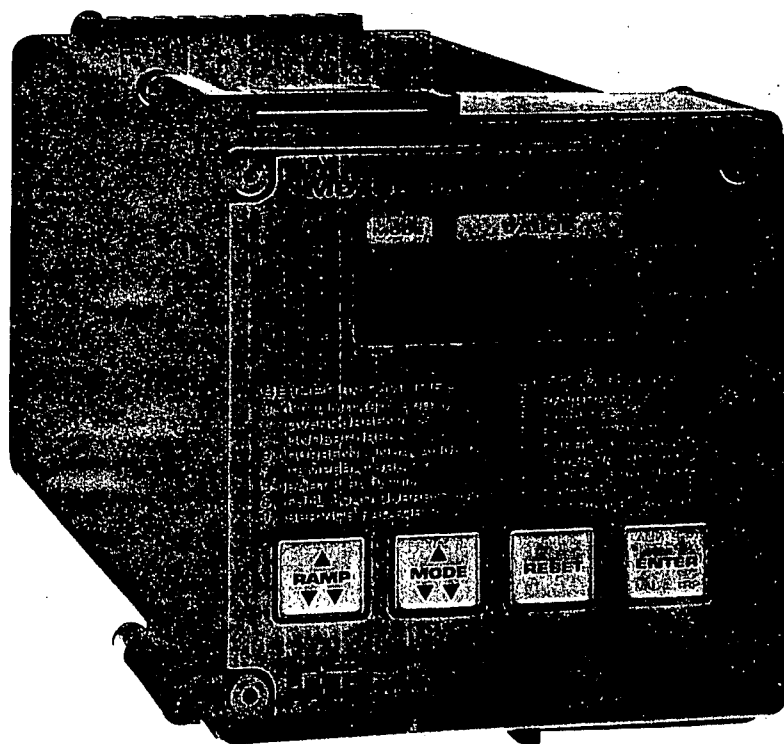




MPU-16A



PROGRAMMABLE MOTOR PROTECTION



EQUIPMENT PTY. LTD.



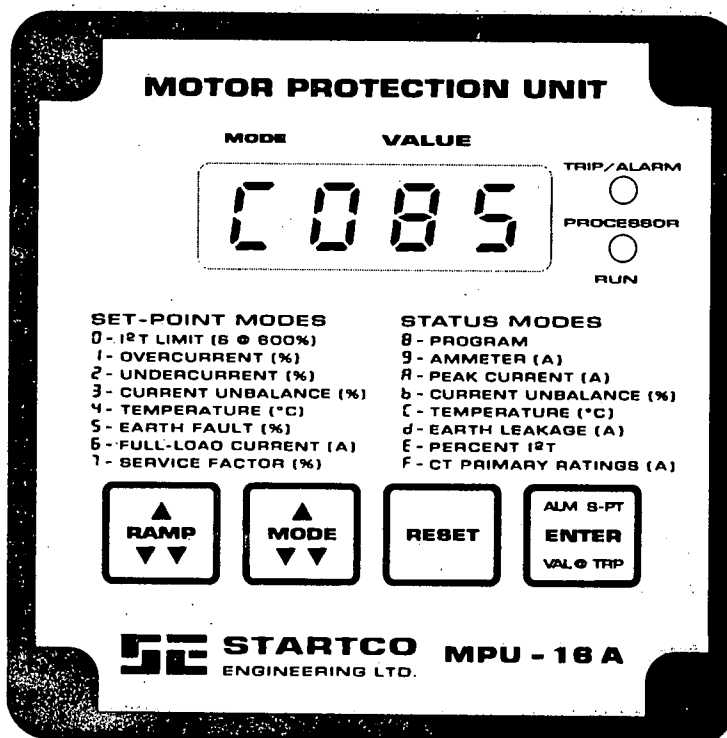
FACEPLATE – ACTUAL SIZE

MODE Digit
Identifies Mode

VALUE Digits
Display Set Points,
Trip-and-Alarm Codes,
and Meter Readings

RAMP Switch
Adjusts **VALUE** Digits

MODE Switch
Selects Modes "0"
through "F"



TRIP/ALARM Red Led
On: Trip or Alarm
Flashing: Program-Change
Lockout Defeated

PROCESSOR RUN Green LED
On: Processor Functional

ENTER Switch
Enters Values
Accesses Alarm Set Points
and Values at Trip

RESET Switch
Resets Trips and Alarms

PROTECTION

- Thermal Overload
- Locked rotor
- Multiple starts
- Long-acceleration starts
- Stalls
- Cyclic overloads

- Overcurrent
- Mechanical jam
- Short circuit

- Overtemperature
- Loss of ventilation
- High ambient temperature
- Open/shorted RTD

- Current Unbalance
- Phase failure/reversal
- Supply unbalance
- Single phasing
- Contactor pole failure

- Undercurrent
- Loss of load

- Earth Fault
- Earth leakage
- Phase-to-frame fault

FEATURES

- Programmed using motor data
- Program-change lockout
- Trip-and-alarm set points
- Trip-and-alarm relays
- Fused, form-C contacts
- Liquid-crystal display
- Nonvolatile memory
- Isolated analog output
- On-line programming
- Emergency thermal reset
- Compact 1/4 DIN size
- Solid-state starter compatible
- Optional backlit display
- Optional remote-keypad input
- Optional isolated RS-485 communications interface

USER SELECTABLE

- Set point delete
- Phase sequence
- Phase-reverse detection
- Earth-fault time delay
- Hot-motor compensation
- Short-circuit trip
- Alarm latch
- Autoreset (Thermal Overload)
- Analog-output parameter
- Fail-safe/non-fail-safe output-relay operation

INFORMATION DISPLAYS

- Trip-and-alarm set points
- Time-to-reset
- Meter values at trip
- Trip-and-alarm indication
- Processor-run indication
- Program-enable indication

METERING DISPLAYS

- Motor current
- Peak motor current
- Percent current modulation
- Percent current unbalance
- Motor temperature
- Earth-leakage current
- Percent I_{st} used

COMPLIANCE

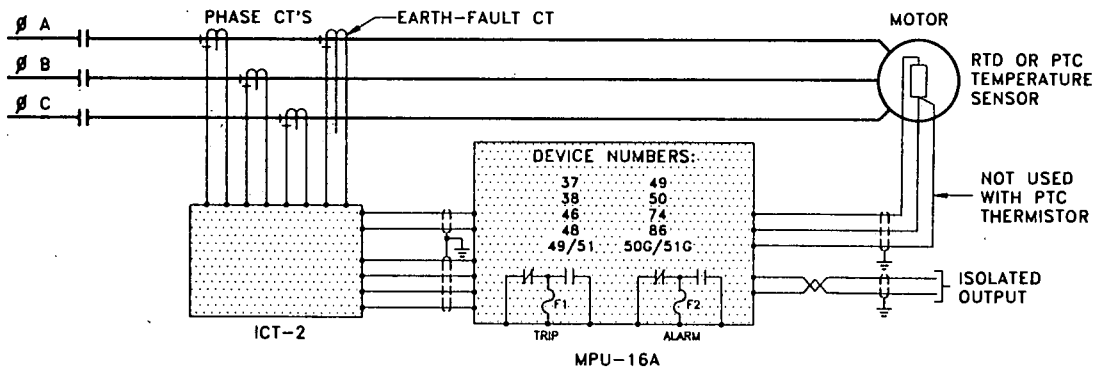
- CSA certified
- UL listed
- Impulse Voltage Withstand to IEC 255.4, Appendix E, Class III
- High-Frequency Disturbance to IEC 255.4, Appendix E, Class III
- Dielectric to IEC 255.5, Clause 6
- Insulation Resistance to IEC 255.5, Clause 7

MODE SPECIFICATIONS

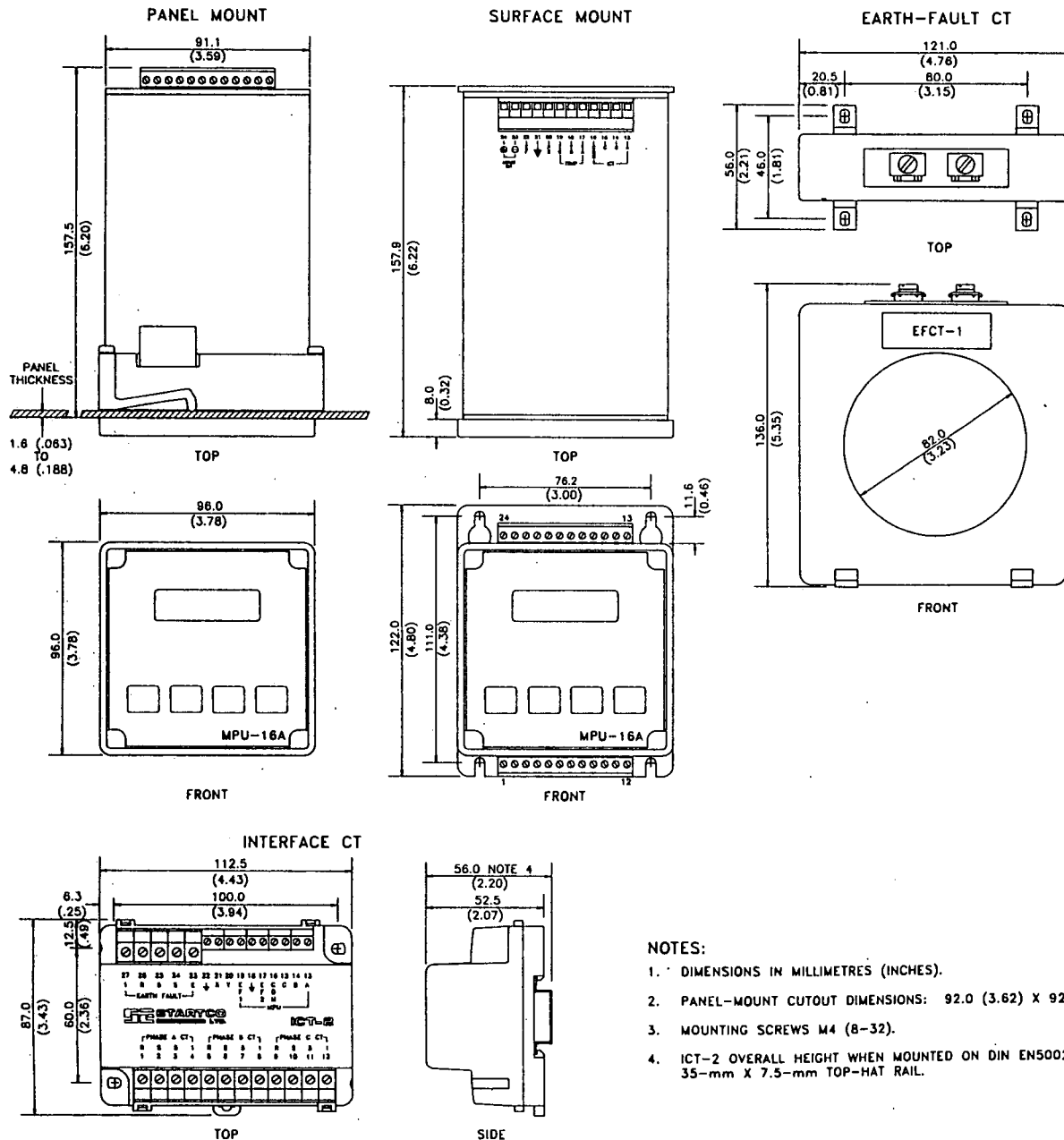
MODE 0 – I_{2t} Limit	
Set-Point Range	1 s to 45 s in 1-second Increments @ 600% FLA
MODE 1 – Overcurrent (Running)	
Set-Point Range	100% to 600% FLA in 25% Increments
Trip-and-Alarm Times	250 ± 125 ms
Short-Circuit Trip Level	1200% FLA
Short-Circuit Trip Time	Instantaneous
MODE 2 – Undercurrent (Running)	
Set-Point Range	15% to 100% FLA in 1% Increments
Trip Time	5 seconds
Alarm Time	1 second
MODE 3 – Current Unbalance	
Set-Point Range	10% to 75% FLA in 1% Increments
Trip Time	5 seconds
Alarm Time	1 second
Phase-Reverse Trip Time	2.0 ± 1.2 seconds
MODE 4 – Temperature (RTD)	
Set-Point Range	50°C to 220°C in 5°C Increments
Trip-and-Alarm Times	1 second
MODE 5 – Earth Fault	
Set-Point Range	1% to 100% EF-CT-Primary Rating in 1% Increments
Trip Times	0.25, 0.5, 1.0 ± 0.1 second, Instantaneous
Alarm Time	250 ± 125 ms
MODE 6 – Full-Load Current	
Set-Point Range	9 A to 800 A in 1-A Increments
MODE 7 – Service Factor	
Set-Point Range	100% to 125% in 1% Increments
MODE 8 – Program Options	
Phase Sequence	AbC/bAC
Phase Reverse	Enable/Disable
Earth-Fault Trip Times	Instantaneous, 0.25 s, 0.5 s, 1.0 s
Hot-Motor Compensation	On/Off
Short-Circuit Trip	On/Off
Alarm Latch	On/Off
Autoreset	On/Off
Relay Operating Mode	Fail Safe/Non Fail Safe
Analog-Output Parameter	Current, %I _{2t} , Temperature, or Earth-Fault
MODE 9 – Ammeter*	
Range	0 to 10 x FLA
Resolution	1 A for I < 1000 A, 100 A for I ≥ 1000 A
MODE A – Peak Current / % Modulation	
Range	0 to 6 x FLA / 0 to 100%
Resolution	1 A for I < 1000 A, 100 A for I ≥ 1000 A / 1%
MODE b – Current Unbalance*	
Range	0 to 100%
Resolution	1%
MODE C – Temperature (RTD)*	
Range	0 to 255°C
Resolution	1°C
MODE d – Earth Leakage*	
Range	0 to 1.25 x EF-CT-Primary Rating
Resolution With:	
EFCT-1	0.02 A
1-A- or 5-A-Secondary CT	1 A for I < 1000 A, 100 A for I ≥ 1000 A
MODE E – Percent I_{2t}* / Time-To-Reset	
Range	0 to 100% / 0 to 85 minutes
Resolution	1% / 1 minute
MODE F – CT-Primary Ratings	
Phase CT	20 A to 1200 A in 5-A Increments
Earth-Fault CT	
EFCT-1	5 A
1-A- or 5-A-Secondary CT	50 A to 2000 A in 50-A Increments

* Pre-trip value retained.

SIMPLIFIED CONNECTION DIAGRAM



DIMENSIONS



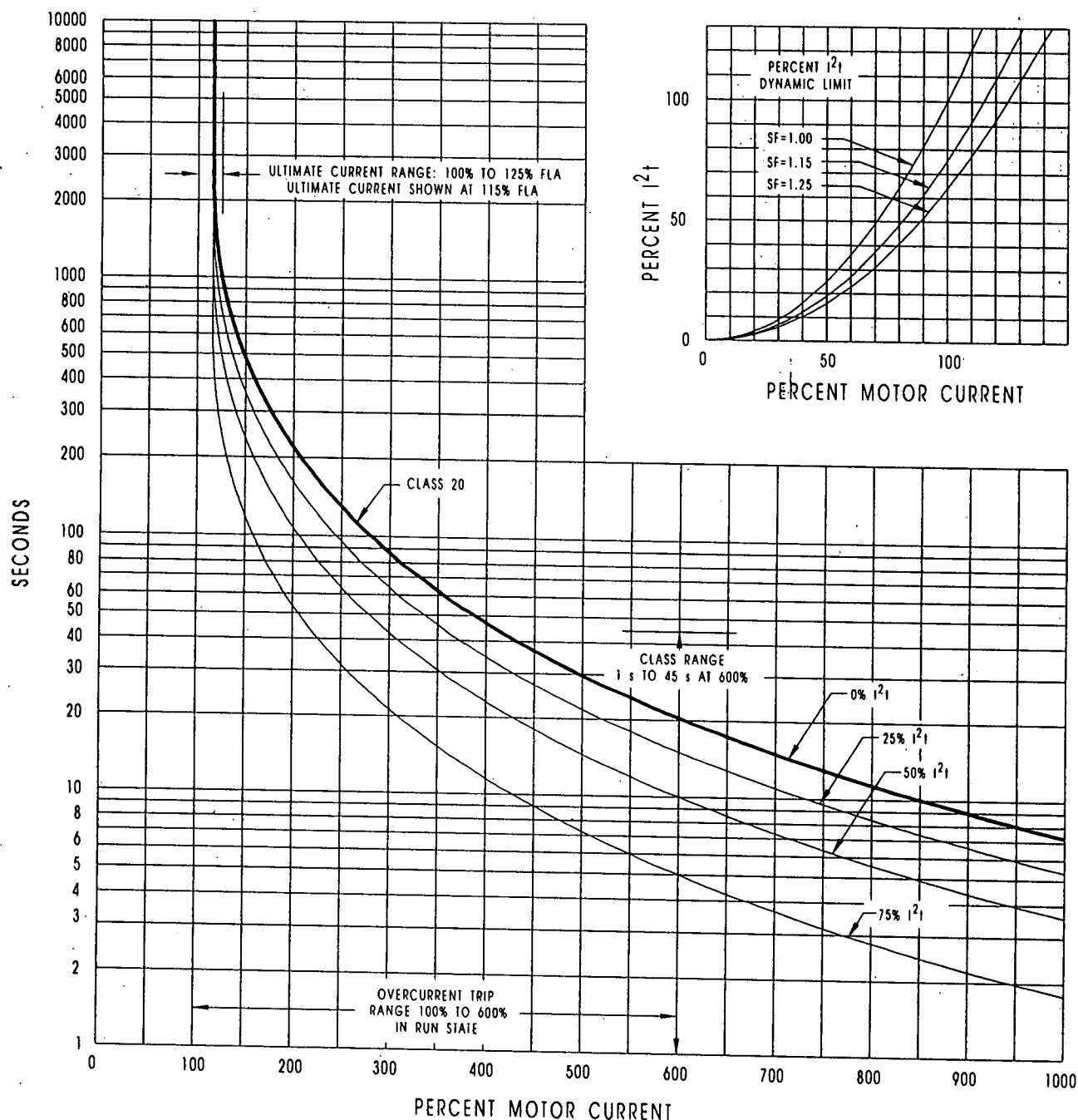
NOTES:

1. DIMENSIONS IN MILLIMETRES (INCHES).
2. PANEL-MOUNT CUTOUT DIMENSIONS: 92.0 (3.62) X 92.0 (3.62).
3. MOUNTING SCREWS M4 (8-32).
4. ICT-2 OVERALL HEIGHT WHEN MOUNTED ON DIN EN50022 35-mm X 7.5-mm TOP-HAT RAIL.

