



A00190 - CPM1

**CONTROL AND
PROTECTION
MODULE**

Operation Manual

CPM1 Manual

Part number: A00190

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Overview

Since their inception in 1987, Bramco Electronics range of **CONTROL** and **PROTECTION MODULES** has proved to be highly reliable and effective in use, evident in the large numbers of units currently in operation.

The advantages of the range extend to the considerable cost benefits in initial purchase price over equivalent individual relays on the market. Large savings in space and cost of installation are also of an advantage.

The Bramco Control & Protection Module is a plug in system of control and protection, tailor made to customer needs. The system offers complete control and protection for mining applications.

Power supplies for the functions are provided internally and a Driver Relay Card is available for heavy duty switching of large contactors, etc. of up to 16-Amp at 240-Volt.

When employing the Driver Relay Card, three heavy duty outputs are provided to discriminate between the protection and/or control functions employed. Additionally, LED indication power is supplied for remote indication of the state of each function within the module.

With the addition of a set of push buttons and a contactor or other power switching device the circuit is complete. Control of the power switching device is achieved through the connection of just two wires to the CPM unit. The internal wiring configures the circuitry to the customers' requirements.

All combinations of functions are fully approved for mining applications.

Employing the latest in technology, the Bramco System is designed for arduous duty and reliable performance.

1. Features

Voltage: 240v or 110v AC

Contact Rating: With Driver Relay Card 16A @ 240V AC
Without Driver Relay Card 5A @ 240V AC
Intrinsically Safe functions without Driver Relay Card 5A or 240V Maximum Limited to 100VA.

Material: Powder Coated Steel

Features: Keyed Cards to prevent incorrect assembly
Keyed Plugs where necessary to prevent incorrect model insertion

Serial Numbered function card Identification.

The system Functions as listed in the table of functions may be purchased as individual units.

Individual units contain the same printed circuit mounted and have identical characteristics as set out in the descriptions for each function.

The Mines Department Approval for the combined CPM Module includes the individual units as Stand - Alone relays.

