



Client : ***BRISBANE WATER***

Document Title : **FORTROSE STREET SEWAGE PUMP STATION
SWITCHBOARD UPGRADE**

OPERATION and MAINTENANCE MANUAL

FORTROSE STREET SEWAGE PUMP STATION SB192

Issue : ***Book 1 of 1***

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Author : ***Peter Hague***

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Contains equipment parameters, settings and programming data.

1.2 Functional Data

Operational description, functional specification, pump curves.

1.3 Misc.

Contains miscellaneous information on construction, installation and operation.

1.4 Technical Data

Contains manufacturers technical data and equipment details.

1.5 Manuals

Contains equipment manuals.

1.6 Schematics.

Contains final 'As Commissioned' drawings for the project.

FORTROSE STREET SEWAGE PUMP STATION**EMOTRON SOFT-STARTER PARAMETERS**

Model MSF-045

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221	Locked Keyboard Info	No, Yes	Yes	No	65

SET POINTS FOR FORTROSE ST.

The set points are as follows:

Wet Well Level Metres	Indicator %	Metres AHD	Function
		8.986	Probe suspension level
		5.50mtrs	Probe suspension length
		5.00mtrs	Probe range
5.00	100.0%	8.486	Probe upper range 20mA
0.00	00.00%	3.486	Probe lower range 4mA
4.52	90.3%	8.003	Surcharge Level
4.20	84.0%	7.686	Surcharge Imminent
1.27	25.4%	4.756	Start pump (TWL)
0.50	10.0%	3.986	Stop pump (BWL)
1.67	33.4%	5.156	High level alarm

START-UP & COMMISSIONING PROCEDURES

1.0 GENERAL

Suitably qualified personnel must install the Switchboard assembly. The following check procedures as a minimum, are recommended after installation and prior to initial power-up.

A thorough visual inspection should be made to every aspect of the Switchboard on arrival. This includes checking the Switchboard for any obvious external damages, loose wire connections, loose cabling, loose equipment (relays, contactors, meters etc.), panels damage in transit etc.

All problems must be rectified immediately as they could cause incorrect operation or permanent damage to the equipment.

1.1 INITIAL POWER-UP CHECKLIST

Only authorised and appropriately trained personnel should carry out the inspection and testing tasks specified, included below but not limited to.

1. Check all cable connections are firmly fastened and secured.
2. Check cable entries are adequately sealed and glanded.
3. Check all clearances.
4. Check main incoming cables are correctly terminated.
5. Check main earth connection for continuity.
6. Check switchboard is free from any impurities (dust, filings etc.).
7. Check all doors and covers are secure and functioning properly.
8. Perform an insulation resistance test on the Switchboard ensuring the results complied with the relevant requirements.

If all inspection and checks have been made, you are now ready to power-up the Switchboard.

1.2 POWER-UP PROCEDURE

Suitably qualified personnel should perform these procedures. These are suggested procedures only, and if specific procedures are available or issued, they **MUST** prevail.

WARNING

Fatalities have been caused by incorrect connection of Mains services. Correct polarity must be ensured as the wrong connection will energise the earthing system of the installation and create a hazardous situation.

Do not connect or re-connect supply to an installation unless correct polarity has been proven by recognised tests.

1. Ensure the main incoming isolator or circuit breaker is isolated.
2. Ensure starter modules are isolated.
3. Energised mains cabling.
4. Turn main circuit breaker on.
5. Ensure that all phase voltages are present and correct.
6. Individual starter modules can now be energised.

PREVENTATIVE MAINTENANCE INSTRUCTIONS

2.0 GENERAL

The Switchboard requires proper care to ensure normal operation at all times. Periodic inspections must be made to determine the exact condition of the Switchboard equipment.

A regular program of systematic maintenance must be established for proper operation of all Switchboard systems. A periodic maintenance schedule must be followed and an inspection log maintained for ready reference. At a minimum, the log must record:

1. inspection interval
2. inspection procedure performed
3. maintenance performed, if any, as a result of inspection
4. name of inspector performing task

2.1 PREVENTATIVE MAINTENANCE

Perform preventative maintenance as instructed in Table 1 below

TABLE 1

Preventative Maintenance Schedule

SCHEDULE REQUIREMENT	PARAGRAPH	Reference:
Monthly	Visual inspection	2.2
Six Monthly	Paintwork Maintenance	2.3
Yearly	Mains connections	2.4
Yearly	Switchboard assembly	2.5

2.2 VISUAL INSPECTION

In conjunction with the annual maintenance test, frequent visual inspection should be carried out. To verify the perfect functioning of the signalling system is to guarantee the immediate indication of any abnormal occurrence in the equipment or its components.

1. Check that all labelling and schedules are complete, up to date and in their correct places
2. Inspect paintwork for signs of corrosion and for any blemishes, which might be susceptible to corrosion in the near future. If inspection indicates areas of rust or corrosion are present, immediately clean and repaint the area. (See section 2.3)
3. Check that the load balance on final subcircuits and incomer corresponds to the specifications

2.3 PAINTWORK CARE AND MAINTENANCE

As a general rule, cleaning of externally located powder coating surfaces must take place every six months. Where salts/pollutants are more prevalent such as seaside or industrial areas, a cleaning program should be carried out more frequently. ie. every three months.

THREE STEPS TO CLEANING POWDER COATED SURFACES

1. Remove loose deposits with a wet sponge (avoid scratching the surface by dry dusting).
2. Using a soft cloth and mild detergent in warm water, clean the powder coating to remove any dust, salt or other deposits.
3. Always rinse after cleaning with fresh water to remove any remaining detergent.

Warning: -

In some cases strong solvents recommended for thinning various types of paints and also for cleaning up mastic's/sealants are harmful to the extended life of the powder coated surface. These solvents should not be used for cleaning purposes. If paint splashes and sealants/mastic's need to be removed then the following solvents can be used safely. Methylated Sprits, Turpentine, White Spirits, Ethyl Alcohol, Isopropanol.

2.4 MAINS CONNECTIONS

WARNING

When inspecting or cleaning any of the equipment mentioned below, all due care must be taken to de-energise the circuits associated with the location being serviced.

All mains connections must be thoroughly inspected on an annual basis.

1. Inspect the tightness of all bolted connections making sure they are firmly secure so that they cannot work themselves loose;
2. Ensure all connections and fixings remain free from dust and dirt build ups and that there is no sign of corrosion;
3. Check that all cable supports and their corresponding fixings are in good working order and are firmly secure;

REPAIRS

Immediately replace all damaged or missing parts found during inspection by personnel who are qualified to carry out the repairs.

CLEANING OF EQUIPMENT

All equipment should be cleaned either with a dry soft brush, a feather duster or an equivalent device depending upon the circumstances. If possible, clean with a jet of dry clean air taking care to avoid any damage to components.



POWER ELECTRIC Switchboards PTY LTD

ABN 73 052 204 118

Manufacturers of Engineered Switchboards for Mining, Industrial and Commercial Projects

FINAL CHECKING PROCEDURE FOR ALL SWITCHBOARDS

SWITCHBOARD TITLE: Fortrose Street MSB

JOB NUMBER: M0278

✓	1. Check switchboard has been built as per the approved drawing. (KA Rating, IP Rating, Form of Segregation)
✓	2. Check all control functions.
✓	3. Check all connections.
✓	4. Check all current transformer ratios.
✓	5. Check all clearances.
✓	6. Check hinges, locks, keys, handles etc, to ensure that they are secure and function properly
✓	7. Check operations of all CFS units, circuit breakers, isolators, contactors, etc.
✓	8. Check main earth connections and continuity.
✓	9. Check that all the neutrals are accessible.
✓	10. Check that all labeling and schedules are in place.
✓	11. Check general condition of switchboard (paintwork, etc)
✓	12. Check switchboard has been cleaned out.
✓	13. Megger switchboard

CIRCUIT	RESULT-1000V MEGGER
R-E	$\geq 200M\Omega$
W-E	$\geq 200M\Omega$
B-E	$\geq 200M\Omega$
R-W	$\geq 200M\Omega$
R-B	$\geq 200M\Omega$
W-B	$\geq 200M\Omega$
NEUT-E	$\geq 200M\Omega$

COMMENTS:

Test okay.

S. McLachlan
CHECKED BY: S. McLachlan

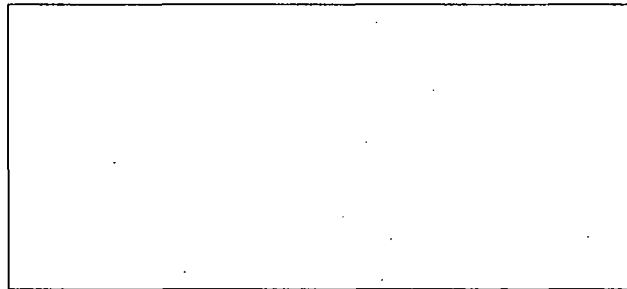
DATE: 09/08/02

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70 Flanders Street, SALISBURY, QUEENSLAND 4107

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



MSF SOFT STARTER INSTRUCTION MANUAL

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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.

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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

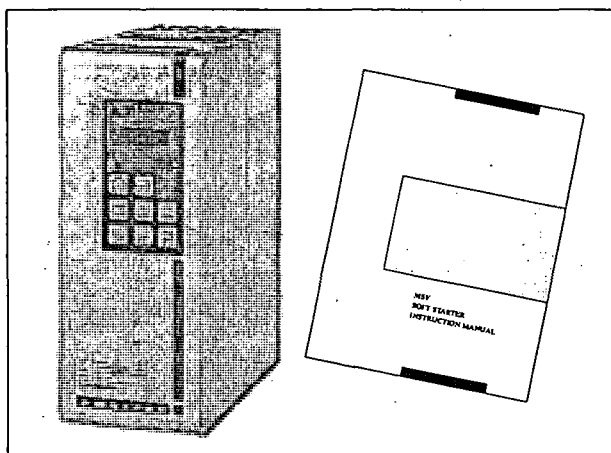


Fig. 1 Scope of delivery.

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.

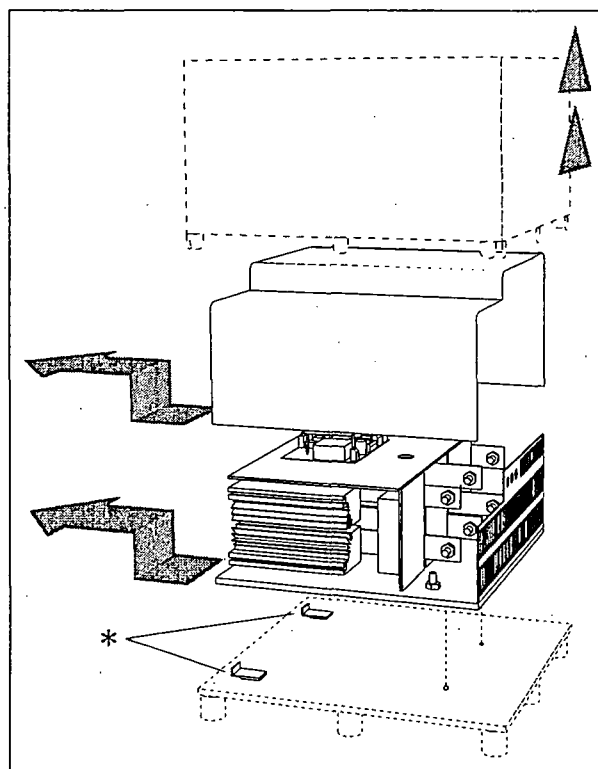
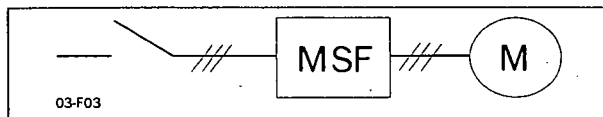


Fig. 2 Unpacking of MSF-310 and larger models.

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 K1 relay.



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

There are 3 different kinds of soft starting control methods:

- **Control method 1-Phase**

The single phase controlled soft starters provide only a reduction in starting torque no control of current or torque. These starters need a main and bypass contactor as well as external motor protections. This is 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.

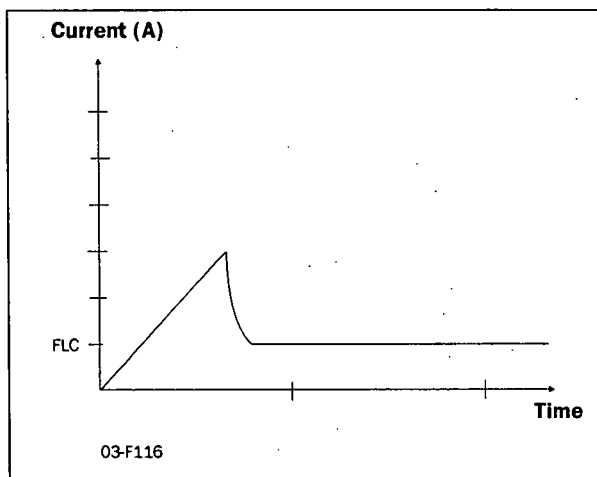


Fig. 3 Voltage control

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.

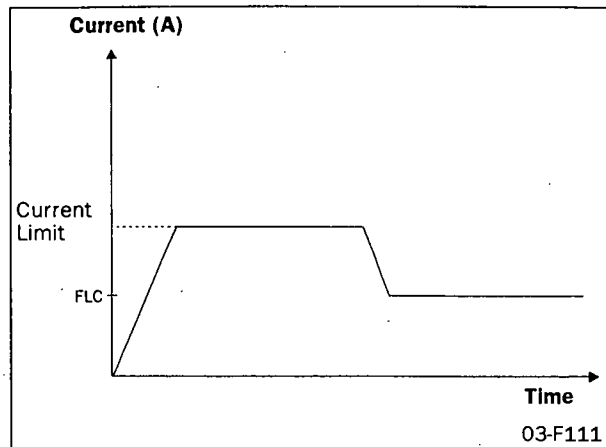


Fig. 4 Current control

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.

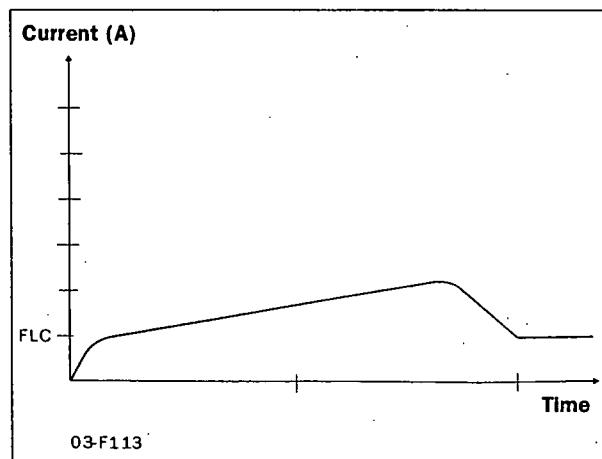


Fig. 5 Torque control

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

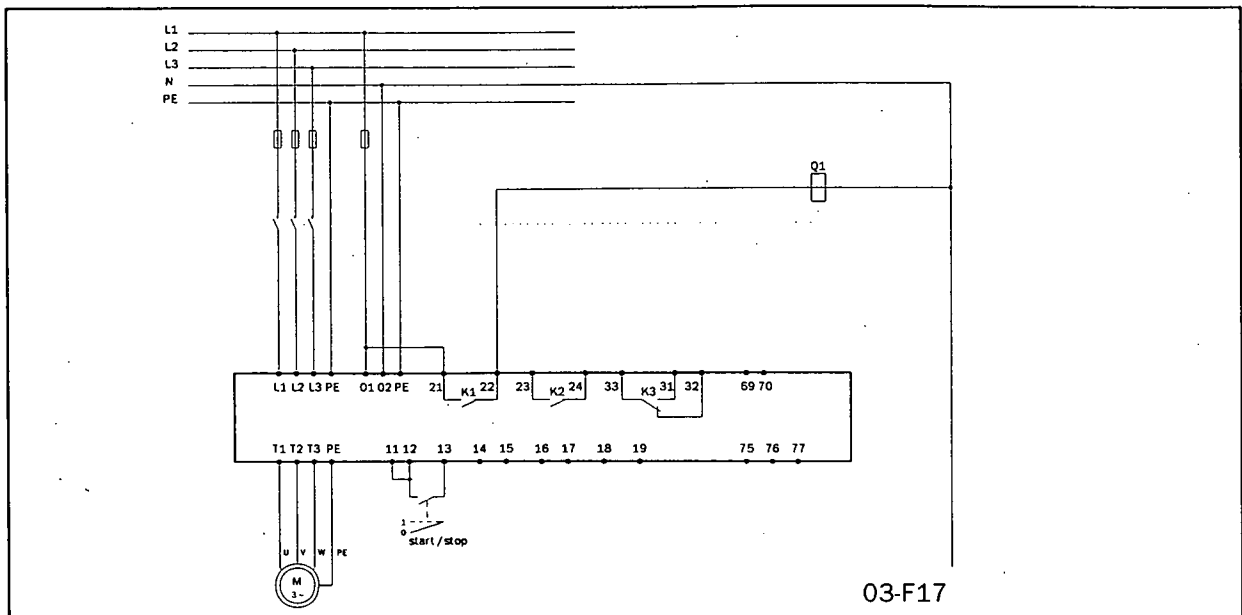


Fig. 6 Standard wiring.

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 $I_{n\text{soft}}$ in Amp

002°	
Start time ramp 1	
10	
Default:	10 sec
Range:	1-60 sec

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

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			
			2
Default:	2		
Range:	1,2,3		

Menu 006 must be set to 1 to be able to operate from keyboard.

NOTE! Factory default setting is remote control (2).

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

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

3.6 Viewing the motor current

Set the display to menu 005. Now the Motor current can be viewed on the display.

005 ^o			
RMS current read-out			
			0.0
Default:	-		
Range:	0.0-9999 Amp.		

NOTE! The menu 005 can be selected at any time when the motor is running.

3.7 Starting



WARNING! Make sure that all safety measures have been taken before starting the motor in order to avoid personal injury.

Start the motor by pressing the "START/STOP" key on the keyboard or through the remote control, PCB terminal 11, 12 and 13. When the start command is given, the mains contactor will be activated by relay K1 (PCB terminal 21 and 22), and the motor then starts softly.

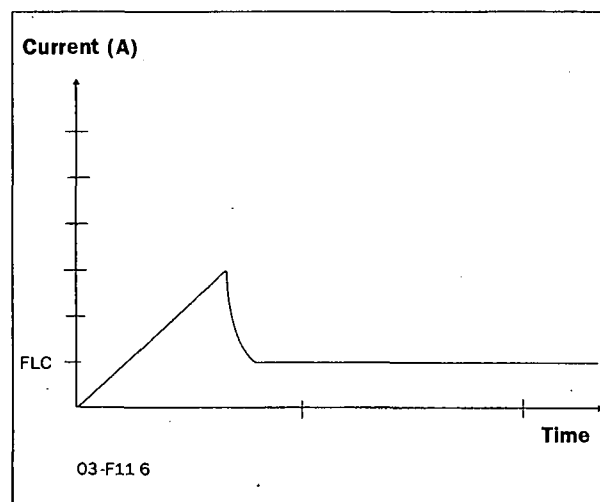


Fig. 7 Example of start ramp with main function voltage ramp.

4. APPLICATIONS AND FUNCTIONS SELECTION

This chapter is a guide to select the correct soft starter rating and the selection of the Main function and additional functions for each different application.

To make the right choice the following tools are used:

- **The norm AC53a.**

This norm helps selecting the soft starter rating with regard to duty cycle, starts per hour and maximum starting current.

- **The Application Rating List.**

With this list the soft starter rating can be selected depending on the kind of application used. The list use 2 levels of the AC53a norm. See table 1, page 15.

- **The Application Function List.**

This table gives an complete overview of most common applications and duties. For each applications the menu's that can be used are given. See table 2, page 17.

- **Function and Combination matrix.**

With these tables it is easy to see which combinations of Main and additional functions are possible, see table 3, page 19 and table 4, page 19.

4.1 Soft starter rating according to AC53a

The IEC947-4-2 standard for electronic starters defines AC53a as a norm for dimensioning of a soft starter.

The MSF soft starter is designed for continuous running. In the Applications table (table 1, page 15) two levels of AC53a are given. This is also given in the technical data tables (see chapter 12, page 74).

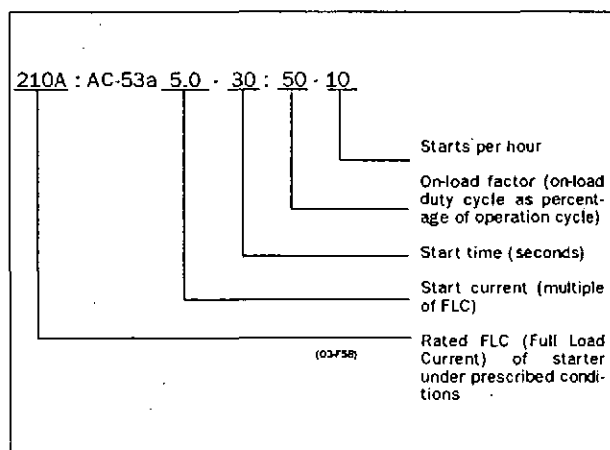


Fig. 8 Rating example AC53a.

The above example indicates a current rating of 210 Amps with a start current ratio of 5.0 x FLC (1050A) for 30 seconds with a 50% duty cycle and 10 starts per hour.

NOTE! If more than 10 starts/hour or other duty cycles are needed, please contact your supplier.

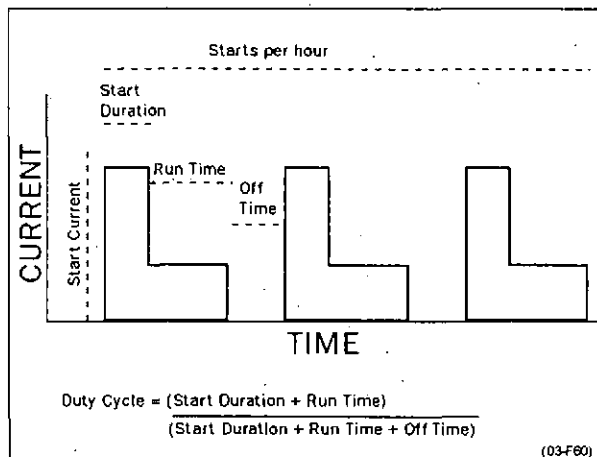


Fig. 9 Duty cycle, non bypass.

4.2 Soft starter rating according to AC53b

This norm is made for Bypass operation. Because the MSF soft starter is designed for continuous operation this norm is not used in the selection tables in this chapter.

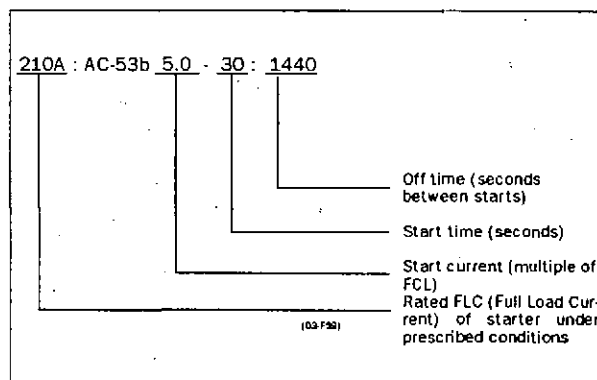


Fig. 10 Rating example AC53b.

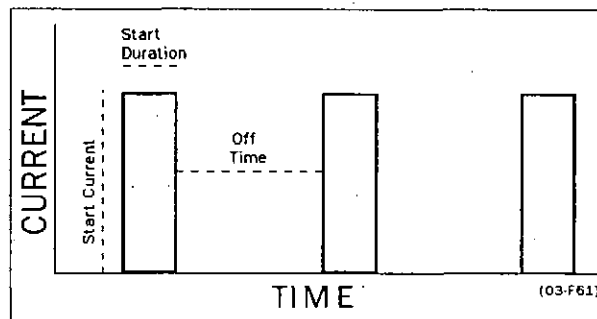


Fig. 11 Duty cycle, bypassed

The above example indicates a current rating of 210 Amps with a start current ratio of 5.0 x FLC (1050A) for 30 seconds with a 24-minute period between starts.

4.3 MSF Soft starter ratings

According to the norms AC53a and AC53b a soft starter can have many current ratings.

NOTE! Because the MSF soft starter is designed for continuous operation the norm AC53b is not used in the application rating list.

With help of the Application Rating List with typical starting currents and categories in the AC53a level (see table 1, page 15 and table 2, page 17) it is easy to select the proper soft starter rating with the application.

The Application Rating List uses two levels for the AC53a norm:

- **AC53a 5.0-30:50-10 (heavy duty)**
This level will be able to start all applications and follows directly the type number of the soft starter.
Example: MSF 370 is 370 Amps FLC and then 5 time this current in starting.
- **AC 53a 3.0-30:50-10 (normal/light duty)**
This level is for a bit lighter applications and here the MSF can manage a higher FLC.
Example: MSF 370 in this norm manage 450 Amps FLC and the 3 times this current in starting

NOTE! To compare Soft Starters it's important to ensure that not only FLC (Full Load Current) is compared but also that the operating parameters are identical.

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 of the MSF functions.
- **Menus.**
Gives the menu numbers and selection for the MSF function.
"25;=1", means: program selection 1 in menu 25.
"36;=1 / 34,35", means: program selection 1 in menu 36, menus 34 and 35 are related to this function.

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 inertia	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)
	X	X	X	X	X	X	X	X	X	X	X	
			X	X	X	X	X	X	X	X	X	
		X	X	X	X	X	X	X	X	X	X	X
		X	X	X	X	X	X	X	X	X	X	X
			X						X	X		
									X	X		
			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

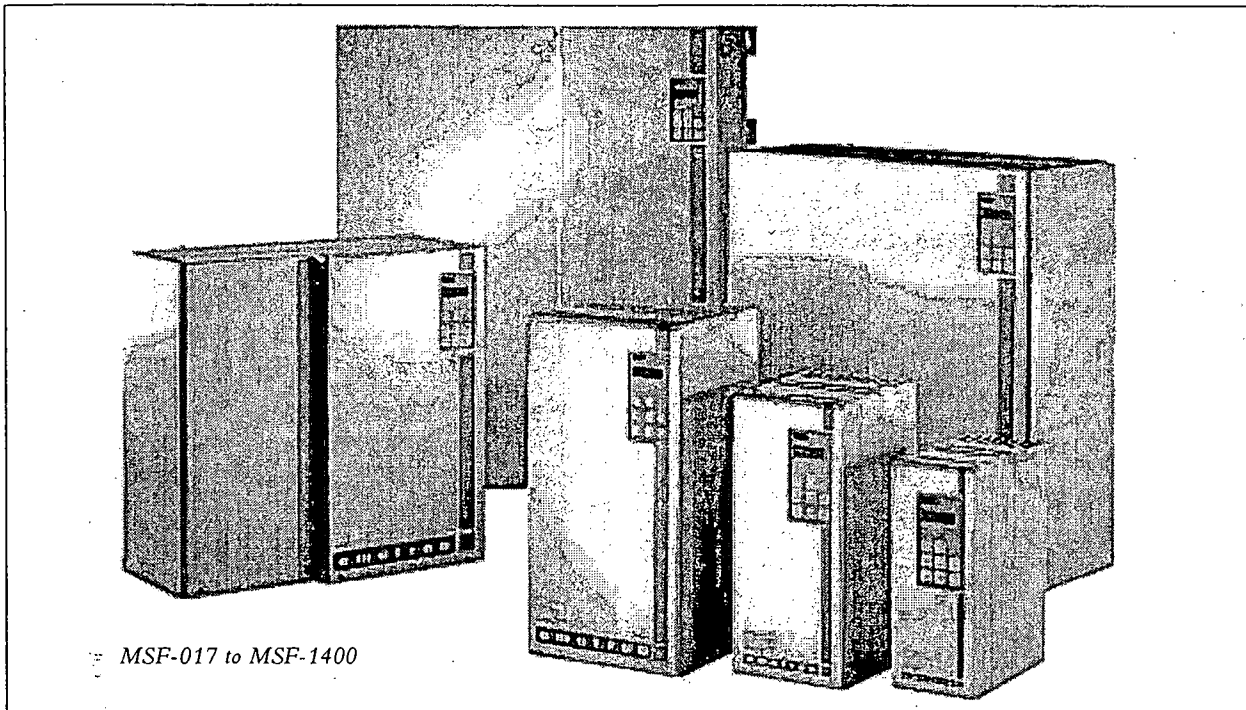


Fig. 12 MSF soft starter models.

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.

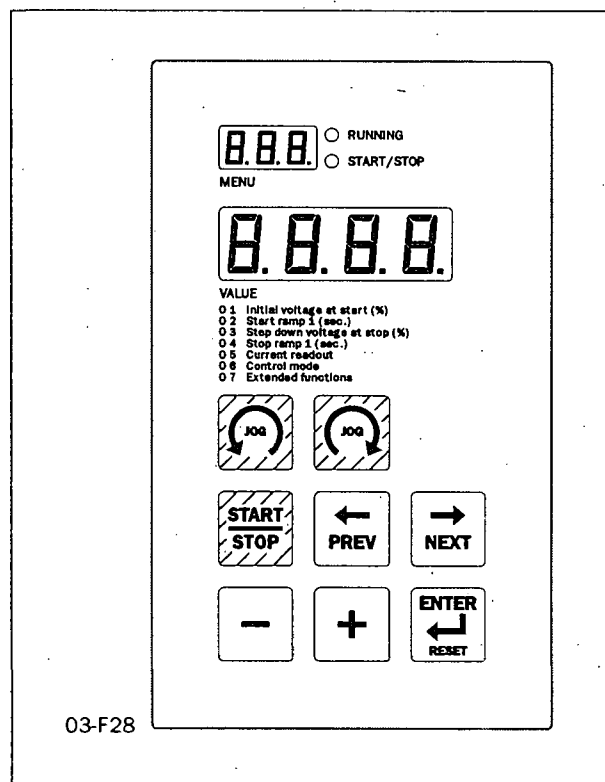


Fig. 13 PPU unit.

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.

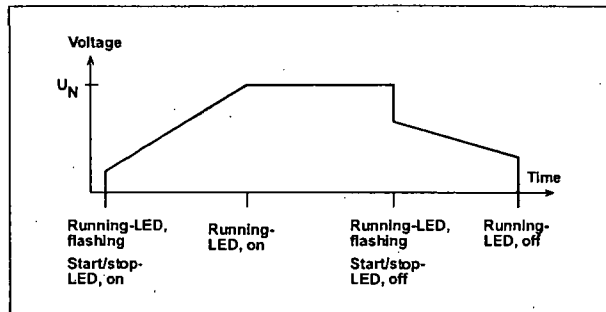


Fig. 14 LED indication at different operation situation.

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.

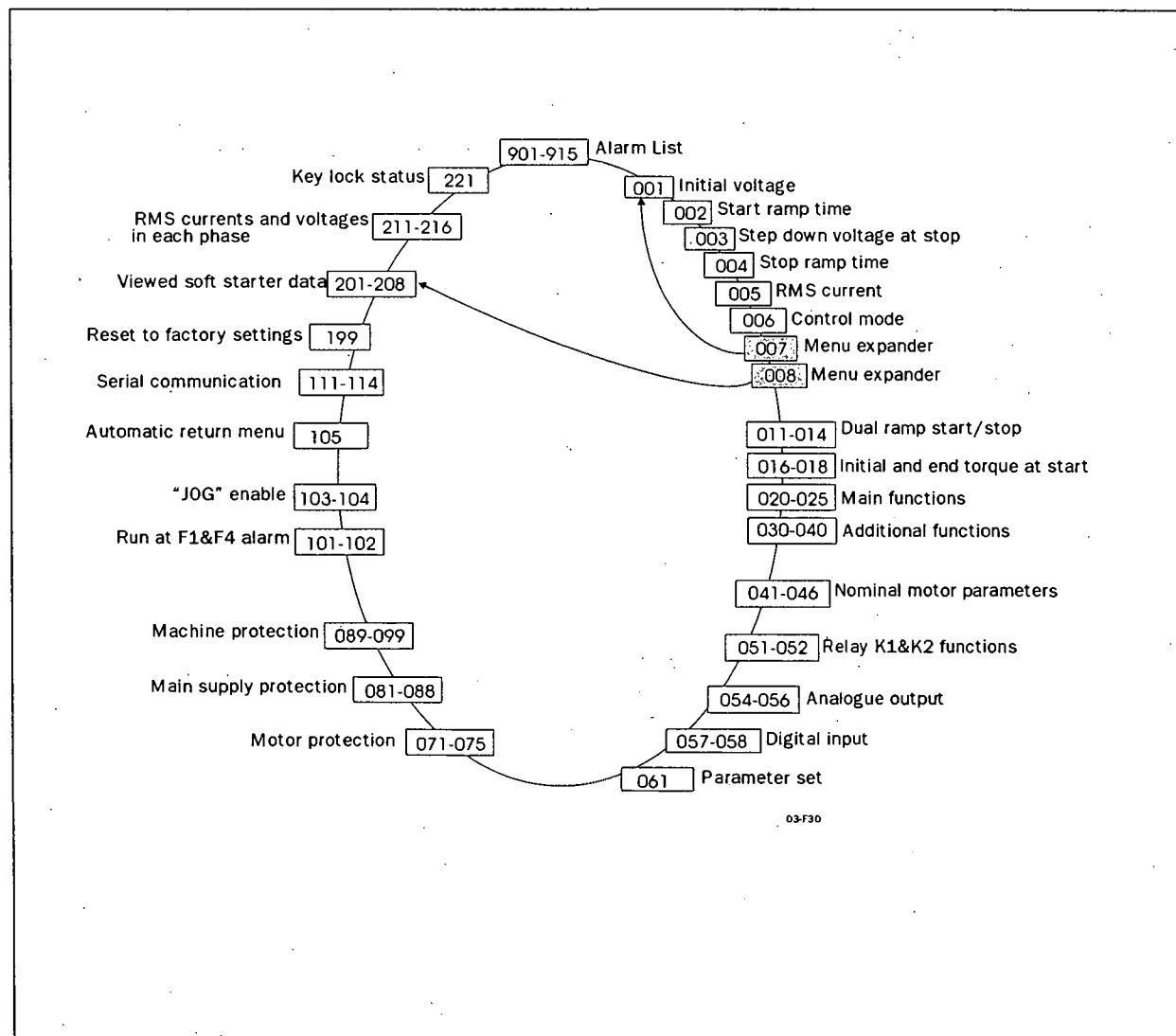


Fig. 15 Menu structure.

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 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

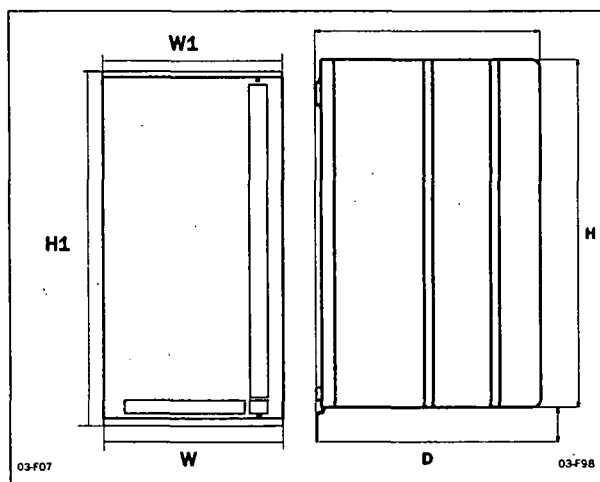


Fig. 16 MSF-017 to MSF-250 dimensions.

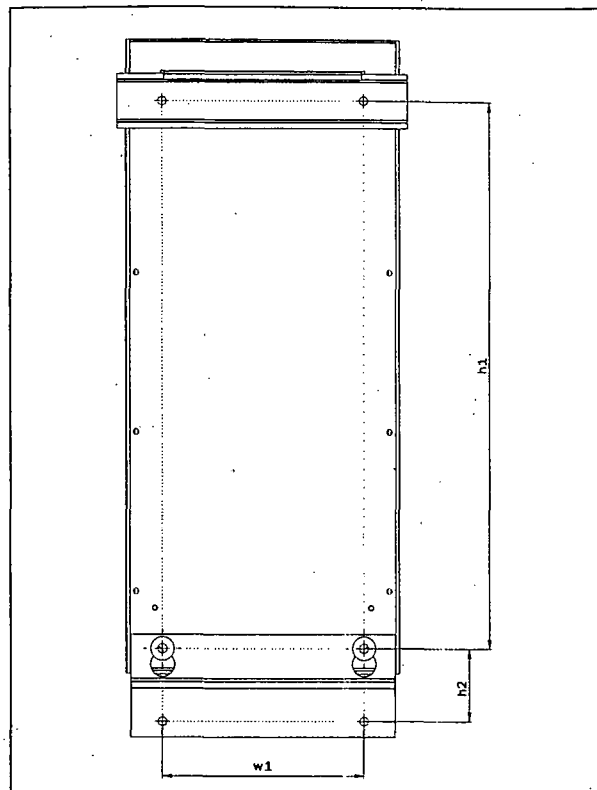


Fig. 17 Hole pattern for MSF-017 to MSF-250 (backside view).

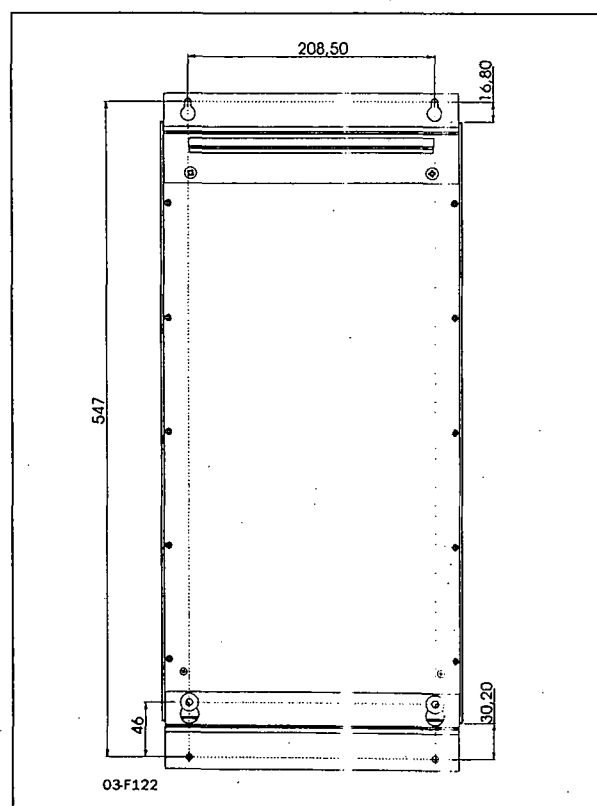


Fig. 18 Hole pattern for MSF-170 to MSF-250 with upper mounting bracket instead of DIN-rail.

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

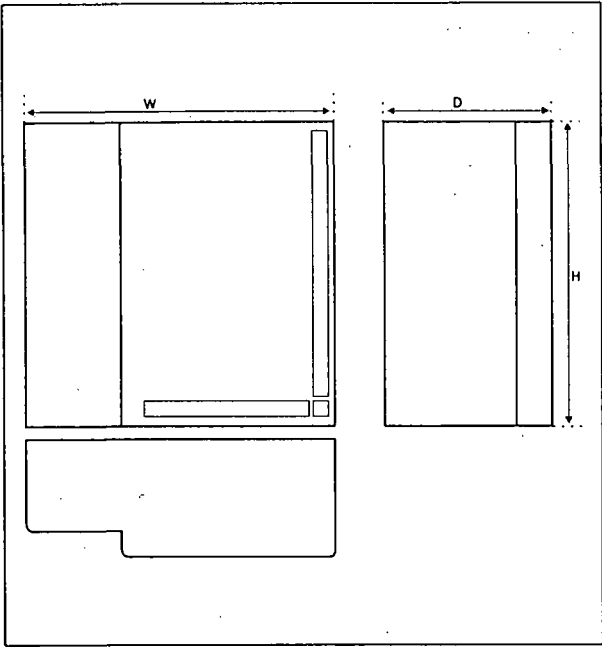


Fig. 19 MSF -310 to MSF -835.

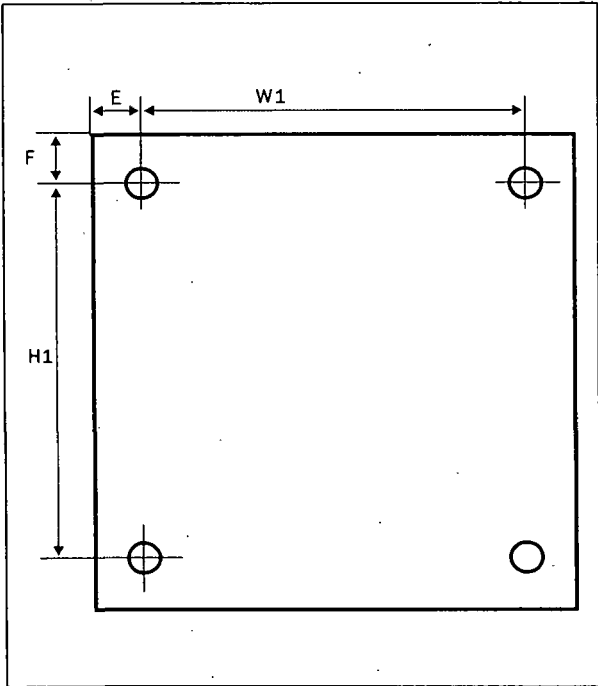


Fig. 20 Hole pattern for screw attachment, MSF-310 to MSF-835. Hole distance (mm).

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

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

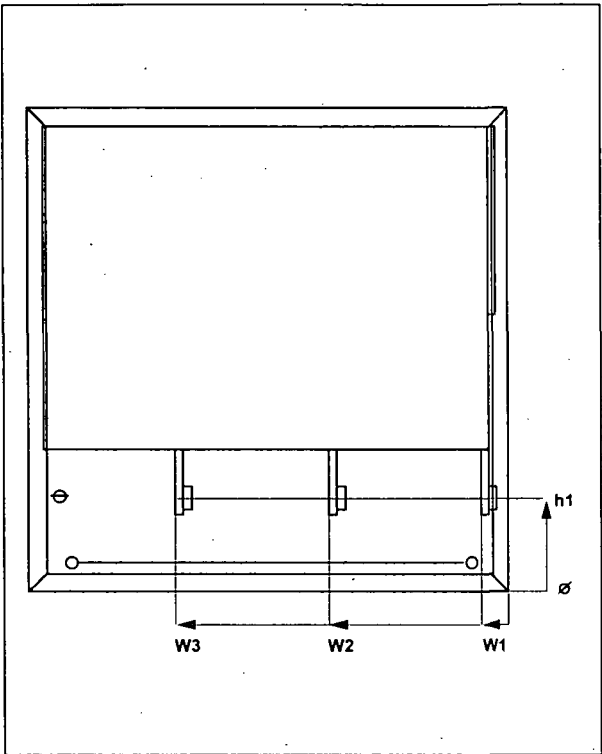


Fig. 21 Busbar distances MSF -310 to MSF -835.

Table 11 Busbar distances

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

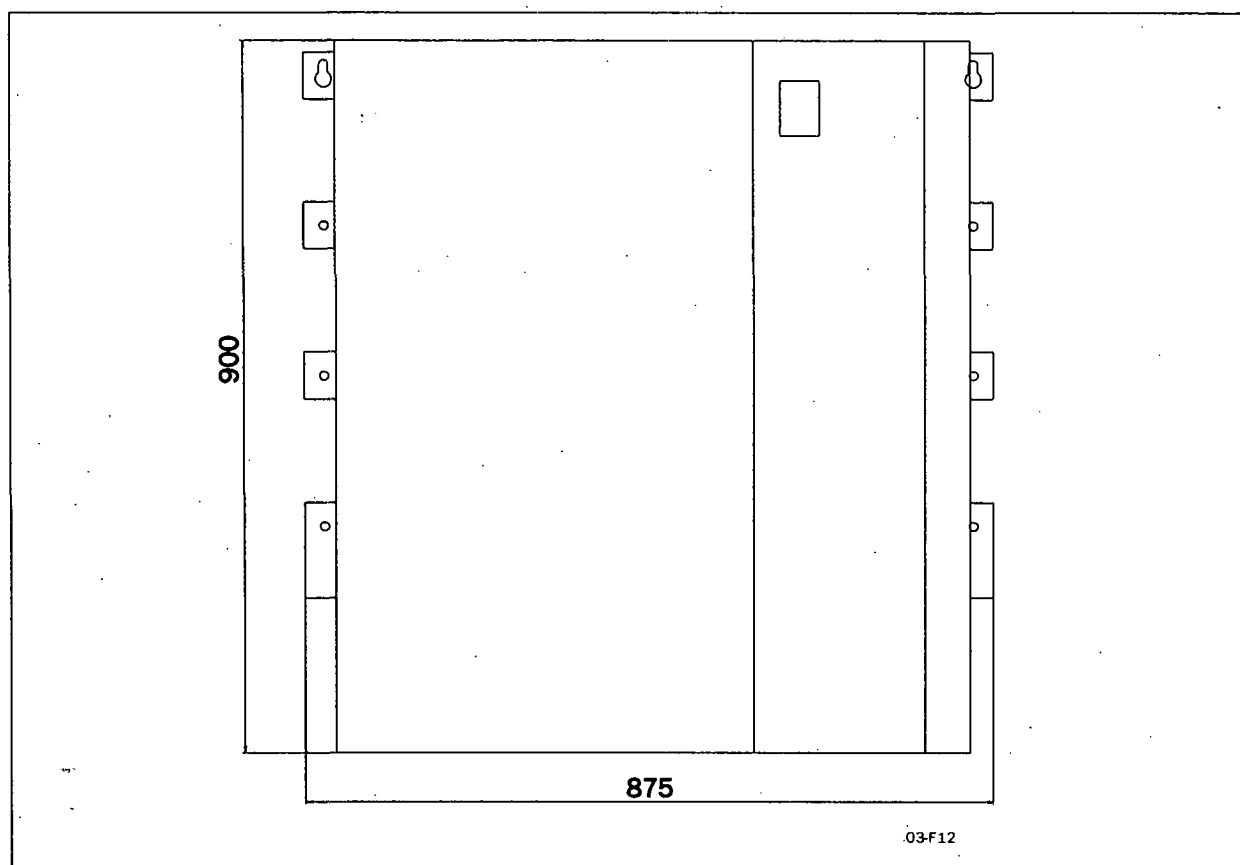


Fig. 22 MSF -1000 to -1400

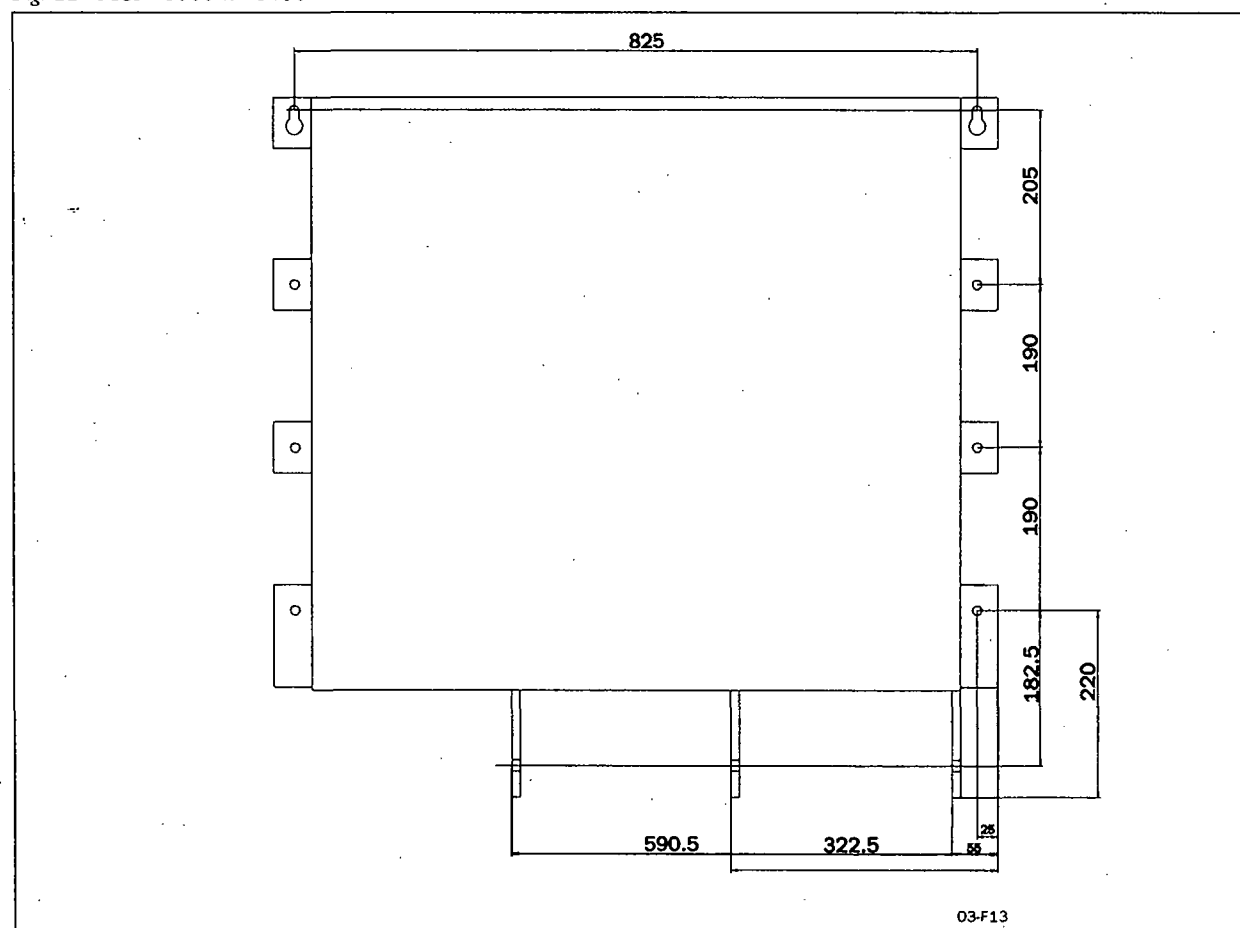


Fig. 23 Hole pattern busbar MSF -1000 to -1400.

6.2 Connections

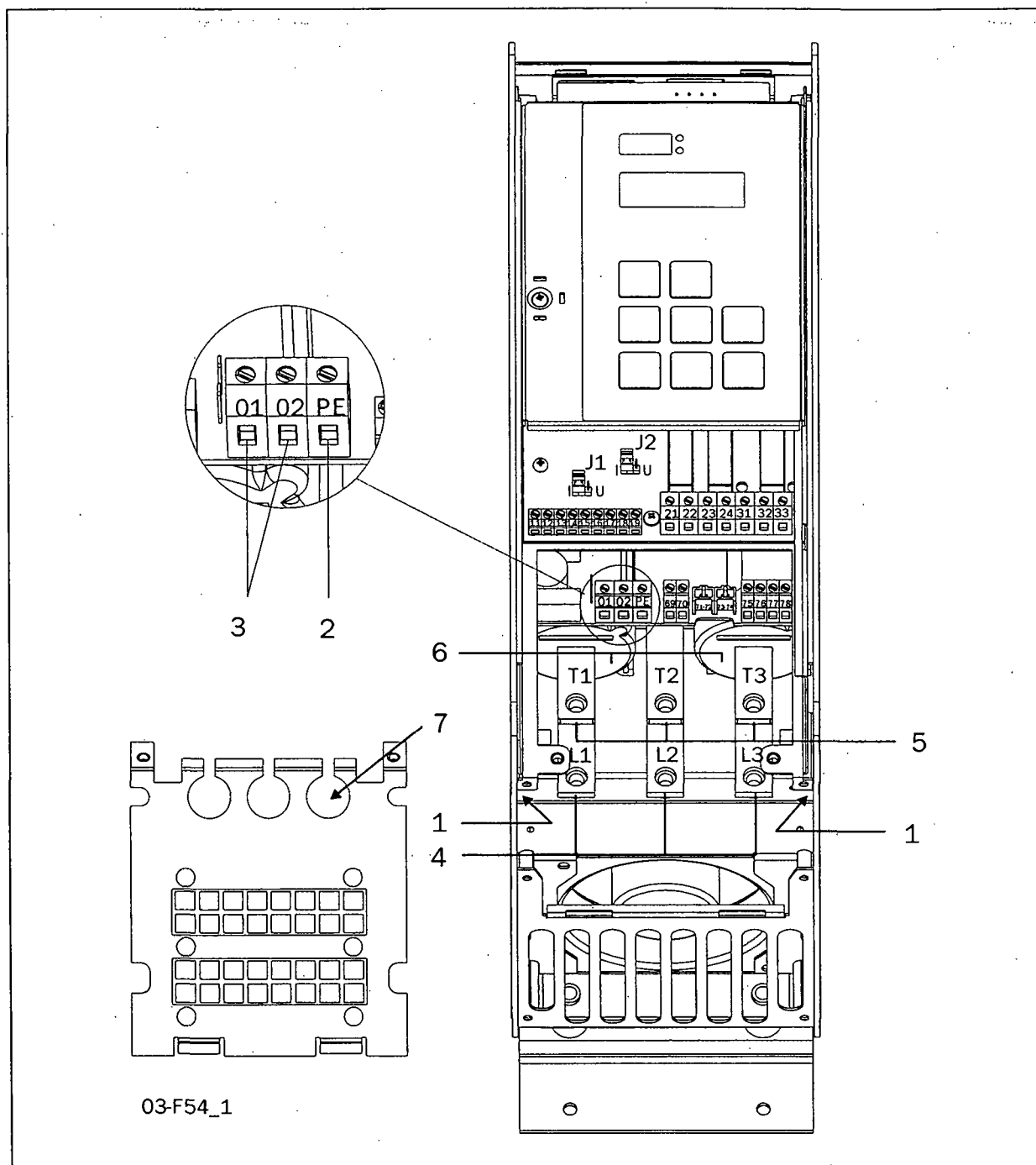


Fig. 24 Connection of MSF-017 to MSF-085.

Connection of MSF-017 to MSF-085

Device connections

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

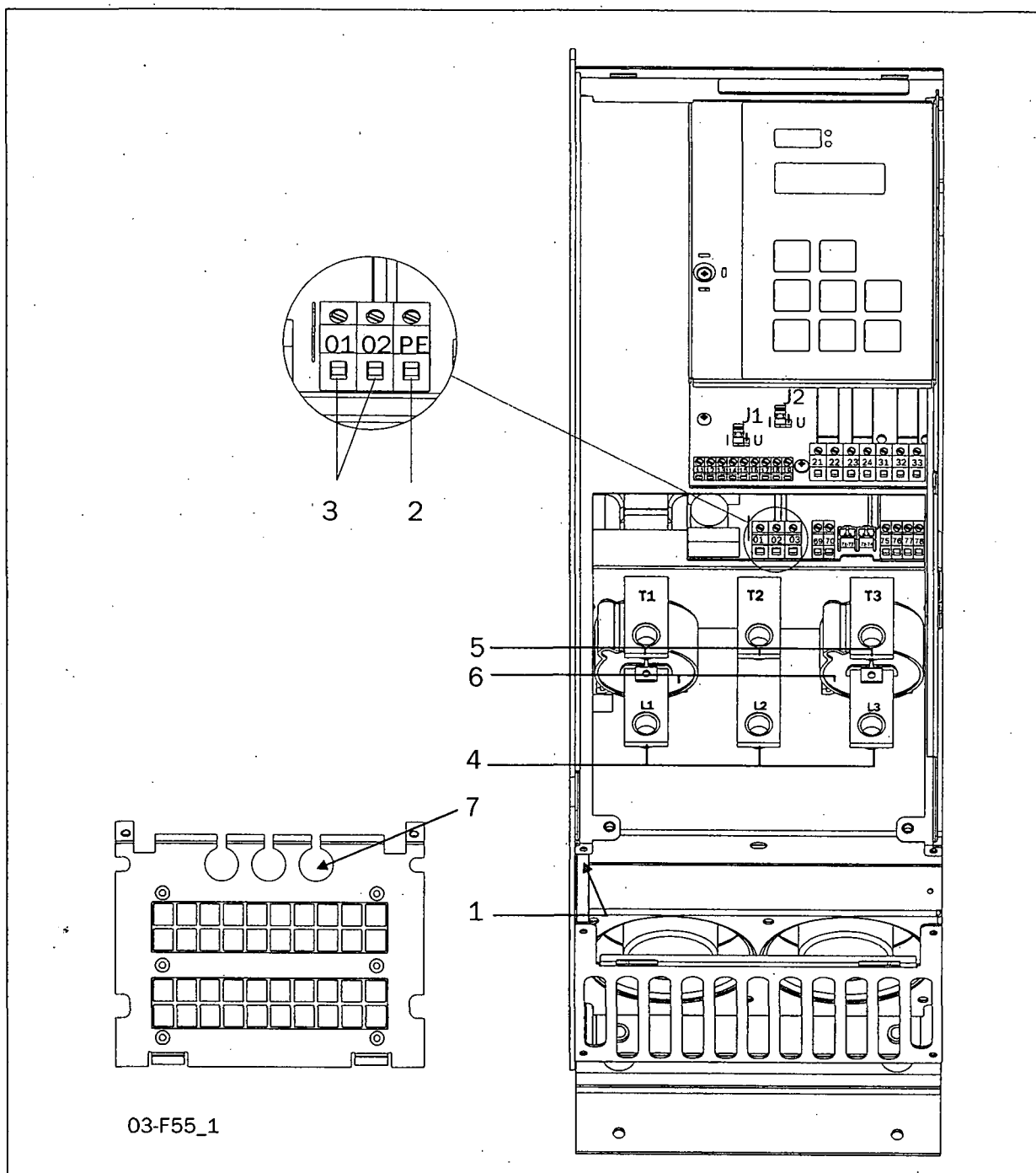


Fig. 25 Connection of MSF-110 to MSF-145.

Connection of MSF-110 to MSF-145

Device connections

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

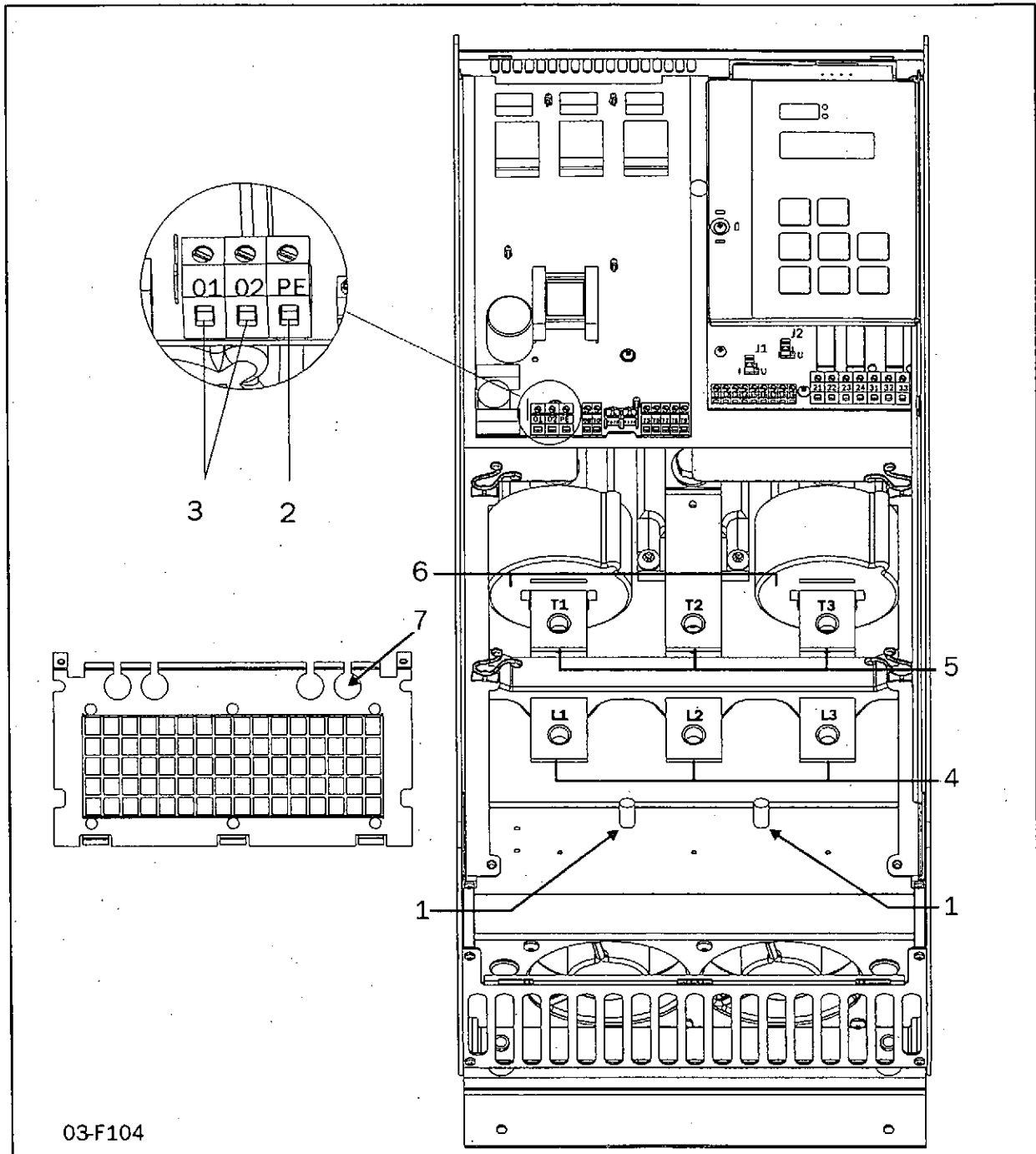


Fig. 26 Connection of MSF-170 to MSF-250

Connection of MSF-170 to MSF-250

Device connections

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

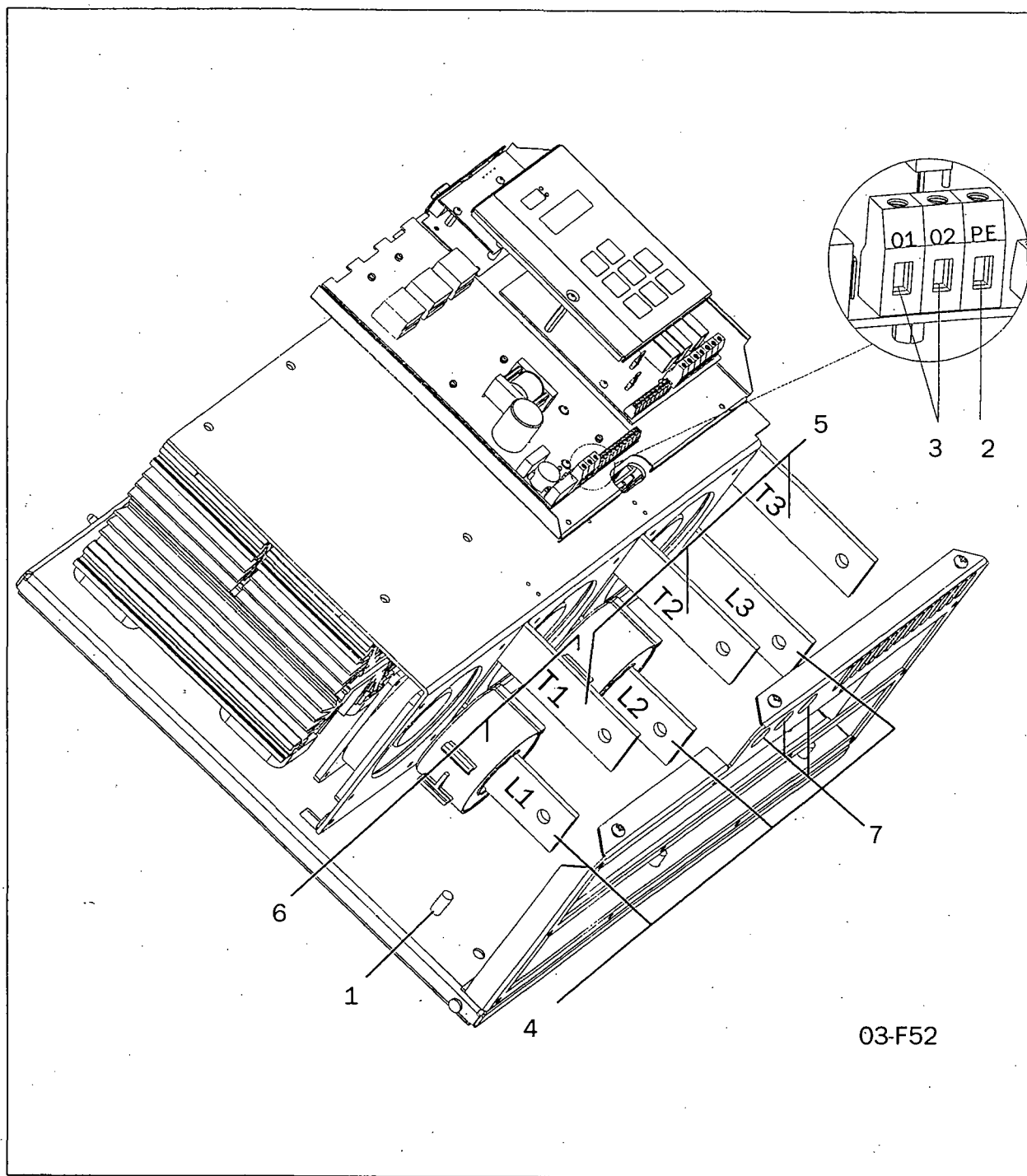


Fig. 27 Connection of MSF-170 to MSF-1400.

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

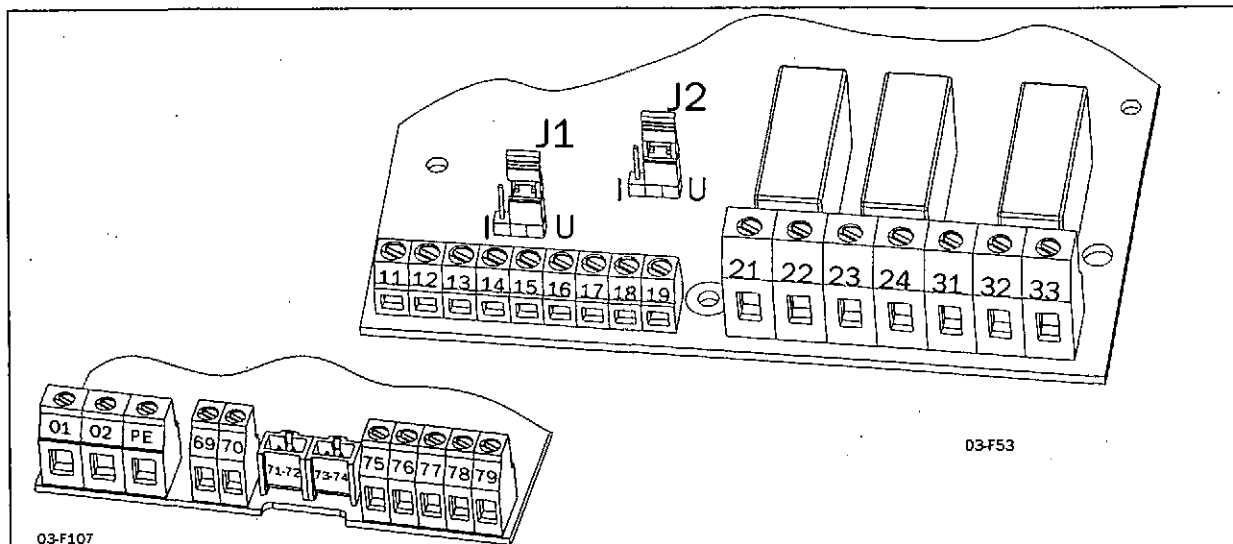


Fig. 28 Connections on the PCB, control card.

Table 12 PCB Terminals

Terminal	Function	Electrical characteristics
01	Supply voltage	100-240 VAC $\pm 10\%$ /380-500 VAC $\pm 10\%$
02		
PE		
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

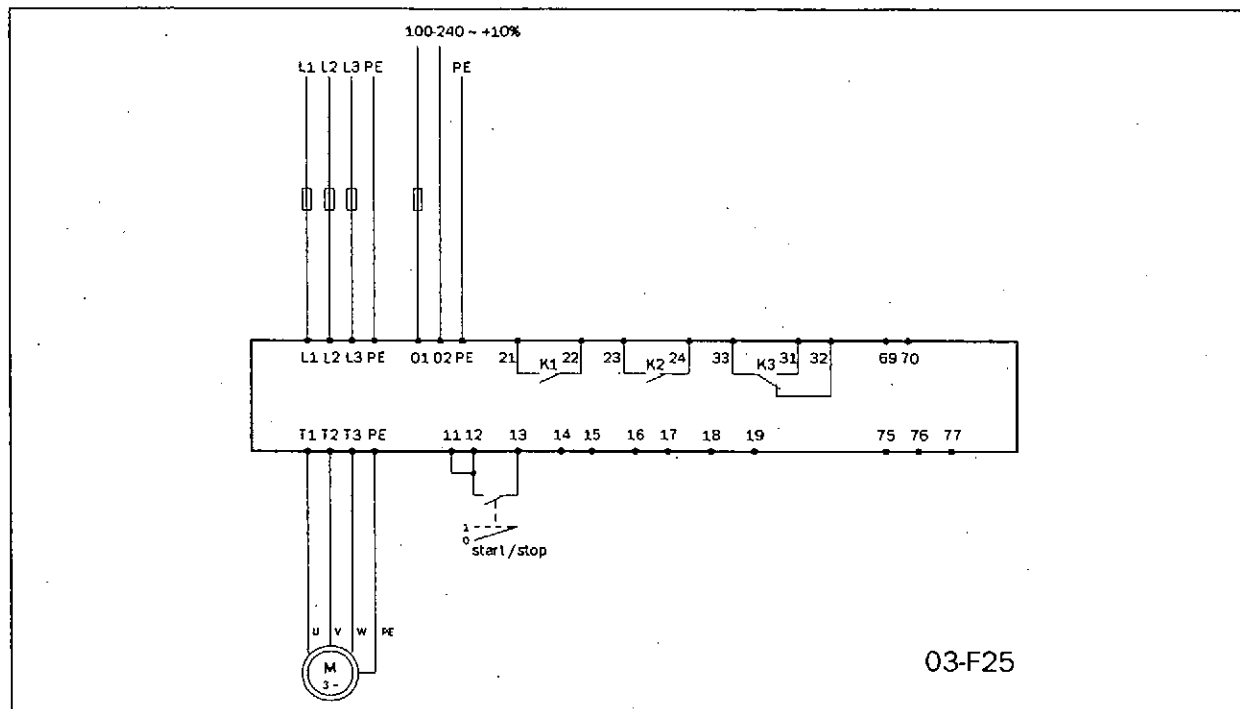


Fig. 29 Wiring circuit, "Minimum wiring".

The figure above shows the "standard 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:

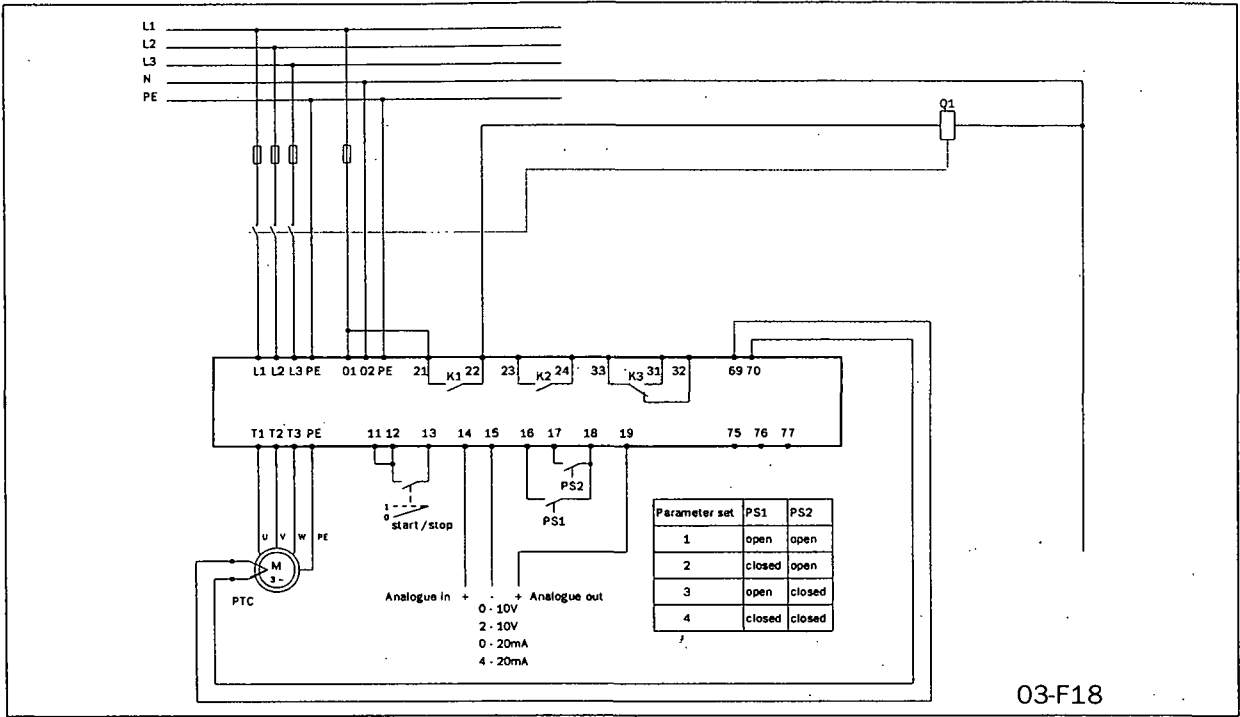


Fig. 30 Analogue input control, parameter set, analogue output and PTC input.

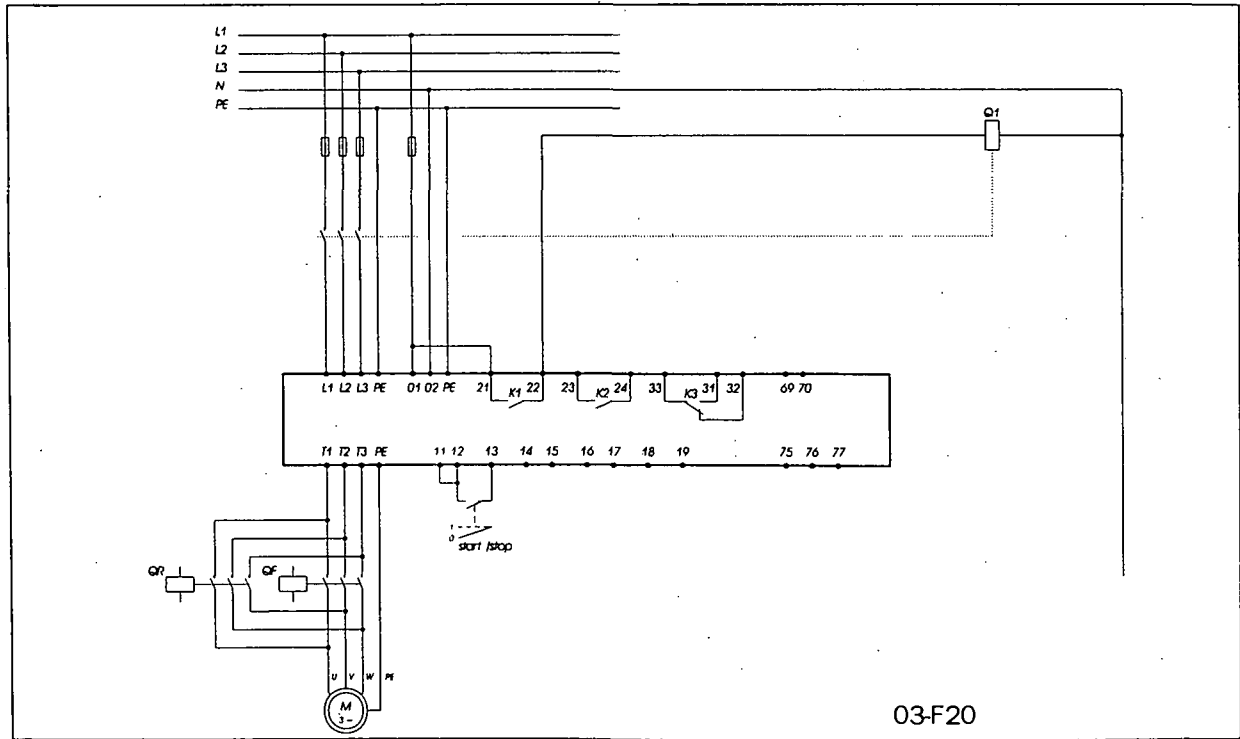


Fig. 31 Forward/reverse wiring circuit.

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	7.27
View functions	201-915	Main view		201-208	7.28
		RMS current per phase		211-213	7.28
		RMS voltage per phase		214-216	7.28
		Keyboard lock status		221	7.29
		Alarm list		901-915	7.30

7.1 Ramp up/down parameters

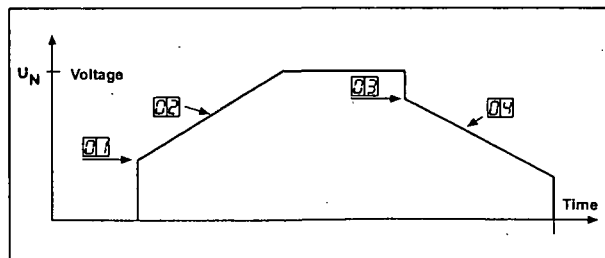


Fig. 32 Menu numbers for start/stop ramps, initial voltage at start and step down voltage at stop.

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			
30			
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			
10			
Default:	10 sec		
Range:	1-60 sec		
Set "Ramp up time" at start.			

003 ^o			
Setting of step down voltage stop ramp 1			
100			
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			
OFF			
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 ^o	
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <div style="border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center; margin: 0 5px;">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.

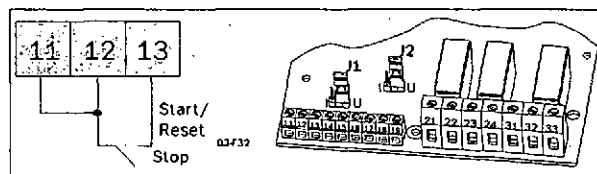
NOTE! A reset via the keyboard will not start or stop the motor.

NOTE! Factory default setting is 2, remote control.

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

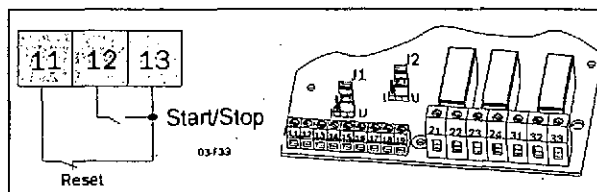
To reset from the keyboard, the "ENTER / RESET" key is used. A reset can be given both when the motor is running and when the motor is stopped. A reset from the keyboard will not start or stop the motor.

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



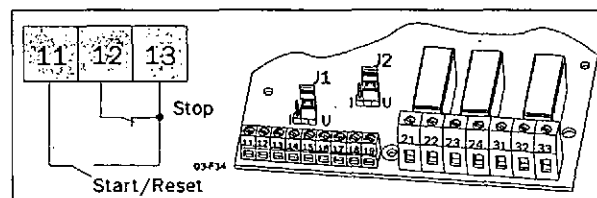
Closing PCB terminals 12 and 13, and a jumper between terminal 11 and 12, will give a start command. Opening the terminals will give a stop. If PCB terminals 12 and 13 is closed at power up a start command is given (automatic start at power up). When a start command is given there will automatically 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			
	o	F	F
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			
	o	F	F
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.

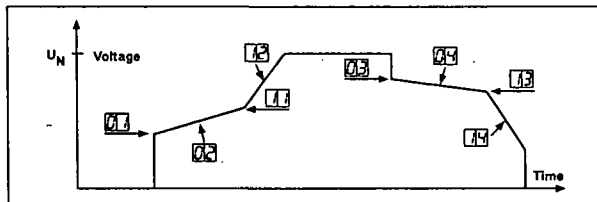


Fig. 33 Menu numbers for dual voltage ramp at start/stop, initial voltage at start and step down-voltage at stop.

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			
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			
	o	F	F
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			
Setting of step down voltage In stop ramp 2			
4 0			
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			
	o	F	F
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 ^o			
Initial torque at start			
		1	0
Default:	10		
Range:	0 - 250% of T _n		
Insert initial torque at start in percent of nominal shaft torque (T _n), see chapter 13, page 79.			

017 ^o			
End torque at start			
	1	5	0
Default:	150		
Range:	50 - 250% of T _n		
Insert end torque at start in percent of nominal shaft torque.			

018 ^o			
End torque at stop			
			0
Default:	0		
Range:	0 - 100% of T _n		
Insert end torque at stop in percent of the nominal motor torque.			

7.6 Current limit (Main Function)

The Current Limit function is used to limit the current drawn when starting (150 - 500% of I_n). This means that current limit is only achieved during set start-up time.

Two kinds of current limit starts are available.

- **Voltage ramp with a limited current.**
If current is below set current limit, this start will act exactly as a voltage ramp start.
- **Current limit start.**
The soft starter will control the current up to set current limit immediately at start, and keep it there until the start is completed or the set start-up time expires.

See Fig. 34 Current limit.

NOTE! Make sure that nominal motor current in menu 042 is correctly inserted.

7.6.1 Voltage ramp with current limit

The settings are carried out in three steps:

1. Estimate starting-time for the motor/machine and select that time in menu 002 (see § 7.1, page 36).
2. Estimate the initial voltage and select this voltage in menu 001 (see § 7.1, page 36).
3. Set the current limit to a suitable value e.g. 300% of I_n in menu 020.

020 ^o			
Voltage ramp with current limit at start			
	o	F	F
Default:	oFF		
Range:	oFF, 150 - 500% I _n		
oFF	Voltage Ramp mode with current limit disabled. Voltage Ramp enabled.		
150-500	Current limit level in Voltage ramp mode.		

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

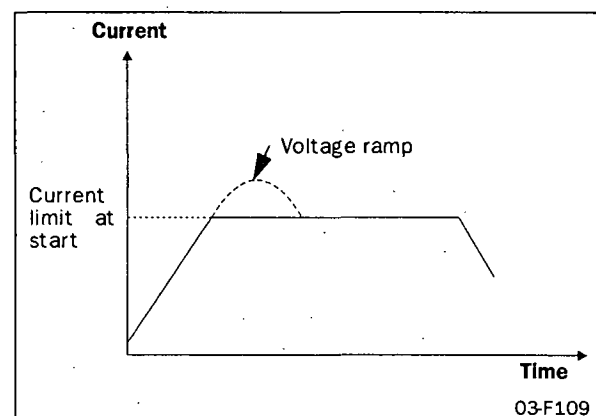


Fig. 34 Current limit

7.6.2 Current limit

The settings are carried out in two steps:

1. Estimate starting time for the motor/machine and select that time in menu 002 (see § 7.1, page 36).
2. Set the current limit to a suitable value e.g. 300% of In in menu 021.

021 ^o	
Current limit at start	
o F F	
Default:	oFF
Range:	oFF, 150 - 500% In
oFF	Current limit mode disabled. Voltage Ramp enabled.
150-500	Current limit level in current limit mode.

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

NOTE! Even though the current limit can be set as low as 150% of the nominal motor current value, this minimum value cannot be used generally. Considerations must be given to the starting torque and the motor before setting the appropriate current limit. "Real start time" can be longer or shorter than the set values depending on the load conditions. This applies to both current limit methods.

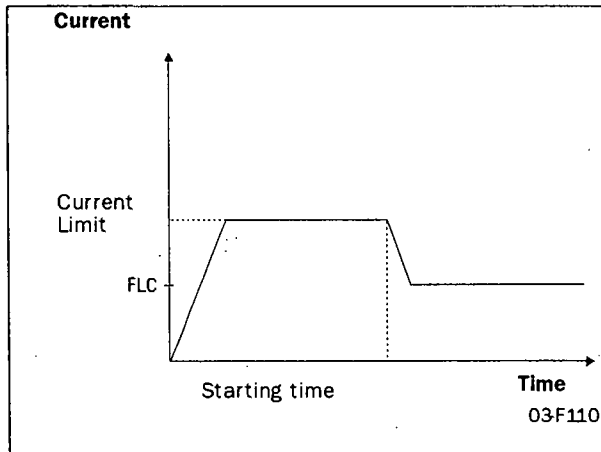


Fig. 35 Current limit

If the starting time is exceeded and the soft starter is still operating at current level, an alarm will be activated. It is possible to let the soft starter to either stop operation or to continue. Note that the current will rise uncontrolled if the operation continues (see § 7.24.2, page 61).

7.7 Pump control (Main Function)

By choosing pump control you will automatically get a stop ramp set to 15 sec. The optimising parameters for this main function are start and stop time; initial torque at start and end torque at start and stop. End torque at stop is used to let go of the pump when it's no longer producing pressure/flow, which can vary on different pumps. See Fig. 36.

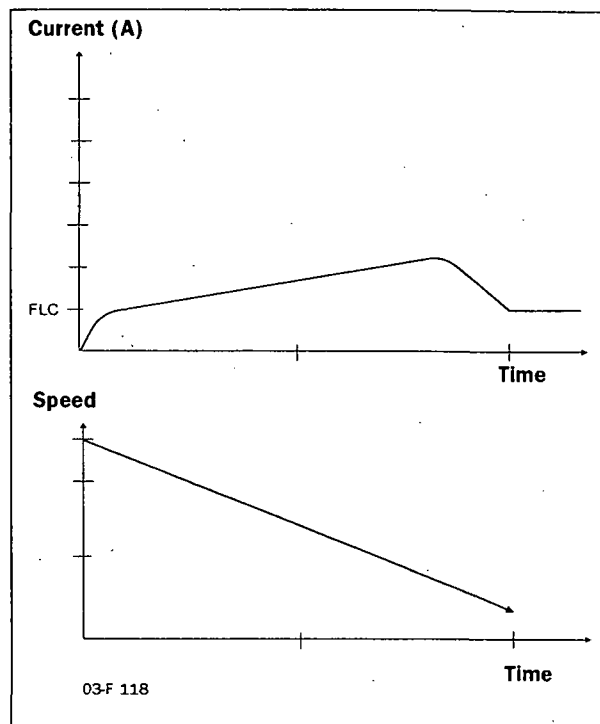


Fig. 36 Pump control

Pump application

The pump application is using Torque ramps for quadratic load. This gives lowest possible current and linear start and stop ramps. Related menus are 2, 4 (see § 7.1, page 36), 16, 17 and 18 (see § 7.5, page 39).

022 ^o	
Setting of pump control	
o F F	
Default:	oFF
Range:	oFF, on
oFF	Pump control disabled. Voltage Ramp enabled.
on	Pump control application is enabled.

NOTE! Only possible when Voltage Ramp mode is enabled. Menu 020-021, 023-025 must be "oFF".

7.8 Analogue Input Control (Main Function)

Soft starting and soft stopping can also be controlled via the Analogue Input Control (0-10 V, 2-10 V, 0-20 mA and 4-20 mA). This control makes it possible to connect optional ramp generators or regulators.

After the start command, the motor voltage is controlled through the remote analogue input.



WARNING! The remote analogue control may not be used for continuous speed regulation of standard motors. With this type of operation the increase in the temperature of the motor must be taken into consideration.

To install the analogue input control, proceed by:

- 1. Connect the ramp generator or regulator to terminal 14 (+) and 15 (-).

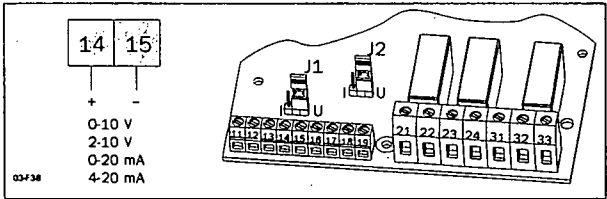


Fig. 37 Wiring for analogue input.

- 2. Set Jumper J1 on the PCB control card to voltage (U) or current control (I) signal position, see Fig. 38 and Fig. 24 on page 28. Factory setting is voltage (U).

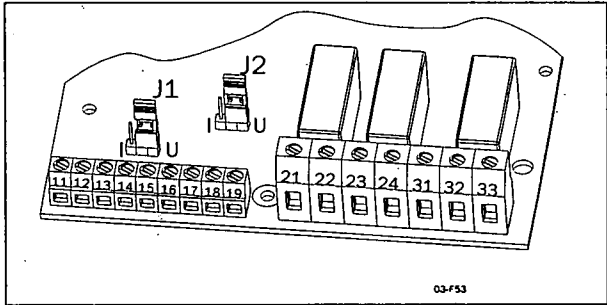


Fig. 38 Setting voltage or current for analogue input.

023°

Setting of Analogue Input control

OFF

OFF

OFF

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°

Setting of D.O.L start

OFF

OFF

OFF

Default:	oFF
Range:	oFF, on
oFF	D.O.L. start disabled. Voltage Ramp enabled.
on	D.O.L. start enabled

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

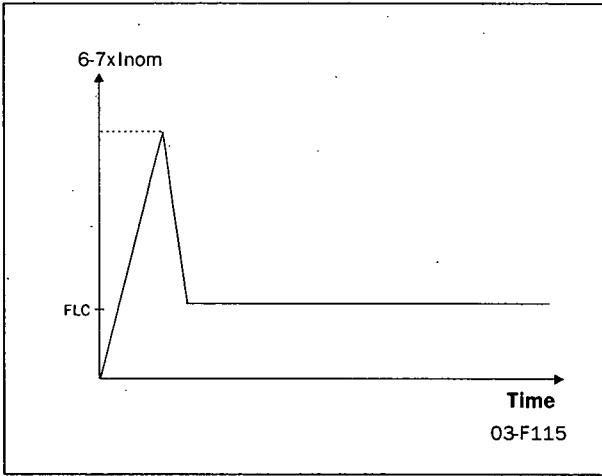


Fig. 39 Full voltage start.

7.10 Torque control (Main function)

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

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

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

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

Example:

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

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

025 ⁰			
Torque control at start/stop			
OFF			
Default:	oFF		
Range:	oFF, 1, 2		
oFF	Torque control is disabled Voltage Ramp enabled.		
1	Torque control with linear torque characteristic		
2	Torque control with square torque characteristic		

NOTE! Torque control mode is only possible when Voltage Ramp mode is enabled (menu 020-024 are "oFF").

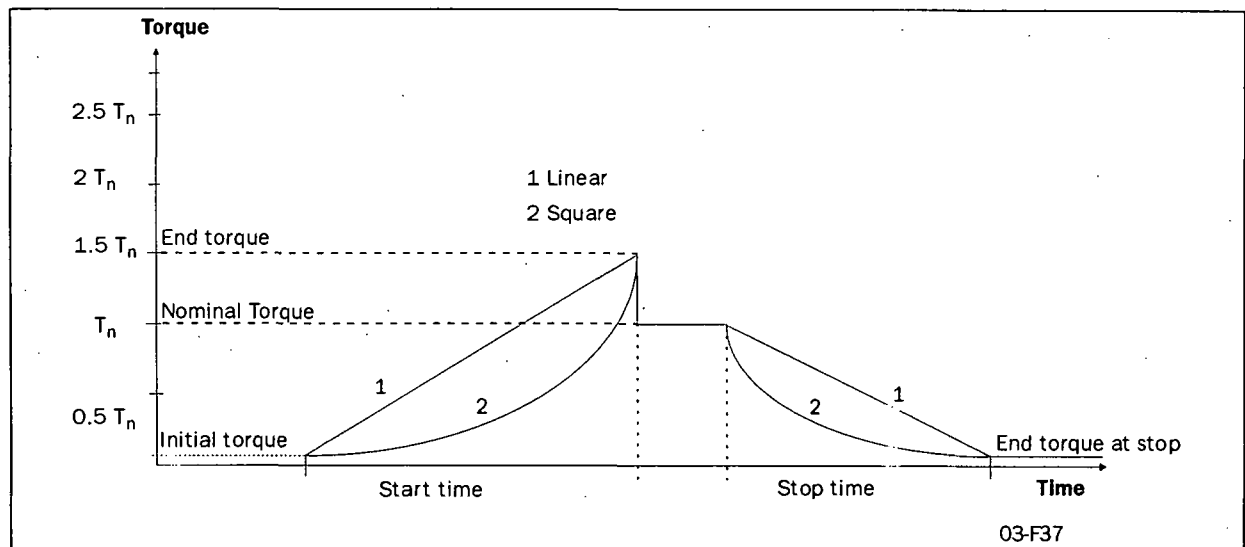


Fig. 40 Torque control at start/stop.

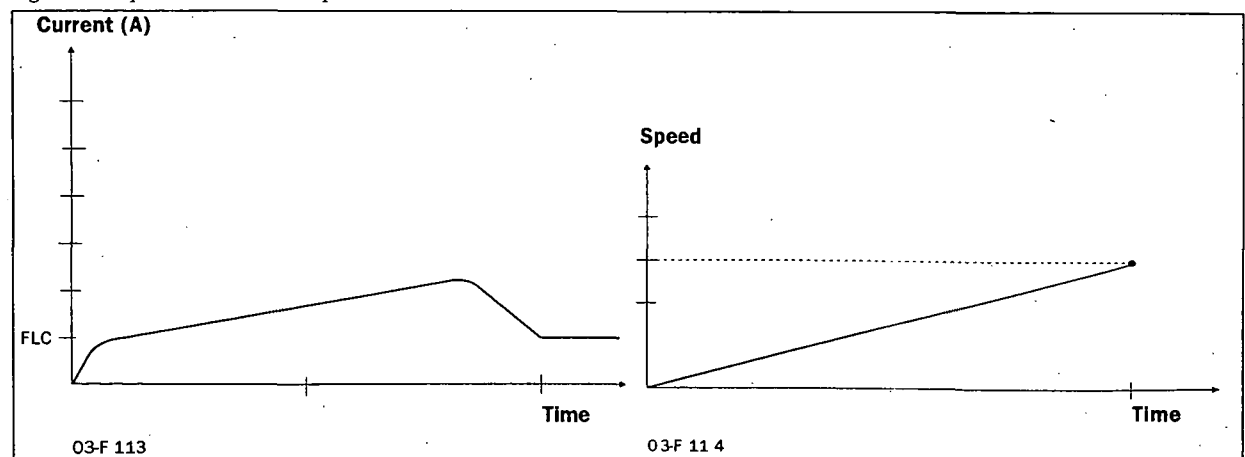


Fig. 41 Current and speed in torque control.

7.11 Torque boost

The Torque Booster enables a high torque to be obtained by providing a high current during 0.1 - 2 sec at start. This enables a soft start of the motor even if the break away torque is high at start. For example in crushing mills applications etc.

When the torque booster function has finished, starting continues according to the selected start mode.

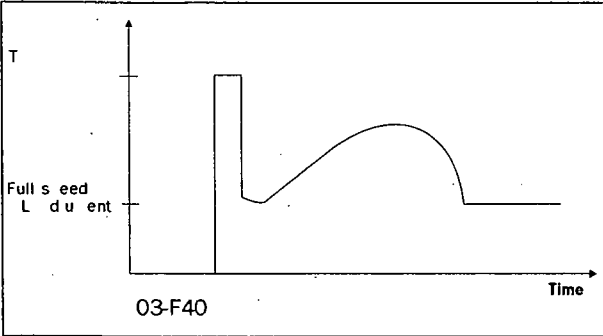


Fig. 42 The principle of the Torque Booster when starting the motor in voltage ramp mode.

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

030°

o

F

F

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°

3

0

0

Torque boost current limit

Default:	300
Range:	300 - 700% of In

The Torque boost current controller use selected value as the motor current reference.

NOTE! Check whether the motor can accelerate the load with "Torque booster", without any harmful mechanical stress.

7.12 Bypass

In cases of high ambient temperatures or other reason it may sometimes be necessary to use a by-pass contactor to minimize the power loss at nominal speed (see Technical Data). By using the built-in Full Voltage Relay function an external contactor can be used to Bypass the soft starter when operating at nominal speed.

Bypass contactor can also be used if soft stop is required. Normally a Bypass contactor is not necessary as the device is designed for continues running conditions, see Fig. 29 on page 33 for wiring example.

NOTE! If one like to use the alarm functions, the extended functions or the viewing functions the 2-pcs current transformers must be mounted outside the soft start as shown in Fig. 44 and Fig. 45 on page 45. For this purpose an optional extension cable for the current transformers is available. Code No 01-2020-00.

032°

o

F

F

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.

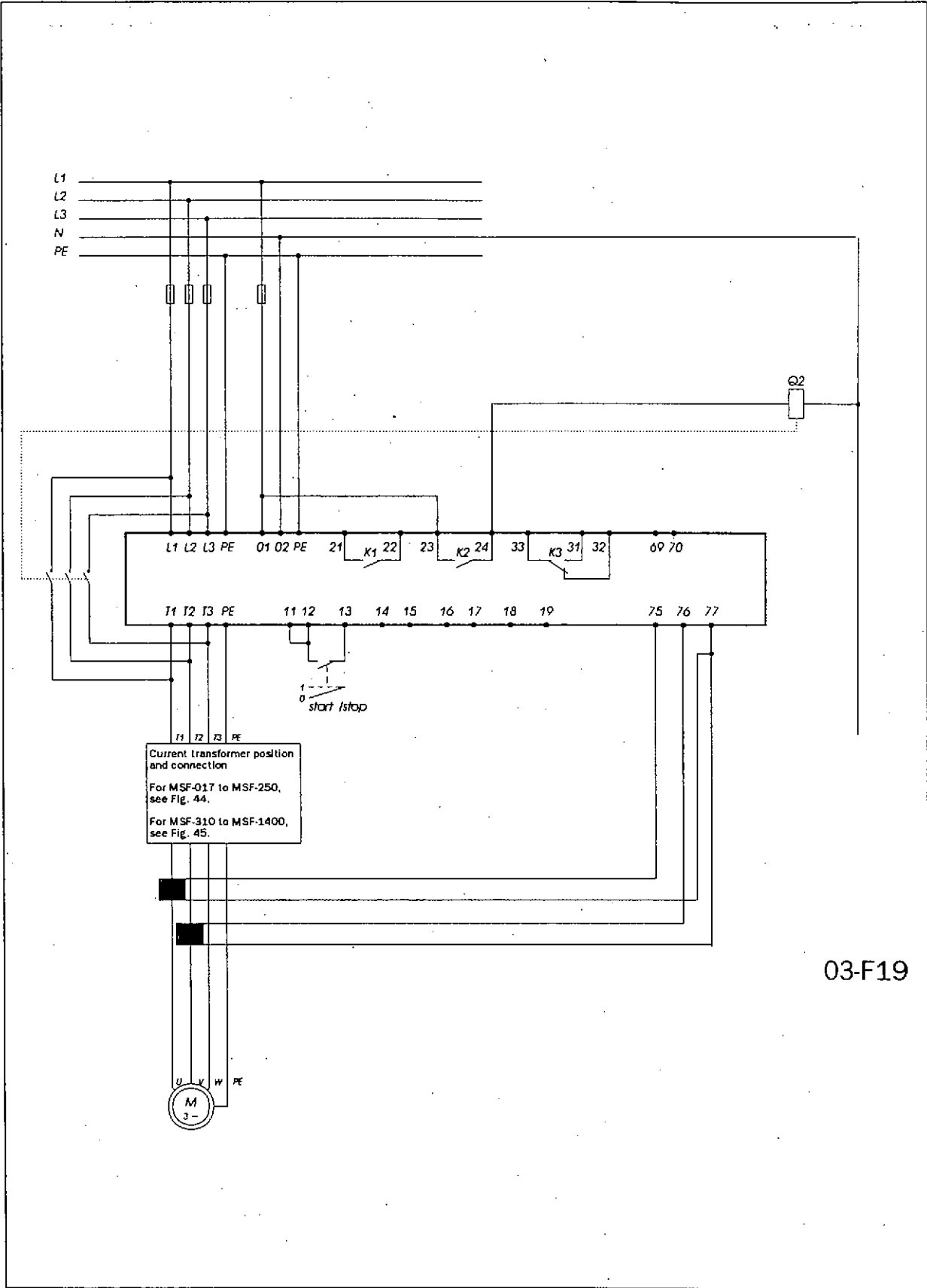


Fig. 43 Bypass wiring example MSF 310-1400.

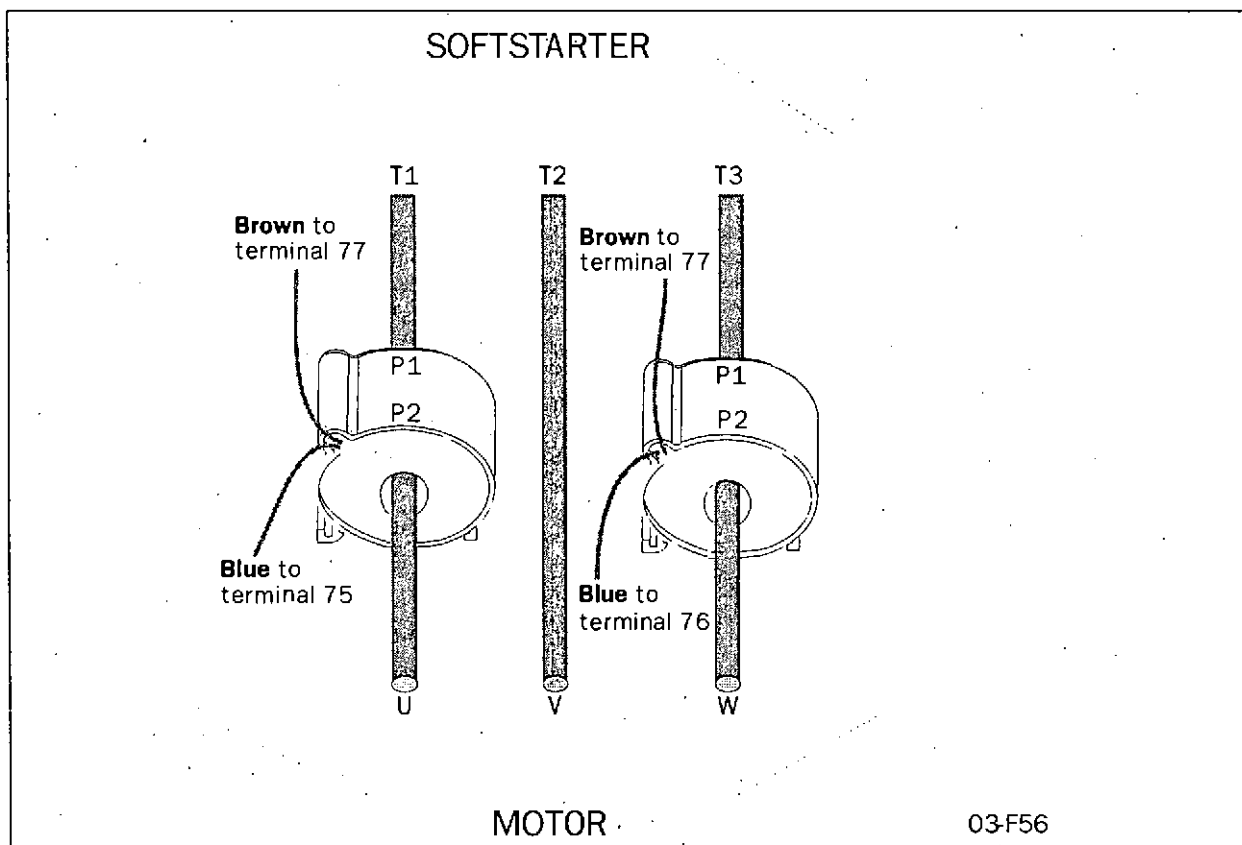


Fig. 44 Current transformer position when Bypass MSF-017 to MSF-250.