PRODUCT DESCRIPTION

The MPU-16A is a microprocessor-based motor protection unit that uses a thermal modelling technique which extends motor protection beyond the limits of other electronic overload relays. This thermal modelling technique allows motor temperature to be continuously tracked regardless of variations in starting, running, overload, or cooling cycles. The result is motor protection that allows a motor to operate within its design limits without nuisance tripping; yet, the MPU-16A quickly and accurately responds to an overload. It does this without the need for acceleration-time, starts-per-hour, or curve-selection programming required by some electronic overload relays. Startco's MPU-16A is fully compatible with solid-state starters and all functions remain operational during current-limited starts.

One of the available 1170 dynamic protection curves is shown below. The thermal model is active for all values of motor current, and the tracking limits shown in the inset graph are the values which $\%I^2t$ (used thermal capacity) tends toward. The rate at which $\%I^2t$ approaches a final value is a function of the service factor and the Mode-0-trip set point. As thermal capacity is used, the protection curve passes through the 25%, 50%, and 75%- I^2t curves. This dynamic overload curve is operational with or without RTD compensation. If the motor is equipped with a RTD temperature sensor, the MPU-16A thermal model can compensate for high ambient temperature and loss of ventilation.



TECHNICAL SPECIFICATIONS

Control Power:	
120/240 Vac, 50/60 \pm 1 Hz	10 VA
Maximum Continuous	135/265 Vac
Minimum Continuous	85/170 Vac
Power-up Voltage	100/200 Vac
Shipping Weight:	
MPU-16A	3.2 kg (7 lbs)
EFCT-1	0.9 kg (2 lbs)
Interface-CT Inputs:	
Thermal Withstand	
Continuous	5 x CT-Secondary Rating
1-Second	80 x CT-Secondary Rating
Burden	< 0.01 Ω
Temperature Input:	
RTD	3 wire; 100- Ω Pt, 100- Ω Ni, 120- Ω Ni, or 10- Ω Cu
PTC	Cold Resistance < 1500 Ω
Output Relays:	
Contact Rating	8 A Resistive, 250 Vac or 24 Vdc, B300 Pilot Duty, 0.25 hp @ 120 Vac.
Contact Configuration	Form C
Fuse Rating (F1 & F2)	8 A, 250 Vac

Analog Output:	
Parameter	0 to 125% FLA, 0 to 100% I ² , 0 to 200°C, or 0 to 100% Earth Leakage

Drive:	
4-20 mA	700 Ω max
0-5 Vdc	25 mA max
0-10 Vdc	25 mA max
Isolation to Ground	300 Vac Continuous
Dielectric Strength	1500 Vac
Resolution	\pm 1% Full Scale

Accuracies:	
Ammeter Accuracy @ FLA	\pm 0.3% Full Scale or \pm 3% Reading ^{1,2}
Earth-Leakage Accuracy	\pm 3% EF-CT-Primary Rating ²
RTD-Temperature Accuracy	\pm 2°C

¹ Ammeter Full Scale = 10 x FLA² Interface-CT Accuracy Included

Environment:	
Operating Temperature	-40°C to 60°C
Storage Temperature	-55°C to 80°C

CT REQUIREMENTS

Phase CT:	
Primary Rating	1.07 to 2.22 x FLA
Secondary Rating	1 A or 5 A

Earth-Fault CT:	
EFCT-1	For prospective earth-fault current \leq 800 A and set points \leq 5 A.
Other	For prospective earth-fault current > 800 A or set points > 5 A, use an earth-fault CT with 50-A to 2000-A primary and 1-A or 5-A secondary.

ORDERING INFORMATION

MPU-16A – Supplied with ICT-2, 6 m (20 ft) ICT-2 interconnection cable, and mounting hardware.

MODEL NUMBER:

MPU-16A - P126 - P10 - 42 - 00

Mount
P Panel
S Surface

Supply Voltage
12 120 Vac
24 240 Vac
SW Switchable 120/240 Vac

Supply Frequency
5 50 Hz
6 60 Hz

Temperature-Sensor Input
P10 100-ohm Platinum RTD
N10 100-ohm Nickel RTD
N12 120-ohm Nickel RTD
C01 10-ohm Copper RTD
PTC PTC Thermistor

Options
00 No Options
01 Backlit Display
02 Remote-Keypad Input
03 Options 01 and 02 Combined
10 RS-485 Communications Interface

Analog Output Type
42 4-20 mA
05 0-5 Vdc
01 0-10 Vdc
00 Required with option 10

EXAMPLE:

MPU-16A-P126-P10-42-00 specifies: panel mount, 120-Vac 60-Hz power supply, 100-ohm platinum RTD temperature-sensor input, and 4-20-mA analog output.

EFCT-1:

Sensitive earth-fault CT. 5-A primary rating, 600-volt class, 82-mm (3.23") window. Supplied with 6-m (20 ft) interconnection cable.

Specifications are subject to change without notice. Startco Engineering Ltd. is not liable for contingent or consequential damages or expenses sustained as a result of a malfunction, incorrect application or adjustment.



LR-62897



LISTED

MANUFACTURED BY:

SE STARTCO
ENGINEERING LTD.

406 Jessop Avenue,
Saskatoon, Saskatchewan, Canada S7N2S5
Tel: (306)373-5505 Fax: (306)374-2245

AUSTRALIAN DISTRIBUTOR:



EQUIPMENT PTY. LTD.

ACN 010479384
33 Achievement Crescent,
Acacia Ridge, QLD 4110
Tel: (07) 274-2566 Fax: (07) 274-2387

LOCAL DISTRIBUTOR:

FUNCTIONAL SPECIFICATION

Rev. 1 25/1/94

OLDFIELD ROAD PUMP STATION

The Oldfield Road Pump Station comprises the following:-

- Two Duty and standby Raw Sewage Pumps No. PP 1 and No. PP 2 and No. PP 3
- Wet well level transmitter LT 500
- Wet well High Level Switch LSHH 501
- Pump Discharge Pressure Transmitters PT 110, 210 and 310
- Flow meters FIT 600 and 610
- Soft Starters 100, 200 and 300
- Motor Protection Units MPU 101, 201 and 301
- Reflux Valve Limit Switches ZS 109, 209 and 309
- Emergency Stops GS 100, 200 and 300
- Auto Manual Selector Switch HS 102, 202 and 302
- Normal Emergency Manual Selector Switch HS 110, 210 and 310
- Programmable Logic Controller PLC
- Pump Motor Power Transmitter JT108/208/308

NORMAL OPERATION

The pump station normally operates with the selector switches in Auto and Normal. This enables the pump speed to be varied in response to the wet well level and the pumps to be controlled by the PLC. If the wet well level reaches a programmed low value the duty pump is stopped by the PLC. When the wet well level reaches a predetermined moderate value the Primary duty pump is started provided it satisfies all the enabling conditions. If the pump wet well level reaches a high value the next duty pump is started provided it satisfies all its enabling conditions. If the wet well level continues to rise and it reaches the high high level switch LSHH501 the standby pump is automatically started and High Level Alarm is transmitted via telemetry. When the wet well level falls below a programmed value the secondary duty pump stops. Initial pump start/stop levels are expected to be as follows but will be finally determined during commissioning.

	Start	Stop
Primary Duty Pump		
Secondary Duty Pump		
Standby Pump		

If a disabling condition of any duty pump other than its stop wet well level becomes active, the standby pump is automatically started.

Primary duty sequence is automatically indexed to the next pump by the PLC after each start.

ABNORMAL OPERATION

If the PLC is not available the Normal/Emergency Manual selector switch can be turned to Emergency Manual. The Auto/Manual Selector switch must also be placed in the Manual position. In this mode pumps can only be started and stopped via their manual start push buttons provided the MPU and soft start temperature enabling conditions are satisfied. However in Manual mode all process interlocks are inactive and the drive can only be stopped via its emergency stop buttons.

A low level switch from the "Vega Probe" should be hard wired in the circuit to ensure that all pumps stop at low level in manual mode independent of the PLC.

The "Emergency Manual" mode could then be used to bypass the low level stop for testing purposes or when the wet well needs to be pumped down.

The local stop should be independent of the PLC. An auxiliary timer should be added to the circuit to enable the soft starter to ramp down prior to opening the contractor. Wet well level high/high should also be wired independently of the PLC.

CONDITION MONITORING

Signals from Discharge Pressure transmitter PT110/210/310, Flowmeter FIT 600/610, wet well level transmitter LT 500 and pump motor power transmitter JT108/208/308 will be used by the PLC to calculate pump efficiency via an algorithm involving pump specific speed. The calculated actual efficiency would be compared with the manufacturers data and if the variance exceeded a predetermined amount an alarm would be raised.

TELEMETRY

The following data initiated by the PLC will be transmitted to Oxley Creek Wastewater Treatment Plant via the RTU.

- Site power on
- Wet well level (not) high high
- Pump No. 1 Ready
- Pump No. 1 Auto
- Pump No. 1 Fault (Clear)
- Pump No. 1 Running
- Pump No. 1 Condition Fault
- Pump No. 2 Ready
- Pump No. 2 Auto
- Pump No. 2 Fault (Clear)
- Pump No. 2 Running
- Pump No. 2 Condition Fault
- Pump No. 3 Ready
- Pump No. 3 Auto
- Pump No. 3 Fault (Clear)
- Pump No. 3 Running

- 3 -

- Pump No. 3 Condition Fault
- Dry well sump (Not) flooded

ENABLING CONDITIONS

The pumps are available to start provided that the following conditions are satisfied.

Auto Normal Mode

- Auto/Manual Selector Switch must be in the Auto Position.
- Normal/Emergency Manual Selector Switch must be in the Normal Position.
- Pump is selected as Duty by the PLC
- Wet Well Level LT 500 must be greater than a predetermined moderate value or High Level Switch LT 501 is activated.
- PLC Healthy
- No disabling conditions of the duty pump appropriate to the mode are active (Refer Below)
- Manual Reset Activated after a Fault
- Pump is selected as standby by the PLC and a disabling condition of the duty pump other than low wet well level, becomes active.

Normal Manual Bypass Mode (Suggested)

- Auto/Manual Selector Switch must be in the manual Position.
- Normal/Emergency Manual Selector Switch must be in the normal Position.
- Wet Well Level LT 500 must be greater than a predetermined moderate value or High Level Switch LT 501 is activated.
- No disabling conditions of the duty pump appropriate to the mode are active (Refer Below)
- Manual Reset Activated after a Fault

Emergency Manual Mode

- Auto/Manual Selector Switch must be in the manual mode.
- Normal/Emergency manual Selector Switch must be in the Emergency Manual mode.
- No disabling condition appropriate to this mode are active (Refer Below).
- Manual reset activated after a fault.

DISABLING CONDITIONS

The pumps are prevented from starting if any of the following conditions become active.

TYPW (G.21/75)

All Modes

- Motor Protection Unit activated if:-
 - Any winding thermistors active
 - Negative phase sequence
 - Current unbalance
 - High ambient temperature
 - Undercurrent
 - Earth fault
- Soft starter Temperature High
- Emergency Stop Activated.
- Water Detected in Motor Oil (suggested to be hard wired).
- Local Control Isolator switched to open circuit.

Auto Normal Mode

- Wet well level LT 500 low.
- Reflux valve limit switch not open after start time delay (0 - 30 secs)
- PLC fault

Normal Manual Mode

- Wet well level LT 500 low.

Emergency Manual Mode

- No additional disabling conditions other than those listed under all modes above.

START SEQUENCE

Providing all enabling conditions are satisfied and there are no disabling conditions active the drive will start as follows:-

Auto Normal Mode

- Wet well level transmitter LT 500 signal reaches an intermediate value.
- Soft Starter Contractor is energised and pump motor starts.
- Reflux Valve Limit Switch (ZS 109/209/309) delay timer (0 - 30 secs) is energised.
- If ZS 109/209/309 makes before Reflux Valve Limit Switch delay timer expires then the close contractor output from the PLC is energised.

TYPW (G.21/75)

- 5 -

Pump running light on local panel is energised and hours run meter is started.

Normal Manual Mode

- Start push button is activated.
- Soft starter contactor is energised.
- Pump running light on local panel is energised and hours run meter is started.

Emergency Manual Mode

- Start push button is activated.
- Soft starter contactor is energised.
- Pump running light on local panel is energised and hours run meter is started.

STOP SEQUENCE

The drive will stop if any one or more disabling conditions described under the respective mode becomes active and as follows:-

All Modes

- Soft starter ramp down timer is energised and contactor is de-energised after expiry of this timer.
- Reflux Valve Limit Switch delay timer is reset.
- Run light on local panel is de-energised and hours run meter is stopped.

ALARMS

The following alarms are initiated by the respective device:-

- "Soft starter Fault" by PLC from soft starter temperature high switch and displayed on local panel.
- "Low Flow Trip" initiated by the PLC when Reflux Valve Limit Switch delay timer expired and reflux valve limit switch does not make.
- "Pump protection trip" by PLC when "MPU" activated is displayed on local panel.
- "Wet Well High Level" alarm is initiated by PLC when multitrode is activated and transmitted to Oxley Creek via Telemetry. (suggested)
- "Pump Condition Low" alarm initiated by the PLC and transmitted to Oxley Creek via telemetry. (suggested)

STATUS INDICATION

The following status indication is mounted on the local panel

- "Ready to run in Auto" (for each pump) initiated whilst MPU not activated; emergency stop not activated, local control isolator closed and soft starter temperature is not high.
- "Pump running Light" is initiated as described under the start sequences.



EMSBY EQUIPMENT PTY. LTD.

A.C.N. 010 479 384

HEAD OFFICE
33 Achievement Crescent
Acacia Ridge Q 4110 Australia
P.O. Box 954
Archerfield Q 4108 Australia

Local Tel: (07) 274 2566
Int. Tel: (617) 274 2566
Local Fax: (07) 274 2387
Int. Fax: (617) 274 2387

INSTRUCTION MANUAL
FOR MIPAC
SOLID STATE
MOTOR STARTERS

EMSBY

**WARNING
HI-POT TESTING**

DO NOT HI-POT THE MIPAC STARTER
UNLESS ALL ELECTRONIC CIRCUITS
ARE FULLY ISOLATED. MAXIMUM HI-
POT VOLTAGE 2 KV.

TO HI-POT STARTER DISCONNECT ALL
CONTROL FUSES AND FIRING LEADS TO
THE THYRISTORS AND DISCONNECT
CONTROL WIRING PLUGS TO THE CA362
PCB.

EMSBY CANNOT ACCEPT WARRANTY
CLAIMS FOR DAMAGE CAUSED AS A
RESULT OF HI-POT TESTING.

EMSBY

INDEX

- 1. DESCRIPTION**
- 2. SPECIFICATIONS**
- 3. RECEIVING AND INSTALLATION**
- 4. START-UP**
- 5. DECELERATION RAMP OPTION**
- 6. TROUBLE SHOOTING**
- 7. SAMPLE INSPECTION PRE-START
AND START-UP CHECK SHEET**
- 8. DIAGRAMS**



1. DESCRIPTION

1.1 OVERVIEW

MIPAC type MPC Solid State Motor Starters contain 6 SCR's (Silicon Controlled Rectifiers), to control the current supplied to any 3 phase A.C. motor. The SCR's are connected in 3 back to back pairs, phase controlled over 180° of each cycle of power line frequency.

The MIPAC Starters utilise phase angle firing techniques for voltage control and use D.C. block firing to all SCR's to ensure consistent firing into highly inductive loads.

The MIPAC Starters are 3 wire connected to the motor and are continuously rated (i.e.) rated to the motor full load current or greater. The MIPAC Starters are rated at 500% overload for 30 seconds or 300% overload for 30 seconds, depending upon model selection and application.

1.2 STANDARD FEATURES

- Current Profile Starting Control System
- L.E.D. indication of all major starter conditions
- Internal control supply voltage 440/415 volt to 18 volt
- Common firing card and control cards for all sizes of starter
- Plug in connections for rapid removal of P.C. boards
- Integral phase rotation, starting phase failure protection, shorted SCR indication
- Heatsink overtemperature protection on MPC-60 and above
- Natural convection up to MPC-40 and forced air ventilation MPC-60 and above.
- "Up to Volts" relay output (1 N/O and 1 N/C contact rated 10 Amp 240VAC) for indicating when starter up to full volts.
- "Fault" relay output (1 N/O and 1 N/C contact based 10AMP 240VAC) to indicate starter fault.
- "Reset" button input for remote reset of starter fault relay.
- Motor overload input for shutdown of starter on motor protection operation.

1.3 OPTIONAL FEATURES

- Deceleration - Ramp Down for water hammer control.
- Tacho Feedback control for conveyors.



2. SPECIFICATIONS

2.1 ELECTRICAL

2.1.1 SUPPLY

Power

Three phase, 440 volt, 50Hz.