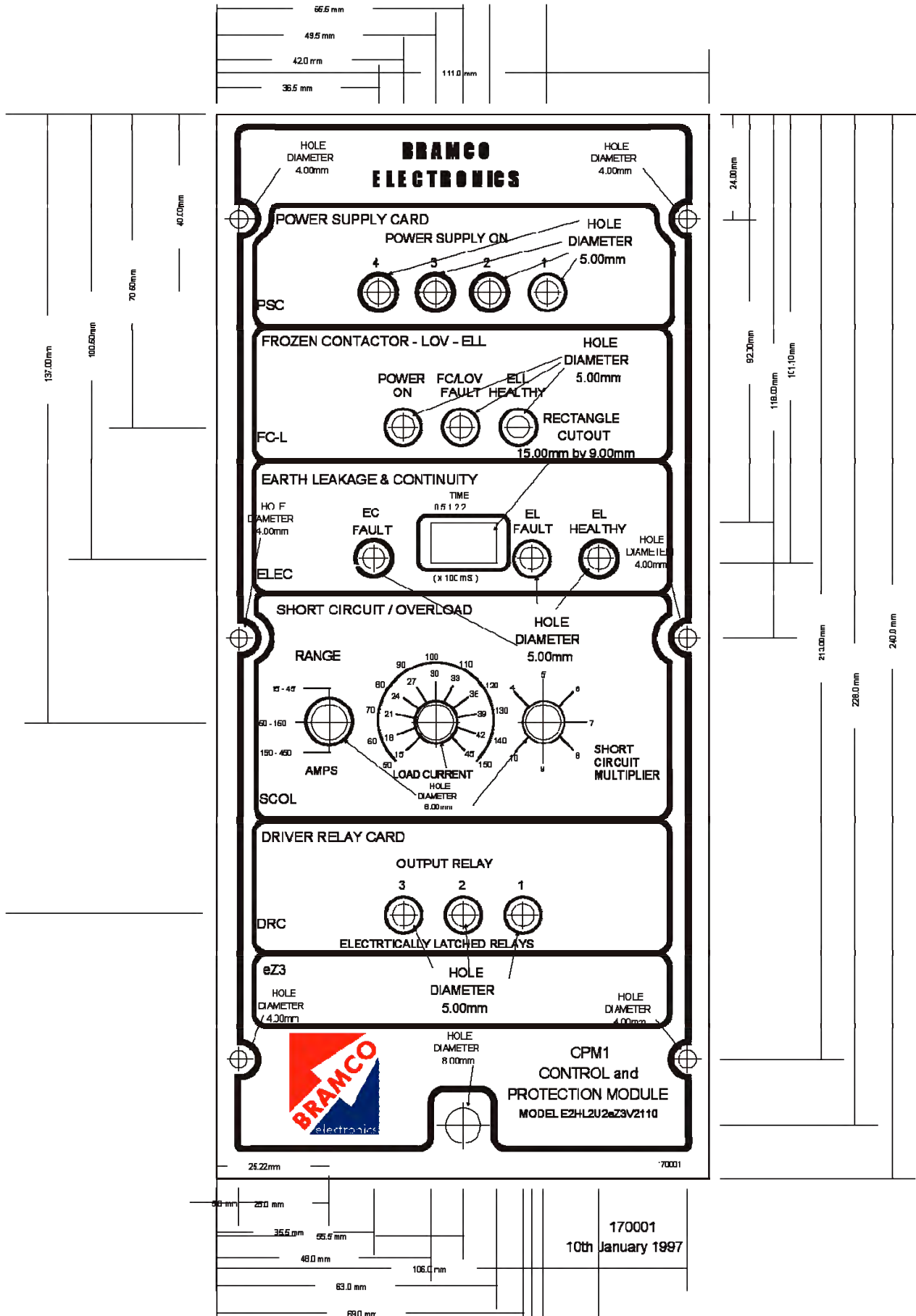
Each of the Stand - Alone relays is housed in an impact resistant P.V.C. enclosure. Each enclosure plugs into and is positively held in a base.

The relay may be rear mounted by fixing the base to a panel. In the case of fascia mounting, the base plugs onto the relay.

Each function is powered from a Bramco Power Supply (PSC) which may be purchased as a double or quadruple output unit. A quadruple unit will supply four (4) individual units with the exception of Earth Continuity, which requires a dual power supply. The power supply, whether dual or quadruple is supplied in the same enclosure as the individual units. A typical enclosure is shown on the back of this sheet with its dimensions.

Individual units may employ the Driver Relay Card (DRC), using the same plug - in enclosure, should heavy - duty switching be required.

1.1. Physical Layout



1.2. Table of Functions

CODE	ITEM	DESCRIPTION	MODEL
#	A	Earth Leakage Non Fail Safe	NEL
#	A2	Earth leakage Non Fail Safe (Retained)	NEL
#	B	Earth Leakage Fail Safe (Retained)	EL
#	B2	Earth Leakage Fail Safe	EL
#	C	Earth Continuity	EC
#	D	Pilot Control	PC
#	E	Combinations of A to D above 1. AC 2. BC 3. AD 4. BD 5. A2C 6. A2D 7. B2C 8. B2D	NELEC ELEC NELPC ELPC
#	F	Frozen Contactor/Loss of Vacuum Non Fail Safe	FC
#	F2	Frozen Contactor/Loss of Vacuum Fail Safe	FC2
#	G	Earth Leakage Lockout Fail Safe	ELL
#	H	Combined (F & G)	FC-L
#	H2	Combined (F2 & G)	FC-L
+	I	Short Circuit(Fault Driven) Non Fail Safe	SCFD
+	I2	Short Circuit(Fault Driven Retained) Non Fail Safe	SCFD
+	J	Short Circuit (Retained) Non Fail Safe	SC
+	J2	Short Circuit Non Fail Safe	SC
+	K	Overload Fail Safe	OL
+	K2	Overload Non Fail Safe	OL
+	L	Combinations of J to K above Short Circuit/Overload JK 2. J2K 3. JK2 4. J2K2	SCOL SCOL SCOL SCOL
#	M	Current Control	CC