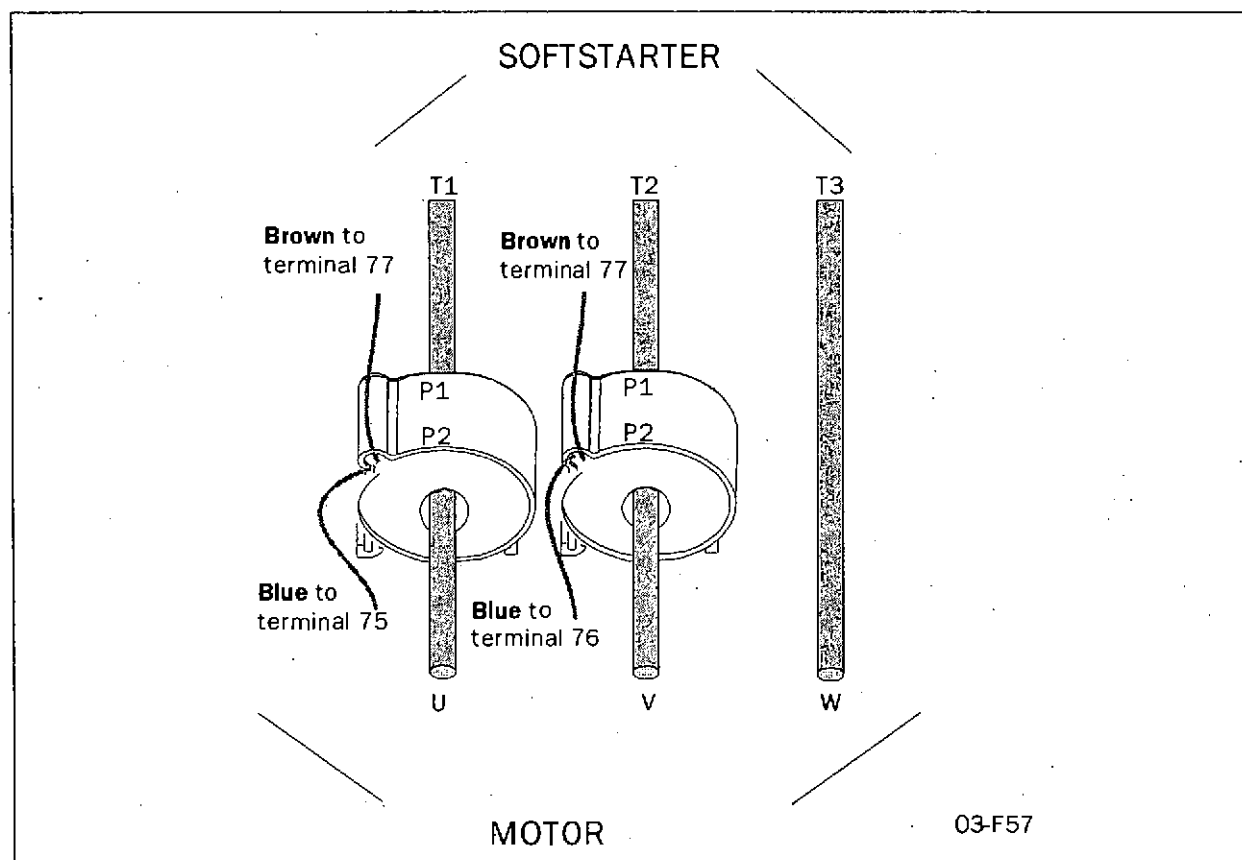


Fig. 45 Current transformer position when Bypass MSF-310 to MSF-1400.

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

OFF

Default:	oFF
Range:	oFF, on
oFF	PFC disabled
on	PFC enabled. The Full voltage relay function does not work.

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

7.14 Brake functions

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

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

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

Dynamic Vector Brake

- Possible to stop motors with high inertia loads from close to synchronous speed.
- At 30% 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

OFF

Default:	oFF
Range:	oFF, 1 - 120 sec
oFF	Brake function disabled
1-120	Brake time

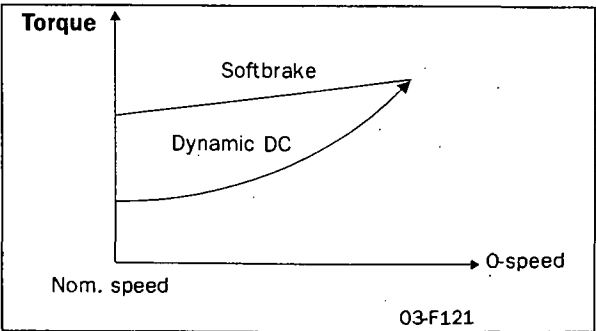


Fig. 46 Braking time

035

°

100

Braking Strength

Default:	100
Range:	100 - 500%

036

°

1

Brake method

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

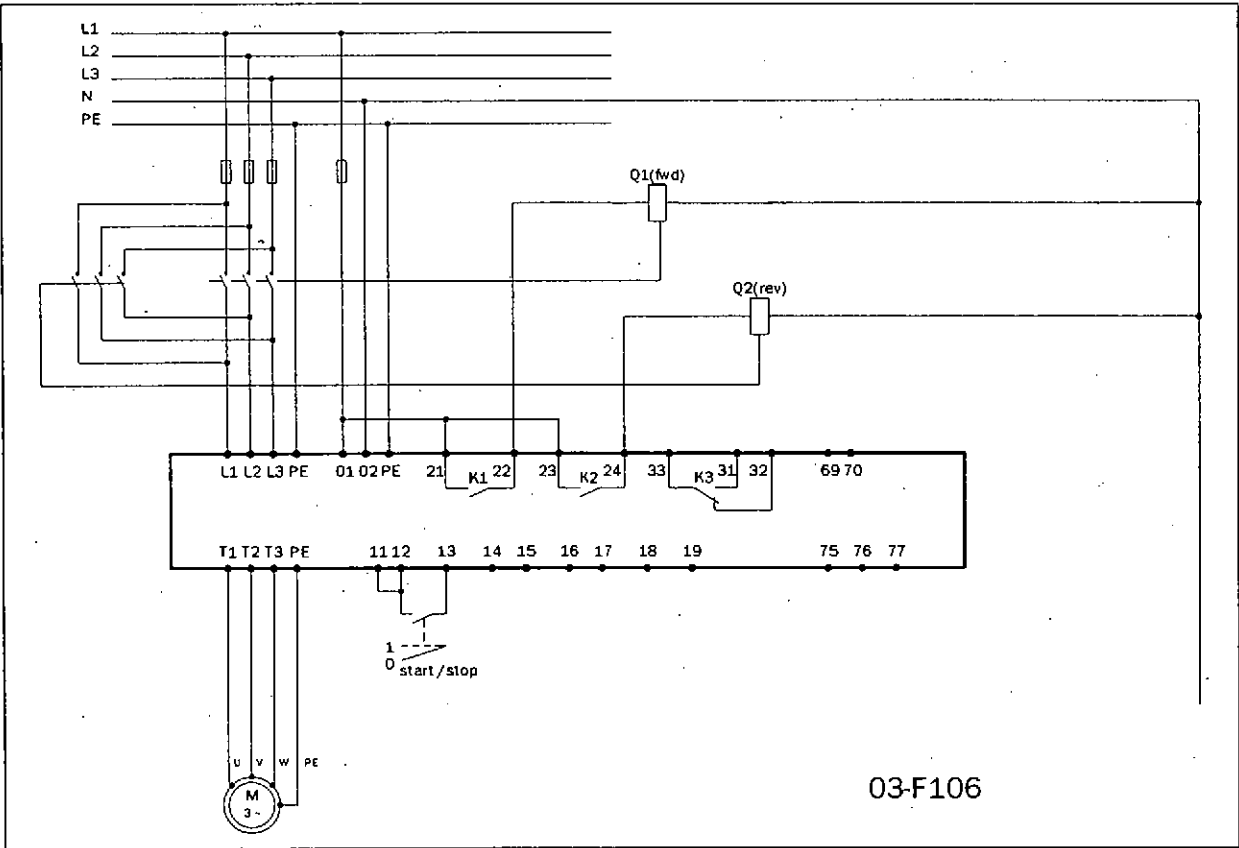


Fig. 47 Soft brake wiring example.

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.

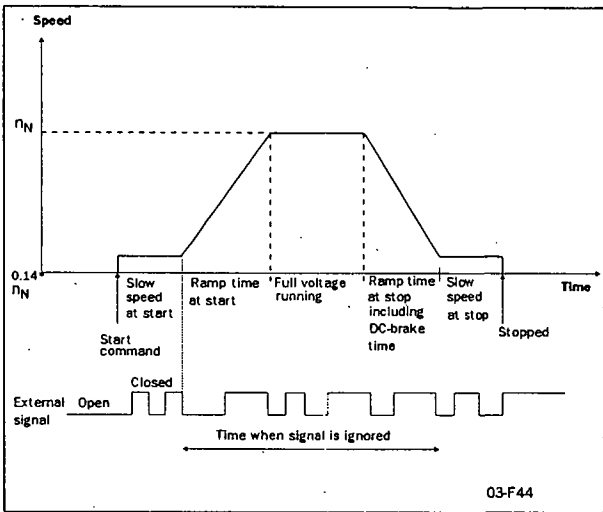


Fig. 48 Slow speed controlled by an external signal.

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

037°

10

Slow speed torque

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

7.15.2 Slow speed during a selected time

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

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

038 ^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.		

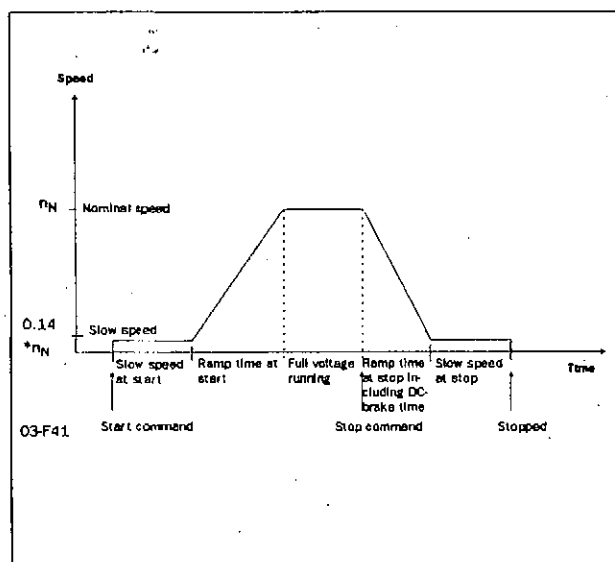


Fig. 49 Slow speed at start/stop during a selected time.

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.

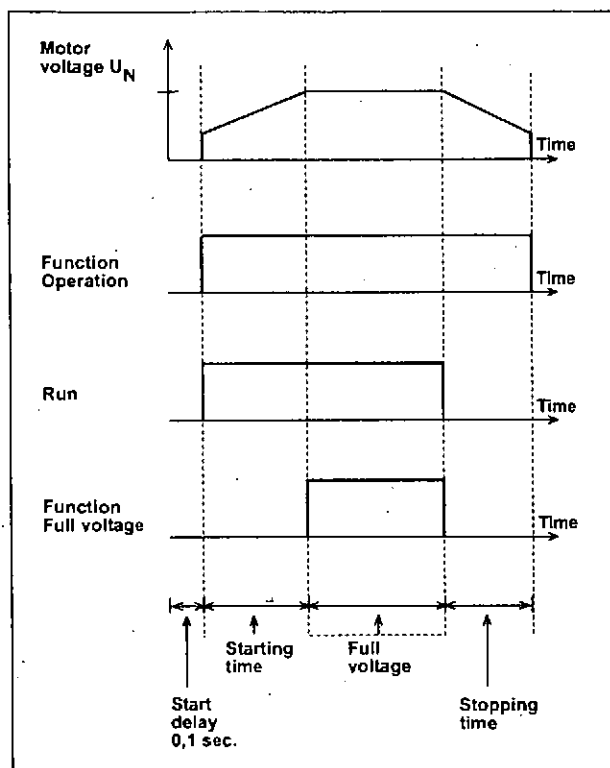


Fig. 50 Start/stop sequence and relay function "Operation" and "Full voltage".

052°			
Setting of K2 Indication			
<div> <div></div> <div></div> <div></div> <div>2</div> </div>			
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°			
Setting of K1 Indication			
<div> <div></div> <div></div> <div></div> <div>1</div> </div>			
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 (-).

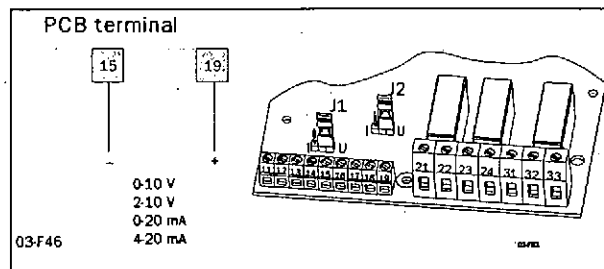


Fig. 51 Wiring for analogue output.

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.

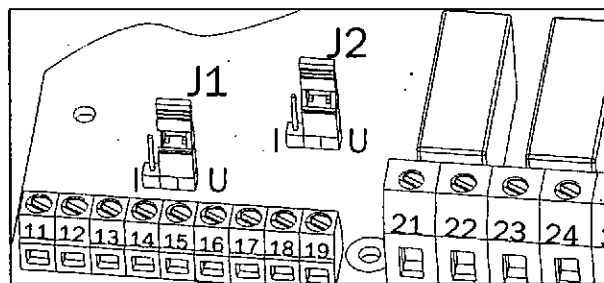


Fig. 52 Setting of current or voltage output.

3. Set the parameter in menu 054.

054°			
Analogue output			
o F F			
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			
1 0 0			
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.

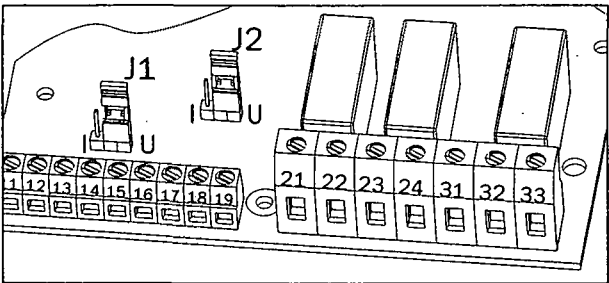


Fig. 53 Setting of J1 for current or voltage control.

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

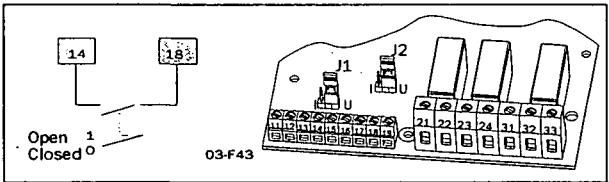


Fig. 54 Wiring for slow speed external input.

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.

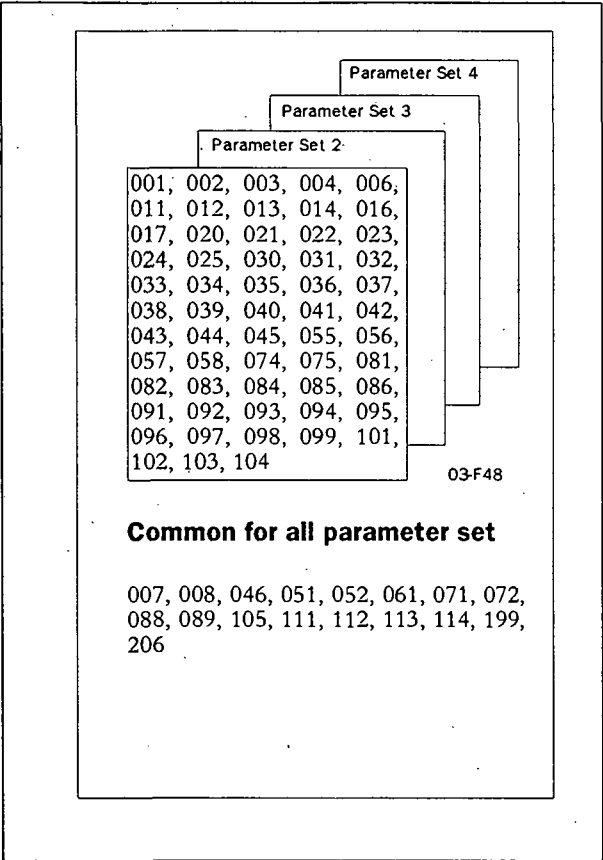


Fig. 55 Parameter overview

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.

061^o_o

1

Parameter set

Default:	1
Range:	0, 1, 2, 3, 4
0	Parameter set are selected by the external input 16 and 17 (see below).
1, 2, 3, 4	Selection of parameter set 1-4.

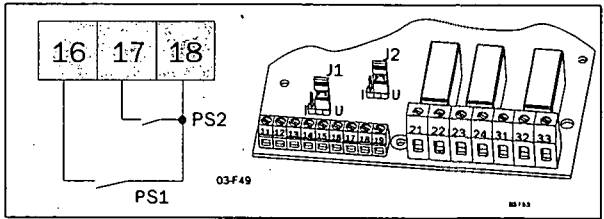


Fig. 56 Connection of external control inputs.

Parameter Set	PS1 (16-18)	PS2 (17-18)
1	Open	Open
2	Closed	Open
3	Open	Closed
4	Closed	Closed

7.21 Motor protection, overload (F2 alarm)

In many cases it is convenient to have a complete starter. The soft starter have a possibility to use either an input PTC signal from the motor, an internal thermal model of the motor for thermal protection or both together at the same time. Slight overload for long time and several overloads of short duration will be detected with both methods.

071 ^o	
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 reseted 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 ^o	
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.

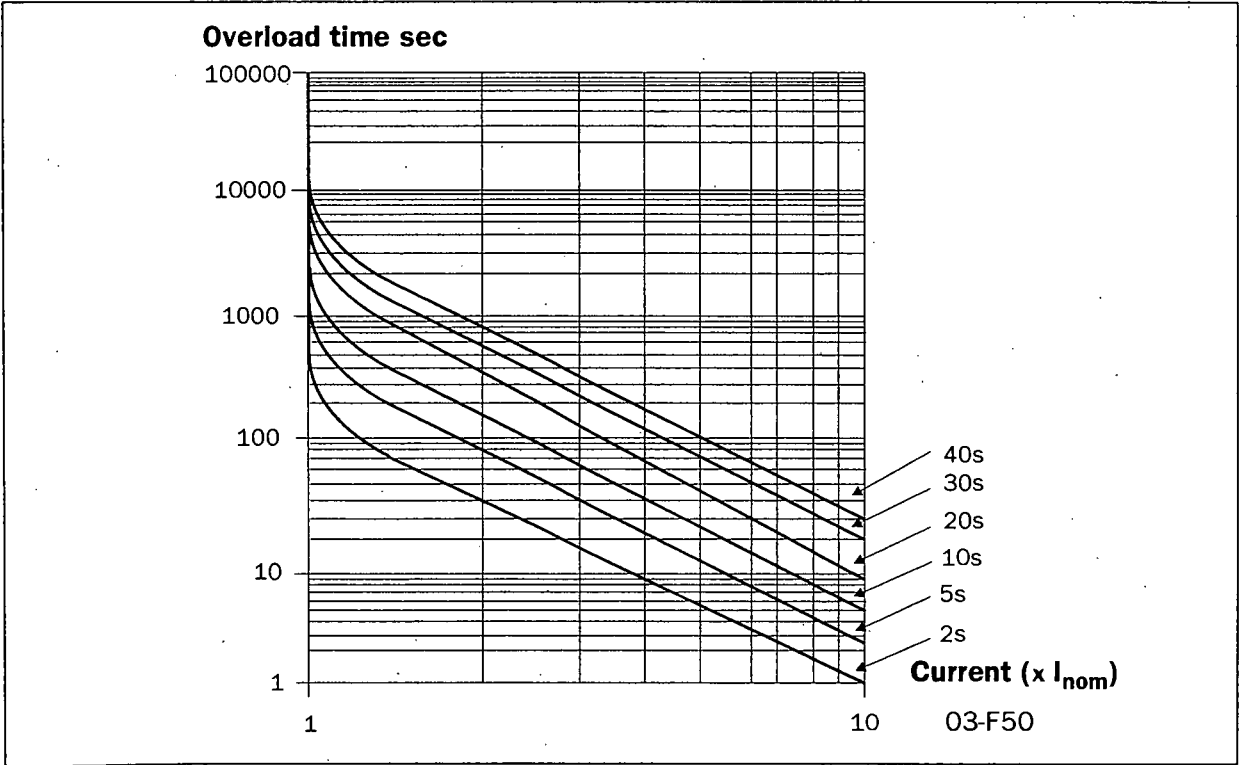


Fig. 57 The thermal curve

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.

085	
Under voltage alarm	
OFF	
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	
OFF	
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	
OFF	
Default:	oFF
Range:	oFF, on
oFF	Phase reversal alarm is disabled
on	Sets the phase reversal Alarm. - Switch on the power supply first. The phase sequence is stored as the correct sequence. - Sets the menu 088 to "on". - Any reversal of phase sequence will cause alarm F16.

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

7.23 Application protection (load monitor)

7.23.1 Load monitor max and min/protection (F6 and F7 alarms)

MSF has a built in load monitor based on the output shaftpower. This is a unique and important function which enables protection of machines and processes driven by the motor connected to the soft starter. Both a Min and Max limit is possible to select.

In combination with the pre-alarm function, see § 7.23.2, page 58, this create a powerful protection. An auto set function is also included for an automatic setting of the alarm limits. A start-up delay time can be selected to avoid undesired alarms at start-up, see Fig. 58 on page 60.

NOTE! The load monitor alarms are all disabled during a stop ramp.

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

090	
Output shaftpower in %	
0	
Default:	-
Range:	0-200%
Measured output shaftpower in % of nominal motor power.	

NOTE! System must be in full voltage running before an auto set is permitted.

The actual power is regarded as 1.00xPact.

The set levels are:

Power max alarm limit[092]:	1.15xP actual
Power max pre-alarm limit[094]:	1.10xP actual
Power min pre-alarm limit[096]:	0.90xP actual
Power min alarm limit[098]:	0.85xP actual

A successful auto set shows a message 'Set' for 3 s and if something goes wrong a message 'no' will be showed.

091°	
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°	
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°	
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°	
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°	
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.

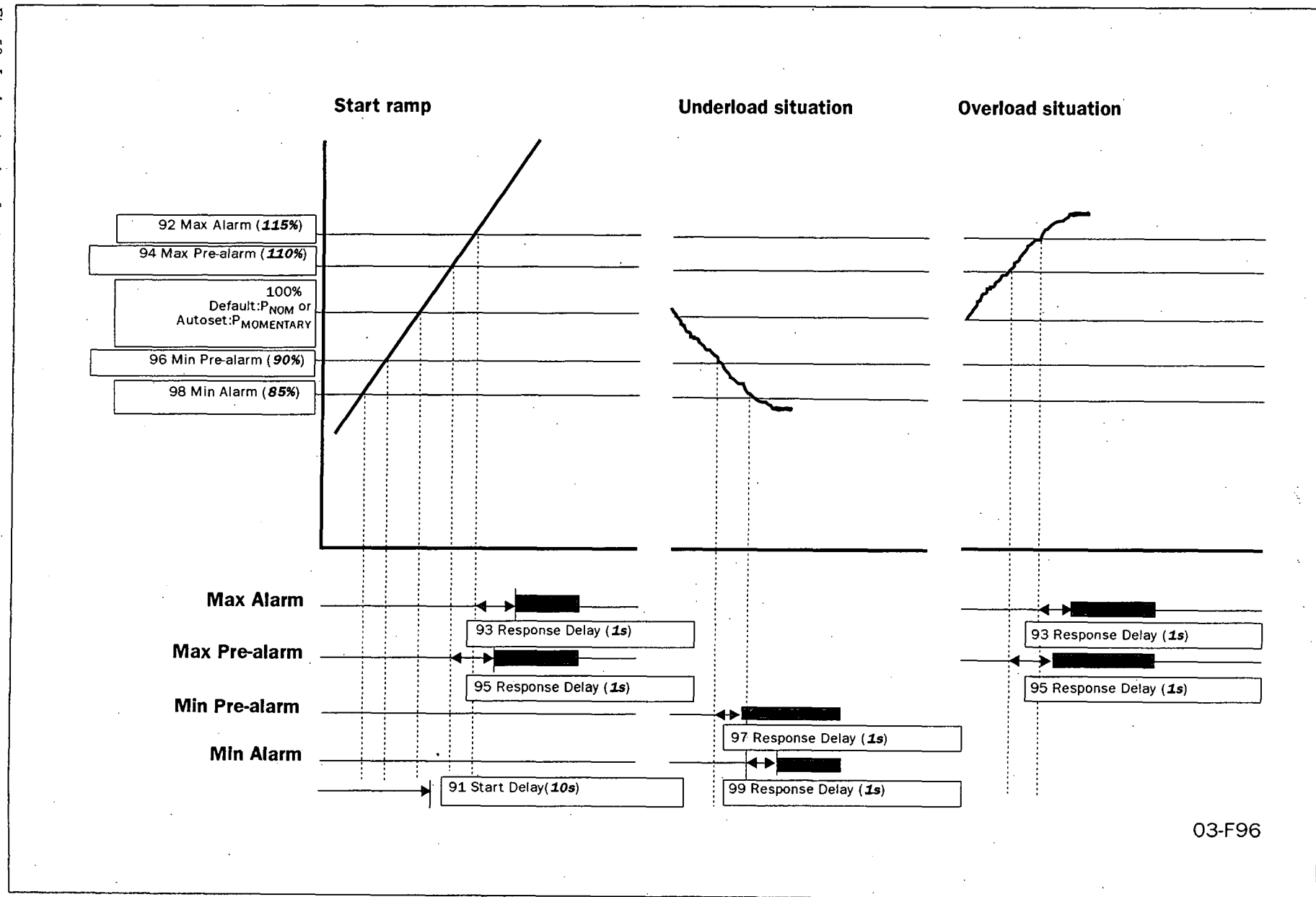
096°					
Min power pre-alarm limit					
<table border="1"> <tr> <td></td> <td></td> <td>9</td> <td>0</td> </tr> </table>				9	0
		9	0		
Default:	90%				
Range:	5 -200% Pn				
<p>Insert limit in % of nominal motor power. The actual power in % of nominal motor power, could be read out in menu 090. If 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		
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		

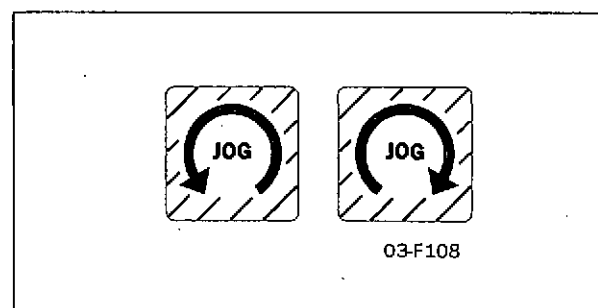


Fig. 59 The 2 Jog keys.

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

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

7.29 View operation

General

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

Measured values

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

Viewing of the measured values

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

201 ^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 menu 005 see § 7.1.1, page 36.

202 ^o	
RMS main voltage	
0.0	
Default:	-
Range:	0-720V
The RMS input main voltage.	

203 ^o	
Output motor shaftpower	
0.0	
Default:	-
Range:	-9999 -+9999kW
Viewing will show negative value if generator mode.	

204 ^o	
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 ^o	
Total power consumption	
0.0000	
Default:	-
Range:	0.000 -2000MWh
View the total power consumption.	

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

207 ^o	
Motor shaft torque	
0.0	
Default:	-
Range:	-9999 - + 9999Nm
Viewing will show negative value if generator mode.	

208 ^o	
Operation time	
0.0	
Default:	-
Range:	Hours
Operation time is calculated when the soft starter is in RUN mode. After 9999 hours the display will show two values.	
Example: 12467 hours shows 1 1 sec	
2467 5sec	

211 ^o	
RMS current in phase L1	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L1.	

212 ^o	
RMS current in phase L2	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L2.	

213 ^o	
RMS current in phase L3	
0.0	
Default:	-
Range:	0.0 - 9999Amp
View the current in phase L3.	

214 ^o	
Main voltage L1-L2	
0	
Default:	-
Range:	0-720V
View main voltage L1-L2.	

215 ^o	
Main voltage L1-L3	
0	
Default:	-
Range:	0 - 720V
View main voltage L1-L3.	

216 ^o	
Main voltage L2-L3	
0	
Default:	-
Range:	0 - 720V
View main voltage L2-L3.	

7.30 Keyboard lock

The keyboard can be locked to prohibit operation and parameter setting by an unauthorised. Lock keyboard by pressing both keys "NEXT →" and "ENTER ←" for at least 2 sec. The message '- Loc' will display when locked. To unlock keyboard press the same 2 keys "NEXT →" and "ENTER ←" for at least 2 sec. The message 'unlo' will display when unlocked.

In locked mode it is possible to view all parameters and read-out, but it is forbidden to set parameters and to operate the soft starter from the keyboard.

The message '-Loc' will display if trying to set a parameter or operate the soft starter in locked mode.

The key lock status can be read out in menu 221.

221 ^o	
Locked keyboard info	
<div> <div></div> <div></div> <div>n</div> <div>o</div> </div>	
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	
<div> <div></div> <div></div> <div>F</div> <div>1</div> </div>	
Default:	-
Range:	F1-F16
View actual alarm	

8. PROTECTION AND ALARM

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

Three categories of alarm are available:

Category 1

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

Category 2

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

Category 3

Alarm that continues to run the motor.

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

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

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

8.1 Alarm description

8.1.1 Alarm with stop and requiring a separate reset

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

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

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

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

8.1.2 Alarm with stop and requiring only a new start command

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

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

8.1.3 Alarm with continue run

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

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

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

8.2 Alarm overview

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

9. TROUBLE SHOOTING

9.1 Fault, cause and solution

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

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

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

10. MAINTENANCE

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



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

Regular maintenance

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

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

11. OPTIONS

The following option are available. Please contact your supplier for more detailed information.

11.1 Serial communication

For serial communication the MODBUS RTU (RS232/RS485) option card is available order number: 01-1733-00.

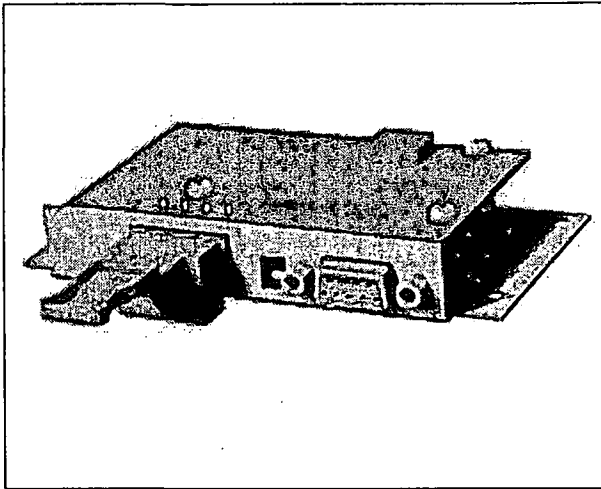


Fig. 60 Option RS232/485

11.2 Field bus systems

Various option cards are available for the following bus systems:

- PROFIBUS DP order number: 01-1734-01
- Device NET, order number: 01-1736-01
- LONWORKS: 01-1737-01
- FIP IO: 01-1738-01
- INTERBUS-S: 01-1735-01

Each system has his own card. The option is delivered with an instruction manual containing the all details for the set-up of the card and the protocol for programming.

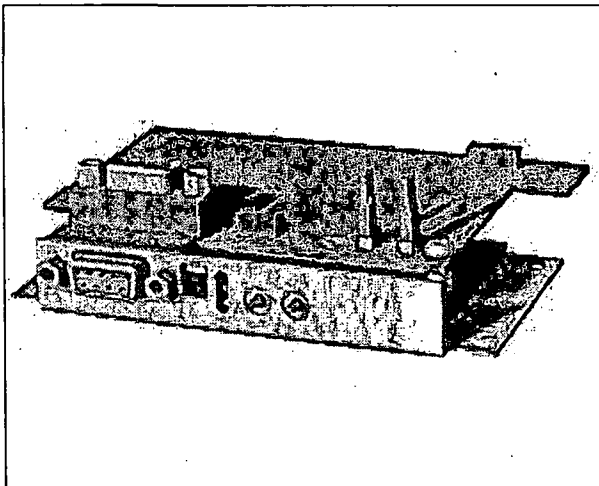


Fig. 61 Option Profibus

11.3 External PPU.

The external PPU option is used to move the PPU (keyboard) from the soft starter to the front of a panel door or control cabinet.

The maximum distance between the soft starter and the external PPU is 3 m.

The option can be factory mounted (01-2138-01) or it can be built in later (01-2138-00). For both versions instruction /data sheet are available.

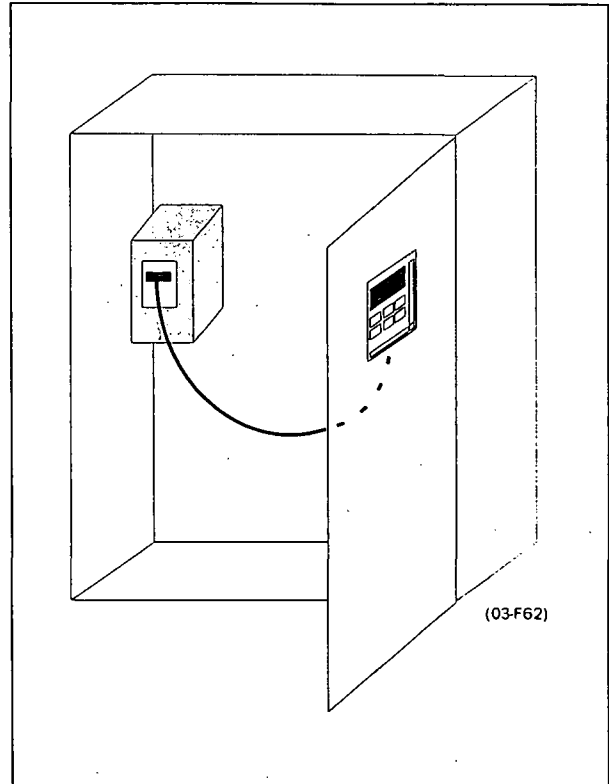


Fig. 62 Shows an example of the External PPU after it has been built in.

11.3.1 Cable kit for external current transformers

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

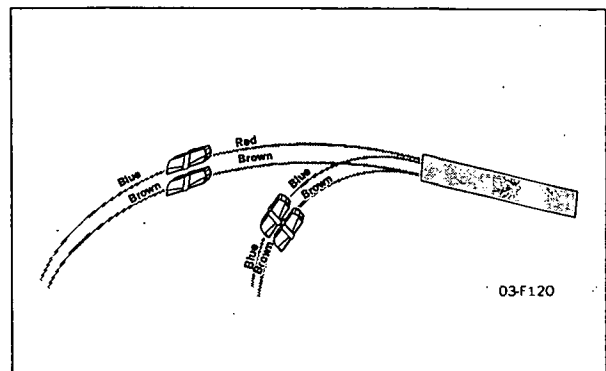


Fig. 63 Cable kit

11.4 Terminal clamp

Data: Single cables, Cu or Al	
Cables	95-300 mm ²
MSF type Cu Cable	310
Bolt for connection to busbar	M10
Dimensions in mm	33x84x47 mm
Order No. single	9350
Data: Parallel cables, Cu or Al	
Cables	2x95-300 mm ²
MSF type and Cu Cable	310 to -835
Bolt for connection to busbar	M10
Dimensions in mm	35x87x65
Order No. parallel	9351

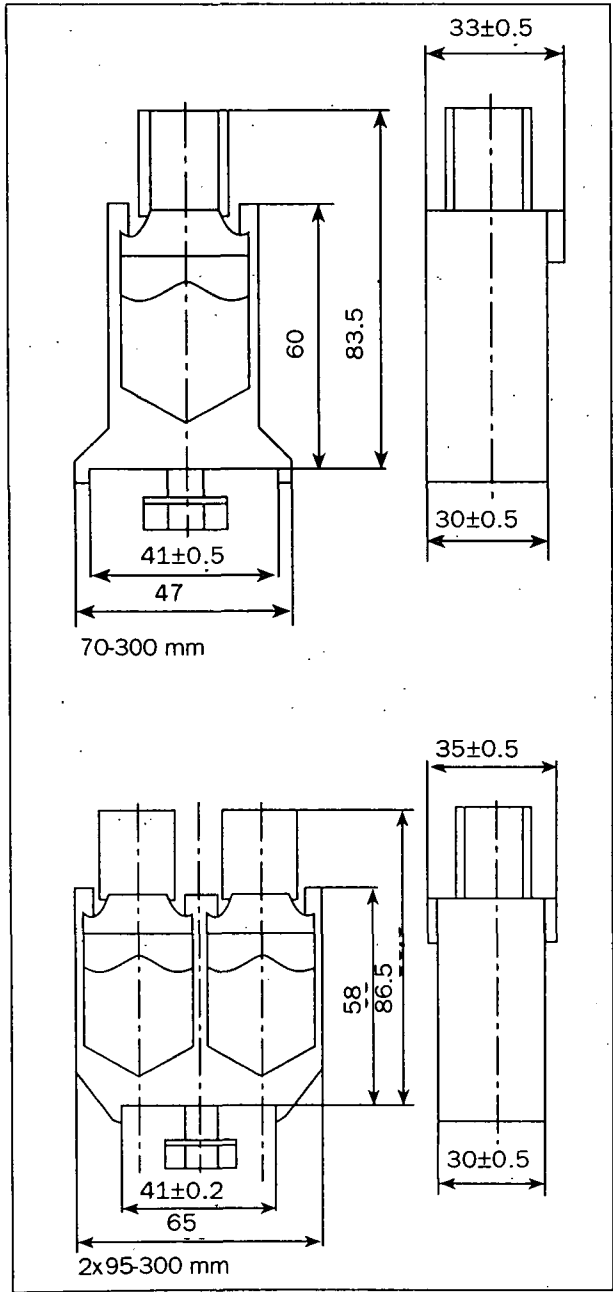


Fig. 64 The terminal clamp.

12. TECHNICAL DATA

3x200–525 V 50/60 Hz Model	MSF-017		MSF-030		MSF-045		MSF-060	
Soft starter rating according to AC35a, see chapter 4, page 13	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light	5.0-30:50-10 heavy	3.0-30:50-10 normal/light
Rated current of soft starter (A)	17	22	30	37	45	60	60	72
Recommended motor size (kW) for 400 V	7.5	11	15	18.5	22	30	30	37
Recommended motor size (kW) for 525 V	11	15	18.5	22	30	37	37	45
Order number: supply voltage (100-240V)	01-1301-01		01-1302-01		01-1303-01		01-1304-01	
Order number: supply voltage (380-500V)	01-1301-02		01-1302-02		01-1303-02		01-1304-02	
3x200-690V 50/60Hz Model	MSF-017		MSF-030		MSF-045		MSF-060	
Rated current of soft starter (A)	17	22	30	37	45	60	60	72
Motor power for 690V	15	18.5	22	30	37	55	55	75*
Order number: supply voltage (100-240V)	01-1321-01		01-1322-01		01-1323-01		01-1324-01	
Order number: supply voltage (380-500V)	01-1321-02		01-1322-02		01-1323-02		01-1324-02	
Electrical Data								
Recommended wiring fuse (A) 1)	25/50	32	35/80	50	50/125	80	63/160	100
Semi-conductor fuses, if required	80 A		125 A		160 A		200 A	
Power loss at rated motor load (W)	50	70	90	120	140	180	180	215
Power consumption control card	20 VA		20 VA		25 VA		25 VA	
Mechanical Data								
Dimensions in mm HxWxD	326x126x260		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	560x260x260		560x260x260		560x260x260		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^2t (fuse) x 1000
MSF-017	80	2.4
MSF-030	125	7.3
MSF-045	150	11.7
MSF-060	200	22
MSF-075	250	42.5
MSF-085	300	71.2
MSF-110	350	95.6
MSF-145	450	137
MSF-170B	700	300
MSF-210B	700	300
MSF-250B	800	450
MSF-310	800	450
MSF-370	1000	600
MSF-450	1200	2100
MSF-570	1400	2700
MSF-710	1800	5300
MSF-835	2000	
MSF-1000	2500	
MSF-1400	3500	

13. SET-UP MENU LIST

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

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

Explanation of units:

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

Calculation shaft torque

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

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

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MAXIMIZING UPTIME



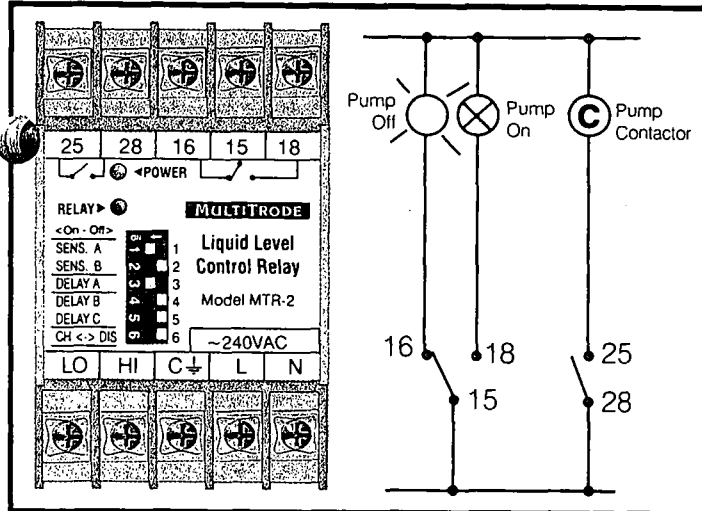
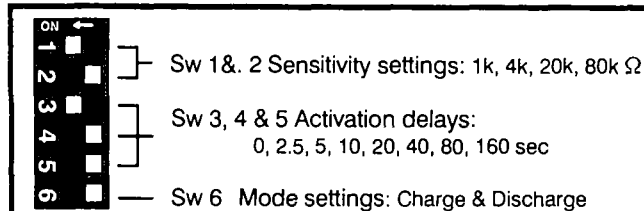
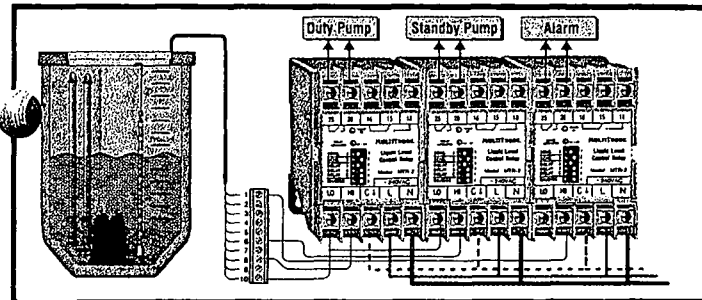
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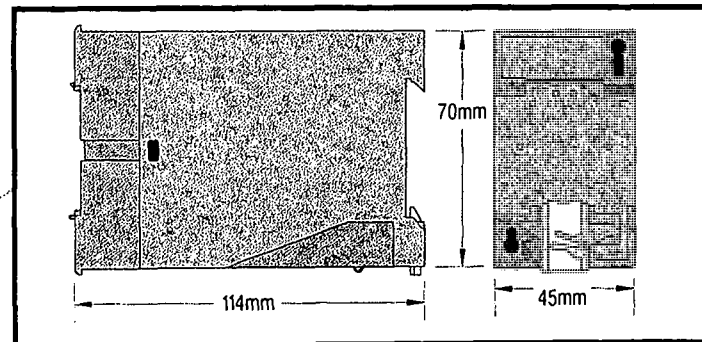
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Made in China
Distributed by ACCO Australia



9 312311 370002

MTR. I/O Terminal Listing**Dip Switch Settings****Multiple MTR Application**

Note: Several relays can be connected to a single probe

Dimensions**Approvals**

UL listed 2P27



Approved for I.S. applications
when installed in conjunction
with a MultiTrode MTISB
Intrinsically Safe Barrier

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MTR Specifications**Mode of operation**

Charge or Discharge (Filling or Emptying)

Probe Inputs

Sensor inputs	2
Sensor voltage	12VAC Nominal
Sensor current	0.8mA max. (per sensor)
Sensitivity	1k, 4k, 20k, 80k Ω

Other Inputs

None

Relay Outputs

No of relay outputs	2 sets : 1 N/O & 1 C/O
Output delay	0, 2.5, 5, 10, 20, 40, 80, 160 sec
Relay contact rating	250 VAC 5A Resistive, 2A Inductive
Relay contact life	10 ⁵ Operations
Terminal size	2 x 2.5mm ² , #13

Other outputs

None

Display

LEDs	Green : Power On, Red : Pump activation
------	--

Communications

None

Physical Product

Dimensions mm	72H x 45W x 114D
Mounting	DIN Rail or 2 x M4 Screws #6
Enclosure	Makrolon (self extinguishing)

Power Supply

Supply Voltage AC	24, 110, 220-240, 415VAC Nominal 50/60Hz
Power Consumption	3.4VA max
Supply Voltage DC	10 to 30VDC, 3 Watts max

Working Temperature Range

- 10⁰ to + 60⁰ C
+ 14⁰ to + 140⁰ F

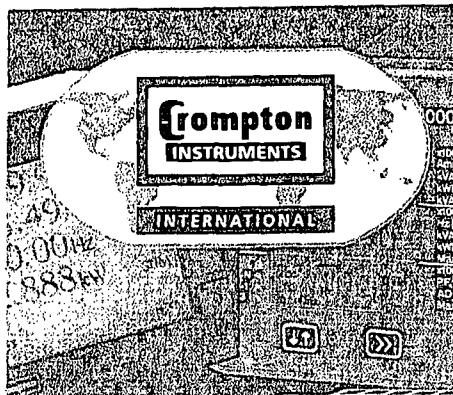
Ordering Information**AVAILABLE MODELS**

MTR - 1	415VAC
MTR - 2	240VAC
MTR - 3	110VAC
MTR - 4	24VAC
MTR - 7	10-30VDC

Ordering Example

e.g. **MTR** - **2** Model Voltage
This order code is for a 240VAC MTR relay

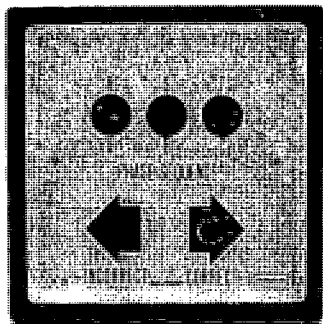
All MultiTrode Products carry a full two year warranty



Application:

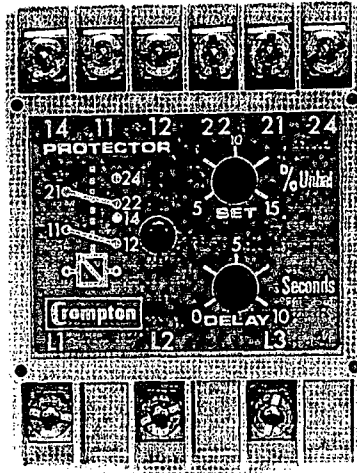
- » Motor protection
- » Motors - Single Phasing
- » Gensets - correct engine rotation
- » All portable equipment
- » All rotating machines

We also manufacture front of panel mounting phase sequence indicators



Protector Trip Relays

250 Series DIN Rail and Wall Mounted - Phase Balance



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

- Phase Loss, Reversal or Sequence
- Phase Unbalance
- System Under Voltage

Introduction

This Crompton Protector is designed to comprehensively monitor the three phase supply. It monitors the correct phase rotation or sequence of three phase supply systems. Rotating machines are particularly vulnerable to incorrect phase sequence. Three phase motors can rotate in the wrong direction, potentially leading to physical damage or the risk of injury to personnel, yet voltage and current readings may appear normal. If one phase is lost because of a blown fuse, electric motors can continue to operate (single phasing) which can result in severe electrical or mechanical damage.

This relay has the added advantage that it will detect the phantom or regenerated phase that can be caused by a single phase failure on some equipment or when running motors at low load levels.

An unbalanced supply voltage can lead to temperature rises in motors. An unbalance voltage as little as 10% can increase operating temperature to 150% of normal.

For permanent installations, this relay should be used to monitor the incoming supply, protecting all equipment against incorrect connection at initial installation or after maintenance work. Rotating machines that cannot tolerate reverse rotation or pose significant risk to personnel under this condition should be individually protected with this relay. The possibility of incorrect supply connection is much more likely in portable equipment or marine applications.

Product Function

The protector continuously monitors the three phase supply. With the correct phase sequence applied and all three voltages are balanced within the required limits, the front panel LED will illuminate and the output relay will be energized. An incorrect sequence, missing phase, out of balance or under voltage condition will de-energize the relay, and the LED will be extinguished.

The setpoint control allows adjustment of the voltage matching between 5% and 15%.

The time delay function operates only for the voltage unbalance condition. The delay can be used to prevent nuisance tripping due to short term unbalance situations. Incorrect phase rotation, a missing phase or an under voltage condition trip the relay immediately.

Protection against:

- Incorrect phase sequence
- Loss of one phase
- Under voltage
- Unbalanced voltage
- A phantom or regenerated phase voltage

Protector Trip Relays

250 Series DIN Rail and Wall Mounted - Phase Balance

Specification

Approvals:	U.L. recognised CSA approved up to 480V.	Set Points:	
		Unbalance:	Adjustable 5% to 15%
System:	3 phase, 3 or 4 wire Frequency: 50 or 60Hz	Time Delay:	Up to 10 seconds adjustable
Nominal Voltage:	100, 110, 120, 208, 277, 220, 230, 240, 380, 400, 415, 440 & 480V	Under Voltage (Type 252-PSG only):	Internally preset at 15% of nominal voltage (other values between 10% and 30% available on request) (not operative if voltage falls below 70% of the nominal voltage or set point on type 252-PSG)
Burden:	3VA approx.		
Voltage Withstand:	1.2 x continuously 1.5 x for 10 x 10 seconds		

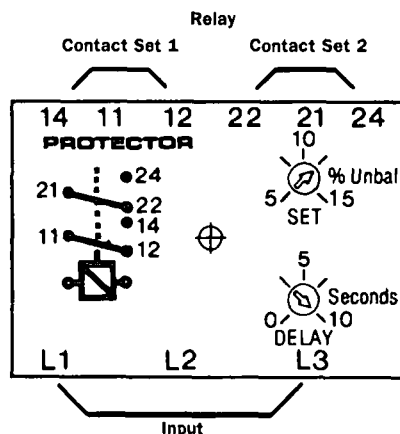
Product Code Examples

Relay	Input	Protection	ANSI No.	Catalogue No.
3 Phase 3 or 4 Wire	120V L-L 60Hz	Phase loss & unbalance	47	252-PSFU-PQBX-C6
	480V L-L 60Hz	Phase loss & unbalance	47	252-PSFU-SEBX-C6
	120V L-L 60Hz	Phase loss, unbalance, under voltage	47/27	252-PSGU-PQBX-C6-T1-IA
	480V L-L 60Hz	Phase loss, unbalance, under voltage	47/27	252-PSGU-SEBX-C6-T1-IA

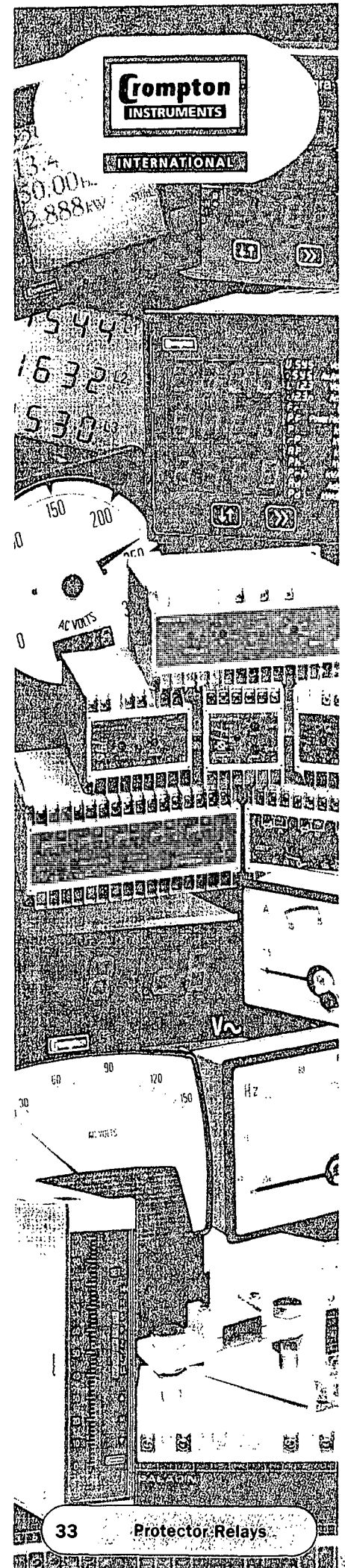
Connection Diagrams

252-PSF

252-PSG

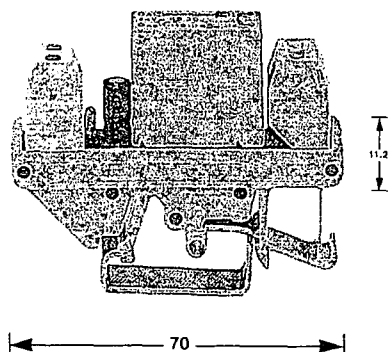


Note: No neutral connection is required



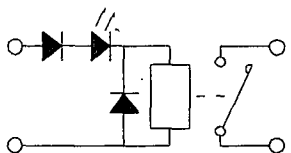
RS30

Slim single relay modules, 1N/O or 1N/C contact

**Specifications**

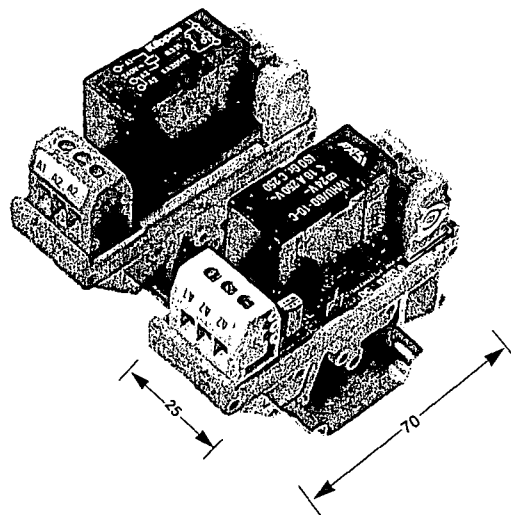
Input:		see ordering data
Output:	Max. voltage	250VAC
	Max. current	see ordering data
	Max. power	ac. load 2000VA
		dc. load 100W
Isolation:	Input to output	4kV ac eff.
Terminals:	Type	GSE5
	Conductor size; solid	0.5-4.0mm ²
	flexible	0.5-2.5mm ²

Ordering Data

	Input Voltage	Switching Current (max)	Cat No.
	12Vdc	5A	11294.2
	24Vdc	5A	11016.2
	48Vdc	5A	11018.2
	110Vdc	5A	11551.2
	12Vdc	5A	11295.2
	24Vdc	5A	11009.2
	48Vdc	5A	11011.2
	110Vdc	5A	11552.2
	110Vac	5A	11021.2
	240Vac	3A	EA20140
	110Vac	5A	11014.2
	240Vac	3A	EA20141

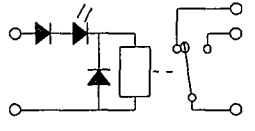
RS31

Compact high power single C/O relay modules

**Specifications**

Input:		see ordering data
Output:	Max. voltage	250V
	Max. current	16A
	Max. power (res load)	ac 3500VA
		dc 480W
	Min. switch current/power	1W/100mA
Isolation:	Input to output	4kV ac eff.
Terminals:	Type	GSE5
	Conductor size;	solid 0.5-4.0mm ²
	flexible	0.5-2.5mm ²
	Insulation stripping length	7mm

Ordering Data

	Input Voltage	Input power	Cat No.
	24Vdc	1W	11283.6
	48Vdc	1W	11507.6
	110Vdc	1W	11503.6
	110Vac	1.2VA	11504.6
	240Vac	1.4VA	EA20142



Applications

- Current measuring applications to 0.5% accuracy

Features

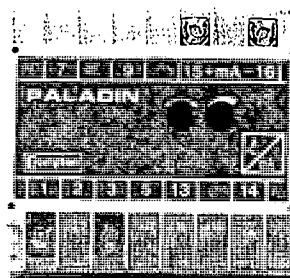
- Average sensing and calibrated to indicate the RMS value of a sine wave with less than 1% distortion

Benefits

- Internal power is derived from the input signal
- Input and output are isolated

Class 0.5 Paladin Transducers

A.C. Current Average Sensing - Self Powered



Specification

Inputs:	1, 5 or 10A A.C. 50 or 60 Hz	Auxiliary Power:	Self Powered
Output:		Output:	0/1, 0/5, 0/10 and 0/20mA

Single Phase Current Transducer - 1 D.C. Output.

Input A.C.	Aux Power	O/P D.C.	Catalogue No.	Connection Diag.
5A 60Hz	Self	0/1mA	253-TAA*-LSFA-C6	1

Applications

- Current measuring down to zero input

Features

- Model TAL provides a current output with a live zero (4-20mA)
- Single or three phase models

Benefits

- Average sensing and calibrated to indicate the RMS value of a sine wave with up to 1% distortion
- Isolation is provided between input, output and auxiliary

A.C. Current Average Sensing - Auxiliary Powered



Specification

Inputs:	1, 5 or 10A A.C. 50 or 60 Hz	Auxiliary Power:	
Output:	0/1, 0/5, 0/10, 0/20, 4/20mA	A.C.:	63.5, 100, 110, 120, 220, 240, 250, 380, 400, 415, 440 and 480V A.C.
		D.C.:	12, 24, 48, 110, 120 or 135V D.C. nominal

Single Phase Current Transducer - 1 D.C. Output.

Input A.C.	A.C. Aux Power	O/P D.C.	Catalogue No.	Connection Diag.
5A 60Hz	120V	4/20mA	253-TAL*-LSHG-C6-DG	6

3 Phase Current Transducers - 3 D.C. Outputs.

Input A.C.	A.C. Aux Power	O/P D.C.	Catalogue No.	Connection Diag.
5A 60 Hz	120V	0/1mA	256-TAS*-LSFA-C6-DG	2
5A 60 Hz	120V	4/20mA	256-TAL*-LSHG-C6-DG	2

With multiple analogue outputs, do not common the -ve terminals.

Class 0.5 Paladin Transducers

Power Transducers

Crompton
INSTRUMENTS

INTERNATIONAL

Applications

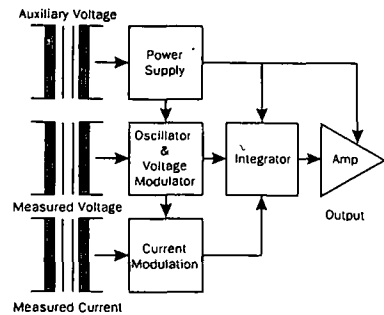
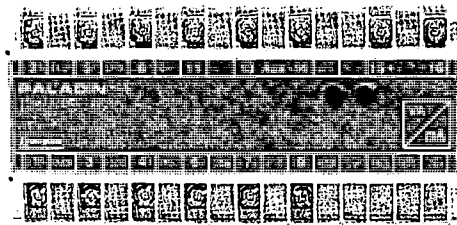
- » A wide range of transducers to measure all forms of power

Features

- » In single or 3 phase balanced or unbalanced, 3 or 4 wire systems
- » For large voltage variations use the auxiliary powered versions

Benefits

- » Self powered units permit voltage variations up to +20% of the nominal input
- » Measures both Import and export power



Principle Of Operation

These Transducers utilise the well proven 'time division multiplication' method of measuring instantaneous power over a wide range of input waveforms. In the self powered version the system voltage provides both power supply and an input to the voltage modulation circuit of an oscillator. Square wave pulses from a multi-vibrator circuit with a

mark-space ratio varied by the measured voltage, and amplitude varied by the measured current, are fed to an integrator and an output amplifier circuit. The D.C. milliamp signal produced is therefore directly proportional to the power input.

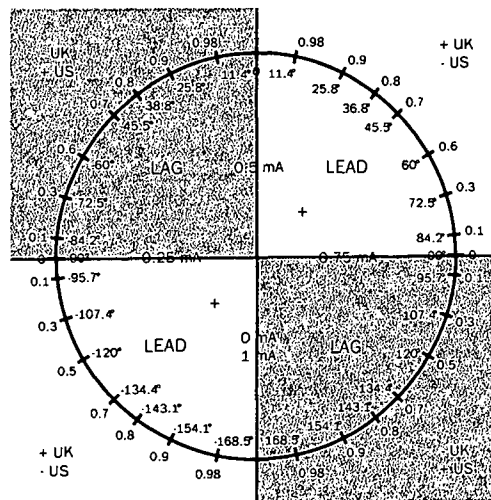
All inputs are isolated by the use of transformers.

Specification

Input Voltage:	63.5, 110, 120, 150, 208, 220, 240, 277, 380, 415, 480V	Auxiliary Power:	Self Powered
Current:	1, 5, 10A	A.C.:	63.5, 110, 120, 150, 208, 220, 240, 277, 380, 415, 480V
Frequency:	50 or 60 or 400Hz	D.C.:	12, 24, 48, 120, 135V
Outputs:	0-1/5/10/20mA		

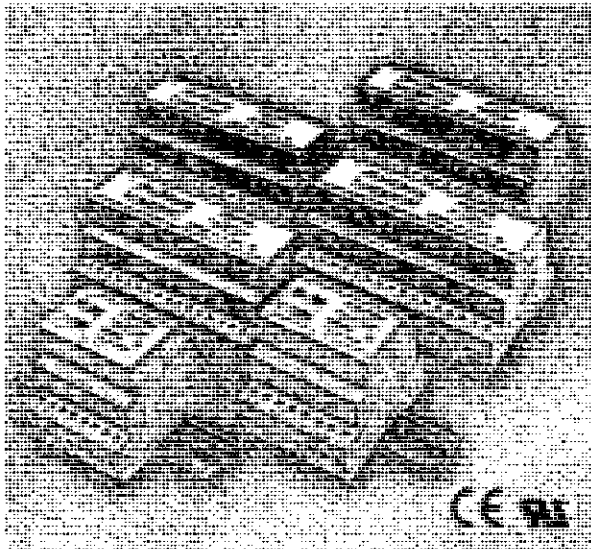
Watt Transducer	Catalogue No.	Connection Diag.	Var Transducer	Catalogue No.	Connection Diag.
Single Phase	256-TWK	14	Single Phase	256-TXK	14
3 Phase 3 Wire Balanced Load	256-TWL	19	3 Phase 3 Wire Balanced Load	256-TXG	34
3 Phase 4 Wire Balanced Load	256-TWH	24	3 Phase 4 Wire Balanced Load	256-TXH	42
3 Phase 3 Wire Unbalanced Load	256-TWM	20	3 Phase 3 Wire Unbalanced Load	256-TXM	20
3 Phase 4 Wire Unbalanced Load	256-TWN	35	3 Phase 4 Wire Unbalanced Load	256-TXN	40
3 Phase 3 Wire Balanced Load (2 Voltage connections)	256-TWS	38			
			VA Transducer		
			Single Phase	256-TYK	14
			3 Phase 3 Wire Balanced Load	256-TYG	41
			3 Phase 4 Wire Balanced Load	256-TYH	42
			3 Phase 3 Wire Unbalanced Load	256-TYM	20
			3 Phase 4 Wire Unbalanced Load	256-TYN	35

Conversion to P.F.



The transducer output, if displayed on an analogue meter, produces an inconvenient non-linear scale. Computer users may find the need for a linearising program. Other transducers are available from Crompton Instruments with a linearised output if required.

Transient Discriminating™ Filter



FEATURES

- Transient Discriminating™ Technology ensures safe operation during abnormal over-voltage events
- Remote protection status monitoring and LED indication
- Compact design fits into most switch and distribution boards
- Models available for all power distribution system types
- High surge rating 50kA ensures long service life
- Optional Alarm Relay and Surge Counter can be retrofitted
- Easy installation - simply clips onto 35mm DIN rail
- UL1449 Edition 2, UL1283 recognised CSA 22.2, C-Tick
- Surge rated to meet ANSI / IEEE C62.41 Cat A, Cat B, Cat C, AS / NZS 1768-1991 Cat A, B, C

TDF

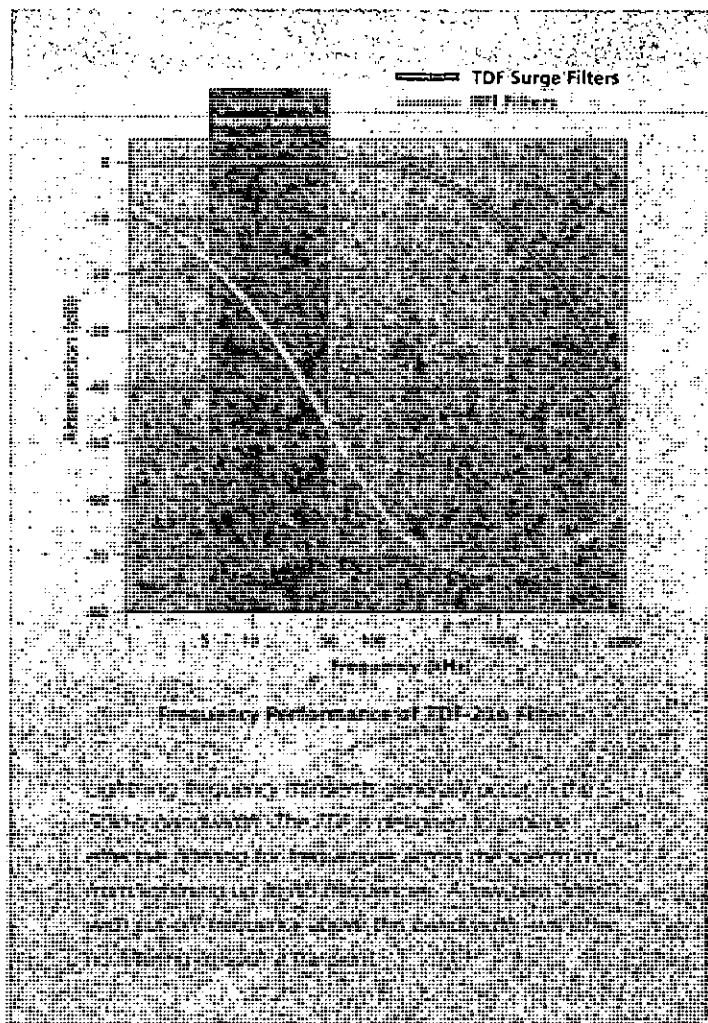
The new Transient Discriminating™ Filter family of two port (or series) SPDs offers high performance and reliable protection from power transients with the convenience of easy installation on 35mm DIN rail mountings. The TDF series has been specifically designed and strongly recommended for protection of critical electronic equipment with the advantage of a robust performance against poor voltage regulation.

The space efficient TDF provides some 65dB attenuation to transients, which not only improves the products residual voltage performance, but assists greatly in reducing the steep rates of voltage and current rise, providing superior protection for sensitive electronic equipment.

Units are available for 3A, 10A and 20A loads and in a range of voltages including 110-120V AC/DC and 240V AC.

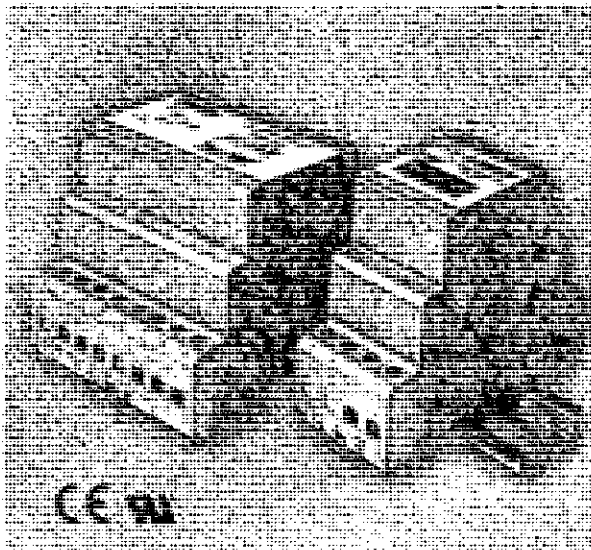
ORDERING INFORMATION

Item Number	Description
TDF-3A-240V	TDF,1 PHASE,3A,240V
TDF-10A-240V	TDF,1 PHASE,10A,240V
TDF-20A-240V	TDF,1 PHASE,20A,240V
TDF-3A-120V	TDF,1 PHASE,3A,120V
TDF-10A-120V	TDF,1 PHASE,10A,120V
TDF-20A-120V	TDF,1 PHASE,20A,120V



AC Power Devices

DINLINE Accessories



FEATURES

TDS Alarm Relay accessory

- For use with external alarm & monitoring systems
- Potential free change-over contacts
- Electronic indicators ideal for poorly illuminated locations
- UL 1449 Edition 2 Recognised

TDS Surge Counter accessory

- No power supply or batteries required to maintain counter
- Multiple diverters can be monitored by a single TDS-SC
- Accidental erasure prevented by non-resettable counter

Alarm Relay & Surge Counter

ERICO's TDS-AR Alarm Relay is an accessory to the TDF and TDS series of surge protection devices. These provide internal monitoring and visual indication of their protection status. The TDS-AR connects to a opto-output and provides a fully isolated potential free changeover alarm contact.

In addition, where the supply voltage is stable the DINLINE Alarm Relay (DAR-275) can be installed. Not only does it provide the same level of internal monitoring and visual indication as the TDS-AR, it has the added benefit of being more cost effective.

The TDS Surge Counter (TDS-SC) is a companion product to the surge diverters and can be used for site monitoring, building information management and predictive maintenance. The TDS-Surge Counter allows accurate and reliable recording of the number of impulses diverted by monitoring the surge current flow. It is powered by the surge energy - no additional power supply or batteries are required. A current transformer provides isolation from the measured circuit and allows monitoring of multiple diverters/filters.

ORDERING INFORMATION

Item Number	Description
TDS-AR	DINLINE ALARM RELAY,TDS, 90-275V
TDS-SC	DINLINE SURGE COUNTER,TDS WITH CT
DAR-275V	DINLINE ALARM RELAY,90V TO 275V
DSC-150V	DINLINE SURGE COUNTER,150V
DSC-275V	DINLINE SURGE COUNTER,275V

SPECIFICATIONS

Operation

Nominal line voltage Vrms:
Contact types:

TDS-AR

90-275
Change over,
2A 30VDC,
250VAC

DAR-275

90-275
Change over,
2A 30VDC,
250VAC

Physicals

Enclosure style:
Dimensions (W x D x H):
Warranty:
Listing:

DIN 43880
36 x 88 x 70mm
5 years
UL Recognized

DIN 43880
36 x 88 x 70mm
5 years
-

Operation

Maximum count:
Sensitivity:

TDS-SC

9999
300A 8/20µs

DSC

9999
300A 8/20µs

Physicals

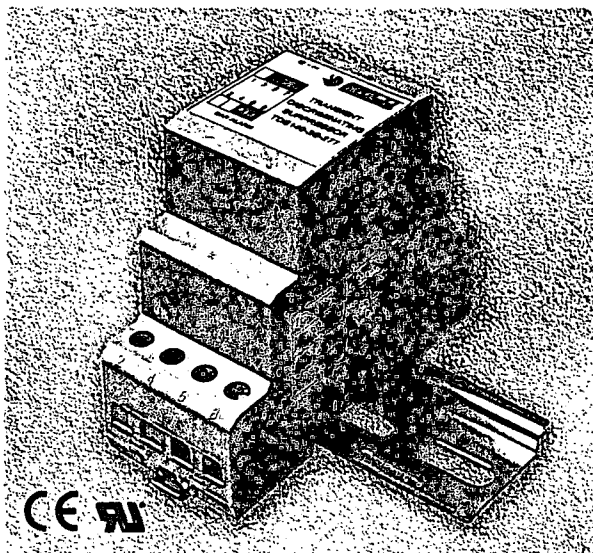
Enclosure style:
Dimensions (W x D x H):
Warranty:
Listing:

DIN 43880
36 x 88 x 70mm
5 years
UL Recognized

DIN 43880
36 x 88 x 70 mm
5 years
-

AC Power Devices

TD DINLINE Surge Diverter



TD™ DINLINE

Transient Discriminating™ (TD™) Technology represents a quantum leap in transient suppression technology for mains powered equipment. It offers a new level of safety and reliability, yet retains optimum protection levels critical for sensitive electronic equipment.

FEATURES

- TD™ Technology for superior service life
- Low let-through voltage
- UL1449 Edition 2 Recognised
- Extra fast transient withstand
- High over-voltage withstand
- Meets international EMC/RFI specifications
- Multipulse capability

ORDERING INFORMATION

Item Number	Description
TDS 140-2S-120	DINLINE SPD, TDS, 1Ph, 40kA, 120V
TDS 140-2S-277	DINLINE SPD, TDS, 1Ph, 40kA, 277V
TDS 180-4S-120	DINLINE SPD, TDS, 1Ph, 80kA, 120V
TDS 180-4S-277	DINLINE SPD, TDS, 1Ph, 80kA, 277V
TDS 1160-8S-120	DINLINE SPD, TDS, 1Ph, 160kA, 120V
TDS 1160-8S-277	DINLINE SPD, TDS, 1Ph, 160kA, 277V
TDS 50-120	DINLINE SPD, TDS, 1Ph, 3M, 20+20+10kA, 120V
TDS 50-240	DINLINE SPD, TDS, 1Ph, 3M, 20+20+10kA, 240V

SPECIFICATIONS

	TD81xx-x8-120	TD81xx-x8-277
Operation		
Nominal Line Voltage:	100-120 Vrms	220-277 Vrms
Frequency:	50 / 60 Hz	50 / 60 Hz
Leakage Current:	< 4 mA	
MCOV (Ph-N, Ph-E, N-E):	240 Vrms	480 Vrms
Max Surge Rating:		
8/20µs	40kA 80kA 160kA	40kA 80kA 160kA
10/350µs	8kA 16kA 32kA	8kA 16kA 32kA
Energy Rating:	1920J 3840J 7680J	1920J 3840J 7680J
Aggregate Surge Material:		
8/20µs	80kA 160kA 320kA	80kA 160kA 320kA
Let-through Voltages:		
@ 3kA 8/20µs	< 480V	< 750V
Let-through Voltages:		
@ 20kA 8/20µs	< 760V	< 980V
Surge Rated to Meet:	ANSI/IEEE C62.41-1991 Cat A, B and C Zone 0/1, Class B/C	

Operation

Operation	TDS50-xxx Three Mode Range	
	TD850-120	TD850-240
Nominal Line Voltage:	100-120 Vrms	220-277 Vrms
Frequency:	50 / 60 Hz/DC	50 / 60 Hz
Leakage Current:	< 0.2 mA	
MCOV (Ph-N, Ph-E, N-E):	170 Vrms	340 Vrms
Max Surge Rating:		
8/20µs	50kA (20+20+10kA) (L-N, L-G, N-G)	50kA (20+20+10kA) (L-N, L-G, N-G)
Energy Rating:	1390J	1390J
Aggregate Surge Material:		
8/20µs	58kA	
UL1449 SVR Rating:		
@ 500A	330V	700V
Let-through Voltages:		
@ 3kA 8/20µs	< 500V	< 800V
Surge Rated to Meet:	ANSI/IEEE C62.41-1991 Cat A, B	Zone 2, Class C

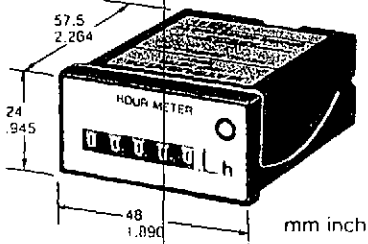
Alarms and Indicators

Status Indication: Staged LED, opto coupler
Voltage free contact 2A @ 250VAC
Available with Alarm relay module

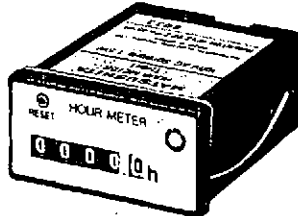
Physicals

Temperature and Humidity:	-35°C to +55°C, 0-90%
Terminals:	1.0mm² to 6.0mm²
Dimensions (WxDxH):	2M (36mm), 4M (72mm), 8M(144mm)
Weight:	200g (2M), 350g (4M), 700g (8M)
Listing:	UL Recognized Component AS3260, IEC950, C Tick
Warranty:	5 years

TH63·TH64 Hour Meters

NAIS**DIN HALF SIZE
HOUR METER****TH63·TH64
Hour Meters**

TH63 (without reset function)



TH64 (with reset function)

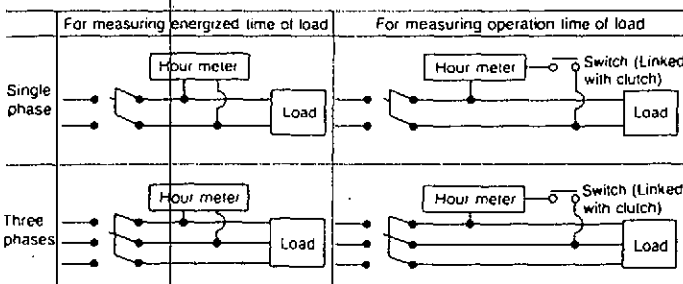
- Compact size offers more panel space.
- Wide measurement range.
- Simple installation.
- High performance motor with 50/60 Hz selection.
- Rotary indicator.
- Time measurement of leased equipment, management of compact equipment operation, maintenance management of various equipment, etc.

PRODUCT TYPE

	Part No.	Rated operating voltage	Max. power consumption	Counting range
TH63 types (without reset)	TH633	12 V AC	Approx. 1.5 W	0 to 99999.9 hours
	TH634	24 V AC		
	TH635	48 V AC		
	TH631	100 V AC		
	TH636	110 V AC		
	TH637	115 to 120 V AC		
	TH632	200 V AC		
	TH638	220 V AC		
	TH639	240 V AC		
TH64 types (with reset)	TH643	12 V AC	Approx. 1.5 W	0 to 9999.9 hours
	TH644	24 V AC		
	TH645	48 V AC		
	TH641	100 V AC		
	TH646	110 V AC		
	TH647	115 to 120 V AC		
	TH642	200 V AC		
	TH648	220 V AC		
	TH649	240 V AC		

SPECIFICATIONS

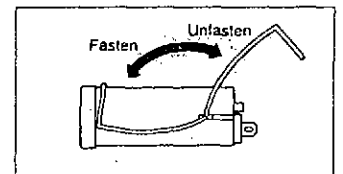
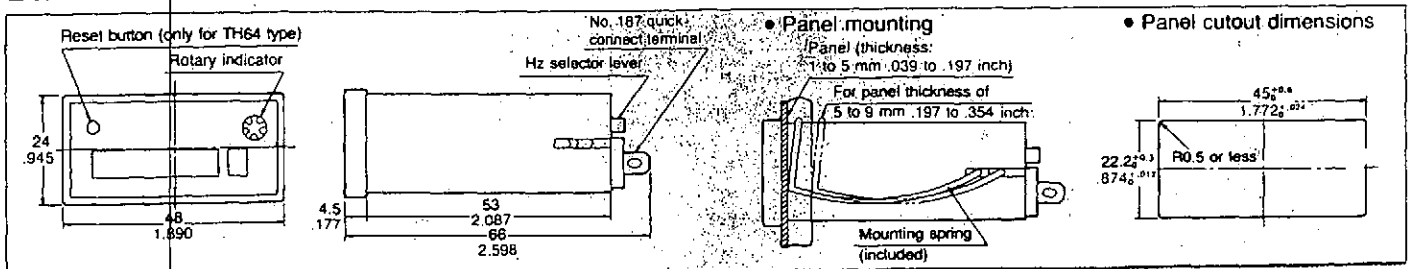
Type	TH63 (without reset)	TH64 (with reset)
Rated operating voltage	12 V AC, 24 V AC, 48 V AC, 100 V AC, 115 to 120 V AC, 200 V AC, 220 V AC, 240 V AC	
Operating voltage range	85 to 115% of rated operating voltage	
Rated frequency	50/60 Hz (selectable by switch)	
Initial insulation resistance (At 500 V DC)	Min. 100 MΩ Between live and dead metal parts	
Initial breakdown voltage	2,000 Vrms Between live and dead metal parts	
Shock resistance	Functional	10 G (4 times on 3 axes)
	Destructive	100 G (5 times on 3 axes)
Vibration resistance	Functional	10 to 55 Hz: 1 cycle/min double amplitude of 0.5 mm (10 min on 3 axes)
	Destructive	
Max. temperature rise	55 deg.	
Ambient temperature	-10 to +50°C ± 14 to +122°F	
Storage temperature	-30 to +60°C -22 to +140°F	
Ambient humidity	Max. 85% RH	
Counting direction	Addition (UP)	

WIRING DIAGRAM

Note: Before operation, check that the Hz selector is set to the power line frequency at the installation site.

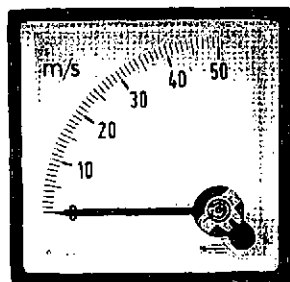
MOUNTING

1. Cut a 22.2^{±0.3} × 45^{±0.6} mm (.874^{±0.012} × 1.772^{±0.024} inch) opening in the panel.
2. Swing the mounting spring to the rear of the hour meter and fit the hour meter into the panel opening. (There is no need to detach the mounting spring from the hour meter.) If the panel is 5 to 9 mm (.197 to .354 inch) thick, move the mounting spring to the other hole toward the rear of the hour meter.
3. Swing the mounting spring to the front of the hour meter to secure the hour meter to the panel.
4. Wire the supplied quick connectors and connect to the hour meter. Be sure to use the supplied insulating sleeves to cover the connectors.

**DIMENSIONS**

240 Series DIN Panel Meters

Moving Coil D.C. Ammeters and Voltmeters



Accuracy: Class 1.5

Ratings:

Ammeters: 100 μ A to 25A,
(200 μ A for 05 model)
4/20mA suppressed
zero
40A for model
243/244-01A

Voltmeters: 50mV to 600V
1/5V suppressed
zero
50, 60, 75, 100,
150mV for use with
shunts

Impedance:

Ammeters: 75mV internal shunt
above 60mA

Voltmeters: 1000 Ω /V above 1V

Further details on our T-Sheet T118
available on request.

Model

Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145

Product Code

Ammeters	242-89A	243-01A	244-01A	246-10A
Ammeters				
suppressed zero	242-89R	243-01R	244-01R	246-10R
Voltmeters	242-89V	243-01V	244-01V	246-10V
Voltmeters				
suppressed zero	242-89S	243-01S	244-01S	246-10S

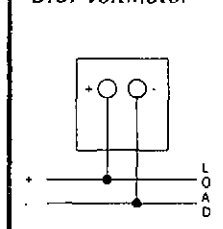
Model

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230

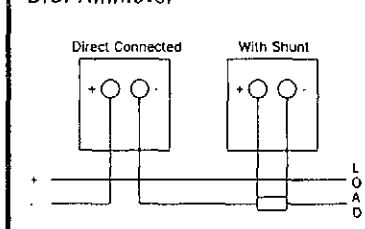
Product Code

Ammeter	242-05A	243-05A	244-05A	246-05A
Ammeters				
suppressed zero	242-05R	243-05R	244-05R	246-05R
Voltmeters	242-05V	243-05V	244-05V	246-05V
Voltmeters				
suppressed zero	242-05S	243-05S	244-05S	246-05S

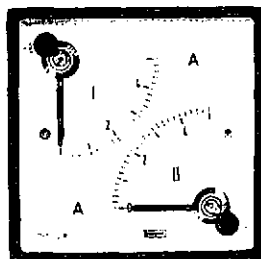
D.C. Voltmeter



D.C. Ammeter



Moving Coil Dual D.C. Ammeters and Voltmeters



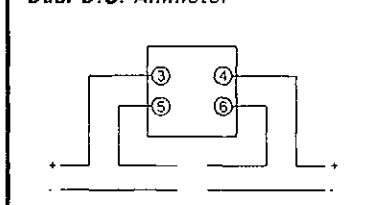
Model

Bezel Size mm	96
Scale length mm	94

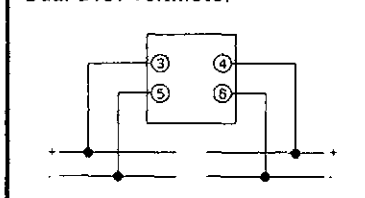
Product Code

Ammeters	244-80M
Voltmeters	244-80E

Dual D.C. Ammeter



Dual D.C. Voltmeter



Accuracy:

Class 1.5

Ratings:

D.C. Current: 100 μ A to 25A direct connected
4/20mA suppressed zero.

D.C. Volts: 50mV to 600V
1/5 volt suppressed zero
50, 60, 75, 150mV for use with shunts.

Crompton
INSTRUMENTS

INTERNATIONAL

Features

- Moving Coil Meters are suitable for all D.C. systems
- The linear scale is calibrated down to zero and the accuracy maintained down to 10%
- High currents are measured with separate shunts and suitably scaled indicators
- Suppressed, centre and offset zero models are available

Features

- Two instruments can be used to measure a wide range of currents and voltages

Benefits

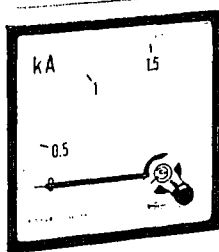
- Dual instruments save both space and time by requiring only one panel cut-out

Application

- The 244-80M allows for independent measurement of two D.C. currents in one case
- The 244-80E allows for independent measurement of two D.C. voltages in one case

240 Series DIN Panel Meters

Moving Iron A.C. Ammeters and Voltmeters



Model

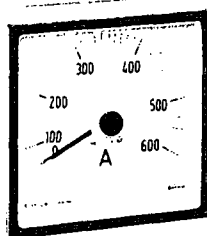
Bezel Size mm	48	72	96	144
Scale length mm	42	65	94	145

Product Code

A.C. ammeter	242-75A	243-02A	244-02A	246-07A
x2 overload ammeter	242-752	243-022	244-022	246-072
x3 overload ammeter	242-753	243-023	244-023	246-073
x5 overload ammeter	242-755	243-025	244-025	246-075
x6 overload ammeter	242-756	243-026	244-026	246-076
Low load ammeter		243-02H	244-02H	
A.C. voltmeter	242-75V	243-02V	244-02V	246-07V
Low middle voltmeter		243-02M	244-02M	

Accuracy: Class 1.5
 Frequency: 50 or 60Hz, (400Hz on request)
 Burden at 50Hz:
 Ammeters: 0.5VA
 Voltmeters: Up to 4.5VA maximum

Ratings:
 Ammeters: 0.5A to 100A A.C. direct connected (40A for 242-75A and 246-07A). Maximum system voltage 720V A.C. Low load / high middle maximum 10A
 Voltmeters: 6V to 600V



Model

Bezel Size mm	48	72	96	144
Scale length mm	72	112	150	230

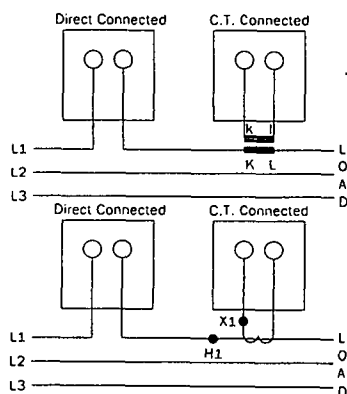
Product Code

Ammeter	242-03A	243-03A	244-03A	246-03A
x2 overload ammeters	242-032	243-032	244-032	246-032
x3 overload ammeters	242-033	243-033	244-033	246-034
x5 overload ammeters	242-035	243-035	244-035	246-035
x6 overload ammeters	242-036	243-036	244-036	246-036
Low load ammeters		243-03H	244-03H	
Voltmeter	242-03V	243-03V	244-03V	246-03V

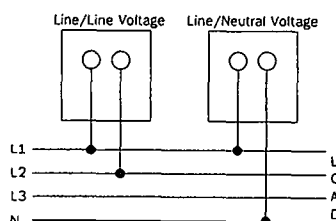
Accuracy: Class 1.5
 Frequency: 50 or 60Hz, (400Hz on request)
 Burden at 50Hz:
 Ammeters: 1.5VA
 Voltmeters: 4.5VA maximum

Ratings:
 Ammeters: 0.5A to 25A A.C. direct connected
 Maximum system voltage 720V A.C.
 Low load / high middle (maximum 10A)
 Voltmeters: 6V to 600V A.C.

A.C. Ammeter



A.C. Voltmeter



Crompton
INSTRUMENTS

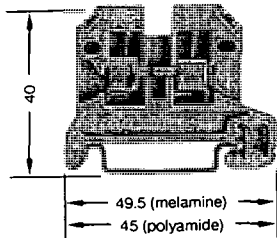
INTERNATIONAL

Features

- Designed to measure A.C. current or voltage. These meters indicate true r.m.s. values and are substantially independent of system waveform
- Can be used to measure D.C. at reduced accuracy
- Scales are calibrated down to 20%. Ammeters can have overload scales x2, x3, x5 or x6 for motor start duty
- Heavy damping is available as an option
- Ammeters can be scaled for use with -/1A or -/5A Current Transformers
- Voltmeters can be scaled for use with Voltage Transformers

SAK 2.5/35

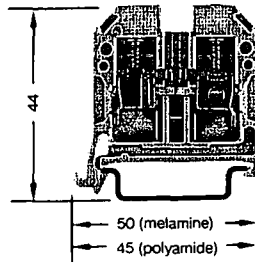
750V 27A



Thickness 6mm

SAK 4/35

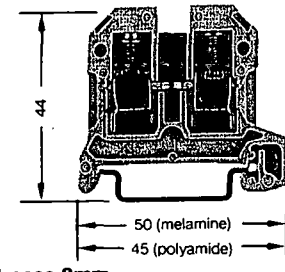
750V 36A



Thickness 6.5mm

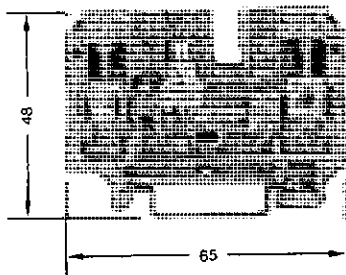
SAK 6/35

750V 47A

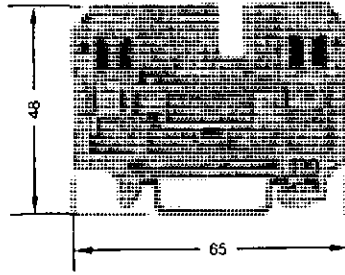


Thickness 8mm

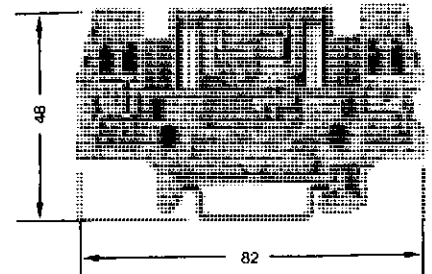
0.5-4		0.5-6		0.5-10	
0.5-2.5		0.5-4		0.5-6	
9		12		12	
Cat. No.		Cat. No.		Cat. No.	
038046		(ORANGE 132366) 044366		038056	
038048		044368		038058	
038042		044362		038052	
		(N)		(N)	
Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
TS 35	038340	TS 35	038340	TS 35	038340
TS 35	067620	TS 35	067620	TS 35	067620
TS 35	049800	TS 35	049800	TS 35	049800
EW 35 (8.5)	038356	EW 35 (8.5)	038356	EW 35 (8.5)	038356
AP (1.5)	046056	AP (1.5) (ORANGE 010516)	011796	AP (1.5)	011796
AP (1.5)	046058	AP (1.5)	011798	AP (1.5)	011798
AP (1.5)	027952	AP (1.5)	011792	AP (1.5)	011792
TW (1.5)	030286	TW (1.5)	013016	TW (1.5)	013016
TW (1.5)	030288	TW (1.5)	013018	TW (1.5)	013018
TW (2.5)	030282	TW (2.5)	013012	TW (2.5)	013012
TSch 1	031916	TSch 1	031916	TSch 1	031916
QL 2	015590	QL 2	013060	QL 2	019430
QL 3	015600	QL 3	013070	QL 3	019440
QL 4	015610	QL 4	013080	QL 4	019450
QL 10	033810	QL 10	033820	QL 10	033830
VH 8	026670	VH 13.5	024850	VH 12	024900
BS (M3 x 15)	035900	BS (M3 x 20)	030300	BS (M3 x 20)	030300
Captive on screw		Captive on screw		Captive on screw	
		VL 2	019700	VL 2	019470
		VH 19	028510	VH 19	028510
		BS (M3 x 25)	029250	BS (M3 x 25)	029250
		SS	016440	SS	016440
PS 2.3Ø	018040	PS 2.3Ø	018040	PS 4Ø	029960
SiB 8.5	028060	SiB 14	016860	SiB 14	016990
AD 4	032560	AD 4	037610	AD 4	037600
BSK (M3 x 22)	012890	BSK (M3 x 22)	012890	BSK (M3 x 22)	012890
ADP 1	048520	ADP 2	048530	ADP 2	048530
HP 1	048556	HP 2	048566	HP 2	048566
DEKAFIX — Section T6		DEKAFIX — Section T6		DEKAFIX — Section T6	

SAKT 1/35
440V 25A

Thickness 8mm

SAKT 1/35
440V 25A

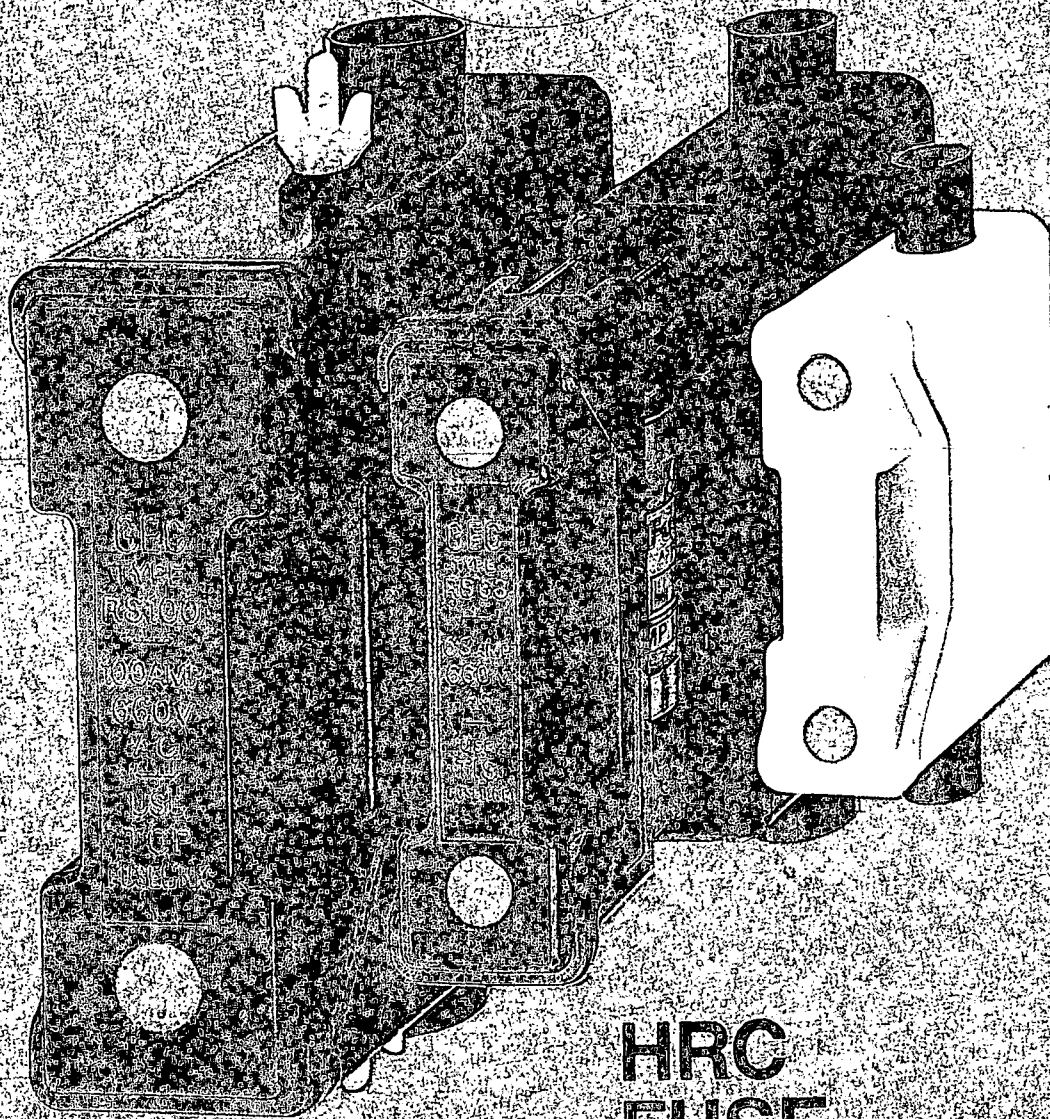
Thickness 8mm

SAKT 2/35
440V 25A

Thickness 8mm

SAKT 1/35 440V 25A		SAKT 1/35 440V 25A		SAKT 2/35 440V 25A	
0.5-10		0.5-10		0.5-10	
0.5-6		0.5-6		0.5-6	
12		12		12	
	Cat. No.		Cat. No.		Cat. No.
	010572		010582		010592
®		®		®	
Type	Cat. No.	Type	Cat. No.	Type	Cat. No.
TS 35	038340	TS 35	038340	TS 35	038340
TS 35	067620	TS 35	067620	TS 35	067620
TS 35	049800	TS 35	049800	TS 35	049800
EW 35 (8.5)		EW 35 (8.5)		EW 35 (8.5)	
	038356		038356		038356
AP (3)		AP (3)		AP (2.5)	
	014672		014672		032912
TW (3)		TW (3)		TW (2.5)	
	024292		024292		035182
TSch 2		TSch 2			
	035366		035366		
QL 2	019430	QL 2	019430	QL 2	019430
QL 3	019440	QL 3	019440	QL 3	019440
QL 4	019450	QL 4	019450	QL 4	019450
QL 10	033830	QL 10	033830	QL 10	033830
VH 13.5	024850	VH 13.5	024850	VH 13.5	024850
BS (M3 x 20)	030300	BS (M3 x 20)	030300	BS (M3 x 20)	030300
QVS 2		QVS 2		QVS 2	
	030730		030730		030730
QVS 3		QVS 3		QVS 3	
	032930		032930		032930
QVS 4		QVS 4		QVS 4	
	030740		030740		030740
VH 19		VH 19		VH 19	
	031800		031800		031800
BS (M3 x 25.5)		BS (M3 x 25.5)		BS (M3 x 25.5)	
	033470		033470		033470
QB 2		QB 2		QB 2	
	020570				020570
QB 3		QB 3		QB 3	
	020580				020580
QB 4		QB 4		QB 4	
	020590				020590
QB 10		QB 10		QB 10	
	034380				034380
VL 2		VL 2			
	019470		019470		
VH 19		VH 19			
	028510		028510		
BS (M3 x 25)		BS (M3 x 25)			
	029250		029250		
SS		SS			
	016440		016440		
PS (4Ø)		PS (4Ø)		PS (4Ø)	
	029960		029960		029960
ADP 3		ADP 3		ADP 3	
	048540		048540		048540
HP 4		HP 4		HP 4	
	048586		048586		048586
DEKAFIX — Section T6		DEKAFIX — Section T6		DEKAFIX — Section T6	

RED SPOT



**HRC
FUSE
FITTINGS**

GEC ALSTHOM

RED SPOT

**Fuse fittings to AS2005.21.2 – 1990 BS88: Part 2: 1988 660 volts A.C./D.C.
Approved by leading Authorities and used in equipment approved by Lloyds.**

SAFETY FEATURES

- ☐ Full Shrouding for personnel safety and complete compliance with the direct contact electric shock.
- ☐ Insulating sleeves are fitted to front connected fuse bases to provide increased protection at the cable entry point.
- ☐ Separate base contact insulating shrouds of great strength and flexibility ensure that no 'live' metal is dangerously exposed when the fuse carrier is removed – this enables an outgoing circuit to be cabled with complete safety to personnel and with continuity of supply to other circuits.
- ☐ Anti-vibration features protect against release of a fuse-carrier due to vibration in service. In the 400 amp size this includes a safety catch which automatically locks on the insertion of the fuse carrier.

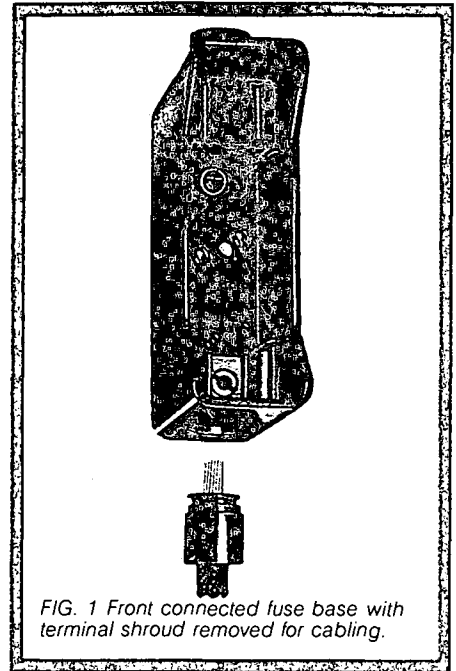


FIG. 1 Front connected fuse base with terminal shroud removed for cabling.

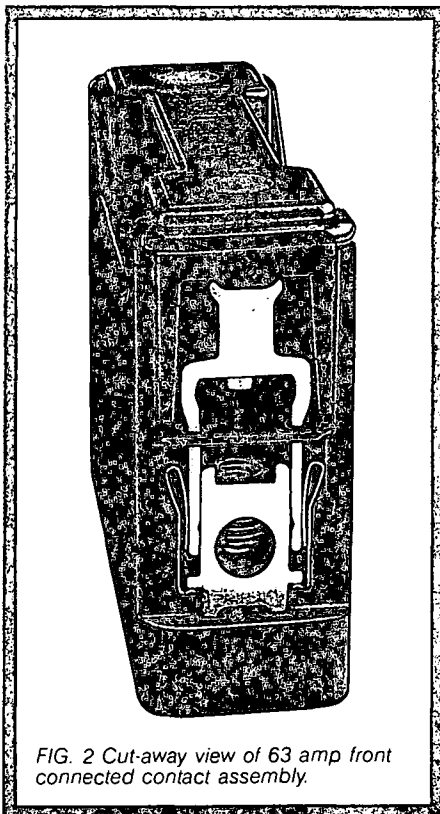


FIG. 2 Cut-away view of 63 amp front connected contact assembly.

RED SPOT SPECIAL FEATURES

20, 32, 63 & 100 amp fuse fittings

Perfect alignment of contacts with single-screw fixing achieved by registration on facets in moulding.

Large contact area and anti-vibration feature incorporated in brass contacts of accurate dimensions.

Tapered shank of fuse link fixing screw ensures easy re-entry.

Safety shroud (cut-away to show base contact) made from moulded red nylon of great strength and flexibility.

Patented non-twist cable clamping screw of large diameter.

Lasting contact pressure ensured by backing stirrups which are located by the shape of the base contact and the moulding.

Carrier and base moulded from flame retardant, non-hygroscopic phenolic.