Control

Single phase, 50VA for fans. 120VAC or 240VAC depending upon voltage specified at time of order.

2.1.2 CONTROL

- .1 Operator devices to be supplied by customer
 - START/STOP push buttons for 3 wire control
 - Run contact or ON/OFF selector switch for 2 wire stop/start control.
 - Reset button for "Starter Fault" reset.
 - Motor Protection
- .2 Outputs available on control PCB CA362
 - "Up to Volts" relay, 2 contacts 1 N/O / 1 N/C 10AMP 240VAC rated.
 - "Starter Fault" relay, 2 contacts 1 N/O / 1 N/C 10AMP 240Volt rated.
- .3 Control voltage
 - A 120Volt or 240Volt AC for fan supply is required. An external fuse (4 AMP) supply is required to be connected to the Starter for fan supply.
 - If the fans are not required to operate continuously, the supply to the fans should be connected via a "Start Relay" contact to start fans only when starter is operating.
 - The "CA362" PCB provides the facility for using the "Up to Volts" relay as a fan "RUN ON" timer, when the Deceleration Ramp Down option is not used. The fan supply circuit can be connected via the "Up to Volts" contacts to switch the fan supply "OFF" 65 seconds after the starter has been shut down. FAN start up should be initiated by a customer supplied "START" relay, not by the "Up to Volts" contact, as this contact only closes after the starting ramp is completed.


EMSBY

2.1.3 POWER

Devices to be supplied by Customer

.1 Circuit breaker or 3 phase isolating switch

- **Short circuit protection:** This must be provided by the customer by means of a circuit breaker, sized according to the relevant Australian Standards and Electricity Supply Authority requirements. The customer should ensure that the interrupting capacity of the circuit breaker is higher than the short-circuit current available from the system. If not, HRC fuses should be placed in series with the circuit breaker. The MCB should be provided with a shunt trip facility to enable 3 phase isolation of the starter in the event of an emergency stop being required.
- **Isolating switch:** If a 3 phase isolating switch is used in preference to a circuit breaker, the isolating switch must always be used together with HRC fuses and series contactor.
- **The Mipac Starter** requires the correct standard phase rotation for the input power supply. The customer should ensure that power wiring to the input to the starter will provide this rotation.

2.1.4 PROTECTION

.1 Protection to be provided by Customer

The Starter is provided with protection as listed below. This protection is designed for the protection of the Starter. The Customer must provide any additional protection required to protect the motor to which the Starter is connected.

.2 Protection provided on Controller

- **Single phase protection:** The MIPAC will not operate if single phase is detected prior to switching on. If the Starter is operating when a single phase fault occurs, the MIPAC will stop.
- **Surge Protection:** The Controller is protected by large MOV's across each pair of SCR's.

EMSBY

2.1.4

PROTECTION

.2 Protection provided on Controller (Continued)

- Heatsink Overtemperature: Overtemperature switches are provided on the power stacks on Starters MPC-60 and larger to protect the controller against overheating.

The starter fault relay will trip if the Controller is subject to overheating. This relay will latch out on a starter fault and will require to be manually reset. The MIPAC Starter will not shut itself down on an overtemperature fault and the customer should incorporate the fault relay output contact into their starter trip or fault indication circuit. Any external reset facilities required are to be supplied by the Customer.


 EMSBY

3. RECEIVING AND INSTALLATION

3.1 LOCATION

The cabinet containing the MIPAC Starter must be installed in an area where the following conditions exist:-

- ambient temperature does not exceed 40°C (unless specified at time of order)
- ambient temperature is not less than 0°C
- altitude above sea level is 2000m or less
- ambient air is reasonably clean and dry. It must be free of flammable or combustible vapours, steam or corrosive gases.

The cabinet must be installed away from any heat source and a minimum clearance of 30 cm is required around the air inlet and outlet louvres on ventilated units. The MIPAC has been designed for 40°C ambient with 15° rise inside the enclosure as maximum. Air flow through any cubicles should ensure these temperatures are not exceeded when the Starter is working at maximum load. For details on the required cubicle air flows, contact EMSBY.

Do not stack one starter above another unless heat deflectors above the lower starter is provided. Failure to deflect the heat when starters are stacked may result in overtemperature malfunction of the starters.

3.2 DERATING DATA

When the unit is installed in poor environmental conditions, it must be derated as follows:-

- 1.5% per °C above 40°C
- 1% for every 100m above 2000m.

3.3 WIRING

The MIPAC Starter is to be connected according to the Australian Standards and other standards applicable in Customer's area.

The Customer is responsible for providing adequate short-circuit protection as described in Section 2.1.3.

EMSBY

3.4

POWER FACTOR CORRECTION CAPACITORS

Power factor correction capacitors can be used in conjunction with MIPAC Starters. However, capacitors must be added ahead of the starter. Never between starter and motor. To do so will cause serious damage to the starter and/or the motor.

EMSBY



4 . START-UP

CAUTION!

Equipment is at possibly lethal AC line voltage when AC power is connected. Pressing "STOP" pushbutton does not remove AC line voltage. All phases must be disconnected before it is safe to touch terminals or control equipment parts.

4.1 INSPECTION

- 4.1.1 Check the Starter is received in good condition with no damage to printed circuit boards or other physical damage visible.
- 4.1.2 Ensure that the Starter has been installed according to above guidelines and relevant drawings.
- 4.1.3 Ensure that the unit has been connected to external devices according to the schematics.
- 4.1.4 Check that all connections are tight.
- 4.1.5 Ensure that the Starter and connecting power cabling to and from the Starter has been checked and no faults exist.
- 4.1.6 Remove any temporary connections or earths from the Starter and motor load.

4.2 PRE-START ADJUSTMENTS

4.2.1 STARTER ADJUSTMENTS AVAILABLE

- 4.2.1 The following adjustments are provided in the CA362 Control PCB.


 EMSBY

Acceleration

- .1. Initial Current Setting - Potentiometer Setting
 - Fully anti-clockwise - 10% voltage output at switch on
 - Fully clockwise - 100% Voltage within 2 seconds at switch on
- .2. Ramp Time - Potentiometer Setting
 - Fully anti-clockwise - 100% output voltage within 2 seconds
 - Fully clockwise - 100% output voltage within 30 seconds
- .3. Maximum Current - Potentiometer Setting
 - Fully anti-clockwise - 110% Rated full load current
 - Fully clockwise - 500% Rated full load current
- 4.2.2 Deceleration Ramp for Water Hammer Control
 - Optional Feature

The following control feature can be enabled on the Standard CA362 PCB by factory modification. The deceleration mode has completely independent settings to the acceleration mode, as follows:-

See separate instructions on pages 15, 16, 17 and 18.

4.2.3 INITIAL CONTROL CARD CA362 SETTINGS

The CA362 Card is a combined voltage current limit control. To provide "Current Profile Starting, set the three potentiometers as follows:-

- .1 Turn "Ramp" Potentiometer to 12 o'clock position.
- .2 Turn "Initial Current" Potentiometer to 10 o'clock position.
- .3 Turn "Maximum Current" Potentiometer fully clockwise.

- 4.2.4 Prior to energising the Starter, check that the plug connector joining the control PCB CA362 to the H.V. Firing Card CA260 is fitting into the socket. A gentle pressure using the thumb will seat any connector which has worked loose during transit.


EMSBY

- 4.2.5 Also check the plug in connections for the external control wiring to the CA362 are seated into the sockets.
- 4.2.6 Check the control voltage is as per the control voltage specified and required for the fans (120 Volts AC or 240 Volts AC).
- 4.2.7 If the "Up to Volts" relay is being used for a "Fan Run On" timer, the RAMP DOWN potentiometer should be adjusted fully clockwise. This will delay the change over contact in the up to volts relay from changing state when the starter is switched off. By adjusting the RAMP DOWN potentiometer to fully clockwise, the opening of the "Up to Volts" contact will be delayed by 65 seconds. This "Fan Run On" feature cannot be used if the Deceleration Ramp Option is used.

4.3 ENERGISING THE STARTER

To check the Starter, a clamp-on ammeter and a voltmeter is required.

- 4.3.1 Set the three CA362 potentiometers as per Clause 4.2.3.
- 4.3.2 Energise the control voltage to the Starter. Check the input control volts on the fan input terminals are correct and note value of the control volts. Check the fans are operating (if fitted to the Starter).
- 4.3.3 Energise the 415 volt, 50 Hz, 3 phase supply to the input power terminals L1, L2 and L3. Check the 3 phase supply voltage phase to phase and phase to earth and note.
- 4.3.4 Check phase rotation of the incoming supply at the terminals of the Starter. The MIPAC starter is phase rotation sensitive and will not start if the incorrect phase position is applied to the power input terminals.
- 4.3.5 On the CA260 Firing Card, check the L.E.D. indication as follows:-
 - .1 Power +15V "ON".
 - .2 Phase rotation/loss "ON".
 - .3 SCR 1 and 4 healthy "ON".
 - .4 SCR 2 and 5 healthy "ON".
 - .5 SCR 3 and 6 healthy "ON".

Note: The SCR healthy L.E.D.'s will not illuminate with the motor disconnected.

- .6 "RELAY ON" L.E.D. "OFF".
- .7 All 6 SCR Gate L.E.D.'s "OFF".

See EMSBY Drawing EM032F01 enclosed for location of CA260 PCB LED's and start relay.


EMSBY

4.3 ENERGISING THE STARTER (Continued)

4.3.6 For Starters fitted with CA362 Control Card:

Close customer "START" contacts on the CA362 Card and note if the motor begins to turn (see **EMSBY** Drawing M-3010-C for PCB CA362 card connection details). If the motor does not turn:-

- .1 Check the "RELAY ON" LED on the CA260 Card is illuminated. If this LED is not illuminated, check the input start signal to the CA362 PCB. The "RELAY ON" LED will be illuminated if the input start signal is healthy.
- .2 If the "RELAY ON" LED is illuminated and the motor does not turn, increase the INITIAL CURRENT POTENTIOMETER clockwise as soon as possible to increase the initial voltage applied to the motor. The clamp on an ammeter or chart recorder should be used to check the initial starting current. If the motor start up is too abrupt, turn the INITIAL CURRENT POTENTIOMETER anti-clockwise to reduce the voltage applied to the motor.
- .3 With the motor starting and rotating satisfactorily, increase or decrease the acceleration "RAMP" Potentiometer to obtain the required acceleration time period. To increase the "RAMP" time, turn the potentiometer clockwise. To reduce the acceleration period, turn the RAMP Potentiometer anti-clockwise.

The CA362 PCB is provided with a DOT Graph Display for Ramp Status Indication. By observing this LED display, the time for the starter to ramp to full volts can be observed.

- .4 If it is required to minimise the maximum starting current during acceleration, the "MAX CURRENT" potentiometer can be used. This potentiometer will limit the maximum current drawn by the motor, during starting. To reduce the maximum current drawn by the motor, turn the MAX CURRENT potentiometer anti-clockwise until the maximum current required during starting, is obtained.

When the "MAX CURRENT" potentiometer is used and the Starter is in current limit, the ramp time set by the "RAMP" potentiometer will be over-ridden by the current limit setting when the motor reaches the current set by the "MAX CURRENT" potentiometer. The motor at this point accelerates under current limit control.


EMSBY

Caution must be used when utilising the "MAX CURRENT" settings as the motor may stall if the current limit is set too low. Ensure the maximum current setting is set correctly to allow sufficient torque to accelerate the motor to overcome the worst load condition.

- .5 With the CA362 card settings providing a smooth controlled acceleration check the Ramp Indication DOT GRAPH on the CA362 is indicating the ramp complete. At the top of ramp the relay RLY2 should change state 1 to 6 seconds after the starter is up to full volts and the ramp complete LED illuminated.

- 4.3.6
- If the acceleration times selected are long, thermal overload settings and fuse ratings may require adjustment.
 - If the motor shudders at approximately 3/4 speed, this may be an indication the acceleration time is too long - reduce the "RAMP" time.

4.3.7 Motor Running Checks

- .1 With the motor running, check the following L.E.D.'s:-
 - 1) 6 SCR Gates "ON"
 - 2) SCR 1 and 4 healthy "OFF"
 - 3) SCR 2 and 5 healthy "OFF"
 - 4) SCR 3 and 6 healthy "OFF"
 - 5) Relay on "ON"
 - 6) Phase Rotation/Loss "ON".
 - 7) Ramp Complete
- .2 Check the motor running current on all 3 phases is within FLC of the starter.
- .3 Check the input phase voltages to starter with motor running (Note: Variation in phase voltage can lead to motor current imbalance).
- .4 Check the voltage drop across the 3 SCR heat sink stacks. Voltage drop readings of 0.9 volts to 2 volts can be expected. Higher voltage drops may indicate the SCR is not firing open fully.
- .5 Shut down the starter and re-check the L.E.D.'s as listed under 4.3.5 above, are illuminated.
- .6 Check the RAMP INDICATION DOT Graph Display has extinguished and the "Up to Volts" relay has changed state and the "Ramp Complete" LED extinguished.



5. DECELERATION RAMP OPTION

The Deceleration Ramp Option on the CA 362 MIPAC Control PCB is designed for use with Centrifugal Pumps driven by standard AC single speed squirrel cage motors. The CA 362 potentiometers provide for independent adjustment of the motor voltage on shutdown.

Two adjustments are provided for setting the deceleration ramp which are:-

.1 RAMP DOWN POTENTIOMETER

- | | |
|------------------------|--|
| - Fully Anti-Clockwise | - Total deceleration within 2 seconds |
| - Fully Clockwise | - Total deceleration within 65 seconds |

.2 VOLTAGE CUT-OFF POTENTIOMETER

- | | |
|------------------------|--|
| - Fully Anti-Clockwise | - Up to volts relay drops off at 10% voltage output |
| - Fully Clockwise | - Up to volts relay drops off at 70% voltage output. |

These settings are shown in Figure 1 below.

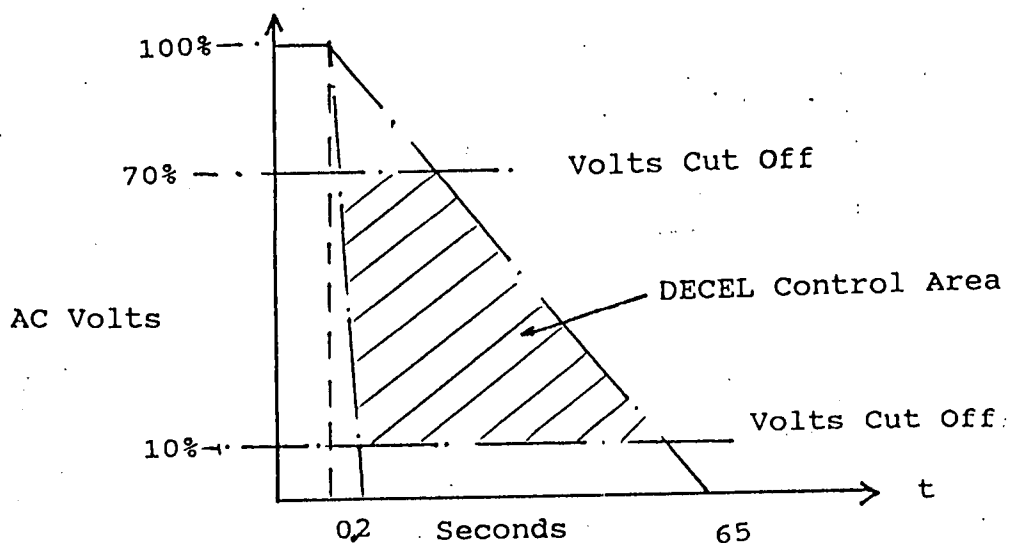


Figure 1



To obtain the optimum settings, the following procedure should be adopted:

Initial Setting

- .3 Set the volts cut-off potentiometer fully anti-clockwise (i.e. at 10% volts).
- .4 Set the Ramp Down potentiometer at mid-span (12 o'clock). This will set the deceleration profile as shown in Figure 2.

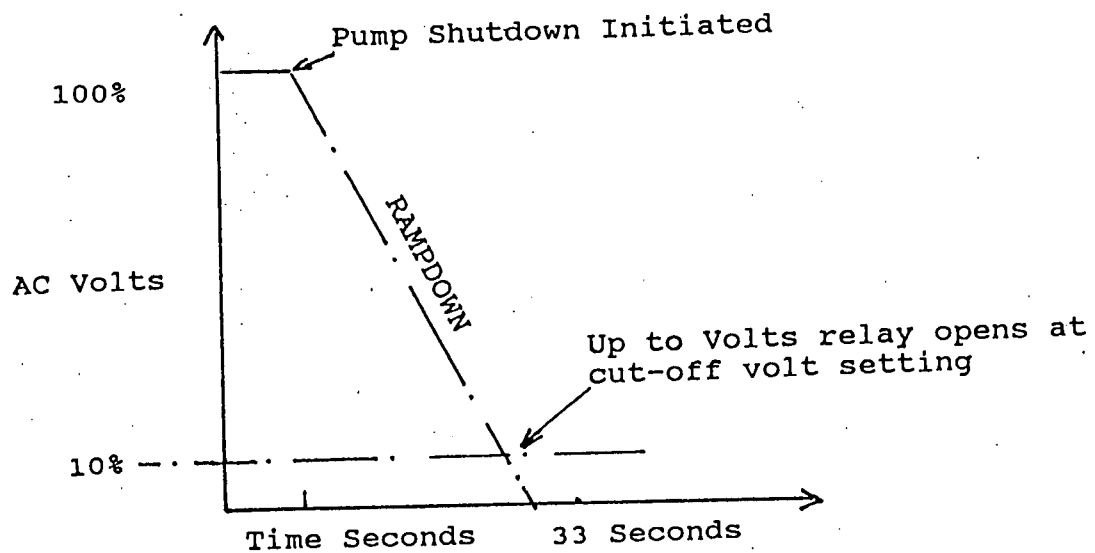


Figure 2

- .5 Operate the pump and initiate a shut down. By observing the Ramp Indication Bar Graph on the CA362 PCB and by listening to the reflux valve, determine the time from shutdown initiation until when the reflux valve is closed.

