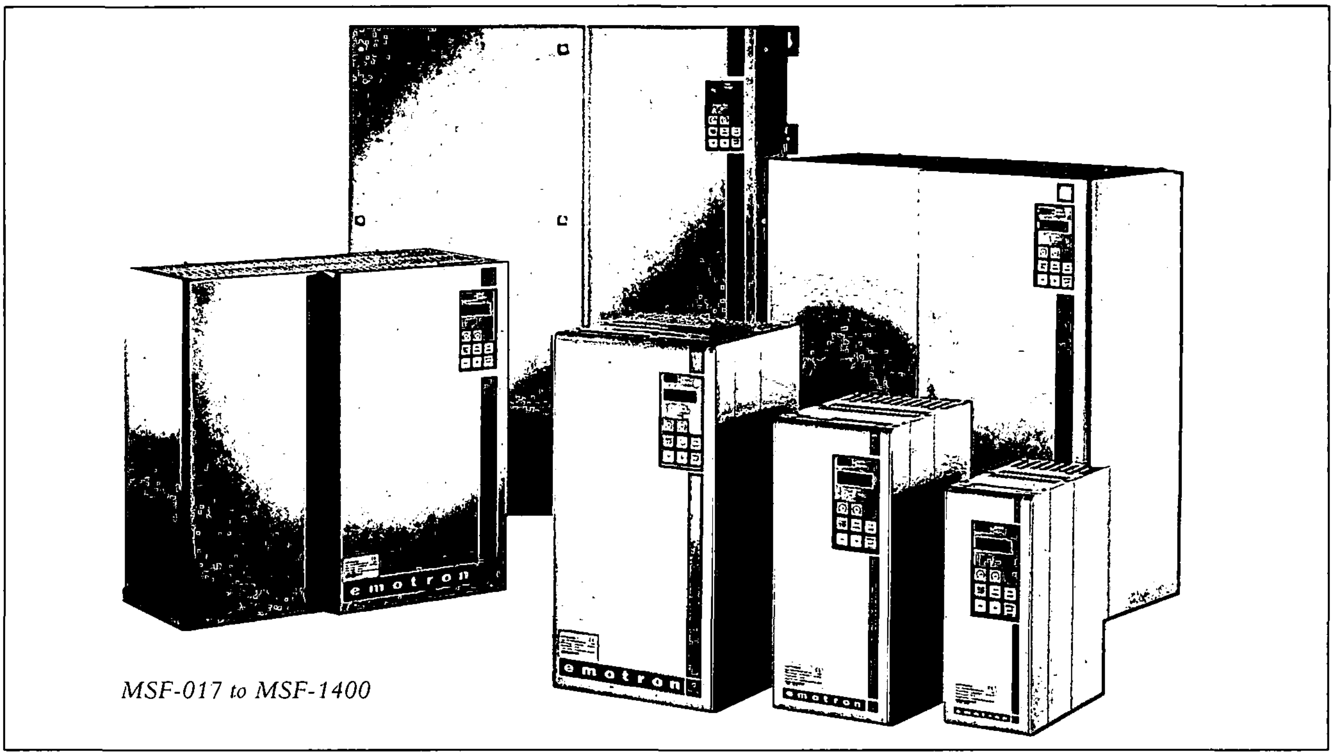


Fig. 12 MSF soft starter models.

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.

5.2 PPU unit

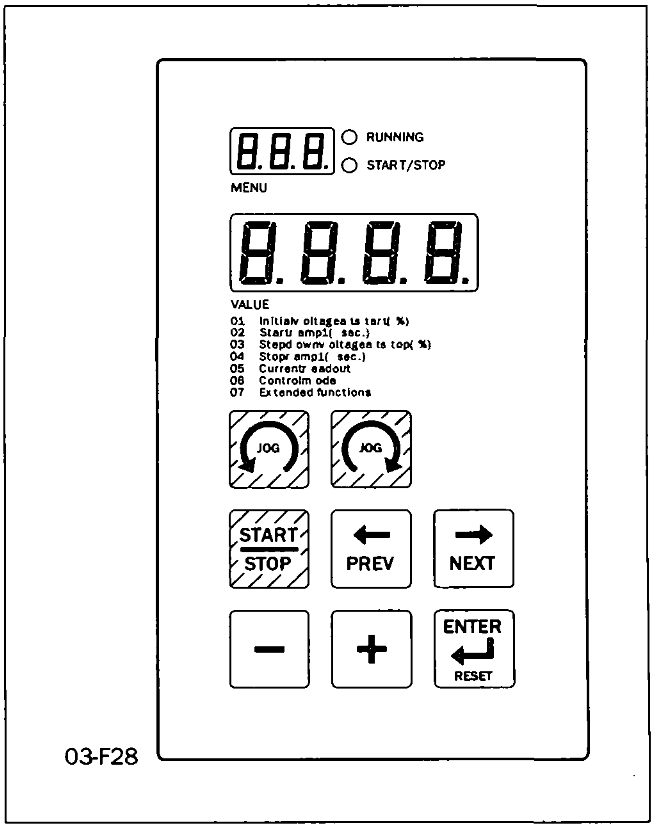


Fig. 13 PPU unit.

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.

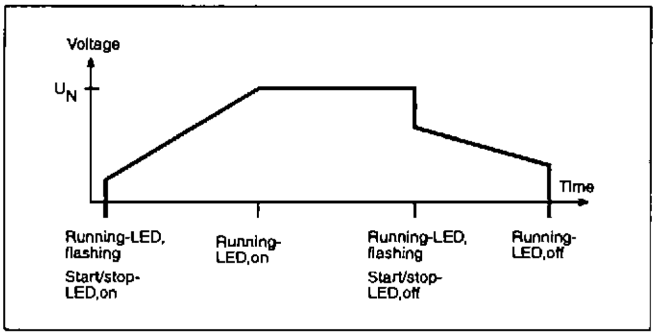


Fig. 14 LED indication at different operation situation.

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.

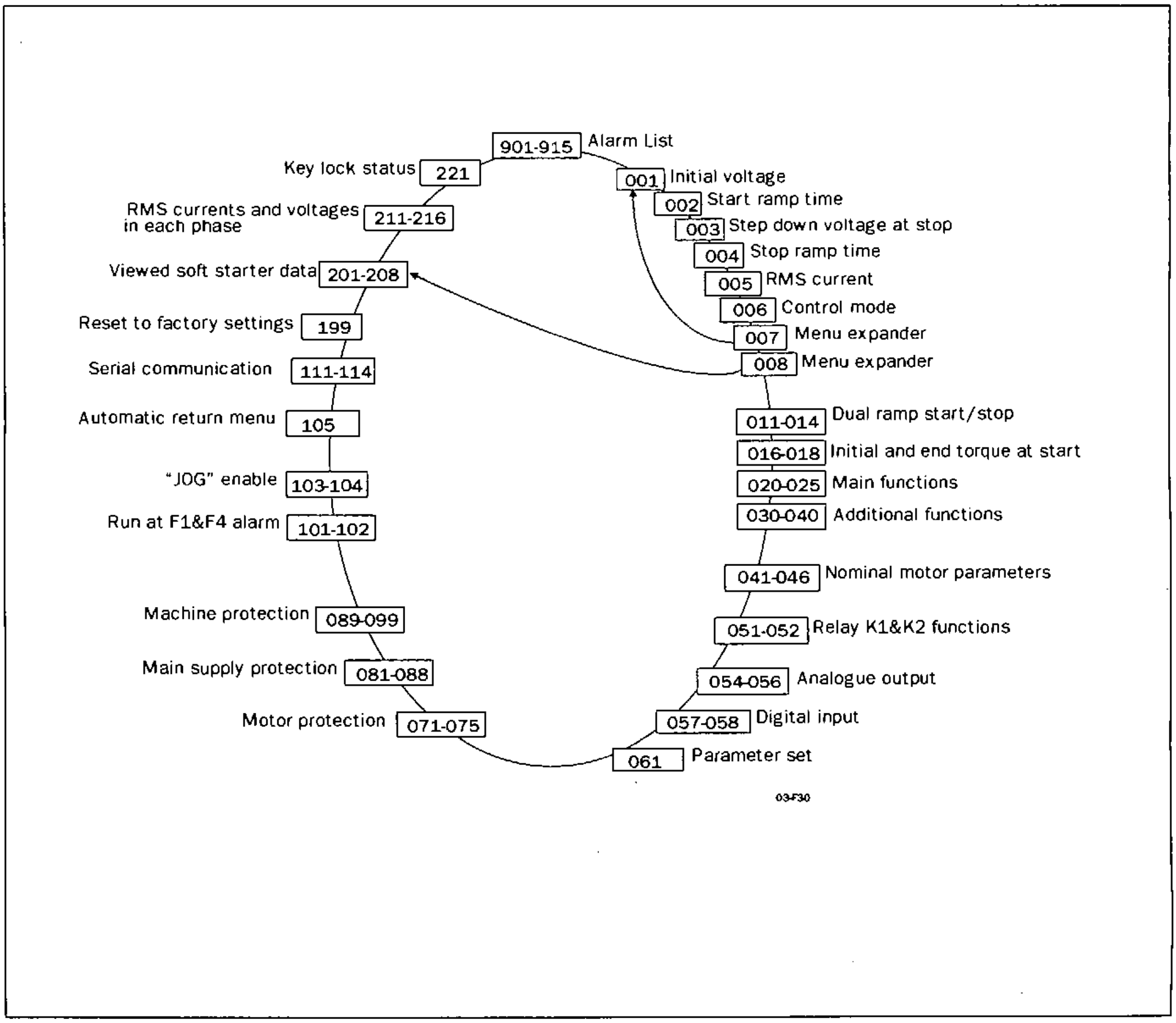


Fig. 15 Menu structure.

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.	START STOP
Display previous menu.	← PREV
Display next menu.	→ NEXT
Decrease value of setting.	−
Increase value of setting.	+
Confirm setting just made. Alarm reset.	ENTER ↵ RESET
JOG Reverse	
JOG Forward	

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 ○ ○

n o

Locked keyboard info

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.

Table 6 Control modes

Control mode	**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**
Keyboard Menu 006=1	Unlocked keyboard	Keyboard	Keyboard	Keyboard	————	Keyboard
	Locked keyboard	————	————	————	————	————
Remote Menu 006=2	Unlocked keyboard	Remote	Remote	Remote and keyboard	Remote	Keyboard
	Locked keyboard	Remote	Remote	Remote	Remote	————
Serial comm. 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

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

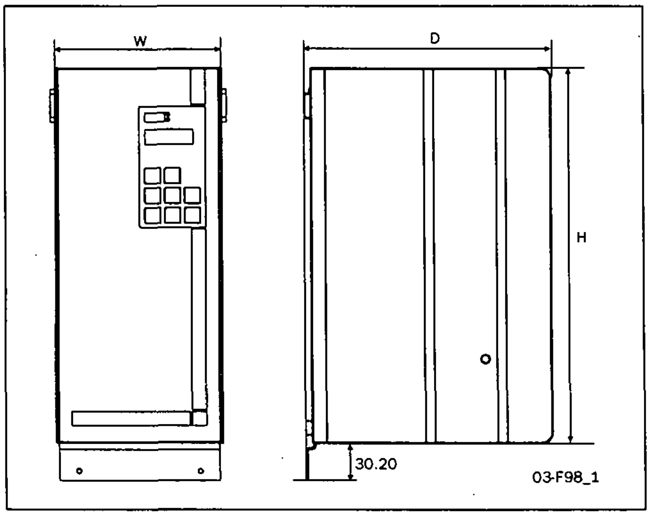


Fig. 16 MSF-017 to MSF-250 dimensions.

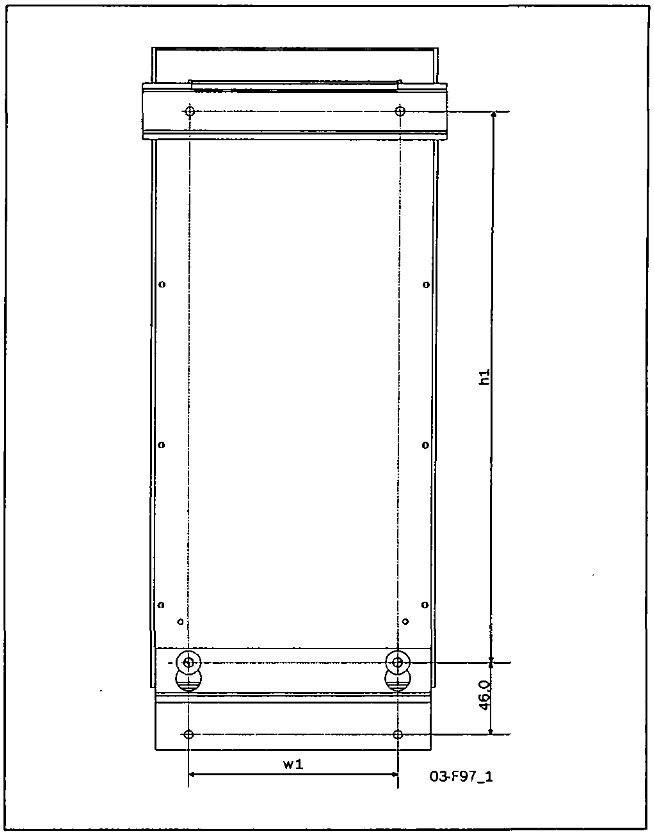


Fig. 17 Hole pattern for MSF-017 to MSF-250 (backside view).

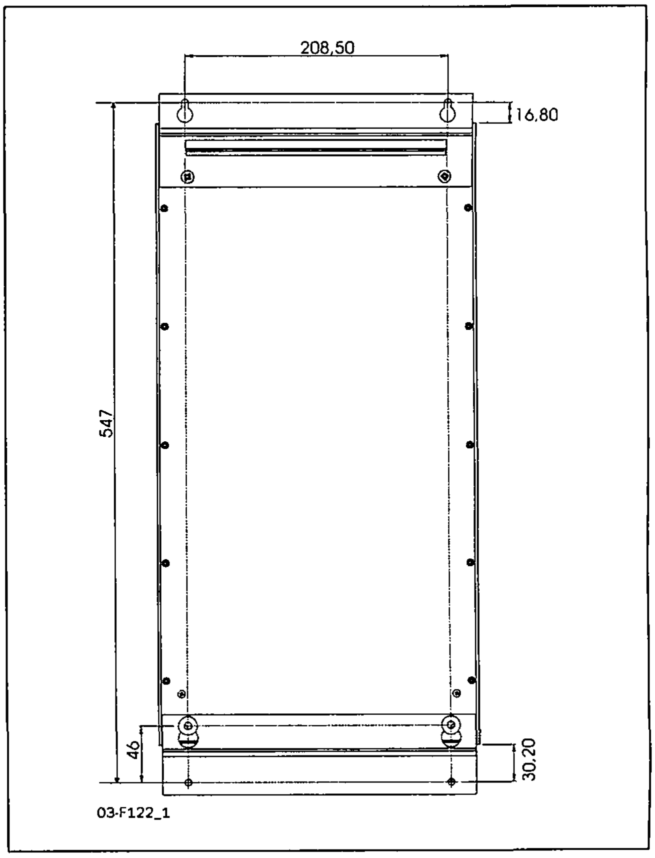


Fig. 18 Hole pattern for MSF-170 to MSF-250 with upper mounting bracket instead of DIN-rail.

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							

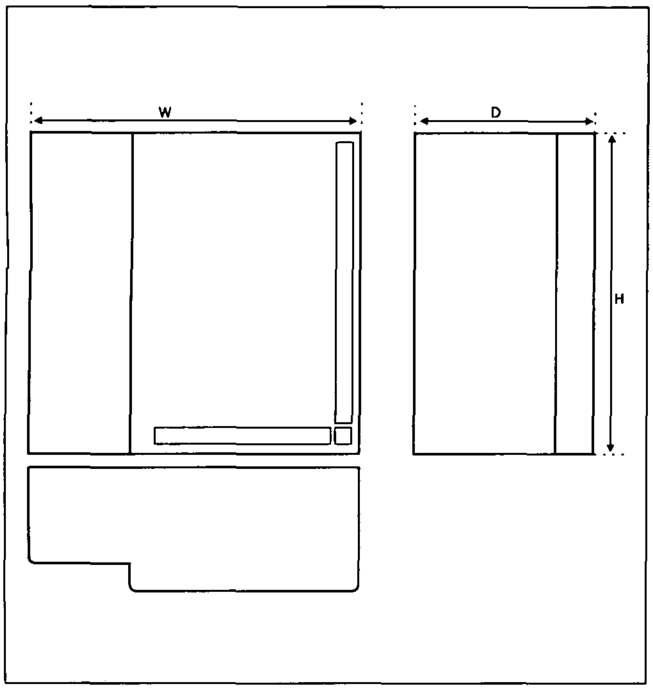


Fig. 19 MSF -310 to MSF -835.

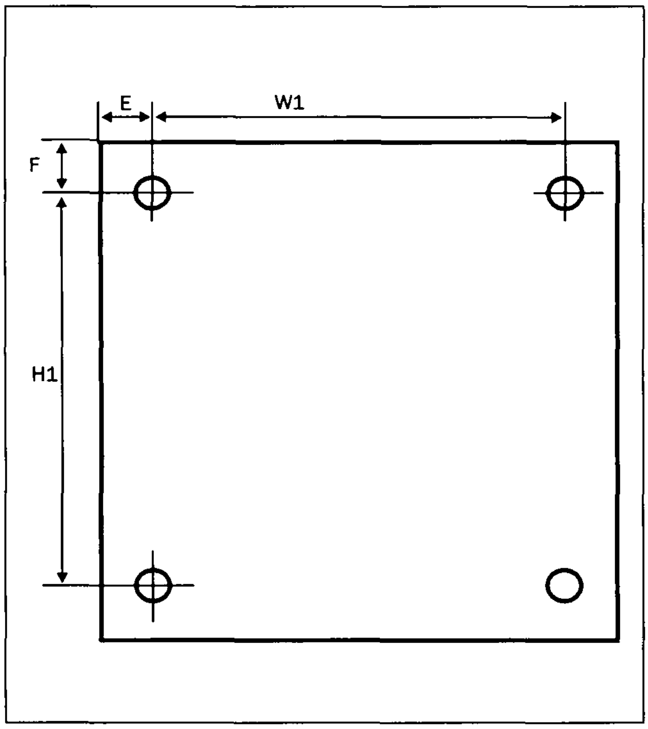


Fig. 20 Hole pattern for screw attachment, MSF-310 to MSF-835. Hole distance (mm).

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).

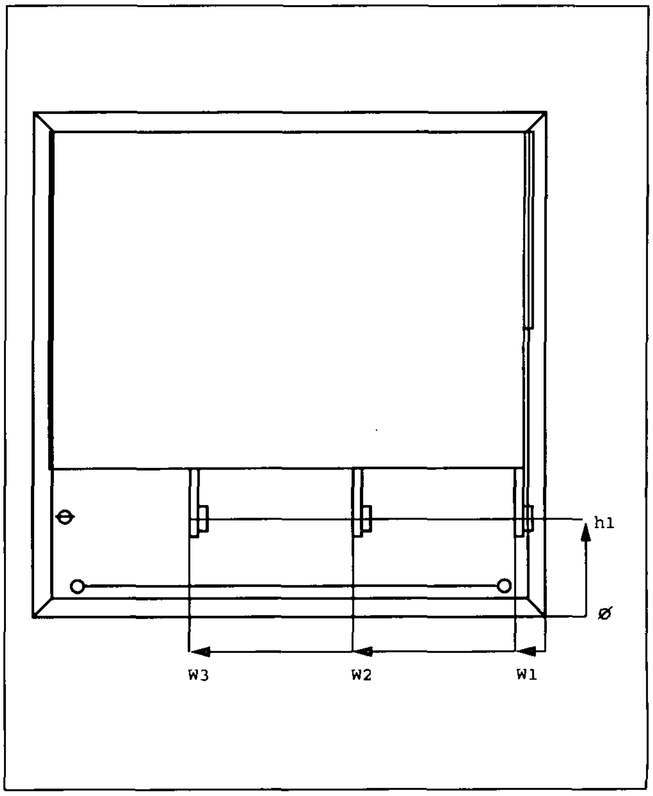


Fig. 21 Busbar distances MSF -310 to MSF -835.

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

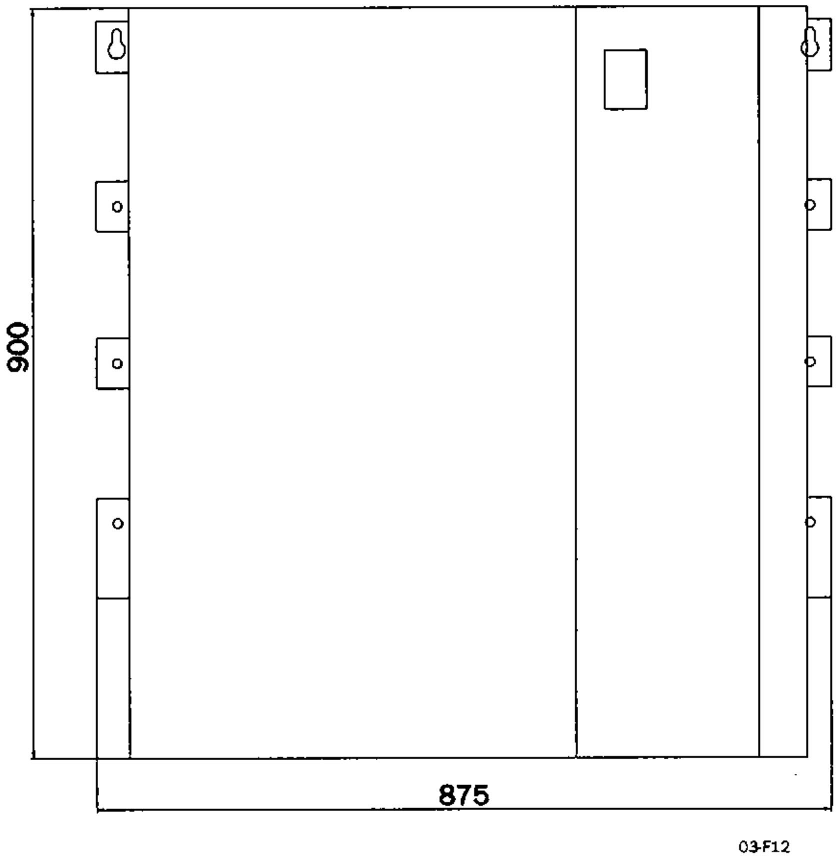


Fig. 22 MSF -1000 to -1400

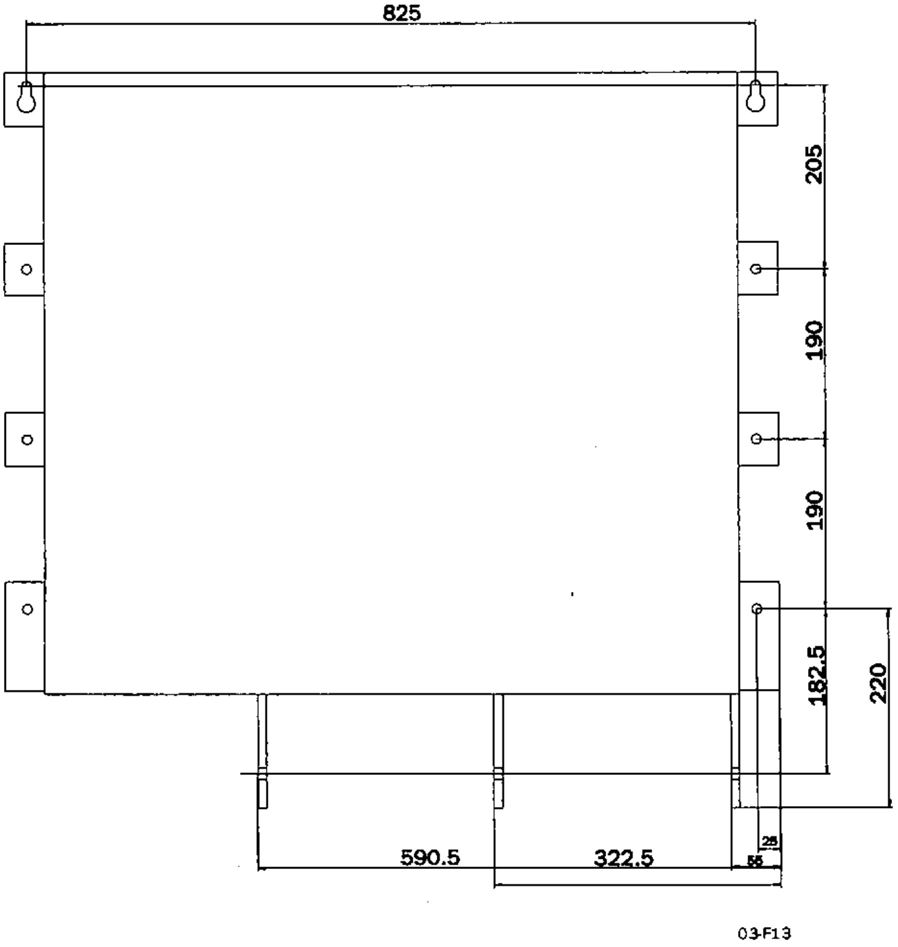


Fig. 23 Hole pattern busbar MSF -1000 to -1400.

6.2 Connections

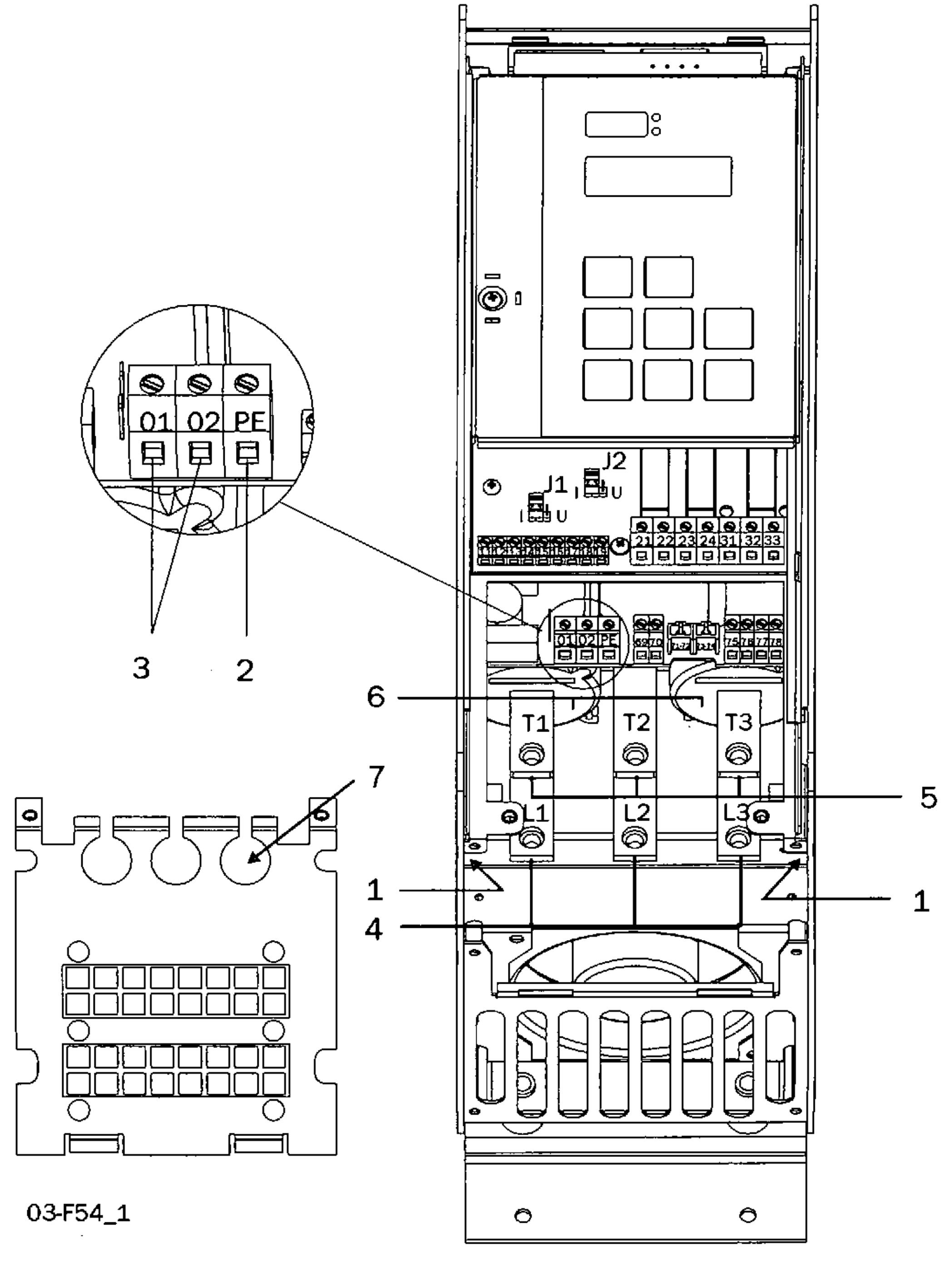


Fig. 24 Connection of MSF-017 to MSF -085.

Connection of MSF-017 to MSF-085

Device connections

1. Protective earth, ⏚ **(PE)**, Mains supply, Motor (on the right and left inside of the cabinet)
2. Protective earth, ⏚ **(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

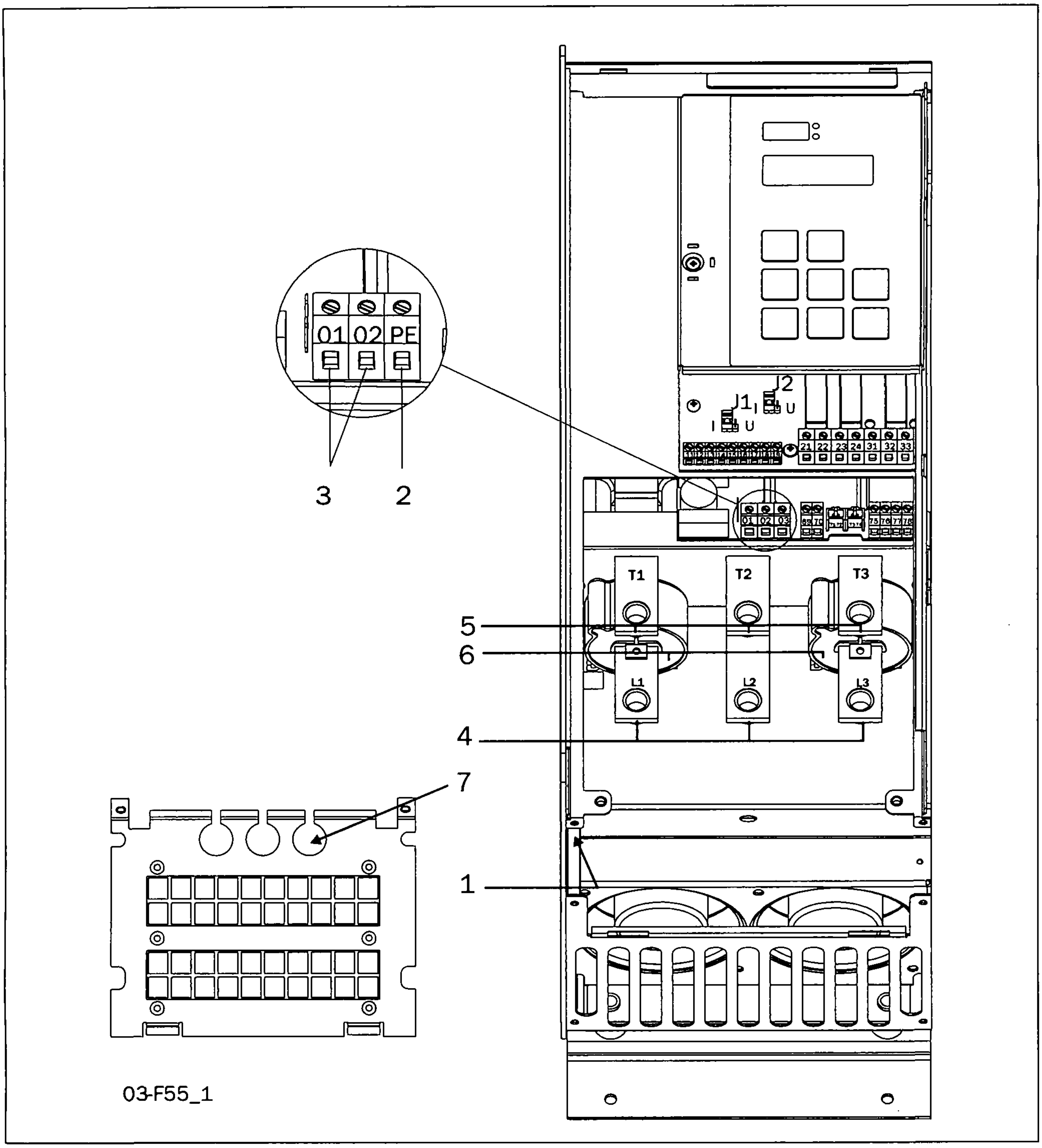


Fig. 25 Connection of MSF-110 to MSF-145.

Connection of MSF-110 to MSF-145

Device connections

1. Protective earth, ⏚ **(PE)**, Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth ⏚ **(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

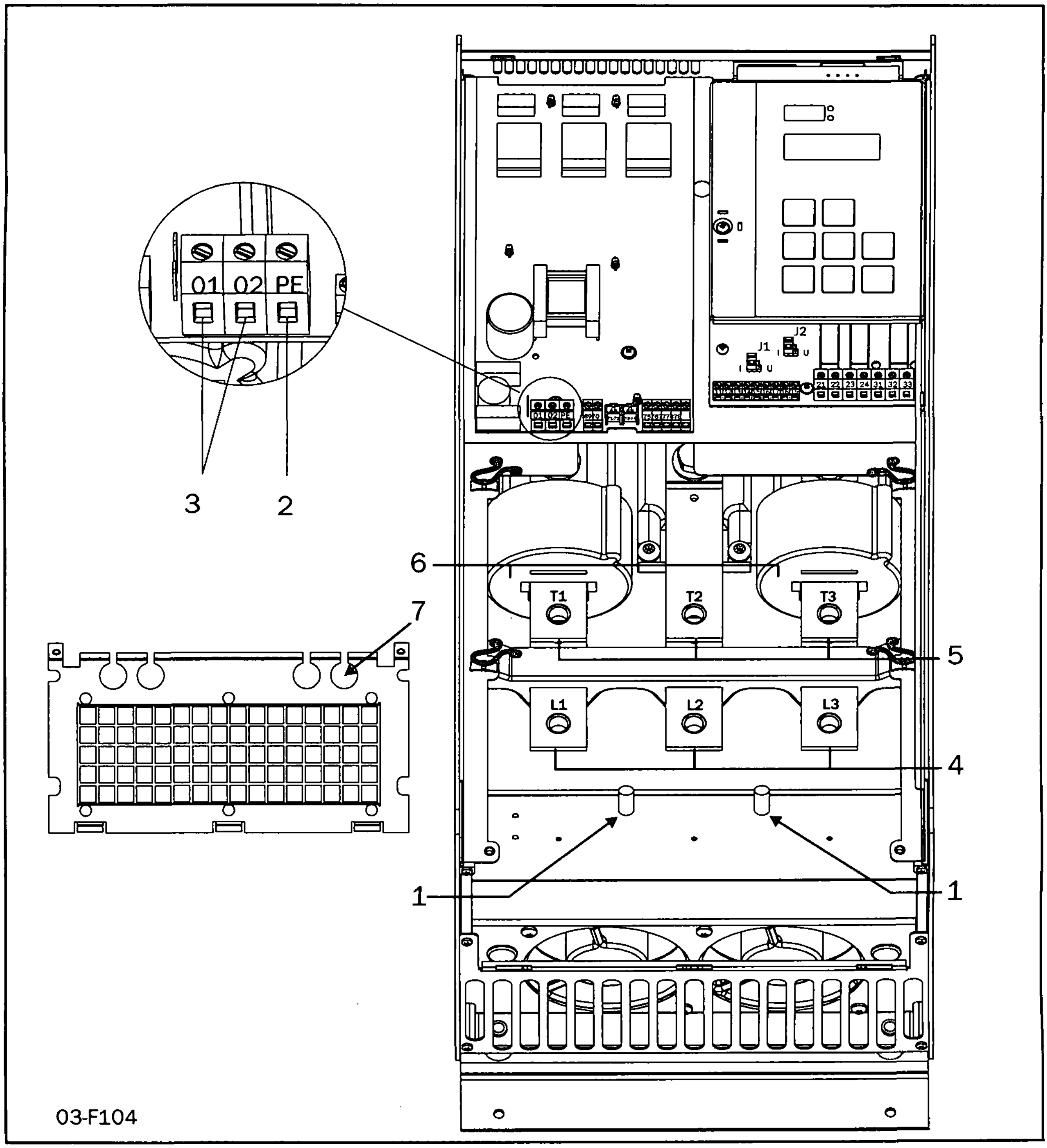


Fig. 26 Connection of MSF-170 to MSF-250

Connection of MSF-170 to MSF-250

Device connections

1. Protective earth, ⏚ **(PE)**, Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth ⏚ **(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

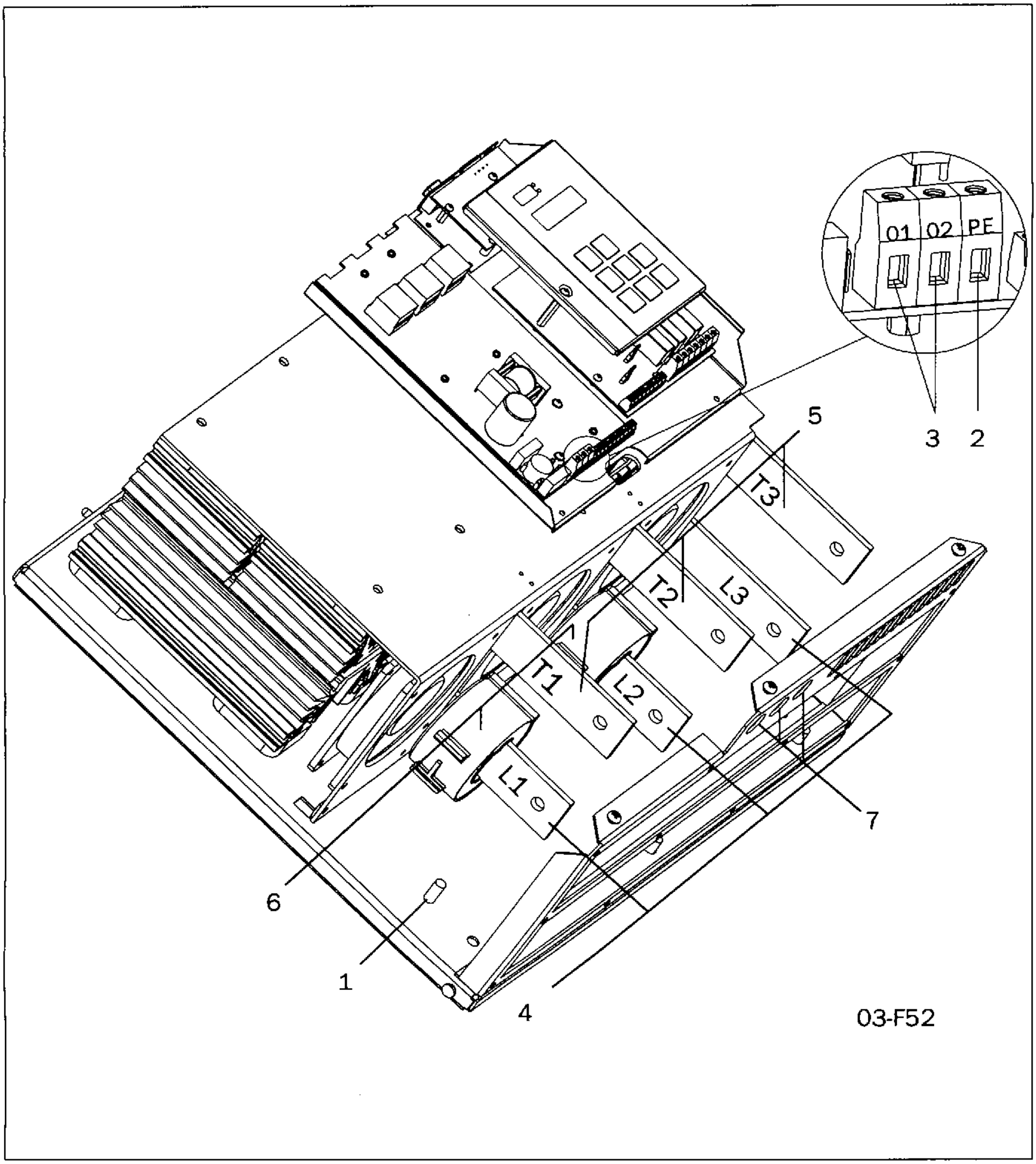


Fig. 27 Connection of MSF-170 to MSF-1400.

Connection of MSF-310 to MSF-1400

Device connections

1. Protective earth, ⏚ **(PE)**, Mains supply and Motor
2. Protective earth, ⏚ **(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

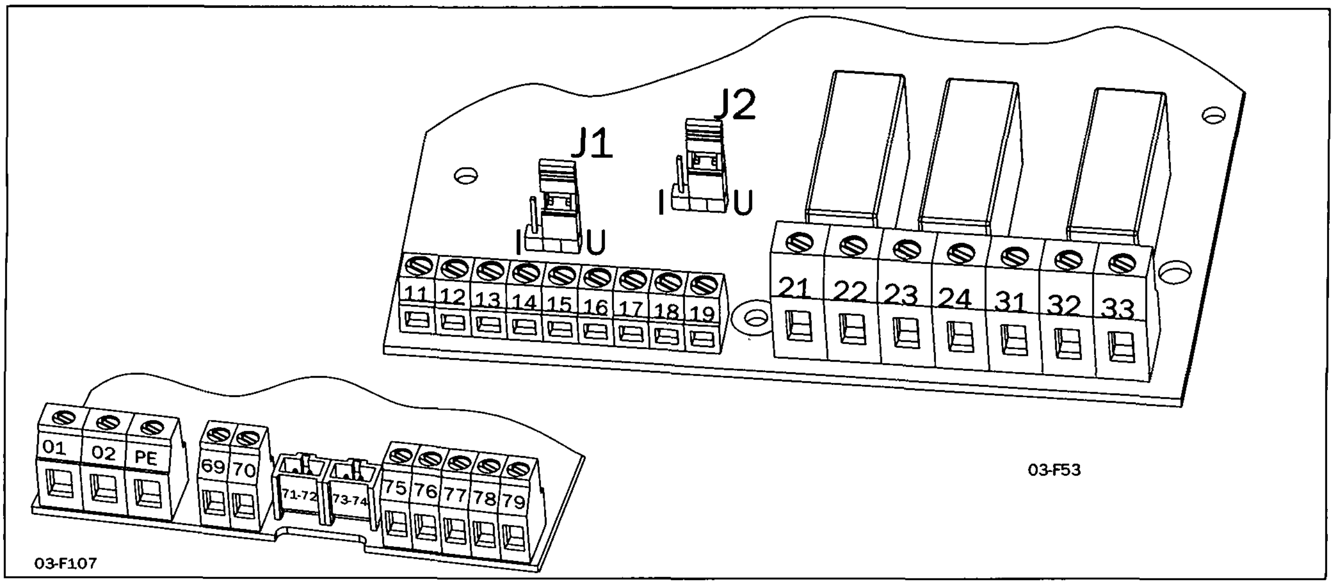


Fig. 28 Connections on the PCB, control card.

Table 12 PCB Terminals

Terminal	Function	Electrical characteristics
01	Supply voltage	100-240 VAC ±10%/380-500 VAC ± 10%
02		
PE	Gnd	⏚
11	Digital inputs for start/stop and reset.	0-3 V --> 0; 8-27 V-> 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 kΩ.
12		
13	Supply/control voltage to PCB terminal 11 and 12, 10 kΩ potentiometer, etc.	+12 VDC ±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 kΩ, current signal: 100 Ω.
15	GND (common)	0 VDC
16	Digital inputs for selection of parameter set.	0-3 V --> 0; 8-27 V-> 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 kΩ.
17		
18	Supply/control voltage to PCB terminal 16 and 17, 10 kΩ potentiometer, etc.	+12 VDC ±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 700Ω 0-20mA and 4-20mA;max load impedance 750Ω
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 kΩ Switch back level 2.2 kΩ.
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

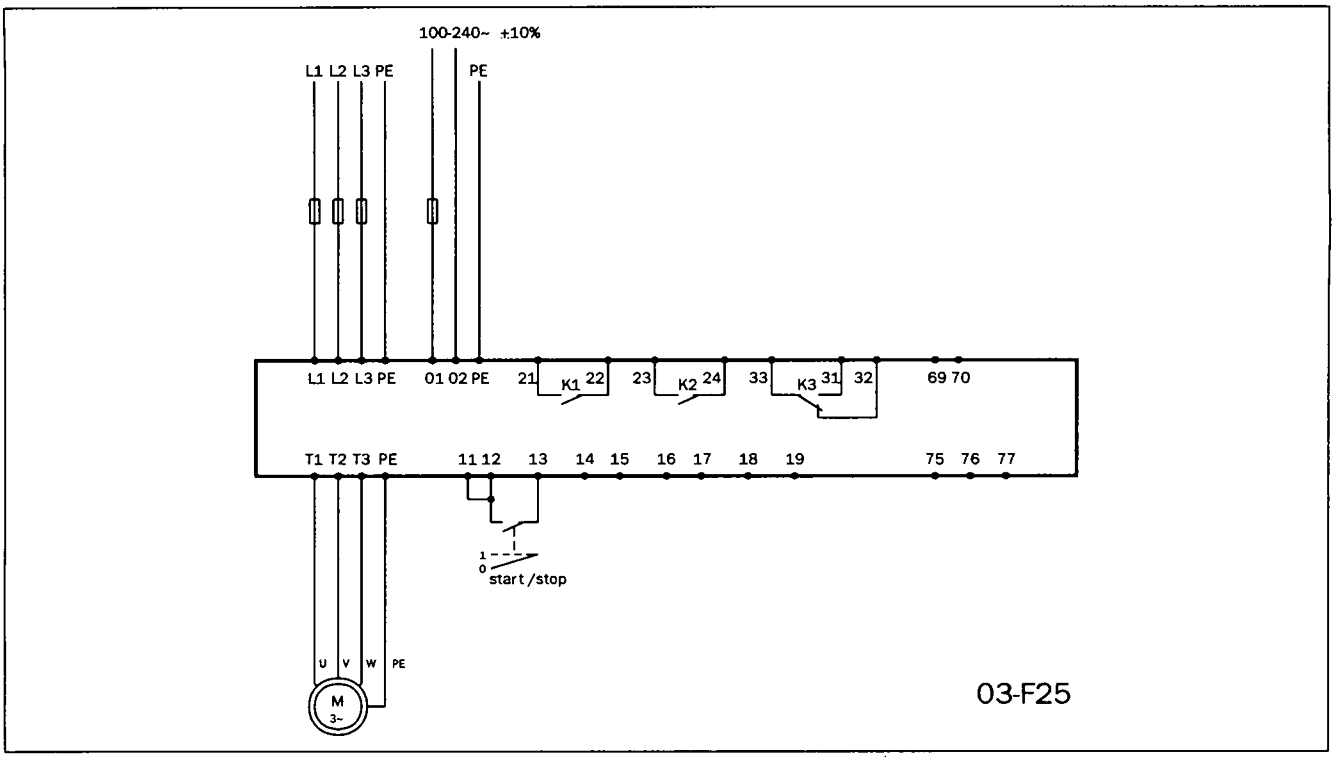


Fig. 29 Wiring circuit, "Minimum wiring".

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 ⏚ (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.

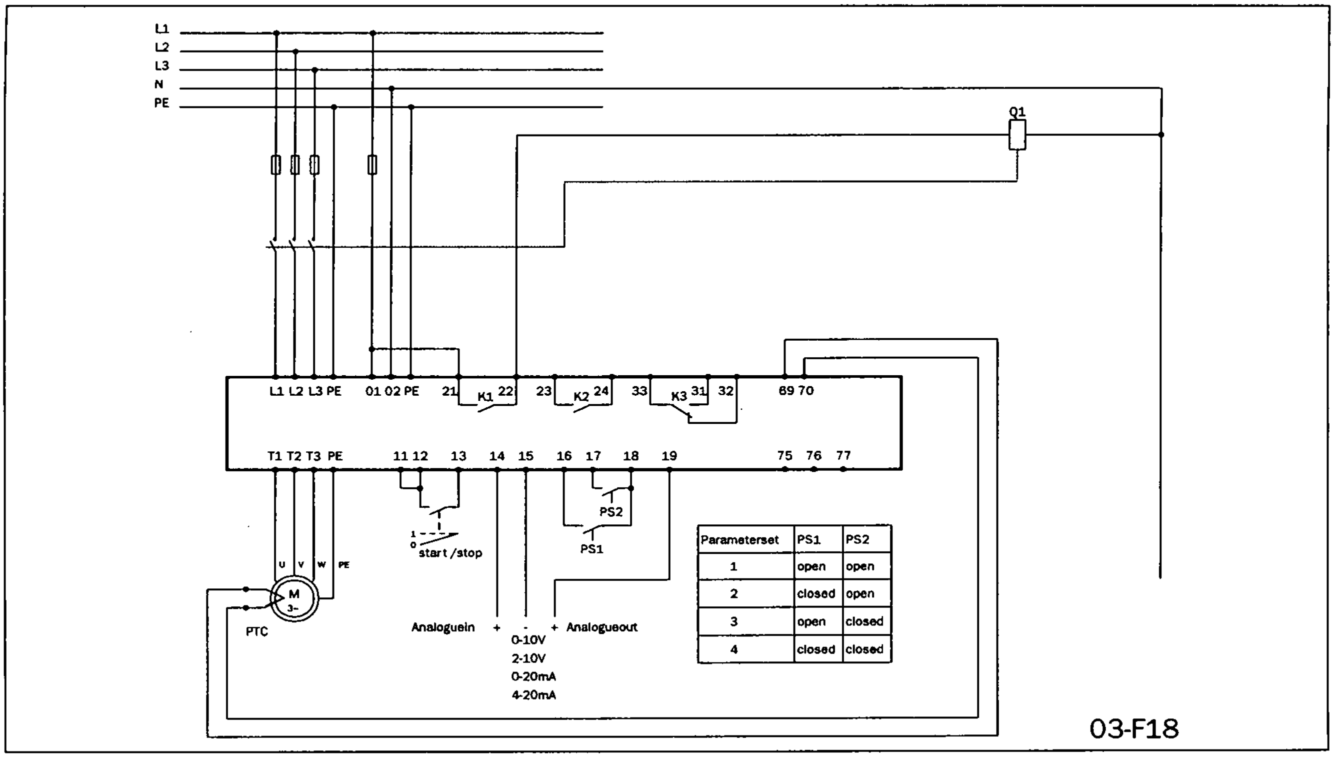
NOTE! If local regulations say that a mains contactor should be used, the K1 then controls it. Always use standard commercial, slow blow fuses, e.g. type gl, gG to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses 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.



Parameterset	PS1	PS2
1	open	open
2	closed	open
3	open	closed
4	closed	closed

Fig. 30 Analogue input control, parameter set, analogue output and PTC input.

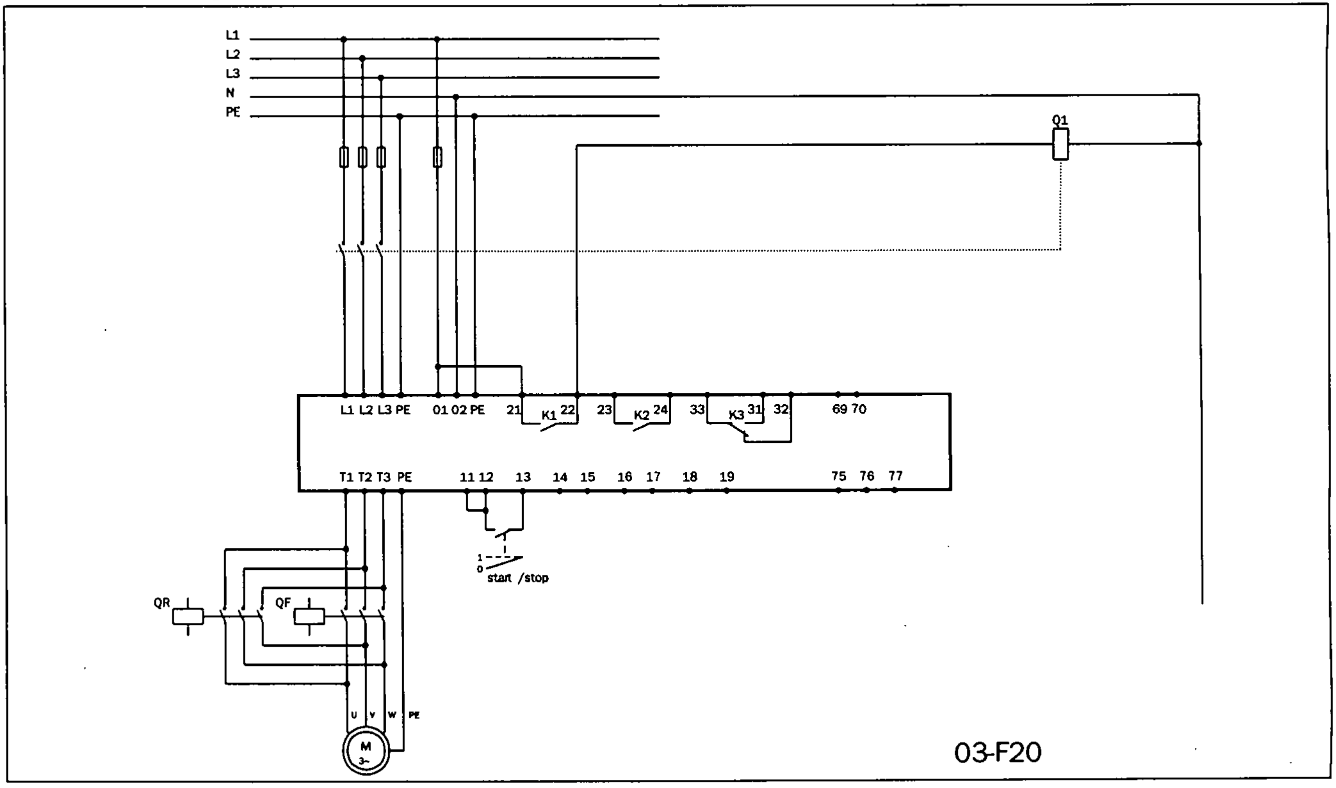


Fig. 31 Forward/reverse wiring circuit.