APPLICATION DATA

RED SPOT

200 & 400 amp fuse fittings

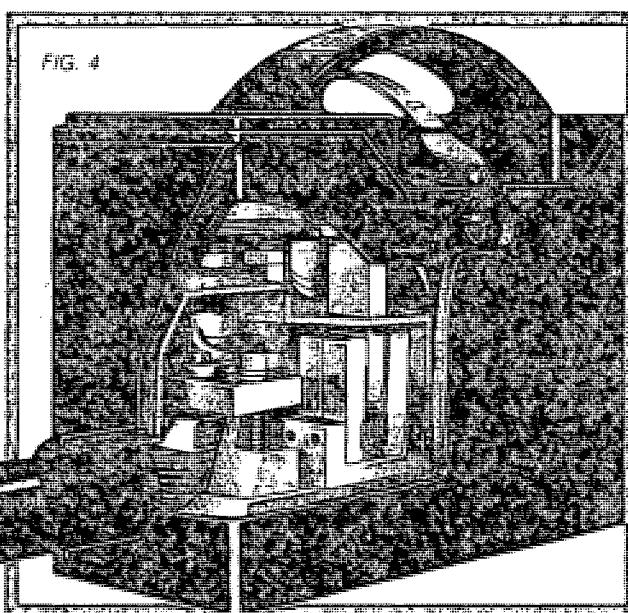
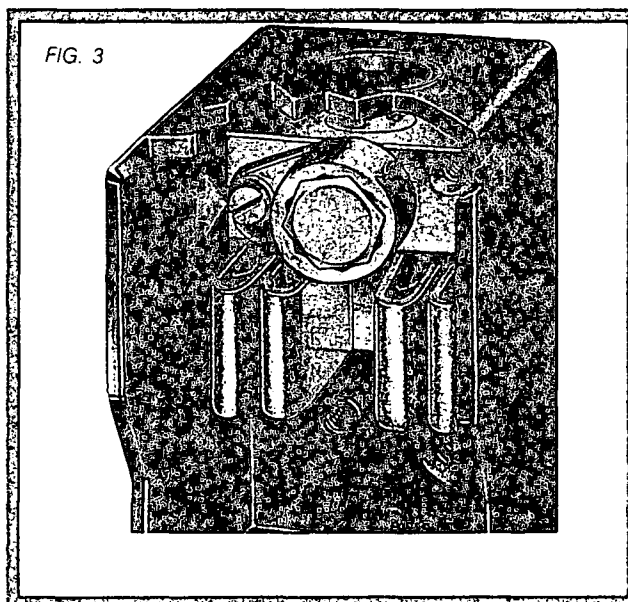
High quality mouldings, safety shrouds and precision made copper contacts ensure reliable operation.

Additional special features

- ☐ Through grip handle for maximum control.
- ☐ Silver plated contacts with generous cross section.
- ☐ Guides to ensure parallel action on insertion or withdrawal of fuse carrier.
- ☐ Patented non-twist cable clamping screws of large diameter on the 200 amp and cable clamping plate on the 400 amp fuse holders prevent damage to cables.
- ☐ Terminal screw locking device, incorporating the principle used in the twelve sided spanner, can be fitted to the hexagon head of the terminal screw, whatever its position when fully tightened, by using one of the two positions provided for locating the captive screw (arrowed in FIG. 3)

FIG. 3 Front connected 200 amp RED SPOT fuse base with shroud removed and with moulding partly cut-away to show silver-plated base contact and terminal screw locking device.

FIG. 4 Front connected 400 amp RED SPOT fuse fitting with moulding partly cut-away to show silver-plated contact, red nylon shroud and cable clamping device.



LIST NUMBERS

for ordering purposes

Standard Colours: Black & White (RS20 – RS100)

Rating amp	Alternative type of connection			
	FRONT	BACK	FRONT/BACK	BACK WIRED
20	RS20H *	RS20P	RS20PH	RS20BW
32	RS32H	RS32P	RS32PH	RS32BW
63	RS63H	RS63P	RS63PH	RS63BW
100	RS100H †	RS100P	RS100PH	RS100BW †
200	RS200H	RS200P	RS200PH	
400	RS400H	RS400P	RS400PH	

† Available with sealed terminal shrouds. List Nos: RS100H-S, RS100BW-S * For Din Rail Mounting order DIN Rail Adaptor Part No: 58B 9020-010.

Illustrations & dimensions shown on pages 5, 6, 7 & 8

APPLICATION DATA

H.R.C. FUSE LINKS ACCOMMODATED

Fuse fitting rating amp	Type 'T' to BS.88:Part 2 & AS2005.21.2	Extended range of Type 'T' to BS.88:Part 2: & AS2005.21.2 for motor circuit protection. (660 volts a.c.)		
		List No.	Current rating amp	Rating for motor starting amp
20	NIT2-20A (550 volts a.c.)	NIT20M25 NIT20M32 (415 volts a.c.)	20 20	25 32
32	TIA2-32A	TIA32M35 TIA32M40 TIA32M50 TIA32M63	32 32 32 32	35 40 50 63
63	TIA2-32A TIS35-63A	TIS63M80 TIS63M100	63 63	80 100
100	TIA2-32A † TIS35-63A † TCP80 & 100A	TCP100M125 TCP100M160 TCP100M200	100 100 100	125 160 200
200	TBC2-63A TC80 & 100A TF125-200A	TF200M250 TF200M315 *	200 200	250 315
400	TBC2-63A § TC80 & 100 § TF125-200 § TKF250 & 315 § TKM250 & 315A TM355 & 400A	TM400M450	400	450

† Adaptor plate required Type 'A' 5BB9306-010

§ Adaptor plate required Type 'B' 5BB9307-010

* 550 volts a.c.

Note: For full details on Type 'T' fuse links, including D.C. performance, please refer to Publication IEF/401 or PSP0000

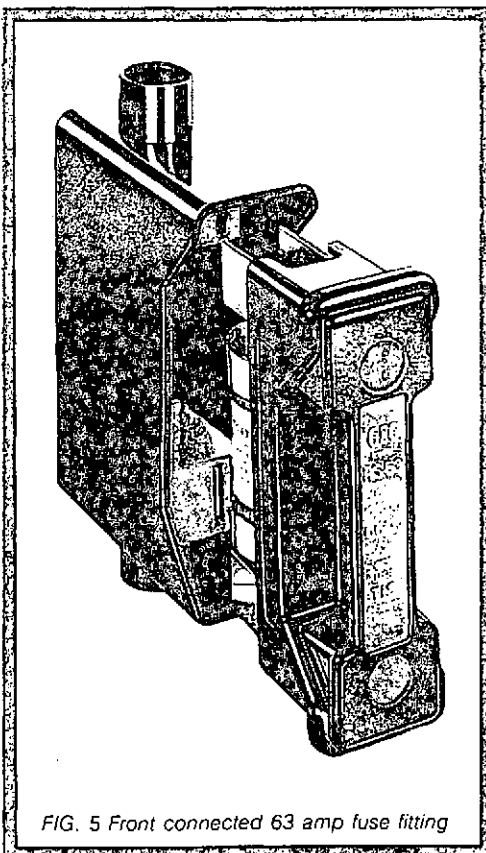


FIG. 5 Front connected 63 amp fuse fitting

METHOD OF CABLING

Front connected fuse fittings

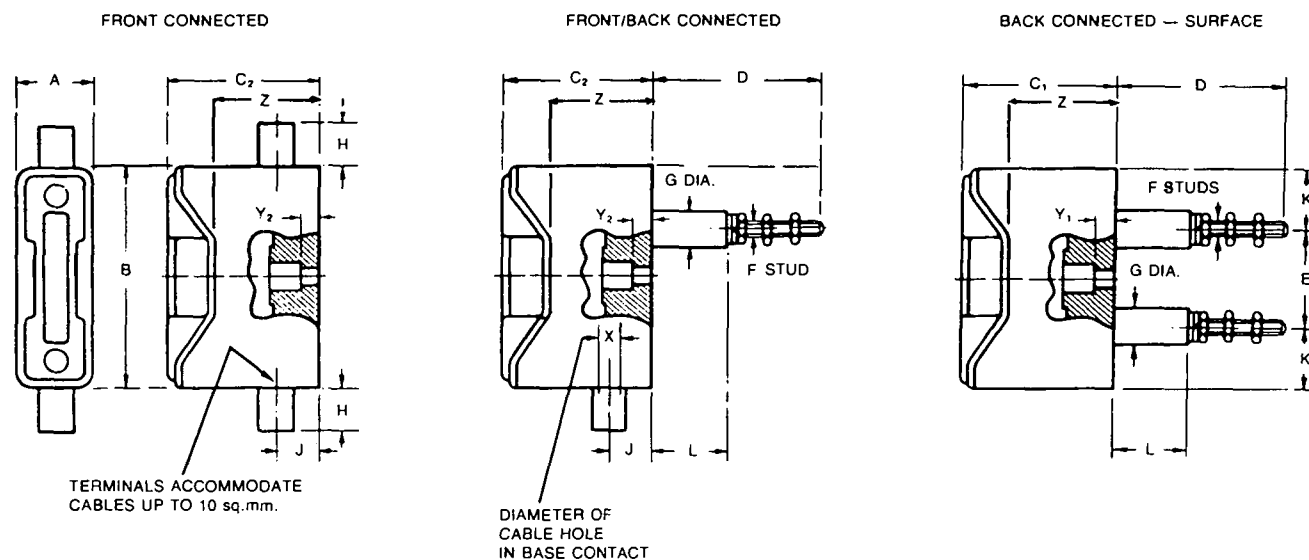
- 1) Remove red nylon insulating shroud to release cable sleeve.
- 2) Remove cable sleeve.
- 3) Fit cable sleeve over cable.
- 4) Fit conductor into fuse base terminal and tighten cable clamping screw to secure. If flexible cables are used, their relatively fine strands may be given increased protection by the use of thin wall copper ferrules over the conductor ends. The following should be taken into account:
 - a) The inside diameter of the thin wall copper ferrule should match that of the bared conductor end as closely as possible.
 - b) The length of the thin wall copper ferrule should match that of the tunnel in the fuse base terminal.
 - c) The wall thickness of the ferrule should be thin enough for the ferrule to be compressed by the tightening of the cable clamping screw. The flexible conductors will then be consolidated within the deformed ferrule.
- 5) Replace red nylon shroud taking care that it holds the cable sleeve in position by locating the shroud in the groove provided in the sleeves.

RS 100 H-S & RS 100 BW-S (COUNCIL SEALABLE)

- 6) Fit nylon screw through the red nylon shroud with the heads of the screws against the shrouds. Fasten the wingnuts on to the fuse fitting base.

DIMENSIONS

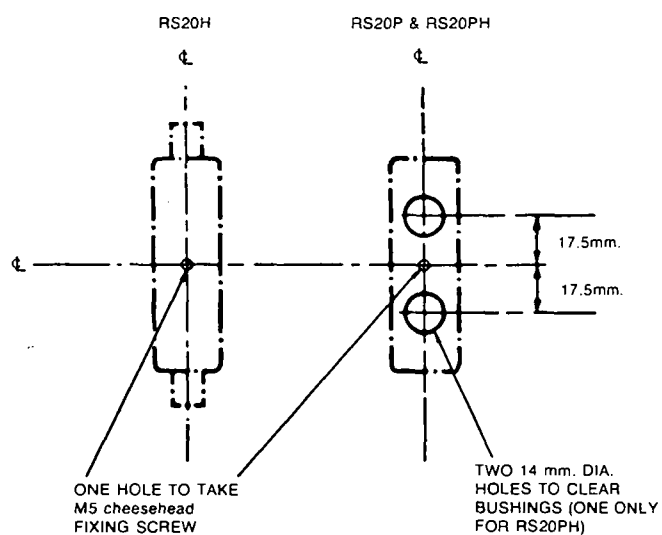
20 amp RED SPOT Fuse Fittings



	A	B	C ₁	C ₂	D	E	F	G	H	J	K	L	X	Y	Y ₂	Z
mm	27.0	79.0	54.0	55.0	63	35	M6	13.5	15.0	16	22.0	29	6.0	5.6	6.6	37

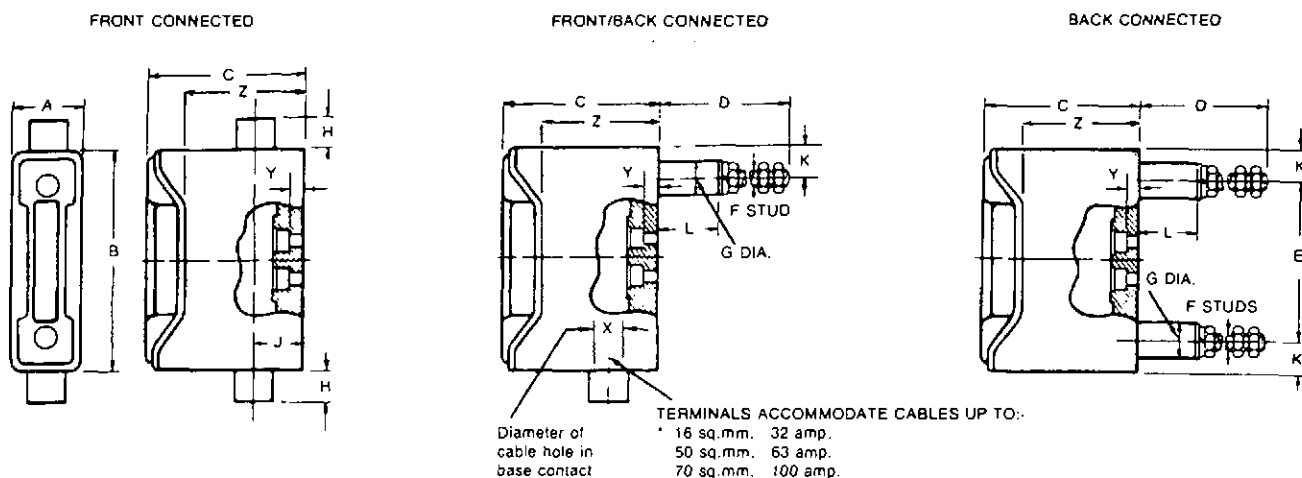
PANEL DRILLING DIMENSIONS

Viewed From Front Of Panel



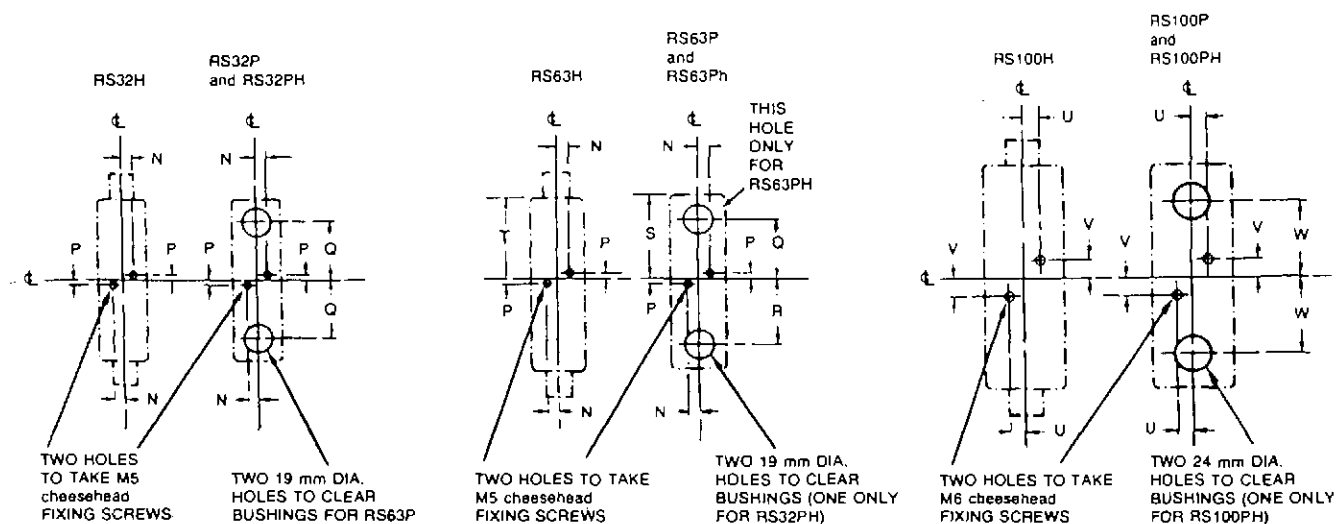
DIMENSIONS

32, 63 & 100 amp RED SPOT Fuse Fittings



Rating amp		A	B	C	D	E	F	G	H	J	K	L	X	Y	Z
32	mm	32	103	70	81.0	73	M6	17.5	15	22	15	29	6.2	5.6	49
63	mm	35	110	75	84.0	78	M8	17.5	15	24	16	29	9.5	5.6	54
100	mm	51	140	100	87	94	M10	22	15	28	23	32	12.7	7.2	74

PANEL DRILLING DIMENSIONS Viewed From Front Of Panel

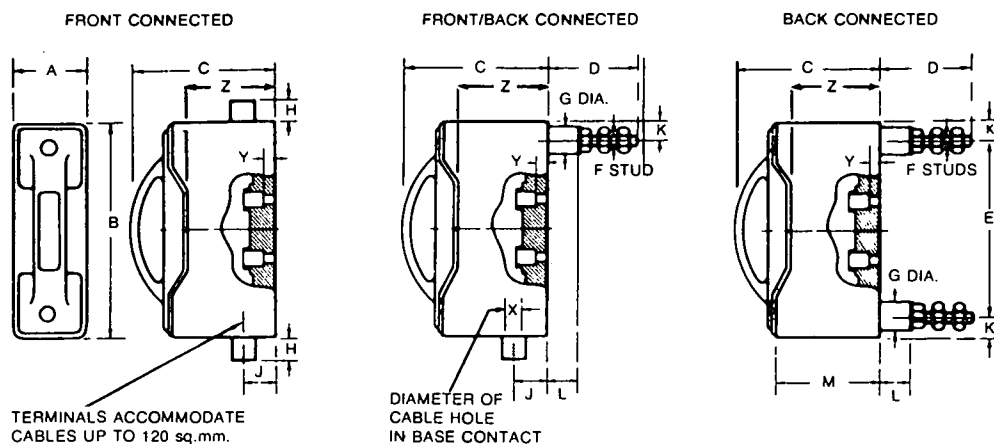


	N	P	Q	R	S	T	U	V	W
mm	6.4	3.2	36.5	41.3	52.4	51.6	9.5	11.1	46.8

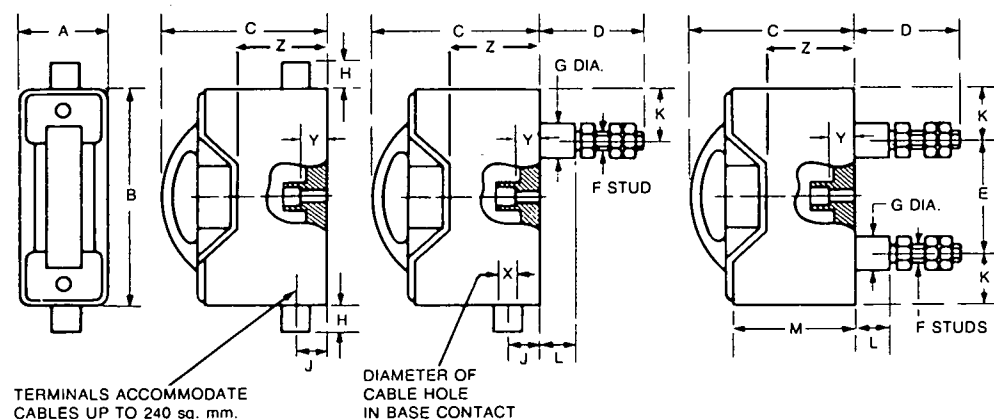
DIMENSIONS

RED SPOT Fuse Fittings

200 amp



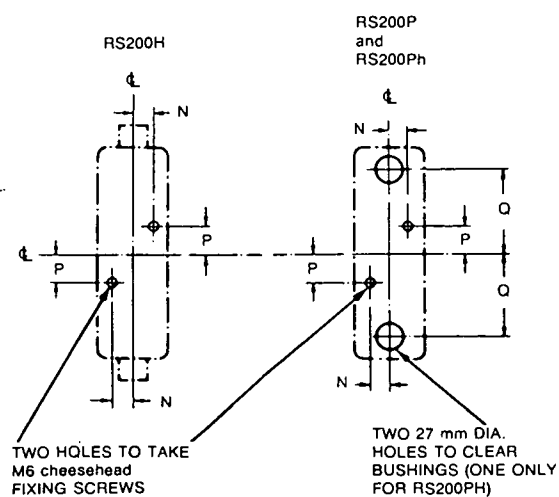
400 amp



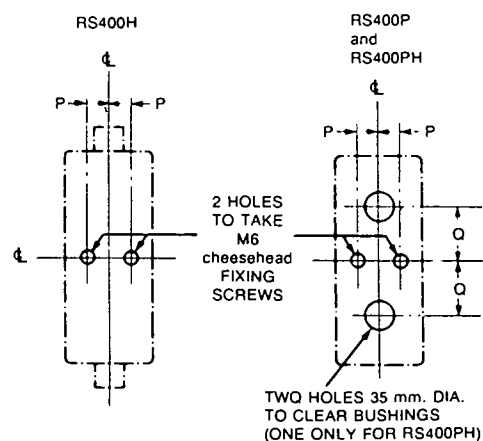
	200 amp	400 amp
	mm	mm
A	70	98
B	216	254.0
C	436.5	192
D	95	114
E	171.5	140
F	M12	M16
G	25	32
H	22	32
J	32	36.5
K	22	57
L	32	38
M	100.0	151
X	16	21
Y	9.5	32
Z	84	130

PANEL DRILLING DIMENSIONS

Viewed From Front Of Panel



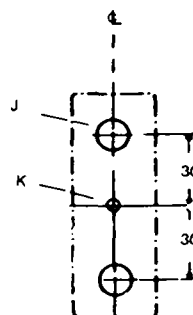
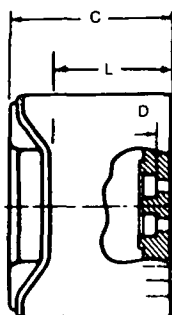
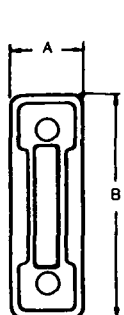
	N	P	Q
mm	19.1	28.6	85.7



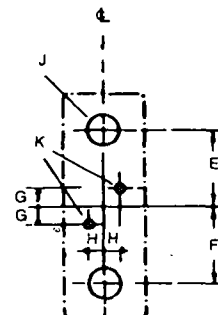
	P	Q
mm	27.0	69.9

DIMENSIONS

RED SPOT H.R.C. Fuse Fittings BACK WIRED PANEL MOUNTED



RS20 BW ONLY



RS 32, 63 & 100 BW

TYPE	Rating Amp	All dimensions in millimetres										
		A	B	C	D	E	F	G	H	J DIA	K	L
RS20BW	20	27	80	54	6	30	30	-	-	8	To Suit M5	37
RS32BW	32	32	103	70	6	40	40	3,2	6,4	8	M5	49
RS63BW	63	35	110	75	6	40	46	3,2	6,4	8	M5	54
RS100BW	100	51	140	100	7	50	50	11	9,5	16	M6	74

SUGGESTED SPECIFICATION

☐ All fuse fittings are to be rated 660Volts and accept bolt-in type HRC fuse links. They are required to be fully shrouded, cable ferrules for front entry type should be supplied as standard.

☐ The design shall be such that when removing or replacing a fuse carrier, it shall not be possible to touch the top contact (line) when the bottom contact (load) is inserted into the base and therefore alive.

☐ Fuse fittings are to be from a range having 20A, 32A, 63A, 100A, 200A and 400A rated fittings.

☐ Associated HRC fuse links shall be rated at 80kA 550/660VAC and be ASTA 20 certified.

☐ Fuse fittings are to be Red Spot type, or equivalent. HRC fuse link shall be either GEC or English Electric Type T or equivalent.

GECALSTHOM

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HOBART
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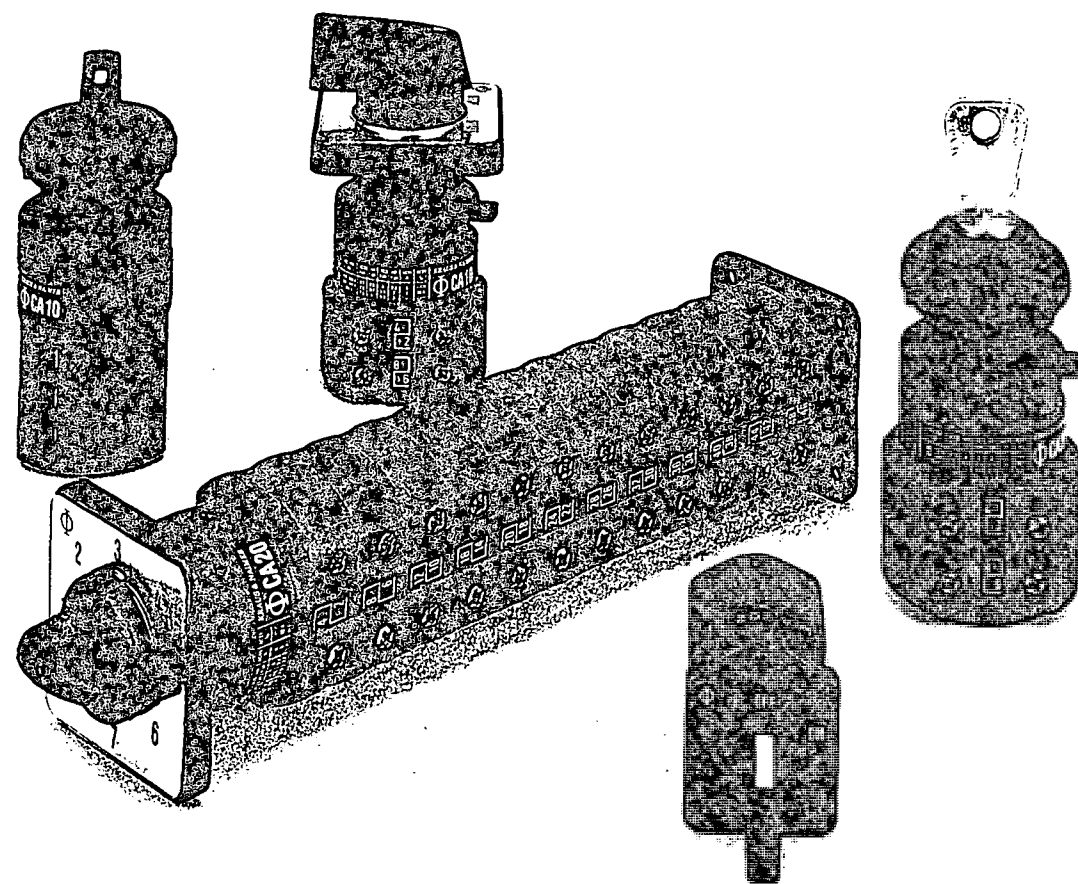
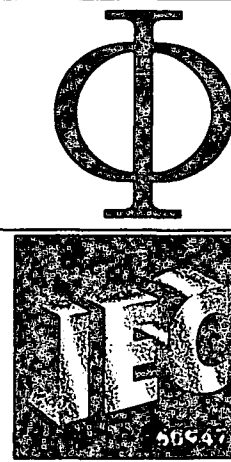
NEWCASTLE
(049) 61 1224

KRAUS & NAIMER

BLUE LINE SWITCHGEAR

Switch Types

CA4, CA4-1, CA10, CA11, CA20, CA25
CA10B, CA11B, CA20B, CA25B



- compact design with the smallest escutcheon plate size of 30 x 30 mm (1.181" x 1.181")
- finger-proof according to VDE 0106 part 100 and VBG 4
- open terminals which are accessible from both sides
- captive plus-minus screws and screwdriver guide
- high switching capacity
- contacts with gold plating (switch types CA4 and CA4-1)

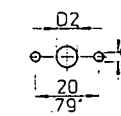
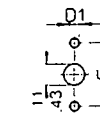
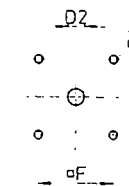
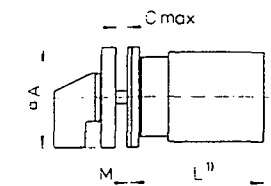
Dimensions
mm
inch

Panel mounting

EF

E22

E/EF



	A	B	C	D1	D2	E	F	M
CA4, CA4-1	30 1.18	28 1.10	4 .16	3.2 .13	8 - 11 .31 - .43	-	-	-
CA10, CA11	48 1.89	43 1.69	4 .16	5 .20	15 - 19 .59 - .75	30 1.17	36 1.42	1.5 .06
CA20	48 1.89	45 1.77	4 .16	5 .20	15 - 19 .59 - .75	30 1.17	36 1.42	1.5 .06
CA25	48 1.89	46 1.81	4 .16	5 .20	15 - 19 .59 - .75	30 1.17	-	-
CA10B, CA11B, CA20B, CA25B	64 2.52	56 2.20	4 .16	5 .20	19 - 22 .75 - .87	-	48 1.89	3 .12

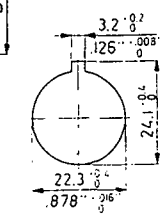
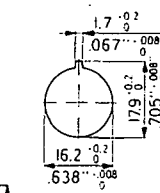
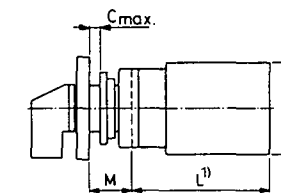
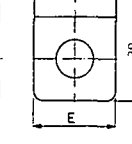
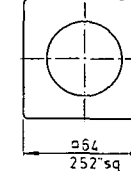
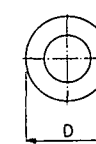
Single hole mounting

FS1/
FT1

FS2/
FT2

FH3

FS4

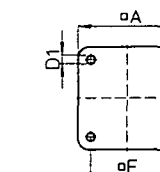
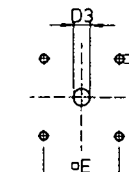
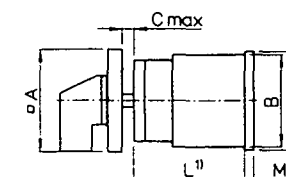


	CA4 CA4-1	CA10 CA11	CA20	CA25
A/E	30 1.18	49 1.93	49 1.93	49 1.93
B	28 1.10	43 1.69	45 1.77	46 1.81
C	4 .16	6 .24	6 .24	6 .24
D	29.5 1.16	39 1.54	39 1.54	39 1.54
M	12.5 .49	20 .79	20 .79	20 .79
FH3...	-	1.07	1.07	1.07

Base mounting

Front mounting

Rear mounting



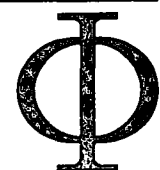
	A	B	C	D1	D2	D3	E	M
CA10, CA11	48 1.89	43 1.69	10.5 .41	4.1 .16	5 .20	8 - 15 .31 - .59	36 1.42	4 .16
CA20	48 1.89	45 1.77	10.5 .41	4.1 .16	5 .20	8 - 15 .31 - .59	36 1.42	4 .16
CA25	48 1.89	46 1.81	10.5 .41	4.1 .16	5 .20	8 - 15 .31 - .59	36 1.42	4 .16
CA10B, CA11B, CA20B, CA25B	64 2.52	56 2.20	13.5 .53	4.1 .16	5 .20	10 - 15 .39 - .59	48 1.89	3.5 .14

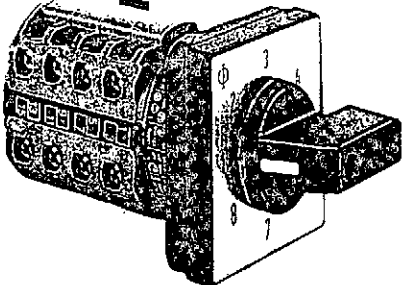
Dimensions L

	1	2	3	4	5	Stages 6	7	8	9	10	11	12
CA4, CA4-1	30 1.18	38 1.50	46 1.81	54 2.13	62 2.44	70 2.76	78 3.07	86 3.39	94 3.70	-	-	-
CA10	31.7 1.25	41.2 1.62	50.7 2.0	60.2 2.37	69.7 2.74	79.2 3.12	88.7 3.49	98.2 3.87	107.7 4.24	117.2 4.61	126.7 4.99	136.2 5.36
CA11	34.9 1.37	47.6 1.87	60.3 2.37	73.0 2.87	85.7 3.37	98.4 3.87	111.1 4.37	123.8 4.87	136.5 5.37	149.2 5.87	161.9 6.37	174.6 6.87
CA20	35.9 1.41	84.6 1.91	61.3 2.41	74 2.91	86.7 3.41	99.4 3.91	112.1 4.41	124.8 4.91	137.5 5.41	150.2 5.91	162.9 6.41	175.6 6.91
CA25	37.2 1.44	51.2 2.02	65.2 2.57	79.2 3.12	93.2 3.67	107.2 4.22	121.2 4.77	135.2 5.32	149.2 5.87	163.2 6.43	177.2 6.98	191.2 7.53
CA10B	37.9 1.49	47.4 1.87	56.9 2.24	66.4 2.61	75.9 2.99	85.4 3.36	94.9 3.74	104.4 4.11	113.9 4.48	123.4 4.86	132.9 5.23	142.4 5.61
CA11B	41.1 1.62	53.8 2.12	66.5 2.62	79.2 3.12	91.9 3.62	104.6 4.12	117.3 4.62	130 5.12	142.7 5.62	155.4 6.12	168.1 6.62	180.8 7.12
CA20B	42.1 1.66	54.8 2.16	67.5 2.66	80.2 3.16	92.9 3.66	105.6 4.16	118.3 4.66	131 5.16	143.7 5.66	156.4 6.16	169.1 6.66	181.8 7.16
CA25B	43.4 1.71	57.4 2.26	71.4 2.81	85.4 3.36	99.4 3.91	113.4 4.46	127.4 5.01	141.4 5.56	155.4 6.11	169.4 6.66	183.4 7.21	197.4 7.76

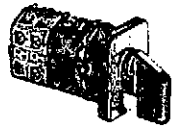

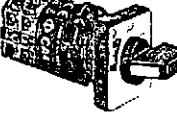
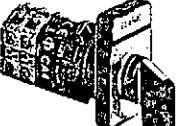
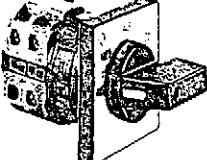
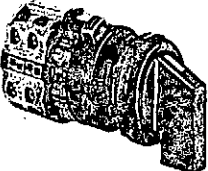
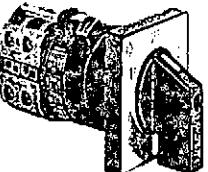
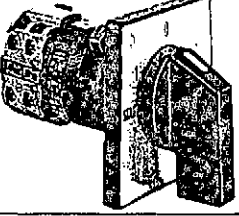
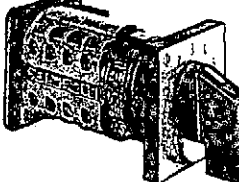
australian solenoid co. pty. ltd.

379 Liverpool Road, ASHFIELD, N.S.W. 2131
P. O. Box 1093, ASHFIELD, N.S.W. 1800
Tel: (02) 9797-7333 Fax: (02) 9797-0092



Construction Data	
<p>The terminals of the CA-series cam switches are accessible from both sides. This is an advantage in cases where the switch is prewired for installation or in cases where the terminal wiring cannot be done in the sequence of the stage. The compact design, the excellent switching capabilities under AC-15, AC-3 resp. AC-23A and the obviously unlimited number of switch developments are characteristic for the CA switches and exceed the requirements of IEC 60947-3 and VDE 0660 part 107.</p> <p>CA switches of this series are supplied with open terminals and protected against accidental finger contact in accordance with VDE 0106 part 100 (VBG 4). Captive plus-minus terminal screws and integrated screwdriver guides facilitate wiring.</p> <p>The CA4 and CA4-1 switches offer maximum space saving benefits. A CA4 or a CA4-1 switch in E mounting 1 stage long and 2 contacts fits into 30 x 30 mm cubicle. The additional length of any further stage is 8 mm. CA4 and CA4-1 contacts are supplied standard with gold plating (CA4 = 1 µ, CA4-1 = 35 µ).</p> <p>Single hole mounting according to EN 50007 with protection IP 65 is suitable for either 16/22 mm (CA4, CA4-1) or 22 mm (CA10-CA25B) diameter holes and is available with key operator, if required.</p> <p>Switching angle of CA switches may be 30°, 45°, 60° or 90°. Switch types CA4 and CA4-1 are available with up to 18 contacts. CA10-CA25B switches are available with up to 24 contacts.</p> <p>A wide range of optional extras and enclosures is available.</p> <p>Your order should include the following data:</p> <ol style="list-style-type: none"> 1. Switch type (selection according to the following tables) 2. Switching program (order a prescribed form for special programs) 3. Mounting type 4. Escutcheon plate and handle 5. Optional extras 	
	

Switch Types				CA4 CA4-1	CA10 CA10B	CA11 CA11B	CA20 CA20B	CA25 CA25B
Rated Insulation Voltage U_i		IEC 60947-3 ¹⁾ , EN 60947-3 ¹⁾ VDE 0660 part 107 ¹⁾ SEV ³⁾ UL/Canada CEE/NEMKO	V	440	690	690	690	690
Rated Impulse Withstand Voltage U_{imp}			kV	4	6	6	6	6
Rated Thermal Current I_{th}		IEC 60947-3, EN 60947-3 VDE 0660 part 107 SEV ³⁾ 380 V 660 V UL/Canada	A	10	20	20	25	32
Rated Operational Current I_n		AC-21A Switching of resistive loads including moderate overloads	A	10	20	20	25	32
AC-1 Resistive or low inductive loads		SEV ³⁾ 380 V 660 V	A	10	16 12	16 12	25 20	32 32
AC-15 Switching of control devices, contactors, valves etc.		IEC 60947-3, EN 60947-3 VDE 0660 220 V-240 V part 107 380 V-440 V	A	2,5 1,5	5 4	5 4	8 5	12 6
Pilot Duty		UL/Canada ³⁾ Heavy	VAC	300	300	600	600	300
Ampere Rating Resistive or low inductive loads		UL/Canada ³⁾	A	10	20 ⁴⁾	20 ⁴⁾	30	30
Resistive loads/Motor load		CEE NEMKO	A	4/2 6/4 ²⁾	10/6 10/6	10/6 -	16/10 20/10	- -
Short Circuit Protection								
Max. fuse size		(gL-characteristic)	A	10	25	25	35	35
Rated short-time withstand current		(1s-current)	A	60	140	140	280	480
Rated Utilization Category		IEC 60947-3, EN 60947-3 VDE 0660 part 107						
AC-3 Direct-on-line starting, star-delta starting		3 phase 220 V-240 V 3 pole 380 V-440 V 500 V 660 V-690 V	kW	1,5 2,2 -	3 5,5 5,5	3 5,5 5,5	4 7,5 7,5	5,5 11 11
		1 phase 110 V 2 pole 220 V-240 V 380 V-440 V	kW	0,3 0,55 0,75	0,6 2,2 3	0,6 2,2 3	1,5 3 3,7	2,2 4 5,5
AC-23A Frequent switching of motors or other high inductive loads		3 phase 220 V-240 V 3 pole 380 V-440 V 500 V 660 V-690 V	kW	1,8 3 -	3,7 7,5 7,5	3,7 7,5 7,5	5,5 11 11	7,5 15 15
		1 phase 110 V 2 pole 220 V-240 V 380 V-440 V	kW	0,37 0,75 1,1	0,75 2,5 3,7	0,75 2,5 3,7	1,5 3 5,5	2,2 4 7,5
Ratings		UL/Canada						
Standard motor load		120 V	HP	0,75	1,5	1,5	3	5
DOL-Rating (similar AC-3)		3 phase 240 V 3 pole 480 V 600 V	HP	1 - -	3 - 5	3 5 10	7,5 10 10	10 - -
		1 phase 120 V 240 V 277 V 480 V 600 V	HP	0,33 0,75 0,75 -	0,5 1 2 -	0,5 1 2 2	1,5 3 3 5	2 5 5 -
Max. Permissible Wire Gage		single-core or stranded wire	mm ² AWG	2x 1,5 14	2x 2,5 12	2x 2,5 12	2x 4 10	2x 6 8
flexible wire (sleeving in accordance with DIN 46228)			mm ² AWG	2x 1,5 (-) 16	2x 2,5 (2,5) 14	2x 2,5 (2,5) 14	2x 4 (2,5) 12	2x 4 (4) 10

Essential Mounting	Code	For type	
	E EF	CA4 CA4-1	Panel mounting two hole p/m two hole p/m Protection IP 65
	FS1		Single hole mounting combined with 16 and 22 mm Protection IP 65 w/o escutcheon plate
	FS2	CA4 CA4-1	with escutcheon plate 30 x 30 mm
	FS4		with escutcheon plate 30 x 39 mm
	E22 EF	CA10 CA11 CA20 CA25 CA10B CA11B CA20B CA25B	Panel mounting Protection IP 65 two hole p/m four hole p/m
	FT1		Single hole mounting 22 mm Protection IP 65 w/o escutcheon plate
	FT2	CA10 CA11 CA20 CA25	with escutcheon plate 48 x 48
	FH3		with escutcheon plate 64 x 64 mm
	VE	CA10 CA11 CA20 CA25 CA10B CA11B CA20B CA25B	Base mounting Protection IP 40 four hole p/m

1) Valid for lines with grounded common neutral termination, overvoltage category III, pollution degree 3. Values for other supply systems on request. 2) Valid for CA4 only. 3) International Standards and Approvals, refer to Catalog 100, page 39. 4) Canada max. 16 A.

TemBreak

Total Protection, Complete Control



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

TemBreak

Total Protection, Complete Control

TemBreak incorporates a series of microprocessor based MCCBs that represents a major evolution in low-voltage distribution systems. They were engineered to meet the requirements of the fast developing information-oriented society. Each model is designed to serve a key point in the system. Providing refined characteristics, incorporating true r.m.s. detection and ensuring the reliability necessary for the efficient functioning of the system.

TemBreak's features are designed to match the needs of the 90's

- Meets Worldwide Users Requirements
- Electronic Type TemBreak
- Achieves a Higher Degree of Protection Co-ordination
- Adjustable Rated Current
- World Wide Standards
- Operation Unaffected by Harmonics
- Adjustable Long and Short Time-delay Trips
- Expanded Protective Functions
- Improved Breaking Performance
- Spacesaving
- Fast Break Mechanism
- Advanced Breaking Technology
- Highest Degree of Protection

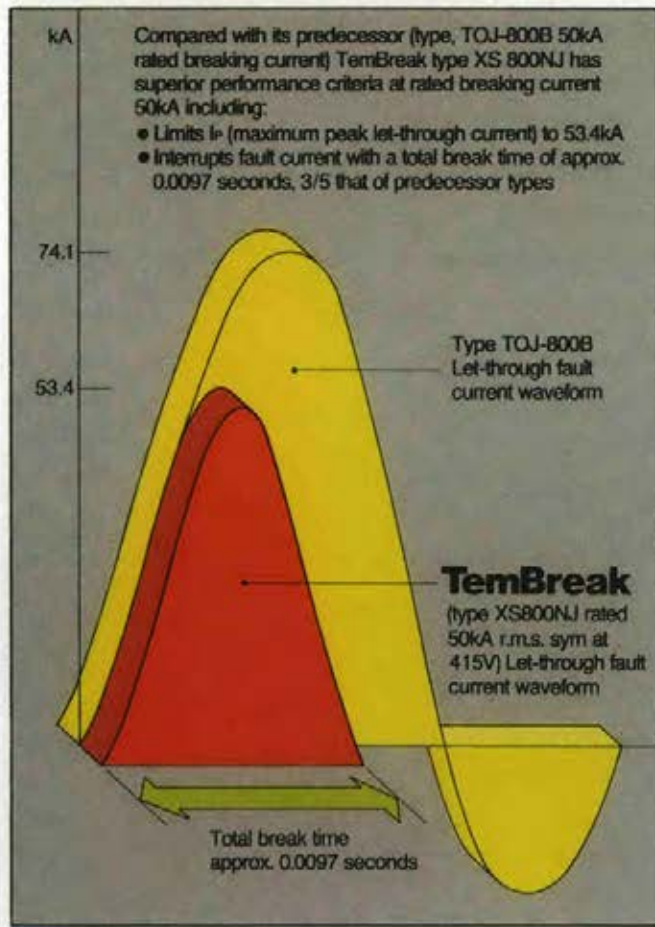
Contents:	Fast Break Mechanism	Page 2
	Advanced Technology	Page 4
	Correspondence TemBreak - Existing Breakers	Page 6
	Precise Protection Co-ordination	Page 8
	OCR Checker	Page 12

Fast Break Mechanism (FBM)

EXCEPTIONAL CURRENT LIMITING QUICK-BREAKING PERFORMANCE

TERASAKI's ingenuity on current breaking is reflected in the new Fast Break Mechanism (FBM) of the TemBreak series. Achieving high-speed, highly-efficient breaking. Its outstanding features include: U-shaped conductors, Dual Repulsive Contacts and Quick-break Arc Chutes (To quickly quench and extinguish ionized arcing gases) The Current Limiting, Quick-Breaking Performance of TemBreak provides exceptional current-limiting characteristics that have not been possible with existing moulded case circuit breakers. The current-limiting characteristics of TemBreak products, up to 800A frame, are outstanding.

REMARKABLE CURRENT — LIMITING FEATURE

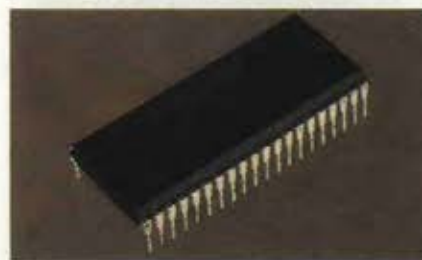
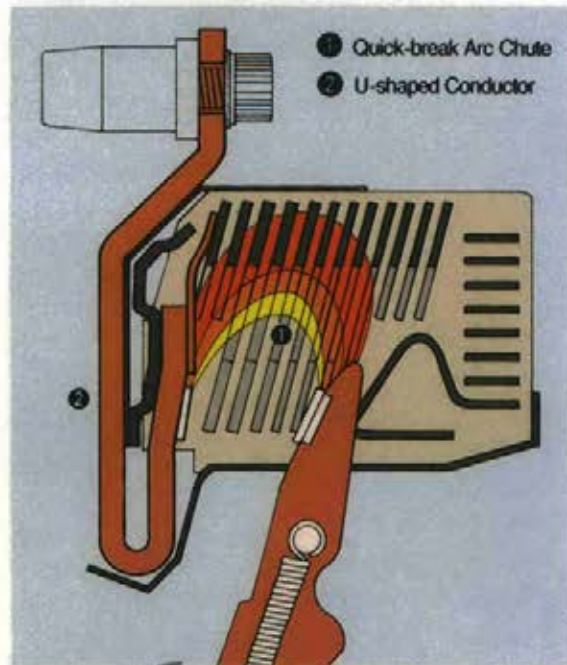


HIGH SPEED, HIGHLY-EFFICIENT BREAKING ACHIEVED!!

U-shaped Conductors

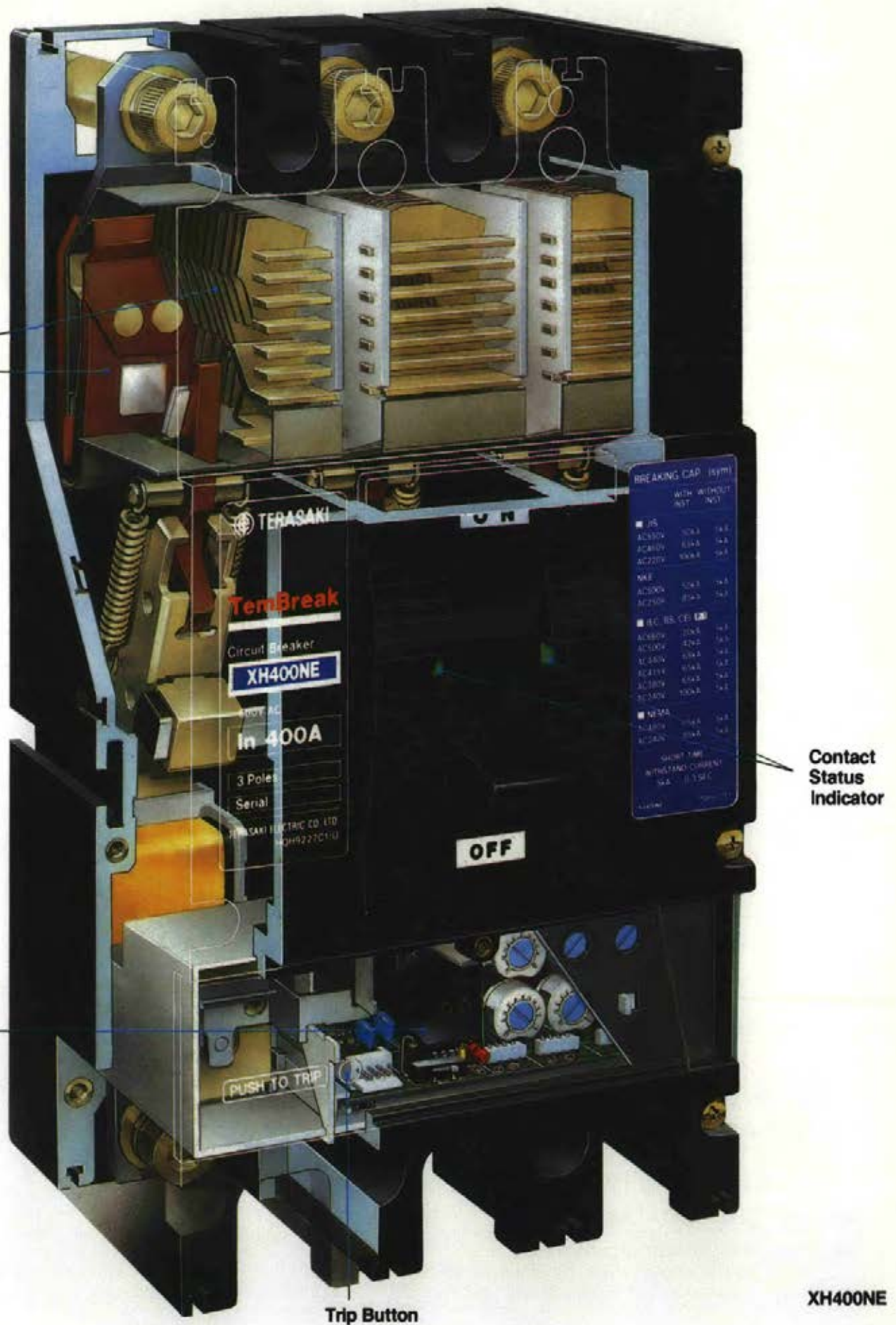
Dual Repulsive Contacts

Quick-break Arc Chutes



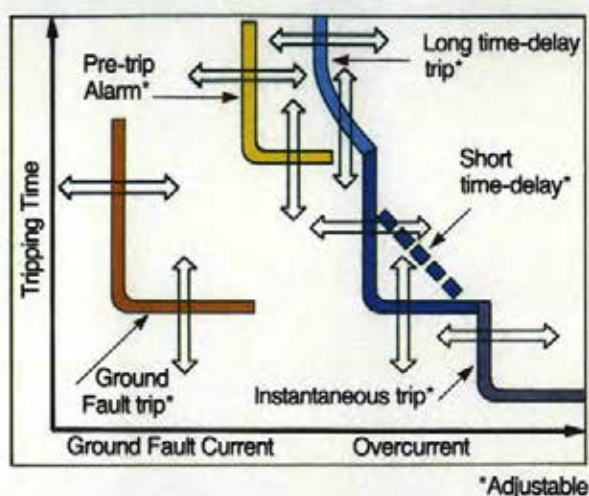
MULTI-PROTECTIVE FUNCTIONS!! By 8-Bit CPU

Terasaki's 28 years of achievements in the field of electronic technology is "second to none". In particular, its microcomputer application engineering has a "first class record" of supplying computer systems, of high, cost-performance to a variety of industrial plants over the past 10 years.

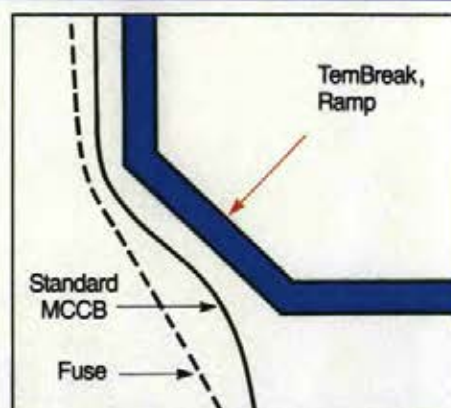


TemBreak contains advanced technology for precise protection co-ordination, anticipating the requirements of commercial buildings and automated factories.

Multiple Protective Functions Incorporating A Wide Range of Pick-Up Current and Time-delay Settings



Protective Characteristics Are Readily Co-ordinated With Those of Thermal-Magnetic MCCBs and Fuses. (The adjustable short time-delay trip has a ramp in its characteristic curve)



TemBreak Meets All Major Standards

Based Standards

IEC PUB 157-1 Part 1/International
Electrotechnical Commission

AS 2184/Australian Standard

BS 4752 Part 1/British Standard

VDE 0660/Verband Deutscher Elektrotechniker

CEI 17.5/Comitato Elettrotecnico Italiano

NEMA AB-1/National Electrical Manufacturers Association

JIS C8 370/Japanese Industrial Standards

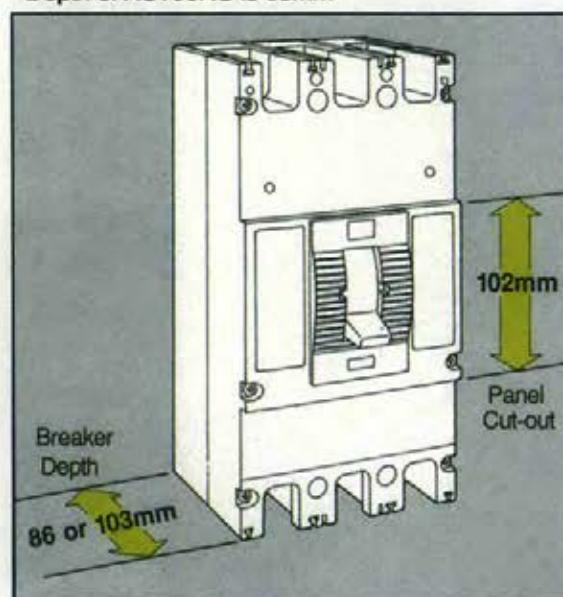
TemBreak's Adjustable Rated Current Type (Meets IEC Standards) And Is Available In A Wide Range For Plant Applications

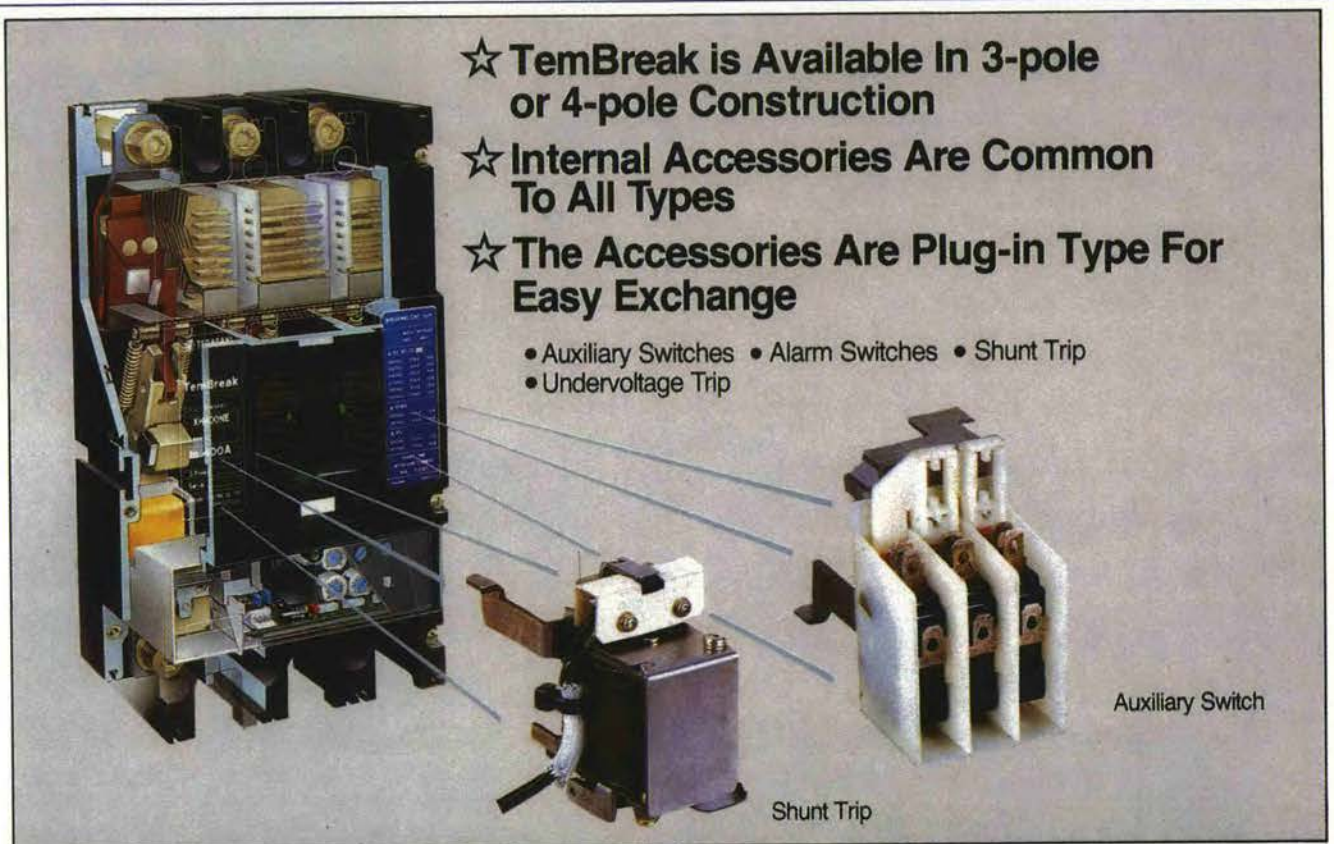
Plug in Mounting Blocks, for Switchboard Use

Note: The degree of protection provided by the mounting blocks for plug-in type TemBreak breakers (for Switchboard use) is IP-20, as defined in IEC Pub, 529.

Unified Dimensions Simplifies Distribution Board Design

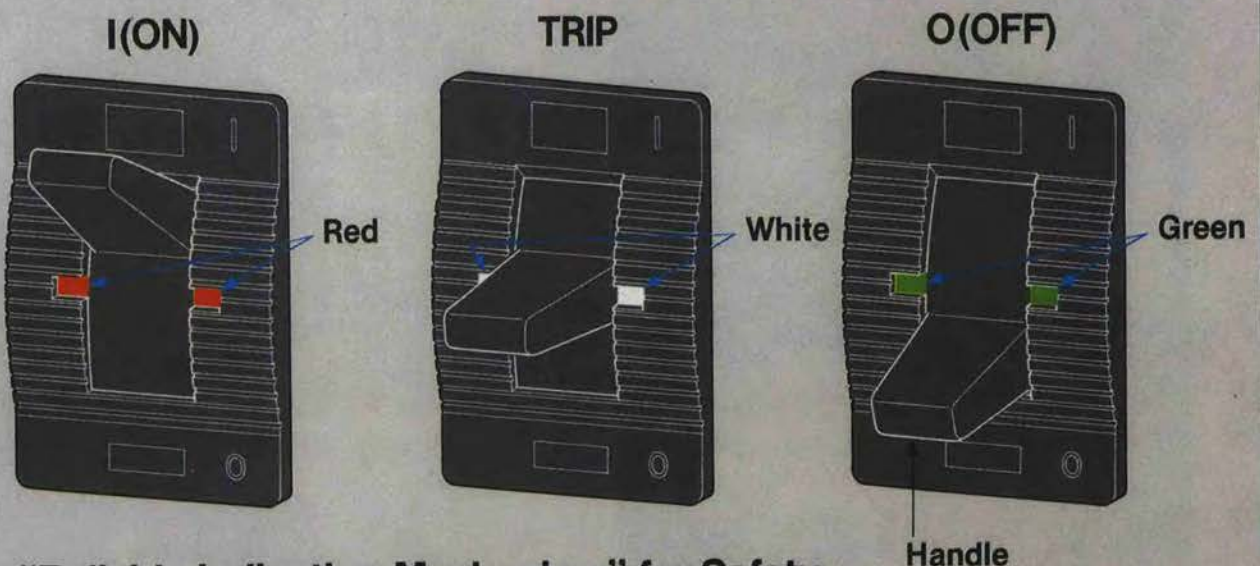
TemBreak includes frame sizes up to 800A which are the most frequently used in distribution boards. Unified dimensions include: Two depth sizes and one panel cut-out height *Depth of XS100NS is 68mm





Contact Status Indication

International symbols are used (colour coded) for status indication; I (ON) Red. TRIP, White. O (OFF) Green.



“Reliable Indication Mechanism,” for Safety

The operating handle indicates the O (OFF) position ONLY when the required isolating distance, between

the fixed and moving contact is achieved (No extra indication is necessary)

TemBreak

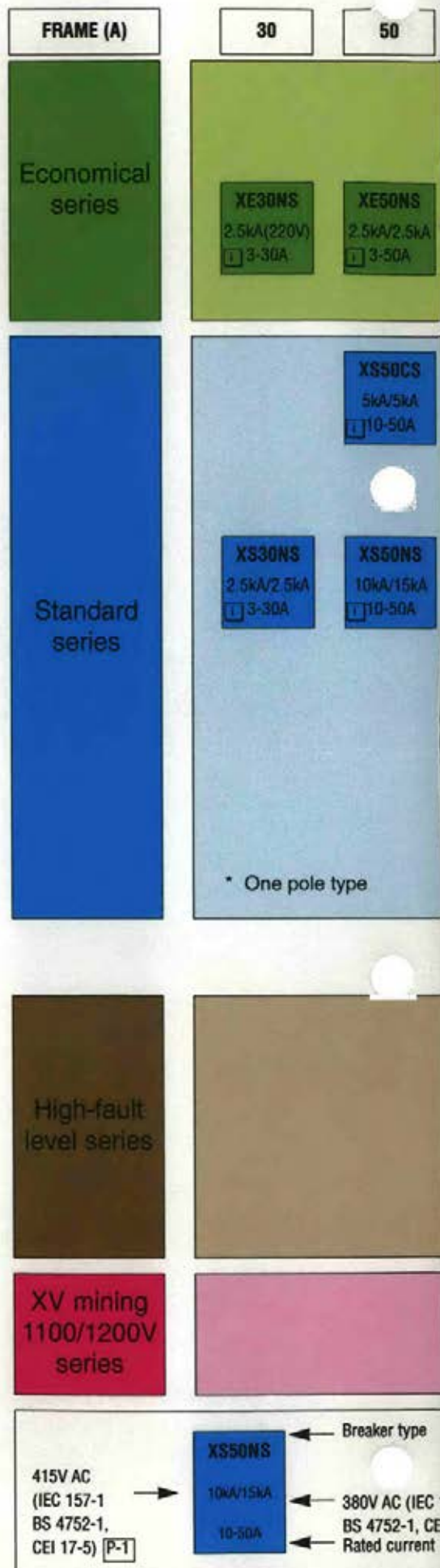
A new generation of MCCBs procuring a major evolution in low voltage distribution systems. Each model provides refined characteristics, incorporating true r.m.s. detection and ensuring the reliability necessary for the efficient functioning of a system.

- ☆ **UNAFFECTED BY HARMONICS**
- ☆ **UNIFIED DIMENSIONS**
- ☆ **3 and 4 POLE CONSTRUCTIONS**



TemBreak series

38 types



100/125	160	225/250	400	600/630	800	1250	1600	2000	2500
---------	-----	---------	-----	---------	-----	------	------	------	------

XE100CS
5kA/5kA
15-100A

XE100NS
10kA/15kA
10-100A

XE225NB
15kA/18kA
125-225A

XE225NS

XE400NS
25kA/25kA
250-400A

XE600NS
25kA/25kA
500-600A

XS125CJ
(XS125CS)*
14kA/18kA
12.5-125A

XS400CJ
30kA/35kA
160-400A

XS630CJ
35kA/45kA
250-630A

XS125NJ
(XS125NS)*
2.5kA/30kA
12.5-125A

XS160NJ
25kA/35kA
100-160A

XS250NJ
25kA/35kA
100-250A

XS400NJ
50kA/50kA
160-400A

XS630NJ
50kA/65kA
250-630A

XS800NJ
50kA/65kA
500-800A

8-bit CPU
XS400NE
50kA/50kA
125-400A

8-bit CPU
XS630NE
50kA/65kA
315-630A

8-bit CPU
XS800NE
50kA/65kA
400-800A

8-bit CPU
XS1250NE
50kA/65kA
630-1250A

8-bit CPU
XS1600NE
85kA/100kA
800-1600A

8-bit CPU
XS2000NE
85kA/100kA
1000-2000A

8-bit CPU
XS2500NE
85kA/100kA
1250-2500A

XS250PJ
35kA/35kA
100-250A

XH125NJ
50kA/50kA
12.5-125A

XH160NJ
50kA/50kA
100-160A

XH250NJ
50kA/50kA
100-250A

8-bit CPU
XH250PE
65kA/65kA
125-250A

8-bit CPU
XH400NE
65kA/65kA
125-400A

8-bit CPU
XH630NE
65kA/65kA
315-630A

8-bit CPU
XH800NE
65kA/65kA
400-800A

XV400NE
12.5kA
125-400A

XV630NE
12.5kA
315-630A


XV800NE
12.5kA
400-800A

XV1250NE
250kA
400-1250A

8-bit CPU
XS800NE
50kA/65kA
400-800A

← **Electronic type TemBreak**

Indicates breaker fitted with microcomputerised protective system.

Note:  Available on indent only.



Precise Protection Co-ordination

TemBreak, Electronic Type

TemBreak Profile *(Electronic type)*

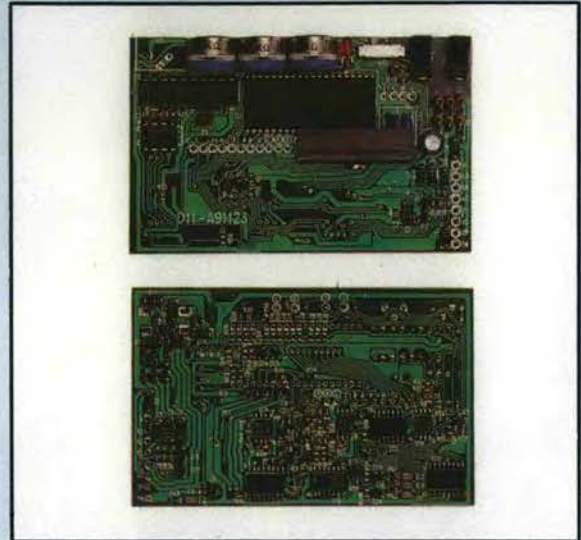
Each electronic type TemBreak product is fitted with an electronic protective device using an 8-bit microprocessor, to provide full protective functions necessary for upgrading low-voltage distribution systems and for achieving the highest reliability in operation.

Operation Unaffected By Harmonics

Semiconductor controlled power equipment in a distribution system can be a source of harmonic currents, which can cause malfunctioning in other equipment within the system.

The TemBreak's electronic protective device is designed to detect, true r.m.s. value of the load current. Therefore, remaining unaffected by harmonics.

TemBreak's electronic protective device consists of a number of flat-package ICs, which are compactly mounted, using high-density double-surface mounting, the most advanced surface mount technology.



Protective Characteristics of TemBreak *(Electronic type)*

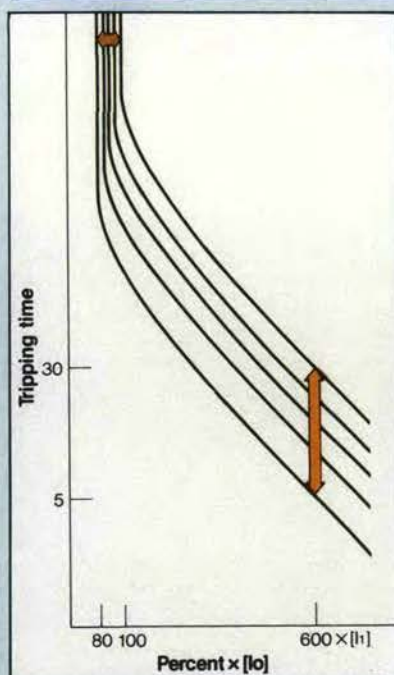
The protective characteristics include:

An adjustable long time-delay (For general industrial plants and for generator protection). An adjustable short time-delay trip (for co-ordination with existing solid-state trip and thermal magnetic trip breakers or fuses). An adjustable instantaneous

trip, an adjustable ground fault trip and an adjustable pre-trip alarm.

NOTE: The ground fault trip and pre-trip alarm can not be used simultaneously in a single breaker.

Adjustable long time-delay trip (LTD) For general industrial applications

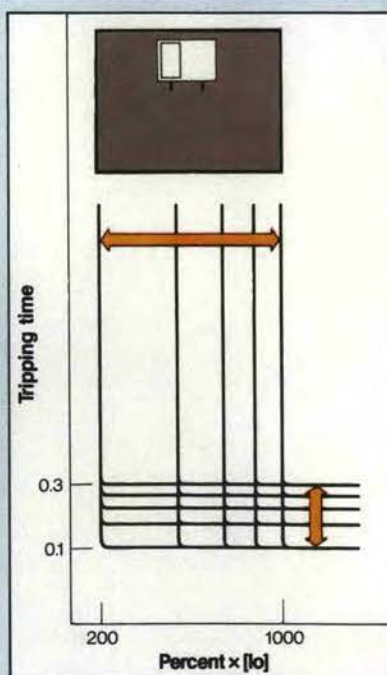


The pick-up current (I_1) of the LTD is adjustable from 80, 85, 90, 95 to 100% of the base current (I_0).



The LTD time delay at 600% of the rated current (I_1) is adjustable from; 5, 10, 15, 20 to 30 secs

Adjustable short time-delay trip (STD) For co-ordination with existing solid-state trip breakers

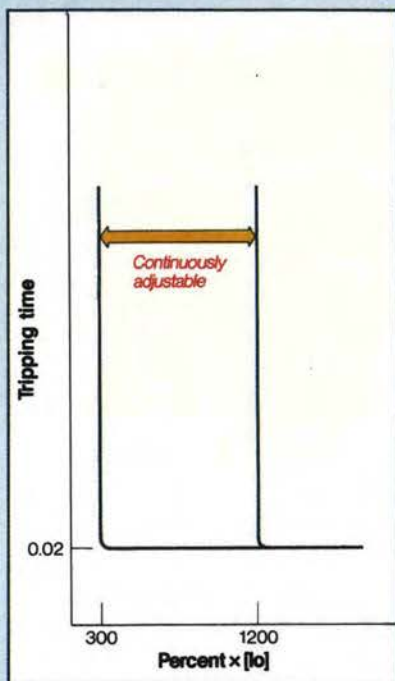


The STD pick-up current (I_2) is adjustable from; 200, 400, 600, 800 to 1000% of the rated current (I_0).



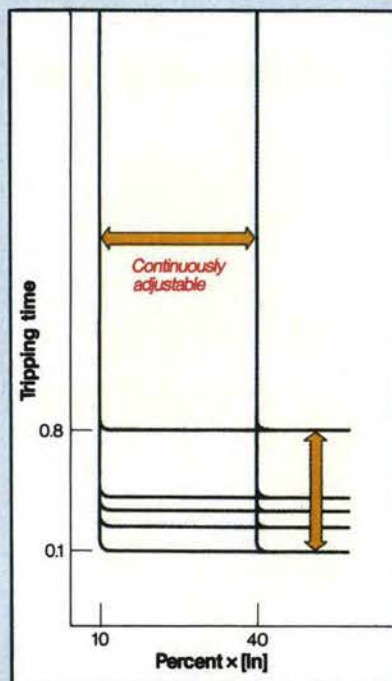
The STD has a definite time-delay characteristic. This opening time is adjustable from; 100, 150, 200, 250 to 300 ms

Adjustable instantaneous trip (INST)



The INST pick-up current [I_3] is continuously adjustable from 300% to 1200% of the rated current [I_o]

Adjustable ground fault trip (GFT)



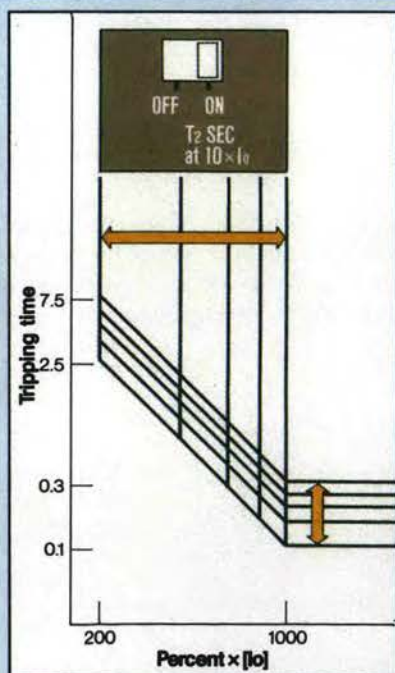
The GFT pick-up current [I_g] is continuously adjustable from 10% to 40% of the rated current [I_n]



The GFT has a definite time-delay characteristic, its opening time is adjustable from; 100, 200, 300, 400 to 800ms

For co-ordination with thermal-magnetic trip breakers or fuses.

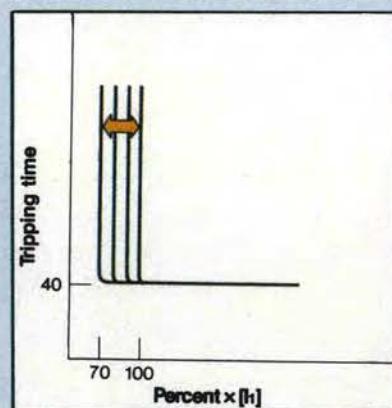
Adjustable pre-trip alarm (PTA)



The STD pick-up current [I_2] is adjustable from 200, 400, 600, 800 to 1000% of the rated current [I_o]



The STD has a time current characteristic of $I^2T = \text{constant}$ (ramp characteristic) for optimum co-ordination with conventional thermal-magnetic type moulded case circuit



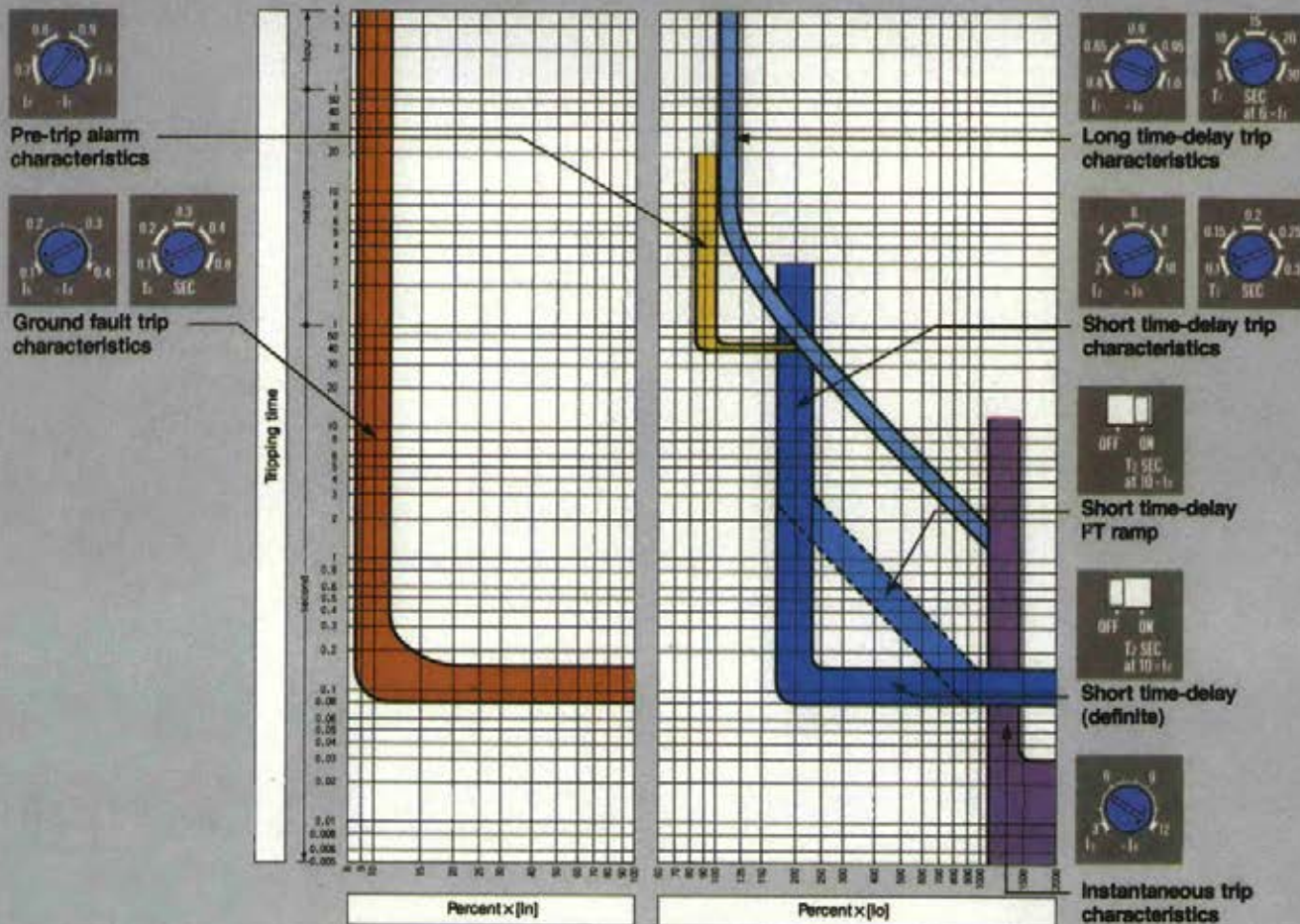
The PTA pick-up current [I_p] is adjustable from 70, 80, 90 to 100% of the rated current [I_1]. The time-delay is 40 seconds fixed. (A separate power source is required)

breakers or fuses. It has a definite time-delay characteristic at current levels above 1000% of the rated current (I_o)

Precise Protection Co-ordination

TemBreak, Electronic Type

Overcurrent tripping characteristics (Example)



Adjustable Rated Current

TemBreak (Electronic type)

The rated current of the electronic type TemBreak is adjustable in 15 steps from 50% to 100% of the nominal rated current, using the base current [I_n] select switch and the rated current [I_r] setting dial.

The rated current of a single breaker is adjustable in 15 steps from 50% to 100%. This is one of the essential features for precise protection co-ordination and for upgrading low-voltage distribution systems.

Base current	63					80					100				
	80 85 90 95 100					80 85 90 95 100					80 85 90 95 100				
Breaker rated current	50	54	57	60	63	64	68	72	76	80	80	85	90	95	100

Example: 72% in this example

Electronic, 8-Bit CPU adjustment face



Type: XS1600NE

Pick-up LED

LED turns on when LTD function picks-up.

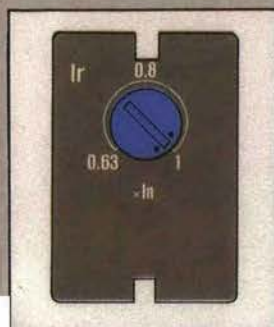
Note: If PTA is fitted, this LED flickers when PTA functions pick-up (separate control power required)

Trip Indicators (Optional)

One of the LEDs is lit to indicate which trip function tripped the breaker LTD, STD/INST or GFT (separate control power required)

TemBreak (Thermal-magnetic trip type)

The rated current is continuously adjustable from 63% to 100% of the nominal rated current. The scale is marked at three positions; 63%, 80% and 100%



TemBreak

OCR Checker (Portable)

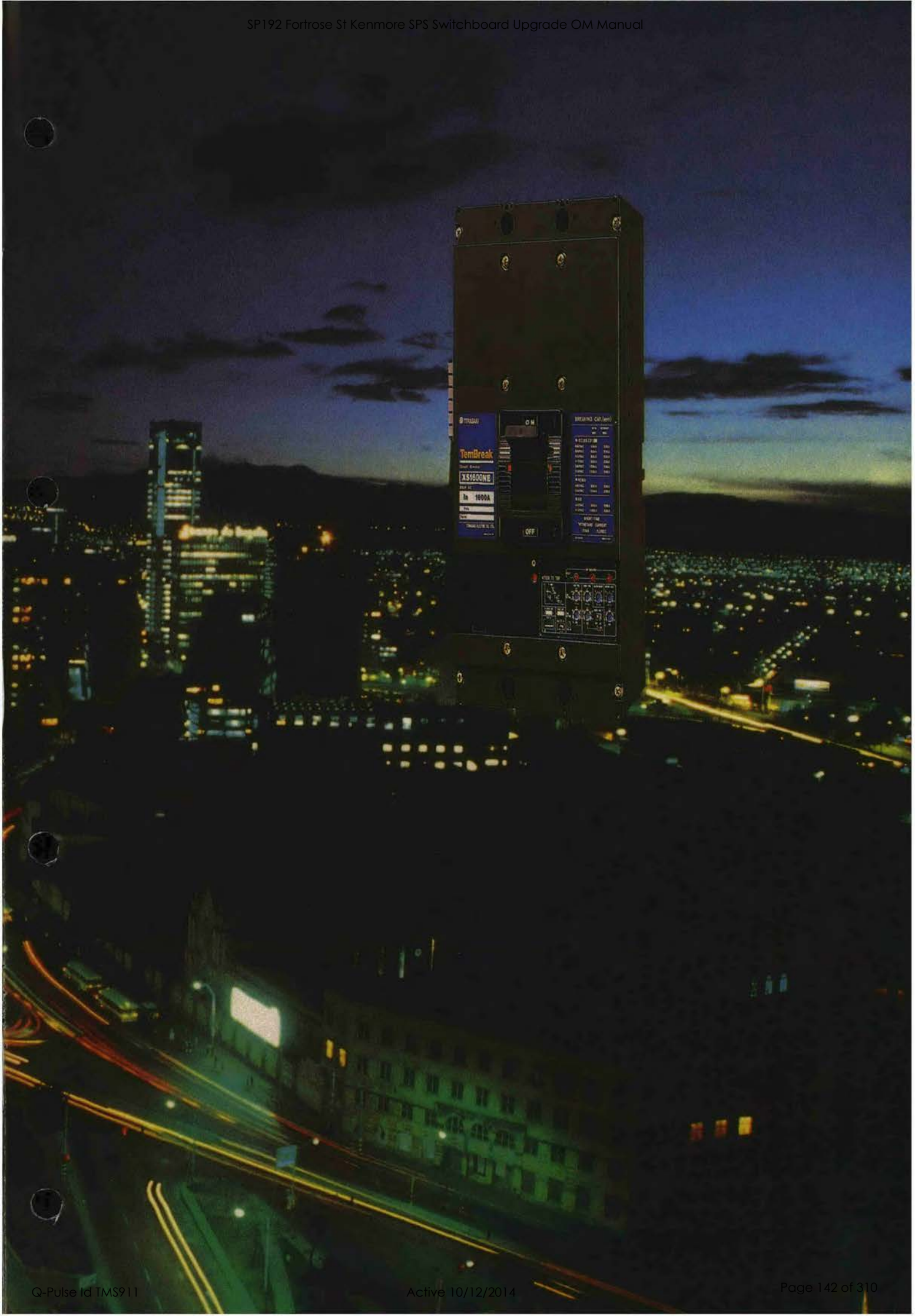


TemBreak OCR checker, type TNS-1, is an easy-to-use instrument for field testing the trip functions of the electronic type TemBreak circuit breakers.

It checks the pick-up current and tripping time values of the functions (LTD, STD, INST and GFT)

The values are indicated digitally on a 3-digit LED display

Power Source 100-110VAC or 220-240VAC,
single phase, 50/60Hz 30VA
Dimensions: 200mm(W) x 84mm (H) x 130mm (D)



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

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P.O. Box 199, Richmond, 3121
Fax: (03) 429 1075

SYDNEY:

30-34 Day Street North, Silverwater, New South Wales 2141. Telephone: (02) 748 3444
P.O. Box 259 Ermington, 2115
Fax: (02) 648 4353

BRISBANE:

25 Turbo Drive, Coorparoo, Queensland 4151 Telephone: (07) 891 6008
P.O. Box 1127, Coorparoo DC, 4151
Fax: (07) 891 6139

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50 Croydon Road, Keswick, South Australia 5035 Telephone: (08) 297 9055
Fax: (08) 371 0962

PERTH:

38-42 Railway Pde., Bayswater, Western Australia 6053 Telephone: (09) 271 8666
Fax: (09) 272 3906

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P.O. Box 326, Mayfield 2304
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Fax: (079) 22 2947

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Cnr Carroll St. & Struan Crt., Toowoomba, Queensland 4350 Telephone: (076) 34 4799
Fax: (076) 33 1796

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NHP

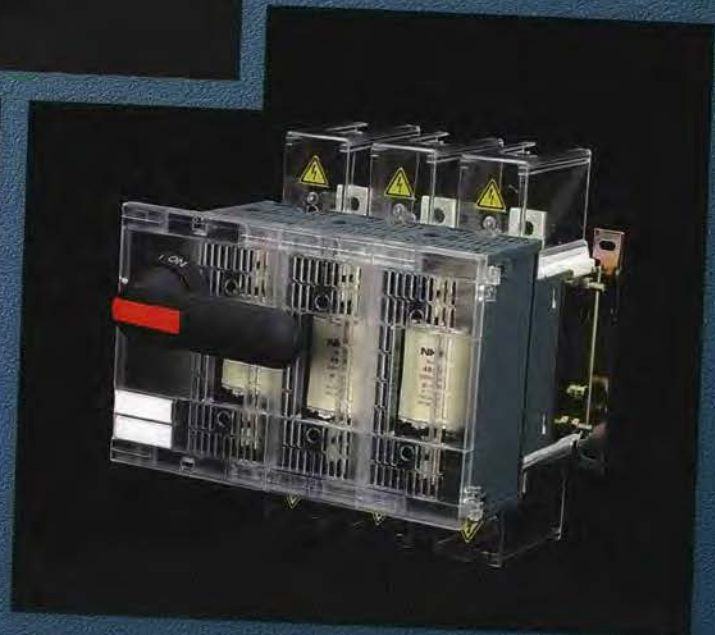
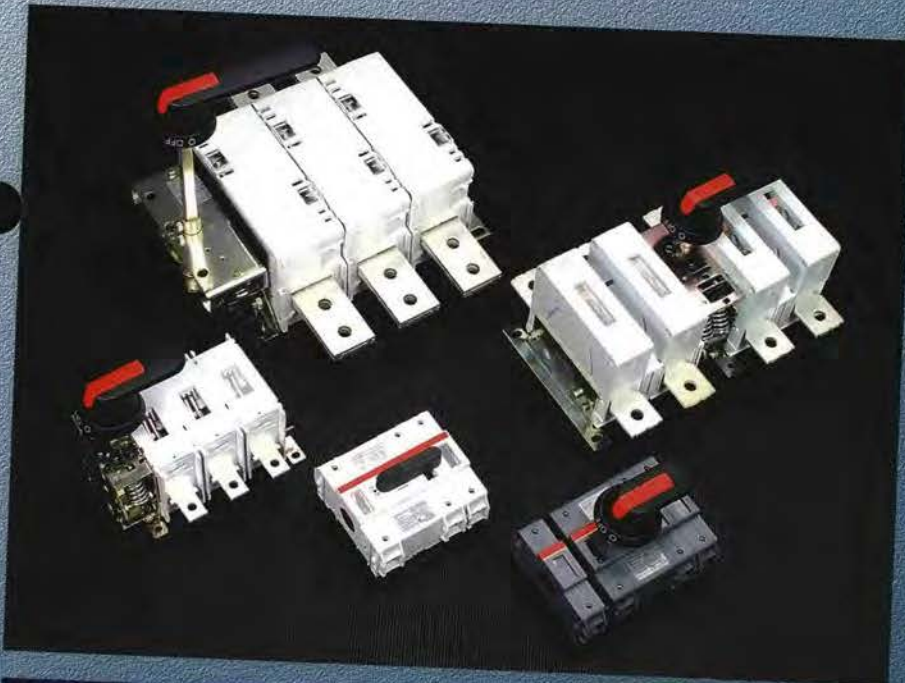
Proudly Australian

Catalogue
SG
June 1999

Strömberg

POWERLINE – SWITCHLINE

OS, OESA switch fuses and OT, OETL load-break switches



NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD
A.C.N. 004 304 812



NHP

NHP was formed in 1968 for the purpose of manufacturing, importing and merchandising a wide range of specialised electrical switchgear, motor control gear and other technical electrical products for Australian industry.

NHP is a wholly Australian owned company and exclusively represents a considerable number of overseas companies. These companies manufacture complementary equipment to the NHP programme, which includes locally manufactured products in Melbourne.

The head office and Melbourne sales organisation is situated at Richmond, with branch offices in Sydney, Brisbane, Adelaide, Perth, Newcastle, Townsville, Rockhampton, Toowoomba, Cairns and Darwin.

The company also has an office in New Zealand primarily involved in the supply of Terasaki circuit breakers and panelboards.

NHP is also represented by agents in Hobart, Launceston and Burnie. NHP products are stocked and distributed through more than 500 centres Australia wide.

Due to this extensive national sales and service network, the company is able to continue a policy of supplying an extensive range of technical electrical equipment, supported by substantial stocks and competent service on a national basis.

All branch offices and agents are connected to the on-line computer network centred in Melbourne. Experienced engineers are also available to assist customers, throughout Australia and to advise on all technical aspects and application requirements of equipment.

NHP is a supplier to the full spectrum of industry which uses industrial type electrical equipment, including mining and general industries, electrical contractors and government departments.

It is the continuing policy of the company to improve both the range and quality of products and services available for the Australian market. Experienced engineering and management personnel continually visit world centres to ensure that the organisation keeps pace with technological advances, research and development and modern marketing techniques.



Strömberg

Strömberg is located in Vaasa, Finland. For many years the company has been a major part of the manufacturing heart of this city. The picture right, shows Strömberg Park – such is the size of this multifaceted electrical manufacturing company. The inset picture shows the entrance to the switchgear factory.

Strömberg began business on July 24th 1889 when Gottfrid Strömberg walked into the Helsinki City Administrative Court to register the electric company he had just founded. The young engineer had in mind some technical improvements with which he could make better direct current dynamos and electrical lighting installations than his rivals.

The unofficial motto of the new company was, "good workmanship and the best raw materials". Over a century later the ideas of the founder of Strömberg live on. The company's own innovations are still the basis of production. Technical know how and product development in response to customer needs are maintained and remain the key principles in the company's operations. Through this technical expertise, research and development Strömberg has recently expanded their research and development of switch fuse and load-break switches.

This has resulted in the introduction of a substantial number of new products for the world market, including the new OH handle range, OS switch fuse and OT small load-break switches. Many of the developments shown in this catalogue are world innovations and have created a new standard in switch design and application. NHP assists Strömberg with its developments to ensure that the Australian market's needs are met with products that suit. NHP's representation of Strömberg stems from the late seventies.



Strömberg

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Strömberg PowerLine

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Switch fuses OS, OESA Overview

The switch fuse combines the many advantages of a load-break switch with the superior short circuit protection capabilities of fuses. Fuses are maintained in a stationary position ensuring long electrical and mechanical life for electrical networks in minimal space. By using switch fuses selectivity is technically assured and simple to apply. The Strömberg range of switch fuses is available in DIN and BS88 standard. Typically DIN fuses can withstand 120 kA and BS fuses 80 kA.

Fuse protection from 32 – 800 Amps, 690 volts

The Strömberg range of switch fuses are available in four major product groups.

- OESA mini 32 amp
- OS32 – 63 amps
- OESA32 – 160 amps
- OESA200 – 800 amps

By its very nature and construction a fuse link has superior short circuit protection capability with regards to higher prospective fault levels. The Strömberg PowerLine switch fuse units are designed to meet the highest requirements of present standards, which include a total safety concept. All Strömberg switch fuses are tested according to IEC 947-3 standard and are certified by the Kema Organisation. The IEC 947-3 standard has, more stringent definitions for isolation, breaking, making and safety.

Range versatility

New features within the range of Strömberg switch fuses add to the performance and ease of use for the end user.

These features include:

- Single pole to four pole versions
- Multipole mechanisms for 6/8 pole units, changeover, bypass and mechanically interlocked switch combinations.
- Auxiliary switches
- New handle designs available in plastic and metal.
- Extension shafts to 535 mm
- Various locking attachments
- Electrical interlocks

This wide selection of versatile accessories help meet the variety of customer specific safety requirements.

Reliable isolation

Strömberg PowerLine switch fuses are tested as switch disconnectors according to IEC 947. The switching mechanism has a double break contact which isolates both sides of the fuse, allowing for safe interchange of the protective device. The design of the Strömberg PowerLine switch fuses allows for reliable isolation throughout the life time of the switch fuse.



Space saving and versatility in installation with back connection terminals.



OESA Mini – Withdrawable fuses reduce installation costs and down time due to fast component replacement. Protected construction, IP 20.



OS – New generation in switch fuses. Full IP20 protection, clip on accessories. Withdrawable fuses.

KEMA
- Certified
IEC 947-3

Strömberg PowerLine

Switch fuses OS, OESA

Overview

NHP

New machine directive IEC204 (EN6024)

The range of Strömberg PowerLine switch fuses have been designed to comply with the above IEC204 directive. Part of this standard requires that the rated impulse withstand voltage (U_{imp}) exceeds 8kV. By complying with this standard it allows the switch fuses to be installed in many environmental conditions, system voltages and installation categories.

Reliable handle indication

As part of the development of the Strömberg PowerLine switch fuse, reliable handle indication reduces the risk of accidents in the case of contact welding. In the first case, the fused device will cut off the maximum current to a level which will prevent contact welding. In the event that contact welding was to occur, the mechanism is designed so as the handle will not turn to the "OFF" position, it will always return towards the "ON" position therefore maintaining the door interlock.

Safety for the user

The switch fuse can withstand high short circuit currents several times with only the low cost fuse element requiring replacement. Depending on the range, as the fuse is isolated on both sides and the door can only be opened when the switch fuse is in the "OFF" position. Additional safety is provided by the padlocking capabilities of the switch fuse. The switch fuse handle can be locked in the off position which will eliminate the possibility of closing the circuit during maintenance procedures or accidental closure of the switch fuse.

Track resistant material

All materials used in the manufacture of the PowerLine switch fuse range are of track resistant material according to IEC112. The construction of the PowerLine range is designed to withstand the high heat and humidity of the tropics as well as the extreme cold of the arctic conditions. The unit can be used in any condition between these two limits.

New pistol handle range OH_ for switch fuse and load-break switches

The new handle designs provided by Strömberg have a number of features.

- New modern design.
- All handles IP 65 protection.
- Defeatable door interlocking.
- Double insulation.
- Homogeneous range of handles for switches from 16A to 800 amps.
- Handle indication via "ON/OFF" as well as I-0.
- Colour availability is black as standard, or safety yellow/red design.
- Hanover design award achieved in 1997 awarded by the Industry Forum Design Germany.



The handle can be padlocked in OFF position with three padlocks, thus preventing door from opening, and the closing of the circuit in maintenance situations.



Reliable indication of contact position on both the handle and on the switch body.



Changing the fuse is safe as the fuse links are isolated on both sides of the fuse. The fuses and the switch fuse do not need any arc blowing space. This contributes to space saving in the design of motor starters.



The handle achieved the Industry Forum Design award at Hanover.

Strömberg PowerLine

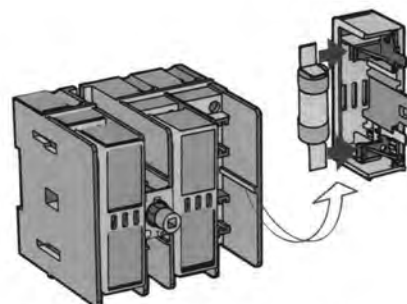
Switch fuses OS, OESA

Overview

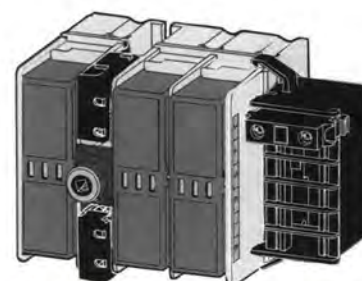
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Mini, 32A – Outstanding features in a compact design

- Totally protected IP20 construction.
- All live parts are not accessible to the human finger.
- Extra shrouding is available if required.
- Auxiliary contact test facility. The auxiliary contacts can be tested without closing the main contacts. This is ideal for commissioning and control circuit fault tracing.
- Interlocked door can be opened in the test position.
- Modern fuse holder replacement design. The fuse holders are interlocked to prevent removal when the switch is in the "ON" position.
- The OESA mini range can take type A1 or F1 BS fuses.



The fuse replacement is completely safe. Fuse can be replaced only, when the switch fuse is in the OFF position.



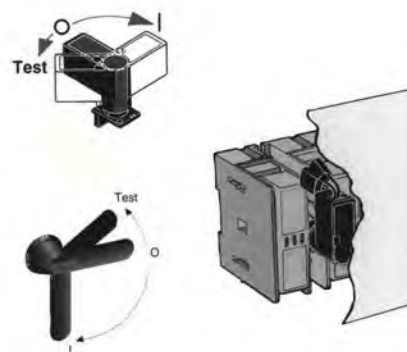
Max. eight auxiliary contacts can be fitted to the OESA mini switch fuses.

Versatile options

The compact mini is provided with DIN rail mounting facilities or base mounting. As part of the standard fuse holder design, extra terminals allow access to the fuses for testing and/or blown fuse indication are standard. The OESA mini is available in 3 and 4 pole configurations. The fourth pole can be switched or fused as required. Eight auxiliary contacts can be fitted to the OESA mini or 2 auxiliary switches can be fitted within the profile of the switch thus not increasing the overall mounting requirements.

The OESA Mini switch fuse uses the same homogenous style of handle as the rest of the Strömberg range

The pistol type handle will accommodate up to 3 padlocks, is door defeatable and has IEC standard markings on the handle.



Padlockable handles in the OFF position. Door interlock, defeatable in ON position.

Strömberg PowerLine

Switch fuses OS, OESA Overview

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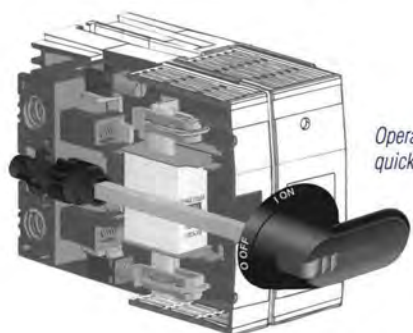
OS, 32...160 Amp – The new OS switch fuses, offer a new dimension in safety and flexibility for fused short-circuit protection

Operator safety

- Fully IP20 protected for both cable connection and fuses.
- Removable fuse holders allow for fast fuse replacement and increased operator safety.
- Fuse holders can not be removed whilst this switch is in the "ON" position.
- Operator independent quick make, quick break mechanism.
- The OS switch fuse range features an over centre operating mechanism, thus the mechanism is charged to the appropriate level and then operates independent of the rotation speed of the shaft.
- Isolation on both sides of the fuses via double switching contacts.
- Auxiliary test position operates without the main contacts being closed which is ideal for commissioning and control circuit fault finding.
- Available in BS and DIN fuse formats.

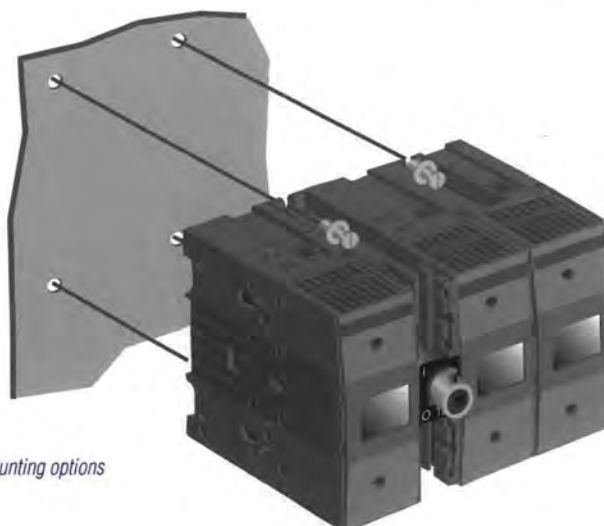
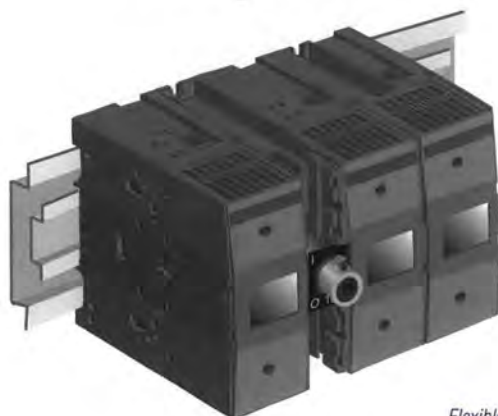
Flexible mounting options

- The OS switch fuse range may be mounted by a 35mm, 75mm DIN rail or base panel mounted.
- The fourth pole can be easily snapped on to the side of the switch fuse.
- Fully symmetrical construction enables mounting on any plane.



Operator independent quick make, quick break mechanism

Withdrawable fuse holders for safe, quick replacement of fuses, BS & DIN



Flexible mounting options

Switch fuses

Strömberg PowerLine

Switch fuses OS, OESA

Overview


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Accessories

- Simple snap on mounting auxiliary contacts allows flexibility for the installer, up to 8 normally open or normally closed single pole contacts can be used.
- Changeover contacts are available upon request.
- All auxiliary contact blocks are IP20 protected as per European standards.
- All auxiliary contacts have a positive opening feature.
- All OS switch fuses have a test function to enable control circuit commissioning and testing.



Various options

- Four pole switch fuses are available.
- IP65 handle available in black or safety red/yellow.
- Fuse links: – DIN 00 or BS88 A2, A3



OH_ pistol type handle

Technical features

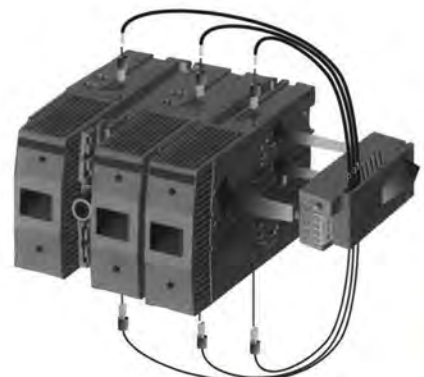
- Short circuit current up to 100 kA.
- Full motor ratings 32/63 Amp = 15/30 kW, AC23.
- Category A up to 500 volts AC.
- Rated impulse withstand voltage 12 kV.
- 20 µm meter thick silver coated contacts to give longer electrical life.



OHB4 direct mount handle

Fuse monitor OFM690

- Galvanic isolation.
- Snap on mounting.
- Operates with all fuses.
- One trip contact.
- One alarm contact plus LED.
- Compact size.
- Supplied from standard connections.
- Wide operating voltage range, 380 volts...690 volts AC.
- Phase unbalance compensated.



OFM 690 fuse monitor

Strömberg PowerLine

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Switch fuses OS, OESA Overview

OESA 32 – 160A

Strömberg range of powerline switch fuses have always been designed with safety as a primary consideration. They have double break contacts which isolate fuse links on both sides of the fuse, to increase the safety to personnel during the replacement of fuse links. The OESA range of load-break switches use the same homogenous handle design available throughout the entire Strömberg range. These handles can be locked in the "OFF" position with three padlocks, preventing the closing of the switch fuse during maintenance procedures. The fast component replacement capabilities of the switch reduce installation costs and down time. The construction is IP20 protection with the addition of shrouds. Various options include back connection terminals to save space and increase the versatility of use.

New auxiliary contacts

New auxiliary contacts are available via a snap on side mounted contact support frame. The auxiliary blocks are rated up to 690 volt AC (IEC947-5-1) and are IP20 protected without any additional shrouding.

Up to 10 auxiliary contacts may be added to the switch fuse, the general design of the OESA range will meet the many and varied needs of customers. The auxiliary contacts feature positive opening operation. A mechanical cam drives the contact block, this prevents contact welding when turning from "ON" to "OFF". Units that use a spring design can, under certain circumstances, weld "ON", thus creating a safety hazard.