If the valve closes quietly and the motor continues to run on with the pump cavitating, this indicates that the slope of the Ramp Down setting is correct but that the time to ramp down to 10% volts is too long. See Figure 3 below.

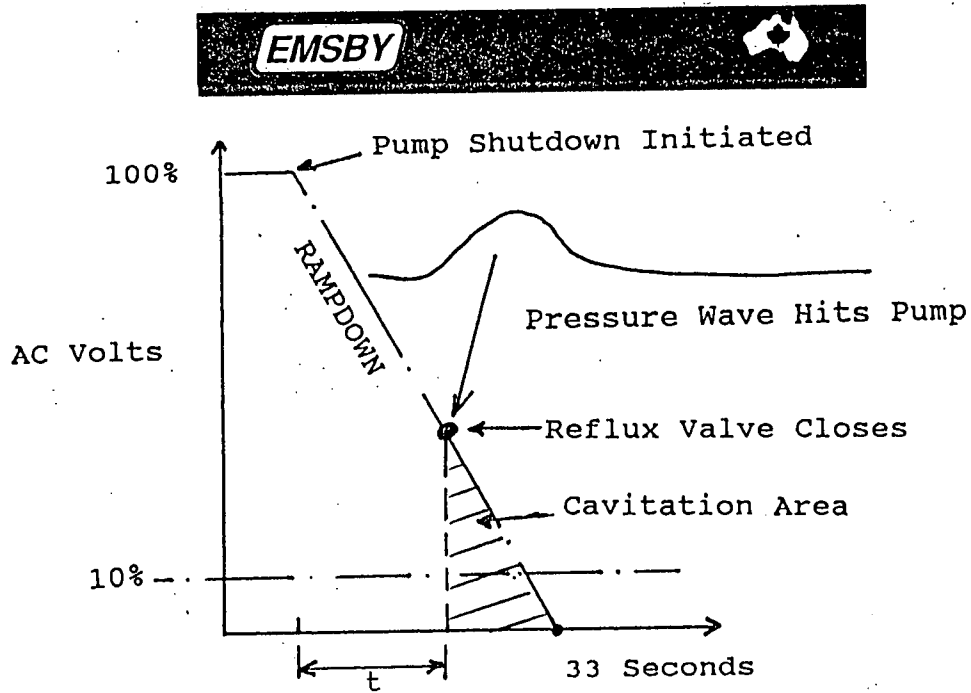


Figure 3

- .6 If the valve "bangs" closed, this indicates that the slope of the Ramp Down is too steep and the Ramp Down setting should be increased until the valve closes quietly. See Figure 4 below.

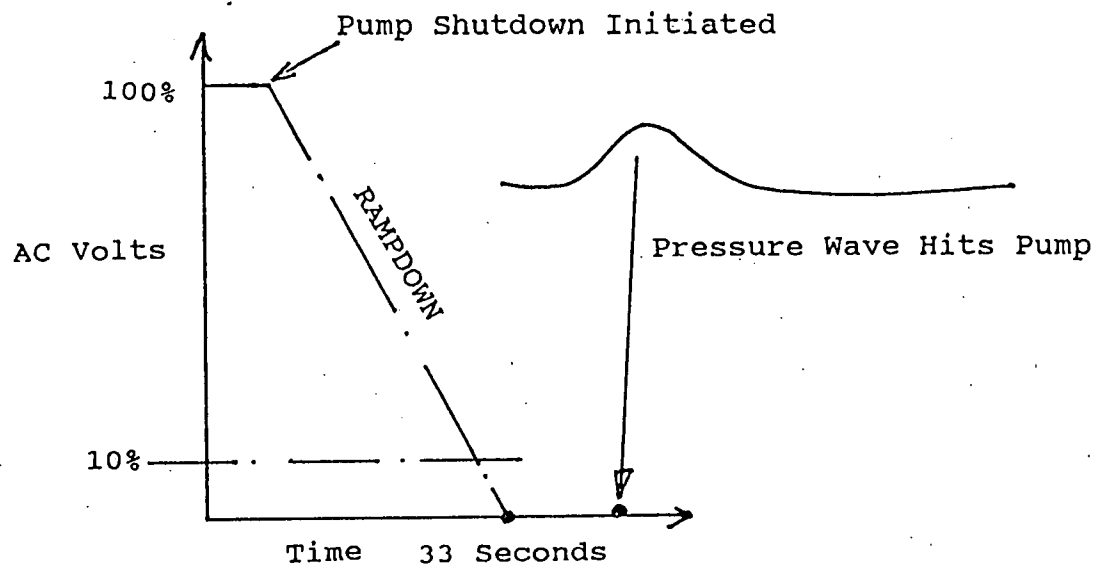


Figure 4


 EMSBY

- .7 If the motor/pump starts to "oscillate" or "hunt" indicating an unstable deceleration situation, the Ramp Down time setting is too long. Reduce the time setting on the Ramp Down potentiometer. By adjusting the Ramp Down time setting, should enable the correct voltage slope to be determined. In some hydraulic conditions there can be some inherent instability in ramp down which cannot be eliminated. The ramp down adjustments should be set to keep this instability to a minimum. This instability should not effect the ability of the starter to close down the reflux valve quietly
- .8 When the reflux valve is closing quietly, the volts cut-off potentiometer can then be adjusted as necessary to reduce the motor "run on" time after the valve has closed. Reset the cut-off volts to approximately 12 o'clock position. (This setting will set the voltage at which the up to volts relay RLY-2 contact across terminals UV2 and UV3 will open. This contact should be wired into the shutdown circuit of the series contactor installed in front of the starter). When the pump stop is initiated and the motor ramps down the reflux valve should close as previously. If the cut-off volts are set correctly, the relay RLY2 should now shut off power to the Starter 1 to 5 seconds after the valve has closed.

If the cut-off volts is set too high, the Starter will be shut down before the required voltage to control the pressure wave is reached and the valve will "bang" closed. Readjust the cut-off volts. If the cut-off volts are set too low, the motor will "run on" and the pump cavitate after the reflux valve has closed.

The cut-off volts should be adjusted until the valve closes quietly and the supply to the starter shut off 1 to 5 seconds after the valve has shut.


 EMSBY

6. TROUBLE SHOOTING ON THE MIPAC SOLID STATE MOTOR STARTER

6.1 DURING COMMISSIONING

<u>Problem</u>	<u>Check</u>	<u>Action</u>
.1 Starter will not start	Phase ROT/FAIL LED on CA260 Card	If not illuminated, change incoming phase rotation. Starter will lock out if incoming phase rotation incorrect. Check phase voltages are equal.
.2 Starter will not start	A link or normally closed contact is applied between terminals 3 and 4 on the CA362 Control Card - Customer Terminals	Ensure N/C contact on protection used or solid link across terminals 3 and 4 is applied on the CA362 Card. (Dwg.M-3010-C enclosed).
.3 Starter will not start	Relay "ON" LED illuminated on CA260 Card	If not illuminated, ensure "Close" signal is applied to start terminals on the CA362 Card.
.4 Starter will not start	Relay "RLYI" has operated. If relay has operated the fault LED will be illuminated.	Check connections from Temp switches (3) switches, 1 switch per phase. All should be N/C if healthy.


 EMSBY


<u>Problem</u>	<u>Check</u>	<u>Action</u>
.5 Starter will not start	Power +15v LED illuminated	<p>If not illuminated, check control fuses feeding synchronising transformer TX2.</p> <p>Check 415 volts available on all 3 input phases of TX2.</p> <p>Check voltage on output of synchronising transformer on CA362 terminals 1,2,3 to terminal 4. Should be 18 to 22VAC.</p>
.6 Motor turns in wrong direction		Change any two phases on motor side of Starter. <u>Do not change incoming supply to Starter.</u>
.7 Motor does not move	Initial current potentiometer is set as per the commissioning instructions	If motor does not accelerate, increase initial current potentiometer clockwise.
.8 Motor accelerates slowly but shudders	Ramp Time Potentiometer is set as per the commissioning instructions	Reduce Ramp Potentiometer anti-clockwise to speed up acceleration.
.9 Motor accelerates but starts to stall after accelerating	Maximum current potentiometer is set as per commissioning instructions	Increase maximum current setting by turning potentiometer clockwise.


 EMSBY

6.2 AFTER BEING IN SERVICE

<u>Condition</u>	<u>Check</u>	<u>Action</u>
.1 Starter will not start	Check relay "ON" LED	Check "START" contacts are making all "STOP" buttons and LOCKOUTS are released. Check any motor protection is reset and N/C contact is made across terminals 3 and 4 on CA362 customer terminals.
.2 Starter will not start	Check Phase ROT/LOSS LED	Check all 440 volt supply fuses are healthy and 440 volts is available to Starter.
.3 Starter will not start	Check if relay RLYI is energised. Fault LED will be illuminated.	Check temperature of cubicle. The temperature switches (1 per phase) will trip when the heat sink temperature reaches 85°C.
.4 Motor current is unbalanced	Supply volts to Starter are equal on all phases (a 2% unbalance in phase voltages can result in up to 20% phase current imbalance).	Check contactor or breaker contacts feeding Starter. Check Main busbar volts

The logo for EMSBY, featuring the word "EMSBY" in a bold, sans-serif font inside a dark rectangular box. To the right of the text is a small, stylized graphic of a flower or star.

6.2 Continued

<u>Condition</u>	<u>Check</u>	<u>Action</u>
.5 Motor current is unbalanced	SCR's on Starter. Check each SCR is firing open when motor up to speed	Measure voltage drop across each SCR. Should be 1.0 volts to 2.0 volts when SCR firing wide open. Check all 6 SCR's. Check firing cables to each SCR. Ensure terminals on CA260 Card are tight. Ensure connections to SCR's are fitted tight on to the lugs. Check no foreign material (eg. aluminium labels) have shorted out SCR connections at SCR.


 EMSBY

7. SAMPLE INSPECTION, PRE-START AND START-UP CHECK SHEET

7.1 INSPECTION

- | | | |
|-------|---|--------|
| 7.1.1 | Starter received in good condition | Yes/No |
| | No loose wires | Yes/No |
| | No breakage to PCB's | Yes/No |
| | Other damage | Yes/No |
| 7.1.2 | Starter installed in cubicle in accordance with manual guidelines | Yes/No |
| 7.1.3 | Starter connected to external devices as per schematics | Yes/No |
| 7.1.4 | All external connections checked tight | Yes/No |
| 7.1.5 | Power cabling into and from Starter installed and checked (connections at line and load end tight etc.) | Yes/No |
| 7.1.6 | All temporary earths and connections removed | Yes/No |

7.2 PRE-START CHECKS

- | | | |
|-------|--|--------|
| 7.2.1 | All CA362 initial settings as per Manual | Yes/No |
| 7.2.2 | PCB plug connections seated correctly | Yes/No |
| 7.2.3 | Control voltage for fans is correct and fused (Control volts - 120 volt or 240VAC as specified in the order) | Yes/No |

7.3 COMMISSIONING CHECKS

(If the Starter is connected to the motor, load tests are only to be carried out in conjunction with the Operations Supervisor).

- | | | |
|-------|---|--------|
| 7.3.1 | Check fan control voltage at starter terminals
_____ Volts AC | |
| 7.3.2 | Check power supply voltage at terminals L1, L2, L3
Check L1-L2 = _____ volts L1-E = _____ volts
L1-L3 = _____ volts L2-E = _____ volts
L2-L3 = _____ volts L3-E = _____ volts | |
| 7.3.3 | Check LED's as listed in the manual are illuminated | Yes/No |



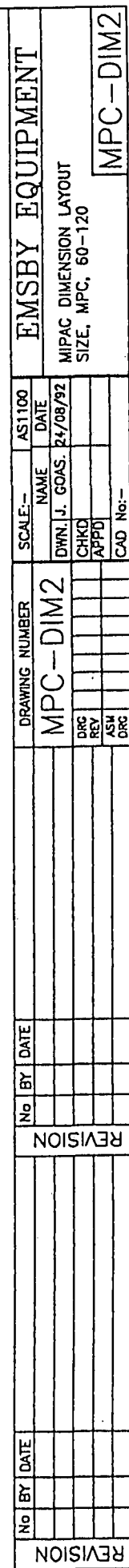
- | | | |
|-------|--|--------|
| 7.3.5 | Check power stack fans running | Yes/No |
| 7.3.6 | Initiate Start - LED "RELAY ON" illuminated | Yes/No |
| | - LED "SCR's ON" illuminated | Yes/No |
| | - "RAMP ACCELERATION" DOT GRAPH illuminated. | Yes/No |
| | - "UP TO VOLTS" LED illuminated at top of ramp | Yes/No |
| 7.3.7 | Check that output phase currents are balanced | Yes/No |
| | A Phase _____ amps | |
| | B Phase _____ amps | |
| | C Phase _____ amps | |
| 7.3.8 | Check voltage drop across each power stack phase | |
| | A Phase _____ volts | |
| | B Phase _____ volts | |
| | C Phase _____ volts | |
| 7.3.9 | Initiate Stop - LED "RELAY ON" extinguished | Yes/No |
| | - LED's "SCR ON" extinguished | Yes/No |
| | - "RAMP ACCELERATION" DOT GRAPH extinguished | Yes/No |
| | - "UP TO VOLTS" LED extinguished | Yes/No |

The above check list is a guide to assist in the checking of the MIPAC Starter prior to energising. The Customer is responsible for ensuring the above check list is applicable to his application. EMSBY cannot accept any liability for errors or omissions in the above typical check list.



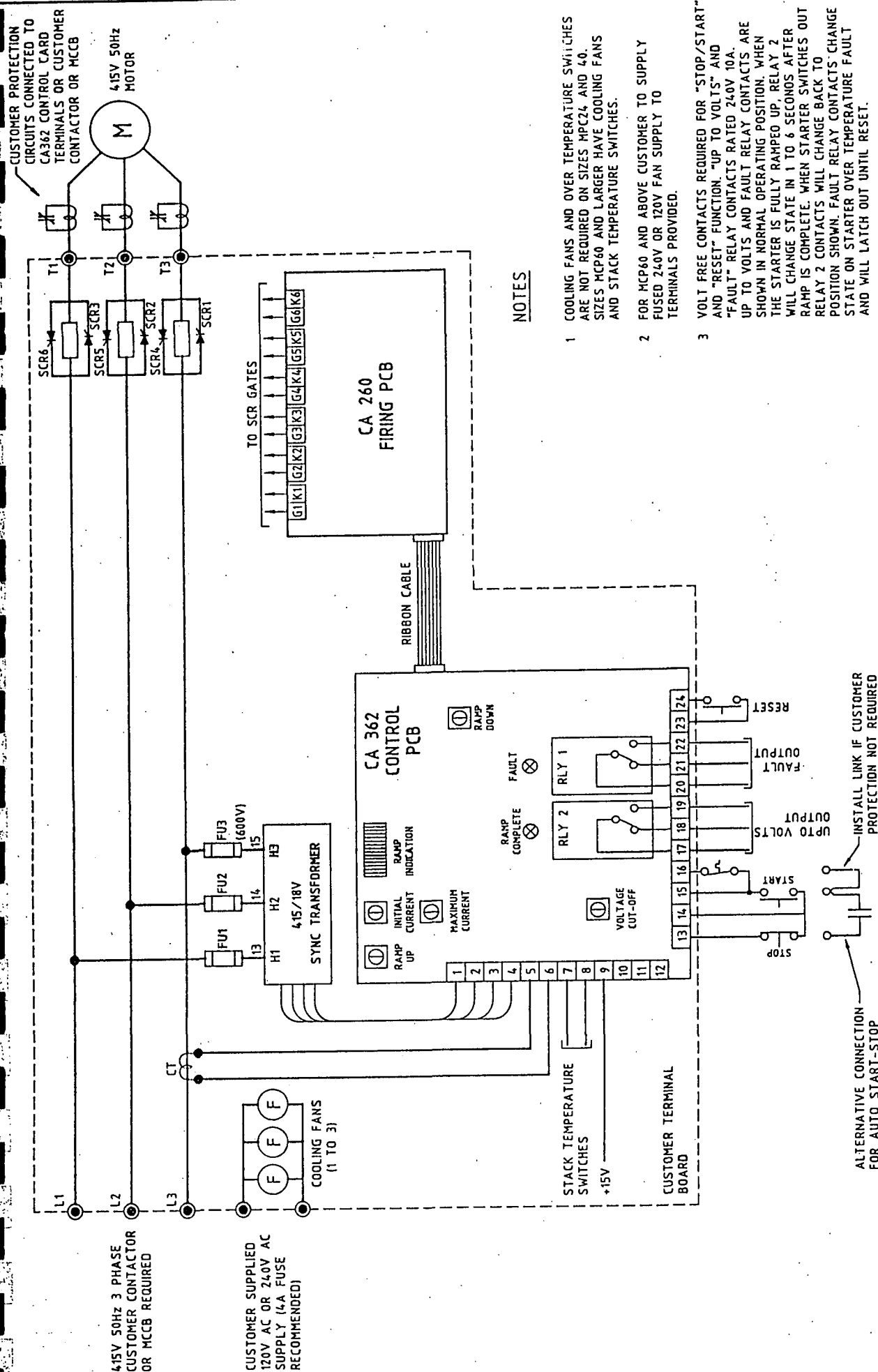
8 DIAGRAMS

REDUCED VOLTAGE MOTOR STARTERS TYPE MIPAC




*** CONSULT FACTORY**

Page 41 of 60




- 1 COOLING FANS AND OVER TEMPERATURE SWITCHES ARE NOT REQUIRED ON SIZES MCP24 AND 40. SIZES MCP40 AND LARGER HAVE COOLING FANS AND STACK TEMPERATURE SWITCHES.
- 2 FOR MCP40 AND ABOVE CUSTOMER TO SUPPLY FUSED 240V OR 120V FAN SUPPLY TO TERMINALS PROVIDED.
- 3 VOLT FREE CONTACTS REQUIRED FOR "STOP/START" AND "RESET" FUNCTION. "UP TO VOLTS" AND "FAULT" RELAY CONTACTS RATED 240V 10A. UP TO VOLTS AND FAULT RELAY CONTACTS ARE SHOWN IN NORMAL OPERATING POSITION. WHEN THE STARTER IS FULLY RAMPED UP, RELAY 2 WILL CHANGE STATE IN 1 TO 6 SECONDS AFTER RAMP IS COMPLETE. WHEN STARTER SWITCHES OUT RELAY 2 CONTACTS WILL CHANGE BACK TO POSITION SHOWN. FAULT RELAY CONTACTS' CHANGE STATE ON LATCH OUT OVER TEMPERATURE FAULT AND WILL LATCH OUT UNTIL RESET.