7. FUNCTIONAL DESCRIPTION SET-UP MENU

This chapter describes all the parameters and functions in numerical order as they appear in the MSF. 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 §
Basic functions	001-008	Basic	Ramp up/down parameters	001-005	7.1
			Start/Stop/Reset command	006	7.2
			Menu Expansion	007-008	7.3
Extended functions	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
View functions	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

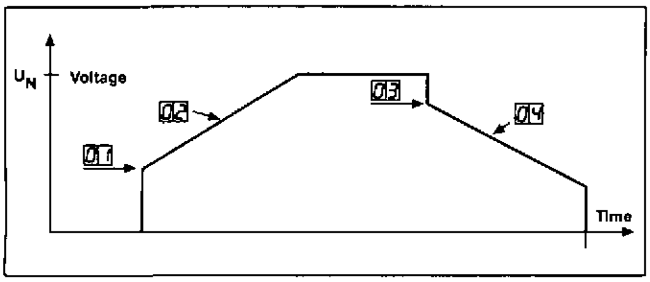


Fig. 32 Menu numbers for start/stop ramps, initial voltage at start and step down voltage at stop.

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

30

Setting the initial voltage at start ramp 1

Default:	30%
Range:	25 - 90% U_n

Set the initial voltage. Normally the factory setting, 30% of U_n, is a suitable choice.

002

10

Setting of start ramp 1

Default:	10 sec
Range:	1-60 sec

Set "Ramp up time" at start.

003

100

Setting of step down voltage stop ramp 1

Default:	100%
Range:	100-40% of U_n

Step down voltage at stop can be used to stop smoothly.

004

oFF

Setting of stop ramp 1

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

0.0

RMS current

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.

006 2	**Selection of control mode**
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. **WARNING! The motor will start if terminals 11, 12, 13 is in start position.**
3	START/STOP/RESET commands via serial interface option. Read the operating instruction supplied with this option.

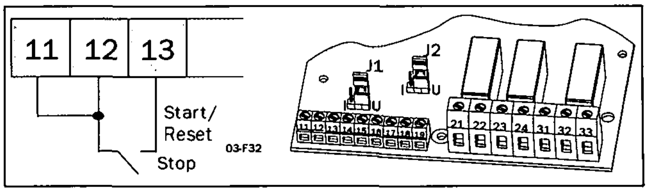
NOTE! A reset via the keyboard will not start or stop the motor.

NOTE! Factory default setting is 2, remote control.

To start and stop from the keyboard, the "START/STOP" key is used.

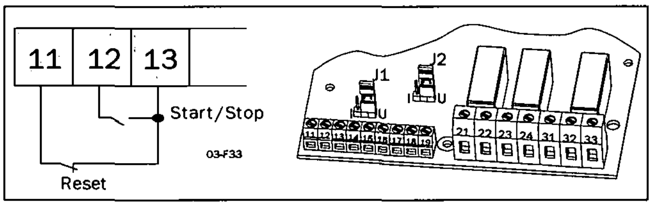
To reset from the keyboard, the "ENTER ↵ / RESET" key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset from the keyboard will not start or stop the motor.

7.2.1 2-wire start/stop with automatic reset at start



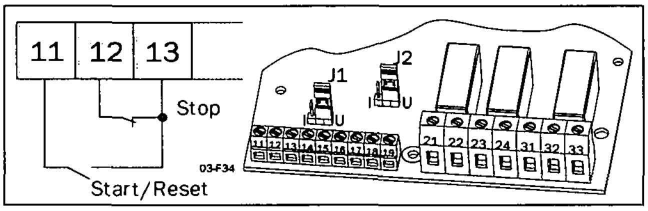
Closing PCB terminals 12 and 13, and a jumper between terminal 11 and 12, will give a start command. Opening the terminals will give a stop. If PCB terminals 12 and 13 is closed at power up a start command is given (automatic start at power up). When a start command is given there will automatically 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	
oFF	**Selecting of extended functions and viewing functions**
Default:	oFF
Range:	oFF, on
oFF	Only function 1-7 are visible
on	- View functions 201-915 are visible - Extended functions (menu 008) selectable

008	
oFF	**Selecting of extended functions**
Default:	oFF
Range:	oFF, on
oFF	Only view function 201-915 are visible.
on	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.

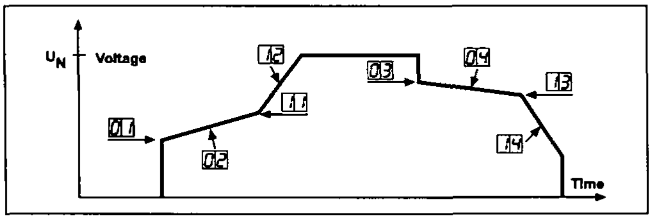


Fig. 33 Menu numbers for dual voltage ramp at start/stop, initial voltage at start and step down-voltage at stop.

The settings are carried out by beginning with the settings in menus 001-004 and 007-008 and proceed with the following steps:

011	
90	**Setting the initial voltage at start ramp 2**
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	
oFF	**Setting of start ramp 2**
Default:	oFF
Range:	oFF, 1-60 sec
oFF	Start ramp 2 disabled
1-60	Set the start ramp 2 time. A dual voltage ramp is active.

013	
40	**Setting of step down voltage in stop ramp 2**
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	
oFF	**Setting of stop ramp time 2**
Default:	oFF
Range:	oFF, 2-120 sec
oFF	Stop ramp 2 disabled
1-60	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

10

Initial torque at start

Default:	10
Range:	0 - 250% of Tn

Insert initial torque at start in percent of nominal shaft torque (Tn), see chapter 13. page 79.

017

150

End torque at start

Default:	150
Range:	50 - 250% of Tn

Insert end torque at start in percent of nominal shaft torque.

018

0

End torque at stop

Default:	0
Range:	0 - 100% of Tn

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 In). 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 In in menu 020.

020

oFF

Voltage ramp with current limit at start

Default:	oFF
Range:	oFF, 150 - 500% In
oFF	Voltage Ramp mode with current limit disabled. Voltage Ramp enabled.
150-500	Current limit level in Voltage ramp mode.

NOTE! Only possible when Voltage Ramp mode is enabled. Menus 021-025 must be "oFF".

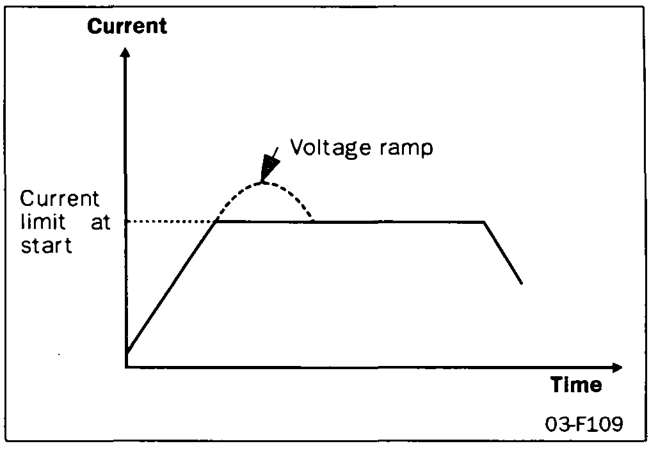


Fig. 34 Current limit

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

oFF

Current limit at start

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.

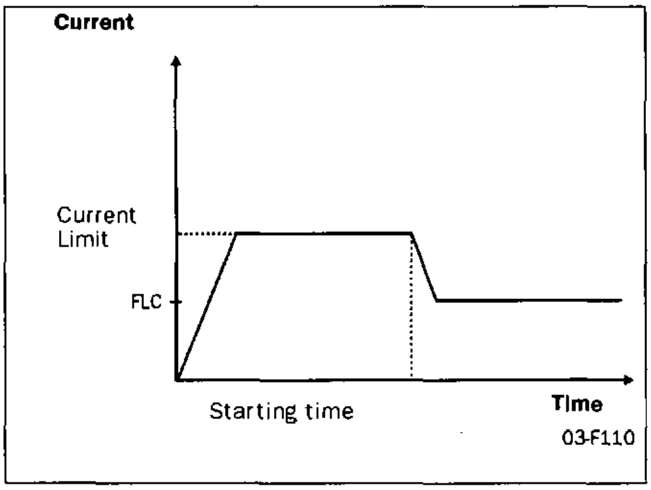


Fig. 35 Current limit

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.

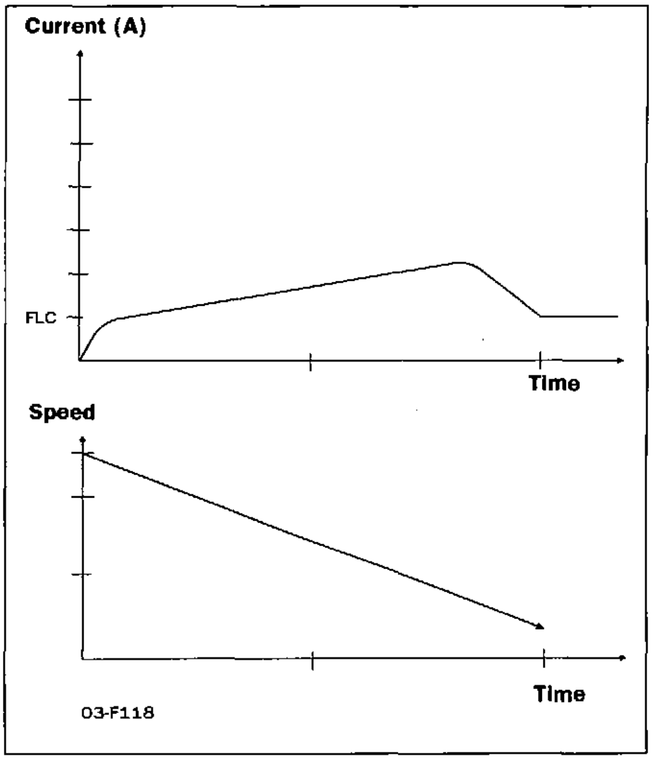


Fig. 36 Pump control

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

oFF

Setting of pump control

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 (–).

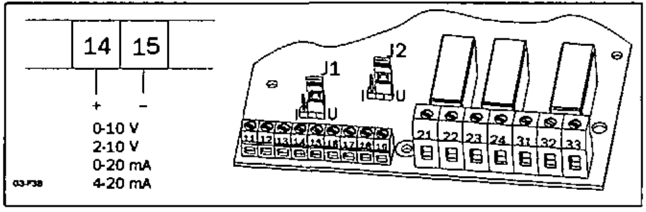


Fig. 37 Wiring for analogue input.

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).

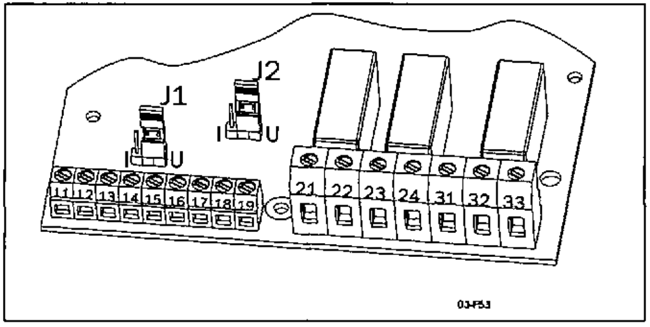


Fig. 38 Setting voltage or current for analogue input.

023

oFF

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

oFF

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".

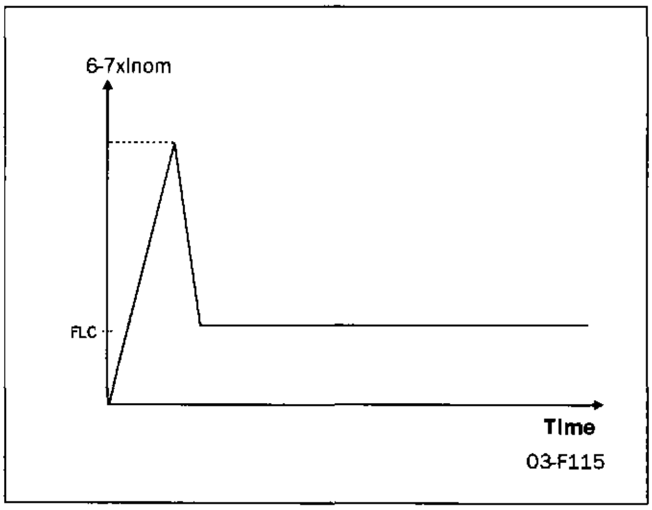


Fig. 39 Full voltage start.

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

oFF

Torque control at start/stop

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").

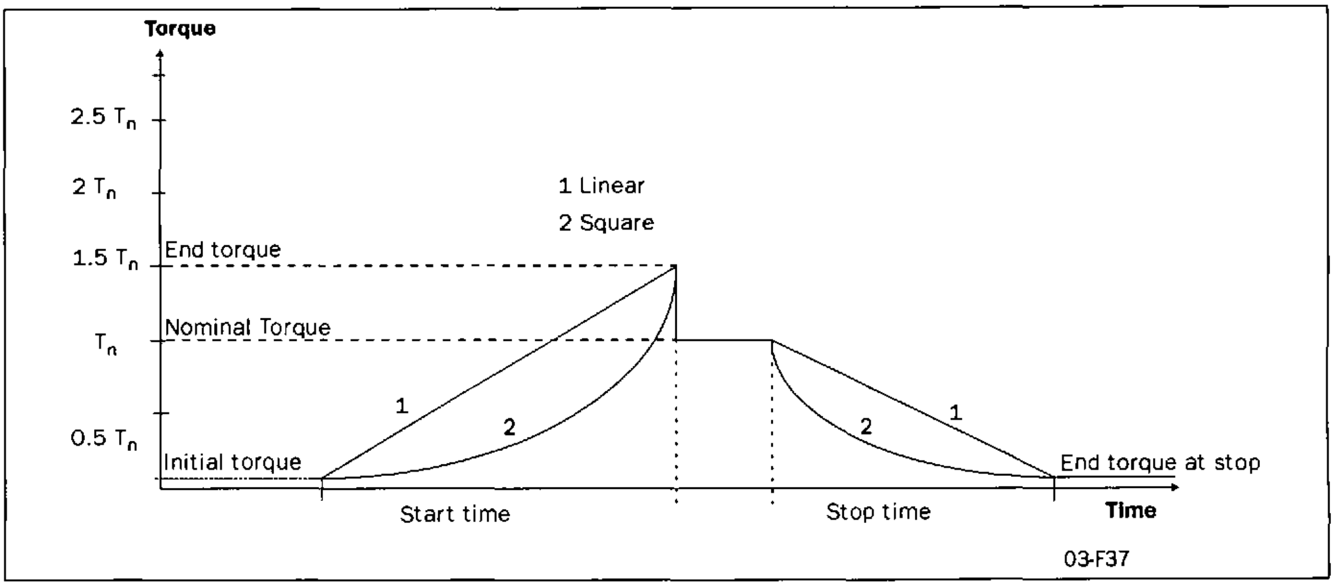


Fig. 40 Torque control at start/stop.

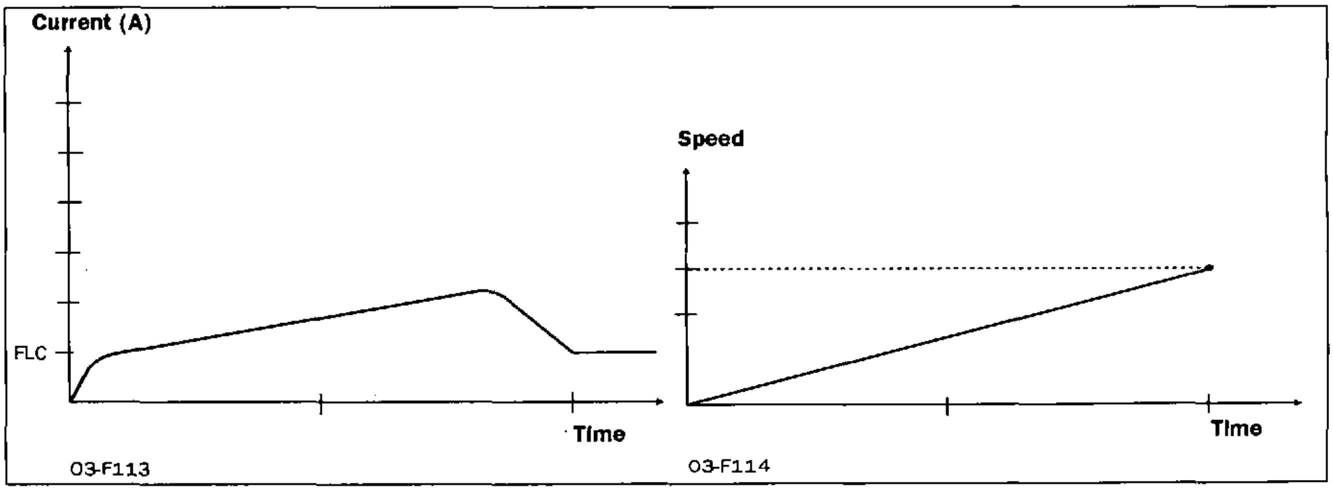


Fig. 41 Current and speed in torque control.

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.

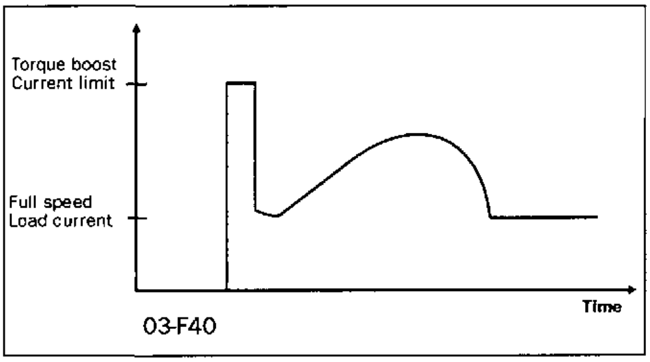


Fig. 42 The principle of the Torque Booster when starting the motor in voltage ramp mode.

See § 4.6, page 19, which main function that can be used with the torque boost.

030

Torque boost active time

oFF

Default:	oFF
Range:	oFF, 0.1 - 2 sec
oFF	Torque boost disabled
0.1-2.0	Set the Torque boost time.

031

Torque boost current limit

300

Default:	300
Range:	300 - 700% of In
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

Setting of Bypass

oFF

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.

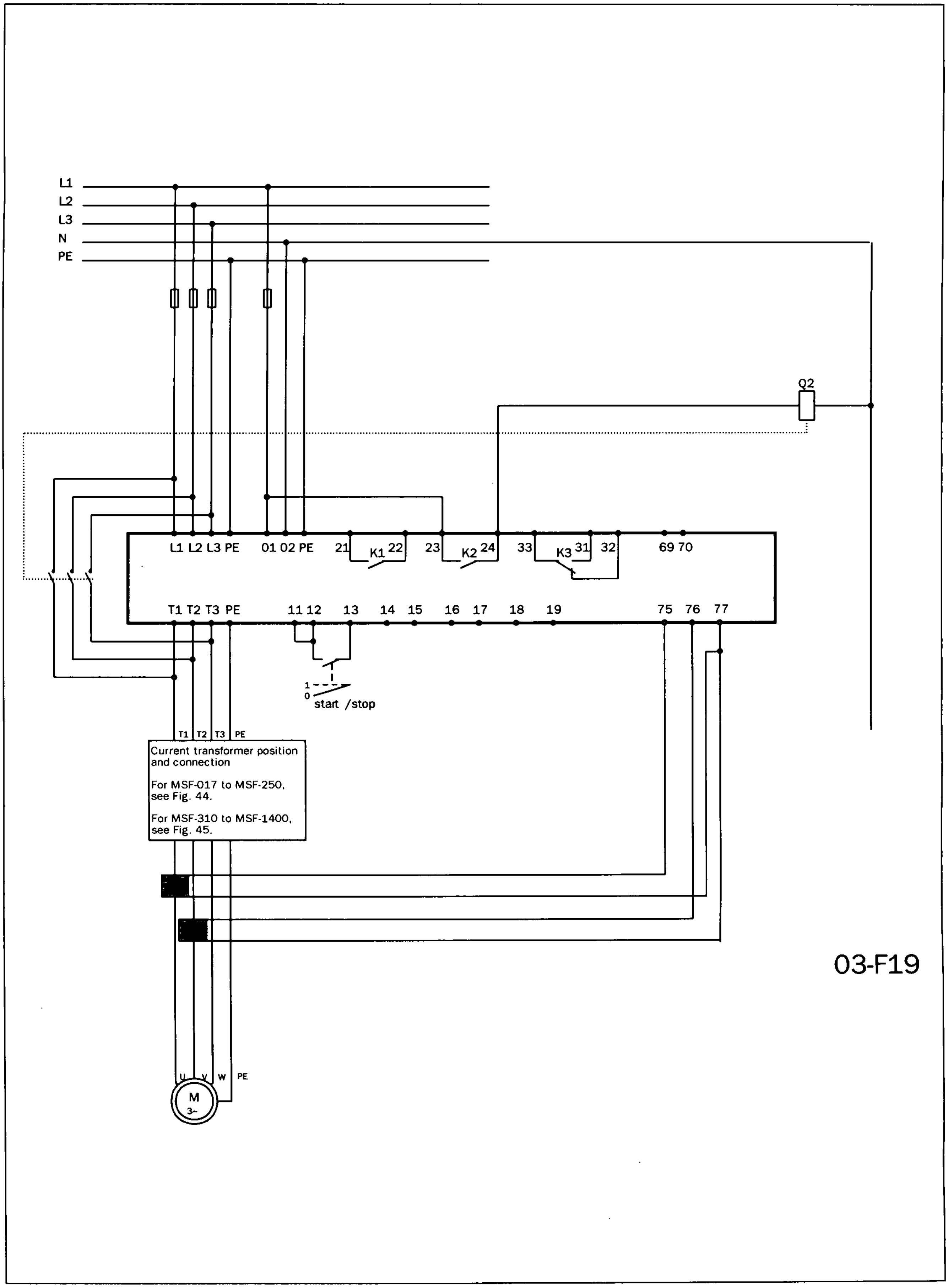


Fig. 43 Bypass wiring example MSF 310-1400.

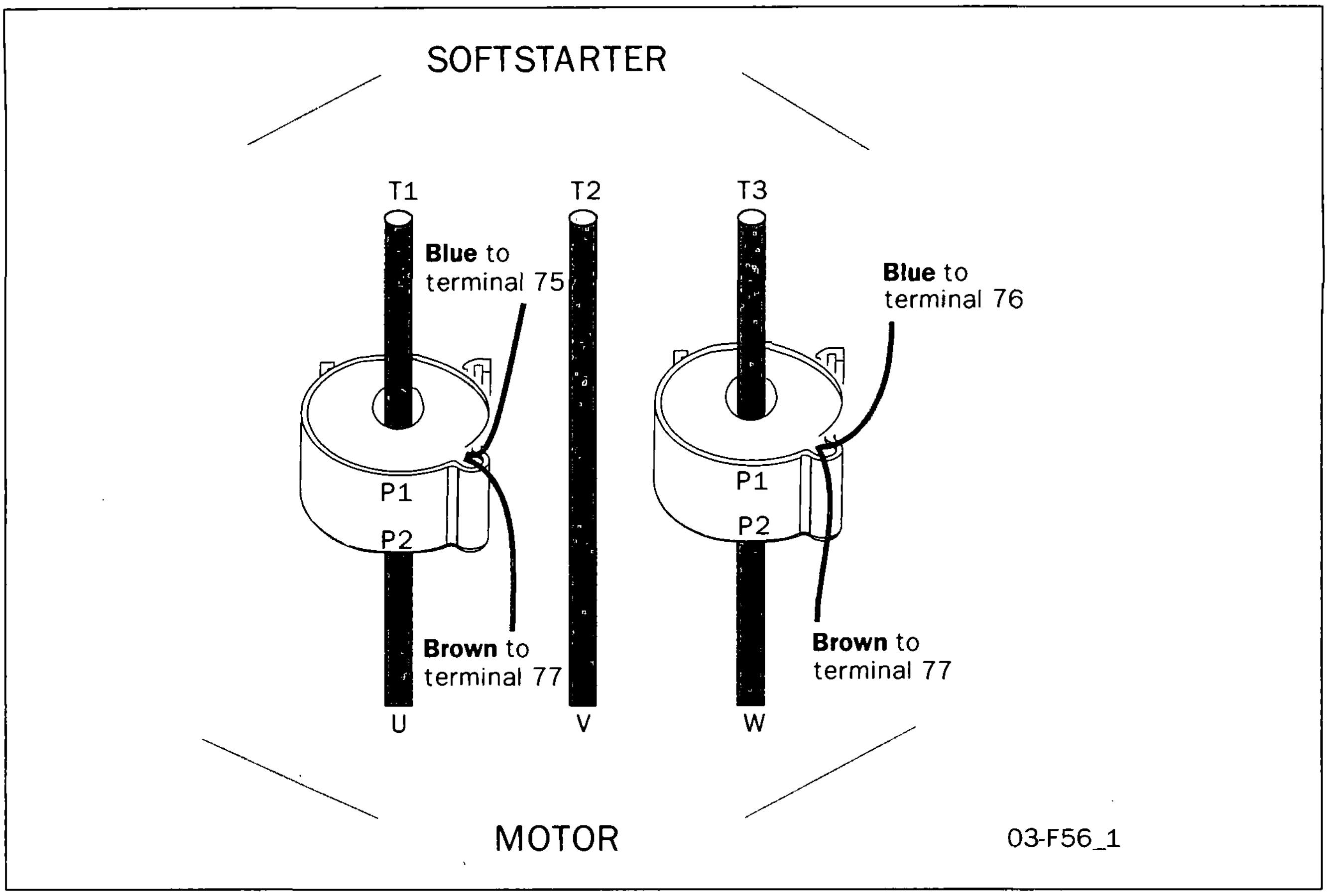


Fig. 44 Current transformer position when Bypass MSF-017 to MSF-250.

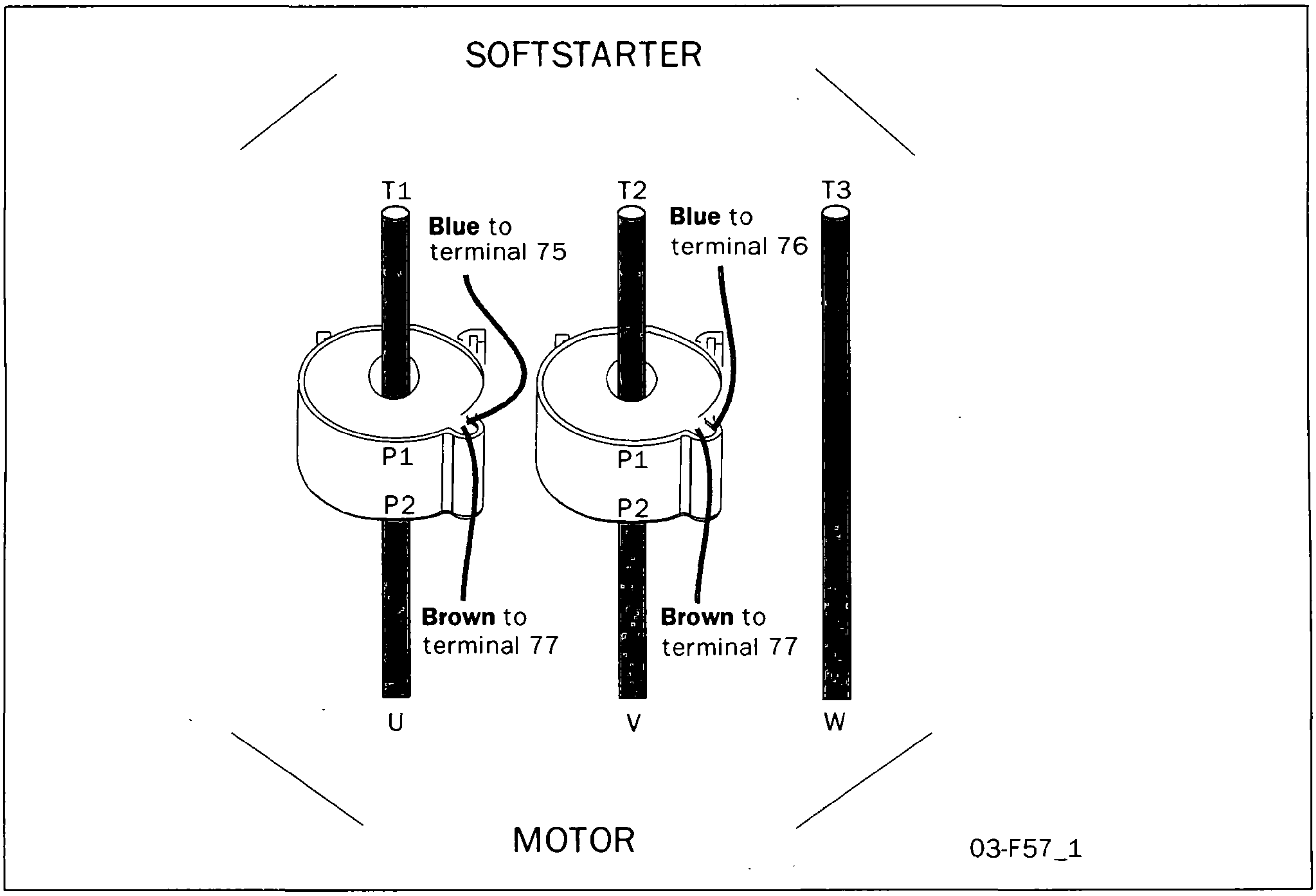


Fig. 45 Current transformer position when Bypass MSF-310 to MSF-1400.

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 oFF	**Setting of PFC**
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 were 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 oFF	**Braking time**
Default:	oFF
Range:	oFF, 1 - 120 sec
oFF	Brake function disabled
1-120	Brake time

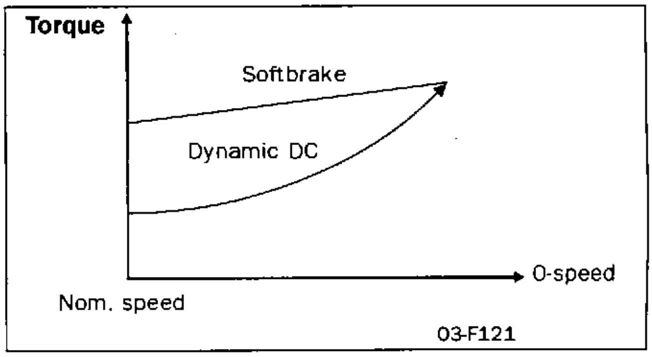


Fig. 46 Braking time

035

Braking Strength

100

Default:	100
Range:	100 - 500%

036

Brake method

1

Default:	1
Range:	1, 2
1	Dynamic vector brake, active
2	Soft brake active

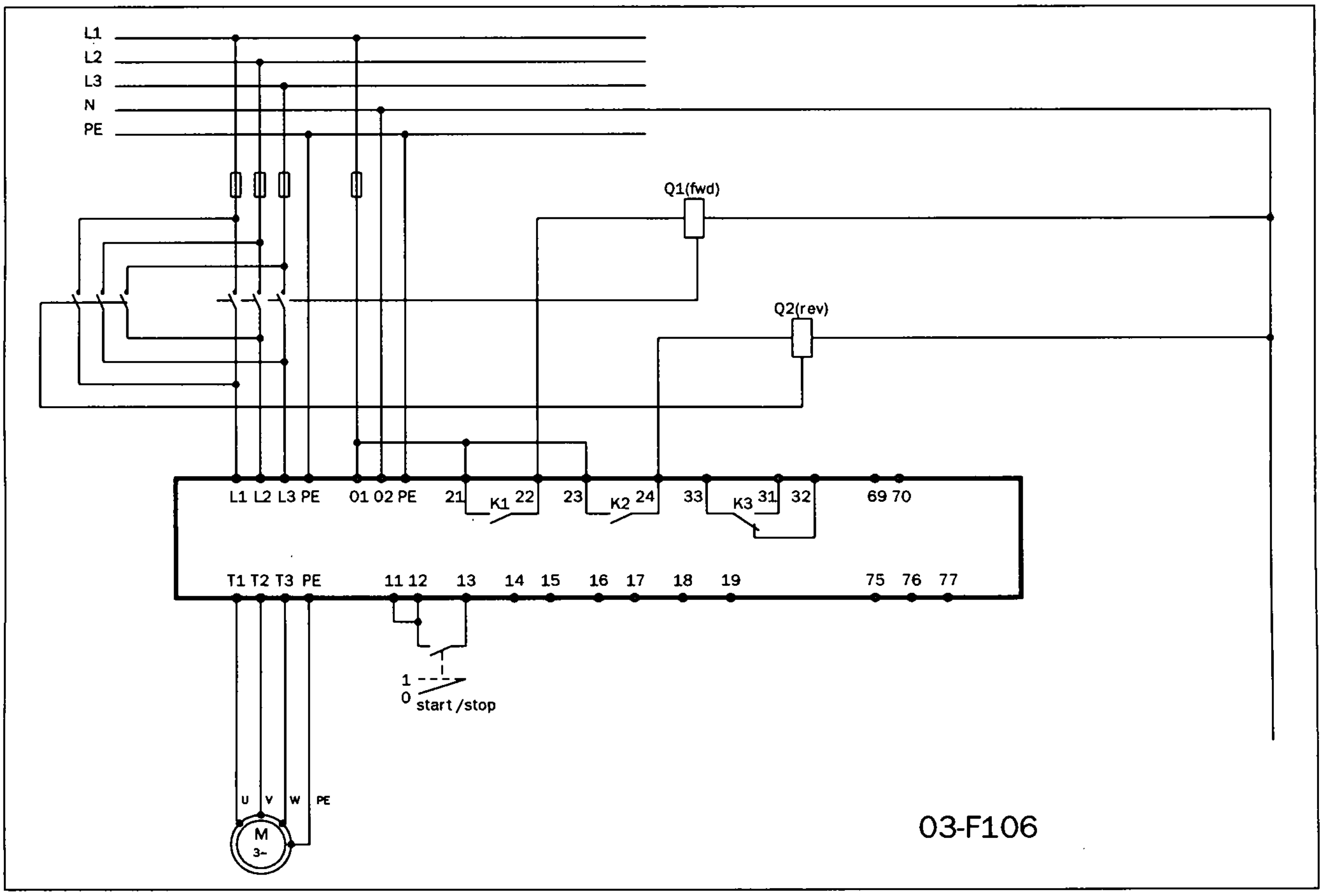


Fig. 47 Soft brake wiring example.

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 (se § 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.

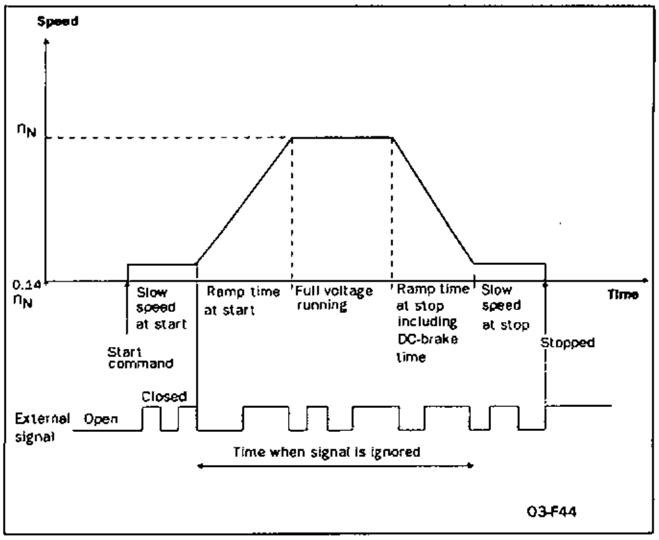


Fig. 48 Slow speed controlled by an external signal.

This additional function can be used together with most of the main functions (see § 4.6, page 19).

037

10

Slow speed torque

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 oFF	**Slow speed time at start**
Default:	oFF
Range:	oFF, 1 - 60 sec
oFF	Slow speed at start is disabled
1-60	Set slow speed time at start.

039 oFF	**Slow speed time at stop**
Default:	oFF
Range:	oFF, 1 - 60 sec
oFF	Slow speed at stop is disabled
1-60	Set slow speed time at stop.

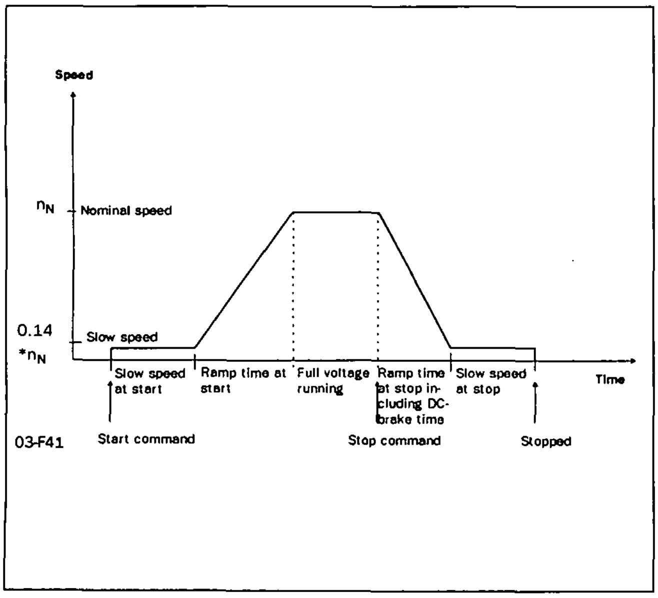


Fig. 49 Slow speed at start/stop during a selected time.

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 oFF	**DC-Brake at slow speed**
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	
400	**Nominal motor voltage**
Default:	400 V
Range:	200-700 V
Make sure the soft starters maximum voltage rating is suitable for chosen motor voltage.	

042	
17	**Nominal motor current**
Default:	Nominal soft starter current
Range:	25% - 150% of Insoft in Amp.

043	
7.5	**Nominal motor power**
Default:	Nominal soft starter power
Range:	25% - 300% of Pnsoft in kW

044	
1450	**Nominal motor speed**
Default:	Nnsoft in rpm
Range:	500-3600 rpm

045	
0.86	**Nominal motor cos phi**
Default:	0.86
Range:	0.50-1.00

046	
50	**Nominal frequency**
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.

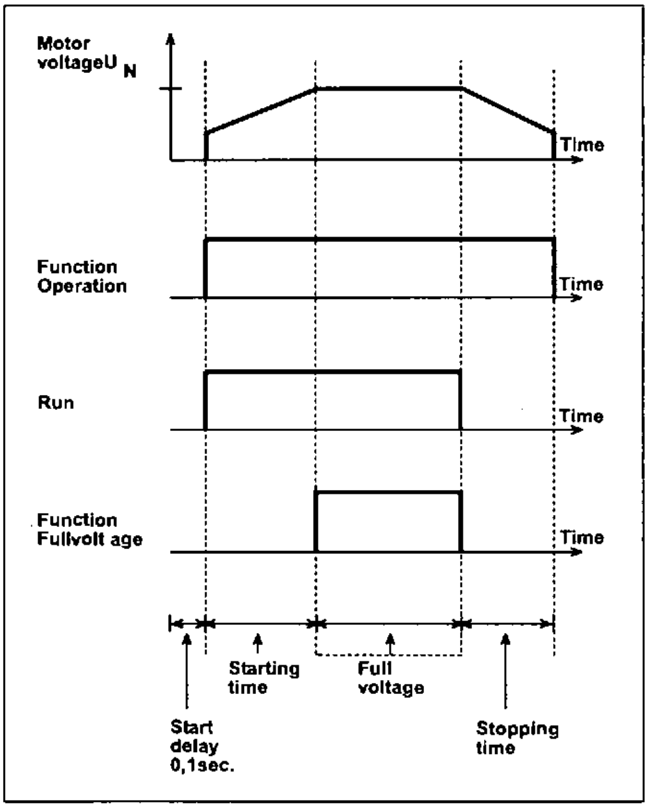


Fig. 50 Start/stop sequence and relay function "Operation" and "Full voltage".

051

1

Setting of K1 indication

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

2

Setting of K2 indication

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 (-).

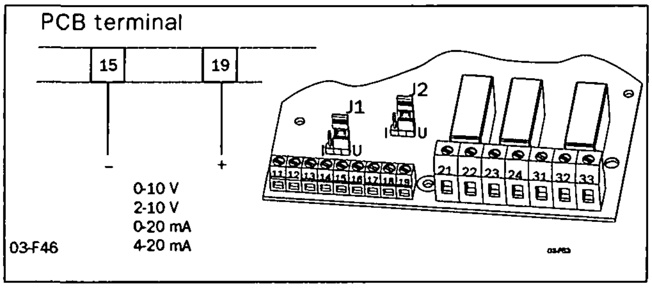


Fig. 51 Wiring for analogue output.

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.

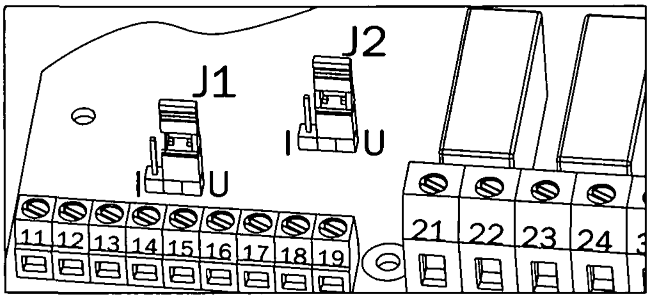


Fig. 52 Setting of current or voltage output.

3. Set the parameter in menu 054.

054

oFF

Analogue output

Default:	oFF
Range:	oFF, 1, 2
oFF	Analogue ouput 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

1

Analogue output value

Default:	1
Range:	1, 2, 3
1	RMS current, default range 0-5xIn
2	Line input RMS voltage, default range 0-720V
3	Output shaft power, default range 0-2xPn

5. Set analogue output gain to adjust the range of chosen analogue output value in menu 056.

056

100

Analogue output gain

Default:	100%
Range:	5-150%

Example on settings:

Set value	I_{scale}	U_{scale}	P_{scale}
100%	0-5xI_n	0-720V	0-2xP_n
50%	0-2.5xI_n	0-360V	0-P_n

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.

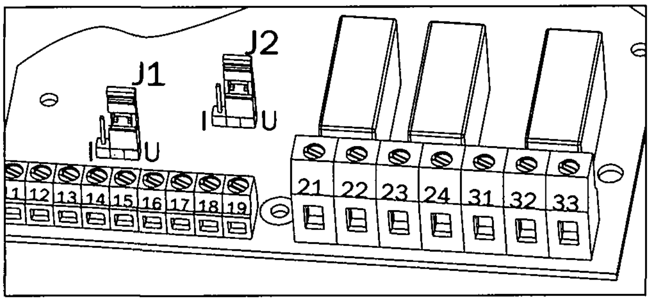


Fig. 53 Setting of J1 for current or voltage control.

Fig. 54 shows a wiring example for the analogue input as it is used for digital input.

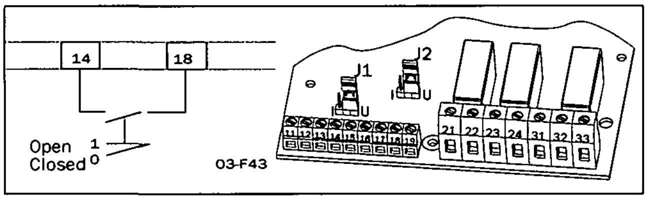


Fig. 54 Wiring for slow speed external input.

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
oFF	No digital input control
1	Rotation sensor for brake functions
2	Slow speed function
3	Jog forward command
4	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.

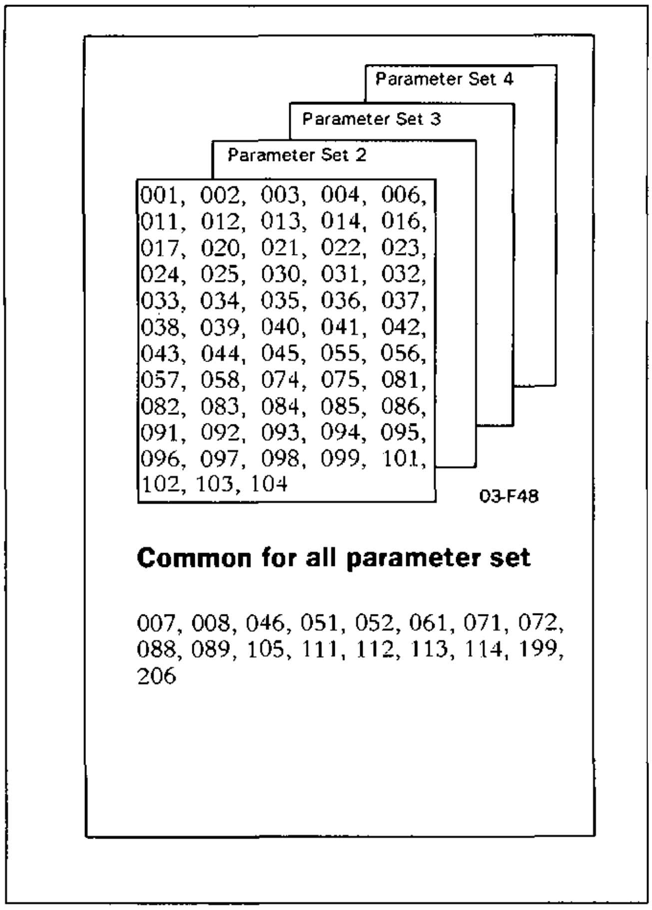
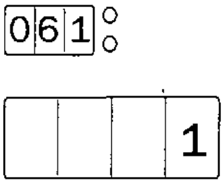


Fig. 55 Parameter overview

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.



Parameter set

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.

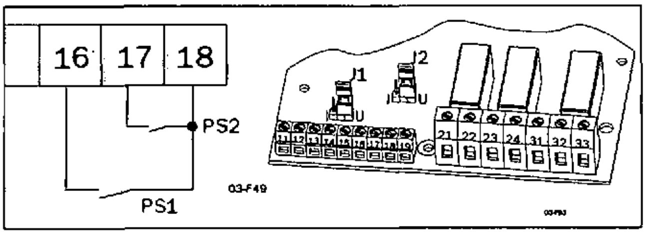


Fig. 56 Connection of external control inputs.

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 no	**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 resetted 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 10	**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.**

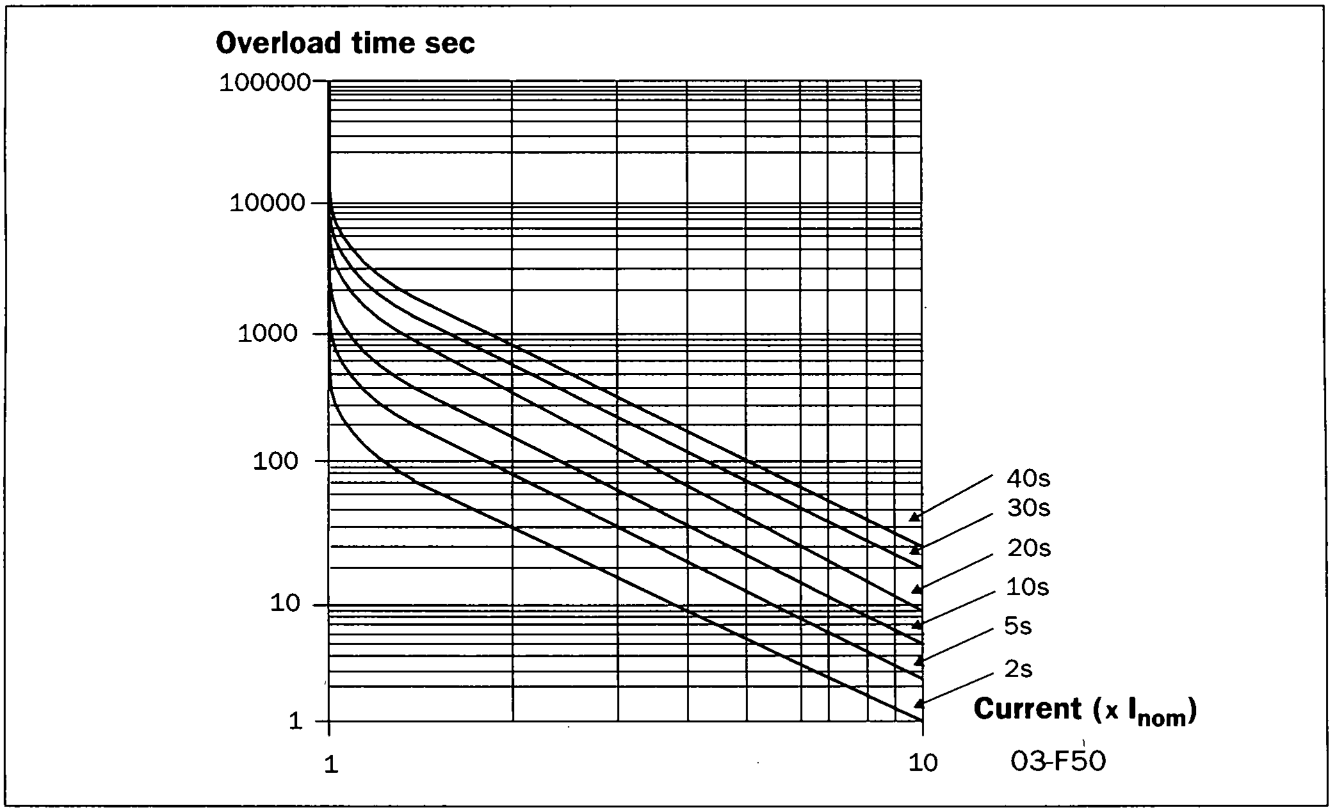


Fig. 57 The thermal curve

073

0

Used thermal capacity

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.

074

oFF

Starts per hour limitation

Default:	oFF
Range:	oFF, 1-99/hour
oFF	Starts per hour limitation is disabled.
1-99	Sets the start per hour limitation alarm. If the selected number is exceeded, alarm F11 occurs.

075

oFF

Locked rotor alarm

Default:	oFF
Range:	oFF, 1.0-10.0 sec
oFF	Locked rotor alarm is disabled
1.0-10.0	An F5 alarm is given when the rotor locks. The alarm is active during starting and running.

7.22 Mains protection

081

10

Voltage unbalance alarm

Default:	10
Range:	2 -25% U_n

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.

082

oFF

Response delay voltage unbalance alarm

Default:	oFF
Range:	oFF, 1-60 sec
oFF	Unbalance voltage alarm is disabled
1-60	Set the response delay time for unbalanced voltage alarm F8.

083

115

Over voltage alarm

Default:	115
Range:	100 -150% U_n

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

oFF

Response delay over voltage alarm

Default:	oFF
Range:	oFF, 1-60 sec
oFF	Overvoltage alarm is disabled
1-60	Set the response delay time for over voltage alarm F9.

085

oFF

Under voltage alarm

Default:	85
Range:	75-100 U_n
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

oFF

Response delay under voltage alarm

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

- - - -

Phase sequence

Default:	-
Range:	L123, L321
L123 is the direct phase sequence. L321 is the reverse phase sequence.	

088

oFF

Phase reversal alarm

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

no

Auto set power limits

Default:	no
Range:	no, YES
no	Auto set is disabled
YES	Auto set is activated if ENTER is pressed.

090

0

Output shaftpower in %

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

10

Start delay power limits

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

115

Max power alarm limit

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

oFF

Response delay max alarm

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

110

Max power pre-alarm limit

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

oFF

Max pre-alarm response delay

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

90

Min power pre-alarm limit

Default:	90%
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 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.

097

oFF

Min pre-alarm response delay

Default:	oFF
Range:	oFF, 0.1 - 25.0 sec
oFF	Min Pre-Alarm is disabled.
0.1-25.0	Sets the response delay of the Min Pre-Alarm level. The Min Pre-alarm is disabled during a stop ramp down.

098

85

Min power alarm limit

Default:	85
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 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.

099

oFF

Min alarm response delay

Default:	oFF
Range:	oFF, 0.1-25.0 sec
oFF	Min Alarm is disabled
0.1-25.0	Sets the response delay of the Min Alarm level. The Min alarm is disabled during a stop ramp down.

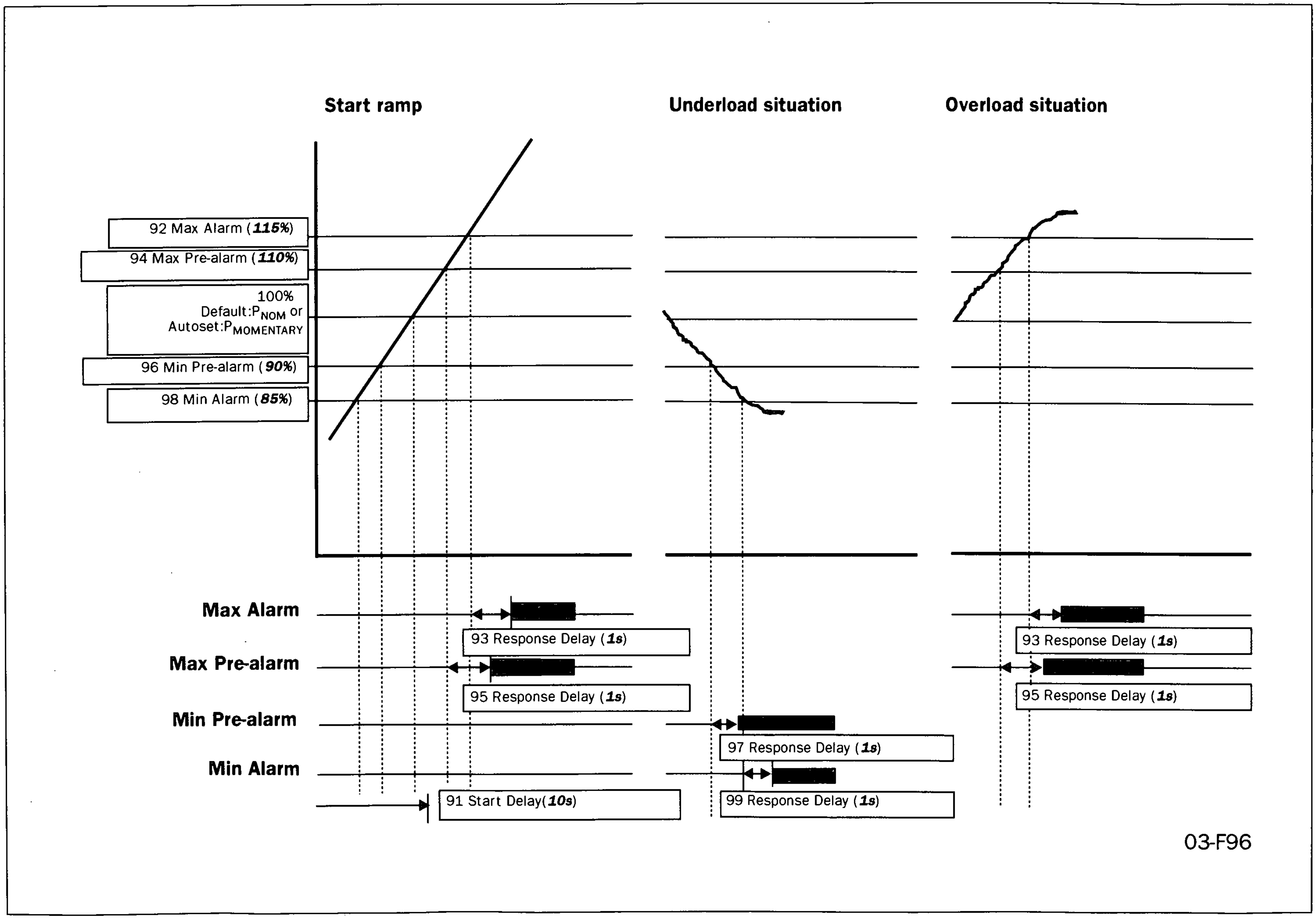


Fig. 58 Load monitor alarm functions.