Test position indication

In line with the advances in the Strömberg PowerLine design, a test position ensures easy and safe commissioning of motor control centres. The test position closes the auxiliary contact enabling control circuit commissioning and fault finding. The blocks are available in N/O, N/C and changeover (upon request).

OESA 200 – 800A

The Strömberg PowerLine switch fuse range has increased safety via snap on fuse covers and terminal shrouds. Strömberg PowerLine switch fuses are designed to meet customer needs in terms of safety, ease of installation, space saving and operational convenience. The major features of the OESA200 to 800 amp switch fuse range are:

- Compact size.
- Mechanical interlocking.
- Direct connection of aluminium cables.
- Double break contacts.
- Remote control via a motor operator.

Easy selectivity with switch fuses

Selectivity is easily achieved via the simple application of fuses. The major advantage of fuses is seen during high fault level situations allowing very low current cut off and limitation of energy (I^2t) to the fault. Switch fuses can be used in type two co-ordination for motor starters, reducing the size of contactors and thus lead to cost saving in motor starters.

Versatility

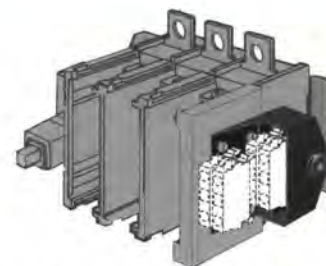
The Strömberg PowerLine switch fuse range has many different handle configurations, this allows ease of installation and versatility in different switchboards. The operating mechanisms can be placed at the end of the switch, between the poles or to the side of the switch (side operated switch fuses).

High performance ratings in compact sizes

A standard design throughout the Strömberg PowerLine switch fuse range, is the unique patented, quick make, quick break mechanism. The rotational speed of the shaft can vary depending on the operator. The quick make, quick break mechanism is designed to be a charged spring arrangement with over centre switching. All switch fuse contacts have a patented self-cleaning design to prevent the build up of arcing by-products.

The Strömberg PowerLine switch fuse range is designed to have a long electrical life and an inherent quality guarantee of reliable performance. The switch fuses have high breaking and making capacity up to 690 volts.

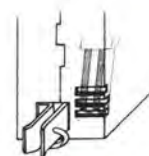
The unique, compact construction saves valuable space in motor control centres and distribution boards.



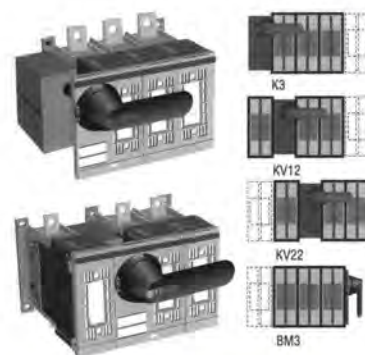
New auxiliary contacts have available contact frame and snap-on mounted single pole contact blocks.



The location of auxiliary contacts.



Visible contacts.



The placement possibilities of the operating mechanism increase ease of installation and adaptability to different switchboards.



Unique patented self-cleaning contacts on both sides of the fuse.

Strömberg Switchline

Load-break switches OT, OETL

Overview

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The Strömberg Switchline range of load-break switches are designed to meet international standards readily accepted by countries throughout the world.

Related standards

All Strömberg Switchline load-break switches comply with IEC947-1 & 3. Other related standards are IEC664, 269 & 204.

Applications

The Strömberg Switchline load-break switches are designed to perform as:

- Switch disconnectors (IEC947 and VDE660)
- Motor circuit switches (AC23 ratings up to 1000 volts)
- Main switches (VDE0113)
- Local safety switches (VDE0660, SS4280605, KY 117-79)
- Special switches (IE earthing devices)
- Busbar couplers (IE OETL 2500 K3/3)

European machine directives (IEC 204, EN 60204 compliant)

The rated impulse withstand voltage (U_{imp}) exceeds 8kV allowing practically free installation for all physical environments, system voltages and installation categories.

Environmentally friendly

All Strömberg products are designed using the latest information on environmentally friendly materials. An example of which is, cadmium, which is not used in any of the contacts, thus, heavy metal pollution in the environment is reduced. All plastics used in the design of the Strömberg Switchline range are fully recyclable.

Track resistant material

All materials used in the manufacture of the Switchline switch load-break range are of track resistant material according to IEC112. The construction of the Switchline range is designed to withstand the high heat and humidity of the tropics as well as the extreme cold of the arctic conditions. The unit can be used in any condition between these two limits.

Total operator safety

The Strömberg Switchline load-break switches can handle many electrical situations where circuit fault levels are up to 100kA. The handles used are part of the Strömberg homogenous range allowing from 45 mm to 275 mm handles to be used. All handles have the following features:

- New modern design
- Standard IP65 protection
- Defeatable door interlocking
- Double insulation
- Handle indication via "ON/OFF" as well as I-0
- Colour availability is black as standard or safety yellow/red design
- Hanover design award achieved in 1997 awarded by the Industry Forum Design of Germany.

As part of the development of the Strömberg Switchline load-break switches handle indication reduces the risk of accidents. In the event that contact welding, was to occur, the mechanism is designed so the handle will not turn to the "OFF" position. It will always return to the "ON" position, therefore, maintaining the door interlock "ON" position.

Auxiliary contacts, electrical interlocks, mechanical interlocks and various attachments for interlocking, contribute to the safe use of the Strömberg range.



Recyclable materials are used and in production process environmental aspects are considered during the production process.



Mechanical interlock



If the contacts are welded together, the handle does not deviate from ON position more than 45°

Strömberg Switchline

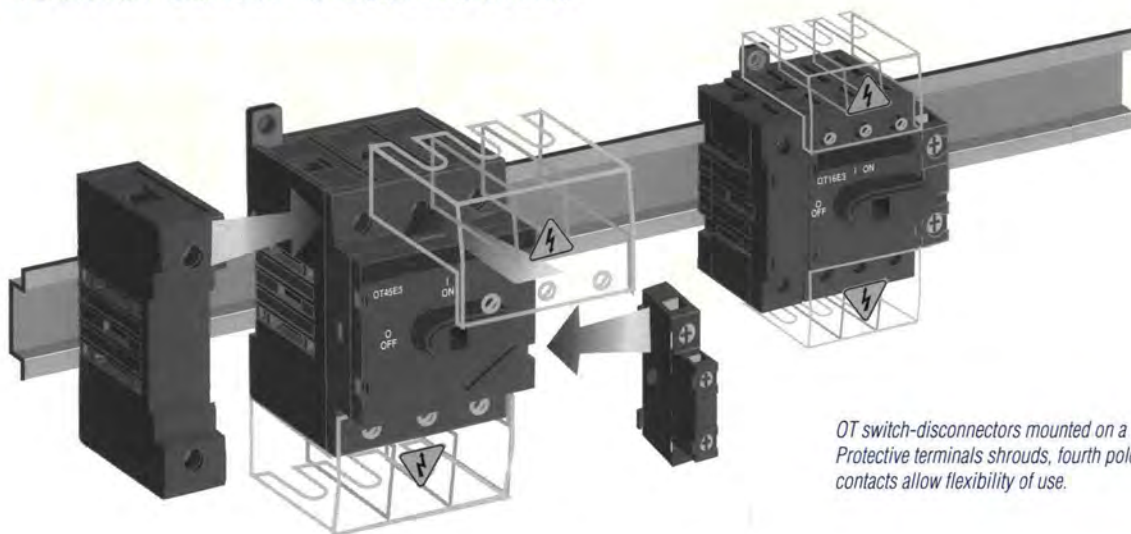
Load-break switches OT, OETL

Overview

NEW
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OT 16E...125E

New modular switch disconnectors



OT switch-disconnectors mounted on a DIN rail. Protective terminals shrouds, four pole and auxiliary contacts allow flexibility of use.

A family of four frame sizes

The OT family has the following current ratings, 16, 25, 32, 45, 63, 80, 100 and 125 amp ratings. The switches comply with the latest specifications of modern low voltage installations. One of the major features of the OT switch range is the quick make / quick break mechanism which is independent of the rotational speed of the shaft. Once the over centre position is reached, the mechanism releases, closing the main contacts giving superior making capacity.

Safe and reliable

The OT range of load-break switches has as standard a front toggle operator. These switches can be fitted with the homogenous range of Strömberg selector and pistol type handles as required. All the switches are IP20 rated, additional shrouding, if required, can be easily snapped onto the switch.



Small compact structure.



Handle can be padlocked in OFF position.



Eight current ranges in four frame sizes.

Strömberg Switchline

Load-break switches OT, OETL Overview

NHP

OT125A and 160E

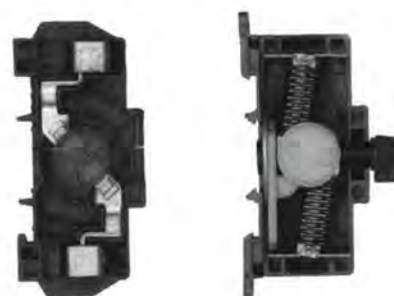
Small in size, big in performance – visual isolators

The OT 125A and 160E load-break switches comply with the latest specifications of modern low voltage installations. The load-break switches are tested according to IEC947-3-1 and 3. The switches are compact, safe and have visible double break contacts, which are self-cleaning. The handle position is the standard Strömberg design with reliable indication. They have operator independent quick make / quick break mechanisms, can be door interlocked and have fully protected clamp type terminals as standard.

The modular design of the OT125A and OT160E allow for universal fitting into various switchboards. The optional fourth pole can be quickly and easily clipped onto the 3 pole switch, allowing for design changes at the last minute. All switches are provided with shaft and handle as standard. The switch mechanism is padlockable in the "OFF" position with 3 padlocks. The OT125A and 160E can be easily mounted on 35mm DIN rail, 75mm DIN rail and base mounting.



Mounting to the door plate.



*Unique contact construction.
Protected terminals.*

*Operator-independent
quick-make / quick-break
mechanism.*

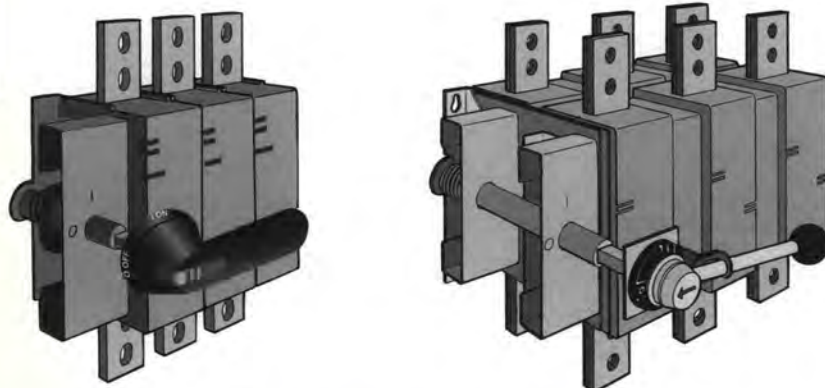
OETL 200...3150

Flexibility of the range

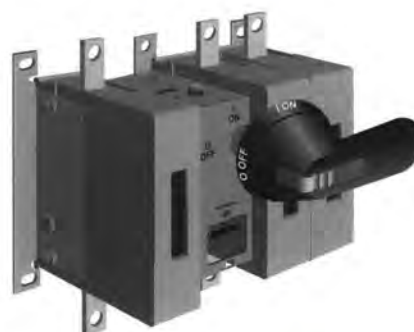
The Strömberg Switchline load-break switches are synonymous with quality and reliability. The high performance of the switches allow for many design possibilities which are adaptable to different switchboards. The switches can be ordered with the mechanism at the end, between poles or to the side of the switch. The modular design enables a variety of different applications from motor control centres to DC switching and busbar couplers. The different pole sizes and phase distances allow for flexible switchboard design. The OETL 200 to OETL 3150 Amp range of Switchline load-break switches can be fitted with changeover mechanisms, mechanical interlocks, electrical interlocks and parallel kits for special applications.



Outboard shaft type



Flexibility of construction gives many possibilities.



Inboard shaft type

Strömberg Switchline

Load-break switches OT, OETL

Overview

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Easy installation

All Strömberg Switchline load-break switches have adjustable shafts, which allow for easy installation into panels of different depths. The large load-break switches are provided with keyhole fixing brackets for easy and quick installation.

Comprehensive optional accessories allow for a variety of switch combinations which are safe and versatile. The outstanding electrical characteristics provided by the Strömberg Switchline range provide space saving and operational convenience in an extremely compact design.

Easy to adapt

Copper busbars can be a significant expense in the design and construction of any switchboard. The Strömberg Switchline load-break switches can simplify construction with various phase distances to match the busbar distance.

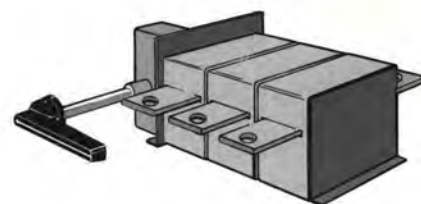
The Strömberg Switchline load-break range can be fitted with motor operators to allow remote control via SCADA systems or Automatic transfer logic panels.

Easy installation

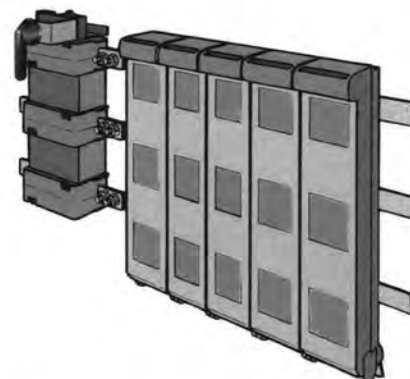
The standard construction of the OETL Strömberg Switchline range of load-break switches increase operator safety via additional terminal shrouds meeting the various demands of end-user safety requirements. Auxiliary contacts can be easily fitted to the top or side of the load-break switch. Visible contacts allow for safety maintenance procedures where visible break is required. Side operated versions of the OETL load-break switches are available up to 800 amps.



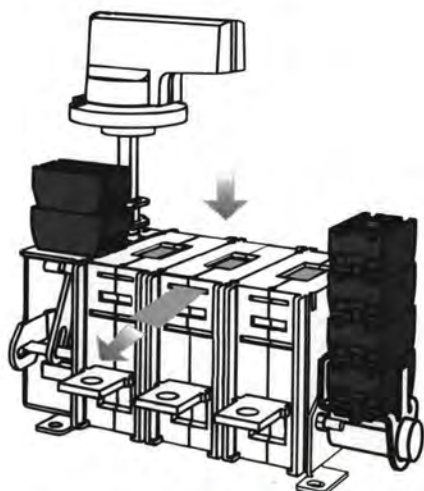
Adjustable shaft-length.



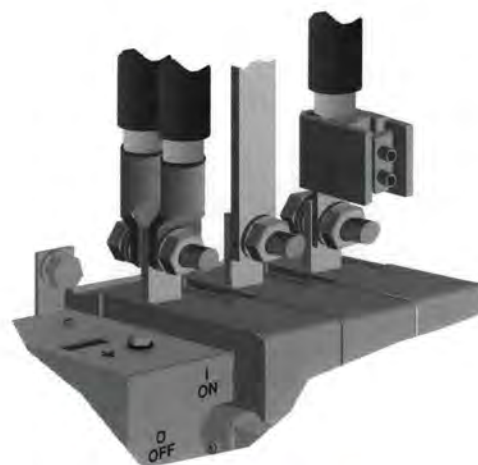
Earthing switch, mounted to a horizontal position.



Load-break switch OETL 1600 K185 can be directly mounted onto a distribution board with switch fuses or fuses bases.



Auxiliary contacts of OETL200...315 and removable windows.



Versatile connecting possibilities.

Load-break switches

Strömberg PowerLine

Switch fuses OS, OESA – IEC 947

Technical data

NHP

Technical data according to IEC 947 for OS, OESA switch-disconnector-fuses

				OESA Mini	PowerLine, OS	
Switch size				32	32	63
Rated insulation voltage	Pollution degree 3	V		1000	1000	1000
Dielectric strength	50 Hz, 1 min	kV		10	10	10
Rated impulse withstand voltage		kV		12	12	12
Rated thermal current in ambient 40 °C / max. fuse power dissipation ¹⁾	In open air	A / W		32/3.5	32/7.5	63/7.5
	In enclosure	A / W		32/3.5	32/7.5	63/7.5
...with minimum cable cross section	In enclosure with solid links	A		32	40	85
		mm ²		6	10	16
Rated operational voltage AC-20 and DC-20		V		1000	1000	1000
Rated operational current, AC 21A	up to 500V	A		32	32	63
Rated operational current, AC 22A	up to 500V	A		32	32	63
Rated operational current, AC 23A	up to 500V	A		32	32	63
Rated operational current / poles in series	48V ²⁾	A		32/2	³⁾	³⁾
DC 21A	110-220V	A		32/2	³⁾	³⁾
	440V	A		32/4	³⁾	³⁾
	500-750V	A		³⁾	³⁾	³⁾
	1000V	A		³⁾	³⁾	³⁾
Rated operational current / poles in series	48V ²⁾	A		32/2	³⁾	³⁾
DC 23A	110-220V	A		32/2	³⁾	³⁾
	440V	A		32/4	³⁾	³⁾
	500-750V	A		³⁾	³⁾	³⁾
	1000V	A		³⁾	³⁾	³⁾
Rated operational power, AC 23A ³⁾						
- The kW-ratings are accurate for 3 phase 1500 R.P.M. standard asynchronous motors						
	415V	kW		15	15	30
Rated breaking capacity in category AC 23A	up to 500V	A		256	504	504
Rated breaking capacity / poles in series	up to 220V	A		128/2	³⁾	³⁾
in category DC 23	440V	A		128/4	³⁾	³⁾
	500-750V	A		³⁾	³⁾	³⁾
	1000V	A		³⁾	³⁾	³⁾
Rated conditional short-circuit current r.m.s. and corresponding max. allowed cut-off current, peak-values	80 kA, 415V	kA		9	17	17
- The cut-off currents refer to single phase fuse tests	100 kA, 500V	kA		7.5	17	17
- Fuse selection tables on request	50 kA, 690V	kA		6	14	14
Rated short-time withstand current, 1s.	R.M.S. -value	kA		1	2.5	2.5
Rated capacitor power	400V	kvar		15	³⁾	³⁾
- The capacitor rating of the switch fuse is limited by the fuse link	415V	kvar		15	³⁾	³⁾
Power loss / pole	With rated current, without fuse	W		2	1	4
Mechanical endurance	Divide by two for operation cycles	Oper.		20000	20000	20000
Fuse types, IEC 269-2	DIN 43620			-	00	00
	BS 88			A1	A2-A3	A2-A3
-size/distance of fuse link bolts-		mm		M4/44.5	M5/73	M5/73
Weight without accessories	3-pole switch fuses	kg		0.7	1.3	1.3
	4-pole switch fuses	kg		0.9	1.6	1.6
Built-in terminal size		mm ²		0.5...10	2.5...25	2.5...25
Terminal bolt size	Metric thread diameter x length	mm ²				
Terminal tightening torque	Counter torque required	Nm		2	3.5	3.5
Fuse-links bolts tightening torque		Nm		2	3.5	3.5
Operating torque	Typical for 3-pole switch fuses	Nm		3	4	4

Notes: ¹⁾ Ambient temperature 60 °C: derating 20%. Mounting on "ceiling": derating 10%. Mounting on wall, horizontal fuses: derating 8%.

²⁾ Utilisation category B.

³⁾ Some fuse links limit these figures further. Starting current characteristics must be considered separately.

⁴⁾ OESA Mini, use 4-pole switches with 2 + 2 parallel contacts in series.

⁵⁾ Care should be taken in the selection of switches for motor applications. In many cases the motor switching capability exceeds that of the maximum size of fuse that the switch can carry. In these cases it is wise to choose the fuse first (perhaps a motor start type) and then choose a suitable switch that can physically carry that fuse.

⁶⁾ Available upon request.

Strömberg PowerLine

Switch fuses OS, OESA – IEC 947

Technical data

NHP

OESA				PowerLine, OESA					
32	63	100	160	200	250	315	400	630	800
750 8 12	750 8 12	750 8 12	750 8 12	1 000 10 12	1 000 10 12	1 000 10 12	1 000 10 12	1 000 10 12	1 000 10 12
32/7.5 32/7.5 40 6	63/7.5 63/7.5 75 16	125/12 125/12 125 50	160/12 135/9 160 50	200/22 200/22 280 95	250/32 250/23, 230/27 315 120	315/32 315/32 400 185	400/45 400/34, 360/37 450 240	630/60 600/45, 570/50 700 2x185	800/65 720/55 900 2x240
750 32 32 32	750 63 63 63	750 125 125 100	750 160 160 100	1000 200 200 200	1000 250 250 250	1000 315 315 315	1000 400 400 400	1000 630 630 630	1000 800 800 720
32/3 32/4	63/3 63/4	125/3 125/4 ^{a)}	160/3 160/4 ^{b)}	200/2 200/2 200/2 200/3 200/4	250/2 250/2 250/2 250/3 250/4	315/2 315/2 315/2 315/3 315/4	400/2 400/2 400/2 400/3 400/4	630/2 630/2 630/2 630/3 630/4	800/2 800/2 800/2 800/3 800/4
32/3	63/3	125/3 100/4 ^{b)}	160/3 100/4 ^{b)}	200/2 200/2 200/2 200/3	250/2 250/2 250/2 250/3	315/2 315/2 315/2 315/3	400/2 400/2 400/2 400/3	630/2 630/2 630/2 630/3 630/4	800/2 800/2 800/2 800/3 800/4
15	30	55	55	110	140	180	230	340	380
256	504	800	800	2000	2000	3200	3200	5760	5760
128/3	256/3	640/3 400/4	640/3 400/4	1000/2 1000/2 1000/3	1000/2 1000/2 1000/3	1600/2 1600/2 1600/3	1600/2 1600/2 1600/3	3200/2 3200/2 3200/3 3200/4	3200/2 3200/2 3200/3 3200/4
10 6	12 9 8	23 17 14	23 17 14	40 40 35	40 40 35	40 40 35	40 40 35	75 75 60	75 75 60
1.5	2	5	5	8	8	10	10	16	16
15 16	30 32	50 55	57 62	90 100	105 115	145 160	180 200	250 270	310 340
0.7	4	5	9	5	11	13	30	55	77
20000	20000	20000	20000	16000	16000	16000	16000	10000	10000
00 A2-A3 M5/73	00 A2-A3 M5/73	00 A2-A4 M5/73, M8/94	00 B1-B2 M8/111	B1-B2 M8/111	1 B1-B2 M8/111	B1-B3 M8/111	2 B1-B4 M8/111	3 C1-C2 M10/133, 184	3 C1-C3 M10/133, 184
1.6 1.9	1.6 1.9	1.8 2.3	1.8 2.3	6.9 7.9	6.9 7.9	7.3 8.3	7.8 8.8	15.5 19.0	17.0 21.0
2.5...25	2.5...25	M8x25	M8x25	M10x40	M10x40	M10x40	M10x40	M12x40	M12x40
5 3.5 3	5 3.5 3	15...22 M5:3.5 / M8:10 5	15...22 10 5	30...44 15 22	30...44 15 22	30...44 15 22	30...44 15 22	50...75 40 28	50...75 40 28

Switch fuses

Strömberg Switchline

NHP

Load-break switches / switch-disconnectors OT, OETL – IEC 947

Technical data

			OT									
Switch size			16E	25E	32E	45E	63E	80E	100E	125E	125A	160E
Rated insulation voltage and operational voltage, AC 20 and DC 20	V		750	750	750	750	750	750	750	750	750	750
Rated impulse withstand voltage	kV		8	8	8	8	8	8	8	8	12	12
Rated thermal current I_{th} open	A		25	32	40	50	63	80	115	125	135	200
AC 20 and DC 20 40°C enclosed	A		25	32	40	50	63	80	115	125	135	160
60°C enclosed	A		25	32	40	50	63	80	115	125	125	160
Rated operational currents												
AC 21A $\leq 500V$	A		16	25	32	45	63	80	100	125	125	200 ¹⁾
1000V ²⁾	A											
AC 22A $\leq 500V$	A		16	25	32	45	63	80	100	125	125	200 ¹⁾
1000V ²⁾	A											
AC 23A $\leq 415V$	A		16	20	23	30	38	55	80	90	105	135
1000V ²⁾	A											
Rated operational currents/poles in series												
DC 21A 48V	A		16/1	25/1	32/1	45/1	63/1	80/1	100/1	125/1	125/1	160/1
110V	A		16/2	25/2	32/2	45/2	63/2	80/2	100/2	125/2	125/1	160/1
220V	A		16/3	25/3	32/3	45/4	63/4	80/4	100/4	125/4	125/2	160/2
440V	A										125/3	160/3
750V	A										125/4	160/4
Rated operational currents/poles in series												
DC 23A 48V	A		16/1	25/1	32/1	45/1	63/1	80/1	100/1	125/1	125/1	160/1
110V	A		16/2	25/2	32/2	45/2	63/2	80/2	100/2	125/2	125/1	160/1
220V	A		16/4	25/4	32/4	45/4	45/4	45/4	63/4	63/4	125/2	160/2
440V	A										125/3	160/3
Rated operational power												
AC 23 240V	kW		3	4	5.5	7.5	11	18.5	22	22	30	45
400/415V	kW		7.5	9	11	15	18.5	30	37	45	55	75
The kW-ratings are accurate for three-phase 1500 r.p.m. standard asynchronous motors.												
500V	kW		7.5	9	11	15	18.5	18.5	37	45	55	75
690V	kW		7.5	9	11	15	15	15	37	45	55	75
Short-circuit current with back-up fuses of size ³⁾ :												
kA			50	50	50	50	50	50	50	50	50	50
A			25	32	40	50	63	80	100	125	250	200
Rated voltage	U _e	V/V	415	415	415	415	415	415	415	415	415/690	415/690
Rated conditional short-circuit current		kA/kA	50	50	50	50	50	50	50	50	80/50	80/50
Max. allowed fuse size		A/A	25	32	40	50	63	80	100	125	160/250	160/250
Max. allowed cut-off current, peak value		kA/kA	6.5	6.5	6.5	8.3	8.5	11	18	18	21.9/21.6	21.9/21.6
Rated short-circuit making capacity, prospective peak value. I_{cm} 690V/500V		kA	0.705	0.705	0.705	1.4	1.4	2.1	3.6	3.6	12	12
Rated short time withstand current, r.m.s I_{cw} ⁴⁾												
0.2s	kA										7	7
1.0s	kA		0.5	0.5	0.5	1	1	1.5	2.5	2.5	4	4
AC breaking capacity												
AC 23 $\leq 415V$	A		128	160	184	240	304	440	640	720	840	1080
500V	A		128	160	184	240	256	256	480	560	720	1000
690V	A		80	88	96	160	160	160	320	400	400	640
Capacitor ratings	400/415V	kvar										
Rated capacitor duty	I_c	A										
Electrical endurance at rated operational current, pf 0.65	operational cycles		3000	3000	3000	3000	3000	3000	3000	3000	1000	1000
Mechanical endurance	operations		20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
Power loss per one pole	W		0.3	0.6	1.0	1.4	2.8	6.4	4	6.3	4.7	6.5
Operating torque	Nm		1	1	1	1.2	1.2	1.2	2	2	6.0	6.0
Weight												
3 pole	kg		0.11	0.11	0.11	0.27	0.27	0.31	0.36	0.36	1.1	1.1
4 pole	kg		0.15	0.15	0.15	0.35	0.35	0.45	0.5	0.5	1.3	1.3
Suitable conductor cross section Cu	mm ²		0.75...10	0.75...10	0.75...10	1.5...25	1.5...25	1.5...50 ²⁾	10...70	10...70	10...70	10...70
Bolt size												

Notes: ¹⁾ At 380...415V when provided with busbar connections OEZX6

²⁾ Minimum stranded 2.5mm

³⁾ Pf 0.95

⁴⁾ IEC 947-3, utilisation category B, infrequent operation.



Figure 1

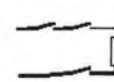


Figure 2

Strömberg Switchline**NHP****Load-break switches / switch-disconnectors OT, OETL – IEC 947**
Technical data

	OETL											
	200	250	315	400	630	800	1000	1250	1600	2500	3150	
	1000 12	1000 12	1000 12	1000 12	1000 12	1000 12	1000 8	1000 8	1000 8	1000 8	1000 8	
	250 200 175	315 270 220	350 315 260	500 500 410	630 630 500	800 720 600	1000 1000 900	1250 1250 1000	1600 1600 1250	2500 2300 1950	3150 2600 2300	
	200 200	250 250	315 315	500 400	630 630	800 630	1000	1250	1600	2500 ⁴⁾	3150 ⁴⁾	
	200 200	250 250	315 250	500 400	630 400	800 400	1000	1250	1600	1600 ⁴⁾	1600 ⁴⁾	
	200 125	250 125	315 125	500 200	630 200	720 200	800	800	800	800 ⁴⁾	800 ⁴⁾	
	200/2 200/2 200/2 200/3 200/4	250/2 250/2 250/2 250/3 250/4	315/2 315/2 315/2 315/3 315/4									
	200/2 200/2 200/2 200/3 200/4	250/2 250/2 250/2 250/3 250/4	315/2 315/2 315/2 315/3 315/4									
	55 110 132 170	75 132 160 200	90 160 200 250	132 200 315 315	180 315 355 355	200 355 400 355	250 400 450	250 400 450	250 400 450	250 400 450	250 400 450	
	100 400	100 400	100 400	100 50 500 630	50 800	80 800	50	50	50	50	50	
	500/690 100/50 400 30	500/690 100/50 400 30	500/690 100/50 400 30	500/690 100/50 500 33	500/690 100/50 800 ⁷⁾ 62	500/690 100/50 800 ⁷⁾ 62	690 45	690 45	690 45	690 50	690 50	
	35	35	35	65	80	80	105	105	105	105/140	105/140	
	17.5 8	17.5 8	17.5 8	35 17	38 17	38 17	100 80	100 80	100 80	110 80	110 80	
	1600 1600 1600	2000 2000 2000	2520 2520 2520	4800 4000 2800	5040 4640 2800	5780 4800 2800	6400 6400 2500 ³⁾	6400 6400 2500 ³⁾	6400 6400 2500 ³⁾	6400 6400 4800 ⁵⁾	6400 6400 4800 ⁵⁾	
	90 135	110 170	140 210	250 400	300 450	330 500						
	1000 16000	1000 16000	1000 16000	1000 10000	1000 10000	500 10000	500 6000	500 6000	500 6000	100 ⁴⁾ 1200	100 ⁴⁾ 1200	
	3.0 3.7	3.0 3.7	3.0 3.7	5.2 6.4	6.2 7.6	6.2 7.6	16.3 20.5	16.3 20.5	17.5 22.5	37 47	37 47	
	3.5 8.2	5.5 8.2	8.5 8.2	13 17	22 21	40 21	27 21	40 21	67 21	90 50	140 50	
	8x25	10x30	10x30	10x40	12x40	12x40	12x60	12x60	12x60	12x60	12x60	

Load-break switches

³⁾ PF 0.65
⁴⁾ IEC 408
⁷⁾ Size 4

Standards
 IEC 947 / 1, 3, IEC 408, BS 5419, VDE 0660
 VDE 0113, UL 508, UL 98, SS 4280605
 CSA C22.2 No. 4 and 14
 KY 119-79, Det Norske Veritas
 Bureau Veritas

Approvals
 ASTA
 SEMKO
 KEMA
 Det Norske Veritas
 Bureau Veritas
 NEMKO
 DEMKO

Finnish Electrical Inspectorate
 Underwriters Laboratories (UL)
 Polish Register of Shipping
 Lloyd's Register of Shipping
 Register of Shipping of the USSR
 Canadian Standards Association (CSA)

Detailed information
 on request.

Strömberg PowerLine

Switch fuses OS, OESA – 32...160A

Ordering information

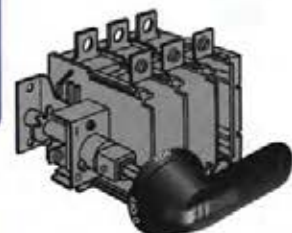
NHP



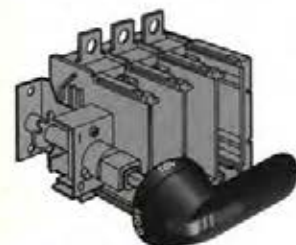
OESA P3 A1 mini



OS 32...63_12 (BS & DIN pattern)



OESA 100 G1 (BS pattern)



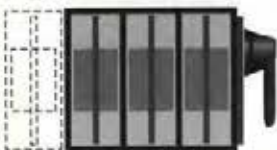
OESA 00-160 (DIN pattern)



Outboard shaft, OESA B3, B4 & D3, D4



Inboard shaft, OESA BV12, BV22 & DV12, DV22



OESA side operated type, see page 19.

BS-pattern 32...160

OESA 32 mini switches include black IP65 handle (OHB65J5) with I-O/On-Off indication and shaft (OXP5X150) length 150mm, mounting depth H=245...325mm. Protected tunnel terminals IP20.

OS 32 and 63 switches includes black IP65 handle (OHB65J6) with I-O/On-Off indication and a shaft (OXP6X150) length 150mm, mounting depth H=141...260mm. Protected tunnel terminals IP20.

OESA 32 and 63 switches have protected tunnel terminals IP 20

black IP 65 handle (OHB65J6) with I-O/On-Off indication and shaft (OXP6X120) length 210 mm, mounting depth H=200...280.

OESA 100 and 160 switches include terminal bolt kit, black IP 65 handle (OHB80J6) with I-O/On-Off indication and shaft (OXP6X210) length 210 mm, mounting depth H=200...280.

Optional handles and shafts – Refer page 26 to 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 43 to 47.

Cat. No.	Number of poles	Rated operational voltage AC 23 [V]	I _h (open) [A]	Rated operational current / rated operational power in category AC 23A, IEC 947 415V [A/kW]	Weight with package [kg]	Fuse type [BS]
OESA 32 P3 A1-H mini	3	690	32	32/15	0.7	A1
OESA 32 P4 A1-H mini	4				0.9	
OESA 32 P3 F1-H mini	3				0.7	NNS
OS 32 B12	3	690	32	32/15	1.3	A2, A3
OS 32 B22 ¹⁾	4				1.6	
OESA 32 G1	3	690	32	32/15	1.6	A2
OESA 32 G4	4 ¹⁾				1.9	
OESA 32 GV22	4				1.9	
OS 63 B12	3	690	63	63/30	1.3	A2, A3
OS 63 B22 ¹⁾	4	690	63		1.6	
OESA 63 G1	3	690	63	63/30	1.6	A2, A3
OESA 63 G4	4 ¹⁾				1.9	
OESA 63 GV31	4				1.9	
OESA 100 G1	3	690	125	100/55	2.2	A2, A3, A4
OESA 100 G4	4 ¹⁾				2.8	
OESA 100 GV31	4				2.8	
OESA 160 B3	3	690	160	100/55	2.2	B1, B2
OESA 160 B4	4 ¹⁾				2.8	

DIN-pattern 32...160

OS 32 and 63 switches includes black IP65 handle (OHB65J6) with I-O/On-Off indication and a shaft (OXP5X150) length 150mm, mounting depth H=141...260mm. Protected tunnel terminals IP20.

OESA 63 switches have protected tunnel terminals, black IP65 (OHB65J6) handle with I-O/On-Off indication and shaft (OXP6X150) 13, length 150 mm, mounting depth H = 140...220.

OESA 125 and 160 switches include terminal bolt kit, black IP65 handle (OHB80J6) with I-O/On-Off indication and shaft (OXP6X150) length 150 mm, mounting depth H = 145...220.

Optional handles and shafts – Refer page 26 to 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 43 to 47.

Cat. No.	Number of poles	Rated operational voltage AC 23 [V]	I _{th} (open) [A]	Rated operational current / rated operational power in category AC 23A, IEC 947 415V [A/kW]	Weight with package [kg]	Fuse type [DIN]
OS 32 D12	3	690	32	32/15	1.3	00
OS 32 D22 ¹⁾	4				1.6	
OS 63 D12	3	690	63	63/30	1.3	00
OS 63 D22 ¹⁾	4				1.6	
OESA 00-63	3	690	63	63/30	1.6	00
OESA 00-63 A4	4-switched neutral				1.9	
OESA 00-125	3	690	125	100/55	2.2	00
OESA 00 125 A4	4-switched neutral				2.8	
OESA 00-160	3	690	160	100/55	2.2	00

Fourth poles – to suit OS switch fuses

Snap on mounting to left side of switch

Cat. No.	Remarks
OS P4N ¹⁾	Switched fourth pole suitable for OS 32...63 3 pole BS and DIN types
OS P4B	Fused fourth pole suitable for OS 32...63 3 pole BS type only
OS P4D	Fused fourth pole suitable for OS 32...63 3 pole DIN type only

Notes: ¹⁾ Utilisation category B

²⁾ The fourth pole in OESA 32...160 is provided with a solid link, which can be replaced by a fuse link.

Inboard shafts for DIN switch fuses available on indent.

³⁾ The fourth pole in OS32...63 is provided with a solid link. Fusible fourth poles available on indent basis.

⁴⁾ Available on indent only.

Strömberg PowerLine

Switch fuses OESA – 200...800A

Ordering information

NHP


OESA 200...800 B3 (BS pattern)



OESA 200...800 BV12 (BS pattern)



OESA 250...800 DV12 (DIN pattern)



Outboard shaft, OESA B3, B4 & D3, D4



Inboard shaft, OESA BV12, BV22 & DV12, DV22



Side operated types, see page 19.

BS-pattern 200...800

OESA 200...400 include terminal bolt kit, IP20 fuse cover, black IP 65 handle (OHB125J12) with I-O/On-Off indication and shaft (OXP12X250), length 250 mm, mounting depth H=250...340.

OESA 630...800 include terminal bolt kit, IP20 fuse cover, black IP65 handle (OHB145J12) with I-O/On-Off indication and shaft (OXP12X250), length 250 mm, mounting depth H=255...325.

Optional handles and shafts – Refer page 26 to 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 48 to 49.

Fuse covers – Refer page 24.

Cat. No.	Number of poles	Rated operational voltage AC 23 [V]	I_{th} (open) [A]	Rated operational current / rated operational power in category AC 23A, IEC 947 415 V [A/kW]	Weight with package [kg]	NHP Fuse type [BS]
OESA 200 B3	3	690	200	200 / 110	7.1	B1, B2
OESA 200 B4	4 ¹⁾				8.2	
OESA 200 BV12	3				7.1	
¹⁾ OESA 200 BV22	4 ¹⁾				8.2	
OESA 250 B3	3	690	250	250 / 140	7.1	B1, B2, B3
¹⁾ OESA 250 B4	4 ¹⁾				8.2	
OESA 250 BV12	3				7.1	
OESA 250 BV22	4 ¹⁾				8.2	
OESA 315 B3	3	690	315	315 / 185	7.9	B1, B2, B3
OESA 315 B4	4 ¹⁾				8.9	
OESA 315 BV12	3				7.9	
¹⁾ OESA 315 BV22	4 ¹⁾				8.9	
OESA 400 B3	3	690	400	400 / 230	8.3	B1, B2, B3, B4
OESA 400 B4	4 ¹⁾				9.4	
OESA 400 BV12	3				8.3	
OESA 400 BV22	4 ¹⁾				9.4	
OESA 630 B3	3	690	630	630 / 340	16.0	C1, C2
¹⁾ OESA 630 B4	4 ¹⁾				21.0	
OESA 630 BV12	3				16.0	
¹⁾ OESA 630 BV22	4 ¹⁾				21.0	
OESA 800 B3	3	690	800	800 / 380	18.0	C1, C2, C3
¹⁾ OESA 800 B4	4 ¹⁾				24.0	
OESA 800 BV12	3				18.0	
¹⁾ OESA 800 BV22	4 ¹⁾				24.0	

DIN-pattern 250...800

OESA 250...400 include terminal bolt kit, black IP 65 (OHB125J12) handle with I-O/On-Off indication and shaft (OXP12X250) length 250 mm, mounting depth H=250...340.

OESA 630...800 include terminal bolt kit, black IP 65 (OHB145J12) handle with I-O/On-Off indication and shaft (OXP12X250) length 250 mm, mounting depth H=255...325.

Optional handles and shafts – Refer page 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 48 to 49.

Fuse covers (not included with Din models)

Cat. No.	Number of poles	Rated operational voltage AC 23 [V]	I_{th} (open) [A]	Rated operational current / rated operational power in category AC 23A, IEC 947 415V [A/kW]	Weight with package [kg]	Fuse type [DIN]
OESA 250 D3	3	690	250	250 / 150	7.3	1
¹⁾ OESA 250 D4	4 ¹⁾				8.2	
¹⁾ OESA 250 DV12	3				7.3	
¹⁾ OESA 250 DV22	4 ¹⁾				8.2	
OESA 400 D3	3	690	400	400 / 230	8.3	2
¹⁾ OESA 400 D4	4 ¹⁾				9.4	
¹⁾ OESA 400 DV12	3				8.3	
¹⁾ OESA 400 DV22	4 ¹⁾				9.4	
OESA 630 D3	3	690	630	630 / 340	16.0	3
¹⁾ OESA 630 D4	4 ¹⁾				21.0	
¹⁾ OESA 630 DV12	3				16.0	
¹⁾ OESA 630 DV22	4 ¹⁾				21.0	
OESA 800 D3	3	690	800	800 / 380	18.0	3
¹⁾ OESA 800 D4	4 ¹⁾				24.0	
¹⁾ OESA 800 DV12	3				18.0	
¹⁾ OESA 800 DV22	4 ¹⁾				24.0	

Notes: ¹⁾ The fourth pole is provided with a solid link which can be replaced by a fuse link if required.

¹⁾ Available on indent only

Strömberg PowerLine

Back connect terminals – Switch fuses OESA 32...800A

Ordering information

NHP
**Special
version
switches**


Outboard shaft
OESA 63 G1 BB



Outboard shaft
OESA 200...800 D3 BB



Inboard shaft
OESA 200...800 DV12 BB



Please, complete the type number
with code: BD
Back connection on upper terminals.



Please, complete the type number with
code: BB
Back connection terminals on both sides
of the switch.



Please, complete the type number with
code: UB
Back connection on lower terminals.

Back connect, BS-pattern 32...160

OESA 32 and 63 switches the normal terminals are protected tunnel terminals, the back connection terminals (cable size 6...35 mm²) include bolt kit. Switches include black IP65 handle (OHB65J6) with I-O/ON-OFF indication and shaft (OXP6X210) length 210mm.
OESA 100 and 160 switches include terminal bolt kit, black IP65 handle (OHB60J6) with I-O/ON-OFF indication and shaft (OXP6X210) length 210mm.

Optional handles and shafts – Refer page 26 to 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 53 to 55.

Fuse covers (not included with 32...160 amp switches – page 24.

Cat. No.	Number of poles	Rated operational voltage AC 23 (V)	I _{th} (open) (A)	Rated operational current / rated operational power in category 415 V, AC 23A, IEC 947 [A/kW]	Weight (kg)	Fuse type (BS)
OESA 32 G1 BB	3	500	32	32/15	1.7	A2
OESA 32 G1 UB					1.6	
OESA 32 G4 BD	4	500	32	32/15	1.9	
OESA 32 G4 BB					2.0	
OESA 32 G4 UB					1.9	
OESA 63 G1 BD	3	690	63	63/30	1.6	A2, A3
OESA 63 G1 BB					1.7	
OESA 63 G1 UB					1.6	
OESA 63 G4 BD	4	690	63	63/30	1.9	
OESA 63 G4 BB					2.0	
OESA 63 G4 UB					1.9	
OESA 100 G1 BD	3	690	125	100/55	2.2	A2, A3, A4
OESA 100 G1 BB					2.3	
OESA 100 G1 UB					2.2	
OESA 100 G4 BD	4	690	125	100/55	2.8	
OESA 100 G4 BB					2.9	
OESA 100 G4 UB					2.8	
OESA 160 B3 BD	3	690	160	100/55	2.2	B1, B2
OESA 160 B3 BB					2.3	
OESA 160 B3 UB					2.2	
OESA 160 B4 BD	4	690	160	100/55	2.8	
OESA 160 B4 BB					2.9	
OESA 160 B4 UB					2.8	

Back connect, BS-pattern 200...800

OESA 200...400 switches include terminal bolt kit, IP20 fuse cover, black IP 65 handle (OHB125J12) with I-O/ON-OFF indication and shaft (OXP12X250) length 250mm.

OESA 630...800 switches include terminal bolt kit, IP20 fuse cover, black IP65 handle (OHB145J12) with I-O/ON-OFF indication and shaft (OXP12X250), length 250mm.

Optional handles and shafts – Refer page 27.

Auxiliaries – Refer page 22.

Fuse selection – Refer page 21.

Dimensional diagrams – Refer page 48 to 49.

Cat. No. Complete the Cat. No. with code BD, BB or UB depending of direction of the terminal	Number of poles	Rated operational voltage AC 23 (V)	I _{th} (open) (A)	Rated operational current / rated operational power in category AC 23A, IEC 947 415V [A/kW]	Weight with package (kg)	Fuse type (BS)
OESA 200 B3_	3	690	200	200 / 110	7.1	B1, B2
OESA 200 B4_	4				8.2	
OESA 200 BV12_	3				7.1	
OESA 200 BV22_	4				8.2	
OESA 315 B3_	3	690	315	315 / 100	7.9	B1, B2, B3
OESA 315 B4_	4				8.9	
OESA 315 BV12_	3				7.9	
OESA 315 BV22_	4				8.9	
OESA 400 B3_	3	690	400	400 / 230	8.3	B1, B2, B3, B4
OESA 400 B4_	4				9.4	
OESA 400 BV12_	3				8.3	
OESA 400 BV22_	4				9.4	
OESA 630 B3_	3	690	630	630 / 340	16.0	C1, C2
OESA 630 B4_	4				21.0	
OESA 630 BV12_	3				16.0	
OESA 630 BV22_	4				21.0	
OESA 800 B3_	3	690	800	800 / 380	18.0	C1, C2, C3
OESA 800 B4_	4				24.0	
OESA 800 BV12_	3				18.0	
OESA 800 BV22_	4				24.0	

Notes: DIN versions are also available on indent.

☐ Available on indent only.

Strömberg PowerLine

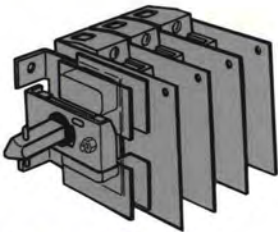
Side operated switch fuses, BS-pattern 32...400A
Ordering information



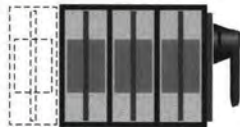
NHP



OESA 32...63 BS12



OESA 32, 63 BM3



Side operated types,
OESA_BM3, BM4
OESA_DM3, DM4

Side operated switch fuses, BS-pattern 32...400

OS 32...63 switches have protected tunnel terminals IP20, black handle (OHB65J6E001S).
OESA 32 and 63 switches have protected tunnel terminals, 2 changeover aux. contacts and handle (OHB80J6E001S).
OESA 200 and 400 switches include terminal bolt kit, fuse cover. Handle kit has to be ordered separately. See page 26.

Optional handles – Refer page 26.
Auxiliaries – Refer page 22.
Fuse selection – Refer page 21.
Dimensional diagrams – Refer page 51 to 52.

<div><div></div><div>Cat. No.</div></div>	Number of poles	Rated operational voltage [V]	I_{th} (open) [A]	Rated operational current / rated operational power in category 415V AC 23/IEC 947 [A/kW]	Weight with package [kg]
OS 32 BS12	3	690	32	32/15	1.6
OS 32 BS22	4				1.9
OESA 32 BM3	3	500	32	32/15	1.5
OESA 32 BM4	4				1.8
OS 63 BS12	3	690	63	63/30	1.6
OS 63 BS22	4				1.9
OESA 63 BM3	3	690	63	63/30	1.5
OESA 63 BM4	4				1.8
OESA 200 BM3	3	690	200	200 / 110	7.2
OESA 200 BM4	4				8.3
OESA 315 BM3	3	690	315	315 / 180	8.0
OESA 315 BM4	4				9.0
OESA 400 BM3	3	690	400	400 / 230	8.4
OESA 400 BM4	4				9.5

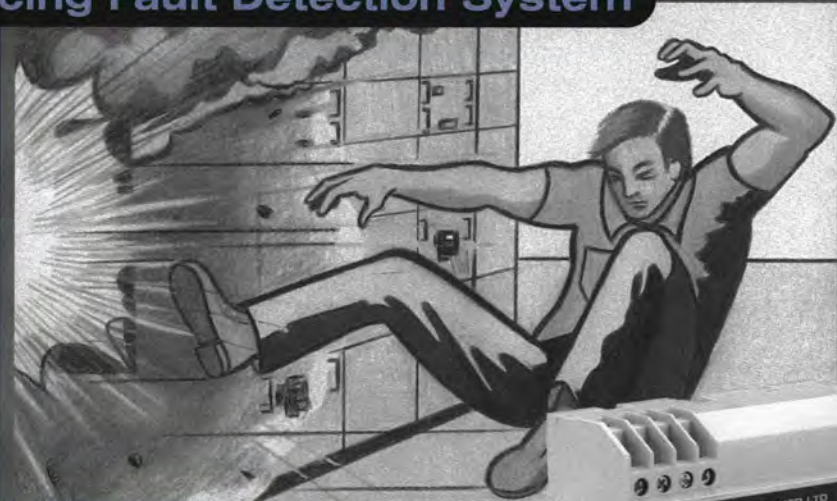
Note:

Available on indent only.

Switch fuses

Arc D-Tect

Arcing Fault Detection System



DETECTS:

DANGEROUS ARCING FAULTS

LIMITS:

COSTLY DOWNTIME & REPAIRS

Strömberg PowerLine

NHP

Enclosed switches – steel & plastic – Switch fuses OS, OESA Ordering information



OS 323 SE



OESA 3153 SE



OS 633 SEP



OESA 1603 SEP

Combining the outstanding features of the 'Eldon' and 'Fibox' series enclosure range with the reliable Strömberg range of switch fuses, enables NHP to offer totally enclosed switches for separate surface mounting.

Midline (fully assembled) Steel – OS 32...63, OESA 100...800

All enclosed switch fuses have a high strength plastic reinforced OH pistol type handle complete with padlock facility, door interlock (defeatable).

Standard features:

- Fully assembled
- Mounting plate
- Removable gland plate top and bottom

- Neutral link
- IP 55 degree of protection
- Options available include: (Contact NHP)
- 4 pole versions
- Auxiliary contacts
- IP65 versions

Switch size [A]	Enclosed thermal current Ith _g [A]	Rated power 415V AC 23 °) [kW]	No. poles	Steel enclosure No.	Dimensions (mm) ¹⁾			Switch type	Cat. No
					Height	Width	Depth		
32A	32A	15kW	3	AM0303020	300	300	200	OS 32 B12	OS 323SE
63A	63A	30kW	3	AM0303020	300	300	200	OS 63 B12	OS 633SE
100A	100A	55kW	3	AM0303020	300	300	200	OESA 100 G1	OESA 1003SE
160A	135A	55kW	3	AM0504020	400	300	200	OESA 160 B3	OESA 1603SE
200A	200A	110kW	3	AM0604026	600	400	250	OESA 200 B3	OESA 2003SE
250A	250A	140kW	3	AM0604026	600	400	250	OESA 250 B3	OESA 2503SE
315A	315A	180kW	3	AM0705026	700	500	250	OESA 315 B3	OESA 3153SE
400A	400A	230kW	3	AM0705026	700	500	250	OESA 400 B3	OESA 4003SE
630A	600A	340kW	3	AM0806032	800	600	300	OESA 630 B3	OESA 6303SE
800A	720A	380kW	3	AM0806032	800	600	300	OESA 800 B3	OESA 8003SE

Midline (fully assembled) Polycarbonate – OS 32...63, OESA 100...160

All enclosed switch fuses have a high strength plastic reinforced OH pistol type handle complete with padlock facility, door interlock (defeatable).

Standard features:

- High impact polycarbonate enclosures
- IP 65 degree of protection

- Non-corrosive enclosure
- Neutral link provided
- Options available include (contact NHP):
- 4 pole versions
- Auxiliary contacts

Switch size [A]	Enclosed thermal current Ith _g [A]	Rated power 415V AC 23 °) [kW]	No. poles	Polycarbonate enclosure No.	Dimensions (mm) ¹⁾			Switch type	Cat. No
					Height	Width	Depth		
32	32	15kW	3	PCR282818G	280	280	180	OS 32 B12	OS 323 SEP
32	32	15kW	3	PCR282818G	280	280	180	OESA 32 G1	OESA 323 SEP
63	63	30kW	3	PCR282818G	280	280	180	OS 63 B12	OS 633 SEP
63	63	30kW	3	PCR282818G	280	280	180	OESA 63 G1	OESA 633 SEP
125	125	55kW	3	PCR382818G	380	280	180	OESA 100 G1	OESA 1003 SEP
160	135	55kW	3	PCR382818G	380	280	180	OESA 160 B3	OESA 1603 SEP

Notes: ¹⁾ External dimensions do not include handles and locks.
²⁾ Actual rated power may be limited to the maximum starting current of the chosen fuse.

Strömberg PowerLine

NHP

Fuse selection, fuse monitor – Switch fuses OS, OESA Accessories

Fuse selection – cross reference guide for Switch Fuses Fuse manufacturers part numbers – Australian/British standard

Switch fuse types	Motor rating (kW) 3ø 415V	Fuse type [BS88] Current rating		NHP COMPACT	GEC	MEM	Siemens	Hawker Siddeley	Holec
OESA 32 P3F1 mini	5.5	F1	2...32	NNS	NS	SN2	3NW NS	F 06	NS
OESA 32 P3A1 mini	5.5	A1	2...32	NNIT	NIT	SA2	3NW NIT	F21	NIT
OS 32...63B, OESA 32...100G	5.5	A2	2...32 amp	NTIA	TIA	SB3	3NW TIA	H07	TIA
OS 32...63B, OESA 100G	15	A3	40...63 amp	NTIS	TIS	SB4	3NW TIS	K07	TIS
OESA 100G	30	-	80...100 amp	NOS	OS	S0	3NW OS	-	-
OESA 100G	30	A4	80...100 amp	NTCP	TCP	SD5	3NW TCP	L14	TCP
-	5.5	Hybrid (A4) 125...200 amp		NTFP	TFP	SD6	3NW TFP	M14	TFP
OESA 160...400B	15	B1	2...63 amp	NTBC	TBC	SF3	3NW TBC	K09	TBC
OESA 160...400B	30	B1	80...100 amp	NTC	TC	SF5	3NW TC	L09	TC
OESA 160...400B	55	B2	125...200 amp	NTF	TF	SF6	3NW TF	M09	TF
OESA 250...400B	110	B3	250...315 amp	NTKF	TKF	SF7	3NW TKF	N09	TKF
OESA 250...400B	110	-	250...315 amp	NTKM	TKM	SG7	3NW TKM	N11	TKM
OESA 400B	150	B4	355...400 amp	NTMF	TMF	SF8	3NW TMF	P09	TMF
OESA 630...800B	150	C1	355...400 amp	NTM	TM	SH8	3NW TIM	P11	TM
OESA 630...800B	280	C2	450...630 amp	NTTM	TTM	SH9	3NW TTM	R11	TTM
OESA 800B	400	C3	710...800 amp	NTLM	TLM	SH10	3NW TLM	S11	TLM
		Din pattern							
OS 32...63D, OESA 32...160D	45	00	6...160 amp	N00	NHG 00	7999	3NA5	-	P851.00
OESA 250D	90	1	25...250 amp	N1	NHG 1	8001	3NA4 144	-	P851.1
OESA 400D	150	2	80...400 amp	N2	NHG 2	8002	3NA4 260	-	P851.2
OESA 630...800D	280	3	315...630 amp	N3	NHG 3	8003	3NA1	-	P851.3



DIN F – DIN fuse extractor handle

DIN fuse handle and mounting bracket

Cat. No.	For	Description
DIN-fuse sizes		
DIN F	00, 1, 2, 3	DIN fuse extractor handle
DIN FMB		For mounting of fuse handle DIN F when not using



OFM 690
Fuse monitor

Fuse monitor, OFM 690

The OFM fuse monitor provides a facility for an immediate tripping option after a fuse has blown. Mounts direct to side of OS 32...63 switches or may be panel mount for use with other OESA switch fuses and OFAX din fuse bases. Includes 1N/O + 1N/C contact plus trip LED indication.

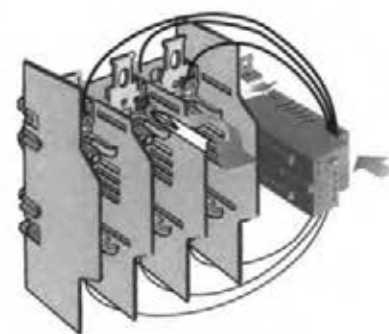
Cat. No.	Rated voltage (V AC)	Weight (kg)
OFM 690	380...690	0.14



OESA 200...800 + OFM 690



OS... + OFM 690



OFAX... + OFM 690

Strömberg PowerLine

Auxiliary contacts – Switch fuses OS 32...63, OESA 32...160 Accessories

NHP


OESA ZX157

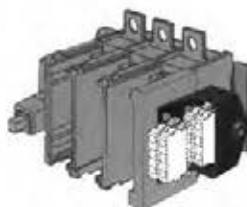
OESAZX 169 +
OBEA 01, 10 as fitted
to OESA mini 32



OBEA 10, 01



OEA 1010, 10 as fitted to OS 32...63



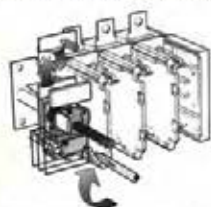
OEA ZX 252 & OBEA 10, 01 (OESA 32...63)
OEA ZX 250 & OBEA 10, 01 (OESA 100...160)



OBEA 10, 01



OEA ZX 252 + 254 extension frame (OESA 32...63)
OEA ZX 250 + 254 extension frame (OESA 100...160)



OZK 7, 8 (Changeover auxiliaries)
as fitted to OESA 32...160

OESA mini 32

Complete ordering of auxiliaries require auxiliary contact frame OESAZX169 and OBEA auxiliaries as required (max 6).
All OBEA aux. require base OESAZX169 for mounting to switch or select ready made kits below.
For ON and OFF functions of auxiliary and main contacts see pages 77.

Cat. No.	Auxiliary contacts	Performance data		Features
OESAZX 169	Auxiliary contact frame. Not suitable for side operated switches			Max. 6 auxiliary contacts (type OBEA_) can be fitted.
OBEA 01 OBEA 10	1 N/O 1 N/C	U_e 120V 230V 415V 690V 125V	I_e : AC15/DC13 8A/- 6A/- 4A/- 2A/- -1.1A	Mounted on side of the switch (max 6), requires aux. contact frame OESAZX 169. Please note that OBEA auxiliaries have opposite polarity on OESA mini than for OESA 32...160
OESAZX 157	1 C/O	U_e 24V 250V 440V	I_e : AC15/DC12 -16A 3A/0.1A 2A/-	Auxiliary/test contacts, direct mounting to the switch mechanism. Doesn't require mounting frame. Max. two change over contacts.

OS 32...63

Snap-on mounting to the switch, IP 20, cable cross section 0.75...2 x 2.5 mm². Max. 6 auxiliary contacts mountable onto the side.
Max. 2 auxiliary contacts mountable between the poles, which are used as Test-contacts, see a function chart below. No frame required.

Cat. No.	Auxiliary contacts	Performance data U_e I_e : AC15		Features		
OA1G 10 OA1G 01	1 N/C 1 N/O	240V 415V 690V	6A 4A 2A	Handle position Test 0 1	Main contacts Open Open Closed	Aux./Test contacts N.O. Closed Open Closed

OESA 32...160

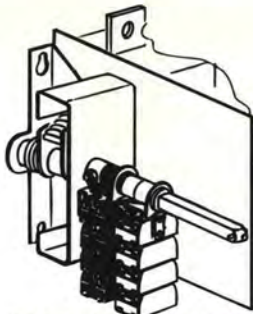
Complete ordering of auxiliaries require auxiliary contact frame OESAZX 250 (100...160A) and OBEA auxiliaries as required. All OBEA auxiliaries require base OESAZX 250 or 252 for mounting to switch, or select ready made kits below.
Protection degree IP 20-OBEA, IP 10-OZK 7, 8. For ON and OFF functions of auxiliary and main contacts see pages 77.

Cat. No.	Auxiliary contacts	Performance data		For switch sizes	Features
OESA ZX 252	Auxiliary contact frame			32...63A	Max. 4 standard contacts OBEA below.
OESA ZX 250	Auxiliary contact frame			100...160A	Max. 4 standard contacts OBEA below.
OESA ZX 254	Auxiliary extension frame			32...160A	Extension frame for extra 4 contacts. Fits to side of basic frame OESA ZX 250 or 252.
OBEA 10	1N/O	U_e 24V 48V 110V 240V 400V	I_e : AC15/DC13 8A/- 6A/- 4A/- 2A/- -1.1A	OESA 32...160A	Mounting with the mounting frames above. Max. 8 aux. blocks possible with extension frame.
OBEA 01	1N/C				
OZK 7	1C/O	U_e 24V 250V 440V	I_e : AC15/DC12 -16A 3A/0.1A 2A/-	32...160A	Aux supplied complete with cam and bracket. No additional frame required.
OZK 8	2C/O				

Strömberg PowerLine

Auxiliary contacts – Switch fuses OESA 200...800A

Accessories



OZ XK _ (as fitted with cam and bracket)



OZ XK _ (as fitted direct to switch)

OESA 200...800

Technical data for OZ XK 1...5:

Protection degree, IP20, cable cross section min. 0.5 mm², max. 2 x 2.5 mm². Insulation voltage 690V. Thermal current I_{th} = 10A. For ON and OFF functions of auxiliary and main contacts see page 78.

Cat. No.	Auxiliary operation to suit switch type		Performance data	
	OESA		IEC 947-5-1	
	200...400A ¹⁾	630...800 ¹⁾	U _e	I _e AC12/DC12
OZ XK 1	1N/O+1N/C ²⁾	1N/O+1N/C	120V	8A/-
OZ XK 2	2N/O+2N/C ²⁾	2N/O+2N/C	125V	-/1.1A
OZ XK 3 ¹⁾	4N/O+4N/C ²⁾	4N/O+4N/C	240V	6A/-
OZ XK 4	2N/O ²⁾	2N/O	250V	-/0.55A
OZ XK 5 ¹⁾	4N/O ²⁾	4N/O	400V	4A/-
OZ XK 12	2N/C ³⁾	-	415V	4A/-
OZ XK 13	4N/C ³⁾	-	440V	-/0.31A
OZ XK 14	1N/O+1N/C ³⁾	-	480V	3A/-
OZ XK 16	4N/O+4N/C ³⁾	-	500V	3A/0.27A
OZ XK 02	2N/O ³⁾	-	600V	-/0.2A
			690V	2A/-

Notes: ¹⁾ 8 N/O + 8 N/C = 2 x OZ XK 3.
²⁾ 8 N/O = 2 x OZ XK 5.
³⁾ 200-400 types may mount auxiliary with bracket supplied or directly on switch.
630-800 must use bracket, will not mount on switch.
Inboard shaft models can fit only one auxiliary to bracket.

¹⁾ Mount direct to switch only.
²⁾ Mount using cam & bracket supplied only.
³⁾ Mount direct to switch or cam & bracket supplied.

Switch fuses

Strömberg

PowerLine switch fuses

NEW



OS, 32...160 Amp – The new OS switch fuses, offer a new dimension in safety and flexibility for fused short-circuit protection

Safety for the operator

- Fully IP20 protected for both cable connection and fuses.
- Removable fuse holders allow for fast fuse replacement and increased operator safety.
- Fuse holders cannot be removed whilst this switch is in the "ON" position.
- Operator independent quick make, quick break mechanism.
- The OS switch fuse range features an over centre operating mechanism, thus the mechanism is charged to the appropriate level and then operates independent of the rotation speed of the shaft.
- Isolation on both sides of the fuses via double switching contacts.
- Auxiliary test position operates without the main contacts being closed which is ideal for commissioning and control circuit fault finding.
- Available in BS and DIN fuse formats.

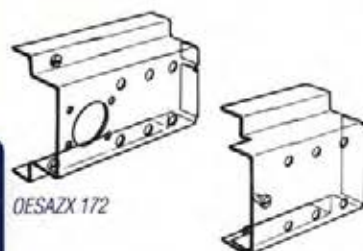
Flexible mounting options

- The OS switch fuse range may be mounted by a 35mm, 75mm DIN rail or base panel mounted.
- The fourth pole can be easily snapped on to the side of the switch fuse.
- Fully symmetrical construction enables any plane of mounting for the switch fuse.

Strömberg PowerLine

Fuse covers – Switch fuses OESA

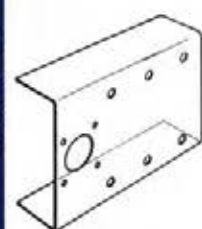
Accessories

NHP


OESAZX 172



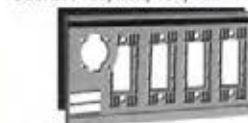
OESAZX 89



OESAZX 3, 44, 74



OESAZX 190, 192, 194, 196



OESAZX 191, 193, 195, 197



OESAZX 205, 207, 209, 211



OESAZX 206, 208, 210, 212



OESAZX 83



OESAZX 204

OESA 32...160

➤ OS type switch fuses do not require fuse covers.

Cat. No.	For switch types	Number of poles
1 OESAZX 44	OESA 00-32, 00-63	3
OESAZX 172	OESA 32 G1, 63 G1	3
1 OESAZX 89	OESA 32 BM3, 63 BM3	3
OESAZX 3	OESA 00-125, 100 G1, 00-160,	3
OESAZX 74	OESA 160 B3	3

OESA 200...800

➤ BS type switch fuses include a fuse shroud as standard when ordering switch fuse.

Cat. No.	For switch types	Number of poles
OESAZX 190	OESA 200B, 250D, 250B	3
1 OESAZX 191	200 BM_, 250 DM_	4
OESAZX 205	OESA 200 BV_, 250 DV_	3
1 OESAZX 206		4
OESAZX 192	OESA 315 B_, 400 D_, 400 B_	3
1 OESAZX 193	315 BM_, 400 DM_, 400 BM_	4
OESAZX 207	OESA 315 BV_, 400 DV_, 400 BV_	3
1 OESAZX 208		4
OESAZX 194	OESA 630 D_, 630 B_	3
1 OESAZX 195		4
OESAZX 209	OESA 630 DV_, 630 BV_	3
1 OESAZX 210		4
OESAZX 196	OESA 800 D_, 800 B_	3
1 OESAZX 197		4
OESAZX 211	OESA 800 DV_, 800 BV_	3
1 OESAZX 212		4

Fuse cover interlock kits

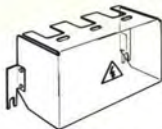
Cat. No.	Features	For switch sizes
1 OESAZX 83 OESAZX 204	The interlock kit prevents the fuse cover from being opened when the switch fuse is in ON position	32...160A 200...800A

Note: 1 Available on indent only.

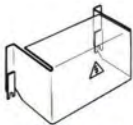
Strömberg PowerLine

Terminal shrouds, links – Switch fuses OESA

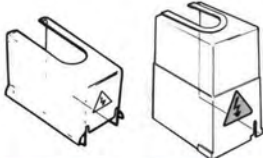
Accessories



OESAZX 8, 75



OESAZX 41, 81

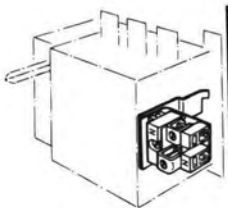


OESAZX 119

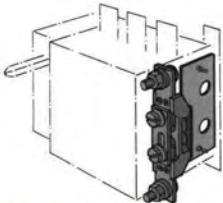
OESAZX 102



63 MFNL, 100 MFNL,
OESAZX 98, OESAZL 79



OESAZX 87, 118



OESAZX 85, 86, 87, 88, 118

Terminal shrouds for switch fuses OESA 100...800A

32 and 63A:

Switch fuses do not require terminal shrouds.

Cat. No.	For switch types	Number of poles	Quantity for full protection [pcs]
OESAZX 8	OESA 100 G, 00-125, 00-160	3	2
OESAZX 41		4	2
OESAZX 75	OESA 160 B	3	2
OESAZX 81		4	2
OESAZX 119	OESA 200...400	3	6
		4	8
OESAZX 102	OESA 630...800	3	6
		4	8

Solid links

Cat. No.	For switch types	Packing [pcs]
63 MFNL	OS 32 B, 63 B, OESA 32 G, 63 G	1
100 MFNL	OESA 100 G	
OESAZX 98	OESA 160 B...400B	
OESAZL 79	OESA 630 B, 800 B	

Neutral links

Cat. No.	I_{th} [A]	Max. cable cross section/Cu [mm ²]	Description	Suitable for switch fuse size
OESAZX 87	63	16	Detachable, mounted to the switch	32...63
OESAZX 118	125	35		125
OESAZX 86	160	240		125...160
OESAZX 85	400	240		200...400
OESAZX 88	800	240		630...800
OESAZX 162	200	10...120	Mounting onto mounting plate	
OESAZX 164	315	10...300		
OESAZX 165	400	10...300		

Note: Available on indent only.

Switch fuses

Strömberg PowerLine

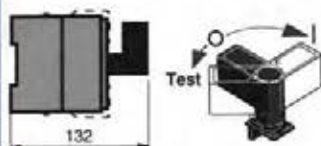
Handles – Switch fuses OS, OESA

Accessories

NHP



OH_65...275J



YASDB 79



OHB 4

YASDA 28
YASDA 8

OETLZX 74

Optional handles – plastic³⁾

Handles for front operated switch fuses

Indication I-ON / 0-OFF.

Shaft has to be ordered separately, see page 27. Door drilling and dimensions see page 69 to 71.

Cat. No.	Colour	Handle length (mm)	For shaft diameter (mm)	Suitable for switch fuse	Features
OHB65J5 ¹⁾	black	65	5	OESA mini 32A	IP65 protection. Padlockable with up to 3 padlocks in OFF position, bail diameter 5...10mm. Handles may be padlocked in ON position with simple modification.
OHY65J5 ¹⁾	yellow-red				
OHB65J6 ¹⁾	black	65	6	OS 32...63A	
OHY65J6 ¹⁾	yellow-red			OESA 32...160A	
OHB80J6	black	80	12	OESA 200...800A	Door interlock in ON position, defeatable.
OHY80J6	yellow-red				
OHB125J12	black	125	12	OESA 630...800A	
OHY125J12	yellow-red				
OHB145J12	black	145	12		
OHY145J12	yellow-red				
OHB175J12	black	175	12		
OHY175J12	yellow-red				
OHB275J12	black	275	12		
OHY275J12	yellow-red				

Direct mount handle

IP00. For direct mount to switch. Padlockable in OFF and test positions.

YASDB 79	black	-	5	OESA mini 32A	Includes a shaft. Padlockable with 2 padlocks.
OHB4		-	6	OS 32...63A	No shaft needed. Padlockable with 3 padlocks.

Handles for side operated switch fuses

IP65. Indication: 32A mini – 1 ON 0 OFF test; OESA 32...400A – 1 ON 0 OFF

OHB65J5 TE00S	black	60	5	OESA 32 BM3 mini	See features for front operated handle above.
OHB80J6 ED01S	black	80	6	OESA 32...160 BM	
OHB145J12 E002S	black	145	12	OESA 200...400 BM	

Handles for changeover & bypass mechanism (see also metal handles below)

IP65. Indication: I - 0 - II. See page for changeover and bypass mechanisms.

OHB80J6ED11	black	80	6	OESA ZW1 (32...160A)	See features for front operated above.
OHB145J12E011		145	12	OESA ZW11 (200...400A 3P)	

Optional handles – metal³⁾

Handles for front operated switch fuses

IP 65, padlockable with 3 padlocks in OFF position, door interlock in ON position. Door drilling Ø45mm, see page 69 to 71.

Shaft must be ordered separately, see page 27. Dimensions see page 69 to 71.

Cat. No.	Colour	Handle length (mm)	For shaft diameter (mm)	Suitable for switch fuse
YASDA 8 ¹⁾	black	220	12	OESA 200...800

Handles for side operated switch fuses

IP 65, padlockable with 3 padlocks in OFF position, door drilling 18mm and dimensions see page 69 to 71.

OETLZX 74	black	145	12	OESA 200...400BM
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Handles for changeover & bypass mechanism (see also plastic handles above)

IP 65, padlockable with 3 padlocks in OFF position, door interlock in ON position, door drilling Ø45mm, see page 69 to 71.

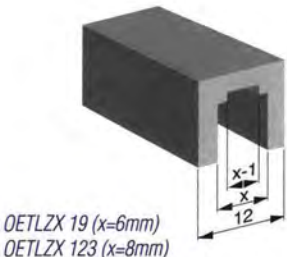
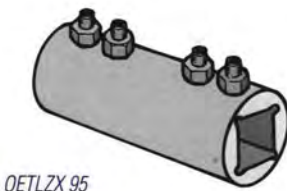
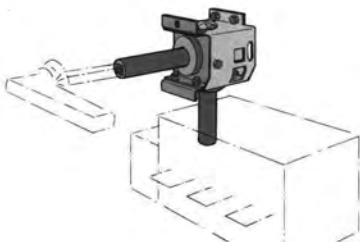
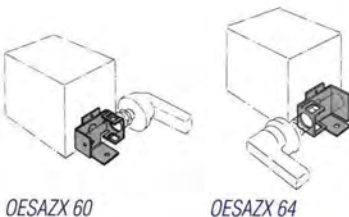
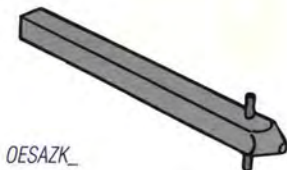
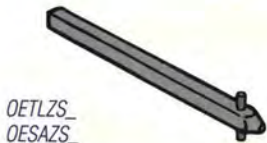
<input type="checkbox"/> YASDA 6	black	320	12	OETL ZW12 (630...800 3P8) 200...800A 4P)
				OETL ZW13 (200...800A)

Notes: ¹⁾ Handle with I ON-0 OFF-test indication available on indent. Contact NHP.
²⁾ Handle available with metal collar (YASDA8MC).
³⁾ Shafts must be ordered separately, see page 27.
☐ Available on indent only.

Strömberg PowerLine



Shafts and shaft accessories – Switch fuses OS, OESA
Accessories



Optional extended shafts – standard

Cat. No.	Length (mm)	Diameter (mm)	H mm		For switch type	For handle type
OXPSX150-V0	150	5	135...210		OESA 32 (mini)	OH_65J5
OXPSX265-V0	265		245...325			OH_65J5 TE00S
OXPSX400-V0	400		380...460			
OXPSX210	210	6	200...280		OS 32...63	OH_65J6
OXPSX290	290		280...360		OESA 32...160	OH_80J6
OXPSX360	360		350...430			OH_80J6 E001S
OXPSX430	430		420...500			OH_80J6E011
<input type="checkbox"/> OXP12X185	185	12	165...275		OESA 200...400	OH_125J12
<input type="checkbox"/> OXP12X250	250	12	230...340		OESA 200...400	OH_145J12
			255...325		OESA 630...800	OH_175J12
						OH_275J12
OXP12X280	280	12	260...370		OESA 200...400	OH_145J12 E002S
			285...355		OESA 630...800	OH_145J12E011
OXP12X325	325	12	305...415		OESA 200...400	OETLZX 74
			330...400		OESA 630...800	
OXP12X395	395	12	375...485		OESA 200...400	
			400...470		OESA 630...800	
OXP12X465	465	12	445...555		OESA 200...400	
			470...540		OESA 630...800	
OXP12X535	535	12	515...625		OESA 200...400	
			540...610		OESA 630...800	
OXP12X395DP ¹⁾	395	12	375...485		OESA 200...400	YASDA 8, YASDA 28
			400...470		OESA 630...800	YASDA 8

Note: ¹⁾ OESA ZK43 DP has double pin for interlocking of door.

Accessories

Shaft direction modification

Cat. No.	For switch type	Remarks
<input type="checkbox"/> OESAZX 60	OESA 32...160A	Modifies the direction of shaft.
<input type="checkbox"/> OESAZX 64		
		left side
		right side

90° angle kit

OETLZX 108	OESA 200...800A	A normal switch can be changed to a side operated switch	12mm shaft
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Shaft extension socket

OETLZX 95	-	For extending the shaft or use in combination with OETLZX 19, OETLZX 123 for shafts of different sizes.	12mm shaft
OETLZX 19	-	Adaptors to place inside of OETLZX 95 to connect shafts of different sizes	6mm & 5mm shaft
OETLZX 123	-		8mm shaft

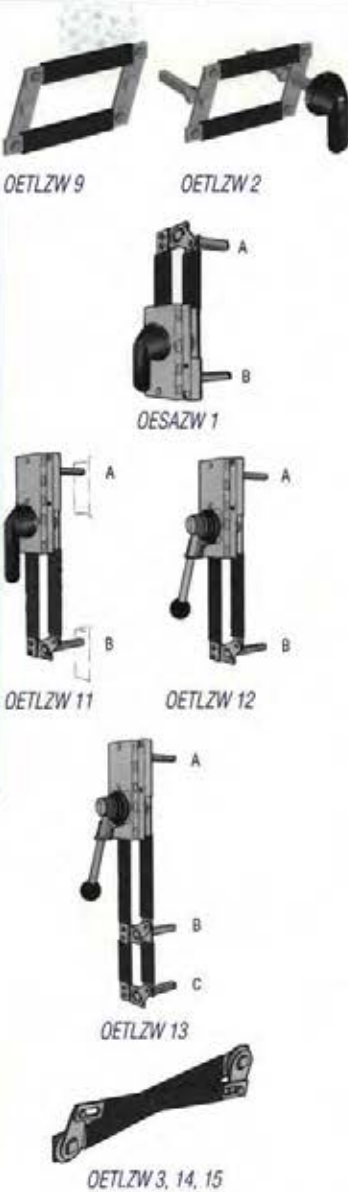
Note: ☐ Available on indent only

Switch fuses

Strömberg PowerLine

Multipole, changeover & bypass mechanisms – Switch fuses OS, OESA Accessories

Switch fuses



The mechanisms are provided with holes, enabling different shaft distances, see example below.
For dimensional diagrams refer pages 72 to 75.
The combination switches can be mounted either horizontally or vertically.

Cat. No.	Shaft distance [mm]	Remark	For switch sizes
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6 and 8-pole mechanism

Parallel attachment for building 6 and 8-pole switches. Both switches work simultaneously.

OESAZW2	45 + (0...13) x 15	The shafts and the standard handle of one of the switches can be used for operating the switch.	OS 32...63, OESA 32...160
OETLZW 9	60 + (0...19) x 20		OESA 200...800

Changeover mechanism

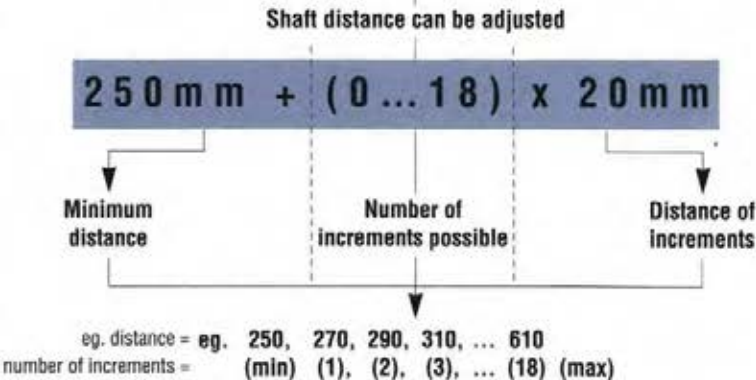
OESAZW 1	90 + (0...10) x 15	Includes shafts and a plastic handle (OH880J6E011) with I-O-II indication.	OS 32...63 OESA 32...160
OETLZW 11	210 + (0...11) x 20	Include shafts and a plastic handle (OH8275J12E011) with I-O-II indication.	OESA 200...400
OETLZW 12	210 + (0...20) x 20	Include shafts and a metallic handle (YASDA 21) with I-O-II indication.	OESA 200 ...400 OESA 630...800

By-pass mechanism

A combination of two switches in parallel with one change-over to by-pass, for example, a breaker for maintenance. The by-pass mechanism can be used together with another combination attachment.

OETLZW 13	Between A and B 210 + (0...18) x 20 Between A and C 250 + (0...18) x 20	Includes shafts and a metal handle (YASDA 6) with I-O-II indication	OESA 200...800
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Example



Mechanical interlock

Prevents one switch from closing to ON-position if the other is not in OFF-position. Suitable shafts and handle; see page 26 to 27.

0OETLZW 3	300	The standard handle and shaft can be used for operation	OESA 200...800
OETLZW 14	250		
OETLZW 15	500		

Note:  Available on indent only.

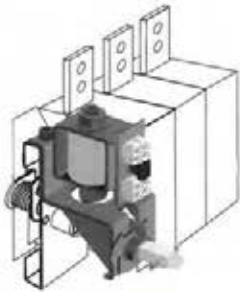
Strömberg PowerLine

NHP

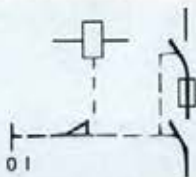
Locking devices and connection accessories – Switch fuses OS, OESA Accessories



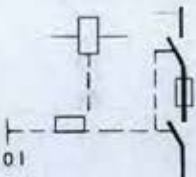
OETLZW 16, 5
Cam attachment (lock and key not included)



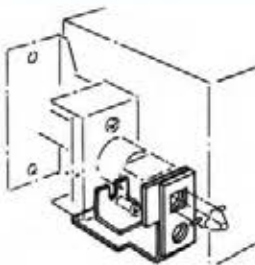
OETLZT 80L



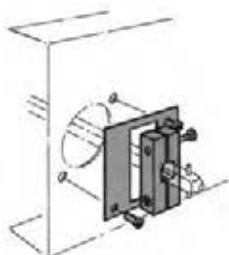
OETLZT 80A



OETLZT 80L



OESAZX 116



OESAZX 83

Locking accessories

Cat. No.	Shaft sizes	For switch sizes	Description
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Cam attachment

OETLZW 16	5,6,8 mm	OS 32...63 OESA 32...160	Cam attachment for Castell, Fortress interlocks Cam attachment for adopting the switches to the interlock system. The lock and key are not included and must be ordered separately (LSF lock no. is H31Q/SHOT/DS). Refer page 76 for mounting dimensions.
OETLZW 5	12 mm	OESA 200...800	

Electrical interlock

OETLZT 80A/ coil voltage	OESA 630...800	Closed circuit principal, for interlocking the switch movement. When the coil circuit is dead, A-types can't be operated to ON-position and L-types to ON- or OFF position. U_n/R : 110V AC/1000 Ω , 220V AC/3900 Ω , 24VDC/48 Ω , 48VDC/190 Ω , 60VDC/300 Ω , 110VDC/1000 Ω , 220VDC/3900 Ω $P = 15\text{ W}$ $U = 0.7...1.1 U_n$
OETLZT 80L/ coil voltage		

Shaft padlock

OESAZX116	OESA 32...160	Shaft padlock. The switch mechanism can be padlocked in OFF position. Shaft padlock is standard feature in large switch fuses.
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Fuse cover interlock

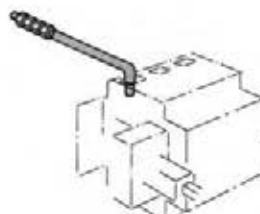
OESAZX 83	OESA 32...160	The kit prevents the fuse cover opening when the switch fuse is in ON position. This feature is standard on OS 32...63.
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Back connection studs

Back connection studs enable easy connection of a switch fuse to busbar

Cat. No.	For switch sizes	Mounting distance from bottom of switch [mm]	Packing [pcs]
<input type="checkbox"/> OESAZX 61	OS, OESA 32...63 A	30...110	3
<input type="checkbox"/> OESAZX 62	OESA 125 A		

Note: ☐ Available on indent only.



OESAZX 61, 62

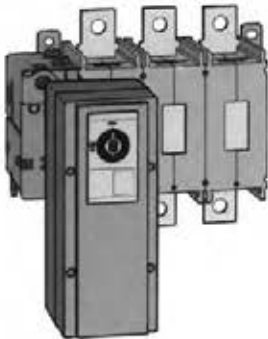
Strömberg PowerLine

Motor operators – Switch fuses, OESA

Accessories



Switch fuses



OEMO Motor Operator

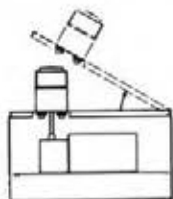
Motor operator

OEMO motor operator has been designed for remote control of the switch. The standard delivery includes complete control circuit, short cable and manual handle (YAS DA23).

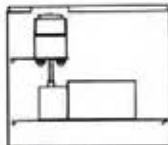
Cat. No.	Functions	For switch fuses	Nominal Current [A] ¹⁾	Max. Current [A] ¹⁾	Weight [kg]
OEMO 002 ¹⁾ ...V OEMO 003 ¹⁾ ...V	(ON-OFF)	OESA 200...400 OESA 630...800	1	4	5.5
OEMO 202 ¹⁾ ...V OEMO 303 ¹⁾ ...V ¹⁾	Change-over mechanism needed	OESA 200...400 OESA 630...800	1	4	5.5

Notes: ¹⁾ Changeover mechanism is required see page and must be ordered together with OEMO 303...
¹⁾ Please include following voltage required in ordering number.
240V AC: ☐ AC: 24V, 48V, 110V
☐ DC: 24V, 48V
¹⁾ Nominal at 240V AC
☐ Available on indent only.

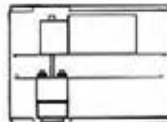
MOUNTING OPTIONS



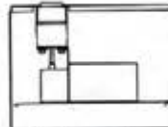
On the door



Behind the door



Behind the switch



Flush mounting

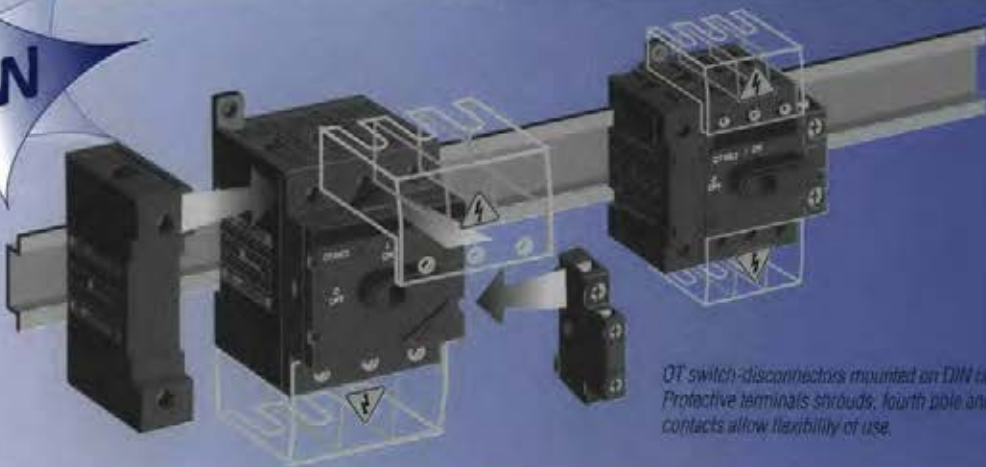
Strömberg Switchline

Load-break switches

OT 16E...125E

New modular switch disconnectors

NEW



OT switch-disconnectors mounted on DIN rail. Protective terminals shrouds, fourth pole and auxiliary contacts allow flexibility of use.

A family of four frame sizes

The OT family has the following current ratings, 16, 25, 32, 45, 63, 80, 100 and 125 amp ratings. The switches comply with the latest specifications of modern low voltage installations. One of the major features of the OT switch range is the quick make / quick break mechanism which is independent of the rotational speed of the shaft. Once the over centre position is reached the mechanism releases, thus, closing the main contacts giving superior making capacity.

Safe and reliable

The OT range of load-break switches has as standard a front toggle operator. These switches can be fitted with the homogenous range of Strömberg selector and pistol type handles as required. All the switches are IP20 rated additional shrouding, if required, can be easily snapped onto the switch.

Strömberg Switchline

NHP

Load-break switches OT 16...160A, OETL 200...315A

Ordering information



OT 16...80E3



OH_ 'Pistol' handle



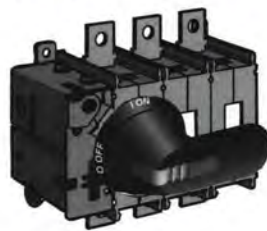
OT 100, 125 E3



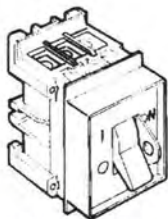
OH_ 'Selector' handle

OT 125A3
OT 160E3

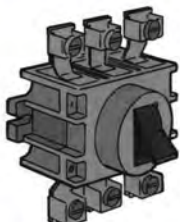
OT 160M3



OETL 200...315 K3



OETL 25C 1 / 40 C1 / 63 C3 / 80 C1



OETL 125C 1

Outboard shaft
OETL K3, K4
OETL D1, D4



Inboard shaft
OETL KV 12,
OETL KV 22.



Side operated.
See page 18.



Rotary type 25A...315 A

OT 16...125E_: Includes IP20 tunnel terminals and standard type handle (pictured) if required with pistol or selector handle see note¹⁾ below.

OT 125A_ , OT 160E_: Includes black IP 65 door mounted handle with On-Off/I-O indication (OHB65J6) and shaft (OXP6X210), length 210mm, mounting depth H=185...215.

OT 125M_ , OT 160M_: Includes IP20 tunnel terminal and ready-mounted shallow handle (YAST 1) are included. No separate shaft needed.

OETL 200...315: Include black IP 65 handle with On-Off /I-O indication (OHB80J8) and shaft (OXP8X140) length 140mm. Mounting depth H=120...220. Terminal bolt kit see page 33.

Optional handles and shafts – Refer page 38 to 39.

Auxiliaries – Refer page 36.

Dimensional diagrams – Refer page 56 to 60.

Enclosed load-break range – Refer page 34 to 35.

Cat. No.	Number of poles	Rated insulation	I _{th} (open) current [A]	Rated operational currents AC 21/AC 23 [A/A]		Weight (kg)	Include handle and shaft	Short time rating 0.2s /1.0s kA
				415V	1000V			
OT 16E3_	3	750	25	16/16	–	0.11	1)	-/0.5
OT 16E4_	4					0.15	1)	
OT 25E3_	3	750	32	25/20	–	0.11	1)	-/0.5
OT 25E4_	4					0.15	1)	
OT 32E3_	3	750	40	32/23	–	0.11	1)	-/0.5
OT 32E4_	4					0.15	1)	
OT 45E3_	3	750	50	45/30	–	0.27	1)	-/1.0
OT 45E4_	4					0.35	1)	
OT 63E3_	3	750	63	63/38	–	0.27	1)	-/1.0
OT 63E4_	4					0.35	1)	
OT 80E3_	3	750	80	80/55	–	0.31	1)	-/1.5
OT 80E4_	4					0.45	1)	
OT 100E3_	3	750	115	100/80	–	0.36	1)	-/2.5
OT 100E4_	4					0.50	1)	
OT 125E3_	3	750	125	125/90	–	0.36	1)	-/2.5
OT 125E4_	4					0.5	1)	
OT 125A3	3	750	135	125/90	–	1.0	Yes	7/4
OT 125A4	4			125/105	–	1.3	Yes	
OT 160E3	3	750	160	160/135	–	1.0	Yes	7/4
OT 160E4	4					1.3	Yes	
OT 160M3	3					1.0	Yes	
OT 160M4	4					1.3	Yes	
OETL 200K3	3	1000	250	200/200	200/125	3.0	Yes	17/10
OETL 200K4	4					3.7	Yes	
OETL 200 KV 12	3					3.0	Yes	
OETL 200 KV 22	4					3.7	Yes	
OETL 250K3	3	1000	315	250/250	250/125	3.0	Yes	17/10
OETL 250K4	4					3.7	Yes	
OETL 250 KV 12	3					3.0	Yes	
OETL 250 KV 22	4					3.7	Yes	
OETL 315K3	3	1000	350	315/315	315/125	3.0	Yes	17/10
OETL 315K4	4					3.7	Yes	
OETL 315 KV 12	3					3.0	Yes	
OETL 315 KV 22	4					3.7	Yes	

Toggle type 25A...125 A

OETL 25C1	3	690	40	25/16	–	0.20	Toggle	0.9/0.9
OETL 25C4	4				–	0.23	Toggle	
OETL 40C1	3	690	63	40/25	–	0.20	Toggle	1.0/1.0
OETL 40C4	4				–	0.23	Toggle	
OETL 63C3	3	690	80	63/63	–	0.30	Toggle	1.5/1.0
OETL 63C4	4		63	63/40	–	0.33	Toggle	
OETL 80C1	3	690	100	80/63	–	0.30	Toggle	1.5/1.5
OETL 125C1	3	690	125	125/75	–	0.45	Toggle	2.5/2.5

Fourth poles – OT rotary load-break switches

Cat. No.	Remarks	Weight with package [kg]
OTPS 32 EP	Suitable for OT 16...32 E3: Dovetail mounting IP20	0.03
OTPS 63 EP	Suitable for OT 45...63 E3: Snap on mounting IP20	0.06
OTPS 80 EP	Suitable for OT 80 E3: Clip on mounting IP20	0.08
OTPS 125 EP	Suitable for OT 100...125 E3: Snap on mounting IP20	0.14
OTPS 160 EP	Suitable for OT 125 A3, OT 160 E3	0.3

Notes: 1) Includes knob type handle as standard. To order with IP65 'pistol' type handle (OHB45J5) and shaft (OXP5X265), 265mm long, include 'P' in part number. To order with IP65 'selector' type handle (OHB2AJ) and shaft (OXS5X250) 265mm long, include 'S' in part number.

1) Available on indent only.

Load-break switches

Strömberg Switchline

NHP

Load-break switches OETL 400A...3150A

Ordering information



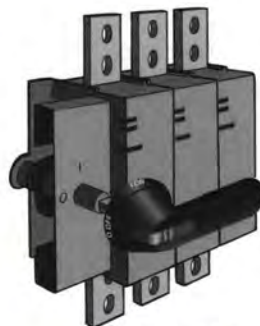
OETL 400...800 K3



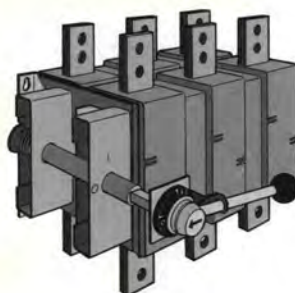
OETL 400...800 KV12



OETL 400...800 KV22



OETL 1000...1600 K3



OETL 2500, 3150 K3



OETL 1600, 2500, 3150 K3/3

Rotary type 400...3150 A

OETL 400...3150: Includes terminal bolt kit. See page 33.

OETL 400...800: Includes black IP 65 handle with I-O/On-Off indication (OHB125J12) and shaft (OXP12X166), length 166mm, mountable height H=160...255mm.

OETL 1000...1600: Includes black IP 65 handle with I-O/On-Off indication (OHB145J12) and shaft (OXP12X250) length 250mm, mountable height H=255...325.

OETL 2500...3150: Includes IP 54 metallic handle with I-O/On-Off indication (YASDA 8) and shaft (OXP12X325) length 325mm, mountable height H=340...535).

Optional handles and shafts – Refer page 38 to 39.

Auxiliaries – Refer page 36.

Enclosed load-break range – Refer page 34 to 35.

Dimensional diagrams – Refer page 61 to 64.

Cat. No.	Number of poles	Rated insulation voltage [V]	I _{th} (open) [A]	Rated operational currents AC 21/AC 23 [A/A]		Weight [kg]	Include handle and shaft	Short time rating 0.2s / 1.0s kA
				415V	1000V			
OETL 400D1	3	1000	500	500/500	400/200	5.2	Yes	30/24
OETL 400D4	4					6.4	Yes	
OETL 400 KV 12	3					5.2	Yes	
OETL 400 KV 22	4					6.4	Yes	
OETL 630K3	3	1000	630	630/630	630/200	6.2	Yes	38/24
OETL 630K4	4					7.6	Yes	
OETL 630KV 12	3					6.2	Yes	
OETL 630KV 22	4					7.6	Yes	
OETL 800K3	3	1000	800	800/720	~200	6.2	Yes	38/24
OETL 800K4	4					7.6	Yes	
OETL 800KV 12	3					6.2	Yes	
OETL 800KV 22	4					7.6	Yes	
OETL 1000K3	3	1000	1000	1000/800	-	16.3	Yes	65/50
OETL 1000K140 ¹⁾	3					17.6	Yes	
¹⁾ OETL 1000K185 ¹⁾	3					17.6	Yes	
OETL 1000K4	4					20.5	Yes	
OETL 1000KV 12	3					16.3	Yes	
OETL 1000KV 22	4					20.5	Yes	
OETL 1250K3	3	1000	1250	1250/800	-	16.3	Yes	65/50
OETL 1250K140	3					17.6	Yes	
OETL 1250K185 ¹⁾	3					17.6	Yes	
OETL 1250K4	4					20.5	Yes	
OETL 1250KV 12	3					16.3	Yes	
¹⁾ OETL 1250KV 22	4					20.5	Yes	
OETL 1600K3	3	1000	1600	1600/800	-	17.5	Yes	65/50
¹⁾ OETL 1600K140 ¹⁾	3					17.6	Yes	
OETL 1600K185 ¹⁾	3					17.6	Yes	
¹⁾ OETL 1600K200 ¹⁾	3					17.6	Yes	
¹⁾ OETL 1600K4	4					22.5	Yes	
OETL 1600KV 12	3					17.5	Yes	
¹⁾ OETL 1600KV 22	4					22.5	Yes	80/65
OETL 1600 K3/3 ¹⁾	3					18	Yes	
OETL 2500K3 ¹⁾	3	1000	2500	2500/- (1600, AC22)	-	37	Yes	
OETL 2500K185 ¹⁾	3					37	Yes	
¹⁾ OETL 2500K4 ¹⁾	4					47	Yes	
OETL 2500KV 12 ¹⁾	3					37	Yes	
OETL 2500KV 22 ¹⁾	4					47	Yes	
OETL 2500K3/3 ¹⁾	3					37	Yes	
¹⁾ OETL 2500K4/4 ¹⁾	4					47	Yes	80/65
OETL 3150K3 ¹⁾	3	1000	3150	3150/- (1600, AC22)	-	37	Yes	
OETL 3150K185 ¹⁾	3					37	Yes	
¹⁾ OETL 3150K4 ¹⁾	4					47	Yes	
OETL 3150KV 12 ¹⁾	3					37	Yes	
OETL 3150KV 22 ¹⁾	4					47	Yes	
¹⁾ OETL 3150 K3/3 ¹⁾	3					37	Yes	
¹⁾ OETL 3150 K4/4 ¹⁾	4					47	Yes	

Notes: ¹⁾ The busbar connections for different busbar arrangements have to be ordered separately, see 'Busbar connections', page 41.

²⁾ With extended phase distances: – OETL 1600 K140: 140 mm. – OETL 1000...3150 K185: 185 mm. – OETL 1600 K200: 200 mm.

³⁾ Bustle switch.

⁴⁾ Available on indent only

Outboard shaft
OETL K3, K4
OETL D1, D4



Inboard shaft
OETL KV 12,
KV 22.



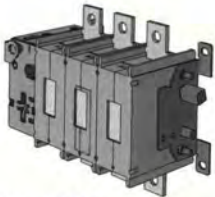
Side operated.
See page 18.



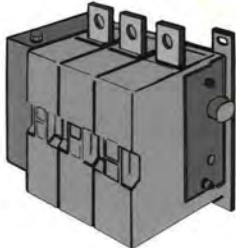
Strömberg Switchline

Side operated and earthing switches – OETL

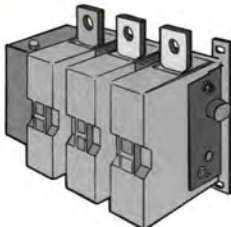
Ordering information



OETL 200, 315KM 3



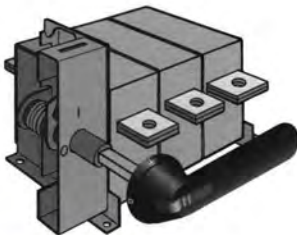
OETL 400DM1



OETL 630, 800KM 3



OETL_ KM3, KM4



OETL 1250M3

Side operated load-break switches 200...800 A

Includes terminal bolt sets. 400...800 include phase barriers.
The handle and shaft have to be ordered separately, see page38 to 39.

Cat. No.	Number of poles	Rated operational voltage [V]	I _{th} (open) [A]	Rated operational currents with AC 21A/AC 23 [A/A]		Weight [kg]
				415V	1000V	
OETL 200KM3 OETL 200KM4	3 4	1000	250	200/200	200/125	3.0 3.7
OETL 250KM3 OETL 250KM4	3 4	1000	315	250/250	250/125	3.0 3.7
OETL 315KM3 OETL 315KM4	3 4	1000	350	315/315	315/125	3.0 3.7
OETL 400DM1 OETL 400DM4	3 4	1000	500	500/500	400/200	5.2 6.3
OETL 630KM3 OETL 630KM4	3 4	1000	630	630/630	630/200	6.2 7.6
OETL 800KM3 OETL 800KM4	3 4	1000	800	800/720	800/-	7.3 9.2

Earthing load-break switches 1250A

Earthing switches include terminal bolt set, M12X60 black IP65 handle (OHB145J12E421) with - 0 indication, padlockable in both positions, door interlock in 'O' position and shaft OXP12X185 length 185mm.

Cat. No.	Number of poles	Short circuit making capacity [kA]		Short time withstand current / 1s [kA]	Weight [kg]
		Peak	RMS		
OETL 1250M3 OETL 1250M140 ¹⁾	3 3	 105	50 / 1.0 s ²⁾	50	16 20.6

Terminal bolt kit details

Switch type	Bolt size	Package [pcs]
OETL 200	M8 x 25mm	6pcs/pack
OETL 250, 315	M10 x 30mm	6pcs/pack
OETL 400	M10 x 40mm	6pcs/pack
OETL 630, 800	M12 x 40mm	6pcs/pack
OETL 1000, 1600	M12 x 60mm	6pcs/pack
OETL 2500, 3150	M12 x 60mm	12pcs/pack

Notes: ¹⁾ Phase distance 140mm.
²⁾ Maximum distance between busbar support and switch terminal 70mm
³⁾ Available on indent only.

Load-break switches

Strömberg Switchline

Enclosed switches, steel enclosed load-break switches OT, OETL

Ordering information

NHP

Enclosed load-break switches are available in 3 steel ranges and 1 plastic range. The 'Standard', 'Midline' and 'Eclipse' steel enclosed isolator have varying standard features and optional features to suit any particular requirement.

Standard – (self assembly made easy) 16...800A

- Standard features:
- IP65 protection

➤ Pistol type padlockable interlocked handle

➤ Neutral link provided with 3 pole versions

➤ 2 x earthing points

➤ Pre drilled mounting plate

➤ 1.2mm sheet steel

➤ Mounting screws provided

➤ Door pre-punched to suit handle
- Auxiliaries – Refer page 36.