#	N	Sequence Timer	ST
#	O	Liquid Pump Control	LPC
#	P	Belt Slip Detection	BSD
#	Q	Belt Signal Line Control	BSC
#	R	Belt Sequence Unit	BSU
#	S	Remote Control Relay	RCR
#	T	Thermistor Control	ThC
+	U	Driver Relay Card	DRC
+	V	Power Supply Card	PSC
#	W	Relay Interposing Module	RIM
+	Z	1. One (1) Latched Flag Relay	LR
		2. Two (2) Latched Flag Relays	LR
		3. Three (3) Latched Flag Relays	LR
		4. Four (4) Latched Flag Relays	LR

Code Key: # Denotes 30mm Module Height Increment
+ Denotes 40mm Module Height Increment

ORDERING DESCRIPTION

The Basic Unit is a Model CPM1

Select the Items to be included in the Module and add the Item code Letter/Number after the CPM1 designation.

For Example: -A Module Containing Earth Leakage / Earth Continuity Combined

-Loss of Vacuum / Earth Leakage Lockout Combined

-Short Circuit! Overload Combined

-Final Drive Relays to suit supply Voltages of 110Volts would have the following Designation:

CPM1 E2HLUV 110

2. Basic Enclosure Dimensions

Modules

The smallest enclosure offered measures 115mm wide x 160mm deep x 140mm high and provides space for 1 x 40mm module and 2 x 30mm modules.

The addition of modules increases overall height only.

There are three additional heights of module available: 190mm high; 230mm high; and 250mm high. These enclosures will accommodate 4, 5, and 6 cards respectively.

The above example would measure:

$$140+40+40=220\text{mm}$$

Base Mount for Modules

165mm wide x 160mm deep x At least 20mm lower than Module.



3. Operation

3.1. Power Driver (DRC)

When fitted, this card is always the bottom card. It contains a transformer, rectifier and smoothing capacitor plus three control relays which have 16-Amp 240-volt rating for heavy duty switching applications. The second 18-volt AC output is most often used to supply external LED indication of the state of each function in the module.

The three power relays in turn give three heavy duty switching outputs from the module. Each relay may be configured within the module from combinations of function. The principal purpose of the power driver is to alleviate the need for external control relays particularly where I.S circuitry is involved with their restrictive 100VA switching limitation.

Three LED's are provided on the front of the card, viewable through the front cover, to indicate relay energised state.

Power Driver Card Specification

Supply Voltage:	110V or 240V 50Hz link select
Transformer:	1 x 6VA 110V/240V to 18V + 18V Tested to AS 2380.7
Fuse:	1 x 500mA size 00 type L754 Max. Prospective Overload 4000A at 0.4pf and 250V
Relays:	3 x Power relays contact rating 16A at 250V AC1 Contact life greater than 2×10^5 operations Coils 24V DC Supplied from Transformer 1 Set C.O. contacts per relay

4. Earth Leakage and Earth Continuity (ELEC)

Pin most modules these two functions are packaged together on one card thus saving space, however, in this technical description each is treated separately.

4.1. Earth Leakage (EL)

The earth leakage function is designed to detect leakage on a power system. The unit is factory adjustable from 0.03Amps to 2.5Amps. The time discrimination provided is adjustable from 25 milliseconds to 550 milliseconds by the selection of switches on the front of the card. With all switches off, the time setting is 15 milliseconds. The switches left to right represent 50, 100, 200, 200 milliseconds respectively. By depressing one or several of the switches, the selected time is the sum of the values of the depressed switches.