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

no

Run at single phase loss

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

no

Run at current limit time-out

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

oFF

JOG forward enable

Default:	oFF
Range:	oFF, on
oFF	JOG forward disabled
on	JOG forward enabled

104

oFF

JOG reverse enable

Default:	oFF
Range:	oFF, on
oFF	JOG reverse disabled
on	JOG reverse enabled

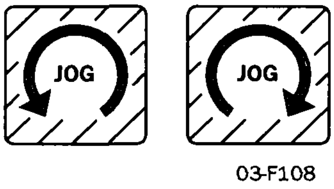


Fig. 59 The 2 Jog keys.

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

oFF

Automatic return menu

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

1

Serial comm unit address

Default:	1
Range:	1-247

This parameter will select the unit address.

112

9.6

Serial comm baudrate

Default:	9.6
Range:	2.4, 4.8, 9.6, 19.2, 38.4 kBaud

This parameter will select the baudrate.

113

0

Serial comm parity

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

1

Serial comm. contact interrupted

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

Reset to factory settings

no

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

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

RMS main voltage

0.0

Default:	-
Range:	0-720V

The RMS input main voltage.

203

Output motor shaftpower

0.0

Default:	-
Range:	-9999 -+9999kW

Viewing will show negative value if generator mode.

204

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

Total power consumption

0.000

Default:	-
Range:	0.000 -2000MWh

View the total power consumption.

206

no

Reset of power consumption

Default:	no
Range:	no, YES
no	No reset of power consumtion.
YES	Reset power consumption in menu 205 to 0.000.

207

0.0

Motor shaft torque

Default:	-
Range:	-9999 - + 9999Nm
Viewing will show negative value if generator mode.	

208

0.0

Operation time

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

0.0

RMS current in phase L1

Default:	-
Range:	0.0 - 9999Amp
View the current in phase L1.	

212

0.0

RMS current in phase L2

Default:	-
Range:	0.0 - 9999Amp
View the current in phase L2.	

213

0.0

RMS current in phase L3

Default:	-
Range:	0.0 - 9999Amp
View the current in phase L3.	

214

0

Main voltage L1-L2

Default:	-
Range:	0-720V
View main voltage L1-L2.	

215

0

Main voltage L1-L3

Default:	-
Range:	0 - 720V
View main voltage L1-L3.	

216

0

Main voltage L2-L3

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 no	**Locked keyboard info**
Default:	no
Range:	no, YES
no	Keyboard is not locked
YES	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 F1	**Alarm**
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 to 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 to 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 to 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 to 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 bee 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.

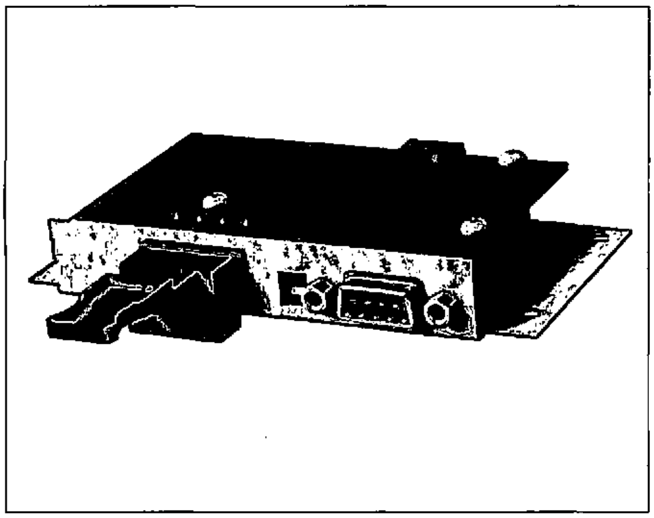


Fig. 60 Option RS232/485

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.

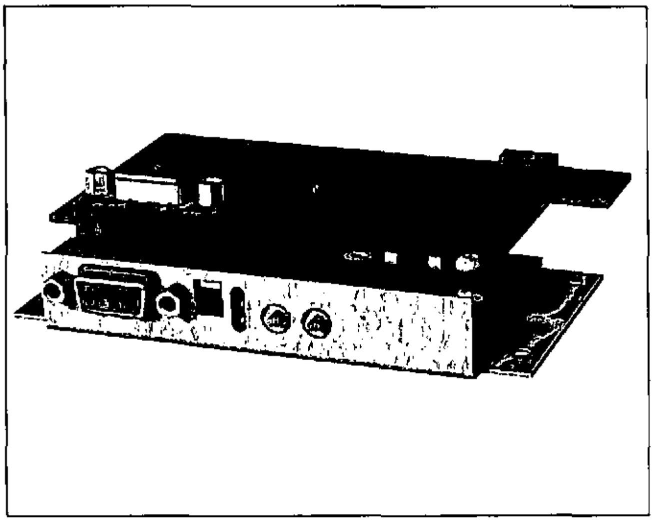


Fig. 61 Option Profibus

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.

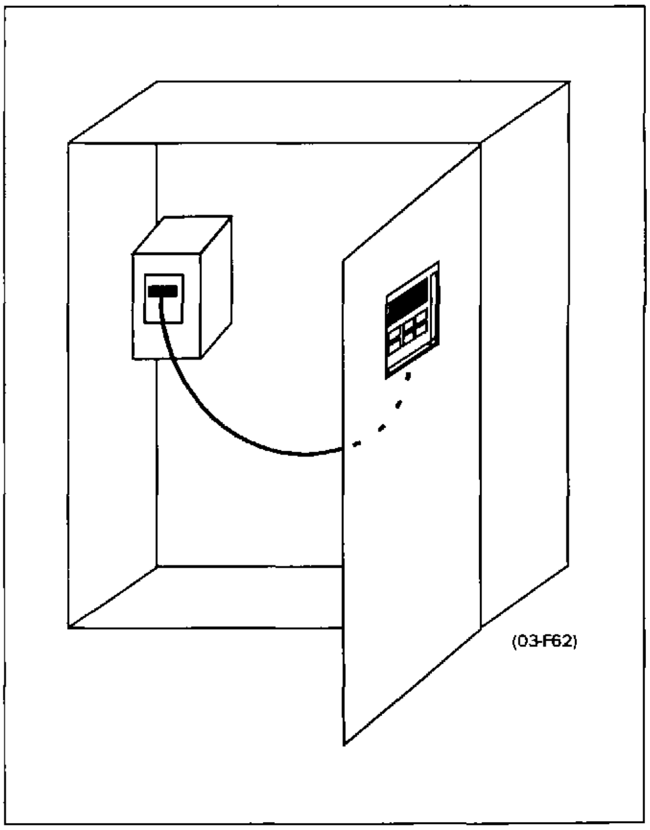


Fig. 62 Shows an example of the External PPU after it has been built in.

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.

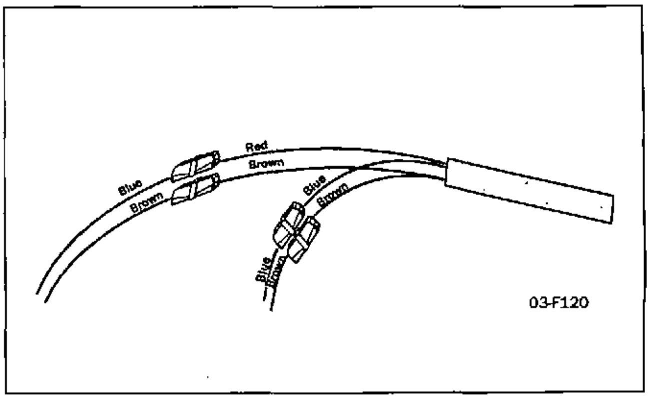


Fig. 63 Cable kit

11.4 Terminal clamp

Data: Single cables, Cu or Al	
Cables	95-300 mm^2
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^2
MSF type and Cu Cable	310 to -835
Bolt for connection to busbar	M10
Dimensions in mm	35x87x65
Order No. parallel	9351

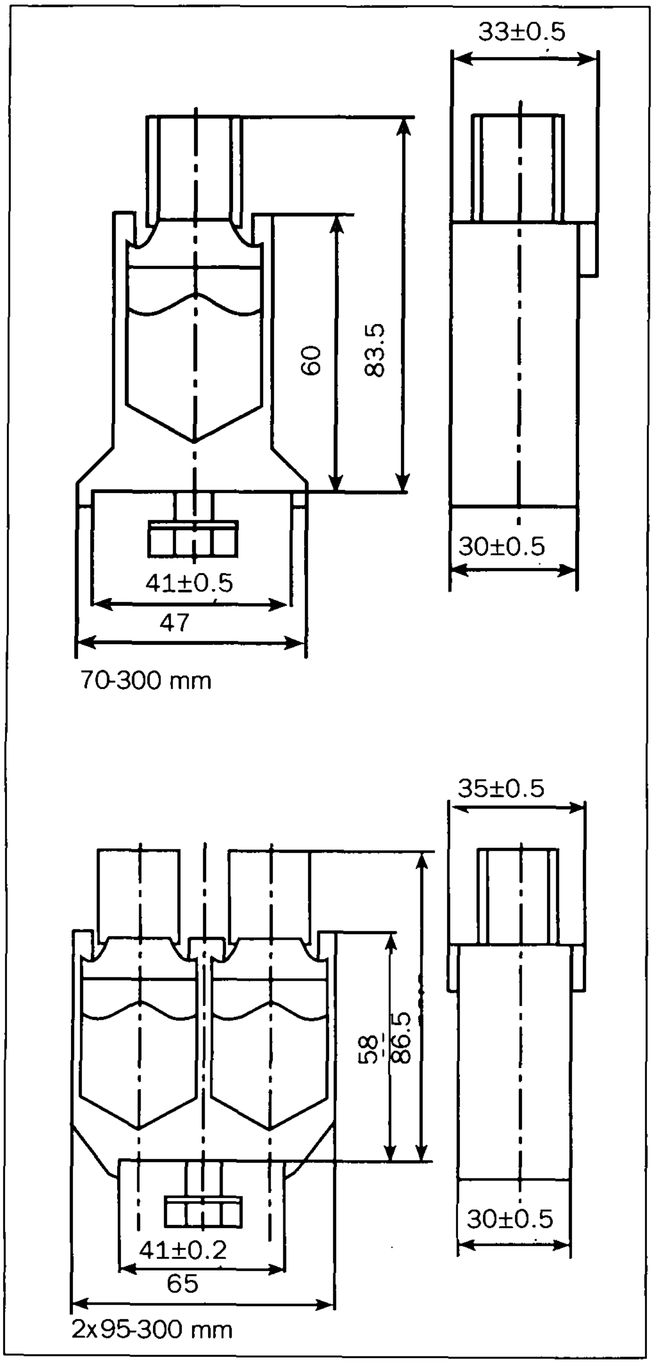


Fig. 64 The terminal clamp.

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: **Heavy** (first column): ramp/direct start
Normal/Light (second column): ramp start

NOTE! Short circuit withstand MSF017-060 5000 rms A when used with K5 or RK5 fuses.

* 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_N	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	
Electrical Data										
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	
Mechanical Data										
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	
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_N	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, 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:	**Heavy** (first column): ramp/direct start **Normal/Light** (second column): ramp start									
NOTE! Short circuit withstand MSF170-250 18000 rms A when used with K5 or RK5 fuses.										

* 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								IP00			
Other General Data												
Ambient temperatures In operation	0 - 40 °C											
Max. e.g. at 80% I_N	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% Tn	1 - 4	10		page 39
017	End torque at start	50 - 250% Tn	1 - 4	150		page 39
018	End torque at stop	0-100% Tn	1 - 4	0		page 39
020	Voltage ramp with current limit at start	oFF, 150 - 500% I_n	1 - 4	oFF		page 39
021	Current limit at start	oFF, 150 - 500% I_n	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_n	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_{nsoft} in Amp	1 - 4	I_{nsoft} in Amp		page 50
043	Nominal motor power	25 - 300% of P_{nsoft} in kW	1 - 4	P_{nsoft} in kW		page 50
044	Nominal speed	500 - 3600 rpm	1 - 4	N_{nsoft} 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% Pn	———	———		page 57
091	Start delay power limits	1 - 250 sec	1 - 4	10		page 58
092	Max power alarm limit	5 - 200% Pn	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% Pn	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% Pn	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%Pn	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

$$T_n = \frac{P_n}{\left(\frac{N_n}{60} x 2\pi\right)}$$

NOTE! The six main functions for motor control, menus 020–025, can only be selected one at a time.

14. INDEX

REPRESENTATION

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01-1363-01 r3

QUICK INSTALLATION CARD - MSF

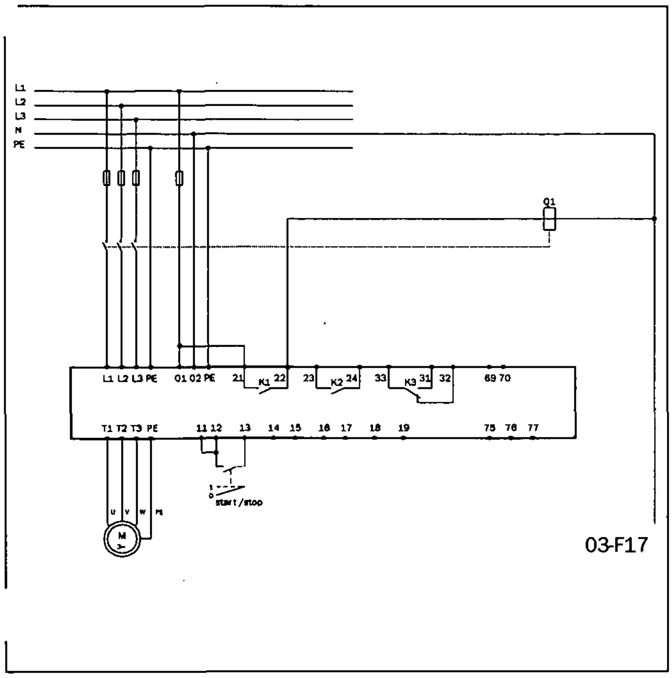

Fig. 1 Standard wiring.

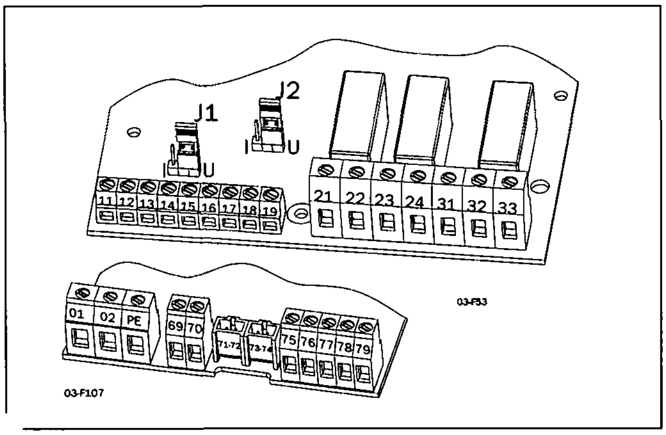

Fig. 2 Connections on the PCB, control card.

Table 1 PCB Terminals

Terminal	Function	Electrical characteristics
01	Supply voltage	100-240 VAC ±10%/380-500 VAC ± 10%
02		
PE	Gnd	⏚
11	Digital inputs for start/stop and reset.	0-3 V --> 0; 8-27 V--> 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 kΩ.
12		
13	Supply/control voltage to PCB terminal 11 and 12, 10 kΩ potentiometer, etc.	+12 VDC ±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 kΩ, current signal: 100 Ω.
15	GND (common)	0 VDC
16	Digital inputs for selection of parameter set.	0-3 V->0; 8-27 V->1. Max. 37V for 10s. Impedance to 0 VDC: 2.2 kΩ.
17		
18	Supply/control voltage to PCB terminal 16 and 17, 10 kΩ potentiometer, etc.	+12 VDC ±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 700Ω 0-20mA and 4-20mA;max load impedance 750Ω
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 kΩ Switch back level 2.2 kΩ.
71-72*	Clickson thermistor	Controlling soft starter cooling fine temperature MSF-170-MSF-835
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.

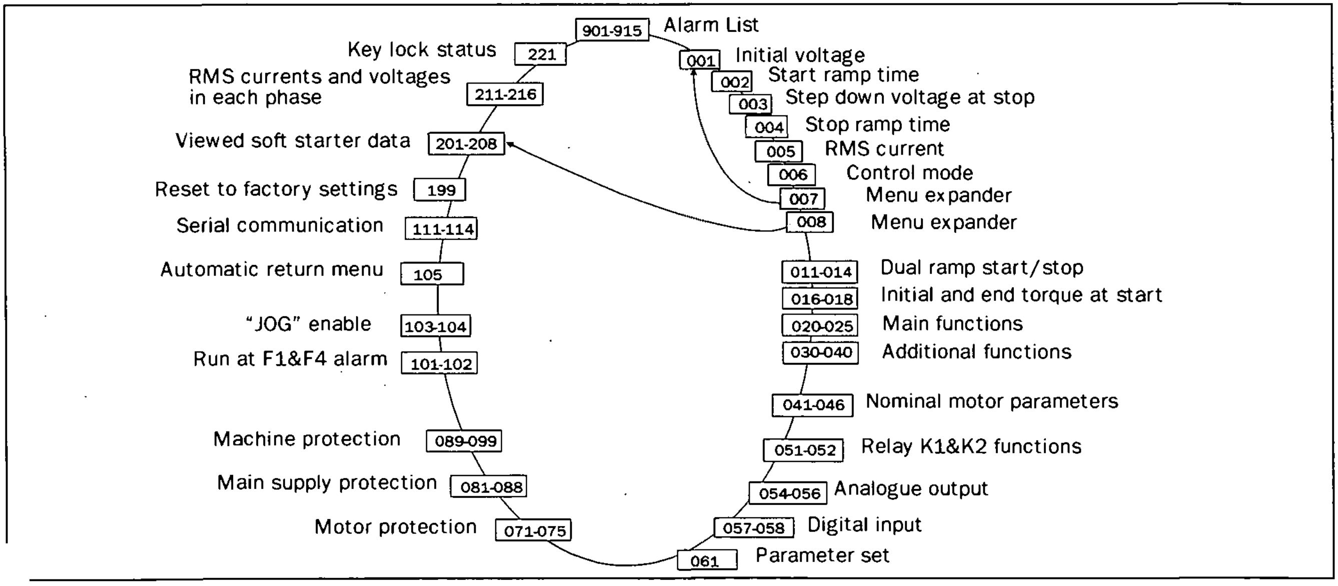

Fig. 3 Menu structure.

Menu nr.	Function/Parameter	Range	Par. set	Factory setting	Page
001	Initial voltage at start	25 - 90% of U	1 - 4	30	page 36
002	Start time ramp 1	1 - 60 s	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 s	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 s	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 s	1 - 4	oFF	page 38
016	Initial torque at start	0 - 250% Tn	1 - 4	10	page 39
017	End torque at start	50 - 250% Tn	1 - 4	150	page 39
018	End torque at stop	0-100% Tn	1 - 4	0	page 39
020	Voltage ramp with current limit at start	oFF, 150 - 500% I_n	1 - 4	oFF	page 39
021	Current limit at start	oFF, 150 - 500% I_n	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 s	1 - 4	oFF	page 43
031	Torque boost current limit	300 - 700% I_n	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	Braking time	oFF, 1 - 120 s	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 s	1 - 4	oFF	page 49
039	Slow speed time at stop	oFF, 1 - 60 s	1 - 4	oFF	page 49
040	DC-Brake at slow speed	oFF, 1-60 s	1 - 4	oFF	page 49
041	Nominal motor voltage	200 - 700 V	1 - 4	400	page 50
042	Nominal motor current	25-150% I_{nsoft} in Amp	1 - 4	I_{nsoft} in Amp	page 50
043	Nominal motor power	25 - 300% of P_{nsoft} in kW	1 - 4	P_{nsoft} in kW	page 50
044	Nominal speed	500 - 3600 rpm	1 - 4	N_{nsoft} 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
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

Menu nr.	Function/Parameter	Range	Par. set	Factory setting	Page
075	Locked rotor alarm	oFF, 1.0-10.0 s	1 - 4	oFF	page 55
081	Voltage unbalance alarm	2 - 25% U_n	1 - 4	10	page
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% Pn	——	——	page 57
091	Start delay power limits	1 - 250 sec	1 - 4	10	page 58
092	Max power alarm limit	5 - 200% Pn	1 - 4	115	page 58
093	Max alarm response delay	oFF, 0.1-25.0 s	1 - 4	oFF	page 58
094	Max power pre-alarm limit	5 - 200% Pn	1 - 4	110	page 58
095	Max pre-alarm response delay	oFF, 0.1-25.0 s	1 - 4	oFF	page 58
096	Min pre-alarm power limit	5 - 200% Pn	1 - 4	90	page 58
097	Min pre-alarm response delay	oFF, 0.1-25.0 s	1 - 4	oFF	page 59
098	Min power alarm limit	5 - 200%Pn	1 - 4	85	page
099	Min alarm response delay	oFF, 0.1-25.0 s	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
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
204	Power factor	0.00 - 1.00	——	——	page
205	Power consumption	0.000-2000 MWh	——	——	page 63
206	Reset power consumption	no, YES	——	no	page 64
207	Shaft torque	-9999-9999Nm	——	——	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

PARAMETER SET LIST-MSF

		Factory setting	Parameter Sets			
			1	2	3	4
001	Initial voltage at start	30				
002	Start time ramp 1	10				
003	Step down voltage at stop	100				
004	Stop time ramp 1	oFF				
005	Current	——	——	——	——	——
006	Control mode	2				
007	Extended functions & metering	oFF		Common for all parameter sets		
008	Extended functions	oFF		Common for all parameter sets		
011	Initial voltage start ramp 2	90				
012	Start time ramp 2	oFF				
013	Step down voltage stop ramp 2	40				
014	Stop time ramp 2	oFF				
016	Initial torque at start	10				
017	End torque at start	150				
018	End torque at stop	0				
020	Voltage ramp with current limit at start	oFF				
021	Current limit at start	oFF				
022	Pump control	oFF				
023	Remote analogue control	oFF				
024	Full voltage start D.O.L	oFF				
025	Torque control	oFF				
030	Torque boost active time	oFF				
031	Torque boost current limit	300				
032	Bypass	oFF				
033	Power Factor Control PFC	oFF				
034	Braking time	oFF				
035	Braking strength	100				
036	Braking methods	1				
037	Slow speed torque	10				
038	Slow speed time at start	oFF				
039	Slow speed time at stop	oFF				
040	DC-Brake at slow speed	oFF				
041	Nominal motor voltage	400				
042	Nominal motor current	I_{nsoft} in Amp				
043	Nominal motor power	P_{nsoft} in kW				
044	Nominal speed	N_{nsoft} in rpm				
045	Nominal power factor	0.86				
046	Nominal frequency	50		Common for all parameter sets		
051	Programmable relay K1	1		Common for all parameter sets		
052	Programmable relay K2	2		Common for all parameter sets		
054	Analogue output	oFF				
055	Analogue output value	1				
056	Scaling analogue output	100				
057	Digital input selection	oFF				
058	Analogue input pulses	1				
061	Parameter set	1	——	——	——	——

		Factory setting	Parameter Sets			
			1	2	3	4
071	Motor PTC input	no		Common for all parameter sets		
072	Internal motor thermal protection class	10				
073	Used thermal capacity	———	———	———	———	———
074	Starts per hour limitation	oFF				
075	Locked rotor alarm	oFF				
081	Voltage unbalance alarm	10				
082	Response delay voltage unbalance alarm	oFF				
083	Over voltage alarm	115				
084	Response delay over voltage alarm	oFF				
085	Under voltage alarm	85				
086	Response delay under voltage alarm	oFF				
087	Phase sequence	———				
088	Phase reversal alarm	oFF		Common for all parameter sets		
089	Auto set power limits	no		Common for all parameter sets		
090	Output shaft power	———				
091	Start delay power limits	10				
092	Max power alarm limit	115				
093	Max alarm response delay	oFF				
094	Max power pre-alarm limit	110				
095	Max pre-alarm response delay	oFF				
096	Min pre-alarm power limit	90				
097	Min pre-alarm response delay	oFF				
098	Min power alarm limit	85				
099	Min alarm response delay	oFF				
101	Run at single phase input failure	no				
102	Run at current limit time-out	no				
103	Jog forward enable	oFF				
104	Jog reverse enable	oFF				
105	Automatic return menu	oFF		Common for all parameter sets		
111	Serial comm. unit address	1		Common for all parameter sets		
112	Serial comm. baudrate	9.6		Common for all parameter sets		
113	Serial comm. parity	0		Common for all parameter sets		
114	Serial comm. contact broken	1		Common for all parameter sets		
199	Reset to factory settings	no		Common for all parameter sets		
201	Current	———	———	———	———	———
202	Line main voltage	———	———	———	———	———
203	Output shaft power	———	———	———	———	———
204	Power factor	———	———	———	———	———
205	Power consumption	———	———	———	———	———
206	Reset power consumption	no		Common for all parameter sets		
207	Shaft torque	———	———	———	———	———
208	Operation time	———	———	———	———	———
211	Current phase L1	———	———	———	———	———
212	Current phase L2	———	———	———	———	———
213	Current phase L3	———	———	———	———	———
214	Line main voltage L1 - L2	———	———	———	———	———
215	Line main voltage L1 - L3	———	———	———	———	———
216	Line main voltage L2 - L3	———	———	———	———	———
221	Locked keyboard info	no	———	———	———	———

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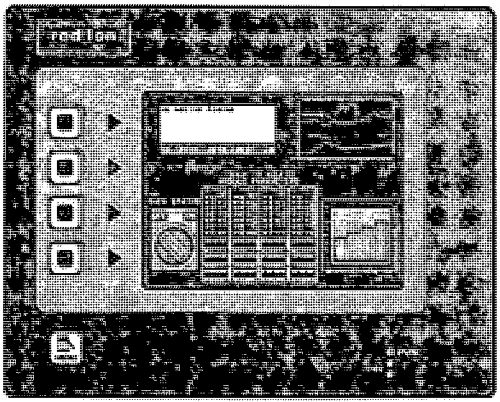
Bulletin No. G306-E
Drawing No. LP0588
Released 4/06

MODEL G306 - GRAPHIC COLOR LCD OPERATOR INTERFACE TERMINAL WITH QVGA DISPLAY AND TOUCHSCREEN



- *CONFIGURED USING CRIMSON SOFTWARE (VERSION 2.0 OR LATER)*
- *UP TO 5 RS-232/422/485 COMMUNICATIONS PORTS (2 RS-232 AND 1 RS-422/485 ON BOARD, 1 RS-232 AND 1 RS422/485 ON OPTIONAL COMMUNICATIONS CARD)*
- *10 BASE T/100 BASE-TX ETHERNET PORT TO NETWORK UNITS AND HOST WEB PAGES*
- *USB PORT TO DOWNLOAD THE UNIT'S CONFIGURATION FROM A PC OR FOR DATA TRANSFERS TO A PC*
- *UNIT'S CONFIGURATION IS STORED IN NON-VOLATILE MEMORY (4 MBYTE FLASH)*
- *COMPACTFLASH® SOCKET TO INCREASE MEMORY CAPACITY*
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- *5-BUTTON KEYPAD FOR ON-SCREEN MENUS*
- *THREE FRONT PANEL LED INDICATORS*
- *POWER UNIT FROM 24 VDC ±20% SUPPLY*
- *RESISTIVE ANALOG TOUCHSCREEN*

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63YN
LABORATORY EQUIPMENT

FOR USE IN HAZARDOUS LOCATIONS:
Class I, Division 2, Groups A, B, C, and D
Class II, Division 2, Groups F and G
Class III, Division 2

GENERAL DESCRIPTION

The G306 Operator Interface Terminal combines unique capabilities normally expected from high-end units with a very affordable price. It is built around a high performance core with integrated functionality. This core allows the G306 to perform many of the normal features of the Paradigm range of Operator Interfaces while improving and adding new features.

The G306 is able to communicate with many different types of hardware using high-speed RS232/422/485 communications ports and Ethernet 10 Base T/100 Base-TX communications. In addition, the G306 features USB for fast downloads of configuration files and access to trending and data logging. A CompactFlash socket is provided so that Flash cards can be used to collect your trending and data logging information as well as to store larger configuration files.

In addition to accessing and controlling of external resources, the G306 allows a user to easily view and enter information. Users can enter data through the touchscreen and/or front panel 5-button keypad.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use the controller to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the controller.

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

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

⚠ **CAUTION:** Risk Of Danger.
Read complete instructions prior to installation and operation of the unit.

⚠ **CAUTION:** Risk of electric shock.

CompactFlash is a registered trademark of CompactFlash Association.

CONTENTS OF PACKAGE

- G306 Operator Interface.
- Panel gasket.
- Template for panel cutout.
- Hardware packet for mounting unit into panel.
- Terminal block for connecting power.

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
G306	Operator Interface for indoor applications, textured finish with embossed keys	G306C000
G3CF	64 MB CompactFlash Card [5]	G3CF064M
	256 MB CompactFlash Card [5]	G3CF256M
	512 MB CompactFlash Card [5]	G3CF512M
G3RS	RS232/485 Optional Communications Cards	G3RS0000
G3CN	CANopen Optional Communications Cards	G3CN0000
PSDR7	DIN Rail Power Supply	PSDR7000
SFCRM2	Crimson 2.0 [2]	SFCRM200
CBL	RS-232 Programming Cable	CBLPROG0
	USB Cable	CBLUSB00
	Communications Cables [1]	CBLxxxxx
DR	DIN Rail Mountable Adapter Products [3]	DRxxxxxx
	Replacement Battery [4]	BAL3R004
G3FILM	Protective Films	G3FILM06

[1] Contact your Red Lion distributor or visit our website for complete selection.
[2] Use this part number to purchase Crimson on CD with a printed manual, USB cable, and RS-232 cable. Otherwise, download for free from www.redlion.net.
[3] Red Lion offers RJ modular jack adapters. Refer to the DR literature for complete details.
[4] Battery type is lithium coin type CR2025.
[5] Industrial grade two million write cycles.

SPECIFICATIONS

1. **POWER REQUIREMENTS**:

Must use Class 2 or SELV rated power supply.
Power connection via removable three position terminal block.

Supply Voltage:	+24 VDC ±20%
Typical Power^1:	8 W
Maximum Power^2:	14 W

Notes:

1. *Typical power with +24 VDC, RS232/485 communications, Ethernet communications, CompactFlash card installed, and display at full brightness.*
2. *Maximum power indicates the most power that can be drawn from the G306. Refer to "Power Supply Requirements" under "Installing and Powering the G306."*
3. *The G306's circuit common is not connected to the enclosure of the unit. See "Connecting to Earth Ground" in the section "Installing and Powering the G306."*
4. *Read "Power Supply Requirements" in the section "Installing and Powering the G306" for additional power supply information.*

2. **BATTERY**: Lithium coin cell. Typical lifetime of 10 years.

3. **LCD DISPLAY**:

SIZE	5.7-inch
TYPE	STN
COLORS	256
PIXELS	320 X 240
BRIGHTNESS	165 cd/m^2
BACKLIGHT*	20,000 HR TYP.

*Lifetime at room temperature. Refer to "Display" in "Software/Unit Operation"

4. **5-KEY KEYPAD**: for on-screen menus.

5. **TOUCHSCREEN**: Resistive analog

6. **MEMORY**:

On Board User Memory: 4 Mbyte of non-volatile Flash memory.

Memory Card: CompactFlash Type II slot for Type I and Type II CompactFlash cards.

7. **COMMUNICATIONS**:

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

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

Serial Ports: Format and Baud Rates for each port are individually software programmable up to 115,200 baud.
PGM Port: RS232 port via RJ12.
COMMS Ports: RS422/485 port via RJ45, and RS232 port via RJ12.
DH485 TXEN: Transmit enable; open collector, V_{OH} = 15 VDC,
V_{OL} = 0.5 V @ 25 mA max.

Note: For additional information on the communications or signal common and connections to earth ground please see the "Connecting to Earth Ground" in the section "Installing and Powering the G306."

Ethernet Port: 10 BASE-T / 100 BASE-TX
RJ45 jack is wired as a NIC (Network Interface Card).
Isolation from Ethernet network to G3 operator interface: 1500 Vrms

8. **ENVIRONMENTAL CONDITIONS**:

Operating Temperature Range: 0 to 50°C
Storage Temperature Range: -20 to 70°C
Operating and Storage Humidity: 80% maximum relative humidity (non-condensing) from 0 to 50°C.
Vibration: Operational 5 to 8 Hz, 0.8" (p-p), 8 to 500 Hz, in X, Y, Z direction, duration: 1 hour, 3 g.
Shock: Operational 40 g, 9 msec in 3 directions.
Altitude: Up to 2000 meters.

9. **CERTIFICATIONS AND COMPLIANCES**:

SAFETY

UL Recognized Component, File #E179259, UL61010-1, CSA 22.2 No.61010-1
Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
UL Listed, File #E211967, UL61010-1, UL1604, CSA 22.2 No. 61010.1, CSA 22.2 No. 213-M1987
LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
Type 4X Enclosure rating (Face only), UL50
IECEE CB Scheme Test Certificate #US/9737/UL,
CB Scheme Test Report #E179259-V01-S04
Issued by Underwriters Laboratories Inc.
IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.
IP66 Enclosure rating (Face only), IEC 529

ELECTROMAGNETIC COMPATIBILITY

Emissions and Immunity to EN 61326: Electrical Equipment for Measurement, Control and Laboratory use.

Immunity to Industrial Locations:		
Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion A 2 kV power 1 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Emissions:		
Emissions	EN 55011	Class A

Note:

1. Criterion A: Normal operation within specified limits.

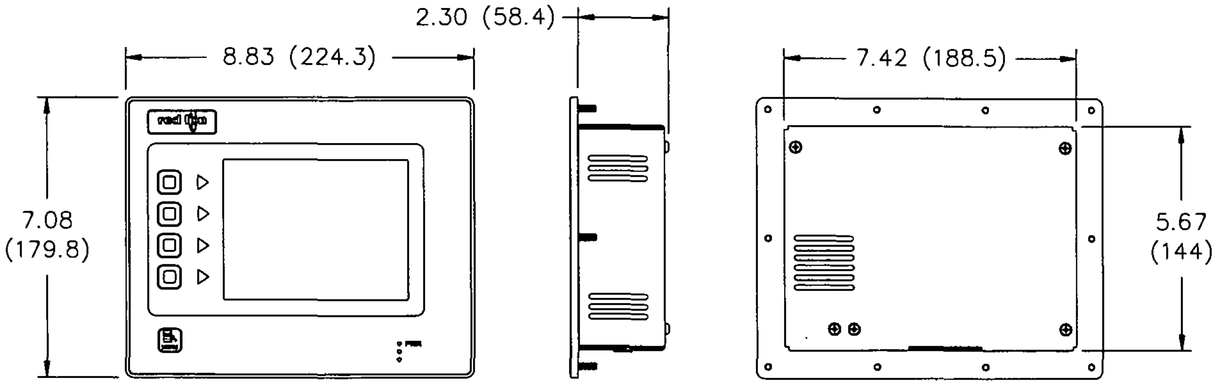
10. **CONSTRUCTION**: Steel rear metal enclosure with NEMA 4X/IP66 aluminum front plate for indoor use only when correctly fitted with the gasket provided. Installation Category II, Pollution Degree 2.

11. **MOUNTING REQUIREMENTS**: Maximum panel thickness is 0.25" (6.3 mm). For NEMA 4X/IP66 sealing, a steel panel with a minimum thickness of 0.125" (3.17 mm) is recommended.

Maximum Mounting Stud Torque: 17 inch-pounds (1.92 N-m)

12. **WEIGHT**: 3.0 lbs (1.36 Kg)

DIMENSIONS In inches (mm)

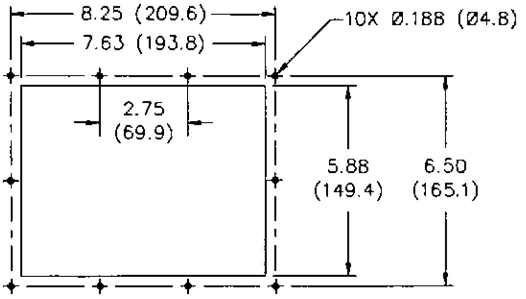


INSTALLING AND POWERING THE G306

MOUNTING INSTRUCTIONS

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

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



All tolerances ±0.010" (±0.25 mm).

ALL NONINCENDIVE CIRCUITS MUST BE WIRED USING DIVISION 2 WIRING METHODS AS SPECIFIED IN ARTICLE 501-4 (b), 502-4 (b), AND 503-3 (b) OF THE NATIONAL ELECTRICAL CODE, NFPA 70 FOR INSTALLATION WITHIN THE UNITED STATES, OR AS SPECIFIED IN SECTION 19-152 OF CANADIAN ELECTRICAL CODE FOR INSTALLATION IN CANADA.

CONNECTING TO EARTH GROUND

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

Each G306 has a chassis ground terminal on the back of the unit. Your unit should be connected to earth ground (protective earth).

The chassis ground is not connected to signal common of the unit. Maintaining isolation between earth ground and signal common is not required to operate your unit. But, other equipment connected to this unit may require isolation between signal common and earth ground. *To maintain isolation between signal common and earth ground care must be taken when connections are made to the unit.* For example, a power supply with isolation between its signal common and earth ground must be used. Also, plugging in a USB cable may connect signal common and earth ground.[1]

[1] USB's shield may be connected to earth ground at the host. USB's shield in turn may also be connected to signal common.

POWER SUPPLY REQUIREMENTS

The G306 requires a 24 VDC power supply. Your unit may draw considerably less than the maximum rated power depending upon the options being used. As additional features are used your unit will draw increasing amounts of power. Items that could cause increases in current are additional communications, optional communications card, CompactFlash card, and other features programmed through Crimson.

In any case, it is very important that the power supply is mounted correctly if the unit is to operate reliably. Please take care to observe the following points:

- The power supply must be mounted close to the unit, with usually not more than 6 feet (1.8 m) of cable between the supply and the operator interface. Ideally, the shortest length possible should be used.
- The wire used to connect the operator interface's power supply should be at least 22-gage wire. If a longer cable run is used, a heavier gage wire should be used. The routing of the cable should be kept away from large contactors, inverters, and other devices which may generate significant electrical noise.
- A power supply with a Class 2 or SELV rating is to be used. A Class 2 or SELV power supply provides isolation to accessible circuits from hazardous voltage levels generated by a mains power supply due to single faults. SELV is an acronym for "safety extra-low voltage." Safety extra-low voltage circuits shall exhibit voltages safe to touch both under normal operating conditions and after a single fault, such as a breakdown of a layer of basic insulation or after the failure of a single component has occurred.

COMMUNICATING WITH THE G306

CONFIGURING A G306

The G306 is configured using Crimson software. Crimson is available as a free download from Red Lion's website, or it can be purchased on CD. Updates to Crimson for new features and drivers are posted on the website as they become available. By configuring the G306 using the latest version of Crimson, you are assured that your unit has the most up to date feature set. Crimson software can configure the G306 through the RS232 PGM port, USB port, or CompactFlash.

The USB port is connected using a standard USB cable with a Type B connector. The driver needed to use the USB port will be installed with Crimson.

The RS232 PGM port uses a programming cable made by Red Lion to connect to the DB9 COM port of your computer. If you choose to make your own cable, use the "G306 Port Pin Out Diagram" for wiring information.

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

USB, DATA TRANSFERS FROM THE COMPACTFLASH CARD

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

In order to transfer data from the CompactFlash card via the USB port, a driver must be installed on your computer. This driver is installed with Crimson and is located in the folder C:\Program Files\Red Lion Controls\Crimson 2.0\Device\ after Crimson is installed. This may have already been accomplished if your G306 was configured using the USB port.

Once the driver is installed, connect the G306 to your PC with a USB cable, and follow "Mounting the CompactFlash" instructions in the Crimson 2 user manual.

CABLES AND DRIVERS

Red Lion has a wide range of cables and drivers for use with many different communication types. A list of these drivers and cables along with pin outs is available from Red Lion's website. New cables and drivers are added on a regular basis. If making your own cable, refer to the "G306 Port Pin Outs" for wiring information.

ETHERNET COMMUNICATIONS

Ethernet communications can be established at either 10 BASE-T or 100 BASE-TX. The G306 unit's RJ45 jack is wired as a NIC (Network Interface Card). For example, when wiring to a hub or switch use a straight-through cable, but when connecting to another NIC use a crossover cable.

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

LED COLOR	DESCRIPTION
YELLOW solid	Link established.
YELLOW flashing	Data being transferred.
GREEN	10 BASE-T Communications
AMBER	100 BASE-TX Communications

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

RS232 PORTS

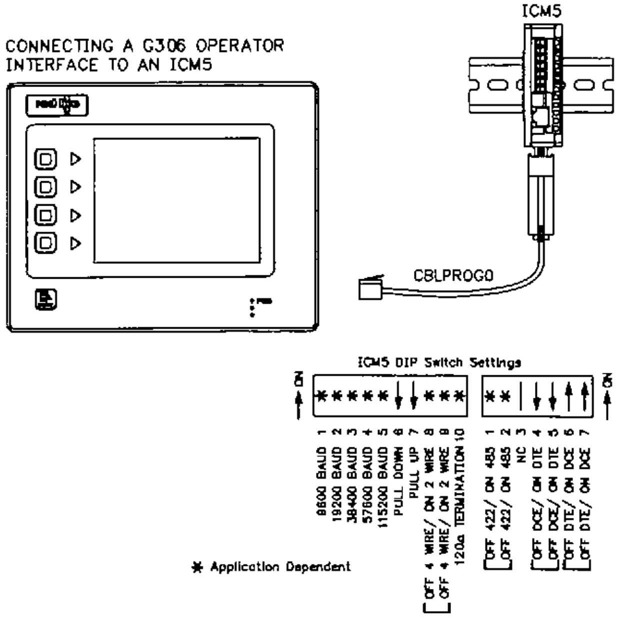
The G306 has two RS232 ports. There is the PGM port and the COMMS port. Although only one of these ports can be used for programming, both ports can be used for communications with a PLC.

The RS232 ports can be used for either master or slave protocols with any G306 configuration.

Examples of RS232 communications could involve another Red Lion product or a PC. By using a cable with RJ12 ends on it, and a twist in the cable, RS232 communications with another G3 product or the Modular Controller can be established. Red Lion part numbers for cables with a twist in them are CBLPROG0 [1], CBLRLC01 [2], or CBLRC02 [3].

G3 RS232 to a PC

Connections			
G3: RJ12	Name	PC: DB9	Name
4	COMM	1	DCD
5	Tx	2	Rx
2	Rx	3	Tx
	N/C	4	DTR
3	COM	5	GND
	N/C	6	DSR
1	CTS	7	RTS
6	RTS	8	CTS
	N/C	9	RI



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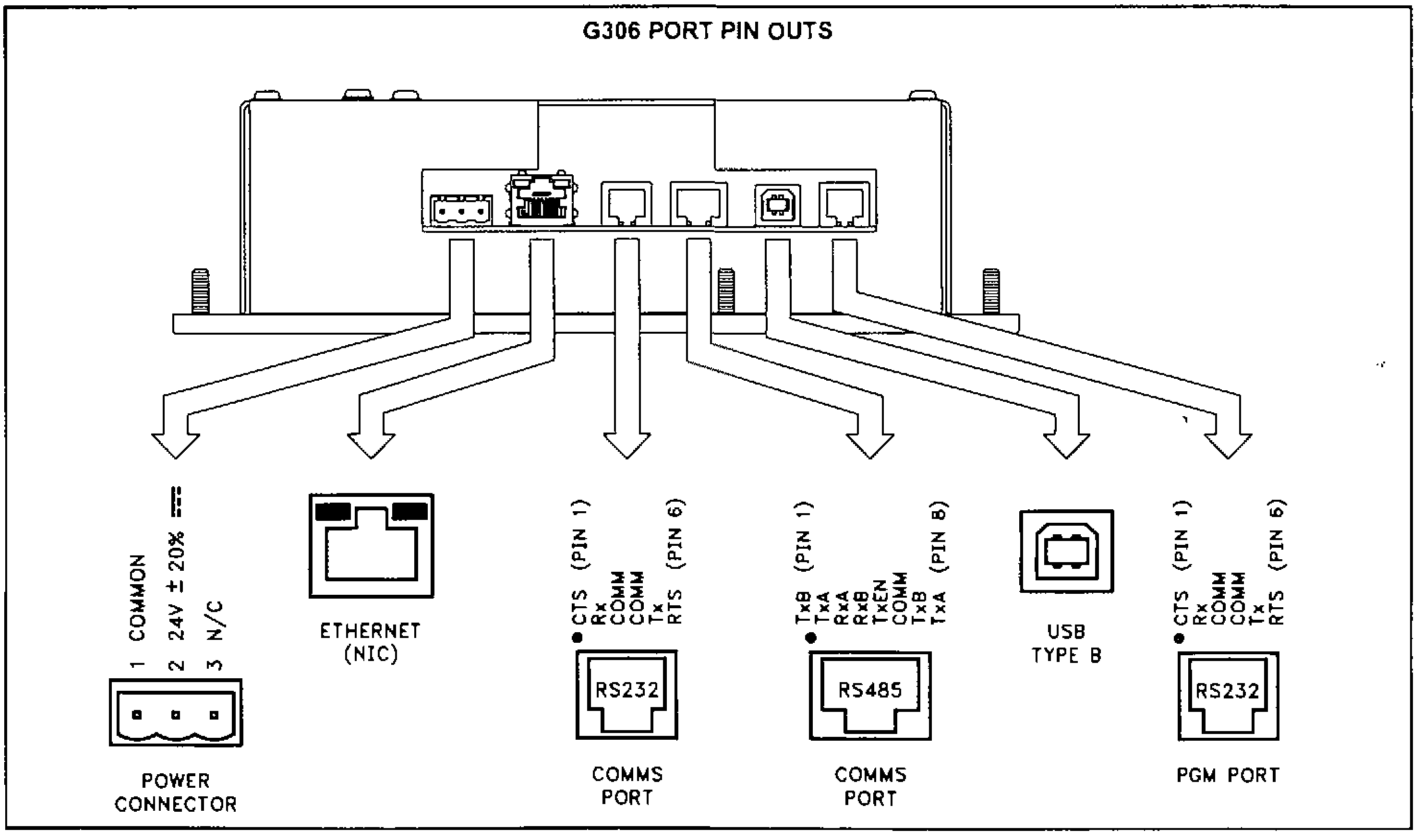
[1] CBLPROG0 can also be used to communicate with either a PC or an ICM5.

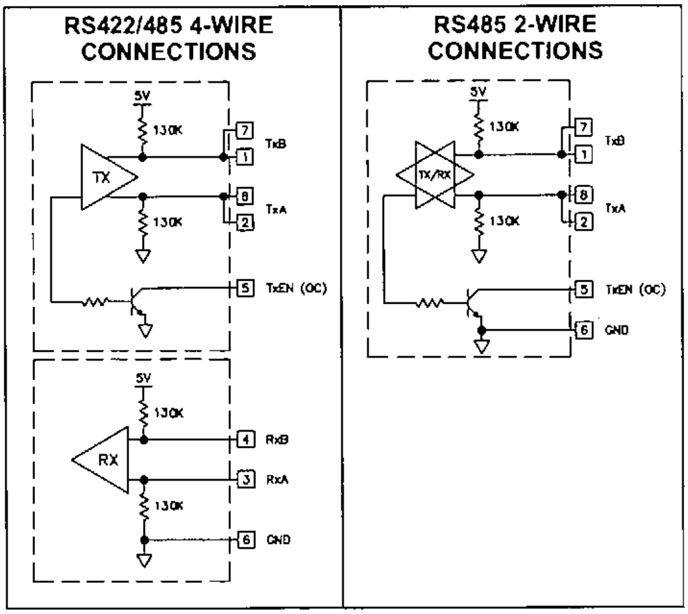
[2] DB9 adapter not included, 1 foot long.

[3] DB9 adapter not included, 10 feet long.



RS422/485 COMMS PORT

The G306 has one RS422/485 port. This port can be configured to act as either RS422 or RS485.



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

DH485 COMMUNICATIONS

The G306's RS422/485 COMMS port can also be used for Allen Bradley DH485 communications.

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

G3 to AB SLC 500 (CBLAB003)

Connections			
RJ45: RLC	Name	RJ45: A-B	Name
1	TxB	1	A
2	TxA	2	B
3, 8	RxA	-	24V
4, 7	RxB	-	COMM
5	TxEN	5	TxEN
6	COMM	4	SHIELD
4, 7	TxB	-	COMM
3, 8	TxA	-	24V

Examples of RS485 2-Wire Connections

G3 to Red Lion RJ11 (CBLRLC00)
DLC, IAMS, ITMS, PAXCDC4C

Connections			
G3: RJ45	Name	RLC: RJ11	Name
5	TxEN	2	TxEN
6	COM	3	COM
1	TxB	5	B-
2	TxA	4	A+

G3 to Modular Controller (CBLRLC05)

Connections			
G3	Name	Modular Controller	Name
1,4	TxB	1,4	TxB
4,1	RxB	4,1	RxB
2,3	TxA	2,3	TxA
3,2	RxA	3,2	RxA
5	TxEN	5	TxEN
6	COM	6	COM
7	TxB	7	TxB
8	TxA	8	TxA

SOFTWARE/UNIT OPERATION

CRIMSON SOFTWARE

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

DISPLAY

This operator interface uses a liquid crystal display (LCD) for displaying text and graphics. The display utilizes a cold cathode fluorescent tube (CCFL) for lighting the display. The CCFL tubes can be dimmed for low light conditions.

These CCFL tubes have a limited lifetime. Backlight lifetime is based upon the amount of time the display is turned on at full intensity. Turning the backlight off when the display is not in use can extend the lifetime of your backlight. This can be accomplished through the Crimson software when configuring your unit.

FRONT PANEL LEDS

There are three front panel LEDs. Shown below is the default status of the LEDs.

LED	INDICATION
RED (TOP, LABELED "PWR")	
FLASHING	Unit is in the boot loader, no valid configuration is loaded.[1]
STEADY	Unit is powered and running an application.
YELLOW (MIDDLE)	
OFF	No CompactFlash card is present.
STEADY	Valid CompactFlash card present.
FLASHING RAPIDLY	CompactFlash card being checked.
FLICKERING	Unit is writing to the CompactFlash, either because it is storing data, or because the PC connected via the USB port has locked the drive.[2]
FLASHING SLOWLY	Incorrectly formatted CompactFlash card present.
GREEN (BOTTOM)	
FLASHING	A tag is in an alarm state.
STEADY	Valid configuration is loaded and there are no alarms present.

1. The operator interface is shipped without a configuration. After downloading a configuration, if the light remains in the flashing state continuously, try cycling power. If the LED still continues to flash, try downloading a configuration again.
2. Do not turn off power to the unit while this light is flickering. The unit writes data in two minute intervals. Later Microsoft operating systems will not lock the drive unless they need to write data; Windows 98 may lock the drive any time it is mounted, thereby interfering with logging. Refer to "Mounting the CompactFlash" in the Crimson 2 User Manual.

TOUCHSCREEN

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

KEYPAD

The G306 keypad consists of five keys that can be used for on-screen menus.

TROUBLESHOOTING YOUR G306

If for any reason you have trouble operating, connecting, or simply have questions concerning your new G306, contact Red Lion's technical support. For contact information, refer to the back page of this bulletin for phone and fax numbers.

EMAIL: techsupport@redlion.net
Web Site: http://www.redlion.net

BATTERY & TIME KEEPING

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

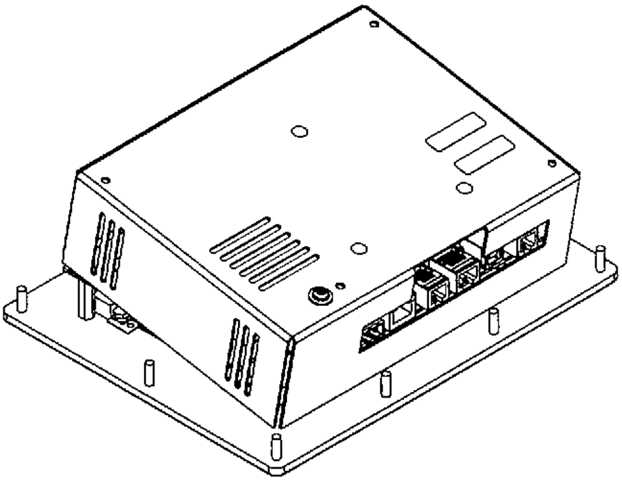
WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN DISCONNECTED AND THE AREA IS KNOWN TO BE NON-HAZARDOUS.

A battery is used to keep time when the unit is without power. Typical accuracy of the G306 time keeping is less than one minute per month drift. The battery of a G306 unit does not affect the unit's memory, all configurations and data is stored in non-volatile memory.

CAUTION: RISK OF ELECTRIC SHOCK
The inverter board, attached to the mounting plate, supplies the high voltage to operate the backlight. Touching the inverter board may result in injury to personnel.

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

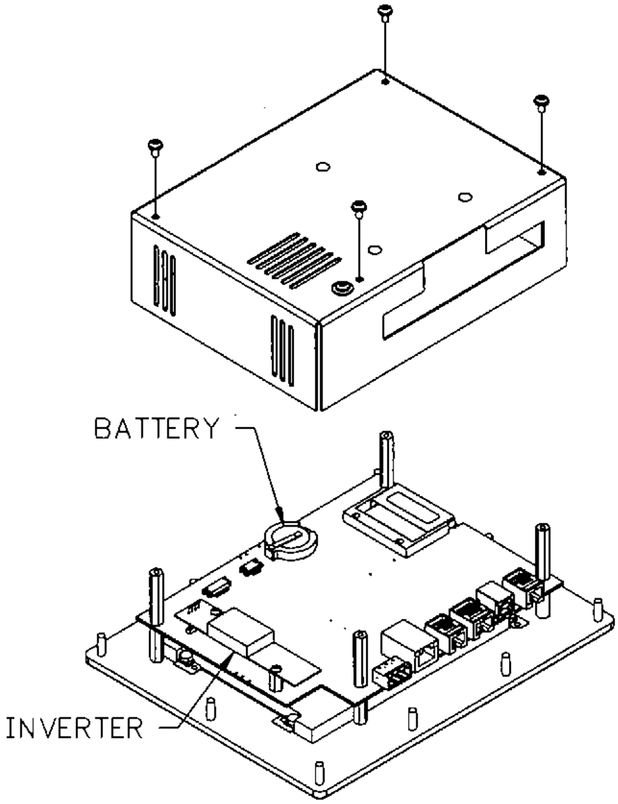
To change the battery of a G306, remove power, cabling, and then the rear cover of the unit. To remove the cover, remove the four screws designated by the arrows on the rear of the unit. Then, by lifting the top side, hinge the cover, thus providing clearance for the connectors on the bottom side of the PCB as shown in the illustration below. Install in the reverse manner.