S1603 – supplied unassembled

Switch size [A]	No. of Poles	Enclosure size			Switch type	Cat. No.
		H	W	D		
16	3	200	200	150	OT 16 E3	OT 163 PSE ¹⁾
25	3	200	200	150	OT 25 E3	OT 253 PSE ¹⁾
32	3	200	200	150	OT 32 E3	OT 323 PSE ¹⁾
45	3	200	200	150	OT 45 E3	OT 453 PSE ¹⁾
63	3	200	200	150	OR 63 E3	OT 63 PSE ¹⁾
80	3	200	200	150	OT 80 E3	OT 80 PSE ¹⁾
100	3	200	200	150	OT 100 E3	OT 100 PSE ¹⁾
200	3	700	380	155	OETL 200 KV12	S2003
200	4	700	380	155	OETL 200 KV22	S2004
250	3	700	380	155	OETL 250 KV12	S2503
250	4	700	380	155	OETL 250 KV22	S2504
315	3	700	380	155	OETL 315 KV12	S3153
315	4	700	380	155	OETL 315 KV22	S3154
400	3	800	460	200	OETL 400 KV12	S4003
400	4	800	460	200	OETL 400 KV22	S4004
630	3	800	460	200	OETL 630 KV12	S6303
630	4	800	460	200	OETL 630 KV22	S6304
800	3	800	460	200	OETL 800 KV12	S8003
800	4	800	460	200	OETL 800 KV22	S8004



OETL 2503 SE

Midline – (fully assembled) 125...1600

- Standard features:
- 'OH' pistol type handle

➤ Provided neutral link

➤ Door hinges left or right

➤ IP 55 protection

➤ Key lockable door

➤ Steel entry gland plate

➤ Fully assembled
- Optional features: (Contact NHP for details)
- 4 pole versions

➤ Side operated versions
- Auxiliaries – Refer page 36.

Switch size [A]	No. of Poles	Dimensions (mm) ¹⁾			Switch type	Cat. No.
		H	W	D		
125	3	400	300	150	OT 125 A3	OT 1253 SE
160	3	400	300	150	OT 160 E3	OT 1603 SE
200	3	500	300	200	OETL 200 K3	OETL 2003 SE
250	3	500	300	200	OETL 250 K3	OETL 2503 SE
315	3	500	300	200	OETL 315 K3	OETL 3153 SE
400	3	600	400	200	OETL 400 K3	OETL 4003 SE
630	3	700	500	250	OETL 630 K3	OETL 6303 SE
800	3	1000	600	250	OETL 800 K3	OETL 8003 SE
1000	3	1200	8000	300	OETL 1000 K3	OETL 10003 SE
1250	3	1200	8000	300	OETL 1250 K3	OETL 12503 SE
1600	3	1200	8000	300	OETL 1600 K3	OETL 16003 SE

Notes: ¹⁾ External dimensions do not include handles and locks.
²⁾ To replace 'pistol' type handle with 'selector' type handle replace 'P' with 'S' in Cat. No. OT163PSE to OT163\$SE.

Strömberg Switchline

NHP

Enclosed switches, steel and plastic load-break switches OT, OETL
Ordering information



E1603
(unassembled, IP 54, steel gland plates)



E1603F
(assembled, IP 54, steel gland plates)



OTP 16



OTP 45



OTP 80, 125

Eclipse – Steel enclosed isolators

Standard features:

- IP 65 degree of protection
- Strömberg pistol type handle
- Steel 3mm aluminium or brass gland plates
- Neutral link provided with 3 pole versions
- 2 x earth studs
- Pre drilled mounting plate
- Mounting screws for switch
- 1.6mm sheet steel
- Door hinged left or right
- Mounting brackets (top and bottom)
- Simple to self assemble

Switch size [A]	No. of Poles	Enclosure size			Switch type	Cat. No.
		H	W	D		
200	3	700	380	155	OETL 200 KV12	E2003
200	4	700	380	155	OETL 200 KV22	E2004
250	3	700	380	155	OETL 250 KV12	E2503
250	4	700	380	155	OETL 250 KV22	E2504
315	3	700	380	155	OETL 315 KV12	E3153
315	4	700	380	155	OETL 315 KV22	E3154
400	3	800	460	200	OETL 400 KV12	E4003
400	4	800	460	200	OETL 400 KV22	E4004
630	3	800	460	200	OETL 630 KV12	E6303
630	4	800	460	200	OETL 630 KV22	E6304
800	3	800	460	200	OETL 800 KV12	E8003
800	4	800	460	200	OETL 800 KV22	E8004

Optional gland plates to suit Eclipse

Switch size [A]	Enclosure size		Cat. No.		
	W	D	3mm Brass	6mm	Aluminium 3mm
200...315	380	155	E7B3	E7B6	E7A3
400...800	460	200	E8B3	E8B6	E8A3
IP65 gasket to suit gland plate E7			E7IP65		
IP65 gasket to suit gland plate E8			E8IP65		

Polyester OTP surface motor isolators – 3 pole

OT enclosed switches:

- Available 16 to 125A
- Integrated earth and neutral connections
- Knockouts for threaded entries top and bottom
- Knockouts in base for rear entry
- Padlockable
- IP65 rated
- Easy to mount
- Cable clamps

Switch size kW (AC 23)	Handle type	Enclosure size			Cat. No.
		H	W	D	
7.5	Selector	120	85	60	OTP 16
9	Selector	150	130	60	OTP 25
11	Selector	150	130	60	OTP 32
15	Selector	200	145	90	OTP 45
18.5	Selector	200	145	90	OTP 63
30	Selector	400	200	140	OTP 80
37	Selector	400	200	140	OTP 125

Note: Other variation of switches and enclosure sizes available, contact NHP for details.

Load-break switches

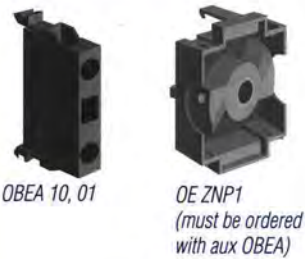
Strömberg Switchline



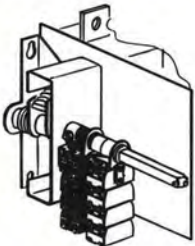
Auxiliary contacts – Load-break switches OT, OETL Accessories



OA1G_ auxiliary contacts – mounted on both sides of switch OT 16E...125E



OZXK_ mounted direct to switch (as fitted to OETL 400...800)



OZXK_ as fitted with cam & bracket (as fitted to OETL 400...3150)

OT 16E...125E

Snap on direct mounting to switch, protection degree IP 20, I+n = 16A, cable cross section max. 2 x 2.5mm². no frame required. For ON and OFF functions of auxiliary and main contacts see page 79.

Cat. No. ¹⁾	Auxiliary contacts	Performance data		Features
OA 1G10	1 N/O	U _e	I _e : AC12/DC12	Mountable to right side of switch (max 2).
		24V	8A/10A	
		48V	-/6A	
		110V	8/2A	
OA 1G01	1 N/C	240V	6A/0.7A	Mountable to left side of switch (max 2).

OT 125A...160E

Complete ordering of auxiliaries by ordering mounting base 'OEZNP1' and OBEA auxiliaries as required (max 6). All OBEA aux require base 'OEZNP1' for mounting to switch. Protection degree IP 20. Cable cross section min. 0.5 mm², max. 2 x 2.5 mm². Insulation voltage 690V AC. Thermal current I_{th} = 10 A. For ON and OFF functions of auxiliary and main contacts see page 79.

Cat. No.	Auxiliary contacts	Performance data		Features
OBEA 10	1 N/O	U _e	I _e : AC12/DC12	Mounting with the mounting base OEZNP1 below.
		24V	8A/10A	Max. 6 aux. blocks.
		48V	-/6A	
		110V	8A/2A	
OBEA 01	1 N/C	240V	6A/0.7A	
		400V	4A/-	
OEZNP 1	Auxiliary contact frame for 3 or 4 pole switches			Max. 6 aux. contacts (type OBEA above) can be fitted.

OETL 200...3150

Protection degree IP 20. Cable cross section min. 0.5 mm², max. 2 x 2.5 mm². Insulation voltage 690V AC. Thermal current I_{th} = 10 A. For ON and OFF functions of auxiliary and main contacts see page 80. Contact numbering according to EN50 013.

Cat. No.	Auxiliary operation to suit switch size			Performance data IEC 947-5-1	
	200...315 ²⁾	400...800A	1000...3150 ³⁾	U _e	I _e AC12/DC12
OZXK 1	2 N/O or 2 N/C ⁴⁾	1 N/O + 1 N/C ⁵⁾	1 N/O + 1 N/C	120V	8A/-
OZXK 2	4 N/O or 4 N/C ⁴⁾	2 N/O + 2 N/C ⁵⁾	2 N/O + 2 N/C	125V	-/1.1A
	2 N/O + 2 N/C ⁴⁾	-	-	240V	6A/-
OZXK 3 ¹⁾	8 N/O or 8 N/C ⁴⁾	4 N/O + 4 N/C ⁵⁾	4 N/O + 4 N/C	250V	-/0.55A
	4 N/O + 4 N/C ⁴⁾	-	-	400V	4A/-
	2 N/O + 6 N/C ⁴⁾	-	-	415V	4A/-
	6 N/O + 2 N/C ⁴⁾	-	-	440V	-/0.31A
OZXK 4	1 N/O + 1 N/C	2 N/O ⁵⁾	2 N/O	480V	3A/-
OZXK 5	2 N/O + 2 N/C	4 N/O ⁵⁾	4 N/O	500V	3A/0.27A
OZXK 12	1 N/O + 1 N/C	2 N/C ²⁾	-	600V	-/0.2A
OZXK 13	2 N/O + 2 N/C	4 N/C ²⁾	-	690V	2A/-
OZXK 14	2 N/O or 2 N/C ⁴⁾	1 N/O or 1 N/C ²⁾	-		
OZXK 16	4 N/O + 4 N/C (same as OZXK3)	4 N/O + 4 N/C ²⁾	-		
OZXK 02	1 N/O+1 N/C	2 N/O ²⁾			

Notes: ¹⁾ 8 N/O + 8 N/C auxiliary contacts = 2 x OZXK 3.
²⁾ Mount direct to switch only.
OZXK 16 uses special side mount cam and bracket.

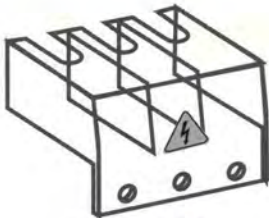
³⁾ Mount using cam & bracket supplied only.
⁴⁾ Aux block rotated 180° will change N/O to N/C, vice versa.
⁵⁾ Mount direct to switch or cam & bracket supplied.



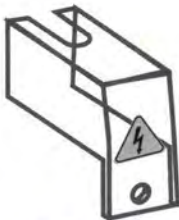
Strömberg Switchline



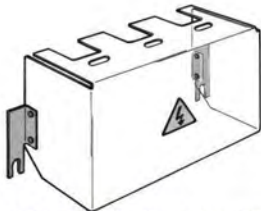
Terminal shrouds – Load-break switches OT, OETL
Accessories



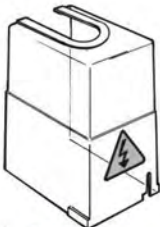
OTS 32,...125T3



OTS 32,...125T1



OETL ZX 31, 32, 93, 94, 111, 112



OETLZX 128 &
OESAZX 102



OETLZX 130

Terminal shrouds for load-break switches – OT, OETL 16...1250A

OT load-break switches OT16...160 offer, IP20 protection as standard.

Cat. No.	For switch sizes	Number of poles	Quantity for full protection [pcs]
OTS 32 T3 OTS 32 T1	OT 16...32E_	3 1	2)
OTS 63 T3 OTS 63 T1	OT 45...63E_	3 1	2)
OTS 80 T3 OTS 80 T1	OT 80E_	3 1	2)
OTS 125 T3 OTS 125 T1	OT 125E_	3 1	2)
OETLZX 128	OETL 200...315	3 4	6 8
OETLZX 31 OETLZX 32	OETL 400	3 4	2 2
OETLZX 177 OETLZX 178	OETL 400KV12 OETL 400KV22	3 4	2 2
OETLZX 179 OETLZX 180	OETL 630...800KV12 OETL 630...800KV22	3 4	2 2
OETLZX 93 OETLZX 94	OETL 630	3 4	2 2
OETLZX 111 OETLZX 112	OETL 800	3 4	2 2
OESAZX 102	OETL 1000, 1250	3 4	6 8

Phase barrier for OETL 200...315

Cat. No.	Description	Packing [pcs]
OETLZX 130	Phase barriers (not needed, when using terminal shrouds OETLZX 128, see above)	4

Notes:) for full 4 pole protection OTS_ T3 & OTS_ T1 must be ordered together.
[] Available on indent only.

Load-break switches

Strömberg Switchline

Handles – Load-break switches OT, OETL Accessories

NHP


OH_1AH 1



OH_3AH 1



OH_2AJ



OH_65...275J_



YAST 1



YASDA 8



OETLZX 74

Optional handles – plastic ¹⁾

Selector type handles for front operated load-break switches.

Indication I ON - O OFF. Shafts must be ordered separately, see page 39. Door drilling Ø53mm and dimensions page 69 to 71.

Cat. No.	Colour	Rating IP	Outline dimension (mm)	Suitable for load-break switch	Features
OHB1AH1	Black	54	48 x 48 x 25	OT 16...80E	Door interlock in 'ON' position
OHY1AH1	Yellow-red				
OHB3AH1	Black	54		OT 16...125E	Door interlock in 'ON' position
OHY3AH1	Yellow-red				Padlockable with one padlock, bail diameter 5...6.3mm
OHB2AJ	Black	65	65 x 65 x 34.5		Door interlock in 'ON' position
OHY2AJ	Yellow-red				Defeatable padlockable with 3 padlocks, bail diameter 5...8mm

Pistol type handles for front operated load-break switches

Shaft has to be ordered separately, see page 39. Door drilling Ø53mm and dimensions page 69 to 71.

Cat. No.	Colour	Handle length (mm)	Shaft diameter (mm)	Suitable for load-break switch	Features
OHB45J5	Black	45	5	OT 16...125E	IP65 protection.
OHY45J5	Yellow-red				
OHB65J5	Black	65	6	OT125A OT160E	Padlockable with up to 3 padlocks in 'OFF' position bail diameter 5...10mm.
OHY65J5	Yellow-red				
OHB80J6	Black	80	8	OETL 200...315	Door interlock in 'ON' position, defeatable.
OHY80J6	Yellow-red				
OHB125J12	Black	125	12	OETL 400...800	Handles may be padlocked in 'ON' position with simple modifications.
OHY125J12	Yellow-red				
OHB145J12	Black	145	12	OETL 400...1600	
OHY145J12	Yellow-red				
OHB175J12	Black	175	12		
OHY175J12	Yellow-red				
OHB275J12	Black	275	12	OETL 400...3150	
OHY275J12	Yellow-red				

Direct mount handle

IP00, For direct mount to switch. See page 31. Dimensions see page 69 to 71.

YAST 1	Black	-	-	OT 125A, OT 160E	No shaft required.
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Handles for side operated switches

Door drilling Ø53mm, see page 70.

OHB80J8 E00S	Black	80	8	OETL 200...315	See features above.
OHB145J12 E00S	Black	145	12	OETL 400...800	Same applies.

Optional handles – metal ¹⁾

Handles for front operated switches

IP 65, padlockable with 3 padlocks in OFF position, door drilling Ø45mm, see page 69 to 71.

Shaft has to be ordered separately, see page 39.

Cat. No.	Colour	Handle length (mm)	Shaft diameter (mm)	Suitable for load-break switch
YASDA 28	Black	145	12	OETL 400...800
YASDA 8	Black	220	12	OETL 400...3150

Handles for side operated switches

IP 65, padlockable with 3 padlocks in OFF position, door drilling Ø18mm, see page 69 to 71. Includes 12mm shaft.

OETLZX 74	Black	185	12	OETL 400...800
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Notes: ¹⁾ Shaft has to be ordered separately see page 39. Handles for changeover and bypass mechanism also available please refer to NHP.
 1) Available on indent only.

Strömberg Switchline

NHP

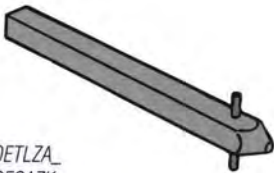
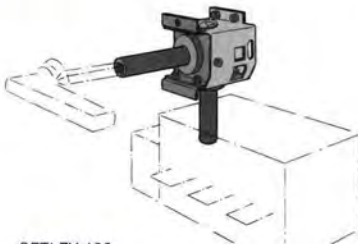
Shafts – Load-break switches OT, OETL Accessories and shaft accessories



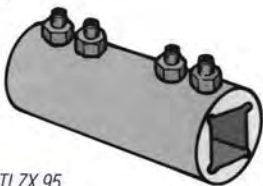
OX_ (for selector type handles)



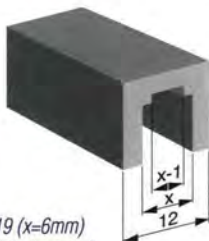
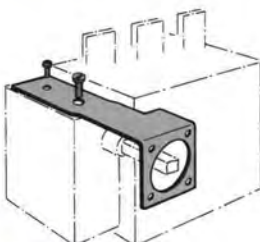
OESAZ_

OETLZA_
OESAZK_

OETLZX 108



OETLZX 95,

OETLZX 19 (x=6mm)
OETLZX 123 (x=8mm)

OHZX 1, 2, 3

Optional extended shafts

Cat. No.	Length (mm)	Diameter (mm)	H mm	For switch type	For handle type
OX5X85	85	5-keyed	Refer dimensional diagrams on page 56 to 57.	OT16...125E	OH_1 AH1 OH_3 AH1 OH_2AJ
OX5X120	120				
OX5X180	180				
OX5X330	330				
OX5X150	150	6	210 295 365 435	OT125A...160E	OH_45J5 OH_65J5
OX5X265	265				
OX5X400	400				
OX6X210	210				
OX6X290	290	8	185...215 220...320 320...420 480...580	OETL 200...315	OH_45J5 OH_80J6 OH_80J6E011
OX6X360	360				
OX6X530	530				
OX8X140	140				
OX8X240	240	12	160...255 230...340 255...325 260...370 285...355 305...415 330...400 340...535 375...485 400...470 410...605 445...555 470...540 480...675 515...625 540...610 550...745	OETL 400...800	OH_80J8 OH_80J8 E00S
OX8X340	340				
OX8X500	500				
OX12X166	166				
OX12X250	250	12	160...255 230...340 255...325 260...370 285...355 305...415 330...400 340...535 375...485 400...470 410...605 445...555 470...540 480...675 515...625 540...610 550...745	OETL 400...800	OH_125J12 OH_145J12 OH_175J12 OH_275J12 OH_145J12 E00S OH_145J12 E001 OETLZX 74
OX12X280	280				
OX12X365	325				
OX12X395	395				
OX12X465	465	12	160...255 230...340 255...325 260...370 285...355 305...415 330...400 340...535 375...485 400...470 410...605 445...555 470...540 480...675 515...625 540...610 550...745	OETL 400...800	YASDA 28, YASDA 8, YASDA 6 YASDA 6, YASDA 8
OX12X535	535				
OX12X395 DP ¹⁾	395				

Accessories

Cat. No.	For switch type	Remarks
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90° angle kit

OETLZX 108	OETL 400...3150	A normal switch can be changed to a side operated switch
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Shaft extension socket

OETLZX 95	OETL 400...3150	A normal switch can be changed to a side operated switch For extending the shaft or use in combination with OETLZX 19, OETLZX 123 for shafts of different size.	12mm shaft
OETLZX 19		Adapters to place inside of OETLZX 95 to connect shafts of different sizes	6mm & 5mm shaft
OETLZX 123			8mm shaft

Handle mounting bracket

OHZX 2	OETL 200...315	Handle support bracket for direct mounting of handle on switch behind door
OHZX 1	OETL 400...800	
OHZX 3	OETL 1000...3150	

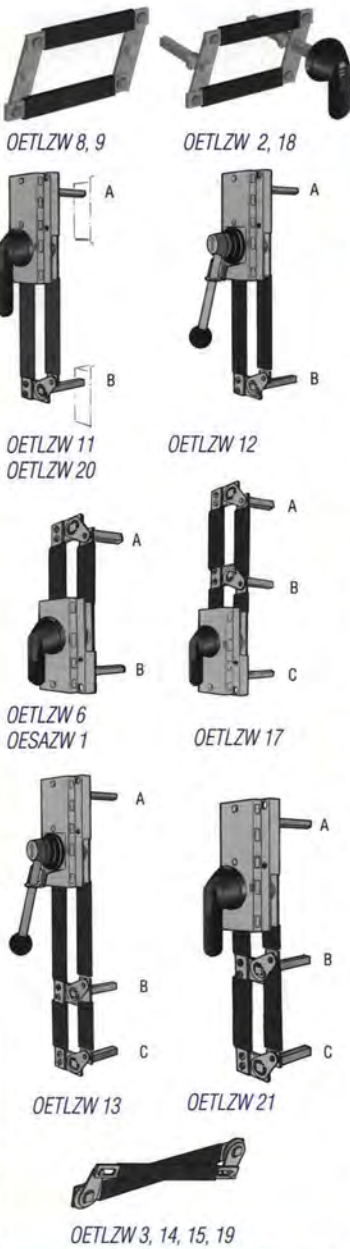
Note: ¹⁾ OXP12395DP has double pin for interlocking of door

Load-break switches

Strömberg Switchline

Multipole, changeover & bypass mechanisms – Load-break OT, OETL Accessories

NHP

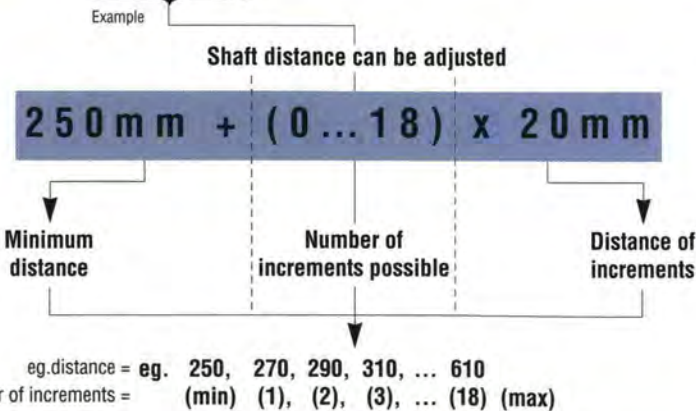


The mechanisms are provided with holes, enabling different shaft distances, see example below.
For dimensional diagrams refer pages 72 to 75.
The combination switches can be mounted either horizontally or vertically.

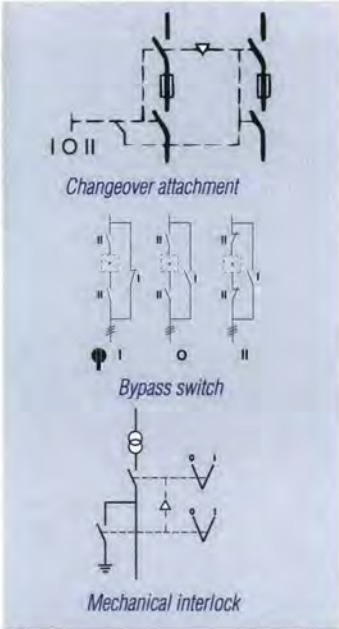
Cat. No.	Shaft distance [mm]	Remark	For switch sizes
6 and 8-pole mechanism			
Parallel attachment for building 6 and 8-pole switches. Both switches work simultaneously.			
OETLZW 8	30 + (0...13) x 15	Requires standard handle (1 pc – see p 38.) and shaft (2 pcs – see p 39.) To suit switch OT 16...125E	OT 16E...125E
OESAZW 2	45 + (0...11) x 15	Includes handle (OHB145J12) and shaft (2 pcs) included in the kit	OT 125A, 160E
OETLZW 18	80 + (0...10) x 20	Includes handle (OHB145J12) and shaft (2 pcs) included in the kit	OETL 200...315
OETLZW 9	60 + (0...19) x 20	Requires 1 handle and 2 shafts for operation. Handle and shafts supplied with switches can be used. Otherwise see p 39 for shafts and p 38 for handles	OETL 400...1600

Changeover mechanism			
OTZW 6	90 + (0...10) x 15	Includes shafts and a plastic handle (OHB80J6E011) with I-O-II indication	OT 16E...125E
OESAZW 1	90 + (0...10) x 15	Includes shafts and a plastic handle (OHB80J6E011) with I-O-II indication	OT 125A, 160E
OETLZW 20	210 + (0...11) x 20	Include shafts and a plastic handle (OHB145J12E011) with I-O-II indication	OETL 200...315
OETLZW 11	210 + (0...11) x 20	Include shafts and a plastic handle (OHB145J12E011) with I-O-II indication	OETL 400
OETLZW 12	210 + (0...20) x 20	Include shafts and a metallic handle (YASDA 6) with I-O-II indication	OETL 630...1600

By-pass mechanism			
A combination of two switches in parallel with one change-over to by-pass, for example, a breaker for maintenance. The by-pass attachment can be used together with another combination attachment.			
OTZW 17	Between A and B 90 + (0...6) x 15 Between A and C 90 + (0...10) x 15	Kit includes shafts and a plastic handle (OHB80J6E011) with I-O-II indication	OT 16E...125E
OETLZW 21	Between A and C 210 + (0...9) x 20 Between A and C 250 + (0...9) x 20	Kit includes shafts and a plastic handle (OHB145J12E011) with I-O-II indication	OETL 200...315
OETLZW 13	Between A and B 210 + (0...18) x 20 Between A and C 250 + (0...18) x 20	Mechanism kit includes shafts and a metal handle with I-O-II indication	OETL 400...1600



Mechanical interlock			
Prevents one switch from closing to ON-position if the other is not in OFF-position. Suitable shafts and handle; see the table below.			
OTZW10	190	The standard handle and shaft can be used for operation	OT 125A...160E
OETLZW 19	(3 pole) (4 pole) 240 280	Requires handle (1 pc) see page 38 and shaft 8mm (2 pcs), see page 39. To suit switch OETL 200...315	OETL 200...315
OETLZW 3	300	Requires handle (1 pc) see page 38 and shaft (2 pc) see page 39.	OETL 400...1600
OETLZW 14	250	For OETL 1000...1600 – OHB175J12, OETL 400...800 – YASDA 6	OETL 400...1600
OETLZW 15	500		OETL 400...3150



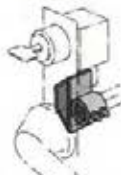
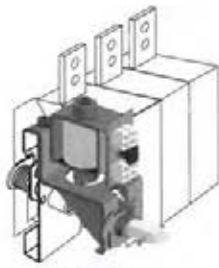
Strömberg Switchline

NHP

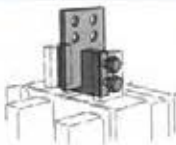
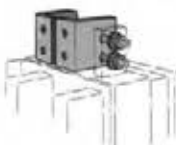
Interlocking and connection accessories – Load-break OT, OETL Accessories



SA 1

OETLZW 16.5
Cam attachment (lock
and key not included)

OETLZT 80_

OETLZT 100, 140
Mounting bracketOETLZT 80 A
Electrical interlockOETLZT 80 L
Electrical interlockOETLZX 115
Vertical mountingOETLZX 114
Vertical / back mountingOETLZX 114/1
Edgewise mounting

Locking accessories

Cat. No.	Shaft sizes	For switch sizes	Description
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Padlock adaptor

SA 1	—	OT 16...125, OT 125A...160E	Padlocking adaptor with 3.5mm hasp.
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Mechanical interlock

OETLZW 16	5,6,8 mm	OT 16...125E, OT 125A, OT 160E	Cam attachment for Castell, Fortress interlocks. Cam attachment for adopting the switches to the interlock system. The lock and key are not included and must be ordered separately (LSF lock no. is H31Q/SHOT/DS). Refer p 76 for mounting dimensions.
OETLZW 5	12 mm	OETL 400...3150	

Electrical interlock

OETLZT 80A/coil voltage AC: 240 DC: <input type="checkbox"/> 60 <input type="checkbox"/> 110 <input type="checkbox"/> 48 <input type="checkbox"/> 60 <input type="checkbox"/> 24 <input type="checkbox"/> 48 <input type="checkbox"/> 24	(Electrical interlock can be mounted directly to OETL 1000...3150 switches. Switch sizes OETL 200...800 require mounting bracket OETL ZT100, 140, see below	Closed circuit principal, for interlocking the switch movement. When the coil circuit is dead, A-types can't be operated to ON-position and L-types to ON- or OFF position. U_n/R : 110V AC/1000Ω, 220V AC/3900Ω, 24VDC/48Ω, 48VDC/190Ω, 60VDC/300Ω, 110VDC/1000Ω, 220VDC/3900Ω P = 15 W $U = 0.7...1.1 U_n$
OETLZT 80L/coil voltage AC: 240 DC: <input type="checkbox"/> 240 <input type="checkbox"/> 110 <input type="checkbox"/> 110 <input type="checkbox"/> 60 <input type="checkbox"/> 60 <input type="checkbox"/> 48 <input type="checkbox"/> 48 <input type="checkbox"/> 24 <input type="checkbox"/> 24		
OETLZT 140	OETL 200...315	Mounting bracket
OETLZT 100	OETL 400...800	- for adapting OETLZT 80_ onto OETL 200...800

Busbar connections for OETL 2500 and OETL 3150

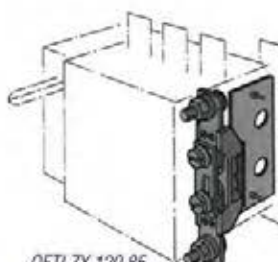
Busbar termination from different directions can be carried out by means of terminal connection kits providing ease and speed of installation.

Cat. No.	Number of connectors	Description	Packing (pcs)	For switches
<input type="checkbox"/> OETLZX 115	6	Vertical mounting	1	3 pole
<input type="checkbox"/> OETLZX 115/1	8			4 pole
OETLZX 114	6	Vertical / back mounting or Edgewise mounting	1	3 pole
OETLZX 114/1	8			4 pole

Neutral links

Cat. No.	I_{th} [A]	Max. cable cross section/Cu [mm ²]	Description	Suitable for switch fuse size
OETLZX 129	400	240	Detachable, mounted to the switch	OETL 200...315
OESAZX 85	400	240		OETL 400...800
OESAZX 162	200	10...120	Mounted separately to the base plate	
OESAZX 164	315	10...300		
OESAZX 165	400	10...300		

Note: ☐ Available on indent only.

OETLZX 129 85
Neutral link

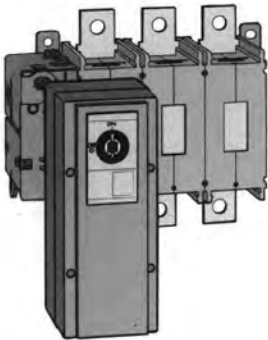
Strömberg Switchline

Motor operators – Load-break switches, OETL Accessories

NHP

Motor operator

OEMO motor operator has been designed for remote control of the switch. The standard delivery includes complete control circuit; short cable and manual handle (YASDA 23).



OEMO Motor Operator

Cat. No.	Functions	For load-break switches	Nominal Current [A]	Max. Current [A]	Weight [kg]
OEMO 001 ¹⁾ OEMO 002 ¹⁾ OEMO 003 ¹⁾ OEMO 004 ¹⁾	1-0 (ON-OFF)	OETL 200...315 OETL 400...800 OETL 1000...1600 OETL 2500...3150	1	4	5.5
OEMO 101 ²⁾ ...V' OEMO 202 ²⁾ ...V' OEMO 303 ²⁾ ...V'	I-O-II Change-over mechanism needed	OETL 200...315 OETL 400...800 OETL 1000...1600	1	4	5.5

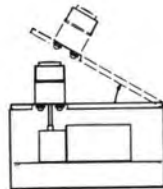
Notes: ¹⁾ Changeover mechanism is required see page 40 and must be ordered together with OEMO 101...103.
²⁾ Please include following voltage required in ordering number.

240V AC ☐ AC: 24V, 48V, 110V

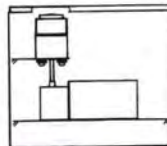
☐ DC: 24V, 48V

☐ Available on indent.

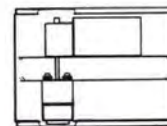
MOUNTING OPTIONS



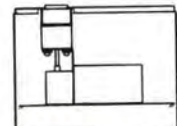
On the door



Behind the door



Behind the switch



Flush mounting

Strömberg Enclosed switches

NHP

Load-break switches



Typical Standard range



Typical Midline range



Typical Eclipse range

Standard range (self assembly made easy)

Steel enclosed load-break switches, 200...800A

- 1.2mm sheet steel enclosure
- Integral earth stud and neutral link
- Pre-drilled mounting plate and door
- Removable door
- Easy self assembly



Midline range (fully assembled)

Steel enclosed load-break switches and switch fuses

Plastic enclosed load-break switches and switch fuses

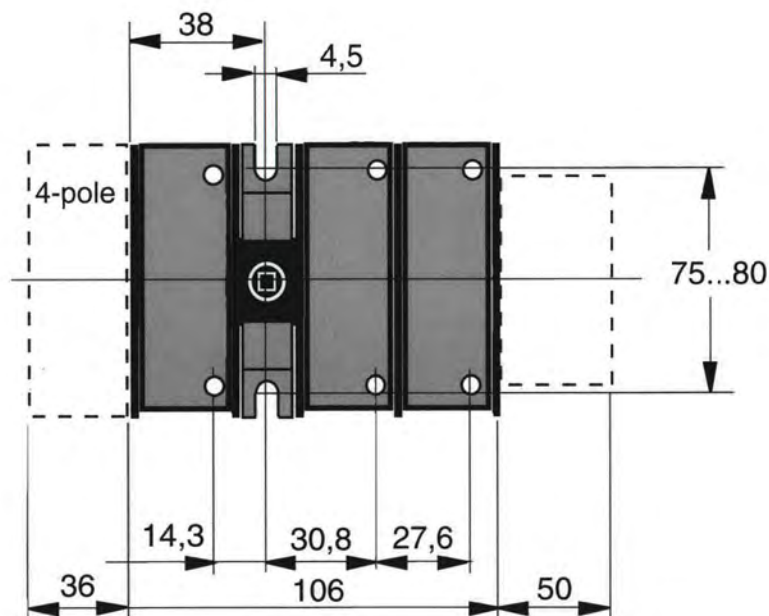
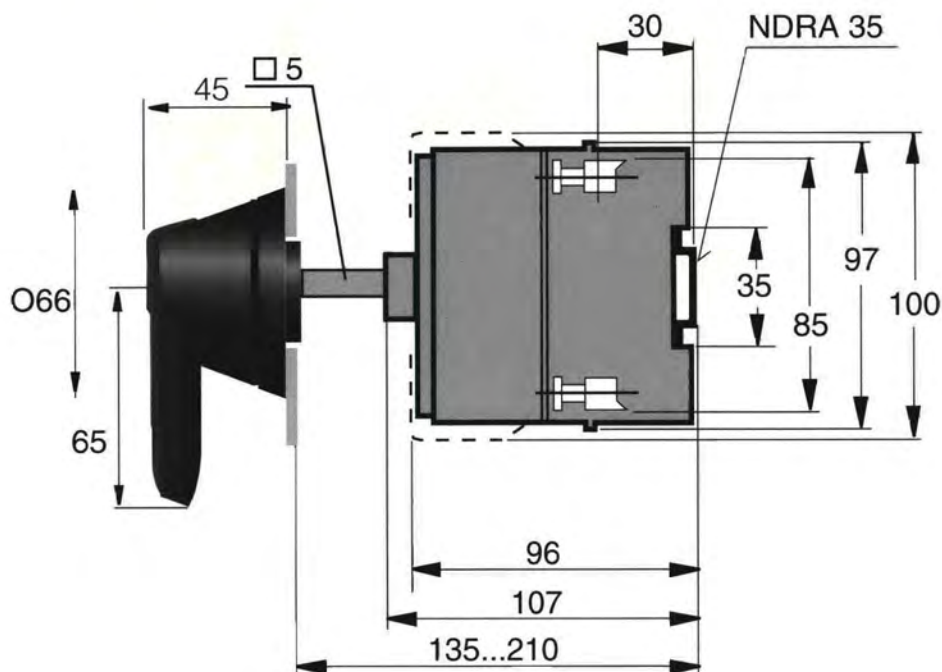
- IP54 protection (minimum)
- Doors hinged left or right
- Polyurethane gasket
- Concealed hinges
- Ratings from 16 to 1600A
- Key lockable door
- Durable powdercoat finish
- Neutral link
- Insulated versions available

Eclipse range (self assembly made easy)

Steel enclosed load-break switches 200...800A

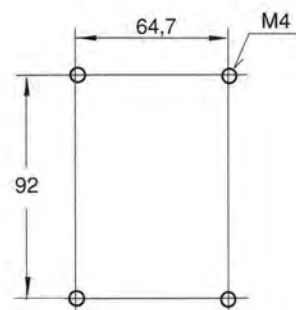
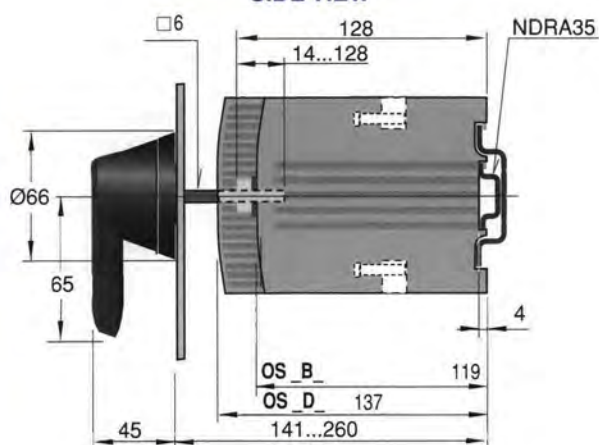
- Fully welded 1.6mm sheet steel enclosure
- IP54 standard or IP65 option
- Aluminium, steel or brass gland plate options
- Durable powdercoat finish
- Neutral link and earth studs provided
- Ratings from 80 to 800A
- Removable doors hinged left or right
- Pre-drilled mounting plate
- Integral wall mounting brackets
- Easy self assembled or fully assembled option

All NHP enclosed switches are finished in RAL7032 powdercoat.

Strömberg PowerLine**Switch fuses OESA 32A – Mini**
Dimensional drawings (mm)**NHP****Mini****OESA mini 3 and 4 pole**

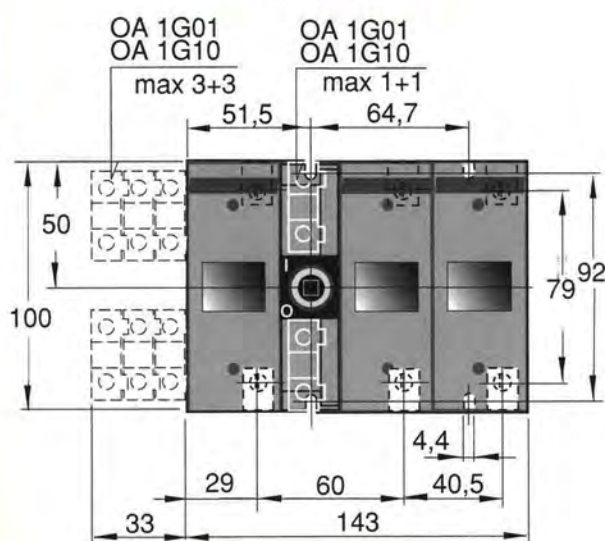
32A and 63A DIN & BS

SIDE VIEW



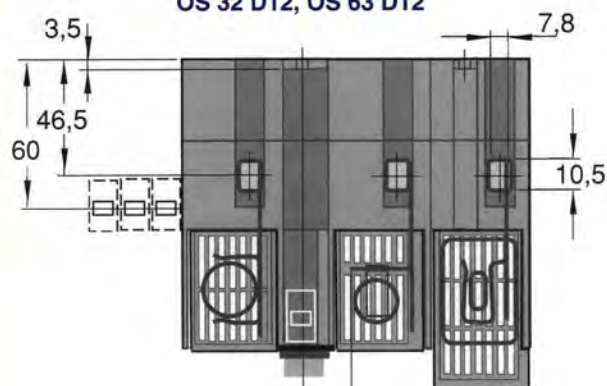
FRONT VIEW – 3 POLE

OS 32 B12, OS 63 B12
OS 32 D12, OS 63 D12



TOP VIEW – 3 POLE

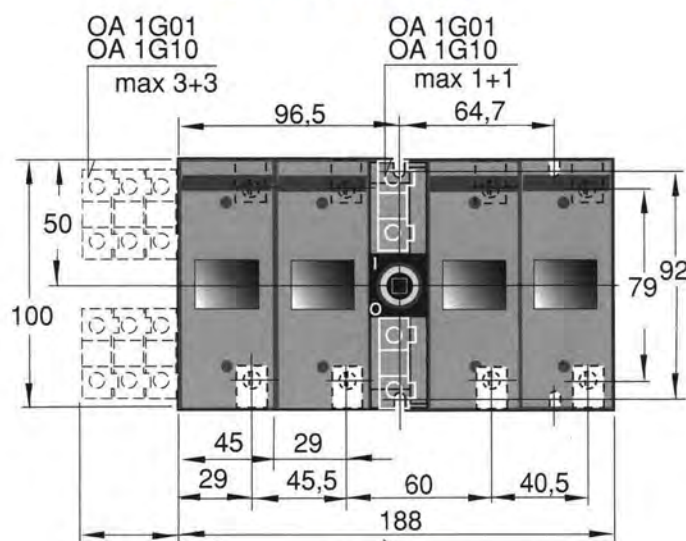
OS 32 B12, OS 63 B12
OS 32 D12, OS 63 D12



BS 88 A2, A3	DIN 00
OS 32B12	OS 32D12
OS 63B12	OS 63D12

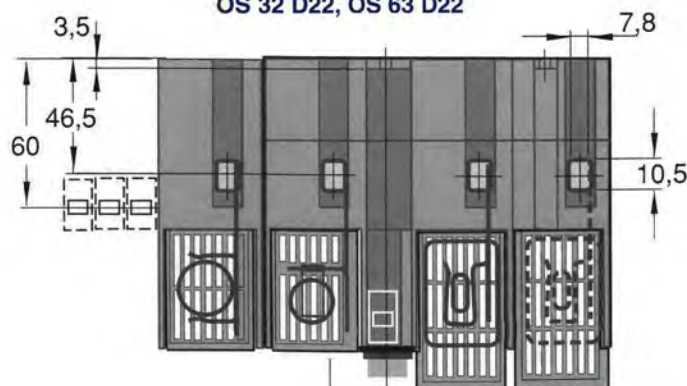
FRONT VIEW – 4 POLE

OS 32 B22, OS 63 B22
OS 32 D22, OS 63 D22



TOP VIEW – 4 POLE

OS 32 B22, OS 63 B22
OS 32 D22, OS 63 D22



BS 88 A2, A3	DIN 00
OS 32B22	OS 32D22
OS 63B22	OS 63D22

Strömberg PowerLine

Switch fuses OESA, 32A...63A – Front operated
Dimensional drawings (mm)

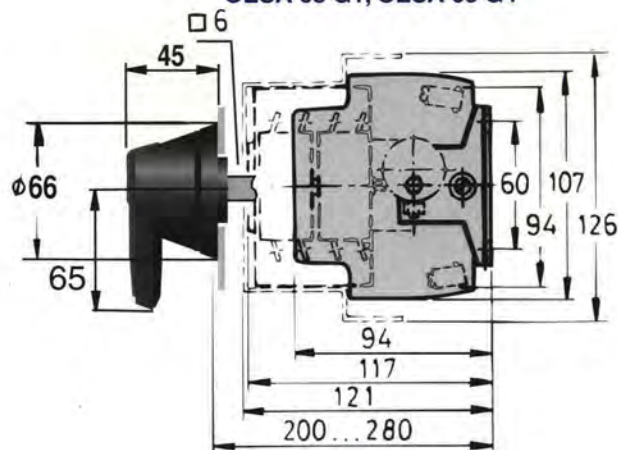
DIN &
BS type

NHP

32A and 63A BS

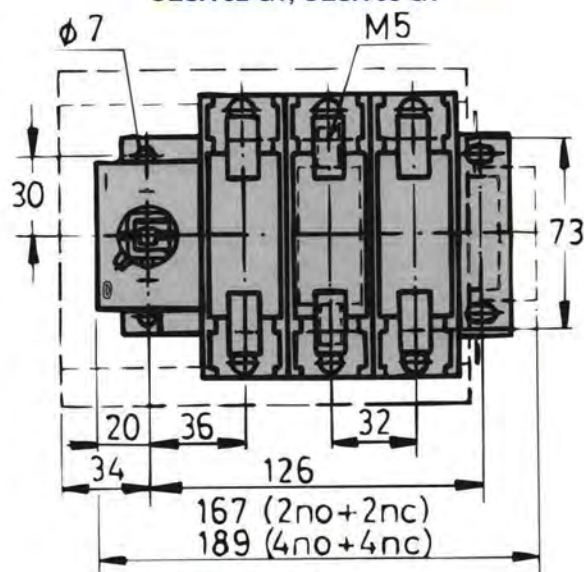
SIDE VIEW

OESA 32 G1, OESA 32 G4
OESA 63 G1, OESA 63 G4



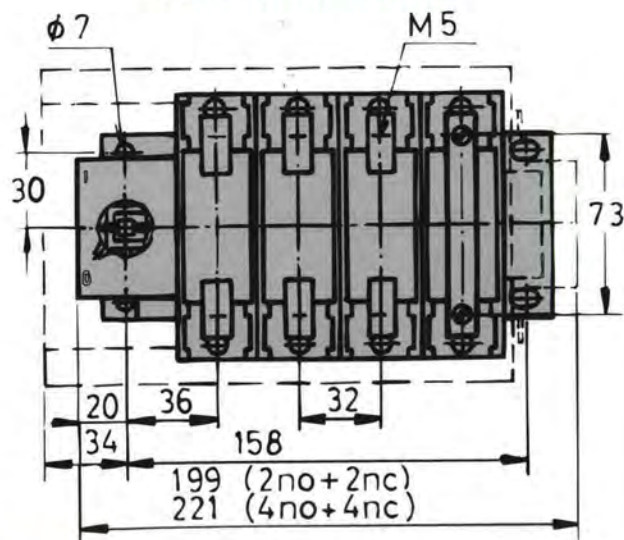
FRONT VIEW – 3 POLE

OESA 32 G1, OESA 63 G1



FRONT VIEW – 4 POLE

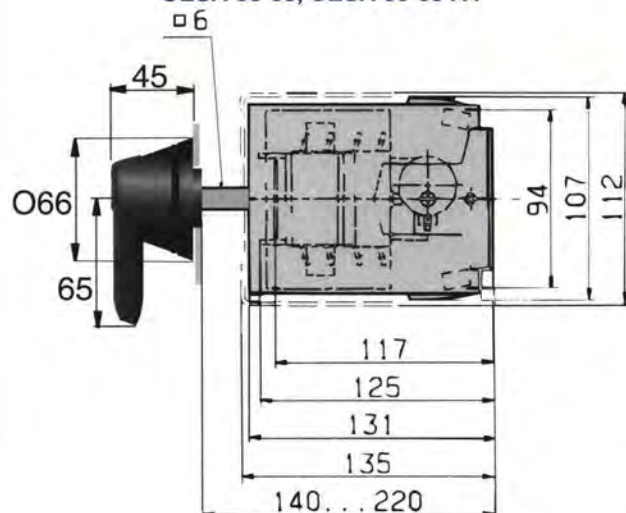
OESA 32 G4, OESA 63 G4



32A and 63A DIN

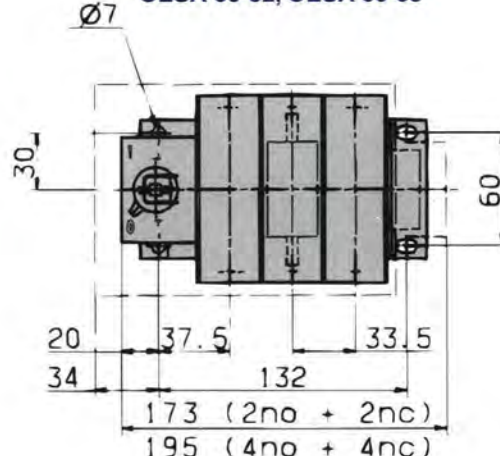
SIDE VIEW

OESA 00-32, OESA 00-32 A4
OESA 00-63, OESA 00-63 A4



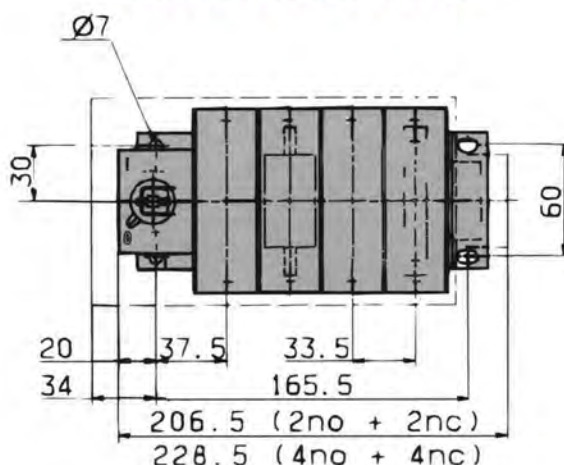
FRONT VIEW – 3 POLE

OESA 00-32, OESA 00-63



FRONT VIEW – 4 POLE

OESA 00-32 A4, OESA 00-63 A4



Switch fuses

Strömberg PowerLine

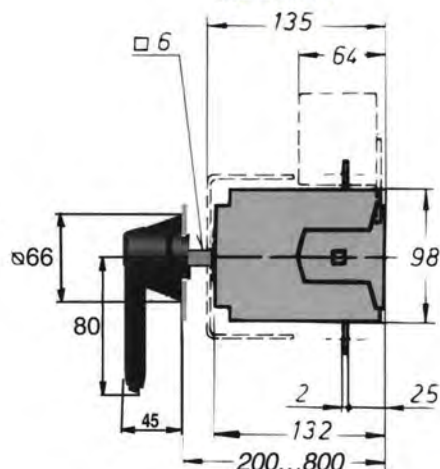
Switch fuses OESA, 100A – Front operated
Dimensional drawings (mm)

NHP

BS
type

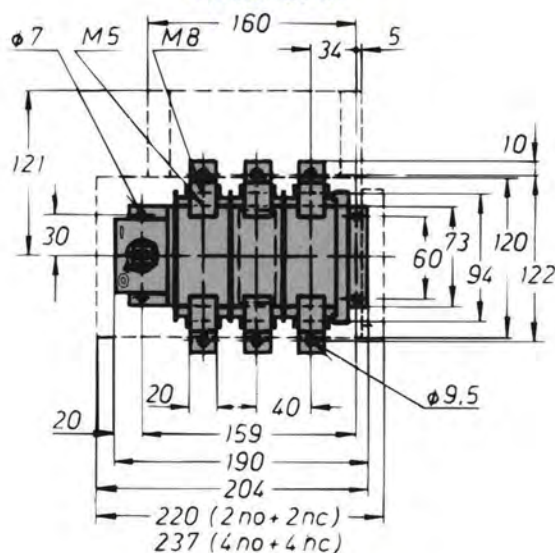
100 A BS

SIDE VIEW

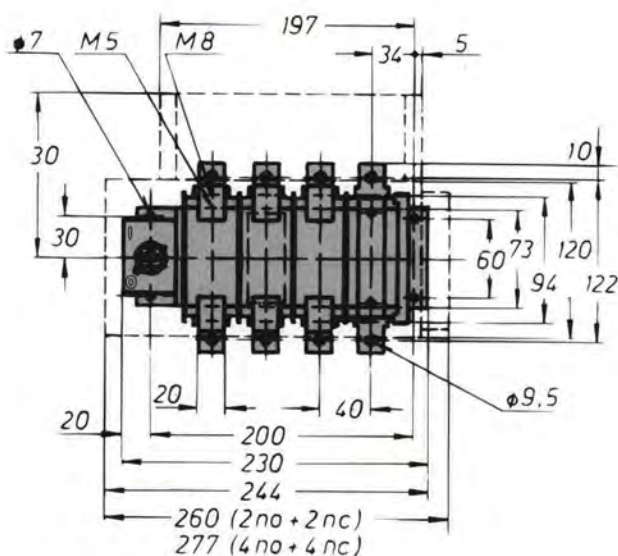


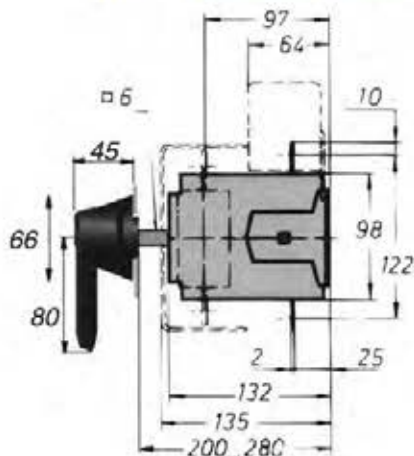
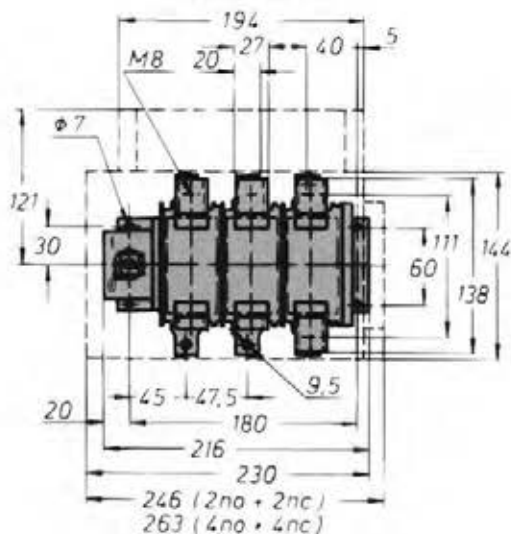
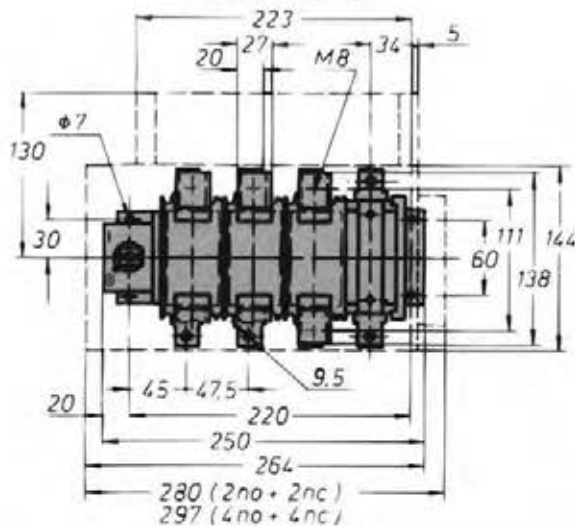
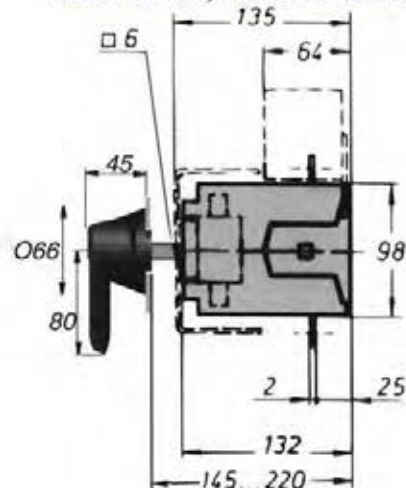
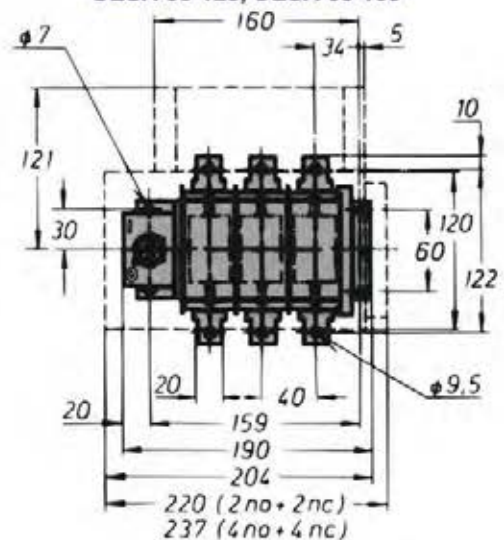
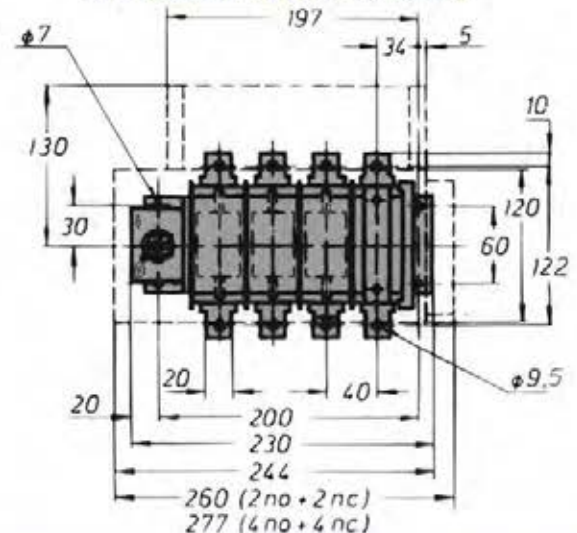
FRONT VIEW – 3 POLE

OESA 100 G1



FRONT VIEW – 4 POLE



Strömberg PowerLine**Switch fuses OESA, 125A...160A – Front operated**
Dimensional drawings (mm)**DIN &
BS type****NHP****160A BS****SIDE VIEW**
OESA 160 B3, OESA 160 B4**FRONT VIEW – 3 POLE**
OESA 160 B3**FRONT VIEW – 4 POLE**
OESA 160 B4**125A and 160A DIN****SIDE VIEW**
OESA 00-125, OESA 00-125 A4
OESA 00-160, OESA 00-160 A4**FRONT VIEW – 3 POLE**
OESA 00-125, OESA 00-160**FRONT VIEW – 4 POLE**
OESA 00-125A4, OESA 00-160 A4

Switch fuses

Strömberg PowerLine

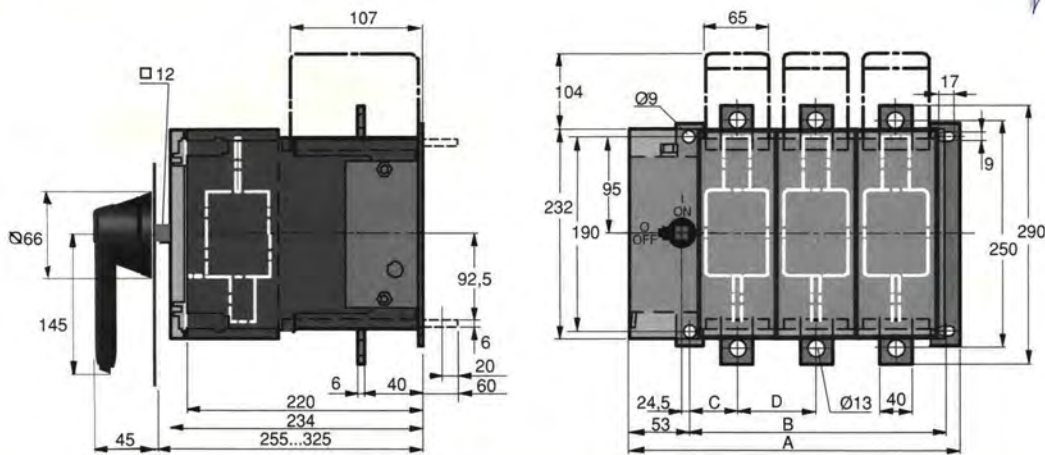
Switch fuses OESA, 630A...800A – Front operated

Dimensional drawings (mm)

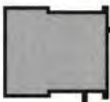
NHP

DIN & BS type

OESA 630A...800A



OESA 630D3



OESA 630D3BD



OESA 630D3BB

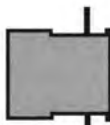
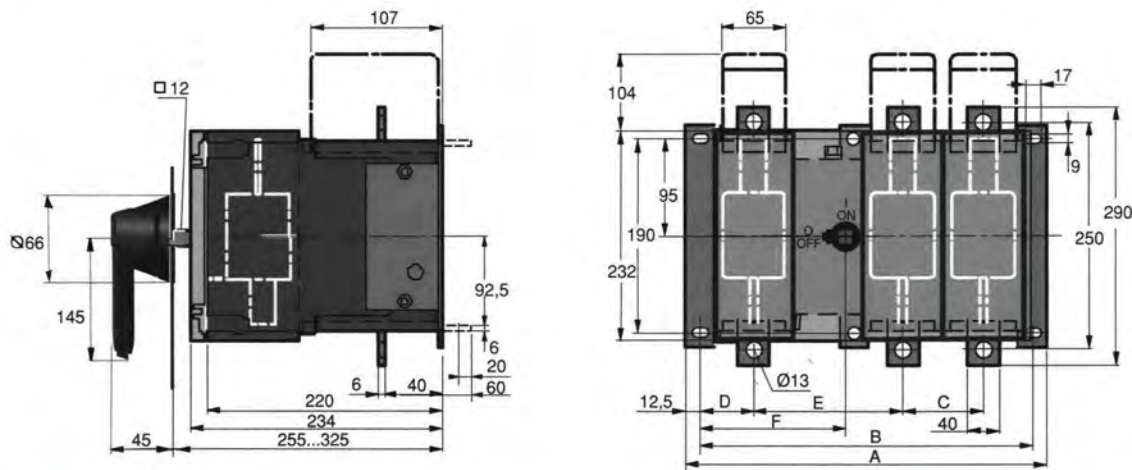


OESA 630D3UB

Switch fuses

Outboard shafts

DIN-pattern	No. of poles	BS-pattern	A	B	C	D
OESA 630D3	3	OESA 630B3	343	278	59	80
OESA 630D4	4	OESA 630B4	423	358	59	80
OESA 800D3	3	OESA 800B3	373	308	64	90
OESA 800D4	4	OESA 800B4	463	398	64	90



OESA 630DV12



OESA 630DV12BD



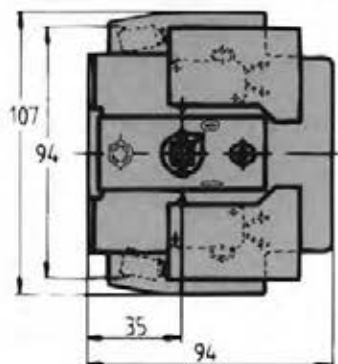
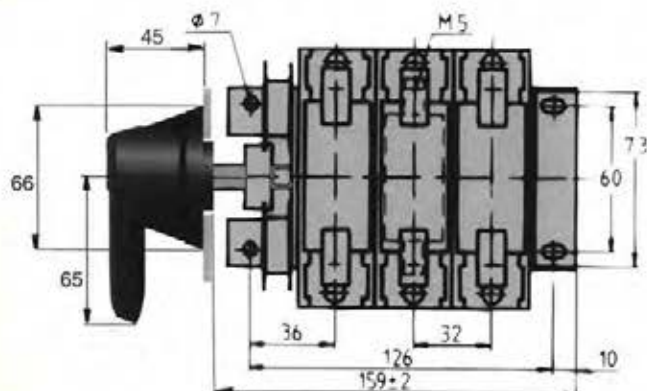
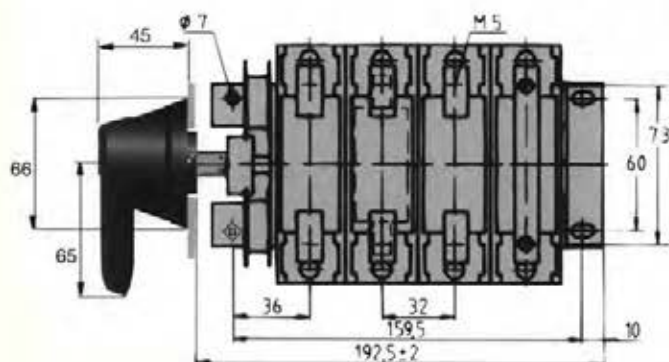
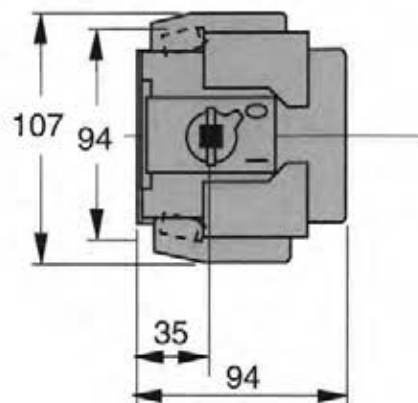
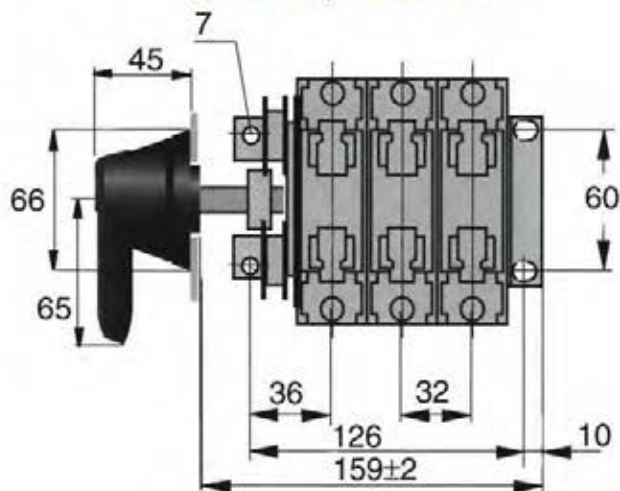
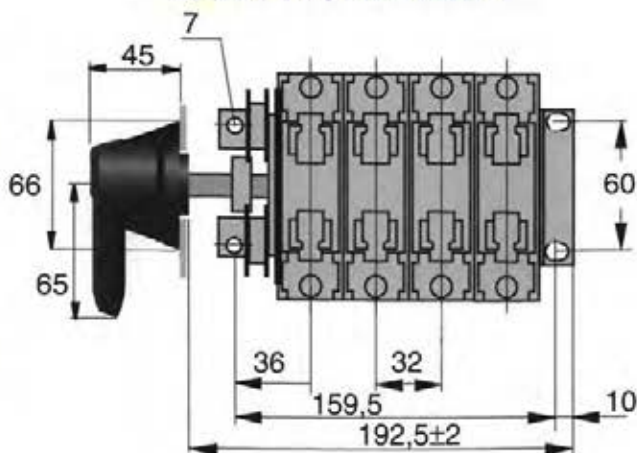
OESA 630DV12BB



OESA 630DV12UB

Inboard shafts

DIN-pattern	No. of poles	BS-pattern	A	B	C	D	E	F
OESA 630DV12	3	OESA 630BV12	378	353	80	59	155	131
OESA 630DV22	4	OESA 630BV22	458	433	80	59	155	211
OESA 800DV12	3	OESA 800BV12	408	383	90	64	165	141
OESA 800DV22	4	OESA 800BV22	498	473	90	64	165	231

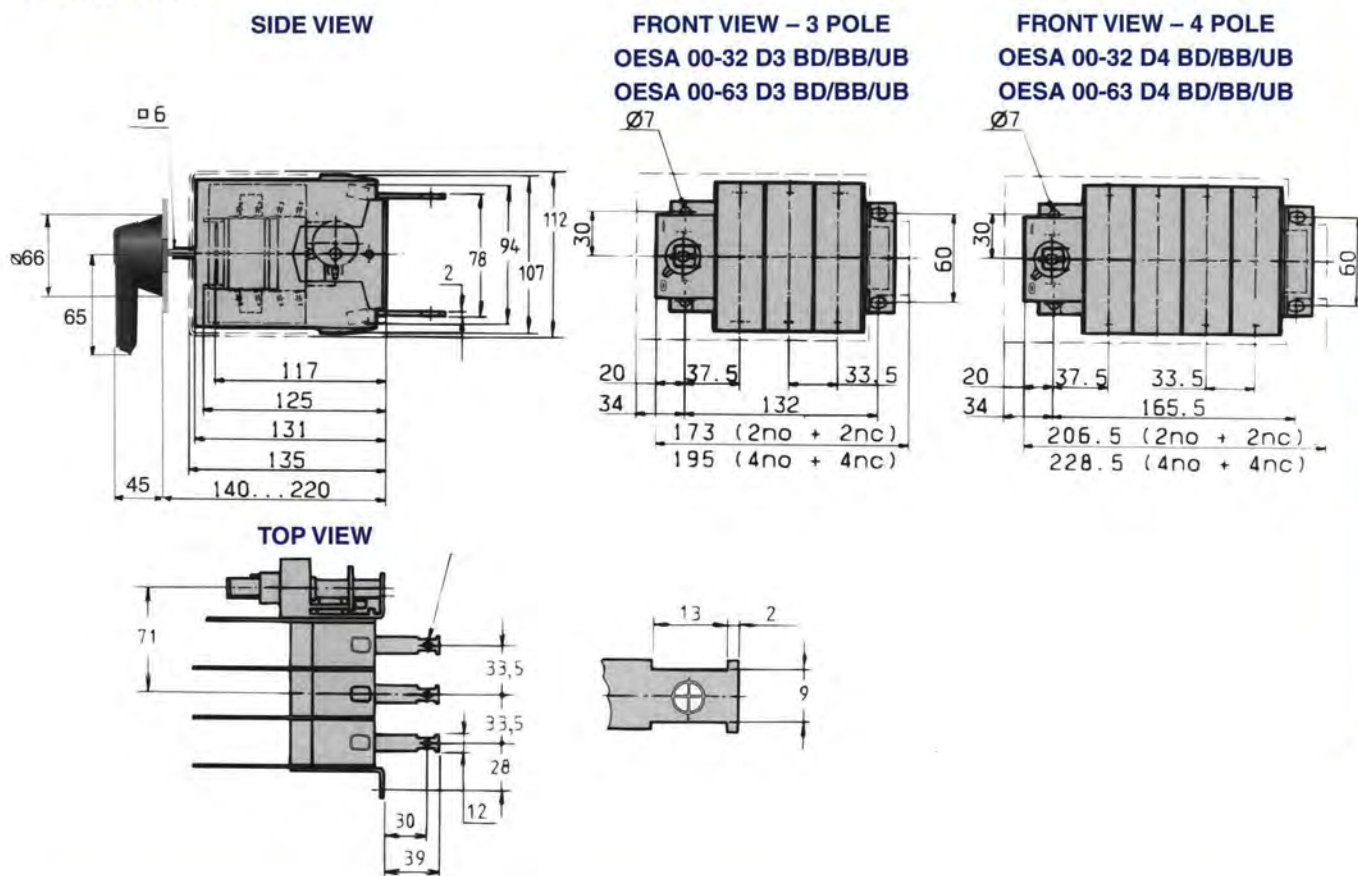
Strömberg PowerLine**Switch fuses OESA, 32A...63A – Side operated**
Dimensional drawings (mm)**NHP****DIN & BS type****32A and 63A BS****SIDE VIEW**
OESA 32 BM3, OESA 32 BM4
OESA 63 BM3, OESA 63 BM4**FRONT VIEW – 3 POLE**
OESA 32 BM3, OESA 63 BM3**FRONT VIEW – 4 POLE**
OESA 32 BM4, OESA 63 BM4**32A and 63A DIN****SIDE VIEW**
OESA 32 DM3, OESA 32 DM4
OESA 63 DM3, OESA 63 DM4**FRONT VIEW – 3 POLE**
OESA 32 DM3, OESA 63 DM3**FRONT VIEW – 4 POLE**
OESA 32 DM4, OESA 63 DM4

Strömberg PowerLine

Switch fuses OESA, 32A...160A – Back connect Dimensional drawings (mm)

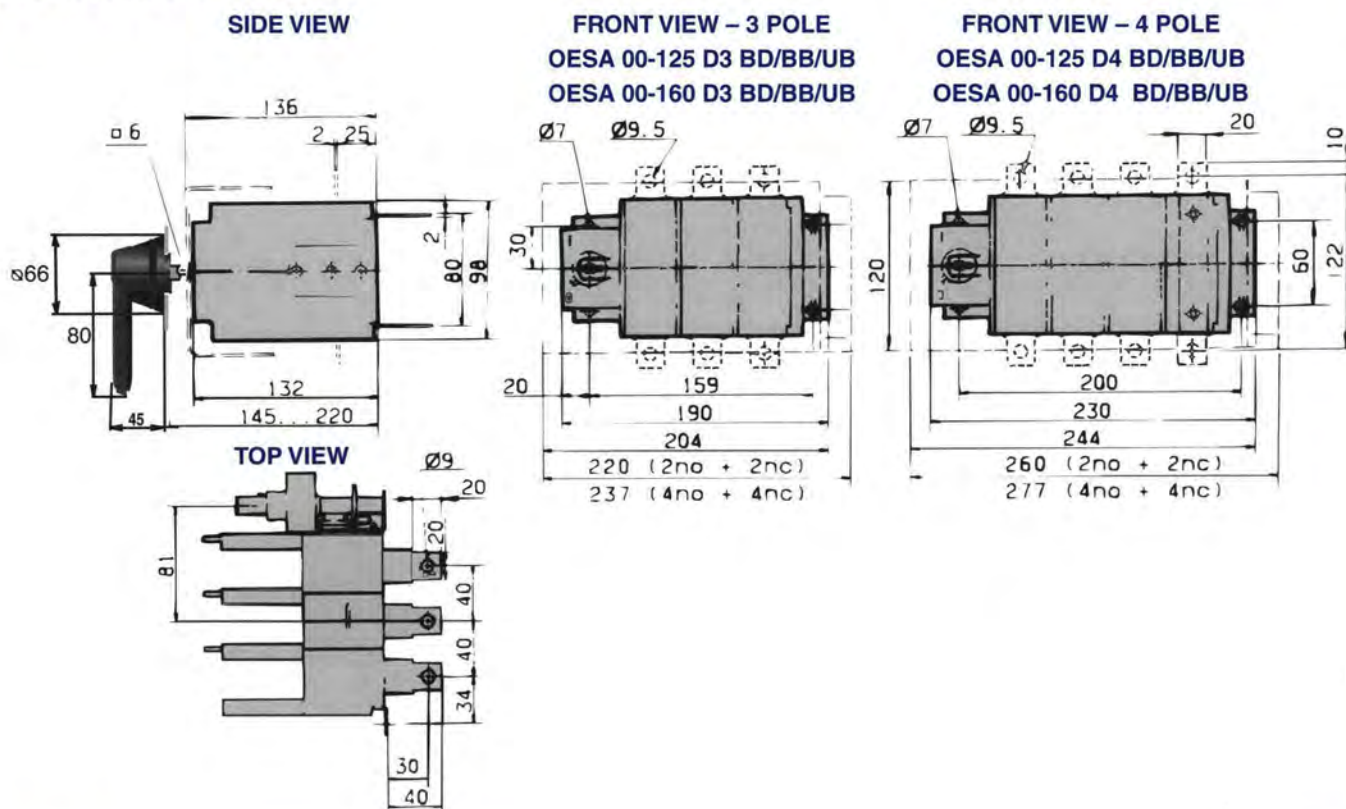
NHP
**DIN
type**

32A and 63A DIN



Switch fuses

125A and 160A DIN



Strömberg PowerLine

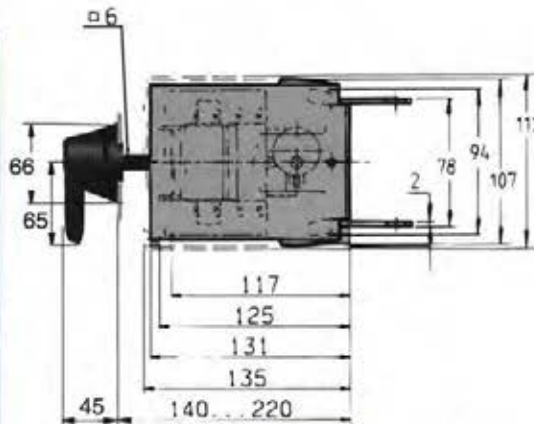
Switch fuses OESA, 32A...100A – Back connect
Dimensional drawings (mm)

NHP

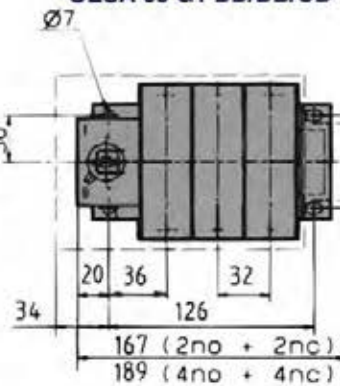
*BS
type*

32A and 63A BS

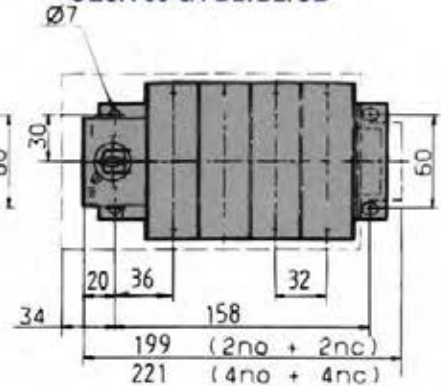
SIDE VIEW



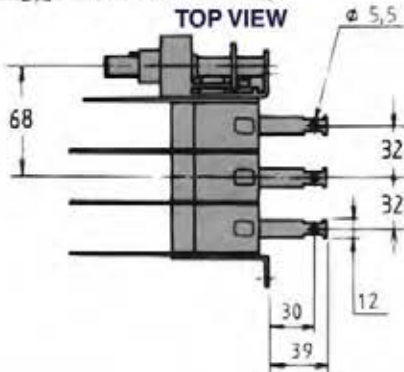
FRONT VIEW – 3 POLE
OESA 32 G1 BD/BB/UB
OESA 63 G1 BD/BB/UB



FRONT VIEW – 4 POLE
OESA 32 G4 BD/BB/UB
OESA 63 G4 BD/BB/UB



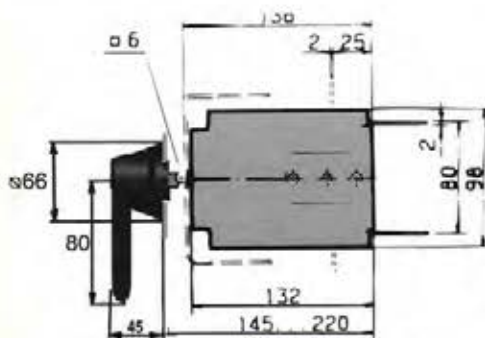
TOP VIEW



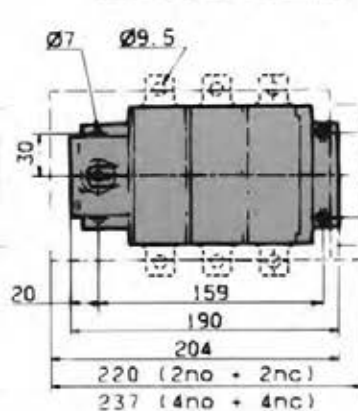
FOR TERMINAL YUZL 30

125A and 160A BS

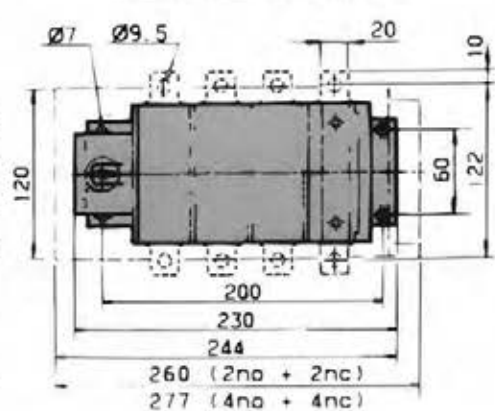
SIDE VIEW



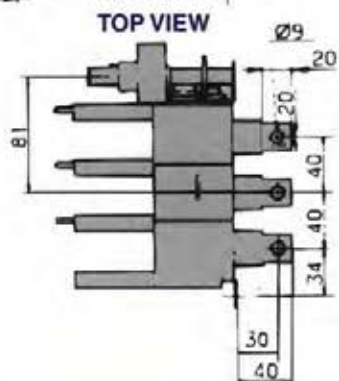
FRONT VIEW – 3 POLE
OESA 100G1 BD/BB/UB



FRONT VIEW – 4 POLE
OESA 100G4 BD/BB/UB



TOP VIEW



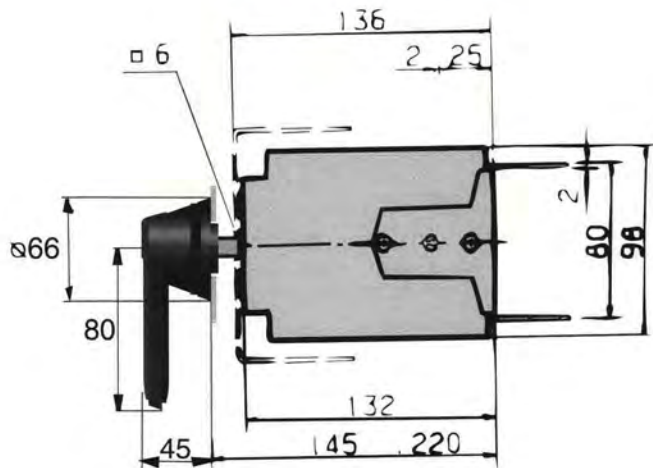
Strömberg PowerLine

Switch fuses OESA, 160A – Back connect Dimensional drawings (mm)

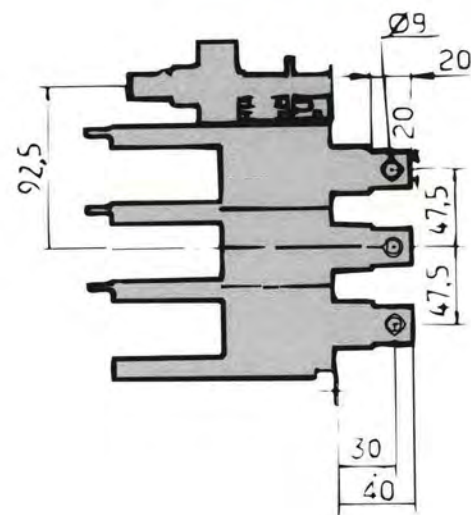
NHP
**Bg
type**

160A BS

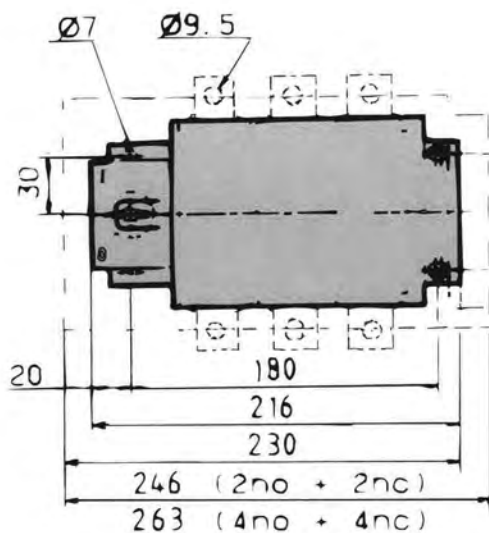
SIDE VIEW
OESA 160 B3 BD/BB/UB
OESA 160 B4 BD/BB/UB



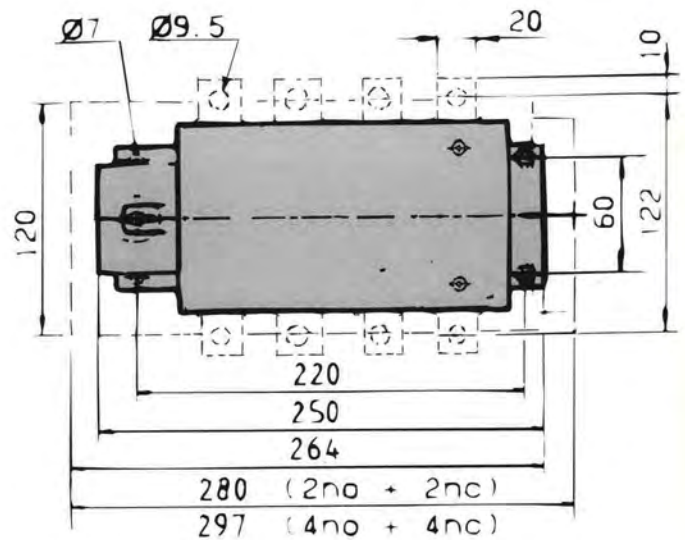
TOP VIEW
OESA 160 B3 BD/BB/UB
OESA 160 B4 BD/BB/UB



FRONT VIEW – 3 POLE
OESA 160 B3 BD/BB/UB



FRONT VIEW – 4 POLE
OESA 160 B4 BD/BB/UB

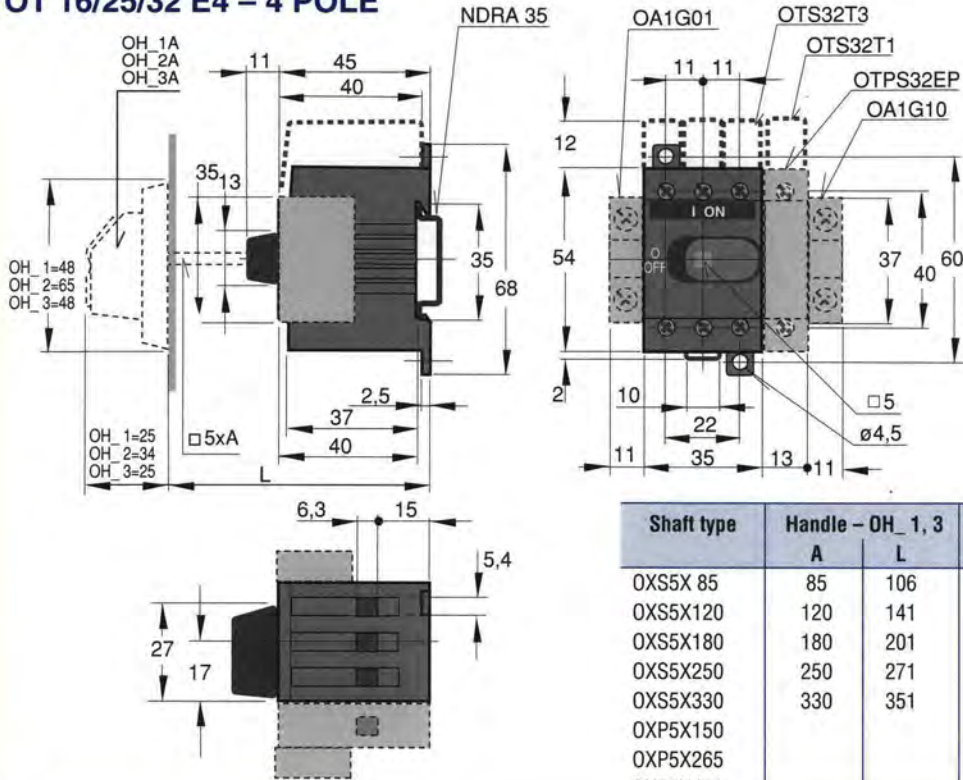


Strömberg Switchline
Load-break switches OT 16E...63E – OT type
Dimensional drawings (mm)

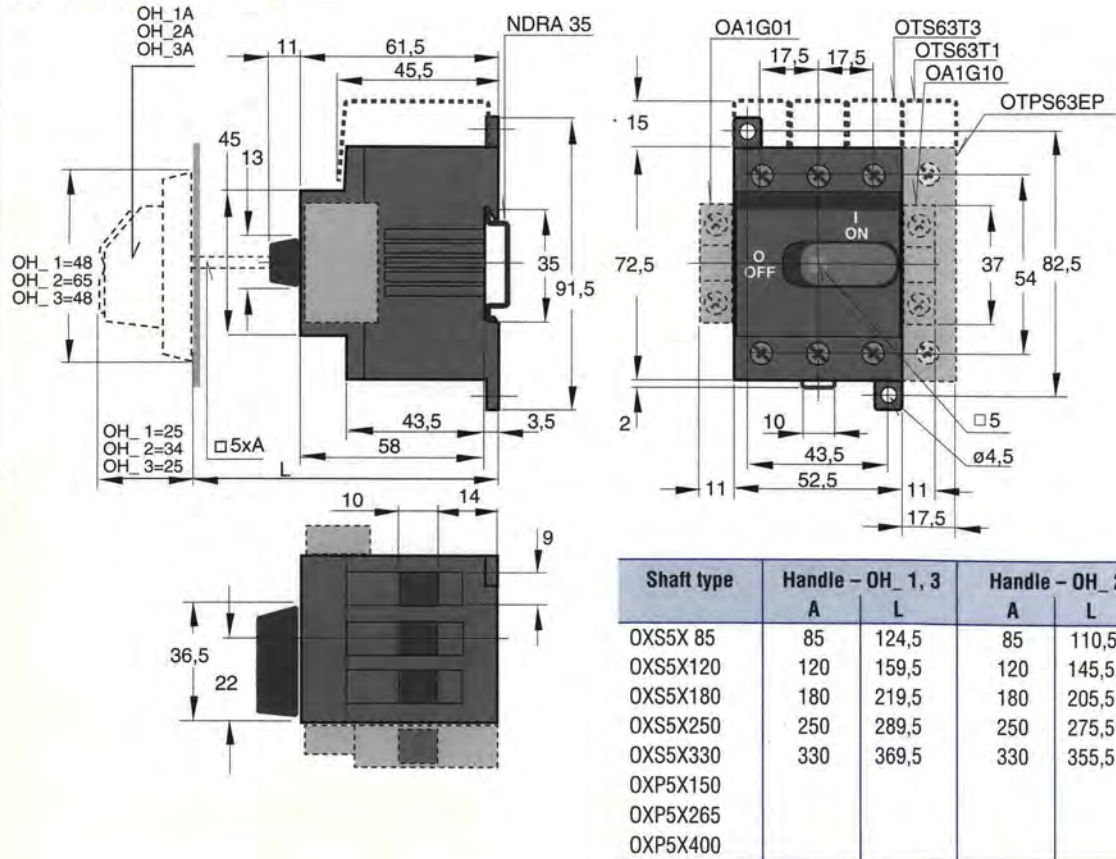


NHP

OT 16/25/32 E3 – 3 POLE
OT 16/25/32 E4 – 4 POLE



OT 45/63 E3 – 3 POLE
OT 45/63 E4 – 4 POLE



Load-break switches

NHP

Shaft type	Handle – OH_1, 3		Handle – OH_2		Handle – OH_45J5	
	A	L	A	L	A	L
OX 85	85	127	85	113		
OX 120	120	162	120	148		
OX 180	180	222	180	208		
OX 250	250	292	250	278		
OX 330	330	375	330	358		
OXZS 48					150	175
OXZS 49					265	290
OXZS 50					400	425

Shaft type	Handle – OH_1, 3		Handle – OH_2		Handle – OH_45J5	
	A	L	A	L	A	L
OX 85	85	112,5	85	98,5		
OX 120	120	147,5	120	133,5		
OX 180	180	207,5	180	193,5		
OX 250	250	277,5	250	263,5		
OX 330	330	375,5	330	343,5		
OXZS 48					150	175
OXZS 49					265	290
OXZS 50					400	425

Strömberg Switchline

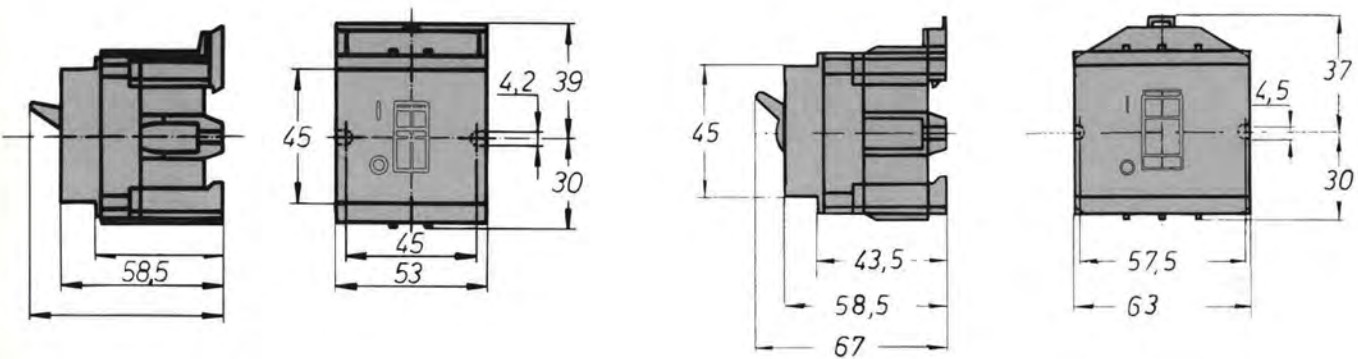
NHP

Load-break switches OETL 25C...125C – Toggle type
Dimensional drawings (mm)

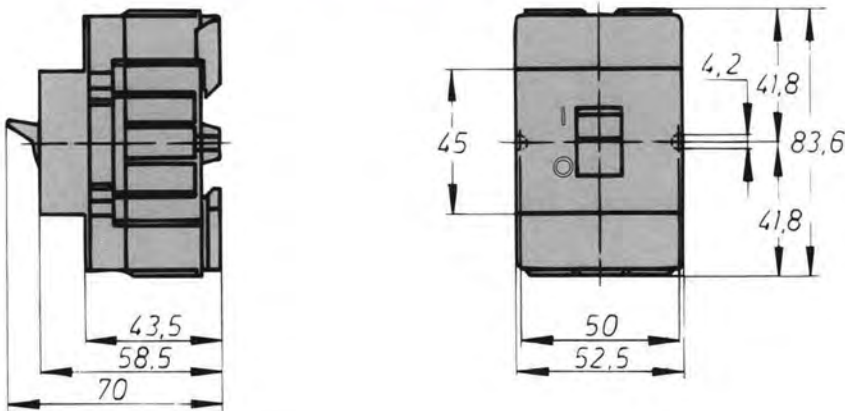


OETL 25/40 C1 – 3 POLE

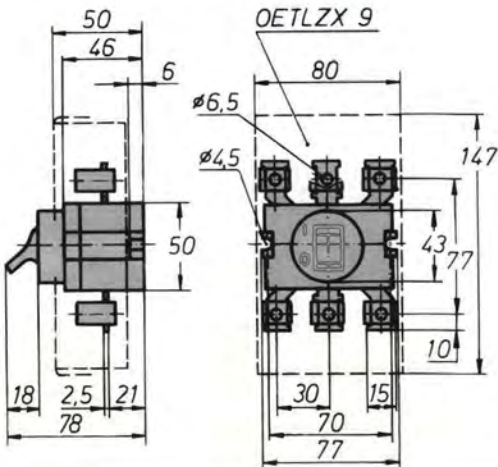
OETL 25/40/63 C4 – 4 POLE



OETL 63 C3, OETL 80C1 – 3 POLE



OETL 125 C1 – 3 POLE



Load-break switches

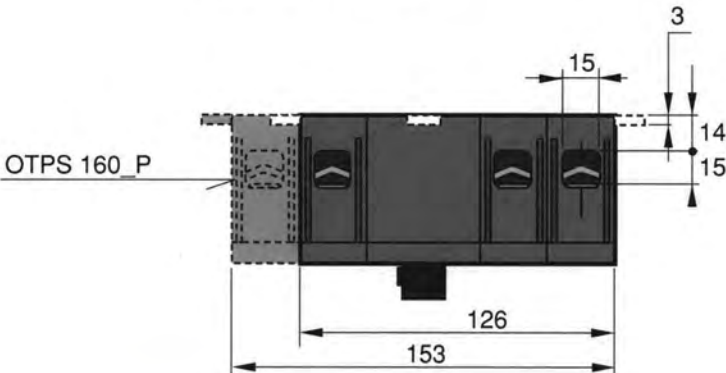
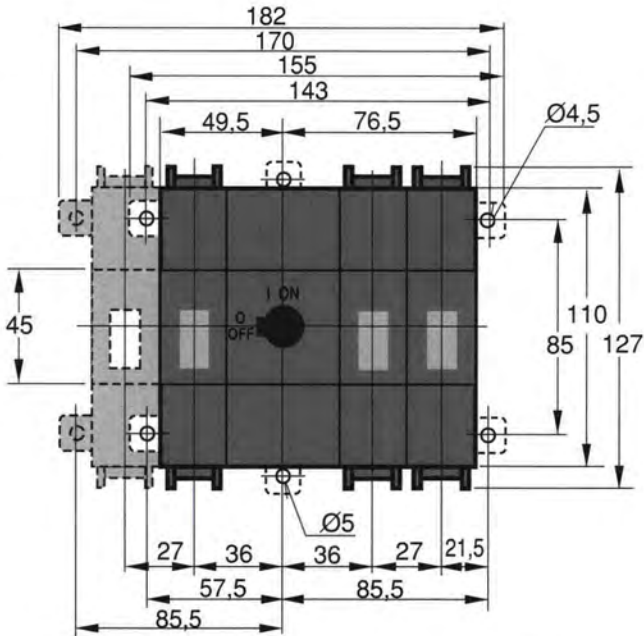
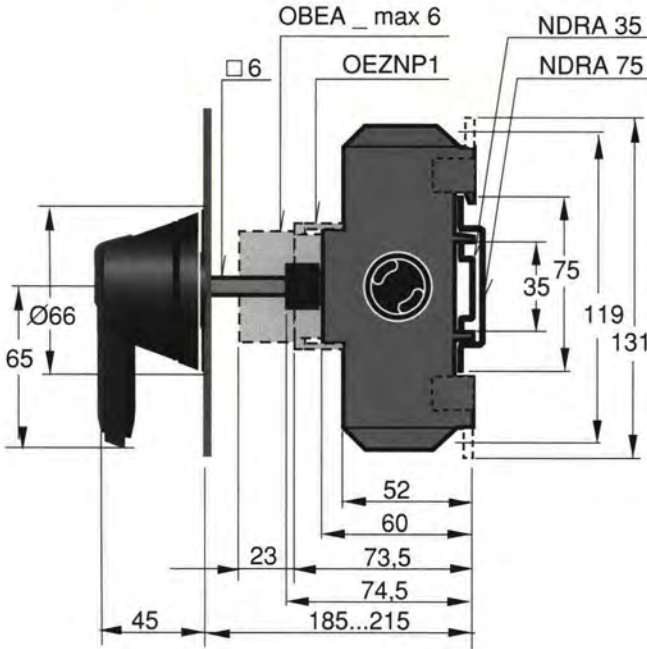
Strömberg Switchline

Load-break OT 125A...160E – OT type Dimensional drawings (mm)

NHP

Visible
contacts

OT 125A3, OT 160E3, OT160M3 – 3 POLE
OT 125A4, OT 160E4, – 4 POLE

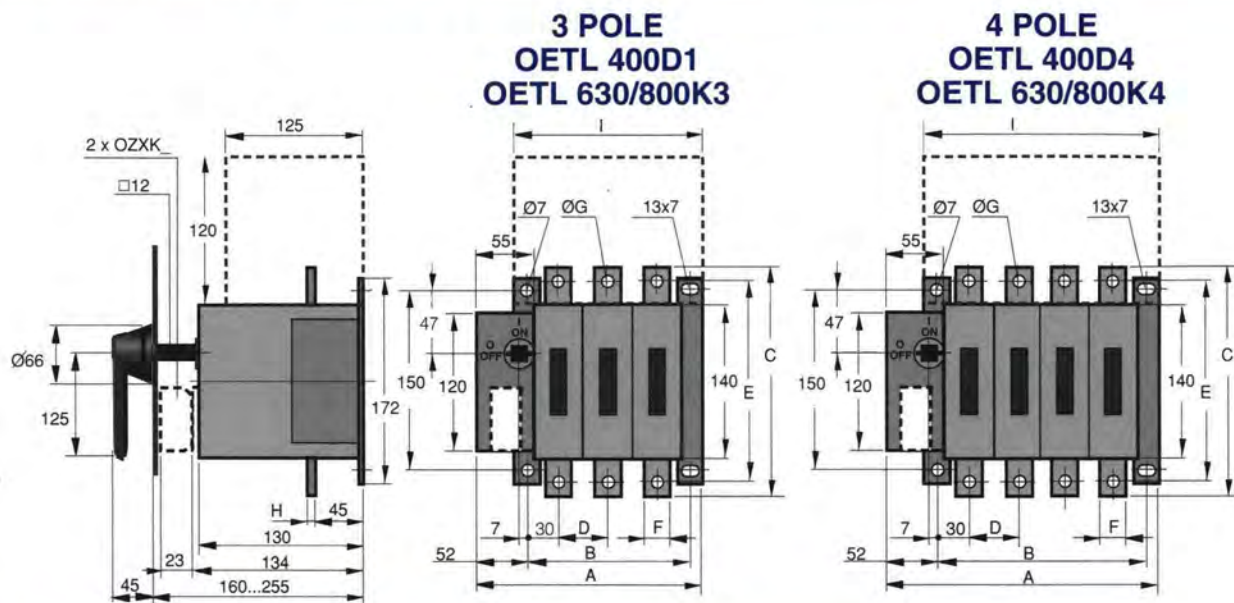


Load-break switches

Strömberg Switchline

NHP

Load-break switches OETL 400...800A – Front operated Dimensional drawings (mm)



Outboard shafts

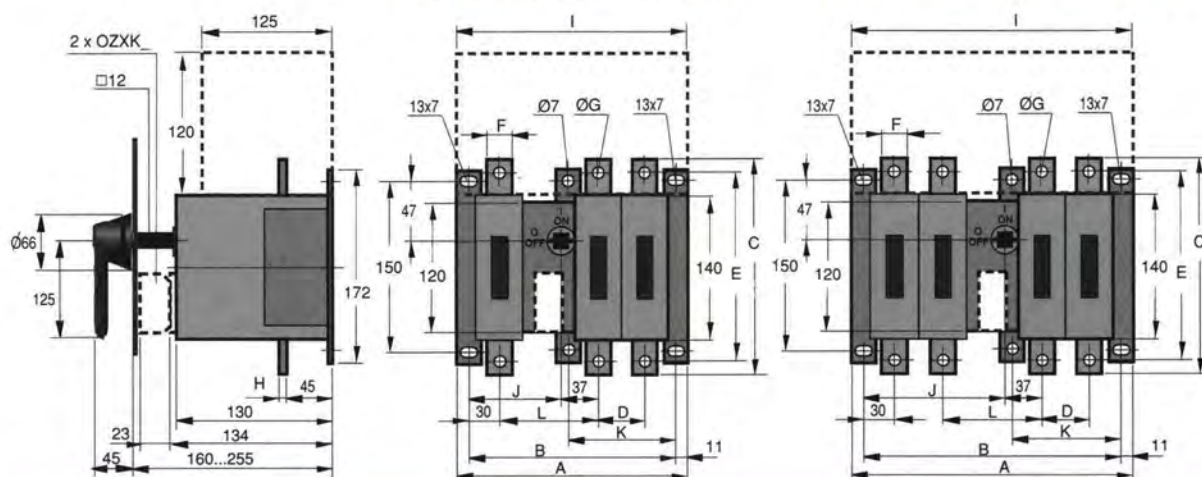
Switch type	No. of poles	A	B	C	D	E	F	G	H	I
OETL 400D1	3	216	153	205	216	180	25	11	4	175
OETL 400D4	4	262	199	205	262	180	25	11	4	175
OETL 630K3	3	248	185	223	248	185	40	13.5	5	207
OETL 630K4	4	310	247	223	310	185	40	13.5	5	269
OETL 800K3	3	264	201	223	264	185	40	13.5	5	223
OETL 800K4	4	334	271	223	334	185	40	13.5	5	293

3 POLE

OETL 400/630/800KV12

4 POLE

OETL 400/630/800KV22



Inboard shafts

Switch type	No. of poles	A	B	C	D	E	F	G	H	I	J	K	L
OETL 400KV12	3	228	206	205	46	180	25	11	4	228	94	104	101
OETL 400KV22	4	274	252	205	46	180	25	11	4	274	140	104	101
OETL 630KV12	3	260	238	223	70	185	40	13.5	5	260	102	128	109
OETL 630KV22	4	330	308	223	70	185	40	13.5	5	330	172	128	109
OETL 800KV12	3	260	238	223	70	185	40	13.5	5	260	102	128	109
OETL 800KV22	4	330	308	223	70	185	40	13.5	5	330	172	128	109