The card is fitted with a latching relay. In this case the earth leakage function is fail safe. Detection of leakage will cause the relay to release and the latching relay to latch out the circuit, thus preventing reclosure of the circuit until the relay is reset. Any failure in the circuitry on the card will cause a latchout. The toroid is integral to the circuitry and disconnection or open circuits in the toroid coil, will cause a fault and latch the circuit Out. A red LED is mounted on the front of the card viewable through the front cover as indication that the unit is latched out.

The function is internally powered from the power driver card.

Detection of leakage is achieved by a Bramco earth leakage toroid. The design of this toroid is such as to never need degaussing. Installation of the toroid requires that the open face of the enclosure be maintained at least 10mm from any ferrous metal. Conductor location in the window of the toroid is not important.

The earth leakage function may be converted to non fail safe operation by changing two links on the card. That is, energise on fault detection. In this mode, the latching relay is removed. No reset is needed for the module.

The power supply to this unit is designed to hold the function in its healthy mode for 2 seconds under no volt conditions, thus preventing premature dropout under system fault conditions.

4.2. Earth Leakage Card Specification

Trip Range	0.03A to 2.5A Factory set
Time Delay	50mS to 550mS (in increments of 50mS) or 25mS
Voltage Tolerance	+20% to -30% of supply Voltage to the Module (i.e. 110V or 240V)
Loss of Supply	Operates for greater than 2 seconds on removal of module supply
Operating Modes	Fail safe - releases on Fault Non Fail safe - Energises on Fault Both are Factory Set
Latch	Magnetic Latch on Fail safe only. On Non Fail safe use the Bramco Latching Flag Relay with mechanical Reset
Relay	
Contacts	2 x C.O. Switching 250Volts 5Amps (resistive)
Rating	Coil to Contacts 2.5'' electrical life Greater than 2 x 10 ⁵ operations at Maximum Load
Toroid	Use Only the Bramco Toroid, Includes common mode current rejection.
General	<ol style="list-style-type: none"> 1. Use Screened Leads to connect Toroid to Relay 2. Harmonic filtering to prevent false trips 3. Power card only from the Bramco Power Supply Card 4. Designed to AS 2081 Earth - Fault Protection for Coal and Shale mines.

5. Earth Continuity (EC)

This function uses two power supplies from the power supply card. The unit monitors the continuity of the earth circuit in a supply cable by grounding the pilot wire in the cable via a diode polarised positive to earth. The function is set to trip and not reset at a value of circuit resistance of 45-ohms maximum. The unit is fail safe and should the pilot be grounded before the diode, the unit will trip and a red LED labelled Pilot or FE short will light which is viewable through the front cover.

Reversing the diode polarity is achievable by swapping the Pilot and earth connection on the terminals provided on the base of the module.

The power supply to this unit is designed to hold the function in its healthy mode for 2 seconds under no volt conditions thus preventing premature dropout under system fault conditions.

5.1. Pilot Control (PC)

The Earth Continuity Function with slight alteration to circuitry doubles as the Bramco Pilot Control function.

Operation of this function requires a 100-ohm resistor and defeat button or device at the end of a cable run to energise the relay. The resistor is connected in series with the diode to ground. Bridging the resistor will allow the relay to pull in. The relay will remain closed with the 100- ohm resistor in circuit up to a maximum 145-ohms loop resistance.

5.2. Earth Continuity/Pilot Control Card Specification

Pick Up	42 Ohms +0%-10%
Drop Out	45 Ohms +0% -10%
For Pilot Control with 100 Ohms \pm5% wire wound run resistor Factory Set	
Pick Up	42 Ohms +0%-10%
Drop Out	145 Ohms +0% -10%
Diode Polarisation	User Selected. Anode or Cathode to Earth
Voltage Tolerance	+20% to -30% of supply Voltage to Module (i.e.110V or 240V)
Loss of Supply	Operates for more than 2 seconds on removal of module supply
<u>Relay</u>	
Contacts	2 x C.O. switching shall not exceed 5A and 250 V and the product shall not exceed 100VA
Rating	Coil to contacts 2.5KV electrical life greater than 2×10^5 operations at maximum load
General	<ol style="list-style-type: none"> 1. wiring to the I.S circuit shall either be separated by an earthed screen from other conductors, or have an insulation to withstand capability of 2000V RMS 2. Power only from the Bramco PSC card fitted with an inflatable transformer 3. Designed to AS2081 4. Tested to AS2380.7

