

PUMP STATION B22

LOBLEY STREET, IPSWICH

ELECTRICAL SWITCHBOARD

OPERATION AND MAINTENANCE

MANUAL

B22
PUMP 3
SP 331

Pump 3, SP331

CONTENTS

1.0 INTRODUCTION

1.1 Operating Instructions

2.0 DESCRIPTION OF OPERATION

2.1 Mode Selection

2.2 Manual Control

2.3 Automatic Control

3.0 CUBICLES

3.1 Main Switchboard

3.2 Termination Cubicle

3.3 Station Service Board

3.4 Spare Parts Cubicle

4.0 EQUIPMENT DESCRIPTION

4.1 Main Pumps

4.2 Sump Pumps

4.3 Vent Control

4.4 Level Control

4.5 Indication

5.0 SCHEDULE OF SPARE PARTS SUPPLIERS

6.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

7.0 TEST SHEETS

8.0 PUMPS

9.0 "AS CONSTRUCTED" DRAWINGS

PP
INDICES 1-31
A4



Ref No 35040
Made in Norway



312311350400

1.0 INTRODUCTION

These operating instructions cover the Ipswich City Council Lobley Street pumping station B22 electrical equipment supplied by J & P Richardson Industries Pty Ltd in September 2003.

1.1 Operating Instructions

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

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

2.0 DESCRIPTION OF OPERATION

2.1 Mode Selection

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

2.2 Manual Control

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

- a). Selecting the "RUN" setting on the "MODE SELECTOR SWITCHES" as described in Clause 2.1.
- b). The pump will start immediately when "RUN" selected.
- c). The pump will stop when "OFF" selected.

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

2.3 Automatic Control

For automatic control of the station: -

- a). The "MODE SELECTOR SWITCHES" on the switchboard should be in the "AUTO" position.
- b). The automatic Duty Selection is done via the PLC software. Refer PLC SOFTWARE Section for details. The total running hours of each pump unit is displayed on the hourmeter located on each pump section of the switchboard.
- c). The automatic starting, and stopping of the pumps is controlled by signals from Master RTU.

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

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

3.0 CUBICLES

3.1 Main Switchboard

This custom built sheetmetal cubicle is based on a free standing, front access with bottom cable entry in accordance with FORM 1 compartmented concept to AS3139.1

CARE MUST BE TAKEN FOR ANY FUTURE ADDITIONS AND/OR REPAIRS TO ENSURE SWITCHBOARD RETAINS VALIDITY OF TYPE TEST CERTIFICATES.

This cubicle contains the main isolator, protection equipment, motor starters, electromechanical control devices, operator type controls, level measuring devices, indicating devices, Telemetry equipment and terminals necessary to provide the required method of operation.

3.2 Termination Cubicle

This custom built sheetmetal cubicle is based on the freestanding, front access, bottom cable entry concept containing terminals for termination of pump and control cabling.

3.3 Station Services Board

This custom built sheetmetal cubicle is based on the freestanding, front access, bottom cable entry concept, containing circuit breakers whose purpose is to distribute power throughout the station.

3.4 Spare Parts Cubicle

This custom built sheetmetal cubicle is based on the freestanding, front access, concept containing spare parts required for the control equipment installed.

4.0 EQUIPMENT DESCRIPTION

4.1 Main Pumps

The two 220kW & one 145kW Main Pump motors have Solid State Soft starting with individual isolation achieved using a Moulded Case Circuit Breaker.

Protection of the motors is achieved by the use of electronic motor protection integral to the Solid State Soft Starter.

4.2 Sump Pumps

The 1.5kW Sump Pump motor has Direct On Line starting with individual isolation achieved using a Moulded Case Circuit Breaker.

Protection of the motors is achieved by the use of thermal overload relays in the motor leads.

The Sump Pump motor electrical indication is provided by indicators and associated selector switch located at the switchboard.

4.3 Vent Fans

The 0.3kW Vent Fan motor has Direct On Line starting with individual isolation achieved using a Moulded Case Circuit Breaker.

Protection of the motors is achieved by the use of thermal overload relays in the motor leads.

The Vent Fan motor electrical indication is provided by indicators associated selector switch located at the switchboard.

4.4 Level Control

The level system adopted involves the use of an Ultrasonic Level Detection System.

The level detection system provides a 4-20mA analogue signal that is used by the Master RTU to control the operation of the main pump units.

The level system adopted involves the use of Electronic Level Detection Relays in conjunction with Multitrode level probes. These relay contacts are used in the control circuitry to control the operation of the main pump units.

4.5 Indication

Indicating lights indicating motor operation and motor protection operation are located in the respective drive sections on the switchboard.

5.0 SCHEDULE OF SPARE PARTS SUPPLIERS - Queensland

A.B.B. KENT - TAYLOR
Unit 8 Fairfield Corporate Park
38 Tennyson Memorial Ave
Yeronga QLD 4105
Ph. (07) 3369 1311

AUSTRALIAN SOLENOID Co. Pty Ltd.,
(Kraus & Naimer)
22 Brookes St.
Bowen Hills QLD 4006
Ph. (07) 3252 8344

BEP ENGINEERING PRODUCTS
Boundary St.
West End QLD 4101
Ph. (07) 3844 1711

BESTOBELL MOBREY
123 Boundary St.
West End QLD 4101
Ph. (07) 3844 1711

CONTROL LOGIC (Pepperl & Fuchs)
34 Thompson St.
Bowen Hills QLD 4006
Ph. (07) 3252 9611

CONWELL TRADING (Electromatic)
52 Doggett St.
Fortitude Valley QLD 4006
Ph. (07) 3252 7850

CROMPTON INSTRUMENTS
8 Welch St.
Underwood QLD 4119
Ph. (07) 3841 1586

EMSBY EQUIPMENT (Fuji/Safronics)
27 Rodwell Street
Archerfield QLD 4108
Ph. (07) 3274 2566

FISCHER & PORTER
44 Cribb St.
Milton QLD 4064
Ph. (07) 3369 0811

GEC ALSTROM
Unit 5 Kingsford Smith Corporate Pk.
Theodore St.
Eagle Farm QLD 4007
Ph. (07) 3268 4344

GILBERT LODGE
1890 Ipswich Rd.
Archerfield QLD 4108
Ph. (07) 3277 6999

HAYMANS ELECTRICAL
65 Spine St.
Sumner Park QLD 4074
Ph. (07) 3376 7333

HEINEMANN
11 Wandoo St
Fortitude Valley QLD 4006
Ph. (07) 3252 3612

MULTITRODE
130 Kingston Road
Underwood QLD 4119
Ph. (07) 3808 4011

N.H.P. Electrical Engineering Products
(Sprecher & Schuh)
25 Turbo Drive.
Corparoo QLD 4151
Ph. (07) 3891 6008

NILSEN ELECTRIC
11 Ross St.
Newstead QLD 4006
Ph. (07) 3257 1313

PACIFIC DATA SYSTEMS PTY LTD (Datataker)
85 Lewis St.
Buranda QLD 4102
Ph. (07) 3391 5077

SCA DISTRIBUTORS (Component Resources)
178 Wecker Road
Mansfield QLD 4122
Ph. (07) 3849 5077

SCA DISTRIBUTORS (Component Resources)
178 Wecker Road
Mansfield QLD 4122
Ph. (07) 3849 5077

SCHNEIDER AUSTRALIA
9 Greystone St.
Tingalpa QLD 4173
Ph. (07) 3890 2112

SIEMENS
9 Parkview St.
Milton QLD 4064

6.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION

UNCLEAR
TEXT



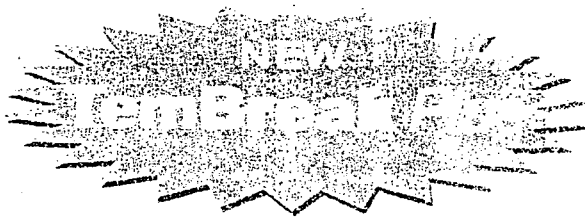
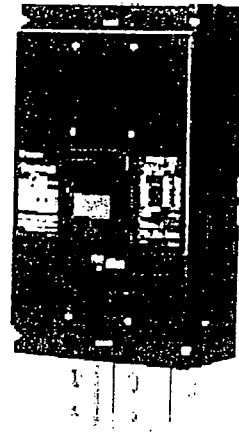
TemBreak MCCB's



XS1250SE and XS1600SE 3 pole

- SE Upstream Selectivity breakers.
- SE series provides enhanced selectivity.
- 3:1 ratio between upstream & downstream MCCB's.
- Ics rating is 75% of Icu.
- Pt switch to assist in obtaining total selectivity.

- True RMS monitoring.
- Electronic trip unit with Long, Short and Instantaneous adjustments.
- Adjustment range 50 - 100% of nominal current rating.
- Standards IEC947-2/AS3947-2.



XS1250SE (3 pole) 3 wire

Ampere rating	Min	Max	Cat. No.
1000	500	1000	XS1250SE 1000 3FC
1250	625	1250	XS1250SE 1250 3FC

AC use	Icu	Ics	Voltage
Model			
XS1250SE	65 kA	49 kA	400/415V
XS1600SE	85 kA	64 kA	400/415V

XS1600SE (3 pole) 3 wire

Ampere rating	Min	Max	Cat. No.
1600	800	1600	XS1600SE 1600 3FC

Description	Code
Ground fault trip	LSIG
Pre-trip alarm	LSIP
Fault indicators	FI
Special LTD curves	-

XS1250SE (4 pole) 4 wire

Ampere rating	Min	Max	Cat. No.
1000	500	1000	XS1250SE 1000 4FC
1250	625	1250	XS1250SE 1250 4FC

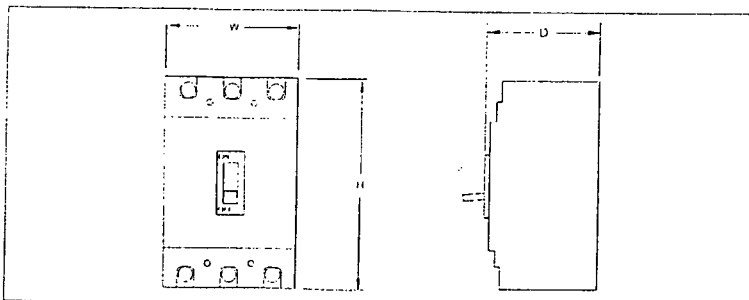
XS1600SE (4 pole) 4 wire

Ampere rating	Min	Max	Cat. No.
1600	800	1600	XS1600SE 1600 4FC

Dimensions (mm)

Description	Height ¹⁾	Width	Depth	kg
XS1250SE 3 pole	370	210	120	22
XS1600SE 3 pole	370	210	140	27
XS1250SE 4 pole	370	280	120	28
XS1600SE 4 pole	370	280	140	35

Chassis (MHC, UHC) ²⁾
TemCurve
Residual current relays



IEC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2 Australia
NEMA USA

ASTA/UK, Aust. standards
Marine
LR/UK
AB/USA
GL/GERMANY
BV/France

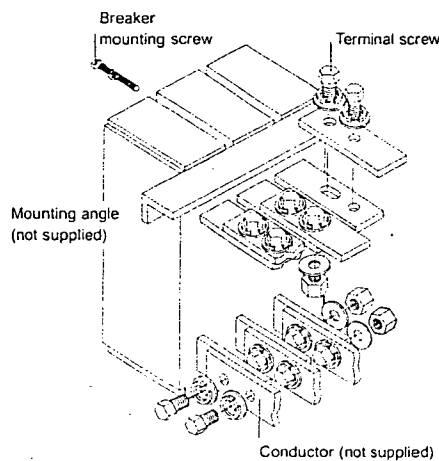
Notes: ¹⁾ Height excludes attached busbar.
²⁾ For XS1250SE only.

Connections and mountings

MCCB accessories

Rear-connection type (RC)

Flat bar stud



Applicable breakers

Horizontal ¹⁾ XS1250, XV1250NE

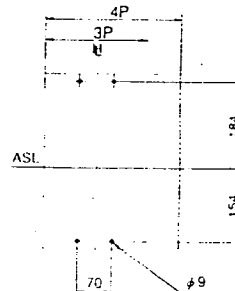
Vertical XS1600, XS2000NE
XS2500NE.

Notes: The arrangement of the flat bar can be made by the user.
If not specified the horizontal arrangement will be supplied.
¹⁾ Vertical arrangement also available on request, contact NHP for details.

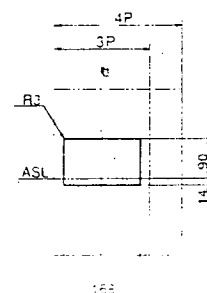
UNCLEAR
TEXT

MCCB accessories

Front connected (standard)



Drilling plan

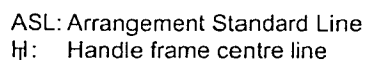


Note: In the standard selection mode, both terminals on the line side and the load side are in the horizontal direction.

Plug-in (optional)

Mounting block

Drilling plan

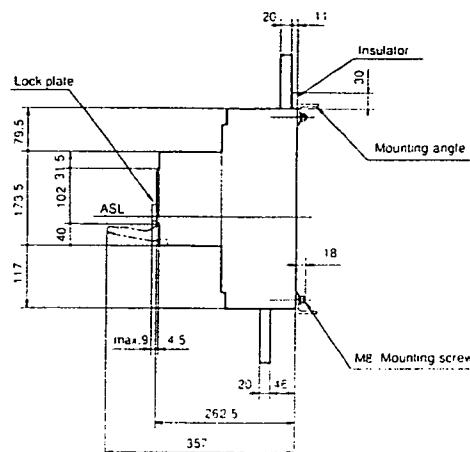
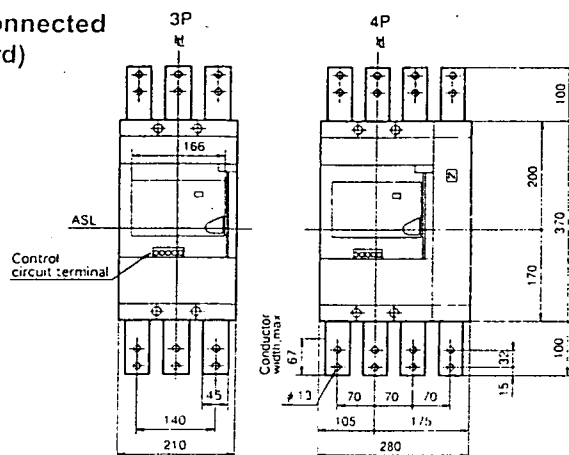


Motor operators for XS1600 NE & SE types, TL630NE, TL800NE, TL1250NE

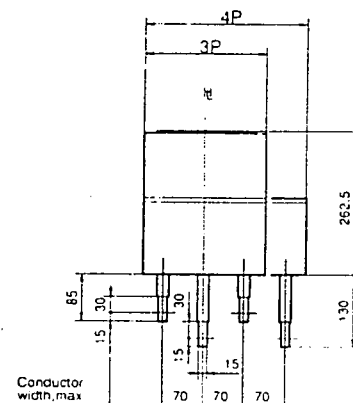
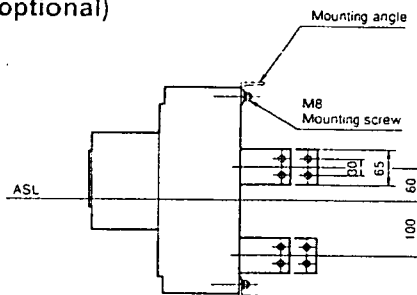
MCCB accessories

Outline dimensions (mm)

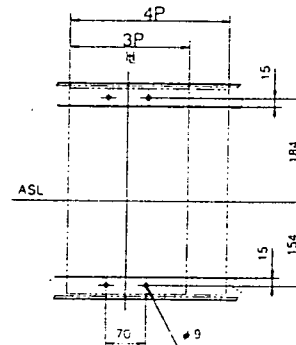
Front connected
(standard)



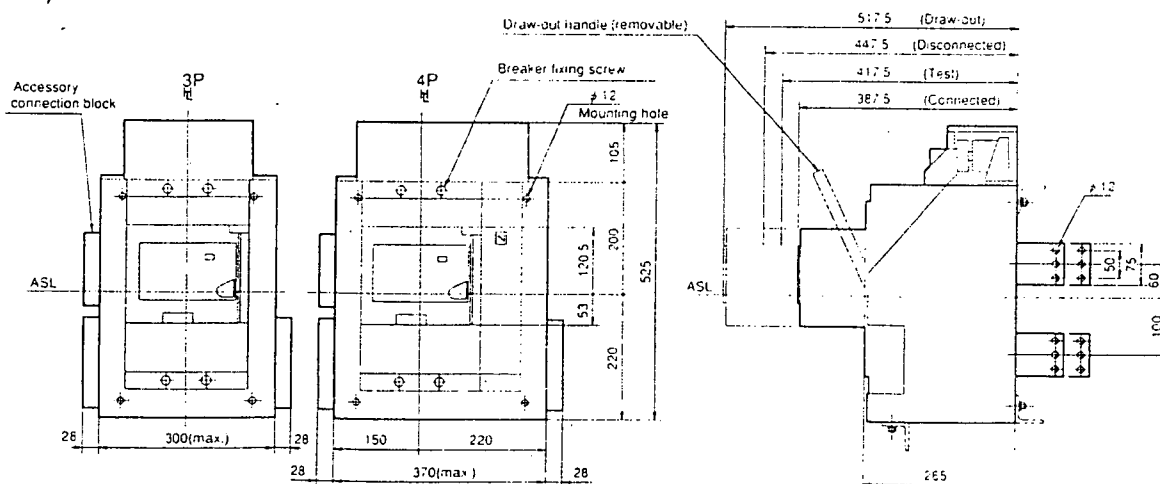
Rear connected
(optional)



Drilling plan



Draw out
(optional)



ASL: Arrangement Standard Line
H: Handle frame centre line

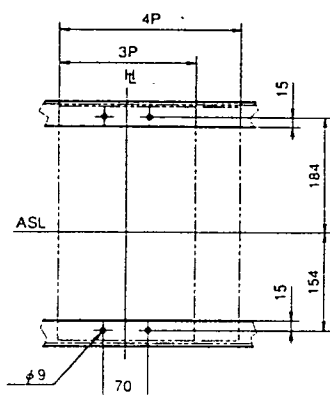
Motor operators for XS1600 TL630NE, TL800NE, TL1250NE

MCCB accessories

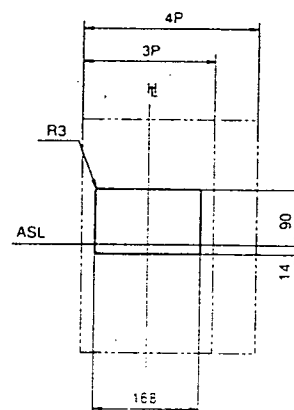
Outline dimensions (mm)

Front connected (standard)

Drilling plan



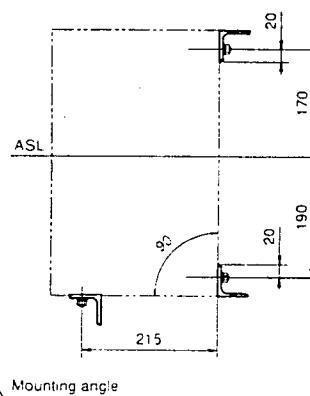
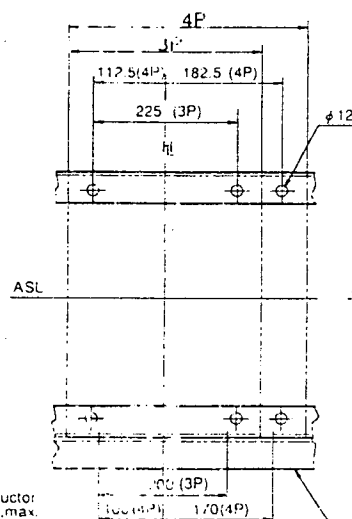
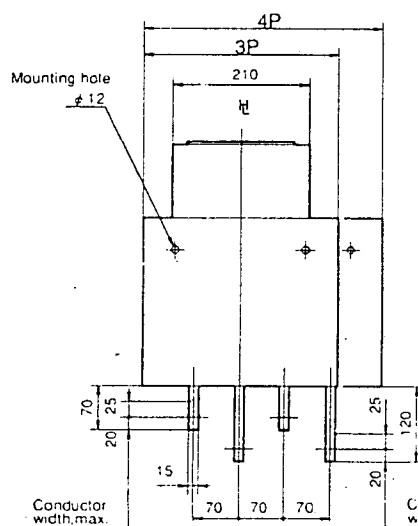
Panel mount



Panel cutout dimensions shown give an allowance of 1mm around the motor operator frame.

Draw out

Drilling plan



ASL: Arrangement Standard Line
HL: Handle frame centre line

External accessories

Frame size: 400/630/800/1250/1600

Description		MCCB	Cat. No.
Mechanical interlocks *)			
Rear beam	3 Pole	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	UXKC0002B
type	3 Pole	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	UXKC0004A
	3 Pole	XS1250SE-XV1250NE	UXKC0006D
	3 Pole	XS1600SE/TL630-1250NE	UXKC0026C
	Cable mechanism	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	UXKC0021B
Cable type	Cable mechanism	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	UXKC0022B
	Cable mechanism	XS1250SE-XV1250NE	UXKC0023B
	Cable mechanism	XS1600SE/TL630-1250NE	UXKC0024B
	Interlocking wire (1.5m)	XS400CJ-XS1600SE/TL400NE-1250NE	UXKC0020A



Cable mechanical interlock



XFH handle operator

XFH extended handle operators

Variable	Anti-clockwise handle kit	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	XFHA34
depth type	Anti-clockwise handle kit	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	XFHA46
(IP 40)	Anti-clockwise handle kit	XS1250-1600NE/SE TL630-1250NE	XFHA49

Note: Clockwise handles available. Contact NHP.

TLK extended handle operators

Variable	IP 65 handle kit	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	TLKA34
depth type	IP 65 handle kit	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	TLKA46
(IP 65)	IP 65 handle kit	XS1250-1600NE/SE-TL630-1250NE	TLKA49



TLK handle operator

TFJ extended handle operators

Panel		XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	TFJ34XU
mount type		XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	TFJ36XU
(IP 55)		XS1250-1600NE/SE-TL630-1250NE	TFJ38XU

Note: L + F locks available. Refer NHP.



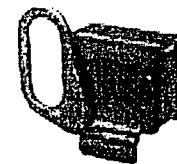
TFJ handle operator

Handle extension

	XS630CJ-XS1600SE-TL630-1250NE	2A2272BAB
--	-------------------------------	-----------

Handle lock

Non captive type	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	UXKB0006A
	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	UXKB0002A
	XS1250-1600NE/SE-TL630-1250NE	UXKB0003A



Handle padlock (UXKB)

Terminal covers (3 pole, Qty 2)

Front	For busbar connected MCCB's	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	2H1413DAA
	For cable connected MCCB's	XS-XH-XV-TL400CJ/NJ/PE/PJ/NE/SE/XH250PJ-TL250NJ	2H1415DAA
	For busbar connected MCCB's	XS-XH-XV630-800CJ/NJ/PJ/NE/PE/SE	2H1417DAA
	For busbar connected MCCB's	XS1250-1600NE/SE-TL630-1250NE	2H1419DAA

Note: For other options refer NHP.



Terminal cover

Interpole barriers

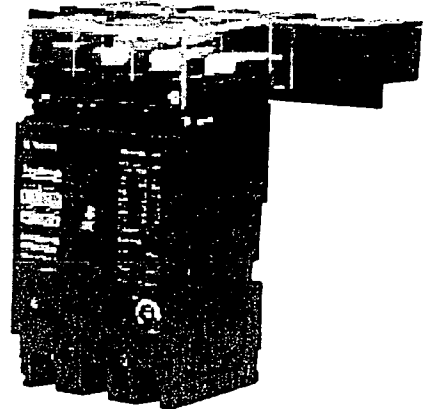
	Not in kits. Order as required.	XS400CJ-XS1600SE/TL400NE-TL1250NE	UXQH0004A
--	---------------------------------	-----------------------------------	-----------

Note: *) Factory fitted only.

UNCLEAR
TEXT

NHP TemPlug

- Available for MCCB's from 12-800 amp frame.
- Easily fitted using supplied hardware.
- Low resistance connection.
- Moulding constructed from UL approved glass filled polyester.
- Polycarbonate terminal cover supplied as standard.
- Assembly bolts directly to module gear plate.
- Lowest watts loss and temperature rise.
- Silver plated contacts with domed face for increased contact pressure.



Current rating (A)	MCCB	Vertical type Cat. No.
12	XM30PB	UPX330M
100	TL100EM/100F	UPX3100F
125	XH125NJ	UPX3125
250	XH250NJ	UPX3250
250	XS400/250	UPX3425
400	XS400/400	UPX3440
800	XS630/800	UPX3800

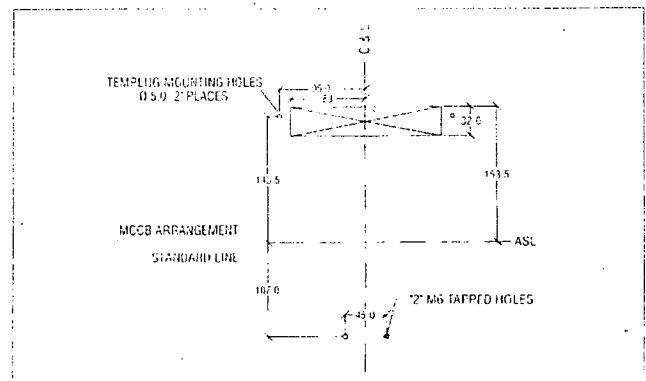
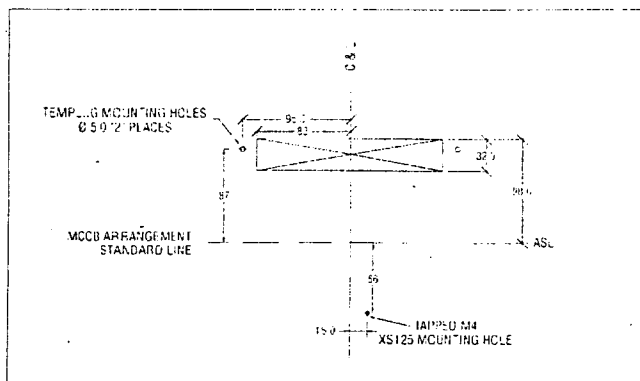
Horizontally mounted versions are indent items, please refer to NHP.

(NHP part prefix for horizontal types is "HBC3")

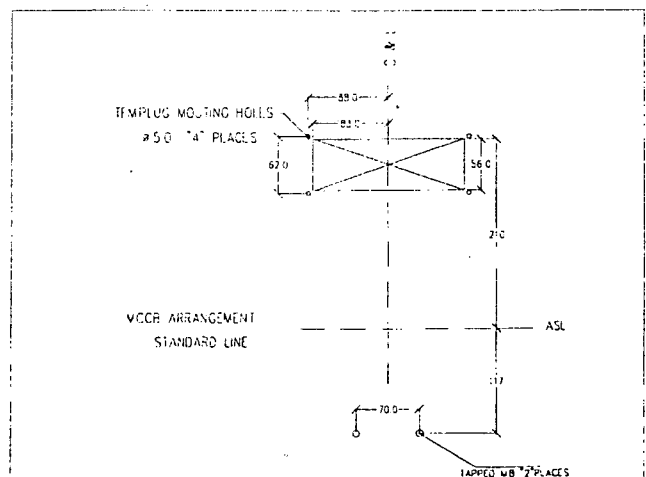
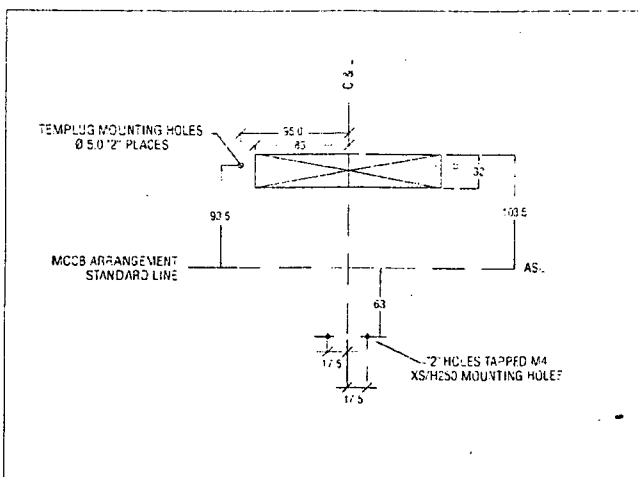
Vertical TemPlug MCCB

Cut-out for TemPlug

TemPlug (125) cut-out



TemPlug (250) cut-out



XS630 and XS800 series thermal magnetic type

- ☐ Adjustable range 63 - 100% of nominal current rating.
- ☐ Standards AS 2184/AS 3947-2.
- ☐ Adjustable thermal, fixed magnetic type.
- ☐ Max. voltage (INSUL) 690V.

XS630CJ (45kA) 3 pole

Ampere

rating	Min	Max	Cat. No.
400	250	400	XS630CJ 400 3
630	400	630	XS630CJ 630 3
630	Non-Auto (9.6kA for 0.3sec) ⁴⁾		XS630/NN 3 ¹⁾

XS630NJ (65kA) 3 pole

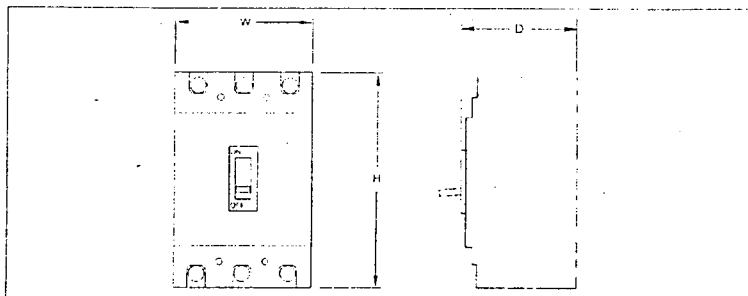
400	250	400	XS630NJ 400 3
630	400	630	XS630NJ 630 3

XS800NJ (65kA) 3 pole ³⁾

800	500	800	XS800NJ 800 3
800	Non-Auto (9.6kA for 0.3sec) ⁴⁾		XS800NN 3 ¹⁾

Dimensions (mm)

Description		Height ²⁾	Width	Depth	kg
XS630NJ/CJ	3 pole	273	210	103	9.0
XS800NJ	3 pole	273	210	103	9.4



Short circuit capacity

Model	I/C	Voltage
XS630CJ	45 kA (AS 2184)	415V 50Hz
XS630NJ	65 kA (AS 2184)	415V 50Hz
XS800NJ	65 kA (AS 2184)	415V 50Hz

Refer to ratings chart at the front of this section.
For ratings to AS 3947-2 and AS 2184, and Ics/Icu.

DC use	I/C ³⁾	Voltage
XS630CJ	40 kA	250V DC
XS630NJ	40 kA	250V DC
XS800NJ	40 kA	250V DC

- Notes:** ¹⁾ Load-break isolating switch only - no short circuit protection.
²⁾ Height excludes attached busbar.
³⁾ For stocked 4 pole models
⁴⁾ MCCB's only.
Short time rating.
⁵⁾ Poles is series.

Product extensions

Chassis (MHC, UHC)

TemCurve

Residual current relays

Base standards

IEC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2/Australia
AS 2184-1990/Australia ⁴⁾
NEMA USA
ANSI C37. 13/USA
JIS C 8372/JAPAN
JEC 160/JAPAN

Approvals

ASTA/UK, Aust. standards
Marine
NK/JAPAN
LR/UK
AB/USA
GL/GERMANY
BV/France
DNV NORWAY

UNCLEAR
TEXT

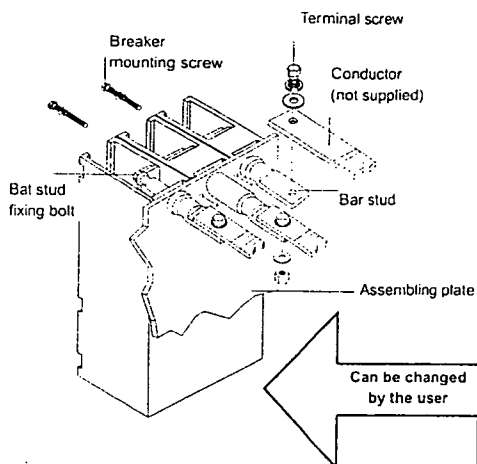
Connections and mountings

MCCB accessories

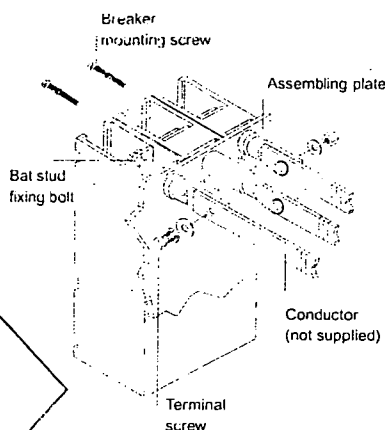
Rear-connection type (RC)

Bolt stud

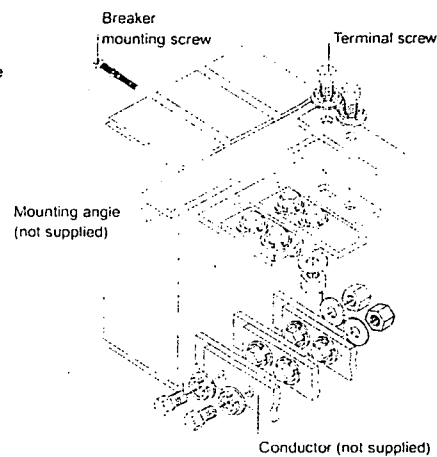
Horizontal (standard)



Vertical



Flat bar stud



Applicable breakers

☐ XE series
XE225NC

☐ XS series
XS250, XS400
XS630, XS800.

☐ XH series
XH160, XH250, XH400,
XH630, XH800.

☐ XM series
XM30PB.

Applicable breakers

Horizontal ¹⁾ XS1250, XV1250NEVertical XS1600, XS2000NE
XS2500NE.

Notes: The arrangement of the flat bar can be made by the user.
If not specified the horizontal arrangement will be supplied.
¹⁾ Vertical arrangement also available on request. contact NHP for details.

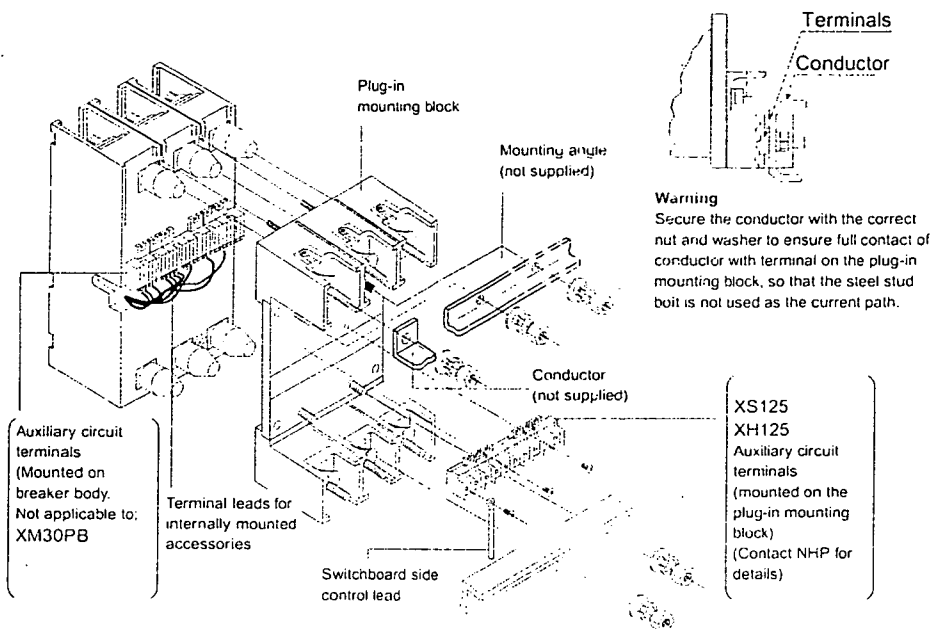
UNCLEAR
TEXT

Types of connections and mountings

MCCB accessories

Plug-in Type

Switchboard use



Types of plug-in mounting blocks for switchboard use

Series	Breaker	Pole	Type
XS	XS125CJ	2, 3, <input type="checkbox"/> 4	XDM2
	XS125NJ		
	XE225NC	3, <input type="checkbox"/> 4	XDM3
	XS250NJ		
	XS400	3, <input type="checkbox"/> 4	XDM4
	XS630	3, <input type="checkbox"/> 4	XDM6
	XS800	3, <input type="checkbox"/> 4	XDM6
XH	XS1250	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM8
	XH125	3, <input type="checkbox"/> 4	XDM2
	XH160PJ	3, <input type="checkbox"/> 4	XDM3
	XH250PJ	3, <input type="checkbox"/> 4	XDM4
	XH250NJ	3, <input type="checkbox"/> 4	XDM4
	XH400	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM6
	XH630	3, 4	<input type="checkbox"/> XDM6
	XH800	3	<input type="checkbox"/> TDM-1DR
XM	XM30PB		

Plug-in type

Degree of protection ☐

The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529

Standard Safety Trip (Trip first plug-in mechanism) indent.

└ The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in" the breaker when it is in the "ON" position.

IP 20 degree of protection and safety trip ¹⁾ are available for plug-in type breakers, for switchboard and distribution board use.

Note: ¹⁾ Available on indent only.

XS400 series thermal magnetic type

- ☐ Adjustment range 63 - 100% of nominal current rating.
- ☐ Standards AS 2184/AS 3497-2.
- ☐ Max voltage (Insulation) 690V.
- ☐ Adjustable thermal and magnetic trip.



XS400CJ (35kA) 3 pole

Ampere rating	Min	Max	Cat. No.
250	160	250	XS400CJ 250 3
400	250	400	XS400CJ 400 3
400	Non-Auto (5kA for 0.3sec)		XS400NN 3 ¹⁾

XS400NJ (50kA) 3 pole

250	160	250	XS400NJ 250 3
400	250	450	XS400NJ 400 3

Short circuit capacity

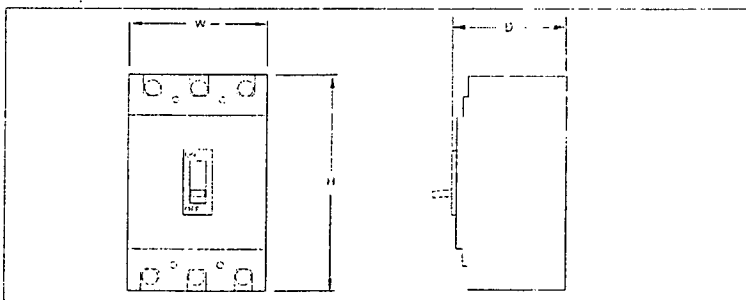
Model	I/C	Voltage
XS400CJ	35 kA (AS 2184)	415V 50Hz
XS400NJ	50 kA	415V 50Hz

DC use	I/C ²⁾	Voltage
XS400CJ	40 kA	250V DC
XS400NJ	40 kA	250V DC

Refer to ratings chart at the front of this section.
For ratings to AS 3947-2 and AS 2184, and Ics/Icu.

Dimensions (mm)

Description		Height	Width	Depth	kg
XS400CJ/NJ	3 pole	260	140	103	4.7



Notes: ¹⁾ Load-break isolating switch only – no protection.
²⁾ MCCB's only.

Product extensions

Chassis (TemWay, MHC, UHC)
TemCurve
Residual current relays

Base standards

IEC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2/Australia
AS 2184-1990/Australia ²⁾
NEMA USA
ANSI C37. 13/USA
JIS C 8372/JAPAN
JEC 160/JAPAN

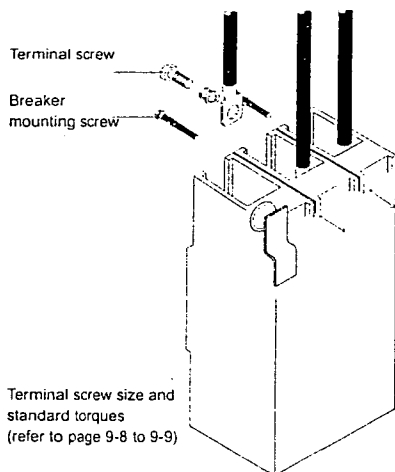
Approvals

ASTA/UK, Aust. standards
Marine
NK/JAPAN
LR/UK
AB/USA
GL/GERMANY
BV/France
DNV NORWAY

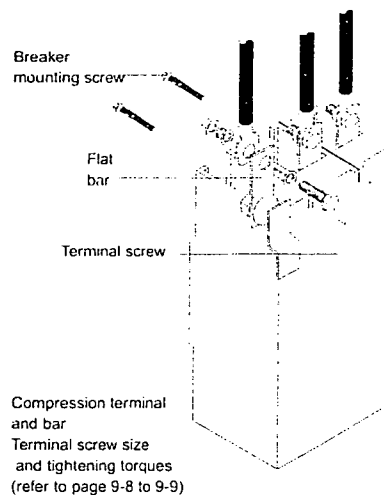
Connections and mountings

Front-connection type (FC)

Compression terminals



Attached flat bar



MCCB accessories

Types of terminal screws (Compression terminal and bar)

Breakers and screw size

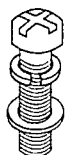
XE series (Economical)

XS series (Standard)

XH series (High-fault level)

XM series (Motor protection)

Pan headed screw

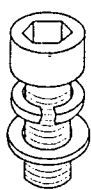


XS125CJ M8
XS125NJ M8

XH125NJ M8
XH125PJ M8

XM30PB M5

Hex socket head bolt



XE225NC M8

XS250NJ M8

XH250NJ M8

XH160PJ M8

XS400 M10

TL250NJ M10

XH400 M10

TL400NJ M10

XV400 M10

XH250PJ M10

UNCLEAR
TEXT

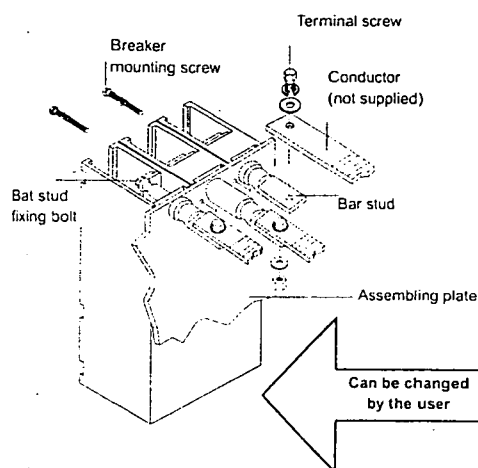
Connections and mountings

MCCB accessories

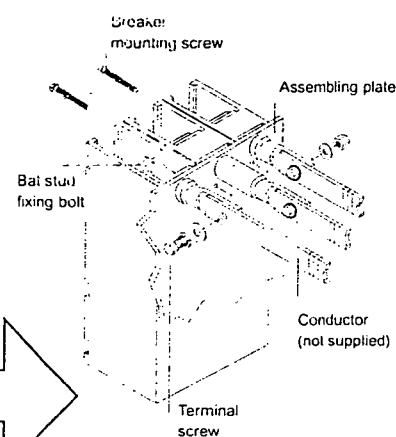
Rear-connection type (RC)

Bolt stud

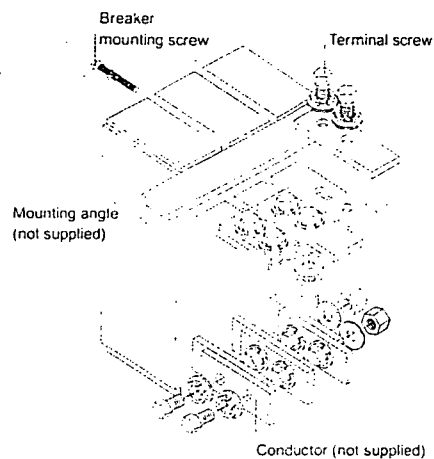
Horizontal (standard)



Vertical



Flat bar stud



Applicable breakers

- ☐ XE series
- XE225NC

- ☐ XS series

XS250, XS400
XS630, XS800.

- ☐ XH series

XH160, XH250, XH400,
XH630, XH800.

- ☐ XM series

XM30PB.

Applicable breakers

Horizontal ¹⁾ XS1250, XV1250NE

Vertical XS1600, XS2000NE
XS2500NE.

Notes: The arrangement of the flat bar can be made by the user.

If not specified the horizontal arrangement will be supplied.

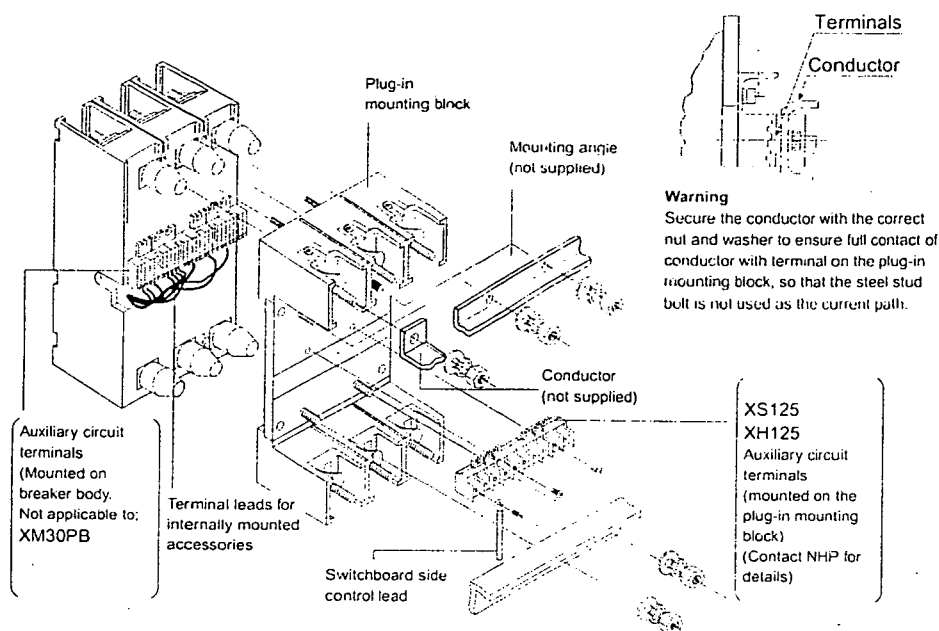
¹⁾ Vertical arrangement also available on request, contact NHP for details.

Types of connections and mountings

MCCB accessories

Plug-in Type

Switchboard use



Types of plug-in mounting blocks for switchboard use

Series	Breaker	Pole	Type
XS	XS125CJ	2, 3, <input type="checkbox"/> 4	XDM2
	XS125NJ		
	XE225NC	3, <input type="checkbox"/> 4	XDM3
	XS250NJ		
	XS400	3, <input type="checkbox"/> 4	XDM4
	XS630	3, <input type="checkbox"/> 4	XDM6
	XS800	3, <input type="checkbox"/> 4	XDM6
XH	XS1250	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM8
	XH125	3, <input type="checkbox"/> 4	XDM2
	XH160PJ	3, <input type="checkbox"/> 4	XDM3
	XH250PJ	3, <input type="checkbox"/> 4	XDM4
	XH250NJ	3, <input type="checkbox"/> 4	XDM4
	XH400	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM6
	XH630	3, 4	<input type="checkbox"/> XDM6
	XH800	3	<input type="checkbox"/> TDM-1DR
XM	XM30PB		

IP 20 degree of protection and safety trip ¹⁾ are available for plug-in type breakers, for switchboard and distribution board use.

Plug-in type

Degree of protection ☐

The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529

Standard Safety Trip (Trip first plug-in mechanism) indent.

└ The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in" the breaker when it is in the "ON" position.

Application table (up to 100A frame)

Breaker	IP cover code	Pole	Qty Req.
XS125	IP 20	2, 3P	1=2
XH125			

Note: ¹⁾ Available on indent only.

PCL XL error

Subsystem: TEXT

Error: IllegalFontData

Operator: Text

Position: 14603

XS125 series

- ☐ Adjustment range 63 - 100% of nominal current rating.
- ☐ Standards AS 2184/AS 3947-2.
- ☐ Adjustable thermal and fixed magnetic trip.
- ☐ Max. voltage (INSUL) 690V.



XS125CJ (18kA) 3 pole

Ampere rating	Min	Max	Cat. No.
20	12.5	20	XS125CJ 20 3
32	20	32	XS125CJ 32 3
50	32	50	XS125CJ 50 3
63	40	63	XS125CJ 63 3
100	63	100	XS125CJ 100 3
125	80	125	XS125CJ 125 3
125	Non-Auto (1.8kA for 1sec)		XS125NN 3 *) *)

XS125NJ (30kA) 2 pole

Ampere rating	Min	Max	Cat. No.
20	12.5	20	XS125NJ 20 2
32	20	32	XS125NJ 32 2
50	32	50	XS125NJ 50 2
63	40	63	XS125NJ 63 2
100	63	100	XS125NJ 100 2
125	80	125	XS125NJ 125 2

XS125NJ (30kA) 3 pole

20	12.5	20	XS125NJ 20 3
32	20	32	XS125NJ 32 3
50	32	50	XS125NJ 50 3
63	40	63	XS125NJ 63 3
100	63	100	XS125NJ 100 3
125	80	125	XS125NJ 125 3

XS125NJ (30kA) 4 pole

20	12.5	20	XS125NJ 20 4
32	20	32	XS125NJ 32 4
50	32	50	XS125NJ 50 4
63	40	63	XS125NJ 63 4
100	63	100	XS125NJ 100 4
125	80	125	XS125NJ 125 4

Notes: *) MCCB's only.

*) Load-break isolating switch only—no overload or short circuit protection.

*) Poles in series.

*) Short time rating. Refer rating chart for technical details.

2 pole models use a 3 pole body with centre pole disabled.
Special generator protection MCCB's available — low instantaneous magnetic setting.

Dimensions (mm)

Description	Height	Width	Depth	kg
XS125CJ 3 pole	155	90	86	1.3
XS125NJ 2 pole	155	90	86	1.3
XS125NJ 3 pole	155	90	86	1.3
XS125NJ 4 pole	155	120	86	1.58



Short circuit capacity

Model	I/C	Voltage
XS125CJ	18 kA (AS2184)	415V 50Hz
XS125NJ	30 kA (AS2184)	415V 50Hz
DC use	I/C *)	Voltage
XS125CJ	10 kA	250V DC
XS125NJ	15 kA	250V DC

Refer to ratings chart at the front of this section.

For ratings to AS 3947-2 and AS 2184, and Ics/Icu.

Product extensions

Chassis (TemWay, MHC, UHC)

Panelboards (TPX)

TemCurve

Base standards

IEC 947-2
BS EN 60947 Part 2
VDE 0660 Part 1
AS 3947-2/Australia
AS 2184-1990/Australia *)
NEMA USA
ANSI C37. 13/USA
JIS C 8372/JAPAN
JEC 160/JAPAN

Approvals

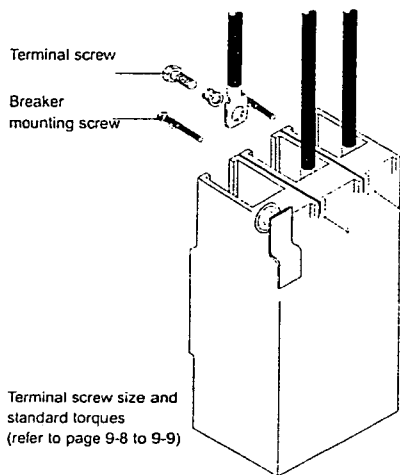
ASTA/UK, Aust. standards
Marine
NK/JAPAN
LR/UK
AB/USA
GL/GERMANY
BV/France
DNV NORWAY

Connections and mountings

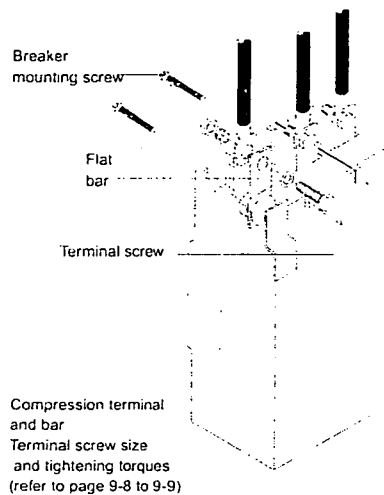
MCCB accessories

Front-connection type (FC)

Compression terminals



Attached flat bar



Types of terminal screws (Compression terminal and bar)

Breakers and screw size

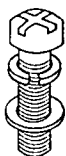
XE series
(Economical)

XS series
(Standard)

XH series
(High-fault level)

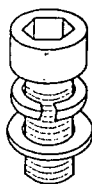
XM series
(Motor protection)

Pan headed screw



XS125CJ	M8	XH125NJ	M8	XM30PB	M5
XS125NJ	M8	XH125PJ	M8		

Hex socket head bolt



XE225NC M8

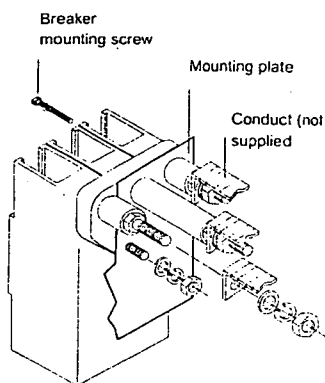
XS250NJ	M8	XH250NJ	M8
		XH160PJ	M8
XS400	M10	TL250NJ	M10
XH400	M10	TL400NJ	M10
XV400	M10	XH250PJ	M10

Connections and mountings

MCCB accessories

Rear-connection type (RC)

Bolt stud



Applicable breakers

- ☐ XS series
XS125CJ, XS125NJ
- ☐ XH series
XH125NJ, XH125PJ

TemBreak XS125CS, CJ, NS, NJ, XH125NJ, TL30F MCCBs

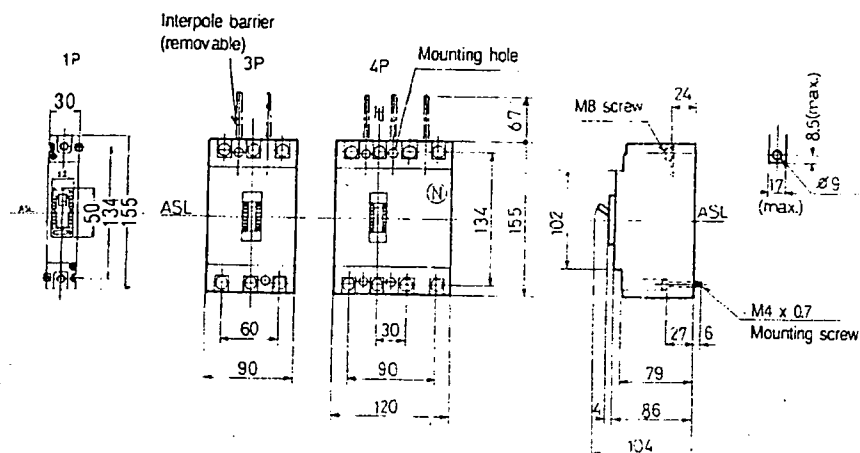
ASL: Arrangement Standard Line

H: Handle frame centre line

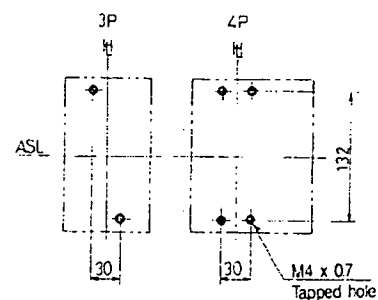
Note: XS125NS 1 pole only

Outline dimensions (mm)

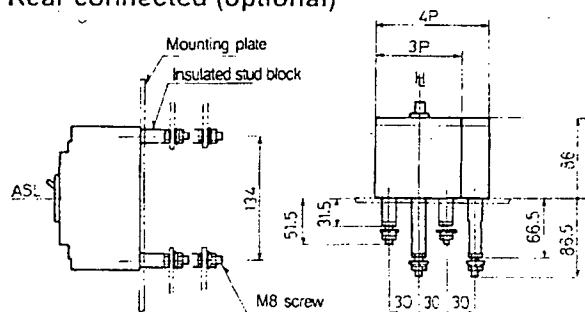
Front connected (standard)



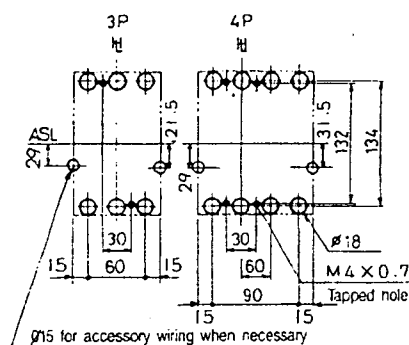
Drilling plan



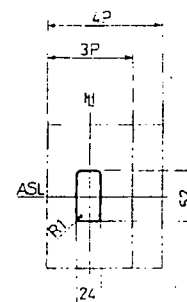
Rear connected (optional)



Drilling plan

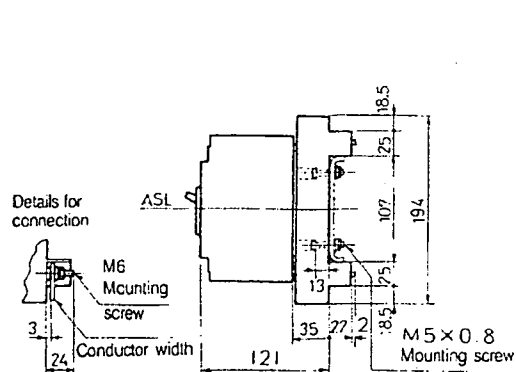


Panel mount

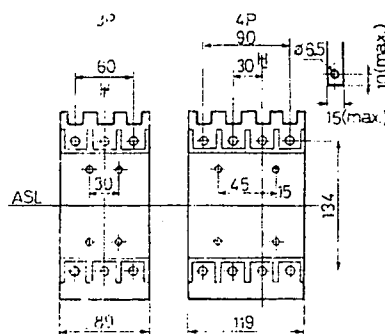


Panel cut out dimensions shown give an allowance of 1.0mm around the handle escutcheon.