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

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

The battery used by the G306 is a lithium type CR2025.



OPTIONAL FEATURES AND ACCESSORIES

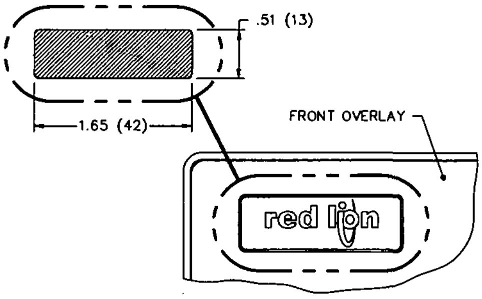
OPTIONAL COMMUNICATION CARD

Red Lion offers optional communication cards for fieldbus communications. These communication cards will allow your G306 to communicate with many of the popular fieldbus protocols.

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

CUSTOM LOGO

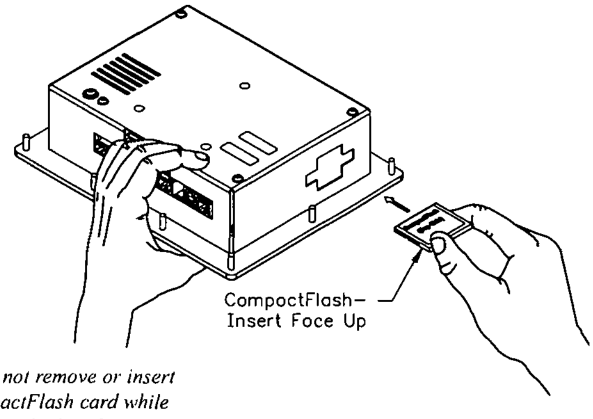
Each G3 operator interface has an embossed area containing the Red Lion logo. Red Lion can provide custom logos to apply to this area. Contact your distributor for additional information and pricing.



COMPACTFLASH SOCKET

CompactFlash socket is a Type II socket that can accept either Type I or II cards. Use cards with a minimum of 4Mbytes with the G306's CompactFlash socket. Cards are available at most computer and office supply retailers.

CompactFlash can be used for configuration transfers, larger configurations, data logging, and trending.



Note: Do not remove or insert the CompactFlash card while power is applied. Refer to "Front Panel LEDs."

Information stored on a CompactFlash card by a G306 can be read by a card reader attached to a PC. This information is stored in IBM (Windows®) PC compatible FAT16 file format.

NOTE

For reliable operation in all of our products, Red Lion recommends the use of SanDisk® and SimpleTech brands of CompactFlash cards.

Industrial grade versions that provide up to two million write/erase cycles minimum are available from Red Lion.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

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TRIO
DATACOM

TC-900DR USER GUIDE

41 Aster Avenue Carrum Downs 3201 Australia Tel: 61 3 9775 0505 Fax: 61 3 9775 0606 www.trio.com.au

GENERAL

The Trio DataCom TC-900DR is a full duplex 900 MHz Radio featuring a fully integrated 4800/9600 bps data radio modem and antenna diplexer. Configuration of the unit is fully programmable, with parameters held in non volatile memory (NVRAM). All configuration parameters are accessible using the TC-DRPROG installation package, consisting of a programming lead, manual and software which will run on a PC under Windows 95/98/NT. It is essential that each unit is programmed to suit individual requirements prior to operation. *For detailed information refer to the TC-900DR Handbook.*

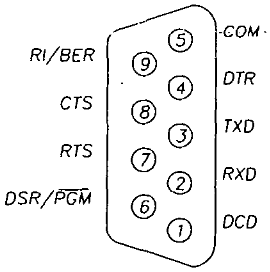
DATA CONNECTION

The data connection is via a DB9 connector labeled 'Port A' (shown below), which is wired as a DCE.

ser Serial "Port A" Pin Assignment.

EXTERNAL VIEW OF `**PORT A**

NOTE: Pin 6 and pin 9 provide a dual function which depends on the mode that the TC-900DR is operating in.

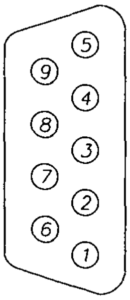


PIN NO. & FUNCTION
1. DATA CARRIER DETECT (DCD)
2. RECEIVE DATA OUTPUT (RXD)
3. TRANSMIT DATA IN (TXD)
4. DATA TERMINAL READY (DTR)
5. COMMON (COM)
6. PROGRAM PIN (PGM)
7. REQUEST TO SEND (RTS)
8. CLEAR TO SEND (CTS)
9. BIT ERROR RATE PIN (BER)

User Serial "Port B" Pin Assignment.

ort B can be used as a secondary data steam (independent of Port A) once configured by the programmer. Port B also has one connection that may be of use for installation. This connection (Pin 9) is Receive Signal Strength Indicator (RSSI) output. 0-5V where 1.5V typically indicates -110dBm and every 0.5V increase indicates an improvement of » 10dBm.

EXTERNAL VIEW OF `**PORT B**'



PIN NO. & FUNCTION
1. DATA CARRIER DETECT (DCD)
2. RECEIVE DATA O/P (RxD)
3. TRANSMIT DATA O/P (TxD)
4. UNUSED
5. COMMON
6. DATA SET RECEIVE (DSR)
7. UNUSED
8. UNUSED
9. RECEIVE SIGNAL STRENGTH

OTE: Port B Pin 9 output has a high impedance of around 50K OHMS and loading will decrease accuracy of the RSSI measurement.

POWER CONNECTIONS

The power required is 13.8VDC nominal, at 600mA (Tx) nominal. If the POWER LED indicator is not illuminated once power is applied, check the internal 1Amp fuse fitted within the unit.

POWER CONNECTOR	PIN ASSIGNMENT
TOP PIN	***+VE SUPPLY (13.8vdc***
BOTTOM PIN	***GROUND***

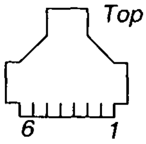
Ext. view of socket

AUXILIARY CONNECTOR

The auxiliary connector is primarily for use with the optional audio handset. The connections to this auxiliary 6 pin RJ11 connector are as follows:

PIN NUMBER	FUNCTION
1	***8 VOLTS***
2	***AUDIO OUT***
3	***GROUND***
4	***MIC INPUT/SENSE***
5	***GROUND***
6	***MANUAL PTT***

External view of socket



The optional audio handset is recommended as an aid in checking installations for radio path viability. This audio handset will only function when fitted prior to applying power to the unit.

The modem upon power up will check the presence of the handset and will inhibit data being transmitted so that voice communications can be established.

Once the path tests have been conducted the audio handsets **MUST be REMOVED** and the unit powered up with the handset removed before data communication can commence.

USER INDICATIONS

The TC-900DR provides 4 LED's that show status information to the user - POWER, RXSIG, SYNC, and TXMIT indications.

The POWER is indicated by a green LED and simply signifies that power has been applied to the unit.

The RXSIG LED (yellow) indicates the level of RSSI signal from the radio IF strip, compared to a threshold level set in the configuration data programmed by the user. If the signal is above the threshold, then the LED indicator is turned on.

In all operation modes except "Programmer mode", the SYNC LED (yellow) indicates when the modem has detected a valid data stream. The SYNC LED is activated, when the modem detects a valid HDLC flag sequence, and remains active until an invalid sequence of seven or more consecutive "1" bits is detected.

The SYNC LED will not be turned on if the RSSI signal strength (as indicated by the RXSIG LED) is below the minimum threshold. This prevents false SYNC detection from noise.

The TXMIT LED (red) indicator is connected directly to the modem's PTT output transistor. Whenever the radio is transmitting, this TXMIT LED indicator will be on.

SPECIAL MODES OF OPERATION

Part of the power-up/reset initialisation phase of the TC-900DR are tests to determine if the modem should enter one of 3 "special operation" modes. *In these modes the TC-900DR won't operate in its standard run mode.*

- Programmer mode.
- Bit error rate test mode.
- Handset mode.

These modes are only entered if the required setup conditions are present at power up. An error mode of operation can also be entered into, if during normal operation, an error condition occurs.

PROGRAMMER MODE

CABLE - Pins 2, 3, 4, 5 straight through with Pin 6 on the DB9 connector of Port A, connected to pin 5. When the modem is powered up with this fitted, the controller senses this and attempts to enter "Programmer mode" and the "SYNC" LED will flash approx. once per second. (Note, the TC-DRPROG programming software and lead has the required connections). Failure to supply the correct password in time, will cause the modem to abandon the "Programmer mode" attempt, and go on with it's normal power-up procedure.

BIT ERROR RATE TEST MODE

Pin 9 of the DB9 connector of Port A, is normally the Ring Indicate output line. However, if this pin is driven positive (connecting it to pin 6 [DSR] and pin 7 [RTS]), then the modem's data transmitter and receiver will enter the BER test mode. This will activate the RF transmitter, and generate a scrambled bit pattern which should be decoded at a receiver as a constant logic "1" level in the unscrambled data. Any errors in the decoded bitstream, will be "0", and the receiver portion of the modem in this mode, will activate the SYNC LED every time it sees a "0" bit.

Note: As the TC-900DR is full duplex this test can operate in both directions simultaneously.

Every error bit detected will activate the SYNC LED. For error rates of 1 in 10^3 and above, the SYNC LED will be ON most of the time. A 1 in 10^4 error rate will show the SYNC LED active for approximately 10% of the time. This function provides a crude indication of Bit Error Rate for installation purposes. Note: Error count messages (ET:XXXX) for every 10,000 bits are presented to Port A for the user. If pin 9 ceases to be driven positive, then the BER Test mode is terminated, and the modem restarts it's initialisation phase.

HANDSET MODE

The modem tests for the presence of a handset plugged into the handset auxiliary port at power up. If a handset is plugged in, the modem will not generate a data stream. However, it will continue to indicate received RF signal strength. The handset has a PTT button, and this signal is connected across the modem's PTT output. Thus the handset PTT switch will not activate the TXMIT LED. It is essential to remove the handset from the unit and reapply power to the unit in order to return to normal operation.

ERROR INDICATION MODES

There are 3 error conditions that cause the RXSIG & SYNC LEDs to be used for error indications and not their normal purpose. Two are fatal conditions, that cause the modem to restart after the duration of the error indication phase.

TRANSMIT POWER LOW

While the modem activates the radio transmitter, it periodically checks the transmit power. If the power measurement is less than a threshold set in the non-volatile memory, then the RXSIG and SYNC LEDs are made to alternate, approximately 4 times per second. The TXMIT LED will also be on during this process. This indication condition will persist for the duration of the transmission. As soon as the transmission is discontinued, the error indication will cease, and the two LEDs revert to their normal function. Factory set to 100 milliWatts.

NVRAM READ ERROR

The DFM4-9DR modem accesses the non-volatile memory as part of it's initialisation phase, to read programming configuration data. If the communication protocol with the device is violated, or the non-volatile memory CRC checksum is found to be incorrect, then the modem indicates this by flashing the RXSIG and SYNC LEDs twice alternately. That is, one LED operates ON and OFF twice, then the other. A total of five cycles of this occurs, then the modem restarts initialisation.

SYNTHESISER LOCK DETECT ERROR

If at any time during normal operation, BER mode, or handset mode, the TBB206 frequency synthesiser indicates an out of lock condition, the modem enters an error indication mode for a short time before restarting.

One LED is turned ON (☼), the LEDs are swapped, then both turned OFF (●). Then the latter LED ON again, swap LEDS, and then OFF. This will give the appearance of a sweeping motion between the LEDs. The following table shows all error condition displays.

Tx PWR Err		NVRAM Err		SYNTH Err	
RXSIG	SYNC	RXSIG	SYNC	RXSIG	SYNC
☼	●	☼	●	☼	●
●	☼	●	●	●	☼
☼	●	☼	●	●	●
●	☼	●	●	●	☼
☼	●	●	☼	☼	●
●	☼	●	●	●	●
☼	●	●	☼		repeat
●	☼	●	●		
continue			repeat		

MOUNTING AND ANTENNA CONNECTION

The TC-900DR should be mounted in a cool, dry, vibration free environment, whilst providing easy access to screws and connections. There are 4 mounting holes on the unit. The antenna should be an external yagi antenna but can be a ground independent dipole mounted via a feeder to the antenna connector (SMA type) for short range applications. However the whole radio modem should be clear of the associated data equipment to prevent mutual interference.

ASSEMBLY OF POWER LEAD

A small plastic bag containing a molex connector (M5557-2R) and two pins (M5556-TL) is provided in the packing box.

The pins are designed to take 18-24 (AWG) wire size with insulation range 1.3 - 3.10mm.

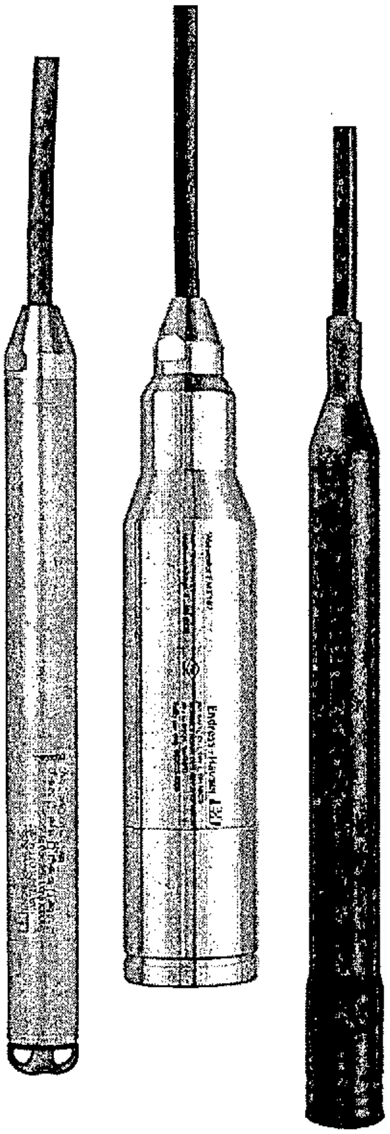
Please take care when crimping the pins. 09/03

Level Pressure Flow Temperature Liquid Analysis Registration Systems Components Services Solutions

Technical Information

Waterpilot FMX167

Hydrostatic Level Measurement
Reliable and rugged level probe with ceramic measuring cell
Compact device for level measurement in fresh water, wastewater and saltwater



Applications

The Waterpilot FMX167 is a pressure sensor for hydrostatic level measurement. Three versions of FMX167 are available at Endress+Hauser:

- FMX167 with an outer diameter = 22 mm (0.87 in): Version very suitable for drinking water applications and for use in probe tubes with small diameters
- FMX167 with an outer diameter = 42 mm (1.66 in): Heavy version and very easy to clean thanks to the flush-mounted diaphragm. Very suitable for wastewater and sewage treatment plants
- FMX167 with an outer diameter = 29 mm (1.15 in): Resistant version for use in saltwater and very suitable for applications on ships (e.g. ballast water tanks)

Your benefits

- High mechanical resistance to overload and aggressive media
- High-precision and long-term stability ceramic measuring cell
- Resistant to climatic changes thanks to potted electronics and 2-filter pressure compensation system
- 4...20 mA output signal with integrated overvoltage protection
- Simultaneous level and temperature measurement by optional integrated temperature sensor Pt 100
- Drinking water approval: KTW, NSF, ACS
- Certified to ATEX, FM and CSA
- Complete measuring point solutions through comprehensive accessories

TI351P/00/en

Endress+Hauser
People for Process Automation

Table of contents

Function and system design

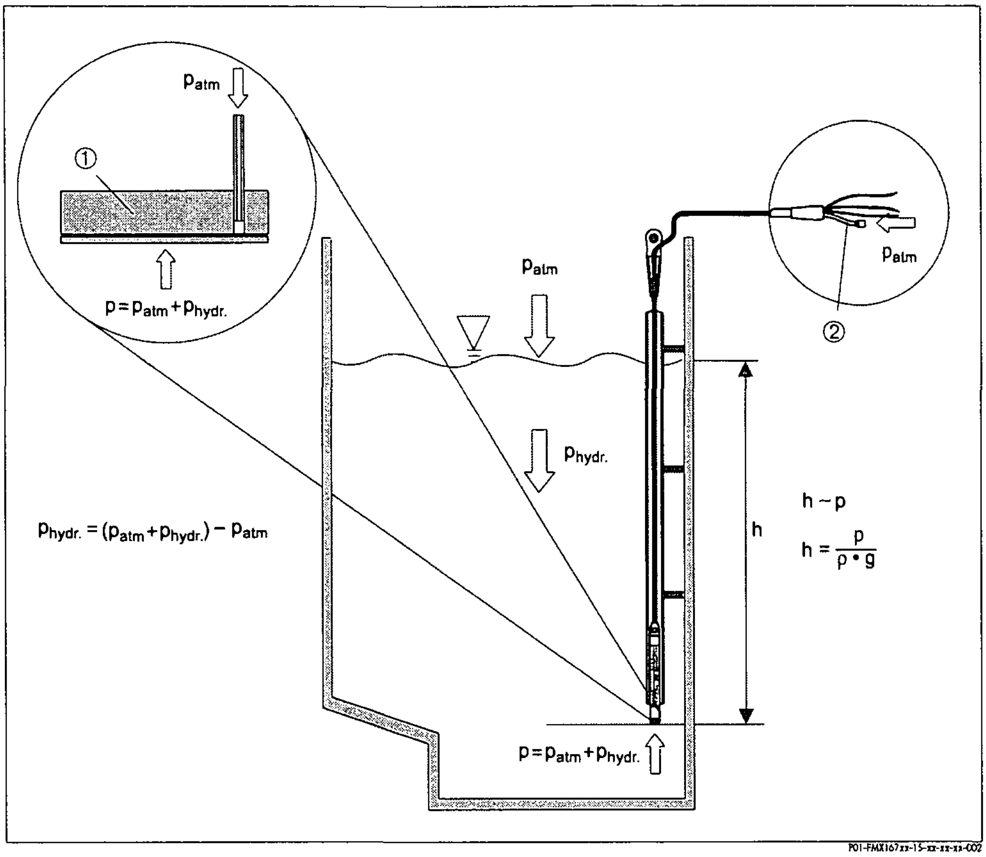
Device selection

Waterpilot FMX167	 P01-FMX167xx-16-xx-xx-xx-002	 P01-FMX167xx-16-xx-xx-xx-003	 P01-FMX167xx-16-xx-xx-xx-004
Field of application	Hydrostatic level measurement in deep wells e.g. drinking water	Hydrostatic level measurement in wastewater	Hydrostatic level measurement in saltwater
Process connection	– Suspension clamp – Extension cable mounting screw with G1 1/2 A or 1 1/2 NPT thread		
Outer diameter	22 mm (0.87 in)	42 mm (1.66 in)	Max. 29 mm (1.15 in)
Seals	– FKM Viton – EPDM[1]	– FKM Viton	– FKM Viton – EPDM
Measuring ranges	– Nine fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O, from 0...0.1 bar to 0...20 bar (0...1 mH_2O to 0...200 mH_2O/ 0...1.5 psi to 0...300 psi/0...3 ftH_2O to 0...600 ftH_2O) – Customer-specific measuring ranges; factory-calibrated		– Seven fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O, from 0...0.1 bar to 0...4 bar (0...1 mH_2O to 0...40 mH_2O/ 0...1.5 psi to 0...60 psi/ 0...3 ftH_2O to 0...150 ftH_2O) – Customer-specific measuring ranges; factory-calibrated
Overload	Up to 40 bar (580 psi)		Up to 25 bar (362 psi)
Process temperature	–10...+70°C (-14...+158°F)		0...+50°C (+32...+122°F)
Ambient temperature range	–10...+70°C (-14...+158°F)		0...+50°C (+32...+122°F)
Maximum measured error	±0.2 % of upper range value (URV)		
Supply voltage	10...30 V DC		
Output	4...20 mA		
Options	– Drinking water approval – Integrated Pt 100 temperature sensor – Integrated Pt 100 temperature sensor and temperature transmitter TMT181 (4...20 mA)	– Integrated Pt 100 temperature sensor – Integrated Pt 100 temperature sensor and temperature transmitter TMT181 (4...20 mA)	– Integrated Pt 100 temperature sensor – Integrated Pt 100 temperature sensor and temperature transmitter TMT181 (4...20 mA)
Specialties	– Integrated overvoltage protection – Large selection of approvals, including ATEX II 2 G, FM and CSA – High-precision, long-term stable and rugged ceramic measuring cell		

1) Recommended for drinking water applications, not suitable for use in hazardous areas

Measuring principle

The ceramic measuring cell is dry, i.e. pressure acts directly on the rugged ceramic diaphragm of Waterpilot FMX167 and causes it to move by max. 0.005 mm.
The effects of air pressure on the liquid surface are transferred via a pressure compensation tube through the extension cable to the rear of the ceramic diaphragm and compensated. Pressure-dependent changes in capacitance caused by diaphragm movement are measured at the electrodes of the ceramic carrier. The electronics convert the movement into a pressure-proportional signal which is linear to the medium level.



FMX167 measuring principle

1	*Ceramic measuring cell*
2	*Pressure compensation tube*
h	*Level height*
p	*Total pressure = hydrostatic pressure + atmospheric pressure*
ρ	*Medium density*
g	*Gravitational acceleration*
phydr.	*Hydrostatic pressure*
patm	*Atmospheric pressure*

Temperature measurement with optional Pt 100

Endress+Hauser offers an optional 4-wire Pt 100 resistance thermometer for Waterpilot FMX167 to measure level and temperature simultaneously. The Pt 100 belongs to Accuracy Class B to DIN EN 60751.

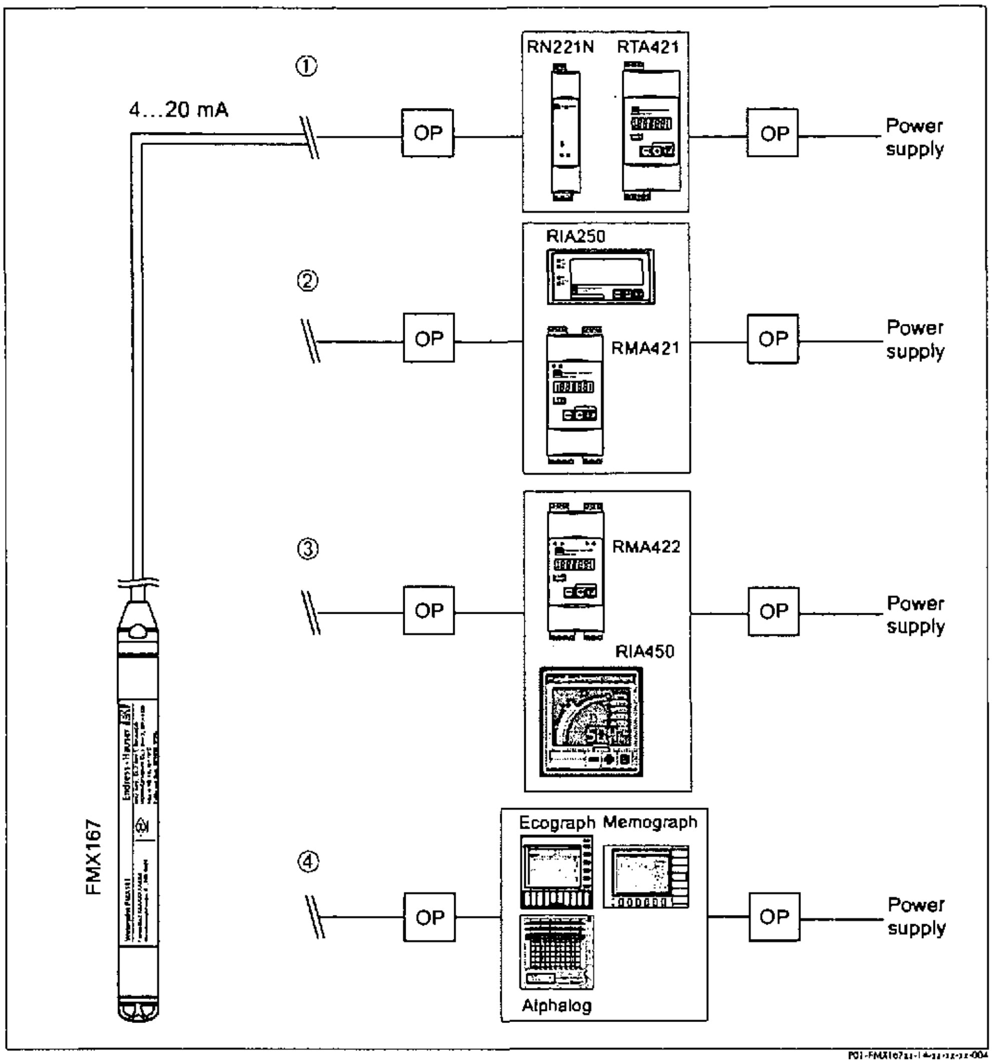
Temperature measurement with optional Pt 100 and temperature transmitter TMT181

To convert the Pt 100 signal to a 4...20 mA signal, Endress+Hauser also offers the TMT181 temperature transmitter.

Measuring system

The complete standard measuring system consists of Waterpilot FMX167 and a transmitter power supply unit with supply voltage of 10...30 V DC.

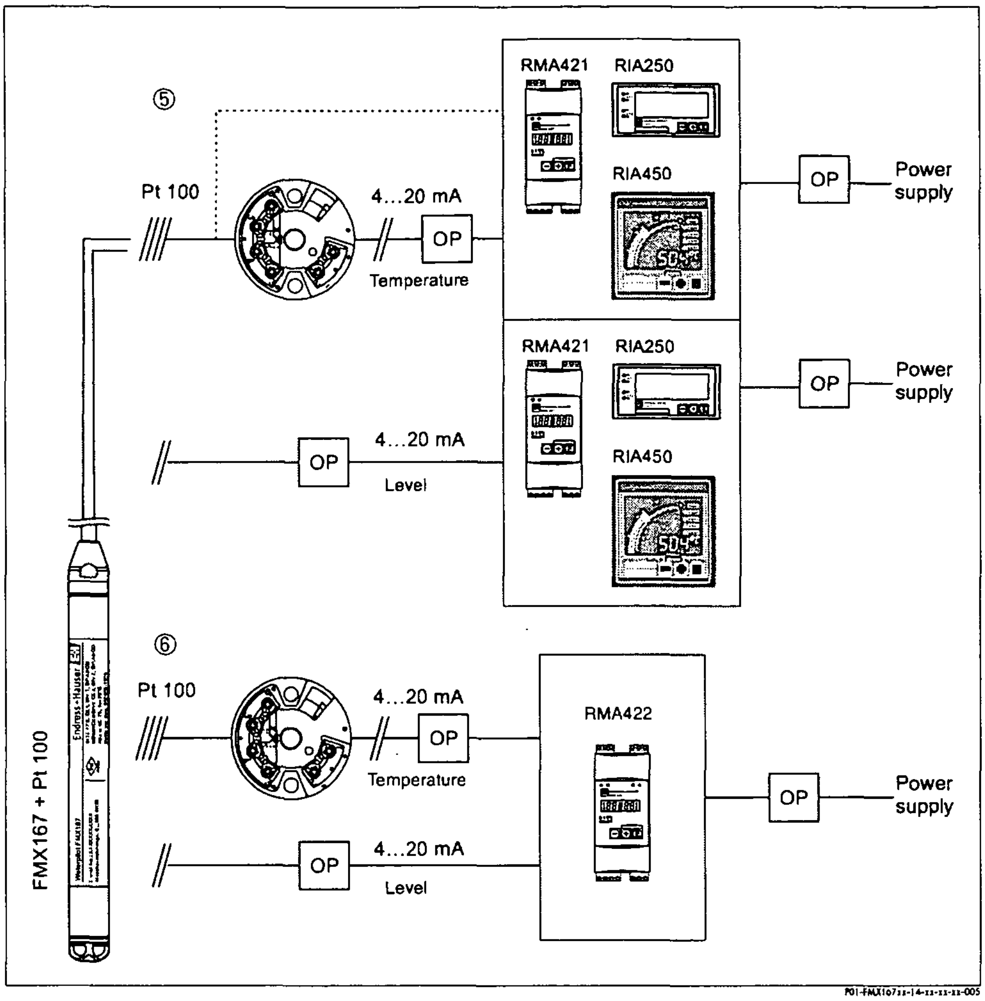
Example for other measuring point solutions with transmitter and possible evaluation units from Endress+Hauser:



Application examples with FMX167

OP Overvoltage protection e.g. HAW from Endress+Hauser

1. Simple cost-effective measuring point solution: Power supply of Waterpilot in hazardous and non-hazardous areas using RN221N active barrier.
   Power supply and additional control of two consumers, e.g. pumps, via limit switch RTA421 with onsite display.
2. Power supply, onsite display, two switch outputs and a signal adaptation (turn down) are integrated in evaluation devices RMA421 (for mounting on hat rails) and RIA250 (for panel mounting). The evaluation unit RMA421 also has a trend recognition function, e.g. optimizing pump control in stormwater overflow basins. This function detects and evaluates changes in a measurable value within a specific time period.
3. If several pumps are used, pump life can be prolonged by alternate switching. With alternating pump control, the pump which was out of service for the longest period of time is switched on. The evaluation units RIA450 (for panel mounting) and RMA422 (for mounting on hat rails) offer this function as well as several others.
4. State-of-the-art recording technology with monitor recorders from Endress+Hauser, e.g. Ecograph, Memograph or hardcopy recorders such as Alphalog for documenting, monitoring, visualizing and archiving.



Application examples with FMX167 with Pt 100

OP Overvoltage protection e.g. HAW from Endress+Hauser

5. If you want to measure, display and evaluate temperature as well as level, e.g. to monitor temperature in fresh water to detect temperature limits for germ formation, you have the following options:
   The optional temperature transmitter can convert the Pt 100 signal into a 4...20 mA signal and transfer it to any customary evaluation unit. Evaluation devices RMA421, RIA250 and RIA450 also offer a direct input for the Pt 100 signal.
6. If you want to detect and evaluate level and temperature with one device, choose the evaluation unit RMA422 with two inputs. It even includes the mathematical operation for linking the input signals.

Input

Measured variable

FMX167 + Pt 100 (optional)

- Hydrostatic pressure of a liquid
- Pt 100: Temperature of a liquid

Temperature transmitter (optional)

- Temperature

Measuring range

- Nine fixed pressure measuring ranges in bar, mH_2O, psi and ftH_2O;
  → Page 18, "Ordering information" Section
- Customer-specific measuring ranges; factory-calibrated
- Temperature measurement from −10...+70°C (+14...+158°F) (optional with Pt 100)

Input signal

FMX167 + Pt 100 (optional)

- Change in capacitance
- Pt 100: Change in resistance

Temperature transmitter (optional)

- Pt 100 resistance signal, 4-wire

Output

Output signal

FMX167 + Pt 100 (optional)

- FMX167: 4...20 mA for hydrostatic pressure measured value, two-wire
- Pt 100: Temperature-dependent resistance of Pt 100

Temperature transmitter (optional)

- 4...20 mA for temperature measured value, two-wire

Load

FMX167 + Pt 100 (optional)

$$R_{tot} \le \frac{U_b - 10\ V}{0.0225\ A} - 2 \cdot 0.09\frac{\Omega}{m} \cdot l - R_{add}$$

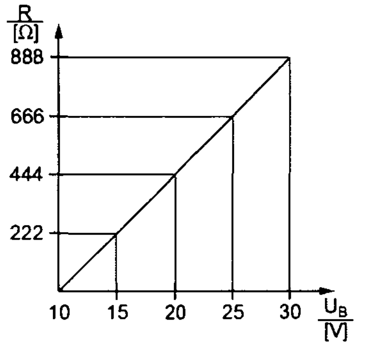
P01-FMX167xx-16-xx-xx-000

Temperature transmitter (optional)

$$R_{tot} \le \frac{U_b - 8\ V}{0.025\ A} - R_{add}$$

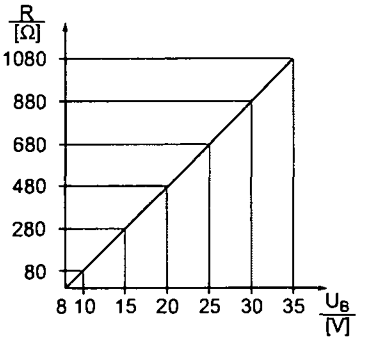
P01-FMX167xx-16-xx-xx-001

Rtot = Max. load resistance [Ω]
Radd = Additional resistances such as resistance of evaluating device and/or display instrument, line resistance [Ω]
Ub = Supply voltage [V]
l = Simple length of extension cable [m] (cable resistance per wire ≤ 0.09 /Ωm)



P01-FMX167xx-05-xx-xx-001

Load chart FMX167 for estimating load resistance. Subtract the additional resistances, e.g. resistance of extension cable, from the calculated value as shown in the equation.



P01-FMX167xx-05-xx-xx-003

Load chart temperature transmitter for estimating load resistance. Subtract the additional resistances from the calculated value as shown in the equation.

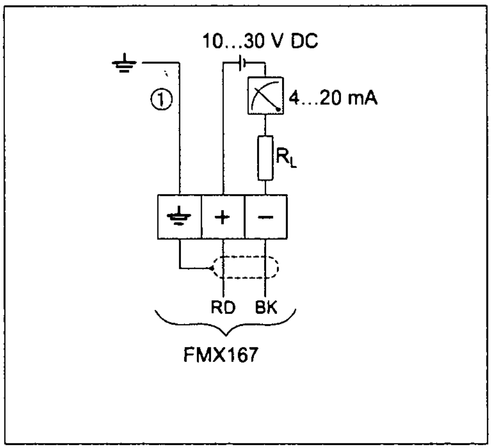
Power supply

Electrical connection

Note!

- When using the measuring device in hazardous areas, national standards and regulations as well as the Safety Instructions (XAs) or Installation or Control Drawings (ZDs) have to be observed. → See also Page 20, "Safety Instructions" and "Installation/Control Drawings" Sections.
- Reverse polarity protection is integrated in the Waterpilot FMX167 and in the temperature transmitter TMT181. Changing the polarities has no impact on operation.
- The cable must end in a dry room or in a proper terminal box. For installation outside, use the terminal box (IP 66/IP 67) with a GORE-TEX® filter from Endress+Hauser. The terminal box can be ordered using the order code of FMX167 (→ see Page 18, "Ordering information" Section) or an accessory (order number: 52006252).

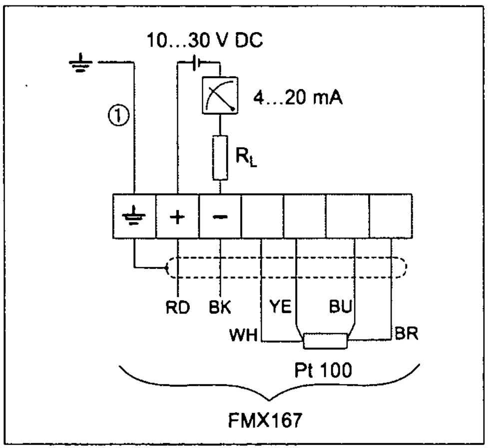
Waterpilot FMX167, standard



P01-FMX167xx-04-xx-xx-xx-008

FMX167 electrical connection, versions "7" or "3" for Feature 70 "Additional options" in the order code (→ see Page 18).

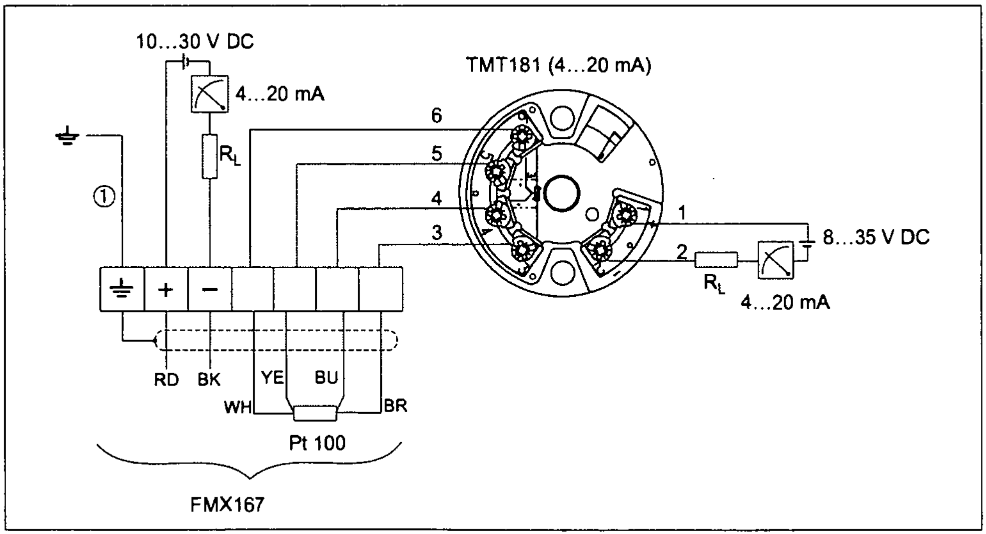
Waterpilot FMX167 with Pt 100



P01-FMX167xx-04-xx-xx-xx-006

FMX167 electrical connection with Pt 100, versions "1" or "4" for Feature 70 "Additional options" in the order code (→ see Page 18).

Waterpilot FMX167 with Pt 100 and TMT181 temperature transmitter (4...20 mA)



P01-FMX167xxx-04-xx-xx-xx-007

FMX167 with Pt 100 and TMT181 temperature transmitter (4...20 mA), version "5" for Feature 70 in the order code (→ see Page 18).

1 Not for FMX167 with outer diameter = 29 mm (1.15 in)

Wire colors: RD = red, BK = black, WH = white, YE = yellow, BU = blue, BR = brown

Supply voltage

Note!
- When using the measuring device in hazardous areas, national standards and regulations as well as the safety instructions (XAs) or Installation or Control Drawings (ZDs) have to be observed. → See also Page 20, "Safety Instructions" and "Installation/Control Drawings" Sections.

FMX167 + Pt 100 (optional)	**Temperature transmitter (optional)**
- FMX167: 10...30 V DC - Pt 100: 10...30 V DC	- 8...35 V DC

Cable specifications

FMX167 + Pt 100 (optional)	**Temperature transmitter (optional)**
- Commercially available instrument cable - Terminals, terminal housing FMX167: 0.08...2.5 mm^2 - If the Pt 100 signal is directly connected to a display and/or evaluation unit, we recommend the use of a shielded cable.	- Commercially available instrument cable - Terminals, terminal housing FMX167: 0.08...2.5 mm^2 - Connection, transmitter: Max. 1.75 mm^2

Power consumption

FMX167 + Pt 100 (optional)	**Temperature transmitter (optional)**
≤ 0.675 W at 30 V DC	≤ 0.875 W at 35 V DC

Current consumption

FMX167 + Pt 100 (optional)	**Temperature transmitter (optional)**
- Max. current consumption: ≤ 22.5 mA Min. current consumption: ≥ 3.5 mA - Pt 100: ≤ 0.6 mA	- Max. current consumption: ≤ 25 mA Min. current consumption: ≥ 3.5 mA - Pt 100 via temperature transmitter: ≤ 0.6 mA

Residual ripple

FMX167 + Pt 100 (optional)	**Temperature transmitter (optional)**
No effect for 4...20 mA signal up to ±5 % residual ripple within permissible range	$U_{ss} \geq 5$ V at $U_B \geq 13$ V, $f_{max.} = 1$ kHz

Performance characteristics

Reference operating conditions

FMX167 + Pt 100 (optional)

DIN EN 60770 T_U = 25°C (77°F)

Temperature transmitter (optional)

Calibration temperature 23°C ± 5 K (73°F ± 5 K)

Maximum measured error

FMX167 + Pt 100 (optional)

- Non-linearity including hysteresis and non-repeatability as per DIN EN 60770: ±0.2% of upper range value (URV)
- Pt 100: Max. ±0.7 K (Class B to DIN EN 60751)

Temperature transmitter (optional)

- ±0.2 K
- With Pt 100: Max. ±0.9 K

Long-term stability

FMX167 + Pt 100 (optional)

±0.1% of upper range value (URL) per year

Temperature transmitter (optional)

≤ 0.1 K per year

Influence of medium temperature on the hydrostatic level measurement of FMX167

- Thermal change in zero signal and output span for typical application temperature range 0...+30°C (+32...+86°F): ±0.4% (±0.5%)* of the upper range limit (URL)
- Thermal change in zero signal and output span for the entire medium temperature range −10...+70°C (+14...+158°F): ±1.0% (±1.5%)* of the upper range limit (URL)
- Temperature coefficient (T_K) of zero signal and output span: 0.15%/10 K (0.3%/10 K)* of the upper range limit (URL)

* Specifications for sensors 0.1 bar (1 mH_2O, 1.5 psi, 3 ftH_2O) and 0.6 bar (6 mH_2O, 10 psi, 20 ftH_2O)

Warm-up period

FMX167 + Pt 100 (optional)

20 ms

Temperature transmitter (optional)

4 s

Rise time

FMX167 + Pt 100 (optional)

- FMX167: 80 ms
- Pt 100: 160 s

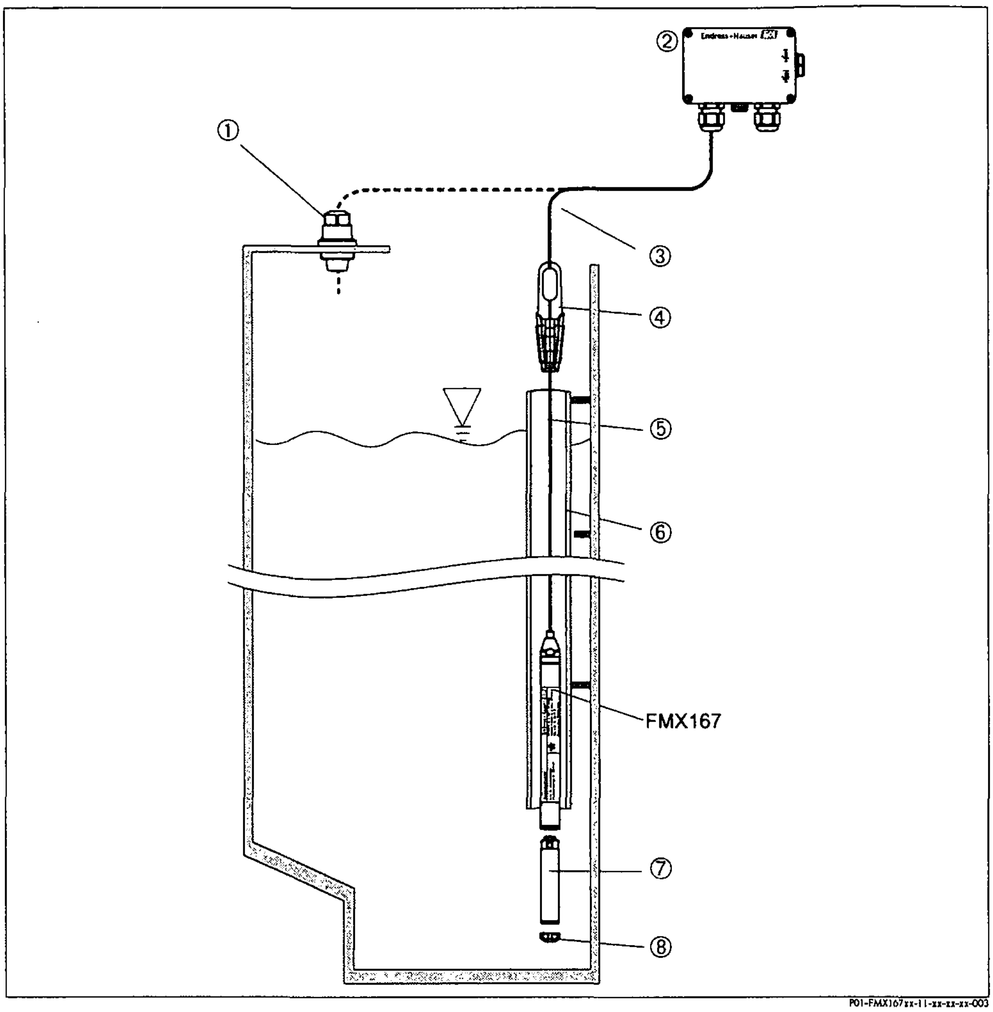
Settling time

FMX167 + Pt 100 (optional)

- FMX167: 150 ms
- Pt 100: 300 s

Installation

Installation instructions



Installation examples, here shown with FMX167 with an outer diameter = 22 mm (0.87 in)

1	*Extension cable mounting screw can be ordered via order code or as an accessory, → see Page 14 and 19*
2	*Terminal housing can be ordered via order code or as an accessory, → see Page 15 and 19*
3	*Extension cable bending radius > 120 mm (4.72 in)*
4	*Suspension clamp can be ordered via order code or as an accessory, → see Page 14 and 19*
5	*Extension cable up to 300 m (384 ft), for max. length → see Page 16, "Extension cable" Section*
6	*Guide tube for FMX167 with outer diameter = 22 mm (0.87 in) internal diameter > 23 mm (0.91 in)*
7	*Additional weight can be ordered as an accessory for FMX167 with outer diameter = 22 mm (0.87 in) and 29 mm (1.15 in), → see Page 19*
8	*Protection cap*

Note!

- A sideways movement of the level probe can lead to measuring errors. Therefore install the probe at a point free from flow and turbulence, or use a guide tube. The internal diameter of the guide tube should be at least 1 mm (0.04 in) bigger than the outer diameter of the selected FMX167.
- The cable must end in a dry room or in a proper terminal box. The terminal box from Endress+Hauser provides optimum humidity and climatic protection and is suitable for outdoor installation.

Environment

Ambient temperature range	**FMX167 + Pt 100 (optional)** ■ FMX167 with outer diameter = 22 mm (0.87 in) and 42 mm (1.66 in): −10...+70°C (+14...+158°F) (= medium temperature) ■ FMX167 with outer diameter = 29 mm (1.15 in): 0...+50°C (+32...+122°F) (= medium temperature)	**Temperature transmitter (optional)** −40...+85°C (−40...+185°F)
Storage temperature	**FMX167 + Pt 100 (optional)** −40...+80°C (−40...+185°F)	**Temperature transmitter (optional)** −40...+100°C (−40...+212°F)
Degree of protection	**FMX167 + Pt 100 (optional)** ■ IP 68, permanently hermetically sealed ■ Optional terminal box: IP 66/IP 67	**Temperature transmitter (optional)** ■ IP 00, moisture condensation permissible ■ When mounted in the optional terminal boxes: IP 66/IP67
Electromagnetic compatibility (EMC)	**FMX167 + Pt 100 (optional)** ■ Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial) ■ Maximum deviation: < 0.5% of span	**Temperature transmitter (optional)** ■ Interference emission to EN 61326 Class B equipment, interference immunity to EN 61326 Appendix A (Industrial)
Overvoltage protection	**FMX167 + Pt 100 (optional)** Integrated overvoltage protection to EN 61000-4-5 ≤ 1.2kV Install overvoltage protection ≥ 1.2 kV, external if necessary	**Temperature transmitter (optional)** Install overvoltage protection, external if necessary.

Process

Medium temperature range	**FMX167 + Pt 100 (optional)** ■ FMX167 with outer diameter = 22 mm (0.87 in) and 42 mm (1.66 in): −10...+70°C (+14...+158°F) ■ FMX167 with outer diameter = 29 mm (1.15 in): 0...+50°C (+32...+122°F)	**Temperature transmitter (optional)** −40...+85°C (−40...+185°C) (= ambient temperature), install temperature transmitter outside medium.

Medium temperature limits

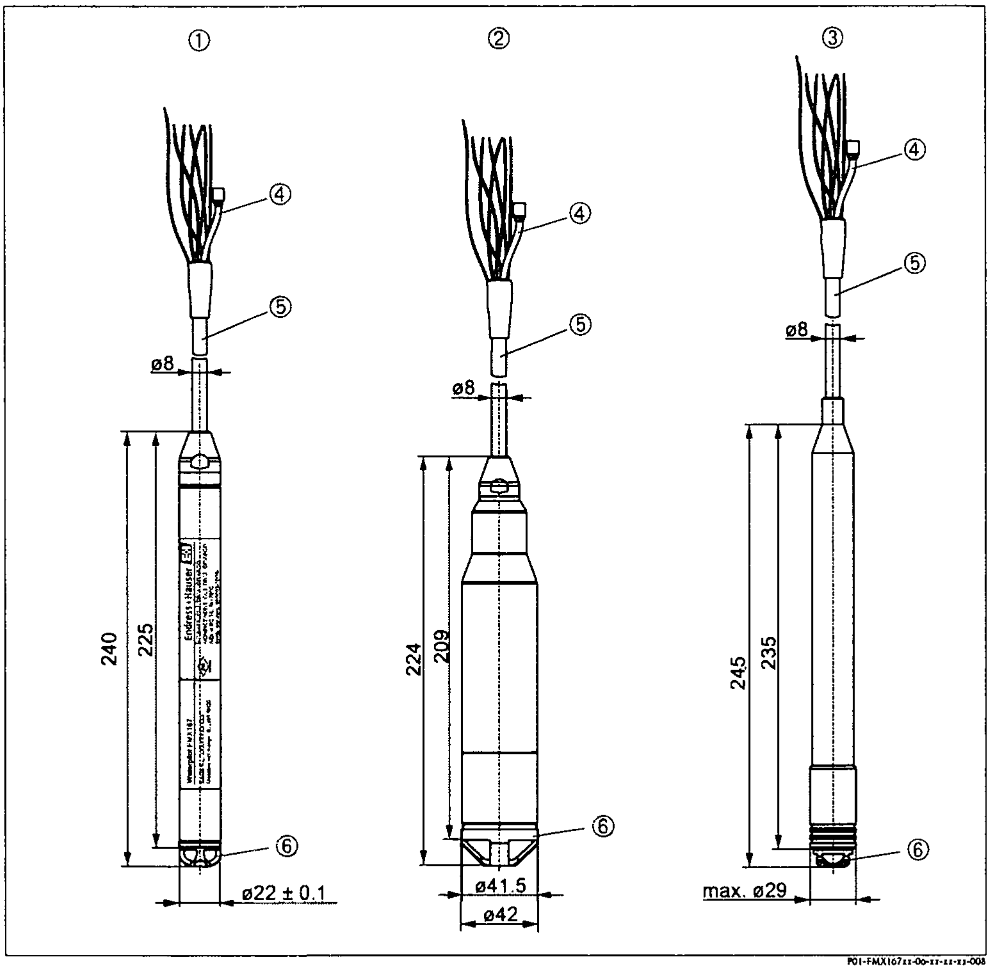
FMX167 + Pt 100 (optional)

- FMX167 with outer diameter
  = 22 mm (0.87 in) and 42 mm (1.66 in):
  -20...+70°C (-4...+158°F)
- FMX167 with outer diameter
  = 29 mm (1.15 in): 0...+50°C (+32...+122°F)

(You may operate the FMX167 in this temperature range. The specification can then be exceeded, e.g. measuring accuracy).