6. Frozen Contactor/Loss of Vacuum – Cable Fault Lockout (FC-L)

These functions are combined on one card in most modules. They will be treated separately here in the technical description.

6.1. Frozen Contactor/Loss of Vacuum (FC/LOV)

This function is designed to detect a leakage of voltage across a switching device of 24Volts or more when the switching device is in the open or tripped position. A barrier is used in conjunction with this function. The barrier is a three phase unit, used to isolate high voltages from the detection equipment. As the barrier is a three phase unit, leakage on any or all of the phases being monitored will be detected and cause a trip. The detection circuit is non fail safe and energises on detection of leakage.

Only one power supply is needed to power the FC and/or the complete FC-L function. The power is provided internally via the power supply card.

The unit requires indication of the state of the circuit switching device (contactor). A normally open contact of a control relay or interlock of the contactor is needed to prevent a healthy state being detected as leakage, causing a trip. This contact grounds the detector circuit, holding off the trip circuit.

A timer is incorporated in the unit. The timer is adjustable to 21 seconds for situations where the system is directly switching motors. The delay is to prevent the detector circuit reacting to a back EMF from the motor.

6.2. Frozen Contactor/Loss of Vacuum

Operating Value	A leakage of 25V or more from the line to the load side of the contactor, when the contactor is switched off, on one, two or all three phases.
Operating Voltages	Uses system voltage to detect fault.
Barrier	Suitable for systems up to 1100V. 1100V to 15V Intrinsically Safe Barrier. The same Barrier is used by the Earth Leakage/Lockout protection.
Voltage Tolerance	+20% to -30% of supply Voltage to the module (i.e.1 10V or 240V).
Loss of Supply	Operates for more than 2 Seconds on removal of module supply.
Operating Mode	Non Fail Safe only. Adjustable delay from "Switch off" of contactor to protection applied to circuit.
<u>Relay</u>	
Contacts	2 x C.O. switching shall not exceed 5A and 250V and the product shall not exceed 100VA.
Rating	Coil to contacts 2.5 A ¹ Electrical life greater than 2×10^5 operations at maximum load.
General	1. Power only from the Bramco power supply card. (PSC) fitted with an infallible transformer. 2. Tested to AS 2830.7

7. Earth Leakage Lockout (ELL)

This function is employed to prevent the closure of power onto a system that has an earth fault.

When incoming mains power is switched on to the system, the ELL scans the outgoing cable and will lockout if an earth fault of 10k-ohms or less is present. The outgoing circuit will be continuously monitored until the contactor or circuit switching device is closed. Detection of a fault will prevent the circuit switching device closing.

The unit is fail safe in operation and will drop out on detection of a fault and remain open until the fault is cleared.

This function, like the Loss of Vacuum, employs a barrier to isolate high voltages from the detector circuit.

The power supply to this unit is designed to maintain the function in its healthy mode for 2 seconds under no volt conditions, thus preventing premature drop out under system fault conditions.