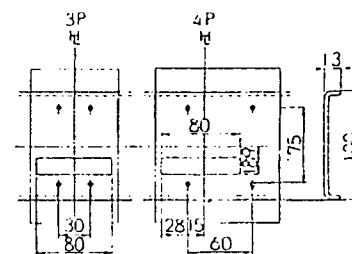
Plug-in (optional)



Mounting block



Drilling plan

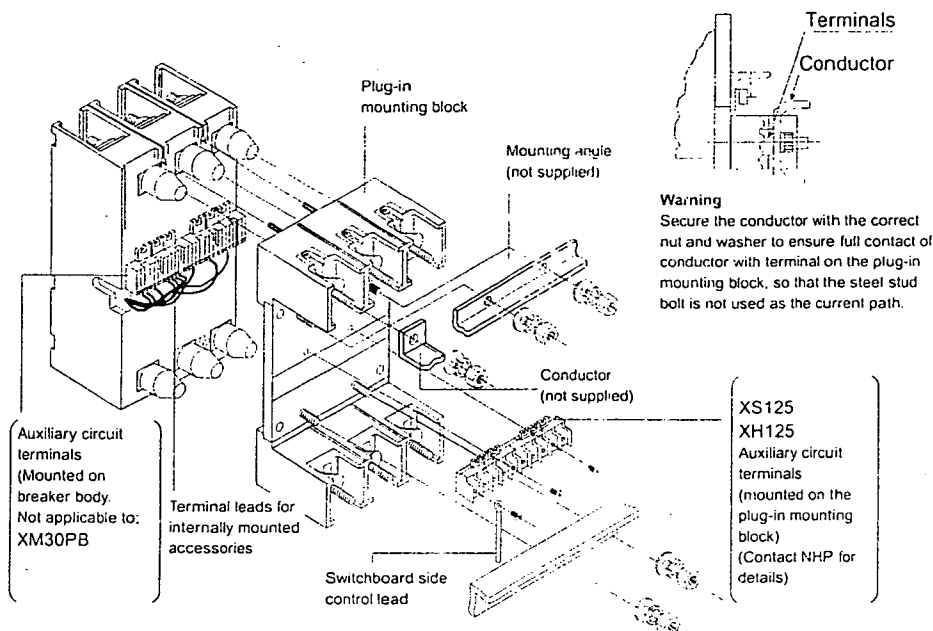


Types of connections and mountings

MCCB accessories

Plug-in Type

Switchboard use



Types of plug-in mounting blocks for switchboard use

Series	Breaker	Pole	Type
XS	XS125CJ	2, 3, <input type="checkbox"/> 4	XDM2
	XS125NJ		
	XE225NC	3, <input type="checkbox"/> 4	XDM3
	XS250NJ		
	XS400	3, <input type="checkbox"/> 4	XDM4
	XS630	3, <input type="checkbox"/> 4	XDM6
XH	XS800	3, <input type="checkbox"/> 4	XDM6
	XS1250	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM8
	XH125	3, <input type="checkbox"/> 4	XDM2
	XH160PJ	3, <input type="checkbox"/> 4	XDM3
	XH250PJ	3, <input type="checkbox"/> 4	XDM4
	XH250NJ	3, <input type="checkbox"/> 4	XDM4
	XH400	3, <input type="checkbox"/> 4	<input type="checkbox"/> XDM6
	XH630	3, 4	<input type="checkbox"/> XDM6
XM	XH800	3	<input type="checkbox"/> TDM-1DR
	XM30PB		

IP 20 degree of protection and safety trip 'I') are available for plug-in type breakers, for switchboard and distribution board use.

Plug-in type

Degree of protection ☐

The degree of protection provided by the mounting blocks for plug in type TemBreak is IP 20 as defined in IEC Pub 529

Standard Safety Trip (Trip first plug-in mechanism) indent.

- The breaker will trip automatically if it is withdrawn while still in the "ON" position. It is not possible to "plug-in" the breaker when it is in the "ON" position.

Application table (up to 100A frame)

Breaker	IP cover code	Pole	Qty Req.
XS125	IP 20	2, 3P	1=2
XH125			

Note: ☐ 'I') Available on indent only.

PCL XL error

Subsystem: TEXT

Error: IllegalFontData

Operator: Text

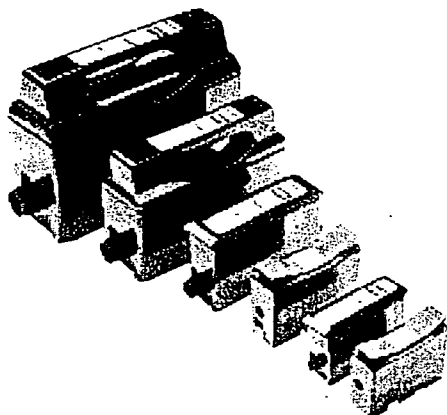
Position: 14563

NHP COMPACT FUSES

Fuse holders BS fuses

NHP

Refer Catalogue NF



N20FW

NV32FW
(clip in)

Fuse holders

- Ratings from 20 to 200A
- Front (FW) or stud/front (SFW) versions
- Complies with BS88

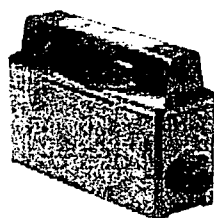
Rating (A)	Fuse link to suit	Cat. No.
20	NNS	NV20FW
32	NNS	NV32FW
63	NES	NV63FW
20	NNIT	N20FW
32	NTIA	N32FW
63	NTIA NTIS	N63FW
100	NTIA '1) NTIS '1) NOS '1) NTCP	N100FW
200	NTBC NTC NTF	N200FW
20	NNIT	N20SFW
32	NTIA	N32SFW
63	NTIA, NTIS	N63SFW
100	NTIA '1) NTIS '1) NOS '1) NTCP	N100SFW
200	NTBC NTC NTF	N200SFW

Compact fuse holders

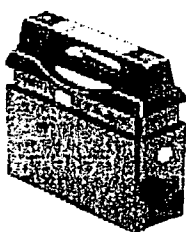
- New compact size
- Front (FW) or stud/front (SFW) versions
- Smaller dimensions
- Saves panel space



Rating (A)	Fuse link to suit	Cat. No.
100	NOS NTIA NTIS	NC100FW
200	NTIA '1) NTIS '1) NTFP NOS '1) NTCP	NC200FW
100	NOS NTIA NTIS	NC100SFW
200	NTIA '1) NTIS '1) NTFP NOS '1) NTCP	NC200SFW



NC100FW



NC200FW

Note: '1) Fuses can be fitted using adaptor 100M FLK.

Refer Catalogue NF

This chart is designed to help choose the correct fuse to fit a particular Strömberg switch fuse (or vice versa) and to help choose the correct replacement fuse. Some data is from other manufacturers publications and as such cannot be guaranteed by NHP. Beware that some motor start fuses are in a larger body size than a normal fuse. It is wise to consult the fuse manufacturers data to determine their particular fuse sizes (ie. A2-C3).

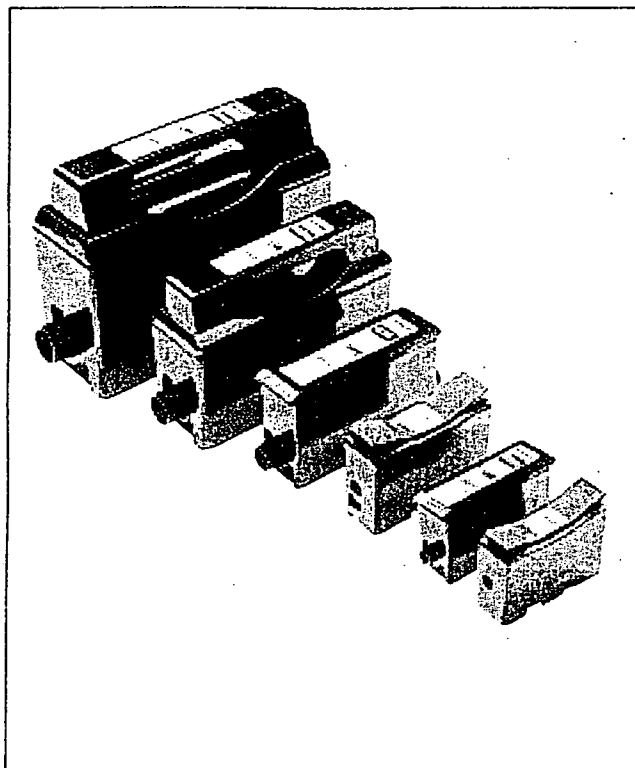
Fuse manufacturers part numbers - Australian/British standard

BS Ref.	Amps	NHP COMPACT FUSES	Alstrom	Holec	GEC	Dorman Smith	Federal	Brush	Siemens
F1	2...32	NNS	SN2	NS	NS	NSD	20/32C	F06	3NW NS
F2	20...63	NES	SP	NES	ES	ESD	-	-	3NW ES
A1	2...32	NNIT	SA2	NIT	NIT	NITD	20/32B	F21	3NW NIT
A2	2...32	NTIA	SB3	TIA	TIA	AAO	32B	H07	3NW TIA
A3	35...63	NTIS	SB4	TIS	TIS	BAO	63B	K07	3NW TIS
-	80...100	NOS	SO	-	OS	OSD	-	K07R	3NW OS
A4	80...100	NTCP	SD5	TCP	TCP	CEO	100B	L14	3NW TCP
Hybrid (A4)	125...200	NTFP ¹⁾	SD6	TFP	TFP	DEO	-	M14	3NW TFP
-	2...32	NTB	SE3	TB	TB	AC	-	K08	-
B1	2...32	NTBC	SF3	TBC	TBC	AD	-	K09	3NW TBC
-	40...63	NTB	SE4	TB	TB	BC	-	K08	3NW TB
B1	40...63	NTBC	SF4	TBC	TBC	BD	63B/C	K09	3NW TBC
B1	80...100	NTC	SF5	TC	TC	CD	100B/C	L09	3NW TC
B2	125...200	NTF	SF6	TF	TF	DD	200B/C	M09	3NW TF
B3	250...315	NTKF	SF7	TKF	TKF	ED	315B/C	N09	3NW TKF
-	250...315	NTKM	SG7	TKM	TKM	-	-	N11	3NW TKM
B4	355...400	NTMF	SF8	TMF	TMF	ED	400B/C	P09	3NW TMF
C1	355...400	NTM	SH8	TM	TM	EF	404B/C	P11	3NW TM
C2	450...630	NTTM	SH9	TTM	TTM	FF	504B/C	R11	3NW TTM
-	450...630	NTT	SY9	-	TT	FG	-	R12	-
C3	710...800	NTLM	SH10	TLM	TLM	GF	804B/C	S12	3NW TLM
-	710...800	NTLT	SY10	-	TLT	GG	-	S12	3NW TLT
D1	1000...1250	NTXU	SJ11	-	TXU	GH	-	U44	-
Din pattern									
00	6...160	N00	7999	P851.00	NHG-00	-	-	-	3NA5
1	25...250	N1	8001	P851.1	NHG-1	-	-	-	3NA4 144
2	80...400	N2	8002	P851.2	NHG-2	-	-	-	3NA4 260
3	315...630	N3	8003	P851.3	NHG-3	-	-	-	3NA1
Fuse holders									
Clip in	20A	NV20FW	V20FW	J2011	SC20				3NW CM20F
	32A	NV32FW	V32FW	-	SC32				3NW 32NNSF
Front wired	20A	N20FW	20MFB	-	RS20H				-
	32A	N32FW	32MFB	J3211	RS32H				3NW CM32F
	63A	N63FW	63MFB	J6311	RS63H				3NW CM63F
	100A	N100FW	100MFB	J9911	RS100H				3NW CM100F
	200A	N200FW	200MFB	J1991	RS200H				3NW 200DF
Stud/ front wired	20A	N20SFW	20MFD	-	RS20PH				-
	32A	N32SFW	32MFD	-	RS32PH				-
	63A	N63SFW	63MFD	-	RS63PH				-
	100A	N100SFW	100MFD	-	RS100PH				-
	200A	N200SFW	200MFD	-	RS200PH				3NW 200DFB

Note: ¹⁾ This hybrid type fuse is actually an A4 size fuse, but as it is over 100 amps it cannot be called an A4 fuse to AS 2005.

NHP
COMPACT

HRC fuse fittings

BS Fuses fittings

NHP Compact fuse gear includes a range of moulded HRC fuse fittings, designed to accept bolt-in and clip-in HRC fuse-links.

Each fuse fitting is fully shrouded to prevent accidental contact with live parts when inserting or withdrawing a carrier and once a fuse carrier has been completely removed.

The fuse carrier and base mouldings are manufactured from high quality thermosetting material finished in black.

NHP fuse fittings accept NHP Compact HRC fuse-links and are available in ratings of 20, 32, 63, 100 and 200 amp and can be supplied in front connected and front / busbar connected.

They are designed to comply with BS88: Part 2, 1988 and are suitable for systems up to 660V. Suitable HRC fuse-links are also to BS88: Part 2, 1988.

The NHP "NV" range of clip-in HRC fuse fittings are available in 20, 32 and 63 amp at 415V. These fuse fittings can be either screw fixed to a mounting panel or mounted directly on standard DIN rail. They comply with BS88: Part 1, 1988 and accept NHP NNS and NES clip-in HRC fuse-links to the same standard.

Clip-in type fuse fittings allow fuse-links to be replaced quickly and simply, as no tools are required. fuse-links are removed from the holder using side pressure on the fuse-link while replacement involves a simple push fit.

Terminal capacities

20 amp	6mm ²
32 amp	16mm ²
63 amp	35mm ²
100 amp	70mm ²
200 amp	150mm ²

Fuse fittings selection guide**Complete fuse units (carriers and bases)**

Cat. No. according to type of connection					Neutral Link Cat. No. No.		BS88 REF	Suitable NHP Compact Fuse-link	
Current rating A	Colour	Front wired	Front/stud	Clip-in type Front/wired	Bolt-in	Clip-in		Bolt/clip-in	Clip-in
20	Black	N20FW	N20SFW	NV20FW	20MFNL	32CLK	A1	NNIT 2-20	NNS2-20
32	Black	N32FW	N32SFW	NV32FW	32MFNL	32CLK	A2	NTIA 2-32	NNS2-32
63	Black	N63FW	N63SFW	NV63FW	63MFNL	63CLK	A2	NTIA 2-32	NES 20-63
							A3	NTIS 35-63	
100	Black	N100FW	N100SFW	—	100MFNL	—	—	NTB 2-63	—
								NTCP 80-100	
								NTBC 2-63	—
200	Black	N200FW	N200SFW	—	200MFNL	—	A4	NTC 80-100	—
							B1	NTF 125-200	
							B1		
							B2		

Note: 1) NTIA and NTIS fuses can be fitted to N100 fittings using adaptor 100MFLK
100A Neutral link is available for N100 fittings: Ref 100MFNL

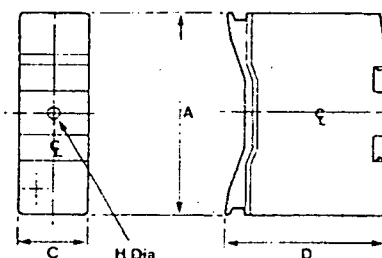
NHP
COMPACT

HRC fuse fittings

BS fuses fittings
Dimensions

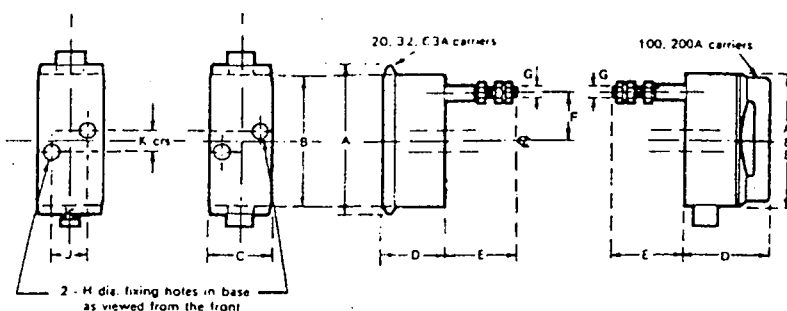
Dimensions (mm)											
	A	B	C	D	E	F	G	H	J	K	Hole dia.
Cat. No.	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
N20	87	79	27	50	63	28	6	5.5	-	-	12
N32	109	101	31	62	60	39	6	5.5	12.7	6.4	12
N63	118	110	35	72	71	39.5	8	5.5	12.7	6.4	14.5
N100	154	154	54	108	80	58.5	10	6.5	19	22	18.5
N200	193	193	70	149	89	69	12	7	38	57	24.5
NV20 (clip-in)	75	-	25	57.7	-	-	-	5.5	-	-	12
NV32 (clip-in)	75	-	25	57.7	-	-	-	5.5	-	-	12
NV63 (clip-in)	88.7	-	31.5	66.34	-	-	-	5.5	-	-	14.5

NV range.
Clip-in / front wired



Front wired

Front / stud wired

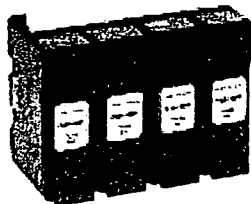


Note: N20 and NV fuse fittings have a single fixing hole in the centre.

NHP COMPACT FUSES**Compact fuses**
BS type**NHP**

Refer Catalogue NF

- Ratings from 2 to 1250A
- Reduced dimensions
- Superior short circuit protection
- Complies with BS88
- Low watts loss

**NVCB8**

Rating (A)	BS 88 Ref	Cat. No.
2	F1	NNS 2
4	F1	NNS 4
6	F1	NNS 6
10	F1	NNS 10
16	F1	NNS 16
20	F1	NNS 20
25	F1	NNS 25
32	F1	NNS 32
20M25	F1	NNS 20M25
20M32	F1	NNS 20M32
20	F2	NES 20
25	F2	NES 25
32	F2	NES 32
40	F2	NES 40
50	F2	NES 50
63	F2	NES 63

Note: M in catalogue No. denotes motor starting type.

NNS_
NES_

NNIT_

NTIA_

BS solid links

Type	To suit fuse holder	Cat. No.
Clip-in	NV32	32CLK
Clip-in	NV63	63CLK
Bolt-in	N20_	20MFNL
Bolt-in	N32_	32MFNL
Bolt-in	N63_	63MFNL
Bolt-in	N100_	100MFNL
Bolt-in	N200_	200MFNL

8 way comb busbar

- Suits NV20FW/NV32FW fuses

Cat. No.

8 way comb busbar **NVCB8**

Rating (A)	BS 88 Ref	Cat. No.
2	A1	NNIT 2
4	A1	NNIT 4
6	A1	NNIT 6
10	A1	NNIT 10
16	A1	NNIT 16
20	A1	NNIT 20
25	A1	NNIT 25
32	A1	NNIT 32
20M25	A1	NNIT 20M25
20M32	A1	NNIT 20M32
32M40	A1	NNIT 32M40
32M50	A1	NNIT 32M50
32M63	A1	NNIT 32M63
2	A2	NTIA 2
4	A2	NTIA 4
6	A2	NTIA 6
10	A2	NTIA 10
16	A2	NTIA 16
20	A2	NTIA 20
25	A2	NTIA 25
32	A2	NTIA 32
32M40	A2	NTIA 32M40
32M50	A2	NTIA 32M50
32M63	A2	NTIA 32M63

Refer Catalogue NF

This chart is designed to help choose the correct fuse to fit a particular Strömberg switch fuse (or vice versa) and to help choose the correct replacement fuse. Some data is from other manufacturers publications and as such cannot be guaranteed by NHP. Beware that some motor start fuses are in a larger body size than a normal fuse. It is wise to consult the fuse manufacturers data to determine their particular fuse sizes (ie. A2-C3).

Fuse manufacturers part numbers - Australian/British standard

BS Ref.	Amps	NHP COMPACT FUSES	Alstrom	Holec	GEC	Dorman Smith	Federal	Brush	Siemens
F1	2...32	NNS	SN2	NS	NS	NSD	20/32C	F06	3NW NS
F2	20...63	NES	SP	NES	ES	ESD	-	-	3NW ES
A1	2...32	NNIT	SA2	NIT	NIT	NITD	20/32B	F21	3NW NIT
A2	2...32	NTIA	SB3	TIA	TIA	AAO	32B	H07	3NW TIA
A3	35...63	NTIS	SB4	TIS	TIS	BAO	63B	K07	3NW TIS
-	80...100	NOS	SO	-	OS	OSD	-	K07R	3NW OS
A4	80...100	NTCP	SD5	TCP	TCP	CEO	100B	L14	3NW TCP
Hybrid (A4)	125...200	NTFP ¹⁾	SD6	TFP	TFP	DEO	-	M14	3NW TFP
-	2...32	NTB	SE3	TB	TB	AC	-	K08	-
B1	2...32	NTBC	SF3	TBC	TBC	AD	-	K09	3NW TBC
-	40...63	NTB	SE4	TB	TB	BC	-	K08	3NW TB
B1	40...63	NTBC	SF4	TBC	TBC	BD	63B/C	K09	3NW TBC
B1	80...100	NTC	SF5	TC	TC	CD	100B/C	L09	3NW TC
B2	125...200	NTF	SF6	TF	TF	DD	200B/C	M09	3NW TF
B3	250...315	NTKF	SF7	TKF	TKF	ED	315B/C	N09	3NW TKF
-	250...315	NTKM	SG7	TKM	TKM	-	-	N11	3NW TKM
B4	355...400	NTMF	SF8	TMF	TMF	ED	400B/C	P09	3NW TMF
C1	355...400	NTM	SH8	TM	TM	EF	404B/C	P11	3NW TM
C2	450...630	NTTM	SH9	TTM	TTM	FF	504B/C	R11	3NW TTM
-	450...630	NTT	SY9	-	TT	FG	-	R12	-
C3	710...800	NTLM	SH10	TLM	TLM	GF	804B/C	S12	3NW TLM
-	710...800	NTLT	SY10	-	TLT	GG	-	S12	3NW TLT
D1	1000...1250	NTXU	SJ11	-	TXU	GH	-	U44	-
Other brands									
00	6...160	N00	7999	P851.00	NHG-00	-	-	-	3NA5
1	25...250	N1	8001	P851.1	NHG-1	-	-	-	3NA4 144
2	80...400	N2	8002	P851.2	NHG-2	-	-	-	3NA4 260
3	315...630	N3	8003	P851.3	NHG-3	-	-	-	3NA1
Other brands									
Clip in	20A	NV20FW	V20FW	J2011	SC20				3NW CM20F
	32A	NV32FW	V32FW	-	SC32				3NW 32NNSF
Front wired	20A	N20FW	20MFB	-	RS20H				-
	32A	N32FW	32MFB	J3211	RS32H				3NW CM32F
	63A	N63FW	63MFB	J6311	RS63H				3NW CM63F
	100A	N100FW	100MFB	J9911	RS100H				3NW CM100F
	200A	N200FW	200MFB	J1991	RS200H				3NW 200DF
Stud/	20A	N20SFW	20MFD	-	RS20PH				-
front wired	32A	N32SFW	32MFD	-	RS32PH				-
	63A	N63SFW	63MFD	-	RS63PH				-
	100A	N100SFW	100MFD	-	RS100PH				-
	200A	N200SFW	200MFD	-	RS200PH				3NW 200DFB

Note: ¹⁾ This hybrid type fuse is actually an A4 size fuse, but as it is over 100 amps it cannot be called an A4 fuse to AS 2005.

**NHP
COMPACT**

HRC cartridge fuse-links

NHP Compact fuses

NHP Compact 415V fuse-links are available in ratings from 2A up to 1250A and advanced design techniques mean that watts loss figures have been substantially reduced whilst protection characteristics remain unchanged.

All NHP Compact HRC fuse-links are manufactured using precision assembly methods to ensure that their performance will conform with the published characteristics within very close tolerances.

Cartridge barrels are extruded under vacuum to prevent the occurrence of air pockets. Each fuse is then fully filled, using a vibratory method, with specially prepared, dried and graded powdered silica. The end caps are press fitted on to the precision ground barrels ensuring a very tight fit.

Fuse elements are accurately shaped and manufactured for consistency and reliability.

All NHP Compact fuse-links are subjected to a resistance test to prove correct assembly.

NHP Compact HRC fuse-links, other than motor rated patterns, have utilisation categories gG.

Schedules of equivalent fuse-links made by certain other manufacturers are included in the following pages. No claim is made of identical performance under all conditions, the schedules being provided to assist on the selection of fuse-links having similar ratings, dimensions and fixing centres. Characteristic curves and associated data are provided to aid accurate discrimination.

Motor rated fuse-links

BS88 now aligns with the international fuse specification IEC 269. The concept of "fusing factor" has been replaced with "utilisation category". Class Q1 fusing factor is now referred to as "gG" and motor rated fuse-links are referred to as "gM". Special motor rated fuse-links are also listed and are available in various barrel sizes, in each case fitted with special fuse elements. Their selection frequently permits the use of lower rated switch and/or fusegear than would be the case using Class gG fuse-links. This range of fuse-links has been ASTA certified for a breaking capacity of 80kA at 415V AC.

NHP Compact industrial bolted pattern fuse-links conform with BS 88: Part 2: 1988 and, have been ASTA certified for a breaking capacity of 80kA at 415V AC or 550V AC and have utilisation categories gG.

NHP Compact fuse-links are suitable for back-up protection in motor circuits, having excellent time delay characteristics with low fusing factor and high rupturing capacity.

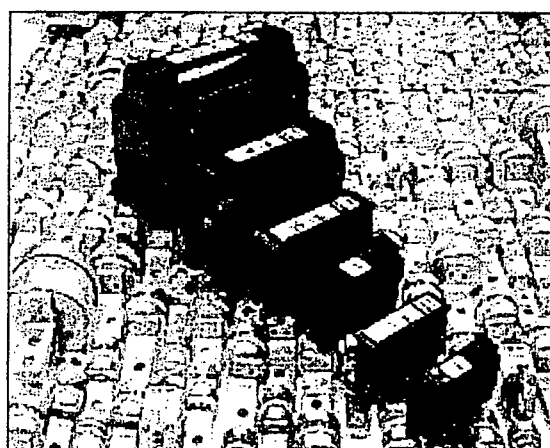
Fuses for use in motor circuits should be selected in accordance with the requirements for the protection of motor control gear as specified by the control gear manufacturer.

As a guide, the following table shows the minimum fuse sizes that may be associated with motors based on the assumption that the starting conditions for typical 3 phase 4 pole 415V motors are; 8 x F.L.C. for 6 secs [D.O.L.] and 4 x F.L.C. for 12 secs [Star Delta].

Should more specific information be required to assist on individual projects please contact your nearest NHP office or distributor.

fuse-link selection for motor circuit protection

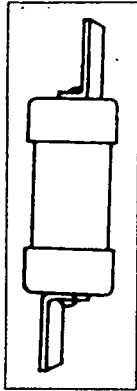
Motor rating		Approx f.l.c. amps	D.O.L. standard fuse-link amps	Starting motor circuit fuse-link	Assisted start standard fuse-link amps
kW	hp				
0.19	0.25	0.7	4		2
0.37	0.5	1.3	6		4
0.55	0.75	1.6	6		4
0.75	1.0	1.8	10		4
1.1	1.5	2.6	10		6
1.5	2.0	3.4	10		10
2.2	3.0	5.0	16		10
3.0	4.0	6.5	16		10
4.0	5.5	8.0	20	20M25	16
5.5	7.5	11.0	25	20M32	16
7.5	10	15	40	32M40	25
11.0	15	22	50	32M50	32
15.0	20	28	63	32M63	40
18.5	25	36	80	63M80	50
22	30	39	80	63M80	63
30	40	52	100	63M100	63
37	50	69	160	100M160	80
45	60	79	160	100M160	100
55	75	96	200		160
75	100	125	200	200M250	160
90	125	156	250	200M250	160
110	150	189	315		200
132	175	224	355		250
150	200	255	355		250
160	220	275	400		315
185	250	318	450		315
200	270	339	500		355
220	300	374	560		400
257	350	450	630		450
295	400	500	710		500
315	430	535	710		560
355	483	580	800		630
400	545	646	800		710
450	612	725	1000		800



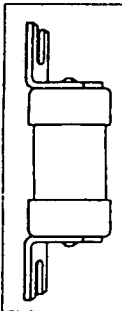
NHP
COMPACT

HRC cartridge fuse-links

Cross reference guide

**NNS Type staggered contacts breaking capacity 80kA at 415V AC to BS 88: Part 6: 1988 Ref. F1**

Current rating A		Overall length	Overall dia.	NHP Cat No.	MEM	GEC/Lawson	Siemens	Cross reference	Brush/Hawker	Bussman/Dorman Smith
Normal	Motor	mm	mm							
2	-	60	14	NNS2	2SN2	NS2	3NW NS2		2F06	NSD2
4	-			NNS4	4SN2	NS4	3NW NS4		4F06	NSD4
6	-			NNS6	6SN2	NS6	3NW NS6		6F06	NSD6
10	-			NNS10	10SN2	NS10	3NW NS10		10F06	NSD10
16	-			NNS16	16SN2	NS16	3NW NS16		16F06	NSD16
20	-			NNS20	20SN2	NS20	3NW NS20		20F06	NSD20
20	25			NNS 20M25	20SN2M25	NS20M25	3NW M25		20M25F06	NSD20M25
20	32			NNS 20M32	20SN2M32	NS20M32	3NW M32		20M32F06	NSD20M32
25	-			NNS25	25SN2	NS25	3NW NS25		25F06	NSD25
32	-			NNS32	32SN2	NS32	3NW NS32		32F06	NSD32

**NES Type staggered contacts breaking capacity 80kA at 415V AC to ASTA certified to BS 88: Part 6: 1988**

20	68	17	NES20	20SP	-	-	-	ESD20
25			NES25	25SP	-	-	-	ESD25
32			NES32	32SP	-	-	-	ESD32
40			NES40	40SP	40ES	3NWES40	40G05	3SD40
50			NES50	50SP	50ES	3NWES50	50G05	ESD50
63			NES63	63SP	63ES	3NWES63	63G05	ESD63

**Industrial bolted pattern: Offset contacts ASTA certified to BS 88: Part 2: 1988.
Complies with IEC 269 Parts 1 and 2. Tested to 80kA at 415V AC**

Current rating A		Fixing centres	BS88 ref	NHP Cat No.	MEM	GEC/Lawson	Siemens	Cross reference	Brush/Hawker	Bussman/Dorman Smith
Normal	Motor									
2	-	44.5	A1	NNIT2	2SA2	NIT2	3NWNIT2		2F21	NITD2
4	-			NNIT4	4SA2	NIT4	3NWNIT4		4F21	NITD4
6	-			NNIT6	6SA2	NIT6	3NWNIT6		6F21	NITD6
10	-			NNIT10	10SA2	NIT10	3NWNIT10		10F21	NITD10
16	-			NNIT16	16SA2	NIT16	3NW NIT16		16F21	NITD16
20	-			NNIT20	20SA2	NIT20	3NWNIT20		20F21	NITD20
20	25			NNIT20M25	20SA2M25	NIT20M25	3NWNIT20M25		20M25F21	NITD20M25
20	32			NNIT20M32	20SA2M32	NIT20M32	3NWNIT20M32		20M32F21	NITD20M32
25	-			NNIT25	25SA2	-	3NWNIT25		25F21	NITD25
32	-			NNIT32	32SA2	-	3NWNIT32		32F21	NITD32
32	40	73	A2	NNIT32M40	32SA2M40	-	3NWNIT32M40		-	-
32	50			NNIT32M50	32SA2M50	-	3NWNIT32M50		-	-
32	63			NNIT32M63	32SA2M63	-	3NWNIT32M63		-	-
2	-			NTIA2	2SB3	TIA2	3NWTIA2		2H07	AA02
4	-			NTIA4	4SB3	TIA4	3NWTIA4		4H07	AA04
6	-			NTIA6	6SB3	TIA6	3NWTIA6		6H07	AA06
10	-			NTIA10	10SB3	TIA10	3NWTIA10		10H07	AA010
16	-			NTIA16	16SB3	TIA16	3NWTIA16		16H07	AA016
20	-			NTIA20	20SB3	TIA20	3NWTIA20		20H07	AA020
25	-			NTIA25	25SB3	TIA25	3NWTIA25		25H07	AA025
32	-			NTIA32	32SB3	TIA32	3NWTIA32		32H07	AA032
32	40			NTIA32M40	32SB3M40	TIA32M40	3NWTIA32M40		32M40H07	AA032M40
32	50			NTIA32M50	32SB3M50	TIA32M50	3NWTIA32M50		32M50H07	AA032M50
32	63			NTIA32M63	32SB3M63	TIA32M63	3NWTIA32M63		32M63H07	AA032M63
35	-	73	A3	NTIS35	35SB4	TIS35	3NWTIS35		35K07	BA035
40	-			NTIS40	40SB4	TIS40	3NWTIS40		40K07	BA040
50	-			NTIS50	50SB4	TIS50	3NWTIS50		50K07	BA050
63	-			NTIS63	63SB4	TIS63	3NWTIS63		63K07	BA063
63	80			NTIS63M80	63SB4M80	TIS63M80	3NWTIS63M80		63M80K07	BA063M80
63	100			NTIS63M100	63SB4M100	TIS63M100	3NWTIS63M100		63M100K07	BA063M100
80	-			NOS80	80SO	OS80	3NWO80		80K07R	OSD80
100	-			NOS100	100SO	OS100	3NWO100		100K07R	OSD100
100	125			NOS100M125		OS100M125	-		100M125K07R	OSD100M125
100	160			NOS100M160		OS100M160	-		100M160K07R	OSD100M160
80	-	94	A4	NTCP80	80SD5	TCP80	3NWTCP80		80L14	CE080
100	-			NTCP100	100SD5	TCP100	3NWTCP100		100L14	CE0100
100	125			NTCP100M125	100SD5M125	TCP100M125	3NWTCP100M125		100M125L14	CE0100M125
100	160			NTCP100M160	100SD5M160	TCP100M160	3NWTCP100M160		100M160L14	CE0100M160
125	-			NTFP125	125SD6	TFP125	3NWTFP125		125M14	DE0125
160	-			NTFP160	160SD6	TFP160	3NWTFP160		160M14	DE0160
200	-			NTFP200	200SD6	TFP200	3NWTFP200		200M14	DE0200
200	250			NTFP200M250	200SD6M250	TFP200M250	-		200M250M14	DE0200M250

NHP
COMPACT

HRC cartridge fuse-links

*Cross reference guide***NHP Compact industrial bolted pattern: Centre contacts: ASTA certified to BS 88: Part 2: 1988.**
Complies with IEC 269 parts 1 and 2. Tested to 80kA at 415V AC, 550V AC.

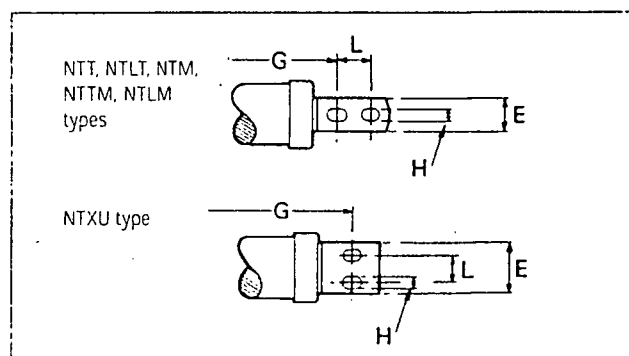
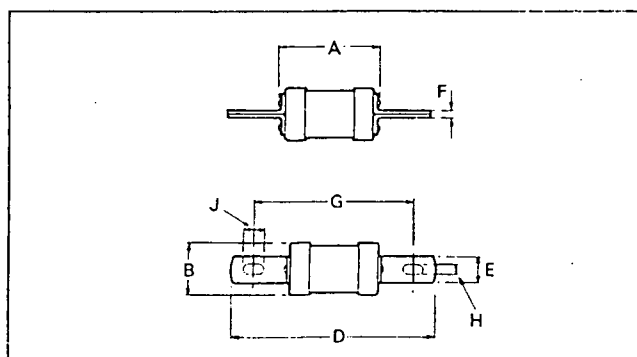
Current rating A		Fixing centres	BS88 ref	NHP Cat No.	Cross reference				
Normal	Motor				MEM	GEC/Lawson	Siemens	Brush/Hawker	Bussman/Dorman Smith
2	-	97	-	NTB2*	2SE3	TB2	3NWTB2	2KO8	AC2
4	-			NTB4*	4SE3	TB4	3NWTB4	4KO8	AC4
6	-			NTB6*	6SE3	TB6	3NWTB6	6KO8	AC6
10	-			NTB10*	10SE3	TB10	3NWTB10	10KO8	AC10
16	-			NTB16*	16SE3	TB16	3NWTB16	16KO8	AC16
20	-			NTB20*	20SE3	TB20	3NWTB20	20KO8	AC20
25	-			NTB25*	25SE3	TB25	3NWTB25	25KO8	AC25
32	-			NTB32*	32SE3	TB32	3NWTB32	32KO8	AC32
40	-			NTB40*	40SE3	TB40	3NWTB40	40KO8	BC40
50	-			NTB50*	50SE3	TB50	3NWTB50	50KO8	BC50
63	-	100	-	NTB63*	63SE3	TB63	3NWTB63	63KO8	BC63
63	80			NTB63M80	63SE4M80	TB63M80	3NWTB63M80	-	-
63	100			NTB63M100	63SE4M100	TB63M100	3NWTB63M100	-	-
2	-	111	B1	NTBC2	2SF3	TBC2	3NW TBC2	2KO9	AD2
4	-			NTBC4	4SF3	TBC4	3NW TBC4	4KO9	AD4
6	-			NTBC6	6SF3	TBC6	3NW TBC6	6KO9	AD6
10	-			NTBC10	10SF3	TBC10	3NW TBC10	10KO9	AD10
16	-			NTBC16	16SF3	TBC16	3NW TBC16	16KO9	AD16
20	-			NTBC20	20SF3	TBC20	3NW TBC20	20KO9	AD20
25	-			NTBC25	25SF3	TBC25	3NW TBC25	25KO9	AD25
32	-			NTBC32	32SF3	TBC32	3NW TBC32	32KO9	AD32
40	-			NTBC40	40SF3	TBC40	3NW TBC40	40KO9	AD40
50	-			NTBC50	50SF3	TBC50	3NW TBC50	50KO9	AD50
63	-	100	-	NTBC63	63SF3	TBC63	3NW TBC63	63KO9	AD63
63	80			NTBC63M80	63SF4M80	TBC63M80	3NW TBC63M80	-	-
63	100			NTBC63M100	63SF4M100	TBC63M100	3NW TBC63M100	-	-
80	-	111	B1	NTC80	80SF5	TC80	3NW TC80	80LO9	CD80
100	-			NTC100	100SF5	TC100	3NW TC100	100LO9	CD100
100	125			NTC100M125	100SF5M125	TC100M125	3NW TC100M125	100M125LO9	CD100M125
100	160			NTC100M160	100SF5M160	TC100M160	3NW TC100M160	100M160LO9	CD100M160
100	200			NTC100M200	100SF5M200	-	-	-	-
125	-	111	B2	NTF125	125SF6	TF125	3NW TF125	125M09	DD125
160	-			NTF160	160SF6	TF160	3NW TF160	160M09	DD160
200	-			NTF200	200SF6	TF200	3NW TF200	200M09	DD200
200	250			NTF200M250	200SF6M250	TF200M250	3NW TF200M250	200M250M09	DD200M250
200	315			NTF200M315	200SF6M315	TF200M315	3NW TF200M315	200M315M09	-
250	-	111	B3	NTKF250	250SF7	TKF250	3NW TKF250	250N09	ED250
315	-			NTKF315	315SF7	TKF315	3NW TKF315	315N09	ED315
315	400			NTKF315M400	315SF7M400	-	3NW TKF315M400	-	-
250	-	133	-	NTKM250	250SG7	TKM250	3NW TKM250	250N11	EF5250
315	-			NTKM315	315SG7	TKM315	3NW TKM315	315N11	EF5315
355	-	111	B4	NTMF355	355SF8	TMF355	3NW TMF355	355P09	ED355
400	-			NTMF400	400SF8	TMF400	3NW TMF400	400P09	ED400
355	-	133/184	C1	NTM355	355SH8	TM355	3NW TM355	355P11	EF355
400	-			NTM400	400SH8	TM400	3NW TM400	400P11	EF400
450	-	133/184	C2	NTTM450	450SH9	TTM450	3NW TTM450	450R11	FF450
500	-			NTTM500	500SH9	TTM500	3NW TTM500	500R11	FF500
560	-			NTTM560	560SH9	TTM560	3NW TTM560	560R11	GF550
630	-			NTTM630	630SH9	TTM630	3NW TTM630	630R11	GF630
450	-	165/229	-	NTT450	450SY9	TT450	3NWTT450	450R12	FG450
500	-			NTT500	500SY9	TT500	3NWTT500	500R12	FG500
560	-			NTT560	560SY9	TT560	3NWTT560	560R12	FG560
630	-			NTT630	630SY9	TT630	3NWTT630	630R12	FG630
710	-	165/229	-	NTLT710	710SY10	TLT710	3NWTLT710	710S12	GG710
800	-			NTLT800	800SY10	TLT800	3NWTLT800	800S12	GG800
710	-	133/184	C3	NTLM710	710SH10	TLM710	3NW TLM710	700S11	GF710
800	-			NTLM800	800SH10	TLM800	3NW TLM800	800S11	GF800
1000	-	149	D1	NTXU1000	1000SJ11	TXU1000	-	1000U44	GH1000
1250	-			NTXU1250	1250SH11	TXU1250	-	1250U44	GH1250

NHP
COMPACT

HRC cartridge fuse-links

*Dimensions***Dimensions (mm)**

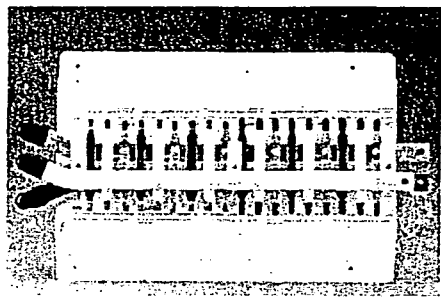
Fuse link type	A max. mm	B max. mm	D max. mm	E mm	F mm	G nom. mm	H mm	J mm	L mm
NNIT	36	14	55	11	0.8	44.5	4.8	-	-
NTIA } NTIS }	56	21	86	9	1.2	73	5.5	7.5	-
NTIS(M)	45	27	90	13	1.6	73	5.8	10	-
NOS	45	27	90	13	1.6	73	5.8	10	-
NTCP	48	27	111	16	3.2	94	9	-	-
NTCP(M)	48	30	111	19	3.2	94	9	-	-
NTFP	48	30	111	19	3.2	94	9	-	-
NTFP(M)	48	40	111	19	3.2	94	9	-	-
NTB	57	21	114	13	1.6	97	7.2	11	-
NTB...M...	57	26	116	13	1.6	97	7.2	11	-
NTBC	57	21	134	16	2.0	111	8.7	16	-
NTBC...M...	58	26	136	16	3.2	111	8.7	16	-
NTC	48	27	134	16	3.2	111	9	12.5	-
NTF	48	30	137	19	3.2	111	9	12.5	-
NTKF	48	40	137	19	3.2	111	9	12.5	-
NTMF	51	40	138	25	5.0	111	9	12.5	-
NTKM	48	40	159	19	3.2	133	10.5	14	-
NTM	51	40	211	25	5.0	133/184	10.5	14	25.4
NTTM	59	53	212	25	6.3	133/184	10.5	14	25.4
NTLM	84	82	210	26	10	133/184	10.3	16	25.4
NTT	83	74	267	38	6.5	165	10.3	16	32
NTLT	84	82	267	38	10	165	10.3	16	32
NTXU	83	100	198	63.5	9.5	149	14.3	19	32



NHP Item Info

NHP E-Cat Version 1 00Q3

Mon 1 Sep 2003 7:00am



Catalogue Number
CD2-36/18-3
Description
CD250A 36WAY 3P DIN-T CHASSIS
List Price (Not including GST)
\$179.00
Unit Of Measure
Ea
Price Schedule
T4

Busbar Chassis (DIN)

Number of poles

36 Pole

Chassis Configuration

250A 3 phase

Features

- The CD chassis system is designed to accept the complete range of Din-T MCBs and applicable accessories.
- Type tested assembly to AS 3439: 250A 20kA 0.2sec.
- Totally new busbar and busbar support design.
- Top busbar feed splayed to suit new compact 160A and 250A main switch.
- All tee-offs prestripped.
- 50% of tee-offs fitted with removeable caps.
- New PPA441 plastic dip coating system.
- Design incorporates MCB mounting on full 35mm DIN rail section.
- New top hat profile steel mounting pan.
- Split tariff kits available.

Benefits

- Provides a fast and flexible mounting and connection system for single and multiphase Din-T MCBs and RCDs used in power distribution systems.
- Design integrity of product is ensured under fault conditions up to the specified duty.
- Improved design flexibility for special configuration busbars, ie 3P+N etc.
- Suitable for direct connection to compact main switch terminals.
- Reduces installation time and increases safety for installers.
- Ensures touch protection for spare tee-offs.
- Increased temperature rating and resistance to stress cracking due to the effects of temperature and ageing.
- Improved mounting security. MCB does not rely on connection with tee-off for fixing strength.
- Increased mechanical rigidity, less cost associated with additional supports.
- Simple and effective method of splitting busbars into multiple sections, ie essential and non-essential loads.

Ordering Information

- - Split tariff kit OSDTK250CD0 available refer NHP.
- - Busbar connections at top of chassis are splayed to suit CDT160MS & CD*250MS compact main switch.
- - Flared busbar extends 25mm beyond top of chassis pan.
- - Bottom busbar connections are not flared but are pre-punched to allow for direct cable connection.
- - 4 pole and other configuration chassis to suit Din-T MCB side mount accessories available to special order.
- - OFFO (line side) of MCB connects to chassis tee-off.

NHP**Miniature circuit breakers****NHP****Din-T6 series 6kA MCB**

- ┘ Standards AS3111, IEC 898.
- ┘ Approval No. N13374.
- ┘ Current range 2-63 amps 1, 2 and 3 pole.
- ┘ Sealable and lockable handle.
- ┘ Available in curve type C and D.
- ┘ Mounts on CD chassis (250A & 355A).

**1 pole 1 module**

In (A)	C - Curve 5-10In	D - Curve 10-20In
2	DIN-T6102C	DIN-T6102D
4	DIN-T6104C	DIN-T6104D
6	DIN-T6106C	DIN-T6106D
10	DIN-T6110C	DIN-T6110D
16	DIN-T6116C	DIN-T6116D
20	DIN-T6120C	DIN-T6120D
25	DIN-T6125C	DIN-T6125D
32	DIN-T6132C	DIN-T6132D
40	DIN-T6140C	DIN-T6140D
50	DIN-T6150C	DIN-T6150D
63	DIN-T6163C	DIN-T6163D

2 pole 2 modules

2	DIN-T6202C	DIN-T6202D
4	DIN-T6204C	DIN-T6204D
6	DIN-T6206C	DIN-T6206D
10	DIN-T6210C	DIN-T6210D
16	DIN-T6216C	DIN-T6216D
20	DIN-T6220C	DIN-T6220D
25	DIN-T6225C	DIN-T6225D
32	DIN-T6232C	DIN-T6232D
40	DIN-T6240C	DIN-T6240D
50	DIN-T6250C	DIN-T6250D
63	DIN-T6263C	DIN-T6263D

3 pole 3 modules

2	DIN-T6302C	DIN-T6302D
4	DIN-T6304C	DIN-T6304D
6	DIN-T6306C	DIN-T6306D
10	DIN-T6310C	DIN-T6310D
16	DIN-T6316C	DIN-T6316D
20	DIN-T6320C	DIN-T6320D
25	DIN-T6325C	DIN-T6325D
32	DIN-T6332C	DIN-T6332D
40	DIN-T6340C	DIN-T6340D
50	DIN-T6350C	DIN-T6350D
63	DIN-T6363C	DIN-T6363D

Short circuit capacity 6000 amps

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

DC use	1P	2P '1)
Short circuit	6000A	6000A
Max.voltage (DC)	24/48V	110V

Use at DC

When using Din-T6 in a DC application the magnetic tripping current is approximately 40% higher than in AC. 50/60Hz.

Shock resistance (in X, Y, Z directions)

20g with shock duration 10ms (minimum 18 shocks).
40g with shock duration 5ms (minimum 18 shocks).

Vibration resistance (in X, Y, Z directions).

3g in frequency range 10 to 55Hz (operating time at least 30 min).

According to IEC 77 16.3 and DIN 40046 part 8.

Storage temperature

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

Operating temperature

From -25°C to +55°C, according to approximately VDE 0664 parts 1 and 2.

Use at 400Hz


At 400Hz the magnetic trip current is approximately 50% higher than in AC 50/60Hz.

Accessories

Add on RCD
Auxiliary/alarm
Shunt trip
Padlockable bracket
Link bars & terminals
Enclosures
Busbar chassis

Notes: '1) 2 poles in series (not 2 x single poles).

The line side is the "OFF" (bottom) side of the MCB.

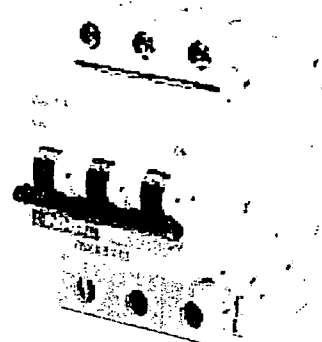
 Available on indent only.

NHP**Miniature circuit breakers****NHP****Din-T6 series 6kA MCB (cont)****Technical data**

Number of poles		1	2	3
Width	(mm)	18	36	54
Depth	(mm)	68	68	68
Rated voltage	(V AC)	240	240	415
Highest rated current	(A)	63	63	63
Terminal capacity	Line side	(mm ²)	25	25
	Load side	(mm ²)	25	25

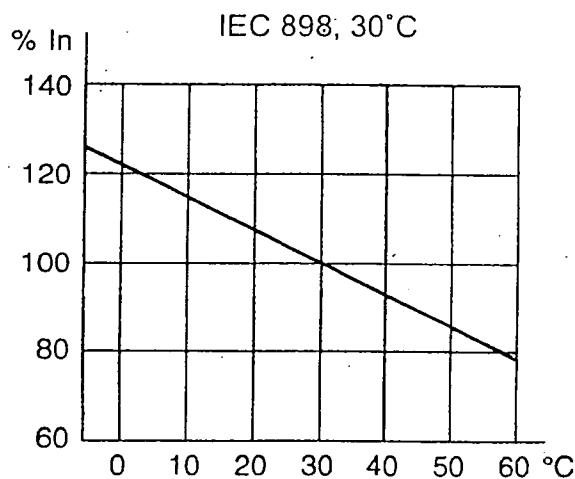
Number of switching operations

Operations 240V AC, In Cos $\varphi=0.9$	10000	10000	10000
DC @ I_n	4000	4000	4000
Insulation resistance (M Ω)	> 10 ⁶	> 10 ⁶	> 10 ⁶
Dielectric strength (kV)	2.5	2.5	2.5

**Ambient temperature influence**

The thermal calibration of the Din-T6 series was carried out at 30°C. Temperatures above or below will alter the trip characteristics controlled through the bi-metal.

See curve below

**Voltage drop and energy loss**

I _n (A)	Voltage drop (V)	Energy loss (W)	Internal resistance (m Ω)
2	0.82	1.6	410
4	0.57	2.3	142.5
6	0.21	1.3	35
10	0.13	1.3	13
16	0.11	1.8	6.9
20	0.14	2.8	7.0
25	0.10	3.0	4.0
32	0.09	3.0	2.8
40	0.08	4.7	2.0
50	0.090	4.5	1.8
63	0.088	5.56	1.4

Catalogue number structure for Din-T MCBs (6, 10, 10H & 15)

DIN-T	X X	X	X X	X
Constant NHP DIN format	Short circuit capacity (A)	Polarity	I_n (A)	Curve type
	4.5 4500	1 1 pole	05 0.5	B 3I _n - 5I _n
	6 6000	2 2 pole	01 1	C 5I _n - 10I _n
	10 10000	3 3 pole	02 2	D 10I _n - 20I _n
	10H 10000	4 4 pole	04 4	
	15 15000		06 6	
			10 10	
			16 16	
			20 20	
			Etc.	

NHP**Miniature circuit breakers****NHP****Din-T6 and Din-T10 series MCB's****Magnetic release**

An electromagnet striker ensures instantaneous tripping in case of short circuit. IEC 898 describes the following types

Curve type	Test current	Tripping time	Applications
C	5 I _n	t ≥ 0.1s	Usual loads such as: - lighting - socket outlets - small motors ¹⁾
	10 I _n	t < 0.1s	
D	10 I _n	t ≥ 0.1s	Control and protection of circuits having high transient inrush currents (large motors, ²⁾ transformers etc).
	20 I _n	t < 0.1s	

Thermal release

The release is initiated by a bimetal strip in case of overload. IEC 898 defines the range of release for specific overload values. Reference ambient temperature is 30°C.

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

Note: ¹⁾ C curve MCBs are suitable for general motor starting applications, see motor starting tables section 10.

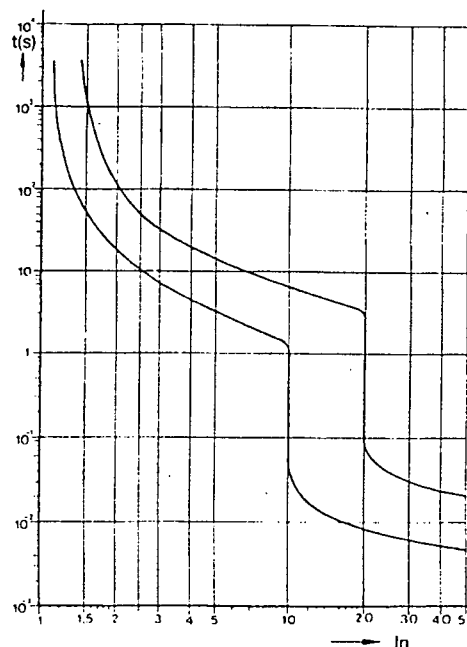
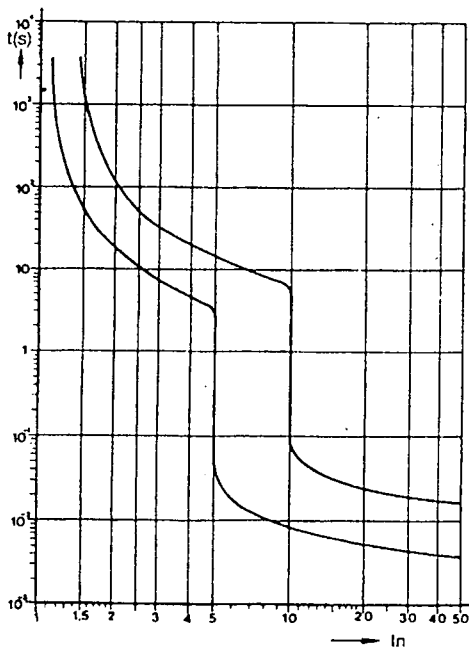
²⁾ D curve MCBs may be selected in more arduous starting applications or may allow a lower current rating MCB to be selected. Refer NHP.

Tripping characteristics according to IEC 898 (Limit-current, tables)

C**D**

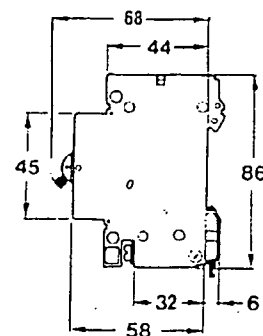
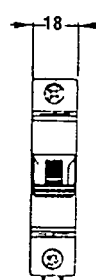
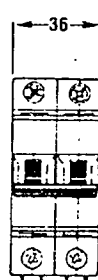
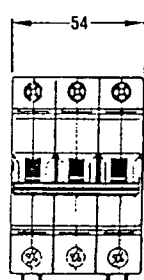
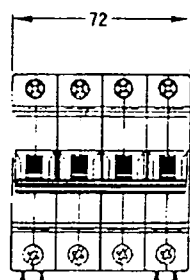
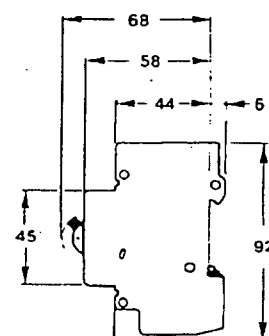
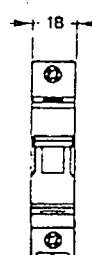
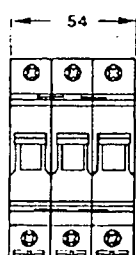
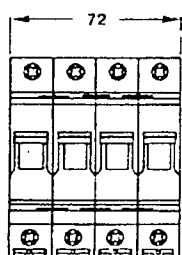
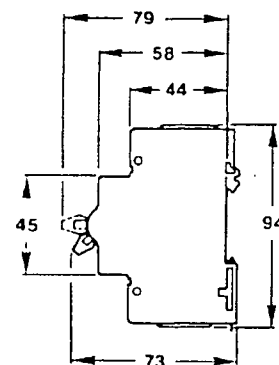
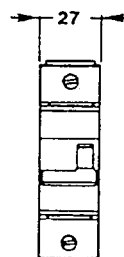
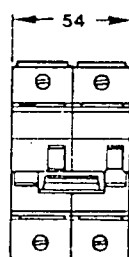
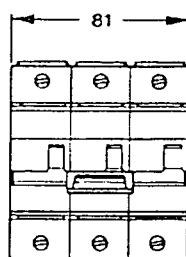
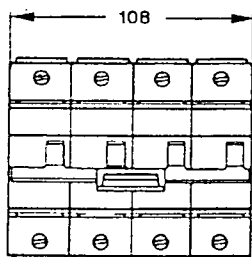
Din-T6: from 2 to 6A
Din-T10: from 0.5 to 6A

Din-T6: from 2 to 6A
Din-T10: from 0.5 to 6A



NHP**Miniature circuit breakers****NHP****Dimensions Din-T6, 10, 10H and 15 series.**

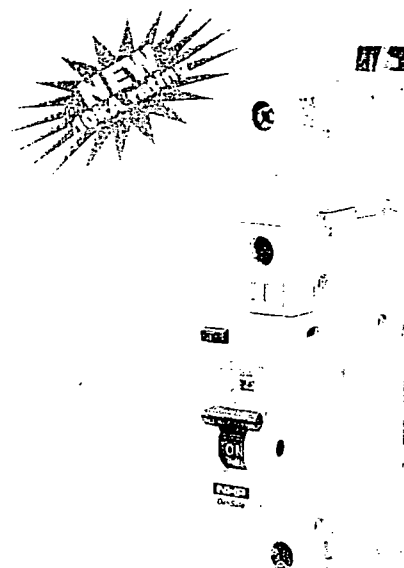
All dimensions in mm

Din-T6 (2-40A)**Din-T6 (50-63A)****Din-T10 and Din-T15 (0.5-63A)****Din-10H (30-125A)**

NHP**Miniature circuit breakers****NHP****Din-Safe single pole width residual current circuit breaker (DRCB)**

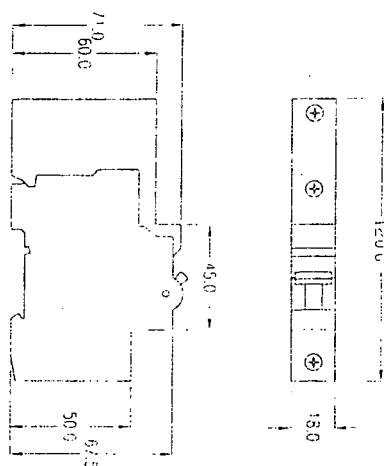
- ┌ Standards IEC1009, IEC 898.
- ┌ Approval N14929.
- ┌ Mining approval NSW MDA Ex. 11593, QLD QMD 987445X.
- ┌ One module wide (18mm).
- ┌ Short circuit, overcurrent and earth leakage protection.
- ┌ Short circuit protection 10kA.
- ┌ Sensitivity 30mA.