Outboard shaft

Strömberg Switchline

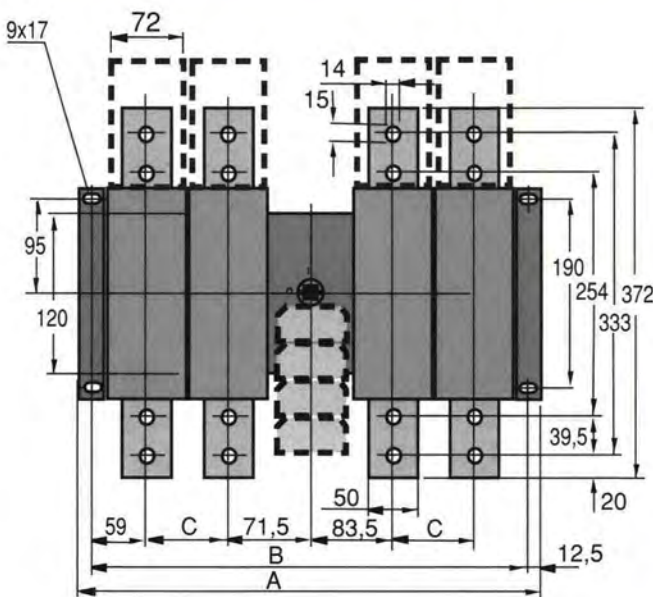
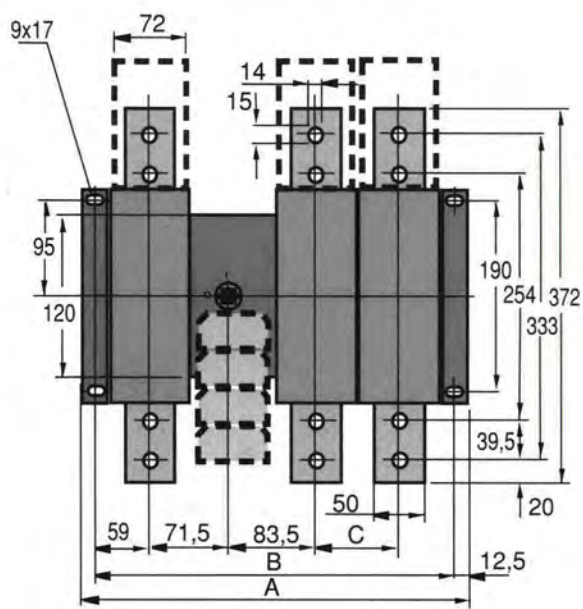


Load-break switches OETL 1000...1600A – Front operated
Dimensional drawings (mm)



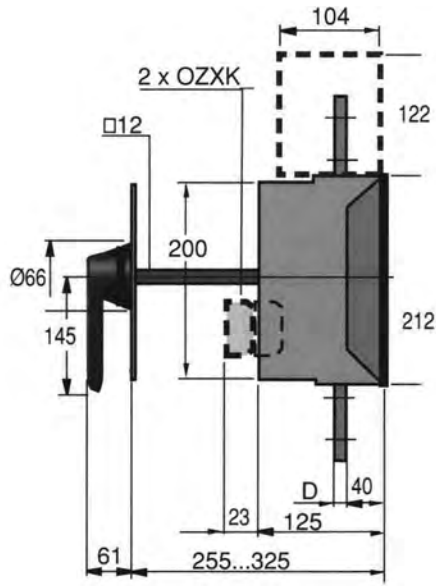
OETL 1000/1250/1600 KV12 – 3 POLE

OETL 1000/1250/1600 KV22 – 3 POLE



Inboard shaft

Switch type	No. of poles	A	B	C	D
OETL 1000KV12	3	378	353	80	12
OETL 1000KV12	4	458	433	80	12
OETL 1000KV12	3	378	353	80	12
OETL 1000KV12	4	458	433	80	12
OETL 1000KV12	3	388	363	90	16
OETL 1000KV12	4	478	453	90	16



Load-break switches

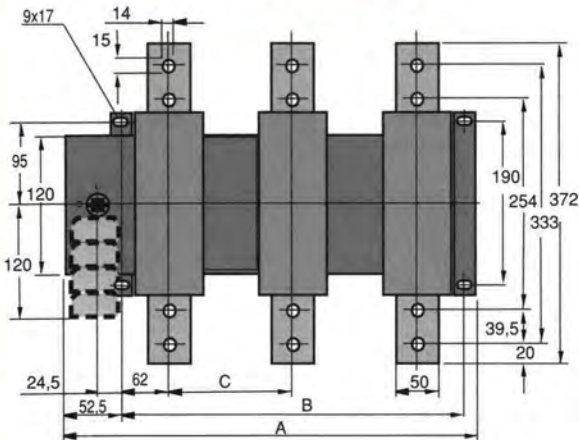
Strömberg Switchline

NHP

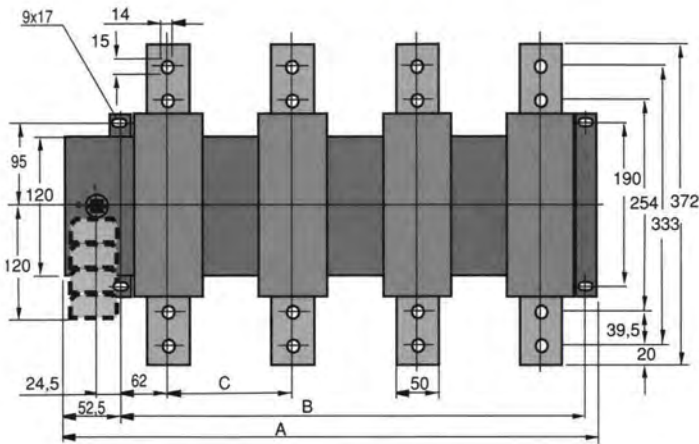
Load-break switches OETL 2500...3150A – Front operated
Dimensional drawings (mm)

Outboard
shaft

3 POLE
OETL 2500/3150 K3
OETL 2500/3150 K185



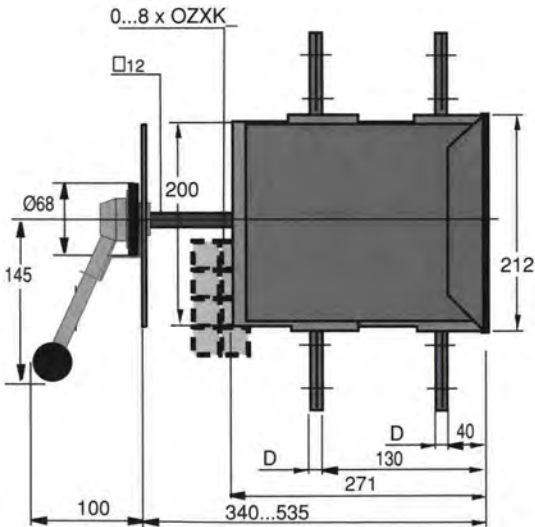
4 POLE
OETL 2500/3150 K4



Load-break switches

Outboard shaft

Switch type	No. of poles	A	B	C	D
OETL 2500K3	3	468	403	139	16
OETL 2500K185	4	562	497	186	16
OETL 2500K4	3	607	542	139	16
OETL 3150K3	4	468	403	139	16
OETL 3150K185	3	562	497	186	16
OETL 3150K4	4	607	542	139	16



Strömberg Switchline

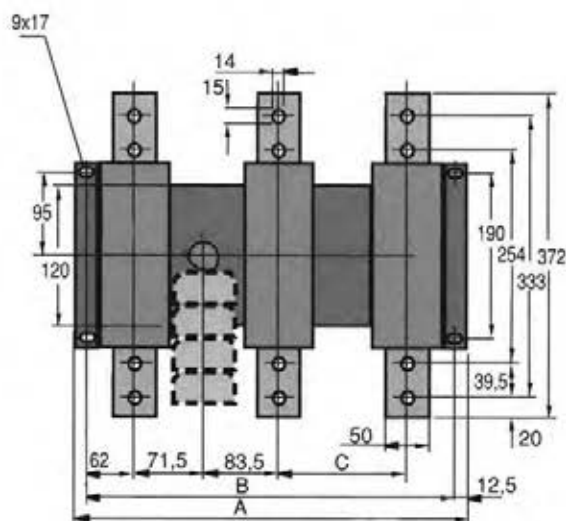
NHP

Load-break switches OETL 2500...3150A – Front operated

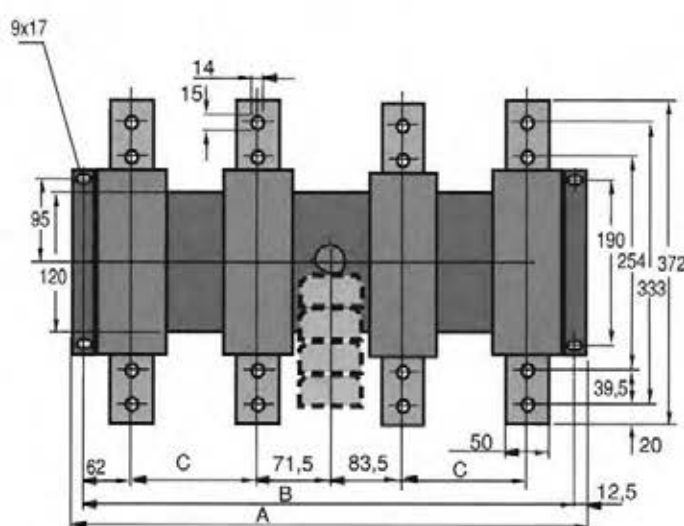
Dimensional drawings (mm)

Inboard shaft

3 POLE
OETL 2500/3150 KV12

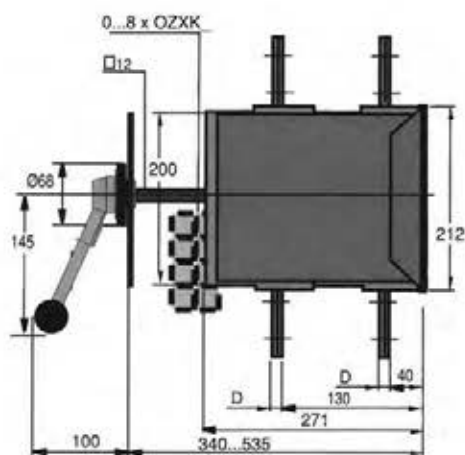


4 POLE
OETL 2500/3150 KV22



Inboard shaft

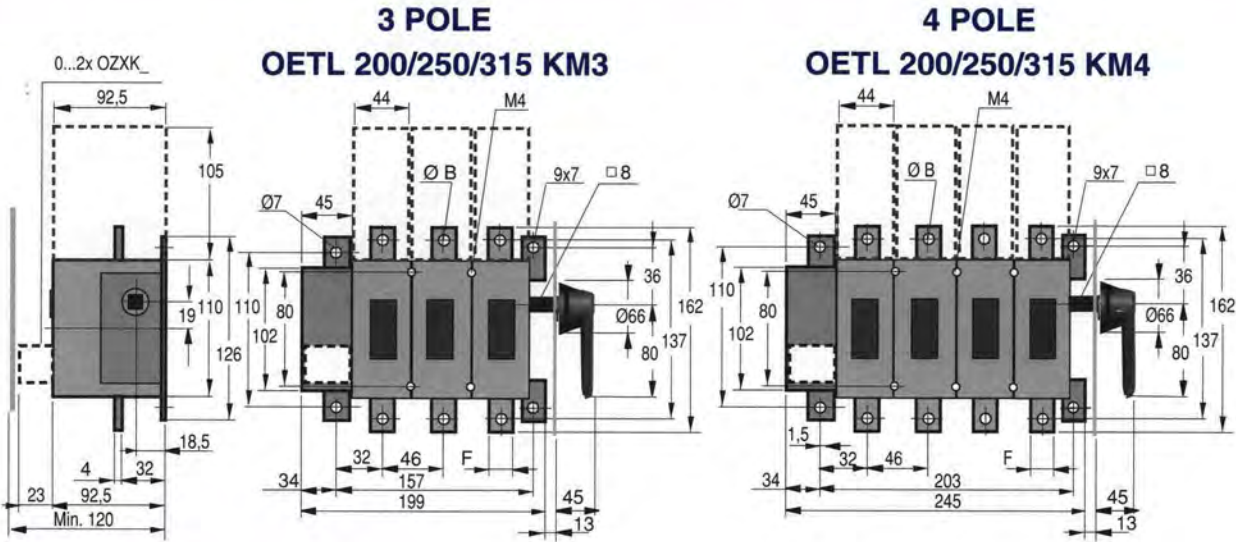
Switch type	No. of poles	A	B	C	D
OETL 2500KV12	3	443	418	139	16
OETL 2500KV22	4	582	557	139	16
OETL 3150KV12	3	443	418	139	16
OETL 3150KV22	4	582	557	139	16


Load-break switches

Strömberg Switchline

Load-break switches OETL 200...800A – Side operated

Dimensional drawings (mm)



200A...315A

Switch type	No. of poles	ØB	F
OETL 200KM3	3	9	20
OETL 200KM4	4	9	20
OETL 250KM3	3	11	25
OETL 250KM4	4	11	25
OETL 315KM3	3	11	25
OETL 315KM4	4	11	25

3 POLE

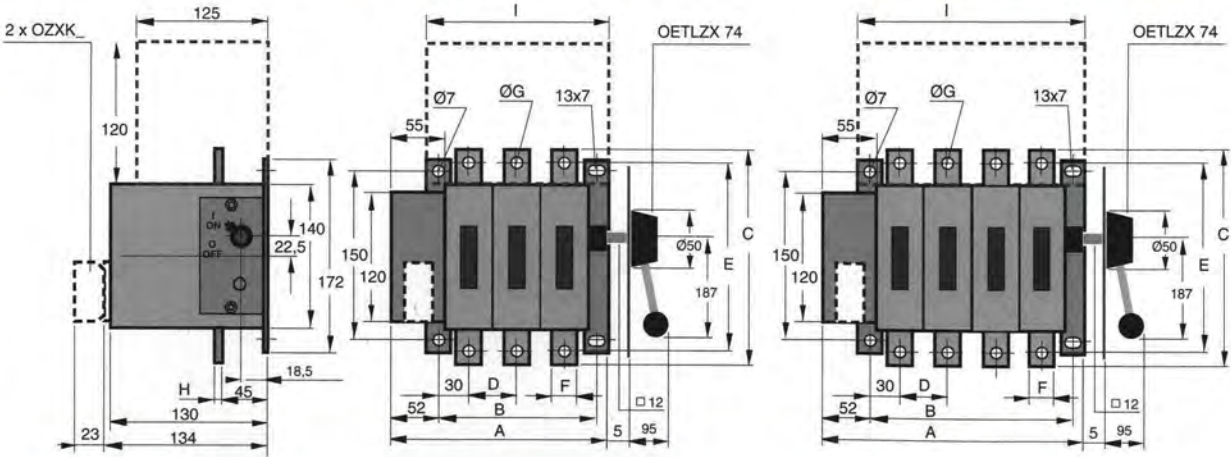
OETL 400 DM1

OETL 630/800 KM3

4 POLE

OETL 400 DM4

OETL 630/800 KM4



400A...800A

Switch type	No. of poles	A	B	C	D	E	F	G	H	I
OETL 400DM1	3	220	153	205	46	180	25	11	4	175
OETL 400DM4	4	266	199	205	46	180	25	11	4	175
OETL 630KM3	3	252	185	223	62	185	40	13.5	5	207
OETL 630KM4	4	314	247	223	62	185	40	13.5	5	269
OETL 800KM3	3	268	201	223	70	185	40	13.5	5	223
OETL 800KM4	4	338	271	223	70	185	40	13.5	5	293

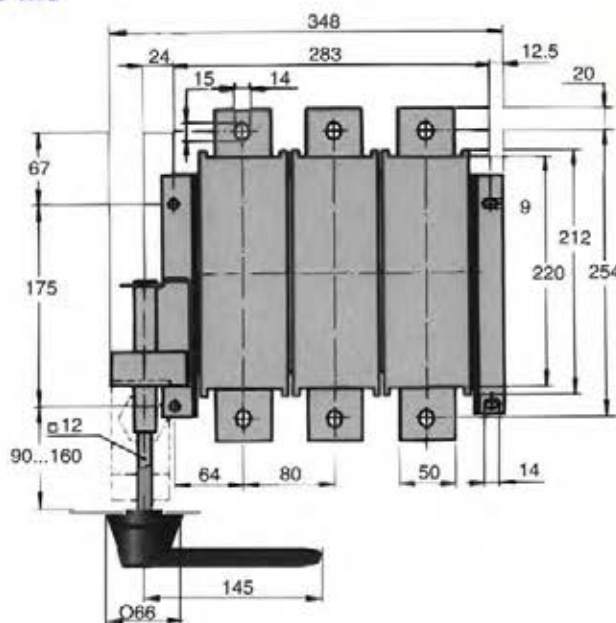
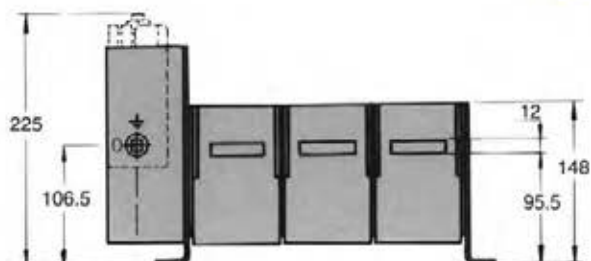
Load-break switches

Strömberg Switchline

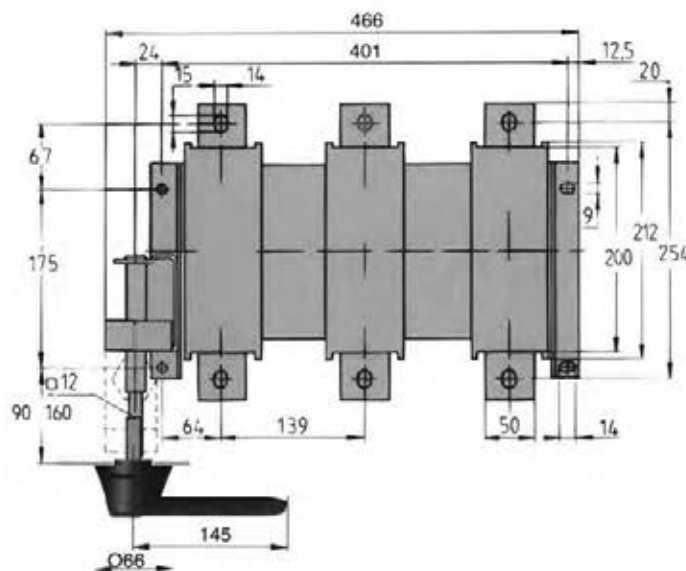
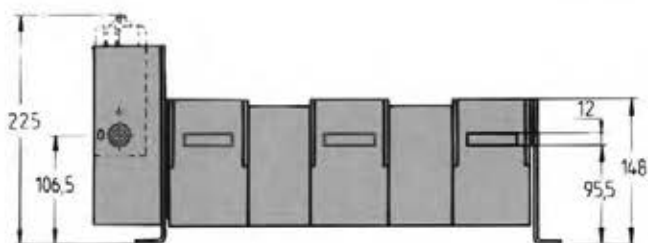
NHP

Load-break switches OETL –1250A Earth switches Dimensional drawings (mm)

3 POLE OETL 1250 M3



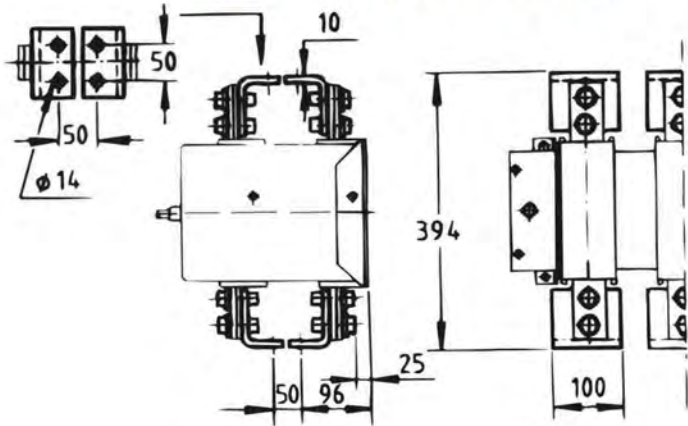
3 POLE OETL 1250 M140



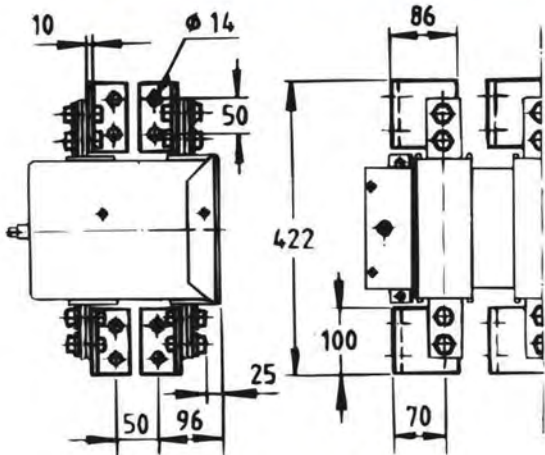
Load-break switches

Connection busbars for OETL 2500 and OETL 3150
Dimensional drawings (mm)

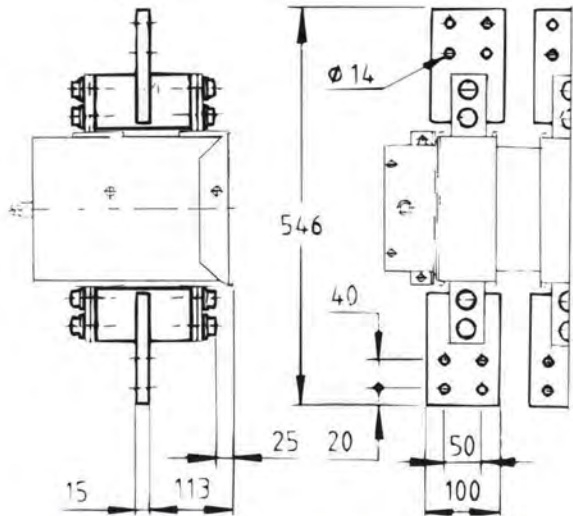
VERTICAL/BACK MOUNTING
OETLZX 114, OETLZX 114/1

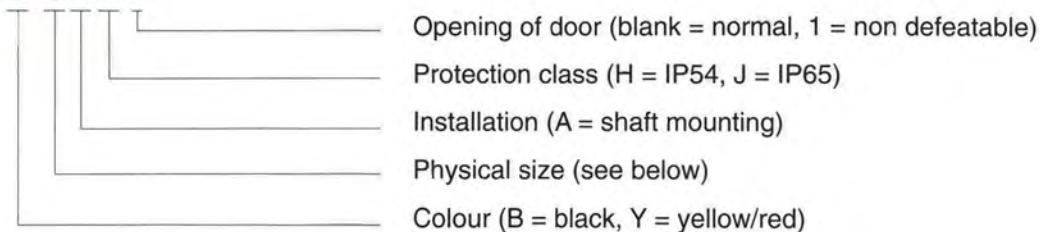
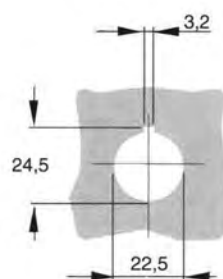
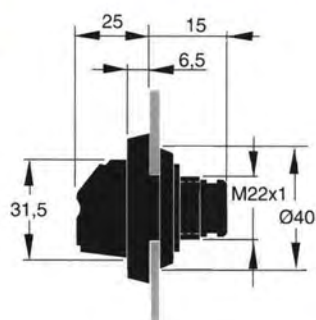


EDGEWISE MOUNTING
OETLZX 114, OETLZX 114/1

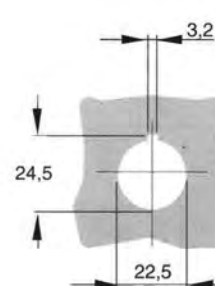
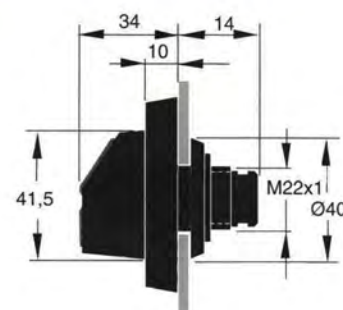


VERTICAL MOUNTING
OETLZX 115, OETLZX 115/1



Strömberg**Handles – Plastic selector type, OH**
Dimensional drawings (mm)**Selector
type****NHP****Part No. Construction****OHB 3AH1****OHB 1AH1, OHY 1AH1**
OHB 3AH1, OHY 3AH1

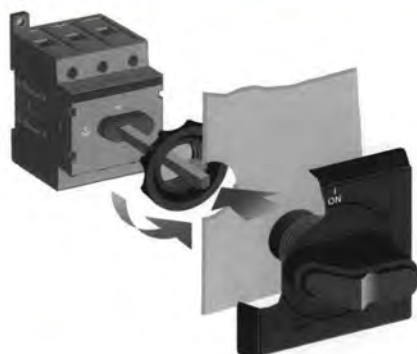
Padlockable in 'OFF' position with 1 padlock Ø5...Ø6.3mm.
OH_ 3AH1 only.

OHB 2AJ, OHY 2AJ

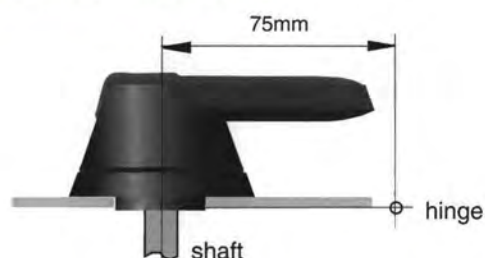
Defeatable in 'ON' position



Padlockable in 'OFF' position
with 3 padlocks Ø5...Ø8mm



Minimum distance between shaft and hinge



Load-break switches

Strömberg
Handles – Plastic pistol type, OH
Dimensional drawings (mm)



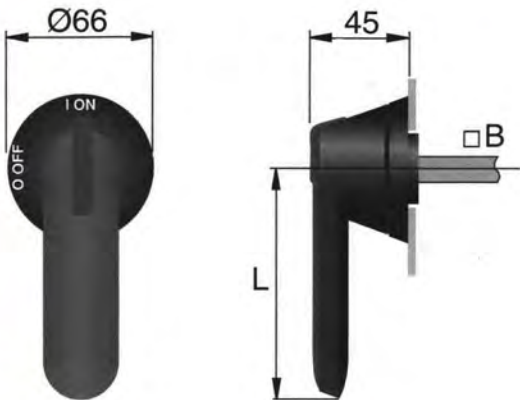
NHP

Part No. Construction

OHB 125J12

- Shaft diameter in mm.
- Protection class (J = IP65)
- Physical size (length of handle in mm)
- Colour (B = black, Y = yellow/red)

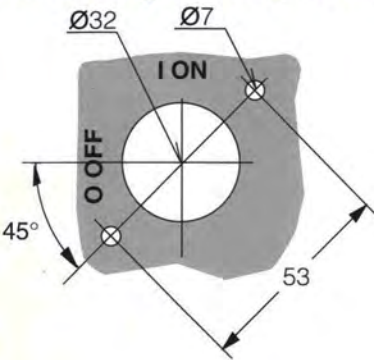
Switch fuses



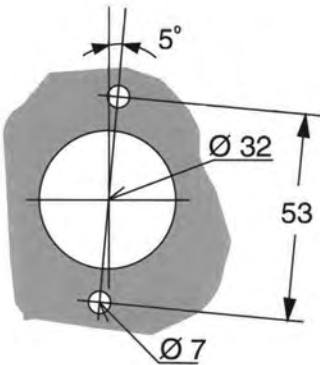
Handle type	Handle length L	Shaft (mm) B
OH_ 45J5	45	5
OH_ 65J5	65	5
OH_ 65J6	65	6
OH_ 80J6	80	6
OH_ 125J12	125	12
OH_ 145J12	145	12
OH_ 175J12	175	12
OH_ 275J12	275	12

Load-break switches

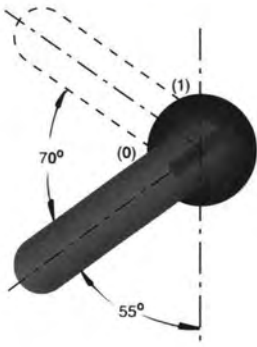
Door drilling for OH_ handles



Front operated handles



Side operated handles, E00_



Pistol type handle features



All pistol type handles are easily defeatable in 'ON' position



Padlockable in 'OFF' position and in 'ON' position with easy irreversible modification contact NHP

Strömberg

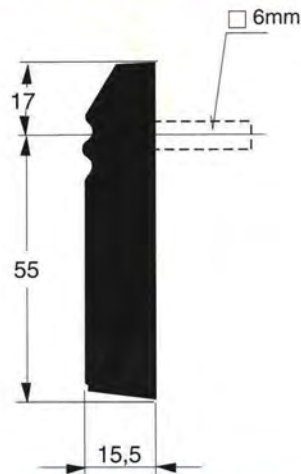
NHP

Handles – Plastic pistol type, OH continued, direct and metal types

Dimensional drawings (mm)

Direct mount handle

YAST1 (to suit switch type OT125A...160E)



OHB 4

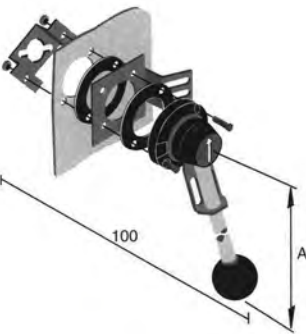
(to suit switch type OS 32...63)



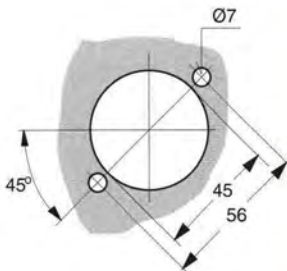
Note: Refer NHP for details

Metallic handles

YASDA 8 (to suit switch types OESA 630...800 E)

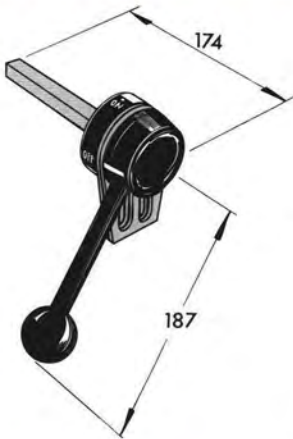


YASDA 8 (A = 220mm)
YASDA 28 (A=145mm)

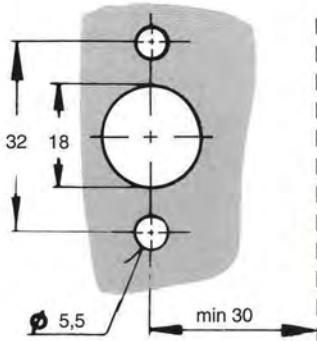


Door drilling for YASDA 8, 28

OETLZX 74 (to suit side operated switches 400...800)

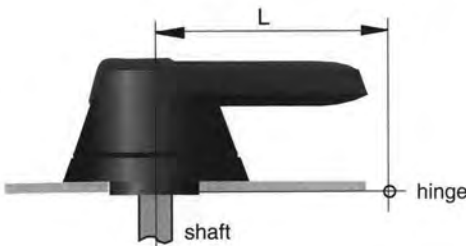


OETLZX 74



Door drilling for OETLZX 74

Minimum distance, L, between the hinge and the rotating shaft

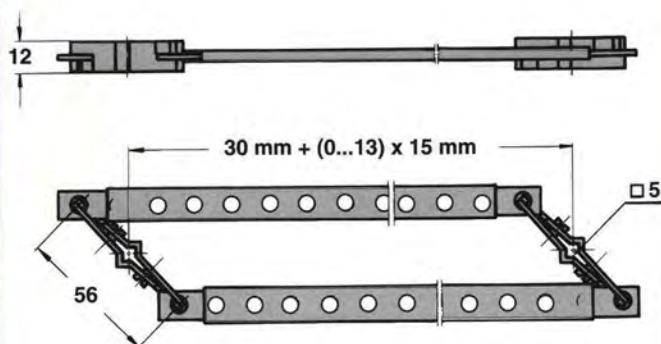


Switch size		L (mm)	Suitable handle
Switch fuse	Load-break		
OS, OESA 32...63	OT 125A...160E	60	OH_45J_, OH_65J_
OESA 32...160	OETL 200...315	80	OH_80J_
OESA 200...400	OETL 400...1600	150	OH_125J_, OH_145J_
OESA 200...800	—	175	OH_175J_
OESA 200...800	OETL 2500...3150	275	OH_275J_
OESA 200...800	OETL 2500...3150	220	YASDA 8

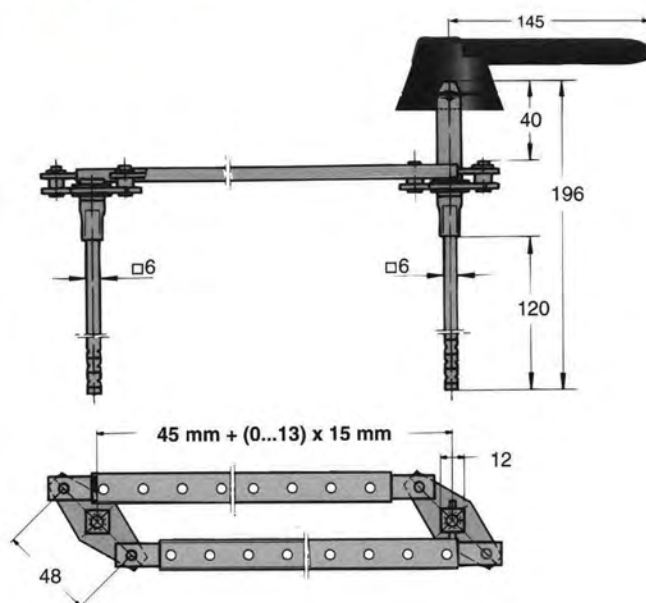
Strömberg**NHP**

Mechanisms – 6 and 8 pole switches

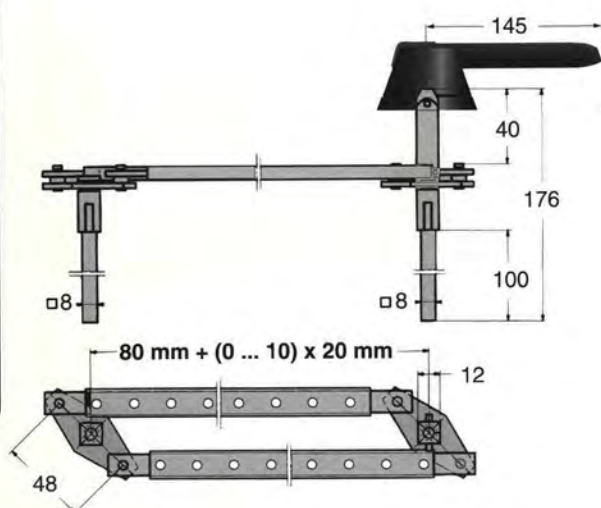
Dimensional drawings (mm)

OETLZW 8

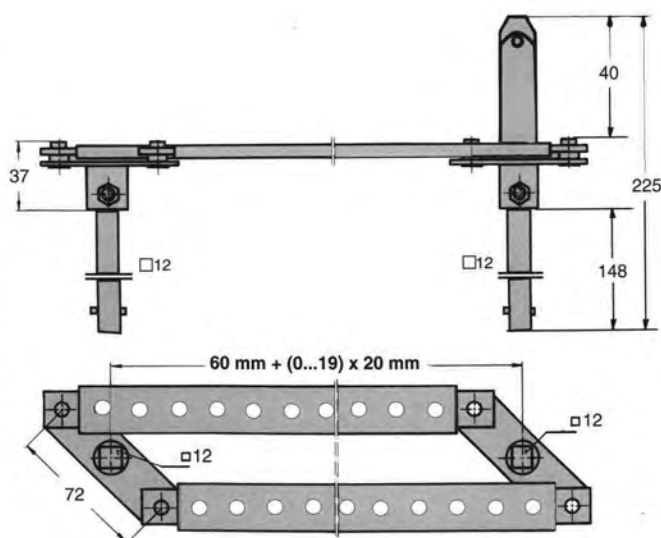
To suit switch type	
Load-break	Switch fuse
OT 16...125E	-

OETLZW 2

To suit switch type	
Load-break	Switch fuse
OT 125A...160E	OS 32...63
	OESA 32...160

OETLZW 18

To suit switch type	
Load-break	Switch fuse
OETL 200...315	-

OETLZW 9

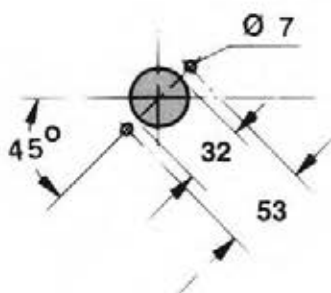
To suit switch type	
Load-break	Switch fuse
OETL 400...1600	OESA 200...800

Strömberg**NHP**

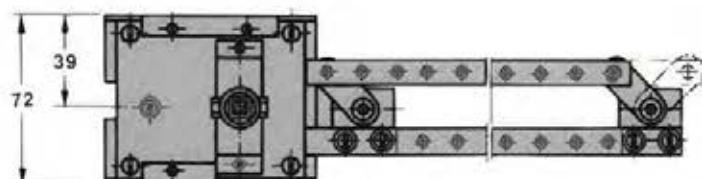
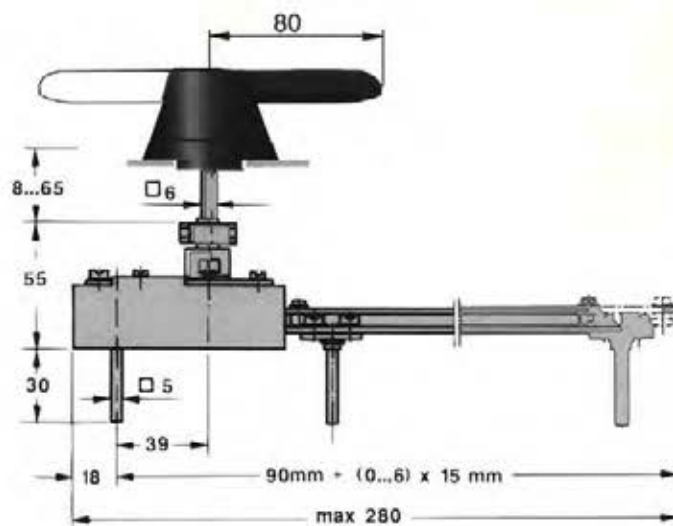
Mechanisms – Changeover and Bypass

Dimensional drawings (mm)

By-pass mechanism OTZW 17

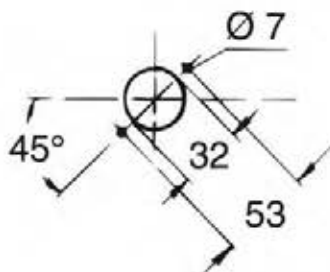


	For switch type
OTZW 17	OT 16E...125E

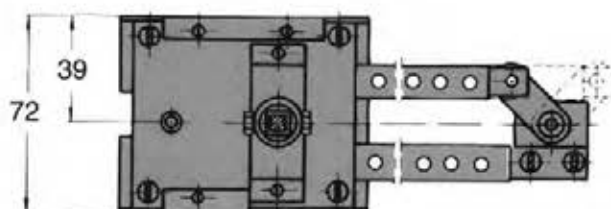
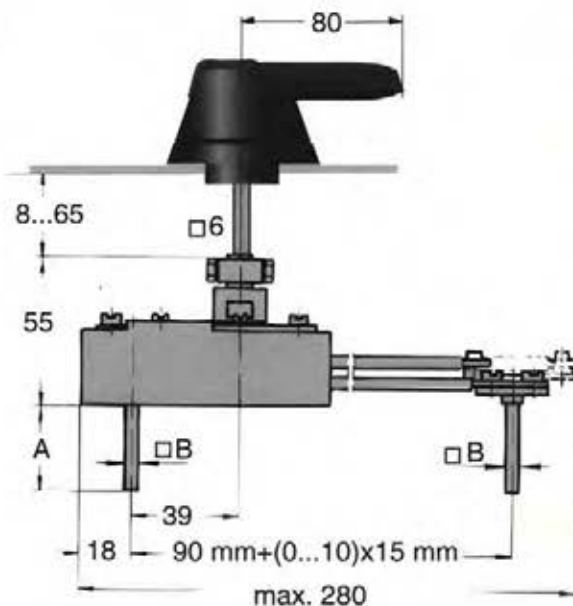


Switch fuses

Changeover mechanism OESAZW 1, OTZW 6

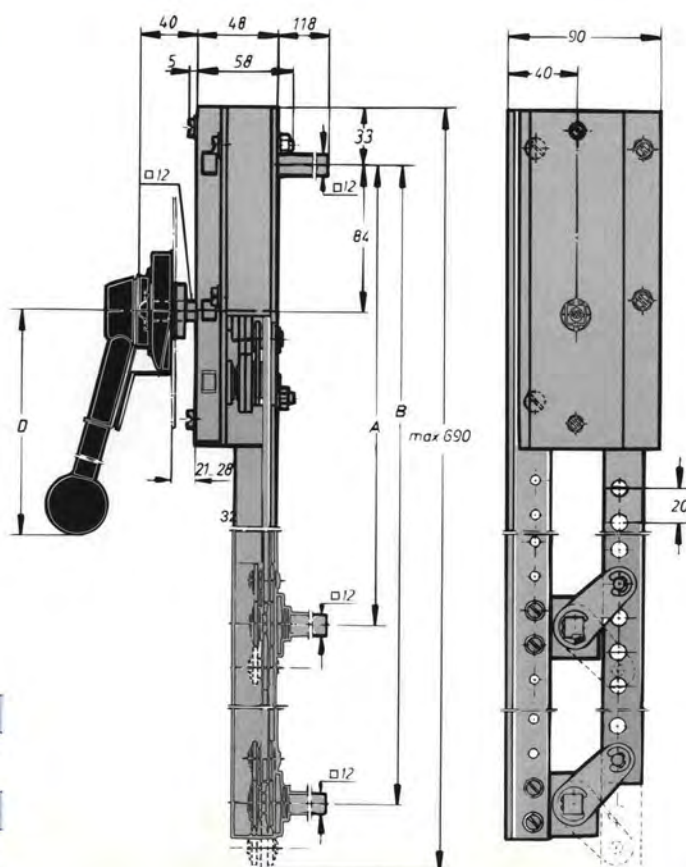


Changeover	For switch type	A	B
OTZW 6	OT 16E...125E	30	5
OESAZW 1	OT 125A...160E	116	6
	OS 32...63, OESA 32...160		



Load-break switches

Changeover	For switch type	A	B	C
OETLZW 11	OESA 200...400, OETL 400	210 + (0...11) x 20mm	—	12
OETLZW 20	OETL 200...315	210 + (0...11) x 20mm	—	8
Bypass				
OETLZW 21	OETL 200...315	210 + (0...9) x 20mm	210 + (0...9) x 20mm	8



Changeover	For switch type	A	B	D
OETLZW 12	OESA 630...800A, OETL 630...1600A	210 + (0...18) x 20mm	—	220mm
Bypass				
OETLZW 13	OESA 200...800A OETL 400...1600A	210 + (0...18) x 20mm	250 + (0...18) x 20mm	320mm

Strömberg

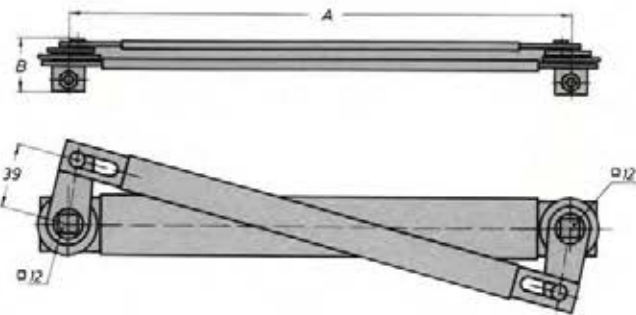
Mechanical interlock, Motor operator

Dimensional drawings (mm)



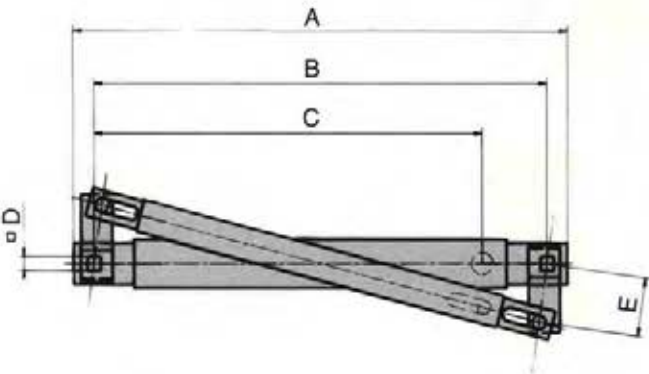
Mechanical interlock

OETLZW 3, 14, 15



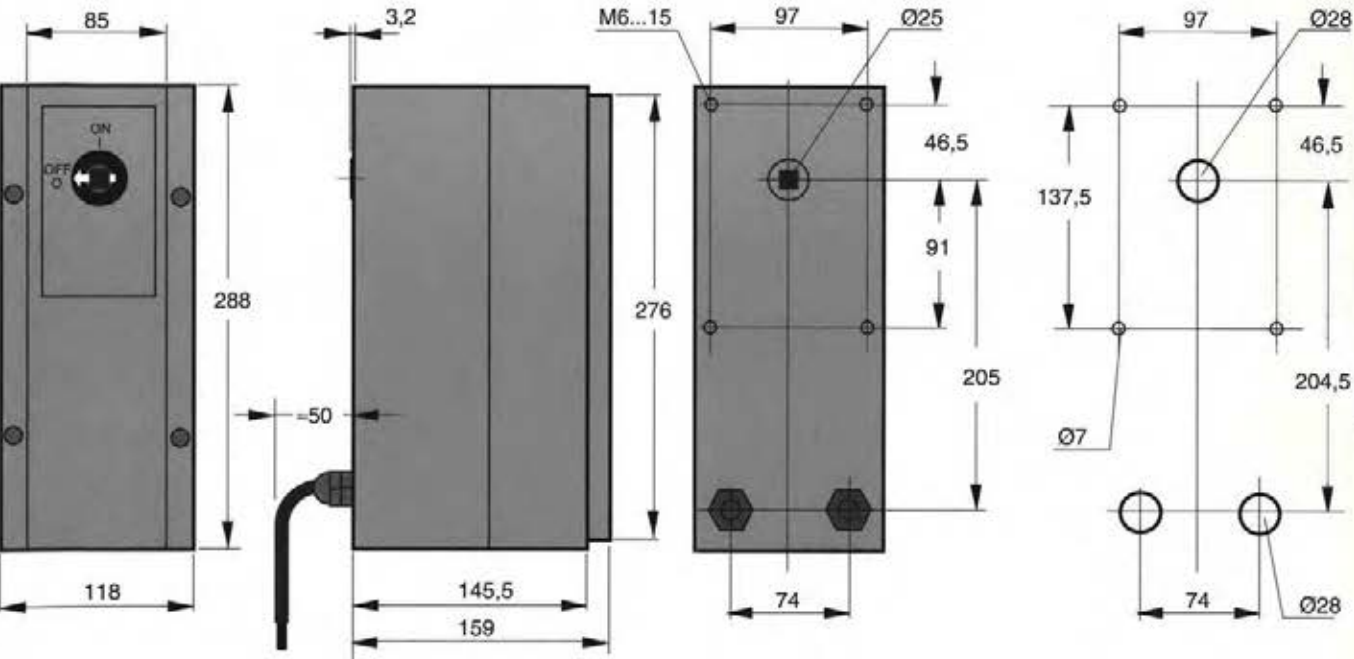
Interlock	For switch type		A	B
	Load-break	Switch fuse		
OETLZW 3	OETL 400...1600	OESA 200...800	300	31
OETLZW 14	OETL 400...1600	OESA 200...800	250	31
OETLZW 15	OETL 400...3150	OESA 200...800	500	36

OETLZW 19, 24
OTZW 10



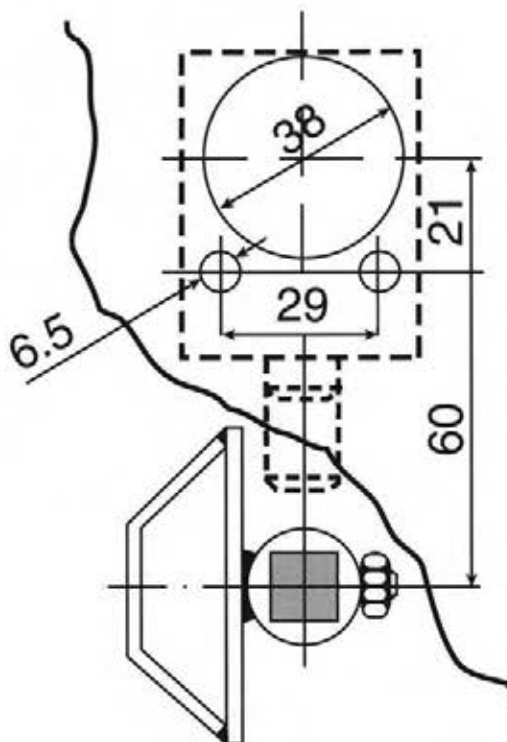
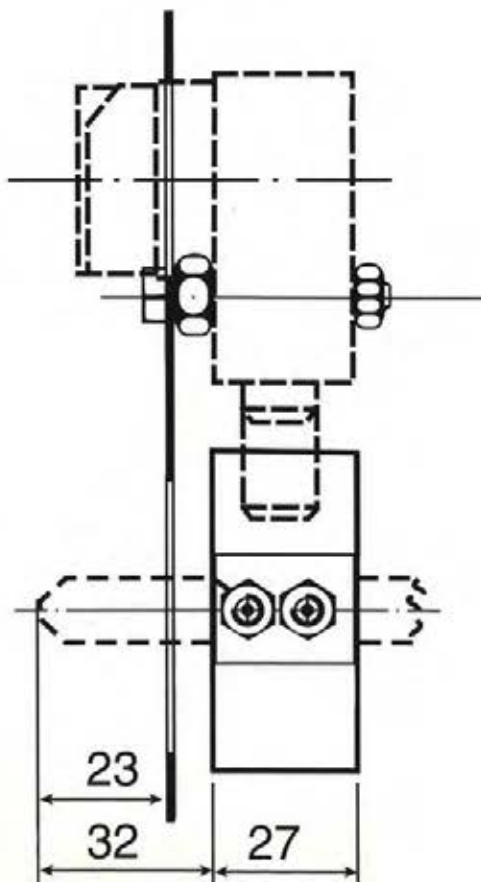
Interlock	For switch type		A	B	C	D	E
	Load-break	Switch fuse					
OETLZW 24	OT 16...125E	-	114	100	-	5	25
OTZW 10	OT125A...160E	-	206	190	-	6	30
OETLZW 19	OETL 200...315	-	305	280	240	8	36

Motor operator OEMO



Strömberg**NHP****Castell, Lowe & Fletcher interlock and cam attachment
Dimensional diagrams (mm)**

OETLZW 5, 16

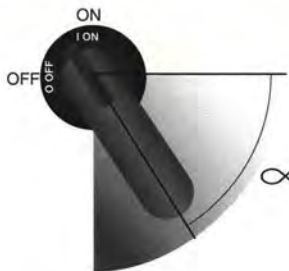
FRONT VIEW**SIDE VIEW**

Strömberg**NHP**

Switch fuses – OESA 32...160A

Auxiliary contact timing functions

Description – ON and OFF functions of auxiliary and main contacts

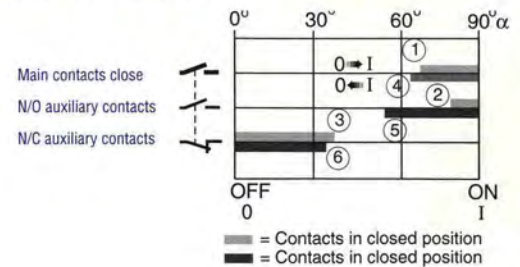


CLOSING

1. Main contacts close
2. N/O auxiliary contacts close
3. N/C auxiliary contacts open

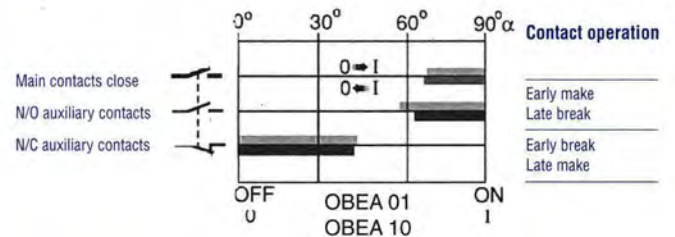
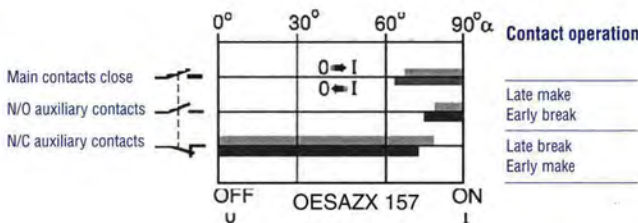
OPENING

4. Main contacts open
5. N/O auxiliary contacts open
6. N/C auxiliary contacts close



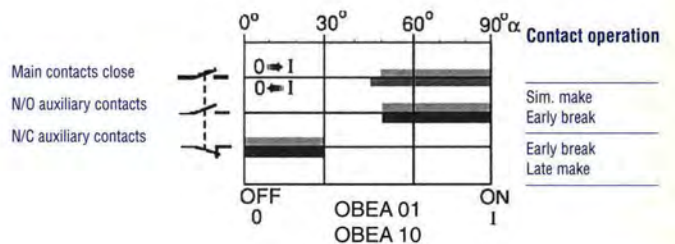
OESA mini 32A

Auxiliary contact	Configuration
OESAZX 157	1 x (changeover)
OESAZX 169 + OBEA 10	1 N/C
OESAZX 169 + OBEA 01	1 N/O



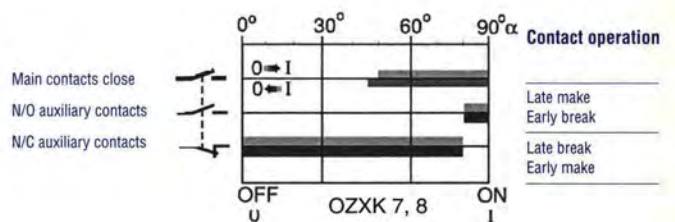
OESA 32...63A

Auxiliary contact	Configuration
OESA ZX252 + 2 x OBEA 10, 01	2 N/O - 2 N/C
OESA ZX252, 254 + 4 x OBEA 10, 01	4 N/O - 4 N/C
OZXK 7	1 x (changeover)
OZXK 8	2 x (changeover)



OESA 125...160A

Auxiliary contact	Configuration
OESA ZX250 + 2 x OBEA 10, 01	2 N/O - 2 N/C
OESA ZX250, 254 + 4 x OBEA 10, 01	4 N/O - 4 N/C
OZXK 7	1 x (changeover)
OZXK 8	2 x (changeover)



Strömberg

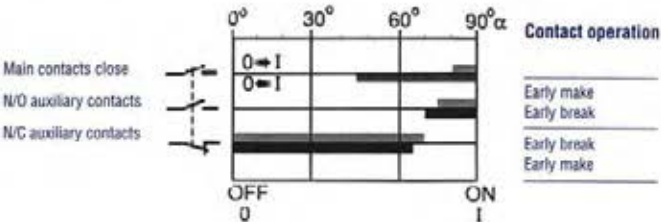
Switch fuses – OESA 200...800A

Auxiliary contact timing functions



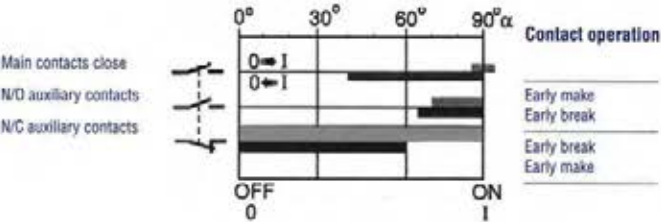
OESA 200A...400A

Auxiliary contact	Configuration
OZXX 1	1 N/O - 1 N/C
OZXX 2	2 N/O - 2 N/C
OZXX 3	4 N/O - 4 N/C
OZXX 4	2 N/O
OZXX 5	4 N/O



OESA 630A...800A

Auxiliary contact	Configuration
OZXX 1	1 N/O - 1 N/C
OZXX 2	2 N/O - 2 N/C
OZXX 3	4 N/O - 4 N/C
OZXX 4	2 N/O
OZXX 5	4 N/O

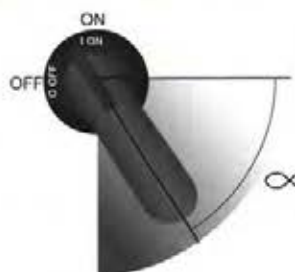


Strömberg**NHP**

Load-break switches – OT 16E...125E & OT 125A, 160E

Auxiliary contact timing functions

Description – ON and OFF functions of auxiliary and main contacts

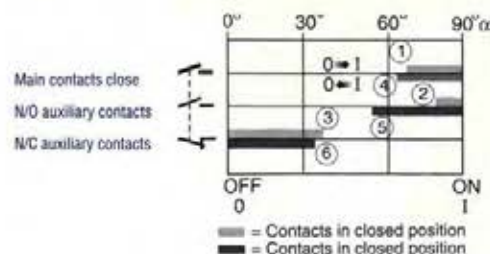


CLOSING

1. Main contacts close
2. N/O auxiliary contacts close
3. N/C auxiliary contacts open

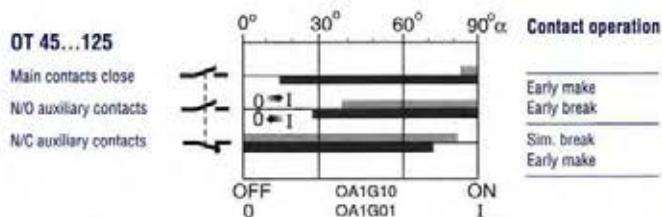
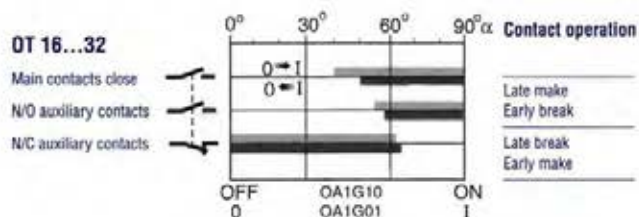
OPENING

4. Main contacts open
5. N/O auxiliary contacts open
6. N/C auxiliary contacts close



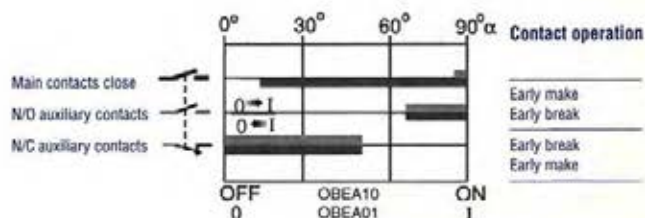
OT 16E,...125E_

Auxiliary contact	Configuration
OA1G10	1 N/O
OA1G01	1 N/C



OT 125A_, OT 160E_

Auxiliary contact	Configuration
OEZNP1 + OBEA 10	1 N/O
OEZNP1 + OBEA 01	1 N/C



Strömberg

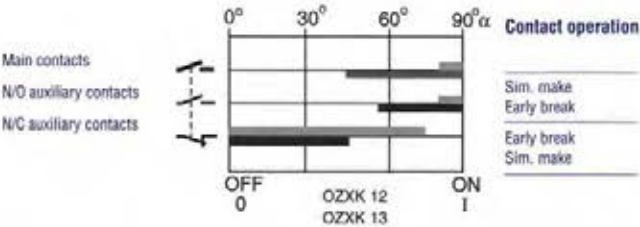
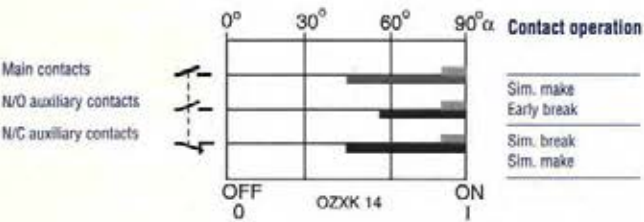
Load-break switches – OETL 200...3150

Auxiliary contact timing functions



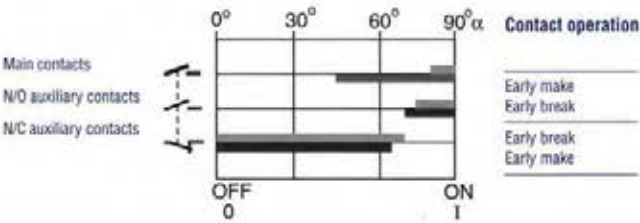
OETL 200, 250, 315K_

Auxiliary contact	Configuration
OZK 12	1 N/O - 1 N/C
OZK 13	2 N/O - 2 N/C
OZK 14	2 N/O OR 2 N/C
OZK 16	4 N/O - N/C



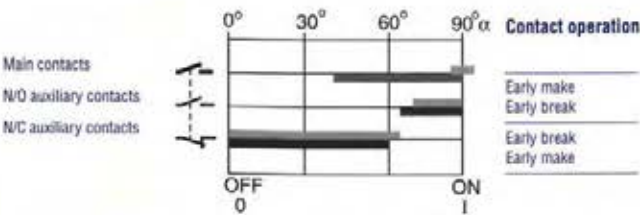
OETL 400D_, 630, 800K_

Auxiliary contact	Configuration
OZK 1	1 N/O - 1 N/C
OZK 2	2 N/O - 2 N/C
OZK 3	4 N/O - 4 N/C
OZK 4	2 N/O
OZK 5	4 N/O



OETL 1000, 1250, 1600, 2500, 3150K_

Auxiliary contact	Configuration
OZK 1	1 N/O - 1 N/C
OZK 2	2 N/O - 2 N/C
OZK 3	4 N/O - 4 N/C
OZK 4	2 N/O
OZK 5	4 N/O

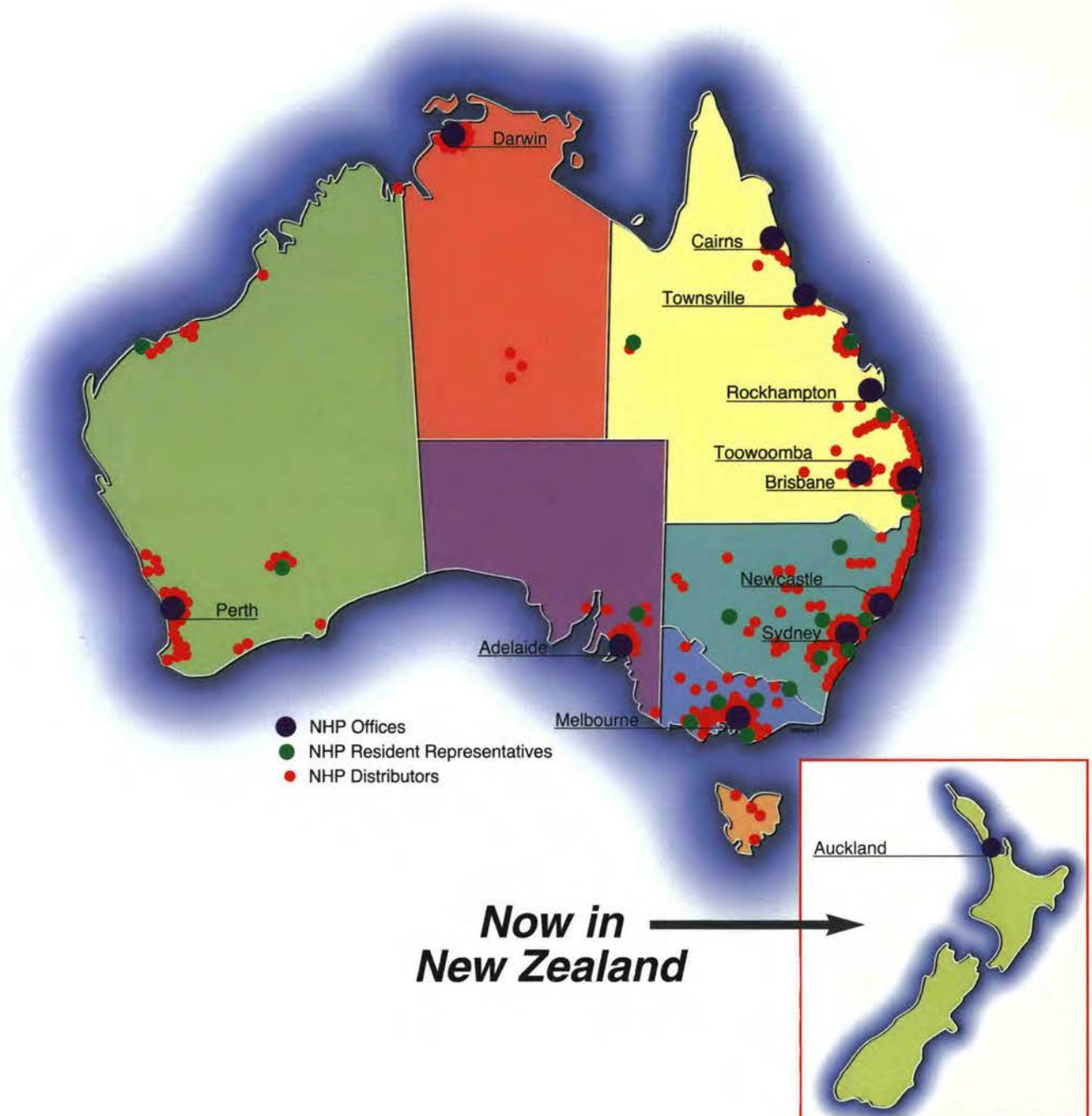


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Erratum - Replacement for Page-7 Catalogue NF 1996 Edition

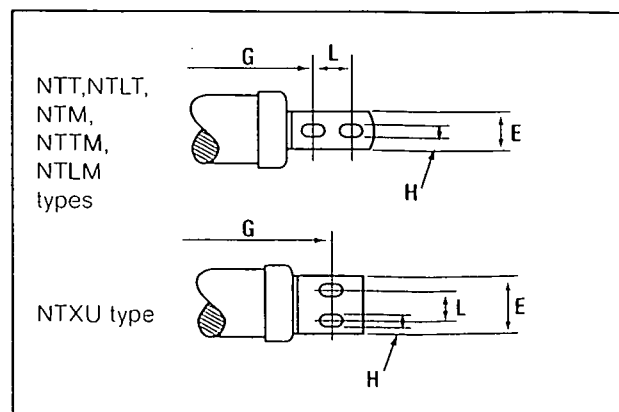
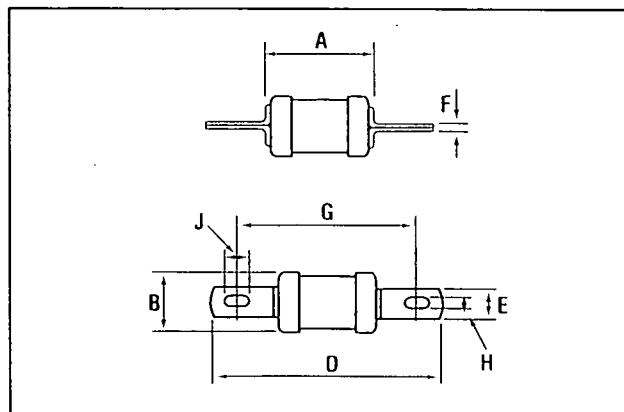
August 2001

NHF COMPACT FUSES

HRC cartridge fuse-links

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	-
NTC(M)	48	30	137	19	3.2	111	9	12.5	-
NTF	48	30	137	19	3.2	111	9	12.5	-
NTF(M)	48	40	137	19	3.2	111	9	12.5	-
NTKF	48	40	137	19	3.2	111	9	12.5	-
NTKF(M)	51	40	138	25	5.0	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 (450-500A)	59	53	212	25	6.3	133/184	10.5	14	25.4
NTTM (560-630A)	59	63	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	165/229	10.3	16	32
NTLT	84	82	267	38	10	165/229	10.3	16	32
NTXU	83	100	198	63.5	9.5	149	14.3	19	32



NHP *COMPACT
FUSES*

Catalogue
NF
August 1996
Revised edition

Compact Fuses

A complete range of
low voltage
BS and DIN fuses

NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

A.C.N. 004 304 812

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NHP was formed in 1968 for the purpose of manufacturing, importing and merchandising a wide range of specialised electrical switchgear, motor control gear and other, technical electrical products. At the time the company absorbed the technical merchandising activities of Johnson and Phillips Limited.

NHP is a wholly Australian owned company and represents a considerable number of overseas companies who manufacture complimentary equipment to the NHP programme, manufactured by NHP in Melbourne. The Head Office and Melbourne sales organisation is situated at Richmond, with branch offices in Sydney, Brisbane, Adelaide, Perth, Newcastle, Townsville, Rockhampton, Toowoomba, Cairns and Darwin.

NHP is represented by Agents in Hobart, Launceston and Burnie. NHP products are also stocked at more than 500 centres throughout Australia.

Due to this extensive national sales and service network the company is able to continue a policy of supplying an extensive range of technical electrical equipment, supported by substantial stocks and competent service back up on a national basis.

All branch offices and agents are connected to the on-line computer network centred in Melbourne.

Experienced engineers are also available to assist customers, throughout Australia and to advise on technical aspects and applications of equipment.

NHP are suppliers to the full spectrum of industry which uses industrial type electrical equipment, including mining industries, general industries, electrical contractors and Government departments.

It is the continuing policy of the company to improve both the range, quality of products and services available. Experienced engineering and management personnel continually visit world centres to ensure that NHP keeps pace with technological advances, research, development and modern marketing techniques.

The addition of a complete range of BS and Din fuses to the NHP product range compliments the well established Stromberg range of switchgear as well as the innovative Slimline switch fuse system.

HRC fuses are safe to use and simple to apply. Today, they are still recognised as the answer for complete short circuit protection, minimising damage to equipment, risk of fire and danger to personnel.

The BS HRC fuse is silent operating and emission free, providing dramatic current and energy limitation characteristics, resulting in reliable back up protection, complimented by accurate discrimination, non deterioration in service and close overcurrent protection.



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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



HRC

High rupturing capacity (HRC) or High breaking capacity denotes the ability of a fuse-link to interrupt extremely high fault currents, usually up to 80kA.

Current limiting fuse-link

A fuse-link that limits the circuit current during its operation to a value much lower than the peak value of the prospective current. In practice, the terms HRC and current limiting are synonymous.

Rated breaking capacity

The highest value of fault current that a fuse-link has been tested to interrupt eg. 80kA.

Rated voltage

The maximum system voltage that the fuse-link is designed to interrupt. Rated voltages may be in AC, DC, or both.

Current rating

The value of current that a fuse-link will carry continuously without deterioration under specified conditions.

Minimum fusing current

The minimum value of current that will cause melting of the fuse element.

Power dissipation

The power released in a fuse-link carrying rated current under a specified condition, usually expressed in watts.

Time current characteristics (refer table 1)

A curve detailing the pre-arcing or operating time as a function of prospective current.

Let through characteristics (I^2t) (refer table 2)

A curve or chart showing values 'pre-arcing' and 'operating' let through energies as a function of prospective current, I^2t is proportional to energy in $\text{Amp}^2 \text{ seconds}$.

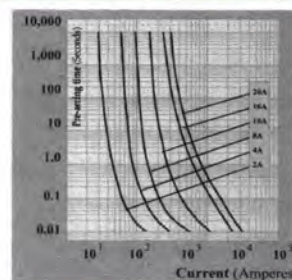
Cut off characteristics (refer table 3)

A curve detailing the cut off current as a function of prospective current. Cut off current being the maximum instantaneous value of current let through by the fuse-link during operation.

Discrimination (refer tables 4 and 5)

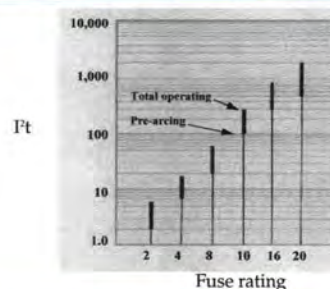
Discrimination is the ability of fuse-links to operate selectively and to disconnect only the parts of the circuit that are subject to faults. Discrimination can be checked by ensuring that the time current characteristics, including their tolerances, do not overlap at any point and that the total let through energy (I^2t) of the downstream (or minor) fuse-link does not exceed the pre-arcing energy (I^2t) of the upstream (or major) fuse-link at the applied system voltage. Discrimination is normally achieved with the ratio of 1.6 between upstream and downstream fuses.

Table 1



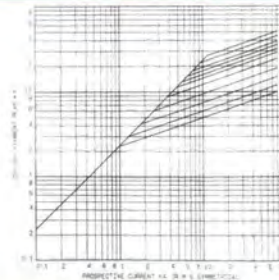
Typical time current curves

Table 2



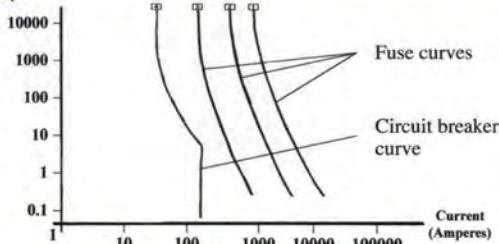
Operating and pre-arcing I^2t values

Table 3



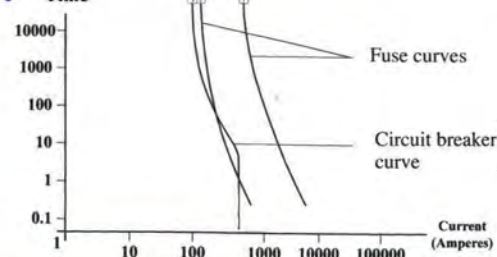
Cut off characteristics

Table 4

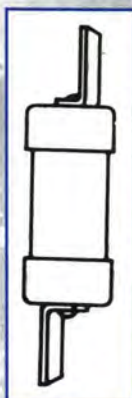


Discrimination achieved

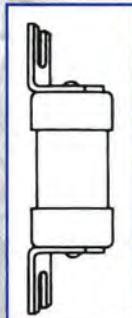
Table 5



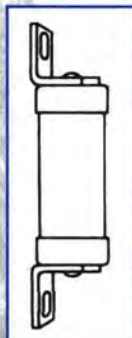
Discrimination NOT achieved

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

Current rating A		Overall length mm	Overall dia. mm	NHP Cat No.	Cross reference				
Normal	Motor				MEM	GEC/Lawson	Siemens	Brush/ Hawker	Bussman/ Dorman Smith
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**

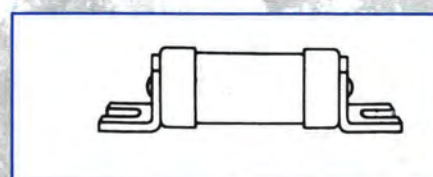
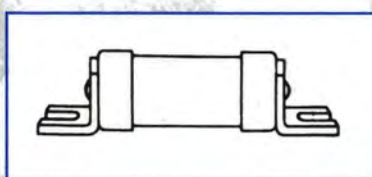
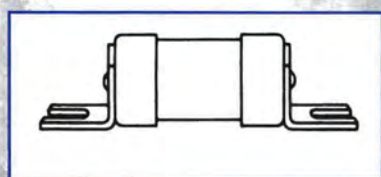
Current rating A		Fixing centres	BS88 ref	NHP Cat No.	Cross reference				
Normal	Motor				MEM	GEC/Lawson	Siemens	Brush/ Hawker	Bussman/ Dorman Smith
2	-	44.5	A1	NNIT2	2SA2	NIT2	3NWNIT2	2F21	NITD2
4	-			NNIT4	4SA2	NIT4	3NWNIT4	4F21	NITD4
6	-			NNIT6	6SA2	NIT6	3NWNIT6	6F21	NITD6
10	-			NNIT10	10SA2	NIT10	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	3NWOS80	80K07R	OSD80
100	-			NOS100	100SO	OS100	3NWOS100	100K07R	OSD100
100	125			NOS100M125	-	OS100M125	-	100M125K07R	OSD100M125
100	160			NOS100M160	-	OS100M160	-	100M160K07R	OSD100M160
80	-	94	A4	NTCP80	80SD5	TCP80	3NWTC80	80L14	CE080
100	-			NTCP100	100SD5	TCP100	3NWTC100	100L14	CE0100
100	125			NTCP100M125	100SD5M125	TCP100M125	3NWTC100M125	100M125L14	CE0100M125
100	160			NTCP100M160	100SD5M160	TCP100M160	3NWTC100M160	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 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.

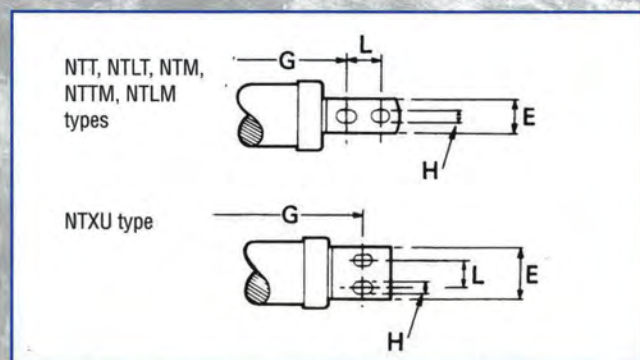
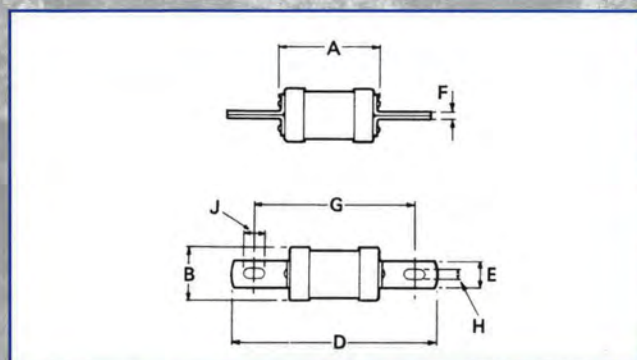
Current rating A		Fixing centres	BS88 ref	NHP Cat No.	Cross reference				Brush/ Hawker	Bussman/ Dorman Smith
Normal	Motor				MEM	GEC/Lawson	Siemens			
2	-	97	-	NTB2*	2SE3	TB2	3NWTB2	2K08	AC2	
4	-			NTB4*	4SE3	TB4	3NWTB4	4K08	AC4	
6	-			NTB6*	6SE3	TB6	3NWTB6	6K08	AC6	
10	-			NTB10*	10SE3	TB10	3NWTB10	10K08	AC10	
16	-			NTB16*	16SE3	TB16	3NWTB16	16K08	AC16	
20	-			NTB20*	20SE3	TB20	3NWTB20	20K08	AC20	
25	-			NTB25*	25SE3	TB25	3NWTB25	25K08	AC25	
32	-			NTB32*	32SE3	TB32	3NWTB32	32K08	AC32	
40	-			NTB40*	40SE3	TB40	3NWTB40	40K08	BC40	
50	-			NTB50*	50SE3	TB50	3NWTB50	50K08	BC50	
63	-	80	-	NTB63*	63SE3	TB63	3NWTB63	63K08	BC63	
63	80			NTB63M80	63SE4M80	TB63M80	3NWTB63M80	-	-	
63	100			NTB63M100	63SE4M100	TB63M100	3NWTB63M100	-	-	
2	-	111	B1	NTBC2	2SF3	TBC2	3NW TBC2	2K09	AD2	
4	-			NTBC4	4SF3	TBC4	3NW TBC4	4K09	AD4	
6	-			NTBC6	6SF3	TBC6	3NW TBC6	6K09	AD6	
10	-			NTBC10	10SF3	TBC10	3NW TBC10	10K09	AD10	
16	-			NTBC16	16SF3	TBC16	3NW TBC16	16K09	AD16	
20	-			NTBC20	20SF3	TBC20	3NW TBC20	20K09	AD20	
25	-			NTBC25	25SF3	TBC25	3NW TBC25	25K09	AD25	
32	-			NTBC32	32SF3	TBC32	3NW TBC32	32K09	AD32	
40	-			NTBC40	40SF3	TBC40	3NW TBC40	40K09	AD40	
50	-			NTBC50	50SF3	TBC50	3NW TBC50	50K09	AD50	
63	-	80	-	NTBC63	63SF3	TBC63	3NW TBC63	63K09	AD63	
63	80			NTBC63M80	63SF4M80	TBC63M80	3NW TBC63M80	-	-	
63	100			NTBC63M100	63SF4M100	TBC63M100	3NW TBC63M100	-	-	
80	-	111	B1	NTC80	80SF5	TC80	3NW TC80	80L09	CD80	
100	-			NTC100	100SF5	TC100	3NW TC100	100L09	CD100	
100	125			NTC100M125	100SF5M125	TC100M125	3NW TC100M125	100M125L09	CD100M125	
100	160			NTC100M160	100SF5M160	TC100M160	3NW TC100M160	100M160L09	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	-	NLT710	710SY10	TLT710	3NWTLT710	710S12	GG710	
800	-			NLT800	800SY10	TLT800	3NWTLT800	800S12	GG800	
710	-	133/ 184	C3	NLT710	710SH10	TLM710	3NW TLM710	700S11	GF710	
800	-			NLT800	800SH10	TLM800	3NW TLM800	800S11	GF800	
1000	-	149	D1	NTXU1000	1000SJ11	TXU1000	-	1000U44	GH1000	
1250	-			NTXU1250	1250SH11	TXU1250	-	1250U44	GH1250	

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
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)	58	26	90	13	1.6	73	5.5	-
NOS	58	27	90	13	1.6	73	5.5	-
NTCP	62	27	110	19	2.4	94	8.7	-
NTCP(M)	62	30	110	19	2.4	94	8.7	-
NTFP	77	30	110	19	2.4	94	8.7	10.3
NTFP(M)	77	40	110	19	2.4	94	8.7	10.3

**Dimensions (mm)**

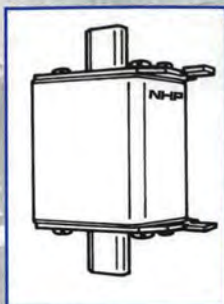
Fuse link type	A max. mm	B max. mm	D max. mm	E mm	F mm	G nom. mm	H mm	J mm	L mm
NTB	57	21	114	13	1.6	97	7.2	11	-
NTB...M...	57	26	116	13	1.6	97	7.2	11	-
NTBC	57	21	134	16	2.0	111	8.7	16	-
NTBC...M...	58	26	136	16	3.2	111	8.7	16	-
NTC	66	36	135	19	3.6	111	8.7	16	-
NTF	76	41	137	19	3.6	111	8.7	16	-
NTKF	76	51	137	26	4.0	111	8.7	16	-
NTMF	81	58	136	26	5.2	111	8.7	16	-
NTKM	76	51	158	26	4.0	133	8.7	16	-
NTM	81	58	210	26	5.2	133/184	10.3	16	25.4
NTTM	83	74	210	26	6.5	133/184	10.3	16	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 COMPACT
FUSES

HRC DIN type fuse-links

(Also referred to as NH type)

DIN fuses
Cross reference guide

N-Type 600V AC *500V AC. Manufactured to DIN43620/1, IEC269-2-1. Rated breaking capacity 120kA r.m.s. Time current gL to VDE 0636/21. Characteristics gG to IEC 269-2-1.

All NHP Compact DIN fuses feature "pop up" blown fuse indication

			Cross reference			
Current rating A	Length mm	NHP Cat No.	MEM	GEC	Legrand	Bussman
SIZE 00	6*	78.5	N006	NHC 006	-	NHC00B
	10*	78.5	N0010	NHC 0010	NHG00C	NHC00B
	16*	78.5	N0016	NHC 0016	NHG00C	NHC00B
	20*	78.5	N0020	NHC 0020	NHG00C	NHC00B
	25*	78.5	N0025	NHC 0025	NHG00C	NHC00B
	32*	78.5	N0032	NHC 0032	NHG00C	NHC00B
	35*	78.5	N0035	NHC 0035	NHG00C	NHC00B
	40*	78.5	N0040	NHC 0040	NHG00C	NHC00B
	50*	78.5	N0050	NHC 0050	NHG00C	NHC00B
	63*	78.5	N0063	NHC 0063	NHG00C	NHC00B
	80*	78.5	N0080	NHC 0080	NHG00C	NHC00B
	100*	78.5	N00100	NHC 00100	NHG00C	NHC00B
	125*	78.5	N00125	NH00125	NHG00	NH 00B
	160*	78.5	N00160	NH00160	NHG00	NH 00B
SIZE 1	25	133.0	N125	NH 0125	NHG1	NH1B
	35	133.0	N135	NH 0135	NHG1	NH1B
	50	133.0	N150	NH 0150	NHG1	NH1B
	63	133.0	N163	NH 0163	NHG1	NH1B
	80	133.0	N180	NH 0180	NHG1	NH1B
	100	133.0	N1100	NH 01100	NHG1	NH1B
	125	133.0	N1125	NH 01125	NHG1	NH1B
	160	133.0	N1160	NH 01160	NHG1	NH1B
	200	133.0	N1200	NH 01200	NHG1	NH1B
	224*	133.0	N1225	NH 01224	NHG1	NH1B
	250*	133.0	N1250	NH 01250	NHG1	NH1B
SIZE 2	80	148.0	N280	NH 0280	NHG2	NH2B
	100	148.0	N2100	NH 02100	NHG2	NH2B
	125	148.0	N2125	NH 02125	NHG2	NH2B
	160	148.0	N2160	NH 02160	NHG2	NH2B
	200	148.0	N2200	NH 02200	NHG2	NH2B
	224	148.0	N2224	NH 02224	NHG2	NH2B
	250	148.0	N2250	NH 02250	NHG2	NH2B
	315	148.0	N2315	NH 02315	NHG2	NH2B
	355*	148.0	N2355	NH 02355	NHG2	NH2B
	400*	148.0	N2400	NH 02400	NHG2	NH2B
SIZE 3	315	150.0	N3315	NH 03315	NHG3	NH3B
	355	150.0	N3355	NH 03355	NHG3	NH3B
	400	150.0	N3400	NH 03400	NHG3	NH3B
	500	150.0	N3500	NH 03500	NHG3	NH3B
	630*	150.0	N3630	NH 03630	NHG3	NH3B

Our NHP DIN fuse extractor handle suits sizes 00 to 3 DIN fuses.

Slimline, the innovative new switch fuse system makes full use of the NHP DIN type fuse.



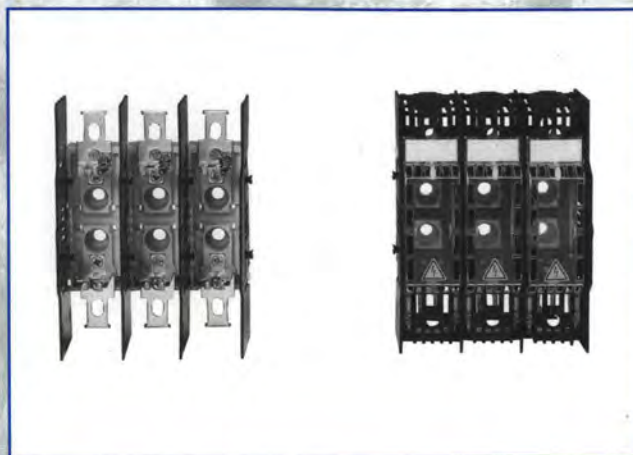
Slimline is a modular, space saving and fully type tested switch fuse and rack system which has proven benefits in its ease of use and economy due to the possibility of reducing overall switchboard size.

To find out more about Slimline, ask your nearest NHP office for a copy of publication SFL.

Stromberg OFAX DIN fuse bases

NHP has a range of single and three pole DIN fuse bases for size 00 and 1 DIN fuses.

Fully shrouded and open versions are available.





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

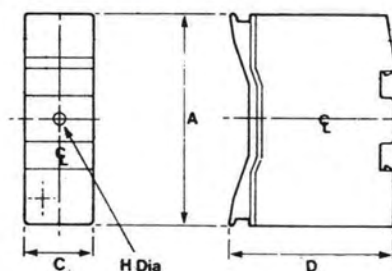
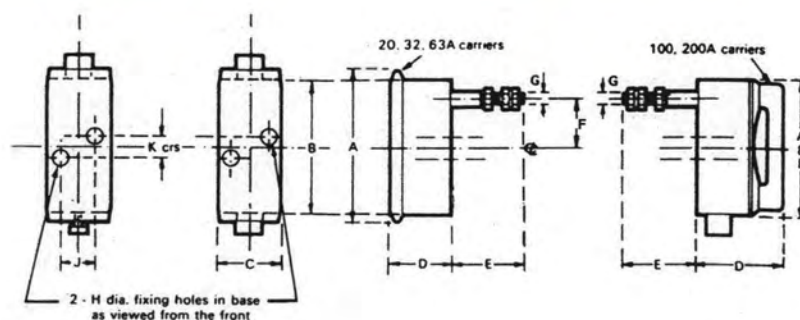
Complete fuse units (carriers and bases)

Current rating A	Colour	Cat. No. according to type of connection			Neutral Link Cat. No. No.		BS88 REF	Suitable NHP Compact Fuse-link	
		Front wired	Front/stud	Clip-in type Front/wired	Bolt-in	Clip-in		Bolt-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 A3	NTIA 2-32 NTIS 35-63	NES 20-63
100	Black	N100FW	N100SFW	—	100MFNL	—	— A4	NTB 2-63 NTCP 80-100 NTBC 2-63 NTC 80-100	— —
200	Black	N200FW	N200SFW	—	200MFNL	—	B1 B2	NTF 125-200	—

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

Dimensions (mm)

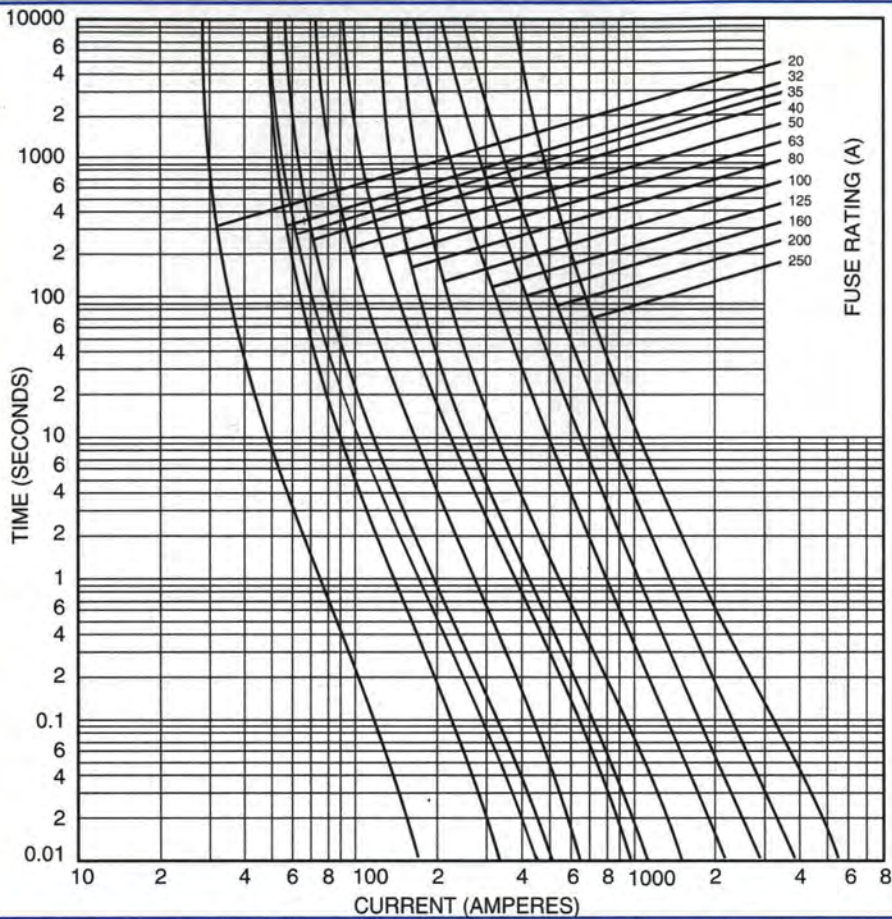
	A	B	C	D	E	F	G	H	J	K	Hole dia.
Cat. No.	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
N20	87	79	27	50	63	28	6	5.5	-	-	12
N32	109	101	31	62	60	39	6	5.5	12.7	6.4	12
N63	118	110	35	72	71	39.5	8	5.5	12.7	6.4	14.5
N100	154	154	54	108	80	58.5	10	6.5	19	22	18.5
N200	193	193	70	149	89	69	12	7	38	57	24.5
NV20 (clip-in)	75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

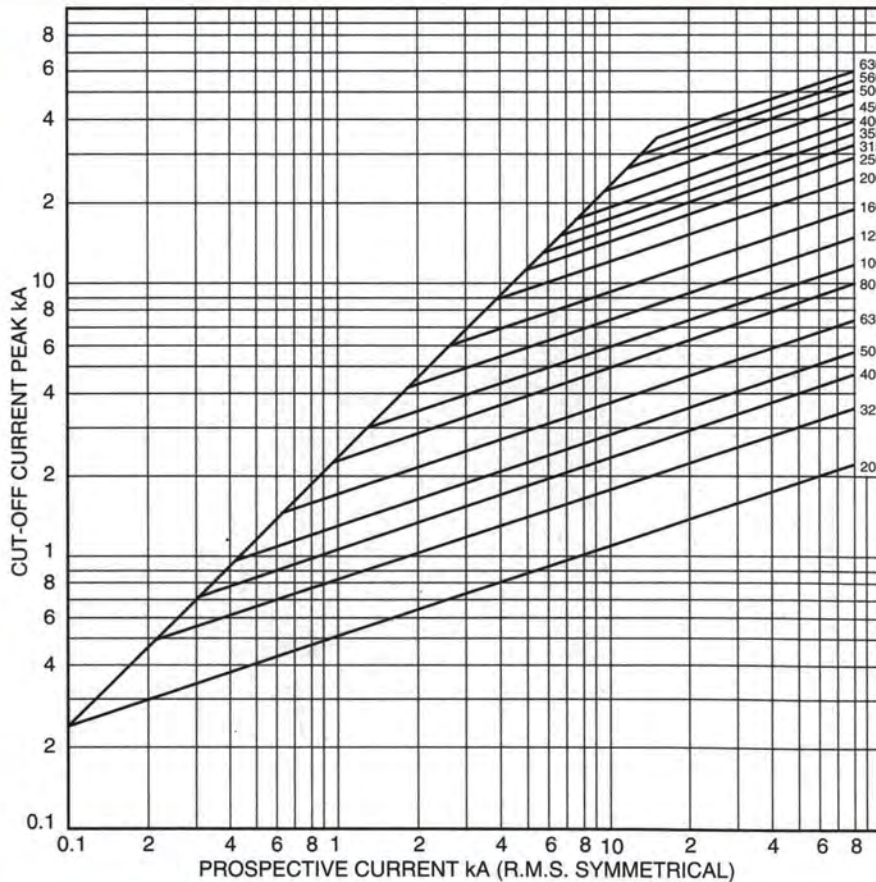
Note: N20 and NV fuse fittings have a single fixing hole in the centre.

I^2t characteristics

Rating (amperes)	I^2t pre-arcing	I^2t total @ 240 volts	I^2t total @ 415 volts
2	2	2	4
4	10	15	21
6	34	52	74
10	188	289	408
16	92	211	412
20	155	355	690
20M25	574	1084	1809
20M32	574	1561	2605
25	826	1084	1809
32	826	1561	2605
35	1200	2400	4100
32M40	2482	4416	7019
32M50	3305	5879	9345
32M63	5875	10452	16612
40	2482	4416	7019
50	3305	5879	9345
63	5875	10452	16612
80 & 63M80	7800	15500	26000
100 & 63M100	14000	28000	46000
125 & 100M125	30000	51000	75500
160 & 100M160	58500	99000	145000
200 & 100M200	120000	205000	300000
250 & 200M250	210000	360000	530000
315 & 200M315	270000	460000	680000
355	365000	620000	915000
400 & 315M400	480000	820000	1200000
450	755000	1300000	1900000
500	1100000	1850000	2700000
560	1200000	2400000	4000000
630	1550000	3100000	5150000
710	1903565	2992861	4306813
800	3820349	6006505	8643534
1000	7000000	1500000	16000000
1250	12000000	20500000	30000000



**NHP Compact
BS fuses from 20
to 250 amps**

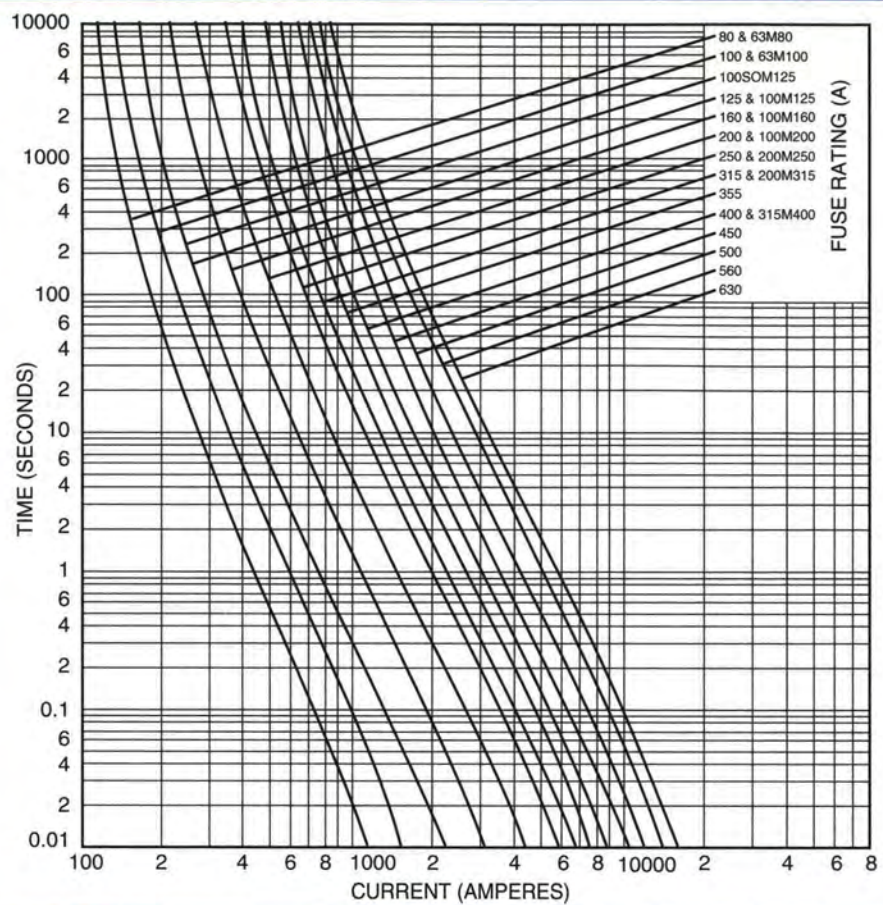


**NHP Compact
BS fuses cut-off
current data from
20 to 630 amps**

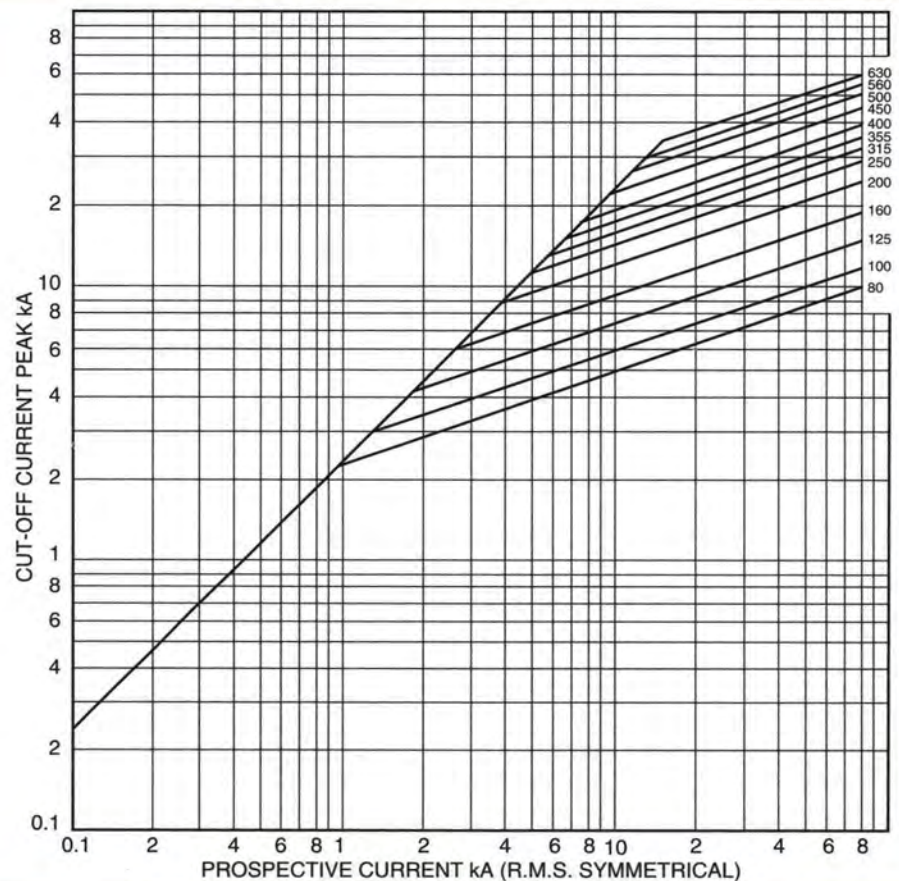
Fuse curves

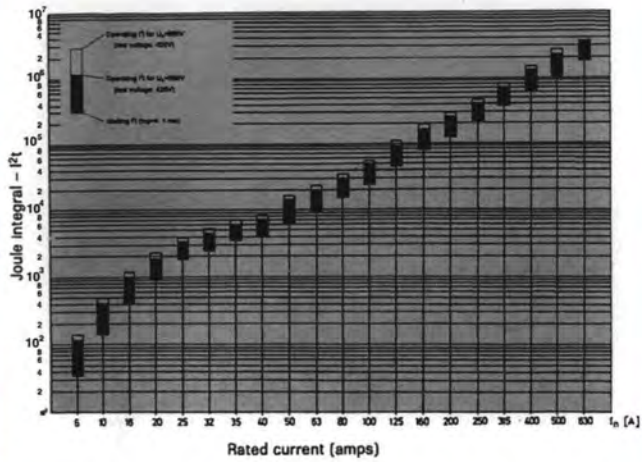
BS fuse curves

**NHP Compact
BS fuses from
80A to 630 amps
(including motor
rated fuses)**



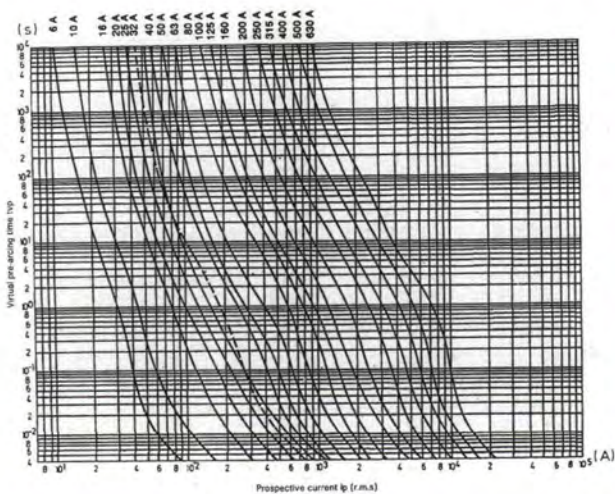
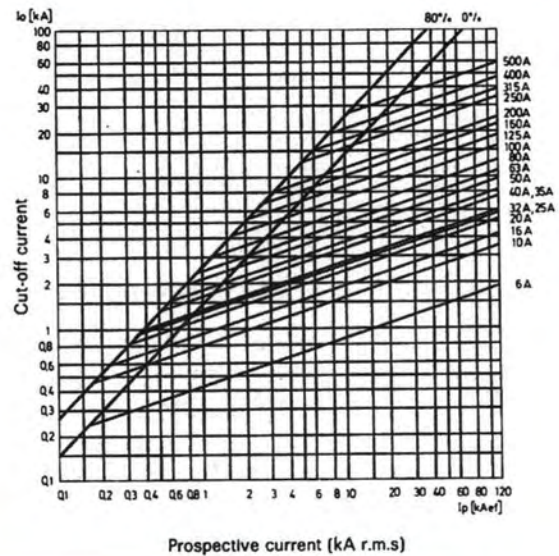
**NHP Compact BS
fuses cut-off
current data from
80 to 630 amps**



NHP COMPACT FUSES**DIN fuses curves and data***DIN fuses curves and data*

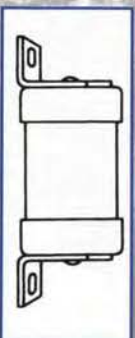
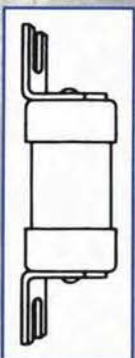
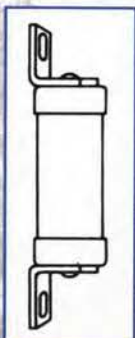
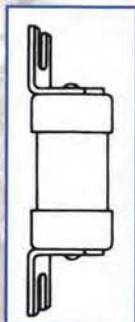
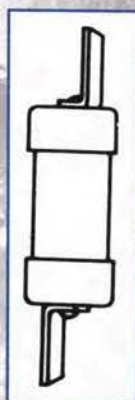
NHP Compact DIN fuses
Pre-arcing and Total I^2t energies,
from 6 to 630 amps

NHP Compact DIN fuses
cut-off current data
from 6 to 500 amps



NHP Compact DIN fuses
Fuse curves
from 6 to 630 amps

Derating tables

**Currents at various ambients:**

Cat. No.	Maximum current at ambient temperature				
	40°C	45°C	50°C	55°C	60°C
NNIT2	2	2	2	2	2
NNIT4	4	4	4	4	4
NNIT6	6	6	6	6	6
NNIT8	8	8	8	8	8
NNIT10	10	10	10	10	10
NNIT16	16	16	16	16	16
NNIT20	20	20	20	20	20
NNIT25	25	25	25	25	25
NNIT32	32	32	32	30	28
NNIT20M25	20	20	20	20	20
NNIT20M32	20	20	20	20	20
NTIA2	2	2	2	2	2
NTIA4	4	4	4	4	4
NTIA6	6	6	6	6	6
NTIA8	8	8	8	8	8
NTIA10	10	10	10	10	10
NTIA16	16	16	16	16	16
NTIA20	20	20	20	20	20
NTIA25	25	25	25	25	25
NTIA32	32	32	31	29	27
NTIA32M40	32	32	32	32	29
NTIA32M50	32	32	32	32	32
NTIA32M63	32	32	32	32	32
NTIS40	40	40	40	39	36
NTIS50	50	50	50	49	45
NTIS63	63	63	63	62	58
NTIS63M80	63	63	63	63	63
NTIS63M100	63	63	63	63	63
NTCP80	80	80	80	80	78
NTCP100	100	100	100	100	96
NTCP100M125	125	122	115	108	100
NTCP100M160	100	100	100	100	100
NTC80	80	80	80	80	80
NTC100	100	100	100	100	95
NTC100M160	100	100	100	100	100
NTFP125	125	125	125	117	109
NTFP160	160	160	158	148	137
NTFP200	167	158	149	140	129
NTFP200M250	200	200	200	189	175
NTF125	125	125	125	125	117
NTF160	160	160	160	150	138
NTF200	200	199	188	176	163
NTF200M250	200	200	200	193	179
NTKF250	250	250	244	228	211
NTKF315	282	267	252	236	218
NTKM250	250	250	250	250	243
NTKM315	314	298	281	262	243
NTMF355	340	323	305	285	264
NTMF400	400	400	385	360	334
NTM355	355	355	335	314	290
NTM400	400	394	372	348	322
NTTM450	438	416	392	367	340
NTTM500	500	484	456	427	395
NTTM560	526	499	471	440	408
NTTM630	587	557	525	491	455
NTT450	450	444	419	392	363
NTT500	500	490	462	432	340
NTT630	569	540	509	476	441
NTLM710	670	636	599	561	519
NTLM800	741	703	663	620	574
NTLT710	679	644	607	568	526
NTLT800	773	733	692	647	599

Notes: Transformer and fluorescent lighting circuits: To cater for inrush currents, the fuse-link selected should have a rating approximately twice the transformer primary current; or the total current required by the maximum number of fluorescent lights to be switched simultaneously.