Mechanical construction

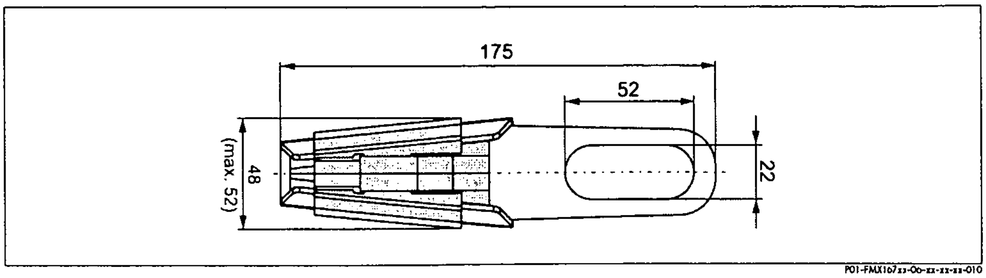
Dimensions of level probe



Versions of FMX167

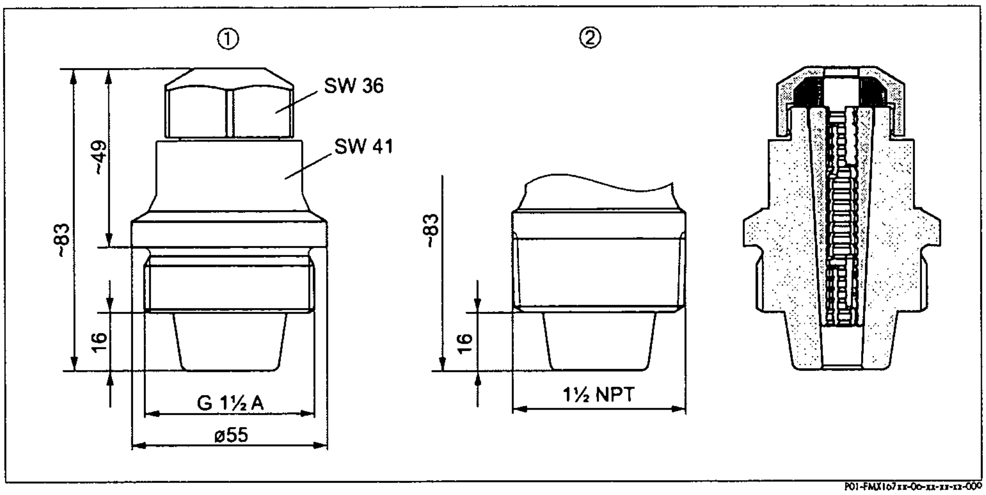
1	*FMX167, version "A" or "D" for Feature 30 "Probe tube" in the order code (→ see Page 18)*
2	*FMX167, version "B" for Feature 30 "Probe tube" in the order code (→ see Page 18)*
3	*FMX167, version "C" for Feature 30 "Probe tube" in the order code (→ see Page 18)*
4	*Pressure compensation tube*
5	*Extension cable*
6	*Protection cap*

Dimensions of suspension clamp



Suspension clamp, version 2 for Feature 20 "Connection" in the order code (→ see Page 18)

Dimensions of extension cable mounting screws

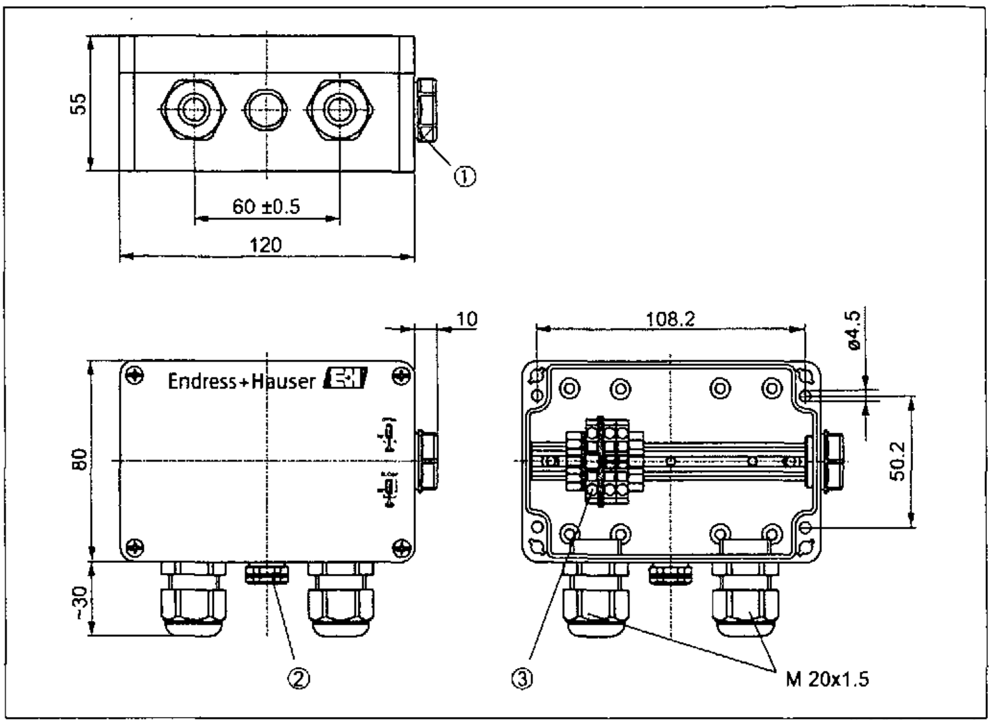


Extension cable mounting screws

1 *Extension cable mounting screw G 1 1/2 A, version "3" for Feature 20 "Connection" in the order code (→ see Page 18)*

2 *Extension cable mounting screw 1 1/2 NPT, version "4" for Feature 20 "Connection" in the order code (→ see Page 18)*

Dimensions of the terminal box IP 66/IP 67 with filter

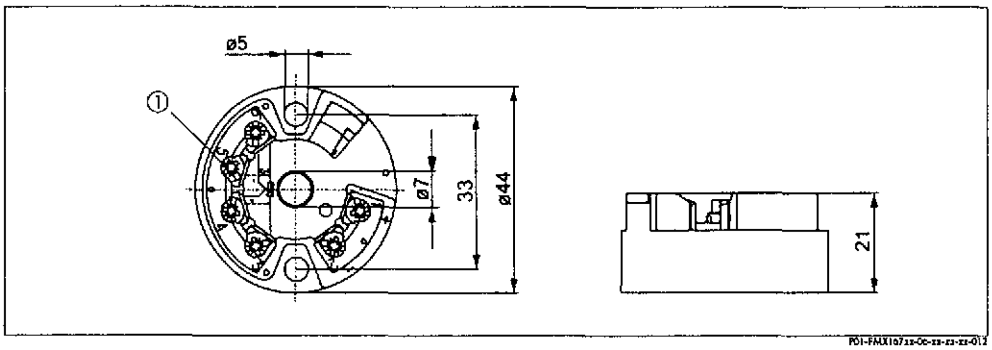


Terminal box

Version "3", "4" or "5" for Feature 70 "Additional options" in the order code (→ see Page 18)

1 Dummy plug M 20x1.5
2 GORE-TEX® filter
3 Terminals for 0.08...2.5 mm²

Dimensions of temperature transmitter TMT181



Temperature transmitter TMT181 (4...20 mA)

Version "5" for Feature 70 "Additional options" in the order code (→ see Page 18). The temperature transmitter can be used in non-hazardous areas and for EEx nA.

Weight

- Level probe, outer diameter = 22 mm (0.87 in): 290 g
- Level probe, outer diameter = 42 mm (1.66 in): 1150 g
- Level probe, outer diameter = 29 mm (1.15 in): 340 g
- Extension cable PE: 52 g/m
- Extension cable FEP: 108 g/m
- Suspension clamp: 170 g
- Extension cable mounting screw G 1 1/2 A: 770 g
- Extension cable mounting screw 1 1/2 NPT: 724 g
- Terminal box: 235 g
- Temperature transmitter: 40 g
- Additional weight: 300 g

Material

Level probe
- Level probe, outer diameter = 22 mm (0,87 in): 1.4435 (AISI 316L)
- Level probe, outer diameter = 42 mm (1.66 in): 1.4435 (AISI 316L)
- Level probe, outer diameter = 29 mm (1.15 in):
  - Level probe: 1.4435 (AISI 316L)
  - Sensor sleeve: PPS (polyphenylene sulfide)
  - Heat-shrink sleeve/cover: Polyolefin

  Metal does not come into contact with the medium.
- Process ceramic: Al_2O_3 aluminium oxide ceramic
- Seal (internal): EPDM or Viton
- Protective cap: PE-HD (high-density polyethylene)
- Extension cable insulation: Either PE (polyethylene) or FEP (fluorinated ethylene propylene). For more information, see the next Section - "Extension cable"
- Suspension clamp: 1.4404 (AISI 316L) and glass fiber reinforced PA (polyamide)
- Extension cable mounting screw G 1 1/2 A: 1.4301 (AISI 304)
- Extension cable mounting screw 1 1/2 NPT: 1.4301 (AISI 304)
- Terminal box: PC (polycarbonate)
- Temperature transmitter: Housing PC (polycarbonate)

Extension cable

Structure of PE extension cable
- Slip-resistant extension cable with strain-relief members made of Dynemo; shielded using aluminium-coated film; insulated with polyethylene (PE), black; copper wires, twisted
- Pressure compensation tube with Teflon filter

Structure of FEP extension cable
- Slip-resistant extension cable; shielded using galvanized steel wire netting; insulated with fluorinated ethylene propylene (FEP), black; copper wires, twisted
- Pressure compensation tube with Teflon filter

Cross-section of PE and FEP extension cable
- Total outer diameter: 8.0 mm ± 0.25 mm (0.315 inch ± 0.0098 inch)
- FMX167: 3 x 0.227 mm^2 + pressure compensation tube with Teflon filter
- FMX167 with Pt 100 (optional): 7 x 0.227 mm^2 + pressure compensation tube with Teflon filter
- Pressure compensation tube with Teflon filter:
  Outer diameter = 2.5 mm (0.098 inch), internal diameter = 1.5 mm (0.059 inch)

Cable resistance of PE and FEP extension cable
- Cable resistance per wire: $\leq 0.09\ \Omega/m$

Cable length of PE and FEP extension cable
- Max. free suspended length (mechanical stability under load): 950 m (39370 inch)
- Please also refer to Page 7, "Load" Section.
- When using the measuring device in hazardous areas, national standards and regulations as well as the safety instructions (XAs) or Installation or Control Drawings (ZDs) have to be observed. → See also Page 20, "Safety Instructions" and "Installation/Control Drawings" Sections.

Further technical data of PE and FEP extension cable
- Minimum bending radius: 120 mm (4.72 inch)
- Tensile strength: Min. 950 N
- Cable extraction force: ≥ 450 N
  (The extension cable could be extracted from the level probe at a tensile force of ≥ 450 N.)
- Resistance to UV light
- PE: Approved for use with drinking water

Terminals

- 3 standard terminals in terminal box
- 4-terminal strip can be ordered as accessory, Order No. 52008938
  Wire cross-section 0.08...2.5 mm^2

Certificates and approvals

CE approval

By attaching the CE symbol, Endress+Hauser confirms that the instrument fulfills all the requirements of the relevant EC directives.

Ex approval, type of protection

- ATEX II 2 G EEx ia IIC T6[1]
- ATEX II 3 G EEx nA II T6
- FM: IS, Class I, Division 1, Groups A–D[1]
- CSA: IS, Class I, Division 1, Groups A–D[1]

[1] Only for Waterpilot FMX167 without Pt 100

Waterpilot FMX167 with outer diameter = 22 mm (0.87 in) is only suitable for use in hazardous areas with the FKM Viton seal.

All explosion protection data are contained in separate explosion protection documentation which you can also request. Explosion protection documents are supplied as standard for all devices approved for use in explosion hazardous areas. → See also Page 20, "Safety Instructions" and "Installation/Control Drawings" Sections.

Drinking water approval (for FMX167 with d_O = 22 mm (0.87 in))

- KTW certificate
- NSF 61 approval
- ACS approval

Marine approval

- GL approval
- ABS approval

External standards and guidelines

DIN EN 60770 (IEC 60770):
Transmitters for use in industrial-control systems
Part 1: Methods for performance evaluation

DIN 16086:
Electrical pressure measuring instruments,
pressure sensors, pressure transmitters,
pressure measuring instruments, concepts, specifications on data sheets

EN 61326 (IEC 61326-1):
Electrical equipment for measurement, control and laboratory use – EMC requirements

Registered trademarks

GORE-TEX®
Registered trademark of W.L. Gore & Associates, Inc., USA

Ordering information

FMX167

10	**Approval**
A	Version for non-hazardous area
B	ATEX II 2 G EEx ia IIC T6
C	ATEX II 3 G EEx nA II T6
S	FM IS, Class I, Division 1, Groups A – D
E	CSA IS, Class I, Division 1, Groups A – D
F	CSA General Purpose

20	**Connection**
1	Probe cable
2	Suspension clamp, AISI 316L
3	Cable mounting screw G 1 1/2, AISI 304
4	Cable mounting screw NPT 1 1/2, AISI 304

30	**Probe tube:**
A	Outer diameter d = 22 mm (0.87 in), AISI 316L
B	Outer diameter d = 42 mm (1.66 in), flush mount, AISI 316L
C	Outer diameter d = 29 mm (1.15 in), AISI 316L with heat-shrink sleeve PPS/polyolefin for saltwater applications
D	Outer diameter d = 22 mm (0.87 in), AISI 316L + drinking water approval KTW/NSF/ACS (can only be selected in conjunction with EPDM seal and PE probe cable)

40 Measuring range:

Measuring range		Measuring range		Max. overload	Vacuum resistance
BA	0...0.1 bar	MA	0...1 mH_2O	5 bar	0 bar_{abs}
BB	0...0.2 bar	MB	0...2 mH_2O	5 bar	0 bar_{abs}
BC	0...0.4 bar	MC	0...4 mH_2O	7 bar	0 bar_{abs}
BD	0...0.6 bar	MD	0...6 mH_2O	10 bar	0 bar_{abs}
BE	0...1.0 bar	ME	0...10 mH_2O	10 bar	0 bar_{abs}
BF	0...2.0 bar	MF	0...20 mH_2O	18 bar	0 bar_{abs}
BG	0...4.0 bar	MG	0...40 mH_2O	25 bar	0 bar_{abs}
BH	0...10.0 bar	MH	0...100 mH_2O	40 bar	0 bar_{abs}
BK	0...20.0 bar	MK	0...200 mH_2O	40 bar	0 bar_{abs}
PA	0...1.5 psi	FA	0...3 ftH_2O	73 psi	0 bar_{abs}
PB	0...3 psi	FB	0...6 ftH_2O	73 psi	0 bar_{abs}
PC	0...6 psi	FC	0...15 ftH_2O	101 psi	0 bar_{abs}
PD	0...10 psi	FD	0...20 ftH_2O	145 psi	0 bar_{abs}
PE	0...15 psi	FE	0...30 ftH_2O	145 psi	0 bar_{abs}
PF	0...30 psi	FF	0...60 ftH_2O	261 psi	0 bar_{abs}
PG	0...60 psi	FG	0...150 ftH_2O	362 psi	0 bar_{abs}
PH	0...150 psi	FH	0...300 ftH_2O	580 psi	0 bar_{abs}
PK	0...300 psi	FK	0...600 ftH_2O	580 psi	0 bar_{abs}
VV	Adjusted to customer specifications from 0 to ___ (upper range value) in ___ (unit), upper range value: 0.1 bar (1 mH_2O, 1.5 psi, 3 ftH_2O) to 20 bar (200 m_2HO, 300 psi, 600 ft_2HO)				

50	**Sensor seal:**
1	FKM Viton
2	EPDM

60	**Probe cable:**
A	... m, shortable, PE
B	10 m, shortable, PE
C	20 m, shortable, PE
E	30 ft, shortable, PE
F	60 ft, shortable, PE
G	... ft, shortable, PE
J	... m, shortable, FEP
K	10 m, shortable, FEP
L	20 m, shortable, FEP
M	30 ft, shortable, FEP
N	60 ft, shortable, FEP
P	... ft, shortable, FEP

FMX167								Complete order code

→ Ordering information for FMX167 continued on next page.

FMX167 (continued)

70							Additional option:	
							7	Basic version
							S	GL/ABS marine certificate
							1	Pt 100, 4-wire
							3	Terminal box IP66/67
							4	Terminal box IP66/67 + Pt 100, 4-wire
							5	Pt 100 + temperature transmitter TMT181, 2-wire, 4...20 mA = –20...+80°C (–4...+176°F)
FMX167								Complete order code

Accessories

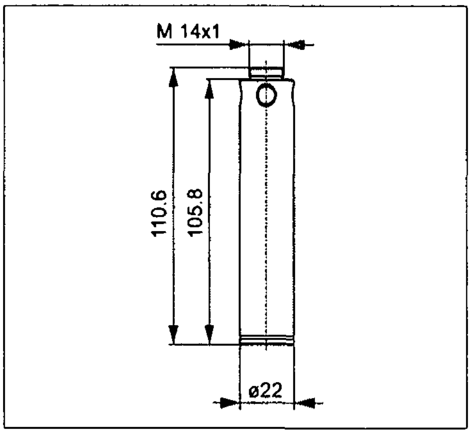
Suspension clamp

- Endress+Hauser offers a suspension clamp for simple FMX167 mounting. → See also Page 14.
- Material: 1.4404 (AISI 316L) and glass fiber reinforced PA (polyamide)
- Order number: 52006151

Terminal box

- Terminal box IP 66/IP 67 with GORE-TEX® filter incl. 3 mounted terminals.
  The terminal box is also suitable for installing a temperature transmitter (Order No. 52008794) or for four additional terminals (Order No. 52008938). → See also Page 15.
- Order number: 52006152

Additional weight (for FMX167 with d_O = 22 mm (0.87 in) and d_O = 29 mm (1.15 in))



P01-FMX167xx-00-xx-xx-014

- To prevent sideways movement leading to measuring errors or to ensure that the device lowers into a guide tube, Endress+Hauser provides additional weights.
  You can screw several weights together. The weights are then attached directly to the FMX167. For FMX167 with outer diameter = 29 mm (1.15 in), a maximum of 5 weights may be screwed on to FMX167.
- Material: 1.4435 (AISI 316L)
- Weight: 300 g
- Order number: 52006153

Temperature transmitter

- Temperature transmitter, 2-wire, preset for measuring range from –20...+80°C (–4...+176°F).
  This setting offers an easily displayable temperature range of 100 K. Note that the Pt 100 resistance thermometer is designed for a temperature range of –10...+70°C (+14...+158°F). → See also Page 15.
- Order number: 52008794

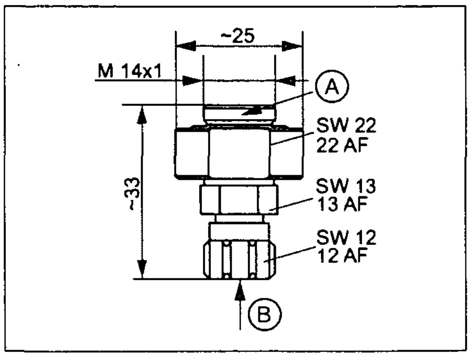
Extension cable mounting screw

- Endress+Hauser offers extension cable mounting screws to simplify the installation of the FMX167 and to close the measuring open. → See also Page 14.
- Material: 1.4301 (AISI 304)
- Order number for extension cable mounting screw with G 1 1/2 A thread: 52008264
- Order number for extension cable mounting screw with 1 1/2 NPT thread: 52009311

Terminals

- Four terminals in strip for FMX167 terminal box, suitable for wire cross-section of 0.08...2.5 mm^2
- Order number: 52008939

Test adapter (for FMX167 with d_O = 22 mm (0.87 in) and d_O = 29 mm (1.15 in))



Test adapter

A Connection suitable for level probe FMX167
B Connection compressed air hose, internal diameter, quick hose gland 4 mm (0.157 in)

- Endress+Hauser offers a test adapter to simplify the function test of level probes.
- Note the maximum pressure for the compressed air hose and the maximum level probe overload. → See also Page 18.
- The maximum pressure for the supplied quick hose gland is 10 bar (145 psi).
- Adapter material: 1.4301 (AISI 304)
- Quick hose gland material: Anodized aluminium
- Adapter weight: 39 g
- Order number: 52011868

Documentation

Field of Activities	▪ Pressure Measurement: FA004P/00/en ▪ Recording Technology: FA014R/09/de ▪ System Components: FA016K/09/en
Technical Information	▪ Temperature Head Transmitter iTEMP PCP TMT181: TI070R/09/en
Operating Instructions	▪ Waterpilot FMX167: BA231P/00/en
Safety Instructions	▪ ATEX II 2 G EEx ia IIC T6: XA131P/00/a3 ▪ ATEX II 3 G EEx nA II T6: XA132P/00/a3
Installation/ Control Drawings	▪ FM IS Class I, Div. 1, Groups A – D: ZD063P/00/en ▪ CSA IS Class I, Div. 1, Groups A – D: ZD064P/00/en
Drinking water approval	▪ SD126P/00/a3

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Endress+Hauser
People for Process Automation

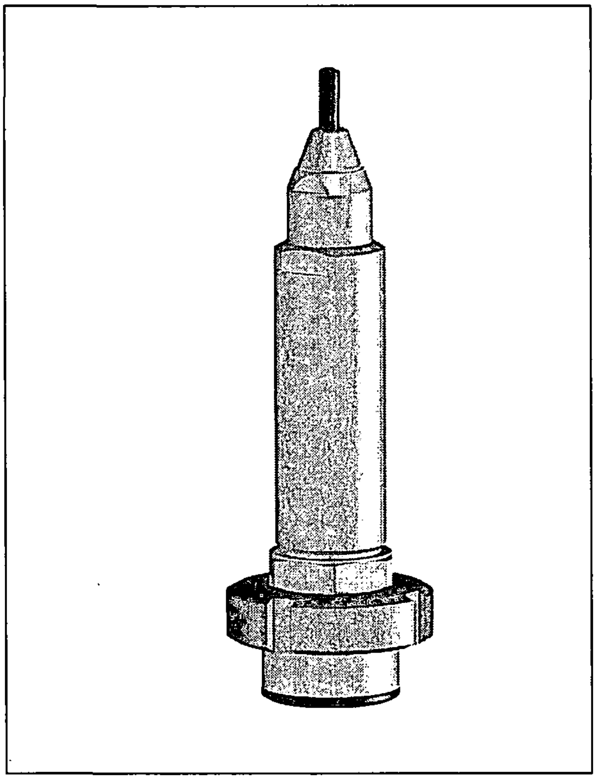
TI351P/00/en/03.06
CCS/FM+SGML 6.0

VEGA

Operating Instructions

VEGABAR 74

4 … 20 mA/HART



Process pressure/
Hydrostatic

Contents

28432-EN-070718

Supplementary documentation

Information:
Depending on the ordered version, supplementary documentation belongs to the scope of delivery. You find this documentation in chapter "*Product description*".

Instructions manuals for accessories and replacement parts

Tip:
To ensure reliable setup and operation of your VEGABAR 74, we offer accessories and replacement parts. The associated documents are:

- Supplementary instructions manual 32036 "*Welded socket and seals*"
- Operating instructions manual 32798 "*Breather housing VEGABOX 02*"
- Operating instructions manual 20591 "*External indicating and adjustment unit VEGADIS 12*"

1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

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

1.3 Symbolism used

ℹ **Information, tip, note**
This symbol indicates helpful additional information.

⚠ **Caution:** If this warning is ignored, faults or malfunctions can result.
Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.
Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex **Ex applications**
This symbol indicates special instructions for Ex applications.

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

→ **Action**
This arrow indicates a single action.

1 **Sequence**
Numbers set in front indicate successive steps in a procedure.

2 For your safety

2.1 Authorised personnel

All operations described in this operating instructions manual must be carried out only by trained specialist personnel authorised by the operator.

During work on and with the device the required personal protection equipment must always be worn.

2.2 Appropriate use

VEGABAR 74 is a pressure transmitter for measurement of gauge pressure, absolute pressure and vacuum.

You can find detailed information on the application range in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

Due to safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about misuse

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

2.4 General safety instructions

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

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the required occupational safety measures with the current valid rules and regulations and also take note of new regulations.

2.5 Safety approval markings and safety tips

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

VEGABAR 74 is in CE conformity with EMC (89/336/EWG), fulfils NAMUR recommendation NE 21 and is in CE conformity with LVD (73/23/EWG).

Conformity has been judged according to the following standards:

- EMC:
  - Emission EN 61326: 2004 (class B)
  - Susceptibility EN 61326: 2004 including supplement A
- LVD: EN 61010-1: 2001

VEGABAR 74 is not subject to the pressure device guideline.[1]

2.7 Fulfilling NAMUR recommendations

VEGABAR 74 fulfills the following NAMUR recommendations:

- NE 21 (interference resistane and emitted interference)
- NE 43 (signal level for failure information)
- NE 53 (compatibility sensor and indicating/adjustment components)

VEGA instruments are generally upward and downward compatible:

- Sensor software to DTM VEGABAR 74 HART
- DTM VEGABAR 74 for adjustment software PACTware™

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

The software version of VEGABAR 74 HART can be read out via PACTware™.

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[1] Due to the flush diaphragm, no own pressure compartment is formed.

You can view all software histories on our website www.vega.com. Make use of this advantage and get registered for update information via e-mail.

2.8 Safety instructions for Ex areas

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

2.9 Environmental instructions

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

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

- Chapter "*Packaging, transport and storage*"
- Chapter "*Disposal*"

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- VEGABAR 74 pressure transmitter
- Documentation
  - this operating instructions manual
  - Test certificate for pressure transmitters
  - Ex-specific "*Safety instructions*" (with Ex-versions)
  - if necessary, further certificates

Components

VEGABAR 74 consists of the following components:

- Process fitting with measuring cell
- Housing with electronics
- Connection cable (direct cable outlet)

The components are available in different versions.

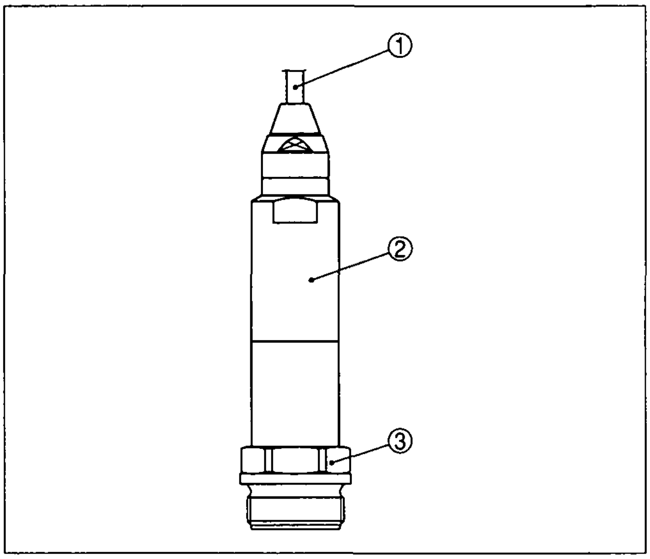

Fig. 1: Example of a VEGABAR 74 with process fitting G1½ A
1 Connection cable
2 Housing with electronics
3 Process fitting with measuring cell

3.2 Principle of operation

Area of application

VEGABAR 74 is a pressure transmitter for use in the paper, food processing and pharmaceutical industry. Thanks to the high protection class IP 68/IP 69K it is particularly suitable for use in humid environment. Depending on the version, it is used for level, gauge pressure, absolute pressure or vacuum measurements. Measured products are gases, vapours and liquids, also with abrasive contents.

Functional principle

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

The CERTEC® measuring cell is also equipped with a temperature sensor. The temperature value can be processed via the signal output.

Supply

Two-wire electronics 4 … 20 mA/HART for power supply and measured value transmission over the same cable.

The supply voltage range can differ depending on the instrument version.

The data for power supply are stated in chapter "*Technical data*" in the "*Supplement*".

3.3 Operation

VEGABAR 74 4 … 20 mA/HART can be adjusted with different adjustment media:

- with external adjustment/indication VEGADIS 12
- an adjustment software according to FDT/DTM standard, e.g. PACTware™ and PC
- with a HART handheld

The kind of adjustment and the adjustment options depend on the selected adjustment component. The entered parameters are generally saved in the respecitive sensor, when adjusting with PACTware™ and PC optionally also in the PC.

3.4 Packaging, transport and storage

Packaging

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

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

Transport

Transport must be carried out under consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

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

4 Mounting

4.1 General instructions

Materials, wetted parts

Make sure that the wetted parts of VEGABAR 74, especially the seal and process fitting, are suitable for the existing process conditions such as pressure, temperature etc. as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" in the "*Supplement*".

Temperature limits

Higher process temperatures often mean also higher ambient temperatures. Make sure that the upper temperature limits stated in chapter "*Technical data*" for the environment of the electronics housing and connection cable are not exceeded.

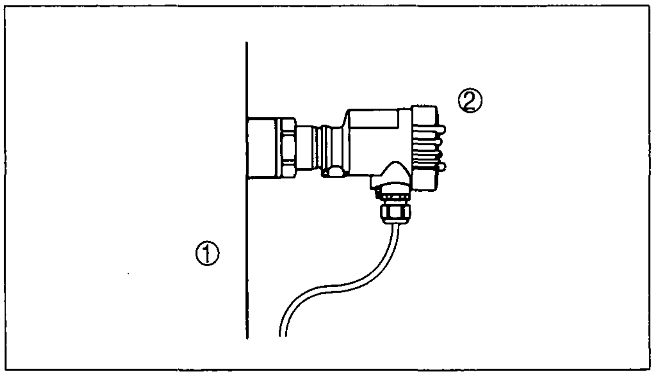

Fig. 2: Temperature ranges
1 Process temperature
2 Ambient temperature

Connection

- The connection cable has a capillary for atmospheric pressure compensation

→ Lead the cable end into a dry space or into a suitable terminal housing.

Information:
VEGA recommends the breather housing VEGABOX 02 or the indication/adjustment VEGADIS 12. Both contain terminals and a ventilation filter for pressure compensation. For mounting outdoors, a suitable protective cover is available.

4.2 Mounting steps

Sealing/Screwing in threaded versions

Seal the thread with teflon, hemp or a similar resistant seal material on the process fitting thread 1½ NPT.

→ Screw VEGABAR 74 into the welded socket. Tighten the hexagon on the process fitting with a suitable wrench. Wrench size, see chapter "*Dimensions*".

Sealing/Screwing in flange versions

Seal the flange connections according to DIN/ANSI with a suitable, resistant seal and mount VEGABAR 74 with suitable screws.

Sealing/Screwing in hygienic fittings

Use the seal suitable for the respective process fitting. You can find the components in the line of VEGA accessories in the supplementary instructions manual "*Welded socket and seals*".

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, versions with integrated overvoltage arresters should be used or external overvoltage arresters should be installed

Tip:
We recommend the version of VEGABAR 74 with integrated overvoltage arrester or VEGA type ÜSB62-36G.X as external overvoltage arreaster.

Take note of safety instructions for Ex applications

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

Select power supply

Power supply and current signal are carried on the same two-wire cable. The voltage supply range can differ depending on the instrument version.

The data for power supply are stated in chapter "*Technical data*" in the "*Supplement*".

Provide a reliable separation of the supply circuit from the mains circuits according to DIN VDE 0106 part 101.

VEGA power supply units VEGATRENN 149AEx, VEGASTAB 690, VEGADIS 371 as well as all VEGAMETs meet this requirement. When using one of these instruments, protection class III is ensured for VEGABAR 74.

Bear in mind the following factors regarding supply voltage:

- Output voltage of the power supply unit can be lower under nominal load (with a sensor current of 20.5 mA or 22 mA in case of fault message)
- Influence of additional instruments in the circuit (see load values in chapter "*Technical data*")

Selecting connection cable

VEGABAR 74 is connected with standard two-wire cable without screen. An outer cable diameter of 5 ... 9 mm ensures the seal effect of the cable gland when connecting via VEGABOX 02 or VEGADIS 12. If electromagnetic interference is expected which is above the test values of EN 61326 for industrial areas, screened cable should be used. For HART multidrop operation we recommend as standard practice the use of screened cable.

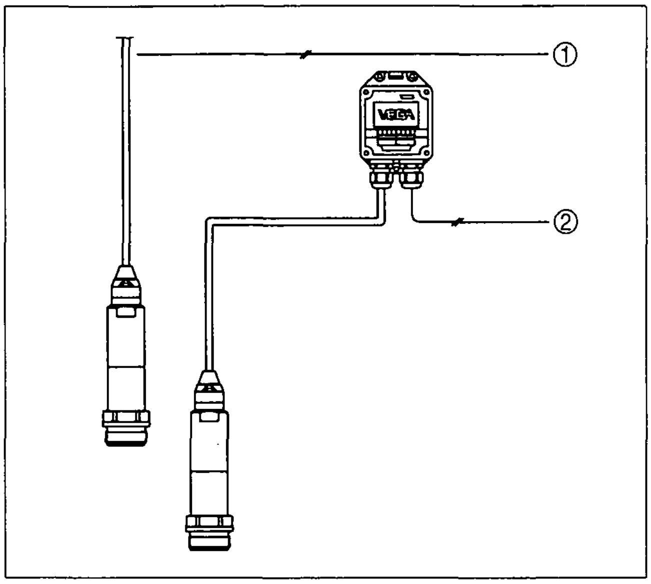

Fig. 3: Connection of VEGABAR 74
1 Direct connection
2 Connection via VEGABOX 02 or VEGADIS 12

Cable screening and grounding

If screened cable is necessary, connect the cable screen on both ends to ground potential. In the VEGABOX 02 or VEGADIS 12, the screen must be connected directly to the internal ground terminal. The ground terminal on the outside of the housing must be connected to the potential equalisation (low impedance).

If potential equalisation currents are expected, the connection on the processing side must be made via a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

Select connection cable for Ex applications

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

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5.2 Connection procedure

Direct connection

Proceed as follows:

1 Wire the connection cable up to the connection compartment. The bending radius must be at least 25 mm.[2]

2 Connect the wire ends to the screw terminals according to the wiring plan

Via VEGABOX 01 or VEGADIS 12

Proceed as follows:

1 Snap connection housing onto the carrier rail or screw it to the mounting plate

2 Loosen the cover screws and remove the cover

3 Insert the cable through the cable entry into the connection housing housing

4 Loosen the screws with a screwdriver

5 Insert the wire ends into the open terminals according to the wiring plan

6 Tighten the screws with a screwdriver

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

8 Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable

9 Connect the supply cable according to steps 3 to 8

10 Screw the housing cover back on

The electrical connection is finished.

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[2] The connection cable is already preconfectioned. After shortening the cable, fasten the type plate with support again to the cable.

5.3 Wiring plan

Direct connection

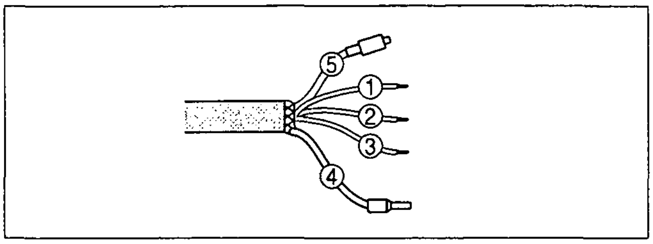

Fig. 4: Wire assignment, connection cable
1. *brown (+): to power supply or to the processing system*
2. *blue (-): to power supply or to the processing system*
3. *yellow: is only required with VEGADIS 12, otherwise connect to minus or with VEGABOX 01 to terminal 3*[3]
4. *Screen*
5. *Breather capillaries with filter element*

Connection via VEGABOX 02

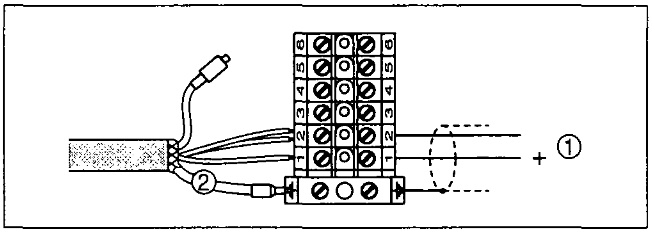

Fig. 5: Terminal assignment VEGABAR 74
1. *To power supply or the processing system*
2. *Screen*[4]

Wire number	Wire colour/Polarity	VEGABAR 74 terminal
1	brown (+)	1
2	blue (-)	2
3	Yellow	2
	Screen	Ground

---

[3] For customer-specific versions already connected with blue (-) when being shipped.

[4] Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

Connection via VEGADIS 12

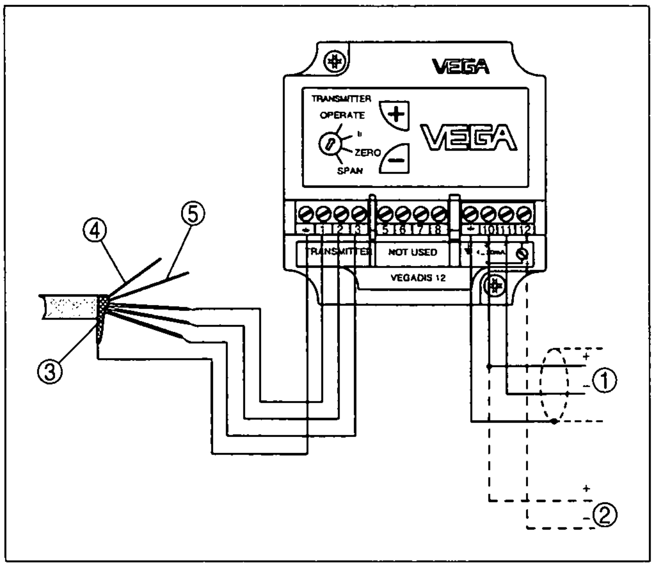

Fig. 6: Terminal assignment, VEGADIS 12

1. *To power supply or the processing system*
2. *Control instrument (4 … 20 mA measurement)*
3. *Screen*[5]
4. *Breather capillaries*
5. *Suspension cable*

Wire number	Wire colour/Polarity	Terminal VEGADIS 12
1	brown (+)	1
2	blue (-)	2
3	Yellow	3

---

[5] Connect screen to ground terminal. Connect ground terminal on the outside of the housing as prescribed. The two terminals are galvanically connected.

6 Set up

6.1 Setup steps without VEGADIS 12

After mounting and electrical connection, VEGABAR 74 is ready for operation.

→ Switch on voltage

The electronics now carries out a self-check for approx. 2 seconds. Then VEGABAR 74 delivers a current of 4 … 20 mA according to the actual level.

6.2 Setup steps with VEGADIS 12

Adjustment volume

- zero - measuring range begin
- span - measuring range end
- ti - Integration time

Adjustment system

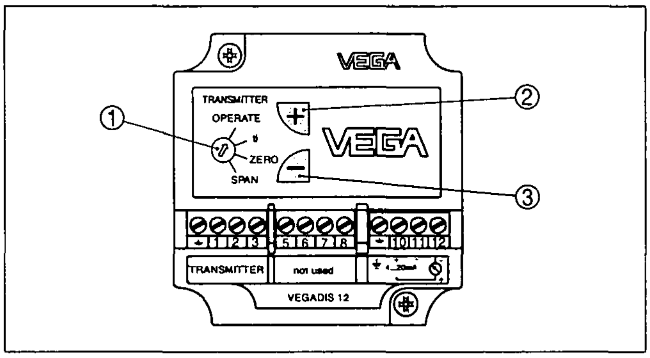

Fig. 7: Adjustment elements of VEGADIS 12

1 Rotary switch: choose the requested function

2 [+] key, change value (rising)

3 [-] key, change value (falling)

- With the rotary switch the requested function is selected
- With the *[+]* and *[-]* keys, the signal current or the integration time are adjusted
- Finally the rotary switch is set to position "*OPERATE*"

The set values are transmitted to the EEPROM memory and remain there even in case of voltage loss.

Adjustment steps, adjustment

Proceed as follows for adjustment with VEGADIS 12:

1. Open housing cover
2. Connect hand multimeter to terminals 10 and 12
3. Meas. range begin: Set rotary switch to "*zero*"

4 Empty the vessel or reduce process pressure
5 Set a current of 4 mA with the *[+]* and *[-]* keys
6 Meas. range end: Set rotary switch to "*span*"
7 Fill the vessel or increase process pressure
8 Set a current of 20 mA with the *[+]* and *[-]* keys
9 Operation: Set rotary switch to "*OPERATE*"
10 Close housing cover

The adjustment data are effective, the output current 4 ... 20 mA corresponds to the actual level.

Adjustment steps, integration time

Proceed as follows for the adjustment of the integration time with VEGADIS 12:

1 Open housing cover
2 Set rotary switch to "*ti*"
3 By pushing the *[-]* key 10-times, make sure that the integration time is set to 0 sec.
4 For every 1 sec. requested integration time, push the *[+]* key once.
5 The integration time is the time required by the output current signal to reach 90 % of the actual height after a sudden level change.
6 Set rotary switch to "*OPERATE*"
7 Close housing cover

Adjustment steps, scaling

The display outputs the current 4 ... 20 mA as bar graph and digital value.

With 4 mA no segment of the bar graph appears, with 20 mA all segments appear. This assignment is fix.

You can scale the digital value to any value between -9999 ... +9999 via the adjustment module.

Proceed as follows for scaling the indication of VEGADIS 12:

1 Open housing cover
2 Initial value: Set rotary switch to "*zero*"
3 Set the requested value, e.g. 0 with the *[+]* and *[-]* keys
4 Final value: Set the rotary switch to "*span*"
5 Set the requested value, e.g. 1000 with the *[+]* and *[-]* keys
6 Decimal point: Set the rotary switch to "*point*"
7 With the *[+]* and *[-]* keys you can adjust the requested value, e.g. 8888 (no decimal point)

8 Set rotary switch to "*OPERATE*"

9 Close housing cover

The adjustment data are effective, the output current 4 ... 20 mA corresponds to the actual level.

7 Setup with PACTware™

7.1 Connect the PC with VEGACONNECT 3

Connecting the PC to the signal cable

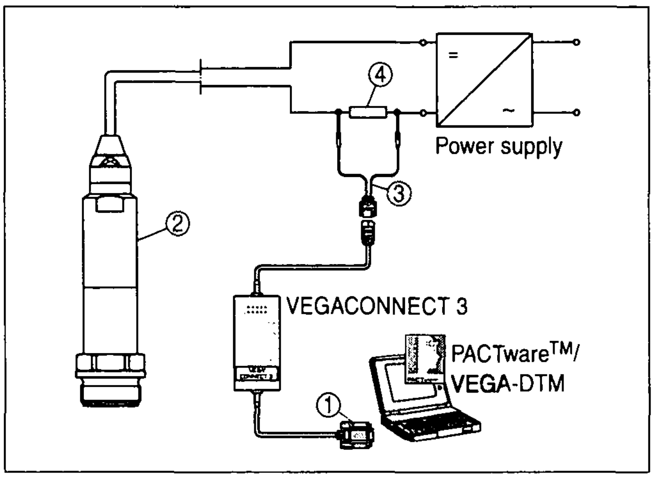

Fig. 8: Connecting the PC to the signal cable
1 RS232 connection (with VEGACONNECT 3) or USB connection (with VEGACONNECT 4)
2 VEGABAR 74
3 HART adapter cable
4 HART resistance 250 Ohm (optional depending on the processing)

Necessary components:

- VEGABAR 74
- PC with PACTware™ and suitable VEGA DTM
- VEGACONNECT 3 or 4 with HART adapter cable (art. no. 2.25397)
- HART resistance approx. 250 Ohm
- Power supply unit

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ohm), an additional external resistance is not necessary (e.g. VEGATRENN 149A, VEGADIS 371, VEGAMET 381/624/625, VEGASCAN 693). In such cases, VEGACONNECT 3 can be connected parallel to the 4 … 20 mA cable.

7.2 Connect the PC with VEGACONNECT 4

Connection via HART

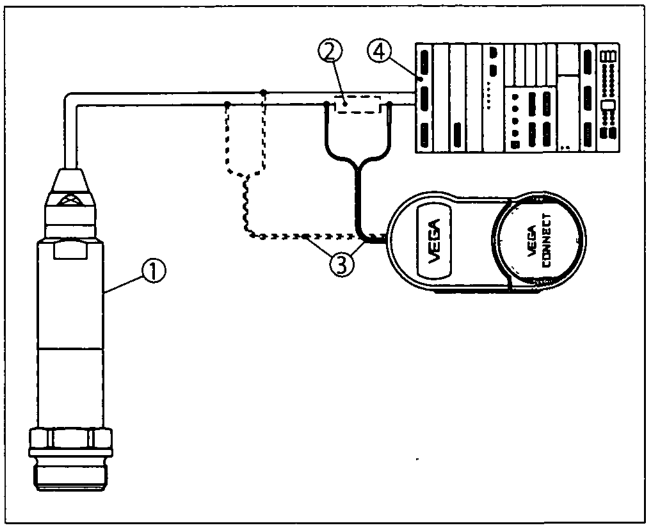

Fig. 9: Connecting the PC via HART to the signal cable
1 VEGABAR 74
2 HART resistance 250 Ohm (optional depending on the processing)
3 Connection cable with 2 mm pins and terminals
4 Processing system/PLC/Voltage supply

Necessary components:

- VEGABAR 74
- PC with PACTware™ and suitable VEGA DTM
- VEGACONNECT 4
- HART resistance 250 Ohm (optional depending on the processing)
- Power supply unit or processing system

Note:
With power supply units with integrated HART resistance (internal resistance approx. 250 Ohm), an additional external resistance is not necessary. This applies, e.g. to the VEGA instruments VEGATRENN 149A, VEGADIS 371, VEGAMET 381). Also usual Ex separators are most of the time equipped with a sufficient current limitation resistor. In such cases, VEGACONNECT 4 can be connected parallel to the 4 … 20 mA cable.

7.3 Parameter adjustment with PACTware™

Further setup steps are described in the operating instructions manual "*DTM Collection/PACTware™*" attached to each CD and which can also be downloaded from our homepage. A detailed description is available in the online help of PACTware™ and the VEGA DTMs.

Note:
Keep in mind that for setup of VEGABAR 74, DTM-Collection in the actual version must be used.

All currently available VEGA DTMs are provided in the DTM Collection on CD and can be obtained from the responsible VEGA agency for a token fee. This CD includes also the up-to-date PACTware™ version. The basic version of this DTM Collection incl. PACTware™ is also available as a free-of-charge download from the Internet.

Go via www.vega.com and "*Downloads*" to the item "*Software*".

7.4 Parameter adjustment with AMS™ and PDM

For VEGA sensors, instrument descriptions for the adjustment programs AMS™ and PDM are available as DD or EDD. The instrument descriptions are already implemented in the current versions of AMS™ and PDM. For older versions of AMS™ and PDM, a free-of-charge download is available via Internet.

Go via www.vega.com and "*Downloads*" to the item "*Software*".

7.5 Saving the parameter adjustment data

It is recommended to document or save the parameter adjustment data. They are hence available for multiple use or service purposes.

The VEGA DTM Collection and PACTware™ in the licensed, professional version provide suitable tools for systematic project documentation and storage.

8 Maintenance and fault rectification

8.1 Maintenance

When used as directed in normal operation, VEGABAR 74 is completely maintenance free.

8.2 Fault clearance

Reaction in case of failures

The operator of the system is responsible for taken suitable measures to remove interferences.

Causes of malfunction

VEGABAR 74 offers maximum reliability. Nevertheless faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Supply
- Signal processing

Fault rectification

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the indicating and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware™ and the suitable DTM. In many cases, the causes can be determined in this way and faults can be rectified.

24 hour service hotline

However, if these measures are not successful, call the VEGA service hotline in urgent cases under the phone no. **+49 1805 858550**.

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

Checking the 4 … 20 mA signal

Connect a handheld multimeter in the suitable measuring range according to the wiring plan.

? 4 … 20 mA signal not stable
  - Level fluctuations
  → Adjust integration time via PACTware™
  - no atmospheric pressure compensation
  → Check the capillaries and cut them clean

→ Check the pressure compensation in the housing and clean the filter element, if necessary

? 4 ... 20 mA signal missing

- Wrong connection to power supply

→ Check connection according to chapter "*Connection steps*" and if necessary, correct according to chapter "*Wiring plan*"

- No voltage supply

→ Check cables for breaks; repair if necessary

- supply voltage too low or load resistance too high

→ Check, adapt if necessary

? Current signal 3.6 mA; 22 mA

- electronics module or measuring cell defective

→ Exchange instrument or return instrument for repair

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

Reaction after fault rectification

Depending on the failure reason and measures taken, the steps described in chapter "*Set up*" must be carried out again, if necessary.

8.3 Instrument repair

If a repair is necessary, please proceed as follows:

You can download a return form (23 KB) from the Internet on our homepage www.vega.com under: "*Downloads - Forms and certificates - Repair form*".

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

- Print and fill out one form per instrument
- Clean the instrument and pack it damage-proof
- Attach the completed form and, if need be, also a safety data sheet outside on the packaging
- Please ask the agency serving you for the address of your return shipment. You can find the respective agency on our website www.vega.com under: "*Company - VEGA worldwide*"

9 Dismounting

9.1 Dismounting steps

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

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

9.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the electronics to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws (in Germany, e.g. ElektroG). Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects to persons and environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you cannot dispose of the instrument properly, please contact us about disposal methods or return.

10 Supplement

10.1 Technical data

General data

Manufacturer	VEGA Grieshaber KG, D-77761 Schiltach
Type name	VEGABAR 74
Parameter, pressure	Gauge pressure, absolute pressure, vacuum
Measuring principle	Ceramic-capacitive, dry measuring cell
Communication interface	None

Materials and weights

Material 316L corresponds to 1.4404 or 1.4435

Materials, wetted parts	
– Process fitting	316L
– Diaphragm	sapphire ceramic® (99.9 % oxide ceramic)
– Seal	FKM (e.g. Viton), Kalrez 6375, EPDM, Chemraz 535
– Seal process fitting thread G½ A, G1½ A	Klingersil C-4400
Materials, non-wetted parts	
– Housing	316L
– Ground terminal	316Ti/316L
– Connection cable	PUR, FEP, PE
– type label support on cable	PE-HART
Weight	0.8 … 8 kg (1.8 … 17.6 lbs), depending on process fitting

Output variable

Output signal	4 … 20 mA/HART
Failure signal	22 mA (3.6 mA), adjustable
Max. output current	22.5 mA
Damping (63 % of the input variable)	0 … 10 s, adjustable
Step response or adjustment time	70 ms (ti: 0 s, 0 … 63 %)
Fulfilled NAMUR recommendations	NE 43

Additional output parameter - temperature

Processing is made via HART-Multidrop

Range	-50 … +150 °C (-58 … +302 °F)
Resolution	1 °C (1.8 °F)
Accuracy	
– in the range of 0 … +100°C (+32 … +212 °F)	±3 K
– in the range of -50 … 0 °C (-58 … +32 °F) and +100 … +150 °C (+212 … +302 °F)	typ. ±4 K

Input variable

Adjustment

Zero adjustable	-20 … +95 % of the nominal measuring range
Span adjustable	3.3 … +120 % of the nominal measuring range
Recommended max. turn down	10:1

Nominal measuring ranges and overload resistance

Nominal range	Overload, max. pressure[6]	Overload, min. pressure
Gauge pressure		
0 … 0.1 bar/0 … 10 kPa	15 bar/1500 kPa	-0.2 bar/-20 kPa
0 … 0.2 bar/0 … 20 kPa	20 bar/2000 kPa	-0.4 bar/-40 kPa
0 … 0.4 bar/0 … 40 kPa	30 bar/3000 kPa	-0.8 bar/-80 kPa
0 … 1 bar/0 … 100 kPa	35 bar/3500 kPa	-1 bar/-100 kPa
0 … 2.5 bar/0 … 250 kPa	50 bar/5000 kPa	-1 bar/-100 kPa
0 … 5 bar/0 … 500 kPa	65 bar/6500 kPa	-1 bar/-100 kPa
0 … 10 bar/0 … 1000 kPa	90 bar/9000 kPa	-1 bar/-100 kPa
0 … 25 bar/0 … 2500 kPa	130 bar/13000 kPa	-1 bar/-100 kPa
0 … 60 bar/0 … 6000 kPa	200 bar/20000 kPa	-1 bar/-100 kPa
-1 … 0 bar/-100 … 0 kPa	35 bar/3500 kPa	-1 bar/-100 kPa
-1 … 1.5 bar/-100 … 150 kPa	50 bar/5000 kPa	-1 bar/-100 kPa
-1 … 5 bar/-100 … 500 kPa	65 bar/6500 kPa	-1 bar/-100 kPa
-1 … 10 bar/-100 … 1000 kPa	90 bar/9000 kPa	-1 bar/-100 kPa
-1 … 25 bar/-100 … 2500 kPa	130 bar/13000 kPa	-1 bar/-100 kPa
-1 … 60 bar/-100 … 6000 kPa	300 bar/30000 kPa	-1 bar/-100 kPa
-0.05 … 0.05 bar/-5 … 5 kPa	15 bar/1500 kPa	-0.2 bar/-20 kPa
-0.1 … 0.1 bar/-10 … 10 kPa	20 bar/2000 kPa	-0.4 bar/-40 kPa

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[6] Limited to 200 bar according to the pressure device directive.

Nominal range	**Overload, max. pressure6)**	**Overload, min. pressure**
-0.2 … 0.2 bar/-20 … 20 kPa	30 bar/3000 kPa	-0.8 bar/-80 kPa
-0.5 … 0.5 bar/-50 … 50 kPa	35 bar/3500 kPa	-1 bar/-100 kPa
Absolute pressure		
0 … 0.1 bar/0 … 10 kPa	15 bar/1500 kPa	
0 … 1 bar/0 … 100 kPa	35 bar/3500 kPa	
0 … 2.5 bar/0 … 250 kPa	50 bar/5000 kPa	
0 … 5 bar/0 … 500 kPa	65 bar/6500 kPa	
0 … 10 bar/0 … 1000 kPa	90 bar/9000 kPa	
0 … 25 bar/0 … 2500 kPa	130 bar/13000 kPa	
0 … 60 bar/0 … 6000 kPa	200 bar/20000 kPa	

Reference conditions and influencing variables (similar to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1

– Temperature	+15 … +25 °C (+59 … +77 °F)
– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psi)
Determination of characteristics	Limit point adjustment according to IEC 61298-2
Characteristics	linear
Reference installation position	upright, diaphragm points downward
Influence of the installation position	<0.2 mbar/20 Pa (0.003 psi)

Deviation determined according to the limit point method according to IEC 60770[7]

Applies to **digital** HART interface as well as to **analogue** current output 4 … 20 mA. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Deviation

– Turn down 1:1 up to 5:1	<0.075 %
– Turn down up to 10:1	<0.015 % x TD

Deviation with absolutely flush process fittings EV, FT

– Turn down 1:1 up to 5:1	<0.05 %
– Turn down up to 10:1	<0.01 % x TD

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[7] Incl. non-linearity, hysteresis and non-repeatability.

Deviation with absolute pressure measuring range 0.1 bar

– Turn down 1:1 up to 5:1	<0.25 % x TD
– Turn down up to 10:1	<0.05 % x TD

Influence of the product or ambient temperature

Applies to **digital** HART interface as well as to **analogue** current output 4 … 20 mA. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Average temperature coefficient of the zero signal

In the compensated temperature range of 0 … +100 °C (+212 °F), reference temperature 20 °C (68 °F):

Average temperature coefficient of the zero signal

– Turn down 1:1	<0.05 %/10 K
– Turn down 1:1 up to 5:1	<0.1 %/10 K
– Turn down up to 10:1	<0.15 %/10 K

Outside the compensated temperature range:

Average temperature coefficient of the zero signal

– Turn down 1:1	typ. <0.05 %/10 K

Thermal change of the current output

Applies also to the **analogue** 4 … 20 mA current output and refers to the set span.

Thermal change, current output	<0.15 % at -40 … +80 °C (-40 … +176 °F)

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

Applies to **digital** HART interface as well as to **analogue** current output 4 … 20 mA. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Long-term drift of the zero signal	<(0.1 % x TD)/1 year

Total deviation (similar to DIN 16086)

The total deviation (max. practical deviation) is the sum of basic accuracy and long-term stability:

$F_{total} = F_{perf} + F_{stab}$

$F_{perf} = \sqrt{((F_T)^2 + (F_{Kl})^2)}$

With

- F_{total}: Total deviation
- F_{perf}: Basic accuracy
- F_{stab}: Long-term drift

- F_T: Temperature coefficient (influence of medium or ambient temperature)
- F_{KI}: Deviation

Ambient conditions

Ambient, storage and transport temperature	
– Connection cable PE	-40 … +60 °C (-40 … +140 °F)
– Connection cable PUR, FEP	-40 … +85 °C (-40 … +185 °F)

Process conditions

The specifications of the pressure stage are used as an overview. The specifications on the type plate are applicable.

Pressure stage, process fitting	
– Thread 316L	PN 60
– Thread Alu	PN 25
– Hygienic fittings 316L	PN 10, PN 16, PN 25, PN 40
– Flange 316L, flange with extension 316L	PN 40 or 150 lbs, 300 lbs
Product temperature depending on the measuring cell seal	
– FKM (e.g. Viton)	-20 … +100 °C (-4 … +212 °F)
– EPDM	-40 … +100 °C (-40 … +212 °F), 1 h: 140 °C/284 °F cleaning temperature
– Kalrez 6375 (FFKM)	-10 … +100 °C (+14 … +212 °F)
– Chemraz 535	-30 … +100 °C (-22 … +212 °F)
Vibration resistance	mechanical vibrations with 4 g and 5 … 100 Hz[8]
Shock resistance	Acceleration 100 g/6 ms[9]

Electromechanical data

Connection cable	
– Configuration	four wires, one suspension cable, one breather capillary, screen braiding, metal foil, mantle
– Wire cross-section	0.5 mm^2 (AWG no. 20)
– wire resistance	<0.036 Ohm/m (0.011 Ohm/ft)
– Standard length	6 m (19.685 ft)
– max. length with VEGADIS 12	200 m (656.168 ft)

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[8] Tested according to the regulations of German Lloyd, GL directive 2.