Ampere rating	Modules (18mm)	Voltage	Short circuit	Trip Sensitivity	Cat. No
10	1	240	10kA	30mA	DRCBH 1030
16	1	240	10kA	30mA	DRCBH 1630
20	1	240	10kA	30mA	DRCBH 2030
25	1	240	10kA	30mA	DRCBH 2530
32	1	240	10kA	30mA	DRCBH 3230

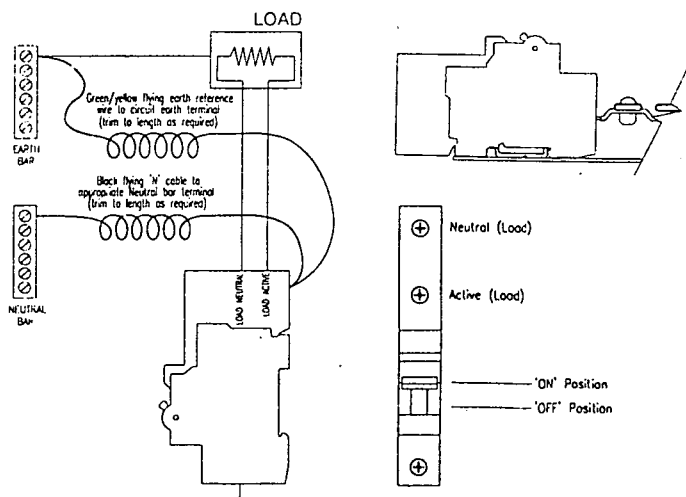
**Operation**

This unit combines the overload and short circuit protection of an MCB with earth leakage protection of an RCD. The unit occupies one, sub-circuit (one pole) of the distribution board and provides single phase protection against overload short circuit and earth leakage current.

- 1) The MCB element provides thermal and magnetic tripping protection which is rated to 10kA prospective fault current.
- 2) The RCD element of the device provides core-balance detection of the difference between the active and neutral currents and amplification to provide high sensitivity. The rated residual operating current ($I_{\Delta n}$) is 30mA.
- 3) The green/yellow earth reference cable in case of loss of supply neutral ensures the device will continue to provide earth leakage protection and will operate normally upon detection of an earth leakage current.

Dimension(mm)**Application**

The Din-Safe single pole width residual current circuit breaker will fit the standard Din-T chassis for use in NHP panelboards. The revolutionary design makes it possible to provide an MCB complete with earth leakage protection in an 18mm wide module which allows a greater number of devices to be fitted into a distribution board.

Connection diagram**Accessories**

Padlock bracket
Link bars and terminals
Enclosures

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

sprecher +
schuh

ACS

AC contactors

3 pole open type with AC coil

NHP

Refer catalogue CA 6, 2212, SACS

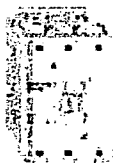
AC 3 rating at 60°C

Ratings to IEC 947 and AS 3497 415V

- For CA 7 contactors with coil terminals on line side, add ...V AC to Catalogue No. Eg - CA 7-9-10-240V AC ¹⁾
- For CA 7 contactors with coil terminals on load side, add ...V AC-U to Catalogue No. Eg - CA 7-9-10-240V AC-U



Contactor CA 7-9



Contactor CA 7-72



Contactor CA 6-105-EI



Contactor CA 6-170-EI



Contactor CA 6-250-EI



Contactor CA 6-420-EI

AC 3 kW ¹⁾	AC 3 Amps ¹⁾	AC 1 ⁴⁾ AC 1 ⁴⁾		Auxiliary contacts standard			Cat. No. ²⁾
		Amps 40°C	Amps 60°C	N/O	N/C	Max.	
4	9	32	32	1	0	9	CA 7-9-10...V AC
				0	1	9	CA 7-9-01...V AC
5.5	12	32	32	1	0	9	CA 7-12-10...V AC
				0	1	9	CA 7-12-01...V AC
7.5	16	32	32	1	0	9	CA 7-16-10...V AC
				0	1	9	CA 7-16-01...V AC
11	23	32	32	1	0	9	CA 7-23-10...V AC
				0	1	9	CA 7-23-01...V AC
15	30	50	45	0	0	8	CA 7-30-00...V AC
18.5	37	50	45	0	0	8	CA 7-37-00...V AC
22	43	85	63	0	0	8	CA 7-43-00...V AC
30	60	100	100	0	0	8	CA 7-60-00...V AC
37	72	100	100	0	0	8	CA 7-72-00...V AC
45	85	100	100	0	0	8	CA 7-85-00...V AC
55 (45)	95 (33)	160	135	1	1	8	CA 6-85-11...V AC
75 (55)	130 (40)	160	135	1	1	8	CA 6-105-11...V AC
90 (75)	155 (55)	250	210	1	1	8	CA 6-140-11...V AC
75 (55)	130 (40)	160	135	1	1	8	CA 6-105-EI-11...V AC ⁴⁾
90 (75)	155 (55)	250	210	1	1	8	CA 6-140-EI-11...V AC ⁴⁾
100 (90)	170 (65)	250	210	1	1	8	CA 6-170-EI-11...V AC ⁴⁾
132 (111)	225 (80)	350	300	1	1	8	CA 6-210-EI-11...V AC ⁴⁾
150 (133)	258 (95)	350	300	1	1	8	CA 6-250-EI-11...V AC ⁴⁾
185 (163)	320 (115)	450	380	1	1	8	CA 6-300-EI-11...V AC ⁴⁾
250 (225)	425 (160)	500	425	1	1	8	CA 6-420-EI-11...V AC ⁴⁾
220 (220)	370 (155)	500	420	2	2	8	CA 5-370...V AC ⁵⁾
265 (280)	450 (200)	600	510	2	2	8	CA 5-450...V AC ⁵⁾
325 (355)	550 (250)	780	645	2	2	8	CA 5-550...V AC ⁵⁾
430 (500)	700 (340)	1000	850	2	2	8	CA 5-700...V AC ⁵⁾
520 (550)	860 (380)	1100	930	2	2	8	CA 5-860...V AC ⁵⁾
600	1000	1200	1020	1	1	8	CA 5-1000...V AC ⁵⁾
700	1150	1350	1150	1	1	8	CA 5-1200...V AC ⁵⁾

Notes: ¹⁾ 1000 volt ratings ().²⁾ Add control voltage to Cat. No. when ordering: 24, 32, 110, 240, 415, 440V 50Hz.

Standard voltages for CA 6-105-EI...250-EI are 24, 48, 110, 240 and 415V AC.

Standard voltages for CA 6-300-EI...420-EI 48, 110, 240 and 415V AC.

Standard voltages for CA 5-370...1200, 110, 240 and 415V AC.

³⁾ All CA 7 coils can be reversed for line or load side coil terminals as required. Both versions are held in NHP stock for convenience.⁴⁾ Electronically controlled mechanism (ECM) with interface suffix (EI).⁵⁾ 55°C enclosed.⁶⁾ Contact NHP for recommended cable size.

sprecher +
schuh

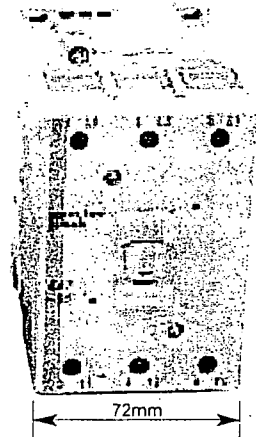
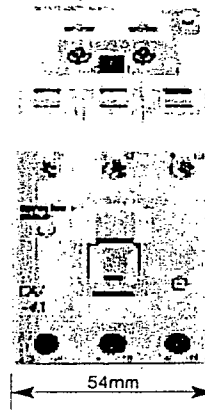
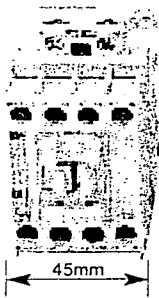
ACS contactors CA 7

4 – 45kW

NHF

Refer catalogue SACS

The highest switching capacity
in the smallest space



Compact without compromise

Compact without compromise is the best way to describe the CA 7 range of contactors and motor protection relays from Sprecher + Schuh. In spite of the new compact dimensions, the CA 7 range features high breaking capacity and extraordinary flexibility. Up to 18.5kW the contactors are only 45mm wide and even the largest 45kW frame is only 72mm wide. The CA 7 contactors are the main component in the new Advanced Control System (ACS).

With CA 7 you have flexibility with auxiliary contacts

Three timing positions

Three timing positions

- ☐ Front mounting.
- ☐ Side mounting left.
- ☐ Side mounting right.

Alternatively you can choose to combine left, right and front mounting auxiliary contacts to fulfil your requirements.

Instead of the top mounted auxiliary contacts, on or off delay timing modules or mechanical latches can be fitted.



Motor switching rating AC 3 @ 415V

CA 7-9	4kW	45mm		9A
CA 7-12	5.5kW			12A
CA 7-16	7.5kW			16A
CA 7-23	11kW			23A
CA 7-30	15kW	45mm		30A
CA 7-37	18.5kW			37A
CA 7-43	22kW	54mm		43A
CA 7-60	30kW	72mm		60A
CA 7-72	37kW			72A
CA 7-85	45kW			85A

With CA 7 you have more clip on accessories

Up to 85 accessories from 9A to 85A

- ☐ On and off delay pneumatic timers.
- ☐ Coil mounted electronic timers on delay, off delay, star delta.
- ☐ Coil mounted 24V DC interface.
- ☐ Coil mounted RC and varistor suppressor modules.
- ☐ Mechanical latch.
- ☐ Mechanical interlock.
- ☐ Mechanical interlock with integrated N/C interlock contacts.
- ☐ Moulded wire link sets for DOL, reversing and star delta starters.
- ☐ Large choice of front and side mounting auxiliary contacts.

ACS contactors CA 7

4 - 45kW

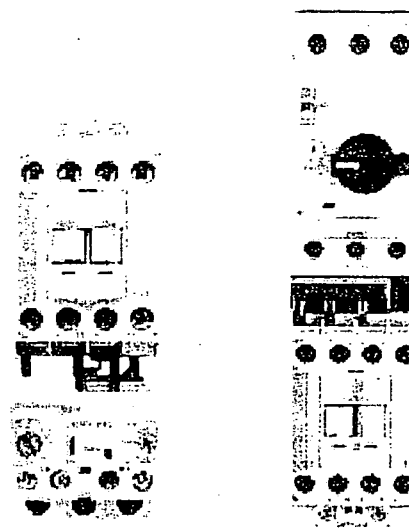
Refer catalogue SACS

Innovation and ease of use provide solutions for your control systems

Coil terminals are always in the correct position

The coil terminations on the CA 7 contactors can be supplied optionally at the top or the bottom of the contactor. It is also a simple task to change this on site should the requirements change.

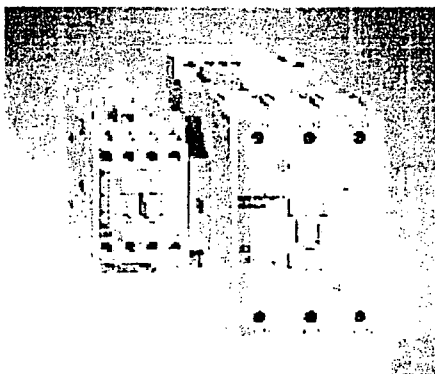
When CA 7 contactors are used in combination with KTA 7 circuit motor circuit breakers the bottom coil terminations are used. For use with standard CT 7 thermal or CEP 7 electronic overloads the top coil termination should be selected.



Mechanical interlocks save space

Only 9mm wide, the CM 7 mechanical interlock snaps into place between any of the CA 7 contactors. It is allowed also to interlock different sizes of the CA 7 range with the same interlock.

The basic mechanical interlock is supplemented by a variation with built in N/C auxiliary contacts for electrical interlocking. This version is also only 9mm wide and further minimises space requirements.

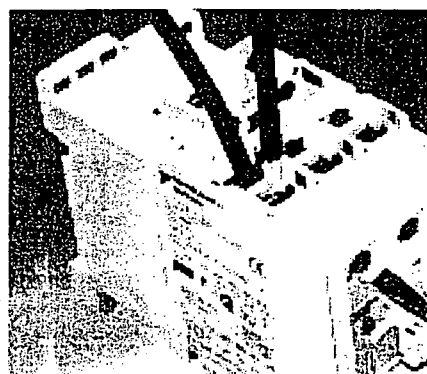


CA 7 contactors provide improved wiring terminals

The main terminals of all CA 7 contactors are designed to accept at least two cables. At the same time they comply with safety standards regarding touch protection.

The larger contactors CA 7-30 and upwards employ a special cage terminal which allows the connection of two cables in separate chambers.

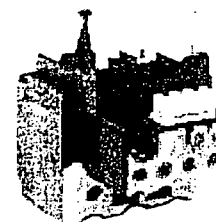
The ease of wiring with CA 7 contactors saves both time and money.



High tech electronic protection for your motors.



High tech electronic protection type CEP 7 in trip class 10 or 20.



Standard thermal overloads type CT 7



ACS thermal overload relays

Type CT 7



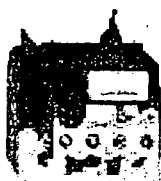
Refer catalogue SACS

Thermal overload relays to IEC 947 and AS 3947



Cat. No. CT 7-24

- ☐ Tripping class 10A.
- ☐ Single phasing sensitivity to IEC 947.
- ☐ Separate N/O and N/C contacts.
- ☐ Reset Auto/Man and test facility.
- ☐ Easy access to control terminals.
- ☐ Trip indicator.



Cat. No. CT 7-45



Cat. No. CT 7-75



Cat. No. CT 7-100



Cat. No. CT 7-24-P-A

Standard motor kW	Approx. kW range @ 415V	Current range A	Suit CA 7	Cat. No.
-	-	0.1...0.16	CA 7-9...37	CT 7-24-0.16
-	-	0.16...0.24	CA 7-9...37	CT 7-24-0.24
-	-	0.24...0.4	CA 7-9...37	CT 7-24-0.4
-	0.1...0.17	0.4...0.6	CA 7-9...37	CT 7-24-0.6
-	0.17...0.34	0.6...1.0	CA 7-9...37	CT 7-24-1
-	0.34...0.6	1.0...1.6	CA 7-9...37	CT 7-24-1.6
1.0	0.6...1.0	1.6...2.4	CA 7-9...37	CT 7-24-2.4
1.5	1.0...1.8	2.4...4	CA 7-9...37	CT 7-24-4
2.2	1.8...2.7	4...6	CA 7-9...37	CT 7-24-6
4	2.7...5.0	6...10	CA 7-9...37	CT 7-24-10
5.5/7.5	5.0...8.0	10...16	CA 7-12...37	CT 7-24-16
11	8.0...12.5	16...24	CA 7-23...37	CT 7-24-24
11/15	9...16	18...30	CA 7-30...43	CT 7-45-30 ²⁾
18.5/22	16...24	30...45	CA 7-37...43	CT 7-45-45 ²⁾
11/15	9...16	18...30	CA 7-60...85	CT 7-75-30
18.5/22	16...24	30...45	CA 7-60...85	CT 7-75-45
30	24...33	45...60	CA 7-60...85	CT 7-75-60
37	33...41	60...75	CA 7-72...85	CT 7-75-75
45	40...45	70...90	Separate mount	CT 7-100-90

Notes: ²⁾ CT 7-45 cannot be separately mounted, use CT 7-75 with equivalent current rating.

PCL XL error

Subsystem: TEXT

Error: IllegalFontData

Operator: Text

Position: 14768

Refer Catalogue CCH

Enclosure venting systems

Features

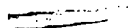
- ☐ Heat resistant ABS plastic housing
- ☐ Self extinguishing according to UL94 V0
- ☐ RAL 7032 grey finish
- ☐ EU4 filtermat high grade
- ☐ 90% dedusting degree
- ☐ Ball bearing axial fans
- ☐ Connection via terminals
- ☐ Low profile



Cat No. GNV 1200 220



Cat No. GNV 2501 220



TB series



Cat No. FAGN 12/25/30



Cat. No. KTS01141

Filter fans c/w grill

Description	V/Hz	Dimensions (mm)	Cat. No.
Filter fan 50 m³/h	240/50-60	130x130	GNV 1200 220
Filter fan 50 m³/h	110/50-60	130x130	GNV 1200 222
Filter fan 50 m³/h	24 DC	130x130	GNV 1200 211
Filter fan 100 m³/h	240/50-60	255x255	GNV 2500 220
Filter fan 100 m³/h	110/50-60	255x255	GNV 2500 222
Filter fan 100 m³/h	24 DC	255x255	GNV 2500 211
Filter fan 220 m³/h	240/50-60	255x255	GNV 2501 220
Filter fan 220 m³/h	110/50-60	255x255	GNV 2501 222
Filter fan 220 m³/h	24 DC	255x255	GNV 2501 211
Filter fan 500 m³/h air in	240/50-60	323x323	GNV 300A 220
Filter fan 500 m³/h air out	240/50-60	323x323	GNV 300P 220
Filter fan 500 m³/h air in	110/50-60	323x323	GNV 300A 222
Filter fan 500 m³/h air out	110/50-60	323x323	GNV 300P 222
Filter fan 500 m³/h air in	415/3/50-60	323x323	GNV 300A 207
Filter fan 500 m³/h air out	415/3/50-60	323x323	GNV 300P 207

Filter fans top mounted

Top mount 550 m³/h	240/50-60	460x380x105	TB 190.00 220
Top mount 550 m³/h	110/50-60	460x380x105	TB 190.00 222
Top mount 900 m³/h	240/50-60	460x380x105	TB 220.00 220
Top mount 900 m³/h	110/50-60	460x380x105	TB 220.00 222
Top mount 1500 m³/h	240/50-60	520x400x160	TB 250.00 200
Top mount 2800 m³/h	240/50-60	600x550x300	TB 350.00 200

Grills and filters

Grill w/- filter, gasket & screws	130x130	GNF 12
Grill w/- filter, gasket & screws	255x255	GNF 25
Grill w/- filter, gasket & screws	323x323	GNF 30

Spare filters

Spare filter (Pkt of 2)	130x130	FAGN12
Spare filter (Pkt of 2)	255x255	FAGN25
Spare filter (Pkt of 2)	323x323	FAGN30

Spare grills

		Cat. No.
Spare grill	130x130	GN12
Spare grill	255x255	GN25
Spare grill	323x323	GN30

Accessories	Contacts	Dial Colour	Cat. No.
Alarm thermostat	N/O makes on temp increase	(blue)	KTS01141
Alarm thermostat	N/C breaks on temp increase	(red)	KTO01140
Alarm thermostat	1 C/O	(black)	FZK01100



Filter Fans

Enclosure venting systems GRV & TB Series

Used when external ambient temperatures are lower than required enclosure temperature.

Filter Fans

- Heat Resistant ABS plastic housing
- Self extinguishing material (UL94VO)
- RAL 7032 grey finish
- EU4 filtermat
- 90% de-dust degree filtermat
- Ball bearing axial fans
- Connections by terminals

Accessories

- Thermostats
- Spare filter mats

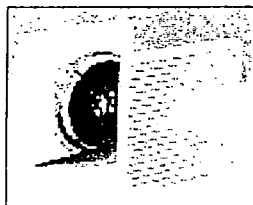
Types

GNV – Filter fan with air grill and mounting package

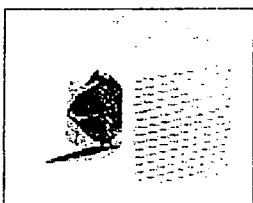
TB – Fan, top mounted

GN – Air grill without filter

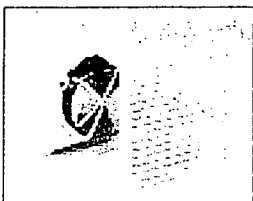
GNF – Air grill with filter



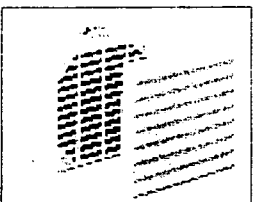
GNV 30 0A



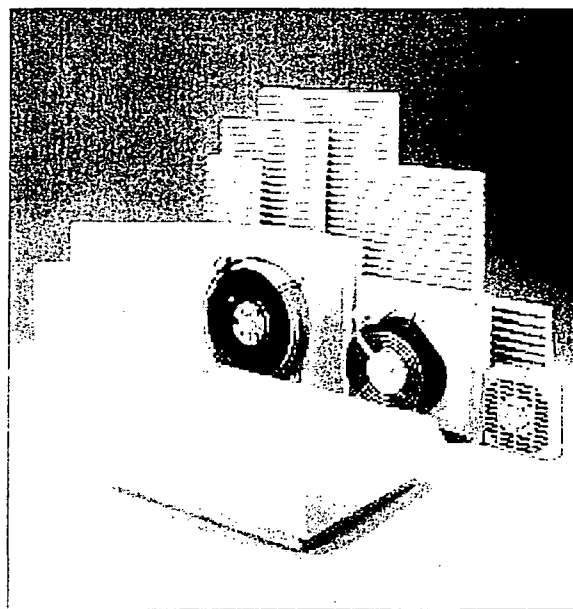
GNV 25 00



GNV 25 01



GNV 12 00



TB Top Mount Fans

Air Grills

Cat. No.	GR/GNF	12	25	30
Dimensions	mm ²	130	255	323
Depth	mm	26	38	38

Ordering Example

If you require a 50m³/h fan 240V 50Hz, your selection would be: GNV 12 00 220

Filter Fans








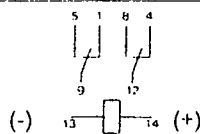
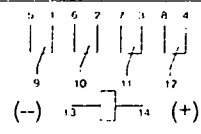
Cat. No.		GNV				TB			
	Units	12 00	25 00	25 01	30 OA 30 OP	190 00	220 00	250 00	350 00
Model									
Dimensions (height)	mm	130	255	255	323	105	105	160	300
(width)	mm	130	255	255	323	460	460	520	600
Internal thickness (depth)	mm	41	93	103	120	380	380	400	550
Fan volume	m³/h	50	100	220	500	550	900	1500	2800
Power absorbed	W	16	16	40	70	75	75	75	75
Current	mA	130	130	300	320	-	-	-	-
Noise level	dB(a)	53	53	58	69	62	70	76	77
Temperature limits	°C	-10 to +70							
Protection degree	IP	IP 54				IP 24			
EXTENSION CODE									
240V 50/60Hz		220	220	220	220	220	220	220	220
110V 50/60Hz		222	222	222	222	222	222	222	222
24V DC		211	211	211	211	-	-	-	-

Miniature control relays


Plug-in or solder

NHP

Refer Catalogue F1

	 finder	 finder
		
	New LED version	New LED version
Cat. No.	55.32.0050 (AC supply) 55.32.0070 ¹⁾ (DC supply)	55.34.0050 (AC supply) 55.34.0070 ¹⁾ (DC supply)
Description	Miniature control relay. Plug-in or solder connection.	Miniature control relay. Plug-in or solder connection.
Contact Data Number & type Switching current/voltage Max. voltage Dielectric strength (to frame)	2 C/O 10 amp 250V (AC 1) 380V AC 1.5kV Gold flashed contacts on request.	4 C/O 5 amp 250V (AC 1) 250V AC 1.5kV Gold flashed contacts available on request.
Coil data: Supply AC DC Resistance (ohms) AC DC Current (mA) AC DC Power Tolerance	6, 12, 24, 32, 48, 110, 240 6, 12, 24, 32, 48, 110  60 & 230AC  125V DC 12, 50, 190, -, 770, 3940, 19100 40, 160, 640, -, 2560, 13440 233, 117, 58, -, 29, 13, 6 150, 75, 38, -, 8, - 1.4VA AC, 0.9W DC -20% to + 10%	6, 12, 24, 32, 48, 110, 240 6, 12, 24, 32, 48, 110  60 AC & DC, 230 AC 12, 50, 190, -, 770, 3940, 19100 40, 160, 640, -, 2560, 13440 233, 117, 58, -, 29, 13, 6 150, 75, 38, -, 18, 8 1.4VA AC, 0.9W DC -20% to +10%
Dimensions (H x W x Projection mm max.)	55.32 20.6 x 27.5 x 33.5	55.34 20.6 x 27.5 x 33.5
Features	Small dimensions, power switching. Press-to-test button with LED and diode.	Small dimensions, power switching. Press-to-test button with LED and diode.
Connection diagram	 For DC supply, pin 14 positive	 For DC supply, pin 14 positive
Bases	94.82, 94.72, 94.12, 94.34.	94.74, DIN rail 94.14, PCB mount 94.34, Rear connect

Note:

- ¹⁾ DC supply version also available without LED. Specify Cat. No. 55.34.0040.
- ²⁾ DC supply version also available without LED. Specify Cat. No. 56.32.
-  Available on indent only.



GENERAL PURPOSE RELAYS

NHP

Series 55 Miniature control relays



Contact and switching current at
1800 operations per hour

Number of C/O	2	4 ¹⁾
Nominal rate at 250V AC 1 (A)	10	5
Switching current at 24V DC (A)	10	5
Breaking current in AC 1 (VA)	2500	1250

Technical data

Nominal coil sensitivity:	1.4 VA AC/0.9W DC
Nominal coil voltages: AC	6, 12, 24, 32, 48, 110, 240
DC	6, 12, 24, 32, 48, 110 other voltages available on indent
Coil operating range:	0.8 to 1.1 of nominal voltage
Nominal current rating 250V AC 1:	see below (for inductive load refer COS ϕ graph adjacent)
Mechanical life:	20 x 10 ⁶ operations in AC, 50 x 10 ⁶ operations in DC
Operate time:	≤12m. sec. energisation ≤10m. sec. de-energisation
Ambient temperature:	-40°C to +70°C
Insulation resistance:	≥ 10,000 M Ω at 500 V DC

Miniature control relay 2 changeover contacts

Cat. No.	Contact Config.	Amps (AC 1)
55.32	Solder or plug-in connection	10
55.12	PCB mounting	10 ²⁾

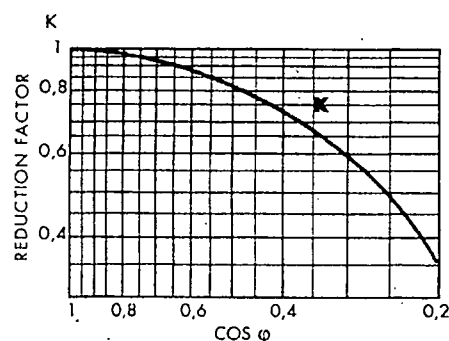
Miniature control relay 4 changeover contacts

Cat. No.	Contact Config.	Amps (AC 1)
55.34	Solder or plug-in connection	5
55.14	PCB mounting	5

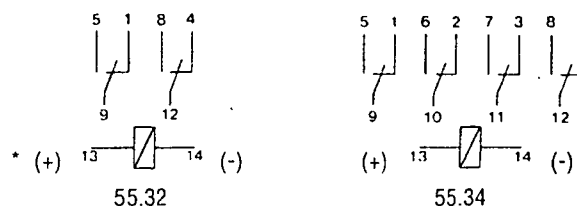
Options

- Gold flashed contacts add 5000 to Part No.

Load reduction coefficient vs cos ϕ

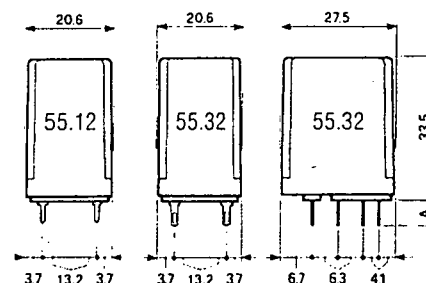


Connections



Note: * Polarity when using LED/Diode modules

Dimensions mm



- Notes: ¹⁾ For adjacent contacts; 250V max.
²⁾ Available in 12V DC and 240V AC only
 Available on indent only.

Recommended bases 2 Pole

94.72

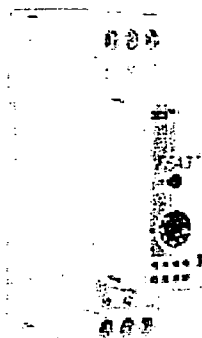
4 Pole 94.74

All technical data is based on an ambient temperature of 20°C. -

Economy electronic time delay relays

Type RZ7-FE (with one changeover contact)

Refer catalogue RZ7



- Only 17.5mm wide (DIN circuit breaker size).
- DIN rail mounting.
- 5 timers cover a high percentage of applications.
- 24...240V AC and 24...48V DC.
- 6 selectable time ranges from 0.05 seconds to 10 hours.
- Terminals all touch protected (IP20).
- LED indication.
- High reliability SMD technology.
- Multifunction unit also available.

On delay timer

Cat. No. RZ7-FEA3TU23

Electronic time delay relays RZ7-FE (with one changeover contact)

All timers have selectable time ranges ¹⁾

0.05 ... 1s

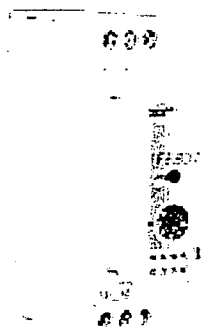
0.5 ... 10s

0.05 ... 60s

0.5 ... 10m

0.5...60m

0.5...10h



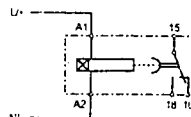
Description

Cat. No. ¹⁾ ²⁾

RZ7-FEA3TU23 On delay timer

On application of the supply voltage the output relay closes after time delay t .

RZ7-FEA3TU23

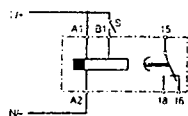
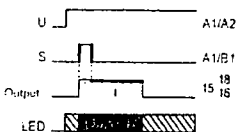


Off delay timer

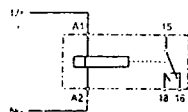
Cat. No. RZ7-FEB3TU23

The output relay closes as soon as B1 terminal is energised. When the B1 terminal is de-energised the output relay remains closed for time delay t .

RZ7-FEB3TU23

On application of the supply voltage the output relay closes for the set time delay t .

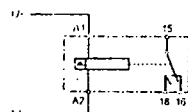
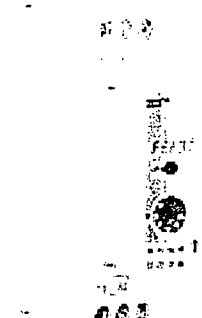
RZ7-FED3TU23

On delay impulse
timing relay

Cat. No. RZ7-FED3TU23

On application of the supply voltage, the output relay closes for the time delay t and then opens for the same set time. The cycle continues until the supply voltage is removed.

RZ7-FEF3TU23

Notes: ¹⁾ All timers are multivoltage 24...240V AC and 24...48V DC.

Simply order function by Cat. No.

²⁾ For technical data on RZ7-FE (with one changeover contact)

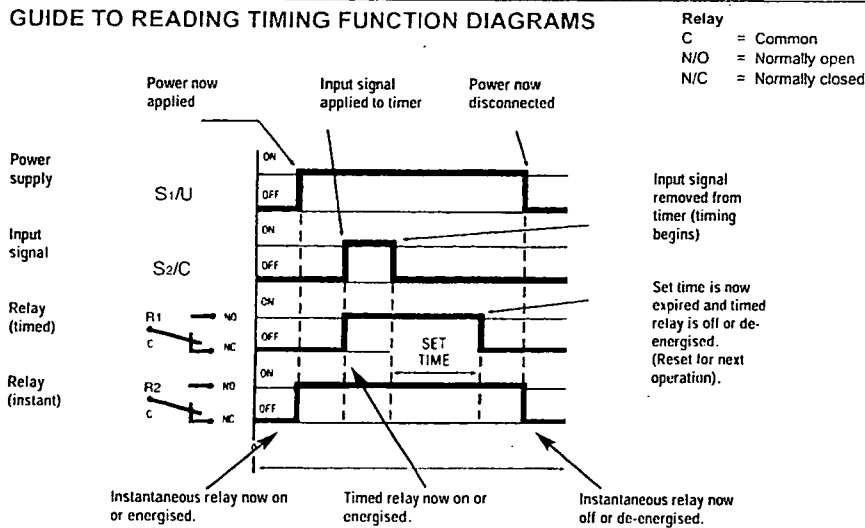
Flasher timer

Cat. No. RZ7-FEF3TU23

Electronic time delay relays

Timing functions

GUIDE TO READING TIMING FUNCTION DIAGRAMS



NOTE:

If power is disconnected during actual timing most electronic timers will reset to the preset time, ready for re-application of supply voltage.

DELAY ON ENERGISATION

1 TIMED CONTACT

Also referred to as:

Delay on
Delay on make
On delay
Delay on operate

FUNCTION DIAGRAM



MODE OF OPERATION

When power is applied to the timer, the set time delay commences and the relay remains in its normal state. At the end of the set time delay, the relay changes over to the opposite position or on state. At the disconnection of the power supply the relay changes back to its normal state, and the timer is reset for its next operation.

SUITABLE PRODUCTS

OARFN, OAR, BAR, OLR, BLR, OLRM, BLRM, OAS, MRA1, OLS, MAR, MLR, CZE7, CRZE4, RZ7-FSA3, RZ7-FSA4 (2 contacts), M814, M815, RZ7-FEA, MRW

DELAY ON DE-ENERGISATION

1 TIMED CONTACT

Also referred to as:

Delay on break
Delay off

FUNCTION DIAGRAM



MODE OF OPERATION

This timer is permanently supplied. When power is applied to the timer it is prepared for operation. At the closure of the input signal, the relay changes over to the opposite position or on state. Timing does not commence. At the loss of the input signal timing commences and at the end of the set time delay the relay changes back to its normal or de-energised state and the timer is reset for its next operation.

SUITABLE PRODUCTS

OCRFN, MRU1, OCR, BCR, BLR, OLRM, BLRM, OLS, BLS, MLR, RZ7-FSB3, RZ7-FSB4 (2 contacts), M814, RZ7-FEB.

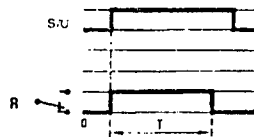
INTERVAL

1 TIMED CONTACT

Also referred to as:

One shot

FUNCTION DIAGRAM



MODE OF OPERATION

When power is applied to the timer, the set time delay commences and the relay changes over to the opposite position or on state. At the end of the set time delay, the relay changes back to its normal or de-energised state, and the timer is reset for its next operation.

SUITABLE PRODUCTS

MRU1, OLR, BLR, OLRM, BLRM, OLS, BLS, MLR, M814, RZ7-FSD3, RZ7-FSM4 (2 contacts), RZ7-FED.

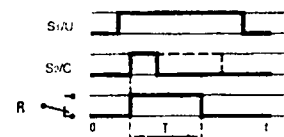
SINGLE SHOT

1 TIMED CONTACT

Also referred to as:

Impulse lengthener

FUNCTION DIAGRAM



MODE OF OPERATION

This timer is permanently supplied. Upon the closure of an input signal the relay changes over to the opposite position or on state and timing commences. At the end of the set time delay, the relay changes back to its normal state and the timer is reset for its next operation. The input signal can be held for either a shorter, or longer time than the preset time delay and it will not influence the operation of the relay.

SUITABLE PRODUCTS

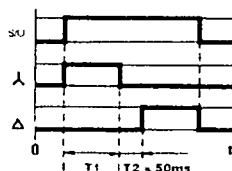
MRU1, OLR, BLR, OLRM, BLRM, OLS, BLS, MLR, M814, RZ7-FSL3.

STAR/DELTA

2 TIMED CONTACTS

This function is utilised to control timed operation of the star and delta contactors in a star delta motor starter.

FUNCTION DIAGRAM



MODE OF OPERATION

When power is applied to the timer, the set time delay T1 commences and the star relay changes over to the opposite position or on state. At the end of the set time delay T1 the star relay changes back to its normal or de-energised state and the fixed preset time T2 commences. At the end of the fixed time delay T2 the delta relay changes over to the opposite position or on state. The delta relay remains on until power is disconnected from the timer.

SUITABLE PRODUCTS

QDR, CRZY4, RZ7-FSY2.

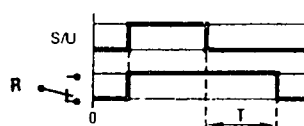
TRUE DELAY OFF

1 TIMED CONTACT

Also referred to as:

Delay on loss of supply
Delay on release

FUNCTION DIAGRAM



MODE OF OPERATION

When power is applied to the timer, the relay changes over to the opposite or on state. Timing does not commence. When the power is disconnected, the set time delay commences, and the relay remains in its on state. At the end of the set time delay, the relay changes back to its normal or de-energised state, and the timer is reset for its next operation.

SUITABLE PRODUCTS

OKR, PKR, RZ7-FSQ

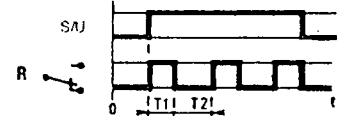
RECYCLING

1 TIMED CONTACT (OFF PULSE FIRST)

Also referred to as:

Repeat cycling
Symmetrical recycler
Asymmetrical recycler

FUNCTION DIAGRAM



MODE OF OPERATION

When power is applied to the timer, the set time delay of the off pulse commences and the relay remains in its normal state. At the end of the set time delay of the off pulse, the relay changes over to the opposite position or on state. The set time delay of the on pulse will now commence and at the end of the set time delay the relay will change back to its normal or de-energised state. This repeat cycling will continue until power is removed from the timer. The timer will then be reset for its next operation to begin with an off pulse. The operation of a recycling timer with on pulse facility is the same as above, although it starts with an on pulse upon application of the power supply.

SUITABLE PRODUCTS

MRL1, ODR, BDR, ODS, BDS, M814, RZ7-FSF3 (on pulse first), RZ7-FSM4 (on pulse first), MDR2U, RZ7-FEF.

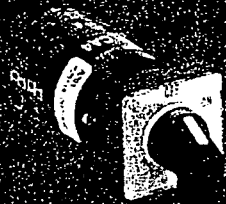
UNCLEAR
TEXT



KRAUS & NAIMER

australian solenoid co. pty. ltd

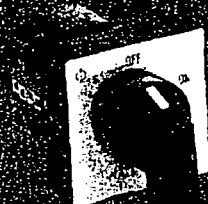
QUICK REFERENCE
CATALOGUE SW90



30mm

S00

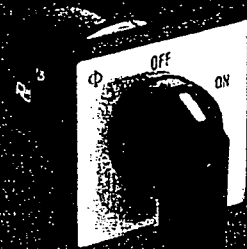
CA4	10A	2.5A	Side access
CG4	10A	2.5A	Rear access
CA4-1	Dry circuit switching		Side access
CG4-1	Dry circuit switching		Rear access



48mm

S0

CA10	20A	7.5kW	Side access
CA20	25A	11kW	Side access
CA20-1	25A	11kW	Side access
CA20-2	25A	11kW	Side access
CG8	20A	7.5kW	Rear access



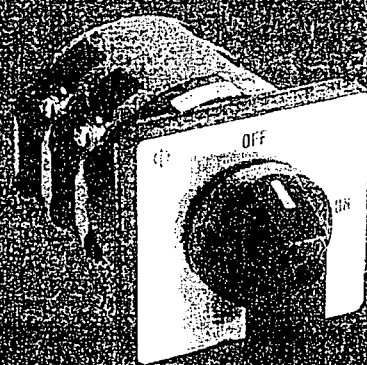
64mm

S1

CA10E	20A	7.5kW	20A
CA20E	25A	11kW	25A
CG6	32A	15kW	32A
CG7	40A	22kW	50A
CA7	63A	30kW	63A

KRAUS & NAIMER industrial switches incorporate ON LOAD motor and power switching capabilities to meet International and National standards together with the option of self cleaning 'H' bridge contacts suitable for modern electronic circuitry and some corrosive environments.

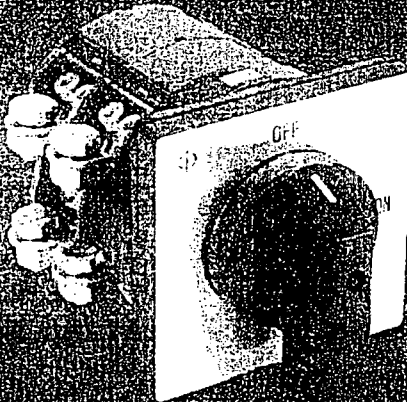
The compact and flexible product design and distribution network allows competitively priced units to your specific requirements to be delivered promptly.



88mm

S2

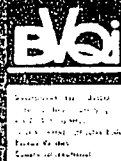
CA3	63A	30kW	63A
CGD	100A	45kW	115A
CL25	150A	75kW	150A



130mm

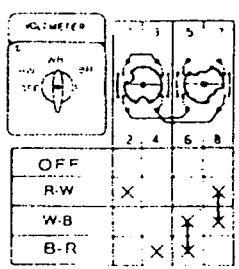
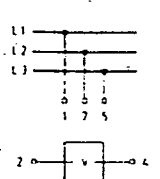
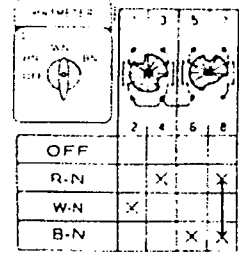
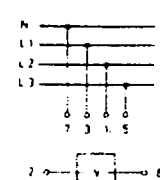
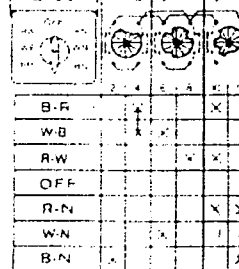
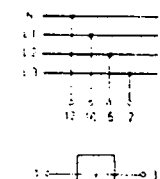
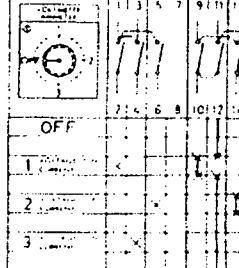
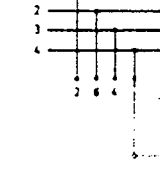
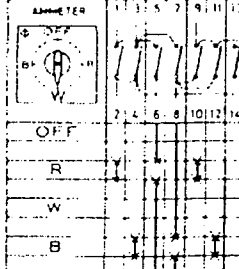
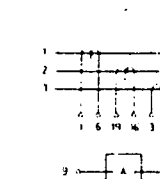
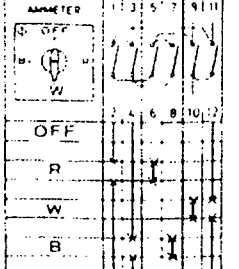
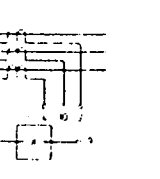
S3

CB15	415A	132kW	315A
LB00	450A	132kW	500A
LB00	500A	132kW	800A
LB00	630A	132kW	1100A



Refer General Catalogue or Switch Technical Data Leaflet for Specific Application Ratings.
For KG Switches - refer brochure A156 GB

UNCLEAR
TEXT

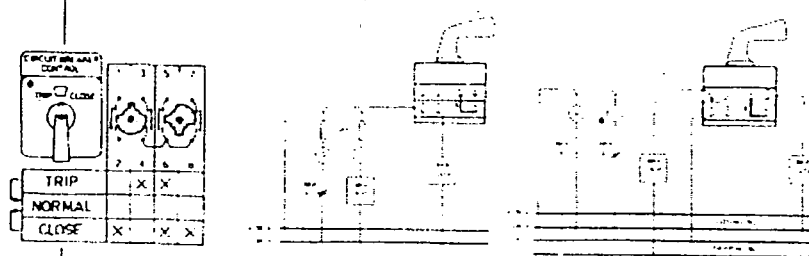
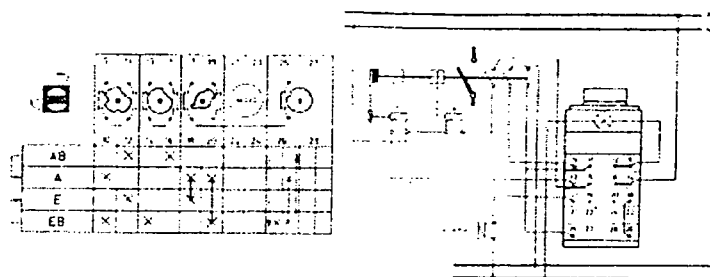
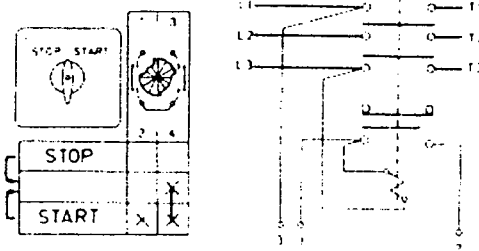
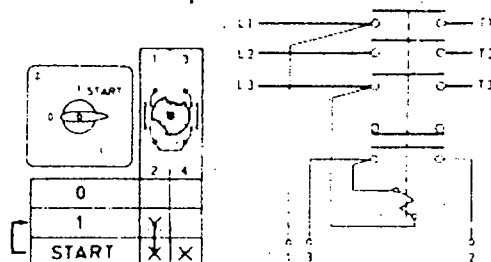
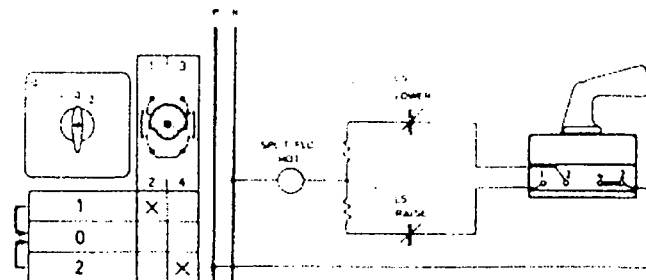
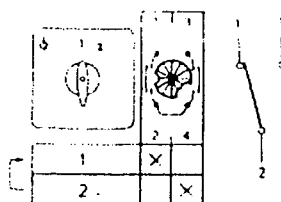
APPLICATION	SWITCH DEVELOPMENT - WIRING DIAGRAM	ORDERING DETAILS	
VOLTMETER SWITCH Three phase Three wire	 	Standard Switch A004-625	CA4 CG4 CA10 CA10B CG8 CA20 CA20B
VOLTMETER SWITCH Three phase To Neutral	 	Standard Switch A005-624	CA4 CG4 CA10 CA10B CG8 CA20 CA20B
VOLTMETER SWITCH Phase to Phase And Phase To Neutral	 	Standard Switch A007-625	CA4 CG4 CA10 CA10B CG8 CA20 CA20B
VOLTMETER AMMETER SWITCH Three Phase Four Wire	 	Standard Switch A033-600	CA4 CG4 CA10 CA10B CG8 CA20 CA20B
AMMETER SWITCH Whole Current	 	Standard Switch A038-622	CA10 CA10B CG8 CA20 CA20B C26 C32 C43 C80
AMMETER SWITCH Three C.T. Coils Star Point	 	Standard Switch A048-624	CA4 CG4 CA10 CA10B CG8 CA20 CA20B

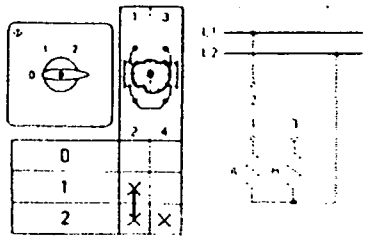
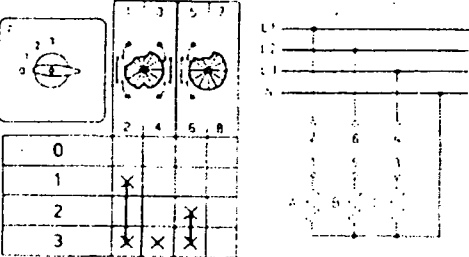
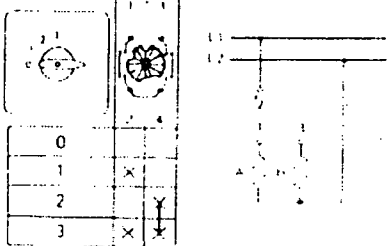
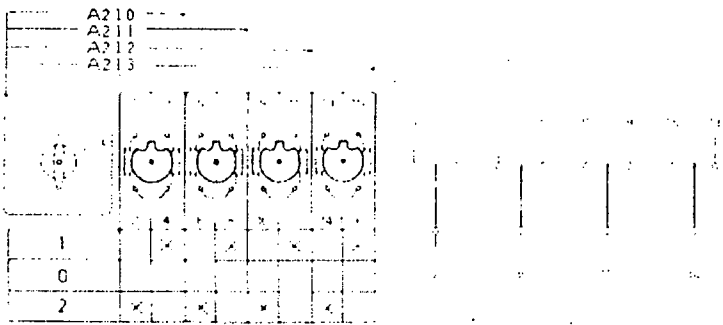
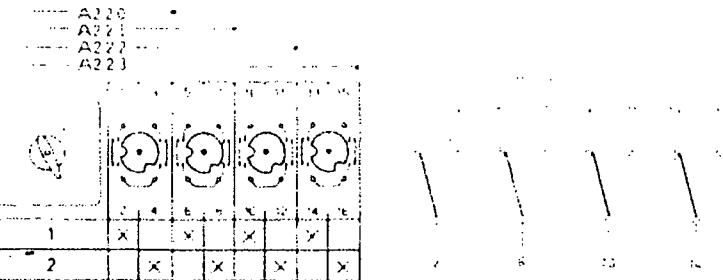
MANY OTHER STANDARD OR SPECIAL CIRCUITARY SWITCHES READILY AVAILABLE

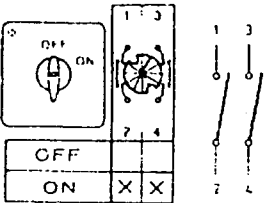
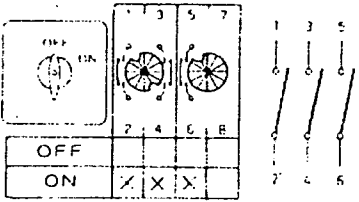
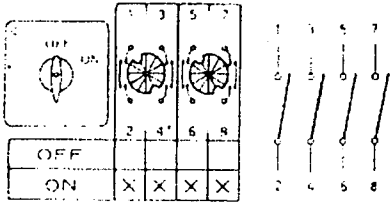
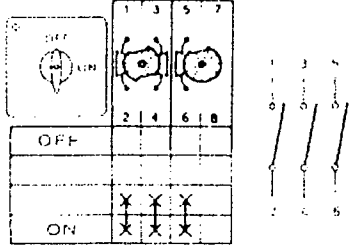
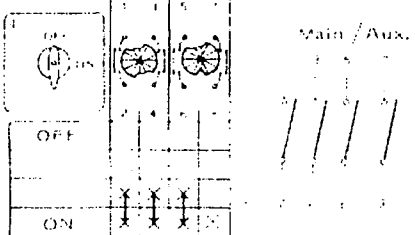
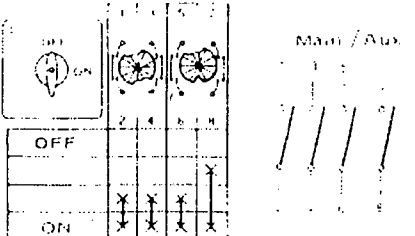
APPLICATION

SWITCH DEVELOPMENT - WIRING DIAGRAM

ORDERING DETAILS

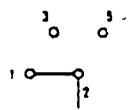
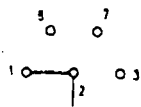
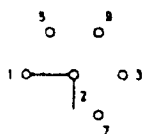
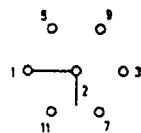
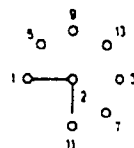
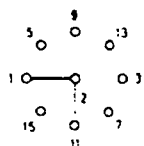
CIRCUIT
BREAKER
CONTROL
SWITCHSpecial Switch
AUH254CA10
CA10B
CA20
CA20B
C26
CAD11
CAD12CONTROL
AND
INDICATOR
SWITCHStandard Switch
A190CA10
CA10B
CA20
CA20B
C26CONTROL
SWITCH
Stop-StartStandard Switch
A176-600CA4
CG4
CA10
CA10B
CG8
CA20
CA20B
C26
CAD11
CAD12CONTROL
SWITCH
Stop-Start
with isolate
positionStandard Switch
A178-600CA4
CG4
CA10
CA10B
CG8
CA20
CA20B
C26
CAD11
CAD12CONTROL
SWITCH
Trip Close
CircuitStandard Switch
A214-600CA4
CG4
CA10
CA10B
CG8
CA20
CA20B
C26
CAD11
CAD12CONTROL
SWITCH
One
Momentary
PositionStandard Switch
A295-600CA4
CG4
CA10
CA10B
CG8
CA20
CA20B
C26
CAD11
CAD12

APPLICATION	SWITCH DEVELOPMENT - WIRING DIAGRAM	ORDERING DETAILS	
GANG SWITCH Two Element		STANDARD SWITCH A310-600	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 CAD11 CAD12
GANG SWITCH Three Element		STANDARD SWITCH A311-600	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 CAD11 CAD12
GANG SWITCH Two Element		STANDARD SWITCH A330-600	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 CAD11 CAD12
CHANGE OVER SWITCHES With off	 <p>"I" series diagrams on application</p>	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 C80	C125 C315 L400 L600 CAD11 CAD12
CHANGE OVER SWITCHES Without Off	 <p>"I" series diagrams on application</p>	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 C80	C125 C315 L400 L600 CAD11 CAD12

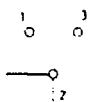
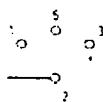
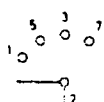
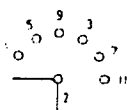
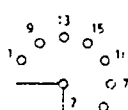
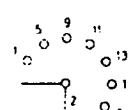
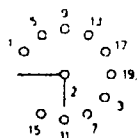
APPLICATION	SWITCH DEVELOPMENT - WIRING DIAGRAM	ORDERING DETAILS	
ISOLATING SWITCHES Two Pole 60° Angle		STANDARD SWITCH A201-620	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 CAD11 CAD12
ISOLATING SWITCHES Three Pole 60° Angle		STANDARD SWITCH A202-620	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42
ISOLATING SWITCH Four Pole 60° Angle		STANDARD SWITCH A203-620	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C42 CAD11 CAD12
ISOLATING SWITCH Three Pole 90° Angle		STANDARD SWITCH A292-621	C26 C32 C42 C80 C125 C315
ISOLATING SWITCH Three Main Poles Plus Early Break Auxiliary Contact		STANDARD SWITCH A327-621	C26 C32 C42 C80 C125 C315 L400
ISOLATING SWITCH Three Main Poles Plus Late Break Auxiliary contact		STANDARD SWITCH A293-621	C26 C32 C42 C80 C125 C315 L400

MULTI-STEP SWITCHES

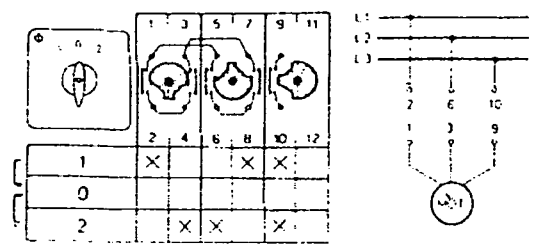
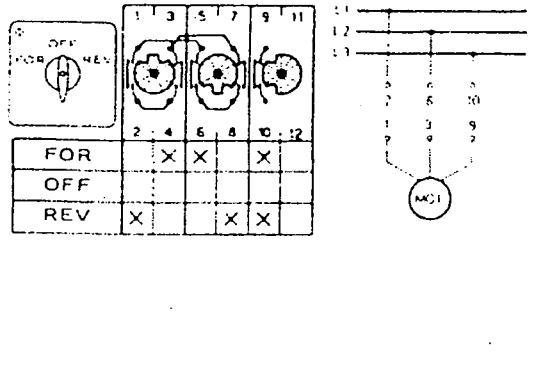
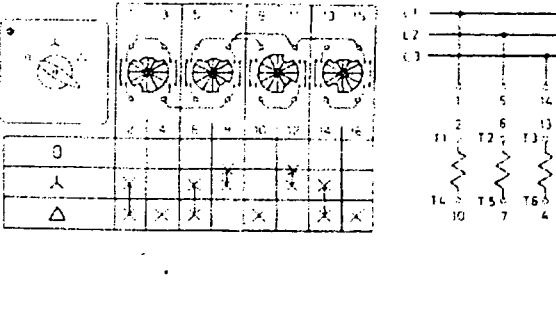
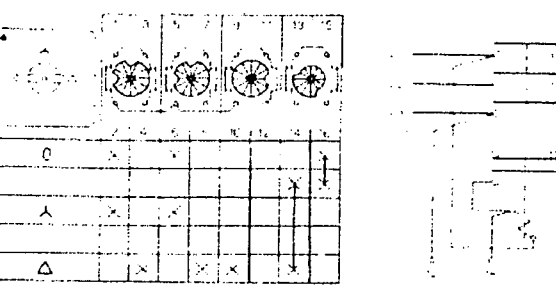
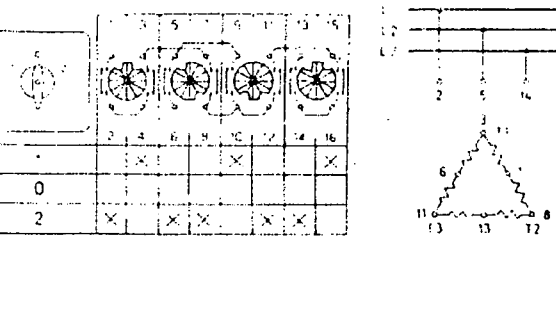
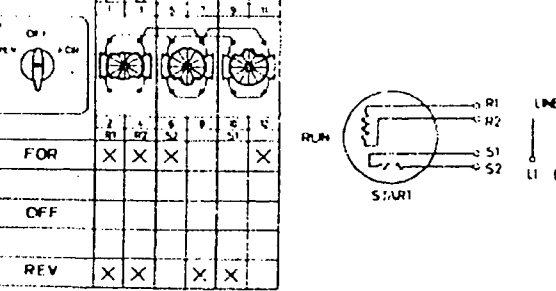
SINGLE POLE WITHOUT OFF

A 230
3 step, 2 st.A 231
4 step, 2 st.A 232
5 step, 3 st.A 233
6 step, 3 st.A 234
7 step, 4 st.A 235
8 step, 4 st.A 236
9 step, 5 st.A 237
10 step, 5 st.A 238
11 step, 6 st.A 239
12 step, 6 st.

SINGLE POLE WITH OFF

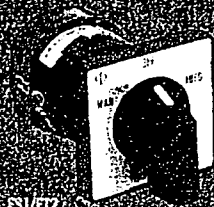
A 240
2 step, 1 st.A 241
3 step, 2 st.A 242
4 step, 2 st.A 243
5 step, 3 st.A 244
6 step, 3 st.A 245
7 step, 4 st.A 246
8 step, 4 st.A 247
9 step, 5 st.A 248
10 step, 5 st.A 249
11 step, 6 st.

Numerous Multi-Pole Multi-Step switches readily available.
Selector switches can be assembled to suit your standard or special circuit requirements.