7.1. Earth Leakage Lockout Card Specification

Operating Value	10KOhms min. to 15KOhms for each phase to earth or all phases to earth. Suitable for systems up to 1100V.
Operating Voltage	15VDC Max. applied to external circuits through the Bramco I.S. Barrier
Barrier	Suitable for systems up to 1100Volts. 1100V to 15V Intrinsically Safe barrier The same barrier is used by the Frozen Contactor Protection
Voltage Tolerance	+20% to -30% of supply Voltage of the module (i.e. 110V or 240V)
Loss of Supply	Operates for more than 2 Seconds on removal of module supply
Operating Mode	Fail Safe Only
<u>Relay</u>	
Contacts	2 x C.O. switching shall not exceed 5Amp and 250V and the product shall not exceed 100VA
Rating	Coil to contacts 2.5KV Electrical life greater than 2×10^5 operations at Maximum load
General	<ol style="list-style-type: none"> 1. Power only from the Bramco Power Supply Card (PSC) fitted with an infallible transformer 2. Designed to AS 2081 3. Tested to AS 2380.7

8. Short Circuit and Overload (SCOL)

In most modules these two functions are packaged together on one card thus saving space.

They will be treated separately here in the technical description.

8.1. Short Circuit (SC)

The Bramco Short Circuit function is available in two forms. Fault driven short circuit protection and protection supplied from its own power source. When combined with the overload, only the powered version is available.

Both systems function identically and have the same operating range and selection.

The short circuit range is adjustable from 60Amps to 4,500Amps. The trip setting is established by selecting a range, fine tuning the actual value and selecting the multiplier value.

e.g. Range - 15 to 45
 Fine - 30
 Multiplier - x6
 = 180 Amps

The multiplier value on the powered version is variable from 4 to 10 times whilst on the Fault Driven unit the values are 4,5,6,7,8,9 and 10 times.

Tripping times on the unit are between .01 and .02 seconds.

Two current transformers (CT's) are employed to detect the current level. These CT's cover the complete range of the unit.

The short circuit function may be supplied with integral latching facilities. The latching relay is electrically resettable.

When combined with the overload function, the selection of the overload limit presets the Short Circuit limit. Selection of the multiplier factor then sets the actual short circuit trip point as a multiple of the overload setting.

Trip time of this unit from switch on to full fault is .01 second.

8.2. Short Circuit Protection Specification

S.C. Tripping Range	Range 1 - 15 to 45Amps Range 2 - 50 to 150Amps Range 3 - 150 to 450Amps
S.C. Setting	By 11 Position Switch to cover the above ranges
S.C. Trip	By 7 Position Multiplier Switch Settings 4x ; 5x ; 6x ; 7x ; 8x ; 9x ; 10x the range setting = the circuit or motor current
Latch	Remanence relay, electrically reset or the Bramco Latching Flag Relay
Current Transformers	2 x Bramco 1000/1 15VA
Time to Trip	Approximately 10 milliseconds
<u>Relay</u>	
Contacts	2 x C.O. Switching 250V 5Amps (Resistive)
Rating	Coil to contacts 2.5KV Electrical life greater than 2×10^5 operations at Maximum load.
Operation	Relay Energises to Trip

9. Overload (OL)

This function provides an easily adjustable electronic overload protection for a supply system and/or electric load. A wide range is provided from one set of current transformers. The current range is adjustable between 15 and 450 amps.

Two performance curves are integral, one normal and one extended for slow starting loads such as fans.

Selection of the duty cycle is by a switch on the front facia of the unit or by switch mounted on the card. If mounted on the card removal of the front facia is required to operate the switch.