REV.	DESCRIPTION	DATE	REV.	DESCRIPTION	DATE



EMSBY
EQUIPMENT PTY. LTD.
A/C N 070 678 304

33 Alchemercent Centre
Alchemer Ridge, Ont. M1S
PO Box 100
Alchemer, Ont. L0B
Fax: (505) 274 2387



33 Alchemercent Centre
Alchemer Ridge, Ont. M1S
PO Box 100
Alchemer, Ont. L0B
Fax: (505) 274 2387

TITLE

SOLID STATE STARTER

MIPAC TYPE MPC 11 kW to 750 kW

TYPICAL CONNECTION DIAGRAM - STANDARD STARTER

DRAWING	M W	DATE	29 - 8 - 92	SCALE	N.T.S.
DRAWING No. EM 031 A01				REV. CUSTOMER	

LEGEND

RLY 3 START RELAY

⊗ R LED - RED

⊗ W LED - WHITE

PT PULSE TRANSFORMER

① POWER LED

— ILLUMINATED WHEN 18 VOLTS
CONTROL POWER HEALTHY

② RELAY "ON" LED

— ILLUMINATED WHEN START
SIGNAL RECEIVED

③

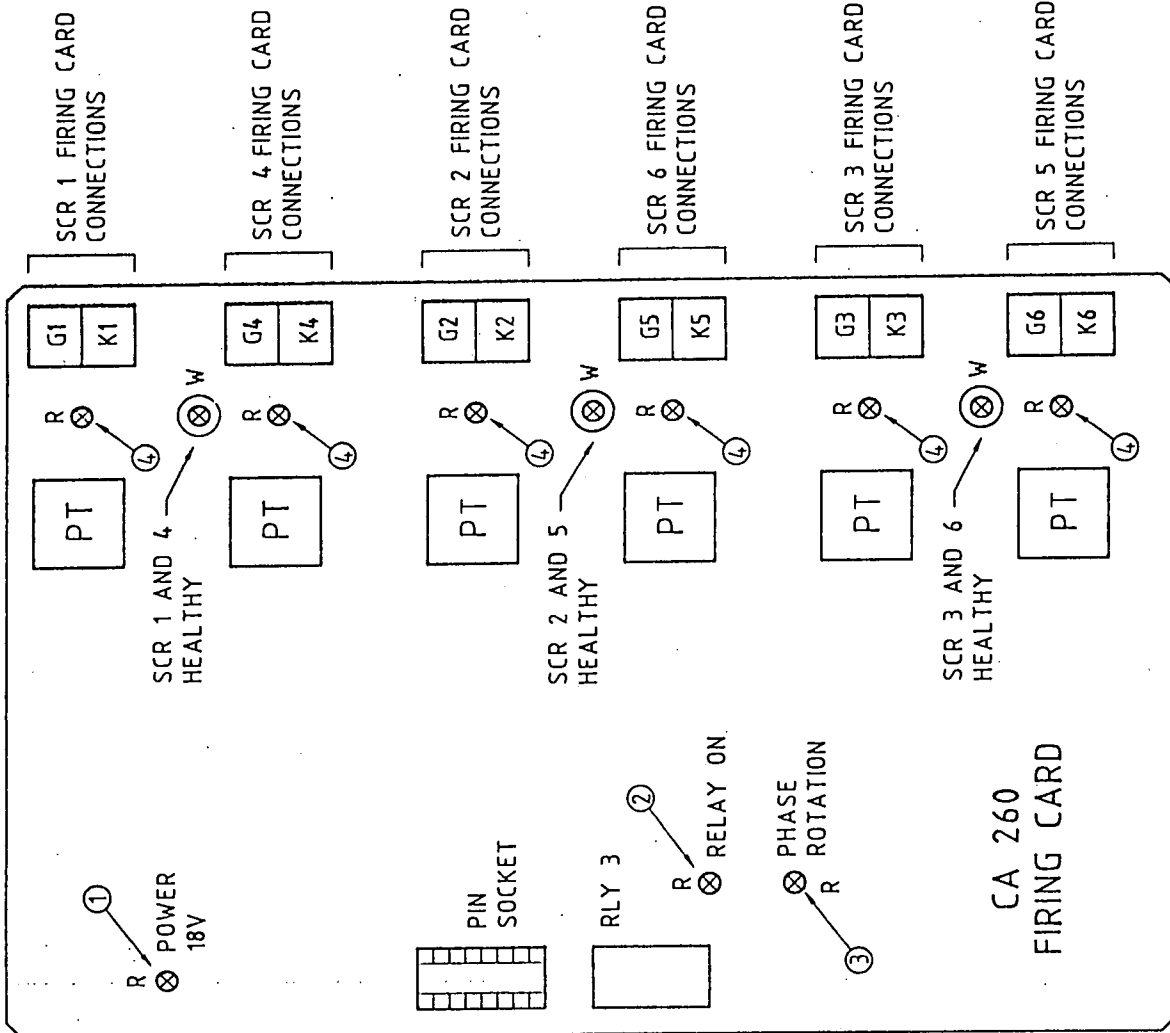
— ILLUMINATED WHEN CORRECT
PHASE ROTATION APPLIED TO
INPUT POWER TERMINALS OF
STARTER

④

SCR FIRING LED

— ILLUMINATED WHEN SCR'S FIRING

SCR HEALTHY LED

— ILLUMINATED WHEN STARTER
SHUT DOWN AND SCR'S
HEALTHY. WILL NOT OPERATE
IF CONTACTOR IS LOCATED ON
THE OUTPUT OF STARTER

EMSBY
EMSBY EQUIPMENT PTY. LTD.
A.C.N. 070 079 364
33 Ashmeade Cres.
Avalon Park, Qld 4110
Australia, Oz 4108

tel 071-274 2546
fax 071-274 2760

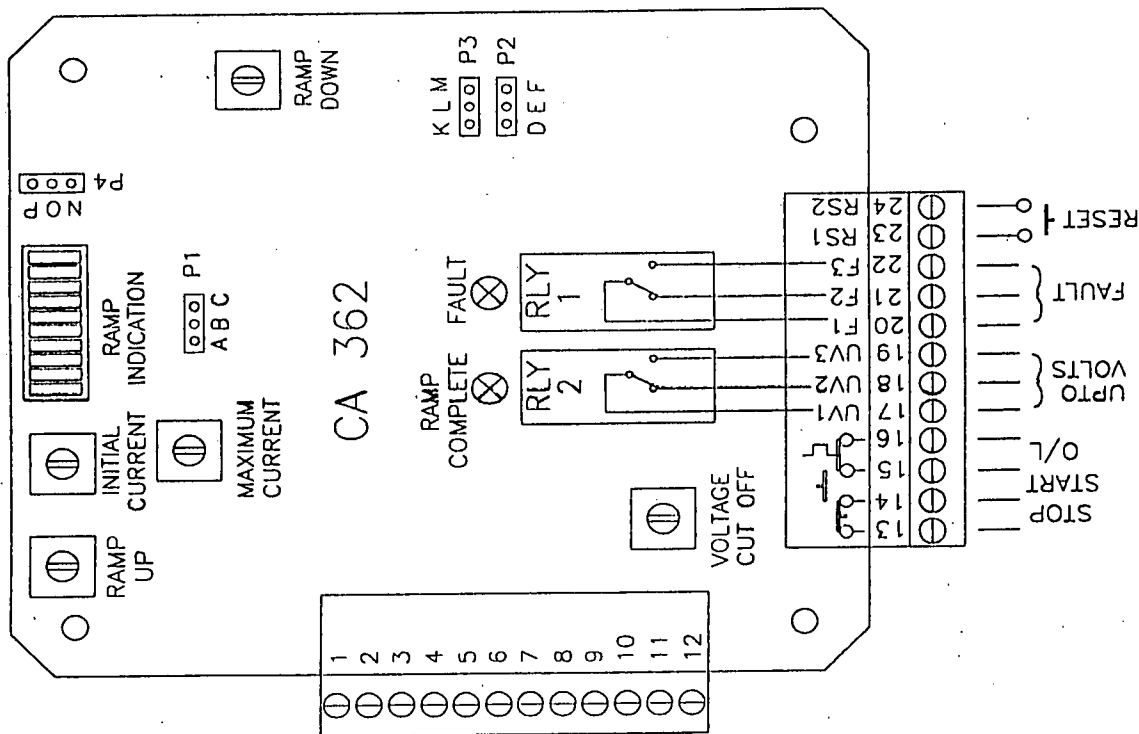
REV.	DESCRIPTION	DATE	REV.	DESCRIPTION	DATE

TITLE MIPAC TYPE MPC SOLID STATE STARTER
CA 260 FIRING CARD PHYSICAL LAYOUT

DRAWN M/W **DATE** 29-8-92 **SCALE** N.T.S.

DRAWING No. EM 032 F01 **REV** 0 **CUSTOMER**

M-3010-C



LEGEND

- STOP. REMOTE STOP INPUT
- START. REMOTE START INPUT
- O/L. THERMAL OVERLOAD INPUT (INSTALL LINK IF NOT USED)
- UV1. UP TO VOLTS RELAY, COMMON
- UV2. UP TO VOLTS RELAY N/C CONTACTS
- UV3. UP TO VOLTS RELAY N/O CONTACTS
- F1. FAULT RELAY, COMMON
- F2. FAULT RELAY N/C CONTACTS
- F3. FAULT RELAY N/O CONTACTS
- RS1,RS2. FAULT RELAY RESET
- RLY1. FAULT RELAY
- RLY2. UP TO VOLTS RELAY

REVISION		No	BY	DATE	No		BY	DATE	DRAWING NUMBER		SCALE:--		AST100		DATE		EMSBY EQUIPMENT LTD.	
										M-3010-C								
																	</	

Phase Balance Relay

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

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

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

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

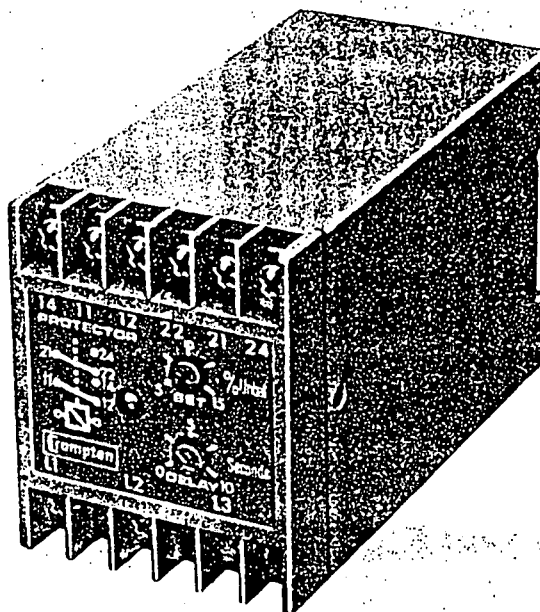
The phase unbalance feature protects motors of any size, from full-load to no-load, against excessive temperature rise due to unbalanced supplies, e.g. a 10% unbalanced supply can increase the temperature rise by 150%. In addition, this also protects against the phantom voltage generated during a single phase failure when running at low load.

Principle of Operation

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

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

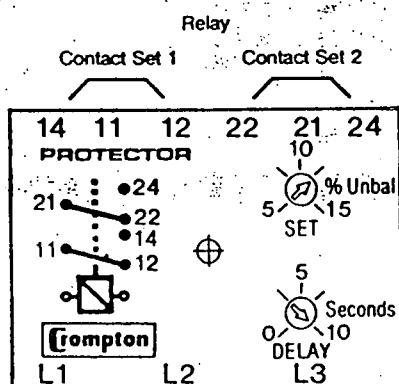
The relay and LED will automatically energise again when all the supply parameters have returned to safe and acceptable limits.



Specification

Type No:	252-PSFW. Phase loss and unbalance only 252-PSGW. Phase loss, unbalance and undervoltage.
Input System:	3 phase, 3 or 4 wire, 50 or 60Hz (specify)
Voltage Ratings:	100-125V, 200-250V or 380-450V (nominal voltage to be specified when ordering)
Burden:	3VA
Voltage Withstand:	1.2 times continuous 1.5 times for 10 x 10s To B.S. 6253
Set Points	
Unbalance:	Adjustable 5% to 15%
Time Delay:	200ms to 10s adjustable (not operative if voltage falls below 70% of nominal or set point or type 252-PSGW)
Under Voltage:	Internally reset at - 15%
(Type 252-PSGW only):	nominal voltage (other values between - 10% and - 30% available on request)
Output Relay	
Type:	DP changeover
Rating ac:	240V, 5A non-inductive
dc:	24V, 5A resistive
Operations:	2 x 10 ⁵ at above load
Reset:	Automatic
Weight:	Approx. 0.3kg

Connection Diagram



Note: Neutral connection not required.

Paladin Watt & Var Transducers

Specification

For general details, see publication SW 250T.

Input

Input voltage: 100-120V, 200-250V,
380-450V, 600V.
Specify exact voltage.

Voltage range: $\pm 20\%$ (0 - 120% with
auxilliary supply).

Input current: 1A, 5A for C.T. out-
puts. 0.2A to 10A
direct connected.

Current range: 0-125%

Frequency: 50Hz, 60Hz.

Voltage burden: 4VA.

Current burden: 1VA.

Power factor
range: watts: 0.1 lag to 0.1 lead
vars: 0.9 lag to 0.9 lead

Output

Nominal d.c. output/load resistance.

mA	0-1	0-5	0-10	0-20	4-20
k Ω	10	2	1	0.5	0.5

Accuracy range: 0-125%

Ripple (peak to
peak): 0.5% at full load
output.

General

Accuracy class: 0.5.

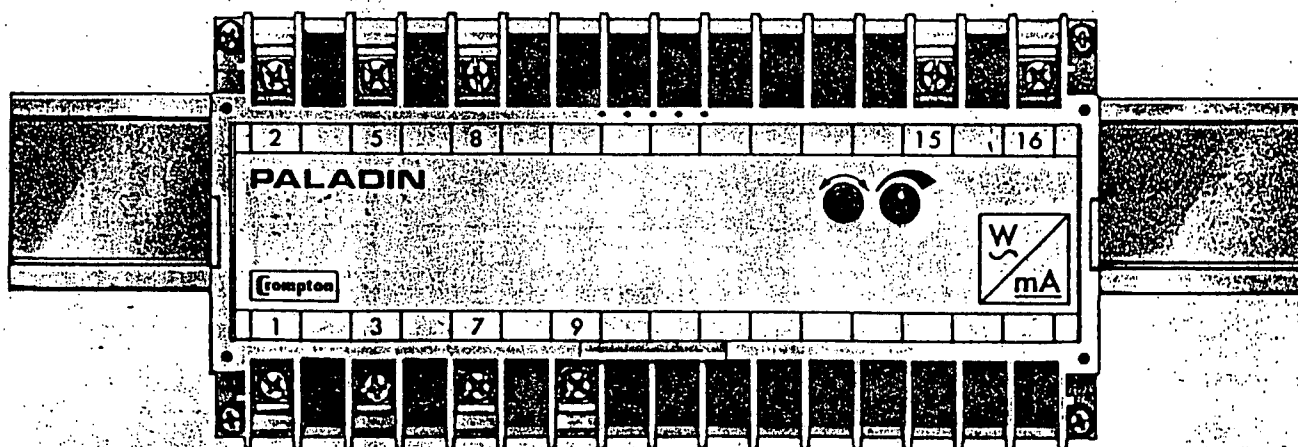
Response time: 0-99% in
300ms.

Temperature coefficient: $\pm 0.03\%/^{\circ}\text{C}$.

Frequency coefficient: $\pm 0.05\%/ \text{Hz}$.

Approx. weight: 1 kg.

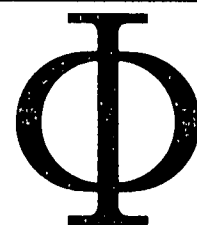
Type Numbers	Balanced Load			Unbalanced Load	
SYSTEM	Single Phase	3 Phase 3 Wire	3 Phase 4 Wire	3 Phase 3 Wire	3 Phase 4 Wire
WATTS	256-TWKW	256-TWLW	256-TWHW	256-TWMW	256-TWNW
VARs	256-TXKW	256-TXGW	256-TXHW	256-TXMW	256-TXNW



Model 256-TWMW 3 Phase 3 Wire unbalanced load Paladin
watts transducer mounted on a 35mm symmetrical rail.