APPLICATION	SWITCH DEVELOPMENT - WIRING DIAGRAM	ORDERING DETAILS	
THREE PHASE REVERSING SWITCH Spring Return To Off		STANDARD SWITCH A228-600	CA10 CA10B CG8 CA20 CA20B C26
THREE PHASE REVERSING SWITCH		STANDARD SWITCH A401-620	CA4 CG4 CA10 CA10B CG8 CA20 CA20B C26 C32 C43 C80
THREE PHASE STAR-DELTA Reduced Voltage Starting		STANDARD SWITCH A410-600	CA10 CA10B CG8 CA20 CA20B C26 C32 C43 C80
THREE PHASE STAR-DELTA SWITCH For use with Contactor		STANDARD SWITCH A419-600	CA10 CA10B CG8 CA20 CA20B C26 C32 C43 C80
THREE PHASE SINGLE WINDING DELTA-OFF DOUBLE STAR TWO SPEED		STANDARD SWITCH A441-600	CA10 CA10B CG8 CA20 CA20B C26 C32 C43 C80
SINGLE PHASE REVERSING SWITCH		STANDARD SWITCH A622-600	CA10 CA10B CG8 CA20 CA20B C26 C32

UNCLEAR
TEXT

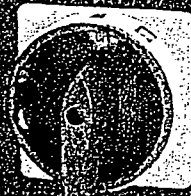
OPTIONAL EXTRAS



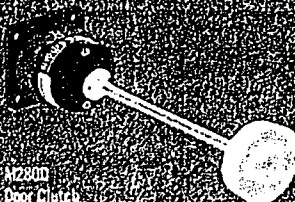
FS1/TT2
Single Hole Mounting
(CA, CG, SD & SU)



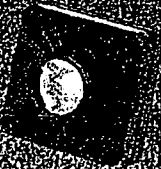
V7500
Key Operator



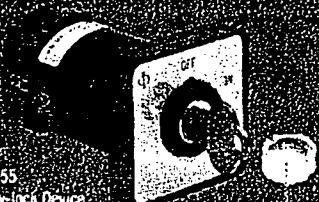
V8400
Padlock Device



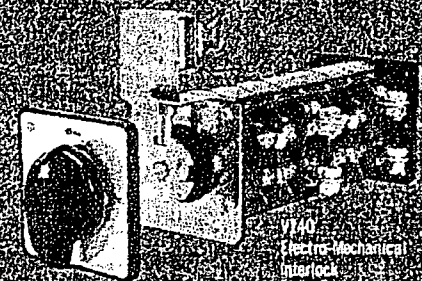
M2800
Door Clutch



V760
Key Lockable



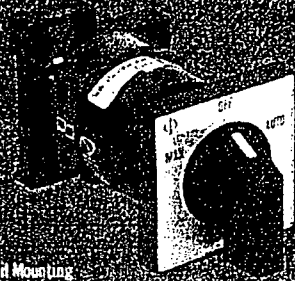
V755
Key-Lock Device



V740
Electric-Mechanical
Interlock



KDI
Heavy Duty Mounting

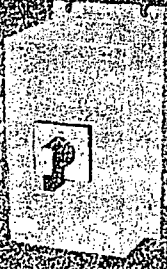


T146K
DIN Rail Mounting
(SO & SU Switches)

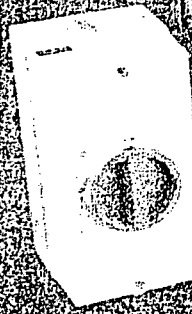
A wide range of accessories and attachments is available from stock including:
Shaft extensions, Base mounting, Heavy duty mounting, Enclosures (IP54, IP66 & D.I.P), Door clutches,
Weatherproof seals, Key locks, Interlocks, Various handles and Escutcheon plates.



ENCLOSION
TIG Stainless Steel



ENCLOSURE



ENCLOSURE



ENCLOSURE



ENCLOSURE



ENCLOSURE



ENCLOSURE

The enclosed is only a selection of an extensive range of our switches and optional extras.
Due to constant development of new products, specifications may alter without notice.

SYDNEY

7/11 Westport Street,
Northmead, N.S.W. 2151
TEL: (02) 9797 7333
FAX: (02) 9797 0092
sales@austrasol.com.au

MELBOURNE

17 Lonsdale Street,
Reverie, VIC 3042
TEL: (03) 9720 9777
FAX: (03) 9720 9766
salesvic@austrasol.com.au

BRISBANE

21 Brinkley Street,
Bowen Hills, Qld. 4006
TEL: (07) 3252 8344
FAX: (07) 3252 1497

ADELAIDE

9790-802 South Road,
Glandore, S.A. 5037
TEL: (08) 8371 1443
FAX: (08) 8371 0901

Pressure Sensor - PS100

The Greenspan Pressure sensor PS100 is calibrated to correct for linearity errors introduced by the sensor transducer. The instrument is packaged in a durable, robust, Delrin or Stainless Steel housing fully sealed against moisture penetration and is hardwired to either vented or non vented cable.

The transducer is a ceramic based capacitive element and is supplied in a variety of standard ranges. Greenspan can supply a copper sensor nose cone which inhibits biological growth on the sensor measuring element.

The Greenspan PS100 provides accurate and reliable data for a wide range of demanding measuring applications, guaranteeing long-term performance in the harshest of environments.

Specifications

Standard Ranges Available	0-2.5m 0-5m 0-10m 0-20m 0-25m 0-35m 0-70m
Operating Temperature	0-50°C
Accuracy	
* Combined linearity, hysteresis and repeatability	± 0.5% FS
* Temperature stability	± 0.01%/°C FS (referenced to 25°C)
Supply Voltage	8-27 VDC Reverse polarity protected Surge protected to 2kV
Quiescent Current	4mA
Warm up time to stable reading	6 secs
Output	4-20mA (2 wire)
Dimensions	Length 310mm SS body 45mm OD Delrin body 47mm OD
Wetted Materials	316 Stainless steel, Delrin
Output Load (min-max)	0-500 ohms at 14V 0-400 ohms at 12V
Storage Temperature	-20 to +60°C

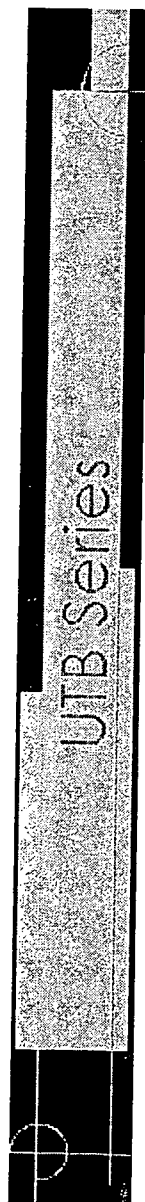
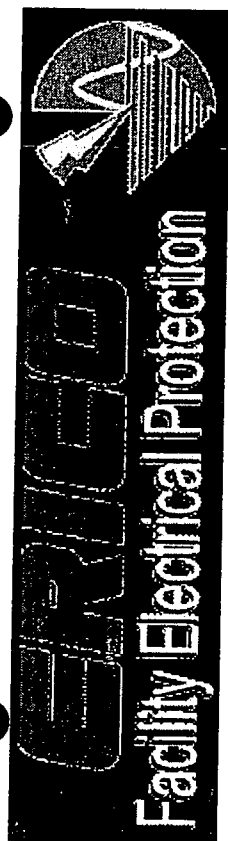


Greenspan Technology Pty Ltd A.C.N. 010 194 751
22 Palmerin Street, Warwick,
Queensland 4370 Australia
Tel +61 7 4660 1888 Fax +61 7 4660 1800
Email: admin@greenspan.com.au
Web site: www.greenspan.com.au

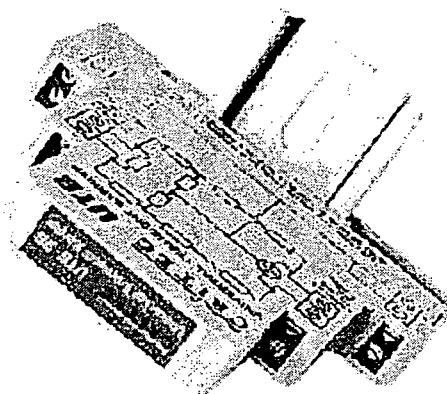


Quality Endorsed Company
ISO 9001
LIC 3067
Standards Australia

GREENSPAN
TECHNOLOGY



Universal Transient Barriers UTB Series



Application

Industrial environments are prone to dangerous and damaging transients and surges which can be induced onto signal lines as a result of lightning and power switching. These surges and transients

Features & Benefits

- Efficient, three stage clamping circuit technology ensures lowest possible residual let-through voltage to sensitive equipment

can cause erroneous equipment operation or corruption of process controllers resulting in system failure. Uncontrolled surges and transients create danger in terms of occupational health and safety and can lead to expensive equipment repairs, considerable production downtime, loss of revenue and loss of profits.

ERICO's UTB series provides transient protection for equipment from surges induced onto balanced pair signal lines and low voltage secondary power supply systems connected to industrial equipment. Industrial equipment can include such systems as programmable logic controllers (PLCs), Supervisory and control and data acquisition (SCADA) equipment, fire and security alarms and industrial monitoring and control equipment.

Specifications

Select the product from the list below to load the appropriate specification sheet:-

UNIVERSAL TRANSIENT BARRIERS - UTB SERIES	
UTB-9	UTB 9V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-18	UTB 18V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-36	UTB 36V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-72	UTB 72V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-100	UTB 100V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-140	UTB 140V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-200	UTB 200V CLAMP 12mm DIN PROFILE, 10kA 8/20us, 1.6A continuous current
UTB-S	UTB Subscriber Line Protector for Modems and Telephone Lines, 10kA
INSTALLATION PRINTS	
UTB-IP	Installation Print for UTB Series Modules



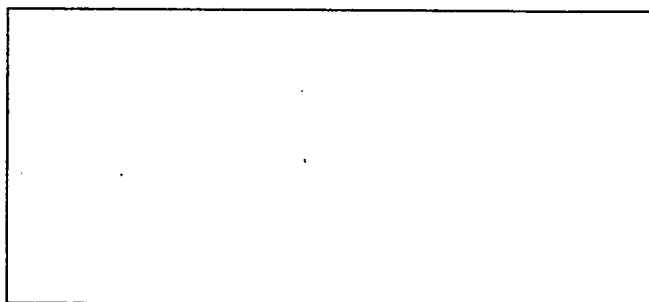
Over-voltage and self-resetting over-current protection
Robust design minimises the risk of damage due to high Earth Potential Rise (EPR)
Models to suit balanced pair signal lines operating at up to 8MHz and line currents up to 1.5A

UTB-S model for telephone / modem circuits
Low profile slim 12mm DIN rail mount, DIN 43 880 profile matches common switchboard panels. Screw mounting accessory included
Genuine 20kA 8/20us surge rating ensures high level protection and long service life.



Copyright © 2001 ERICO Inc.
Release Version: 2.00 [Europe / Asia]
This CD-ROM was last updated: August 2001 By: MJC

Valid for the following Soft starter Models:
MSF-017 to MSF-1400



MSF SOFT STARTER

INSTRUCTION MANUAL

Document number: 01-1363-01

Edition: r2

Date of release: 2001-04-20

© Copyright Emotron AB 2000

Emotron retain the right to change specifications and illustrations in the text, without prior notification. The contents of this document may not be copied without the explicit permission of Emotron AB.

SAFETY INSTRUCTIONS

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 gI, gG, to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if preferred. The normal guarantee is valid even if superfast semiconductor fuses are not used.

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

1. GENERAL INFORMATION	6	5.6	Keyboard lock	23
1.1 Integrated safety systems	6	5.7	Overview of soft starter operation and parameter set-up.	23
1.2 Safety measures	6	6. INSTALLATION AND CONNECTION	24	
1.3 Notes to the Instruction Manual	6	6.1	Installation of the soft starter in a cabinet	24
1.4 How to use the Instruction Manual	6	6.2	Connections	28
1.5 Standards	6	6.3	Connection and setting on the PCB control card	32
1.6 Tests in accordance with norm EN60204	6	6.4	Minimum wiring	33
1.7 Inspection at delivery	7	6.5	Wiring examples	34
1.7.1 Transport and packing	7	7. FUNCTIONAL DESCRIPTION SET-UP MENU	35	
1.8 Unpacking of MSF-310 and larger types	7	7.1	Ramp up/down parameters	36
2. DESCRIPTION	8	7.1.1	RMS current [005]	36
2.1 General	8	7.2	Start/stop/reset command	37
2.2 MSF control methods	9	7.2.1	2-wire start/stop with automatic reset at start	37
2.2.1 General features	9	7.2.2	2-wire start/stop with separate reset	37
3. HOW TO GET STARTED	10	7.2.3	3-wire start/stop with automatic reset at start.	37
3.1 Checklist	10	7.3	Menu expansion setting.	38
3.2 Main functions/Applications	10	7.4	Voltage control dual ramp	38
3.3 Motor Data	10	7.5	Torque control parameters	39
3.4 Setting of the start and stop ramps	11	7.6	Current limit (Main Function)	39
3.5 Setting the start command	12	7.6.1	Voltage ramp with current limit	39
3.6 Viewing the motor current	12	7.6.2	Current limit	40
3.7 Starting	12	7.7	Pump control (Main Function)	40
4. APPLICATIONS AND FUNCTIONS SELECTION	13	7.8	Analogue Input Control (Main Function)	41
4.1 Soft starter rating according to AC53a	13	7.9	Full voltage start, D.O.L. (Main Function)	41
4.2 Soft starter rating according to AC53b	13	7.10	Torque control (Main function)	42
4.3 MSF Soft starter ratings	14	7.11	Torque boost	43
4.4 The Application Ratings List	14	7.12	Bypass	43
4.5 The Application Functions List	16	7.13	Power Factor Control	46
4.6 Function and combination matrix	19	7.14	Brake functions	46
4.7 Special condition	20	7.15	Slow speed and Jog functions	48
4.7.1 Small motor or low load	20	7.15.1	Slow speed controlled by an external signal.	48
4.7.2 Ambient temperature below 0xC	20	7.15.2	Slow speed during a selected time	49
4.7.3 Phase compensation capacitor	20	7.15.3	Jog Functions	49
4.7.4 Pole-changing contactor and two speed motor	20	7.15.4	DC-brake after slow speed at stop [040]	49
4.7.5 Shielded motor cable	20	7.16	Motor data setting	50
4.7.6 Slip ring motors	20	7.17	Programmable relay K1 and K2	51
4.7.7 Pump control with soft starter and frequency inverter together	20	7.18	Analogue output	52
4.7.8 Starting with counter clockwise rotating loads	20	7.19	Digital input selection	53
4.7.9 Running motors in parallel	20	7.20	Parameter Set	54
4.7.10 How to calculate heat dissipation in cabinets	20	7.21	Motor protection, overload (F2 alarm)	55
4.7.11 Insulation test on motor	20	7.22	Mains protection	56
4.7.12 Operation above 1000 m	20	7.23	Application protection (load monitor)	57
4.7.13 Reversing	20	7.23.1	Load monitor max and min/protection (F6 and F7 alarms)	57
5. OPERATION OF THE SOFT STARTER	21	7.23.2	Pre-alarm	58
5.1 General description of user interface	21	7.24	Resume alarms	61
5.2 PPU unit	21	7.24.1	Phase input failure F1	61
5.3 LED display	22	7.24.2	Run at current limit time-out F4	61
5.4 The Menu Structure	22	7.25	Slow speed with JOG	61
5.5 The keys	23			

7.26	Automatic return menu	62
7.27	Communication option, related Parameters	62
7.28	Reset to factory setting [199]	63
7.29	View operation	63
7.30	Keyboard lock	65
7.31	Alarm list	65
8.	PROTECTION AND ALARM	66
8.1	Alarm description	66
8.1.1	Alarm with stop and requiring a separate reset	66
8.1.2	Alarm with stop and requiring only a new start command	66
8.1.3	Alarm with continue run	66
8.2	Alarm overview	67
9.	TROUBLE SHOOTING	68
9.1	Fault, cause and solution	68
10.	MAINTENANCE	71
11.	OPTIONS	72
11.1	Serial communication	72
11.2	Field bus systems	72
11.3	External PPU.	72
11.3.1	Cable kit for external current transformers.....	72
11.4	Terminal clamp	73
12.	TECHNICAL DATA	74
13.	SET-UP MENU LIST	79
14.	INDEX	82
	REPRESENTATION	85

List of tables

Table 1	Applications Rating List	15
Table 2	Application Function List	17
Table 3	Combination matrix	19
Table 4	Start/stop combination.	19
Table 5	The keys	23
Table 6	Control modes	23
Table 7	MSF-017 to MSF-250.	25
Table 8	MSF-017 to MSF-250	25
Table 9	MSF-310 to MSF-1400	25
Table 10	MSF-310 to MSF-1400.	25
Table 11	Busbar distances	26
Table 12	PCB Terminals	32
Table 13	Set-up Menu overview	35

List of figures

Fig. 1	Scope of delivery.	7	Fig. 54	Wiring for slow speed external input.	53
Fig. 2	Unpacking of MSF-310 and larger models.	7	Fig. 55	Parameter overview	54
Fig. 3	Voltage control	8	Fig. 56	Connection of external control inputs.	54
Fig. 4	Current control	8	Fig. 57	The thermal curve	55
Fig. 5	Torque control	8	Fig. 58	Load monitor alarm functions.	60
Fig. 6	Standard wiring.	10	Fig. 59	The 2 Jog keys.	61
Fig. 7	Example of start ramp with main function voltage ramp.	12	Fig. 60	Option RS232/485	72
Fig. 8	Rating example AC53a.	13	Fig. 61	Option Profibus	72
Fig. 9	Duty cycle, non bypass.	13	Fig. 62	Shows an example of the External PPU after it has been built in.	72
Fig. 10	Rating example AC53b.	13	Fig. 63	Cable kit	72
Fig. 11	Duty cycle, bypassed	13	Fig. 64	The terminal clamp.	73
Fig. 12	MSF soft starter models.	21			
Fig. 13	PPU unit.	21			
Fig. 14	LED indication at different operation situation.	22			
Fig. 15	Menu structure.	22			
Fig. 16	MSF-017 to MSF-250 dimensions.	24			
Fig. 17	Hole pattern for MSF-017 to MSF-250	24			
Fig. 18	Hole pattern for MSF-170 to MSF-250 with upper mounting bracket instead of DIN-rail.	24			
Fig. 19	MSF -310 to MSF -835.	26			
Fig. 20	Hole pattern for screw attachment, MSF-310 to MSF-835. Hole distance (mm).	26			
Fig. 21	Busbar distances MSF -310 to MSF -835.	26			
Fig. 22	MSF -1000 to -1400	27			
Fig. 23	Hole pattern busbar MSF -1000 to -1400.	27			
Fig. 24	Connection of MSF-017 to MSF -085.	28			
Fig. 25	Connection of MSF-110 to MSF-145.	29			
Fig. 26	Connection of MSF-170 to MSF-250	30			
Fig. 27	Connection of MSF-170 to MSF-1400.	31			
Fig. 28	Connections on the PCB, control card.	32			
Fig. 29	Wiring circuit, "Minimum wiring".	33			
Fig. 30	Analogue input control, parameter set, analogue output and PTC input.	34			
Fig. 31	Forward/reverse wiring circuit.	34			
Fig. 32	Menu numbers for start/stop ramps, initial voltage at start and step down voltage at stop.	36			
Fig. 33	Menu numbers for dual voltage ramp at start/stop, initial voltage at start and step down-voltage at stop.	38			
Fig. 34	Current limit	39			
Fig. 35	Current limit	40			
Fig. 36	Pump control	40			
Fig. 37	Wiring for analogue input.	41			
Fig. 38	Setting voltage or current for analogue input.	41			
Fig. 39	Full voltage start.	41			
Fig. 40	Torque control at start/stop.	42			
Fig. 41	Current and speed in torque control.	42			
Fig. 42	The principle of the Torque Booster when starting the motor in voltage ramp mode.	43			
Fig. 43	Bypass wiring example MSF 310-1400.	44			
Fig. 44	Current transformer position when Bypass MSF-017 to MSF-250.	45			
Fig. 45	Current transformer position when Bypass MSF-310 to MSF-1400.	45			
Fig. 46	Braking time	46			
Fig. 47	Soft brake wiring example.	47			
Fig. 48	Slow speed controlled by an external signal.	48			
Fig. 49	Slow speed at start/stop during a selected time.	49			
Fig. 50	Start/stop sequence and relay function "Operation" and "Full voltage".	51			
Fig. 51	Wiring for analogue output.	52			
Fig. 52	Setting of current or voltage output.	52			
Fig. 53	Setting of J1 for current or voltage control.	53			

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 \perp (PE).

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

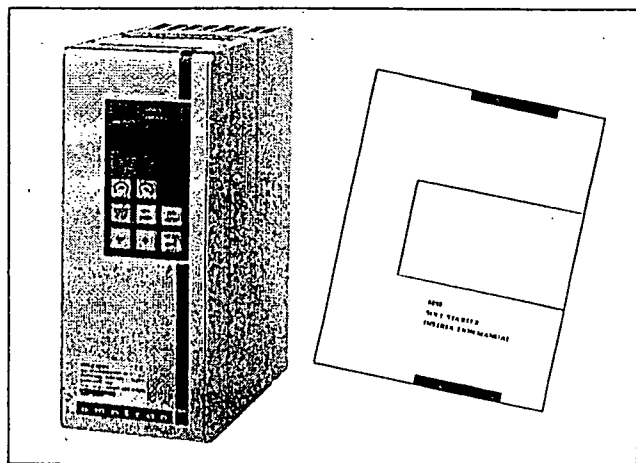


Fig. 1 Scope of delivery.

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 dismantled, 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.

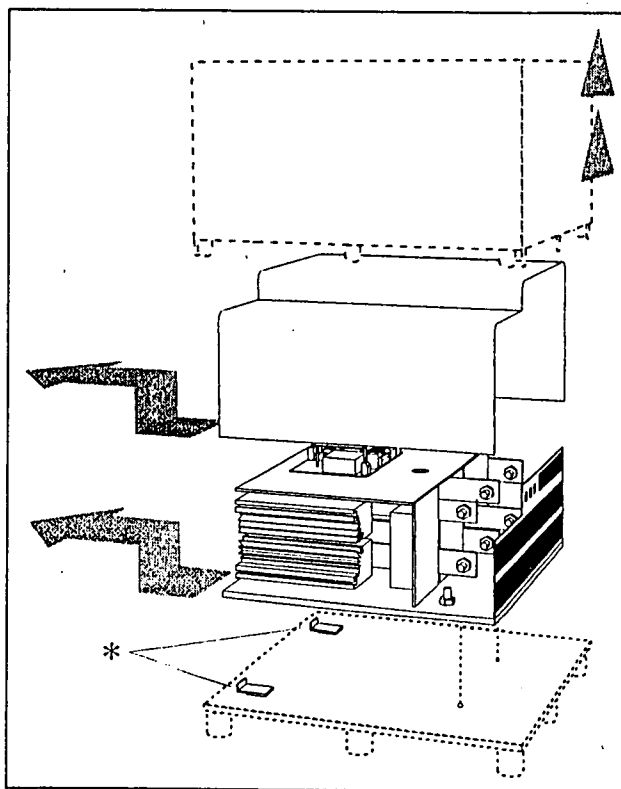
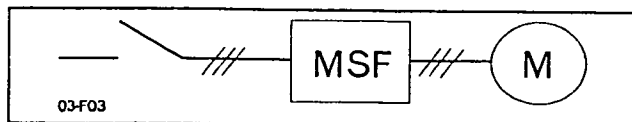


Fig. 2 Unpacking of MSF-310 and larger models.

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 KI 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 an 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.

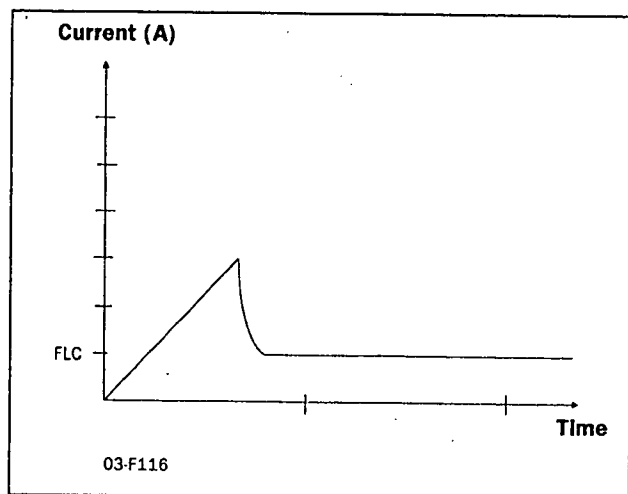


Fig. 3 Voltage control

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 on the maximum current allowed for the application.

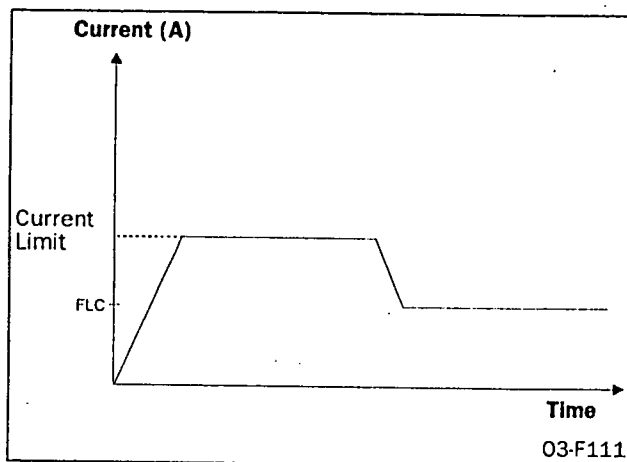


Fig. 4 Current control

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.

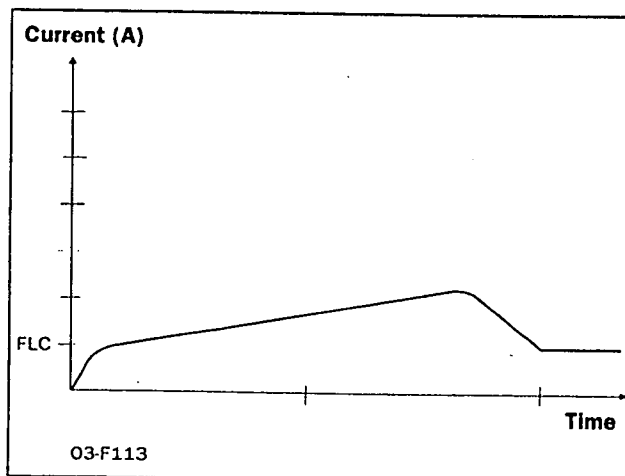


Fig. 5 Torque control

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

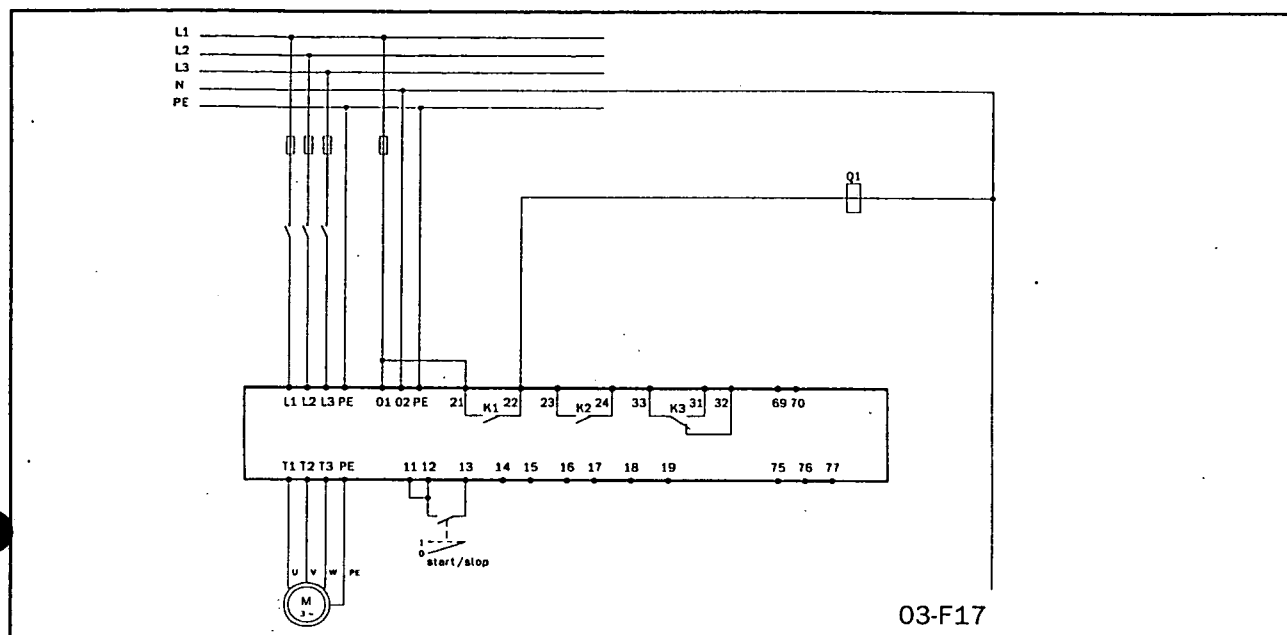


Fig. 6 Standard wiring.

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.

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

3.2 Main functions/Applications



WARNING! Make sure that all safety measures have been taken before switching on the supply.

Switch on the control voltage (normally 1 x 230 V), all segments in the display and the two LED's will be illuminated for a few seconds. Then the display will show menu 001. An illuminated display indicates there is supply voltage on the PCB. Check that you have mains voltage on the mains contactor or on the thyristors. The settings are carried out according to following:

The first step in the settings is to set menu 007 and 008 to "ON" to reach the main functions 020-025 and motor data 041-046.

NOTE! The main function is chosen according to the application. The tables in the applications and functions selection (table 1, page 15), gives the information to choose the proper main function.

3.3 Motor Data

Set the data, according to the motor type plate to obtain optimal settings for starting, stopping and motor protection.

NOTE! The default settings are for a standard 4-pole motor acc. to the nominal power of the soft-starter. The soft starter will run even if no specific motor data is selected, but the performance will not be optimal.

041°	
Nominal motor voltage	
400	
Default:	400 V
Range:	200-700 V

046°	
Nominal frequency	
50	
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.

042°	
Nominal motor current	
45	
Default:	Nominal current soft starter
Range:	25% - 150% of $I_{n_{soft}}$ in Amp

043°	
Nominal motor power	
22	
Default:	Nominal power soft starter
Range:	25% - 300% of $P_{n_{soft}}$ in kW

002°	
Start time ramp 1	
10	
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.

044°	
Nominal motor speed	
1450	
Default:	Nominal speed soft starter
Range:	500-3600 rpm

004°	
Stop time ramp 1	
oFF	
Default:	oFF
Range:	oFF, 2-120 sec

Set "ramp down time" at stop (2-120 s).
"oFF" if only soft start requires.

045°	
Nominal motor cos phi	
.86	
Default:	0.86
Range:	0.50-1.00

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 ^o	
Selection of control mode	
<div> <div></div> <div></div> <div></div> <div>2</div> </div>	
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 ^o	
RMS current read-out	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
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.

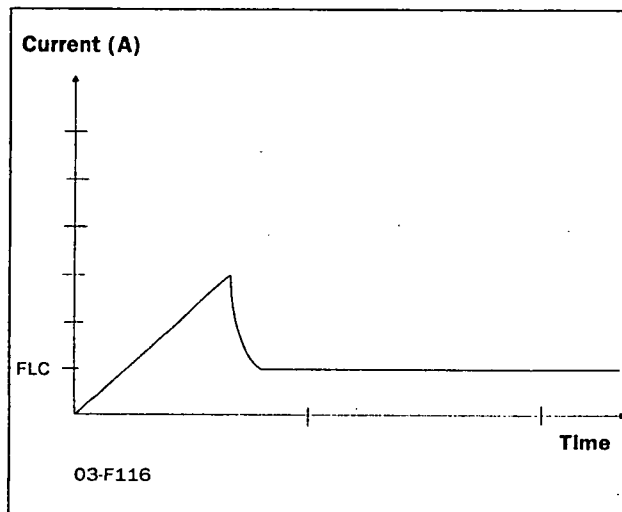


Fig. 7 Example of start ramp with main function voltage ramp.

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).

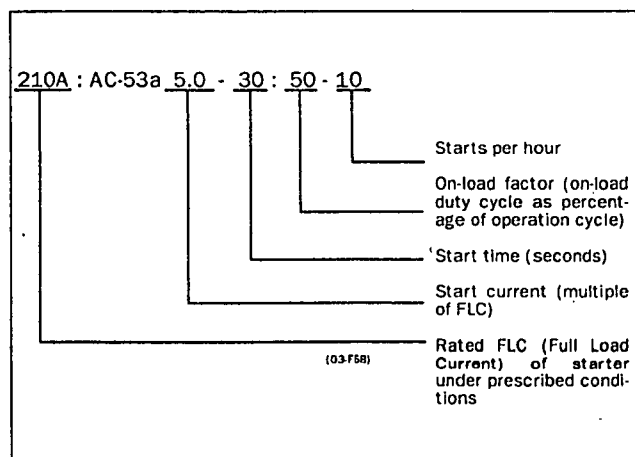


Fig. 8 Rating example AC53a.

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.

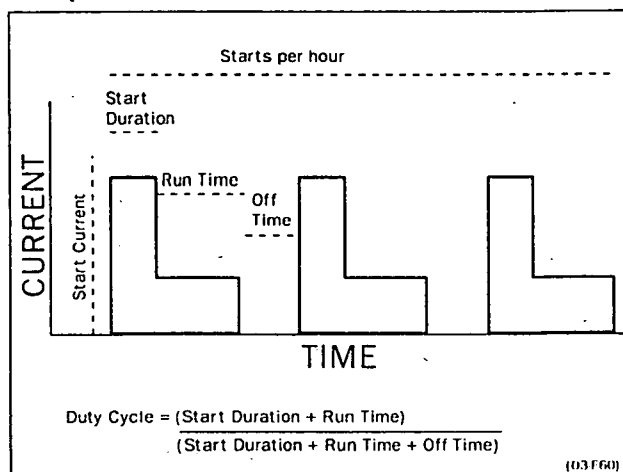


Fig. 9 Duty cycle, non bypass.

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.

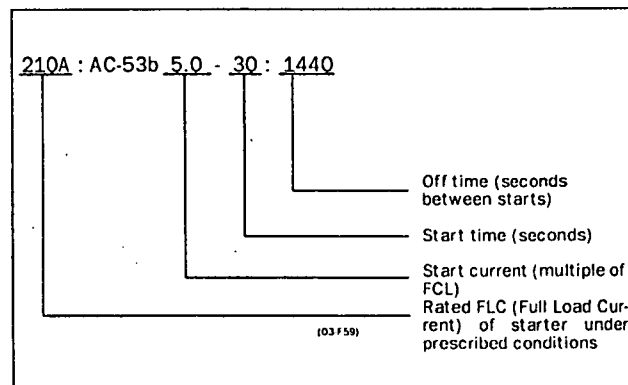


Fig. 10 Rating example AC53b.

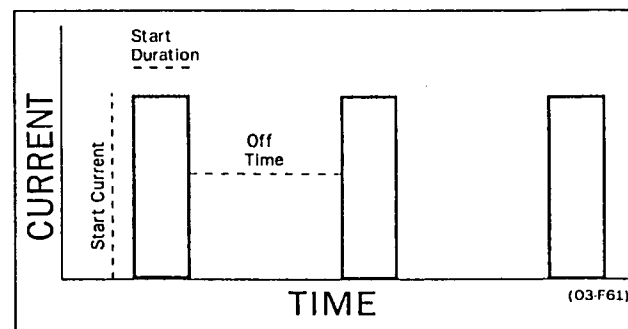


Fig. 11 Duty cycle, bypassed

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.

EXAMPLE:

Roller Mill:

- This is an application for heavy duty.
- Typical starting current of 350%.
- 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.

4.4 The Application Ratings List

Table 1 gives the Application Ratings List. With this list the rating for the soft starter and Main Function menu can be selected.

Description and use of the table:

- **Applications.**

This column gives the various applications. If the machine or application is not in this list, try to identify a similar machine or application. If in doubt please contact your supplier.

- **AC53a ratings.**

The rating according to AC53a norm is here classified in 2 ratings. The first for normal/light duty (3.0-30:50-10) and the second for heavy duty (5.0-30:50-10)

- **Typical Starting current.**

Gives the typical starting current for each application

- **Main Function menu.**

The Main Function menu is advised here.
"25;=1", means: program selection 1 in menu 25.

- **Stop function.**

Gives a possible Stop function if applicable.
"36;=1 / 38-40", means: program selection 1 in menu 36, also menus 38 to 40 can be selected.

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		-
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 please contact your supplier.
- **Problem.**
This column describes possible problems that are familiar for this kind of application.
- **Solution MSF.**
Gives the possible solution for the problem using one 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

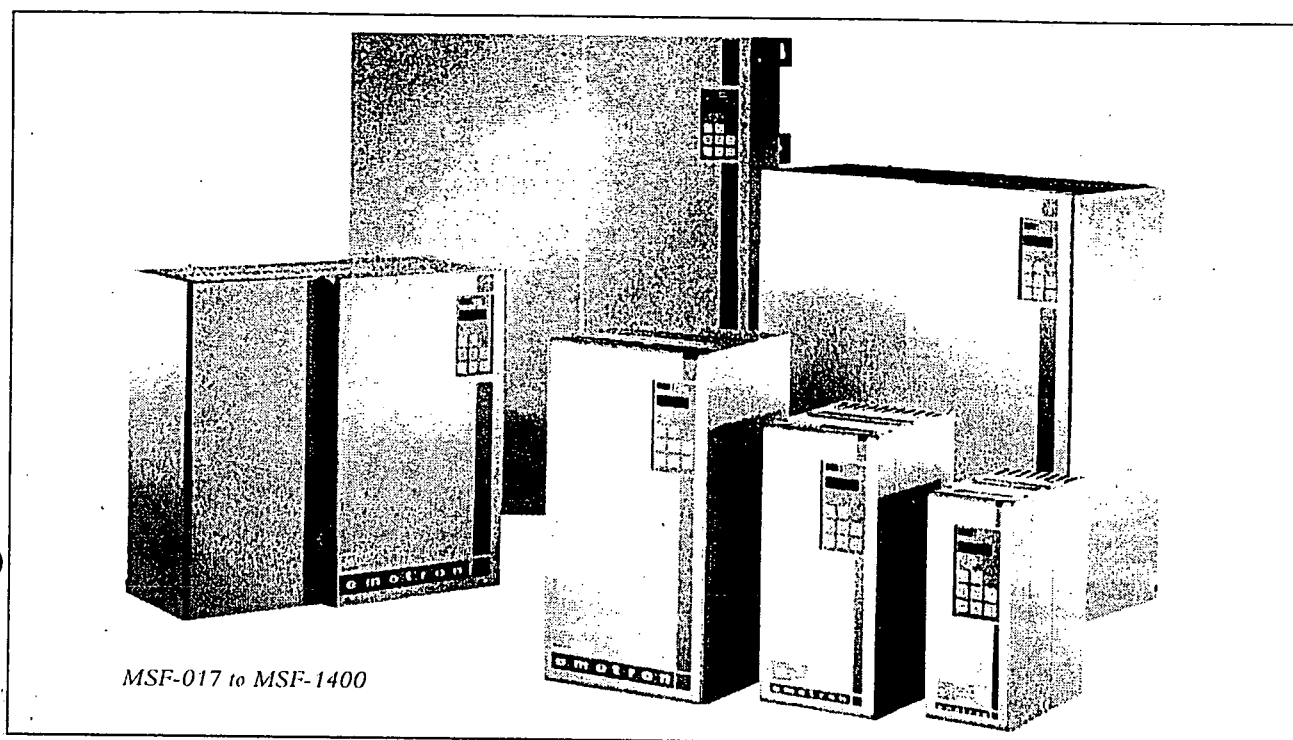


Fig. 12 MSF soft starter models.

5.2 PPU unit

5.1 General description of user interface



WARNING! Never operate the soft starter with removed front cover.

To obtain the required operation, a number of parameters must be set in the soft starter.

Setting/configuration is done either from the built-in keyboard or by a computer/control system through the serial interface or bus (option). Controlling the motor i.e. start/stop, selection of parameter set, is done either from the keyboard, through the remote control inputs or through the serial interface (option).

Setting



WARNING! Make sure that all safety measures have been taken before switching on the supply.

Switch on the supply (normally 1 x 230 V), all segments in the display will light up for a few seconds. Then the display will show menu 001. An illuminated display indicates there is supply voltage on the PCB.

Check that you have voltage on the mains contactor or on the thyristors. To be able to use all extended functions and optimize of the performance, program the motor data.

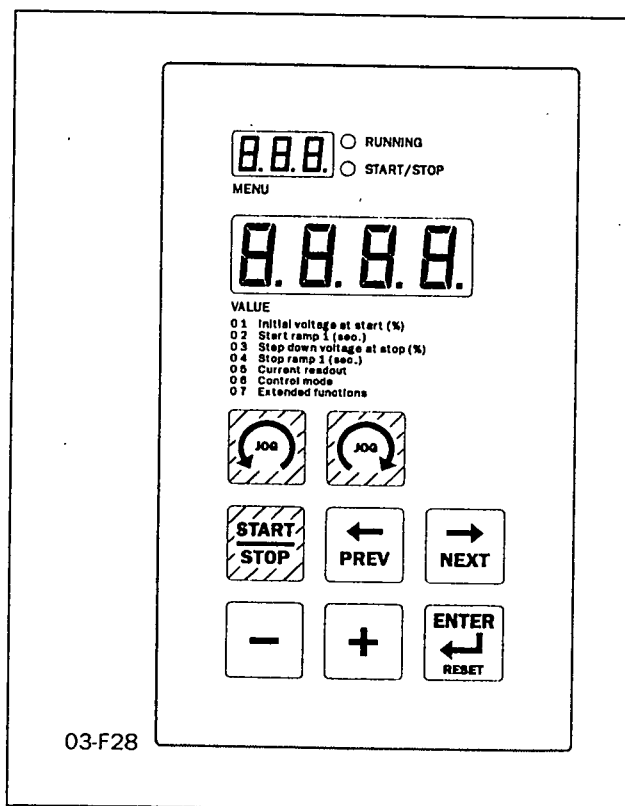


Fig. 13 PPU unit.

The programming and presentation unit (PPU) is a build-in operator panel with two light emitting diodes, three + four seven-segment LED-displays and a keyboard.

5.3 LED display

The two light emitting diodes indicates start/stop and running motor/machine. When a start command is given either from the PPU, through the serial interface (option) or through the remote control inputs, the start/stop-LED will be illuminated.

At a stop command the start/stop-LED will switch off. When the motor is running, the running-LED is flashing during ramp up and down and is illuminated continuously at full motor voltage.

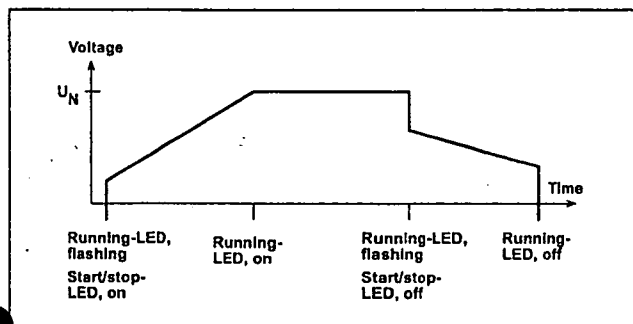


Fig. 14 LED indication at different operation situation.

5.4 The Menu Structure

The menus are organised in a simple one level structure with the possibility to limit the number of menus that are reachable by setting the value in menu 007 to "oFF" (factory setting). With this setting only the basic menus 001, 002, 003, 004, 005, 006 and 007 can be reached.

This to simplify the setting when only voltage start/stop ramps are used.

If menu 007 is in "on" and menu 008 "oFF" it is possible to reach all viewing menus and alarm lists as well.

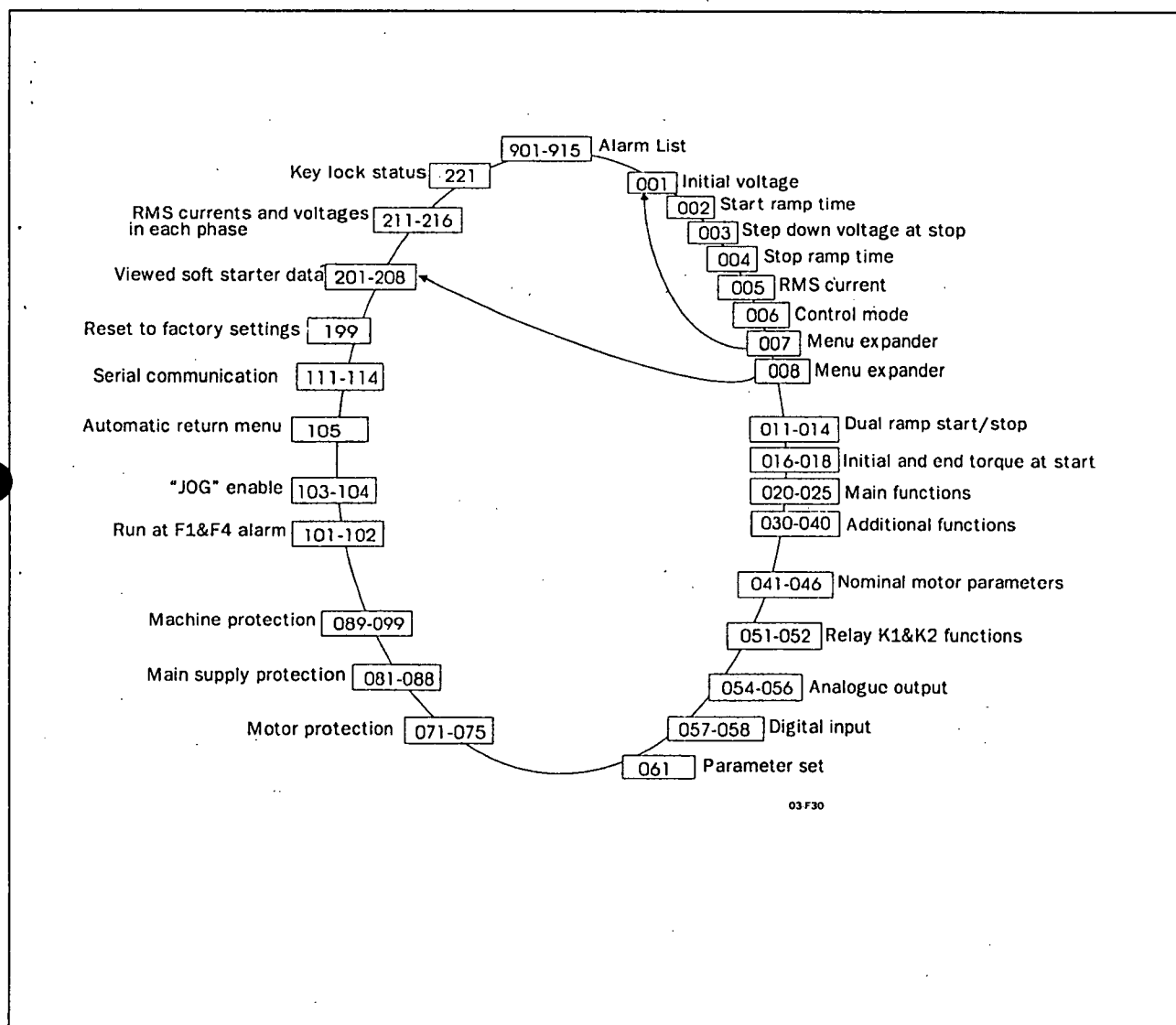


Fig. 15 Menu structure.

5.5 The keys

The function of the keyboard are based on a few simple rules. At power up menu 001 is shown automatically. Use the "NEXT →" and "PREV ←" keys to move between menus. To scroll through menu numbers, press and hold either the "NEXT →" or the "PREV ←" key. The "+" and "-" keys are used to increase respectively decrease the value of setting. The value is flashing during setting. The "ENTER ↵" key confirms the setting just made, and the value will go from flashing to stable. The "START/STOP" key is only used to start and stop the motor/machine.



The  and  keys are only used for JOG from the keyboard. Please note one has to select enable in menu 103 or 104, see § 7.25, page 61.

Table 5 The keys









Start/stop motor operation.	
Display previous menu.	
Display next menu.	
Decrease value of setting.	
Increase value of setting.	
Confirm setting just made. Alarm reset.	
JOG Reverse	
JOG Forward	

Table 6 Control modes

Operation/ Set-up		Start/Stop	JOG fwd/rev	Alarm reset	Setting of parameters	
					Parameter set with external selection Menu 061=0	Parameter set with internal selection Menu 061=1-4
Control mode						
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

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 ⁰	
<div> <div></div> <div></div> <div>n</div> <div>o</div> </div>	
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.

6. INSTALLATION AND CONNECTION

Mounting, wiring and setting the device into operation must be carried out by trained personnel (electricians specialised in heavy current technology):

- In accordance with the local safety regulations of the electricity supply company.
- In accordance with DIN VDE 0100 for setting up heavy current plants.

Care must be taken to ensure that personnel do not come into contact with live circuit components.



WARNING! Never operate the soft starter with removed front cover.

6.1 Installation of the soft starter in a cabinet

When installing the soft starter:

- Ensure that the cabinet will be sufficiently ventilated, after the installation.
- Keep the minimum free space, see the tables on page 25.
- Ensure that air can flow freely from the bottom to the top.

NOTE! When installing the soft starter, make sure it does not come into contact with live components. The heat generated must be dispersed via the cooling fins to prevent damage to the thyristors (free circulation of air).

MSF-017 to MSF-835 soft starters are all delivered as enclosed versions with front opening. The units have bottom entry for cables etc. see Fig. 25 on page 29 and Fig. 27 on page 31. MSF-1000 and MSF-1400 are delivered as open chassis.

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

NOTE! For UL-approval use 75°C Copper wire only.

MSF-017 to MSF-250

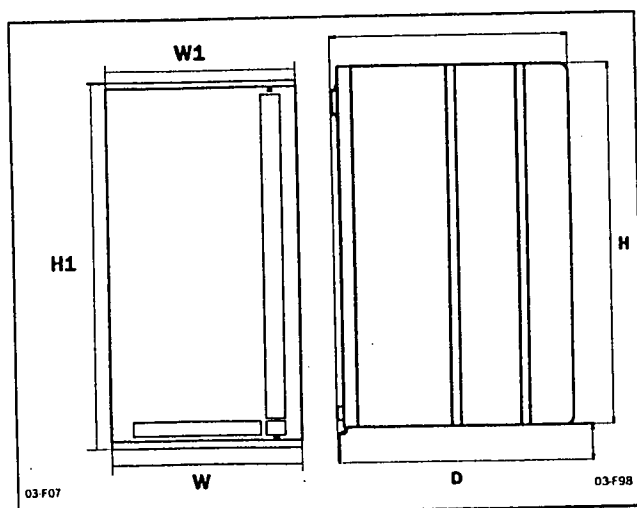


Fig. 16 MSF-017 to MSF-250 dimensions.

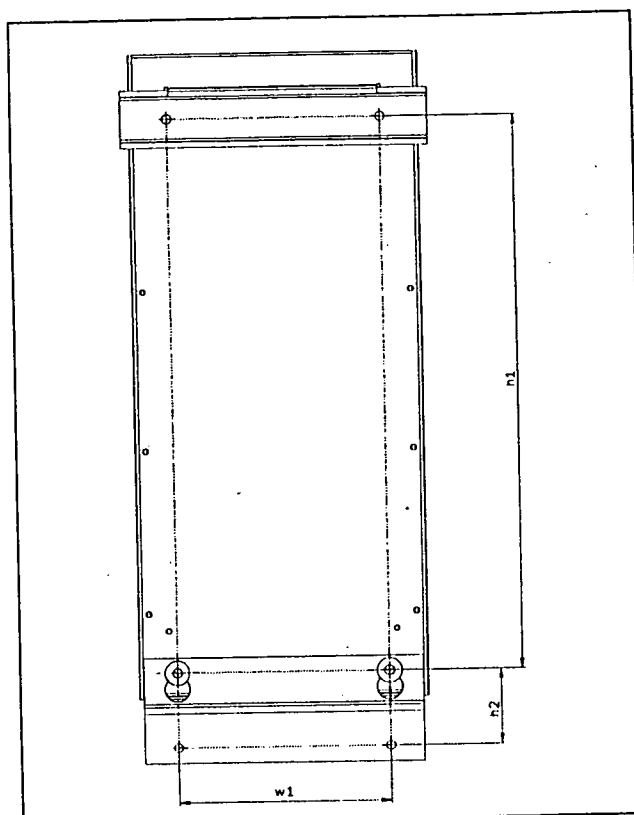


Fig. 17 Hole pattern for MSF-017 to MSF-250 (backside view).

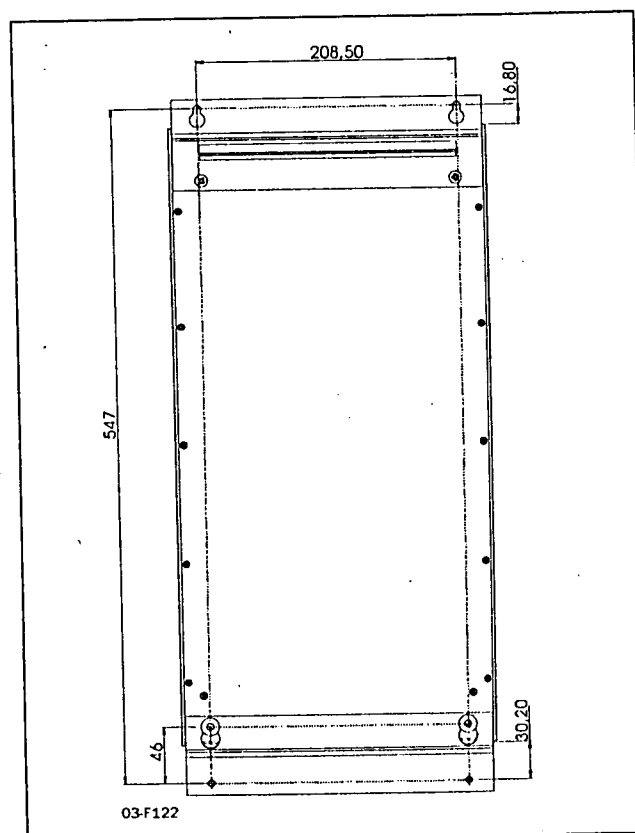


Fig. 18 Hole pattern for MSF-170 to MSF-250 with upper mounting bracket instead of DIN-rail.

MSF-017 to MSF-250

Table 7 MSF-017 to MSF-250.

MSF model	Class	Connection	Conv./ Fan	Dimension HxWxD (mm)	Hole dist. w1 (mm)	Hole dist. h1 (mm)	Diam./ screw	Weight (kg)
-017, -030	IP 20	Busbars	Convection	320x126x260	78.5	265	5.5/M5	6.7
-045, -060, -075, -085	IP 20	Busbars	Fan	320x126x260	78.5	265	5.5/M5	6.9
-110, -145	IP 20	Busbars	Fan	400x176x260	128.5	345	5.5/M5	12.0
-170, -210, -250	IP 20	Busbars	Fan	500x260x260	208.5	445	5.5/M5	20

Table 8 MSF-017 to MSF-250

MSF model	Minimum free space (mm):			Dimension Connection busbars Cu	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-017, -030, -045	100	100	0	15x4 (M6), PE (M6)	8	8	0.6
-060, -075, -085	100	100	0	15x4 (M8), PE (M6)	12	8	0.6
-110, -145	100	100	0	20x4 (M10), PE (M8)	20	12	0.6
-170, -210, -250	100	100	0	30x4 (M10), PE (M8)	20	12	0.6

1) Above: wall-soft starter or soft starter-soft starter

MSF-310 to MSF-1400

Table 9 MSF-310 to MSF-1400 see Fig. 20 on page 26.

MSF model	Class	Connection	Conv./ Fan	Dimension HxWxD (mm)	Hole dist. w1 (mm)	Hole dist. h1 (mm)	Diam./ screw	Weight (kg)
-310	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	42
-370, -450	IP 20	Busbars	Fan	532x547x278	460	450	8.5/M8	46
-570	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	64
-710	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	78
-835	IP 20	Busbars	Fan	687x640x302	550	600	8.5/M8	80
-1000, -1400	IP00	Busbar	Fan	900x875x336	Fig. 23		8.5/M8	175

Table 10 MSF-310 to MSF-1400.

MSF model	Minimum free space (mm):			Dimension Connection, busbars Al	Tightening torque for bolt (Nm)		
	above 1)	below	at side		Cable	PE-cable	Supply and PE
-310, -370, -450	100	100	0	40x8 (M12)	50	12	0.6
-570, -710, -835	100	100	0	40x10 (M12)	50	12	0.6
-1000, -1400	100	100	100	75x10 (M12)	50	12	0.6

1) Above: Wall-soft starter or soft starter-soft starter

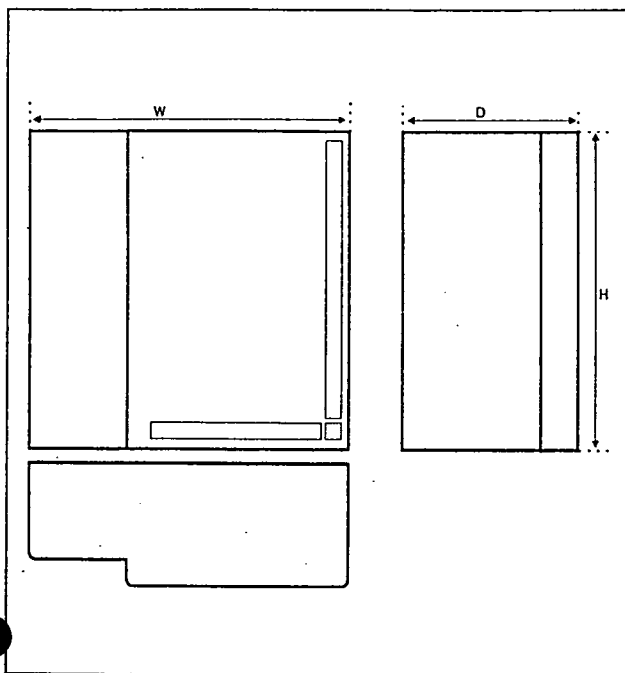


Fig. 19 MSF -310 to MSF -835.

MSF	e	f
-310 to -450	44	39
-570 to -835	45.5	39

Observe that the two supplied mounting hooks (see § 1.8, page 7 and Fig. 2 on page 7 must be used for mounting the soft-starter as upper support (only MSF-310 to MSF-835).

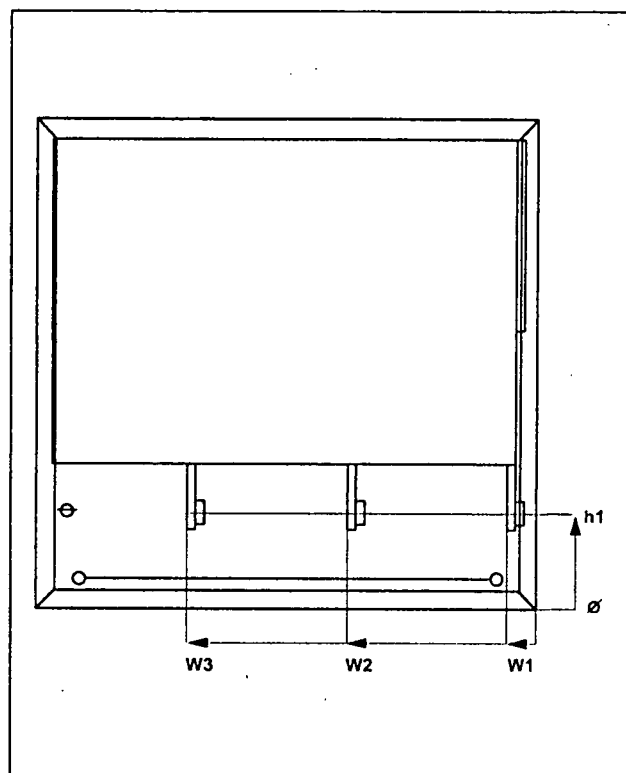


Fig. 21 Busbar distances MSF -310 to MSF -835.