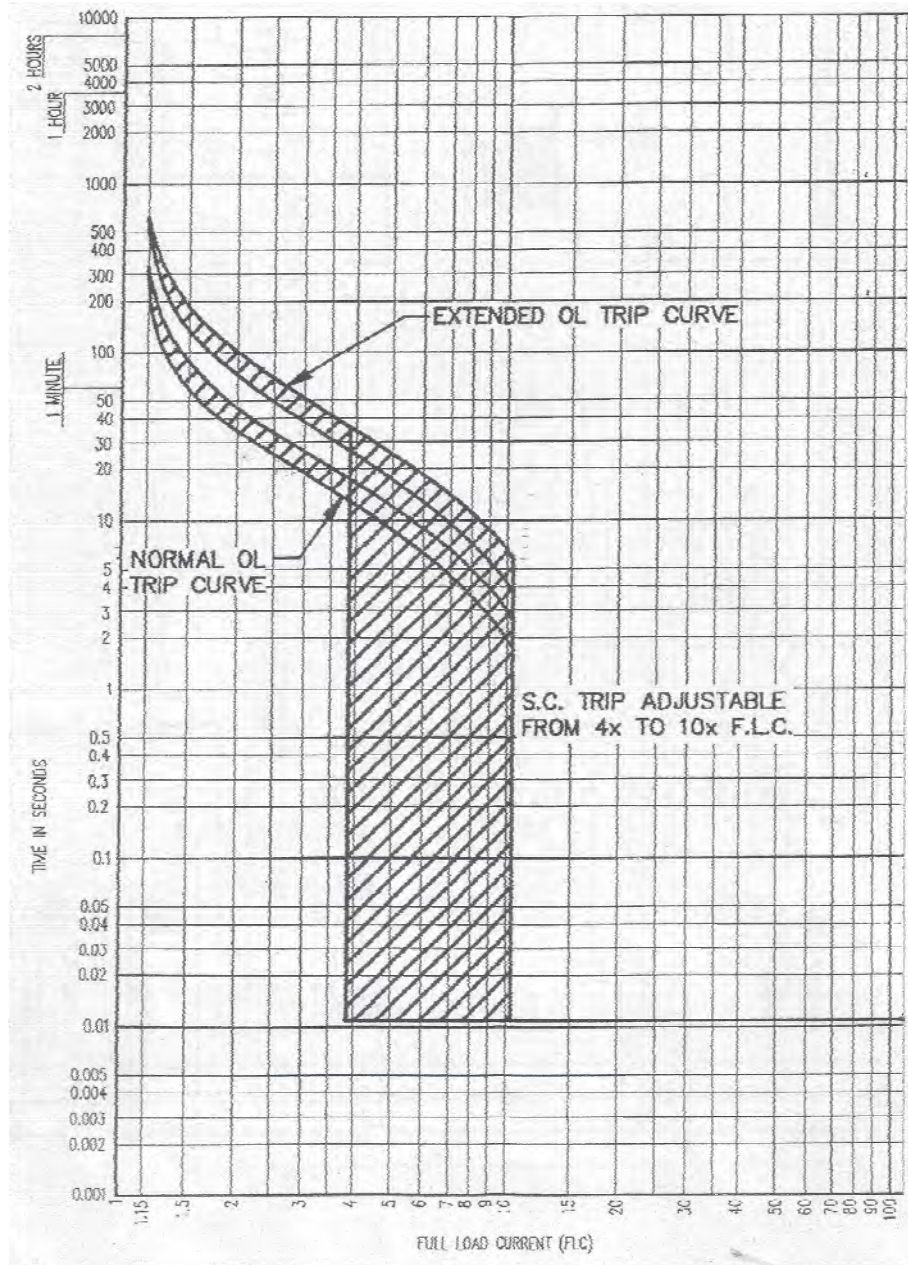
Performance of the unit is in accordance with the curves supplied and is absolute, there being no hot and cold characteristic.

To set the desired load current, select the range that the set point falls within and adjust the fine selector to the desired set point.