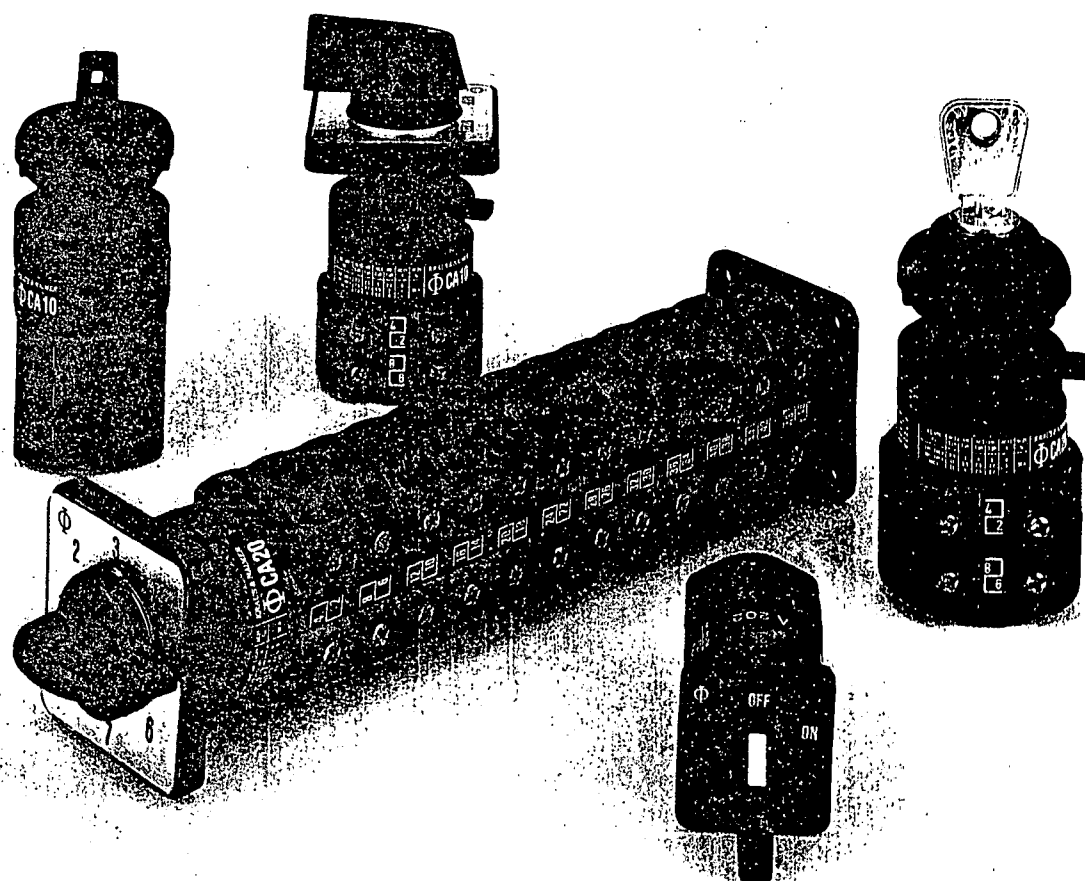
KRAUS & NAIMER

BLUE LINE SWITCHGEAR

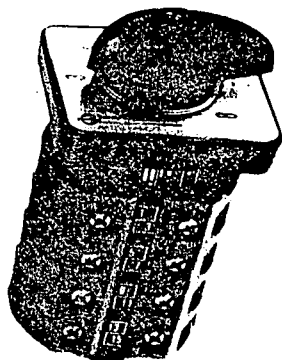


Switch Types

CA4, CA10, CA11, CA20, CA10B, CA11B, CA20B



-
- compact design with the smallest escutcheon plate size of 30 x 30 mm (1.181" x 1.181")
 - finger-proof acc. 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 capability
 - contacts with gold plating (switch type CA4)
-



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 AC1, AC3 and AC23 and the obviously unlimited number of switch developments are characteristic for the CA switches.

CA switches of this series are supplied with open terminals and protected against accidental finger contact in accordance with VDE 0106, section 100 (VBG 4). Captive plus-minus terminal screws and integrated screwdriver guides facilitate wiring.

The CA4 switches offer maximum space saving benefits. CA4 switch in E mounting 1 stage long and 2 contacts fits into 0 x 30 x 30 mm cubicle. The additional length of any further stage is 8 mm. CA4 contacts are supplied standard with gold plating of 1 μ .

Single hole mounting according to EN 50007 with protection IP 65 is suitable for either 16 or 22 and 22 or 30 mm diameter holes and is available with key operator, if required.

Switching angle of CA switches may be 30°, 45°, 60° or 90°. Switch type CA 4 is available with up to 18 contacts. CA 10, CA 11 and CA 20 switches are available with up to 24 contacts.

wide range of optional extras and enclosures is available.

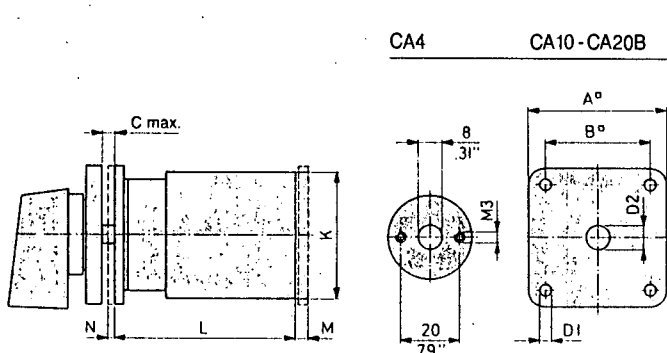
Our order should include the following data:

1. Switch type (selection according to the following tables)
2. Switching program (order a prescribed form for special programs)
3. Mounting type
 - a. Escutcheon plate
 - b. Handle
 - c. Optional extras

SWITCH TYPES				ESSENTIAL MOUNTING								
Nominal voltage IEC/VDE/BS UL/CSA SEV CEE 24	Main switch characteristic Isolator conditions are met up to:	Thermal current I _{th} IEC/VDE/BS UL/CSA SEV	Nominal current I _n AC 21 IEC/VDE/BS AC 1 SEV AC 11 IEC/VDE UL/CSA Pilot Duty — Contact Rating Code Ampere Rating CEE 24 Resistive/Motor load	CA4 CA10 CA10B CA11B CA20B	for			Panel mounting CA4 CA10 CA11 CA20 CA10B CA11B CA20B with shaft seal				
					Code	IP front	type					
V	V	V	V	500 300 380 380	660 660 660 380	660 660 660 380	660 660 660 380	E EF	40 65	CA4 CA10 CA11 CA20 CA10B CA11B CA20B	Panel mounting	
V	V	V	V	250	380	380	380					
A	A	A	A	10 10 10	20 16 16	20 16 16	32 30 25	VE	40	CA10 CA11 CA20 CA10B CA11B CA20B	Base mounting	
A	A	A	A	10 10 2,5 1,5	20 16 6 4	20 16 6 4	32 30 8 5					
A	A	A	A	A300	A300	A600	A600					
A	A	A	A	10	16	16	30					
A	A	A	A	4	10	10	16					
A	A	A	A	2	7	7	10					
AC 2	220-240 V 380-440 V 3 pole	220 V 380 V 440 V 3 pole	2,5 4,5 5,5 6,6	4 7,5 10 10	4 7,5 10 10	4 7,5 10 10	5,5 11 15 13	FS1	65	CA4	Single hole mounting combined with 16 and 22 mm without escutcheon plate	
AC 3	220-240 V 380-440 V 3 pole	220 V 380 V 440 V 3 pole	1,5 2,2 3 3	3 5,5 5,5 5,5	3 5,5 5,5 5,5	3 5,5 5,5 5,5	4 7,5 7,5 7,5	FS2	65	CA4	with escutcheon plate 30 x 30 mm	
AC 23	110 V 220 V 380-440 V 3 pole	110 V 220 V 380 V 440 V 3 pole	0,3 0,55 0,75 1,1	0,6 2,2 2,2 3,7	0,6 2,2 2,2 3,7	0,6 2,2 2,2 3,7	1,5 3 3,7 5,5	FS4	65		with escutcheon plate 30 x 39 mm	
UL/CSA	120 V 240 V 480-600 V 3 pole	120 V 240 V 480 V 600 V 3 pole	0,37 0,75 1,1 1,1	0,75 2,5 2,5 3,7	0,75 2,5 2,5 3,7	0,75 2,5 2,5 3,7	1,5 3 3 5,5	FT1	65	CA10 CA11 CA20	Single hole mounting combined with 22 and 30 mm without escutcheon plate	
Standard motor load	120 V 240 V 480-600 V 3 pole	120 V 240 V 480 V 600 V 3 pole	1 1 1 1	1,5 3 5 5	1,5 3 5 5	1,5 3 5 5	2 5 10 10	FT2	65		with escutcheon plate 49 x 49 mm	
Max. fuse size (I _L -characteristic) Rated conditional short-circuit current				A	10	25	25	35				
Max. permissible wire gage stranded wire 2 x flexible (with sleeve) 2 x				mm ² AWG	1,5 1,4	2,5 12	2,5 12	4 10				

DIMENSIONS mm inch

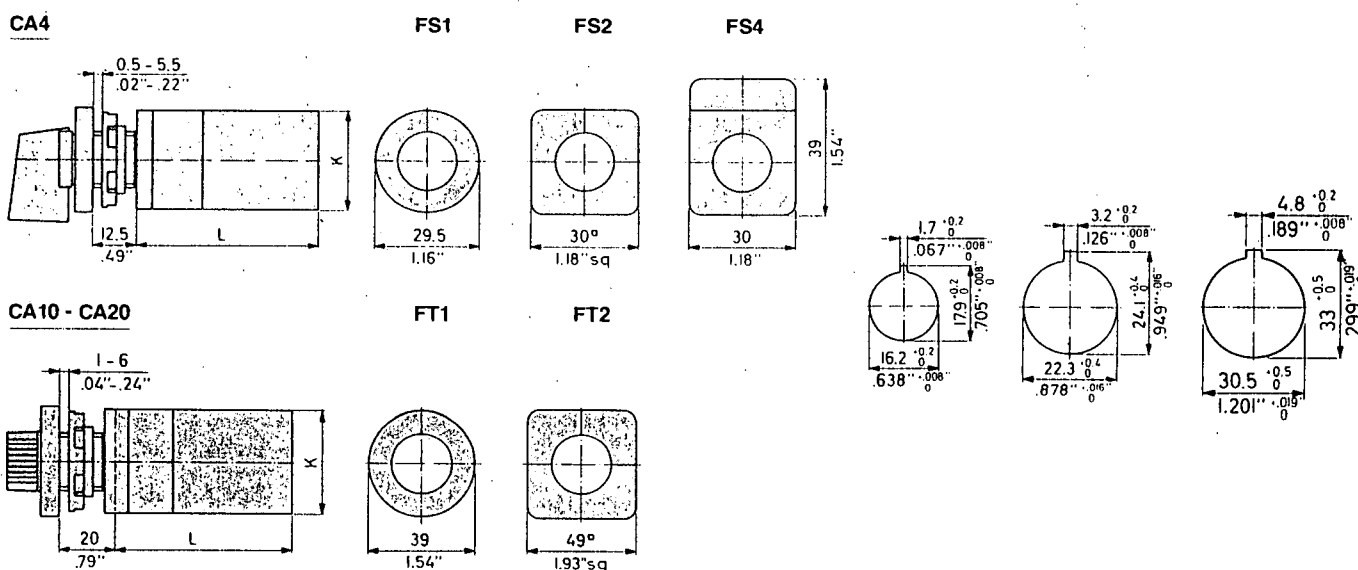
Panel mounting and base mounting



Mount- ing		CA4	CA10- CA20	CA10B- CA20B	Mount- ing		CA4	CA10- CA20	CA10B- CA20B
E/EF/VE ¹⁾	A	30 1.18	48 1.89	64 2.52	E	D2 -		6 .24	8,5 .34
	B	-	36 1.42	48 1.89	EF	D2 -		16 .63	20 .79
E	C	4,5 .18	4 .16	4 .16	VE	M -		4 .16	4 .16
VE	C	-	10,5 .41	13,5 .53	EF	N 1		2 .04	2 .08
E/EF/VE	D1 -		4,1 .16	4,1 .16					

1) CA4: Dimensions of the escutcheon plate, excepting VE mounting

Single hole mounting 16 or 22 mm and 22 or 30 mm



Dimensions L and K

Type	1	2	3	4	5	6	7	8	9	10	11	12	K
CA4	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	-	-	-	28 1.1
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	43 1.69
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	43 1.69
CA20	35.9 1.41	48.6 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	45 1.77
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	138.4 5.45	56 2.2
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	56 2.2
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	56 2.2

australian solenoid co. pty. ltd.

(Registered in N. S. W.)
HEAD OFFICE

379 LIVERPOOL ROAD ASHFIELD N. S. W. 2131 P. O. BOX 109

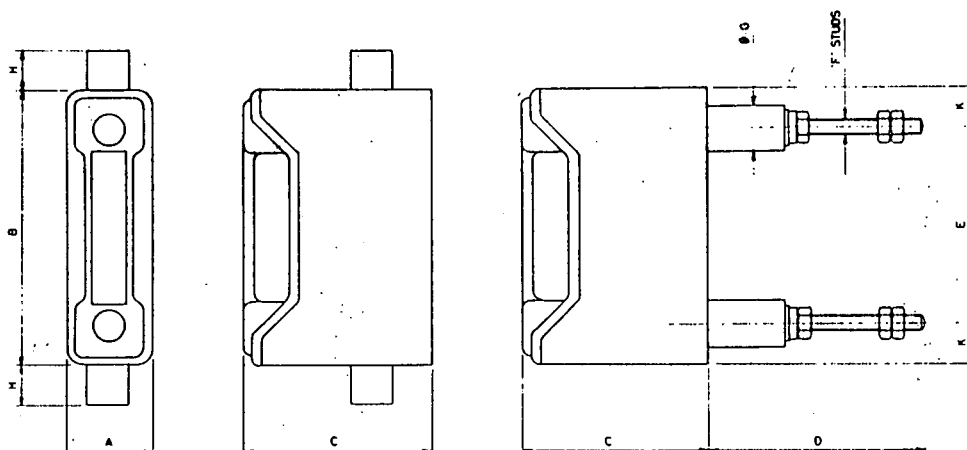
TELEPHONE: (02) 797-7333 FAX: (02) 797-0092 TELEX: AUOLSOD AA23029 CABLE ADDRESS: AUSTRASOL SYDNEY



'RED SPOT'

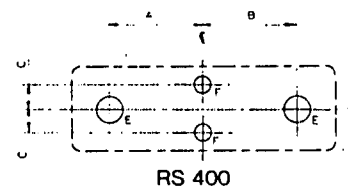
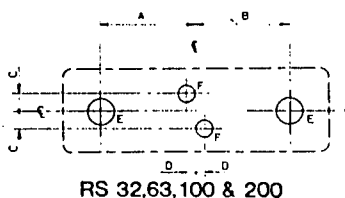
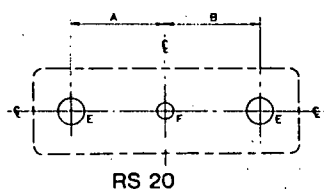
HRC FUSE HOLDERS

Dimensions



Type	Rating Amp	A	B	C	D P,PH ONLY	E	F P,PH ONLY	G DIA P,PH ONLY	H	K	Max Cable Size
RS20	20	27	80	54	63	35	M6	13,5	15	22,2	10mm ²
RS32	32	32	103	70	81	73	M6	17,5	15	15,1	16mm ²
RS63	63	35	110	75	84	78	M8	17,5	15	15,9	50mm ²
RS100	100	51	140	100	87	94	M10	22,2	15	23	70mm ²
RS200	200	70	216	136,5	95	171,5	M12	25,4	22	22,2	120mm ²
RS400	400	98,5	254	192	114	140	M16	31,8	32	57,2	240mm ²

PANEL DRILLING DIMENSIONS



DIM	FUSE HOLDER TYPE																			
	20 H	20 P	20 PH	20 BW	32 H	32 P	32 PH	32 BW	63 H	63 P	63 PH	63 BW	100 H	100 P	100 PH	100 BW	200 H	200 P	200 PH	400 H
A	-	17,5	17,5	17,5	-	36,5	36,5	36,5	-	36,5	36,5	36,5	-	46,8	46,8	46,8	-	85,7	85,7	-
B	-	17,5	-	17,5	-	36,5	-	36,5	-	41,3	-	41,3	-	46,8	-	46,8	-	85,7	-	-
C	-	-	-	-	6,4	6,4	6,4	6,4	6,4	6,4	6,4	6,4	11,1	11,1	11,1	11,1	19,1	19,1	19,1	27
D	-	-	-	-	3,2	3,2	3,2	3,2	3,2	3,2	3,2	3,2	9,5	9,5	9,5	9,5	28,6	28,6	28,6	-
E	-	Ø15	Ø15	Ø8	-	Ø20	Ø20	Ø8	-	Ø20	Ø20	Ø8	-	Ø24	Ø24	Ø16	-	Ø27	Ø27	-
F	HOLES TO SUIT M5 SCREWS										HOLES TO SUIT M6 SCREWS.									

FUSE LINK/FUSE HOLDER SELECTION TABLE AND MOTOR START RECOMMENDATIONS



CLIP-IN HRC FUSE LINKS AND HOLDERS - 415V.A.C.

Fuse Fitting	Connections Available	Associated Fuse Link	Kw	HP	FLC	Standard Fuse
SC20	H.P.BW	NS2-20A	.37	0.5	1	NS4
			.55	0.75	1.5	NS6
			.75	1	1.9	NS10
			1.1	1.5	2.5	NS10
			1.5	2	3.4	NS16
			2.2	3	4.8	NS16
SC32	H.P.BW	NS2-32A	3	4	6.4	NS20
			4	5.5	8.1	NS25
			5.5	7.5	11.6	NS32
SC63	H.BW	* NS2-32 ES40-63	7.5	10	14.4	ES40
			11	15	21.1	ES50
			15	20	28	ES63

BOLT-IN HRC FUSE LINKS AND HOLDERS - 415V.A.C.