Capacitor circuits: Three-phase power factor correction capacitors also have transient high-inrush characteristics. In addition, fuse protection needs to take into account circuit harmonics. Practical experience has shown that a fuse-link rated at 50% higher than the rated capacitor current provides a satisfactory solution.

NHP COMPACT FUSES

Suggested specification

NHP Compact fuses

BS fuses

- ◆ All HRC fuses shall be suitable for use on 415 volt systems and shall be ASTA 20 certified to BS88: Part 2 : 1988 and AS 2005.
- ◆ Cartridge barrels shall be extruded under vacuum to prevent the occurrence of air pockets.
- ◆ All fuse-links shall be subjected to a resistance test during the manufacturing process to prove correct assembly.
- ◆ Fuse caps and tags shall be mechanically connected and soldered to ensure reliability and maximum rigidity under fault conditions. End caps shall be press fitted onto precision ground barrels.
- ◆ Fuses shall be fitted internally with Kevlar™ discs to prevent burn back under fault conditions.
- ◆ Watts loss from fuses must be within the limits of the applicable standard.
- ◆ All fuses must be identified by indelible and non deteriorate printing on the barrels. Paper labels, which may fall off in time are not acceptable.
- ◆ All fuses must be filled with graded silica using a vibratory method to ensure correct filling.
- ◆ HRC fuses are to be NHP Compact, with a full range available from 2 to 1250A.

DIN fuses

- ◆ DIN fuses shall be manufactured to comply with DIN 43620-1 and IEC 269-2-1.
- ◆ All DIN fuses shall have a rated breaking capacity of 120kA RMS.
- ◆ All DIN fuses must incorporate an indicator for blown fuse identification.
- ◆ DIN fuses must be VDE marked to indicate conformity with VDE requirements.
- ◆ DIN fuse-links shall be NHP Compact with a full range available from 2 to 630A.

Fuse fittings

- ◆ Fuse fittings are to be fully shrouded to prevent accidental contact with live parts whilst inserting or withdrawing a carrier and shall be designed to accept BS fuses, either bolt in or clip-in models.
- ◆ Fuse fittings must comply with BS88 requirements and be suitable for use on systems upto 415V.
- ◆ Fuse fittings shall be NHP Compact with ratings available from 20 to 200A.

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P.O. Box 1127, Coorparoo DC, 4151

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HOBART: H.M. Bamford (Hobart), 199 Harrington St.,
Tas. 7000 Phone: (03) 6234 9299 Fax: (03) 6231 1693

LAUNCESTON: H.M. Bamford (Launceston), 59 Garfield St.,
Tas. 7250 Phone: (03) 6344 8811 Fax: (03) 6344 4069

BURNIE: H.M. Bamford (Burnie), 6 Wellington St.,
Tas. 7320 Phone: (03) 6432 2588 Fax: (03) 6432 2580

NHP*Proudly Australian*

RH Series — General Purpose Midget Relays

Key features of the RH series include:

- Compact midget size saves space
- High switching capacity (10A)
- Choice of blade or PCB style terminals
- Relay options include indicator light, check button, and top mounting bracket
- DIN rail, surface, panel, and PCB type sockets available for a wide range of mounting applications



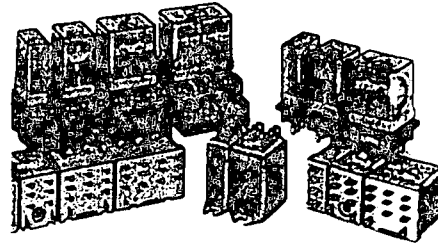
UL Recognized
Files No. E67770
E59804
E64245



CSA Certified
File No. LR35144



File No. BL951113332319



Specifications	Contact Material	Silver cadmium oxide
	Contact Resistance	50mΩ maximum (initial value)
	Minimum Applicable Load	24V DC/30mA, 5V DC/100mA (reference value)
	Operating Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Release Time	SPDT (RH1), DPDT (RH2): 20ms maximum 3PDT (RH3), 4PDT (RH4): 25ms maximum
	Power Consumption	SPDT (RH1): DC: 0.8W AC: 1.1VA (50Hz), 1VA (60Hz) DPDT (RH2): DC: 0.9W AC: 1.4VA (50Hz), 1.2VA (60Hz) 3PDT (RH3): DC: 1.5W AC: 2VA (50Hz), 1.7VA (60Hz) 4PDT (RH4): DC: 1.5W AC: 2.5VA (50Hz), 2VA (60Hz)
	Insulation Resistance	100MΩ min (measured with a 500V DC megger)
	Dielectric Strength	SPDT (RH1) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
		DPDT (RH2), 3PDT (RH3), 4PDT (RH4) Between live and dead parts: 2,000V AC, 1 minute; Between contact circuit and operating coil: 2,000V AC, 1 minute; Between contact circuits: 2,000V AC, 1 minute; Between contacts of the same pole: 1,000V AC, 1 minute
	Frequency Response	1,800 operations/hour
	Temperature Rise	Coil: 85°C maximum Contact: 65°C maximum
	Vibration Resistance	0 to 6G (55Hz maximum)
	Shock Resistance	SPDT/DPDT: 200N (approximately 20G) 3PDT/4PDT: 100N (approximately 10G)
	Life Expectancy	Electrical: over 500,000 operations at 120V AC, 10A; (over 200,000 operations at 120V AC, 10A for SPDT (RH1), 3PDT (RH3), 4PDT (RH4)) Mechanical: 50,000,000 operations
	Operating Temperature	-30 to +70°C
	Weight	SPDT: 24g, DPDT: 37g (approximately) 3PDT: 50g, 4PDT: 74g (approximately)



See page D-29 for dimensions.

Operational Characteristics

Maximum Continuous Applied Voltage (AC/DC) at 20°C	110% of the rated voltage
Minimum Operating Voltage (AC/DC) at 20°C	80% of the rated voltage
Drop-Out Voltage (AC)	30% or more of the rated voltage
Drop-Out Voltage (DC)	10% or more of the rated voltage

Ordering Information

Order standard voltages for fastest delivery. Allow extra delivery time for non-standard voltages.

Basic Part No.

RH2B-U

Coil Voltage:

AC110-120V

Relays

RH Series



Part Numbers

Part Numbers: RH Series with Options

Termination	Contact Configuration	Basic Part No.	Indicator Light	Check Button	Indicator Light and Check Button	Top Bracket
B (blade)	SPDT	RH1B-U	RH1B-L*	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-ULC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	RH3B-ULC	RH3B-UT
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-ULC	RH4B-UT
V2 (PCB 0.078" [2mm] wide)	SPDT	RH1V2-U	RH1V2-L*	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	RH2V2-ULC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	RH3V2-ULC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	RH4V2-ULC	—

1. * RH1B(V2)-L is not UL recognized.

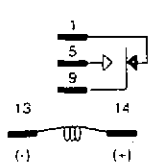
2. For Coil and Contact Ratings, see the next page.

Part Numbers: Sockets

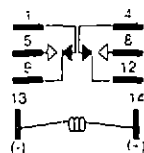
Relay	Standard DIN Rail Mount	Finger-Safe DIN Rail Mount	Surface Mount	Panel Mount	PCB Mount	Spring (optional)
RH1B	SH1B-05	SH1B-05C	—	SH1B-51	SH1B-62	SY2S-02F1 SFA-101 SFA-202 SY4S-51F1 SFA-301 SFA-302
RH2B	SH2B-05	SH2B-05C	SH2B-02	SH2B-51	SH2B-62	SY4S-02F1 SFA-101 SFA-202 SY4S-51F1
RH3B	SH3B-05	SH3B-05C	—	SH3B-51	SH3B-62	SH3B-05F1 SFA-101, -202 SY4S-51F1
RH4B	SH4B-05	SH4B-05C	—	SH4B-51	SH4B-62	SH4B-02F1 SFA-101, -202 SY4S-51F1

3. See Section F for details on sockets. All DIN rail mount sockets shown above can be mounted using DIN rail BNDN1000.

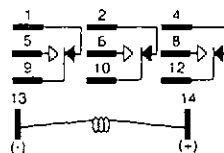
Internal Circuit



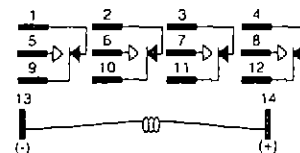
RH1



RH2



RH3



RH4

Ratings

Coil Ratings

Rated Voltage		Rated Current $\pm 15\%$ at 20°C								Coil Resistance $\pm 15\%$ at 20°C			
		60Hz				50Hz							
		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
AC	6V	150mA	200mA	280mA	330mA	170mA	238mA	330mA	387mA	18.8Ω	9.4Ω	6.0Ω	5.4Ω
	12V	75mA	100mA	140mA	165mA	86mA	118mA	165mA	196mA	76.8Ω	39.3Ω	25.3Ω	21.2Ω
	24V	37mA	50mA	70mA	83mA	42mA	59.7mA	81mA	98mA	300Ω	153Ω	103Ω	84.5Ω
	120V*	7.5mA	11mA	14.2mA	16.5mA	8.6mA	12.9mA	16.4mA	19.5mA	7,680Ω	4,170Ω	27,70Ω	22,20Ω
	240V†	3.2mA	5.5mA	7.1mA	8.3mA	3.7mA	6.5mA	8.2mA	9.8mA	3,1200Ω	15,210Ω	12,100Ω	91,20Ω
		SPDT		DPDT		3PDT		4PDT		SPDT	DPDT	3PDT	4PDT
DC	6V	128mA		150mA		240mA		250mA		47Ω	40Ω	25Ω	24Ω
	12V	64mA		75mA		120mA		125mA		188Ω	160Ω	100Ω	96Ω
	24V	32mA		36.9mA		60mA		62mA		750Ω	650Ω	400Ω	388Ω
	48V	18mA		18.5mA		30mA		31mA		2,660Ω	2,600Ω	1,600Ω	15,50Ω
	110V‡	8mA		9.1mA		12.8mA		15mA		13,800Ω	12,100Ω	8,600Ω	7,340Ω



* For RH2 relays = 110/120V AC.

† For RH2 relays = 220/240V AC.

‡ For RH2 relays = 100/110V DC.

Contact Ratings

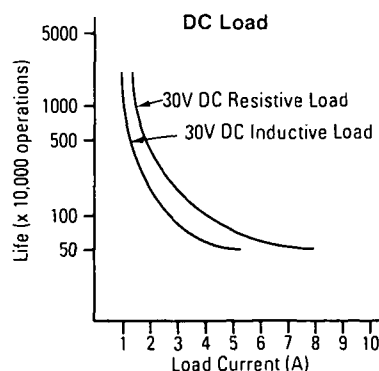
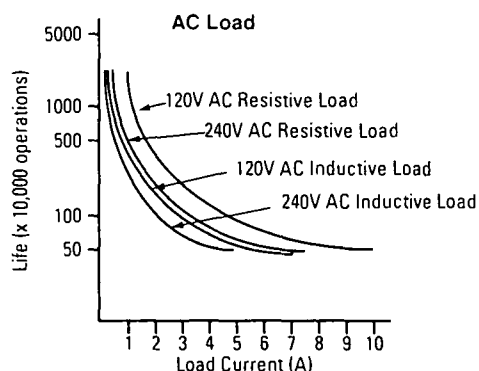
Voltage	Rating	Resistive				Inductive				Motor Load	
		SPDT	DPDT	3PDT	4PDT	SPDT	DPDT	3PDT	4PDT	SPDT	DPDT
28V DC	UL	10A	10A	10A	10A	7.5A	—	—	7.5A	—	—
30V DC	UL	—	—	—	—	7A	7A	—	—	—	—
	CSA	10A	10A	10A	10A	7A	7.5A	7.5A	7.5A	—	—
110V DC	Nominal	0.5A	0.5A	0.5A	0.5A	0.3A	0.3A	0.3A	0.3A	—	—
120V AC	UL	—	—	—	—	7.5A	—	—	7.5A	1/6	1/6
	CSA	10A	10A	10A	10A	7A	7.5A	7.5A	7.5A	—	—
240V AC	UL	10A	10A	—	7.5A	7A	7A	7A	5A	1/3	1/3
	CSA	7A	7.5A	7.5A	4.5A	5A	5A	5A	5A	—	—



1. * 6.5A/pole, 20A total.

2. Inductive load $\cos \phi = 0.3$, $L/R = 7ms$.

Electrical Life Curves



sprecher+schuh
The ultimate in technology

NHP

CS 7 HEAVY DUTY INDUSTRIAL RELAYS

A reputation for reliable and versatile performance

Up to 12 poles



Fitted with a 4 pole front mount and side mount auxiliary contact block (10 pole configuration)



Fitted with optional pneumatic timer and side mount auxiliary contact block (6 pole configuration)



Fitted with side mount auxiliary contact blocks (7 pole configuration)



Basic 4 pole CS 7 relay (Cat. No. CS7-40E shown)

- 25 amp rating for basic CS 7 relay
- Reliable long life
- Up to 12 pole configuration is possible with add-on auxiliary blocks
- Common accessories to CA 7 contactor
- Choice of front and side mount auxiliary contact blocks
- Auxiliaries rated up to 10 amps
- Interchangeable coils
- Electronic compatible contacts
- Choice of accessories (timers, latches, interlocks, etc)
- Reversible coil connections

This size available as contactor "CA 7" up to 11 kW

NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD
A.B.N. 84 004 304 812

ACS
Advanced Control System

CS 7 control relay

Features

- Complies with IEC 947
- High contact reliability
- Basic 4 pole relay can be increased up to a 12 pole relay with add on contact blocks
- Choice of front mount or side mount accessories
- Electronic compatibility

Control Voltages

AC = 24, 32, 110, 240, 415 V 50 Hz

DC = 24, 36, 48, 110, 240 V DC

CS 7 industrial control relays share the same design as the CA 7 contactor range. They are compact and designed for heavy duty industrial control applications where reliability and versatility are essential.

CS 7 relays are designed for fast and trouble free installation and maintenance. All accessories are modular and snap-on without the use of tools. The relays are DIN/Screw mounted so they can be installed, moved or replaced quickly.

Basic 4 pole CS 7 relay AC coil

Contact arrangement	Cat. No.
2 N/O 2 N/C	CS7-22E...V
3 N/O 1 N/C	CS7-31E...V
4 N/O 0 N/C	CS7-40E...V



AC version

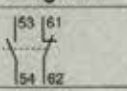
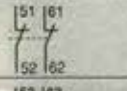
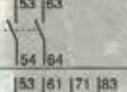
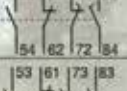
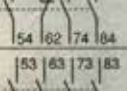
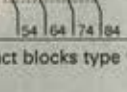


DC version

Basic 4 pole CS 7 relay DC coil

Contact arrangement	Cat. No.
0 N/O 4 N/C	CS7C-04E...V
1 N/O 3 N/C	CS7C-13E...V
2 N/O 2 N/C	CS7C-22E...V
3 N/O 1 N/C	CS7C-31E...V
4 N/O 0 N/C	CS7C-40E...V

Top mounting auxiliary contact blocks ¹⁾

N/O	N/C	Diagram	Reference	Suit CS 7	Cat. No.
1	1		11	All	CS 7-PV-11
0	2		02	All	CS 7-PV-02
2	0		20	All	CS 7-PV-20
1+1E	1+1L		L22	All	CS 7-PV-L22
3	1		31	All	CS 7-PV-31
4	0		40	All	CS 7-PV-40

Examples of CS 7 accessories



Front mount



Side mount



Front mount pneumatic timer

Note: ¹⁾ Other contact blocks type CA 7-P can be used providing terminal numbers are acceptable. (Refer CA 7 contactor auxiliaries, Part A section 1).

NHP ELECTRICAL ENGINEERING PRODUCTS PTY LTD

A.B.N. 84 004 304 812

www.nhp.com.au



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62 Leyland Street Garbutt Qld. 4814

208 Denison Street Rockhampton Qld. 4700

Cnr Carroll St. & Struan Crt. Toowoomba, Qld. 4350

14/128 Lyons Street Bungalow Qld. 4870

50 Croydon Road Keswick S.A. 5035

38 Belmont Ave. Rivervale W.A. 6103

3 Steele Street Winnellie N.T. 0820

2/65 Albert Road Moonah Tasmania 7009

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Modern high current contactors with
Electronically Controlled Mechanism (ECM)
and Advanced Contact Systems

Tomorrow's Technology Today

NHP

Melbourne Premises



Sydney Premises



Brisbane Premises

Rockwell Automation **Sprecher+Schuh**



Sprecher + Schuh administrative building at Aarau



Part of the low voltage factory at Aarau

Sprecher + Schuh has been one of the leading manufacturers of high quality electrical equipment in Europe for many years. The company was founded by Carl Sprecher in 1900 in Aarau, Switzerland, but in 1993 the company was acquired by Rockwell International and now operates under the direction of Rockwell Automation.

The Sprecher + Schuh facility in Switzerland will continue to operate and develop products for world markets as a centre of excellence and will continue to produce low voltage control gear products, including the world famous Sprecher + Schuh contactor range.

In 1968 NHP was appointed the exclusive Australian agent for Sprecher + Schuh low voltage motor control gear products which were primarily manufactured at the head office of the company in Aarau, Switzerland.

Since 1966 when Sprecher + Schuh equipment was introduced into the Australian market it has received remarkable acceptance from Australian industry. This has been largely due to the technical superiority of the products produced to traditional Swiss exacting standards of precision engineering.

NHP was formed in 1968 for the purpose of manufacturing, importing and merchandising a wide range of specialised electrical switchgear, motor control gear and other technical electrical products for Australian industry.

NHP is a wholly Australian owned company and exclusively represents a considerable number of overseas companies. These companies manufacture complementary equipment to the NHP programme, which includes locally manufactured products in Melbourne.

The head office and Melbourne sales organisation is situated at Richmond, with branch offices in Sydney, Brisbane, Adelaide, Perth, Newcastle, Townsville, Rockhampton, Toowoomba, Cairns and Darwin.

The company is also represented by agents in Hobart, Launceston and Burnie. NHP products are stocked and distributed through more than 500 centres Australia wide.

Due to this extensive national sales and service network, the company is able to continue a policy of supplying an extensive

range of technical electrical equipment, supported by substantial stocks and competent service on a national basis.

All branch offices and agents are connected to the on-line computer network centred in Melbourne. Experienced engineers are also available to assist customers, throughout Australia and to advise on all technical aspects and application requirements of equipment.

NHP is a supplier to the full spectrum of industry which uses industrial type electrical equipment, including mining and general industries, electrical contractors and government departments.

It is the continuing policy of the company to improve both the range and quality of products and services available for the Australian market. Experienced engineering and management personnel continually visit world centres to ensure that the organisation keeps pace with technological advances, research and development and modern marketing techniques.

NHP
Proudly Australian

These high standards are the result of strict manufacturing controls and testing, and by the use of the latest high quality materials available. This high quality has resulted in remarkable reliability ensuring long life and excellent performance.

NHP has welcomed the acquisition of Sprecher + Schuh by Rockwell because international businesses in the electro-mechanical field requires very substantial volumes to minimise production costs. In manufacture there are ever increasing costs associated with advanced research and development technology, complicated tooling, and sophisticated automated production lines.

Rockwell is committed to providing substantial increases in funds available for R & D and the latest production techniques.

Rockwell/Sprecher + Schuh will be better able to achieve economies of scale and international growth as a result of the union.

The full range of Sprecher + Schuh equipment is freely available throughout Australia from the NHP organisation or NHP representatives and distributors.

The Ultimate in Motor Control



NHP Policy statement

NHP is a team of people, committed to the advancement of our business, and the business of our customers, in every respect.

We are a wholly Australian owned corporate citizen marketing a wide range of quality low-voltage industrial motor control, distribution switchgear and protection equipment.

We develop, manufacture and distribute a range of quality Australian made products.

NHP is dedicated to continually improving the quality of life of our customers, our suppliers and our staff through leadership, dedication, innovation and excellent service.



NHP's switchgear can be found in a variety of applications across Australia:

1. Switchboards for large industrial applications.
2. Sydney's mono-rail system.
3. Pump-starting of water systems in outback Australia.
4. Distribution-boards for Australian industry.
5. Refinery plants.
6. High rise city buildings controlling lighting, power and providing a safe environment.
7. Providing switchgear for the building industry to safely and cost-effectively complete construction.

The complete CA 6 range

**1000V
RATED**

Electronic coil control provides unique benefits for the user.

The CA 6 range from CA 6-105-EI to CA 6-420-EI is fitted with the electronically controlled mechanism (ECM), which also includes a PLC interface as standard.

ECM stands for "Electronically Controlled Mechanism", which is an electronic circuit that regulates the voltage to the contactor coil. "ECM" provides the benefit of defined pick-up voltages and a wide control voltage range.



Benefits of the system include:

- Clearly defined pick-up and dropout voltage (ON and OFF) levels.
- No contactor chatter and high contact reliability.
- Wide voltage range of coils.

Cat. No.	CA 6-85	CA 6-105	CA 6-140
		CA 6-105-EI	CA 6-140-EI
Standard overload	CT 6-90, CEF 1-11/12	CT 6-110, CEF 1-11/12	CT 6-150, CEF 1-11/12
Alternative electronic overload	CET 4 + CWE 4-180	CET 4 + CWE 4-180	CET 4 + CWE 4-180
AC 3 kW @ 415V	55	75	90
AC 3 kW @ 1000V	45	55	75

with electronic control (ECM)*

NHP


* Electronically Controlled Mechanism (ECM)



- Built-in overvoltage suppression.
- Low power consumption for both pick-up and holding (longer cable runs possible).
- Built-in PLC (mA control) interface.

CA 6-170-EI
CA 6-210-EI
CA 6-250-EI
CA 6-300-EI
CA 6-420-EI

CT 6-200, CEF 1-11/12

CEF 1-41/42/52

CEF 1-41/42/52

CEF 1-41/42/52

CEF 1-41/42/52

CET 4 + CWE 4-180

CET 4 + CWE 4-630

CET 4 + CWE 4-630

CET 4 + CWE 4-630

CET 4 + CWE 4-630

100

132

150

185

250

90

110

133

163

225

CA 6 . . . a complete system

The development of the CA 6 range has now extended to the CA 6-420-EI, the complete range now covering 1000 volt, AC 3 ratings up to 225kW with 415 volt ratings up to 250kW.

Special design features of these contactors include a unique electronically controlled mechanism (ECM) which is standard on all sizes except the CA 6-85-11.

Electronically controlled mechanism (ECM)

The electronically controlled mechanism has, with the release of the larger CA 6 contactors, been further improved. As well as providing the unique advantages of electronic coil control, the ECM version now includes a **built in PLC interface**. These are identified with the suffix EI on the Cat. No.

What is "ECM"

ECM stands for "Electronically Controlled Mechanism". With the version EI, an electronic circuit regulates the voltage to the contactor coil. This is achieved using an ASIC (application specific integrated circuit) which precisely controls the pick-up and drop-out levels of the contactor. This provides decisive advantages for the user.

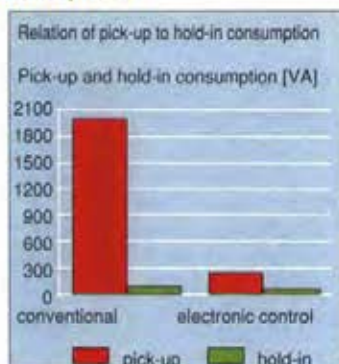
- Very low pick-up and hold coil consumption.
- No contact chatter because of defined pick-up and drop-out voltages.
- High contact reliability due to minimised tendency to contact bounce.
- Built-in suppression circuits.
- Built-in PLC interface.
- Wide voltage tolerance of coils suitable for 50/60Hz (DC versions also available).
- EMC compatibility:
(Note: EMC is not to be confused with ECM. EMC means that the contactors also conform to Electromagnetic compatibility standards for noise emission and immunity).

Best features:

CA 6 contactors are manufactured in 2 frame sizes, the first frame size accommodates 85-170A and the second frame size accommodates 210-420A.

CA 6 contactors use common accessories and take up to 8 auxiliary contacts.

Relation of pick-up to hold-in consumption



Extremely low pick-up and hold-in coil consumption compared with conventional contactors.

Robust and versatile

- Rated up to 1000 volts.
- Type 2 co-ordination with fuses or circuit breakers.
- High thermal capacity.
- High switching capacity.
- Mechanical interlock does not increase overall width.
- Up to 8 auxiliary contacts.
- Flexible busbars and mounting plates available for quick assembly of starter combinations.
- Choice of electronic motor protection or CT 6 thermal overloads.
- Plug-in voltage suppressors.



Safety first

- Arc chamber cannot be removed with the contactor energised.
- Contactor cannot be energised unless arc chambers are locked into place.
- Switch position indicator (manual operation of contactor not possible).
- Closed arc chambers prevent hot gases escaping. Safety distance in front of contactor not necessary.
- Touch proof design using special insulated terminal blocks and terminal covers.
- No cadmium or asbestos (environmentally safe).

Interlocking mechanism



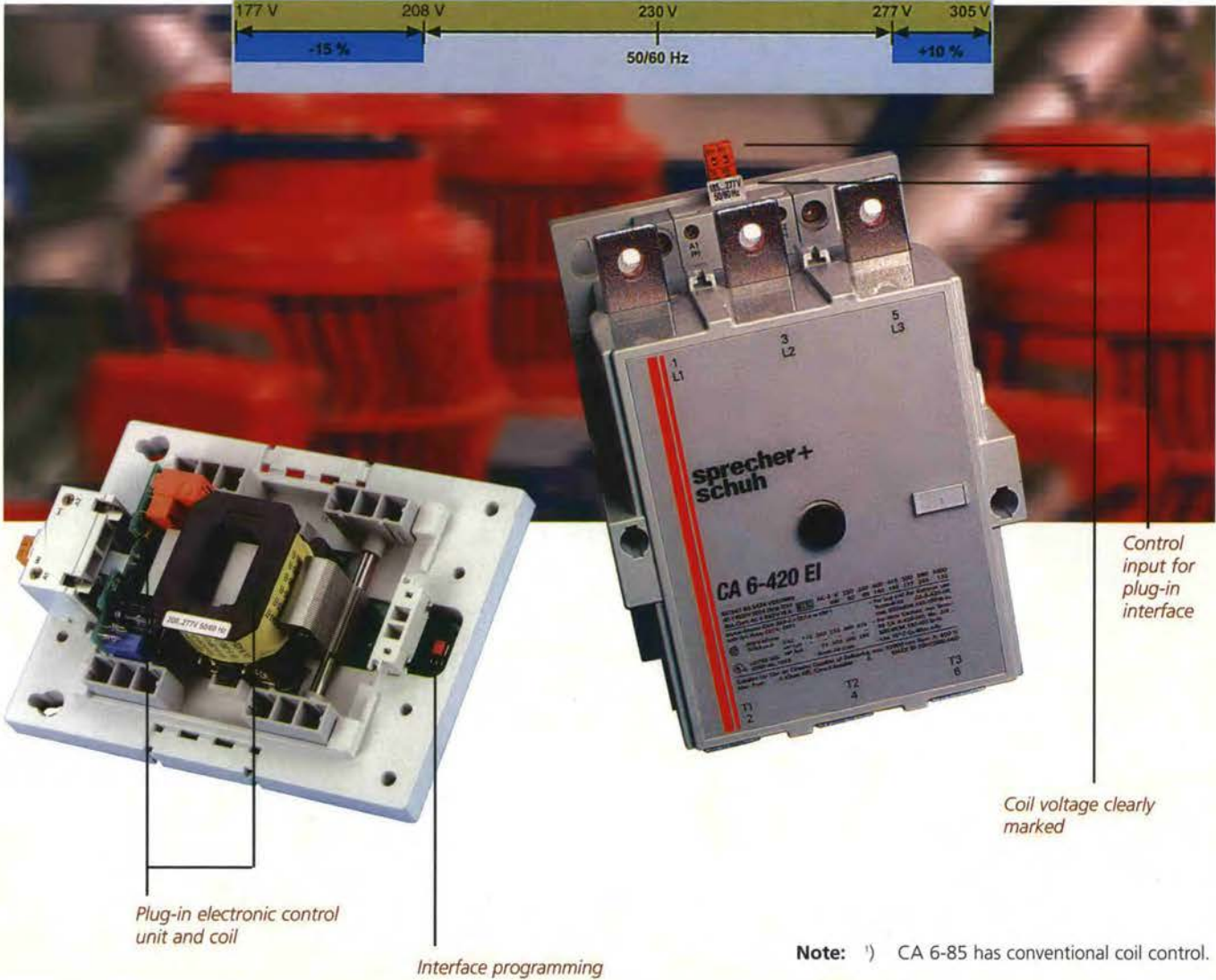
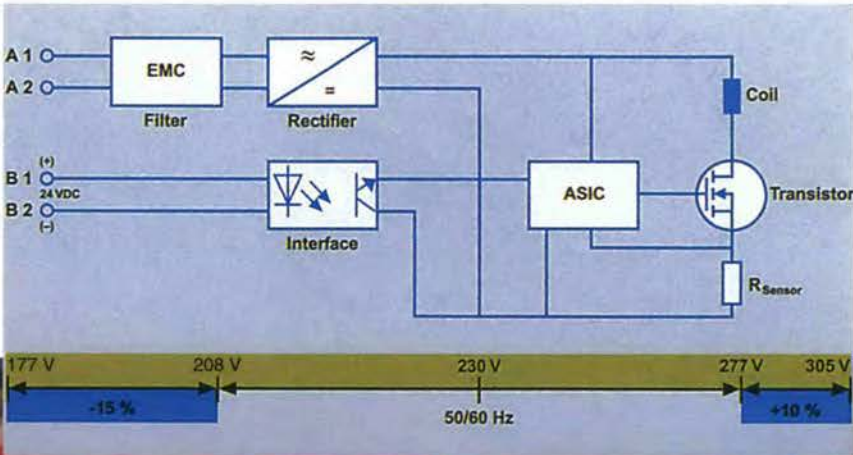
your connection to the future

NHP



CA 6-170-EI 90kW contactor with ECM

Cat. No.	kW @ AC 3 415V	kW @ AC 3 1000V
CA 6-85 '1)	55	45
CA 6-105(-EI)	75	55
CA 6-140(-EI)	90	75
CA 6-170-EI	100	90
CA 6-210-EI	132	110
CA 6-250-EI	150	133
CA 6-300-EI	185	163
CA 6-420-EI	250	225



Note: '1) CA 6-85 has conventional coil control.

CA 6 advanced contact system

Electronic coil system ECM

Provides chatter free operation of the main contacts thus increasing contact life and reliability.

Laminated moving contact system designed to promote arc control.

Contact identification

CA 6-85	- No 1
CA 6-105	- No 2
CA 6-105-EI	- No 22
CA 6-140	- No 33
CA 6-140-EI	- No 3
CA 6-170-EI	- No 4
CA 6-210-EI	- No 5
CA 6-250-EI	- No 6
CA 6-300-EI	- No 7
CA 6-420-EI	- No 8

Main contacts easily maintained and replaced from the front without disturbing the main connections

Safety lockout system



Tips on contact replacement

Evaluation of contact condition

The contact surface of a new contact system is by no means smooth. It consists rather of a large number of small surfaces through which the partial currents flow from the fixed contact to the moving contact. The reason for this is the "natural" roughness of the surface of the contact plate, which does not affect the practical function of the contact.

Distinctly visible traces of erosion are left behind by the very first switchings and after a larger number of switchings are distributed over the entire contact surface. After a small number of switchings the entire contact surface is rough and blackened. Notched edges and erosion tapering toward the arcing chamber are also normal signs of wear.

Switching elements of silver alloys have the characteristic that they retain the favourable characteristics with regard to contact reliability, closing capability and current carrying capacity even with an eroded surface.

Under no circumstances may rough contact surfaces be filed smooth, because such action will not improve the switching performance and valuable contact material would only be lost.

It is particularly important for the contact making to occur exclusively with the silver plating; whether the plating is smooth or eroded is not so important. The end of the contact element service life is reached when larger pieces have broken out of the contact plating, or when the danger of contact with the base material exists.

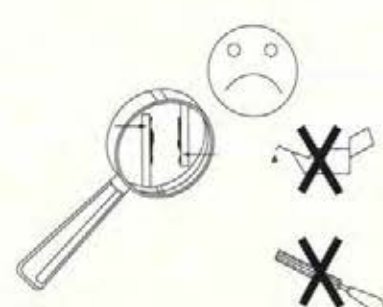
Contact maintenance



Note that contact erosion need not be equal on all three poles. This is because the opening operation is usually synchronised with the AC control phase of the same supply source. The result of this is that the extinguishing phase is always the same. Periodic changing of the control phase will provide a more uniform burn-off of the contact system. The assessment of wear is to be based on the contact element exhibiting the greatest amount of wear.

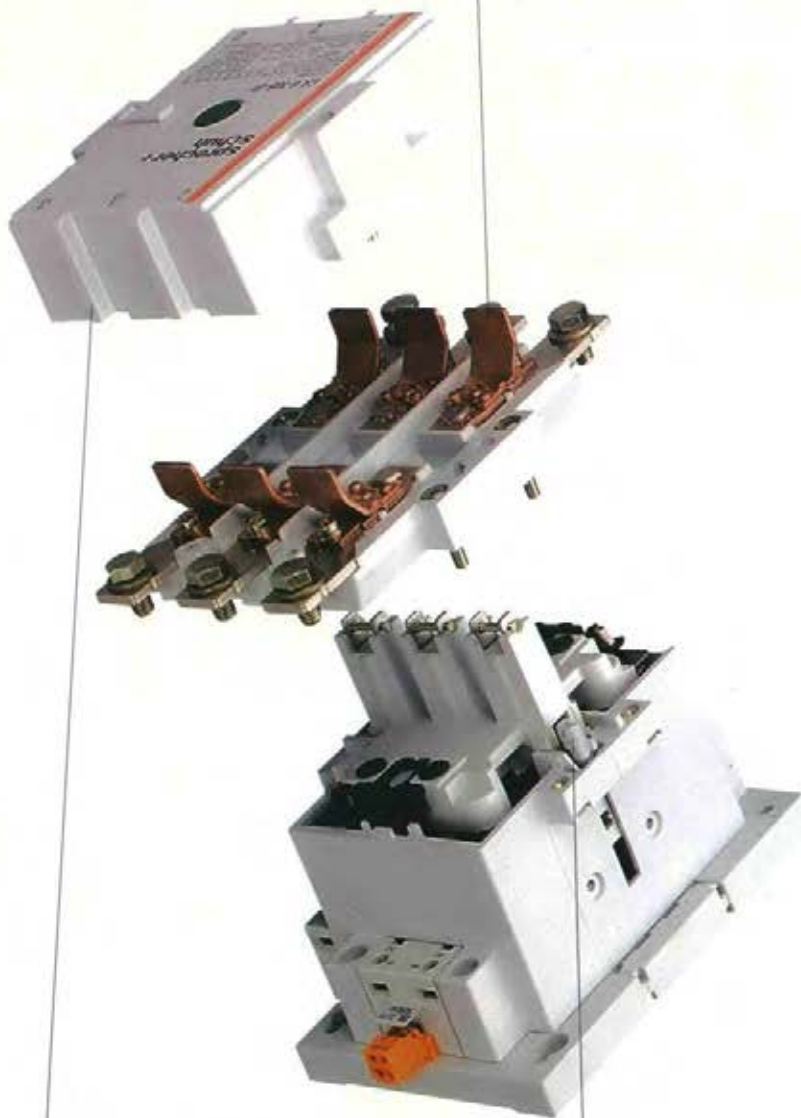
Note -

Uniform burn-off of all three phase contacts can be obtained by periodically changing over the phases of the AC control circuit.



– reliable high current switching **NHP**

Arc runner plate assists on drawing arc away from contacts.



Rapid movement of the arc into the chamber reduces arc pressure and emitted gases. No dangerous gases emitted to cables and connection.

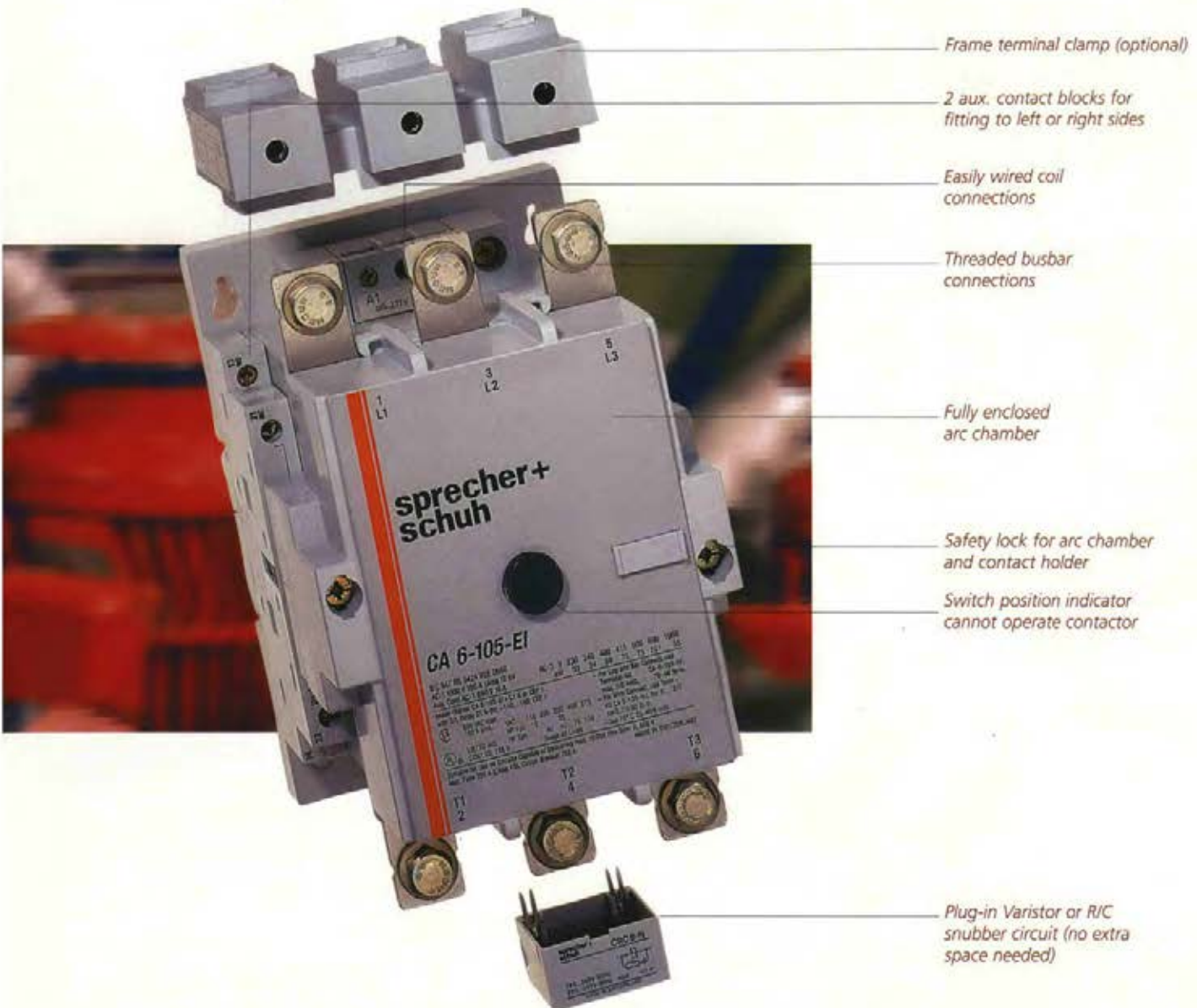
Safety lockout system (mechanical interlock)



Efficient arc quenching chamber
Carefully designed and positioned arc splitter plates quickly interrupt the current on opening.



Enclosed arc chamber reduces the required clearance to 7mm between the CA 6 contactors and metal enclosures.



You save installation time and increase safety by using the CA 6



The distance between the mounting surface and the terminals is the same on all CA 6 units regardless of rating. Only then can switchgear be wired simply and efficiently.



Play safe! The snap-on terminal cover provides for touch protection according to DIN VDE 0106 and VGB 4. The contactors are automatically touch-proof according to IP 2LX when using the frame terminal clamp.



Our CA 6 contactors can be mechanically interlocked without occupying additional space. A really good idea on the part of our engineers to minimise the size of your plant.

Optimum protection

NHP


CA 6 contactors keep your circuit breaker options open – and you gain the flexibility you've been looking for.

CA 6 contactors and KTA 3 circuit breakers are the ideal starter combination for every application.

- With four ratings (100, 160, 250 and 400A) the KTA 3 circuit breakers cover the full range of CA 6 ratings.
- All KTA 3 circuit breakers incorporate effective short circuit and overload protection with a minimum of wiring.
- The modern design is not only pleasing, it saves space as well.
- Provision is made on both CA 6 contactors and KTA 3 circuit breakers for subsequently adding many useful accessories on site. Your starter can be adapted quickly and at low cost to suit changing requirements.

The complete range –

1000 volt contactors type CA 6 (55kW to 250kW 415V AC 3 rating)

The CA 6 Sprecher + Schuh contactors offer the latest in switching technology up to 1000 volts. The first frame size of contactors to be released in the CA 6 range are the CA 6-85 to CA 6-170-EI, which cover both 415 and 1000 volt ratings and provides AC 3 switching

capacities for 1000 volt motors up to 90kW.

The development of the CA 6 range has also now been extended to the CA 6-420-EI, the complete range now covers 1000 volts. AC 3 ratings up to

225kW with 415 volt ratings up to 250kW. The special design features of these contactors include a unique Electronically Controlled Mechanism (ECM) which is a standard feature for the CA 6-105-EI up to the CA 6-420-EI range of contactors.



Quick wiring



Only 2 sets of flexible flat conductors are needed to wire all contactors up to 90kW, which makes wiring up starters a quick and simple job.

Improved performance

- Precisely defined pick-up and drop-out voltages. No contact chattering is possible.
- Smooth operation in the whole voltage range minimises any tendency to contact bounce. This improves contact life even under adverse conditions.
- Low pick-up and hold-in consumption. Reduces power consumption and keeps temperature rise to a minimum.
- Brief supply voltage dips caused by heavy motor starting currents are automatically bridged for secure motor starting.
- Wide voltage range coils are suitable for both 50 and 60Hz operation.
- Built-in over voltage protection and suppression circuits eliminate interference from the coil.

Versatile

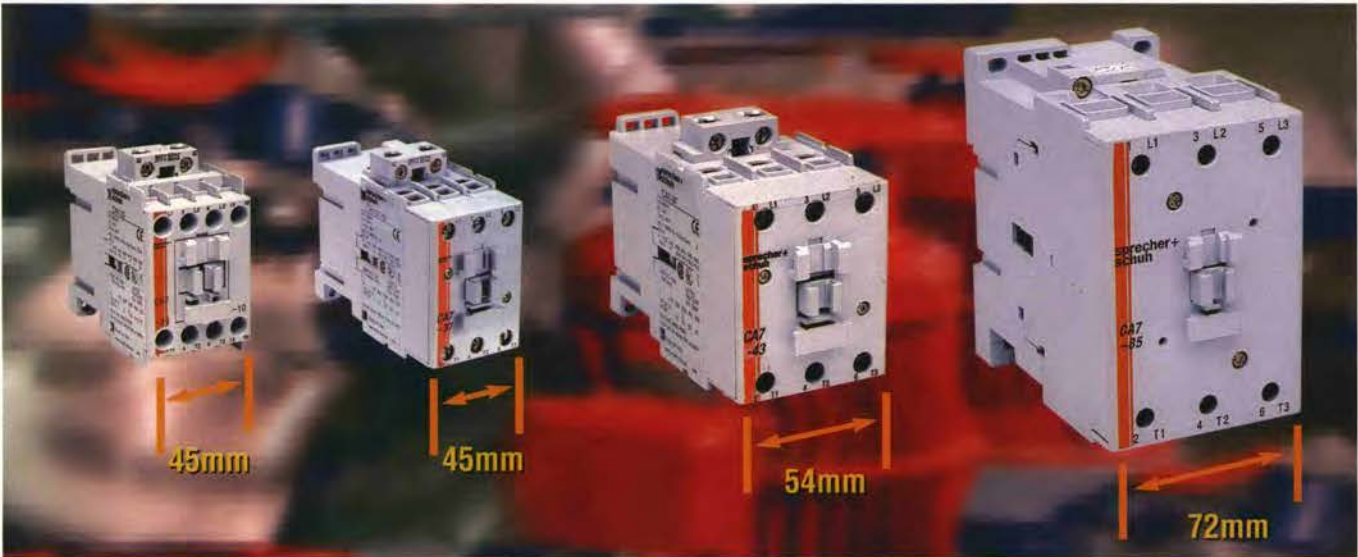


Matching terminal lugs enable CT 6 and CEF 1 electronic motor protection relays to be mounted directly onto the contactors. (CT 6 shown)

– from Sprecher + Schuh



Advanced Control System (ACS) CA 7 contactors
(4kW to 45kW 415V AC 3 rating)



AC 3 ratings 415V	4kW (9A)					
	5.5kW (12A)					30kW (60A)
	7.5kW (16A)	15kW (30A)				37kW (72A)
	11kW (23A)	18.5kW (37A)	22kW (43A)			45kW (85A)

CA 7 contactors complement the CA 6 range covering AC 3 kW ratings from 4–45kW in 4 compact frame sizes.

Contactors type CA 5 (220kW to 700kW 415V AC 3 rating)

Rated to IEC 947



High current contactors CA 5 start where the CA 6 range ends. This extends the Sprecher + Schuh complete range up to 700kW AC 3. Like CA 6 contactors the sizes CA 5–370...860 are 1000 volt rated.

Contactor Cat. No.	AC 1 amp 40°C	AC 2 / AC 3 approx. kW @ 415V	AC 2 / AC 3 approx. kW @ 1000V ¹⁾
CA 5-370	500	220	220
CA 5-450	600	265	280
CA 5-550	760	325	355
CA 5-700	1000	430	500
CA 5-860	1100	520	550
CA 5-1000	1200	600	–
CA 5-1200	1350	700	–

Note: ¹⁾ IEC 158-1

CA 6 contactor ratings chart

CONTACTOR RATINGS CHART

Ratings
To: AS 3947-4 IEC 947-4
Tested to IEC 947-4

CA 6-85 ¹⁾

CA 6-105 ¹⁾
CA 6-105-EI ¹⁾

CA 6-140 ¹⁾
CA 6-140-EI ¹⁾

CA 6-170-EI ¹⁾
Rated voltage
- 1000 Volts - ⁷⁾
CURRENT RATINGS AT OPERATIONAL VOLTAGE 415V ¹²⁾ 1000 VOLT RATINGS ()

40°C I_{th}	AC 1	Amps	160	160	250	250
60°C	AC 1	Amps	135	135	210	210
	AC 2, AC 3, AC 4	Amps	95 (33)	130 (40)	155 (55)	170 (65)

MOTOR STARTER RATINGS AT OPERATIONAL VOLTAGE 415V. ALL kW RATINGS APPROXIMATE ⁵⁾

AC 2, AC 3 AC 4 ¹⁰⁾	Slip-ring motors	kW@415V	55	75	90	100
	and cage motors	kW@1000V	45	55	75	90
	Inching/plugging					
Star delta ¹¹⁾	Line/delta	kW	100	132	160	173
	Star point Y		165	225	270	300
	Star point Δ		240	320	380	420
Auto transformer ¹²⁾ and liquid resistance ¹³⁾	Line	kW	55	75	90	100
	Transformer		90	125	150	170
	Star point Y		120	150	190	230

CAPACITOR AND LAMP SWITCHING













Single capacitors	40/60°C ⁸⁾ 415V	Kvar	81/68	81/68	126/106	126/106
Variable capacitors	40/60°C ⁹⁾ 415V	Kvar	44/44	56/56	76/76	112/106
Tungsten per phase	40°C	Amps	107	120	140	170
Fluorescent (compensated) ¹⁴⁾			80	90	105	128

MECHANICAL, ELECTRICAL AND COIL DATA

Mechanical life		OPS	10 mill	10 mill	10 mill	10 mill
Electrical life at AC 3, 415V		OPS	0.8 mill	0.6 mill	0.7 mill	1 mill
Contactor operations (Max no load)		OPS/HR	3000	1200	1200	1200
Switching delay	Make	mSec	20-47	60	60	60
AC coil	Break		6-12	30-55	30-55	30-55
Coil data AC	Pick-up	VA	650 ²⁾	260-409	260-409	260-409
		W	310	161-295	161-295	161-295
	Hold	VA	50	11.7-26.5	11.7-26.5	11.7-26.5
		W	10	4.6-14.4	4.6-14.4	4.6-14.4
Coil data DC	Pick-up	W	540	230-332	230-332	230-332
	Hold		8	4.4-6.0	4.4-6.0	4.4-6.0
Rated making capacity at 415V AC 4		Amps	1140	1560	1860	2040
Rated breaking capacity at 415V AC 4		Amps	950	1300	1550	1700
Auxiliary contacts	Available	Std/Max	2/8	2/8	2/8	2/8
Integral auxiliary	AC 1 60°C	Amps	-	-	-	-
Contact	AC 15, 415V	Amps	-	-	-	-
Add-on auxiliary	AC 1 60°C	Amps	12	12	12	12
Block	AC 15, 415V	Amps	2.5	2.5	2.5	2.5

MOTOR PROTECTION SELECTION

Alternative electronic overload selection						
Overload range	Type	Amps	CET 4 ⁴⁾ 20-180	CET 4 ⁴⁾ 20-180	CET 4 ⁴⁾ 20-180	CET 4 ⁴⁾ 20-180
Standard thermal or electronic overload						
Overload range	Type ⁶⁾	Amps	CT 6-90 CEF 1-11/12 70-90	CT 6-110 CEF 1-11/12 85-110	CT 6-150 CEF 1-11/12 105-150	CT 6-200 CEF 1-11/12 140-200

			
CA 6-210-EI ¹⁾	CA 6-250-EI ¹⁾	CA 6-300-EI ¹⁾	CA 6-420-EI ¹⁾
- 1000 Volts - ⁷⁾			
350	350	450	500
300	300	380	425
225 (80)	258 (95)	320 (115)	425 (160)
132	150	185	250
111	133	163	225
231	263	335	452
390	450	550	750
560	630	780	1050
132	150	185	250
220	250	308	425
310	410	435	580
176/151	176/151	226/191	252/214
170/151	176/151	226/191	252/214
210	250	300	420
158	188	225	315
10 mill	10 mill	10 mill	10 mill
0.85 mill	0.95 mill	0.85 mill	0.95 mill
1200	1200	1200	1000
60	60	60	60
30-55	30-55	30-55	30-55
260-409	260-409	260-409	590
161-295	161-295	161-295	161-295
11.7-26.5	11.7-26.5	11.7-26.5	11.7-26.5
4.6-14.4	4.6-14.4	4.6-14.4	4.6-14.4
230-332	230-332	230-332	375
4.4-6.0	4.4-6.0	4.4-6.0	7
2724	3096	3780	5100
2270	2580	3150	4250
2/8	2/8	2/8	2/8
-	-	-	-
12	12	12	12
2.5	2.5	2.5	2.5
			
CET 4 ⁴⁾	CET 4 ⁴⁾	CET 4 ⁴⁾	CET 4 ⁴⁾
160-630	160-630	160-630	160-630
			
CEF 1-41/42/52	CEF 1-41/42/52	CEF 1-41/42/52	CEF 1-41/42/52
160-630	160-630	160-630	160-630

Notes: ¹⁾ CA 6-85...CA 6-140 available with standard coil. CA 6-105-EI...CA 6-420-EI are fitted as standard with ECM coils.

²⁾ CA 6-85...CA 6-140 AC coil data is for standard coil.

³⁾ CA 6-105...CA 6-140 AC coil data (standard coil).

Pull-in Hold

VA 650 50

W 310 10

DC coil data:

Pull-in Hold

W 540 8

⁴⁾ When fitted with appropriate current converter CWE 4.

⁵⁾ All switching ratings are at 50/60Hz, may also be suitable for 400Hz, refer NHP.

⁶⁾ CT 6 series 70 amps to 200 amps.

⁷⁾ 1000V current ratings are shown ().

⁸⁾ Single and 3 phase capacitors switched onto a network.

⁹⁾ Parallel switched capacitors, min 8μH inductance between switched capacitors.

¹⁰⁾ Based on reduced contact life refer NHP.

¹¹⁾ Star delta to AS 1202 part 2 class 0.3.

¹²⁾ Auto transformer to AS 1202 part 3 class 0.1 on load factor 60%.

Ratings based on 80% tapping. Higher ratings for lower taps available.

¹³⁾ For liquid resistance starters use line and transformer contact.

¹⁴⁾ For 2 parallel paths 1.7 x le.
For parallel paths 2.5 x le.

A choice of motor protection



CA 6 with CT 6 thermal overload Here, the CT 6 displays innovative design concepts, with the direct mounting of the Sprecher + Schuh RT 3 thermistor protection relay.

Thermal overload relay CT 6 with 'differential' protection (1000V)

The thermal overload relay CT 6 provides economical protection of motors in the range of 45 to 98kW. Available in 4 current ranges, each unit has space for the mounting of thermistor relays type RT 3.

Cat. No.	Current range	For contactor
CT 6-90	68 - 90 amps	CA 6-85
CT 6-110	85 - 110 amps	CA 6-105 (-EI)
CT 6-150	105 - 150 amps	CA 6-140 (-EI)
CT 6-200	140 - 200 amps	CA 6-170 (-EI)
RT 3-A	Thermistor relay with auto reset	
RT 3-M	Thermistor relay with manual reset	



Cat. No. CEF 1-12
Electronic motor protection relay

Electronic motor protection relay CEF 1 (1000V)

The CEF 1 electronic motor protection relay is the ideal partner for the CA 6 range of contactors. It is available with or without thermistor protection and covers all motor currents from 20 to 630 amps. Other features include 15 trip classes up to 30 sec., an improved phase failure/asymmetry protection and all CEF 1 relays fit directly to the CA 6 contactors.

Cat. No.	Current range	For contactor
CEF 1-11/12	20 - 180 amps	CA 6-85...170-EI
CEF 1-41/42/52	160 - 630 amps	CA 6-210-EI...420-EI



Cat. No. CET 4 + CWE 4
Electronic motor protection relay

Electronic motor protection relay CET 4 (1000V)

The CA 6 range of contactors is ready made to accept the ultimate in motor protection, the CET 4 electronic motor protection relay. Protection, warning, display of data, control features and communication options are the 5 main functions for the CET 4 relay. With the CET 4 'in control' the ultimate starter will provide you with all the data you need to know about your motor.

Cat. No.	Current range	For contactor
CET 4 + CWE 4-180	20 - 180 amps	CA 6-85...170-EI
CET 4 + CWE 4-630	160 - 630 amps	CA 6-210-EI...420-EI



Cat. No. CWE 4 – VS
Busbar connection set

Busbar connection sets

Busbar sets are required for connection between the contactors CA 6-85...170-EI and CEF 1-11/12 relays or CWE 4-180 current converters. CA 6-210-EI...420-EI contactors connect to CEF 1-41/42/52 or CWE 4-630 with busbar already attached to the relays and current converters

Use busbar set	Relay or current converter
Cat. No.	Contactor
CWE 4-VS	CA 6-85/105-EI connects to CEF 1-11/12 or CWE 4-180
CWE 4-VS2	CA 6-140-EI/170-EI connects to CEF 1-11/12 or CWE 4-180

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CA 6 AC contactor selection

3 pole open type with AC or DC coil

Contactors CA 6-85...CA 6-420-EI

Rating to IEC 947 and AS 3497 415V

AC operated contactors



Cat. No. CA 6-105-EI
Contactor

Cat. No. ²⁾	AC 3 kW ¹⁾	AC 3 Amps ¹⁾	AC 1 40°C	AC 1 Amps 60°C	Auxiliary contacts standard		
					N/O	N/C	Max.
CA 6-85-11...V	55 (45)	95 (33)	160	135	1	1	8
CA 6-105-11...V	75 (55)	130 (40)	160	135	1	1	8
CA 6-105-EI-11...V ³⁾	75 (55)	130 (40)	160	135	1	1	8
CA 6-140-11...V	90(75)	155(55)	250	210	1	1	8
CA 6-140-EI-11...V ³⁾	90 (75)	155 (55)	250	210	1	1	8
CA 6-170-EI-11...V	100 (90)	170 (65)	250	210	1	1	8
CA 6-210-EI-11...V	132 (111)	225 (80)	350	300	1	1	8
CA 6-250-EI-11...V	150 (133)	258 (95)	350	300	1	1	8
CA 6-300-EI-11...V	185 (163)	320 (115)	450	380	1	1	8
CA 6-420-EI-11...V	250 (225)	425 (160)	500	425	1	1	8

DC operated AC contactors with continuously rated coils



Cat. No. CA 6-170-EI
Contactor

Cat. No. ²⁾	AC 3 kW ¹⁾	AC 3 Amps ¹⁾	AC 1 40°C	AC 1 Amps 60°C	Auxiliary contacts standard		
					N/O	N/C	Max.
CA 6-85-L22...VDC	55 (45)	95 (33)	160	135	1	1	8
CA 6-105-L22...VDC	75 (55)	130 (40)	160	135	2	2	8
CA 6-105-EI-11...VDC ³⁾	75 (55)	130 (40)	160	135	1	1	8
CA 6-140-L22...VDC	90 (75)	155 (55)	250	210	2	2	8
CA 6-140-EI-11...VDC ³⁾	90 (75)	155 (55)	250	210	1	1	8
CA 6-170-EI-11...VDC	100 (90)	170 (65)	250	210	1	1	8
CA 6-210-EI-11...VDC	132 (111)	225 (80)	350	300	1	1	8
CA 6-250-EI-11...VDC	150 (133)	258 (95)	350	300	1	1	8
CA 6-300-EI-11...VDC	185 (163)	320 (115)	450	380	1	1	8
CA 6-420-EI-11...VDC	250 (225)	425 (160)	500	425	1	1	8

CA 6 starter combination selection

Motor kW (415V)	Contactor	Thermal overload	Electronic ⁴⁾
55	CA 6-85	CT 6-90	CEF 1-11
75	CA 6-105 (-EI)	CT 6-110	CEF 1-11
90	CA 6-140 (-EI)	CT 6-150	CEF 1-11
100	CA 6-170-EI	CT 6-200	CEF 1-11
132	CA 6-210-EI	-	CEF 1-41
150	CA 6-250-EI	-	CEF 1-41
185	CA 6-300-EI	-	CEF 1-41
250	CA 6-420-EI	-	CEF 1-52

Notes: ¹⁾ 1000 volt ratings ().

²⁾ Add control voltage to Cat. No. when ordering:

24, 48, 110, 240, 415V AC for CA 6-85...CA 6-140 with conventional coil and 24VAC for CA 6-105-EI...CA 6-170-EI, 48, 110, 240 400V AC for CA 6-105-EI...CA 6-420-EI

³⁾ Add control voltage to Cat. No. when ordering:

12, 24, 48, 110, 220 240V DC for CA 6-85...CA 6-140
48, 110 and 220V DC for CA 6-105-EI...CA 6-420-EI
24VDC for CA 6-105-EI...CA 6-300-EI

⁴⁾ Basic protection relays (thermal & electronic overloads) listed refer page 20 for other options.

⁵⁾ CA 6-105, CA 6-140 also available with conventional coil.



Compact 90kW 1000 volt starter with
CEF 1 electronic motor protection

Auxiliary contacts for CA 6



Cat. No. CA 6-P2-11
Common auxiliary blocks to suit
all CA 6 contactors



Cat. No. CA 6-85
Contactor



Cat. No. CA 6-170-EI
Contactor

Auxiliary contact blocks for contactor CA 6 ¹⁾

Cat. No.	Description	Contacts	Position	Diagram
CA 6-P1-11	For fitting left	N/O + N/C	1	
CA 6-P3-11	For fitting left	N/O + N/C	3	
CA 6-P2-11	For fitting right	N/O + N/C	2	
CA 6-P4-11	For fitting right	N/O + N/C	4	
CA 6-P2-L11 ²⁾	For fitting right	N/O + N/C (late break)	2	
CA 6-P2-B11	For fitting right	1 changeover (low voltage)	2	
CA 6-P3-B11	For fitting left	1 changeover (low voltage)	3	

Positioning of auxiliary contacts

3	1	CA 6	2	4
---	---	------	---	---

Note: Position one (CA 6-P1-11)
fitted as standard on
CA 6 contactors.

Auxiliary contacts CA 6-P

Each contactor is fitted as standard with an auxiliary contact block type CA 6-P1-11 (1 N/O + 1 N/C). Up to 3 additional blocks can be fitted giving a maximum of 4 N/O + 4 N/C. They can be fitted on the left or right side of the contactor. With one auxiliary block mounted on each side, the overall width of the contactor does not increase.

Low Voltage compatible auxiliary contacts

All CA 6 auxiliary contacts are suitable for low voltage switching according to DIN standard 19240. The criteria is a switching voltage of 17V DC, 5mA with 100 million operations MTBF. The contacts xx B11 are a sealed contact suitable for extra low current/voltage switching. (Refer technical data).

- Notes:** ¹⁾ Maximum of four blocks per contactor. One CA 6-P1-11 block provided standard on each unit.
²⁾ To be used with DC coil.

Thermal and electronic overloads



CA 6 with CT 6 thermal overload. Here the CT 6 shows innovative design by the addition of the RT 3 thermistor protection relay.

Thermal overload relay CT 6 with 'differential' protection (CA 6-85 to CA 6-170-EI)

The thermal overload relay CT 6 provides economical protection of motors in the range of 45 to 98kW. Available in 4 current ranges, each unit has space for the mounting of thermistor relays type RT 3.

Cat. No. ¹⁾	Separate mounting Cat. No.	Approx. kW @ 415V	DOL setting range in amps	For mounting on contactor ²⁾
CT 6-90	CTA 6-90	40 - 50	68 - 90	CA 6-85/105 (EI)
CT 6-110	CTA 6-110	49 - 61	85 - 110	CA 6-85/105 (EI)
CT 6-150	CTA 6-150	60 - 85	105 - 150	CA 6-140-EI/170-EI
CT 6-200	CTA 6-200	80 - 110	140 - 200	CA 6-140-EI/170-EI
RT 3-A		Thermistor relay with auto reset		
RT 3-M		Thermistor relay with manual reset		



Cat. No. CEF 1-11
Electronic motor protection relay

Electronic motor protection relay CEF 1

Features for CEF 1

CEF 1-11...V, CEF 1-41...V

- Thermal overload with 15 selectable curves.
- Phase failure and asymmetry protection.

CEF 1-12...V, CEF 1-42...V, CEF 1-52...V

- Thermal overload with 15 selectable curves.
- Phase failure and asymmetry thermistor input protection.
- Overcurrent indication (flashing LED).

Cat. No. ¹⁾	Approx. kW @ 415V	Current range amps	For mounting on contactor ²⁾
CEF 1-11...V	11 - 100	20 - 180	CA 6-85...170-EI
CEF 1-12...V	11 - 100	20 - 180	CA 6-85...170-EI
CEF 1-41...V	90 - 240	160 - 400	CA 6-210-EI...420-EI
CEF 1-42...V	90 - 240	160 - 400	CA 6-210-EI...420-EI
CEF 1-52...V	90 - 380	160 - 630	CA 6-210-EI...420-EI



Cat. No. CEF 1-42
Electronic motor protection relay

Electronic motor protection relay CET 4

(As an alternative the CET 4 electronic motor protection relay can be used)

Type	For contactors	Current range amps
CET 4 + CWE 4-180	CA 6-85...170-EI	20 - 180
CET 4 + CWE 4-630	CA 6-210-EI...420-EI	160 - 630

- Notes: ¹⁾ 'Differential action' single phasing protection.
Automatic or manual reset, fitted with electronically separated signalling contact.
²⁾ For recommended fuses refer type '2' co-ordination in Catalogue C-CO.



Cat. No. CEF 1-52
Electronic motor protection relay

Accessories for CA 6 contactors



Cat. No. CM 6
Mechanical interlock for contactors



Cat. No. CA 6-HB
3 pole terminal block



Cat. No. CA 6-105-VLHB
Connection links flat conductor set



Cat. No. CA 6-105-VYU
Connection link shorting bar



Cat. No. CRC 6
Plug-in voltage suppressor

General accessories

Cat. No.	Description
CM 6	Mechanical interlock for CA 6-85 to CA 6-420-EI
CA 6-HA1	Main terminal cover for CA 6-85 to CA 6-105
CA 6-HA2	Main terminal cover for CA 6-140 and CA 6-105-EI to CA 6-170-EI
CA 6-HA3	Main terminal cover for CA 6-210-EI to CA 6-420-EI
CA 6-HB1	Terminal block - 3 pole for CA 6-85/105 ¹⁾
CA 6-HB2	Terminal block - 3 pole for CA 6-140/CA 6-105-EI to CA 6-170-EI
CA 6-HB3	Terminal block - 3 pole for CA 6-210-EI to CA 6-420-EI
CA 6-105-PS	Mounting plate for DOL starter CAT 6 (for CA 6-85...CA 6-170-EI)
CA 6-105-PU	Mounting plate for reversing starter CAUT 6 (for CA 6-85...CA 6-170-EI)
CA 6-105-PY	Mounting plate for star delta starter CAYT 6 (for CA 6-85...CA 6-170-EI)
CA 6-250-PS	Mounting plate for DOL starter CAT 6 (for CA 6-210-EI...CA 6-420-EI)
CA 6-250-PU	Mounting plate for reversing starter CAUT 6 (for CA 6-210-EI...CA 6-420-EI)
CA 6-250-PY	Mounting plate for star delta starter CAYT 6 (for CA 6-210-EI...CA 6-420-EI)

Connection links (rated to 1000 volts)

CA 6-105-VLHB	Flat conductor set input for reversing / star delta 50mm ² (for CA 6-HB...)
CA 6-105-VTHB	Flat conductor set output for reversing starters 50mm ² (for CA 6-HB...)
CA 6-105-VY	Flexible cable set-link CA 6 to CA 3 star contactor 16mm ²
CA 6-105-VYS	Flexible cable set - star point for CA 3-60-N...72-N 16mm ²
CA 6-105-VYU	Shorting bar for CA 6-85...CA 6-170-EI as a star point
CA 6-250-VL	Flat conductor set input for reversing star delta 120mm ²
CA 6-250-VT	Flat conductor set output for reversing starters 120mm ²
CA 6-250-VY	Flexible cable set-link CA 6-140-EI...CA 6-170-EI star contactor 80mm ²
CA 6-250-VYU	Shorting bar for CA 6-210-EI...CA 6-420-EI as a star point

Plug-in voltage suppressors ¹⁾

CRC 6-48	AC 21 - 48V 50Hz	R - C
CRC 6-110	AC 95 - 110V 50Hz	R - C
CRC 6-240	AC 190 - 240V 50Hz	R - C
CRC 6-550	AC 380 - 550V 50Hz	R - C
CRV 6-55	AC 12 - 55V	varistor
CRV 6-136	AC 56 - 136V	varistor
CRV 6-277	AC 137 - 277V	varistor
CRV 6-575	AC 278 - 575V	varistor

Busbars

	Connection busbar for direct connection of CA 6 to CET 4 (CWE 4-180) or CEF 1-11/12
CWE 4-VS	For CA 6-85/105
CWE 4-VS2	For CA 6-140 and 105-EI...CA 6-170-EI

- Notes: ¹⁾ Set of 2 pieces gives protection IP2LX to IEC 947.
Allows connection of rectangular bar, solid or flexible cable without lugs.
²⁾ Plug-in to bottom of all CA 6 contactors - select to suit coil voltage.
DC coils have in-built suppression diodes (not required for EI type contactors).

Spares

Arc chambers – main contact sets – coils



Cat. No. ARC 6-85
Arc Chamber



Cat. No. CA 6-140-MCS
Fixed and moving contacts



Cat. No. CAC 6-300-EI-240AC
Spare coil set showing coil and circuit card

Arc chambers

Cat. No.	To suit contactor
CA 6-85-ARC	CA 6-85
CA 6-105-ARC	CA 6-105
CA 6-105-EI-ARC	CA 6-105-EI
CA 6-140-ARC	CA 6-140
CA 6-140-EI-ARC	CA 6-140-EI
CA 6-170-EI-ARC	CA 6-170-EI
CA 6-210-EI-ARC	CA 6-210-EI
CA 6-250-EI-ARC	CA 6-250-EI
CA 6-300-EI-ARC	CA 6-300-EI
CA 6-420-EI-ARC	CA 6-420-EI

Main contact sets (3 pole)

Cat. No.	To suit contactor	Contact set No. ¹⁾
CA 6-85-MCS	CA 6-85	1
CA 6-105-MCS	CA 6-105	2
CA 6-105-EI-MCS	CA 6-105-EI	22
CA 6-140-MCS	CA 6-140	3
CA 6-140-EI-MCS	CA 6-140-EI	33
CA 6-170-MCS	CA 6-170-EI	4
CA 6-210-MCS	CA 6-210-EI	5
CA 6-250-MCS	CA 6-250-EI	6
CA 6-300-MCS	CA 6-300-EI	7
CA 6-420-MCS	CA 6-420-EI	8

Spare AC coils for contactors CA 6

Cat. No.	To suit contactor	
CAC 6-105...V AC	CA 6-85...140	standard
CAC 6-170...V AC ³⁾	CA 6-140...170	old E coil
CAC 6-300-EI...V AC	CA 6-105-EI...300-EI	electronic ²⁾
CAC 6-420-EI...V AC	CA 6-420-EI	electronic ²⁾

Spare DC coils for contactors CA 6

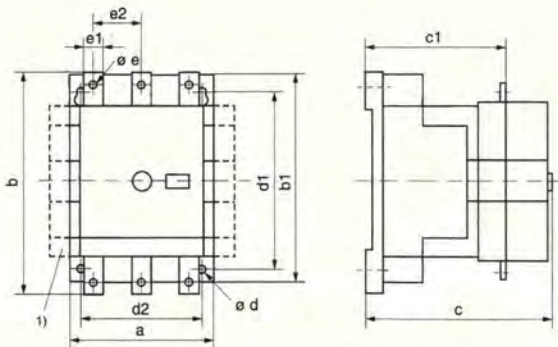
Cat. No.	To suit contactor	
CAC 6-105...V DC	CA 6-85...140	standard
CAC 6-170...V DC	CA 6-140E...170E	old E coil
CAC 6-300-EI...V DC	CA 6-105-EI...300-EI	EI electronic
CAC 6-420-EI...V DC	CA 6-420-EI	electronic

- Notes:** ¹⁾ Contact set identification number.
²⁾ Electronically controlled coils (ECM):-
 24V = 24-28V 50/60Hz 110V = 110-130V 50/60Hz 400V = 380-400V 50/60Hz
 48V = 43-65V 50/60Hz 240V = 208-277V 50/60Hz
³⁾ Limited availability please enquire.
 When ordering specify if contactor is suffix E or EI.

Dimensions
for contactors and overloads CA 6 + CT 6



CA 6 contactors

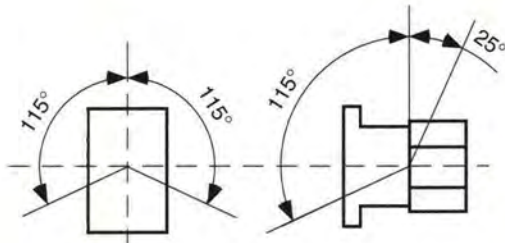


Type	a	b	b1	c	c1	ød	d1	d2	øe	e1	e2
CA 6-85/CA 6-105	120	182	170	156	110	5.2	145	100	M6	16	39
CA 6-140/CA 6-105EI/CA 6-170EI	120	182	170	156	110	5.2	145	100	M8	20	39
CA 6-210-EI...CA 6-420-EI	155	222	205	180	110	6.5	180	130	M10	25	48

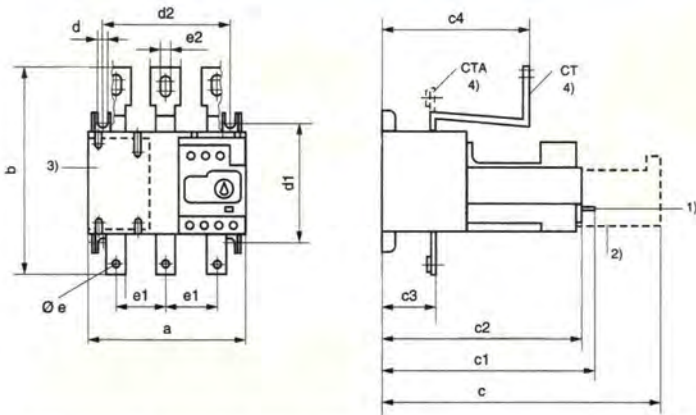
Notes: 1) No increase in base dimension when fitted with P1, P2 aux. For auxiliary contact P3, P4 plus 13.5mm.

Mounting positions CA 6

Contactor	(mm)
With aux. switch block P1 or P2	a
+P3, or +P4	13.5 each+a
With mechanical interlock	a+a
With frame terminal block	14 each+b
With protection against accidental contact HA 1	20...40 each+b
With protection element	b
With label holder	c...+5



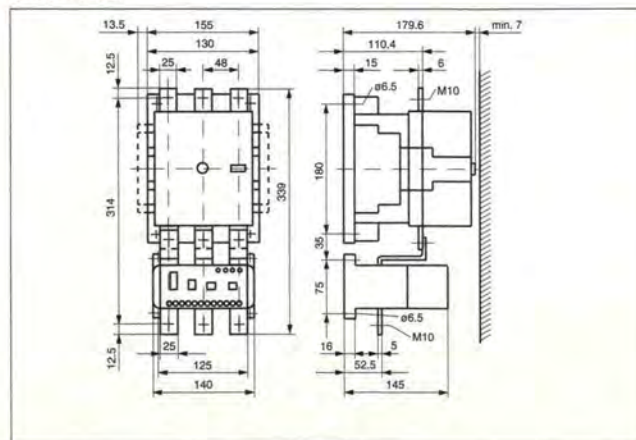
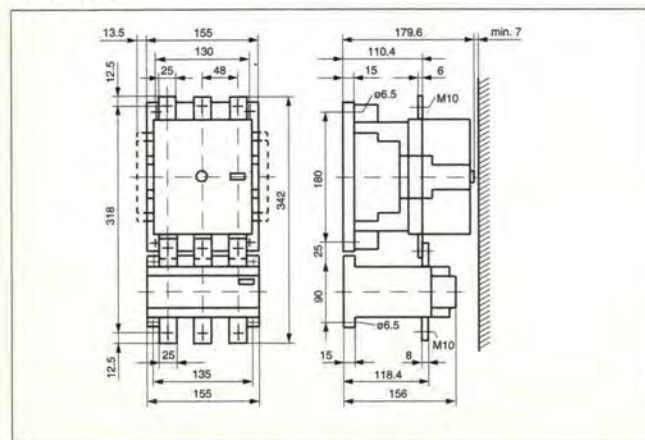
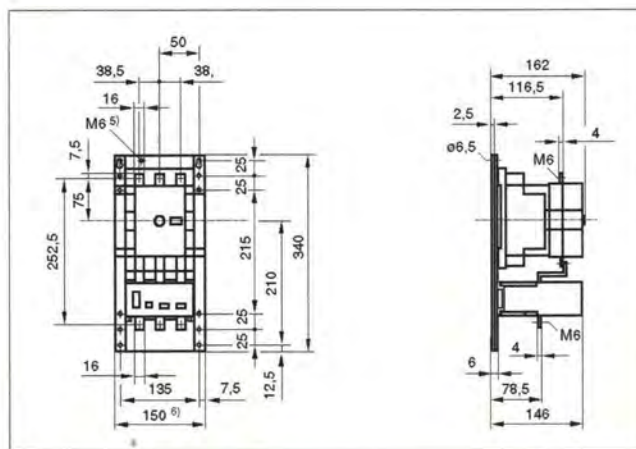
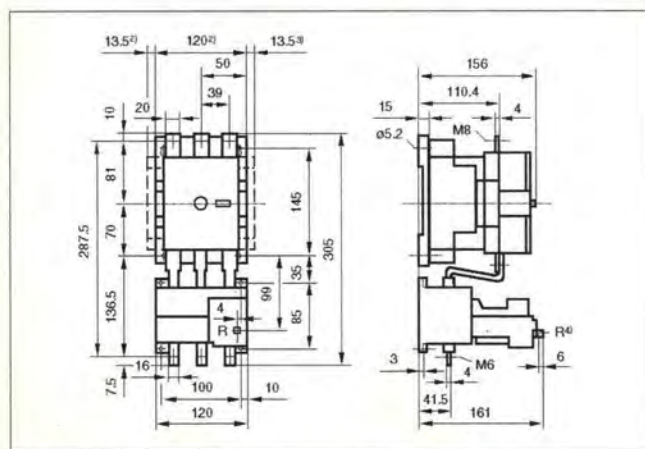
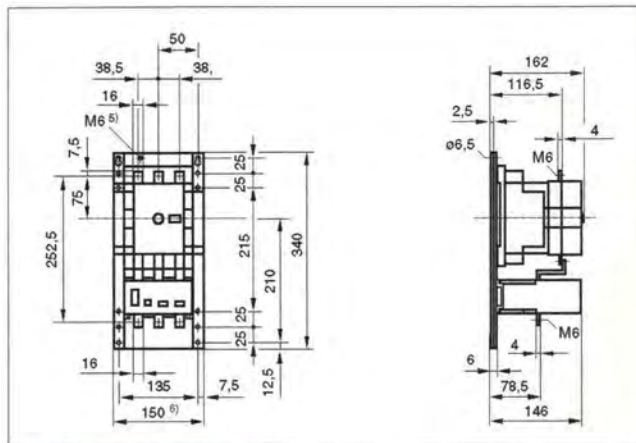
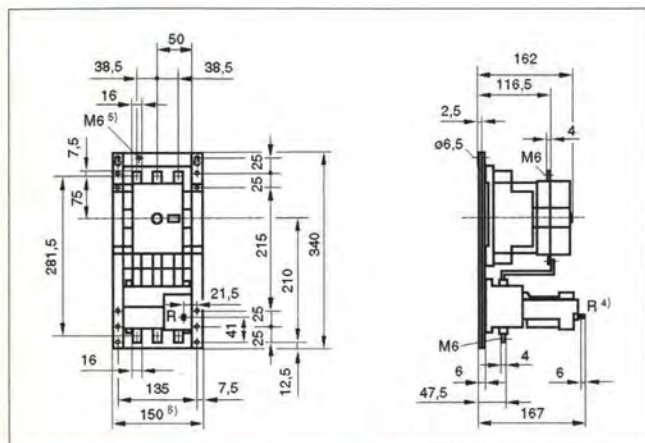
CT 6 thermal overload



Type	a	b	c	c1	c2	c3	c4	d	d1	d2	øe	e1	e2
CT 6-90...CT 6-110	120	148	193	161	151.5	41	114	-	85	100	M6	39	8.5
CT 6-150...CT 6-200	120	170	193	161	151.5	45	114	-	85	100	M8	39	8.5
CTA 6-90...CTA 6-100	120	133	193	161	151.5	41	-	-	85	100	M6	39	M6
CTA 6-150...CTA 6-200	120	176	193	161	151.5	45	-	-	85	100	M8	39	M8

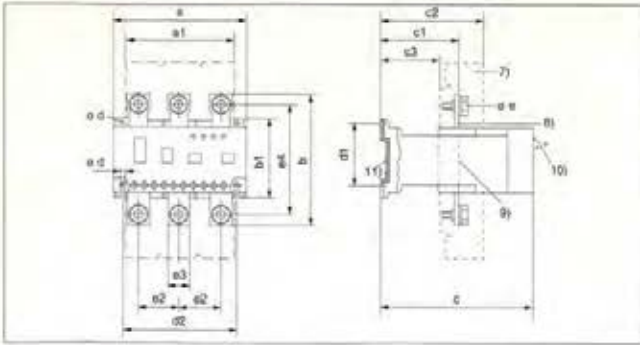
Notes: 1) Button travel – 3.5mm for “reset”, 6mm for “test”.
2) With reset magnet CMR.
3) Space for fitting CS 4 or CS 3 or RT 3 thermistor relay (M3.5 screws and nuts required).
4) CT = direct mounting on CA 6, CTA = for separate mounting.

- ☐ Complete contactor range up to 425 amps.
- ☐ 1000 volt rated.
- ☐ Available with electronic motor protection CEF 1.
- ☐ Option for electronic coil control (ECM).
- ☐ Built in safety features.
- ☐ Tested to IEC 947.

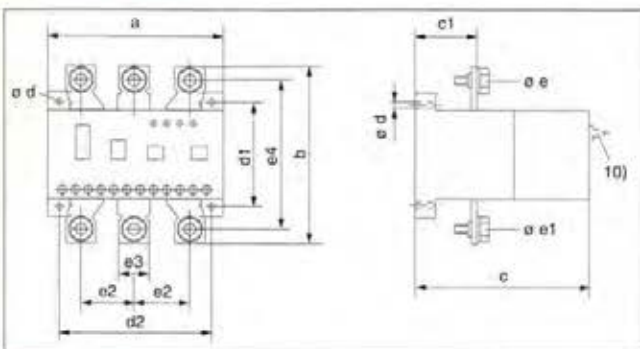


Dimensions for electronic motor protection relay CEF 1

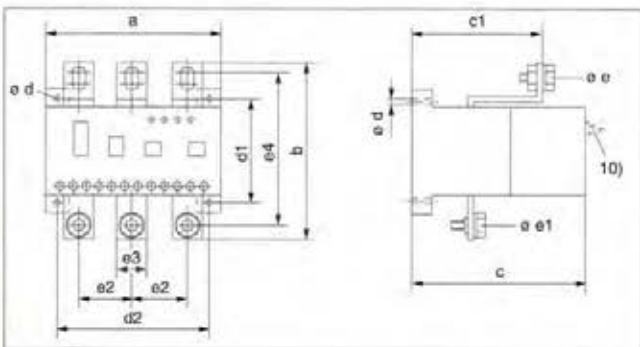
Dimensions (mm)



CEF 1-11, CEF 1-12



CEF 1-41, CEF 1-42



CEF 1-52

CEF 1-

Dim	11	12	41/42	52
a	120	120	140	155
a1	105	105	-	-
b	100	100	142	138
b ¹²⁾	119	119	142	138
b1	73	73	-	-
ød	5.4	5.4	5.8	6.5
d1	55...60	55...60	75	90
d2	100	100	125	135
øe	M8x12	M8x12	M10x25	M10x25
øe1	-	-	M10x16	M10x16
e2	38.5	38.5	8	48
e3	16	16	25	25
e4	82	82	117	113
e4 ¹²⁾	99	99	117	113
c	140	140	145	177.2
c1	72	72	117	118
c2	93.5	93.5	-	-
c3	53.5	53.5	-	-

Notes: ¹⁾ Shown mounted on optional DOL mounting plate refer previous page for separate contactor and overload dimensions.

²⁾ With one or two auxiliary contact blocks CA 6-P.

³⁾ For 3rd and 4th auxiliary contact blocks add 13.5mm each.

⁴⁾ R = reset button: 3.5mm travel = reset, 6mm travel = test.

⁵⁾ Earthing terminal.

⁶⁾ For 1...4 CA 6-P auxiliary contact blocks.

⁷⁾ Touch protected.

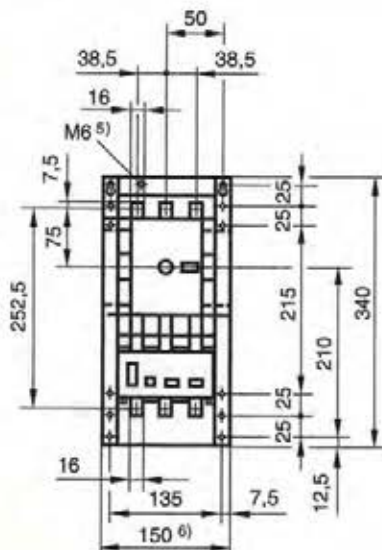
⁸⁾ Busbar for universal application CWE 4-VM.

⁹⁾ Loop through openings 19 x 19mm.

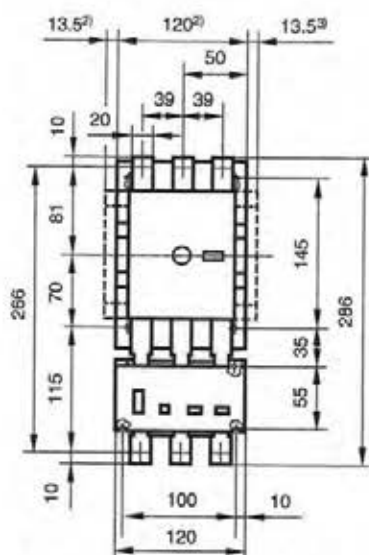
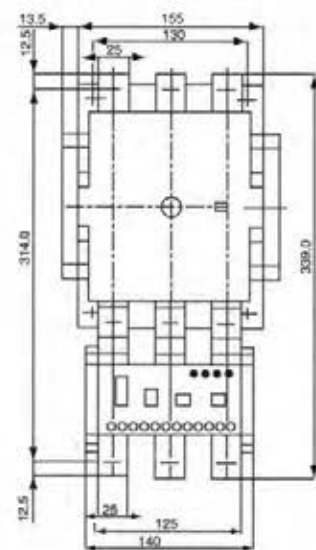
¹⁰⁾ With remote reset module CER 1; C = C+29mm.

¹¹⁾ Provision for mounting on a top hat rail EN50022-35.

¹²⁾ CWE 4-VM.



CA 6-85, CA 6-105 + CEF 1

CA 6-105-EI
CA 6-140-EI, CA 6-170-EI + CEF 1

CA 6-210-EI... CA 6-420-EI + CEF 1-41/42

CA 6 contactors

General technical information

Contactors CA 6-85...CA 6-420-EI



- Rated up to 1000 volts.
- Built in PLC interface.
- Type 2 co-ordination with fuses or circuit breakers.
- Very low pick-up and hold coil consumption.
- CA 6 contactors are designed to fulfil the requirements according to IEC 947.
- Compact design, small base area.

General technical data CA 6

Approvals

CE, UL, CSA, Lloyd's Reg. of shipping, SUVA, Germanischer Lloyd.



SEV
Switzerland



CSA
Canada



UL listed
USA



UL recognised
USA



Germanischer
Lloyd
FRG



Lloyd's Reg.
of Shipping
UK



RINA
Italy



Bureau
Veritas
France



KEMA
Netherland

Rated voltage withstand

IEC, AS, BS, SEV, VDE 0660
acc. to UL, NAMA, CSA, EEMAC
Rated impulse voltage withstand

1000V

600V

CA 6-... 12kV

CA 6-P... 8kV

Thermal rating acc. to UL/CSA

Rated voltage
Continuous rating
Switching capacity
Rated voltage
Switching capacity

CA 6-P...

AC [V] max. 600

40°C [A] 10 general purpose

AC Heavy pilot duty (A 600)

DC [V] max. 600

standard pilot duty (P 600)

Test voltage

1 minute (acc. to IEC 947-1)

3500V

Rated voltage

AC

230, 240, 400, 415, 500,

690, 1000V

DC

24, 48, 110, 220, 440V

Insulation class of the coil

Class 'B' acc. to VDE 0660, Table 22

Rated frequency of coil

AC 50/60 Hz, DC

Protection class

P00 (open) IEC 529 and DIN 40 050

Ambient temperature

Storage

-40°C...+80°C

Operation

-25°C...+60°C

Climate withstand

Cyclically changing humid atmosphere acc. to
nach DIN 50 016 and 40 046, Part 38, IEC 68

Max. Altitude of installation site

2000m above sea level acc. to IEC 947-1.

Protection against accidental contact

Touch proof acc. to VDE 0106, Part 100

Contactor with box terminal block

Protection class

IP 2LX

IEC 529 and DIN 40 050

Auxiliary switch

Protection class

IP 2LX

IEC 529 and DIN 40 050

CA 6 contactors

Technical information



Specifications according to IEC

AC 1 active power load 3 phase switching

Cat. No.	- CA 6-85	- 105 - 105-EI	- 140 - 140-EI	- 170-EI	- 210-EI	- 250-EI	- 300-EI	- 420-EI
Ambient temp 40°C (690V) [A]	160	160	250	250	350	350	450	500
Ambient temp 60°C (690V) [A]	135	135	210	210	300	300	380	425

Switching of 3 phase motors

AC 2 / AC 3 / AC 4	(415V) [A]	95	130	155	170	225	258	320	425
	(1000V)[A]	33	40	55	65	80	95	115	160
	(415V) [kW]	55	75	90	100	132	150	185	250
	(1000V)[kW]	45	55	75	90	111	133	163	225

AC 4 at approx. 200,000 operations

	(240V) [A]	38	47	60	72	90	105	115	144
	(415V) [A]	38	47	60	72	90	105	115	144
	(240V) [kW]	12	15	19	23	29	34	37	48
	(415V) [kW]	21	26	34	40	52	60	66	83

AC 4 for squirrel cage motors

AC 2 / AC 3 / AC 4	(240V) [A]	85	105	140	170	210	250	300	420
	(415V) [A]	95	130	155	170	227	258	315	425
	(240V) [kW]	27	34	47	57	70	83	101	141
	(415V) [kW]	55	75	90	100	132	150	185	250

Star delta starter

	(415V) [kW]	100	132	160	173	231	263	335	452
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Rated making capacity

AC 4	(415V) [A]	1140	1560	1860	2040	2724	3096	3780	5100
	(1000V)[A]	396	480	660	780	960	1140	1380	1920

Rated breaking capacity

AC 4	(415V) [A]	950	1300	1550	1700	2270	2580	3150	4250
	(1000V)[A]	330	400	550	650	800	950	1150	1600

Switching frequency

AC 4	[oper/h]	60	60	50	40	40	40	40	40
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Specifications according to IEC

Switching power transformers

Cat. No.		CA 6-85	-105 -105-EI	-140 -140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
AC 6a according to IEC 947-4-1									
(415V)	[A]	43	59	70	77	102	116	142	191
(1000V)	[A]	15	18	25	29	36	43	52	72
(415V)	[kVA]	31	42	50	55	73	83	102	137
(1000V)	[kVA]	26	31	43	51	62	74	90	125

Switching three phase capacitors

Minimum inductance of leads

between capacitors in parallel: 6µH

Single capacitors

40°C	(415V)	[Kvar]	81	81	126	126	176	176	226	252
	(1000V)	[Kvar]	194	194	303	303	424	424	546	606
60°C	(415V)	[Kvar]	68	68	106	106	151	151	191	214
	(1000V)	[Kvar]	164	164	255	255	364	364	461	515

Group capacitors

40°C	(415V)	[Kvar]	44	56	76	112	170	176	226	252
	(1000V)	[Kvar]	46	58	79	116	177	251	361	606
60°C	(415V)	[Kvar]	44	56	76	106	151	151	191	214
	(1000V)	[Kvar]	46	58	79	116	177	251	361	515

Switching lamps

Filament AC 5a	[A]	107	120	140	170	210	250	300	420
Gas discharge AC 5a									
Open	[A]	144	144	225	225	315	315	405	450
Closed	[A]	121.5	121.5	189	189	270	270	342	383

Load carrying capacity per UL/CSA

Lloyds Register of Shipping

Continuous current

Open	[A]	178	178	250	250	350	350	420	500
Enclosed	[A]	160	160	220	220	300	300	340	420

CA 6 contactors

Technical information



Specifications according to IEC

Switching DC loads

Cat. No.		CA 6-85	-105 -105-EI	-140 -140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
Non inductive or slightly inductive loads resistance furnaces									
DC 1 at 60°C									
1 contact	24/48V [A]	135	135	210	210	300	300	380	425
	110V [A]	135	135	210	210	300	300	380	425
	220V [A]	3	3	3.3	3.3	4.9	4.9	4.9	5.2
	440V [A]	0.6	0.6	0.75	0.75	1	1	1	1.2
2 contacts in series	24/48V [A]	135	135	210	210	300	300	300	300
	110V [A]	135	135	210	210	300	300	300	300
	220V [A]	135	135	210	210	300	300	300	300
	440V [A]	3	3	3.3	3.3	4.9	4.9	4.9	4.9
3 contacts in series	24/48V [A]	135	135	210	210	300	300	300	300
	110V [A]	135	135	210	210	300	300	300	300
	220V [A]	135	135	210	210	300	300	300	300
	440V [A]	11	11	11	11	4.9	4.9	4.9	4.9

Shunt wound motors

Starting, reverse current breaking,
reversing, stepping DC 3, 60°C

3 contacts in series	24/48V [A]	135	135	210	210	300	300	300	425
	110V [A]	135	135	210	210	300	300	300	425
	220V [A]	135	135	210	210	300	300	300	425
	440V [A]	3	3	3.5	3.5	3.5	4.1	4.1	5.8

Series wound motors

Starting, reverse current breaking,
reversing, stepping DC 5, 60°C

3 contacts in series	24/48V [A]	80	80	120	120	170	170	170	240
	110V [A]	80	80	120	120	170	170	170	240
	220V [A]	80	80	120	120	170	170	170	240
	440V [A]	1.2	1.2	2.1	2.1	2.1	2.4	2.4	3.0

Short time withstand

Icw, 60°C	1s [A]	1800	1800	2550	2550	3405	3870	4725	6376
	4s [A]	1500	1500	1970	1970	3150	3870	4100	6376
	10s [A]	1040	1040	1240	1360	2360	2520	2840	4700
	15s [A]	860	860	1130	1130	2000	2110	2270	3460
	60s [A]	650	650	850	850	1215	1300	1500	1880
	240s [A]	340	340	600	600	705	750	840	1280
	900s [A]	240	240	440	440	460	500	590	840

Minimum cooling time

at zero current	[min]	20	20	20	20	30	30	30	30
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Specifications according to IEC

Resistance and power dissipation

Cat. No.		CA 6-85	-105 -105-EI	-140 -140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
Main current circuit resist.	[mΩ]	0.4	0.4	0.42	0.42	0.22	0.22	0.18	0.15
Power dissipated by all circuits									
at le AC 3, 415V	[W]	10.8	20.3	30.3	36.4	34.3	44.3	53.6	81.3
Total power dissipation at le AC 3									
AC control	[W]	20.8	24.9-34.7	34.9-44.7	41.0-50.8	38.9-48.7	48.9-58.7	58.2-68.0	ca 86-96
DC control	[W]	18.8	24.7-26.3	34.7-36.3	40.8-42.4	38.7-40.3	48.7-50.3	58.0-59.6	ca 86-88

Life span in millions of operations

Mechanical									
AC control	[x10 ⁶]	10	10	10	10	10	10	10	10
DC control	[x10 ⁶]	10	10	10	10	10	10	10	10
Weight									
AC control	[kg]	3.3	3.8	3.8	3.8	7.5	7.5	7.5	7.5
DC control	[kg]	3.3	3.8	3.8	3.8	7.5	7.5	7.5	7.5

Power dissipation

Cat. No.		CT 6-90	CT 6-110	CT 6-150	CT 6-200
Power dissipation of					
CT 6 overloads	[W]	6.5	7.5	10.5	14

Admissible contactor load versus ambient air temperature loading AC 1

Cat. No.		40°C	45°C	50°C	55°C	60°C	65°C	70°C
CA 6-85	[A]	160	150	145	140	135	105	95
CA 6-105 (EI)	[A]	160	150	145	140	135	105	95
CA 6-140-EI	[A]	250	235	220	215	210	170	150
CA 6-170-EI	[A]	250	235	220	215	210	170	150
CA 6-210-EI	[A]	350	330	320	310	300	275	260
CA 6-250-EI	[A]	350	330	320	310	300	275	260
CA 6-300-EI	[A]	450	440	430	410	380	365	340
CA 6-420-EI	[A]	500	490	480	455	425	405	380

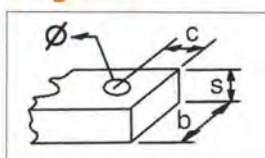
CA 6 contactors

Technical information

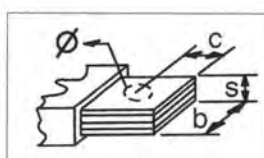
Specifications according to IEC

Description	CA 6	-85	-105	-105-EI	-140	-140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
Conductor type ¹⁾											
b	max.	20			25					30	
c	max.	10			12.5					15	
s	max.	2 x 5			2 x 5					2 x 6	
ø	max.	6.1			8.3					10.5	
Rec. torque	[Nm]	8...10			10...12					16	
Cross section per											
UL/CSA	[AWG]	6...2/0			6...250 MCM					8...600 MCM	
Rec. torque	[lb-in]	70...90			90...110					375	
With frame term. block ²⁾		CA 6-HB1 ⁴⁾			CA 6-HB2 ⁴⁾					CA 6-HB3 ⁴⁾ ⁵⁾	
1. conductors	[mm ²]	16...70 ⁶⁾			16...95 ³⁾ ⁶⁾					25...185 ⁶⁾	
2. conductors	[mm ²]	16...70			16...95 ³⁾ ⁶⁾					25...185 ⁶⁾	
1. conductors	[mm ²]	16...95 ⁶⁾			16...120 ³⁾					25...240	
2. conductors	[mm ²]	16...95			16...120 ³⁾					25...240	
b	max.	[mm]	16		20					25	
s	above	[mm]	3...9		3...9					6...20	
s	bottom	[mm]	3...12		3...14					6...20	
Rec. torque	[Nm]	8...10			10...12					20...20	
Cross section per UL/CSA											
above	[AWG]	No. 6...1 / 0 AWG			No. 6...1 / 0 AWG					No. 4 AWG...600 MCM	
bottom	[AWG]	No. 6...3 / 0 AWG			No. 6 AWG...250 MCM					No. 4 AWG...600 MCM	
Rec. torque	[lb-in]	70...90			90...110					80...220	

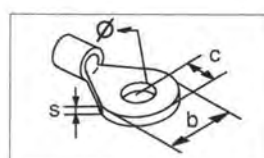
Diagram 1



Solid busbar

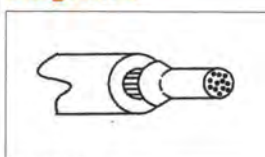


Flexible busbar

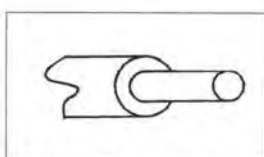


Cable lug

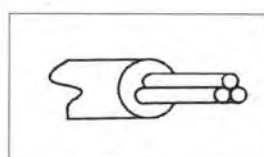
Diagram 2



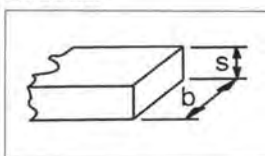
Bootlace



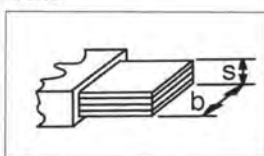
Solid



Stranded



Solid busbar



Flexible busbar

- Notes:**
- ¹⁾ Refer to diagram 1 above.
 - ²⁾ Refer to diagram 2 above.
 - ³⁾ At CT(A) 6-150/200 min 25mm².
 - ⁴⁾ Hexagon socket size screw.
 - ⁵⁾ CA 6-HB3 not suitable for CEF(B) 1-41/42 and CWE 4-630/825-MCM630.
 - ⁶⁾ With cable sleeve according to DIN 46228.
 - ⁷⁾ Hexagonal screw.