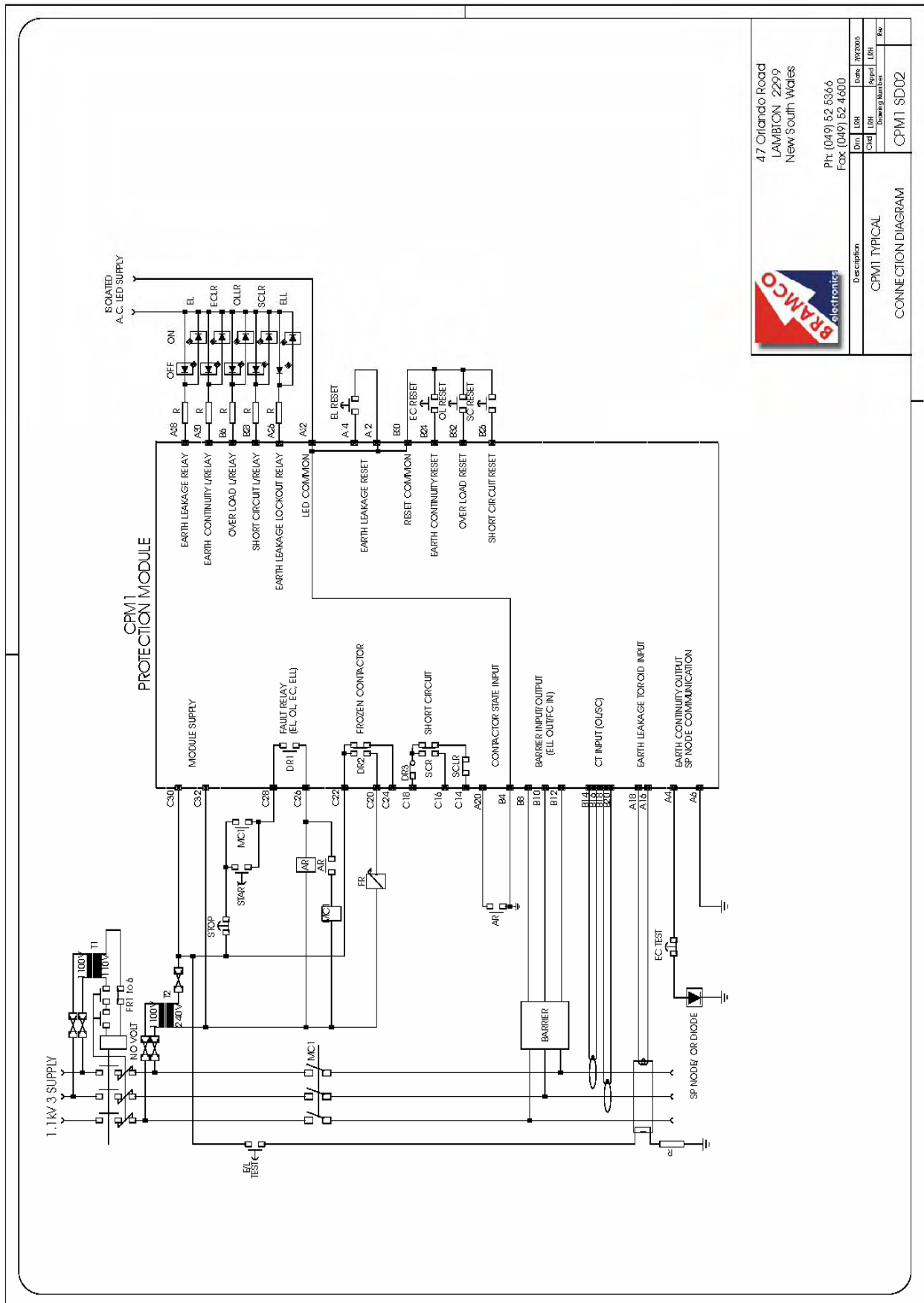

This function is powered from within the module. When combined with a short circuit, one extra selector is added to set the short circuit trip point as a multiple of the overload setting.

The power supply to this unit is designed to hold the function in its healthy mode for 2 seconds under no volt conditions, thus preventing premature dropout under system fault conditions.

10. Overload (OL) Curves



11. Typical Connections

47 Orlando Road
 LAMBTON 2299
 New South Wales

Ph: (049) 52 5366
 Fax: (049) 52 4600

Description		Drawn	Checked	Reviewed
CPM1 TYPICAL CONNECTION DIAGRAM		DR	DR	DR
CPM1 SDO2		DR	DR	DR