[9] Tested according to EN 60068-2-27.

– Min. bending radius at 25 °C/77 °F	25 mm (0.985 in)
– Diameter	approx. 8 mm (0.315 in)
– Colour - standard PE	Black
– Colour - standard PUR	Blue
– Colour - Ex-version	Blue

Voltage supply

Supply voltage	
– Non-Ex instrument	12 … 36 V DC
– EEx ia instrument	12 … 29 V DC
Permissible residual ripple	
– <100 Hz	U_{ss} <1 V
– 100 Hz … 10 kHz	U_{ss} <10 mV
Load	see diagram

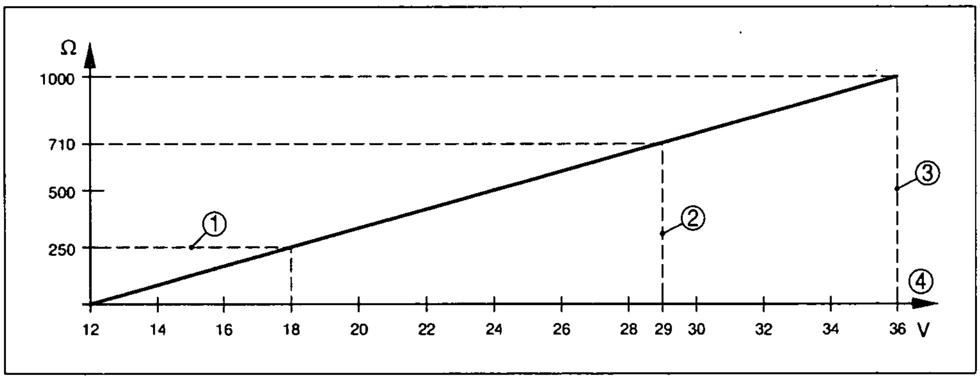


Fig. 10: Voltage diagram VEGABAR 74
1 HART load
2 Voltage limit Ex instrument
3 Voltage limit non-Ex instrument
4 Voltage supply

Load in conjunction with VEGADIS 12	see diagram

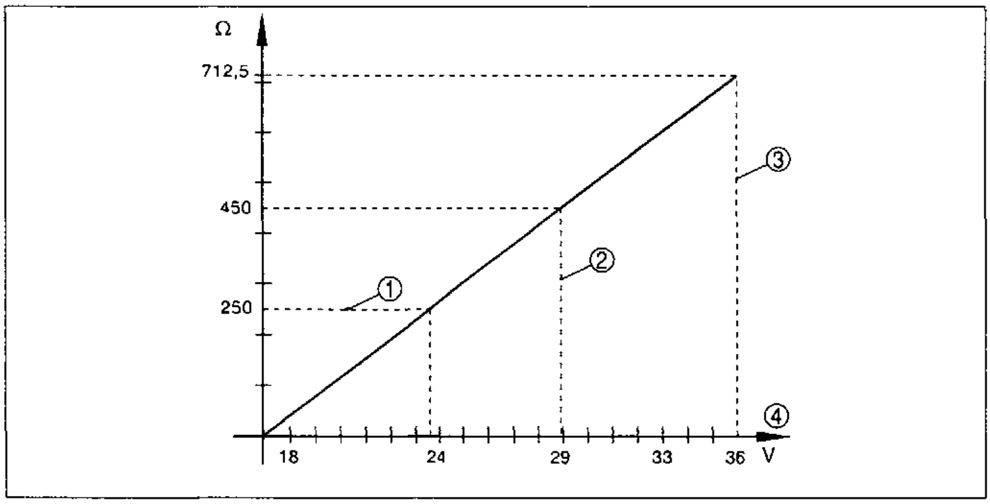


Fig. 11: Voltage diagram VEGABAR 74 with VEGADIS 12
1 HART load
2 Voltage limit Ex instrument
3 Voltage limit non-Ex instrument
4 Voltage supply

Integrated overvoltage protection	
Nominal leakage current (8/20 μs)	10 kA
Min. response time	<25 ns

Electrical protective measures	
Protection	IP 68 (25 bar)/IP 69K
Overvoltage category	III
Protection class	III

Approvals[10]	
ATEX ia	ATEX II 1G EEx ia IIC T6; ATEX II 2G EEx ia IIC T6
Ship approvals	GL, LRS, ABS, CCS, RINA, DNV
Others	WHG

---

[10] Deviating data in Ex applications: see separate safety instructions.

10.2 Dimensions

VEGABAR 74 - threaded fitting

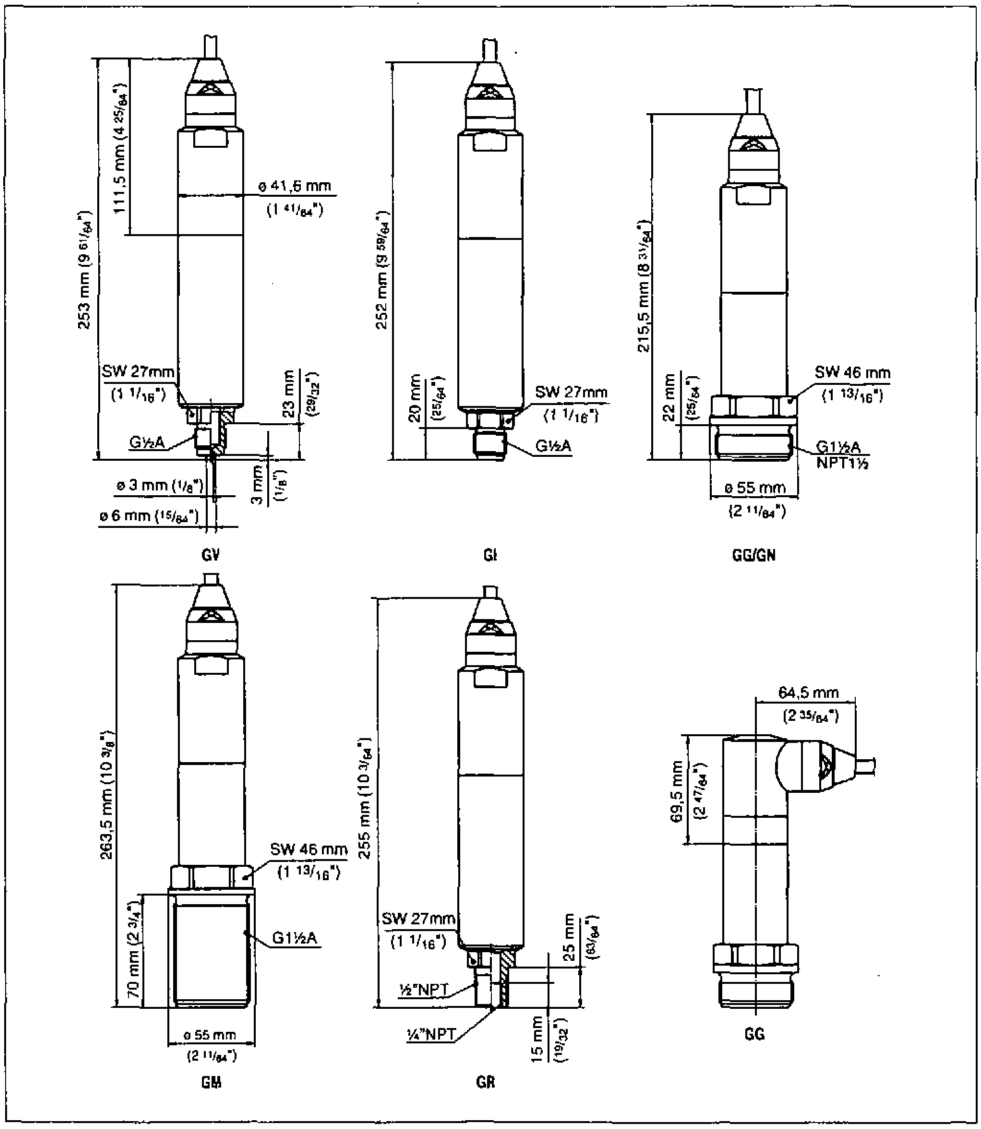


Fig. 12: VEGABAR 74 threaded fitting: GV = G½ A manometer connection EN 837, GI = G½ A inner G¼ A, GG = G1½ A, GN = 1½ NPT, GM = G1½ A 70 mm, GR = ½ NPT inner ¼ NPT

VEGABAR 74 - hygienic fitting 1

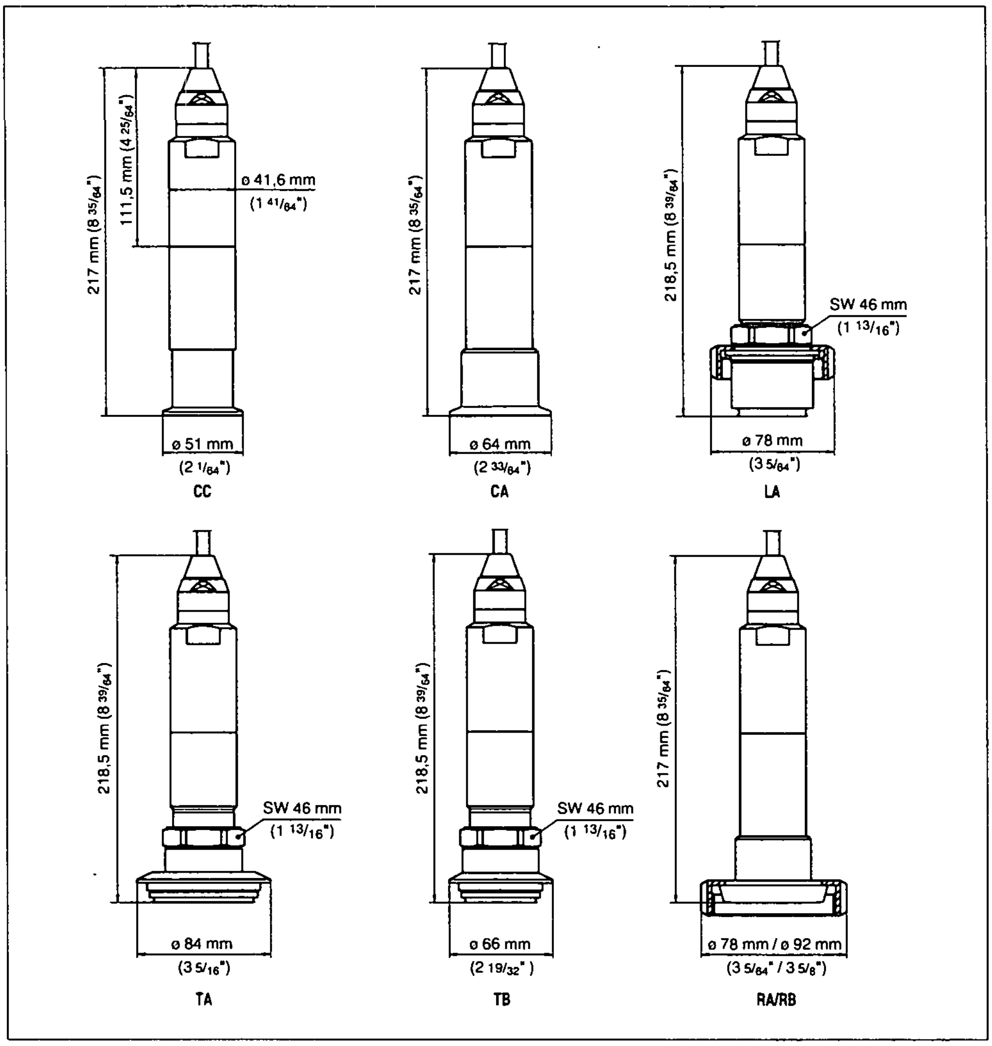


Fig. 13: VEGABAR 74 hygienic fitting: CC = Tri-Clamp 1½", CA = Tri-Clamp 2", LA = hygienic fitting with compression nut F40, TA = Tuchenhagen Varivent DN 32, TB = Tuchenhagen Varivent DN 25, RA/RB = bolting DN 40/DN 50 according to DIN 11851

VEGABAR 74 - hygienic fitting 2

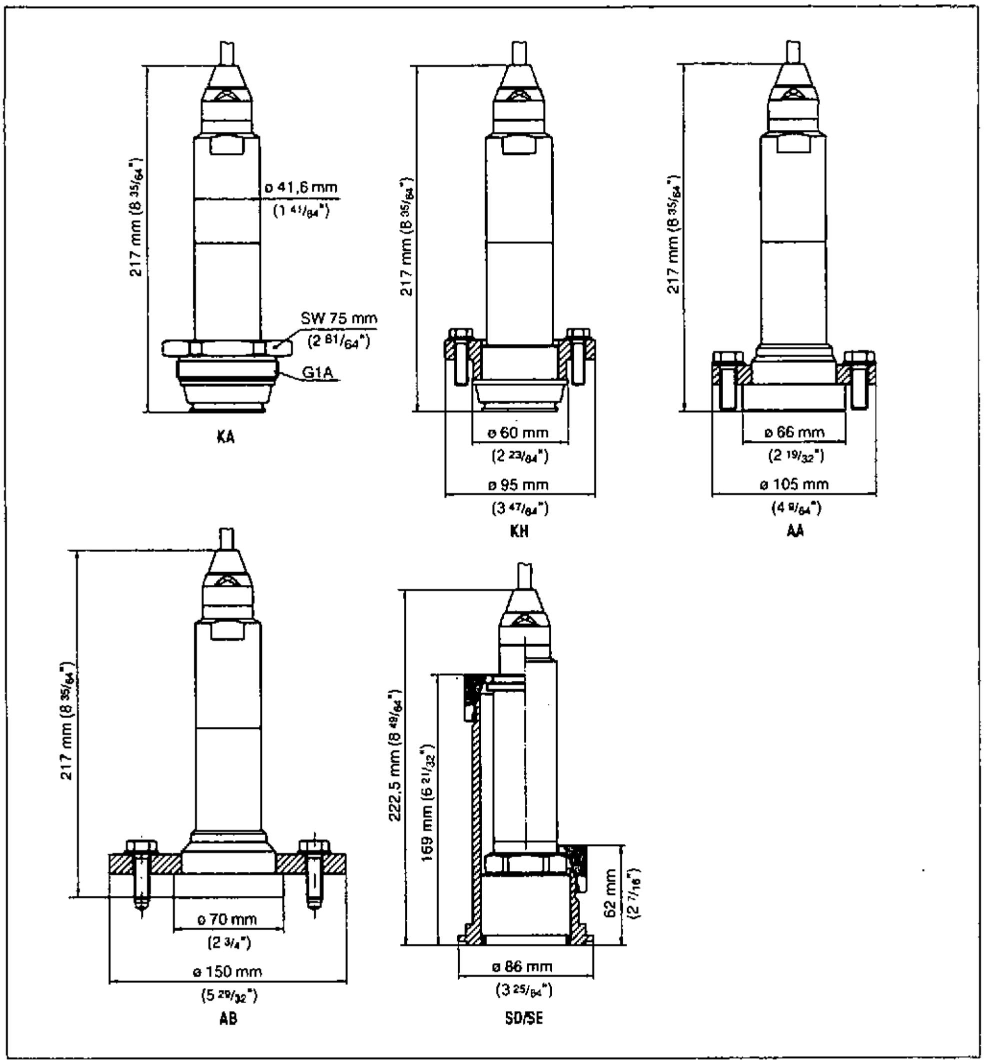
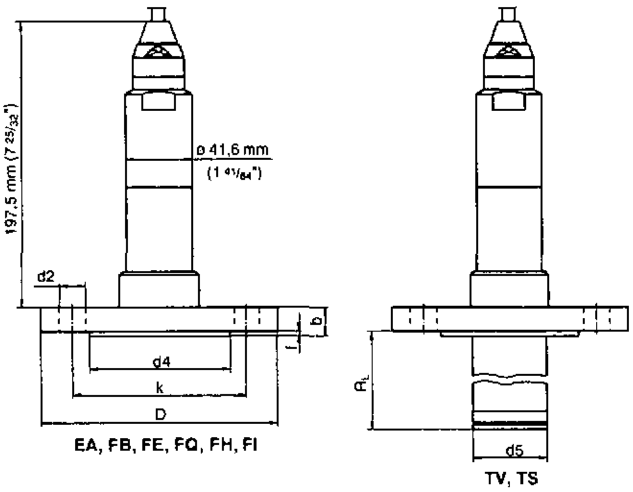


Fig. 14: VEGABAR 74 KA/KH = cone DN 40, AA = DRD, SD/SE = Anderson 3" long/short fitting

VEGABAR 74 - flange connection



①	DN	PN	D	b	k	d2	d4	f	RL	d5
EA	40	40	5 29/32"	45/64"	4 21/64"	4xø 45/64"	3 15/32"	1/8"	-	-
FB	50	40	6 1/2"	25/32"	4 59/64"	4xø 45/64"	4 1/64"	1/8"	-	-
FE	80	40	7 7/8"	15/16"	6 10/64"	8xø 45/64"	5 7/16"	1/8"	-	-

②	"	lbs	D	b	k	d2	d4	f	RL	d5
FQ	1 ½"	150	5"	11/16"	3 14/16"	4xø 5/8"	2 7/8"	1/8"	-	-
FH	2"	150	6"	3/4"	4 3/4"	4xø 5/8"	3 5/8"	1/8"	-	-
FI	3"	150	7 1/2"	3/4"	6	4xø 5/8"	6	1/8"	-	-

③	DN	PN	D	b	k	d2	d4	f	RL	d5
TV	50	40	6 1/2"	25/32"	4 59/64"	4xø 45/64"	4 1/64"	1/8"	④	1 1/2"
TS	80	40	7 7/8"	15/16"	6 19/64"	8xø 45/64"	5 7/16"	1/8"		1 1/2"

Fig. 15: VEGABAR 74 - flange connection

1 Flange connection according to DIN 2501
2 Flange fitting according to ANSI B16.5
3 Flange with extension
4 Order-specific

VEGABAR 74 - threaded fitting for paper industry

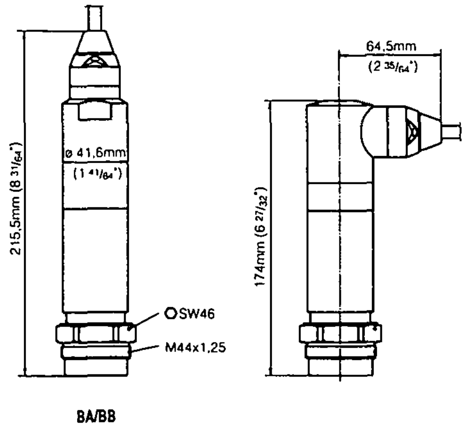


Fig. 16: VEGABAR 74 - connection for paper industry: BA/BB = M44x1.25

VEGABAR 74 - extension fitting for paper industry

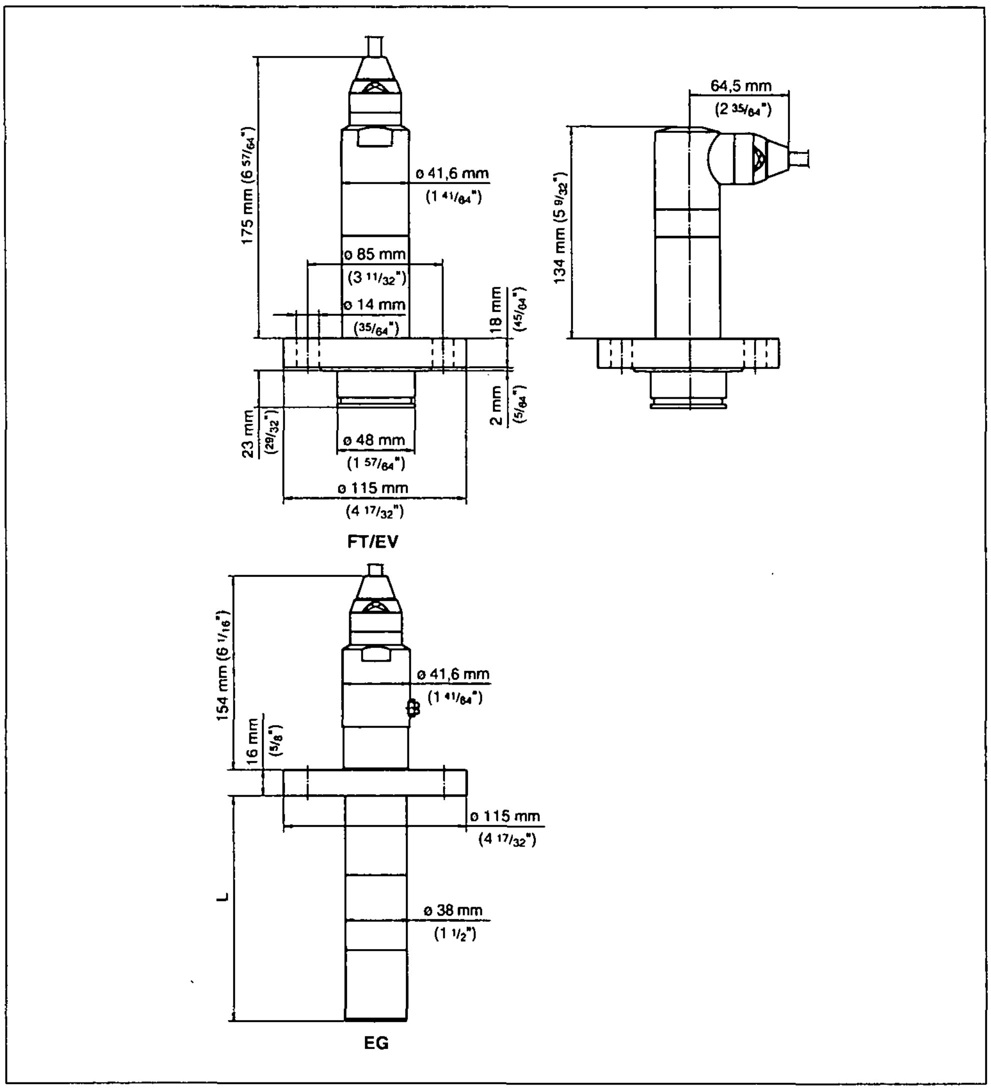


Fig. 17: VEGABAR 74 - extension fitting for paper industry: EV/FT = absolutely flush for pulper (EV 2-times flattened), EG = extension for ball valve fitting (L = order-specific)

10.3 Industrial property rights

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进一步信息请参见网站<http://www.vega.com>。

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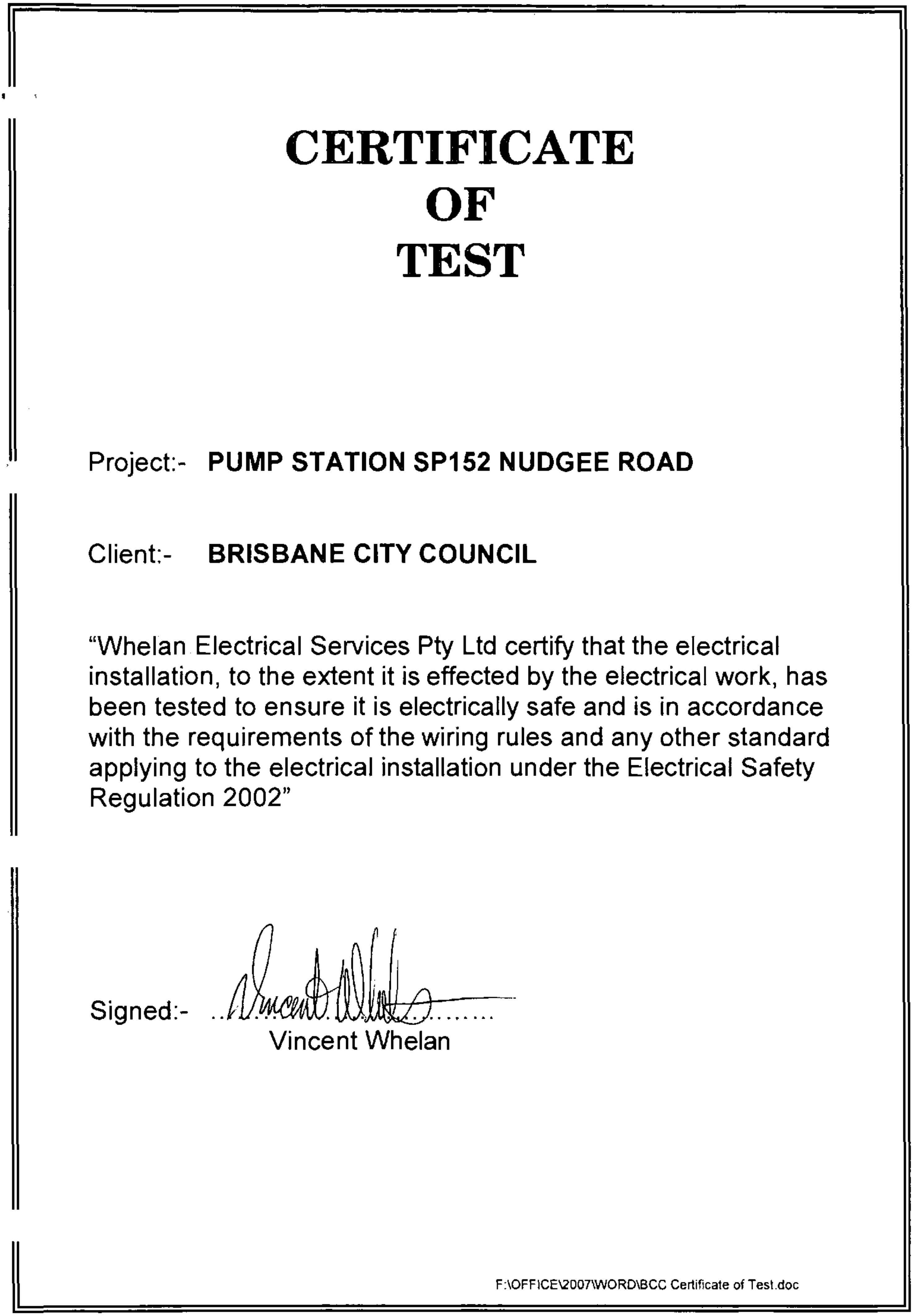
VEGA Grieshaber KG
Am Hohenstein 113
77761 Schiltach
Germany
Phone +49 7836 50-0
Fax +49 7836 50-201
E-mail: info@de.vega.com
www.vega.com

ISO 9001 Q VEGA

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

Subject to change without prior notice 28432-EN-070718



CERTIFICATE
OF
TEST

Project:- **PUMP STATION SP152 NUDGEE ROAD**

Client:- **BRISBANE CITY COUNCIL**

"Whelan Electrical Services Pty Ltd certify that the electrical installation, to the extent it is effected by the electrical work, has been tested to ensure it is electrically safe and is in accordance with the requirements of the wiring rules and any other standard applying to the electrical installation under the Electrical Safety Regulation 2002"

Signed:- ....
Vincent Whelan

F:\OFFICE\2007\WORD\BCC Certificate of Test.doc

SP152 Nudgee Road SEWAGE PUMP STATION

EMOTRON SOFT-STARTER PARAMETERS

MENU No.	FUNCTION	RANGE	VALUE	FACTORY	PAGE
001	Initial Voltage @ Start Ramp 1	25-90% U_n	30	30	36
002	Start Time Ramp 1	1-60 sec	10	10	36
003	Step Down Voltage @ Stop Ramp1	100-40% U_n	100	100	36
004	Stop Time Ramp 1	Off, 2-120 sec	3	Off	36
005	RMS Current	0.0 - 9999 Amp	--	--	36
006	Control Mode	1, 2, 3	2	2	37
007	Extended Functions	Off, On	On	Off	38
008	Extended Functions	Off, On	On	Off	38
011	Initial Voltage @ Start Ramp 2	30-90% Un	90	90	38
012	Start Time Ramp 2	Off, 1-60 sec	Off	Off	38
013	Step Down Voltage @ Stop Ramp2	100-40% Un	40	40	38
014	Stop Time Ramp 2	Off, 2-120 sec	Off	Off	38
016	Initial Torque @ Start	0-250% T_n	10	10	39
017	End Torque @ Start	50-250% T_n	150	150	39
018	End Torque @ Stop	0-100% T_n	0	0	39
020	Voltage Ramp w Current Limit	Off, 150-500% I_n	Off	Off	39
021	Current Limit @ Start	Off, 150-500% I_n	Off	Off	40
022	Setting of Pump Control	Off, On	Off	Off	40
023	Remote Analogue Control	Off, 1, 2	Off	Off	41
024	Full Voltage Start DOL	Off, On	Off	Off	41
025	Torque Control	Off, 1, 2	Off	Off	42
030	Torque Boost Active Time	Off, 0.1 - 2sec	Off	Off	43
031	Torque Boost Current Limit	300 - 700% I_n	300	300	43
032	Setting Of Bypass	Off, On	On	Off	43
033	Power Factor Control	Off, On	Off	Off	46
034	Braking Time	Off, 1 - 120sec	Off	Off	46
035	Braking Strength	100 - 500%	100	100	47
036	Braking Method	1, 2	1	1	47
037	Slow Speed Torque	10 - 100	10	10	48
038	Slow Speed Time @ Start	Off, 1 - 60sec	Off	Off	49
039	Slow Speed Time @ Stop	Off, 1 - 60sec	Off	Off	49
040	DC-Brake at Slow Speed	Off, 1 - 60sec	Off	Off	49
041	Nominal Motor Voltage	200 - 700 V	415	400	50
042	Nominal Motor Current	25%-150% Insoft	14	softstarter current	50
043	Nominal Motor Power	25%-300% Pnsoft	7.5	softstarter power	50
044	Nominal Motor Speed	500 - 3600rpm	1430	softstarter speed	50
045	Nominal Motor Cos phi	0.50 - 1.0	0.86	0.86	50
046	Nominal Motor Frequency	50/60Hz	50	50	50
051	Setting Relay K1	1, 2, 3, 4, 5	1	1	51
052	Setting Relay K2	1, 2, 3, 4, 5	2	2	51
054	Analogue Output	Off, 1, 2	Off	Off	52
055	Analogue Output Value	1, 2, 3	1	1	52
056	Analogue Output Gain	5 - 150%	100	100	52
057	Digital Input Selection	Off, 1 - 4	Off	Off	53
058	Digital Input Pulses	1 - 100	1	1	53
061	Parameter Set	0, 1, 2, 3, 4	1	1	54

MENU No.	FUNCTION	RANGE	VALUE	FACTORY	PAGE
071	Motor PTC Input	No, Yes	Yes	No	55
072	Internal Motor Thermal Prot.	Off, 2-40 sec	10	10	55
073	Used Thermal Capacity	0 - 150%	--	--	56
074	Starts per Hour Limitation	Off, 1-99/Hr	Off	Off	56
075	Locked Rotor Alarm	Off, 1.0-10.0 sec	Off	Off	56
081	Voltage Unbalance Alarm	2 - 25% U_n	10	10	56
082	Resp. Delay Volt Unbal Alarm	Off, 1-60 sec	Off	Off	56
083	Over Voltage Alarm	100 - 150% U_n	115	115	56
084	Resp Delay Over Voltage Alarm	Off, 1-60 sec	Off	Off	56
085	Under Voltage Alarm	75 - 100 U_n	85	85	57
086	Resp Delay Under Volt Alarm	Off, 1-60 sec	Off	Off	57
087	Phase Sequence	L123, L321			57
088	Phase Reversal Alarm	Off, On	Off	Off	57
089	Auto Set Power Limits	No, Yes	No	No	57
090	Output Shaftpower %	0 - 200%	0	0	57
091	Start Delay Power Limits	1-250 sec	10	10	58
092	Max Power Alarm Limit	5 - 200% P_n	115	115	58
093	Resp Delay Max Alarm	Off, 0.1-25.0 sec	Off	Off	58
094	Max Power Pre-Alarm Limit	5 - 200% P_n	110	110	58
095	Max Pre-Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	58
096	Min Power Pre-Alarm Limit	5 - 200% P_n	90	90	59
097	Min Pre-Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	59
098	Min Power Alarm Limit	5 - 200% P_n	85	85	59
099	Min Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	59
101	Run @ Single Phase Loss	No, Yes	No	No	61
102	Run @ Current Limit Time-out	No, Yes	No	No	61
103	Jog Forward Enable	Off, On	Off	Off	61
104	Jog Reverse Enable	Off, On	Off	Off	61
105	Automatic Return Menu	Off, 1 - 999	Off	Off	62
111	Serial Comm Unit Address	1 - 247	Pmp1=1 Pmp2=2	1	62
112	Serial Comm Baudrate	2.4 - 38.4 kBaud	9.6	9.6	62
113	Serial Comm Parity	0, 1	1	0	62
114	Serial Comm Contact Interrupt	Off, 1, 2	Off	1	62
199	Reset to Factory Settings	No, Yes	No	No	63
201	RMS Current	0-9999 Amp	--	--	63
202	RMS Main Voltage	0 - 720 V	--	--	63
203	Output Motor Shaftpower	-9999 - 9999kW	--	--	63
204	Power Factor	0.0 - 1	--	--	63
205	Total Power Consumption	0.0 - 2000MWh	--	--	63
206	Reset Power Comsumption	No, Yes	No	No	64
207	Motor Shaft Torque	-9999 - 9999Nm	--	--	64
208	Operation Time	Hours	--	--	64
211	RMS Current in Phase L1	0.0 - 9999 Amp	--	--	64
212	RMS Current in Phase L2	0.0 - 9999 Amp	--	--	64
213	RMS Current in Phase L3	0.0 - 9999 Amp	--	--	64
214	Main Voltage L1-L2	0 - 720 V	--	--	64
215	Main Voltage L1-L3	0 - 720 V	--	--	64
216	Main Voltage L2-L3	0 - 720 V	--	--	64
221	Locked Keyboard Info	No, Yes	Yes	No	65

FIR001 FACTORY INSPECTION REPORT - SWITCHBOARDS

PROJECT: SP152 NUDGEE RD.

PROJECT No:

Inspector: P. HAGUE

Legend: Acc=Accept Rej=Reject N/A= Not Applicable

Item No.	Activity Description	Comments	Inspection Results			Date Accepted
			Acc	Rej	N/A	
1	Dimensions Correct as per Contract Drawing		✓			22-8
2	Material/Finish as per Specification		✓			"
3	Unauthorised Modifications		✓			"
4	Bolts Fitted / Tight		✓			"
5	IP Rating as per Specifications		✓			"
6	Panel Layout as per Drawings	SOME ITEMS TO BE MOVED	✓			"
7	Labelling - Wording, Size, Fixing, Material, Level	SOME MISSING	✓			4-9
8	Enclosure Free of Debris		✓			22-8
9	Components Fitted are as Specified		✓			"
10	Main Switches/Circuit Breakers/Fuses Sizes OK		✓			"
11	Thermal Overloads Appropriately Set				—	
12	CT Ratios are as Specified				—	
13	Metering Fuses Fed off Line Side Main Sw & CT's				—	
14	Equip Fed from Line Side is Appropriately Labelled	ADD. AS REQ.	✓			"
15	Neutral & Earth Connections not in CT Section				—	"
	All Neutral Connections are Accessible		✓			"
17	MEN Connections Provided	TO BE PROVIDED	✓			4-9
18	Earth Bar/Earth Connections Fitted & OK		✓			22-8
19	Check Phasing of Circuits		✓			"
20	Cores Ferruled & Numbered		✓			"
21	Colour Coding of Wiring as per Spec.		✓			"
22	Terminals Identified per Dwg. and Spares Provided	NOT PROVIDED	✓			4-9
23	Indicators Fitted with Correct Coloured Bezels				—	
24	Selector Switches Engraved Correctly		✓			22-8
25	Main Switches Lockable/Defeatable as per Spec.		✓			"
26	Terminals & Busbar Connections Tight		✓			"
27	Busbars appropriately shielded		✓			"
28	Check internal access & routes for field cabling		✓			"
29	Check Operation of Mech & Key Interlocks				—	
30	Check Operation and Orientation of Door Handles		✓			"
31	Circuit Breakers Isolate Stated Circuits		✓			"
32	ELCB's Tested		✓			"
33	Test Sheets Provided for Insulation Tests	DONE – SUPPLIED IN MANUALS	✓			"
	Test Sheets Provided for Earth Continuity Tests	" " "	✓			"
35	"As Built" Drawings Marked Up		✓			"
36	Legend, Drawings & Log Book Holder Provided		✓			"
37	Laytop Support Tray Provided		✓			"
38	Sunshields Fitted with IP56 Maintained		✓			"
39	Door Locks as Required		✓			"
40	I/O Tested to PLC Terminals	BY WHALAN	✓			"
41	Manual Functions Tested		✓			"
42	Outlets fitted to Sw/Bd as required		✓			"
43	Surge Diverter earthed to adjacent stud.		✓			"
44	Switchboard Lights Function OK		✓			"
45	Adequate access to RTU comms plugs		✓			"
46	No Split Gland Plates		✓			"
47	N/L & E/L have adequate bolts for main N & E		✓			"
48	Aerial Support is Adjustable		✓			"
49	Check cable access dimensions		✓			"
50						
51						

Special Notes:

Signature

Date 22-8-2007

SP152 NUDGEE RD SEWAGE PUMP STATION

EMOTRON SOFT-STARTER PARAMETERS

MENU No.	FUNCTION	RANGE	VALUE	FACTORY	PAGE
001	Initial Voltage @ Start Ramp 1	25-90% U_n	30	30	36
002	Start Time Ramp 1	1-60 sec	10	10	36
003	Step Down Voltage @ Stop Ramp1	100-40% U_n	100	100	36
004	Stop Time Ramp 1	Off, 2-120 sec	~~3~~ 10	Off	36
005	RMS Current	0.0 - 9999 Amp	–	–	36
006	Control Mode	1, 2, 3	2	2	37
007	Extended Functions	Off, On	On	Off	38
008	Extended Functions	Off, On	On	Off	38
011	Initial Voltage @ Start Ramp 2	30-90% Un	90	90	38
012	Start Time Ramp 2	Off, 1-60 sec	Off	Off	38
013	Step Down Voltage @ Stop Ramp2	100-40% Un	40	40	38
014	Stop Time Ramp 2	Off, 2-120 sec	Off	Off	38
016	Initial Torque @ Start	0-250% T_n	10	10	39
017	End Torque @ Start	50-250% T_n	150	150	39
018	End Torque @ Stop	0-100% T_n	0	0	39
020	Voltage Ramp w Current Limit	Off, 150-500% I_n	Off	Off	39
021	Current Limit @ Start	Off, 150-500% I_n	Off	Off	40
022	Setting of Pump Control	Off, On	~~Off~~ ON	Off	40
023	Remote Analogue Control	Off, 1, 2	Off	Off	41
024	Full Voltage Start DOL	Off, On	Off	Off	41
025	Torque Control	Off, 1, 2	Off	Off	42
030	Torque Boost Active Time	Off, 0.1 - 2sec	Off	Off	43
031	Torque Boost Current Limit	300 - 700% I_n	300	300	43
032	Setting Of Bypass	Off, On	On	Off	43
033	Power Factor Control	Off, On	Off	Off	46
034	Braking Time	Off, 1 - 120sec	Off	Off	46
035	Braking Strength	100 - 500%	100	100	47
036	Braking Method	1, 2	1	1	47
037	Slow Speed Torque	10 - 100	10	10	48
038	Slow Speed Time @ Start	Off, 1 - 60sec	Off	Off	49
039	Slow Speed Time @ Stop	Off, 1 - 60sec	Off	Off	49
040	DC-Brake at Slow Speed	Off, 1 - 60sec	Off	Off	49
041	Nominal Motor Voltage	200 - 700 V	~~400~~ 415	400	50
042	Nominal Motor Current	25%-150% Insoft	~~145~~ 14	softstarter current	50
043	Nominal Motor Power	25%-300% Pnsoft	~~75~~ 7.5	softstarter power	50
044	Nominal Motor Speed	500 - 3600rpm	1480	softstarter speed	50
045	Nominal Motor Cos phi	0.50 - 1.0	0.86	0.86	50
046	Nominal Motor Frequency	50/60Hz	50	50	50
051	Setting Relay K1	1, 2, 3, 4, 5	1	1	51
052	Setting Relay K2	1, 2, 3, 4, 5	2	2	51
054	Analogue Output	Off, 1, 2	Off	Off	52
055	Analogue Output Value	1, 2, 3	1	1	52
056	Analogue Output Gain	5 - 150%	100	100	52
057	Digital Input Selection	Off, 1 - 4	Off	Off	53
058	Digital Input Pulses	1 - 100	1	1	53
061	Parameter Set	0, 1, 2, 3, 4	1	1	54

MENU No.	FUNCTION	RANGE	VALUE	FACTORY	PAGE
071	Motor PTC Input	No, Yes	Yes	No	55
072	Internal Motor Thermal Prot.	Off, 2-40 sec	10	10	55
073	Used Thermal Capacity	0 - 150%	--	--	56
074	Starts per Hour Limitation	Off, 1-99/Hr	Off	Off	56
075	Locked Rotor Alarm	Off, 1.0-10.0 sec	Off	Off	56
081	Voltage Unbalance Alarm	2 - 25% U_n	10	10	56
082	Resp. Delay Volt Unbal Alarm	Off, 1-60 sec	Off	Off	56
083	Over Voltage Alarm	100 - 150% U_n	115	115	56
084	Resp Delay Over Voltage Alarm	Off, 1-60 sec	Off	Off	56
085	Under Voltage Alarm	75 - 100 U_n	85	85	57
086	Resp Delay Under Volt Alarm	Off, 1-60 sec	Off	Off	57
087	Phase Sequence	L123, L321			57
088	Phase Reversal Alarm	Off, On	Off	Off	57
089	Auto Set Power Limits	No, Yes	No	No	57
090	Output Shaftpower %	0 - 200%	0	0	57
091	Start Delay Power Limits	1-250 sec	10	10	58
092	Max Power Alarm Limit	5 - 200% P_n	115	115	58
093	Resp Delay Max Alarm	Off, 0.1-25.0 sec	Off	Off	58
094	Max Power Pre-Alarm Limit	5 - 200% P_n	110	110	58
095	Max Pre-Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	58
096	Min Power Pre-Alarm Limit	5 - 200% P_n	90	90	59
097	Min Pre-Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	59
098	Min Power Alarm Limit	5 - 200% P_n	85	85	59
099	Min Alarm Resp Delay	Off, 0.1-25.0 sec	Off	Off	59
101	Run @ Single Phase Loss	No, Yes	No	No	61
102	Run @ Current Limit Time-out	No, Yes	No	No	61
103	Jog Forward Enable	Off, On	Off	Off	61
104	Jog Reverse Enable	Off, On	Off	Off	61
105	Automatic Return Menu	Off, 1 - 999	Off	Off	62
111	Serial Comm Unit Address	1 - 247	P1=1 P2=2 1	1	62
112	Serial Comm Baudrate	2.4 - 38.4 kBaud	9.6	9.6	62
113	Serial Comm Parity	0, 1	1	0	62
114	Serial Comm Contact Interrupt	Off, 1, 2	Off	1	62
199	Reset to Factory Settings	No, Yes	No	No	63
201	RMS Current	0-9999 Amp	--	--	63
202	RMS Main Voltage	0 - 720 V	--	--	63
203	Output Motor Shaftpower	-9999 - 9999kW	--	--	63
204	Power Factor	0.0 - 1	--	--	63
205	Total Power Consumption	0.0 - 2000MWh	--	--	63
206	Reset Power Comsumption	No, Yes	No	No	64
207	Motor Shaft Torque	-9999 - 9999Nm	--	--	64
208	Operation Time	Hours	--	--	64
211	RMS Current in Phase L1	0.0 - 9999 Amp	--	--	64
212	RMS Current in Phase L2	0.0 - 9999 Amp	--	--	64
213	RMS Current in Phase L3	0.0 - 9999 Amp	--	--	64
214	Main Voltage L1-L2	0 - 720 V	--	--	64
215	Main Voltage L1-L3	0 - 720 V	--	--	64
216	Main Voltage L2-L3	0 - 720 V	--	--	64
221	Locked Keyboard Info	No, Yes	Yes	No	65

WHELAN ELECTRICAL SERVICES PTY LTD
ACN. 062 697 063

QUALITY FORM

Form 001 - Inspection & Test Plan - Switchboards

Page No. 1

Inspection Test Plan - Quality Program AS 85-1823	
Client:- BRISBANE CITY COUNCIL	DWG N°:- 0023
Project:- S/B REPLACEMENT	Consultants:-
Date:- 20/08/07.	Job N°:- NUDGEE RD
Item:- S/B CUBICLE	Contract:- BW 70107-06/07
Test Location:- YANDINA	Built By:- C/T + W.E.S.
Elect. Insp. By:- BL Date: / /	Audited By:- S. FARRELLY

Construction -	Compliance -			Remarks -
	Yes	No	X - Not Specified	
Material - To be Stated	✓			Material: 3mm AL
Folds - Quality	✓			Good: ✓
Welds - Quality	✓			Good: ✓
Edges - Quality	✓			Good: ✓ Smooth: ✓
Vents - Quality	✓			Gauze Mat: ✓
Mounting Arrangement	✓			Base: ✓
Gasket &/OR Seals	✓			Continuous:
Doors &/OR Covers	✓			Fit: GOOD
Paint Work	✓			Quality of Finish: ✓ Colour: MIST GREEN
External Crevices Welded & Ground	✓			Application-Indoor: Application-Outdoor: ✓
Drawing Receptacle Fitted	✓			Type: A4
Spares Receptacle			✓	
Door Stays Fitted	✓			
Cabinet Cleaned	✓			
General Condition Status	✓			
I.P. Rating	✓			I.P. Rating: IP55
Locks	✓			Type: SWING HANDLE
Sheetmetal Inspected By: W.E.S.				Date: 20/8/07

Notes:-

WHELAN ELECTRICAL SERVICES PTY LTD
ACN. 062 697 063

QUALITY FORM

Form 001 - Inspection & Test Plan - Switchboards

0720 Nudgee Rd

Page No. 2

Equipment Fit Out	Compliance			Remarks
	Yes	No	X - Not Specified	
Main Switch	✓			Rating:
Metering Space & Board	✓			Materials:
Job No. Label	✓			
Circuit Breakers	✓			
Phase Failure	✓			
Phase Failure Timer			✓	Settings:
Over Temperature	✓			Resistors Req: Fitted:
Thermal Overload	✓			Settings:
Motor Isolators			✓	
Ammeters		✓		Scale: Dir/C.T.
Voltmeter		✓		
Selector Switches		✓		
Push Buttons	✓			
Indicator Lights		✓		
Labelling	✓			Attached: ✓
Thermistor Terms Labelled				
Duct Covers	✓			Cable Tied: ✓
Auto Trans O/Temp			✓	Thermistor: Microtherm:
Terminals Clamp Type	✓			
Cables Numbered	✓			Minimum Size:
Live Terminals Shielded				
Equipment Plugs	✓			Supplied Loose:
32 Volt Lead Light			✓	Supplied Loose:
Earth Leakage & G.P.O.	✓			
Fluoro Light	✓			Plug In: Dir. Con.
Three Phase Outlet	✓			Size: 32A
Hinged Panels Earthed	✓			
Spare Space	✓			
Neutral & Earth Links	✓			
Fixings in Place	✓			
Looming of Wiring	✓			Workmanship:
Hinging of Wiring	✓			Supported:
Accessibility of Equipment	✓			
Cleanliness	✓			Vacuumed: ✓
Alarm Light			✓	Cabinet Mounted: Elsewhere:
Cabling Areas	✓			Adequate: ✓ Tight:
Gland Plates Fitted	✓			
Loose Items	✓			State Items: Battery - [illegible]

C:\QAFM.3A Issue Date - 18/01/96 Revision No 4 **QUALITY FORM**

WHELAN ELECTRICAL SERVICES PTY LTD
ACN. 062 697 063

QUALITY FORM

Form 001 - Inspection & Test Plan - Switchboards Page No. 3

- TESTS -					
POWER OFF	**PASS**	**FAIL**	**POWER ON**	**PASS**	**FAIL**
EARTH CONTINUITY			Pump Controller	✓	
1. G.P.O.'s	✓		Phase Fail	✓	
2. Cabinet	✓		Thermistors	✓	
3. Hinged Panels	✓		Overloads	N/A	
4. Terminals	✓		Manual Operation	✓	
INSULATION			Auto Operation	✓	
1. G.P.O.'s	✓		Duty Selection	N/A	
2. Motor Circuits	✓		Outlets	✓	
			R.C.D.'s	✓	
			Voltmeter		
			Other Controls	✓	
			Pump 1, Power C/B	✓	
			Pump 1, Control C/B	✓	
** DO NOT MEGGER THERMISTORS **			Pump 2, Power C/B	✓	
			Pump 2, Control C/B	✓	
			Common Control C/B	✓	

DEFECTS:	Sign:	Date:
Job, C/B, Main Sw, Main E/bar,	SJ	20/08/07
N/link, RTU; labels	SJ	29/08/07

Notes:

C:\QAFM.3A Issue Date - 18/01/96 Revision No 4 QUALITY FORM

SSM085

STANDARD ELECTRICAL SPECIFICATION

STANDARD FIXED SPEED SEWAGE PUMPING STATION

F.A.T.

FACTORY ACCEPTANCE TEST TEST DOCUMENT

Site ID and Name	SP152 Nudgee Rd
Test Date	22nd / Aug 2007
Test Location	Whelan's - Yandina
Electrical Inspector	Peter Hague
RTU Programmer (NCS)	Gerard Anderson
Electricians	Whelan.

SP152

1 PRELIMINARY CHECKS

ELECTRICAL INSPECTION

Confirm Electrical Inspector has completed checklist "CA-17a" prior to commencement of functional test Peter Hague - Electrical Inspector	OK ☐

POINT TO POINT

Task	Outcome
Ensure that the Switchboard Manufacturer has completed a full point to point check on all switchboard wiring. (The switchboard manufacturer should provide a complete set of drawings with the circuitrs 'highlighted' as they are checked as proof that the test has been completed). These drawings should be marked up with any changes to provide the AS BUILT markups (in conjuction with any modifications made during Site Acceptance Testing).	OK ☑

CONFIRM STANDARD OPTIONS FOR THE SITE

Ensure that the standard options that are detailed in the the Site Specific Funtional Specifcation are also detailed in the site drawings and are enabled in the RTU database (check in the INIT Block)

Option	Description	Spec	Dwg	Code
A	Individual pump moisture in oil (MIO) sensor and fault relay	☐	☐	☐
B	Individual pump motor protection fault (moisture in stator and temperature)	☐	☐	☐
C	Individual pump reflux valve micro switch	☐	☐	☐
D	Upstream manhole surcharge imminent	☐	☐	☐
E	Station dry well sump pump and level indication sensors and relays	☐	☐	☐
F	Station permanent generator (ATS and control connections).	☐	☐	☐
G	Station emergency storage level sensor.	☐	☐	☐
H	Station delivery flow meter	☐	☐	☐
I	Backup communication	☐	☐	☐
J	Pump de-contactors NOT IN CODE	☑	☐	☐
K	Cathodic protection	☐	☐	☐
L	Motor thermistor NOT IN CODE	☑	☑	☐
M	Odour Control - Carbon Scrubber	☐	☐	☐
N	Current transformer (CT) metering NOT IN CODE	☐	☐	☐
O	Pump interlock	☐	☐	☐
P	Wet well washer	☐	☐	☐
R	Telemetry Radio NOT IN FSA CODE	☐	☐	☐
S	Ultrasonic Level Sensor	☐	☐	☐
T	Single Sided Switchboard NOT IN CODE	☐	☐	☐
U	Delivery Pressure Transmitter	☐	☐	☐
V	Chemical Dosing	☐	☐	☐

NB SP152 Database not available from Logica CMG.

Switchboard Electrically Inspected by	Switchboard Programmed and Factory Tested by
Name:.............................. Date:	Name: G. Anderson Date: 22/8/07
Signature:	Signature:

2 TESTING PROCEDURE

NB Initial level range is 0-6M probe cannot source 0-4M probe.

POWER UP THE BOARD

Task	Outcome
Check that the board powers up OK (Power Supplies and Switchboard Lights turn on).	OK ☑

PROGRAM THE RTU

Task	Outcome
Check CPU Firmware Version and Serial Number	Serial Number 0706_2591 Firmware Ver 1.1.4.
Confiure the RTU site strings and record the followigng information.	IP Address 192.168.34.54 ← Test IP Only! 34.117 ← Real IP! Subnet mask 255.255.255.0
Load the latest standard Code into the RTU	Code Name spi2f_03
Check that the .main file has been downloaded from the IDTS	OK ☑

PROGRAM THE DISPLAY PANEL

Task	Outcome
Load the latest standard Code into the Display Panel	Code Name SPxxxSRW_03
Check CPU Firmware Version and Serial Number MAC ID: 00-05-E4-00-37-45	PT#: G306C000 Serial Number 23075
Check that the Display panel is operating correclty	OK ☑

PROGRAM THE RADIO (PRIMARY COMMUNICATIONS) (OPTION R)

Task VA 3.2.1	Outcome
Check that the correct radio type has been installed - high or low (transmit frequency) iD Series: DR900-07A02	High ☐ Low ☑ # 28118
Program the Radio and record the following settings	Tx MHz Rx MHz Port A – SID CODE Port B – SID CODE
Record the Proposed Base Station for the Site	Bartleys Hill

BACKUP COMMUNICATION (OPTION I)

Task	Outcome
Confirm that the Modem is powered up and that the RTU can communicate to the Modem.	OK ☐ N/A NO BACKUP COMMS

Switchboard Electrically Inspected by

Name:............................ Date: ....

Signature: ....

Switchboard Programmed and Factory Tested by

Name: G. Anderson Date: 22/8/07

Signature:

SP152

MOTOR STARTER

Task	Outcome
Check that the motor starter is programmed and able to start the each pump	Pump 1 - OK ☑ Pump 2 - OK ☑

MODBUS

Task	Outcome
Confirm that the modbus link from the RTU to the Soft Starters and the Display Panel is operating correctly ✓	OK ☑

BATTERY

Task	Outcome
Check that the battery is connected and charging (i.e. 24V across the terminals).	OK ☑
Check that the RTU is running off battery when the mains supply is isolated	OK ☑

POINT TO POINT

Task	Outcome
Using the Physical I-O Spreadsheeet check each individual physical I-O Wired to the RTU from beginning to end. ie press the actual button and watch the I-O change in Isagraf. Output lights and relays activate Inject 4-20mA into the Analog Inputs The I-O spreadsheet should be ticked and signed by the test and atteched to this FAT Test Document. Also confirm that the display panel is showing the correct information during each point to point check	OK ☑

HARD WIRED EMERGENCY PUMPING MODE FUNCTIONALITY CHECK

Task	Outcome
Turn off the RTU and perform the following steps to confirm that the emergency pumpng mode is functioning correcly.	
Simulate a surcharge imminent and ensure that the SIDT Timer starts to time	OK ☑
Ensure that the SIDT Timer expires after 15 sec and activates the EMGDT Timer	OK ☑
Ensure the EMGDT Timer (Delay off) is set at 80 % of the surcharge pumping time in the code and that it immediately activates EMG1 and that pump 1 starts 100% = 600 sec 80% = 480 sec	OK ☑
Ensure that the EMG2 timer is set at 20 sec (equal to the ramp up time in the soft starter) and that it starts pump 2 (20 seconds after pump 1 starts)	OK ☑
Ensure both pumps are able to be stopped via the interupt function	OK ☑
De-activate the surcharge imminent timer and ensure that both pumps continue to run untl the EMGDT timer expires and that both pumps ramp down when the timer expires	OK ☑

NB Set to 80% of RTU coded surch pumping time so that hard wired ckt + therefore "Surch Pumping Mode Active D/I" times out before RTU + No Pumps Fail to Stop alarm is generated in RTU.