Coil circuit

Operating Limits

Cat. No.		CA 6-85 CA 6-105 CA 6-140	-105-EI	-140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
50Hz, 60Hz, 50/60Hz									
	pick-up [xUs]	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1
	drop-out [xUs]	0.3...0.6	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5
Dc control									
	pick-up [xUs]	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1	0.85...1.1
	drop-out [xUs]	0.3...0.6	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5	0.3...0.5

Coil voltage pick-up, drop-out & maximum

CA 6-105-EI to CA 6-300-EI (AC) ¹⁾

Nominal voltage		24...28V AC	43...65V AC	110...130V AC	208...277V AC	380...400V AC
Pick-up voltage	[V]	20.4	36.6	93.5	177	323
Drop-out voltage	[V]	<18	<32.3	<82.5	<156	<285
Maximum voltage	[V]	30.8	71.5	143	305	440

CA 6-420-EI (AC)

Pick-up voltage	[V]	N/A	36.6	93.5	177	323
Drop-out voltage	[V]	N/A	<32.3	<82.5	<156	<285
Maximum voltage	[V]	N/A	71.5	143	305	440

CA 6-105-EI to CA 6-300-EI (DC)

Nominal voltage		24...28V DC	48...72V DC	90...135V DC	170...255V DC
Pick-up voltage	[V]	20.4	40.8	76.5	145
Drop-out voltage	[V]	<18	<36	<67.5	<128
Maximum voltage	[V]	30.8	79.2	149	281

CA 6-420-EI (DC)

Pick-up voltage	[V]	N/A	40.8	76.5	145
Drop-out voltage	[V]	N/A	<36	<67.5	<128
Maximum voltage	[V]	N/A	79.2	149	281

Switching delay

Cat. No.		CA 6-85 CA 6-105 CA 6-140	-105-EI	-140-EI	-170-EI	-210-EI	-250-EI	-300-EI	-420-EI
AC	make [mS]	20...47	60	60	60	60	60	60	60
	break [mS]	6...12	50	50	50	50	50	50	50
DC	make [mS]	60	60	60	60	60	60	60	60
	break [mS]	12...20	55	55	55	55	55	55	55

Notes: ¹⁾ 24V AC only available for CA 6-105-EI...CA 6-170-EI

CA 6 contactors

Technical information



CA 6 auxiliary loads (CA 6-P1/P2/P3/P4-11) ¹⁾

Switching AC loads

Cat. No.	at 40°C (A)		at 60°C (A)			
AC 1	16		12			
	230 V (A)	240 V (A)	400 V (A)	415 V (A)	500 V (A)	690 V (A)
AC15 rated at voltage of	5.5	5	3	2.5	1.6	1

Switching DC loads

Description	24V DC (A)	48V DC (A)	110V DC (A)	220V DC (A)	440V DC (A)
L/R <1mS, resistance loads at	16	9	3.5	0.55	0.2
L/R <15mS, inductive loads with economy resistor in series	9	5	2	0.4	0.16
DC 13, switching electromagnets	5	2	0.7	0.25	0.12

Fuse gG

Description	N/O [A]	N/C [A]
Short circuit protection with no welding of contacts according to IEC 947-5	16	16

Minimum switching capacity to DIN 19240 @ 17V DC

Description		
Standard auxiliary	[mA]	5mA
low voltage auxiliary	[mA]	1mA

CA 6 low voltage auxiliary contact blocks (CA 6-P2/P3-B11)

Low voltage

Technical data IEC 947

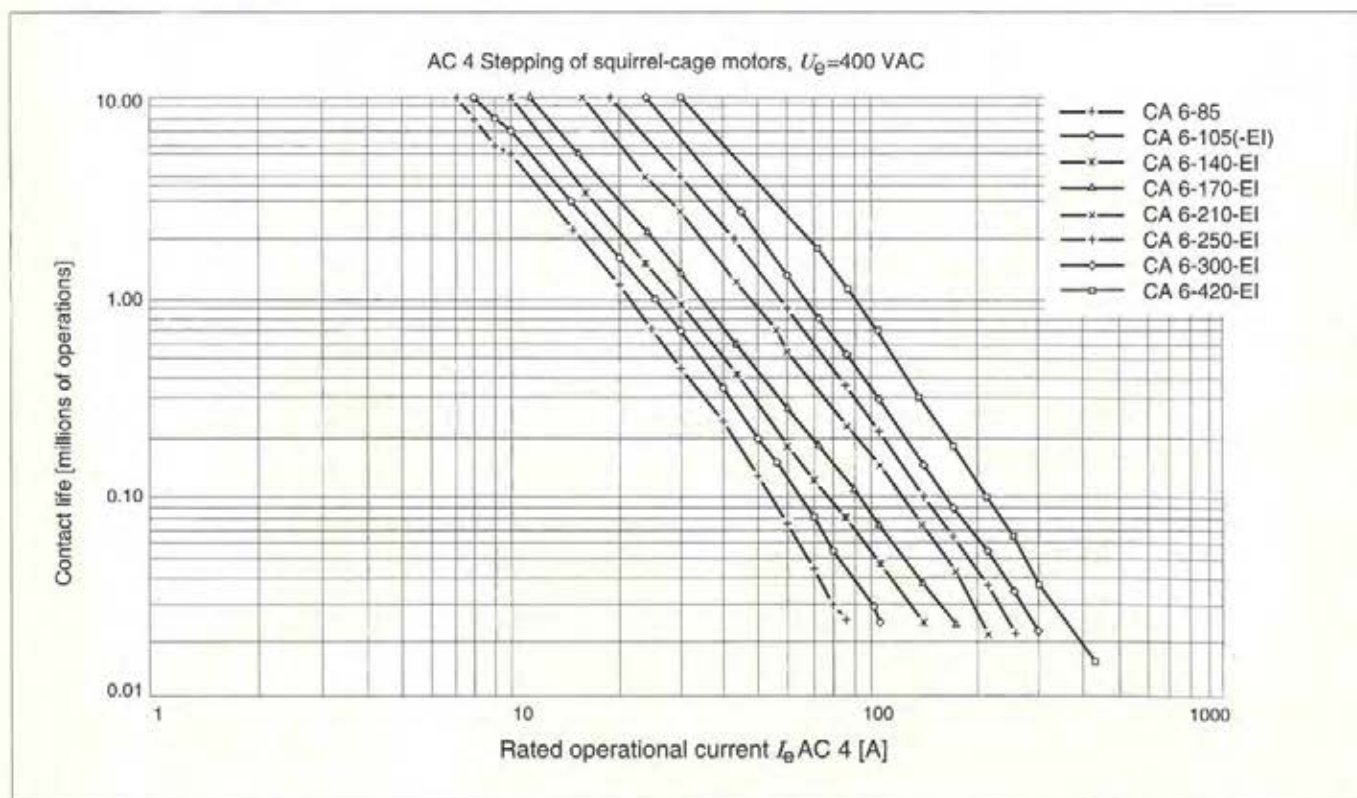
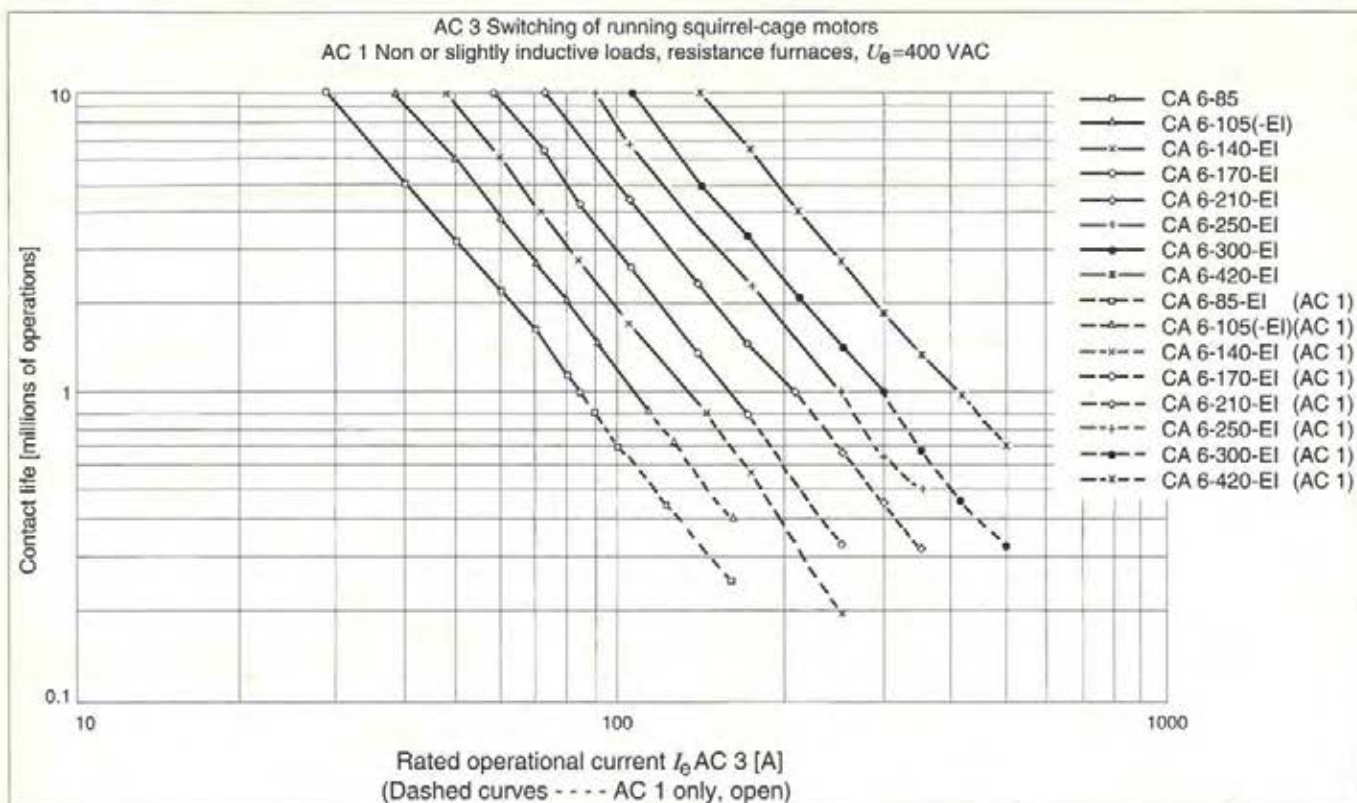
Description	Voltage	Amps
AC 1	250	0.1A
AC 15 / DC 13 min	3...125	1...100mA

Notes: ¹⁾ See data for CA 6-P2/P3-B11.

CA 6 contactors

Technical information – performance graphs

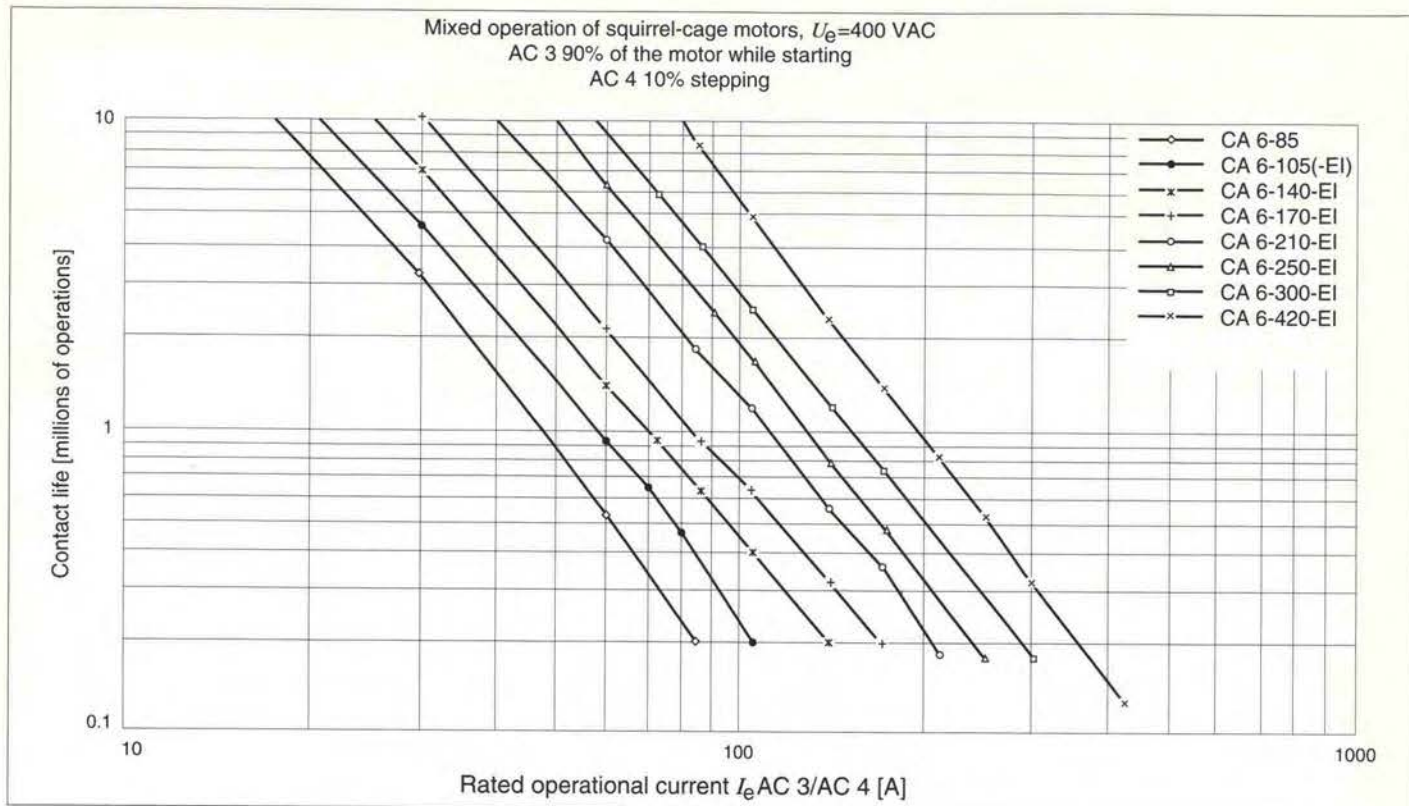
Electrical life



CA 6 contactors

Technical information – performance graphs

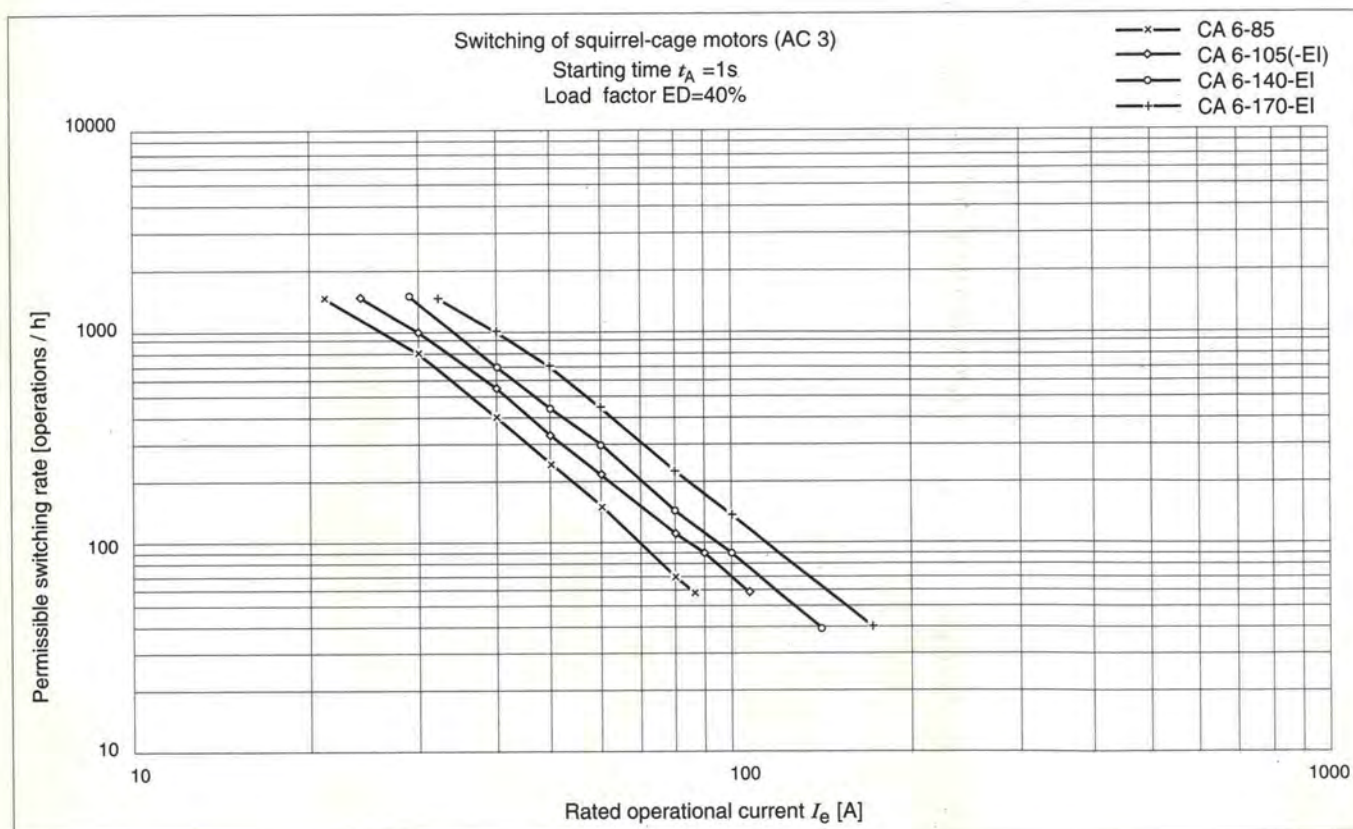
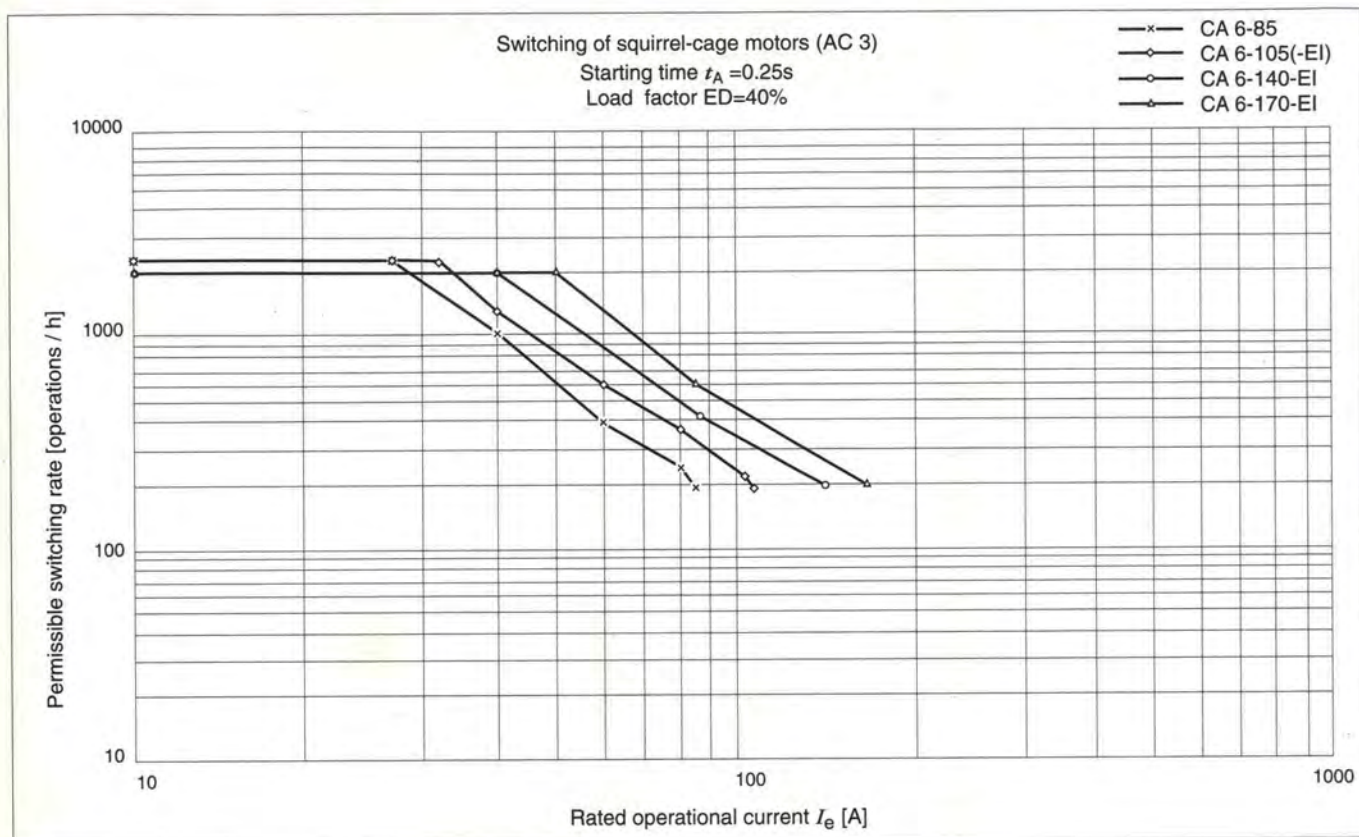
Electrical life



CA 6 contactors

Technical information – performance graphs

Permissible switching rate

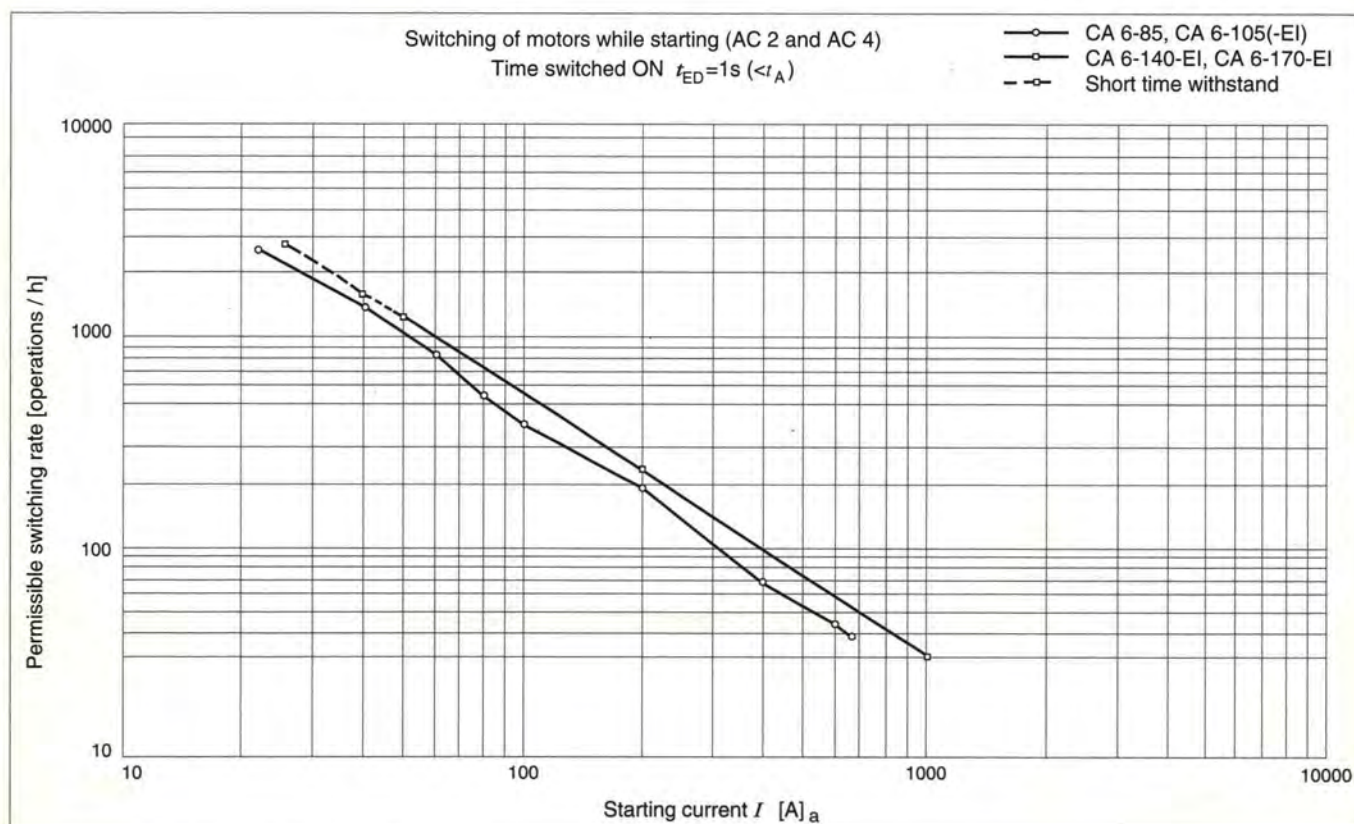
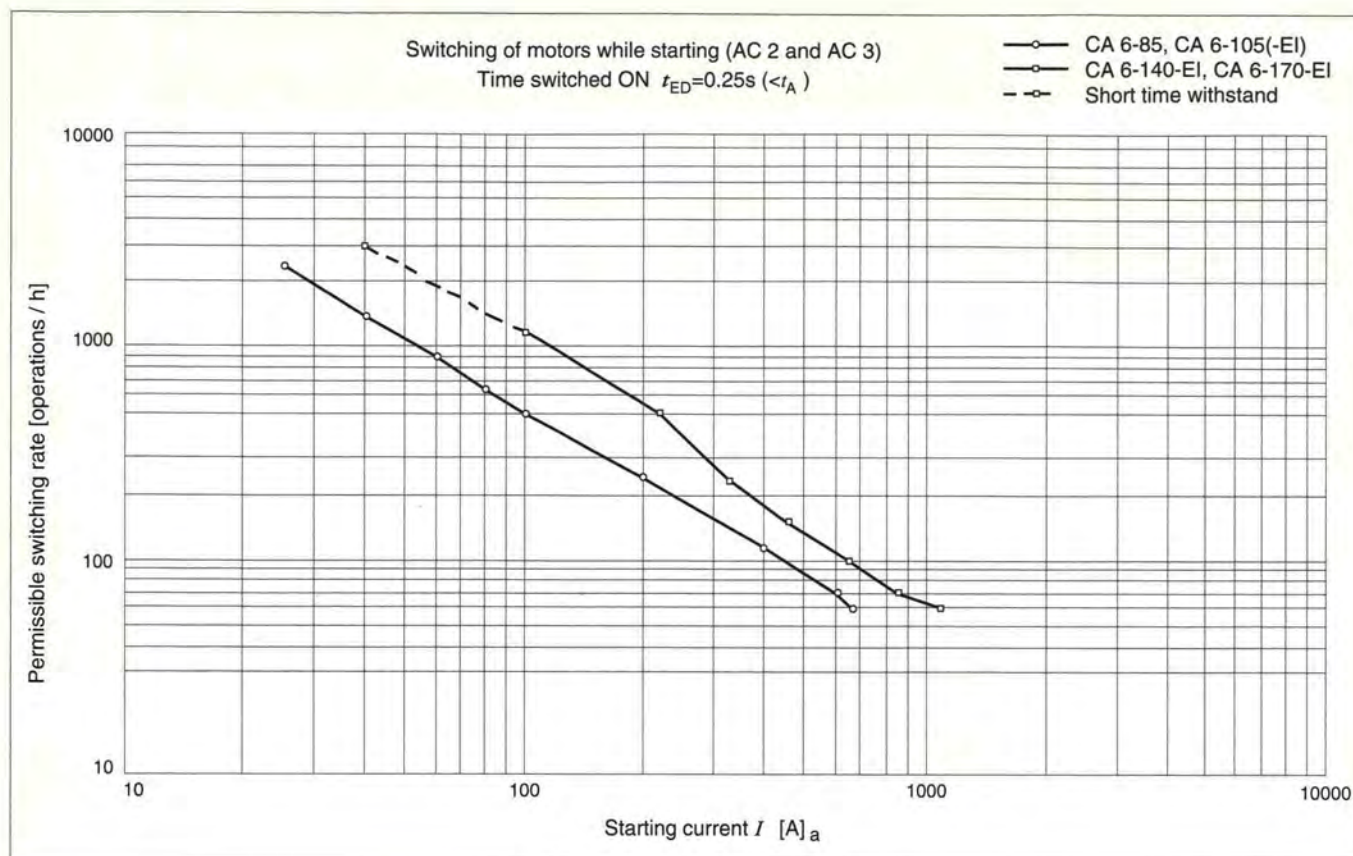


CA 6 contactors

Technical information – performance graphs



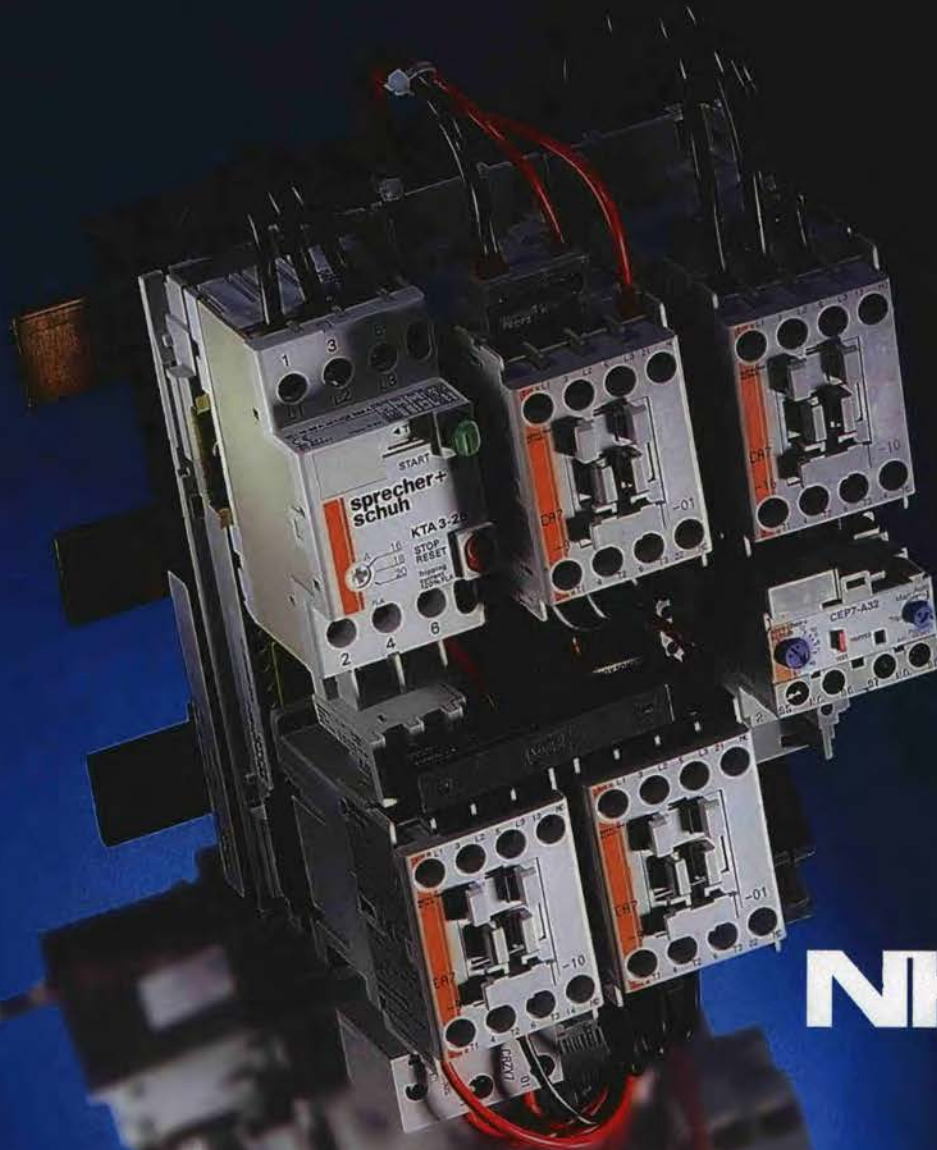
Permissible switching rate



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ADVANCED CONTROL SYSTEM

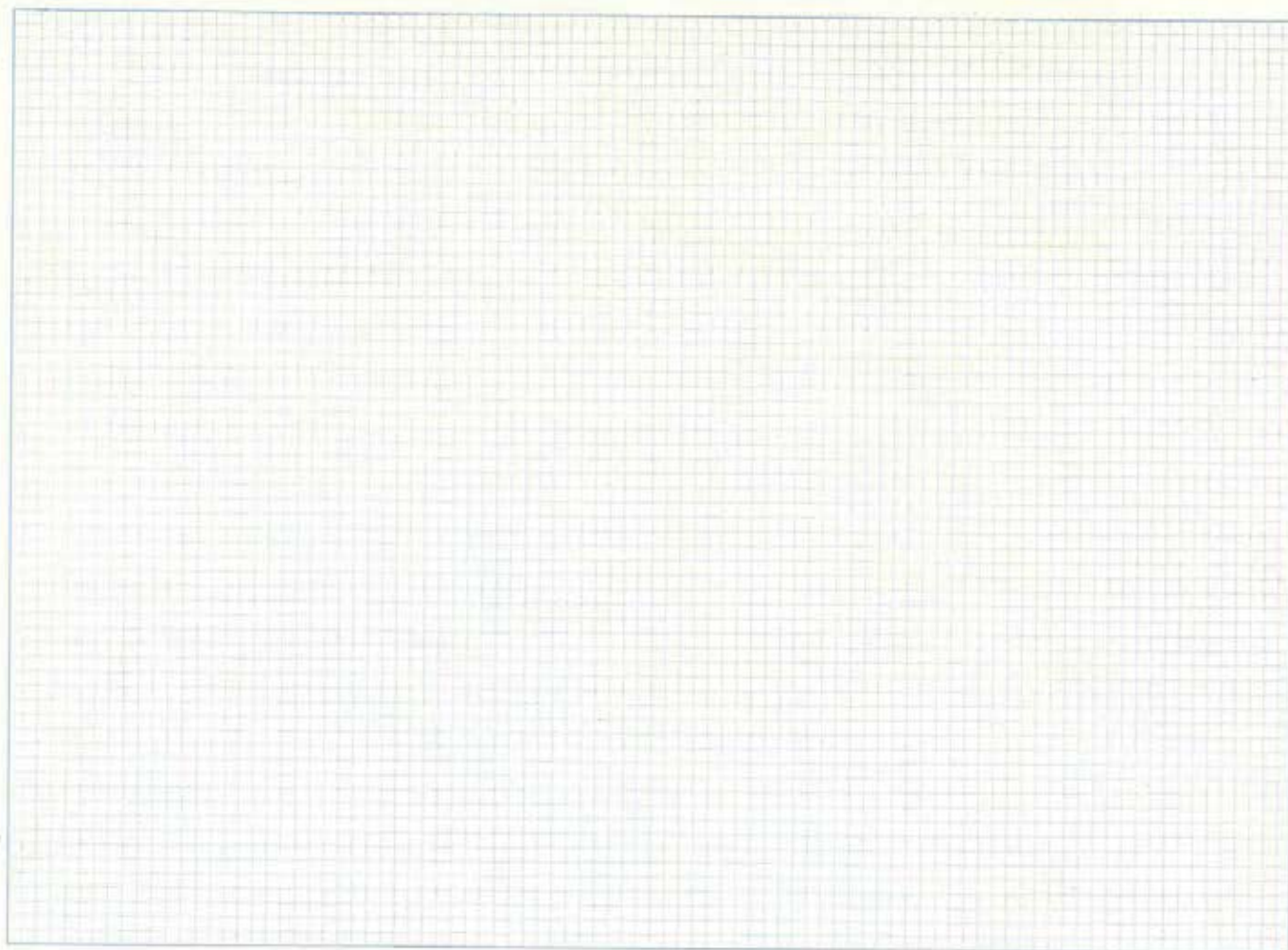
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Notes:

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FORTROSE ST SP192 SWITCHBOARD UPGRADE ELECTRICAL DRAWINGS

ELECTRICAL DRAWING LIST		
Sheet No.	DWG N°.	TITLE
	3014/100	DRAWING INDEX
01	3014/101	INCOMER & DISTRIBUTION SCHEMATIC DIAGRAM
02	3014/102	PUMP 01 SCHEMATIC DIAGRAM
03	3014/103	PUMP 02 SCHEMATIC DIAGRAM
04	3014/104	COMMON CONTROL & ALARMS SCHEMATIC DIAGRAM
05	3014/105	PLC/RTU SCHEMATIC DIAGRAM
06	3014/106	PLC/RTU TERMINATION DIAGRAM
07	3014/107	EQUIPMENT LIST
08	3014/108	CABLE SCHEDULE
09	3014/109	SWITCHBOARD & RTU CUBICLE LABEL SCHEDULE
10	3014/110	SWITCHBOARD GENERAL ARRANGEMENT
11	3014/111	RTU PANEL LAYOUT
12	3014/112	SITE LAYOUT

No.	DATE	AMENDMENT	INITIALS
MANAGER OF BUSINESS		DATE	
ASSET SERVICES			
MANAGER OF OPERATIONS		DATE	
MANAGER PROFESSIONAL SERVICES - ENGINEERING		DATE	
SUPERVISING ENGINEER		R.P.E.O. NO.	DATE
CADD FILE	3014-100-Rev7.dwg		
JOB FILE	SURVEY NO.		
SURVEYED	FIELD BOOK		
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DESIGN CHECK	SPK	JUN 02	
DRAWN	DPM	MAY 02	
DRAFTING CHECK	VMU	JUN 02	



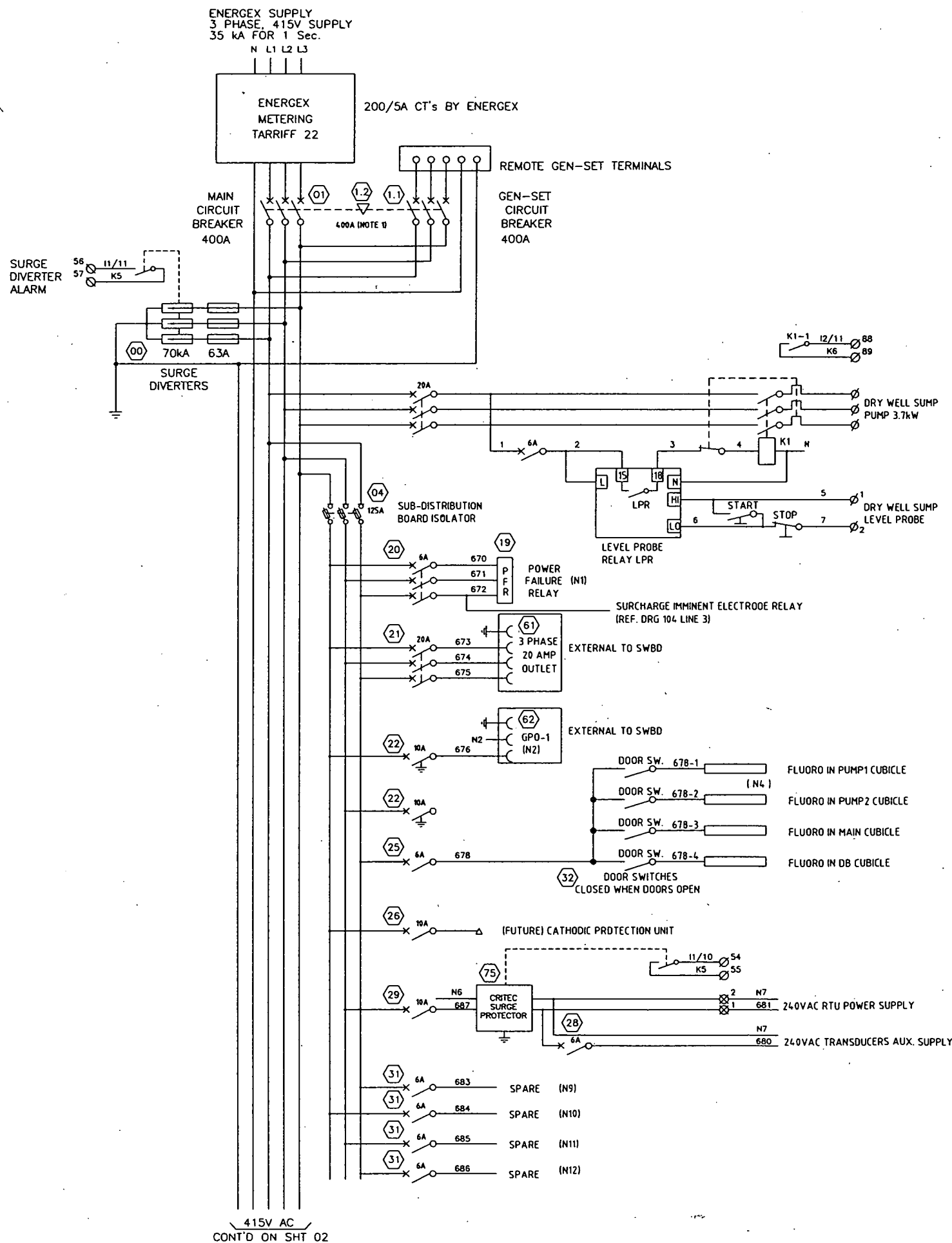
PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
DRAWING INDEX

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/100	AMEND. A

NOTES

1. INCOMING & PUMP CIRCUIT BREAKERS ARE LINE SIDE SHROUDED.
5. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED:
MAIN PUMP No. 1 = 1
MAIN PUMP No. 2 = 2
COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)



LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- SWBO 240VAC TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

Sheet 01

AS BUILT

C	18.08.03	AS BUILT	HT
B	12.9.02	GENERAL REVISIONS	HT
A	25.06.02	FOR CONSTRUCTION	PM
No	DATE	AMENDMENT	INITIALS
MANAGER OF BUSINESS		DATE	
ASSET SERVICES		DATE	
MANAGER OF OPERATIONS		DATE	
MANAGER PROFESSIONAL SERVICES - ENGINEERING		DATE	
SUPERVISING ENGINEER		R.P.E.Q. NO.	DATE
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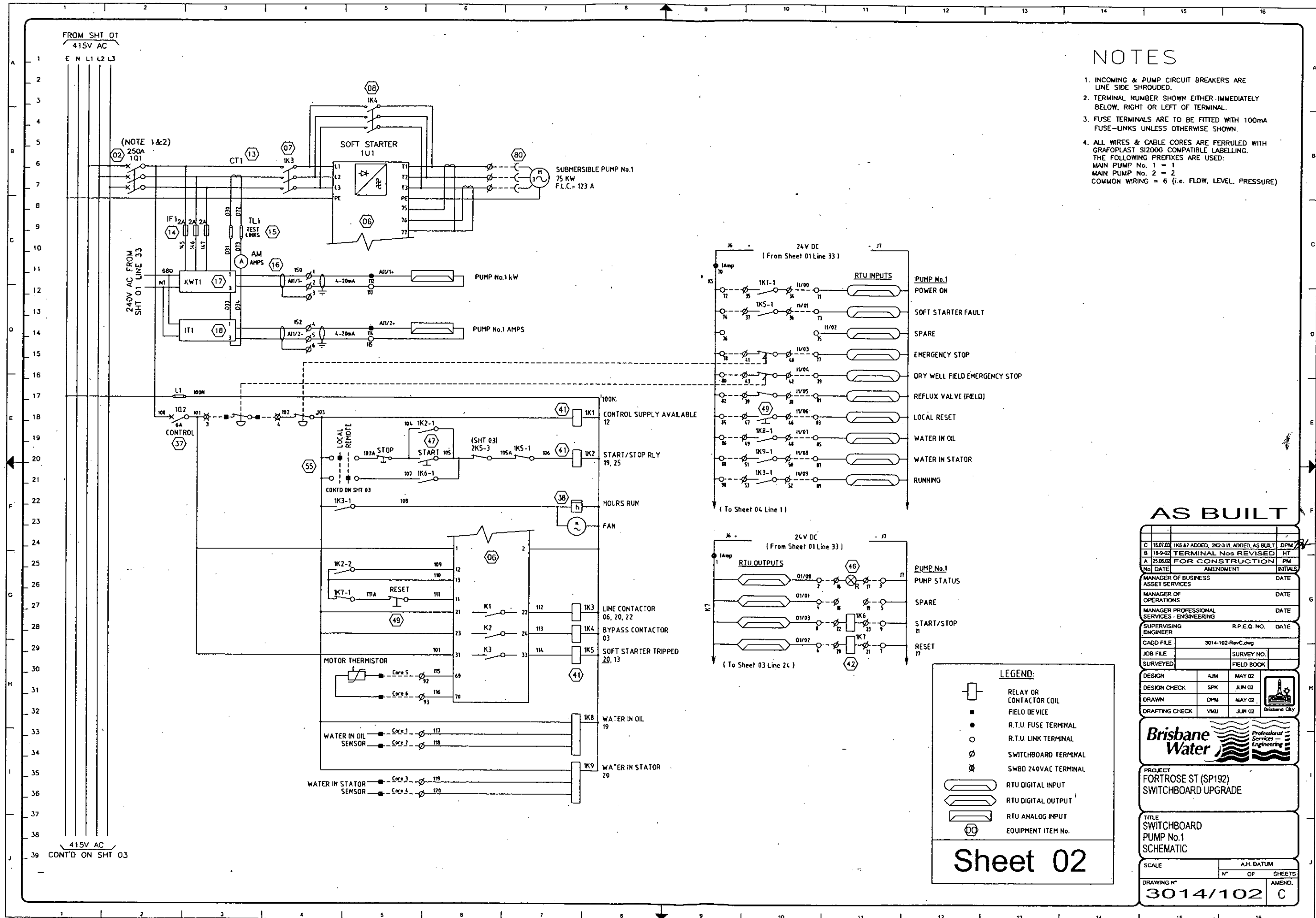
PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD
INCOMER & DISTRIBUTION
SCHEMATIC

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/101	C

NOTES

1. INCOMING & PUMP CIRCUIT BREAKERS ARE LINE SIDE SHROUDED.
2. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
3. FUSE TERMINALS ARE TO BE FITTED WITH 100mA FUSE-LINKS UNLESS OTHERWISE SHOWN.
4. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED:
MAIN PUMP No. 1 = 1
MAIN PUMP No. 2 = 2
COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)



AS BUILT

C	18/07/02	1K6 & 17 ADDED, 2K2-3 M. ADDED, AS BUILT	DPM
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A	25/06/02	FOR CONSTRUCTION	PM
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MANAGER OF BUSINESS ASSET SERVICES			
MANAGER OF OPERATIONS			
MANAGER PROFESSIONAL SERVICES - ENGINEERING			
SUPERVISING ENGINEER			
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SURVEYED		FIELD BOOK	
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DRAFTING CHECK	VWU	JUN 02	



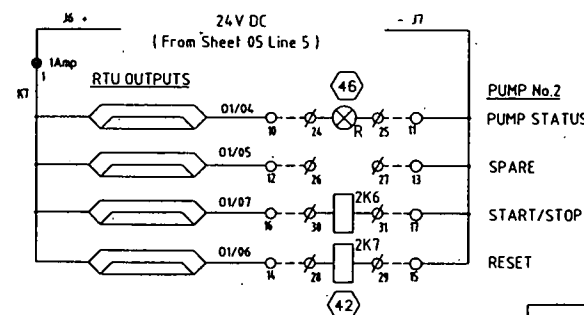
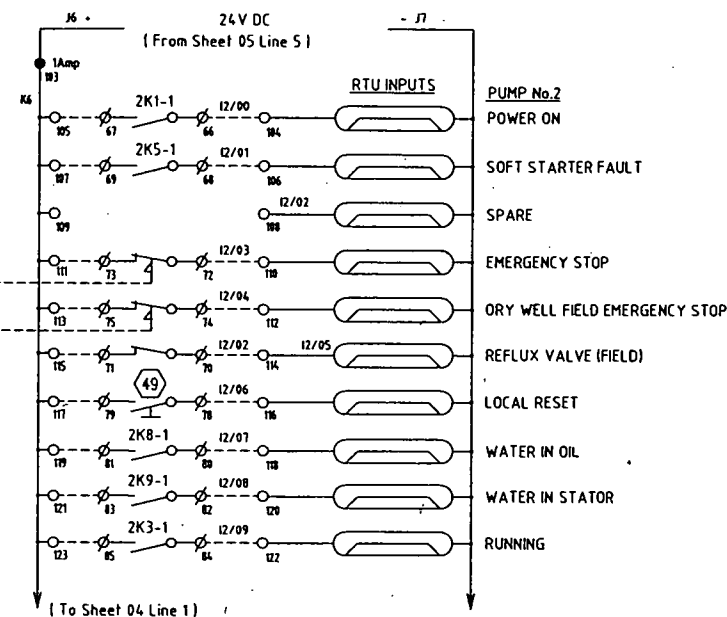
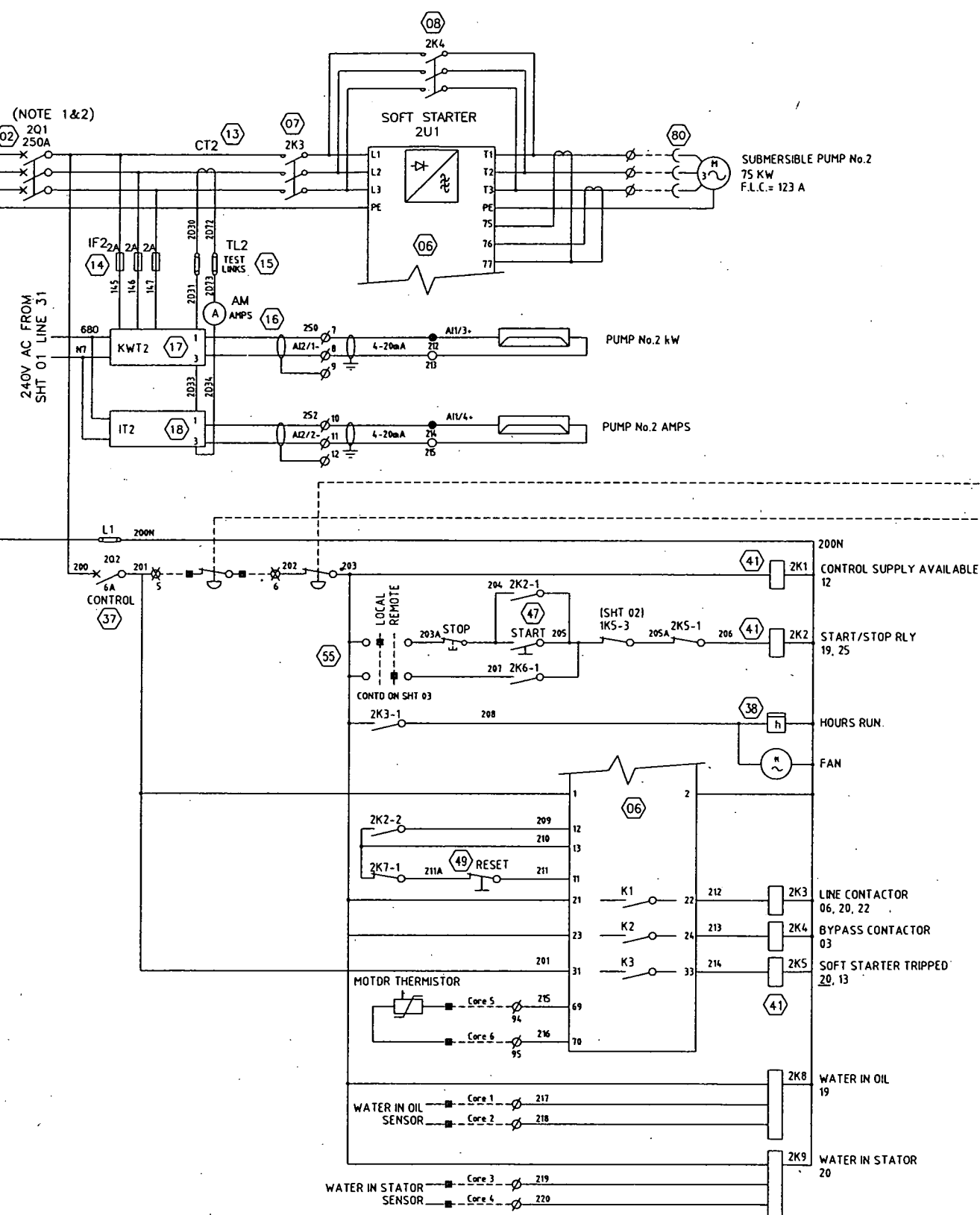
PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD
PUMP No.1
SCHEMATIC

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/102	C

NOTES

1. INCOMING & PUMP CIRCUIT BREAKERS ARE LINE SIDE SHROUDED.
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LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL
- R.T.U. LINK TERMINAL
- SWITCHBOARD TERMINAL
- SWBD 240VAC TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

Sheet 03

AS BUILT

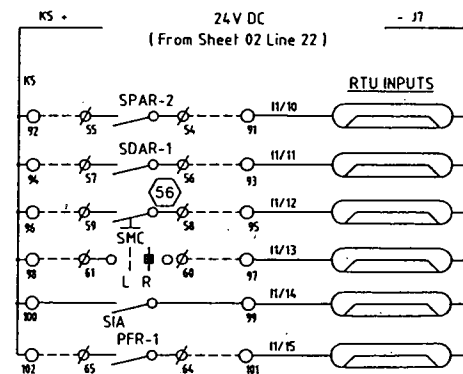
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ASSET SERVICES			
MANAGER OF OPERATIONS	DATE		
MANAGER PROFESSIONAL SERVICES - ENGINEERING	DATE		
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SURVEYED	FIELD BOOK		
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DESIGN CHECK	SPK	JUN 02	
DRAWN	DPM	MAY 02	
DRAFTING CHECK	VMU	JUN 02	



PROJECT	FORTROSE ST (SP192)
TITLE	SWITCHBOARD
	PUMP No.2
	SCHEMATIC

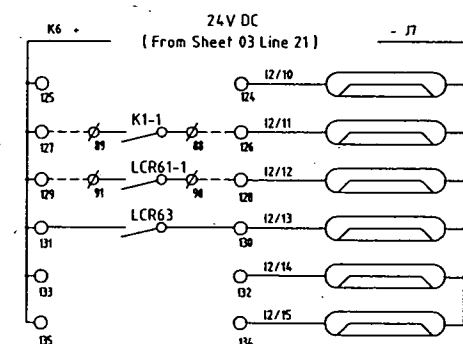
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DRAWING N°	N° OF SHEETS
3014/103	C

ELV CONTROL

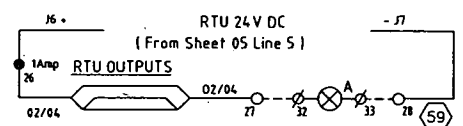


COMMON CONTROL

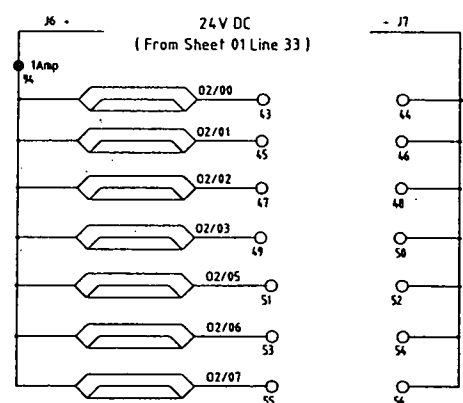
RTU SURGE PROTECTION ALARM
SURGE DIVERTER ALARM
SITE ATTENTION ALARM
RESET PUSHBUTTON
LOCAL REMOTE - STATION CONTROL
SURCHARGE IMMINENT ALARM (in RTU cabinet)
SITE POWER ON



SPARE
SUMP PUMP RUNNING
SPARE
STATION TRIP LEVEL (IN RTU CABINET)
SPARE
SPARE



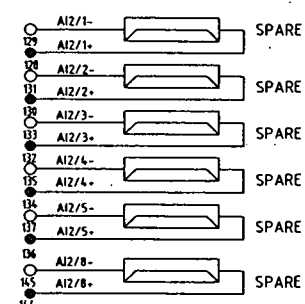
ATTENTION INDICATOR
(SWITCHBOARD)



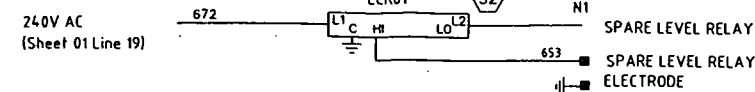
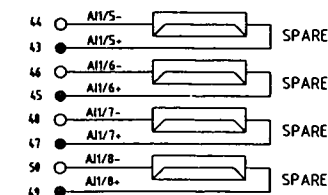
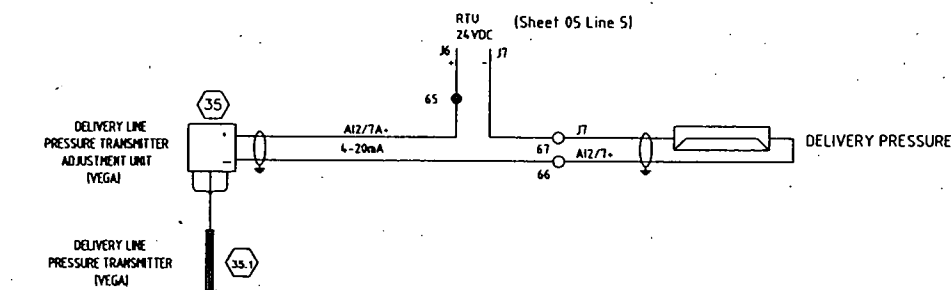
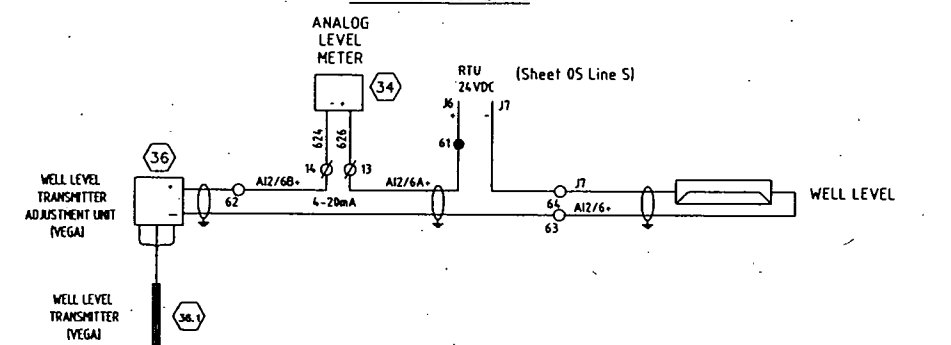
SPARE
SPARE
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SPARE

FUTURE

RTU ANALOG INPUTS



240V AC CONTROL

RTU ANALOG INPUTS
FOR INSTRUMENTS

SURGE DIVERTERS
(Sheet 01 Line 10)

SD ALARM RELAY

NOTES

- ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST S12000 COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED:
MAIN PUMP No. 1 = 1
MAIN PUMP No. 2 = 2
COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
- TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
- FUSE TERMINALS ARE TO BE FITTED WITH 100mA FUSE TERMINALS UNLESS OTHERWISE SHOWN.

AS BUILT

C	21.07.03	AS BUILT		
B	18-9-02	TERMINAL NOS REVISED	HT	
A	25.06.02	FOR CONSTRUCTION	PM	
No	DATE	AMENDMENT	INITIALS	
MANAGER OF BUSINESS ASSET SERVICES				
MANAGER OF OPERATIONS				
MANAGER PROFESSIONAL SERVICES - ENGINEERING				
SUPERVISING ENGINEER				
CADD FILE	3014-104-RevC.dwg			
JOB FILE		SURVEY NO.		
SURVEYED		FIELD BOOK		
DESIGN	AJM	MAY 02		
DESIGN CHECK	SPK	JUN 02		
DRAWN	DPM	MAY 02		
DRAFTING CHECK	VMU	JUN 02		



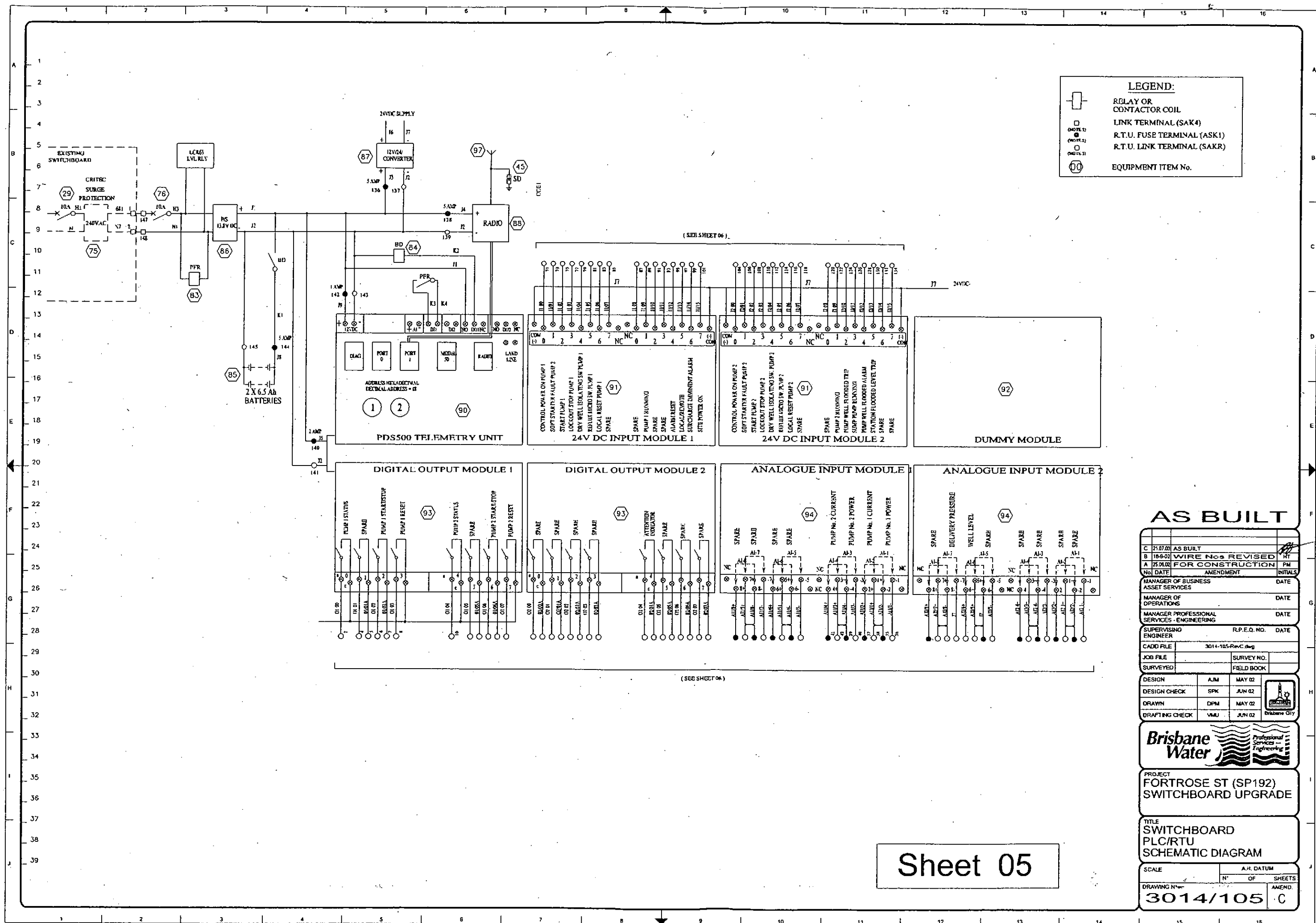
PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD
COMMON CONTROLS & ALARMS
SCHEMATIC

SCALE
DRAWING N°
3014/104

A.H. DATUM
N° OF SHEETS
C

Sheet 04






ITEM No	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	SENT TO DATE	SENT TO SWBD BUILDER DATE	CORRECTLY INSTALLED BY	DATE
00	3	SURGE DIVERTER	ERICO/CRITEC	TDS-08-05				
00.1	1	SURGE DIVERTER ALARM	ERICO/CRITEC	TDS-AR				
01	1	MAIN CIRCUIT BREAKER - SHROUD	TERASAKI	XSA-0001				
01.1	1	GEN CIRCUIT BREAKER - SHROUD	TERASAKI	XSA-0001				
01.2	1	MECHANICAL INTERLOCK	TERASAKI	XLV				
02	2	PUMP CIRCUIT BREAKER - SHROUD	TERASAKI	XSP-0001				
03								
04	1	SUB-DISTRIBUTION BOARD CB	TERASAKI	DM-TM10SC				
05	1	SUB-DISTRIBUTION BOARD CHASSIS	TERASAKI	MD25A-BU				
06	2	SOFT STARTER	EMATRON	MSF-M5				
07	2	LINE CONTACTORS - AUX	SPRECHER & SCHUH	CAG-10A-E1				
08	2	BY-PASS CONTACTORS - AUX	SPRECHER & SCHUH	CAG-10A-E1				
09								
10								
11								
12								
13								
14								
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16								
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37								
38								
39								

ITEM No	QTY	DESCRIPTION	MANUFACTURER	CATALOGUE No	SENT TO DATE	SENT TO SWBD BUILDER DATE	CORRECTLY INSTALLED BY	DATE
52	1	SURCHARGE ALARM RELAY	MULTITRIDE	NTR-2				
53								
54								
55	1	STATION CONTROL SELECTOR SW.	KRAUS & HAMPE	CAD11-A200-MH05A/WH1				
56	1	SITE ATTENTION RESET	SPRECHER & SCHUH	DSP-F43LX10				
57								
58								
59	1	SITE ATTENTION ALARM	SPRECHER & SCHUH	DSP-PS3000				
60								
61	1	3 PHASE OUTLET	CLIPSAL	S4S4Z0LE				
62	1	1 PHASE OUTLET	CLIPSAL	1SV900				
63	1	NEUTRAL LINK	CLIPSAL	BP1NS010				
64	1	EARTH LINK	CLIPSAL	BP1NS010				
65		SWITCHBOARD TERMINALS	PHOENIX					
65.1	16	ANALOGUE DISCONNECT	PHOENIX	UK-5				
65.2	16	END PLATE	PHOENIX	TO SUIT UK-5				
65.3	26	FUSE TERMINAL	PHOENIX	UK-5 HES1				
65.4	26	END PLATE	PHOENIX	TO SUIT UK-5 HES1				
65.5	26	FUSE CARTRIDGE	PHOENIX	FUSE 20x25mm				
65.6	103	DISCONNECT TERMINAL	PHOENIX	UK-5				
65.7	5	END PLATE	PHOENIX	TO SUIT UK-5				
65.8	9	END STOP	PHOENIX	TO SUIT UK-5				
66	1	MAIN NEUTRAL LINK	CLIPSAL	ZOLA66				
67	1	MAIN EARTH LINK	CLIPSAL	ZOLA66				
68	1	INSTRUMENTATION EARTH LINK	CLIPSAL	BP1NSC10				
69								
70								
71								
72								
73								
74								
75	1	RTU SURGE REDUCTION FILTER	CRITEC	TDF-WA-24V - ALN RLY OF EQUIV.				
76	1	CATHODE PROTECTION UNIT						
77	1	BATTERY ENCLOSURE	NETWORK	DWG TR1-23 DETAIL J				
78	1	BATTERY VENT	FIBOX	MBW564				
79	1	RTU LAPTOP G.P.D.	CLIPSAL	15 / 44 / 44.5A				
80	2	DECONTACTOR	MARECHAL	(SEE NOTE 1)				
81	2	ANGLE ADAPTOR	MARECHAL	31-30000-427				
82	2	PLUG TOP	MARECHAL	31-37013-172				
83	1	RTU POWER FAIL RELAY	IZUMI	RI02B-4J-24VAC				
84	1	RTU BATTERY DISCHARGE RELAY	IZUMI	RI02B-4J-12VDC				
85	1	RTU POWER SUPPLY 13.8VDC	POWERBOX	PSK-15				
86	1	RTU 12V/24VDC CONVERTER	POWERBOX	VT1254SC12				
87	2	BATTERY	APOLLO	MDR2				
88	1	RADIO	TRIO	TR-9900A/L				
89	4	EXPANSION BASE	SYMAX	BWSEB01				
90	1	TELEMETRY UNIT	HUNTER WATERTECH	POSSON				
91	2	DIGITAL INPUT MODULE	SYMAX	BWSD016				
92	1	DUPLEX MODULE	SYMAX	BWSD011				
93	2	DIGITAL OUTPUT MODULES	SYMAX	BWSD100				
94	2	ANALOGUE INPUT MODULE	HUNTER WATERTECH	POSSAN				
95	2	C.P. PLUG/SOCKET 4PIN	CLIPSAL SAC SERIES	SAPAL10 - S4S04.10				
96								
97	1	ANTENNA	R.F. INDUSTRIES	YB006-02				
97.1	1	ANTENNA MAST	SWBD BUILDER					
97.2	1	COAX CABLE (INTERNAL)	R.F. INDUSTRIES	RG58				
97.3	1	COAX CABLE (EXTERNAL)	R.F. INDUSTRIES	RG213				
97.4	1	COAX PLUG	R.F. INDUSTRIES	SHA				
97.5	1	COAX PLUG	R.F. INDUSTRIES	H08 (PALE)				
97.6	2	COAX PLUG	R.F. INDUSTRIES	H07 (PALE)				
97.7	1	U CLAMPS	R.F. INDUSTRIES	UNV				

Sheet 07

AS BUILT

B	20.08.03	AS BUILT	
A	25.08.02	FOR CONSTRUCTION	PM
No	DATE	AMENDMENT	INITIALS
MANAGER OF BUSINESS ASSET SERVICES		DATE	
MANAGER OF OPERATIONS		DATE	
MANAGER PROFESSIONAL SERVICES - ENGINEERING		DATE	
SUPERVISING ENGINEER		R.P.E.Q. NO.	DATE
CADD FILE	3014-107-RavB.dwg		
JOB FILE	SURVEY NO.		
SURVEYED	FIELD BOOK		
DESIGN	AJM	MAY 02	
DESIGN CHECK	SPK	JUN 02	
DRAWN	DPM	MAY 02	
DRAFTING CHECK	VMU	JUN 02	



PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE


TITLE
SWITCHBOARD
EQUIPMENT LIST

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/107	B

CABLE No.	SIZE mm ²	CORES	TYPE	LENGTH (m)	FROM - TO - VIA ROUTE	CABLE FUNCTION	CORRECTLY INSTALLED	
							INITIAL	DATE
P01	15	2+earth		6.5	New MCB on S/B to new RTU enclosure	NEW CABLE		
P02	10		Building wire	6	Existing S/B Earth Bar to new RTU enclosure	EXISTING CABLE		
P03	2.5	2+earth		6	Switchboard G.P.O. Fuse to new G.P.O. near RTU Cubicle	NEW CABLE		
P04	120	1C		20	EXTERNAL GEN-SET CONNECTION BOX TO NEW SWITCHBOARD	NEW CABLE		
P05	120	1C		20	EXTERNAL GEN-SET CONNECTION BOX TO NEW SWITCHBOARD	NEW CABLE		
P06	120	1C		20	EXTERNAL GEN-SET CONNECTION BOX TO NEW SWITCHBOARD	NEW CABLE		
P07	35	1C		20	EXTERNAL GEN-SET CONNECTION BOX TO NEW SWITCHBOARD	NEW CABLE		
E1	35	1C		20	EXTERNAL GEN-SET CONNECTION BOX TO NEW SWITCHBOARD	NEW CABLE		
X01			Coax	1.5	New switchboard radio to aerial	NEW CABLE		
X02			Coax	9	Aerial surge protector to aerial	NEW CABLE		
C01		20 Pr	Dekoron	6.5	New Marshalling Terminal Strip (MTS) to RTU terminals	NEW CABLE		
C02		10 Pr	Dekoron	6.5	New Marshalling Terminal Strip (MTS) to RTU terminals	NEW CABLE		
C03		10Pr	Dekoron	6.5	Site Power Failure Relay to MTS	NEW CABLE		
C04		1Pr	Dekoron	2	Pump 1 CCE Relay to MTS	DELETE		
C05		1Pr	Dekoron	3	Pump 2 CCE Relay to MTS	DELETE		
C06		1Pr	Dekoron	2	Pump 1 Monitor Relay to MTS	DELETE		
C07		1Pr	Dekoron	3	Pump 2 Monitor Relay to MTS	DELETE		
C08		1Pr	Dekoron	4	Pump 1 & 2 PWF Relays to MTS	DELETE		
C09		1Pr	Dekoron	2	Pump 1 KW Transducer to MTS	DELETE		
C10		1Pr	Dekoron	3	Pump 2 KW Transducer to MTS	DELETE		
C11			Special cable	20	Well Level Probe to Evaluation Unit in RTU Enclosure	DELETE		
C12			Special cable	16	Multitrode Probe to Relay in RTU enclosure	DELETE		
C13			Special cable	27	Pressure Tx to evaluation unit in RTU enclosure	DELETE		
C14		1Pr	Dekoron	1	Pump 1 Terminal Strip to new MTS	DELETE		
C15		1Pr	Dekoron	1	Pump 2 Terminal Strip to new MTS	DELETE		
C16		1Pr	Dekoron	3	Pump 1 Motor Current transducer to MTS	DELETE		
C17		1Pr	Dekoron	3	Pump 2 Motor Current transducer to MTS	DELETE		
C18		1Pr	Twin	15	Site Attention Alarm strobe to RTU terminals	DELETE		
C19		1Pr	Dekoron	2.5	Sump Pump Contactor to MTS	DELETE		
C20		1Pr	Dekoron	2	Pump 1 Status Indicator to MTS	DELETE		
C21		1Pr	Dekoron	2	Pump 1 Start Pushbutton to MTS	DELETE		
C22		1Pr	Dekoron	2	Pump 1 Emergency Stop Pushbutton to MTS	DELETE		
C23		1Pr	Dekoron	2	Pump 1 Reset Pushbutton to MTS	DELETE		
C24		1Pr	Dekoron	3	Pump 2 Status Indicator to MTS	DELETE		
C25		1Pr	Dekoron	3	Pump 2 Start Pushbutton to MTS	DELETE		
C26		1Pr	Dekoron	3	Pump 2 Emergency Stop Pushbutton to MTS	DELETE		
C27		1Pr	Dekoron	3	Pump 2 Reset Pushbutton to MTS	DELETE		
C28		1Pr	Dekoron	3	Station Control Selector to MTS	DELETE		
C29		1Pr	Dekoron	3	Well Level Analogue Indicator to MTS	DELETE		

Sheet 08

AS BUILT

B 20.08.02 AS BUILT		A 25.08.02 FOR CONSTRUCTION		PM
NO DATE	AMENDMENT	INITIALS		
MANAGER OF BUSINESS ASSET SERVICES		DATE		
MANAGER OF OPERATIONS		DATE		
MANAGER PROFESSIONAL SERVICES - ENGINEERING		DATE		
SUPERVISING ENGINEER		R.P.E.O. NO.		DATE
CADD FILE		3014-108-RevB.dwg		
JOB FILE		SURVEY NO.		
SURVEYED		FIELD BOOK		
DESIGN	AJM	MAY 02		
DESIGN CHECK	SPK	JUN 02		
DRAWN	DPM	MAY 02		
DRAFTING CHECK	VMU	JUN 02		



PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD
CABLE SCHEDULE

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/108	AMEND. B

ITEM No	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED DATE	ITEM No	DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED DATE
00	SURGE DIVERTER	LIGHTNING ARRESTORS		4mm	TRAFFOLYTE W/B/W		49	PUMP RESET PUSH BUTTON	LOCAL RESET	LOCAL RESET	4mm	TRAFFOLYTE W/B/W	
01	MAIN CIRCUIT BREAKER	MAIN SWITCH (Note 1)		10mm	TRAFFOLYTE W/B/W		50						
02	PUMP CIRCUIT BREAKER	PUMP No 1 (Note 1)	PUMP No 2 (Note 1)	4mm	TRAFFOLYTE W/B/W		51						
03				4mm	TRAFFOLYTE W/B/W		52	SURCHARGE ALARM	LOCAL SURCHARGE IMMINENT		4mm	TRAFFOLYTE W/B/W	
04	SUB-DISTRIBUTION BOARD CFS	SUB-DISTRIBUTION BOARD 32/4/3A		6mm	TRAFFOLYTE W/B/W		53						
04.1				4mm			54						
04.2							55	STATION CONTROL SELECTOR SW.	STATION CONTROL SITE ATTENTION ALARM RESET		4mm	TRAFFOLYTE W/B/W	
05							56	SITE ATTENTION RESET			4mm	TRAFFOLYTE W/B/W	
06	SOFT STARTER	SOFT STARTER PUMP No 1	SOFT STARTER PUMP No 2	4mm	TRAFFOLYTE W/B/W		57						
06.1				4mm			58						
07							59	SITE ATTENTION ALARM	ATTENTION ALARM		4mm	TRAFFOLYTE W/B/W	
07.1	LINE CONTACTOR	IK3 LINE CONTACTOR	2K3 LINE CONTACTOR	4mm	TRAFFOLYTE W/B/W		60						
07.2				4mm			61	3 PHASE OUTLET	3 Ø OUTLET		4mm	TRAFFOLYTE W/B/W	
07.3							62	1 PHASE OUTLET	1 Ø OUTLET		4mm	TRAFFOLYTE W/B/W	
08							63	NEUTRAL LINK	NEUTRAL		4mm	TRAFFOLYTE W/B/W	
09	BYPASS CONTACTOR	IK4 BYPASS CONTACTOR	2K4 BYPASS CONTACTOR	4mm	TRAFFOLYTE W/B/W		64	EARTH LINK	EARTH		4mm	TRAFFOLYTE W/B/W	
09							65						
10							65.1						
11							65.2						
12	PUMP INSTRUMENT CT	PUMP No 1 75A/5 1 PRIMARY TURNS	PUMP No 2 75A/5 1 PRIMARY TURNS	4mm	TRAFFOLYTE W/B/W		65.3						
13	INSTRUMENT FUSES	F1 2/20A	F2 2/20A	4mm	TRAFFOLYTE W/B/W		65.4						
14							65.5						
14.1							65.6						
15	CT TEST LINK	TL1	TL2	4mm	TRAFFOLYTE W/B/W		65.7						
15.1							65.8						
15.2							66	MAIN NEUTRAL LINK	MAIN NEUTRAL		4mm	TRAFFOLYTE W/B/W	
15.3							67	MAIN EARTH LINK	MAIN EARTH		4mm	TRAFFOLYTE W/B/W	
16							68	INSTRUMENTATION EARTH LINK	INSTRUMENTATION EARTH		4mm	TRAFFOLYTE W/B/W	
17	PUMP AMPMETER	PUMP No 1	PUMP No 2	4mm	TRAFFOLYTE W/B/W		69						
18	KW TRANSFORMERS	KWT1 KILOWATT TRANSFORMER	KWT2 KILOWATT TRANSFORMER	4mm	TRAFFOLYTE W/B/W		70						
19	CURRENT TRANSFORMER	IT1 CURRENT TRANSFORMER	IT2 CURRENT TRANSFORMER	4mm	TRAFFOLYTE W/B/W		71						
20	PHASE FAILURE RELAY	PER PHASE FAIL RELAY		4mm	TRAFFOLYTE W/B/W		72						
21	3 PHASE OUTLET CIRCUIT BREAKER	3 PHASE OUTLET ISOLATOR		4mm	TRAFFOLYTE W/B/W		73						
22	1 PHASE OUTLET CIRCUIT BREAKER	1 PHASE OUTLET		4mm	TRAFFOLYTE W/B/W		74	24VDC CIRCUIT BREAKER	24VDC SUPPLY		4mm	TRAFFOLYTE W/B/W	
23							75						
24	RTU LAP TOP GPO CIRCUIT BKR	RTU LAP TOP GPO		4mm	TRAFFOLYTE W/B/W		76						
25	SW/BO FLUID CIRCUIT BREAKER	SW/BO BOARD LIGHTS		4mm	TRAFFOLYTE W/B/W		77	BATTERY ENCLOSURE	RTU BATTERIES		4mm	TRAFFOLYTE W/B/W	
26	CATHODE PROTECTION CIRCUIT BKR	CATHODE PROTECTION		4mm	TRAFFOLYTE W/B/W		78						
27	24VDC POWER SUPPLY CIRCUIT BKR	24VDC POWER SUPPLY		4mm	TRAFFOLYTE W/B/W		79	RTU LAPTOP G.P.O.	RTU LAPTOP G.P.O.		4mm	TRAFFOLYTE W/B/W	
28	TRANSFORMERS CIRCUIT BREAKER	TRANSFORMERS SUPPLY		4mm	TRAFFOLYTE W/B/W		80	DECONTACTOR	PUMP No 1	PUMP No 2	4mm	TRAFFOLYTE W/B/W	
29	RTU CIRCUIT BREAKER	RTU SUPPLY		4mm	TRAFFOLYTE W/B/W		81						
30							82						
31							83	RTU POWER FAIL RELAY	PF		4mm	TRAFFOLYTE W/B/W	
32							84	RTU BATTERY DISCHARGE RELAY	BD		4mm	TRAFFOLYTE W/B/W	
33							85	RTU POWER SUPPLY	RTU POWER SUPPLY		4mm	TRAFFOLYTE W/B/W	
34	WELL LEVEL INDICATOR	WELL LEVEL		4mm	TRAFFOLYTE W/B/W		86	12/24VDC CONVERTER	12/24VDC CONVERTER		4mm	TRAFFOLYTE W/B/W	
35	PRESSURE TRANSMITTER RELAY	PRESSURE TRANSMITTER		4mm	TRAFFOLYTE W/B/W								
36	WELL LEVEL TRANSMITTER	WELL LEVEL TRANSMITTER		4mm	TRAFFOLYTE W/B/W								
37	PUMP CONTROL CIRCUIT BKR	PUMP No 1 CONTROL	PUMP No 2 CONTROL	4mm	TRAFFOLYTE W/B/W								
38	PUMP HOURS RUN METER	HOURS RUN PUMP No 1	HOURS RUN PUMP No 2	4mm	TRAFFOLYTE W/B/W								
39	THERMISTOR RELAYS	TR1 THERMISTOR RELAY	TR2 THERMISTOR RELAY	4mm	TRAFFOLYTE W/B/W								
40													
41	CONTROL SUPPLY AVAILABLE	IK1 CCT. ON	2K1 CCT. ON	4mm	TRAFFOLYTE W/B/W								
42													
43													
44													
45													
46	PUMP STATUS INDICATOR	PUMP STATUS (REFER DETAIL THIS SHEET)	PUMP STATUS	4mm	TRAFFOLYTE W/B/W								
47	PUMP START PUSH BUTTON	PUMP START	PUMP START	4mm	TRAFFOLYTE W/B/W								
48	PUMP STOP PUSH BUTTON	PUMP EMERGENCY STOP	PUMP EMERGENCY STOP	4mm	TRAFFOLYTE W/B/W								

NOTE:
LABELS FITTED ADJACENT ASSOCIATED EQUIPMENT
LABELS OBTAINED BY SWITCHBOARD WIRING ARE RELOCATED TO ADJACENT DUCT LID
DUCT LID SECURED BY SINGLE CABLE TIE AT ONE CORNER

FORTROSE STREET
SP192
RTU CUBICLE

ITEM 100

APPROX. 400mm x 140mm
20mm HIGH LETTERS

WARNING

THIS SITE IS MONITORED BY THE CONTROL ROOM
OPERATOR.
PLEASE INFORM THE OPERATOR BEFORE
ISOLATING PUMPS OR STATION

ITEM 101

APPROX. 250mm x 100mm
8mm HIGH LETTERS

PLEASE CHECK THAT THE
STATION IS IN REMOTE MODE
BEFORE LEAVING THE SITE

ITEM 102

APPROX. 220mm x 60mm
8mm HIGH LETTERS

AS BUILT

B 20.08.03		A 25.08.03		FOR CONSTRUCTION		PM	
NO. DATE		AMENDMENT		INITIALS		DATE	
MANAGER OF BUSINESS ASSET SERVICES				DATE			
MANAGER OF OPERATIONS				DATE			
MANAGER PROFESSIONAL SERVICES - ENGINEERING				DATE			
SUPERVISING ENGINEER		R.P.E.Q. NO.		DATE			
CADD FILE		3014-109-RevB.dwg					
JOB FILE		SURVEY NO.					
SURVEYED		FIELD BOOK					
DESIGN		AJM		MAY 02			
DESIGN CHECK		SPK		JUN 02			
DRAWN		DPM		MAY 02			
DRAFTING CHECK		VMU		JUN 02			



PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD & RTU CUBICLE
LABEL SCHEDULE

SCALE	A.H. DATUM
DRAWING N°	N° DF SHEETS
3014/109	B

Sheet 09

22/08/2003 1:20 AM

NOTES:

1. CONSTRUCTION

2mm SHEET STEEL ON GALV.100 CHANNEL PLINTH,
FRONT ACCESS, BOTTOM ENTRY, POWDER COATED FINISH.

2. RATING

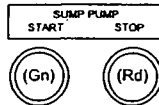
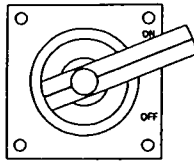
ENVIRONMENTAL:- IPS4.

SEGREGATION:- FORM 4

FAULT LEVEL:- 30kA FOR 1 SECOND

INCOMERS:- 400A NORMAL, 400A GEN-SET

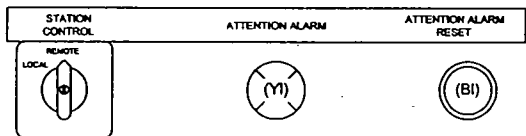
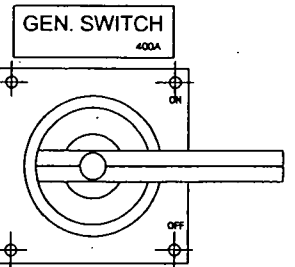
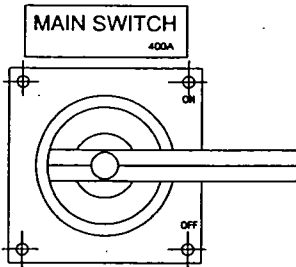
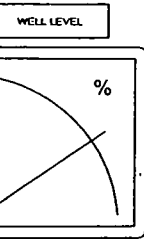
DRIVES:- 2off 75kW MAIN PUMPS, 1off 3.7kW SUMP PUMP



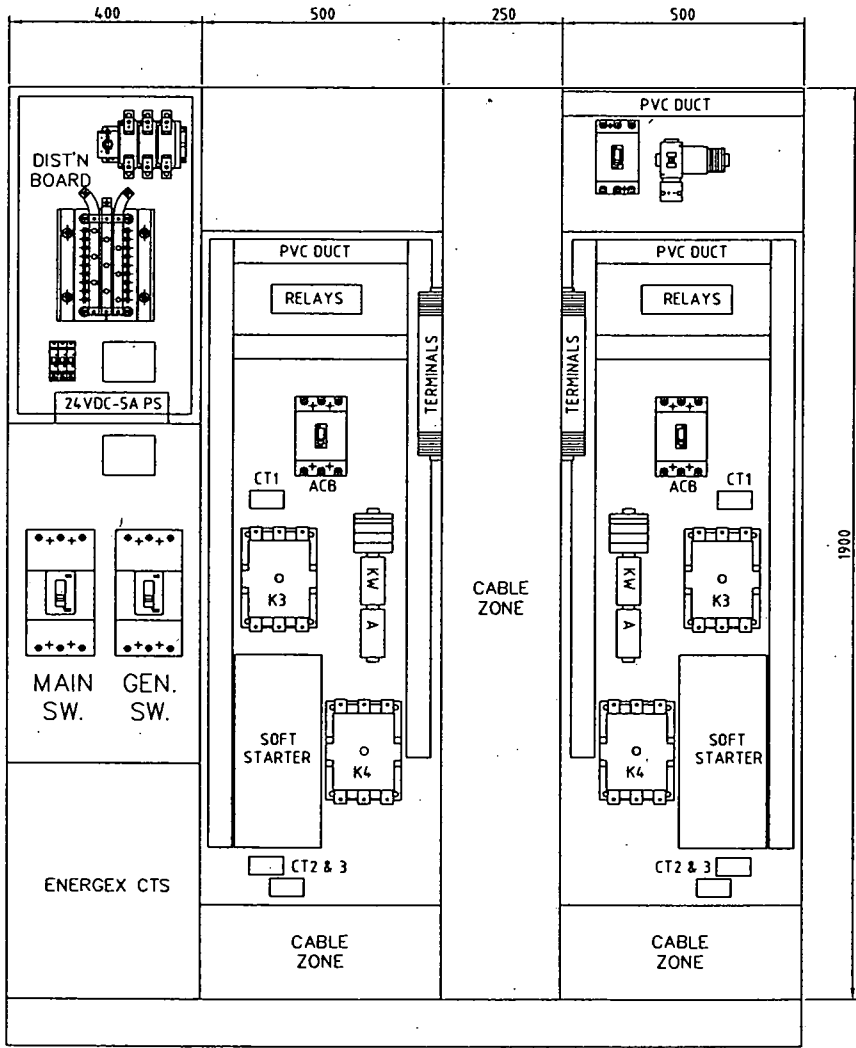
SUMP PUMP
DETAIL "B"

SP 192 - FORTROSE ST

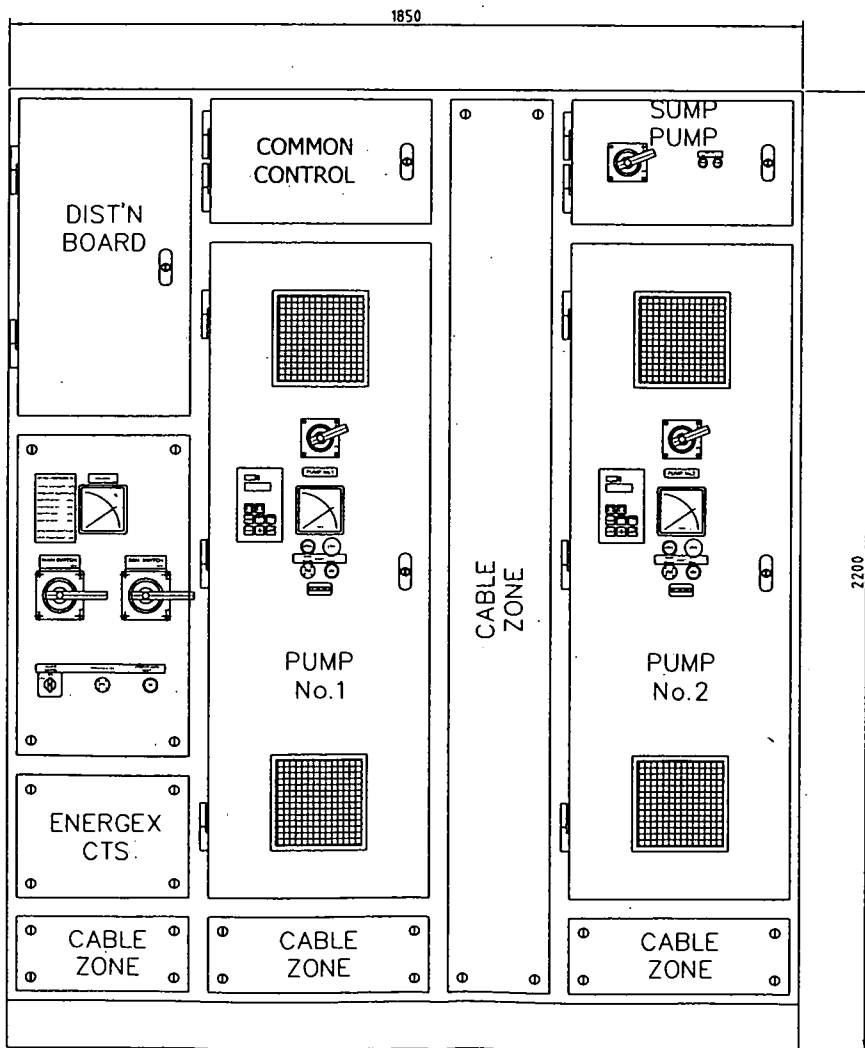
ACTUAL SURCHARGE	mm%
SURCHARGE IMMINENT	mm%
DUTY 'A' START	mm%
DUTY 'B' START	mm%
DUTY 'A' STOP	mm%
DUTY 'B' STOP	mm%
LEVEL PROBE LENGTH	mm
LEVEL PROBE RANGE	mm



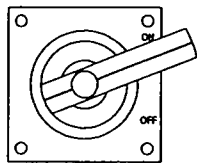
MAIN PANEL
DETAIL "A"



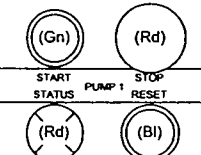
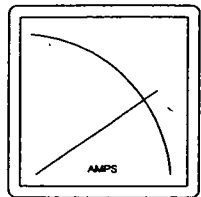
INTERNAL LAYOUT



EXTERNAL LAYOUT



PUMP No.?



HOURS RUN

TYPICAL PUMP
DETAIL "C"

AS BUILT

C	20.08.02	AS BUILT	
B	18-9-02	DIMENSIONS REVISED	HT
A	25.08.02	FOR CONSTRUCTION	PM
No	DATE	AMENDMENT	INITIALS
MANAGER OF BUSINESS		ASSET SERVICES	DATE
MANAGER OF OPERATIONS			DATE
MANAGER PROFESSIONAL SERVICES - ENGINEERING			DATE
SUPERVISING ENGINEER		R.P.E.Q. NO.	DATE
CADD FILE		3014-110-RevC.dwg	
JOB FILE		SURVEY NO.	
SURVEYED		FIELD BOOK	
DESIGN	AJM	MAY 02	
DESIGN CHECK	SPK	JUN 02	
DRAWN	DPM	MAY 02	
DRAFTING CHECK	VMU	JUN 02	

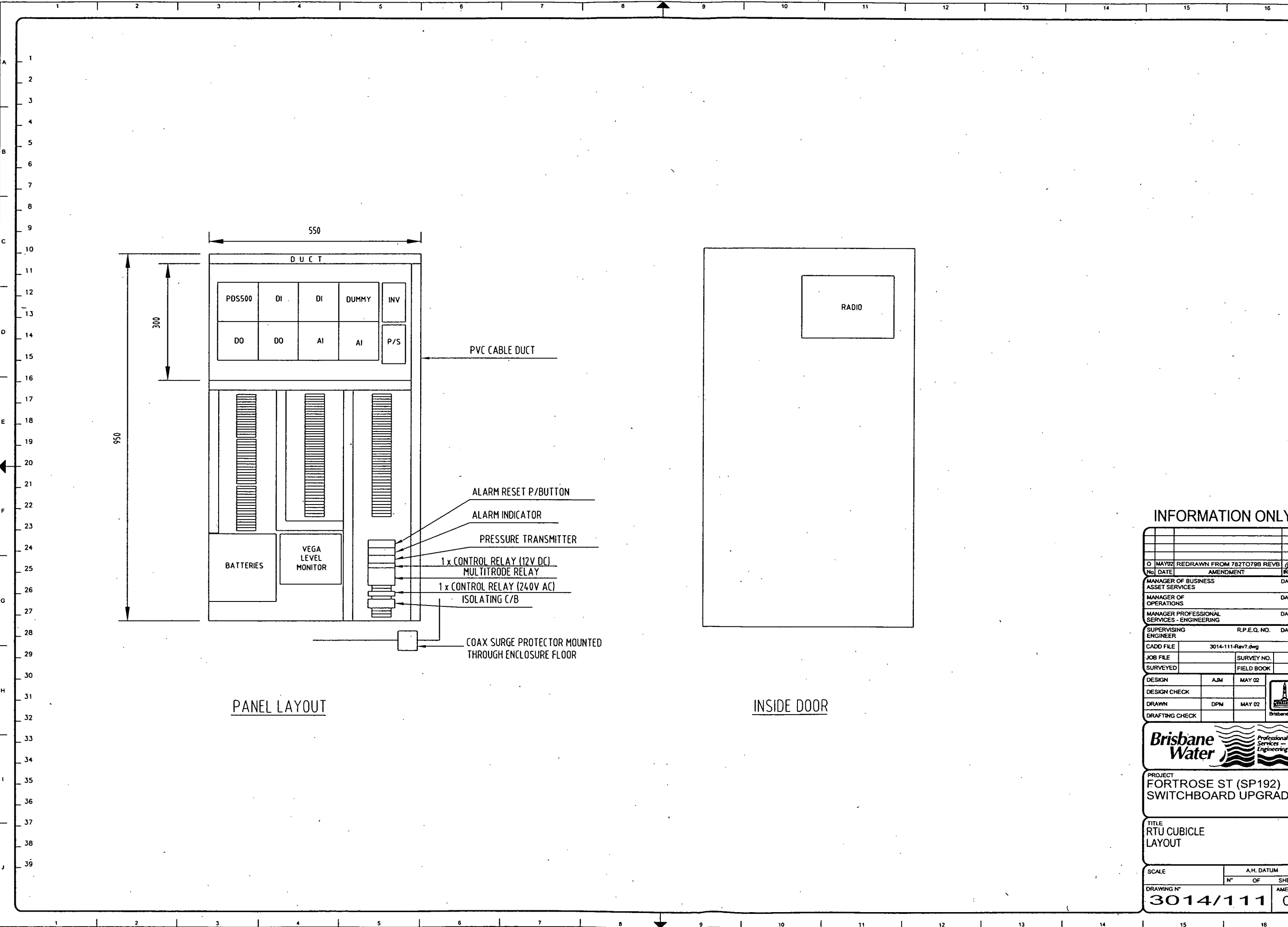


PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SWITCHBOARD
LAYOUT

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/110	C

28/08/2003 11:14 AM



INFORMATION ONLY

O MAY02 REDRAWN FROM 782TO798 REV8		
No.	DATE	AMENDMENT
MANAGER OF BUSINESS ASSET SERVICES		
MANAGER OF OPERATIONS		
MANAGER PROFESSIONAL SERVICES - ENGINEERING		
SUPERVISING ENGINEER		
CADD FILE 3014-111-Rev7.dwg		
JOB FILE		
SURVEYED		
DESIGN	AJM	MAY 02
DESIGN CHECK		
DRAWN	DFM	MAY 02
DRAFTING CHECK		

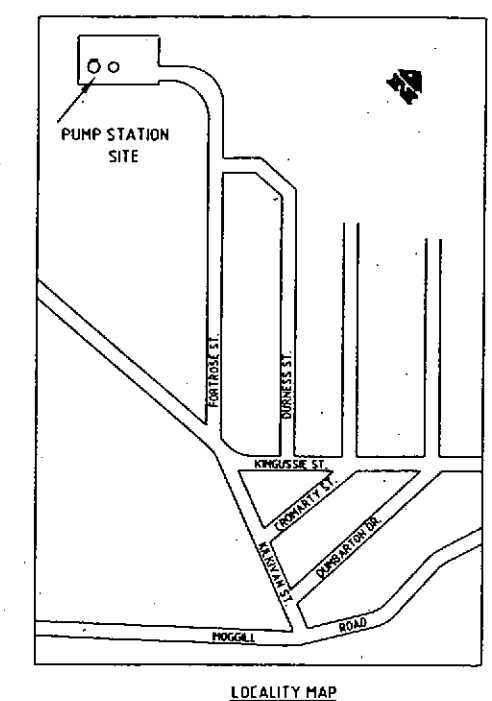
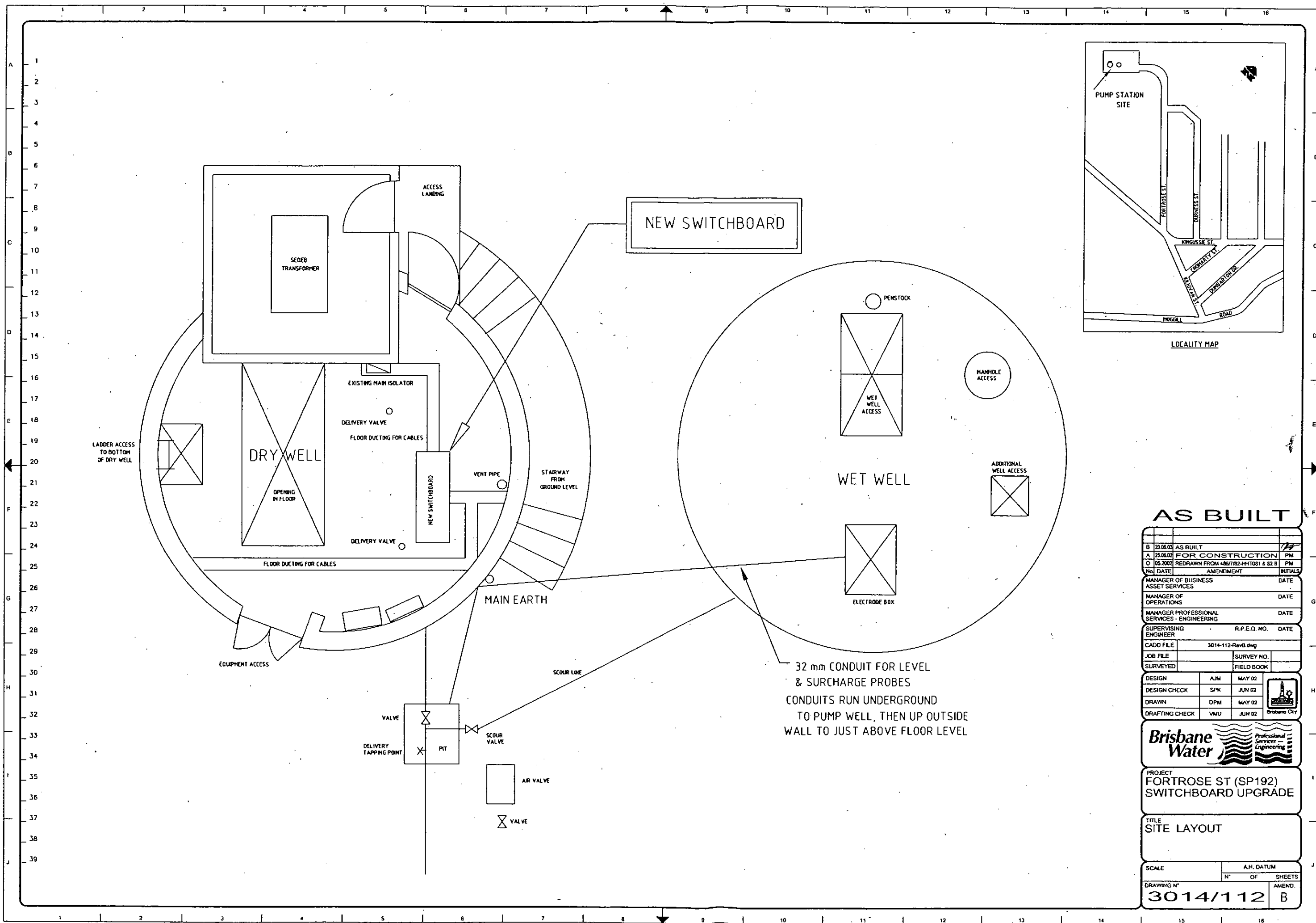


PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
RTU CUBICLE
LAYOUT

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/111	0

22/08/2003 11:25 AM



AS BUILT

B	20.06.03	AS BUILT	PM
A	25.06.03	FOR CONSTRUCTION	PM
O	05.06.02	REDRAWN FROM 4867/02-HHT001 & 02 B	PM
DATE	AMENDMENT	INITIALS	
MANAGER OF BUSINESS ASSET SERVICES	DATE		
MANAGER OF OPERATIONS	DATE		
MANAGER PROFESSIONAL SERVICES - ENGINEERING	DATE		
SUPERVISING ENGINEER	R.P.E.Q. NO.	DATE	
CADD FILE	3014-112-Rev0.dwg		
JOB FILE	SURVEY NO.		
SURVEYED	FIELD BOOK		
DESIGN	AJM	MAY 02	
DESIGN CHECK	SPK	JUN 02	
DRAWN	DPM	MAY 02	
DRAFTING CHECK	VMU	JUN 02	

Brisbane Water Professional Services Engineering

PROJECT
FORTROSE ST (SP192)
SWITCHBOARD UPGRADE

TITLE
SITE LAYOUT

SCALE	A.H. DATUM
DRAWING N°	N° OF SHEETS
3014/112	B

22/08/2003 3:30 AM