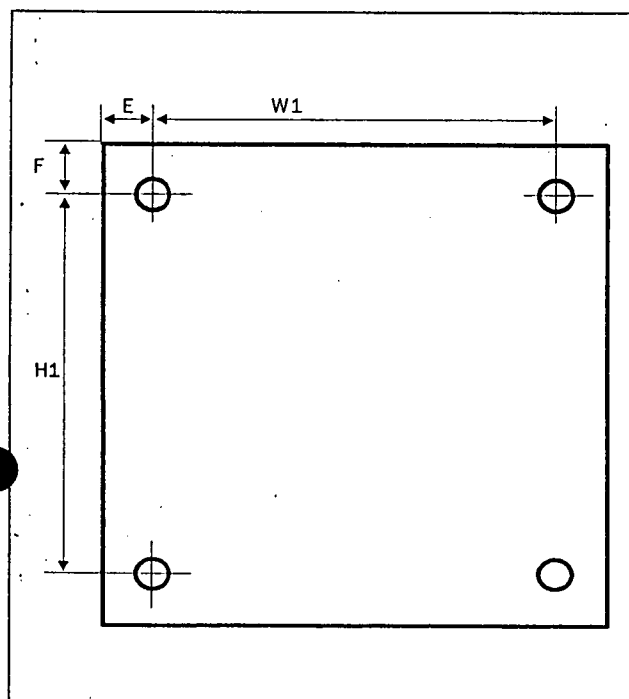


Fig. 20 Hole pattern for screw attachment, MSF-310 to MSF-835. Hole distance (mm).

Table 11 Busbar distances

MSF model	Dist. h1 (mm)	Dist. w1 (mm)	Dist. w2 (mm)	Dist. w3 (mm)
-310 to -450	104	33	206	379
-570 to -835	129	35	239.5	444
-1000 -1400		55	322.5	590.5

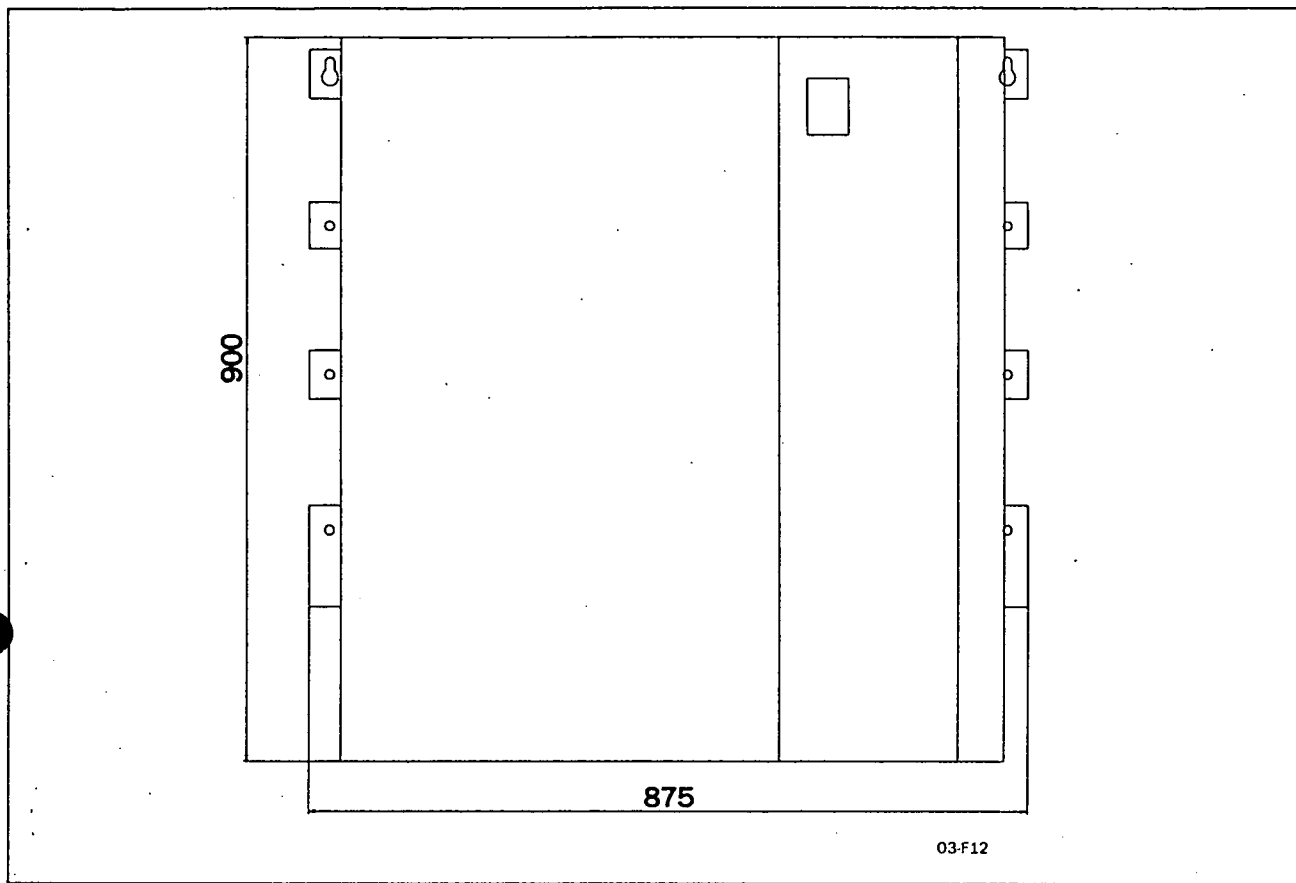


Fig. 22 MSF-1000 to -1400

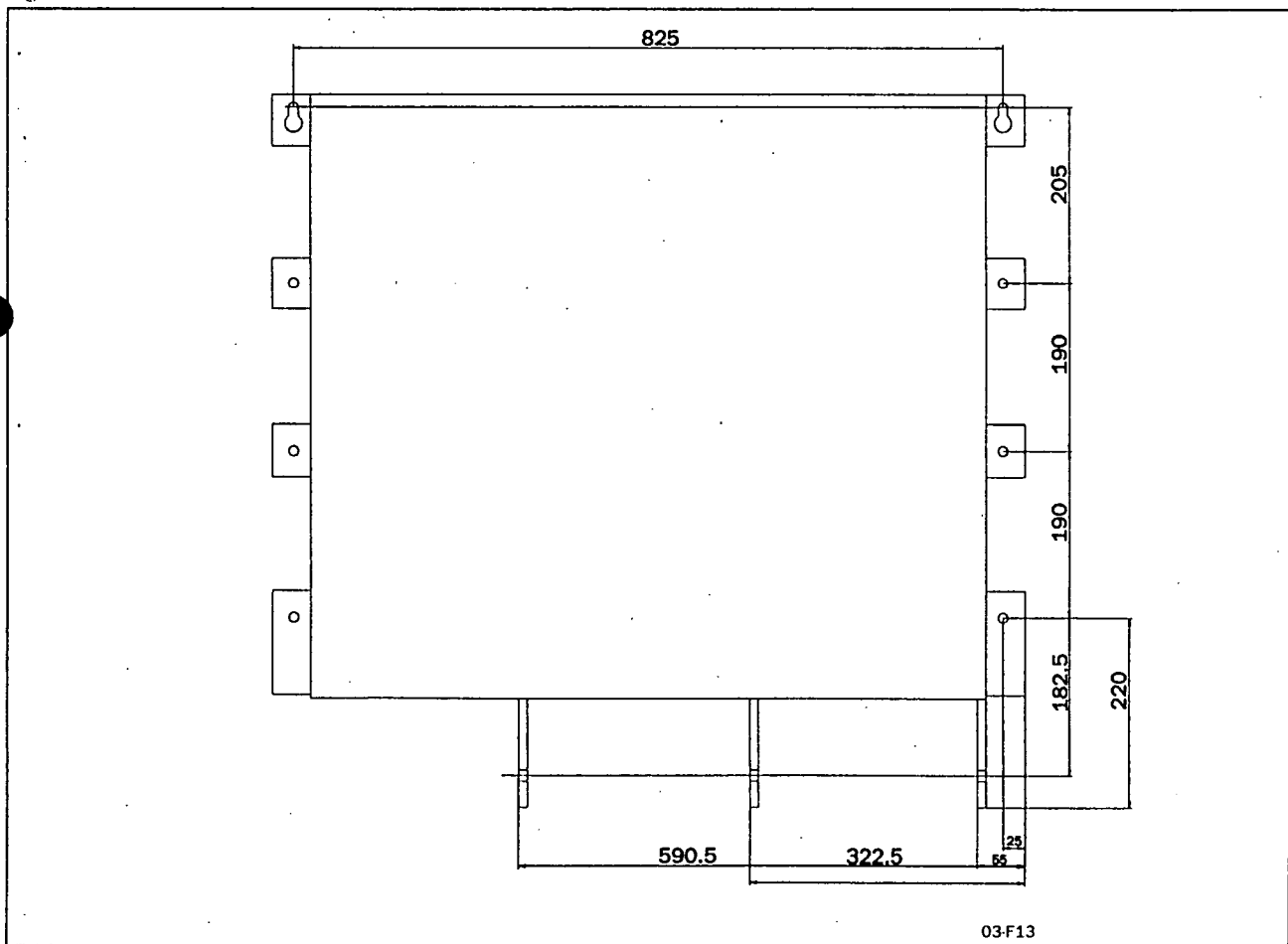


Fig. 23 Hole pattern busbar MSF-1000 to -1400.

6.2 Connections

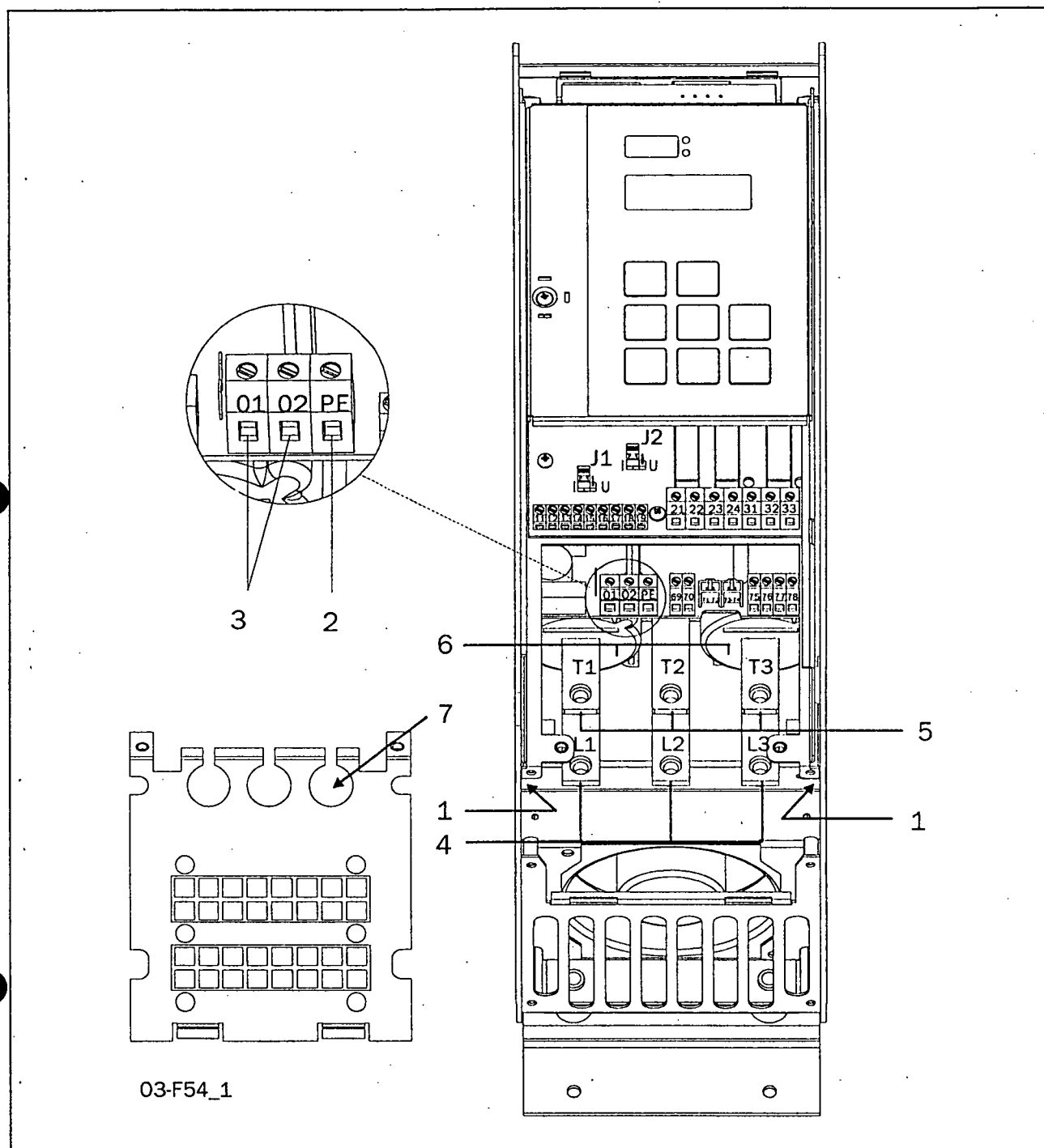


Fig. 24 Connection of MSF-017 to MSF-085.

Connection of MSF-017 to MSF-085

Device connections

1. Protective earth, \perp (PE), Mains supply, Motor (on the right and left inside of the cabinet)
2. Protective earth, \perp (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

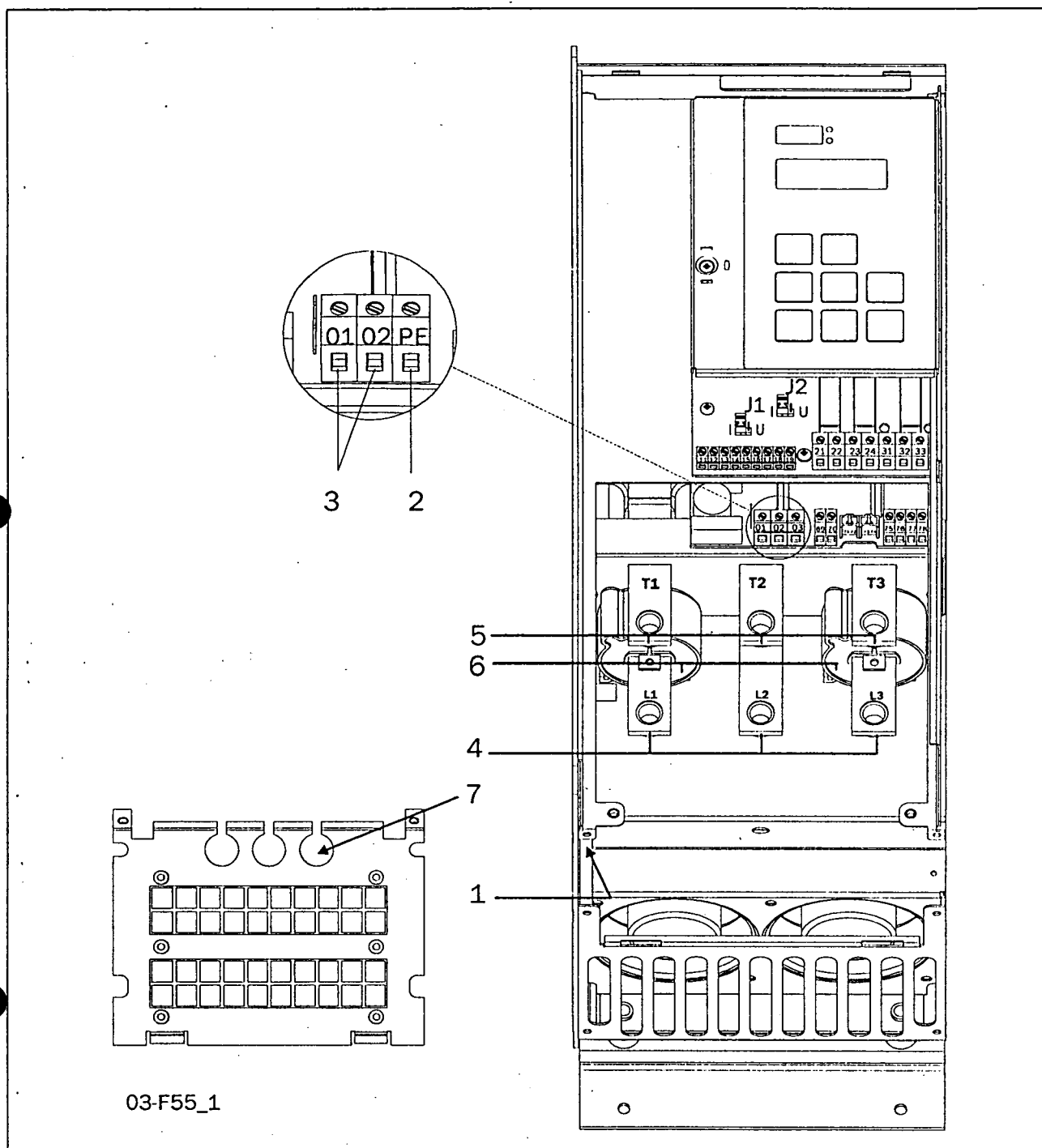
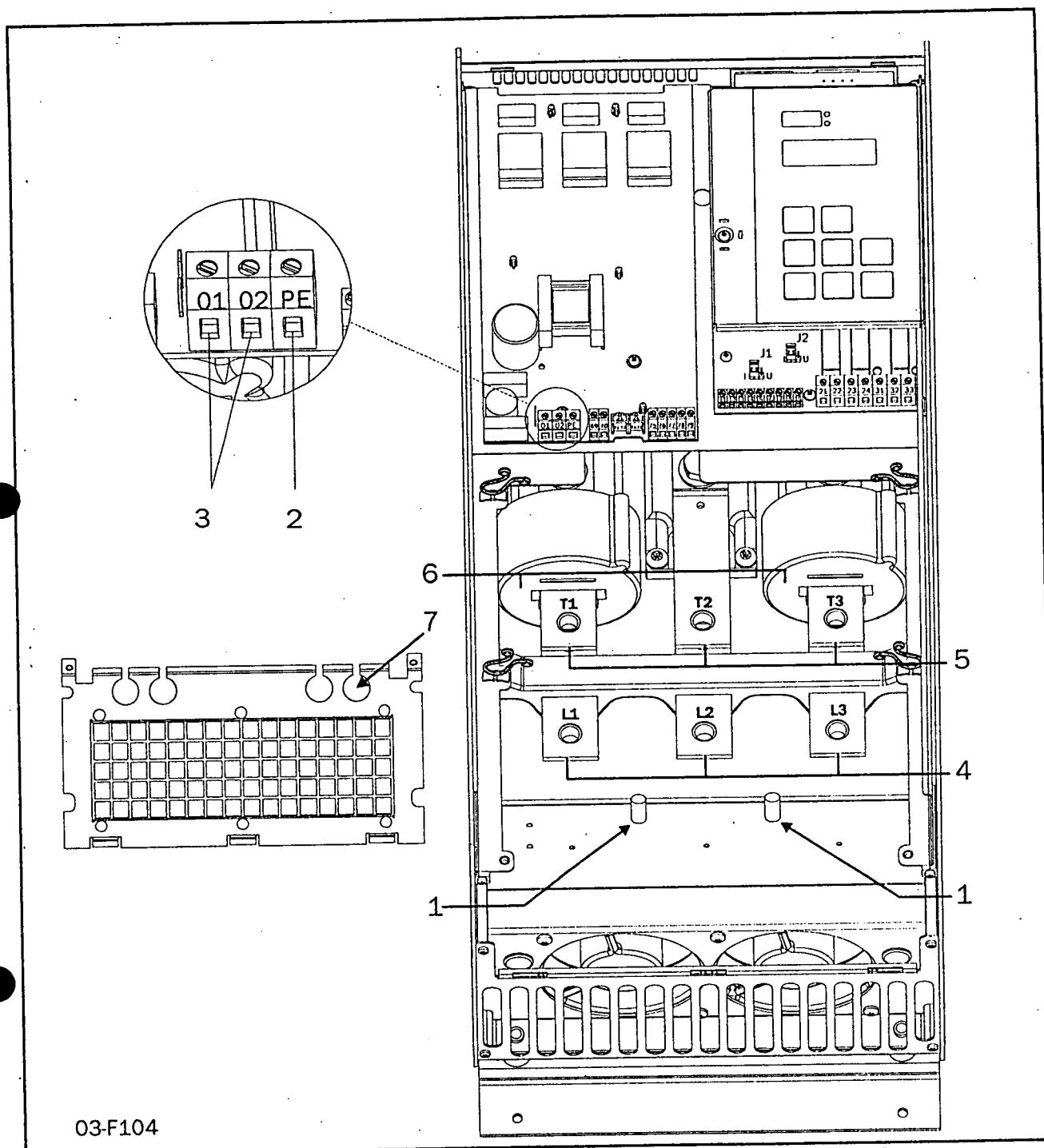


Fig. 25 Connection of MSF-110 to MSF-145.

Connection of MSF-110 to MSF-145

Device connections

1. Protective earth, \perp (PE), Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth \perp (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables



03-F104

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

Connection of MSF-170 to MSF-250

Device connections

1. Protective earth, \perp (PE), Mains supply, Motor (on the left inside of the cabinet)
2. Protective earth \perp (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

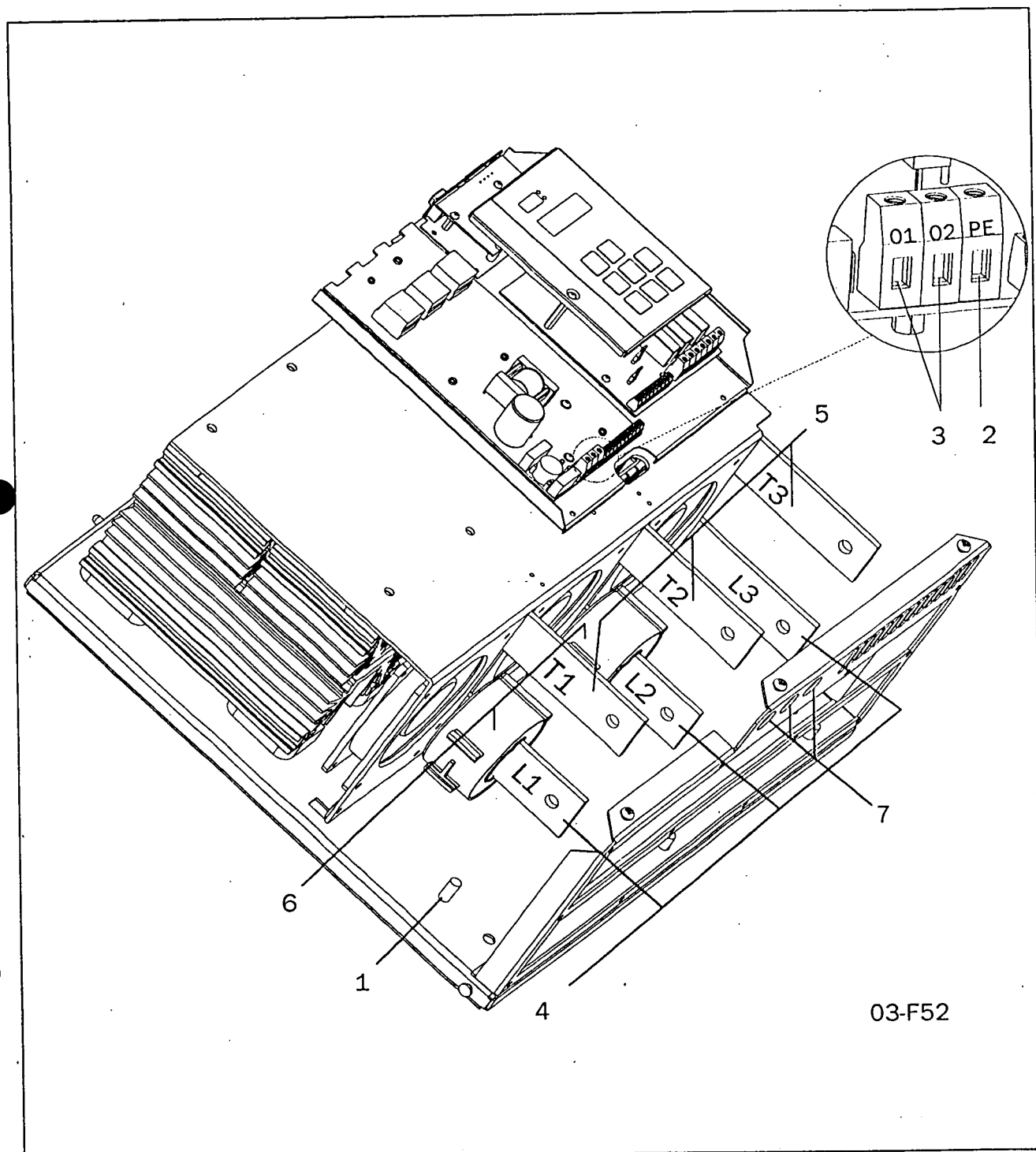


Fig. 27 Connection of MSF-170 to MSF-1400.

Connection of MSF-310 to MSF-1400

Device connections

1. Protective earth, \perp (PE), Mains supply and Motor
2. Protective earth, \perp (PE), Control voltage
3. Control voltage connection 01, 02
4. Mains supply L1, L2, L3
5. Motor power supply T1, T2, T3
6. Current transformers (possible to mount outside for bypass see § 7.12, page 43)
7. Mounting of EMC gland for control cables

6.3 Connection and setting on the PCB control card

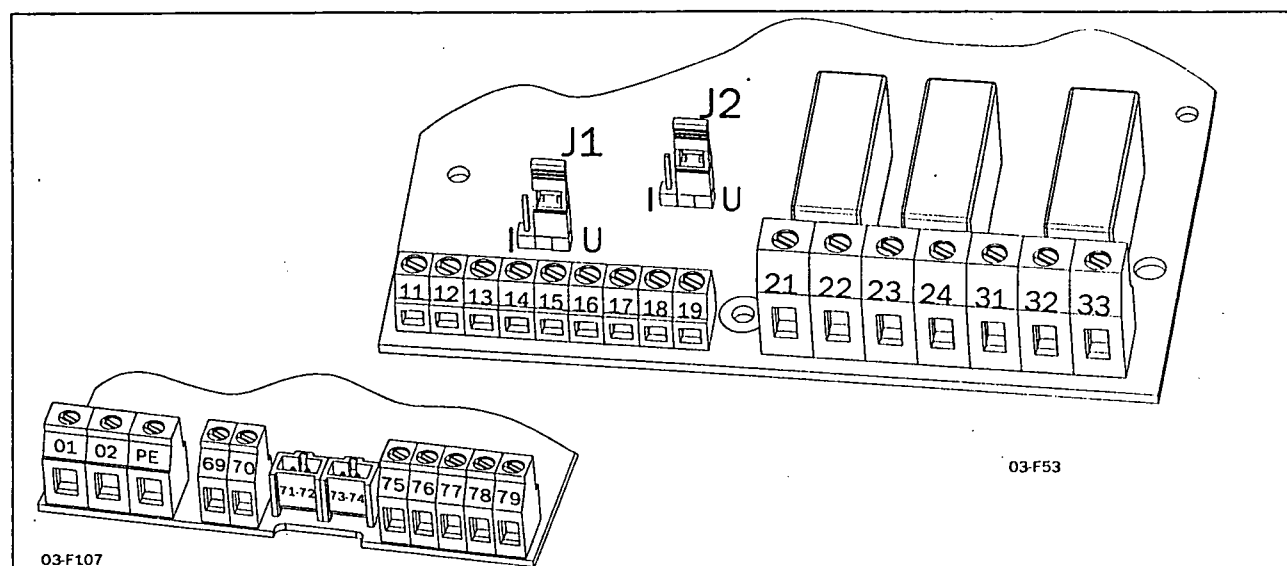


Fig. 28 Connections on the PCB control card.

Table 12 PCB Terminals

Terminal	Function	Electrical characteristics
01	Supply voltage	100-240 VAC $\pm 10\%$ /380-500 VAC $\pm 10\%$
02		
PE	Gnd	\downarrow
11	Digital inputs for start/stop and reset.	0-3 V \rightarrow 0; 8-27 V \rightarrow 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 k Ω .
12		
13	Supply/control voltage to PCB terminal 11 and 12, 10 k Ω potentiometer, etc.	+12 VDC $\pm 5\%$. Max. current from +12 VDC: 50mA. Short circuit proof.
14	Remote analogue input control, 0-10 V, 2-10 V, 0-20 mA and 4-20 mA/digital input.	Impedance to terminal 15 (0 VDC) voltage signal: 125 k Ω , current signal: 100 Ω .
15	GND (common)	0 VDC
16	Digital inputs for selection of parameter set.	0-3 V \rightarrow 0; 8-27 V \rightarrow 1. Max. 37 V for 10 sec. Impedance to 0 VDC: 2.2 k Ω .
17		
18	Supply/control voltage to PCB terminal 16 and 17, 10 k Ω potentiometer, etc.	+12 VDC $\pm 5\%$. Max. current from +12 VDC = 50mA. Short circuit proof.
19	Remote analogue output control	Analogue Output contact: 0-10V, 2-10V; min load impedance 700 Ω 0-20mA and 4-20mA; max load impedance 750 Ω
21	Programmable relay K1. Factory setting is "Operation" indication by closing terminal 21 - 22.	1-pole closing contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
22		
23	Programmable relay K2. Factory setting is "Full voltage" indication by closing terminal 23-24.	1-pole closing contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
24		
31	Alarm relay K3, closed to 33 at alarm.	1-pole change over contact, 250 VAC 8A or 24 VDC 8A resistive, 250 VAC, 3A inductive.
32	Alarm relay K3, opened at alarm.	
33	Alarm relay K3, common terminal.	
69-70	PTC Thermistor input	Alarm level 2.4 k Ω Switch back level 2.2 k Ω .
71-72*	Clickson thermistor	Controlling soft starter cooling fine temperature MSF-310 - MSF-1400
73-74*	NTC thermistor	Temperature measuring of soft starter cooling fine
75	Current transformer input, cable S1 (blue)	Connection of L1 or T1 phase current transformer
76	Current transformer input, cable S1 (blue)	Connection of L3, T3 phase (MSF 017 - MSF 250) or L2, T2 phase (MSF 310 - MSF 1400)
77	Current transformer input, cable S2 (brown)	Common connection for terminal 75 and 76
78*	Fan connection	24 VDC
79*	Fan connection	0 VDC

*Internal connection, no customer use.

6.4 Minimum wiring

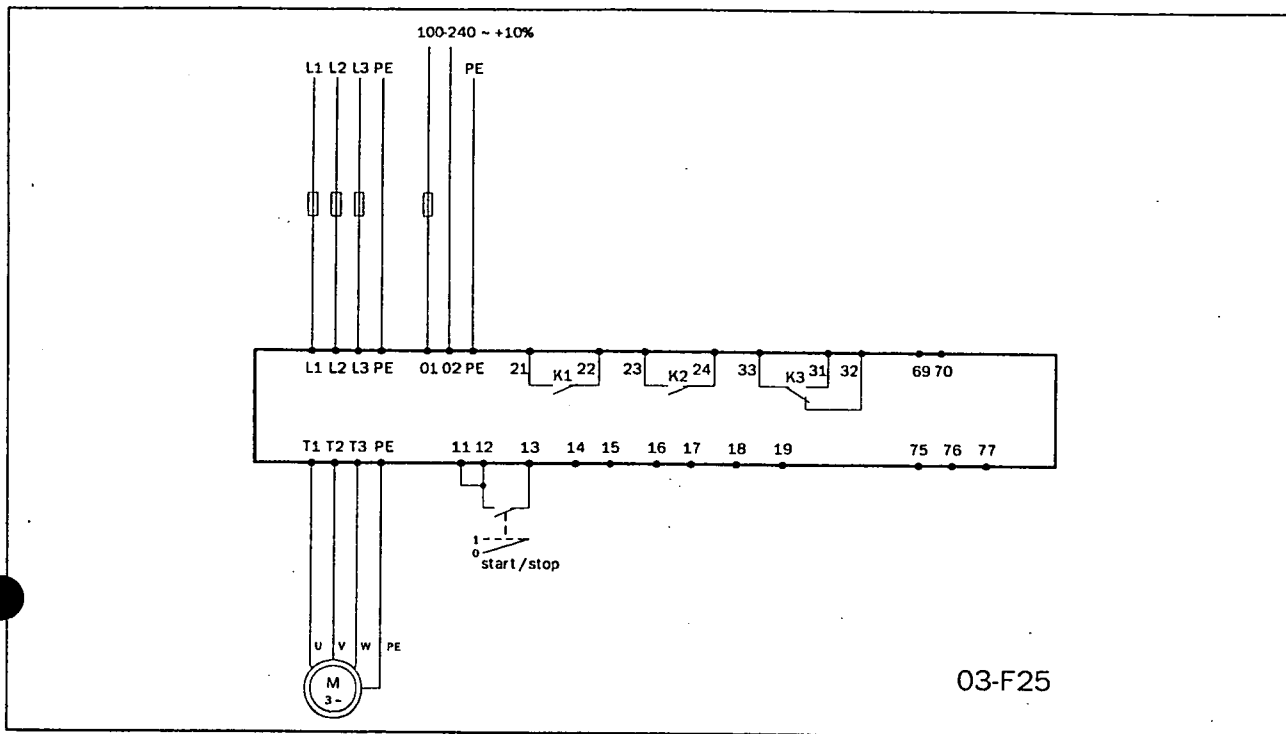


Fig. 29 Wiring circuit, "Minimum wiring".

The figure above shows the "minimum wiring". See § 6.1, page 24, for tightening torque for bolts etc.

1. Connect Protective Earth (PE) to earth screw marked \perp (PE).
2. Connect the soft starter between the 3-phase mains supply and the motor. On the soft starter the mains side is marked L1, L2 and L3 and the motor side with T1, T2 and T3.
3. Connect the control voltage (100-240 VAC) for the control card at terminal 01 and 02.
4. Connect relay K1 (terminals 21 and 22) to the control circuit.
5. Connect PCB terminal 12 and 13 (PCB terminal 11-12 must be linked) to, e.g. a 2-position switch (on/off) or a PLC, etc., to obtain control of soft start/stop. (For start/stop command from keyboard menu 006 must be set to 01).
6. Ensure the installation complies with the appropriate local regulations.

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

NOTE! If local regulations say that a mains contactor should be used, the K1 then controls it. Always use standard commercial, slow blow fuses, e.g. type gI, gG to protect the wiring and prevent short circuiting. To protect the thyristors against short-circuit currents, superfast semiconductor fuses can be used if preferred. The normal guarantee is valid even if superfast semiconductor fuses are not used. All signal inputs and outputs are galvanically insulated from the mains supply.

6.5 Wiring examples

Fig. 30 gives an wiring example with the following functions.

- Analogue input control, see § 7.7, page 40
- Parameter set selection, see § 7.20, page 54
- Analogue output, see § 7.18, page 52
- PTC input, see § 7.21, page 55

For more information see § 6.3, page 32.

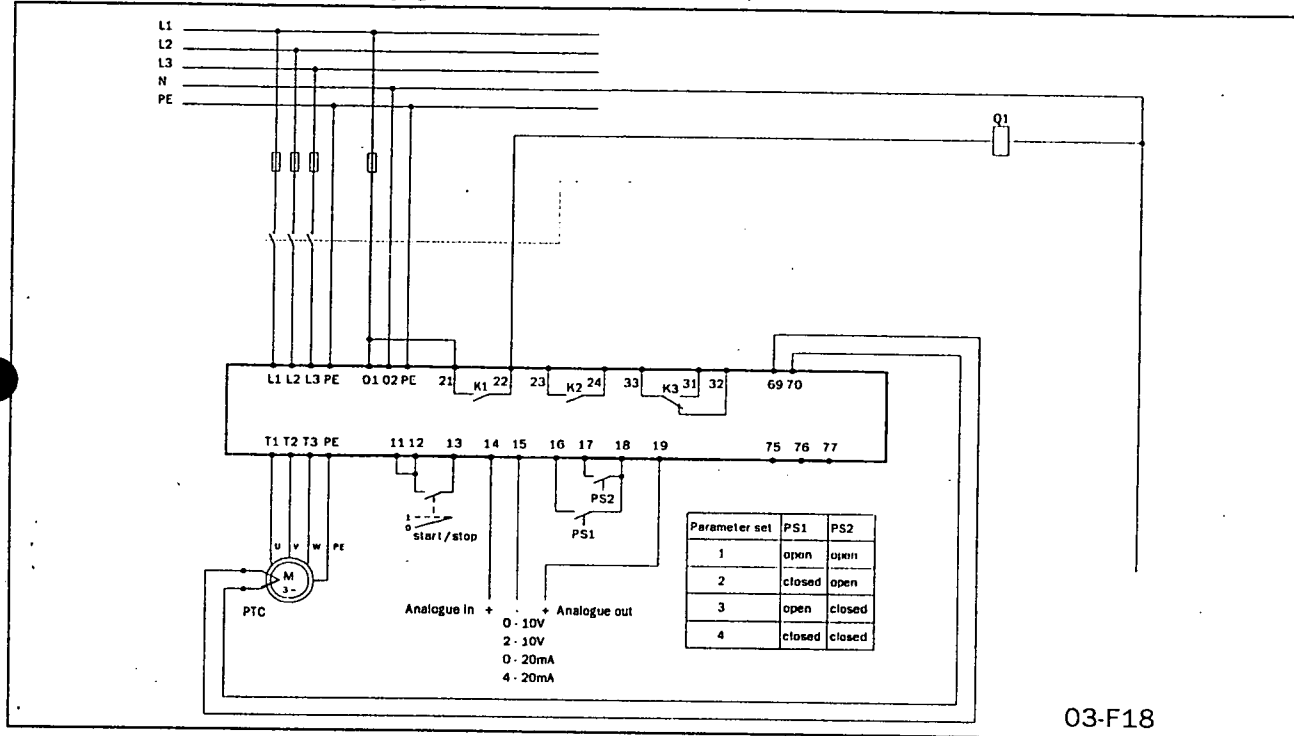


Fig. 30 Analogue input control, parameter set, analogue output and PTC input.

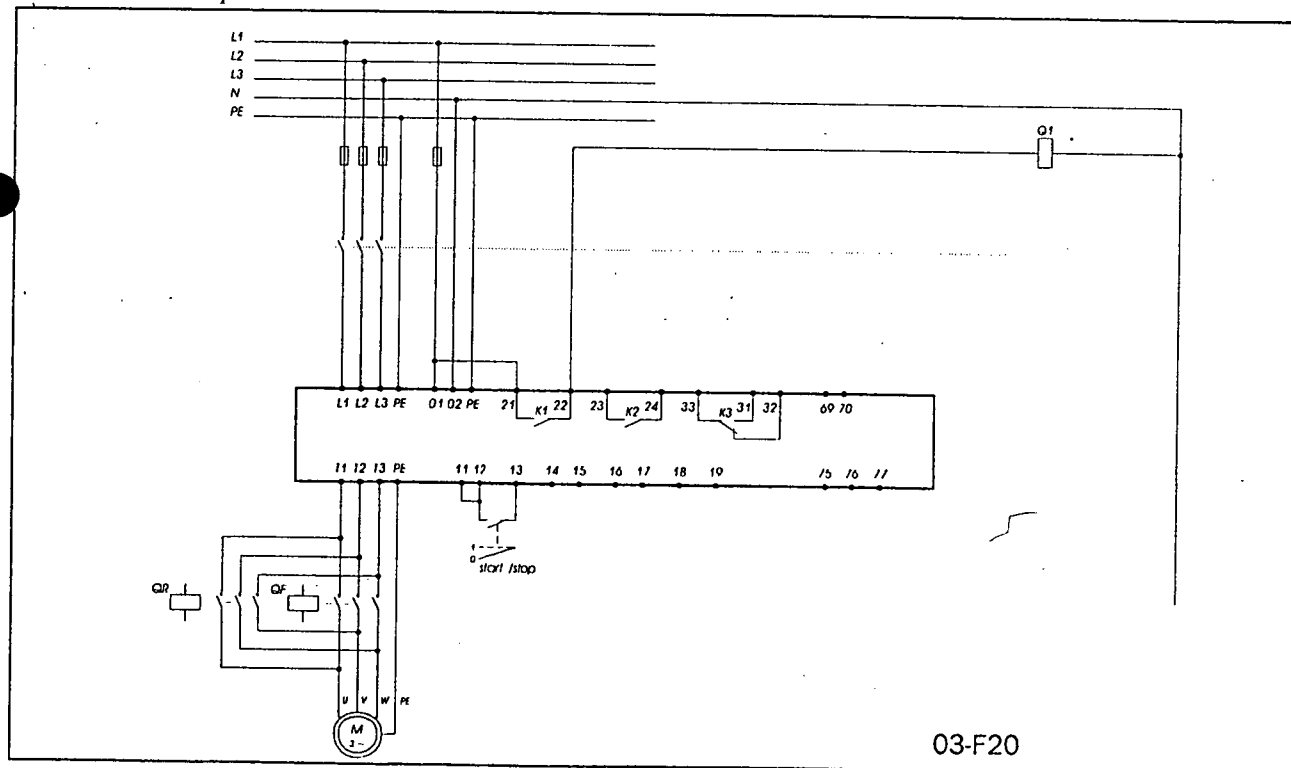


Fig. 31 Forward/reverse wiring circuit.

7. FUNCTIONAL DESCRIPTION SET-UP MENU

This chapter describes all the parameters and functions in numerical order as they appear in the 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

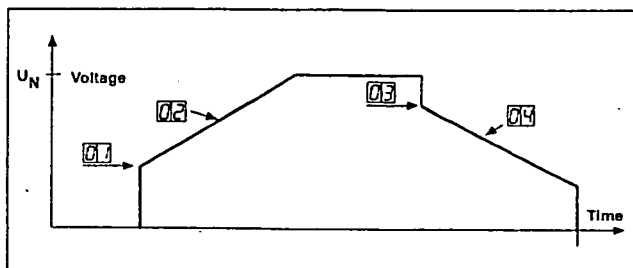


Fig. 32 Menu numbers for start/stop ramps, initial voltage at start and step down voltage at stop.

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 ^o			
Setting the Initial voltage at start ramp 1			
		3	0
Default:	30%		
Range:	25 - 90% U_n		
Set the initial voltage. Normally the factory setting, 30% of U_n , is a suitable choice.			

002 ^o			
Setting of start ramp 1			
		1	0
Default:	10 sec		
Range:	1-60 sec		
Set "Ramp up time" at start.			

003 ^o			
Setting of step down voltage stop ramp 1			
	1	0	0
Default:	100%		
Range:	100-40% of U_n		
Step down voltage at stop can be used to stop smoothly.			

004 ^o			
Setting of stop ramp 1			
	0	F	F
Default:	oFF		
Range:	oFF, 2-120 sec		
oFF	Stop ramp disabled		
2-120	Set "Ramp down time" at stop		

7.1.1 RMS current [005]

005 ^o			
RMS current			
		0.	0
Default:	-----		
Range:	0.0-9999Amp		
Read-out of the RMS motor current.			

NOTE! This is the same read-out as function 201, see § 7.28, page 63.

7.2 Start/stop/reset command

Start/stop of the motor and reset of alarm is done either from the keyboard, through the remote control inputs or through the serial interface (option). The remote control inputs start/stop/reset (PCB terminals 11, 12 and 13) can be connected for 2-wire or 3-wire control.

006 ⁰	
<div> <div></div> <div></div> <div></div> <div>2</div> </div> 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.

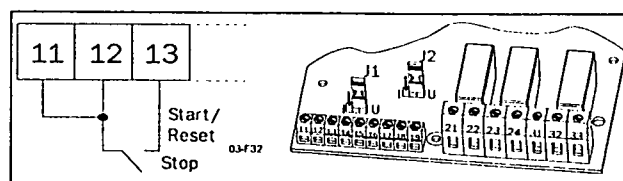
NOTE! A reset via the keyboard will not start or stop the motor.

NOTE! Factory default setting is 2, remote control.

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

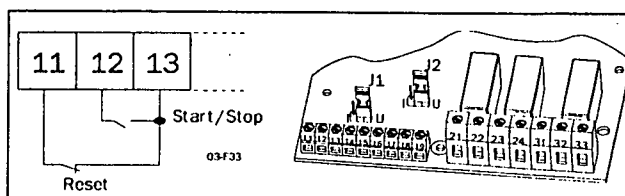
To reset from the keyboard, the "ENTER ↵ / RESET" key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset from the keyboard will not start or stop the motor.

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



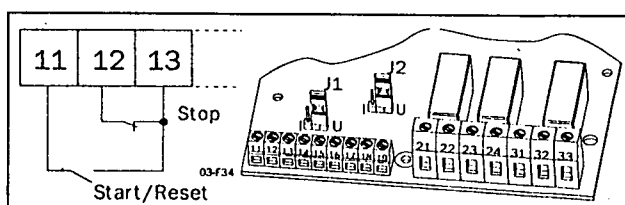
Closing PCB terminals 12 and 13, and a jumper between terminal 11 and 12, will give a start command. Opening the terminals will give a stop. If PCB terminals 12 and 13 is closed at power up a start command is given (automatic start at power up). When a start command is given there will automatically 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 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">o</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> </div>			
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 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">o</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> </div>			
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.

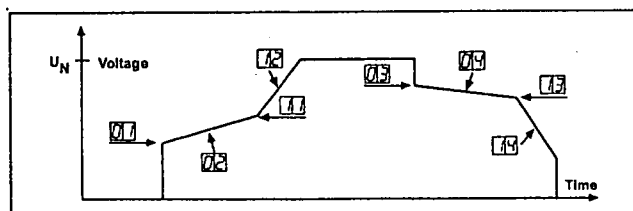


Fig. 33 Menu numbers for dual voltage ramp at start/stop, initial voltage at start and step down-voltage at stop.

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

011 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">9</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">0</div> </div>			
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 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">o</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> </div>			
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 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">0</div> </div>			
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 ^o			
<div style="display: flex; align-items: center; justify-content: center;"> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">o</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> <div style="border: 1px solid black; padding: 2px 5px; margin: 0 5px;">F</div> </div>			
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°			
Initial torque at start			
		1	0
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°			
End torque at start			
	1	5	0
Default:	150		
Range:	50 - 250% of Tn		
Insert end torque at start in percent of nominal shaft torque.			

018°			
End torque at stop			
			0
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°			
Voltage ramp with current limit at start			
	0	F	F
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".

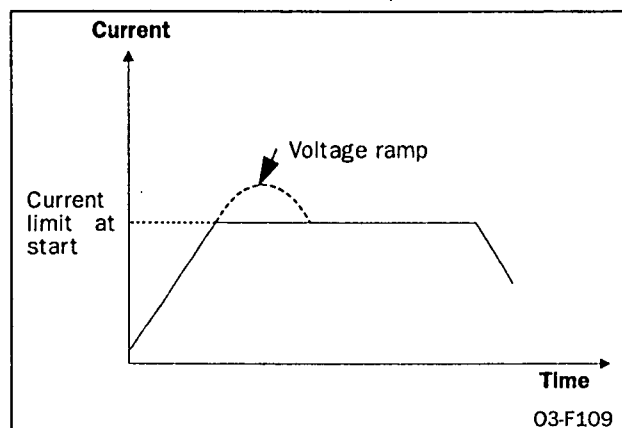


Fig. 34 Current limit

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 I_n in menu 021.

021 ^o	
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 10px;">o F F</div> <div>Current limit at start</div> </div>	
Default:	oFF
Range:	oFF, 150 - 500% I_n
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.

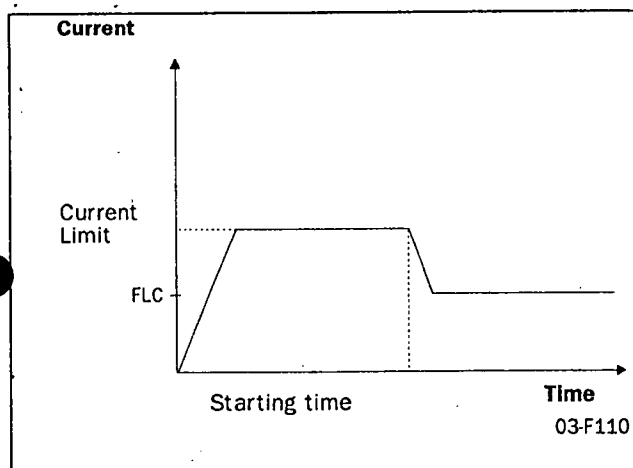


Fig. 35 Current limit

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.

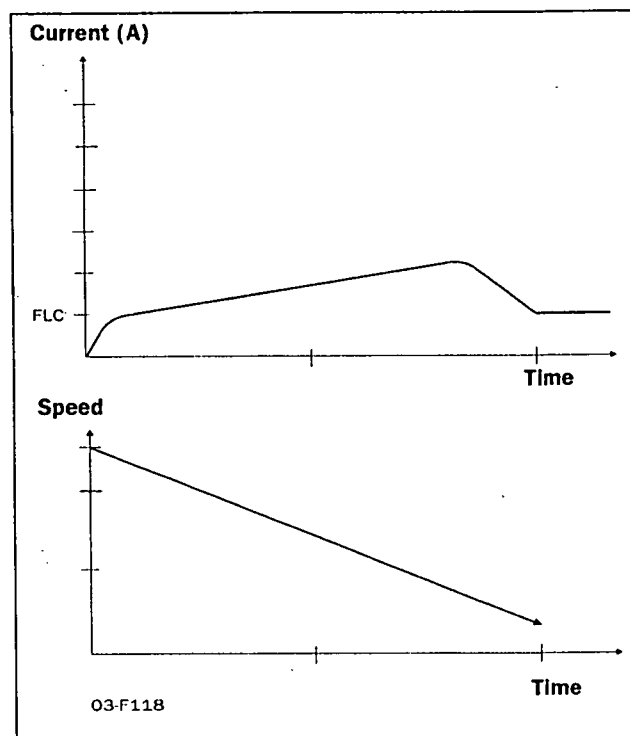


Fig. 36 Pump control

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 ^o	
<div style="display: flex; align-items: center;"> <div style="border: 1px solid black; padding: 2px 10px; margin-right: 10px;">o F F</div> <div>Setting of pump control</div> </div>	
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 (-).

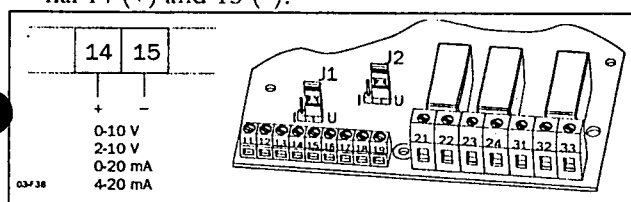


Fig. 37 Wiring for analogue input.

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).

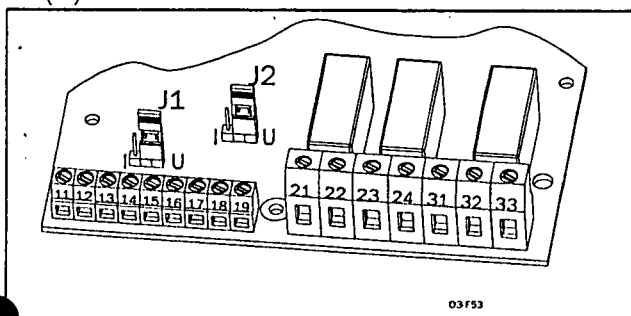


Fig. 38 Setting voltage or current for analogue input.

023°	
o F F	
Selection of Analogue Input control	
Default:	oFF
Range:	oFF, 1, 2
oFF	Analogue input disabled. Voltage Ramp enabled.
1	Analogue input is set for 0-10V/ 0-20mA control signal
2	Analogue input is set for 2-10V/ 4-20mA control signal.

NOTE! Only possible when Voltage Ramp mode is enabled.
Menu 020-022, 024, 025 must be "oFF"

7.9 Full voltage start, D.O.L. (Main Function)

The motor can be accelerated as if it was connected directly to the mains. For this type of operation:

Check whether the motor can accelerate the required load (D.O.L.-start, Direct On Line start). This function can be used even with shorted thyristors.

024°	
o F F	
Setting of D.O.L. start	
Default:	oFF
Range:	oFF, on
oFF	D.O.L. start disabled. Voltage Ramp enabled.
on	D.O.L. start enabled

NOTE! Only possible when Voltage Ramp mode is enabled.
Menu 020-023, 025 must be "oFF".

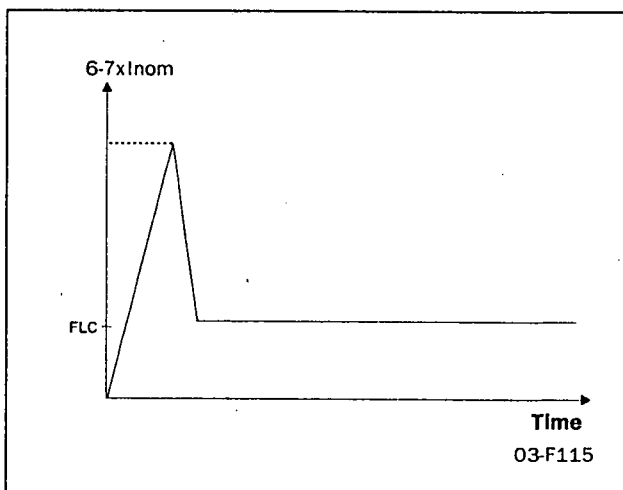


Fig. 39 Full voltage start.

7.10 Torque control (Main function)

This main function can be used to make a start according to a pre-defined torque reference curve. Two different load characteristics, linear and square, are possible to select.

At start/stop the torque controller will follow the selected characteristic.

A torque start/stop behaviour can be seen in Fig. 40.

A perfect start and stop with torque ramps have a good linearity of current. To optimise this, use the setting of initial torque (menu 16) and end torque (menu 18). See also § 7.5, page 39.

Example:

Default for initial torque is 10% so if starting a more heavy load this will result in a small current peak in beginning of ramp. By increasing this value to 30/70% the current peak will not appear.

The end torque is increased mainly if the application has a high inertial load, like planers, saws and centrifuges. A current peak will appear in the end of ramp because the load is pushing the speed more or less by itself. By increasing this level to 150-250% the current will be linear and low.

<table border="1"><tr><td>0</td><td>2</td><td>5</td><td>0</td></tr></table>				0	2	5	0	Torque control at start/stop	
0	2	5	0						
<table border="1"><tr><td></td><td>0</td><td>F</td><td>F</td></tr></table>					0	F	F		
	0	F	F						
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").

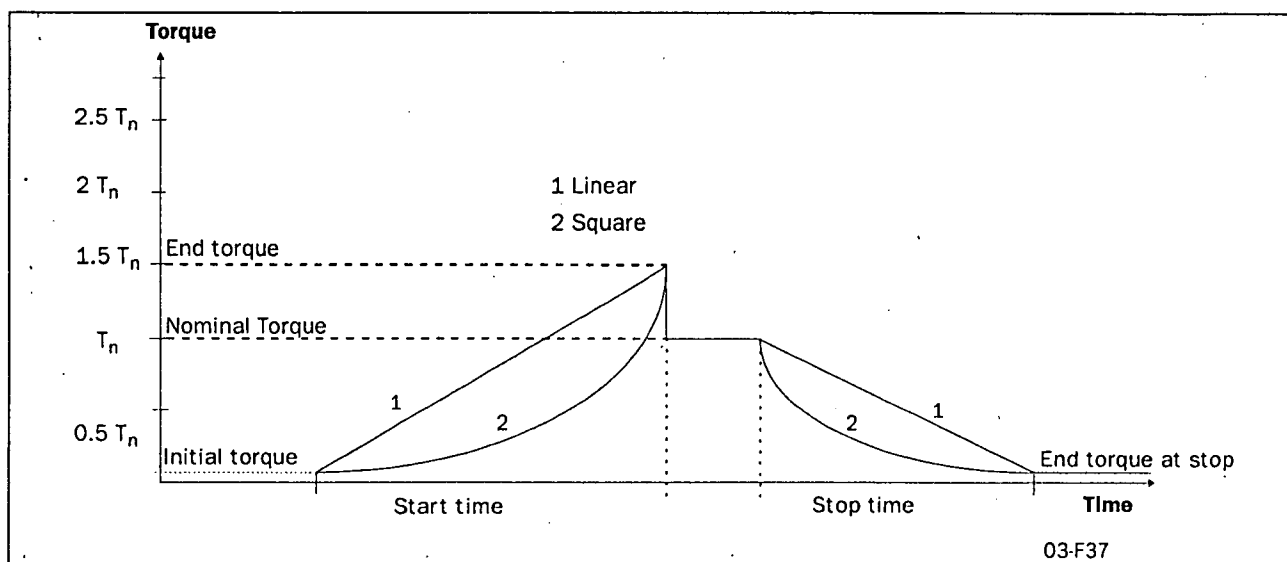


Fig. 40 Torque control at start/stop.

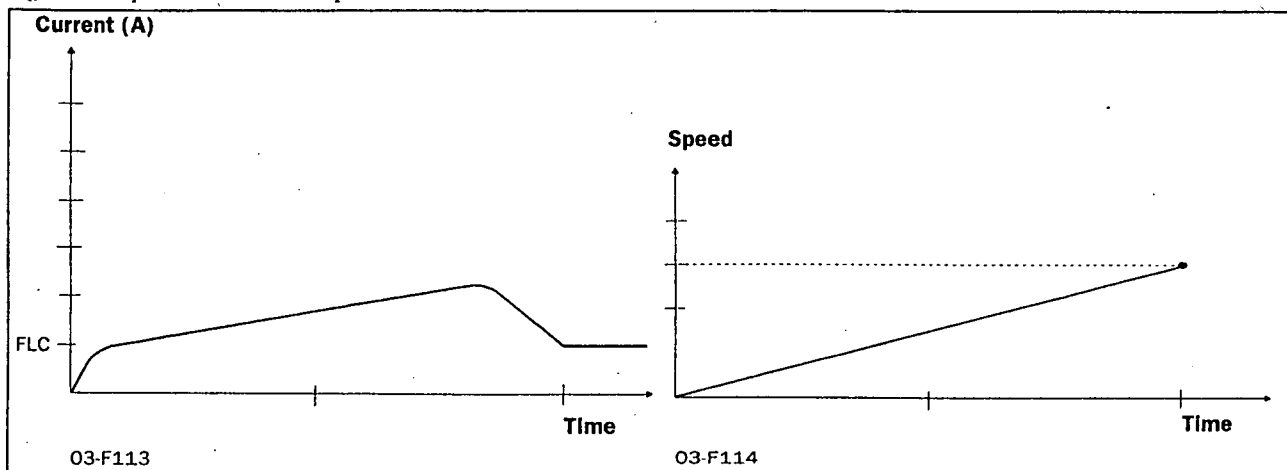


Fig. 41 Current and speed in torque control.

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.

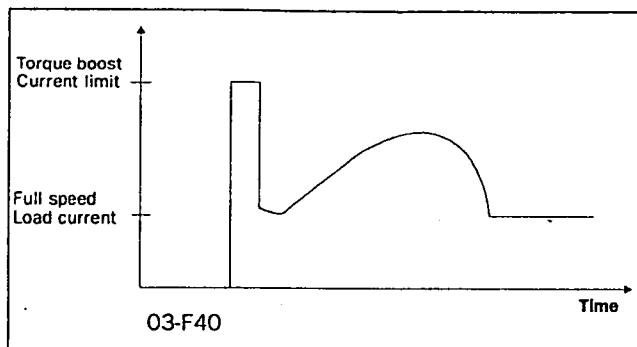


Fig. 42 The principle of the Torque Booster when starting the motor in voltage ramp mode.

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

030 ^o	
OFF	
Torque boost active time	
Default:	oFF
Range:	oFF, 0.1 - 2 sec
oFF	Torque boost disabled
0.1-2.0	Set the Torque boost time.

031 ^o	
300	
Torque boost current limit	
Default:	300
Range:	300 - 700% of I _n
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 ^o	
OFF	
Setting of Bypass	
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.