Switchboard Electrically Inspected by

Name:............................... Date: ....

Signature: ....

Switchboard Programmed and Factory Tested by

Name:.................... Date: 22/8/07

Signature: G Anderson

SP152

SUMP PUMP AND DRY WELL CIRCUIT (OPTION E) NO SUMP PUMP

Task N/A	Outcome
Activate the stop electrode input to simulate a level above the stop level – The sump pump should still be off at this stage	OK ☐
Activate the start electrode input to simulate a level above the start level – The sump pump should now start	OK ☐
De-activate the start electrode – the pump should keep running	OK ☐
De-activate the stop electrode – the pump should stop	OK ☐
Activate the Alarm level electrode	
Confirm operation of relay and input to RTU	OK ☐
Activate the Trip level electrode This will stop all sewer pumps from running in local, remote (via Software) or under the control of the Emergency Pumping Circuit Circuit (Via the sewer pump interupt relays). Confirm this by trying to start the sewer pumps in all 3 modes.	Pump 1 - OK ☐ Pump 2 - OK ☐
Confirm that the each sewer pump can still be run under the control of that pumps Emergency Start Switch	Pump 1 - OK ☐ Pump 2 - OK ☐

PUMP INTERLOCKING (OPTION O) NO INTERLOCKING

Task N/A	Outcome
For a fully interlocked site	
Ensure that the 2 pumps can not run either from a RTU command, Emergency Pumping Circuit or the Emergecy Pumping Mode Switch	OK ☐
For a generator only interlocked site	
Ensure that 2 pumps can run simultaneously when the station is poweted by Energex. (From the RTU, Emergency Pumping Circuit and the Emergecy Pumping Mode Switch)	OK ☐
Ensure that the 2 pumps can <u>not</u> run either from a RTU command, Emergency Pumping Circuit or the Emergecy Pumping Mode Switch while the stations is powered from the Generator	OK ☐
Pump Faulted Scenario	
Ensure that if pump 1 is faulted, pump 2 can still start both via the RTU and the Emergency Pumping Circuit.	OK ☐
Ensure that if pump 2 is faulted, pump 1 can still start both via the RTU and the Emergency Pumping Circuit.	OK ☐

GENERATOR FUNCTIONALITY N/A (OPTION F) NO GENERATOR

Task	Outcome
Ensure all Inteposing Relays are wired as per the drawigns	OK ☐

CATHODIC PROTECTION N/A (OPTION K) NO CP

Task	Outcome
Ensure all CP Circuit has been wired as per the drawigns	OK ☐

Switchboard Electrically Inspected by

Name:...... .... Date: ....

Signature: ....

Switchboard Programmed and Factory Tested by

Name:....G. Anderson... Date: ....

Signature: ....

S 52 Nudgee Rd

F.A.T. 22/23 Aug 07

Whelans - Yandina

REVISION CONTROL

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet

Version	Date	Author	Comment
0.00	18-01-2006	Alex Witthoft	Initial Version developed from SP068 Tufnell Rd
0.10	07-02-2006	Alex Witthoft	Re-arranged Digital Outputs & Combined Wet Well High and Surcharge Signal test into Wet Well Signal Test
0.20	10-02-2006	Alex Witthoft	Removed Pump 3 and added Generator Tags. Also added "OPTION" Comments
0.30	11-04-2006	Alex Witthoft	Modified IO allocation to match standard drawings, updated formatting
0.40	10-05-2006	Alex Witthoft	Modified Bearing Temperatur to Motor Temperature (ie Winding OR Bearing Temp Fault).
0.50	16-06-2006	Alex Witthoft	Modified Formatting
0.60	18-07-2006	Alex Witthoft	Added Valve Pit Level Probe
0.70	11-12-2006	Alex Witthoft	Added Battery OK DI
0.80	18-12-2006	Alex Witthoft	Modification after review by Peter Hague (To match updated standard drawings)
0.90	19-12-2006	Alex Witthoft	Added Options forumlas
0.92	10-07-2007	Alex Witthoft	Added Options T, U & V
0.93	07-08-2007	Alex Witthoft	Merged Option B & C into B(now motor protection fault) - moved option D to C (reflux), added new Option D (Upstream manhole)

[illegible]	[illegible]	STANDARD [illegible]
[illegible]	[illegible]	[illegible]
A	Y	Individual pump moisture in oil (MIO) sensor and fault relay.
B	Y	Individual pump moisture in stator (MIS) sensor and fault relay and/or bearing temperature fault sensor and fault relay
C	Y	Individual pump reflux valve micro switch.
D	Y	Upstream Manhole Surcharge Imminent Probe
E	Y	Station dry well sump pump and level indication sensors and relays.
F	Y	Station permanent generator (ATS and control connections).
G	Y	Station emergency storage level sensor.
H	Y	Station delivery flow meter.
[illegible]	Y	Backup Communication Options [illegible]
[illegible]	Field	Pump Connection Method (Direct/De-Contactor/Field Disconnect)
K	Y	Cathodic Protection.
L	[illegible]	Motor Thermistor [illegible]
M	Y	Odour Control
N	[illegible]	Current Transformer (CT) metering [illegible]
O	None	Pump Interlocking (Full/Gen Only/None)
P	Y	Wet Well Washer
Q	Y	Valve Pit Sump Pump and Level
R	Low	Telemetry Radio (High/Low/No)
S	Y	Wet Well Ultrasonic Level Sensor
[illegible]	[illegible]	Single Sided Switchboard [illegible]
U	Y	Delivery Pressure Transmitter
V	Y	Chemical Dosing

RTU powerbox P/S PB251-24CH-T-CC
251-2161X1

SP 152 Nudgee Rd.

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet **Digital Input Card 1**

I/O #	MITS Tag	Description	Off State	On State	Term. #	Wire #	Schem	Term	O	~~Comment~~			FAT	SAT
										S/Board Wiring	Red Lion Panel			
0	pmp1mainsPower	Pump control power available	Off	On	3 & 4	DI00	02	09	-	✓	✓	✓	☐	
1	pmp1localStart	Pump local start pushbutton	Not Pressed	Pressed	5 & 6	DI01	02	09	-	✓		✓	☐	
2	pmp1localStop	Pump local stop pushbutton	Not Pressed	Pressed	7 & 8	DI02	02	09	-	✓		✓	☐	
3	pmp1eStop	Pump emergency stop pushbutton	Fault	Healthy	9 & 10	DI03	02	09	-	✓	✓	✓	☐	
4	pmp1localReset	Pump local reset pushbutton	Not Pressed	Pressed	11 & 12	DI04	02	09	-	✓		✓	☐	
5	pmp1running	Pump running	Not Running	Running	13 & 14	DI05	02	09	-	✓		✓	☐	
6	pmp1fault	Pump starter fault	Healthy	Fault	15 & 16	DI06	02	09	-	✓		✓	☐	
7	pmp1MIOFault	Pump moisture in oil	Healthy	Fault	17 & 18	DI07	02	09	A	N/A			☐	☐
8	pmp1motorProtFault	Pump motor protection fault	Healthy	Fault	19 & 20	DI08	02	09	B	N/A			☐	☐
9	pmp1reflux	Pump reflux valve microswitch	Not Closed (Flow)	Closed (No Flow)	21 & 22	DI09	02	09	C	N/A			☐	☐
10	stn1MHsurchImm	Station manhole surcharge imminent	Healthy	Surcharge Imm	23 & 24	DI10	02	09	D	N/A			☐	☐
11	stn1energexPower	Station energex mains power	Off	On	25 & 26	DI11	07	09	-	✓		✓	☐	
12	stn1mainsPower	Station mains power	Off	On	27 & 28	DI12	07	09	-	✓		✓	☐	
13	stn1surgeDivOK	Station surge diverter heatlhy	Fault	Healthy	29 & 30	DI13	07	09	-	✓			☐	
14	stn1localRemote	Station local remote switch	Local	Remote	31 & 32	DI14	07	09	-	✓	✓	✓	☐	
15	wwl1surchImm	Wet well surcharge imminent	Healthy	Surcharge Imm	33 & 34	DI15	07	09	-	✓	✓	✓	☐	☐

Change R.Li label to CH Power

Graphic ↑ ↖ I/O Page

FACTORY ACCEPTANCE TESTED BY: G Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

- * Check Red Lion display of Hi/SurchImm (Check) Electrode Test Fail inputs (appears to trigger the Alarm points).
- * Correct the position of Wet well Level A/I on the Red Lion Display (should be A/I 1 not 4!)
- * Red Lion display of Pump 2 Amps/KW not correct (RTU displays correct values)
- * Analog I/P 1, when 0mA (open cct) Logica A/I moving from 1 to 65
- * Red Lion display of Pressure A/I appears wrong
- * Red Lion does not display RTU Mains Fail. / Energex Mains Fail, Add to Overview Page
- * RTU Powerbox P/S does not provide battery fault alarm. + does not power RTU when Energex off + Battery replaced. i.e. you need to cycle 240V before battery reconnected

- * Label for Transfer Switch D/I: "Generator Transfer Switch in Normal Supply Position"

SP152 Nudgee Rd FAT

SSM084 Standard Fixed Speed 2P - Physical I-O List 0-93 DI2

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet **Digital Input Card 2**

W/B Power Supply not working → 27

I/O #	MITS Tag	Description	Off State	On State	Term. #	Wire #	Schem	Term	O	Comment		FAT	SAT
										RTU I/O	Red Lion		
16	pmp2mainsPower	Pump control power available	Off	On	37 & 38	DI16	03	10	-	✓	✓	☐	
17	pmp2localStart	Pump local start pushbutton	Not Pressed	Pressed	39 & 40	DI17	03	10	-	✓	✓	☐	
18	pmp2localStop	Pump local stop pushbutton	Not Pressed	Pressed	41 & 42	DI18	03	10	-	✓	✓	☐	
19	pmp2eStop	Pump emergency stop pushbutton	Fault	Healthy	43 & 44	DI19	03	10	-	✓	✓	☐	
20	pmp2localReset	Pump local reset pushbutton	Not Pressed	Pressed	45 & 46	DI20	03	10	-	✓	✓	☐	
21	pmp2running	Pump running	Not Running	Running	47 & 48	DI21	03	10	-	✓		☐	
22	pmp2fault	Pump starter fault	Healthy	Fault	49 & 50	DI22	03	10	-	✓		☐	
23	pmp2MIOFault	Pump moisture in oil	Healthy	Fault	51 & 52	DI23	03	10	A	N/A		☐	☐
24	pmp2motorProtFault	Pump motor protection fault	Healthy	Fault	53 & 54	DI24	03	10	B	N/A		☐	☐
25	pmp2reflux	Pump reflux valve microswitch	Not Closed (Flow)	Closed (No Flow)	55 & 56	DI25	03	10	C	N/A		☐	☐
26					57 & 58	DI26	03	10	^	N/A			
27	rtu1BattSystem	RTU battery system OK	Fault	Healthy	59 & 60	DI27	07	10	-	✓		☐	
28	rtu1mainsPower	RTU control power	Off	On	61 & 62	DI28	07	10	-	✓		☐	
29	stn1emergPmpMode	Station emergency pumping mode	Not Active	Active	63 & 64	DI29	07	10	-	✓	✓	☐	
30	wwl1high	Wet well high level	Healthy	High	65 & 66	DI30	07	10	-	✓		☐	
31	stn1DoorStatus	Station security alarm (Doorswitch)	Alarm	Healthy	67 & 68	DI31	06	10	-	✓		☐	☐

FACTORY ACCEPTANCE TESTED BY: G. Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet Digital Input Card 3

I/O #	MITS Tag	Description	Off State	On State	Term. #	Wire #	Schem	Term	O	Comment	FAT	SAT
32	stnlTSGstatus	Station transfer switch - generator status	Not Generator	Generator	71 & 72	DI32	05	10	-	✓	☐	
33	genlfault	Generator fault	Ok	Alarm	73 & 74	DI33	05	10	F		☐	☐
34	genlwarning	Generator warning	Ok	Alarm	75 & 76	DI34	05	10	F		☐	☐
35	genllowFuel	Generator low fuel	Ok	Low	77 & 78	DI35	05	10	F		☐	☐
36	genlmedFuel	Generator medium fuel	Ok	Medium	79 & 80	DI36	05	10	F		☐	☐
37	genlrunning	Generator running	Stopped	Running	81 & 82	DI37	05	10	F		☐	☐
38	genlcanpoyDoors	Generator security	Unsecured	Secured	83 & 84	DI38	05	10	F		☐	☐
39	genllocCBTripped	Generator CB status	Closed	Tripped	85 & 86	DI39	05	10	F		☐	☐
40	genlauto	Generator mode	Auto	Not Auto	87 & 88	DI40	05	10	F		☐	☐
41	genlonSite	Generator on site	False	True	89 & 90	DI41	05	10	F		☐	☐
42	pitlflooded	Valve pit flooded	Not Flooded	Flooded	91 & 92	DI42	07	10	Q		☐	☐
43	cprllocalReset	Cathodic protection local reset	Not Pressed	Pressed	93 & 94	DI43	07	10	K		☐	
44	smplrunning	Sump pump running	Healthy	Fault	95 & 96	DI44	04	10	E		☐	☐
45	smplhealthy	Sump pump healthy	Not Running	Running	97 & 98	DI45	04	10	E		☐	☐
46	stnlfloodHigh	Dry well flooded high alarm level	Healthy	High	99 & 100	DI46	04	10	E		☐	☐
47	stnlfloodTrip	Dry well flooded trip level	Healthy	Trip	101 & 102	DI47	04	10	E		☐	☐

FACTORY ACCEPTANCE TESTED BY: G. Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet **Digital Output Card 1**

I/O #	MITS Tag	Description	Off State	On State	Term. #	Wire #	Schem	Term	O	Comment	FAT	SAT
0	pmploperate	Pump run command	Off	Run	105 & 106	DO00	02	11	-	✓	☐	
1	pmplresetCmd	Pump fault reset	Off	Reset	107 & 108	DO01	02	11	-	✓	☐	
2	pmplinterupt	Pump emergency mode interrupt	Off	Interupt	109 & 110	DO02	02	11	-	✓	☐	
3					111 & 112	DO03	02	11	^			
4	wwllsignalTest	Wet well signal test	Off	On	113 & 114	DO04	07	11	-		☐	☐
5	wwllwasher	Wet well washer solenoid	Off	On	115 & 116	DO05	07	11	P		☐	☐
6	wwllstrobe	Station strobe light	Off	On	117 & 118	DO06	07	11	E		☐	☐
7	stnlodourControl	Station Odour Control	Off	On	119 & 120	DO07	07	11	I		☐	☐

FACTORY ACCEPTANCE TESTED BY: G. Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet **Digital Output Card 2**

I/O #	MITS Tag	Description	Off State	On State	Term. #	Wire #	Schem	Term	O	Comment	FAT	SAT
8	pmp2operate	Pump run command	Off	Run	123 & 124	DO08		11	-	✓	☐	
9	pmp2resetCmd	Pump fault reset	Off	Reset	125 & 126	DO09		11	-	✓	☐	
10	pmp2interupt	Pump emergency mode interrupt	Off	Interupt	127 & 128	DO10		11	-	✓	☐	
11					129 & 130	DO11		11	^			
12	gen1start	Generator remote start	Off	On	131 & 132	DO12		11	F		☐	☐
13	cpr1deenergise	Cathodic protection de-energise rectifier	Off	On	133 & 134	DO13		11	K		☐	
14	cpr1faultInd	Cathodic protection fault indication	Off	On	135 & 136	DO14		11	K		☐	
15					137 & 138	DO15		11	^			

FACTORY ACCEPTANCE TESTED BY: G.Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet Analog Input Card 1

I/O #	MITS Tag	Description	4mA	20mA	Term. #	Wire #	Schem	Term	O	Comment	FAT	SAT
0	wwl1rawSignal	Wet well level raw signal			147 & 148	AI00+,AI00-	07	12	-	✓	☐	☐
1	pre1rawSignal	Delivery pressure raw signal			149 & 150	AI01+,AI01-	07	12	U	✓	☐	☐
2	est1rawSignal	Emergency storage level raw signal			151 & 152	AI02+,AI02-	07	12	G		☐	☐
3	ult1rawSignal	Ultrasonic Wet Well level raw signal			153 & 154	AI03+,AI03-	07	12	S		☐	☐
4					155 & 156	AI04+,AI04-	07	12	^			
5					157 & 158	AI05+,AI05-	07	12	^			
6	cpr1current	Cathodic protection rectifier current			159 & 160	AI06+,AI06-	07	12	K		☐	☐
7	flw1rawSignal	Delivery flow raw signal			161 & 162	AI07+,AI07-	07	12	H		☐	☐

FACTORY ACCEPTANCE TESTED BY: G Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

SP[xxx] [SITE NAME]

Physical I.O. Spreadsheet **Analog Output Card 1**

I/O #	MITS Tag	Description	4mA	20mA	Term. #	Wire #	Schem	Term	O	Comment	FAT	SAT
0					-	-	-	-	^			
1					-	-	-	-	^			
2					-	-	-	-	^			
3	stnlchemDosingRate	Station Chemical Dosing Rate	0%	100%	-	-	-	-	V		☐	☐

FACTORY ACCEPTANCE TESTED BY: G Anderson Date 23/8/07

SITE ACCEPTANCE TESTED BY: Date / /

BRISBANE WATER

SP152 NUDGEE ROAD SEWAGE PUMPING STATION

SITE COVER SHEET

ELECTRICAL DRAWINGS INDEX

DWG N°.	TITLE	SHEET	REVISIONS				
486/5/7-0023-000	SITE COVER SHEET	00	P1	A			
486/5/7-0023-001	POWER DISTRIBUTION SCHEMATIC DIAGRAM	01	P1	A			
486/5/7-0023-002	PUMP 01 SCHEMATIC DIAGRAM	02	P1	A			
486/5/7-0023-003	PUMP 02 SCHEMATIC DIAGRAM	03	P1	A			
486/5/7-0023-004	*RESERVED (SUMP PUMP)*	04					
486/5/7-0023-005	*RESERVED (GENERATOR CONTROL)*	05					
486/5/7-0023-006	COMMON CONTROLS SCHEMATIC DIAGRAM	06	P1	A			
486/5/7-0023-007	COMMON RTU I/O SCHEMATIC DIAGRAM	07	P1	A			
486/5/7-0023-008	RTU POWER DISTRIBUTION SCHEMATIC DIAGRAM	08	P1	A			
486/5/7-0023-009	RTU DIGITAL INPUTS TERMINATION DIAGRAM	09	P1	A			
486/5/7-0023-010	RTU DIGITAL INPUTS TERMINATION DIAGRAM	10	P1	A			
486/5/7-0023-011	RTU DIGITAL OUTPUTS TERMINATION DIAGRAM	11	P1	A			
486/5/7-0023-012	RTU ANALOGS & MISCELLANEOUS TERMINATION DIAGRAM	12	P1	A			
486/5/7-0023-013	*RESERVED (COMMON CONTROLS TERMINATION DIAGRAM)*	13					
486/5/7-0023-014	EQUIPMENT LIST	14	P1	A			
486/5/7-0023-015	CABLE SCHEDULE	15	P1	A			
486/5/7-0023-016	SWITCHBOARD LABEL SCHEDULE	16	P1	A			
486/5/7-0023-017	SWITCHBOARD CONSTRUCTION DETAILS	17	P1	A			
486/5/7-0023-018	SWITCHBOARD CONSTRUCTION DETAILS	18	P1	A			
486/5/7-0023-019	RAG REDUCTION TUBE FOR THE HYDROSTATIC LEVEL PROBE	19	P1	A			
486/5/7-0023-020	*RESERVED (CATHODIC PROTECTION UNIT)*	20					
486/5/7-0023-021	*RESERVED (FIELD DISCONNECTION BOX)*	21					
486/5/7-0023-022	SWITCHBOARD GENERAL ARRANGEMENT - DOUBLE SIDED	22	P1	A			
486/5/7-0023-023	SLAB & CONDUIT DETAILS	23	P1	A			

STANDARD VARIABLES

DESCRIPTION	VALUES
CT METERING ISOLATOR	NOT APPLICABLE
NORMAL SUPPLY MAIN SWITCH	100A XS250NJ/160
GENERATOR SUPPLY MAIN SWITCH	100A XS250NJ/160
PUMP1 CIRCUIT BREAKER	20A XH125NJ/20
PUMP2 CIRCUIT BREAKER	20A XH125NJ/20
DRY WELL SUMP PUMP CIRCUIT BREAKER	NOT APPLICABLE
PUMP SOFT STARTER SIZE	MSF-017 +
PUMP RATING	7.5kW 14A
PUMP LINE CONTACTOR	CA7-30
PUMP BYPASS CONTACTOR	CA7-30
SUMP PUMP RATING	NOT APPLICABLE
SUMP PUMP CONTACTOR & TOL	NOT APPLICABLE
PUMP SOCKET OUTLET + INCLINE SLEEVE	0S3 3134013972 + 51CA058
PUMP INLET PLUG + HANDLE	0S3 3138013972 + 313A013
WET WELL LEVEL TRANSMITTER	FM167-A2BMC1A3 4m
EMERGENCY STORAGE WELL LEVEL TRANSMITTER	NOT APPLICABLE
DELIVERY PRESSURE TRANSMITTER	BR74XXGG1EHA2X 25m
WET WELL ULTRASONIC LEVEL SENSOR	NOT APPLICABLE
FLOWMETER RANGE	NOT APPLICABLE
RADIO	DR900-07A02-D0
EMERGENCY PUMPING TIME	600sec
No of SINGLE POINT PROBES	2
INCOMING MAINS SUPPLY CABLE	16mm²
MAIN EARTHING CABLE	6mm²
INCOMING GENERATOR SUPPLY CABLE	NOT APPLICABLE
PUMP MOTOR SUPPLY CABLE	EXISTING

STANDARD DESIGN OPTIONS

OPTION	DESCRIPTION	FITTED
~~A~~	~~INDIVIDUAL PUMP MOISTURE IN OIL (MIO) SENSOR AND FAULT RELAY~~	☒ NO
~~B~~	~~INDIVIDUAL PUMP MOISTURE IN STATOR (MIS) SENSOR AND FAULT RELAY~~	☒ NO
~~C~~	~~INDIVIDUAL PUMP BEARING TEMPERATURE SENSOR AND FAULT RELAY~~	☒ NO
~~D~~	~~INDIVIDUAL PUMP REFLUX VALVE MICROSWITCH~~	☒ NO
~~E~~	~~STATION DRY WELL SUMP PUMP AND LEVEL INDICATION SENSORS AND RELAYS~~	☒ NO
~~F~~	~~STATION PERMANENT GENERATOR - ATS AND CONTROL CONNECTIONS~~	☒ NO
~~G~~	~~STATION EMERGENCY STORAGE LEVEL SENSOR~~	☒ NO
~~H~~	~~STATION DELIVERY FLOWMETER~~	☒ NO
~~I~~	~~BACKUP COMMUNICATION OPTIONS~~	☒ NO
J	PUMP CONNECTION (Via De-contactors)	YES ☒
~~K~~	~~CATHODIC PROTECTION~~	☒ NO
L	MOTOR THERMISTORS (Via De-contactors)	YES ☒
~~M~~	~~ODOUR CONTROL~~	☒ NO
~~N~~	~~CURRENT TRANSFORMER (CT) METERING~~	☒ NO
~~O~~	~~PUMPS ELECTRICAL INTERLOCK~~	☒ NO
~~P~~	~~WET WELL WASHER~~	☒ NO
~~Q~~	~~VALVE PIT PUMP PUMP AND LEVEL PROBE~~	☒ NO
R	TELEMETRY RADIO	YES ☒
~~S~~	~~WET WELL ULTRASONIC LEVEL SENSOR~~	☒ NO
T	DOUBLE SIDED SWITCHBOARD	YES ☒
U	DELIVERY PRESSURE TRANSMITTER	YES ☒

Sheet 00

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
A	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
O	1.07	ISSUED FOR TENDER	P.H.	

Reference Drawings

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CAD FILE	57-0023set_A
B.C.C. FILE No.	

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Original signed by A.WITTHOFT 17.1.07
DESIGN CHECK R.P.E.Q. No. DATE

Orig Signed by R.JANFADA 5192 17.1.07
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
SITE COVER SHEET

SHEET No. 0
BRISBANE WATER DRAWING No. 486/5/7-0023-000
AMEND. A

STD TEMPLATE SP-07-65 Ver1.0

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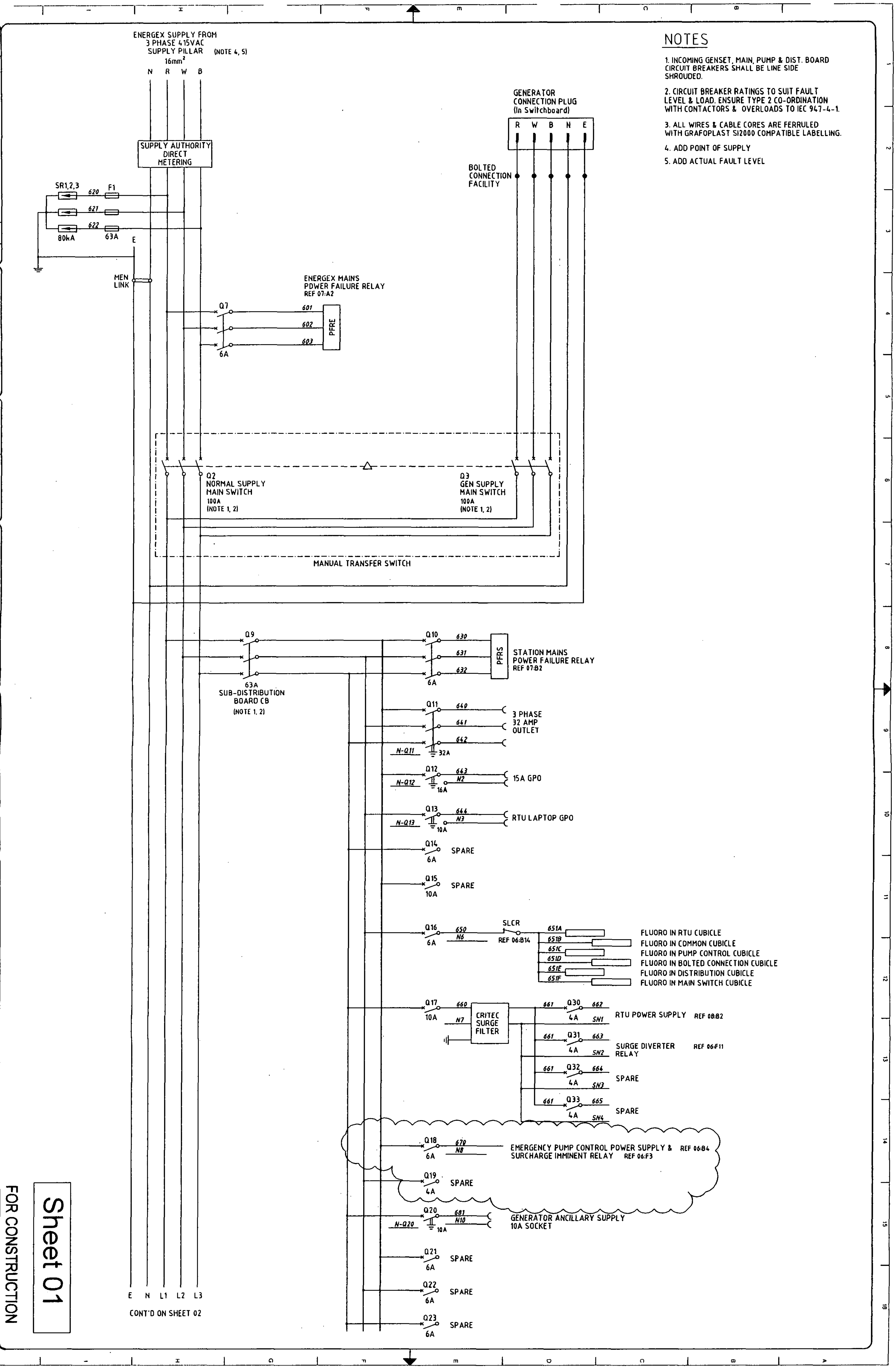

NOTES

1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD. ENSURE TYPE 2 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. ADD POINT OF SUPPLY
5. ADD ACTUAL FAULT LEVEL

No	DATE	AMENDMENT	DRN.	APD.
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DESIGN CHECK Original signed by A.WITTHOFT R.P.E.Q. No. DATE 17.1.07

PRINCIPAL DESIGN MANAGER Orig Signed by R.JANFADA 5192 DATE 17.1.07
CLIENT DELEGATE Original Signed by P.SHERRIFF DATE 18.1.07

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
POWER DISTRIBUTION
SCHEMATIC DIAGRAM

SHEET No. 1
BRISBANE WATER DRAWING No.
486/5/7-0023-001
AMEND.
A

Sheet 01

FOR CONSTRUCTION

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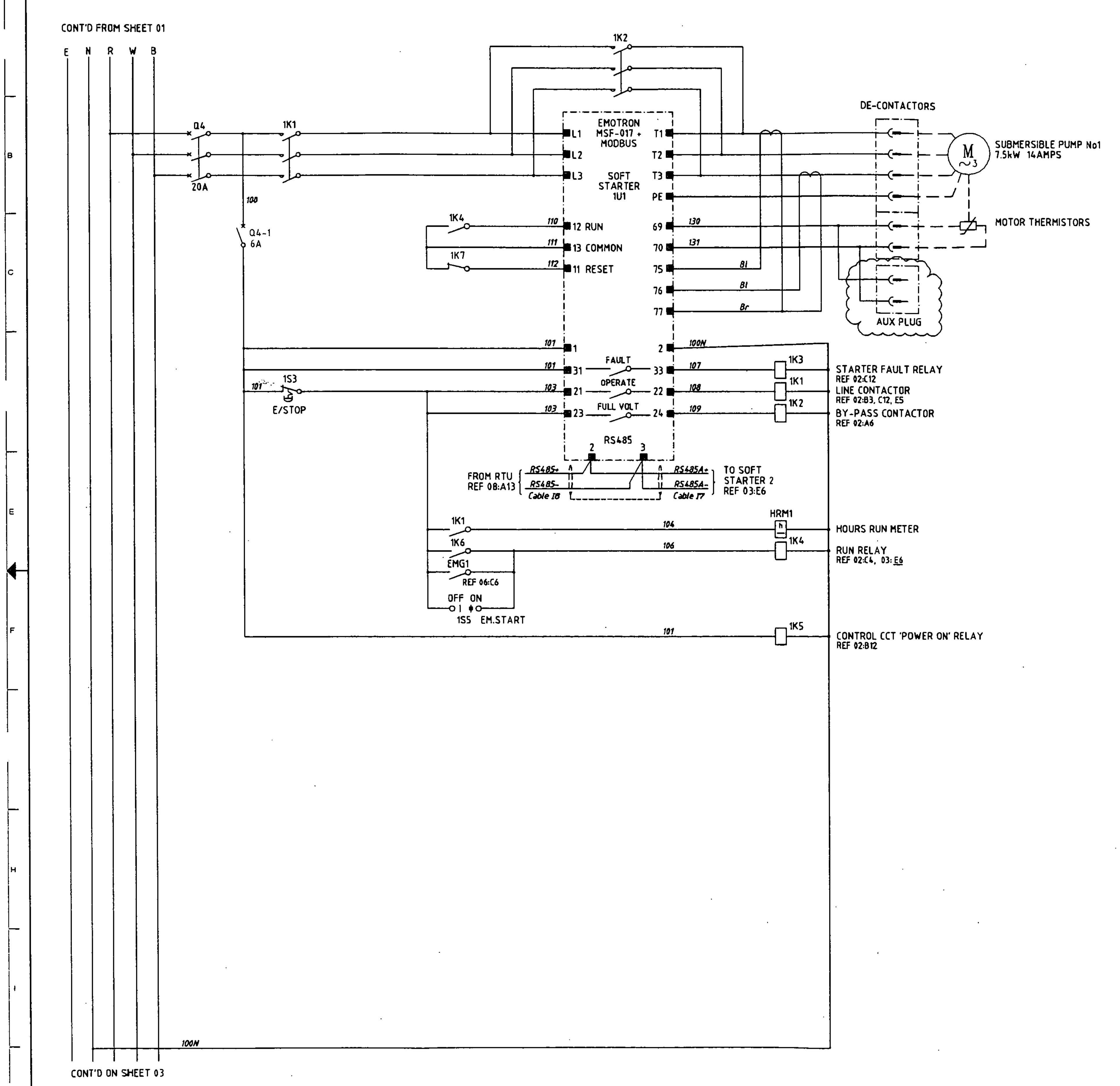

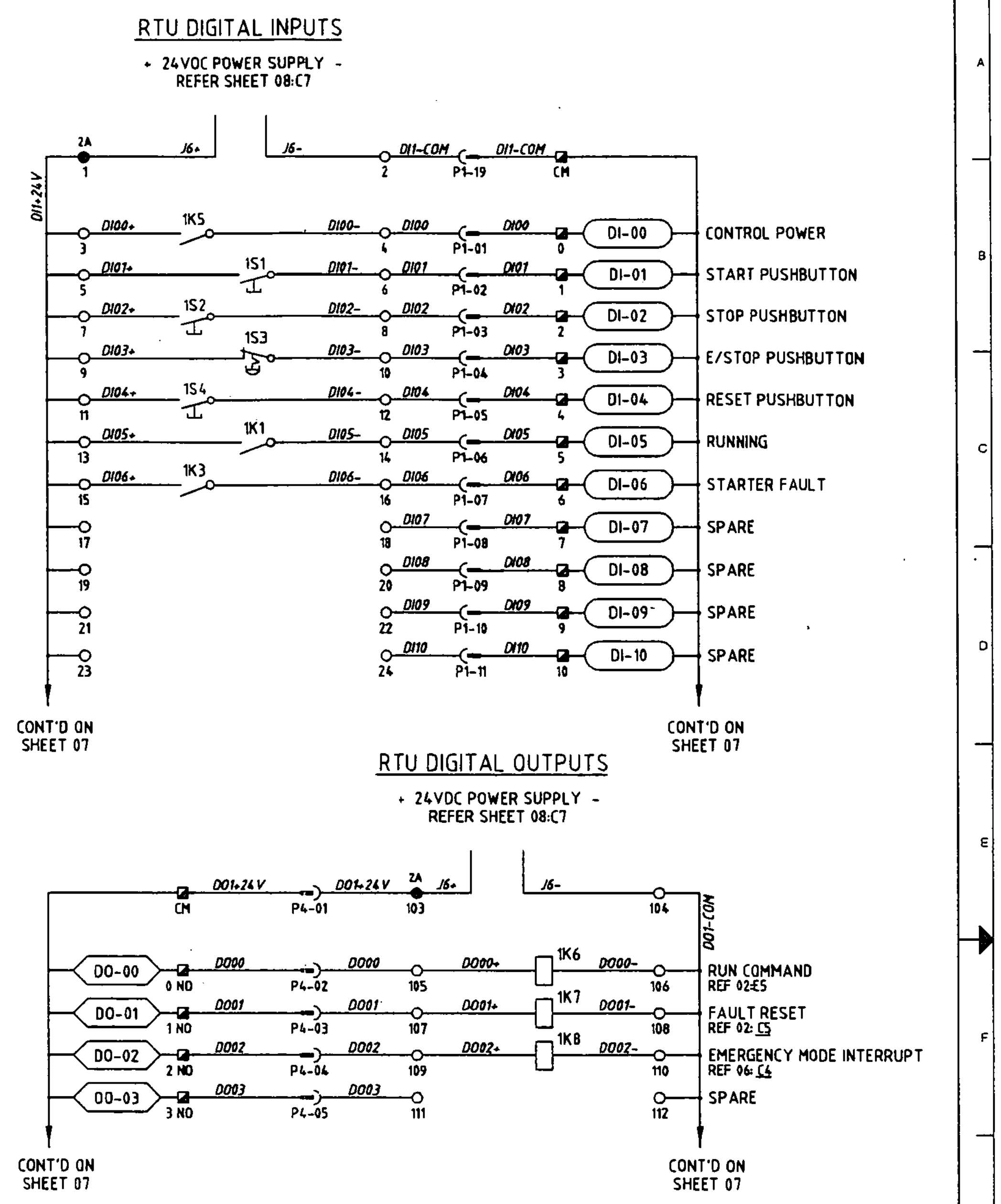

LEGEND:

▲	SWITCHBOARD POWER TERMINAL
Ø	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
DI1-02	RTU DIGITAL INPUT
DO1-02	RTU DIGITAL OUTPUT
AI1-02	RTU ANALOGUE INPUT
AO1-02	RTU ANALOGUE OUTPUT

NOTES

1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD ENSURE TYPE 2 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. FAULT LEVEL OF 20kA AT 415V FOR 0.2sec.

Sheet 02

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
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0	1.07	ISSUED FOR TENDER	P.H.	

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Orig Signed by R.JANFADA 5192 17.1.07
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Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
PUMP No1
SCHEMATIC DIAGRAM

SHEET No. 2
BRISBANE WATER DRAWING No. 486/5/7-0023-002
AMEND. A

STD TEMPLATE SP-SP-SS Ver1.0

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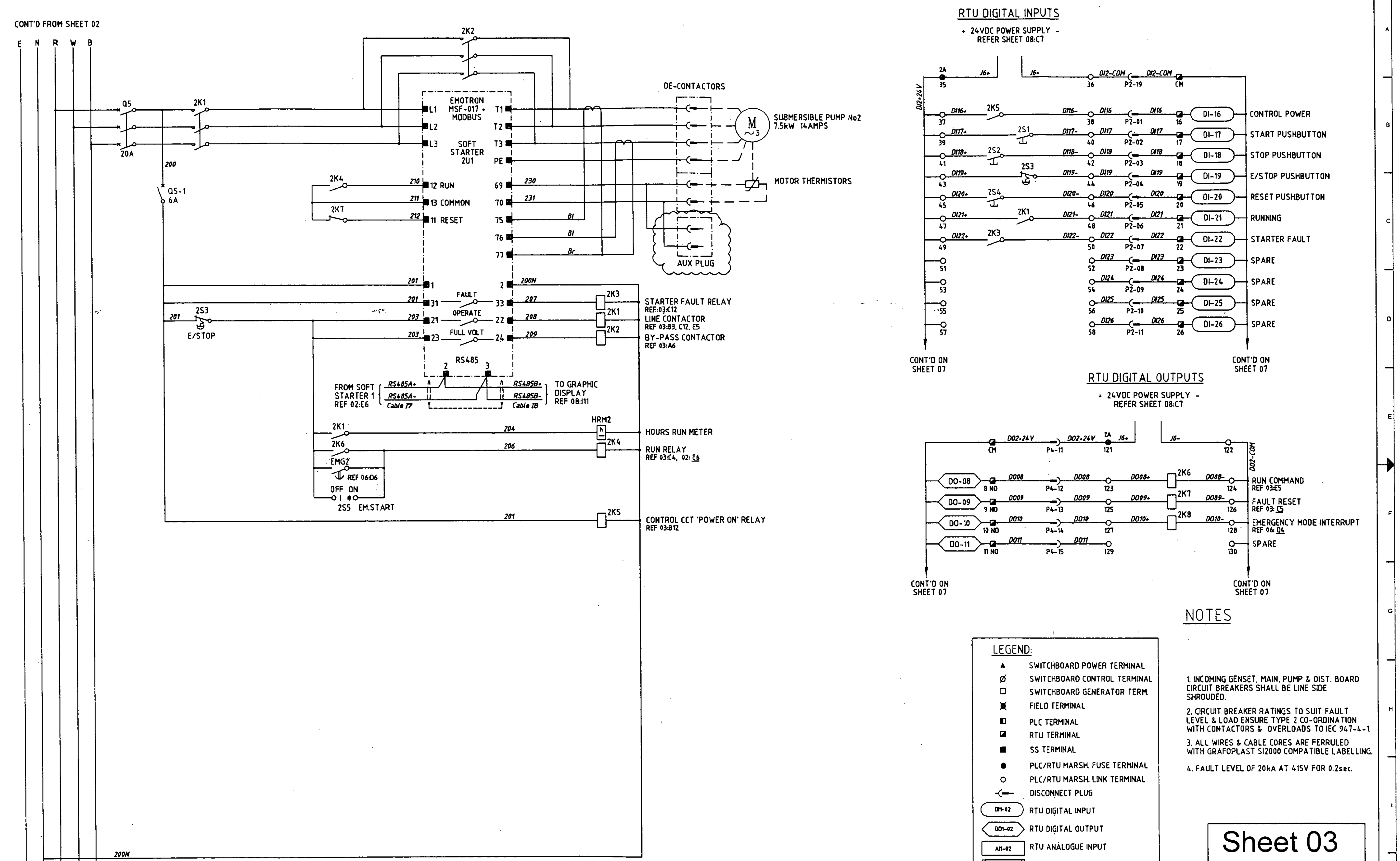

NOTES

1. INCOMING GENSET, MAIN, PUMP & DIST. BOARD CIRCUIT BREAKERS SHALL BE LINE SIDE SHROUDED.
2. CIRCUIT BREAKER RATINGS TO SUIT FAULT LEVEL & LOAD ENSURE TYPE 2 CO-ORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
4. FAULT LEVEL OF 20kA AT 415V FOR 0.2sec.

LEGEND:

▲	SWITCHBOARD POWER TERMINAL
Ø	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
DI1-02	RTU DIGITAL INPUT
DO1-02	RTU DIGITAL OUTPUT
AI1-02	RTU ANALOGUE INPUT
AO1-02	RTU ANALOGUE OUTPUT

Sheet 03

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
.				
.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

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BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
PUMP No2
SCHEMATIC DIAGRAM

SHEET No. 3
BRISBANE WATER DRAWING No. 486/5/7-0023-003
AMEND. A

STD TEMPLATE SP-EP-S3 Ver1.0

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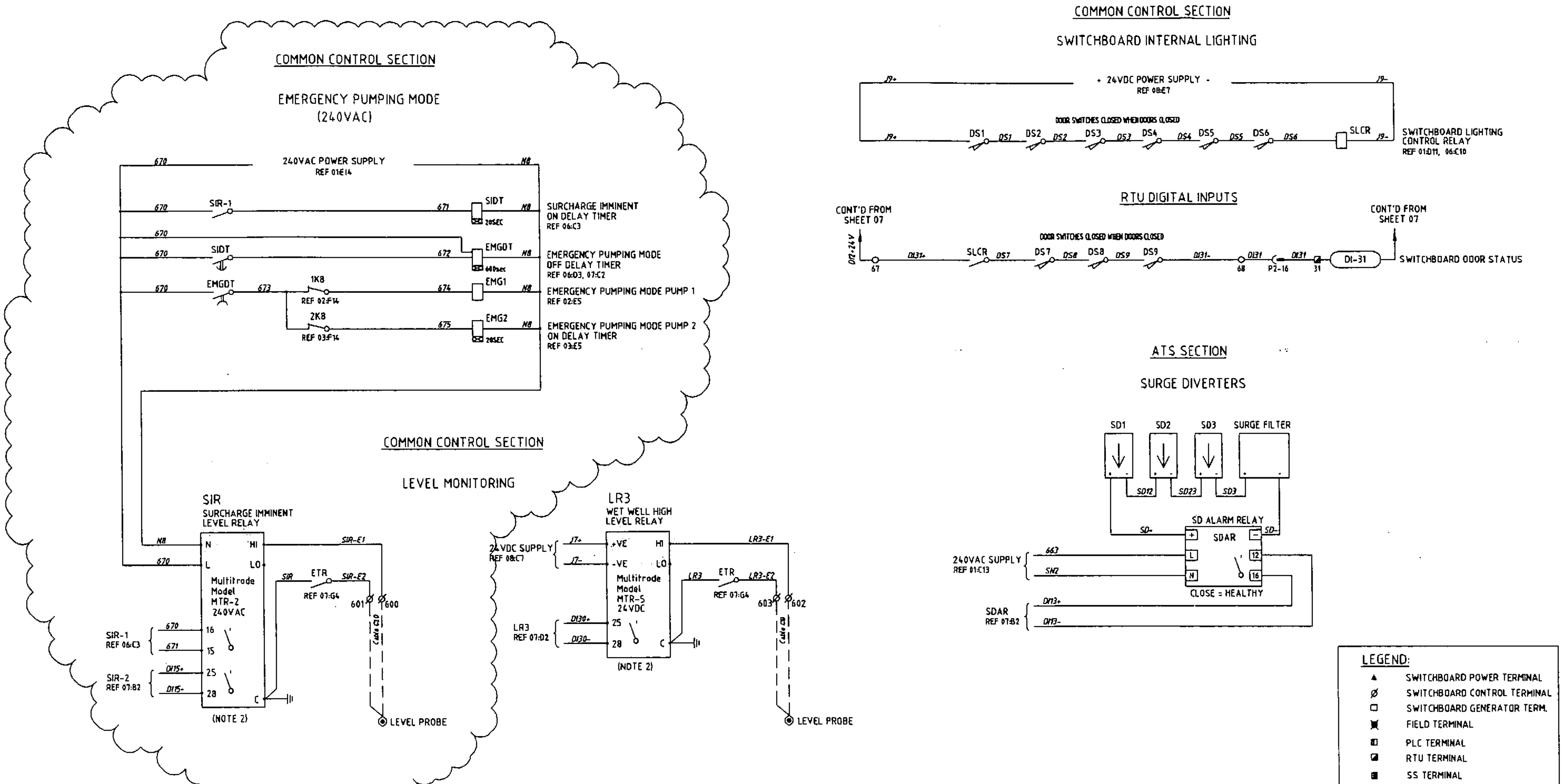

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.

2. SET DIPSWITCH TO 'DISCHARGE' MODE.

LEGEND:

▲	SWITCHBOARD POWER TERMINAL
Ø	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
(DI1-02)	RTU DIGITAL INPUT
DO1-02	RTU DIGITAL OUTPUT
[AI1-02]	RTU ANALOGUE INPUT
[AO1-02]	RTU ANALOGUE OUTPUT

Sheet 06

FOR CONSTRUCTION

.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.	
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BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
COMMON CONTROLS
SCHEMATIC DIAGRAM

SHEET No. 6
BRISBANE WATER DRAWING No. 486/5/7-0023-006
AMEND. A

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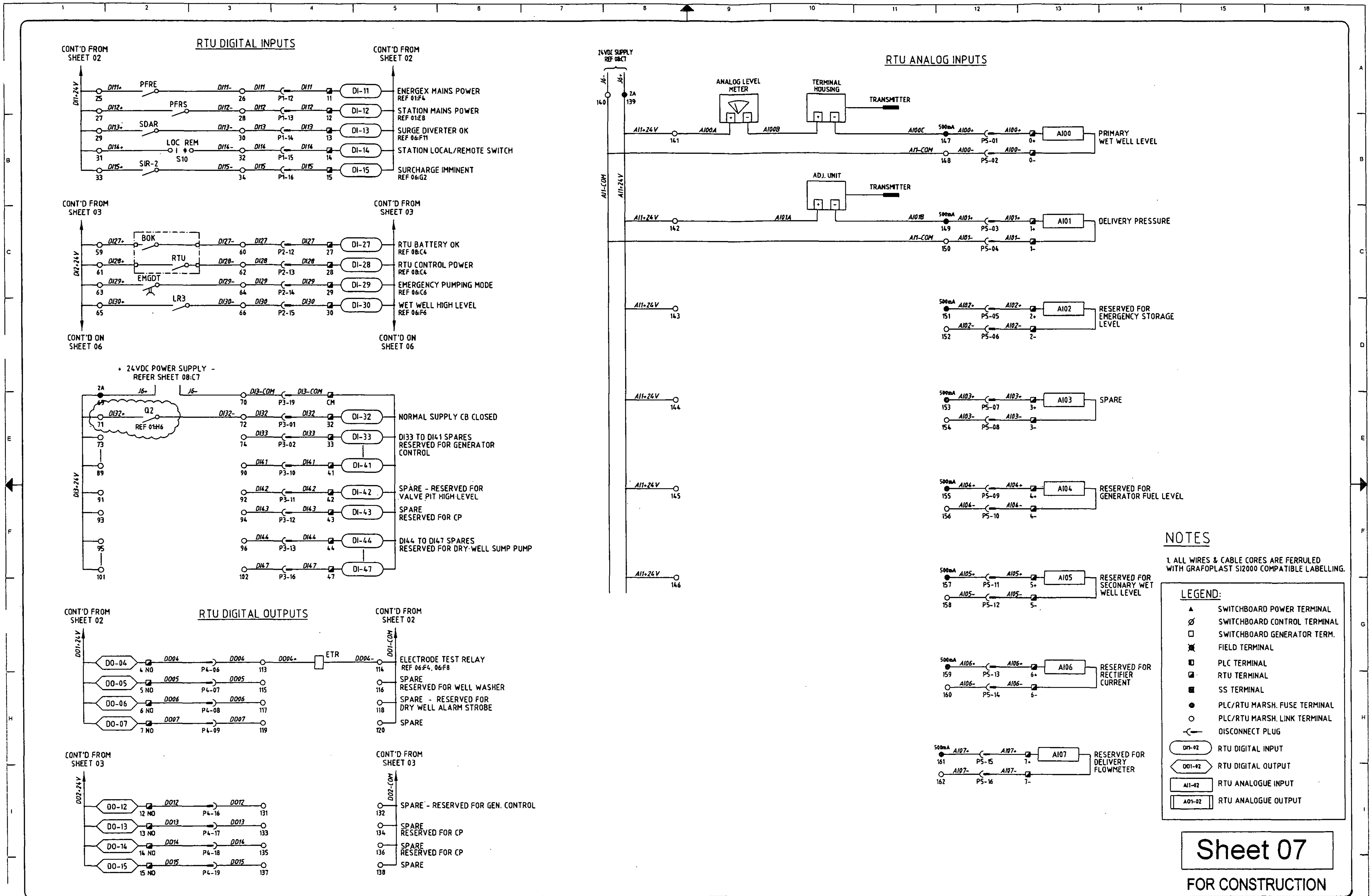

Sheet 07

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
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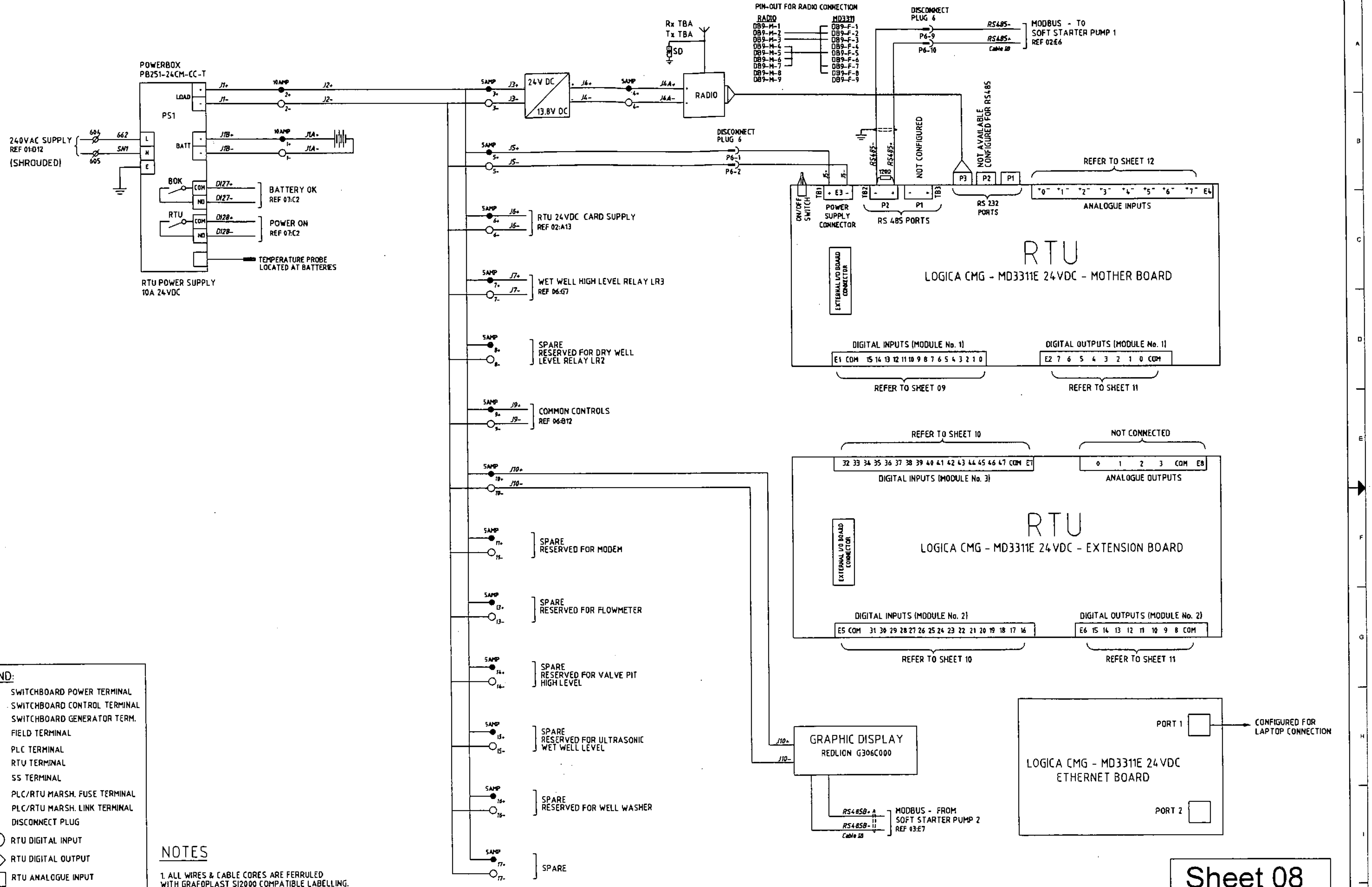
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
COMMON RTU I/O
SCHEMATIC DIAGRAM

SHEET No. 7
BRISBANE WATER DRAWING No. 486/5/7-0023-007
AMEND. A



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
DI1-02	RTU DIGITAL INPUT
DO1-02	RTU DIGITAL OUTPUT
AI1-02	RTU ANALOGUE INPUT
AO1-02	RTU ANALOGUE OUTPUT

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 08

FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

Reference Drawings

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Orig Signed by R.JANFADA 5192 17.1.07
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

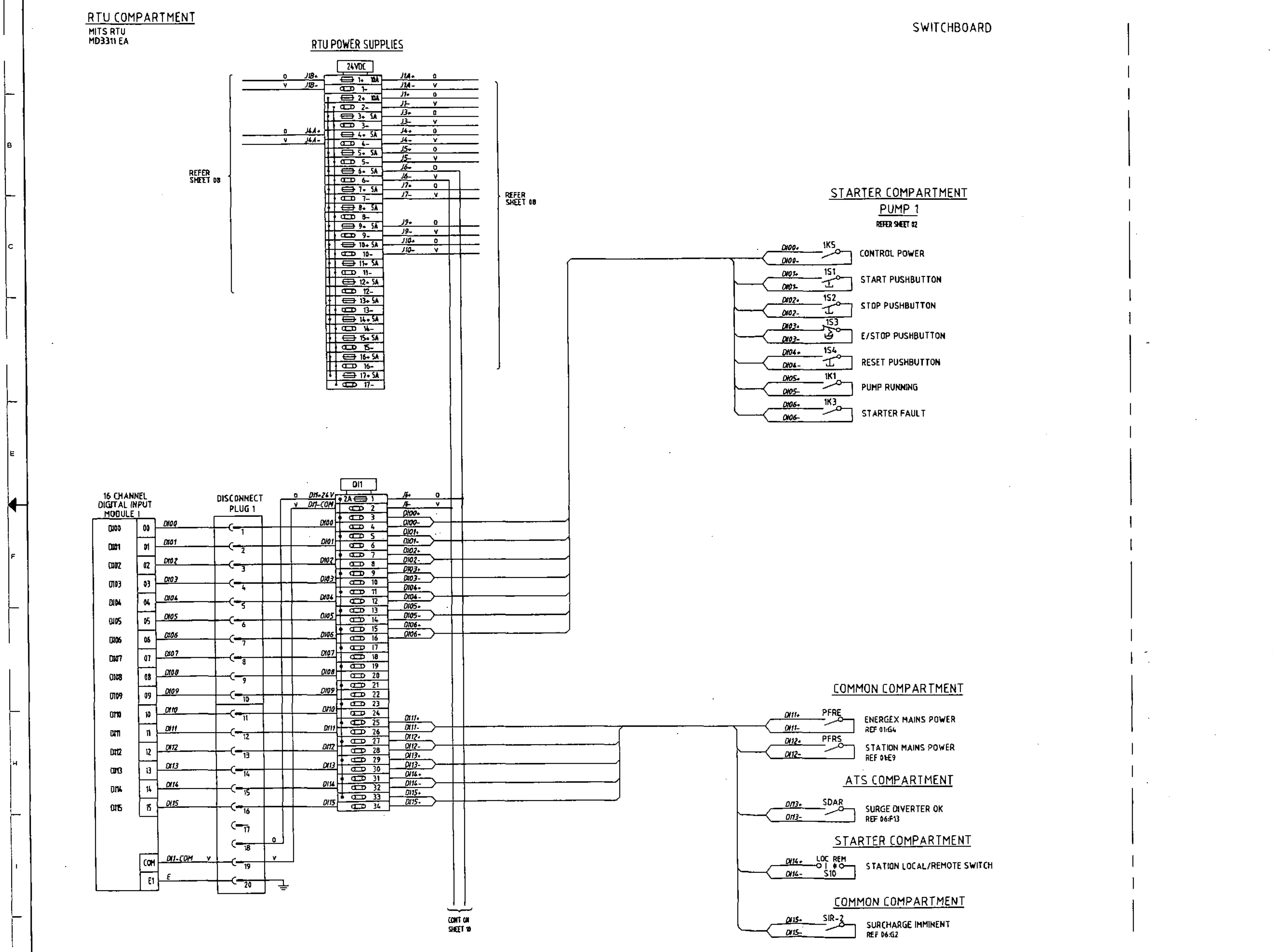
BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
RTU POWER DISTRIBUTION
SCHEMATIC DIAGRAM

SHEET No. 8
BRISBANE WATER DRAWING No. 486/5/7-0023-008
AMEND. A

STD TEMPLATE SP-EP-AS Ver1.0



LEGEND:

C??	CABLE IDENTIFIER
-(—	DISCONNECT PLUG
5	FUSE TERMINAL
5	DISCONNECT LINK TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.