Fuse Fitting	Connections Available	Associated Fuse Links	† "DIRECT ON LINE MOTOR START RECOMMENDATIONS (415V AC)"				
			Kw	HP	FLC	Standard Fuse	Motor Fuse
RS20	H.P.PH.BW	NIT2-20A	0.37	0.5	1	NIT4	—
			0.55	0.75	1.5	NIT6	—
			0.75	1	1.9	NIT10	—
			1.1	1.5	2.5	NIT10	—
			1.5	2	3.4	NIT16	—
			2.2	3	4.8	NIT16	—
			3	4	6.4	NIT20	—
		NIT20M25	4	5.5	8.1	—	NIT20M25
		NIT20M32	5.5	7.5	11.6	—	NIT20M32
RS32	H.P.PH.BW	TIA2-32A	0.37	0.5	1	TIA4	—
			0.55	0.75	1.5	TIA6	—
			0.75	1	1.9	TIA10	—
			1.1	1.5	2.5	TIA10	—
			1.5	2	3.4	TIA16	—
			2.2	3	4.8	TIA16	—
			3	4	6.4	TIA20	—
			4	5.5	8.1	TIA25	—
			5.5	7.5	11.6	TIA32	—
		TIA32M35	7.5	10	14.4	—	TIA32M35
		TIA32M50	11	15	21.1	—	TIA32M50
		TIA32M63	15	20	28	—	TIA32M63
RS63	H.P.PH.BW	TIA2-32A TIS35-63A	7.5	10	14.4	TIS35	—
			11	15	21.1	TIS50	—
			15	20	28	TIS63	—
		TIS63M80 TIS63M100	18.5	25	35	—	TIS63M80
			22	30	41	—	TIS63M80
			30	40	55	—	TIS63M100
RS100	H.P.PH.BW	TCP80 TCP100	22	30	41	TCP80	—
			30	40	55	TCP100	—
			37	50	69	—	TCP100M125
		TCP100M125	45	60	83	—	TCP100M160
		TCP100M160	55	75	99	—	TCP100M200
		TCP100M200					
RS200	H.P.PH	TBC2-63A TC80-100A	37	50	69	TF125	—
			45	60	83	TF160	—
			55	75	99	TF200	—
		TF125-200A	75	100	136	—	TF200M250
		TF200M250	90	120	162	—	TF200M250
		TF200M250					
RS400	H.P.PH	TKM250/315	110	150	200	TM355	—
			132	175	231	TM355	—
			150	200	263	TM400	—
		TKM355/400	160	215	281	TM400	—
		TKM355/400	185	250	324	—	TM400M450
		TM400M450	200	270	350	—	TM400M450

A FULL RANGE OF HRC FUSE LINKS ARE AVAILABLE FROM 2 AMP TO 1600 AMP

Refer publication IEF401 for technical details.

Asta 20 certified and complying with AS 2005 & BS88.

†D.O.L start based upon 7 x FLC for 10 seconds

*To accommodate the 'NS' fuselink additional fuse carrier list No: SCA63 is required. This must be specified at the time of ordering.

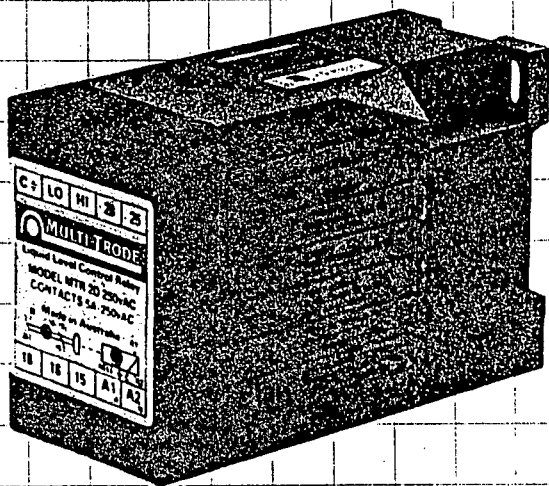


MULTI TRODE

PRODUCT BULLETIN

LEVEL CONTROL RELAYS

MTPB.2.1



Many benefits available to users by the incorporation of variable mode switches unique to the MTR control relay

Multi Trode MTR control relays feature variable mode switches to enable users to operate the Multi Trode system in a broad range of applications.

- **CHARGING/DISCHARGING MODE**
Enabling tanks to be filled or emptied by pumps or gravity.

- **HIGH/LOW SENSITIVITY**
For operation in high or low conductivity liquids such as clear water through to acid solutions.

- **DELAY/INSTANT OPERATION MODE**
Enables effective operation from still water through to areas of high wave action.

Timers for pump sequencing are unnecessary when relays are alternatively set on delay and instant settings.

Introduction to the Multi Trode MTR single appliance control relay

The Multi Trode MTR Control Relay was specifically developed for use with the multi-sensored probe to active and deactivate a single appliance such as a pump, solenoid valve or alarm. The control relay with its internal latching mechanism maintains control through a given differential dependent on the sensor points selected at the multi-sensored probe.

The MTR control relay will function effectively in a wide range of conductive liquids, from clear water through to heavy sludge.

The Multi Trode MTR control relay together with the Multi Trode probe provide an effective, economical method of level control and monitoring for basic pump stations incorporating several pumps and alarms.

Important time saving features of MTR control relays and Multi Trode probes during testing and commissioning

Simplified testing and commissioning procedures are possible when using MTR relays and multi-sensored probes.

The high intensity leds mounted on the face of the relay will verify the state of the specific appliance to be activated or deactivated as the probe is lifted through the liquid. The various relays will operate in sequence as the liquid makes contact or falls away from the corresponding sensors.

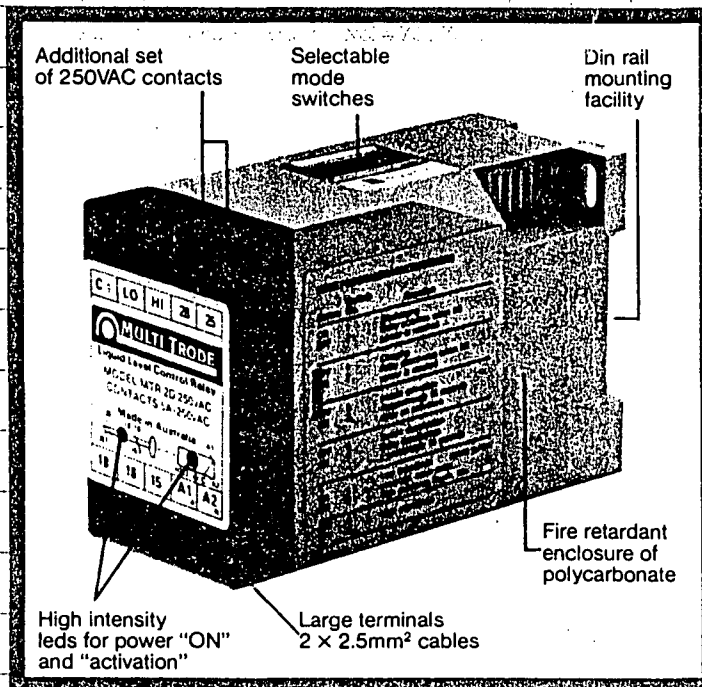
Applications requiring the control of more than a single appliance

To take full advantage of the Multi Trode multi-sensored probe concept, several MTR control relays can be connected to the probe at various levels, providing a broad range of switching and differential options.

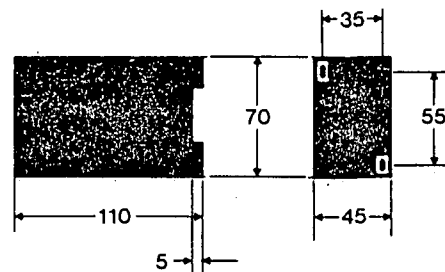
MTR control relays will perform effectively when connected in the following manner:

- Series of control relays each using separate sensors for activation and deactivation.
- Series of control relays using a common low sensor.
- Series of control relays using a common high sensor.
- Series of control relays using different stop sensor points.
- Low and high of separate control relays being connected to a single sensor, enabling activation and deactivation to occur at the one sensor.

Specification of the MTR control relay



MTR DIMENSIONS — mm

MODEL DESIGNATION
ORDERING INFORMATION

MTR	X	X	
			Sensitivity D 100-20 (K ohms) G 15-3
			Supply 2 240 vAC 3 110 vAC 4 24 vAC 5 24 vDC 6 12 vDC
			Series

Method of operation

The Multi Trode MTR Control Relay is a conductive liquid level control device which when used with the Multi Trode multi-sensored probe, enables dual point activation/deactivation of pumps, alarms and other monitoring and control equipment.

The control relay functions by providing an extra low alternating current supply to the selected sensor on the probe; via the numbered probe cable. As the liquid makes contact with the appropriate sensor point on the probe, conductivity occurs as the leakage current circuit loop is completed to earth. The relay senses the conductivity and latches. This state is maintained until the circuit is broken when the liquid passes the selected stop sensor. The relay then resets for the next operation.

Operation of the MTR control relay set in charging mode

With the control relay switch set to CHARGING MODE ON, contacts #15 #16 changeover to #15 #18 when the liquid falls beyond the low sensor. Concurrently, a second set of electrically separate contacts #25 #28 close, enabling dual control or monitoring if required.

These two sets of contacts are maintained in this state until the liquid reaches the selected high sensor. Deactivation then occurs and the control relay resets to the original mode.

Operation of the MTR controller set in the discharging mode

In the DISCHARGING MODE the relay activates when the high sensor is reached and contacts #15 #18 and #25 #28 close.

The relay remains in this latched state until the liquid falls beyond the low sensor, when resetting occurs. The liquid must then reach the high sensor to re-activate the control relay.

MTR instantaneous or delay mode setting

In the DELAY HIGH MODE, the relay pauses for approximately 15 seconds after the liquid reaches the high sensor to activate/deactivate. In DELAY LOW MODE, the relay will wait 15 seconds before operating after the liquid falls beyond the low sensor to activate/deactivate. (Depending on mode selected — i.e. charging/discharging.)

The control relay is set at INSTANTANEOUS OPERATION MODE reduces the 15 second delay to approximately 500 milliseconds before activation/deactivation occurs after the liquid reaches the appropriate sensor.

Specifications

Sensor Voltage	24VAC Nominal (2.5mA)
Number of Outputs	2 sets, 1 no & 1 changeover
Contact Rating	5 amp 250VAC resistive
Contact Life	10 ⁵ operations
Supply Voltage (+/-10%)	240, 110, 24VAC 50/60 Hz 24, 12VDC
Power Consumption	3VA (max)
Dimensions mm (inches)	H70 (2.75") x W45 (1.75") x D110 (4.3")
Terminal Size mm (inches)	2 x 2.5mm ² (0.64 ² inch)
Display Leds	Green-power on, amber-activation
Enclosure type	Moulded polycarbonate
Mounting arrangement	Din rail or 2 x 4mm screws (3/16")
Sensitivity	Selectable via high/low switch
Standard Sensitivities	100K ohms - 20K ohms, 15K ohms - 3K ohms
Other features	Charge/discharge switch Instantaneous/delay (15 sec approx.)
Working temperature C(F)	Minus 10°C (±14°F) plus 60°C (140°F)



Multi Trode Manufactured and Marketed by
Systems and Research Technologies Pty. Ltd.
13 Kenway Dr. Underwood, Queensland, 4119, Australia.
Ph. (07) 808 5422. Fax (07) 808 0011.
Multi Trode products are covered by International patents
and patent applications incl US Pat. No. 4,739,786.

MULTI TRODE

PRODUCT BULLETIN

MULTI-SENSORED PROBES

MTPB 1.1M

Introduction to the Multi Trode System and the Multi-Sensored Probes

The Multi Trode liquid level system is a conductance activated control system, utilising the electrical conductivity of the liquid to carry a small current which activates the necessary controls.

The one-piece, multi-sensored probe unit is central and essential to the effectiveness of the Multi Trode system. The patented design probe provides ease of installation, simple adjustment, extreme versatility and freedom from the effects of fouling and turbulence.

Several devices such as pumps, alarms, valves and solenoids as well as telemetry and monitoring systems can be activated at different levels from one probe.

In situations having large differentials or small level increments, several probes can be configured to achieve the appropriate control over the entire range.

Reliability and proven performance over a wide range of applications in several countries

Multi Trode probes have been operating effectively in aggressive liquids such as sewage and sludge since early 1980. Extensive trials and close monitoring by water and sewerage engineers have consistently endorsed the fact that Multi Trode saves money by providing many years of trouble-free operation in even the harshest environments.

Fundamental to the effectiveness of the Multi Trode system is the single piece, pressure-injected construction of the probe, making it totally impervious to the ingress of moisture. The sensing points are of AVESTA 254 SMO,* a highly corrosion-resistant alloy.

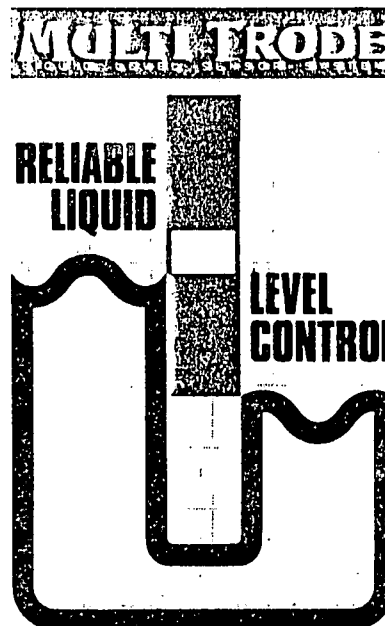
Multi Trode Systems are operating effectively every day of every year in over 300 municipal shires in Australia, together with industry and water and sewerage plants in Canada, New Zealand and the U.S.A.

Specific benefits of the Multi-Sensored Probe

- Eliminates bubbler tube blockage, compressor failure and maintenance costs of bubbler systems.
- Eliminates ragging, rafting, tangling and fat build-up on mercury switches.
- Eliminates shorting, ragging, corrosion and electrolysis of fabricated probe systems.
- Enables reliable operation in areas of extreme turbulence.
- Enables reliable operation in fatty pits, even in extremely low temperatures such as those experienced in some areas of Canada.

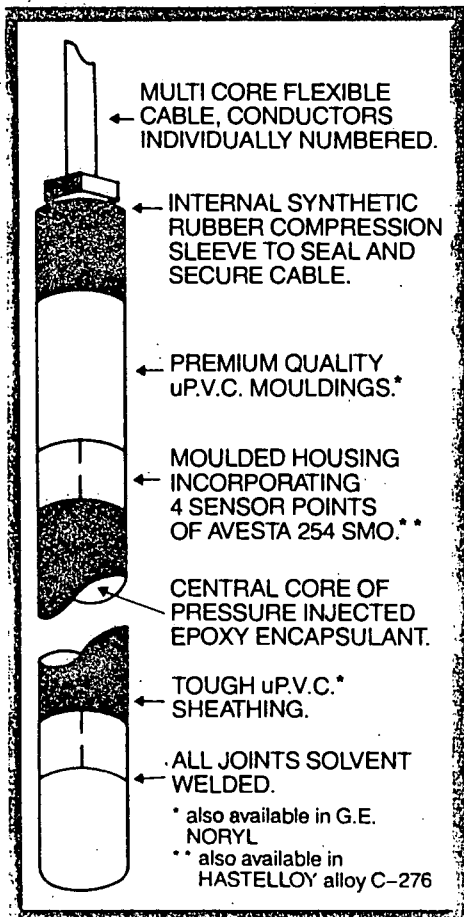
User benefits of Multi Trode Probes over other forms of Level Control Equipment

- Installation of the Multi Trode system is quick, easy and can be achieved without entering the wet well. All brackets, screws and cleaning devices are supplied with each probe. Servicing does not require personnel to enter hazardous areas.
- Multi Trode provides real savings for pump station operators through low initial cost, low installed cost, low maintenance cost, no replacement parts requirement, commonality of componentry to minimise inventory and greatly reduced call-out costs.
- Operators will appreciate the easy selection of levels to accommodate varying demands by simple switching at cubicle without any need to enter pit.
- Multi Trode provides for multiple stop levels which if used can reduce water hammer problems associated with reflux valves.



* Probes are also available with HASTELLOY alloy C-276 Sensors.

SPECIFICATIONS



Specifications and construction of Multi Trode Probes

The Multi Trode is a solid-cored, multiple-sensored, conductive liquid level detection probe used for activating pumps, alarms and other monitoring and control devices.

Materials used in its construction are of premium quality with exposed parts being either uP.V.C. or AVESTA 254 SMO stainless steel.*

The highly corrosion-resistant sensor monitoring points are integrally moulded into uP.V.C.* housings and located at equal spacings along the length of the probe. Sensor points are internally crimp-connected within the probe to individually numbered control cables which terminate at the control cubicle.

Designed to support the weight of the probe without any additional fixing requirement, the flexible cable is sealed and secured by a synthetic rubber compression fitting at the top of the probe.

To achieve complete sealing of the probe and its component parts, the unit is pressure injected with an epoxy encapsulant, ensuring that the probe is an homogeneous mass totally impervious to the ingress of moisture.

For dimensions and specifications of standard probes, refer to Table 1.

* HI-SPEC PROBES

Probes are available for operation in temperatures up to 140°C and for use in a broad range of corrosive liquids. These are manufactured using G.E. NORYL and HASTELLOY alloy C-276 Sensors.