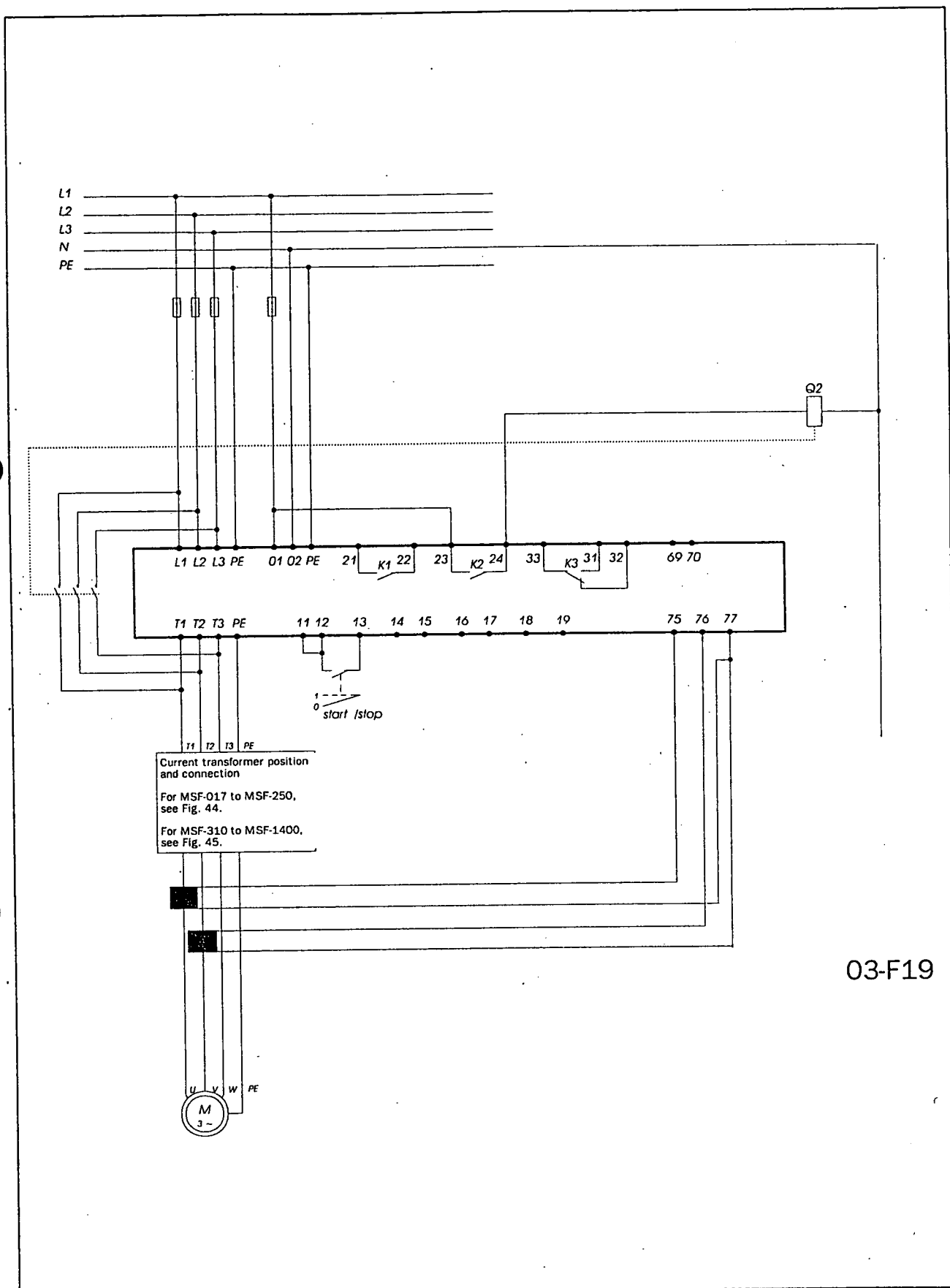


Fig. 43 Bypass wiring example MSF 310-1400.

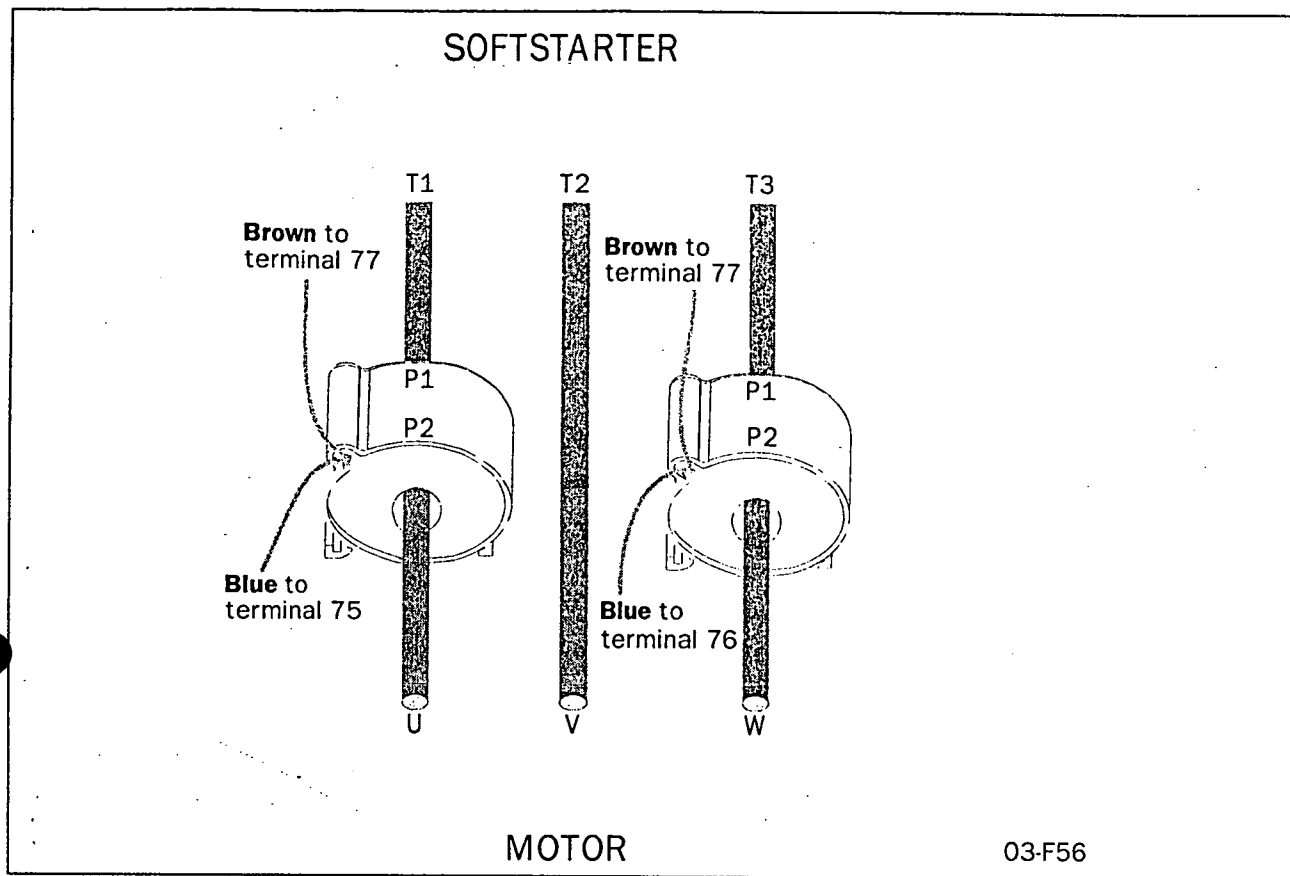


Fig. 44 Current transformer position when Bypass MSF-017 to MSF-250.

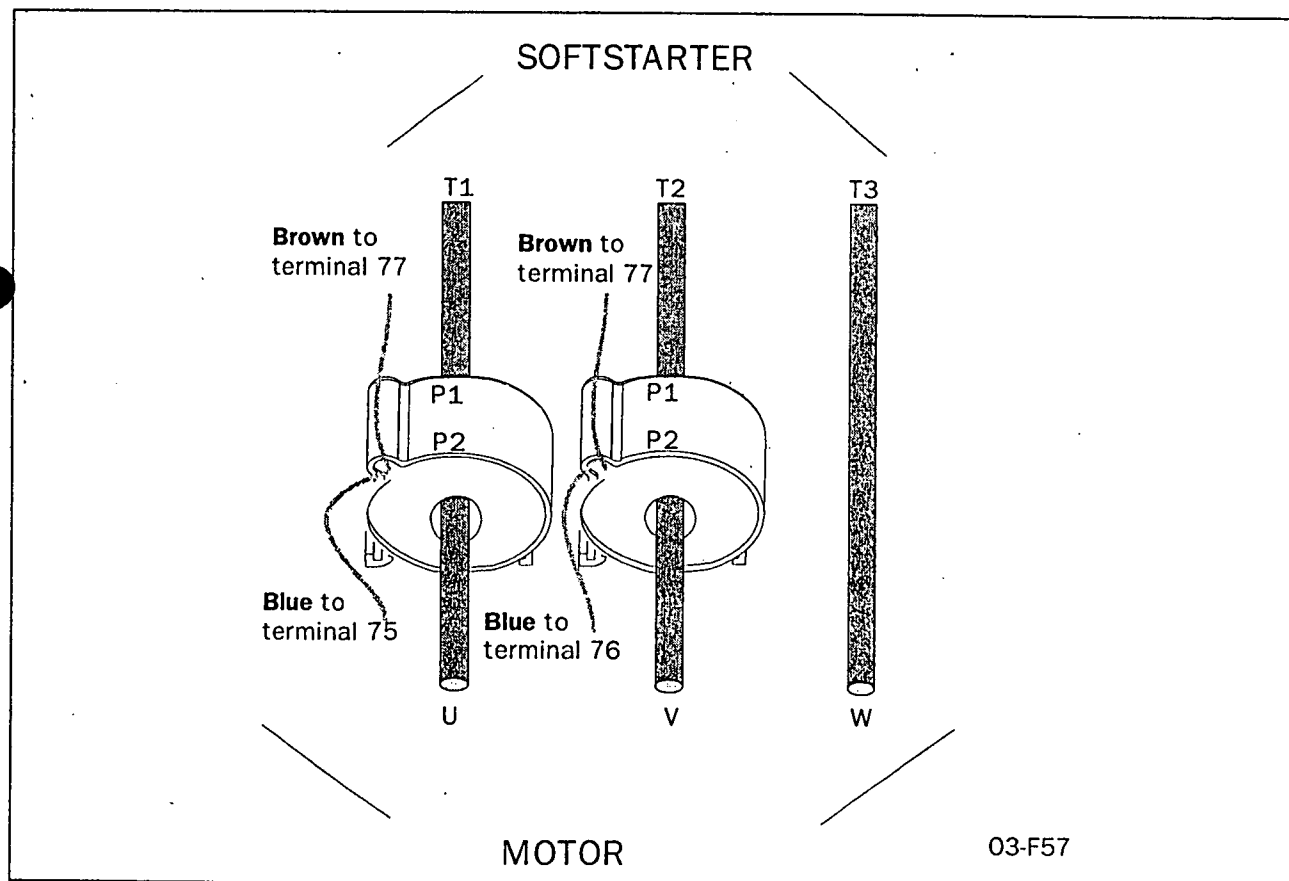


Fig. 45 Current transformer position when Bypass MSF-310 to MSF-1400.

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 ^o					
Setting of PFC					
<table border="1"> <tr> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>			o	F	F
	o	F	F		
Default:	oFF				
Range:	oFF, on				
oFF	PFC disabled				
on	PFC enabled. The Full voltage relay function does not work.				

NOTE! If the PFC is used the EMC-directive is not fulfilled.

7.14 Brake functions

There are two built in braking methods for applications where the normal stop ramp is not enough.

- **Dynamic DC-brake**
Increases the braking torque by decreasing speed.
- **Soft brake**
Gives a high torque at the start of the braking and then also increasing torque by decreasing speed.

In both methods the MSF detects when the motor is standing still, so rotating in wrong direction is avoided.

Dynamic Vector Brake

- Possible to stop motors with high inertia loads from close to synchronous speed.
- At 70% of the nominal speed a DC-brake is activated until the motor is standing still or the selected Braking Time has expired (see menu 34, next page).
- No contactor needed.
- For extra safety, the soft starter has a digital input signal for monitoring standstill so that at real motor standstill will stop the output voltage immediately (see § 7.19, page 53).

Soft brake

- Even very high inertia loads can be stopped
- The Soft brake is a controlled reversing of the motor as the MSF measures the speed during braking.
- Two contactors are needed which can be placed on the in- or output of the soft starter. On the input the first contactor is connected to relay K1 which is also used as a mains contactor.
- At 30% of the nominal speed a DC-brake is activated until the motor is standing still or the selected Braking Time has expired (menu 34, next page).

- For extra safety, the soft starter has a digital input signal for monitoring standstill. So that the output voltage is stopped immediately (see menu 57-58, § 7.19, page 53).

See Fig. 47 on page 47 for the following set-up sequence:

- Soft brake is activated if menu 36=2 and menu 34 has a time selected (see next page).
- Menu 51 and 52 are automatically set to 5 and 4 to get the correct relay functions on K1 and K2 (see § 7.17, page 51).
- Relay K1 should be used to connect a contactor for supply L1, L2, L3 to MSF or motor.
- Relay K2 is used to connect phase shifting contactor to change L1, L2 and L3 to MSF or motor.
- At start K1 is activated and connects L1, L2, L3 then the motor starts. At stop K1 opens and disconnects L1, L2, and L3 and after 1s K2 connects with the other phase sequence and the braking of the motor is active.

NOTE! Soft brake uses both programmable relays. For other functions, see also the function table in chapter 7. page 35.

NOTE! For several start/stops it is recommend to use the PTC Input.



WARNING! If the Soft Brake function has been selected once and after that the Bypass function is selected, then the relay functions on K1 and K2 remain in the Soft Brake functionality. Therefore it is necessary to change the relay functions in menu 51-52 manually to the Bypass functions (see § 7.17, page 51) or reset to default in menu 199 (see § 7.28, page 63) and select the Bypass function again.

034 ^o					
Braking time					
<table border="1"> <tr> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>			o	F	F
	o	F	F		
Default:	oFF				
Range:	oFF, 1 - 120 sec				
oFF	Brake function disabled				
1-120	Brake time				

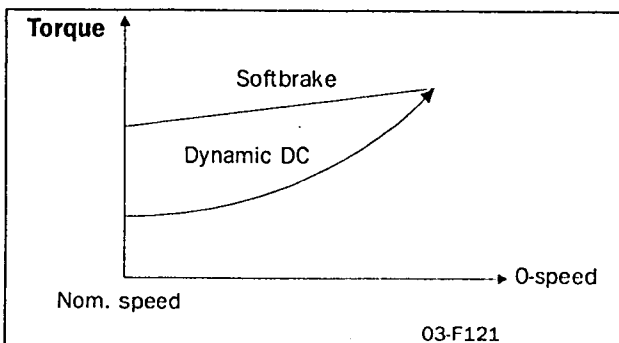


Fig. 46 Braking time

035 ^o			
Braking Strength			
1 0 0			
Default:	100		
Range:	100 - 500%		

036 ^o			
Brake method			
1			
Default:	1		
Range:	1, 2		
1	Dynamic vector brake, active		
2	Soft brake active		

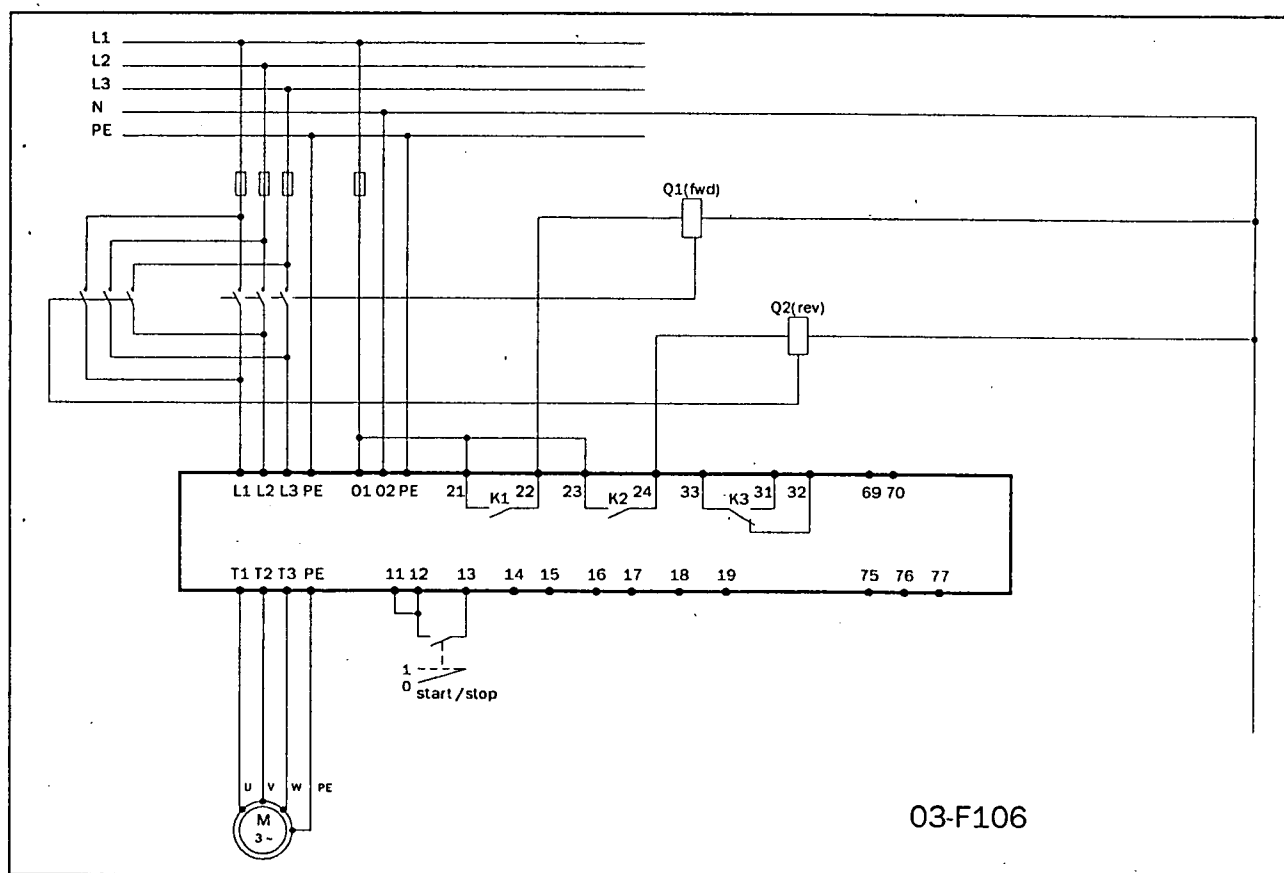


Fig. 47 Soft brake wiring example.

7.15 Slow speed and Jog functions

The soft starter is able to run the motor at a fixed slow speed for a limited period of time.

The slow speed will be about 14% of the full speed in the forward direction and 9% in the reverse direction.

The following functions are possible:

- **Slow speed controlled by an external signal.**
The digital input is used to run at slow speed at a start or stop command for a selected number of pulses (edges) generated by an external sensor (photo cell, micro switch, etc.). See § 7.19, page 53 for more instructions.
- **Slow Speed during a selected time period.**
The slow speed will be active after a stop command for a selected time period. See § 7.19, page 53 for more instructions.
- **Slow Speed using the "JOG"-commands.**
The slow Speed can be activated via the JOG keys on the keyboard or externally via the analogue input. See § 7.25, page 61 for more instructions.

7.15.1 Slow speed controlled by an external signal.

With these setting it is possible to have an external pulse or edge signal controlling the time that the Slow Speed is active either after a Start command or a Stop command or at both commands. The following menu's are involved:

Menu	Function	See page
57	Digital input selection	page 53
58	Pulse selection	page 53
37	Slow speed torque	page 49
38	Slow speed time at start	page 49
39	Slow speed time at stop	page 49
40	DC-Brake at slow speed	page 49

Installation is as follows:

1. Set the analogue input selection for Slow Speed operation. Menu 57=2. See § 7.19, page 53. See Fig. 37 on page 41 for a wiring example.
2. Select in menu 38 (see § 7.15.2, page 49) the Slow Speed at Start time. This time will now be the absolute maximum time for Slow Speed to be active after a start command, in case the external signal will not appear.
3. Select in menu 39 (see § 7.15.2, page 49) the Slow Speed at Stop time. This time will now be the absolute maximum time for Slow Speed to be active after a stop command, in case the external signal will not appear.
4. Select in menu 57 (see § 7.19, page 53) the number of edges to be ignored by the Slow Speed input, before a start or stop is executed at slow speed. The edges are generated by an external sensor (photo cell, micro switch, etc.).

The Slow Speed torque (menu 37) and DC-Brake after Slow Speed (menu 40) can be selected if needed. (see § 7.15.4, page 49).

When the number of edges exceeds or the time expire, a start according to selected main function is made.

At stop, the motor will ramp down (if selected) and DC brake (if selected) before a slow speed forward at stop will begin. Slow speed will last as long as the number of edges on the external input is below parameter value in menu 036 and the max duration time doesn't expires. When the number of edges exceeds or the time expire, a stop is made.

In Fig. 48 on page 48 the selected number of edges are 4. It is recommended to select DC-brake (see § 7.14, page 46) before a slow speed at stop if it is a high inertia load. See Fig. 29 on page 33 for wiring diagram. In case one use DC-brake, see § 7.15.4, page 49.

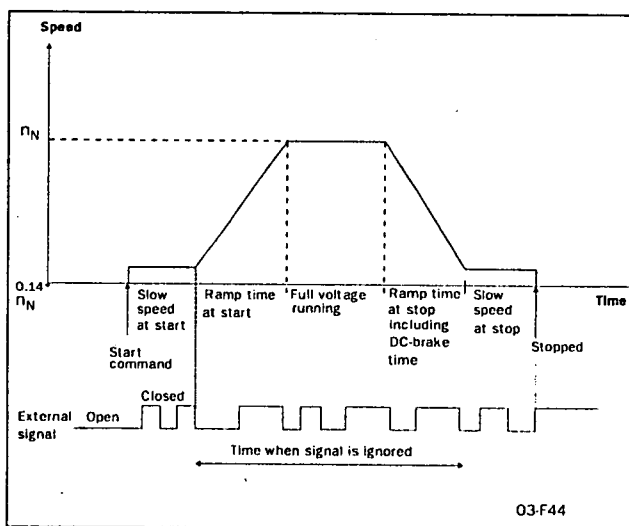


Fig. 48 Slow speed controlled by an external signal.

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

037		°
Slow speed torque		
10		
Default:	10	
Range:	10-100	
Select the magnitude of the slow speed torque.		

7.15.2 Slow speed during a selected time

It is possible to have a slow speed in forward direction before a start and after a stop. The duration of the slow speed is selectable in menus 038 and 039.

It is recommended to select DC brake (see § 7.14, page 46) before a slow speed at stop if it is a high inertia load. This slow speed function is possible in all control modes, keyboard, remote and serial communication.

038 ^o			
Slow speed time at start			
	o	F	F
Default:	oFF		
Range:	oFF, 1 - 60 sec		
oFF	Slow speed at start is disabled		
1-60	Set slow speed time at start.		

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

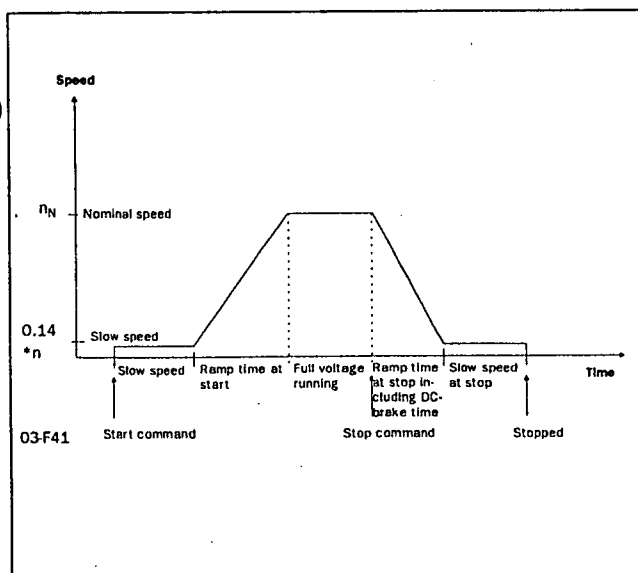


Fig. 49 Slow speed at start/stop during a selected time.

The Slow speed torque (menu 37) and the DC-Brake after Slow speed (menu 40, § 7.15.4, page 49) can be selected if needed.

7.15.3 Jog Functions

The Jog commands can be used to let the motor run at a Slow speed (forward or reverse) as long as the Jog command is active.

The Jog commands can be activated in 2 different ways:

- **Jog keys**

The Jog-Forward and Jog-reverse keys on the control panel. The keys can be programmed separate for each function. See § 7.25, page 61 for more instructions

- **External Jog command**



The external command is given via terminal 14 at the digital input. Only 1 function (forward or reverse) can be programmed to the digital input at the time. See § 7.19, page 53 for more instructions.

7.15.4 DC-brake after slow speed at stop [040]

A DC-brake after a slow speed at stop is possible to have, i.e. for a high inertia load or for a precise stop.

The current is controlled and the reference value for the normal DC-brake function is used (see § 7.15.4, page 49).

The duration for the DC-brake is possible to select.

This DC-brake function is not applied when the "JOG  " and "JOG  " keys are used.

040 ^o			
DC-Brake at slow speed			
	o	F	F
Default:	oFF		
Range:	oFF, 1-60		
oFF	DC-brake after slow speed at stop disabled.		
1-60	DC-brake duration time after slow speed at stop.		

7.16 Motor data setting

The first step in the settings is to set menu 007 and 008 to "on" to be able to reach the menus 041-046 and enter the motor data.

NOTE! The default factory settings are for a standard 4-pole motor acc. to the nominal current and power of the soft starter. The soft starter will run even if no specific motor data is selected, but the performance will not be optimal.

041 ^o			
Nominal motor voltage			
	4	0	0
Default:	400 V		
Range:	200-700 V		
Make sure the soft starters maximum voltage rating is suitable for chosen motor voltage.			

042 ^o			
Nominal motor current			
		1	7
Default:	Nominal soft starter current		
Range:	25% - 150% of Insoft in Amp.		

043 ^o			
Nominal motor power			
		7.	5
Default:	Nominal soft starter power		
Range:	25% - 300% of Pnsoft in kW		

044 ^o			
Nominal motor speed			
1	4	5	0
Default:	Nnsoft in rpm		
Range:	500-3600 rpm		

045 ^o			
Nominal motor cos phi			
	0.	8	6
Default:	0.86		
Range:	0.50-1.00		

046 ^o			
Nominal frequency			
		5	0
Default:	50 Hz		
Range:	50/60 Hz		

NOTE! Now go back to menu 007, 008 and set it to "oFF" and then to menu 001.

7.17 Programmable relay K1 and K2

The soft starter has three built-in auxiliary relays, K3 (change over contacts), is always used as an alarm relay. The other two relays, K1 and K2 (closing contacts), are programmable.

K1 and K2 can be set to either "Operation", "Full Voltage" or "Pre-alarm" indication. If DC-brake is chosen the relay K2 will be dedicated to this function.

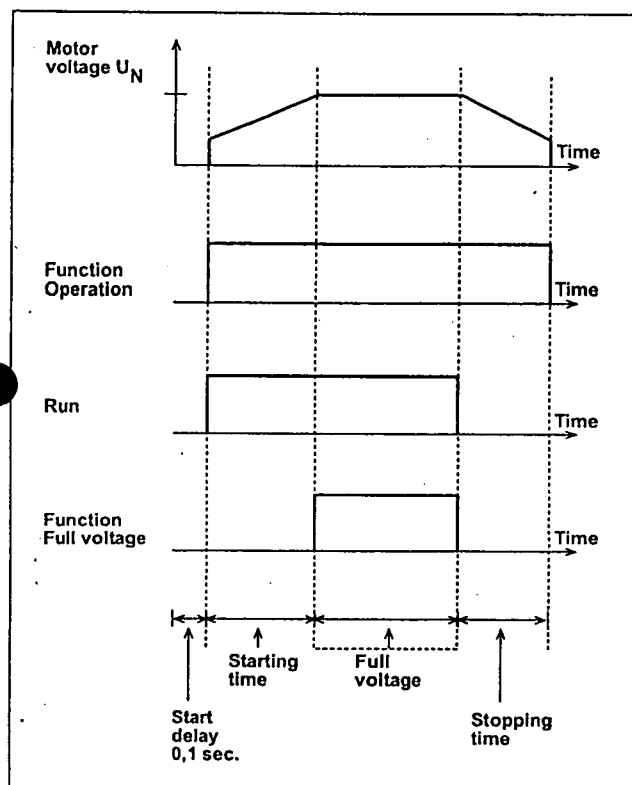


Fig. 50 Start/stop sequence and relay function "Operation" and "Full voltage".

052 ^o	
Setting of K2 Indication	
2	
Default:	2
Range:	1, 2, 3, 4, 5
1	K2 is set for "Operation"
2	K2 is set for "Full Voltage"
3	K2 is set for "Power pre-alarm"
4	K2 is set for "Softbrake"
5	K2 is set for "Run"



WARNING! If the Soft Brake function has been selected once and after that the Bypass function is selected, then the relay functions on K1 and K2 remain in the Soft Brake functionality. Therefore it is necessary to change the relay functions in menu 51-52 manually to the Bypass functions (see § 7.12, page 43) or reset to default in menu 199 (see § 7.28, page 63) and select the Bypass function again.

051 ^o	
Setting of K1 Indication	
1	
Default:	1
Range:	1, 2, 3, 4, 5
1	K1 is set for "Operation"
2	K1 is set for "Full Voltage"
3	K1 is set for "Power pre-alarm"
4	No function
5	K1 is set for "Run"

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 (-).

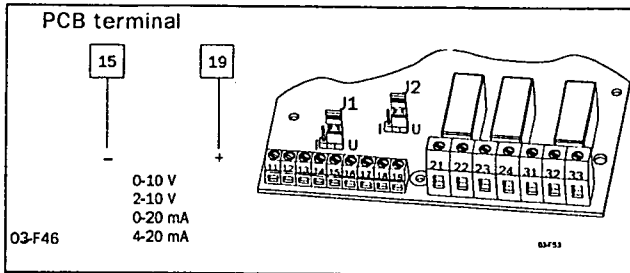


Fig. 51 Wiring for analogue output.

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.

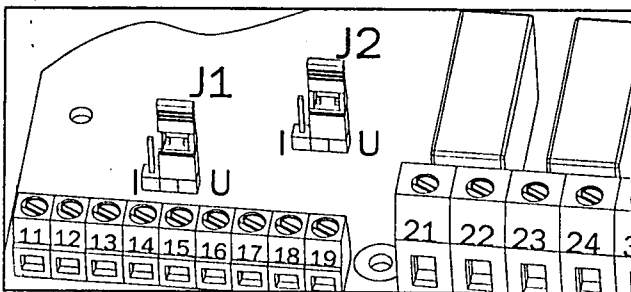


Fig. 52 Setting of current or voltage output.

3. Set the parameter in menu 054.

054°	
Analogue output	
OFF	
Default:	oFF
Range:	oFF, 1, 2
oFF	Analogue output is disabled
1	Analogue output is set to 0-10V/0-20mA
2	Analogue output is set to 0-10V/4-20mA

4. Choose a read-out value in menu 055

055°	
Analogue output value	
1	
Default:	1
Range:	1, 2, 3
1	RMS current, default range 0-5xI _n
2	Line input RMS voltage, default range 0-720V
3	Output shaft power, default range 0-2xP _n

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

056°	
Analogue output gain	
100	
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.

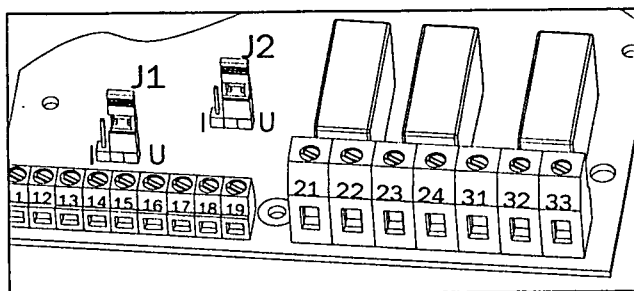


Fig. 53 Setting of J1 for current or voltage control.

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

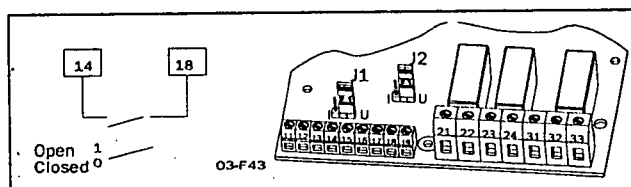


Fig. 54 Wiring for slow speed external input.

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.

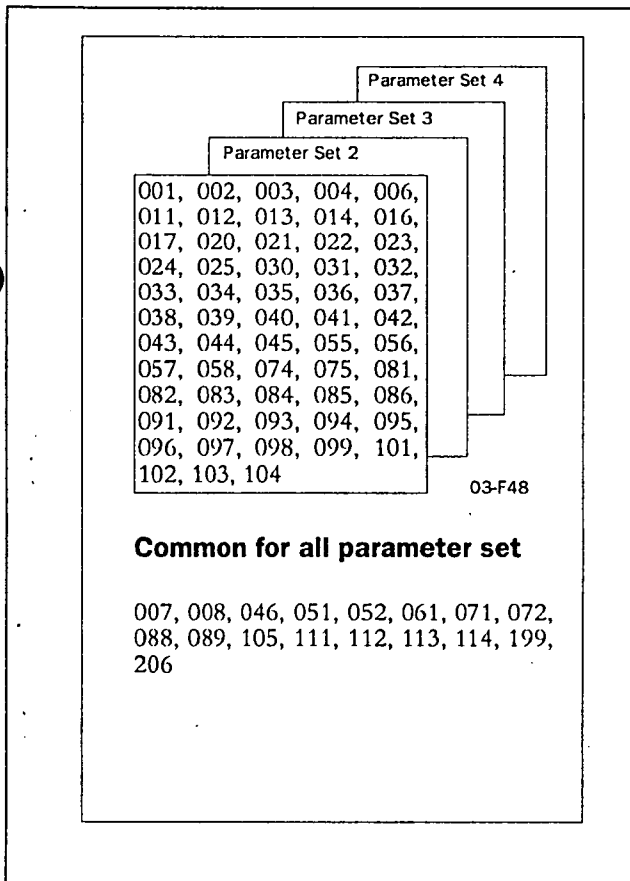


Fig. 55 Parameter overview

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.

<div>061⁰</div> <div>Parameter set</div> <div>1</div>	
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.

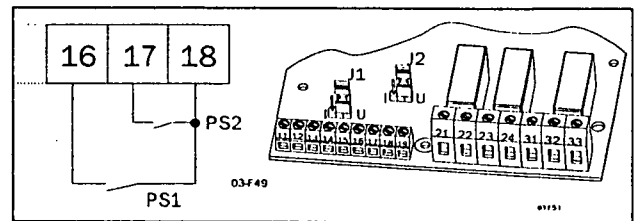


Fig. 56 Connection of external control inputs.

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°	
Motor PTC Input	
n o	
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°	
Internal motor thermal protection	
1 0	
Default:	10
Range:	oFF, 2-40 sec
oFF	Internal motor protection is disabled.
2-40	Selection of the thermal curve according to Fig. 57 - Check that menu 042 is set to the proper motor current (see § 7.16, page 50). - If the current exceeds the 100% level an F2 alarm is activated. - The motor model thermal capacity must cool down to 95% before reset can be accepted. - Used thermal capacity in menu 073 in § 7.21, page 55.

NOTE! If 'Bypass' is used check that the current transformers are placed and connected correctly (see Fig. 43 on page 44).



CAUTION! Used thermal capacity is set to 0 if the control board loses its supply (terminal 01 and 02). This means that the internal thermal model starts with a 'cold' motor, which perhaps in reality is not the case. This means that the motor can be overheated.

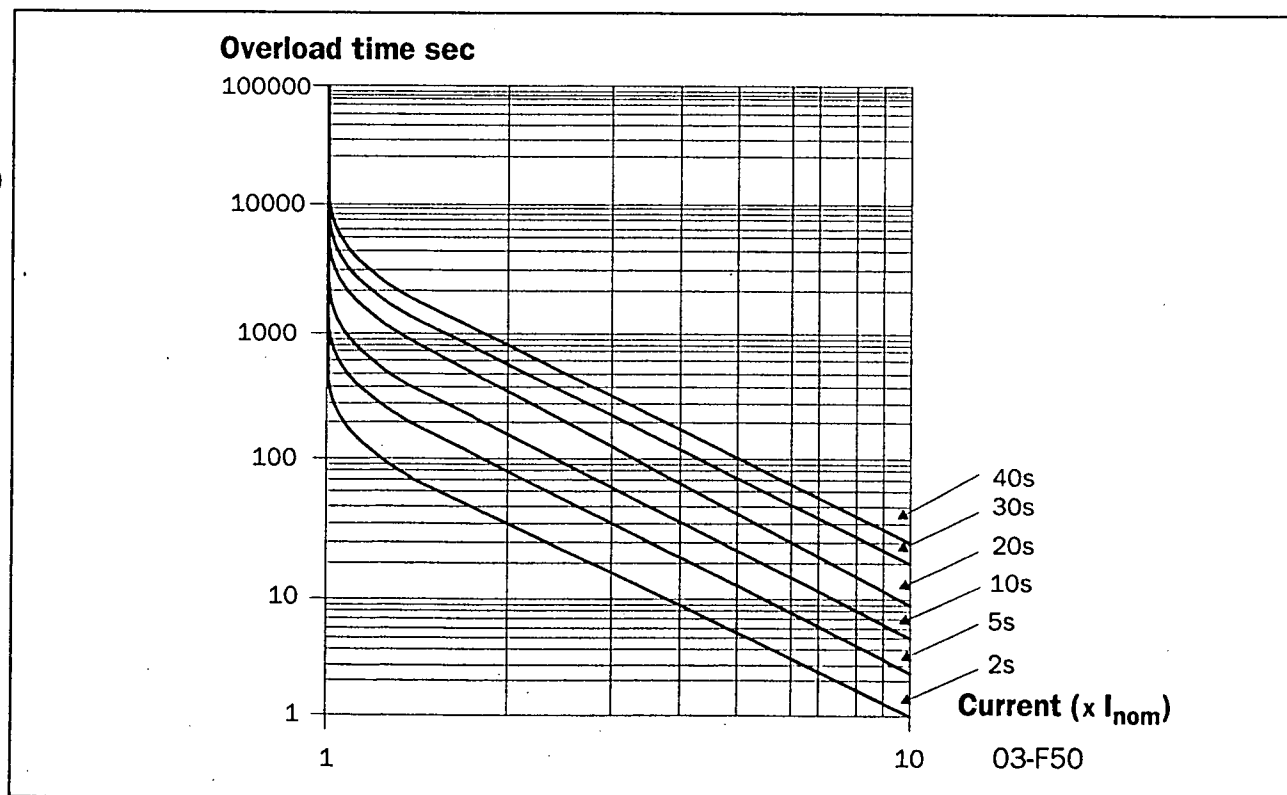


Fig. 57 The thermal curve

7.22 Mains protection

073 ^o	
Used thermal capacity	
<div> <div></div> <div></div> <div></div> <div>0</div> </div>	
Default:	-
Range:	0-150%
Read-out of the used thermal capacity. If menu 072 'Internal motor thermal protection' is selected oFF, the capacity is shown as if the default class 10 was selected.	

081 ^o	
Voltage unbalance alarm	
<div> <div></div> <div></div> <div>1</div> <div>0</div> </div>	
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.	

074 ^o	
Starts per hour limitation	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
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.

082 ^o	
Response delay voltage unbalance alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1-60 sec
oFF	Unbalance voltage alarm is disabled
1-60	Set the response delay time for unbalanced voltage alarm F8.

075 ^o	
Locked rotor alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1.0-10.0 sec
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.

083 ^o	
Over voltage alarm	
<div> <div></div> <div>1</div> <div>1</div> <div>5</div> </div>	
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 ^o	
Response delay over voltage alarm	
<div> <div></div> <div>o</div> <div>F</div> <div>F</div> </div>	
Default:	oFF
Range:	oFF, 1-60 sec
oFF	Overvoltage alarm is disabled
1-60	Set the response delay time for over voltage alarm F9.

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.

085°	
Under voltage alarm	
o F F	
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°	
Response delay under voltage alarm	
o F F	
Default:	oFF
Range:	oFF, 1-60 sec
oFF	Under voltage alarm is disabled
1-60	Set the response delay time for under voltage alarm F10

087°	
Phase sequence	
- - - -	
Default:	-
Range:	L123, L321
L123 is the direct phase sequence. L321 is the reverse phase sequence.	

088°	
Phase reversal alarm	
o F F	
Default:	oFF
Range:	oFF, on
oFF	Phase reversal alarm is disabled
on	Sets the phase reversal Alarm. - Switch on the power supply first. The phase sequence is stored as the correct sequence. - Sets the menu 088 to "on". - Any reversal of phase sequence will cause alarm F16.

NOTE! The actual phase sequence can be viewed in menu 87.

089°	
Auto set power limits	
n o	
Default:	no
Range:	no, YES
no	Auto set is disabled
YES	Auto set is activated if ENTER is pressed.

090°	
Output shaftpower in %	
o	
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 ^o	
Start delay power limits	
10	
Default:	10 sec
Range:	1-250 sec
From start command during selected delay time, all power load monitor alarms and pre-alarms are disabled.	

092 ^o	
Max power alarm limit	
115	
Default:	115
Range:	5-200% Pn
Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power exceeds selected limit, an F6-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect this limit even if the alarm is set "oFF" in menu 093. This is a category 1 alarm.	

093 ^o	
Response delay max alarm	
oFF	
Default:	oFF
Range:	oFF, 0.1-25.0 sec
oFF	Max Alarm is disabled.
0.1-25.0	Sets the response delay of the Max Alarm level.

7.23.2 Pre-alarm

It could be useful to know if the load is changing towards a load alarm limit. It is possible to insert both a Max and Min pre-alarm limit based on the motor output shaft power. If the load exceeds one of these limits, a pre-alarm condition occurs.

It should be noted that it is not normal alarms. They will not be inserted in the alarm list, not activating the alarm relay output, not displayed on the display and they will not stop operation. But it is possible to activate relay K1 or K2 if a pre-alarm condition occurs. To have pre-alarm status on any of these relays, select value 3 in menu 051 or 052 (see § 7.17, page 51).

A start-up delay time can be selected in menu 091 to avoid undesired pre-alarms at start-up. Note that this time is also shared with power Max and Min alarms.

NOTE! The pre-alarm status is always available on the serial communication.

094 ^o	
Max power pre-alarm limit	
110	
Default:	110
Range:	5 -200% Pn
Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power exceeds selected limit, a pre-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect selected limit even if the pre-alarm is set "oFF" in menu 095.	

095 ^o	
Max pre-alarm response delay	
oFF	
Default:	oFF
Range:	oFF, 0.1 - 25.0 sec
oFF	Max Pre-Alarm is disabled.
0.1-25.0	Sets the response delay of the Max Pre-Alarm level.

096°					
Min power pre-alarm limit					
<table border="1"> <tr> <td></td> <td></td> <td>9</td> <td>0</td> </tr> </table>				9	0
		9	0		
Default:	90%				
Range:	5 -200% Pn				
<p>Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power goes below selected limit, a pre-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect selected limit even if the pre-alarm is set "oFF" in menu 097.</p>					

099°						
Min alarm response delay						
<table border="1"> <tr> <td></td> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>				o	F	F
		o	F	F		
Default:	oFF					
Range:	oFF, 0.1-25.0 sec					
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.					

097°						
Min pre-alarm response delay						
<table border="1"> <tr> <td></td> <td></td> <td>o</td> <td>F</td> <td>F</td> </tr> </table>				o	F	F
		o	F	F		
Default:	oFF					
Range:	oFF, 0.1 - 25.0 sec					
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°					
Min power alarm limit					
<table border="1"> <tr> <td></td> <td></td> <td>8</td> <td>5</td> </tr> </table>				8	5
		8	5		
Default:	85				
Range:	5-200% Pn				
<p>Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If output shaft power goes below selected limit, an F7-alarm occurs after the response delay time. The 'Auto set' function in menu 089, affect this limit even if the alarm is set 'oFF' in menu 099. This is a category 1 alarm.</p>					

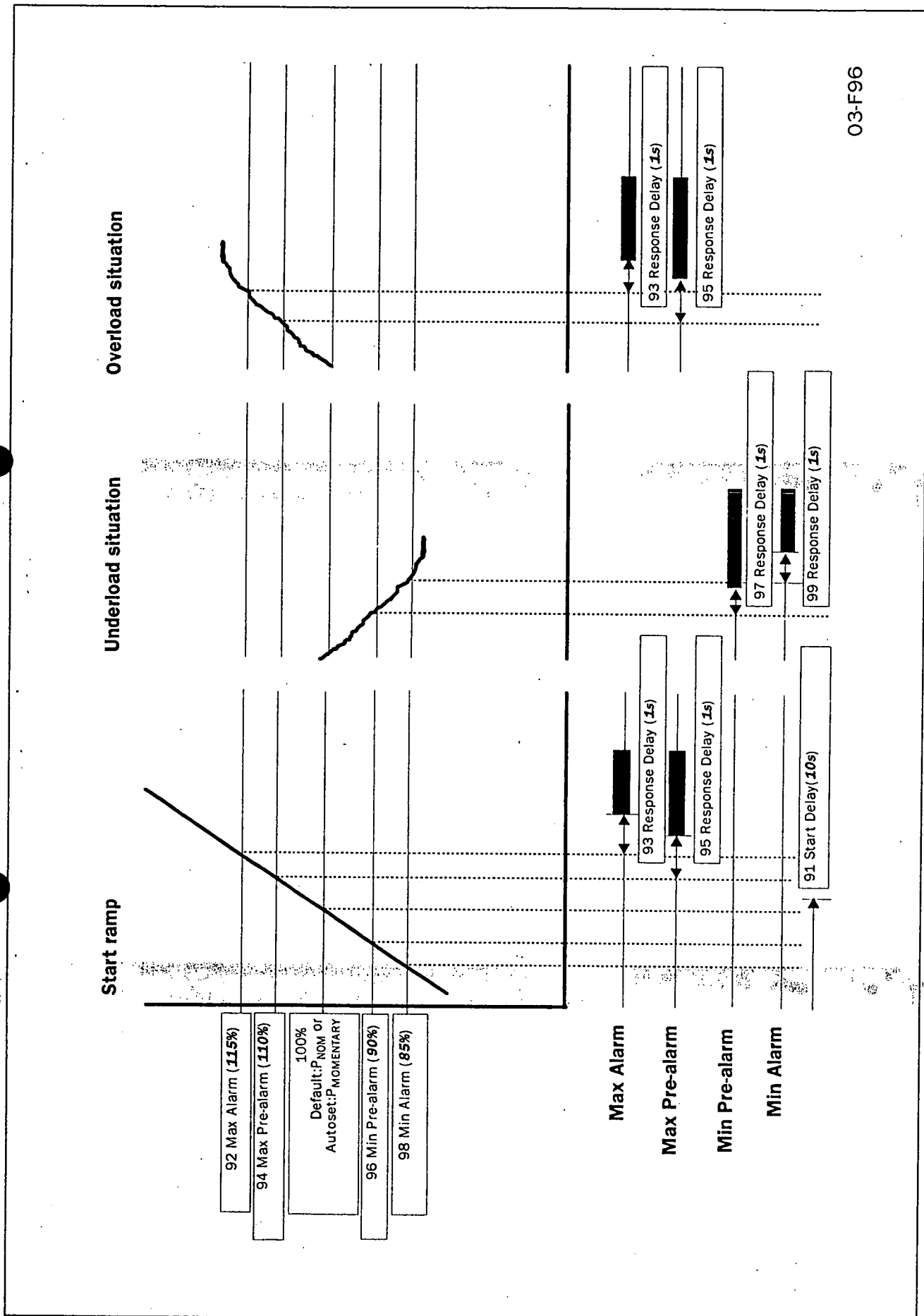


Fig. 58 Load monitor alarm functions.

7.24 Resume alarms

7.24.1 Phase input failure F1

- **Multiple phase failure.**
Shorter failure than 100ms is ignored. If failure duration time is between 100 ms and 2 s, operation is temporary stopped and a soft start is made if the failure disappears before 2 s. If failure duration time is longer than 2 s, an F1 alarm is given in cat. 2.
- **Single phase failure.**
During start up (acceleration) the behaviour is like multiple phase failure below. When full voltage running there is a possibility to select the behaviour.

101 ^o	
Run at single phase loss	
n o	
Default:	no
Range:	no, YES
no	Soft starter trips if a single phase loss is detected. Alarm F1 (category 2) will appear after 2 sec.
YES	Soft starter continues to run after a single phase loss. - Alarm F1 appears after 2 sec. - If the loose phase is reconnect the alarm is reset automatically. - If running on 2 phases, a stop command will give a Direct on line stop (freewheel)

7.24.2 Run at current limit time-out F4

In modes 'Current limit at start' and 'Voltage ramp with current limit at start' an alarm is activated if still operating at current limit level when selected ramp time exceeds. If an alarm occurs there is a possibility to select the behaviour.

102 ^o	
Run at current limit time-out	
n o	
Default:	no Alarm F4 appears after 2 sec.
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 ^o	
JOG forward enable	
o F F	
Default:	oFF
Range:	oFF, on
oFF	JOG forward disabled
on	JOG forward enabled

104 ^o	
JOG reverse enable	
o F F	
Default:	oFF
Range:	oFF, on
oFF	JOG reverse disabled
on	JOG reverse enabled

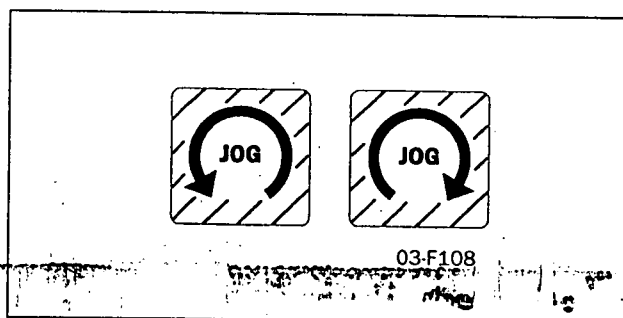


Fig. 59 The 2 Jog keys.

7.26 Automatic return menu

Often it is desirable to have a specific menu on the display during operation, i.e. RMS current or power consumption. The Automatic return menu function gives the possibility to select any menu in the menu system.

The menu selected will come up on the display after 60 sec. if no keyboard activity. The alarm messages (F1-F16) have a priority over menu 105 (as they have for all menus).

105 ^o			
<div> <div> <div></div> <div>0</div> <div>F</div> <div>F</div> </div> </div>			
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 ^o			
<div> <div> <div></div> <div></div> <div></div> <div>1</div> </div> </div>			
Serial comm unit address			
Default:	1		
Range:	1-247		
This parameter will select the unit address.			

112 ^o			
<div> <div> <div></div> <div></div> <div>9.</div> <div>6</div> </div> </div>			
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 ^o			
<div> <div> <div></div> <div></div> <div></div> <div>0</div> </div> </div>			
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 ^o			
<div> <div> <div></div> <div></div> <div></div> <div>1</div> </div> </div>			
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			
n o			
Default:	no		
Range:	no, YES		
no	No reset		
YES	Reset all functions to the factory defaults incl. all 4 Parameter Sets.		

NOTE! Reset to factory settings is not allowed at run.

7.29 View operation

General

The soft start includes as standard a numerous metering functions which eliminates the need of additional transducers and meters.

Measured values

- Current RMS 3-phase current and per phase
- Voltage RMS 3-phase voltage and per phase
- Output shaft power /torque kW/Nm
- Power factor
- Power consumption in kWh
- Operation time in hours

Viewing of the measured values

After setting motor data and extended functions one can set menu 008 in oFF and will then automatically move to menu 201, the first menu viewing the measured values and thus eliminate to scroll through menu 011 to menu 199.

201°			
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			
0.0 0 0			
Default:	-		
Range:	0.000 -2000MWh		
View the total power consumption.			

206°	
Reset of power consumption	
<div> <div></div> <div></div> <div>n</div> <div>o</div> </div>	
Default:	no
Range:	no, YES
no	No reset of power consumption.
YES	Reset power consumption in menu 205 to 0.000.

212°	
RMS current in phase L2	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L2.	

207°	
Motor shaft torque	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
Default:	-
Range:	-9999 - + 9999Nm
Viewing will show negative value if generator mode.	

213°	
RMS current in phase L3	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L3.	

208°	
Operation time	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
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	

214°	
Main voltage L1-L2	
<div> <div></div> <div></div> <div></div> <div>0</div> </div>	
Default:	-
Range:	0-720V
View main voltage L1-L2.	

211°	
RMS current in phase L1	
<div> <div></div> <div></div> <div>0.</div> <div>0</div> </div>	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L1.	

215°	
Main voltage L1-L3	
<div> <div></div> <div></div> <div></div> <div>0</div> </div>	
Default:	-
Range:	0 - 720V
View main voltage L1-L3.	

216°	
Main voltage L2-L3	
<div> <div></div> <div></div> <div></div> <div>0</div> </div>	
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 ^o					
Locked keyboard info					
<table border="1"> <tr> <td></td> <td></td> <td>n</td> <td>o</td> </tr> </table>				n	o
		n	o		
Default:	no				
Range:	no, YES				
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 ^o					
Alarm					
<table border="1"> <tr> <td></td> <td></td> <td>F</td> <td>1</td> </tr> </table>				F	1
		F	1		
Default:	-				
Range:	F1-F16				
View actual alarm					

8. PROTECTION AND ALARM

The soft starter is equipped with a protection system for the motor, the machine and for the soft starter itself.

Three categories of alarm are available:

Category 1

Alarm that stops the motor and need a separate reset before a new start can be accepted.

Category 2

Alarm that stops the motor and accepts a new start command without any separate reset.

Category 3

Alarm that continues to run the motor.

All alarm, except pre-alarm, will activate the alarm relay output K3, flash a red fault number on the display and it will also be placed in the alarm list. As long as the alarm is active, the display is locked in the alarm indication.

The relay output K3 can be used in the control circuit for actions needed when alarm occurs.

If more than one alarm is active, it is the last alarm that is presented on the display.

8.1 Alarm description

8.1.1 Alarm with stop and requiring a separate reset

Operation will stop for a category 1 alarm. A separate reset is needed before a new start command is accepted. It is possible to reset from keyboard (pushing "ENTER/RESET") regardless of selected control mode. It is also possible to reset the alarm from the actual control mode (i.e. if control mode is serial communication, a reset is possible to do from serial communication).

A reset is accepted first when the alarm source goes back to normal.

When a reset is made, the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

After a reset is made the system is ready for a new start command.

8.1.2 Alarm with stop and requiring only a new start command

Operation will stop for a category 2 alarm. A restart can be done and at the same time the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

It is still possible to reset the alarm in the same way as for category 1 alarms (see 8.1.1), if a start is not required at the time.

8.1.3 Alarm with continue run

Operation will continue run for a category 3 alarm. Some different reset behaviour is possible (see remarks for the specific alarms in § 8.2, page 67).

- Automatic reset when the alarm source goes back to normal.
- Automatic reset when a stop command is given.
- Manual reset during run.

When the reset occurs, the alarm relay output K3 is deactivated, the alarm indication on the display disappear and the original menu shows.

8.2 Alarm overview

Display Indication	Protective function	Alarm category	Remark
F1	Phase input failure.	Cat 3. Run with auto reset.	Single phase failure when full voltage running if menu 101 'Run at phase loss' = YES. If the fault phase comes back, an automatic reset is made.
		Cat 2. Stop with reset in start.	Multiple phase failure or single phase failure when not full voltage running or if menu 101 'Run at phase loss' = no.
F2	Motor protection, overload.	Cat 1. Stop with manual reset.	If menu 071 'Motor PTC input' = YES, cool down the motor. If menu 071 'Motor PTC input' = no, the internal model has to 'cool' down.
F3	Soft start overheated	Cat 1. Stop with manual reset.	If not cooled down, a reset will not be accepted.
F4	Full speed not reached at set current limit and start time.	If menu 102 'Run at current limit time-out' = no. Cat 2. Stop with reset in start.	The current limit start is not completed.
		If menu 102 'Run at current limit time-out' = YES. Cat 3. Run with manual reset.	When start time expired, a 6 sec ramp is used to reach full voltage, without control of the current. Reset the alarm with either a manual reset or a stop command.
F5	Locked rotor.	Cat 1. Stop with manual reset.	Motor and/or machine protection.
F6	Above max power limit.	Cat 1. Stop with manual reset.	Machine protection.
F7	Below min power limit.	Cat 1. Stop with manual reset.	Machine protection.
F8	Voltage unbalance.	Cat 2. Stop with reset in start.	Motor protection.
F9	Over voltage.	Cat 2. Stop with reset in start.	Motor protection.
F10	Under voltage.	Cat 2. Stop with reset in start.	Motor protection.
F11	Starts / hour exceeded.	Cat 2. Stop with reset in start.	Motor and/or machine protection.
F12	Shorted thyristor.	Cat 3. Run with manual reset.	When stop command comes, the stop will be a 'Direct On Line' stop, and the soft starter will be resetted. After this fault it is possible to start only in 'Direct On Line' mode. One or more thyristors probably damaged.
F13	Open thyristor.	Cat 1. Stop with manual reset.	One or more thyristors probably damaged.
F14	Motor terminal open.	Cat 1. Stop with manual reset.	Motor not correctly connected.
F15	Serial communication broken.	If menu 114 Serial comm. contact broken = 1. Cat 2. Stop with reset in start.	Serial communication broken will stop operation. Run from keyboard if necessary.
		If menu 114 Serial comm. contact broken = 2. Cat 3. Run with auto reset.	Serial communication broken will not stop operation. Stop from keyboard if necessary.
F16	Phase reversal alarm.	Cat 1. Stop with manual reset.	Incorrect phase order on main voltage input.

9. TROUBLE SHOOTING

9.1 Fault, cause and solution

Observation	Fault Indication	Cause	Solution
The display is not illuminated.	None	No control voltage.	Switch on the control voltage.
The motor does not run.	F1 (Phase input failure)	Fuse defective.	Renew the fuse.
		No mains supply.	Switch the main supply on.
	F2 (Motor protection, overload)	Perhaps PTC connection. Perhaps incorrect nominal motor current inserted (menu 042).	Check the PTC input if PTC protection is used. If internal protection is used, perhaps an other class could be used (menu 072). Cool down the motor and make a reset.
	F3 (Soft start overheated)	Ambient temperature too high. soft starter duty cycle exceeded. Perhaps fan failure.	Check ventilation of cabinet. Check the size of the cabinet. Clean the cooling fins. If the fan(s) is not working correct, contact your local MSF sales outlet.
	F4 (Full speed not reached at set current limit and start time)	Current limit parameters are perhaps not matched to the load and motor.	Increase the starting time and/or the current limit level.
	F5 (Locked rotor)	Something stuck in the machine or perhaps motor bearing failure.	Check the machine and motor bearings. Perhaps the alarm delay time can be set longer (menu 075).
	F6 (Above max power limit)	Overload	Over load. Check the machine. Perhaps the alarm delay time can be set longer (menu 093).
	F7 (Below min power limit)	Underload	Under load. Check the machine. Perhaps the alarm delay time can be set longer (menu 099).
	F8 (Voltage unbalance)	Main supply voltage unbalance.	Check mains supply.
	F9 (Over voltage)	Main supply over voltage.	Check mains supply.
	F10 (Under voltage)	Main supply under voltage.	Check mains supply.
	F11 (Starts / hour exceeded)	Number of starts exceeded according to menu 074.	Wait and make a new start. Perhaps the number of starts / hour could be increased in menu 074.
	F13 (Open thyristor)	Perhaps a damaged thyristor.	Make a reset and a restart. If the same alarm appears immediately, contact your local MSF sales outlet.
	F14 (Motor terminal open)	Open motor contact, cable or motor winding.	If the fault is not found, reset the alarm and inspect the alarm list. If alarm F12 is found, a thyristor is probably shorted. Make a restart. If alarm F14 appears immediately, contact your local MSF sales outlet.