2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 09

FOR CONSTRUCTION

No.	DATE	AMENDMENT	DRN.	APD.
.	06.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

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DESIGN R.P.E.Q. No. DATE
Original signed by A.WITTHOFT 17.1.07
DESIGN CHECK R.P.E.Q. No. DATE

Orig Signed by R.JANFADA 5192 17.1.07
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

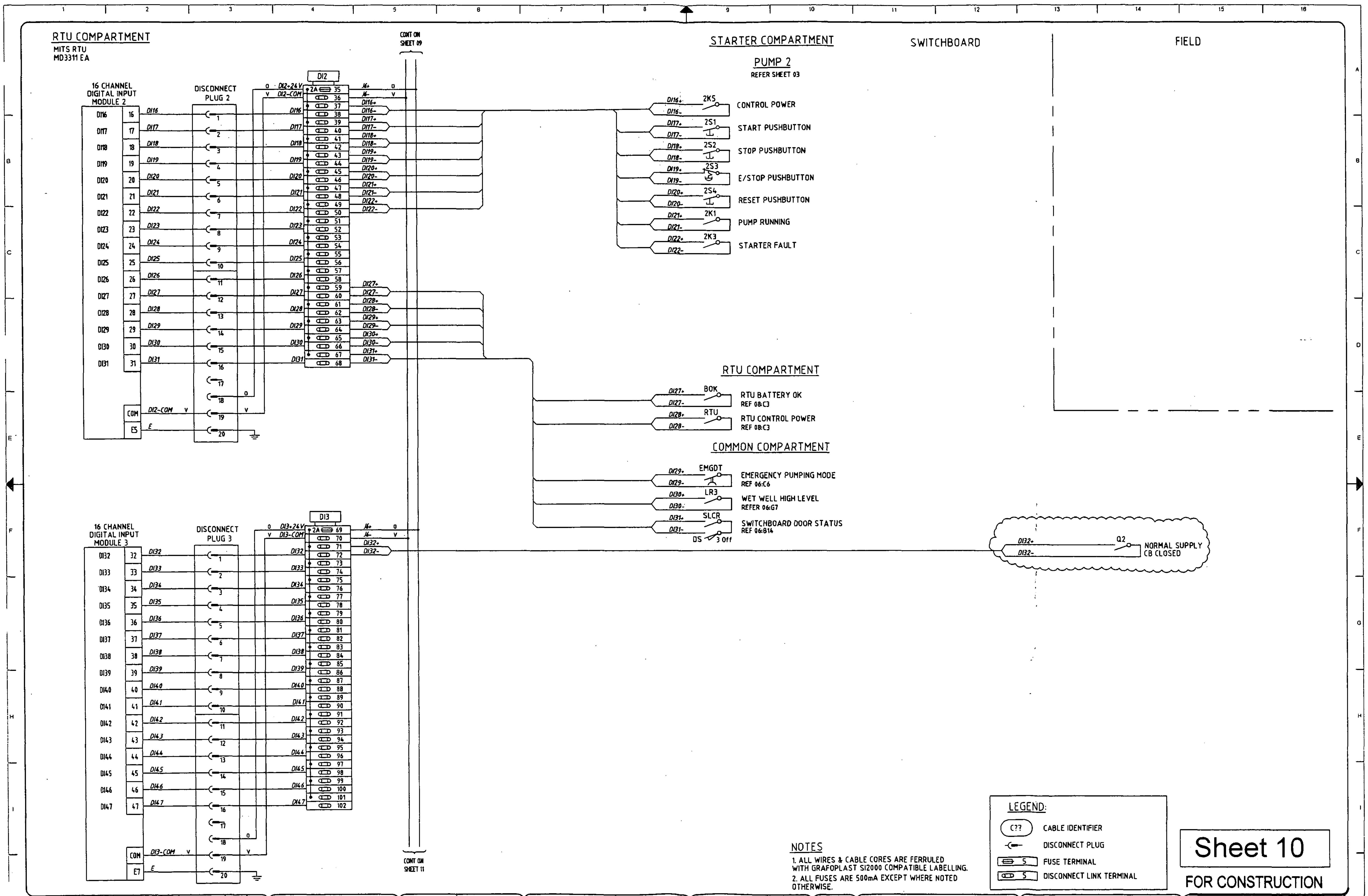
SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
RTU DIGITAL INPUTS
TERMINATION DIAGRAM

SHEET No. 9
BRISBANE WATER DRAWING No. 486/5/7-0023-009
AMEND. A

STD TEMPLATE SP-EP-SS Ver1.0

G:\194 water supp\268 drafting\6248 plans\electrical\2. sewerage\networks\sp152 nudgee rd\reliability improvement\for construction\57-0023set_a.dwg - PRINTED 1:29:08 PM - 15/06/07



NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

LEGEND:

(??)	CABLE IDENTIFIER
-(-	DISCONNECT PLUG
⊟ 5	FUSE TERMINAL
⊂⊃ 5	DISCONNECT LINK TERMINAL

Sheet 10

FOR CONSTRUCTION

.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	
No.	DATE	AMENDMENT	DRN.	APD.

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Reference Drawings

DRAFTED	P.HAGUE
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CAD FILE	57-0023set_A
B.C.C. FILE No.	

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DESIGN CHECK R.P.E.Q. No. DATE

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PRINCIPAL DESIGN MANAGER DATE
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CLIENT DELEGATE DATE

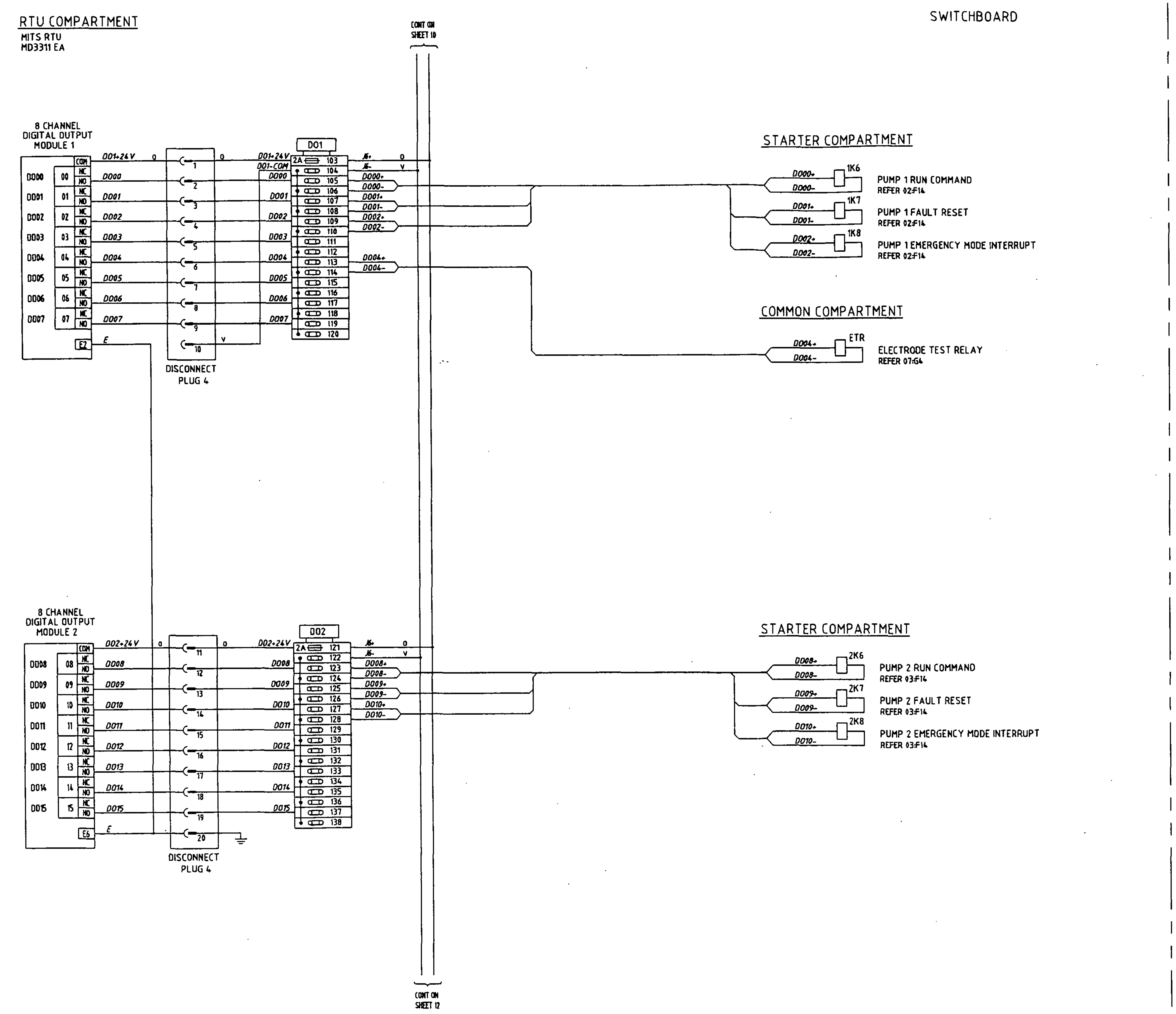
BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
RTU DIGITAL INPUTS
TERMINATION DIAGRAM

SHEET No. 10
BRISBANE WATER DRAWING No. AMEND.
486/5/7-0023-010 A

STD TEMPLATE SP-EP-SS



LEGEND:

C??	CABLE IDENTIFIER
-(—	DISCONNECT PLUG
Ø	SWITCHBOARD CONTROL TERMINAL
⊟ 5	FUSE TERMINAL
⊂⊃ 5	DISCONNECT LINK TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.

2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 11

FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

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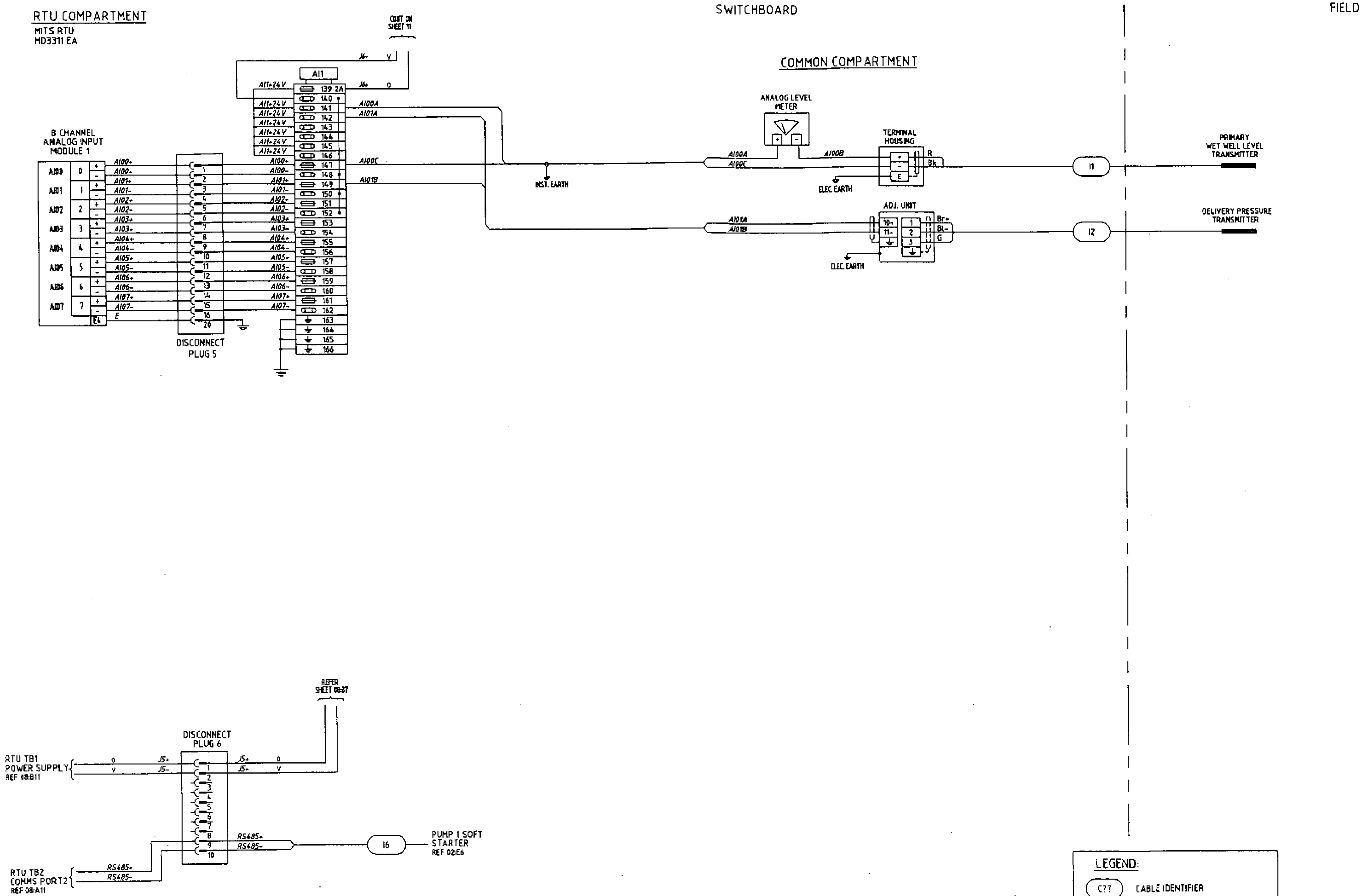
BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
RTU DIGITAL OUTPUTS
TERMINATION DIAGRAM

SHEET No. 11
BRISBANE WATER DRAWING No. 486/5/7-0023-011
AMEND. A

STD TEMPLATE SP-EP-03 Ver1.0



LEGEND:

(C??)	CABLE IDENTIFIER
─<─	DISCONNECT PLUG
⊟ 5	FUSE TERMINAL
⊂⊃ 5	DISCONNECT LINK TERMINAL
⏚ 5	EARTH TERMINAL

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST SI2000 COMPATIBLE LABELLING.
2. ALL FUSES ARE 500mA EXCEPT WHERE NOTED OTHERWISE.

Sheet 12

FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

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BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
RTU ANALOGS & MISCELLANEOUS
TERMINATION DIAGRAM

SHEET No. 12
BRISBANE WATER DRAWING No. 486/5/7-0023-012
AMEND. A

STD TEMPLATE SP-07-SS WFU

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ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
1					N	
2	1	Q2 NORMAL SUPPLY MAIN SWITCH	TERASAKI	XS250NJ/160	-	+ N/O AUX CONTACT
3	1	Q3 GENERATOR SUPPLY MAIN SWITCH	TERASAKI	XS250NJ/160	-	
4	1	Q4 PUMP1 CIRCUIT BREAKER	TERASAKI	XH125NJ/20	-	Set @ ???A
5	1	Q5 PUMP2 CIRCUIT BREAKER	TERASAKI	XH125NJ/20	-	Set @ ???A
6					E	
7	1	Q7 ENERGEX PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCB15306C	-	
8					F	
9	1	Q9 SUB-DISTRIBUTION BOARD CIRCUIT BREAKER	TERASAKI	XS125NJ/63	-	
10	1	Q10 STATION MAINS PHASE FAILURE CIRCUIT BREAKER	TERASAKI	DTCB6306C	-	
11	1	Q11 3 PHASE OUTLET CIRCUIT BREAKER	TERASAKI	DTCB6332C	-	PLUS DSRCM-32-30-3PN
12	1	Q12 15A GPO CIRCUIT BREAKER	TERASAKI	DSRCBH-16-30A	-	
13	1	Q13 RTU LAPTOP GPO CIRCUIT BREAKER	TERASAKI	DSRCBH-10-30A	-	
14	1	Q14 SPARE	TERASAKI	DTCB6106C	E	
15	1	Q15 SPARE	TERASAKI	DTCB6110C	E	
16	1	Q16 SW/BD INTERNAL LIGHTING CIRCUIT BREAKER	TERASAKI	DTCB6106C		
17	1	Q17 SURGE FILTER CIRCUIT BREAKER	TERASAKI	DTCB6110C	-	
18	1	Q18 EM PUMP CNTRL & SURCHARGE IMMINENT CB	TERASAKI	DTCB6106C	-	
19	1	Q19 SPARE	TERASAKI	DTCB6104C	-	
20	1	Q20 GENERATOR AUXILLARY SUPPLY CIRCUIT BREAKER	TERASAKI	DSRCBH-10-30A	-	
21	1	Q21 SPARE	TERASAKI	DTCB6106C	K	
22	1	Q22 SPARE	TERASAKI	DTCB6106C	Q	
23	1	Q23 SPARE CIRCUIT BREAKER	TERASAKI	DTCB6106C	-	
24		NOT USED				
25		NOT USED				
26	1	Q30 RTU POWER SUPPLY CIRCUIT BREAKER	TERASAKI	DTCB6104C	-	
27	1	Q31 SURGE DIVERTERS RELAY CIRCUIT BREAKER	TERASAKI	DTCB6104C	-	
28	1	Q32 SPARE	TERASAKI	DTCB6104C	H	
29	1	Q33 SPARE	TERASAKI	DTCB6104C	-	
30		NOT USED				
31	1	Q4-1 PUMP1 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB6106C	-	
32	1	Q5-1 PUMP2 CONTROL CIRCUIT BREAKER	TERASAKI	DTCB6106C	-	
33					E	
34		NOT USED				
35					F	
36	1	DISTRIBUTION BOARD CHASSIS	TERASAKI	CD-2-24/18-3U	-	
37	3	F1 - SURGE DIVERTER CIRCUIT FUSES	NHP	63AMP 63MS	-	FUSES & HOLDERS
38	3	SURGE DIVERTER	CRITEC	TDS-180-4S-277	-	
39	1	SURGE DIVERTER ALARM RELAY - SDAR	CRITEC	DAR-275V	-	
40	1	RTU SURGE REDUCTION FILTER	CRITEC	TDF-10A-240V	-	
41	1	ENERGEX MAINS PHASE FAILURE RELAY - PFRE	CROMPTON INSTRUMENTS	252-PSGW	-	
42		NOT USED				
43	1	STATION MAINS PHASE FAILURE RELAY - PFRS	CROMPTON INSTRUMENTS	252-PSGW	-	
44		NOT USED				
45	1	MAIN NEUTRAL LINK	D&L ELEC	DLAN6	-	INSULATED
46	1	MAIN EARTH LINK	D&L ELEC	DLAE6	-	
47	1	DIST. BD NEUTRAL LINK	D&L ELEC	2DLA18	-	INSULATED
48	1	DIST. BD EARTH LINK	D&L ELEC	2DLAE18	-	
49	1	SURGE DIVERTER EARTH LINK	CLIPSAL	LSP	-	
50	1	INSTRUMENT EARTH LINK	D&L ELEC	DLBE12	-	INSULATED
51	1	RTU FILTERED SUPPLY NEUTRAL LINK	CLIPSAL	L7	-	INSULATED
52	1	3 PHASE SWITCHED OUTLET	CLIPSAL	56C432	-	USE ENCLOSURE AS SHROUD
53	1	1 PHASE OUTLET 15A	CLIPSAL	15/15+90B (SHROUD)	-	
54	1	RTU LAPTOP GPO	CLIPSAL	15+449A+449AP	-	
55	1	1 PHASE OUTLET - GENERATOR AUX POWER	CLIPSAL	56SO310	M	IP56
56	1	3 PHASE N&E APPLIANCE INLET - GENERATOR POWER	MENNEKES	361	M	c/w PROTECTIVE CAP 40787
57	1	3 PHASE N&E CONNECTOR - GENERATOR POWER	MENNEKES	1121	M	
58	9	SW/BD DOOR MICRO SWITCHES	CAMSCO	SM202	-	9 OFF N/O
59	6	SW/BD 8W INTERNAL FLURO LIGHTS	THORN	BB0108	-	
60	2	PUMP SOFT STARTER	EMOTRON	MSF-017 + MODBUS COMMS		
61	2	EXTERNAL KEYPAD KIT	EMOTRON	01-2138-00	-	
62	4	CURRENT TRANSFORMERS + CT CABLE KIT 01-2020-00	EMOTRON	TO SUIT MSF-017 +		
63	2	PUMP LINE CONTACTOR - K1	SPRECHER & SCHUH	CA7-30		
64	2	PUMP BY-PASS CONTACTOR - K2	SPRECHER & SCHUH	CA7-30		

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
65	2	PUMP FAULT RELAY - K3	IDEC	RH2B-UL-240VAC	-	
66	2	PUMP RUN RELAY - K4	IDEC	RH2B-UL-240VAC	-	
67	2	PUMP CONTROL CCT POWER ON RELAY - K5	IDEC	RH2B-UL-240VAC	-	
68	2	PUMP RUN COMMAND RELAY - K6	IDEC	RH2B-UL-24VDC	-	
69	2	PUMP FAULT RESET RELAY - K7	IDEC	RH2B-UL-24VDC	-	
70	2	PUMP EMERGENCY MODE INTERRUPT RELAY - K8	IDEC	RH2B-UL-24VDC	-	
71					A	
72					B	
73					C	
74	2	PUMP START PUSHBUTTON - S1	SPRECHER & SCHUH	D7P-F3-PX10	-	
75	2	PUMP STOP PUSHBUTTON - S2	SPRECHER & SCHUH	D7P-F4-PX10	-	
76	2	PUMP EM/STOP PUSHBUTTON - S3	SPRECHER & SCHUH	D7P-MT34-PX02S	-	c/w 60mm E/Stop Ring - Label
77	2	PUMP RESET PUSHBUTTON - S4	SPRECHER & SCHUH	D7P-F6-PX10	-	
78	2	PUMP HOUR RUN METER	NATIONAL	TH639	-	
79	2	PUMP POWER SOCKET OUTLET + INCLINE SLEEVE	MARECHAL	DS3 31340013972 + 51CA058	J	
80	2	PUMP POWER INLET PLUG + HANDLE	MARECHAL	DS3 31380013972 + 31BA013	J	
81	2	PUMP CONTROL SOCKET OUTLET + INCLINE SLEEVE	MARECHAL	PN7C 01P4060 + 01NA053	J	
82	2	PUMP CONTROL INLET PLUG + HANDLE	MARECHAL	PN7C 01P8060 + 01NA313	J	
83					E	
84					E	
85					E	
86					E	
87					E	
88		NOT USED				
89					E	
90					E	
91	1	LR3- WET WELL HIGH LEVEL RELAY	MULTITRODE	MTR-5	-	24VDC
92					Q	
93	1	SIR - SURCHARGE IMMINENT LEVEL RELAY	MULTITRODE	MTR-2	-	240VAC
94	2	SINGLE POINT PROBES	MULTITRODE	0.2/2-'x' (2 core)	-	'x' = CABLE LENGTH TO SUIT
95	1	EMERGENCY PUMPING MODE RELAY PUMP1 - EMG1	IDEC	RH2B-UL-24VDC	-	
96	1	SURCHARGE IMMINENT DELAY TIMER - SIDT	SPRECHER & SCHUH	RZ7-FSA 3E U23	-	ON DELAY
97	1	EMERGENCY PUMPING MODE TIMER - EMGDT	SPRECHER & SCHUH	RZ7-FSB 4U- U23	-	OFF DELAY 0.05-60min
98	1	EMERGENCY PUMPING MODE TIMER PUMP2- EMG2	SPRECHER & SCHUH	RZ7-FSA 3E U23	-	ON DELAY
99	2	EMERGENCY PUMPING MODE SWITCH - S5	SPRECHER & SCHUH	D7P-LSM25-PX10	-	ENGRAVE 'OFF' 'ON'
100		NOT USED				
101					F	
102					F	
103					F	
104					F	
105					F	
106					F	
107					F	
108					F	
109					F	
110					F	
111					F	
112					F	
113					F	
114		NOT USED				
115	1	GRAPHIC DISPLAY	REDLION	G306C000	-	
116		NOT USED				
117	1	SW/BD LIGHTING CONTROL RELAY - SLCR	IDEC	RH2B-UL-24VDC	-	
118	1	STATION LOCAL/REMOTE SWITCH - S10	KRAUS & NAIMER	CAD11	-	ENGRAVE 'LOCAL REMOTE'
119	1	ELECTRODES TEST RELAY - ETR	IDEC	RH4B-UL-24VDC	-	
120					P	
121	1	WET WELL LEVEL INDICATOR	CROMPTON INSTRUMENTS	244-01KG-HG-IP-SR 4-20mA	-	0-100% ADJ RED POINTER
122		NOT USED				
123		NOT USED				
124		NOT USED				
125		NOT USED				
126		NOT USED				
127					S	
128					S	

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	OPT	REMARKS
129					K	
130					K	
131		NOT USED				
132					H	
133	1	WET WELL LEVEL TRANSMITTER	ENDRUSS + HAUSER	FMI67-A2BMC1A3	-	RANGE = 4m
134	1	WET WELL LEVEL TRANSMITTER TERMINAL HOUSING	ENDRUSS + HAUSER	(Part of Item 133)	-	
135					G	
136					G	
137	1	DELIVERY PRESSURE TRANSMITTER	VEGA VEGABAR74	BR74XXGG1EHA2X	U	RANGE = 25m
138	1	DELIVERY PRESSURE ADJUSTMENT UNIT	VEGA VEGA DIS12	VEGADIS12XBAX	U	
139	1	RTU POWER SUPPLY 24VDC	POWERBOX	PB251-24CM-CC-T	-	
140	1	RADIO 24V/13.8VDC CONVERTER	POWERBOX	PB1M-24126-CE	R	
141					I	
142	2	BATTERIES	YUASA	UXH50-12	-	
143	1	RADIO	TRIO	DR900-07A02-D0	R	
144	1	ANTENNA	TRIO	YAGI ANTENAL	R	15 ELEMENT 13dB ALUM
145	1	RADIO COAX SURGE PROTECTION UNIT	POLYPHASER CORPORATION	IS-50NX-C2	R	
146	1	TELEMETRY UNIT	LOGICA CMG	MD3311EAL/271D-0-T	-	
147					I	
148					I	
149	5	DISCONNECT PLUGS	PHOENIX CONTACT	MSTB 2,5/20-ST-5.08	-	
150	1	DISCONNECT PLUGS	PHOENIX CONTACT	MSTB 2,5/10-ST-5.08	-	
151	5	DISCONNECT BLOCKS	PHOENIX CONTACT	UMSTBVK2,5/20-G-5.08	-	
152	1	DISCONNECT BLOCKS	PHOENIX CONTACT	UMSTBVK2,5/10-G-5.08	-	
153	5	CABLE HOUSING	PHOENIX CONTACT	KGS-MSTB2.5/20	-	
154	1	CABLE HOUSING	PHOENIX CONTACT	KGS-MSTB2.5/10	-	
155	1	CODING PINS	PHOENIX CONTACT	CP-MSTB + CR-MSTB	-	
156	1	ANTENNA MAST c/w 20mm NYLON CABLE GLAND	SWBD BUILDER		R	LENGTH = 6 MTRS
157	1	COAX CABLE (INTERNAL)	R.F. INDUSTRIES	RG58	R	
158	1	COAX CABLE (EXTERNAL)	R.F. INDUSTRIES	RG213	R	
159	1	COAX PLUG	R.F. INDUSTRIES	SMA	R	
160	1	COAX PLUG	R.F. INDUSTRIES	N08 (MALE)	R	
161	1	COAX PLUG	R.F. INDUSTRIES	N07 (MALE)	R	
162	1	U CLAMPS	R.F. INDUSTRIES	UNV	R	
163		NOT USED				
164		SWITCHBOARD TERMINALS				
164.1	Lot	FUSED TERMINALS with LED 24V INDICATION	PHOENIX CONTACT	UT4-HESI LED24 (5x20)	-	
164.2	Lot	FUSE CARTRIDGES	PHOENIX CONTACT	M205	-	RATINGS AS REQUIRED
164.3	Lot	DISCONNECT TERMINALS	PHOENIX CONTACT	UT4-MT P/P	-	
164.4	4	EARTH TERMINALS	PHOENIX CONTACT	UT4-MTD-PE/S	-	
164.5	8	GROUP MARKER CARRIER	PHOENIX CONTACT	UBE	-	
164.6	2	TEST PLUG ADAPTOR	PHOENIX CONTACT	PS-6	-	
164.7	1	SCREW DRIVER	PHOENIX CONTACT	SZS 0.6 x 3.5	-	
164.8	Lot	PLUG-IN BRIDGE	PHOENIX CONTACT	FBS	-	AS REQUIRED
164.9						
165	2	CORROSION INHIBITOR	CORTEC	VPCI-110 OR 111	-	FROM AP CONTROLS
166	Lot	WET WELL CONDUIT SEALING BUNGS	RUBBER	TO SUIT CONDUITS	-	Detail "W"
167		NOT USED				
168	1	ENERGEX PADLOCK - 45mm brass pin tumbler	H.A. REED LOCKSMITHS	KEY No 325	-	
169		NOT USED				
170	Lot	S/STEEL FITTINGS AS DETAILED FOR PRESSURE TX	FITTINGS	STAINLESS STEEL	U	Sheet 19
171	1	EARTH ROD CONNECTION BOX	NESCO	ERB1	-	
172	1	LINE TAP - BONDING TO EARTHING ROD	CLIPSAL	BP26	-	
173	1	EARTHING ROD	COPPER ROD	13mm Diameter	-	
174		NOT USED				
175		NOT USED				
176		NOT USED				

Sheet 14

FOR CONSTRUCTION

No	DATE	AMENDMENT	DRN.	APD.
.				
.	06.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

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Reference Drawings

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BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
EQUIPMENT LIST

SHEET No. 14
BRISBANE WATER DRAWING No. 486/5/7-0023-014
AMEND. A

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CABLE No.	STATUS (Note 2)	SIZE	CORES	TYPE	LENGTH (m)	FROM	TO	CABLE FUNCTION	NOTES
P01	NEW	16mm²	4C+E	PVC/CU/PVC		ENERGEX Supply Pillar	Switchboard	Incoming Mains Supply	
P02	NEW	6mm²	1C	Building Wire		Switchboard	Earth stake	Main Earth	
P03		-							
P04		-							
P05		-							
P06		-							
P07	EXISTING		3C+E	Flexible (Submersible)		Switchboard	Pump No1	Pump 1 Motor Feed	
P7A	EXISTING		4C	Flexible (Submersible)		Switchboard	Pump No1	Pump 1 Motor Thermistors	
P08		-							
P09		-							
P10	EXISTING		3C+E	Flexible (Submersible)		Switchboard	Pump No2	Pump 2 Motor Feed	
P10A	EXISTING		4C	Flexible (Submersible)		Switchboard	Pump No2	Pump 2 Motor Thermistors	
P11		-							
P11A		-							
P12		-							
P13		-							
P14		-							
P14A		-							
C01		-							
C02		-							
C03		-							
C04		-							
C05		-							
C06		-							
C07		-							
C08		-							
C09	NEW		2C	Vendor- Special	25mtrs	Switchboard	Wet Well High Level Probe	Wet Well Level Signal (LR3).	
		-							
C10	NEW		2C	Vendor- Special	25mtrs	Switchboard	Surcharge Imminent Probe	Surcharge Imminent Signal (SIR)	
		-							
C11		-							
C12		-							
C13A		-							
C13B		-							
C14		-							
C15		-							
C16		-							
C17		-							
C18		-							
C19		-							
C20		-							
I01	NEW			Vendor	25mtrs	Switchboard	Wet Well Hydroscopic Level Sensor	Primary Wet Well Level	
		-							
I02	NEW			Vendor	25mtrs	Switchboard	Delivery Pressure Transmitter	Delivery Pressure	
I03		-							
I04		-							
I04A		-							
I06	NEW		1 Pr	REXON B20		Switchboard - RTU	Switchboard - Pump 1 Soft Starter	RS485 Comms	
I07	NEW		1 Pr	REXON B20		Switchboard - Pump 1 Soft Starter	Switchboard - Pump 2 Soft Starter	RS485 Comms	
I08	NEW		1 Pr	REXON B20		Switchboard - Pump 2 Soft Starter	Switchboard - Graphic Display	RS485 Comms	
X01	NEW			Vendor		Switchboard - Radio	Aerial Coax Surge Protector	Radio Communications	
X02	NEW			Vendor		Aerial Coax Surge Protector	Aerial	Radio Communications	Refer Detail 'M'

NOTE:

1. THE CONTRACTOR IS RESPONSIBLE IN DETERMINING THE ACTUAL CABLE LENGTHS REQUIRED ON SITE.
2. USE EXISTING CABLES IF SIZE & CONDITION IS ADEQUATE FOR NEW LOADS & FUNCTIONS. OTHERWISE SUPPLY & INSTALL NEW CABLES. TYPE & SIZE AS PER THIS SCHEDULE.

Sheet 15

FOR CONSTRUCTION

No.	DATE	AMENDMENT	ORN.	APD.
.				
.	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
0	1.07	ISSUED FOR TENDER	P.H.	

Reference Drawings

DRAFTED	P.HAGUE
DRAFTING CHECK	A.WITTHOFT
CAD FILE	57-0023set_A
B.C.C. FILE No.	

Original Signed by P.HAGUE 17.1.07
DESIGN R.P.E.Q. No. DATE
Original signed by A.WITTHOFT 17.1.07
DESIGN CHECK R.P.E.Q. No. DATE

Orig Signed by R.JANFADA 5192 17.1.07
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
CABLE SCHEDULE

SHEET No. 15
BRISBANE WATER DRAWING No. 486/5/7-0023-015
AMEND. A

STD TEMPLATE SP-EP-SS Ver1.0

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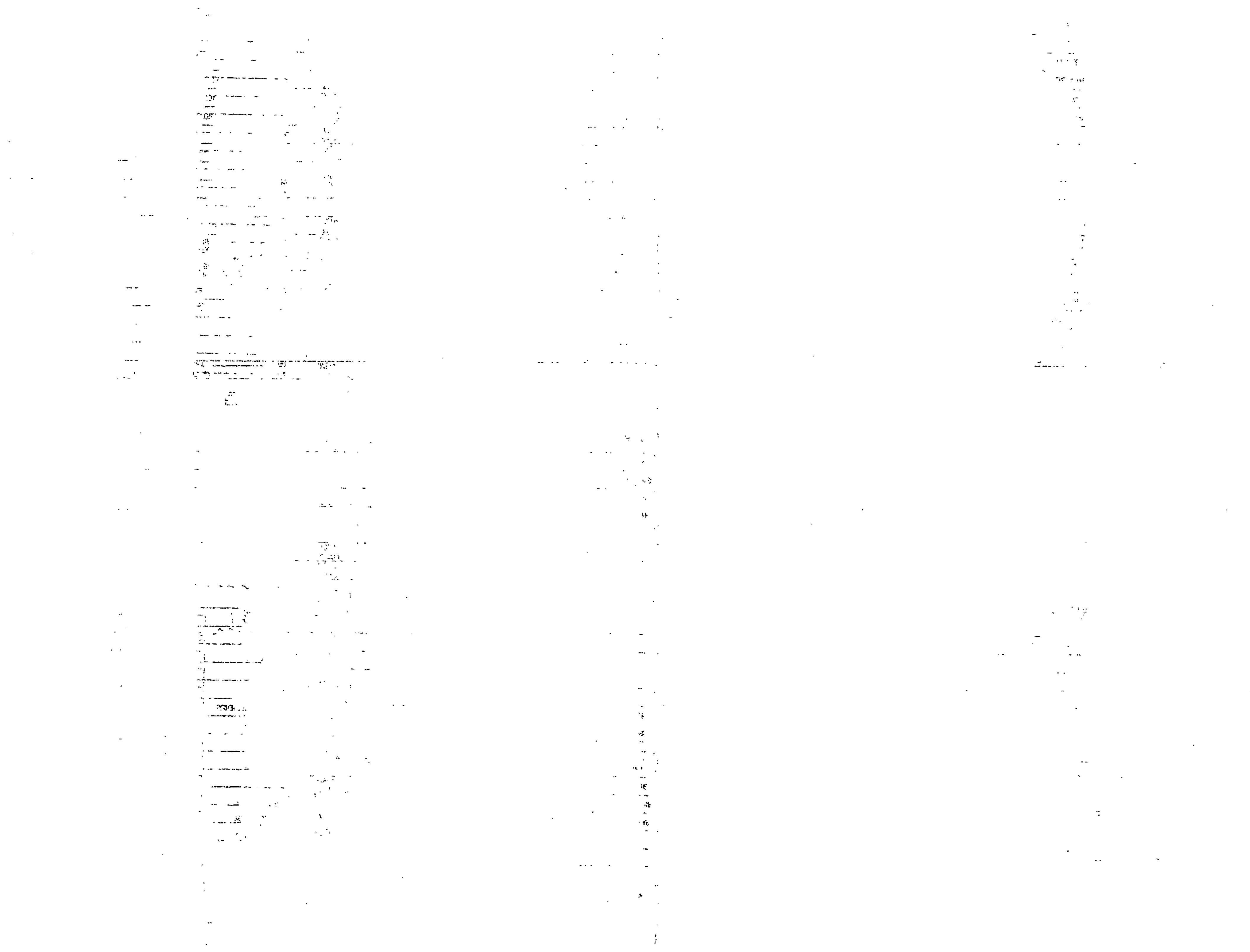

ITEM #	OPT.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR
02		ENERGEX SUPPLY	NORMAL SUPPLY MAIN SWITCH 100A		10mm 4mm	TRAFFOLYTE B/W/B
03		GENERATOR SUPPLY	GENERATOR SUPPLY MAIN SWITCH 100A		10mm 4mm	TRAFFOLYTE B/W/B
04/05		PUMP CIRCUIT BREAKER	PUMP No1 20A	PUMP No2 20A	6mm 4mm	TRAFFOLYTE W/B/W
07		PHASE FAILURE CIRCUIT BREAKER	ENERGEX PHASE FAILURE CB Q7		4mm 4mm	TRAFFOLYTE W/B/W
08						
09		SUB-DISTRIBUTION BOARD CB	SUB-DISTRIBUTION BOARD 63A		6mm 4mm	TRAFFOLYTE W/B/W
10		PHASE FAILURE CIRCUIT BREAKER	STATION PHASE FAILURE CB Q10		4mm 4mm	TRAFFOLYTE W/B/W
11		3 PHASE OUTLET CIRCUIT BREAKER	3Φ OUTLET Q11		4mm 4mm	TRAFFOLYTE W/B/W
12		1 PHASE OUTLET CIRCUIT BREAKER	1Φ GPO Q12		4mm 4mm	TRAFFOLYTE W/B/W
13		RTU LAPTOP CIRCUIT BREAKER	RTU LAPTOP GPO Q13		4mm 4mm	TRAFFOLYTE W/B/W
16		SWITCHBOARD LIGHTING CIRCUIT BREAKER	SWITCHBOARD LIGHTING Q16		4mm 6mm	TRAFFOLYTE W/B/W
17		~~RTU SURGE FILTER CIRCUIT BREAKER~~	RTU SURGE FILTER Q17		4mm 4mm	TRAFFOLYTE W/B/W
18		EM PUMP CONTROL & SIR CIRCUIT BREAKER	EM PUMPING CCT & SIR Q18		4mm 4mm	TRAFFOLYTE W/B/W
19		SPARE CIRCUIT BREAKER	SPARE Q19		4mm 4mm	TRAFFOLYTE W/B/W
20		GENERATOR ANCILLARY SUPPLY CB	GENERATOR ANCILLARY SUPPLY Q20		4mm 4mm	TRAFFOLYTE W/B/W
23		SPARE CIRCUIT BREAKER	SPARE Q23		4mm 4mm	TRAFFOLYTE W/B/W
26		RTU POWER SUPPLY CIRCUIT BREAKER	RTU POWER SUPPLY Q30		4mm 4mm	TRAFFOLYTE W/B/W
27		SURGE DIVERTER RELAY CIRCUIT BREAKER	SURGE DIVERTER RELAY Q31		4mm 4mm	TRAFFOLYTE W/B/W
29		SPARE CIRCUIT BREAKER	SPARE Q33		4mm 4mm	TRAFFOLYTE W/B/W
31/32		PUMP CONTROL CIRCUIT BREAKER	PUMP No1 Q4-1	PUMP No2 Q5-1	4mm 4mm	TRAFFOLYTE W/B/W
37		SURGE DIVERTER FUSES	SURGE DIVERTER FUSES 63A	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	TRAFFOLYTE W/B/W - R/W/R
38		SURGE DIVERTERS	LIGHTNING ARRESTORS		4mm	TRAFFOLYTE W/B/W
39		SURGE DIVERTER ALARM RELAY	SDAR		4mm 4mm	TRAFFOLYTE W/B/W
40		RTU SURGE REDUCTION FILTER	RTU SURGE REDUCTION FILTER		4mm 4mm	TRAFFOLYTE W/B/W
41		PHASE FAILURE RELAY	ENERGEX MAINS POWER FAIL - PFRE	FED FROM LINE SIDE OF MAIN SWITCH	4mm 4mm	TRAFFOLYTE W/B/W - R/W/R
43		PHASE FAILURE RELAY	STATION MAINS POWER FAIL - PFRS		4mm 4mm	TRAFFOLYTE W/B/W
45		MAIN NEUTRAL LINK	MAIN NEUTRAL		4mm	TRAFFOLYTE W/B/W
46		MAIN EARTH LINK	MAIN EARTH		4mm	TRAFFOLYTE W/B/W
47		SUB-BOARD NEUTRAL LINK	NEUTRAL		4mm	TRAFFOLYTE W/B/W
48		SUB-BOARD EARTH LINK	EARTH		4mm	TRAFFOLYTE W/B/W
49		SURGE DIVERTER EARTH LINK	EARTH		4mm	TRAFFOLYTE W/B/W
50		INSTRUMENT EARTH LINK	INSTRUMENT EARTH		4mm	TRAFFOLYTE W/B/W
51		RTU FILTERED SUPPLY NEUTRAL LINK	FILTERED SUPPLY NEUTRAL		4mm 4mm	TRAFFOLYTE W/B/W
54		LAPTOP GPO	LAPTOP GPO		4mm	TRAFFOLYTE W/B/W
55	M	GENERATOR 240VAC CONNECTION SOCKET	GENERATOR AUX SUPPLY		4mm 4mm	TRAFFOLYTE W/B/W
56	M	GENERATOR POWER CONNECTION SOCKET	GENERATOR CONNECTION		6mm 6mm	TRAFFOLYTE W/B/W
60		PUMP SOFT STARTER	PUMP No1 1U1	PUMP No2 2U1	6mm 4mm	TRAFFOLYTE W/B/W
61		PUMP SOFT STARTER KEYPAD	PUMP No1	PUMP No2	6mm	TRAFFOLYTE W/B/W
63		LINE CONTACTOR	PUMP 1 1K1	PUMP 2 2K1	4mm 4mm	TRAFFOLYTE W/B/W
64		BYPASS CONTACTOR	PUMP 1 1K2	PUMP 2 2K2	4mm 4mm	TRAFFOLYTE W/B/W
65		PUMP S/STARTER FAULT RELAY	1K3	2K3	4mm	TRAFFOLYTE W/B/W
66		PUMP RUN RELAY	1K4	2K4	4mm	TRAFFOLYTE W/B/W
67		PUMP POWER ON RELAY	1K5	2K5	4mm	TRAFFOLYTE W/B/W
68		PUMP RUN COMMAND RELAY	1K6	2K6	4mm	TRAFFOLYTE W/B/W
69		PUMP FAULT RESET RELAY	1K7	2K7	4mm	TRAFFOLYTE W/B/W
70		PUMP EMERGENCY MODE INTERRUPT RELAY	1K8	2K8	4mm	TRAFFOLYTE W/B/W

ITEM #	OPT.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR
74		PUMP START PUSHBUTTON	START	START	4mm	TRAFFOLYTE W/B/W
75		PUMP STOP PUSHBUTTON	STOP	STOP	4mm	TRAFFOLYTE W/B/W
76		PUMP EM.STOP PUSHBUTTON	EMERGENCY STOP	EMERGENCY STOP	4mm	TRAFFOLYTE Y/B/Y
77		PUMP RESET PUSHBUTTON	FAULT RESET	FAULT RESET	4mm	TRAFFOLYTE W/B/W
78		PUMP HOURS RUN METER	HOURS RUN	HOURS RUN	4mm	TRAFFOLYTE W/B/W
79/80	J	PUMP DE-CONTACTOR	PUMP No1	PUMP No2	6mm	TRAFFOLYTE W/B/W
81/82	J	PUMP AUX CONTROL PLUG & SOCKET	PUMP No1	PUMP No2	6mm	TRAFFOLYTE W/B/W
91		WET WELL HIGH LEVEL RELAY	LR3		4mm	TRAFFOLYTE W/B/W
93		SURCHARGE IMMINENT LEVEL RELAY	SIR		4mm	TRAFFOLYTE W/B/W
95		EMERGENCY PUMPING MODE PUMP 1 RELAY	EMG1		4mm	TRAFFOLYTE W/B/W
96		SURCHARGE IMMINENT ON DELAY TIMER	SIDT		4mm	TRAFFOLYTE W/B/W
97		EMERGENCY PUMPING MODE OFF DELAY TIMER	EMGOT		4mm	TRAFFOLYTE W/B/W
98		EMERGENCY PUMPING MODE PUMP 2 TIMER	EMG2		4mm	TRAFFOLYTE W/B/W
99		EMERGENCY PUMPING MODE START SWITCH	EMERGENCY PUMPING MODE	EMERGENCY PUMPING MODE	4mm 4mm	TRAFFOLYTE W/B/W
117		SWITCHBOARD LIGHTING CONTROL RELAY	SLCR		4mm	TRAFFOLYTE W/B/W
118		STATION LOCAL/REMOTE SELECTOR SWITCH	CONTROL MODE		4mm	TRAFFOLYTE W/B/W
119		ELECTRODES TEST RELAY	ETR		4mm	TRAFFOLYTE W/B/W
121		WET WELL LEVEL INDICATOR	WET WELL LEVEL		4mm	TRAFFOLYTE W/B/W
133		WET WELL LEVEL ADJ. UNIT	PRIMARY WET WELL LEVEL		4mm	TRAFFOLYTE W/B/W
137	U	DELIVERY PRESSURE ADJ. UNIT	DELIVERY PRESSURE		4mm	TRAFFOLYTE W/B/W
139		RTU 240VAC/24VDC POWER SUPPLY	RTU 24VDC POWER SUPPLY		4mm 4mm	TRAFFOLYTE W/B/W
140	R	RADIO 24V/13.8VDC CONVERTER	24/12 VDC CONVERTER - RADIO		4mm 4mm	TRAFFOLYTE W/B/W
143	R	RADIO	RADIO		4mm	TRAFFOLYTE W/B/W
145	R	RADIO COAX SURGE PROTECTION	RADIO SURGE PROTECTION		4mm	TRAFFOLYTE W/B/W
146		TELEMETRY UNIT	RTU		4mm	TRAFFOLYTE W/B/W

ITEM #	OPT.	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR
		TERMINAL HEADER	RTU POWER SUPPLIES		4mm 4mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	DIGITAL INPUTS DI1	DIGITAL INPUTS DI2	4mm 4mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	DIGITAL INPUTS DI3		4mm 4mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	DIGITAL OUTPUTS DO1	DIGITAL OUTPUTS DO2	4mm 4mm	TRAFFOLYTE W/B/W
		TERMINAL HEADER	ANALOG INPUTS AI1		4mm 4mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Above Circuit Breakers)	NON FILTERED SUPPLY		6mm 6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Above Circuit Breakers)	FILTERED SUPPLY		6mm 6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (Incomer Section)	MEN BEHIND		6mm	TRAFFOLYTE W/B/W
		HEADER LABEL (MainSwitch Section)	SURGE DIVERTER FUSES BEHIND		6mm	TRAFFOLYTE W/B/W
	M	GENERATOR INTERFACE TERMINALS	GENERATOR INTERFACE		4mm 4mm	TRAFFOLYTE W/B/W
		GLAND PLATE LABEL (RTU Section)	SPARE CONDUITS BELOW FOR FUTURE INSTALLS		6mm 6mm	TRAFFOLYTE W/B/W

EXTERNAL LABEL LIST

LABEL	TEXT	TEXT HEIGHT	PAINT FILL LETTERING	SIZE	QTY	OPT
A	SPxxx	20mm	Black	100x35	1	
B	RTU	10mm	Black	50x20	1	
C	PUMP CONTROL	10mm	Black	120x20	1	
D	WARNING THIS SITE IS MONITORED BY NETWORK CONTROL. PLEASE INFORM THE OPERATOR BEFORE ISOLATING PUMPS OR STATION	8mm	Black	250x100	2	
E	PLEASE CHECK THAT THE STATION IS IN REMOTE MODE BEFORE LEAVING SITE	8mm	Black	210x60	1	
F	COMMON CONTROL	10mm	Black	120x20	1	
I	MAIN SWITCHES	10mm	Black	120x20	1	
J	DISTRIBUTION BOARD	10mm	Black	150x20	1	
L	GENERATOR CONNECTIONS	10mm	Black	180x20	1	F
M	PUMP DE-CONTACTORS	10mm	Black	150x20	1	J
N	GENERATOR INLET	10mm	Black	200x20	1	F
O	BATTERIES	10mm	Black	80x20	1	
P	SUPPLY AUTHORITY METERING	10mm	Black	200x20	1	
Q	DANGER 415V	10mm	Black	100x20	1	
R	DANGER - 2 SOURSES OF SUPPLY	10mm	Red	220x20	1	
	EXTERNAL LABELS 1mm THICK 316 GRADE STAINLESS STEEL. FIXED WITH M3 316 STAINLESS STEEL METAL THREADS.					

DETAIL Q

Sheet 16

FOR CONSTRUCTION

	08.07	ISSUED FOR CONSTRUCTION	P.H.	A.W.
C	1.07	ISSUED FOR TENDER	P.H.	
No	DATE	AMENDMENT	DRN.	APD.

Reference Drawings

DRAFTED P.HAGUE
DRAFTING CHECK A.WITTHOFT
CAD FILE 57-0023set_A
B.C.C. FILE No.

Original Signed by P.HAGUE 17.1.07
DESIGN R.P.E.Q. No. DATE
Original signed by A.WITTHOFT 17.1.07
DESIGN CHECK R.P.E.Q. No. DATE

Orig Signed by R.JANFADA 5192 17.1.07
PRINCIPAL DESIGN MANAGER DATE
Original Signed by P.SHERRIFF 18.1.07
CLIENT DELEGATE DATE

BRISBANE WATER

SITE
SP152 NUDGEE ROAD
SEWAGE PUMP STATION

TITLE
SWITCHBOARD
LABEL SCHEDULE

SHEET No. 18
BRISBANE WATER DRAWING No. 486/5/7-0023-016
AMEND. A

STD TEMPLATE SP-EP-03 Ver3

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