Two year warranty of Multi Trode probes

Multi Trode probes are subject to a two year warranty against defective workmanship provided probes are installed as per the procedures laid down by Multi Trode Control Systems Pty Ltd and are used in conjunction with an appropriate Multi Trode control device or an approved level control relay.

TABLE 1

Model designation
Overall length, mm
Number of sensing points
Sensor increments, mm
Standard cable lengths, m
Maximum differential, mm
Probe diameter, mm
Control cable # numerical
Sensor material
Core material
Sensor numbering
Cable type

Surface area of sensor mm²
Max operating temp C
Min operating temp C
Weight packed kg
for cable lengths: 10m
30m

SPECIFICATIONS & DIMENSIONS OF PROBES

3/10	2/10	1/10	0.5/3
2875	1975	1075	475
10	10	10	3
300	200	100	150
10,30	10,30	10,30	10,30
2700	1800	900	300
34	34	34	34
1-10	1-10	1-10	1-3

_____ Avesta 254 SMO
_____ Epoxy resin encapsulant
_____ Top to bottom #1-10, #1-3
Purpose manufactured PVC/PVC insulated and sheathed,
V75, 3 core or 10 core
_____ 4 x 40 mm² per level
_____ + 80°C
_____ minus 10°C

7
13

6
12

5
11

3
7

INSTALLATION KIT SUPPLIED WITH PROBES

_____ 1 x Stainless Steel suspension hook
_____ 1 x SS bracket with polyurethane wiper
_____ 3 x SS 25mm #8 fixing screws
_____ 2 x nylon cable ties
_____ 3 x PVC masonry plugs
_____ cubicle identification label
_____ Installation instructions
_____ wiring diagram

Not supplied with 0.2/1 probes.

MODEL DESIGNATION ORDERING INFORMATION

MUL	X/X	X M	_____ cable length m
			_____ number of sensors
			_____ length of probe
			_____ probe series

MULTI TRODE
INTEGRAL LEVEL SENSOR SYSTEMS

Multi Trode Control Systems Pty. Ltd.
13 Kenway Drive, Underwood Q 4119 AUSTRALIA
P.O. BOX 35, Underwood Q 4119
Phone: (07) 808 5422 Fax: (07) 808 0011

Feed-through Terminals Type SAK

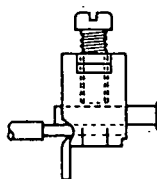
The SAK Series of feed-through terminal blocks are employed for the connection of various conductor sizes. The bare conductor is inserted directly into the yoke with no further preparation, and the tightening of the screw effects a vibration proof connection.

Most terminal types are available in either melamine moulding material or polyamide 6.6 and are designed to be mounted directly on assembly rail TS32 to EN50035. (BS5825)

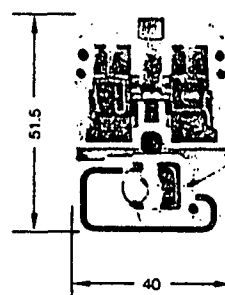
Cross connection can be achieved using standard QL2-QL10 jumper bars fitted in the centre of each terminal block. Switchable connections can be achieved using the switchable link VL2.

For additional safety covers type AD may be fitted with a plastic screw on top of the terminal block.







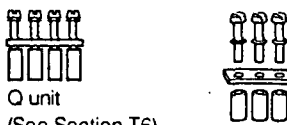

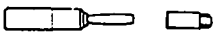


Screw Clamp Connections



SAK 4 750V 36A



Thickness 6.5mm

Technical Data			
Conductor size	Solid (mm ²)	0.5-6	
	Stranded (mm ²)	0.5-4	
Insulation stripping length (mm)		12	
Ordering Data		Cat. No.	
Moulding material		Polyamide	012836
When ordering EEx'e' and Ex'N' terminals, add suffix 'e' or 'N' to the catalogue number		Polyamide	012838
		Melamine	012832
		Melamine	012837
Approvals		BASEEFA-Ex CEBB   (N) (D) (E) (F)	
All Approvals are listed in Approvals Guide			
Terminal Rail (2m)		Type	Cat. No.
	Steel	TS32	012280
	Steel (M6 Slots)	TS32	067610
Locking pin (1m) — optional	Steel	SST 3	015270
End Bracket (thickness mm)		EWK1 (8.5)	
			
End Plate (thickness mm)			
	Polyamide	AP (1.5)	011796
	Polyamide	AP (1.5)	011798
	Melamine	AP (1.5)	011792
	Melamine	AP (1.5)	011797
Partition (thickness mm)			
	Polyamide	TW (1.5)	013016
	Polyamide	TW (1.5)	013018
	Melamine	TW (2.5)	013012
	Melamine	TW (2.5)	013017
	Resin bonded paper	TW (0.5)	019710
Small partition		Polyamide	
Cross Connections			
 Q unit (See Section T6)	2 way	QL 2	013060
	3 way	QL 3	013070
	4 way	QL 4	013080
	10 way	QL 10	033820
	Sleeve	VH 13.5	024850
	Screw	BS (M3 x 20)	030300
	Washer	Captive on screw	
	Bi-pole plug	QS2	021270
Switching Link			
	2 way	VL 2	019700
	Sleeve	VH 19	028510
	Screw	BS (M3 x 25)	029250
	Washer	SS	016440
Test Plug			
	Plug	PS (2.3Ø)	018040
	Plug bolt	StB 8.5	021570
Warning Label			
	Label	AD 4	037610
	Plastic screw	BSK (M3 x 22)	012890
Cover (1m)			
	Transparent cover	ADP 2	048530
	Support bracket	HP 2	048566
Marking Tags			
All marking systems are shown in Section T6		DEKAFIX — Section T6	

For additional accessories see Section T6

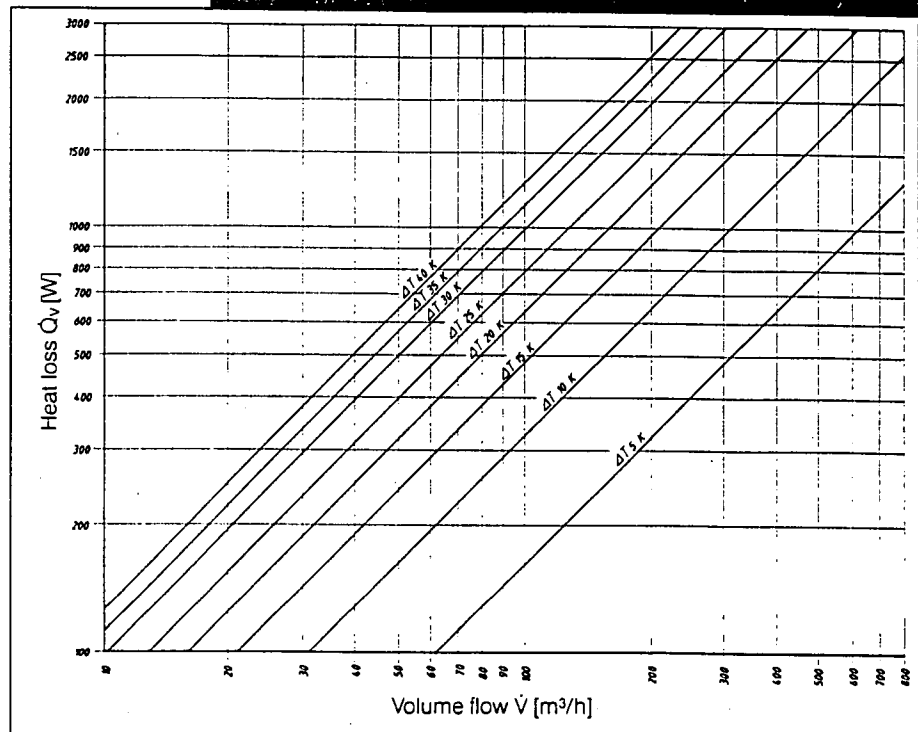
Active 29/01/2014

Page 56 of 60

Fan Units with Filters SK

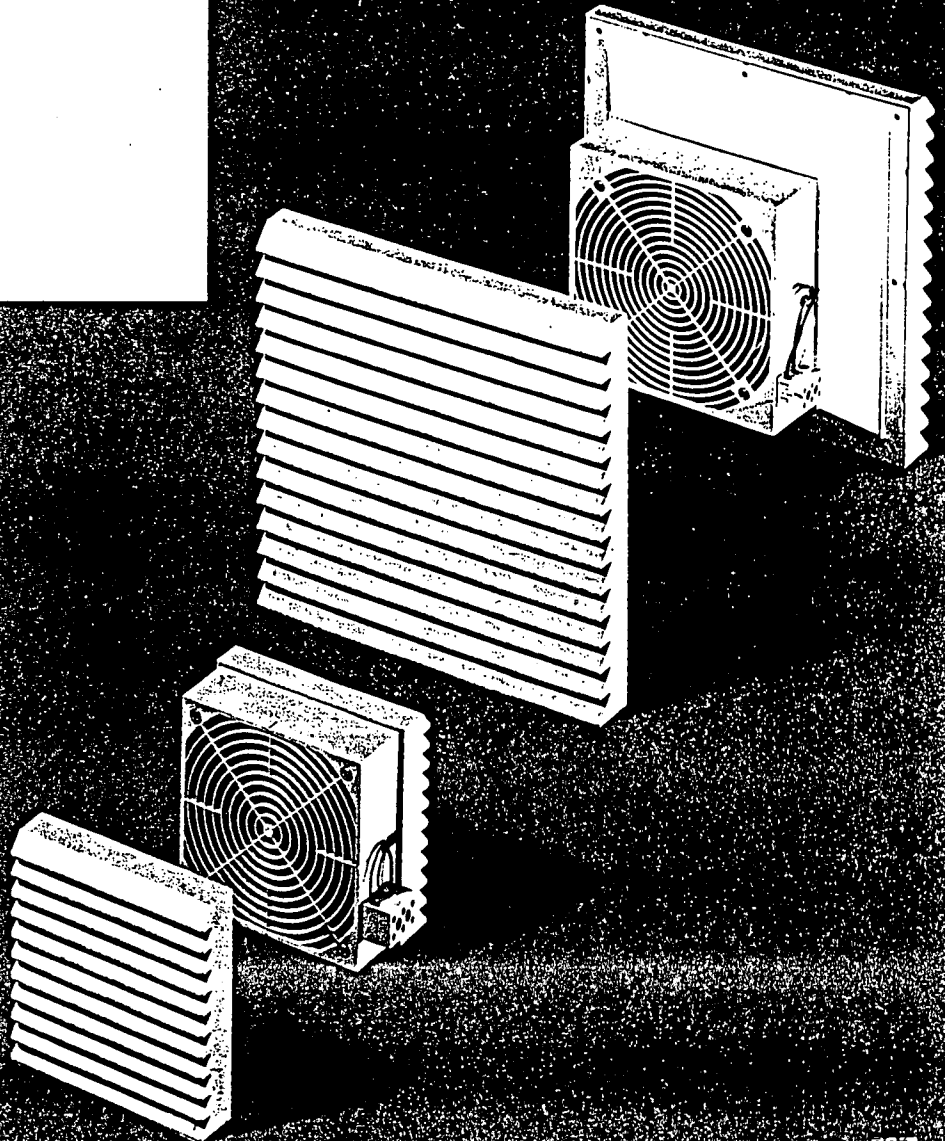
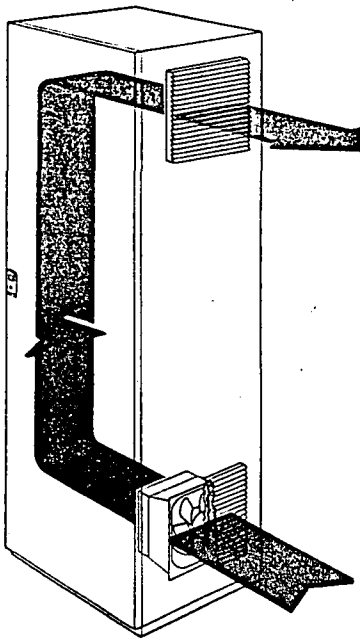
Technical Description:

- The fan units with filters are mounted with 8 screws and appropriate cutouts, simply and quickly, even retroactively. The fans require no maintenance.
- The filter mats can be replaced and cleaned, and they are characterized by high filtration properties and long-term re-usability.
- For extremely fine dust with grain sizes below 10 μ , we recommend the use of a fine filter mat (see accessories).
- The housings are made of heat resistant ABS plastic (-35 °C to + 85 °C) and are self-extinguishing in accordance with UL-94 VO, their tracking resistance is approximately KA 3.
- All fan units with filters are equipped with a thermal winding protection and/or impedance protection. The fan units with filters SK 3150, SK 3165, SK 3151, SK 3166, SK 3152, and SK 3167 carry the CSA approval LR 59132.

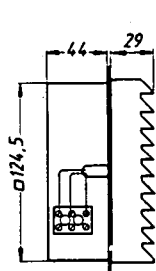
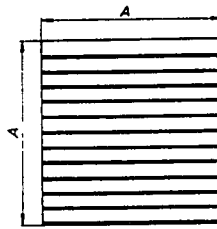
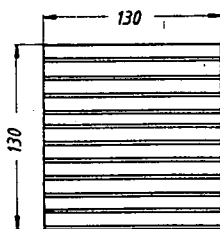


LR 59132

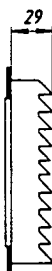
Method of Operation



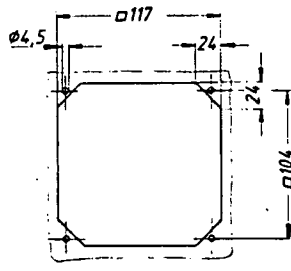
SK
SK
SK
SK
SK
SK
SK



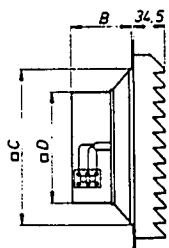
Fan Units w. Filter
SK 3150
SK 3165



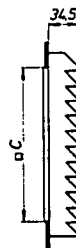
Outlet Filter
SK 3160



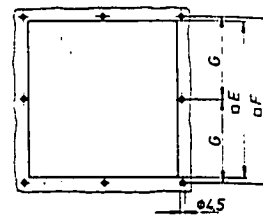
Mounting Cutout
SK 3150/60/65



Fan Units w. Filter
SK 3151/52/53
SK 3166/67/68



Outlet Filter
SK 3161/62/63



Mounting Cutout
SK 3151 - 3168

Model No.	SK 3150	SK 3165	SK 3151	SK 3166
Axial fan with self-starting shaded pole motor				
Rated voltage	230 V	110/50	230 V	110/50
Volt/Hz	50/60 Hz	115/60	50/60 Hz	115/60
Current rating	0.11 A	0.24 A	0.11 A	0.24 A
Power	18 W	20 W	18 W	20 W
Noise level	48.5/49 dB (A)		47.5/48 dB (A)	
Motor speed	2650/3100 rpm		2650/3100 rpm	
Protective category DIN 40 050	IP 43		IP 43	
Temperature range	-10 °C to +55 °C		-10 °C to +55 °C	
Air throughput (unimpeded airflow)	48 m³/h		103 (70) m³/h*	
with outlet filter	1 SK 3160, 35 m³/h 2 SK 3160, 42 m³/h 1 SK 3161, 42 m³/h		1 SK 3161, 61 (48) m³/h* 2 SK 3160, 59 (47) m³/h* 2 SK 3161, 85 (62) m³/h* 1 SK 3162, 78 (58) m³/h*	
Special voltages available on request				

* = Values in brackets () apply when using fine filter

Model No.	SK 3152	SK 3167	SK 3153	SK 3168
Axial fan with self-starting shaded pole motor			Axial fan with capacitor motor	
Rated voltage	230 V	110/50	230 V	110/50
Volt/Hz	50/60 Hz	115/60	50/60 Hz	115/60
Capacitor value			2 µF	8 µF
Current rating	0.225 A	0.6 A	0.38 A	0.6 A
Power	35 W	42 W	70 W	75 W
Noise level	59 dB (A)		64/69 dB (A)	
Motor speed	2850/3350 rpm		2650/3000 rpm	
Protective category DIN 40 050	IP 43		IP 43	
Temperature range	-10 °C to +55 °C		-10 °C to +55 °C	
Air throughput (unimpeded airflow)	220 (130) m³/h*		500 (340) m³/h*	
with outlet filter	1 SK 3162, 150 (105) m³/h* 2 SK 3161, 160 (110) m³/h* 2 SK 3162, 190 (120) m³/h* 1 SK 3163, 180 (118) m³/h*		1 SK 3163, 360 (285) m³/h* 2 SK 3162, 380 (285) m³/h* 2 SK 3163, 440 (320) m³/h*	
Special voltages available on request				

* = Values in brackets () apply when using fine filter

Fan units with filters	3151/66	3152/67	3153/68
Outlet filters	3161	3162	3163
A	204	255	323
B	66	103.5	140
C	175	222	290
D	124.5	160	206
E	177	223	292
F	185	234	302
G	-	117	151

Power	Air throughput unimpeded airflow	Rated voltage Volt/Hz	Model No.
18 W	48 m³/h	230 V 50/60 Hz	SK 3150
20 W	48 m³/h	110/50 115/60	SK 3165
18 W	103 m³/h	230 V 50/60 Hz	SK 3151
20 W	103 m³/h	110/50 115/60	SK 3166
35 W	220 m³/h	230 V 50/60 Hz	SK 3152
42 W	220 m³/h	110/50 115/60	SK 3167
58 W	500 m³/h	230 V 50/60 Hz	SK 3153
75 W	500 m³/h	110/50 115/60	SK 3168

Supply includes:

Fan unit with filter, complete, ready for installation. Drilling template.

Accessories:

- Spare filter mats Page 344
- Fine filter mats Page 345
- Sealing frame for fan units with filters, to afford a higher protection category Page 345
- Thermostat Page 343