Observation	Fault Indication	Cause	Solution
The motor does not run.	F15 (Serial communication broken)	Serial communication broken.	Make a reset and try to establish contact. Check contacts, cables and option board. Verify - System address (menu 111). - Baudrate (menu 112). - Parity (menu 113). If the fault is not found, run the motor with keyboard control if urgent (set menu 006 to "1"). See also manual for serial communication.
	F16 (Phase reversal)	Incorrect phase sequence on main supply.	Switch L2 and L3 input phases.
	----	Start command comes perhaps from incorrect control source. (i.e. start from keyboard when remote control is selected).	Give start command from correct source (menu 006).
	-Loc	System in keyboard lock.	Unlock keyboard by pressing the keys 'NEXT' and 'ENTER' for at least 3 sec.
The motor is running but an alarm is given.	F1 (Phase input failure)	Failure in one phase. Perhaps fuse defective.	Check fuses and mains supply. Deselect 'Run at single phase input failure' in menu 101, if stop is desired at single phase loss.
	F4 (Full speed not reached at set current limit and start time)	Current limit parameters are perhaps not matched to the load and motor.	Increase the starting time and/or the current limit level. Deselect 'Run at current limit time-out' in menu 102, if stop is desired at current limit time-out.
	F12 (Shorted thyristor)	Perhaps a damaged thyristor.	When stop command is given, a free wheel stop is made. Make a reset and a restart. If alarm F14 appears immediately, contact your local MSF sales outlet. If it is urgent to start the motor, set soft starter in 'Direct On Line' (menu 024). It is possible to start in this mode.
		By pass contactor is used but menu 032 'Bypass' is not set to "on".	Set menu 032 'Bypass' to "on".
	F15 (Serial communication broken)	Serial communication broken.	Make a reset and try to establish contact. Check contacts, cables and option board. Verify - System address (menu 111). - Baudrate (menu 112). - Parity (menu 113). If the fault is not found, run the motor with keyboard control if urgent, see also manual for serial communication.

Observation	Fault Indication	Cause	Solution
The motor jerks etc.	When starting, motor reaches full speed but it jerks or vibrates.	If 'Torque control' or 'Pump control' is selected, it is necessary to input motor data into the system.	Input nominal motor data in menus 041-046. Select the proper load characteristic in menu 025. Select a correct initial- and end torque at start in menus 016 and 017. If 'Bypass' is selected, check that the current transformers are correct connected.
		Starting time too short.	Increase starting time.
		Starting voltage incorrectly set.	Adjust starting voltage.
		Motor too small in relation to rated current of soft starter.	Use a smaller model of the soft starter.
		Motor too large in relation to load of soft starter.	Use larger model of soft starter.
		Starting voltage not set correctly	Readjust the start ramp. Select the current limit function.
	Starting or stopping time too long, soft does not work.	Ramp times not set correctly.	Readjust the start and/or stop ramp time.
		Motor too large or too small in relation to load.	Change to another motor size.
The monitor function does not work.	No alarm or pre-alarm	It is necessary to input nominal motor data for this function. Incorrect alarm levels.	Input nominal motor data in menus 041-046. Adjust alarm levels in menus 091 - 099. If 'Bypass' is selected, check that the current transformers are correct connected.
Unexplainable alarm.	F5, F6, F7, F8, F9, F10	Alarm delay time is too short.	Adjust the response delay times for the alarms in menus 075, 082, 084, 086, 093 and 099.
The system seems locked in an alarm.	F2 (Motor protection, overload)	PTC input terminal could be open. Motor could still be too warm. If internal motor protection is used, the cooling in the internal model take some time.	PTC input terminal should be short circuit if not used. Wait until motor PTC gives an OK (not overheated) signal. Wait until the internal cooling is done. Try to reset the alarm after a while.
	F3 (Soft start overheated)	Ambient temperature too high. Perhaps fan failure.	Check that cables from power part are connected in terminals 073, 074, 071 and 072. MSF-017 to MSF-145 should have a short circuit between 071 and 072. Check also that the fan(s) is rotating.
Parameter will not be accepted.	----	If the menu number is one of 020 - 025, only one can be selected. In other words only one main mode is possible at a time.	Deselect the other main mode before selecting the new one.
		If menu 061, 'Parameter set' is set to "0", the system is in a remote parameter selection mode. It is now impossible to change most of the parameters.	Set the menu 061, 'Parameter set' to a value between "1" - "4" and then it is possible to change any parameter.
		During acceleration, deceleration, slow speed, DC brake and Power factor control mode, it is impossible to change parameters.	Set parameters during stop or full voltage running.
		If control source is serial comm., it is impossible to change parameters from keyboard and vice versa.	Change parameters from the actual control source.
		Some menus include only read out values and not parameters.	Read-out values can not be altered. In table 13, page 35, read-out menus has '---' in the factory setting column.
	-Loc	Keyboard is locked.	Unlock keyboard by pressing the keys 'NEXT' and 'ENTER' for at least 3 sec.

10. MAINTENANCE

In general the soft starter is maintenance free. There are however some things which should be checked regularly. Especially if the surroundings are dusty the unit should be cleaned regularly.



WARNING! Do not touch parts inside the enclosure of the unit when the control and motor voltage is switched on.

Regular maintenance

- Check that nothing in the soft starter has been damaged by vibration (loose screws or connections).
- Check external wiring, connections and control signals. Tighten terminal screws and busbar bolts if necessary.
- Check that PCB boards, thyristors and cooling fin are free from dust. Clean with compressed air if necessary. Make sure the PCB boards and thyristors are undamaged.
- Check for signs of overheating (changes in colour on PCB boards, oxidation of solder points etc.). Check that the temperature is within permissible limits.
- Check that the cooling fan/s permit free air flow. Clean any external air filters if necessary.

In the event of fault or if a fault cannot be cured by using the fault-tracing table in chapter 9. page 68.

11. OPTIONS

The following options 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.

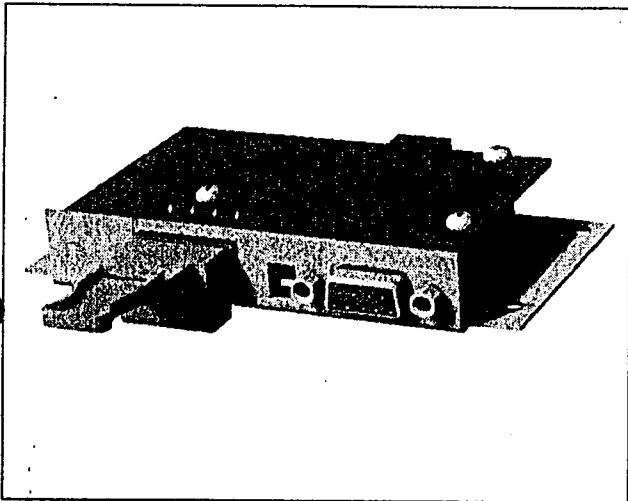


Fig. 60 Option RS232/485

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 its 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.

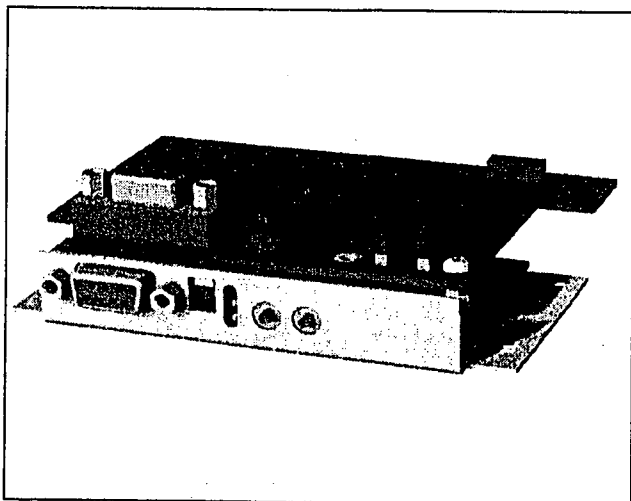


Fig. 61 Option Profibus

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.

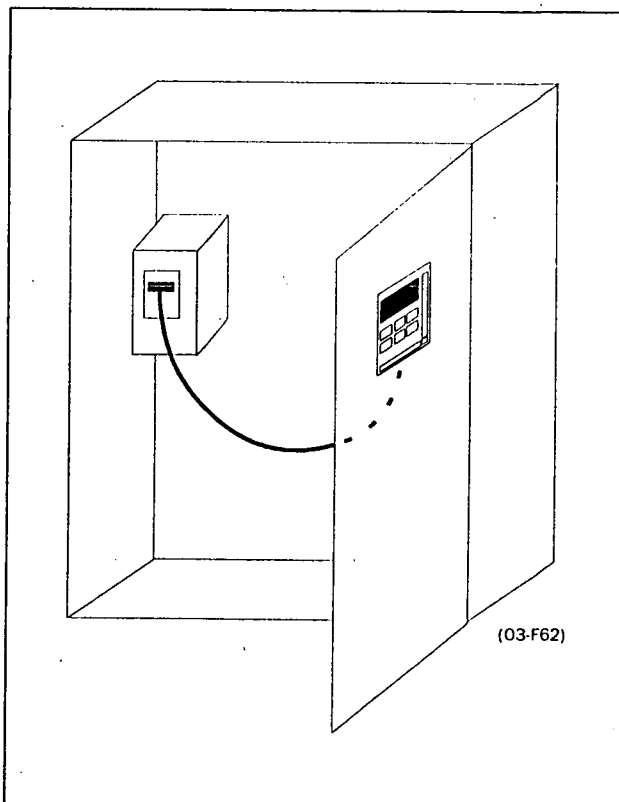


Fig. 62 Shows an example of the External PPU after it has been built in.

11.3.1 Cable kit for external current transformers

This kit is used for the bypass function, to connect the external current transformers more easily. order number: 01-2020-00.

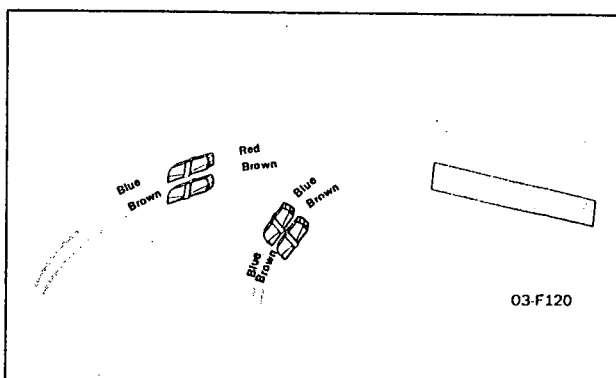


Fig. 63 Cable kit

11.4 Terminal clamp

Data: Single cables, Cu or Al

Cables 95-300 mm²

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 mm²

MSF type and Cu Cable 310 to -835

Bolt for connection to busbar M10

Dimensions in mm 35x87x65

Order No. parallel 9351

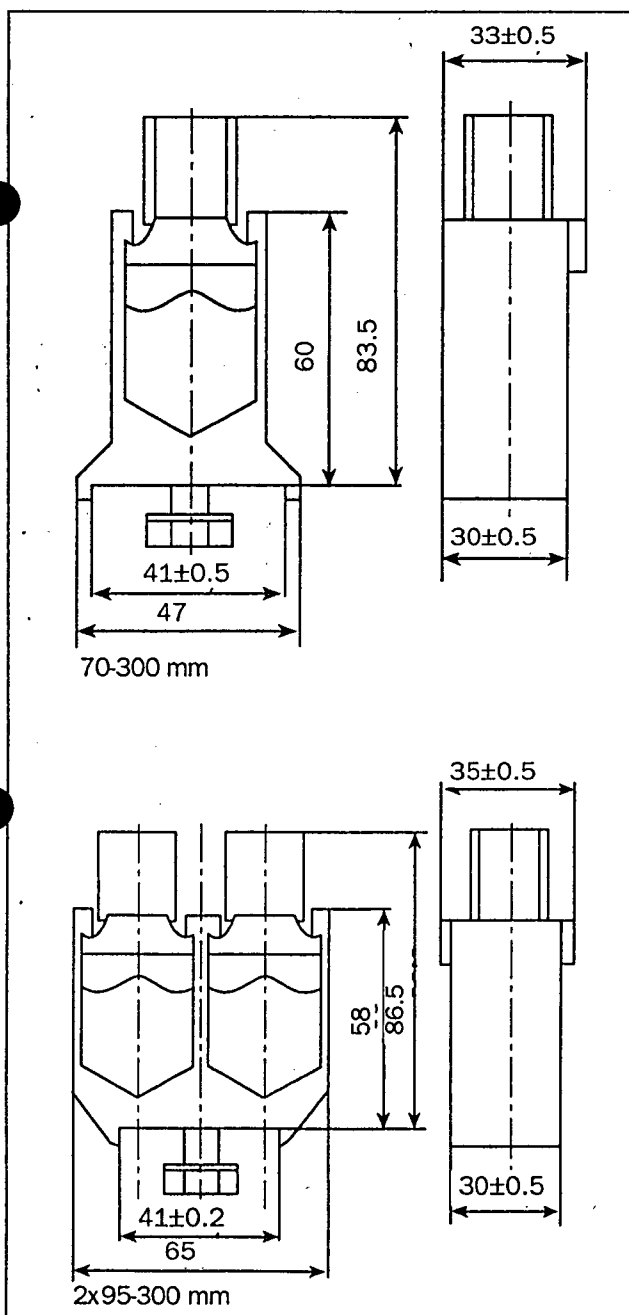


Fig. 64 The terminal clamp.

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	250
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 ² t (fuse) x 1000
MSF-017	80	2.4
MSF-030	125	7.3
MSF-045	150	11.7
MSF-060	200	22
MSF-075	250	42.5
MSF-085	300	71.2
MSF-110	350	95.6
MSF-145	450	137
MSF-170B	700	300
MSF-210B	700	300
MSF-250B	800	450
MSF-310	800	450
MSF-370	1000	600
MSF-450	1200	2100
MSF-570	1400	2700
MSF-710	1800	5300
MSF-835	2000	
MSF-1000	2500	
MSF-1400	3500	

13. SET-UP MENU LIST

Menu number	Function/Parameter	Range	Par.set	Factory setting	Value	Page
001	Initial voltage at start	25 - 90% of U	1 - 4	30		page 36
002	Start time ramp 1	1 - 60 sec	1 - 4	10		page 36
003	Step down voltage at stop	100 - 40% U	1 - 4	100		page 36
004	Stop time ramp 1	oFF, 2 - 120 sec	1 - 4	oFF		page 36
005	Current	0.0 - 9999 Amp	-----	-----		page 36
006	Control mode	1, 2, 3	1 - 4	2		page 37
007	Extended functions & metering	oFF, on	-----	oFF		page 38
008	Extended functions	oFF, on	-----	oFF		page 38
011	Initial voltage start ramp 2	30 - 90% U	1 - 4	90		page 38
012	Start time ramp 2	oFF, 1 - 60 sec	1 - 4	oFF		page 38
013	Step down voltage stop ramp 2	100 - 40% U	1 - 4	40		page 38
014	Stop time ramp 2	oFF, 2 - 120 sec	1 - 4	oFF		page 38
016	Initial torque at start	0 - 250% T _n	1 - 4	10		page 39
017	End torque at start	50 - 250% T _n	1 - 4	150		page 39
018	End torque at stop	0-100% T _n	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	1		page 51
052	Programmable relay K2	1, 2, 3, 4, 5	-----	2		page 51
054	Analogue output	oFF, 1, 2	1 - 4	oFF		page 52
055	Analogue output value	1, 2, 3	1 - 4	1		page 52
056	Scaling analogue output	5 - 150%	1 - 4	100		page 52
057	Digital input selection	oFF, 1, 2, 3, 4	1 - 4	oFF		page 53
058	Digital input pulses	1-100	1 - 4	1		page 53
061	Parameter set	0, 1, 2, 3, 4	-----	1		page 54
071	Motor PTC input	no, YES	-----	no		page 55
072	Internal motor thermal protection class	oFF, 2 - 40 sec	-----	10		page 55
073	Used thermal capacity	0 - 150%	-----	-----		page 55
074	Starts per hour limitation	oFF, 1 - 99/hour	1 - 4	oFF		page 55
075	Locked rotor alarm	oFF, 1.0 - 10.0 sec	1 - 4	oFF		page 55
081	Voltage unbalance alarm	2 - 25% U_n	1 - 4	10		page 56
082	Response delay voltage unbalance alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 56
083	Over voltage alarm	100 - 150% U_n	1 - 4	115		page 56
084	Response delay over voltage alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 56
085	Under voltage alarm	75 - 100% U_n	1 - 4	85		page 57
086	Response delay under voltage alarm	oFF, 1 - 60 sec	1 - 4	oFF		page 57
087	Phase sequence	L123, L321	-----	-----		page 57
088	Phase reversal alarm	oFF, on	-----	oFF		page 57
089	Auto set power limits	no, YES	-----	no		page 57
090	Output shaft power	0.0 - 200.0% P_n	-----	-----		page 57
091	Start delay power limits	1 - 250 sec	1 - 4	10		page 58
092	Max power alarm limit	5 - 200% P_n	1 - 4	115		page 58
093	Max alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 58
094	Max power pre-alarm limit	5 - 200% P_n	1 - 4	110		page 58
095	Max pre-alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 58
096	Min pre-alarm power limit	5 - 200% P_n	1 - 4	90		page 58
097	Min pre-alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 59
098	Min power alarm limit	5 - 200% P_n	1 - 4	85		page 59
099	Min alarm response delay	oFF, 0.1 - 25.0 sec	1 - 4	oFF		page 59
101	Run at single phase input failure	no, YES	1 - 4	no		page 61
102	Run at current limit time-out	no, YES	1 - 4	no		page 61
103	Jog forward enable	oFF, on	1 - 4	oFF		page 61
104	Jog reverse enable	oFF, on	1 - 4	oFF		page 61
105	Automatic return menu	oFF, 1-999	-----	oFF		page 62
111	Serial comm. unit address	1 - 247	-----	1		page 62
112	Serial comm. baudrate	2.4 - 38.4 kBaud	-----	9.6		page 62

Menu number	Function/Parameter	Range	Par.set	Factory setting	Value	Page
113	Serial comm. parity	0, 1	-----	0		page 62
114	Serial comm. contact broken	off, 1, 2	-----	1		page 62
199	Reset to factory settings	no, YES	-----	no		page 63
201	Current	0.0 - 9999 Amp	-----	-----		page 63
202	Line main voltage	0 - 720 V	-----	-----		page 63
203	Output shaft power	-9999 - 9999 kW	-----	-----		page 63
204	Power factor	0.00 - 1.00	-----	-----		page 63
205	Power consumption	0.000 - 2000 MWh	-----	-----		page 63
206	Reset power consumption	no, YES	-----	no		page 64
207	Shaft torque	-9999 - 9999 Nm	-----	-----		page 64
208	Operation time	Hours	-----	-----		page 64
211	Current phase L1	0.0 - 9999 Amp	-----	-----		page 64
212	Current phase L2	0.0 - 9999 Amp	-----	-----		page 64
213	Current phase L3	0.0 - 9999 Amp	-----	-----		page 64
214	Line main voltage L1 - L2	0 - 720 V	-----	-----		page 64
215	Line main voltage L1 - L3	0 - 720 V	-----	-----		page 64
216	Line main voltage L2 - L3	0 - 720 V	-----	-----		page 64
221	Locked keyboard info	no, YES	-----	no		page 65
901	Alarm list, Latest error	F1 - F16	-----	-----		page 65
902-915	Alarm list, Older error in chronological order	F1 - F16	-----	-----		page 65

Explanation of units:

U	Input line voltage
Un	Nominal motor voltage.
In	Nominal motor current.
Pn	Nominal motor power.
Nn	Nominal motor speed.
Tn	Nominal shaft torque.
Insoft	Nominal current soft starter.
Pnsoft	Nominal power soft starter.
Nnsoft	Nominal speed soft starter.

Calculation shaft torque

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

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

14. INDEX

Numerics

2-wire start/stop	37
3-wire start/stop	37

A

Above max power limit	67
Alarm category	67
Alarm list	65
Alarm reset	23
Ambient temperatures . 10, 20, 74, 75, 77	
analogue control	32
Analogue input	32, 41
Analogue output	32, 52
Analogue output gain	52
Analogue output value	52
Auto set power limits	57
automatic reset	37
Automatic return menu	62

B

Basic parameter setting	10
Below min power limit	67
Brake method	47
Braking Strenght	47
Braking time	46
Busbars	25, 26
Bypass	43
Bypass contactor	44

C

Cabinet	24
Checklist	10
Clickson thermistor	32
Combination matrix	19
Complaint	7
Confirm setting	23
Connections	28, 32
Control mode	23, 37
Control voltage	32
control voltage	33
Control voltage connection	28, 31
Cooling fins	24
cos phi	50
Current	63
Current in phase L1	64
Current in phase L2	64
Current in phase L3	64
Current limit	39
Current limit time-out	61
Current transformer	45

D

D.O.L start	41
DC-brake	46
DC-Brake at slow speed	49
Decrease value	23
Decrease value of setting	23

Device connections	28, 31
different operation situation	22
Digital inputs	32
Dimension	25, 74
DIN VDE 0100	24
Direct On Line start	41
Dismantling	2
Display next window	23
Display previous window	23
Dual voltage ramp	38

E

Electrical characteristic	32
Electrical Data	74, 75, 76, 77
EMC	74, 75, 76, 77
Emergency	2
End torque	39

F

Factory settings	63
Features	9
Forward/reverse	34
Free circulation of air	24
frequency	50
Frequency inverter	20
Front cover	21
Full speed not reached	67
Full voltage	51
Full voltage start	41
Function	79

G

General Data	74
General description	21

H

Heat dissipation	20
High ambient temperatures	43

I

Increase value	23
Increase value of setting	23
Initial torque	39
Initial voltage at start ramp 1	36
Initial voltage at start ramp 2	38
INSPECTION AT DELIVERY	7
Installation	24
Insulation test	20

J

JOG Forward	23, 61
JOG fwd/rev	23
JOG Reverse	23, 61
Jumper J1	41
Jumper J2	52

K

Keyboard	23
----------------	----

Keyboard lock	23, 65
keys	23

L

LED display	22
Live circuit components	24
Load monitor	57
Locked rotor	67
Low load	20

M

Main functions	81
Mains contactor	10
Mains supply	28, 31
Mains voltage	10
MAINTENANCE	71
Matrix	19
Max power alarm limit	58
Max power pre-alarm limit	58
Max pre-alarm response delay	58
Mechanical Data	74, 75, 76, 77

Menu

001	36
002	11, 36
003	36
004	11, 36
005	12, 36
006	12, 37
007	38
008	38
011	38
012	38
013	38
014	38
016	39
017	39
020	39
021	40
022	40
023	41
024	41
025	42
030	43
031	43
032	43
033	46
034	46
035	47
036	47
037	48
038	49
039	49
040	49
041	11, 50
042	50
043	11, 50
044	11, 50
045	11, 50
046	11, 50

051	51	Motor current	50	Q	
052	51	Motor data	50	Quick Set-up	10
054	52	Motor power	50	R	
055	52	Motor power supply	28, 31	Rating plate	10
056	52	Motor protection, overload	55, 67	Recyclable material	2
057	53	Motor shaft torque	64	Regular maintenance	71
058	53	Motor speed	50	Relay K1	32, 51
061	54	Motor terminal open	67	Relay K2	32
071	55	Motor voltage	50	Relay K3	32
072	55	MOUNTING	24	Remote	23
073	56	MOUNTING/WIRING	24	Reset	23
074	56			reset	66
075	56	N		Response delay max alarm	58
081	56	Next	23	RMS current	36, 63
082	56	Nominal frequency	11	RMS main voltage	63
083	56	Nominal motor cos phi	11	Rotating loads	20
084	56	Nominal motor current	11	Running motors	20
085	57	Nominal motor power	11	Running-LED	22
086	57	Nominal motor speed	11		
087	57	Norms/Standards	74, 75, 76, 77	S	
088	57	NTC thermistor	32	Safety	2, 6
089	57			Safety measures	10
090	57	O		Scrapping	2
091	58	Open thyristor	67	Selection of control mode	12
092	58	Operation	51	Semiconductor fuses	33, 78
093	58	Operation time	63, 64	Serial comm.	23
094	58	Operation/Set-up	23	Serial communication broken	67
095	58	Operator panel	21	Shaftpower	57, 63
096	59	Output motor shaftpower	63	Shielded motor cable	20
097	59	Output shaftpower	57, 63	Shorted thyristor	67
098	59	Over voltage	56, 67	Simple soft start and soft stop	10
099	59			Slip ring motors	20
101	61	P		Slow blow fuses	33
102	61	Parallel	20	Slow speed time at start	49
103	61	Parallel cables	73	Slow speed time at stop	49
104	61	Parameter	79	Slow speed torque	48
105	62	Parameter Set	32, 54	Small motor	20
199	63	PFC	46	Softbrake	51
201	63	Phase compensation capacitor	20	Softstart overheated	67
202	63	Phase input failure	67	Spare parts	2
203	63	Phase loss	61	standard commercial fuses	78
204	63	Phase reversal alarm	67	Standard wiring	10, 33
205	63	Phase sequence	57	Standards	6
206	64	Pole-changing contactor	20	Start command	22
207	64	Potentiometer	32	Start delay power limits	58
208	64	Power consumption	63	Start ramp 1	36
211	64	Power factor	63	Start ramp 2	38
212	64	Power Factor Control	46	Start the motor	12
213	64	Power loss	10	Start time ramp 1	11
214	64	PPU unit	21	Start/Stop	12, 23
215	64	Pre-alarm	51, 58	Start/stop combination	19
216	64	Prevent damage to the thyristors	24	Start/stop/reset from keyboard	12
221	23, 65	Previous	23	Start/stop-LED	22
901	65	Programmable relay	51	Starting	12
RMS current read-out	12	Programming and presentation unit (PPU)	21	STARTING/OPERATING	79
Menu expansion	38	protection/insulation	74, 75, 76, 77	Starts per hour	67
Menu Structure	22	Protective earth	28, 31	Starts per hour limitation	56
Min alarm response delay	59	PTC	55	Step down voltage in stop ramp 2	38
Min power alarm limit	59	PTC Thermistor input	32	Step down voltage stop ramp 1	36
Min power pre-alarm limit	59	Pump control	40	Stop command	22
Min pre-alarm response delay	59			Stop ramp 1	36
Minimum free space	24, 25				
Motor	31				

Stop ramp time 2	38
Stop time ramp 1	11
storage	7
Supply voltage	32, 74
switch	2
Switch the device off	2
Switch-off procedures	2

T

TECHNICAL DATA	74
Terminal	32
Terminal clamp	78
Terminals	32
Thermal capacity	56
Thermal protection	55
Tightening torque	25
Torque boost active time	43
Torque boost current limit	43
Torque booster	43
Torque control	42
Trained personnel	2, 10
Transport	7
TROUBLESHOOTING	68
Two speed motor	20

U

Under voltage	57, 67
Unpacking	7

V

VIEW OPERATION	63
Voltage	63
Voltage unbalance	56, 67

W

Weight	74
Wiring circuit	33
Wiring example	34

REPRESENTATION

ADL Co.
P.O. Box 47
12 50 40 MOSCOW
Russia
Tel. 00007- 095268 7423
Fax 00007- 095268 0348
rousian@adlserv.aha.ru

AUTOMATECH Sp.zo.o
ul. Ryżowa 84
PL-02482 OPACZ-KOLONIA
Poland
Tel. 0048- 22-723 06 62
Fax 0048- 22-723 06 06
b.kolodziejczyk@automatech.it.pl

Elimko
8. Cadde 68. Sokak Nr. 16
06510 Emek-ANKARA
Turkey
Tel. 0090 - 312 212 64 50
Fax 0090 - 312 212 41 43

Elpro Drive , S. R. O.
ul. Miru 3
CZ 73961 TRINEC
Tjeckien Republic
Tel. 00420W 659434661
Fax 00420W 659325864
agorgol@elprocz.cz

Emotron AB
Box 222 25
SE-250 24 HELSINGBORG
Sweden
Tel. +46 42 169900
Fax +46 42 169949
info@emotron.com

Emotron Antriebssysteme GmbH
Goethestrasse 6
38855 WERNIGERODE
Germany
Tel. 0049- 3943 92050
Fax 0049- 3943 92055
info@emotron-as.de

Emotron B.V.
P.O. Box 132
5531 NX BLADEL
Holland
Tel. 0031- 497 389222
Fax 0031- 497 386275
info@emotron.nl

Emotron Drives (UK) Ltd
Spaces Business Centre
Radway Green Park
Alsager
Cheshire
CW2 5PR
Great Britain
Tel. 0044- 1270 879440
Fax 0044- 1270 886119
trevor@emotron.freemove.co.uk

Emotron El-Fi SA
Arlbau 229
ES-08021 BARCELONA
Spain
Tel. 0034- 93 209 14 99
Fax 0034- 93 209 12 45
emotron@emotron.es

Emotron Inc
3440 Granite Circle
TOLEDO, OH 43617
USA
Tel. 001- (419) 841-7774
Fax 001- (419) 843-5816
paul.hackett@usa-emotron.com

Emsby
27 Rodwell Street
QUE - 4108 ARCHERFIELD
Australia
Tel. 0061- 7 3274 2566
Fax 0061- 7 3274 2387
dkirkegaard@emsby.com

Esquire Engineering sdn bhd
13, Jln Jurutera U1/23, Seksyen U1
Hicom-Glenmarie Industrial Park
40000 Shah Alam SELANGOR
Malaysia
Tel. 0060- 3 519 1958
Fax 0060- 3 519 1960
barry_h@tm.net.my

HEDTEC OY
P.O.B 110
SF-00201 HELSINGFORS
Finland
Tel. 00358- 9 682881
Fax 00358- 9 674918
kaj.nyberg@hedengren.fi

Ingeniör Ivar Pettersen AS
Postboks 166
N-3001 DRAMMEN
Norway
Tel. 0047- 32 21 21 21
Fax 0047- 32 21 21 99
lars.hennum@pettersen.no

K.K. El-Fi
2-18-4 Hagoromocho
1900021 Tachikawa
J- TOKYO
Japan
Tel. 0081- 42 528 8820
Fax 0081- 42 528 8821
sato.hiroyuki@el-fi.co.jp

MAS for Eng. & Trad
From Tahreer St
12, a-Abee Ema'ma St.
DOKKI GIZA
Egypt
Tel. 0020- 2 3357947
Fax 0020- 2 3357948

Mohamad Eid Kari
Marjeh -square,
Euphorat st. Dagestani
Bld. 1st. Fl. POB 31203
DAMASKUS
Syria
Tel. 00963- 11 222 3867
Fax 00963- 11 224 5425

Pardis International
Golbarg W. Kerman
S. Rahmati E. No.202
TEHERAN
Iran
Tel. 0098- 21 7838571
Fax 0098- 21 7838571
mehraban@irtp.com

Safronics (PTY) LTD
27 Heronmere Road
P O Box 38045
2016 BOOYSENS
South Africa
Tel. 0027- 11 434 1345
Fax 0027- 11 434 1359
rann@pixie.co.za

TENSON Engineering Ltd
Room 908, Nan Fung Commercial
Center
19 LAM LOK St
KOWLOON BAY
Hong Kong
Tel. +852 2758 0878
Fax +852 2759 5335
sammy@tenson.com.hk

WELLFORD CHILE S.A.
ENCALA 103645
Madrid No 1602 - Santiago
SANTIAGO
Chile
Tel. 0056- 2 556 26 55
Fax 0056- 2 556 35 28
encala@hotmail.com

Voltampere s.a.
2nd klm Lagada-Redina
GR-57200 THESSALONIKI
Greece
Tel. 0030- 394 26188
Fax 0030- 394 26189
automation@voltampere.gr

www.emotron.com



MAXIMIZING UPTIME

7.0 TEST SHEETS



J. & P. RICHARDSON INDUSTRIES PTY LTD

114 Campbell Avenue, WACOL QLD 4076

Ph: (07) 3271 2911 - Fax: (07) 3271 3623

E-mail: jpr@jpr.com.au

SWITCHBOARD & SHEETMETAL INSPECTION REPORT

Customer Name: I.C.C.			Job No: B58428		
Item: PUMP STATION B22 <i>ALUMINIUM</i>			Drawing No: E03 - B58428/B04/B1/C2		
TASK	PRODUCT DETAIL	INSPECTED BY	DATE	PASS/ FAIL	CORRECTIVE ACTION REQUEST OR COMMENTS
Design	Documents	<i>KM</i>	<i>9/7/03</i>		
Drafting	Documents	<i>KM</i>	<i>9/7/03</i>		
Sheetmetal (Refer F1018 for details)	Switchboard	<i>Jhel</i>	<i>22/7/03</i>	<i>PASS</i>	
	Doors	<i>Jhel</i>			
	Cell/Panels	<i>Jhel</i>			
Painting					
Process	Powder / Wet				
Min DFT (40 STD)					
Cure Test					
Colour Exterior	<i>WASH</i>	<i>Howard</i>	<i>22/07/03</i>	<i>PASS</i>	
Colour Internal		<i>Wash</i>			
Colour Panels	<i>WHITE</i>				
Cubicle Erection					
Electrical Fitout (In accordance with drawings)		<i>C. Kippen</i>	<i>11/8/03</i>	<i>PASS</i>	
Inspection & Test (Refer to F1019)		<i>D. Griffin</i>	<i>11/8/03</i>	<i>PASS</i>	
Packing					
Comments:					
<i>all Regs have been done? Howard Wash 22/07/03</i>					
<i>(PROGRAMMED INSTALLED BY PARASYN 11/8/03)</i>					
NOTE: - Manufacture is not to proceed to the next process until the item has passed inspection					
Affix Status Here: -					
Yellow		Awaiting Inspection			
Green		Inspection & Test Passed			
Red		Inspection & Test Failed, Awaiting Rectification			

**J. & P. RICHARDSON INDUSTRIES PTY. LTD.**

114 Campbell Avenue, WACOL QLD 4076

Ph: (07) 3271 2911 - Fax: (07) 3271 3623

E-mail: jpr@jpr.com.au

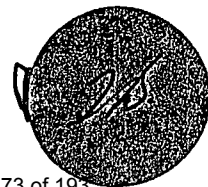
SWITCHBOARD / SHEETMETAL
INSPECTION CHECKLIST

CLIENT: <i>ICC</i>			JOB NO: <i>558428</i>		
PRODUCT DESCRIPTION: <i>PUMP STATION. B22</i>			DRAWING & SCHEDULE NUMBERS <i>E03-B58428-BOA-01-E2</i>		
CONSTRUCTION	QUALITY		COMPLIANCE WITH DRAWINGS		REMARKS OR ACTION
	GOOD	POOR	YES	NO	
1. Folds			✓		
2. Welds			✓		
3. Edges / File			✓		
4. Gauge			✓		
5. Material			✓		
6. Ventilation Openings / Filter Bracket			✓		
7. Equipment Mounting Arrangement			✓		
8. Doors Stiffened					
9. Escutcheons and Lexan Covers				✓	
10. Cable Saddles			✓		
11. Grinding			✓		
12. Door Stays Fitted			✓		
13. Earth Studs			✓		
14. Rubber Retainer				✓	
15. Drawing Holder					
16. Hat Sections					
17. Locking Bars Fitted			✓		
18. External Crevice Welded And Ground			✓		
19. Legend Cards					
20. General Conditions Satisfactory			✓		
21. Cabinet Clean			✓		
22. Job Name and Number Marked			✓		
INSPECTED BY: <i>[Signature]</i>			DATE: <i>22-7-03</i>		

AFFIX STATUS HERE

Yellow
Green
Red

Awaiting Inspection
Inspected/Tested Passed
Inspected/Tested waiting Rectification





J. & P. RICHARDSON INDUSTRIES PTY LTD

114 Campbell Avenue, WACOL QLD 4076

Ph: (07) 3271 2911 - Fax: (07) 3271 3623

E-mail: jpr@jpr.com.au

SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

Customer Name: IPSWICH CITY COUNCIL							
Project: PUMP STATION B22							
JPR Job No: B58428				Item:			
Constructed by: C. KIPPEN				Tested by: D. GRIFFIN		Date: 11/8/03	
Item check list: To comply with Drawings, Documents & Specification							
Main Functional Unit/s	Qty	✓	Size	✓	Fuses/O/L	✓	
Fuse Fittings	Qty	✓	Size	✓	Fuse Size	✓	
Circuit Breakers	Qty	✓	Size	✓	O/L		
Neutral	Reqd	✓	Size	✓	ID		
Earthing	Checked	✓	Size	✓			
C.T.s	Qty		Rating				
Meters	Qty		Rating				
Contactors	Qty	✓	Rating	✓	Voltage	✓	
Overloads	Qty	✓	Rating	✓			
Relays	Qty	✓	Rating	✓	Voltage	✓	
Timers	Qty	✓	Rating	✓	Voltage	✓	
Control Switches	Qty	✓	Rating	✓	Function	✓	
Push Buttons	Qty	✓	Rating	✓	Function	✓	
Pilot Lights	Qty	✓	Rating	✓	Voltage	✓	
Transformers	Qty	✓	Rating	✓	Voltage	✓	
Auto Transformers	Qty		Rating		Voltage		
Terminals	Qty	✓	Size	✓	ID	✓	
Engraving	Qty	✓	Size	✓	ID		
Cabling	Type	✓	Size	✓	ID		
Busbars	Type		Size		ID		
Escutcheons / Shrouds	Type	✓	Material	✓	IP rating	✓	
S.A. Metering CTs	Qty		Rating				
S.A. Metering Links	Type						
S.A. Meters	Type		Size				
	Qty		Size				
	Qty		Size				
	Qty		Size				
	Qty		Size				
	Qty		Size				
	Qty		Size				
General Check List:							
IP Sealing	Rating	✓	Type	✓	Operation	✓	
Door Latches	Qty	✓	Type	✓	Operation	✓	
Ventilation	Required	✓	Type	✓	Operation	✓	
Circuit Schedule	Required	✓	Fitted	✓	Checked	OK	
Random Terminal Tightness	Power	✓	Control	✓	Result	OK	
Busbar System	Clearances	✓	Joints	✓	ID	✓	
Earth Continuity	Body to E	✓	Doors to E	✓	Panels to E	✓	
Cubicle Cleaned	✓						
Paint Finish Intact	N/A.						
Comments:							

Form No. F1029/2

Ph: (07) 3271 2911 - Fax: (07) 3271 3623

E-mail: jpr@jpr.com.au

Customer Name: IPSWICH CITY COUNCIL	
Project: PUMP STATION B22	
JPR Job No: B58428	Switchboard:
Constructed by: C. KIPPEN	Tested by: D. GRIFFIN
Date: 11/8/03	

CONTINUITY TEST

[illegible]

Sketch:

INSULATION TESTS TO SECTION 8 OF AS3439.1-1993

Designation	1000 V Test	2.5 kV Test (1min)	1000 V Test
Red to Earth	200+ M Ω		
White to Earth	200+ M Ω		
Blue to Earth	200+ M Ω		
Neutral to Earth	200+ M Ω		
Red to White	200+ M Ω		
Red to Blue	200+ M Ω		
White to Blue	200+ M Ω		

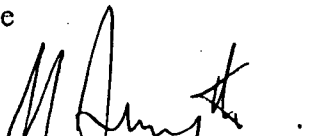
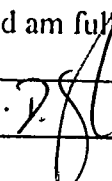
Comments:

JOB SAFETY ANALYSISLIVE LOW VOLTAGE WORKTESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP

DATE: 5./8./03

AUTHORISATIONS		PERSONAL PROTECTIVE EQUIPMENT				
<ul style="list-style-type: none"> Authorisation from person in charge  (Signature)	<input checked="" type="checkbox"/> YES	<ul style="list-style-type: none"> Long cotton clothing Insulating work gloves in test Insulating mats / covers in test Switchboard rescue kit in test 	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES			
TASK LIVE LOW VOLTAGE WORK TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES	<ul style="list-style-type: none"> Isolation points identified and accessible Work area clear of obstructions Unauthorised access prevented to work area P.P.E. is fit for purpose Test equipment is fit for purpose Written authority to proceed has been obtained from a person in charge JPR authorisation to conduct live work is current Approved dedicated power supply only used for testing. 	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES			
	OPTION (A) RCD protected outputs used at power supply	<ul style="list-style-type: none"> > RCD protection checked daily prior to use > Safety Observer is not required 	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES	<input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES <input checked="" type="checkbox"/> YES		
	OPTION (B) Non RCD protected outputs used at power supply	<ul style="list-style-type: none"> > Supervisor consulted prior to use > Safety Observer is in attendance 	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES	<input type="checkbox"/> YES <input type="checkbox"/> YES <input type="checkbox"/> YES		
	I understand and am fully aware of the requirements of this job safety analysis.					
	Signatures:	1. 	2.	3.	4.	5.

KSB Ajax Pumps Pty. Ltd.

Electric Submersible Pump Test Data

Test No.: 297-03

Customer:

J&P RICHARDSON

Project:

LOBLEY ST. SPS B22

KSB Ajax Branch:

MELBOURNE

Unit No.:

35956-1

Tag No.:

Measuring Instruments:

Flow:

300mm MAGNA FLOW METER

Discharge Head:

DPI-705

PUMP

Make: KSB-AJAX

Type: SUB

Size: K300-630

Series: NCD

Serial No.: 35956-1

Imp.Dia.: 560 mm

Suction Pipe Dia.: 1000000 mm

Discharge Pipe Dia.: 300 mm

Gage Hight Cor.: 0 m

DUTY

Flow:

186.5 l/s

Head:

42 M

Speed:

998 rpm

Power:

998 kW

Efficiency Pump:

Efficiency O / A:

kWh / kWh

MOTOR

Make:

KSB-AJAX

Frame:

WD533

Speed:

988 rpm

Supply:

415 / 3 ph / 50 Hz

Type:

SUB

Serial No.:

35956-1

Power:

165 kW

Amps:

293 A

Efficiencies:

1/4 F.L.:

0.95

1/2 F.L.:

0.952

3/4 F.L.:

0.949

5/4 F.L.:

Water Temperature:

Test Standard:

°C

AS2417-2001, Grade 2

Point	Flow	Disch. Head	AMPS	Power In (Motor)	Motor Effy	DYH	Speed	Flow	Total Head	Power In (pump)	Pump Effy	O/All Effy	Energy per Vol kWh/d
No	l/s	m	I	kW		m	rpm	l/s	m	kW			#DIV/0!
1	0.00	51.10	141.00	67.70	0.918	0.00	988	0.00	51.10	61.62	0.00	0.000	0.000
2	104.00	45.50	181.00	99.50	0.951	0.11	988	104.00	45.61	94.09	49.42	0.470	0.2641
3	151.00	43.40	199.00	112.00	0.951	0.23	988	151.00	43.63	105.98	60.95	0.580	0.2047
4	187.50	41.20	208.00	119.00	0.951	0.36	988	187.50	41.56	112.65	67.82	0.645	0.1752
5	221.00	39.10	219.00	126.00	0.952	0.50	988	221.00	39.60	119.32	71.90	0.684	0.1574
6	291.00	34.40	240.00	139.00	0.951	0.86	988	291.00	35.26	131.57	76.47	0.728	0.1318
7	400.00	25.80	263.00	153.00	0.950	1.63	988	400.00	27.43	144.66	74.37	0.707	0.1056

Test Officer:

Witnessed by:

KLAUS BIERMANN

N/A

Signed:

Signed:

Comments:

Date:

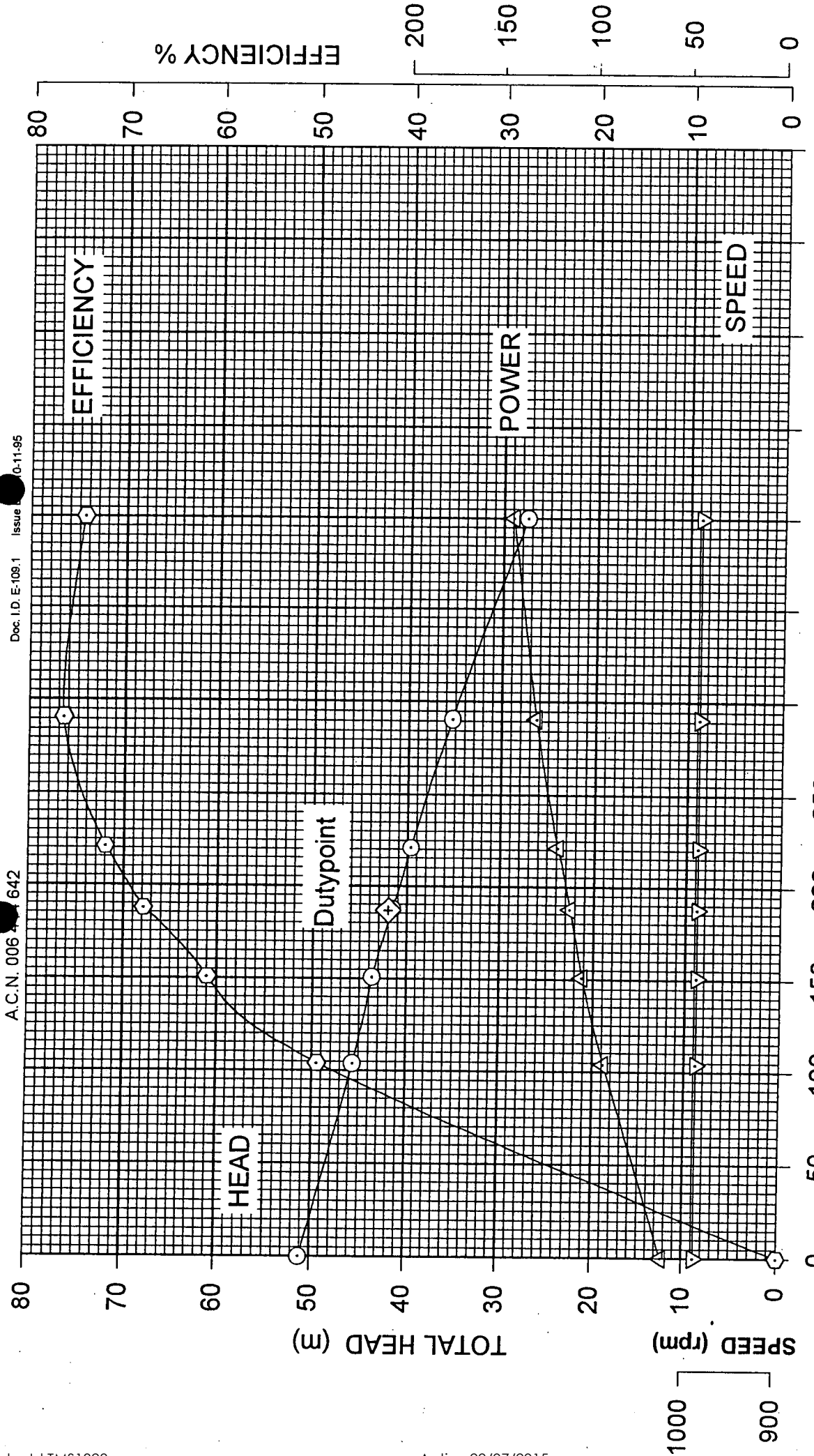
8.8.03

ISSUE DATE 17.04.03

Doc No. E-3.3

A.C.N. 006 411 642

Doc. I.D. E-108.1 Issue 10-11-95



CLIENT AND REFERENCE J&P RICHARDSON LOBLEY ST. SPS B22	UNIT NUMBER 35956-1 TEST NUMBER 297-03 PUMP SERIAL 35956-1	IMPELLER DIAMETER 560 MM	NOMINAL SPEED 998 RPM	KSB AJAX K300-630 NCD	CURVE No. 297-03	ISSUE 1
					DATE 8.8.03	

1P SWICH WATER

PRESSURE SENSOR



22 Palmerin Street, Warwick 4370 Qld
Australia.

Tel: 0746 601888

Fax: 0746 601800

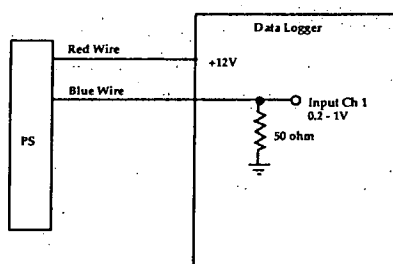
CERTIFICATE of CONFORMANCE

Product Information

Model No.	PS100	Customer:	J&P Richardson Industries Pty Ltd
		Ref:	SO0008549
Serial No.	019443	Cable Length	20 metres
Range	0 - 10 m H ₂ O	Supply Voltage	8 - 27 VDC
Output	FS 20.00 mA	Connection +ve	Red
	Zero 4.00 mA	o/p	Blue
Linearity*	+/- 0.5 % of FS	Shield	Yellow /Green
Accuracy	+/- 0.75% FS (over 0-50°C)	Connection Code	BW2
Sensor Type	Gauge	For connection detail please refer to Connector Chart supplied.	

User Notes

1. AS1376 is used to convert kPa to metres of water (1kPa = 102.15 mm water).
2. Do not attempt to dismantle the sensor as it will void the warranty.
Contact your agent for technical advice.
3. The sensor is protected against reverse polarity connection.
4. Connection: This is a two wire system, the current outputs are measured
across a nom 50 ohm load resistor as illustrated below:



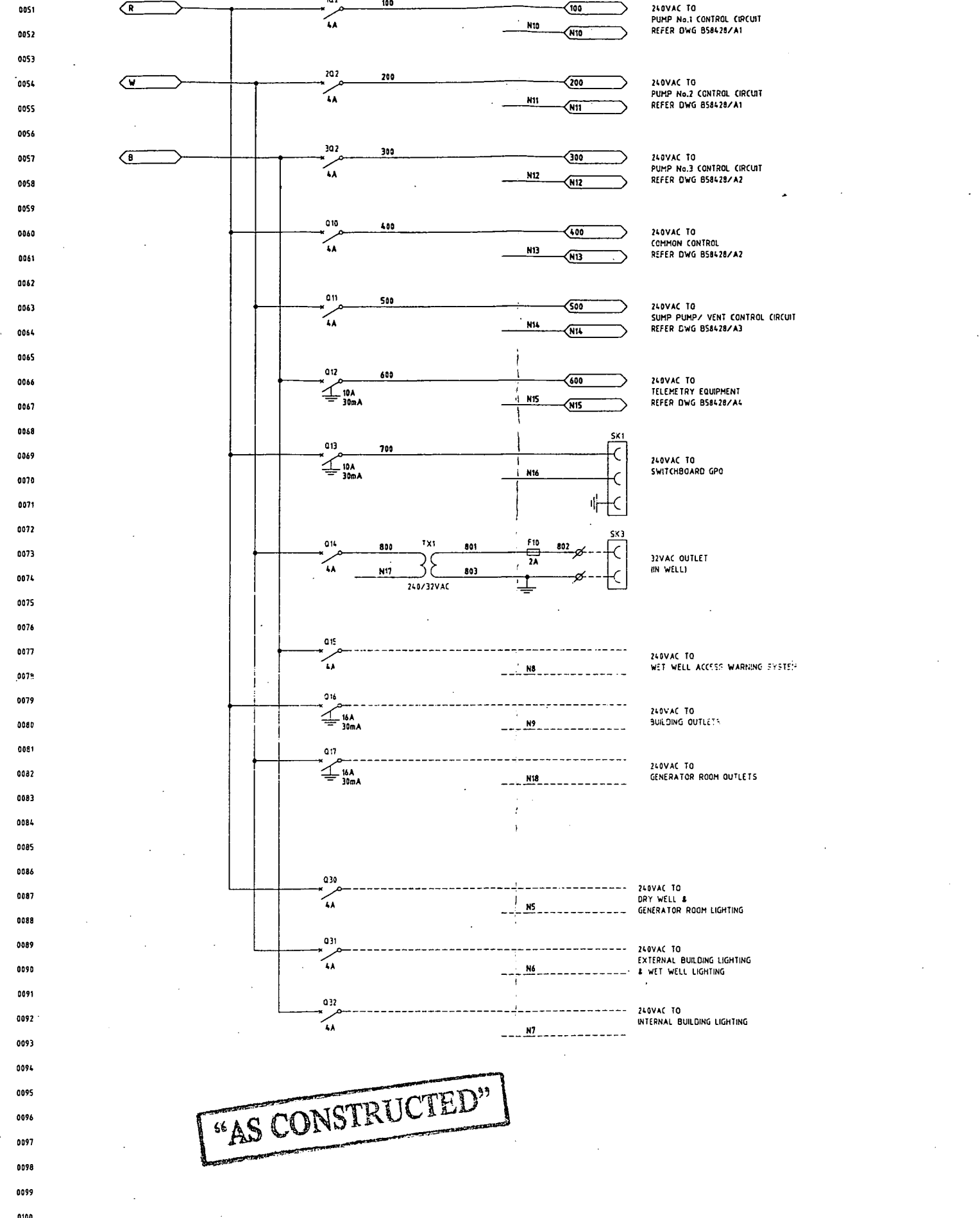
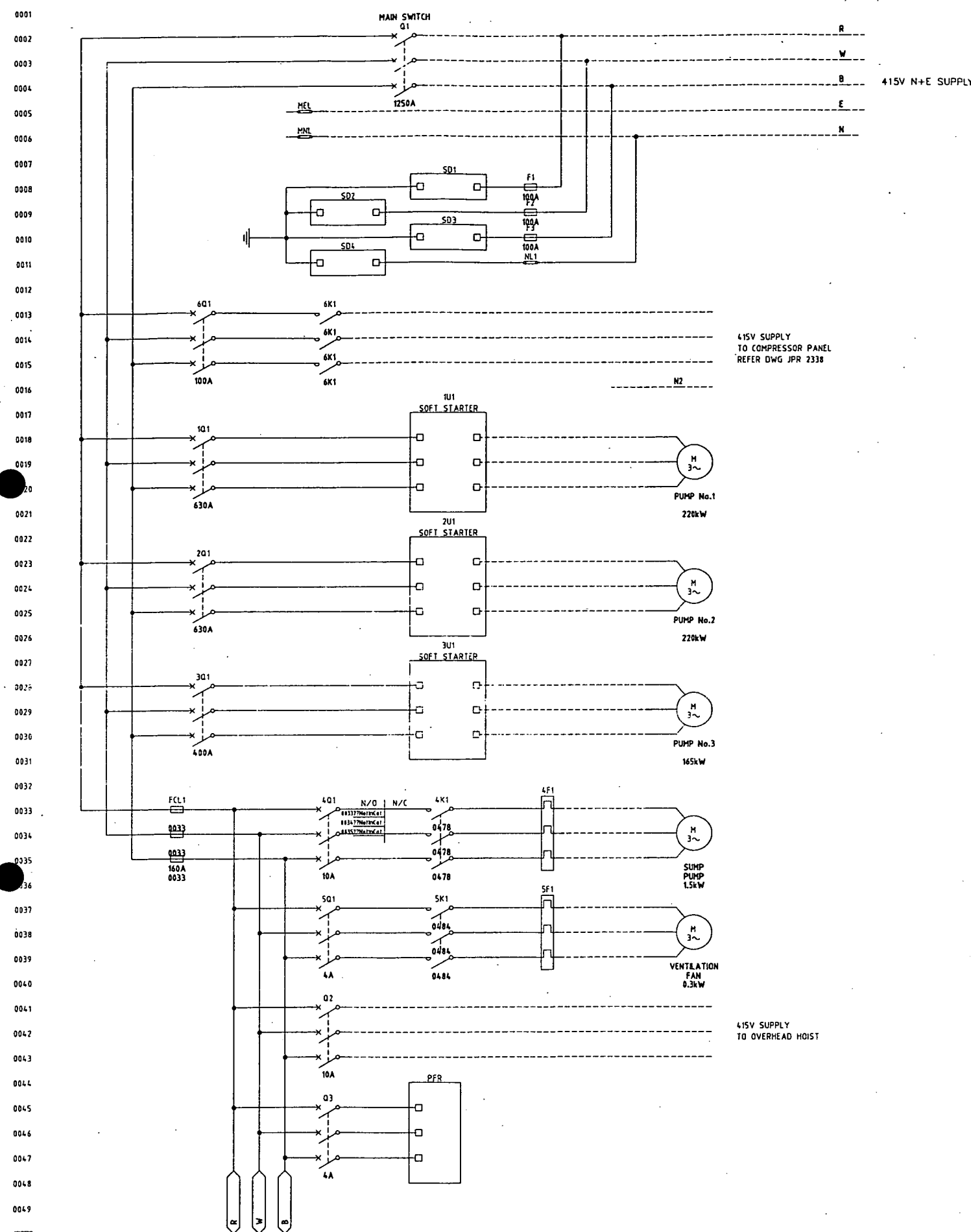
5. *Combined Linearity, Hysteresis and Repeatability

Inspected By: 

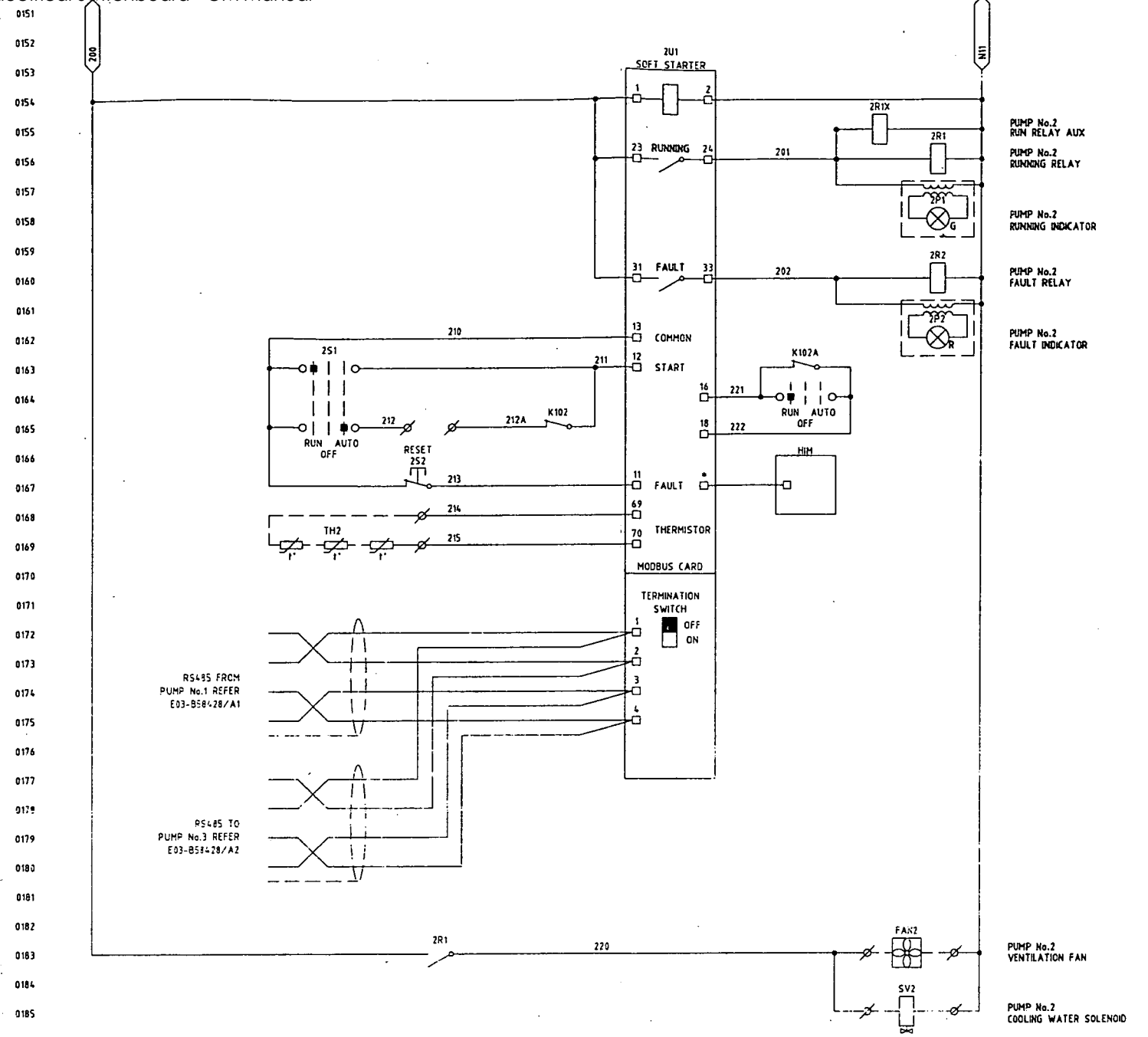
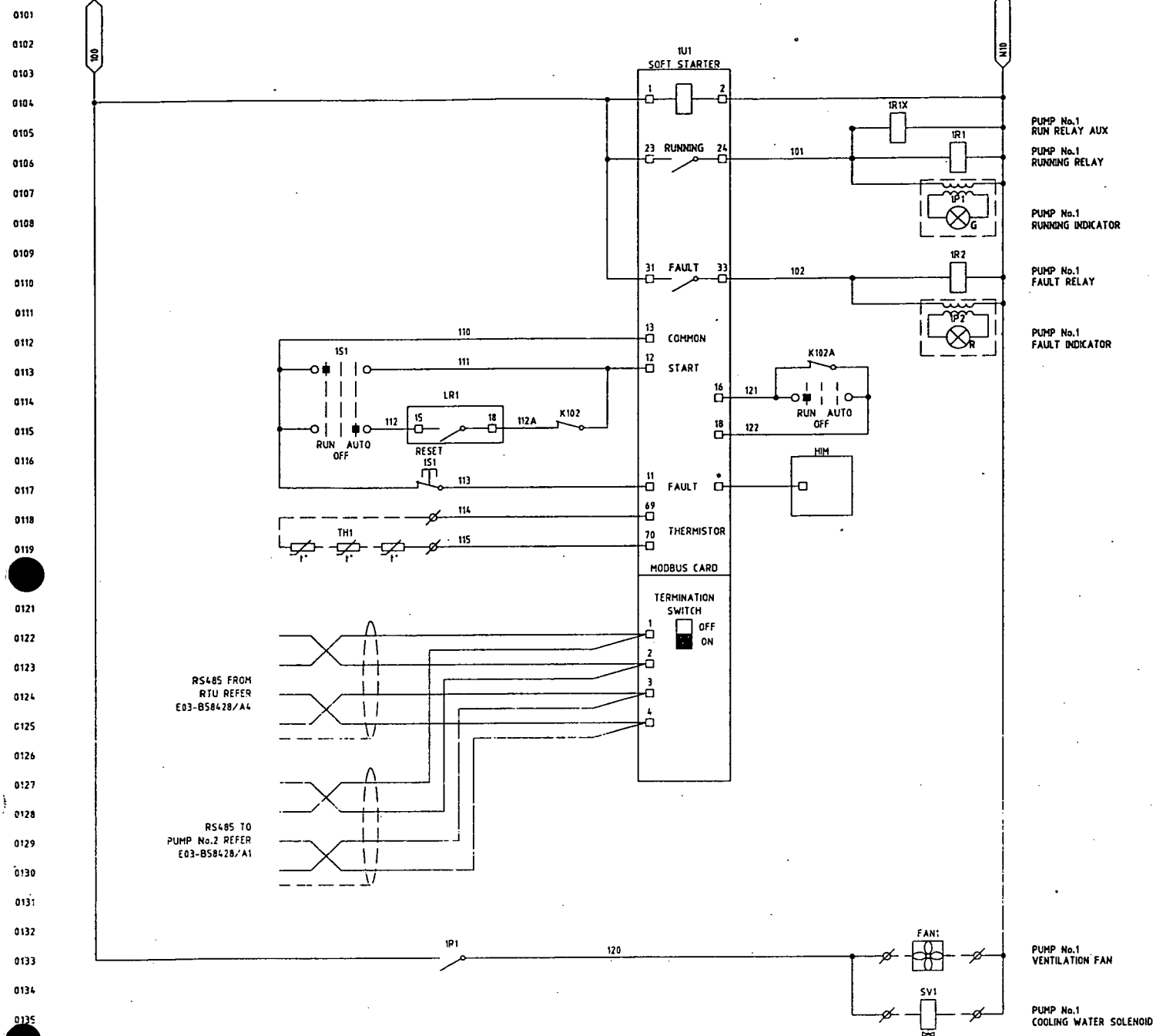
21 August, 2003

8.0 PUMPS

9.0 "AS CONSTRUCTED" DRAWINGS



<p>THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.</p> <p>© 2002</p> <p>FILE NAME:</p>		<p>HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER</p> <p>YOU ARE RESPONSIBLE</p> <p>FOR YOUR SAFETY</p> <p>LAST AMENDMENT DATE:</p>		<p>LETTER</p> <p>B AS INSTALLED</p> <p>A AS CONSTRUCTED</p> <p>DESCRIPTION</p>		<p>DATE</p> <p>02-09-03</p> <p>12-08-03</p> <p>DATE</p>		<p>AM'D BY</p> <p>G.P.</p> <p>G.P.</p> <p>AM'D BY</p>		<p>CHK'D</p> <p>G.P.</p> <p>CHK'D</p>		<p>SCALE</p> <p>DESIGNED K.D.M</p> <p>TRACED K.D.H</p> <p>CHECKED M.S</p> <p>DATE 27-05-03</p> <p>APPROVED</p>		<p>CLIENT NAME</p> <p>IPSWICH CITY COUNCIL</p> <p>JOB No.</p> <p>B58428</p>		<p>J. & P. RICHARDSON</p> <p>INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076</p> <p>ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325</p> <p>Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU</p>		<p>DRAWING No</p> <p>E03-B58428/A0</p> <p>AMENDMENT</p> <p>B</p>	
--	--	---	--	--	--	---	--	---	--	---------------------------------------	--	--	--	---	--	---	--	--	--



THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION
D	AS INSTALLED RELAYS 1R1X & 2R1X ADDED
C	AS CONSTRUCTED RELAY K102A ADDED
B	AUTO START LRI RELAY ADDED TO 1U1
A	AUTO START LRI RELAY DELETED FROM 1U1

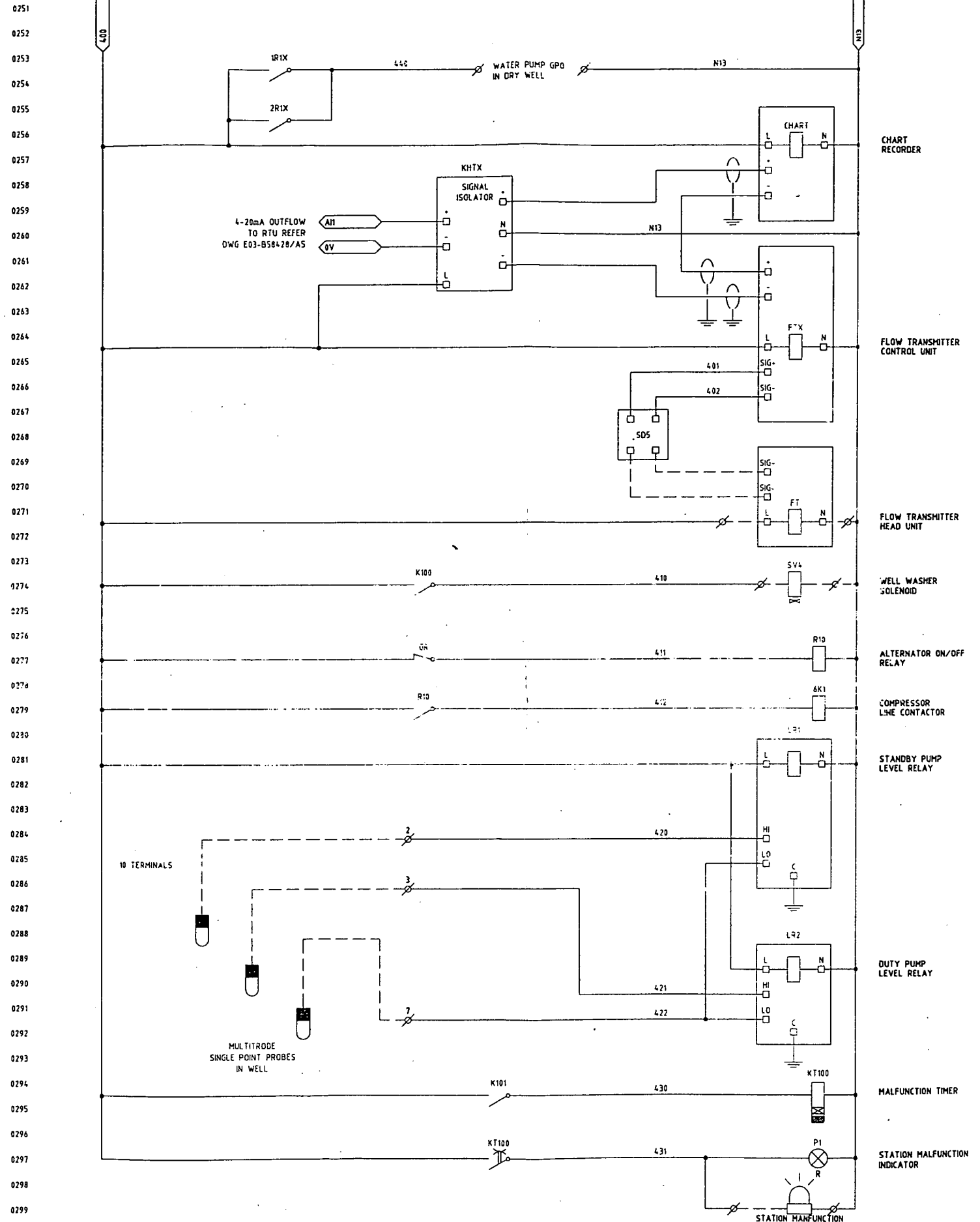
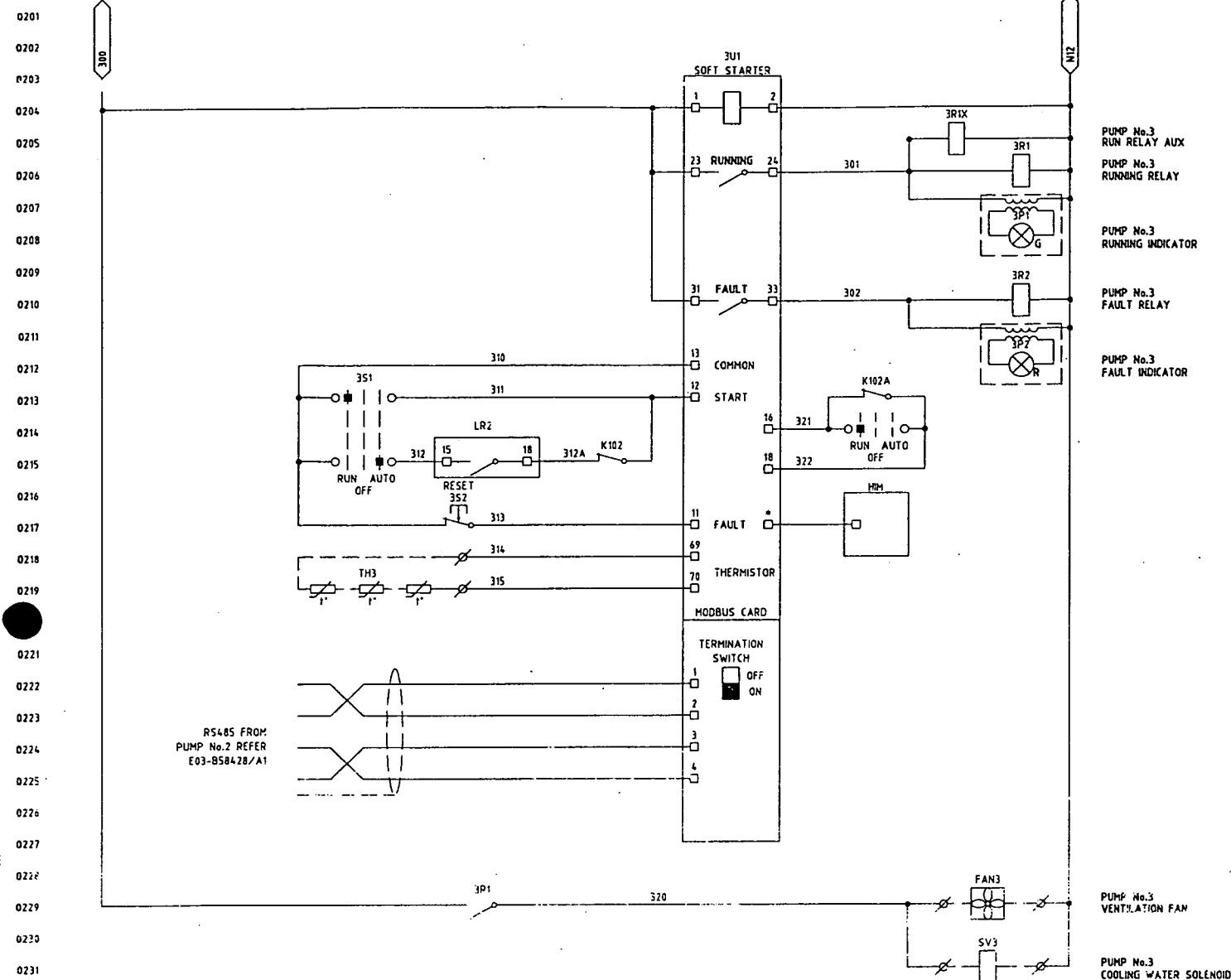
DESCRIPTION

DATE	AM'D BY	CHK'D	JOB No.
02-09-03	G.P.	G.P.	
14-08-03	G.P.	G.P.	
16-07-03	K.D.M.	K.D.M.	
02-07-03	K.D.M.	K.D.M.	

SCALE	N.T.S.
DESIGNED	K.D.M.
TRACED	K.D.M.
CHECKED	K.D.M.
DATE	27-05-03
APPROVED	
CLIENT NAME	IPSWICH CITY COUNCIL

J. & P. RICHARDSON
IPSWICH CITY COUNCIL
PUMP STATION B22
LOBLEY STREET, IPSWICH
MOTOR CONTROL CENTRE
WIRING SCHEMATIC

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU
DRAWING No
E03-B58428/A1
AMENDMENT
D



THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.
© 2002

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION
D	AS INSTALLED RELAY 3R1X AND COMPRESSOR SOLENOID VALVE ADDED
C	AS CONSTRUCTED RELAY K102A ADDED
B	LEVEL RELAYS LRI & LR2 ADDED
A	LEVEL RELAYS LRI & LR2 DELETED

DESCRIPTION

SCALE	N.T.S.
DESIGNED	K.D.M.
TRACED	K.D.M.
CHECKED	K.D.M.
DATE	27-05-03
APPROVED	
CLIENT NAME	IPSWICH CITY COUNCIL
JOB No.	B58428

J. & P. RICHARDSON

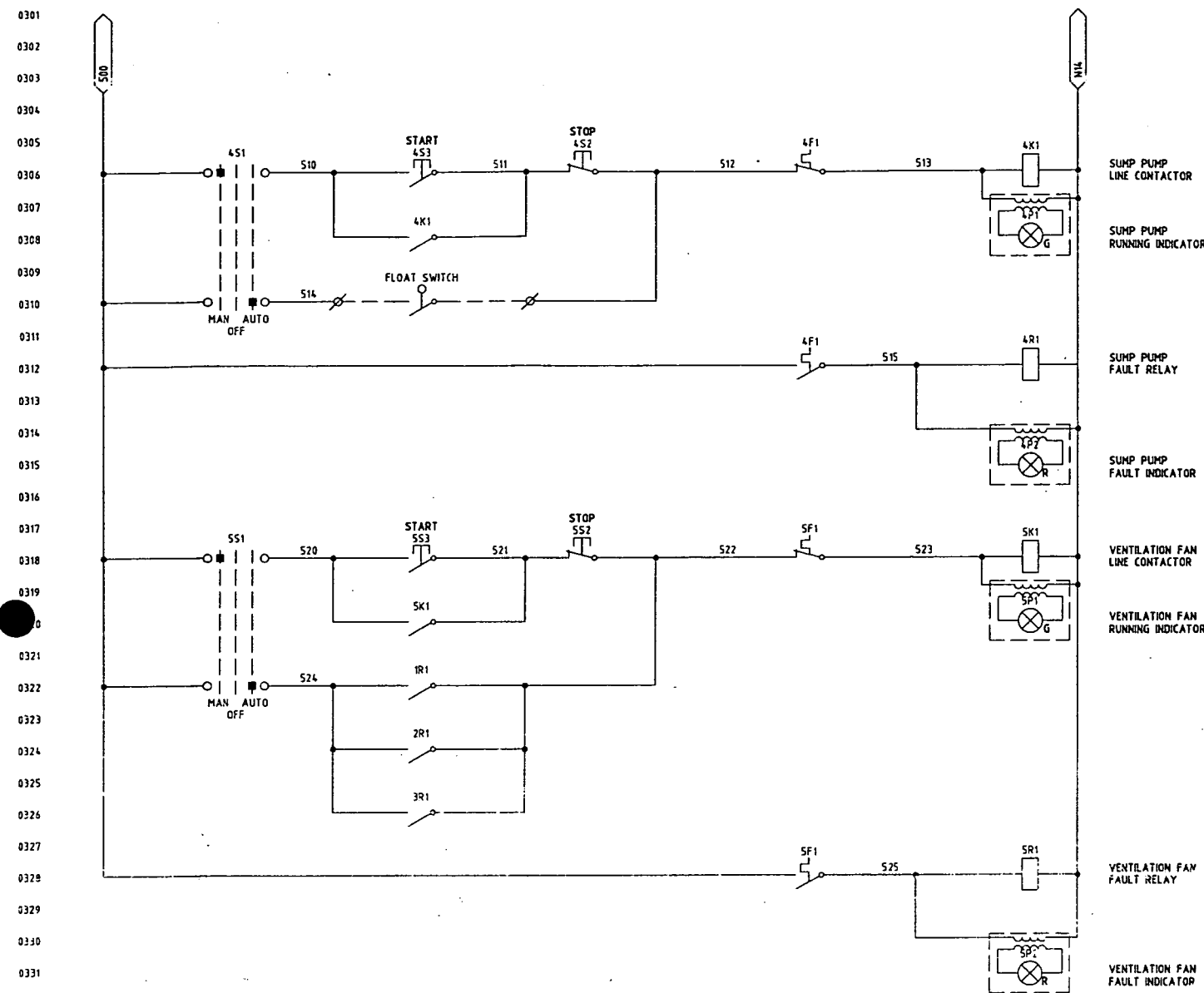
IPSWICH CITY COUNCIL
PUMP STATION B22
LOBLEY STREET, IPSWICH
MOTOR CONTROL CENTRE
WIRING SCHEMATIC

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 13 001 952 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPRO@JPR.COM.AU

DRAWING No

E03-B58428/A2

AMENDMENT
D



THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE:

A AS CONSTRUCTED

LETTER DESCRIPTION

SCALE
DESIGNED
TRACED
CHECKED
DATE
APPROVED

N.T.S.
K.D.M.
K.D.M.
K.D.M.
27-05-03

CLIENT NAME
JOB No.

IPSWICH CITY COUNCIL
B58428

J. & P. RICHARDSON

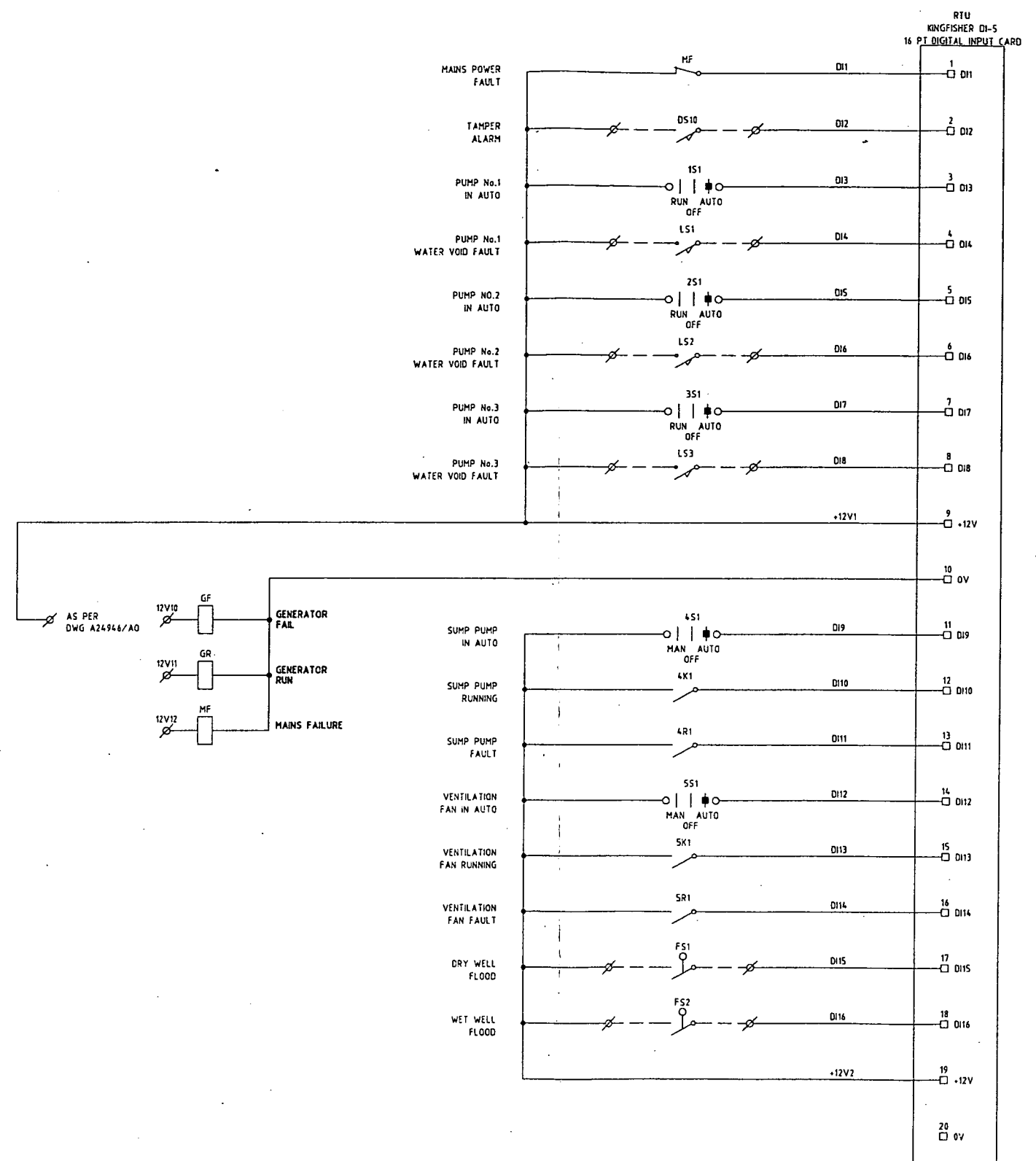
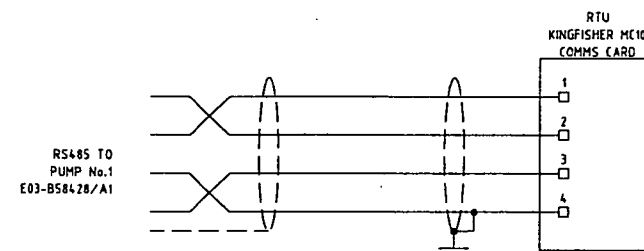
IPSWICH CITY COUNCIL
PUMP STATION B22
LOBLEY STREET, IPSWICH
MOTOR CONTROL CENTRE
WIRING SCHEMATIC

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 1911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

DRAWING No
E03-B58428/A3

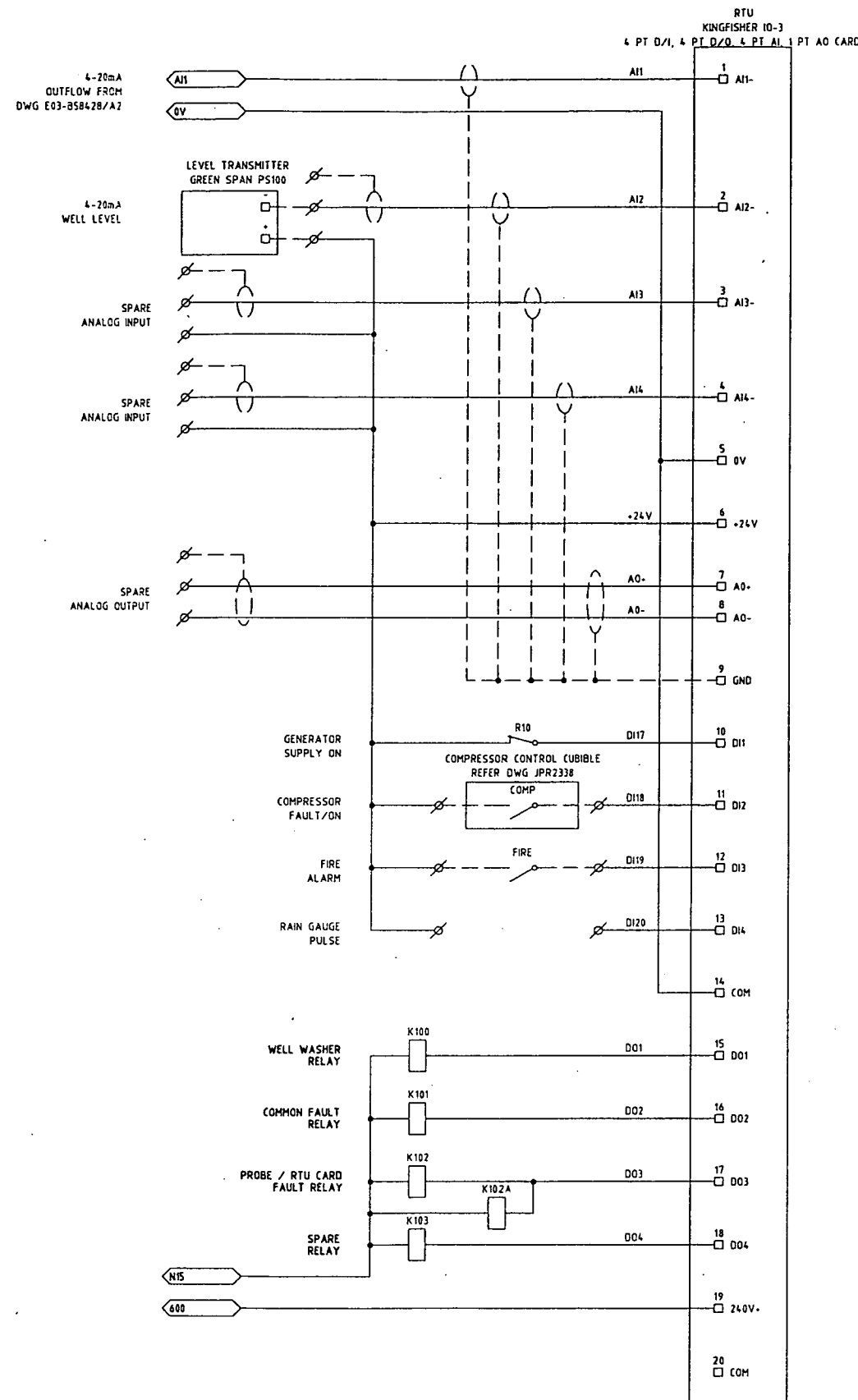


AMENDMENT
A



"AS CONSTRUCTED"

THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.		HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER								SCALE DESIGNED K.D.M. TRACED K.D.M. CHECKED K.D.M. DATE 27-05-03 APPROVED		J. & P. RICHARDSON		INDUSTRIES PTY LTD - 1114 CAMPBELL AVE WAGOL 4076 ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325 Ph(07)3271 2911 Fax(07)3271 3623 Email JPRA@JPRI.COM.AU	
© 2002		YOU ARE RESPONSIBLE										TITLE		DRAWING No	
FILE NAME:		FOR YOUR SAFETY										IPSWICH CITY COUNCIL PUMP STATION B22 LOBLEY STREET, IPSWICH MOTOR CONTROL CENTRE RTU WIRING SCHEMATIC		E03-B58428/A4	
LAST AMENDMENT DATE:		LETTER		DESCRIPTION		DATE		AM'D BY		CHK'D		JOB No.		AMENDMENT	
		D		AS INSTALLED RELAYS GF, GR & MF ADDED		02-09-03		G.P				CLIENT IPSPWICH CITY COUNCIL		D	
		A		AS CONSTRUCTED		14-08-03		G.P				NAME			
		B		WET WELL OVERFLOW FLOATSWITCH ADDED		16-07-03		K.D.M		K.D.M					
		A		WET WELL OVERFLOW FLOATSWITCH DELETED		02-07-03		K.D.M		K.D.M					



AS CONSTRUCTED

<p>THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.</p> <p>© 2002</p>		<p>HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER</p> <p>YOU ARE RESPONSIBLE</p> <p>FOR YOUR SAFETY</p> <p>LAST AMENDMENT DATE:</p>		<p>LETTER</p> <p>DESCRIPTION</p> <p>C AS INSTALLED NEUTRAL NIS ADDED</p> <p>B AS CONSTRUCTED K102A RELAY ADDED</p> <p>A PROBE / RTU CARD FAULT ADDED</p>		<p>SCALE</p> <p>DESIGNED K.D.M</p> <p>TRACED K.D.M</p> <p>CHECKED K.D.M</p> <p>DATE 27-05-03</p> <p>APPROVED</p>		<p>N.T.S</p> <p>K.D.M</p> <p>K.D.M</p> <p>K.D.M</p> <p>27-05-03</p>		<p>J. & P. RICHARDSON</p> <p>INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076</p> <p>ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325</p> <p>Ph(07)3271 2911 Fax(07)3271 3623 Email JPROJPR.COM.AU</p>		<p>TITLE</p> <p>IPSWICH CITY COUNCIL</p> <p>PUMP STATION B22</p> <p>LOBLEY STREET, IPSWICH</p> <p>MOTOR CONTROL CENTRE</p> <p>RTU WIRING SCHEMATIC</p>		<p>DRAWING No</p> <p>E03-B58428/A5</p> <p>AMENDMENT</p> <p>C</p>	
--	--	---	--	--	--	--	--	---	--	---	--	--	--	--	--

ITEM	QTY	MAKE & NUMBER	DESCRIPTION	LABEL
Q1	1	TERASAKI XS1250SE1250FC	3P 1250A MCCB	MAIN SWITCH
Q1	1	TERASKI XFHA49	MCCB HANDLE	MAIN SWITCH
1/2Q1	2	TERASAKI XS630CJ6303P	3P 630A MCCB	PUMP 1/2
1/2Q1	2	TERASAKI XFHA46	MCCB HANDLE	PUMP 1/2
1/2Q1	2	TERASAKI UPX3800	630A MCCB BUSPLUG	N/A
3Q1	1	TERASAKI XS400NJ4003P	3P 400A MCCB	PUMP 3
3Q1	1	TERASAKI XFHA34	MCCB HANDLE	PUMP 3
3Q1	1	TERASAKI UPX3440	400A MCCB BUSPLUG	3Q1
6Q1	1	TERASAKI XS125NJ1253P	3P 125A MCCB	COMPRESSOR
6Q1	1	TERASAKI XFHA22	MCCB HANDLE	COMPRESSOR
1/2U1	2	EMOTRON MSF370	450A SOFT STARTER	1/2U1
3U1	1	EMOTRON MSF310	370A SOFTSTARTER	3U1
1/2/3U1	3	EMOTRON 01-2138-00	DOOR MOUNT KEYPAD KIT	1/2/3U1
1/2/3U1	3	EMOTRON 01-1733-00	RS232/485 MODBUS CARDS	1/2/3U1
FCL1	1	NHP EASYLINK XLP00	3P 160A FCL CARRIER	FCL1
FCL1	3	NHP N00160	160A FUSE CARDRIDGES	FCL1
DB1	1	TERASAKI CD250-36/18-3U	36P 250A MCB CHASSIS	DB1
TBA	2	TERASAKI DTCB6304C	3P 4A MCB	TBA
TBA	2	TERASAKI DTCB6310C	3P 10A MCB	TBA
TBA	10	TERASAKI DTCB1304C	1P 4A MCB	TBA
TBA	2	TERASAKI DSRCBH1030A	1P 10A 30mA MCB/RCD	TBA
TBA	2	TERASAKI DSRCBH1630A	1P 16A 30mA MCB/RCD	TBA
SD1-4	4	TITAN DR1P45K230DC	1P 45ka SURGE DIVERTOR	SD1-4
F1-3	3	NHP NV100FW	BLACK 100A FUSE CARRIER	F1-3
NL1	1	NHP NC100FWW	WHITE 100A FUSE CARRIER	NL1
F1-3	3	NHP NOS100	100A FUSE CARDRIDGES	F1-3
NL1	1	NHP 100MFNL	100A SOLID LINK	NL1
F10	1	NHP NV20FW	20A FUSE CARRIER	F10
F10	1	NHP NSS2	2A FUSE CARDRIDGE	F10
4/5K1	2	SPREACHER & SCHUH CA7-9-10-240VAC	4kW CONTACTOR	4/5K1
6K1	1	SPREACHER & SCHUH CA7-60-00-240VAC	32kW CONTACTOR	6K1

ITEM	QTY	MAKE & NUMBER	DESCRIPTION	LABEL
4F1	1	SPREACHER & SCHUH CT7-24-4	1.5kw THERMAL OVERLOAD	4F1
5F1	1	SPREACHER & SCHUH CT7-24-1.6	0.37kw THERMAL OVERLOAD	5F1
TX1	1	SEAFORD SFO100 240/32VAC	100VA 32V TRANSFORMER	TX1
SK1	1	CLIPSAL 56C315	250V 15A GPO	SK1
SK2	1	CLIPSAL 2015 c/w 449A	250V 15A GPO	SK2
FAN1/2/3	3	COSMOTEC TB19000220	240VAC EXHAUST FANS	N/A
FILTERS	12	GNF25	INLET FILTERS	FILTERS
N/A	32	DORE ELECTRICS BBC4N	BUSBAR SUPPORTS	N/A
CHART	1	TBA	CHART RECORDER (FREE ISSUE)	CHART RECORDER
FLOW TX	1	TBA	FLOW TX CONTROL UNIT	FLOW TX
1-3S1	3	KRAUS & NAIMER CA10-A212-FT2-603	RUN/OFF/AUTO SELECTOR SWITCH	RUN/OFF/AUTO
4-5S1	2	KRAUS & NAIMER CA10-A212-FT2-603	MAN/OFF/AUTO SELECTOR SWITCH	MAN/OFF/AUTO
4-5S2	2	SPREACHER & SCHUH D5P-F402W3LX01	STOP PUSHBUTTON	STOP
4-5S3	2	SPREACHER & SCHUH D5P-F301W3LX10	START PUSHBUTTON	START
1-3S2	3	SPREACHER & SCHUH D5P-F607W3LX10	RESET PUSHBUTTON	RESET
1-5P1	5	SPREACHER & SCHUH D5P-P33DL0/3T7	GREEN INDICATOR	RUNNING
1-5P2/P1	6	SPREACHER & SCHUH D5P-P43DL0/3T7	RED INDICATOR	FAULT
1-5P1/2/P1	11	SPREACHER & SCHUH BA9S-I3-6V-1.2L	240VAC NEON BULB	N/A
SD5	1	CRITEC UTB36	36V SURGE DIVERTOR	SD5
TERMS	58	SPREACHER & SCHUH V7-W4	4mm THROUGH TERMINAL	TERMS
TERMS	5	SPREACHER & SCHUH V7-EB3	THROUGH TERMINAL ENDPLATE	TERMS
TERMS	10	SPREACHER & SCHUH V7-EA35	TERMINAL ENDCLAMP	TERMS
RELAYS	13	FINDER 55.34.0054.240VAC	4P 240VAC CONTROL RELAY	TBA
RELAYS	13	FINDER 94.04	4P RELAY BASE	TBA
LR1/2	2	MULTITRODE MTR-2 240VAC	LEVEL RELAY	LR1/2
PROBES	3	MULTITRODE 0.2/1 20M	1 POINT LEVEL PROBE 20M CABLE	N/A
PFR	1	CROUZET EWS.415V	PHASE FAILURE RELAY	PFR
KT100	1	SPREACHER & SCHUH RZ7-FEA3TU23	FLASHER TIMER	KT100
LTX	1	GREENSPAN PS100	LEVEL TRANSMITTER	LTX
RTU	1	KINGFISHER (SUPPLIED BY PARASYN)	TBA	RTU

“AS CONSTRUCTED”

THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.
© 2002

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE:

C AS CONSTRUCTED
B LEVEL RELAYS & PROBES ADDED
A LEVEL RELAYS & PROBES DELETED

LETTER

DESCRIPTION

SCALE
DESIGNED
TRACED
CHECKED
DATE
APPROVED
14-08-03 G.P.
16-07-03 K.D.M.
02-07-03 K.D.M.
DATE AM'D BY CHK'D
JOB No. B58428

J. & P. RICHARDSON

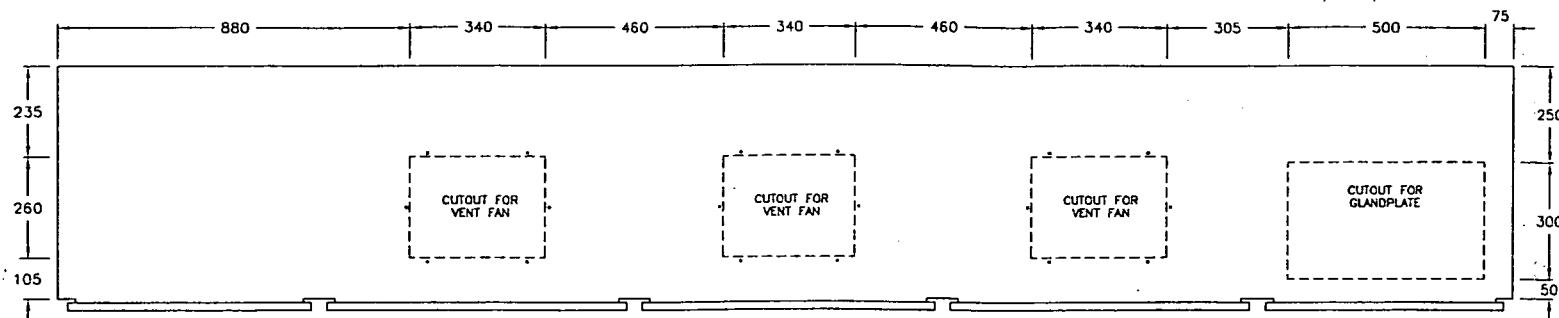
TITLE
IPSWICH CITY COUNCIL
PUMP STATION B22
LOBLEY STREET, IPSWICH
MOTOR CONTROL CENTRE
EQUIPMENT SCHEDULE

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

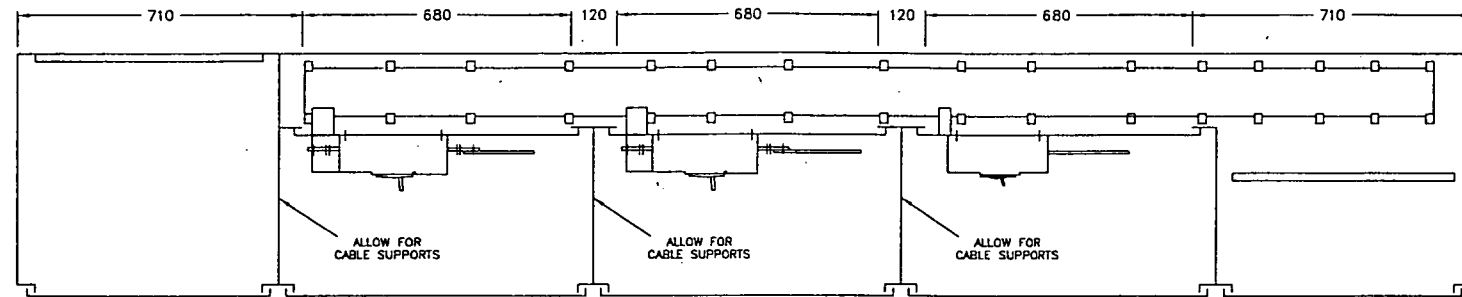
DRAWING No

E03-B58428/A6

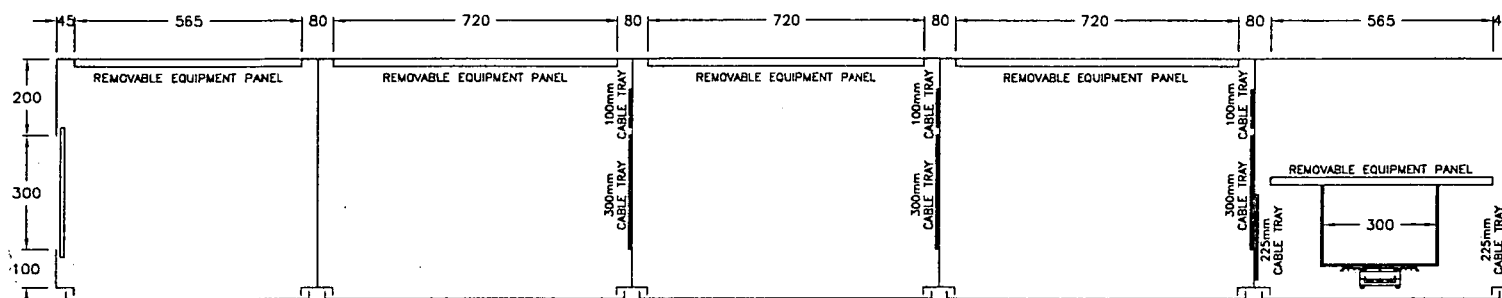
AMENDMENT
C



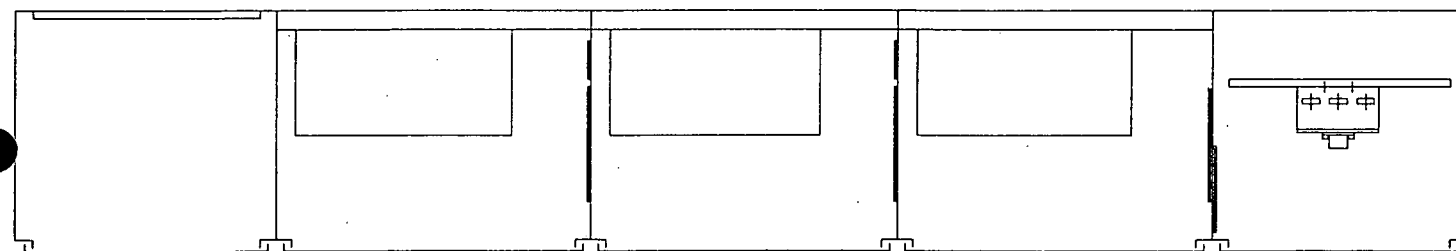
TOP ELEVATION



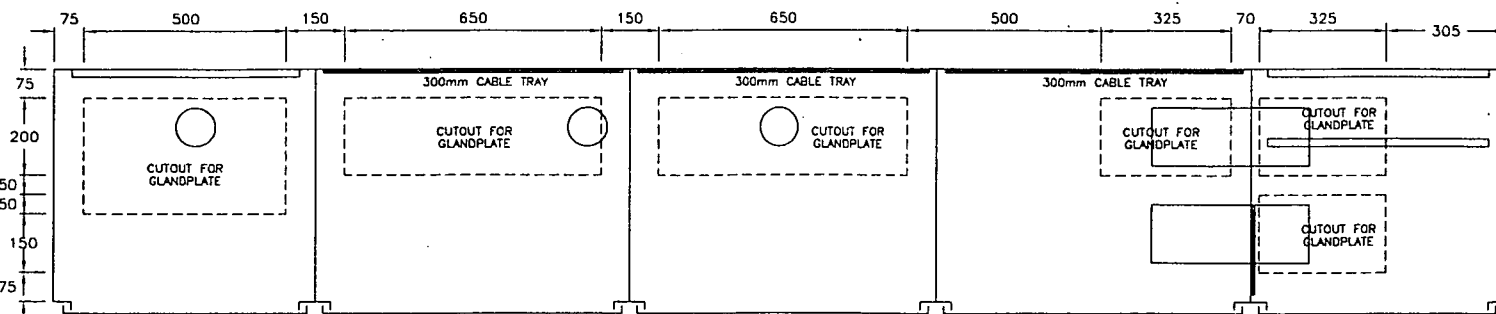
SECTION FF



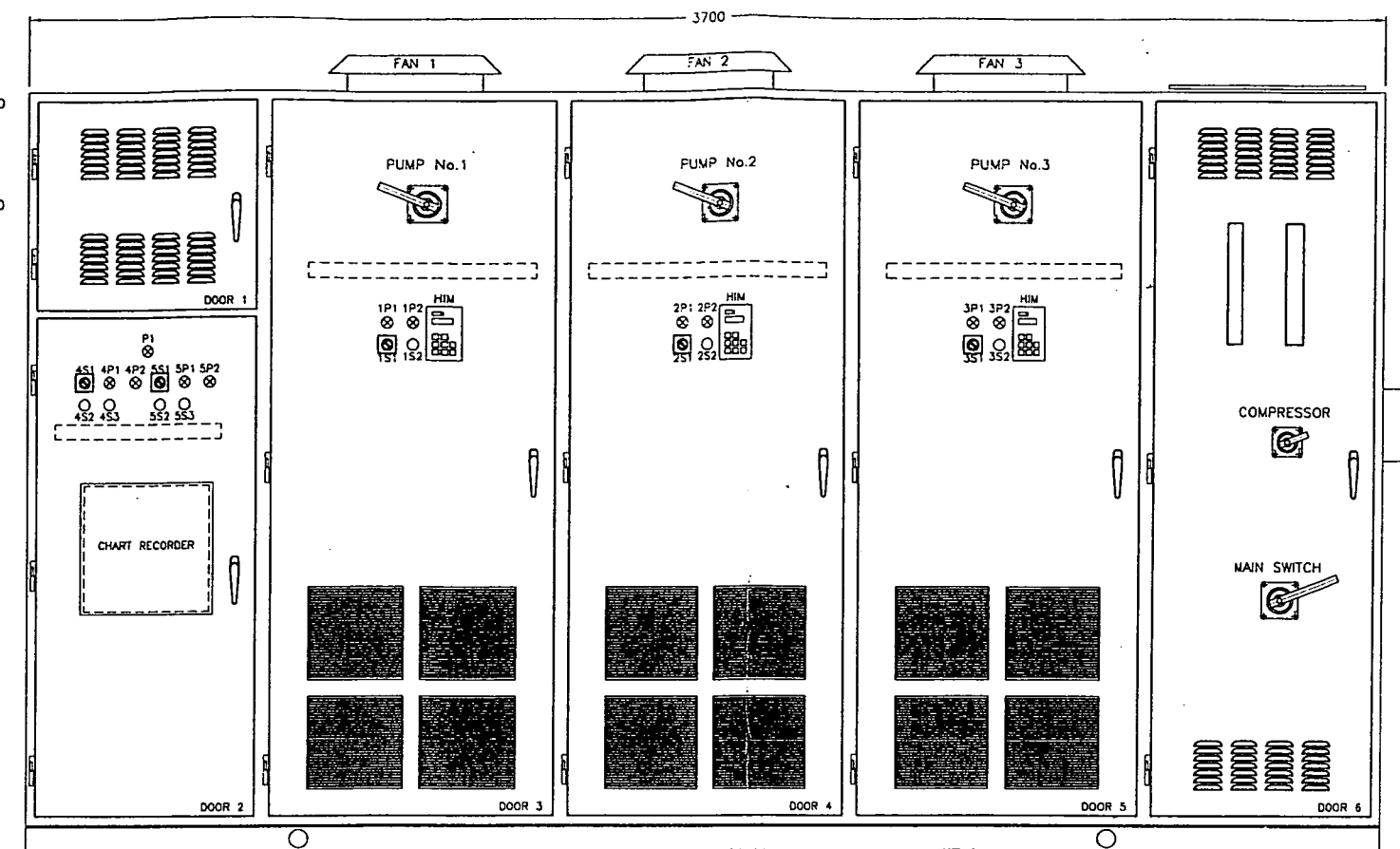
SECTION GG



SECTION HH



SECTION II



FRONT DOORS

"AS CONSTRUCTED"

THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE:

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
A	AS CONSTRUCTED	14-08-03	G.P.	

SCALE	1:10 AT A1
DESIGNED	K.D.M.
TRACED	K.D.M.
CHECKED	K.D.M.
DATE	28-05-03
APPROVED	K.H.D.
CLIENT NAME	IPSWICH CITY COUNCIL
JOB No.	B58428

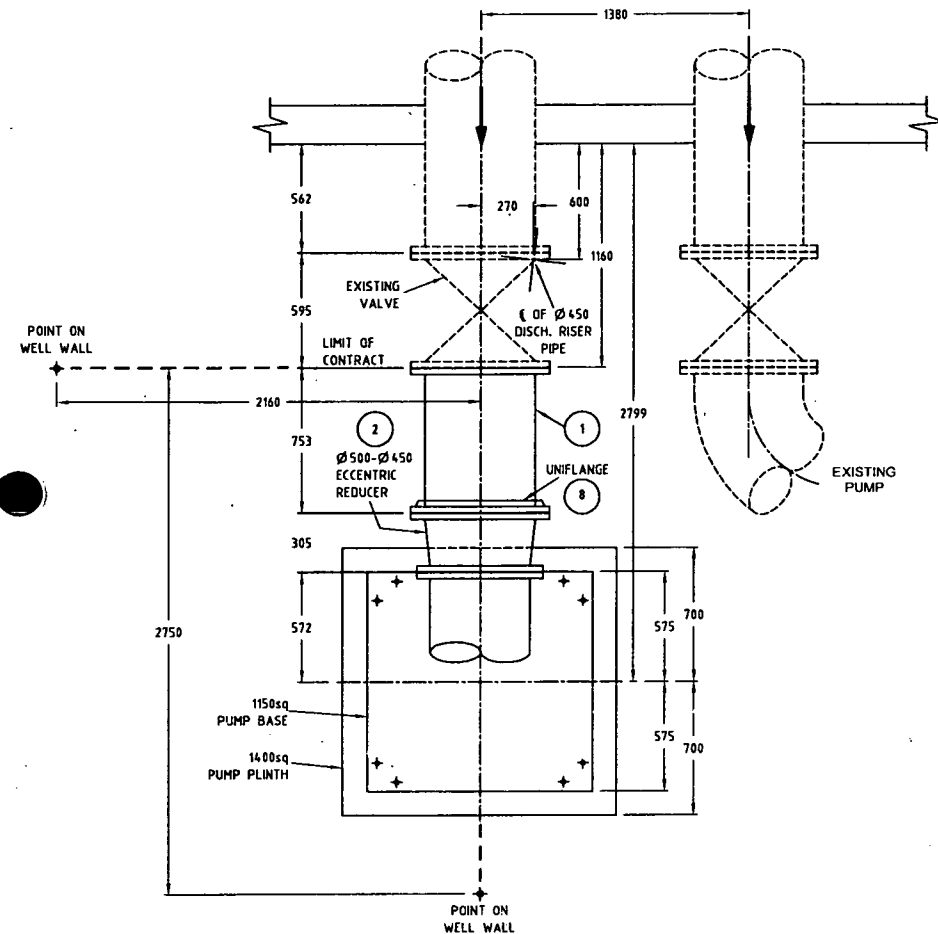
J. & P. RICHARDSON

IPSWICH CITY COUNCIL
PUMP STATION B22
LOBLEY STREET, IPSWICH
MOTOR CONTROL CENTRE
GENERAL ARRANGEMENT

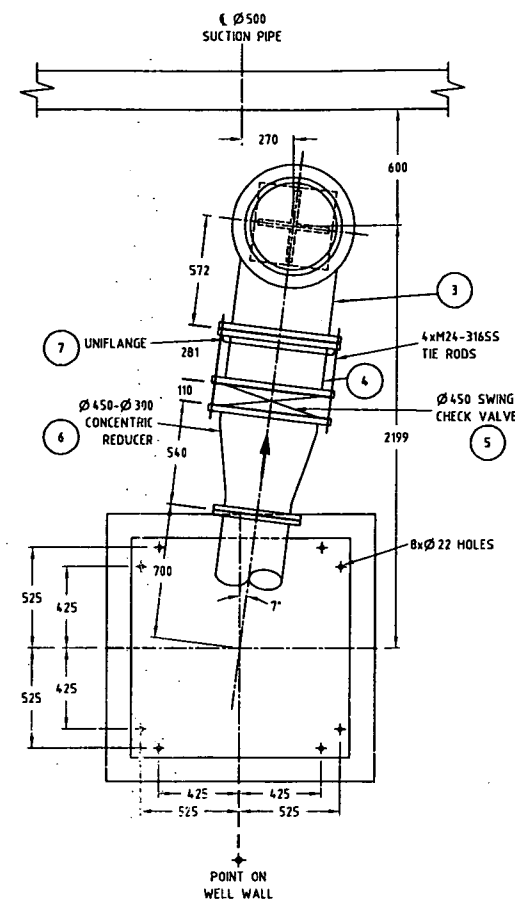
INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

DRAWING No
E03-B58428/B1

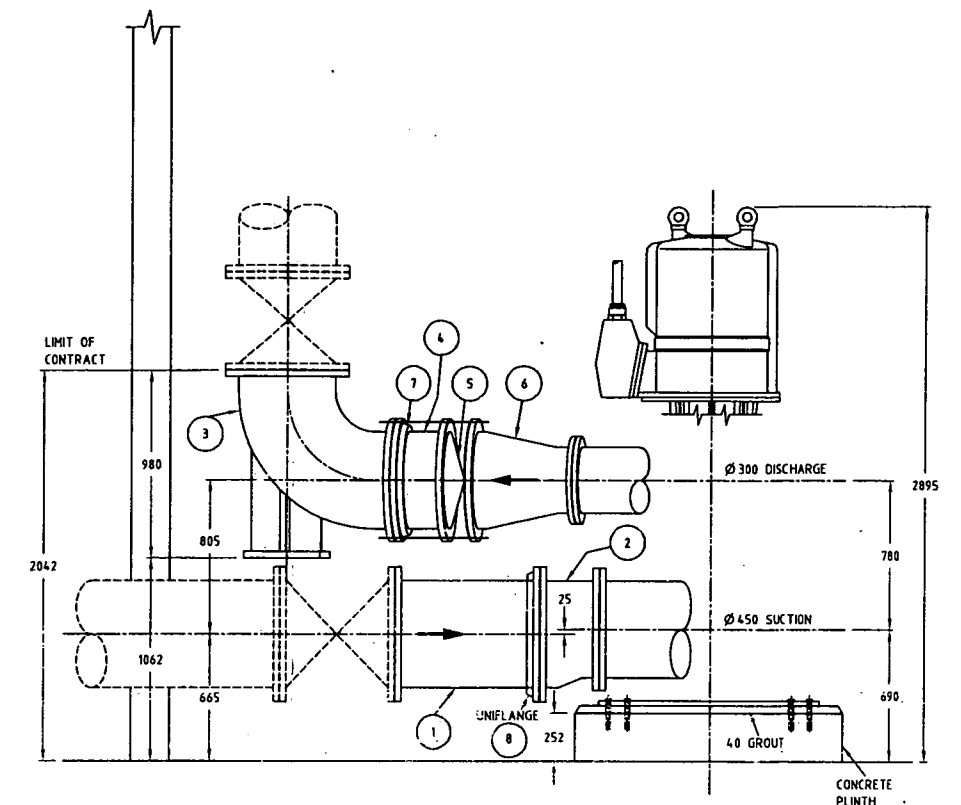
AMENDMENT
A



SUCTION PLAN



DISCHARGE PLAN



ELEVATION

"AS CONSTRUCTED"

NOTE:
1. PUMP KSB AJAX MODEL K300-630 NCD D533 FR
2. EXISTING PIPEWORK TO LIMITS OF CONTRACT SHOWN DOTTED

J. & P. RICHARDSON

INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
PH(07)3271 2911 Fax(07)3271 3823 Email JPRO@PR.COM.AU

TITLE
IPSWICH CITY COUNCIL
PUMP STATION No.822
LOBLEY STREET IPSWICH
PIPEWORK LAYOUT

DRAWING No
P02-B58428/X0

AMENDMENT
A

SCALE	1:20
DESIGNED	P.H.
TRACED	P.H.
CHECKED	B.C. 15-1-03
DATE	15-1-03
APPROVED	
CLIENT NAME	IPSWICH CITY COUNCIL
JOB No.	858428

DATE	19-3-03	AM'D BY	P.H.	CHK'D	B.C. 19-3-03
------	---------	---------	------	-------	--------------

ITEMS SUPPLIED BY JPR	
ITEM No.	DESCRIPTION
8	500dia. UNIFLANGE

LETTER	DESCRIPTION	DATE	AM'D BY	CHK'D
A	PUMP BASE DETAILS AMENDED TO "AS CONSTRUCTED" KSB DRAWING	19-3-03	P.H.	B.C. 19-3-03

EXISTING ITEMS BEING RE-USED	
ITEM No.	DESCRIPTION
1	500dia. DF PIPE CUT TO SUIT
2	500dia. - 450dia. DF ECCENTRIC REDUCER
3	450dia. DF 90deg. DUCKFOOT BEND
4	450dia. FL/PE PIPE CUT TO SUIT
5	450dia. VALVE
6	450dia. - 300dia. DF CONCENTRIC REDUCER
7	450dia. UNIFLANGE

THIS DRAWING OR PART THEREOF IS PROTECTED BY THE LAWS OF COPYRIGHT & MAY NOT BE COPIED OR REPRODUCED WITHOUT THE EXPRESS PERMISSION OF J & P RICHARDSON INDUSTRIES.

© 2002

FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK? REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER

YOU ARE RESPONSIBLE

FOR YOUR SAFETY

LAST AMENDMENT DATE: