MINING ELECTRICS

PM2000 MANUAL

INSTRUCTIONS FOR USE

Prepared by
ATF Mining Electrics

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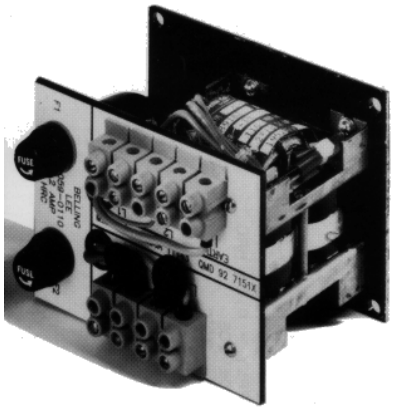
System Description

The PM2000 relay is a microprocessor based integrated protection relay intended for use predominantly in underground coal mines. The relay was originally developed in Australia and as such much of the documentation is written in the terminology used by Australian industry.

The relay is unique in that the unit itself requires no adjustment to operating parameters whilst it is in service regardless of the connected load. While this does not pose a problem in normal industry where the connected load does not change from day to day it is certainly not the case in the underground coal mining industry where it is common practice to have multi outlet power centres with the loads connected via trailing cables, and spare outlets available should these outlets become faulty. This philosophy has meant that in previous systems outlets were set up to have a particular machine plugged into a particular outlet and if for some reason the outlet became unserviceable then the spare outlet had to be configured for that machine. In most other systems, it is necessary to manually set things such as overload, earth fault etc. making changing outlets a specialised task.

With the PM2000 system this function is done automatically simply by plugging in the machine. If during operation the outlet should become faulty then all that is required to continue, is for the machine to be unplugged from the faulty outlet and plugged into a spare. This system is called machine recognition and works by reading an encoded chip located in the load machine. This system is of major benefit when additional control of the connected loads is required. For example, in the longwall system, the sequencing of drives is all taken care of automatically by utilising the identification label feature of machine recognition. This means that because the PM2000 knows that the Tailgate drive is plugged into the outlet that it controls then the system can start and stop the Tailgate motor in its correct sequence.

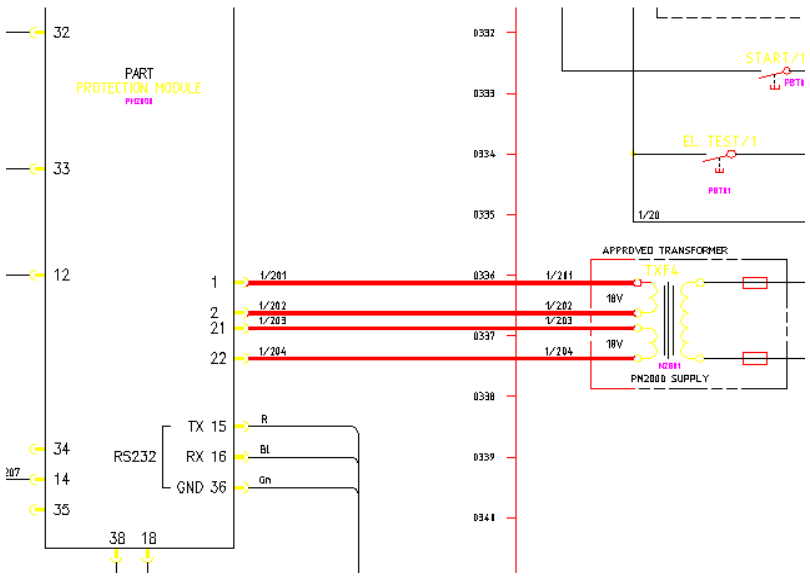
The PM2000 system consists of 3 parts, a PM2000 unit located in the power centre or distribution box, an IMT unit which is located in the load machine, and a supply transformer which is also located in the power centre.



Power Supply.

The PM2000 module features low power consumption in all modes of operation. Accordingly up to four PM2000's can be powered from a single 18 VA transformer. The transformer must be an MM Mining approved type N2801 (110 VAC), N2802 (240 VAC) or N2806 (415 VAC), which has two 18 volt secondary windings.

The power supply from the supply transformer is connected to the PM2000 relay via the single plug located at the back of the PM2000 relay. This section of a typical schematic drawing shows the connection of the windings. The two windings of the transformer are isolated from each other and connected as shown. The windings are connected to pins 1&2 and 21&22 respectively. It is important not to cross these connections over. When connecting multiple PM2000 modules to a single supply transformer it is important that the instantaneous polarity of the windings is maintained.

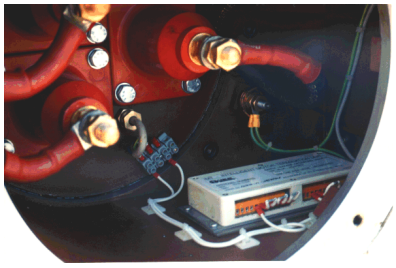


PM2000 Relay

The PM2000 relay is normally located in the distribution and control box or transformer. All of the external connections are made through a single plug located at the rear of the unit. All PM2000 relays are identical and as such any PM2000 may be exchanged with any other relay regardless of the circuit voltage.

IMT

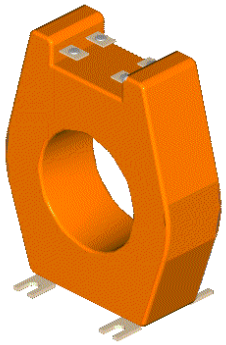
The IMT is an essential part of the PM2000 system. An IMT module contains all the information necessary to set the protection and control functions of the PM2000 module. These settings are burnt into the IMT chip at the factory prior to despatch. The IMT is then installed in the machine and remains there for life. As the characteristics of the machine cannot change then there is no need to alter the IMT characteristics. This machine can then be powered from any supply distribution centre containing a PM2000 relay without any further setting being necessary. The setting data is transmitted from the IMT to the PM2000 via the pilot conductor in the machine trailing cable at certain times during operation.



The figure shows an IMT located in a longwall motor terminal box.

The power to run the IMT is derived from the PM2000 module via the pilot connection. This pilot connection is also used as the medium for the data transmission from the IMT to the PM2000 for the protection settings.

Protection Features of the PM2000 System



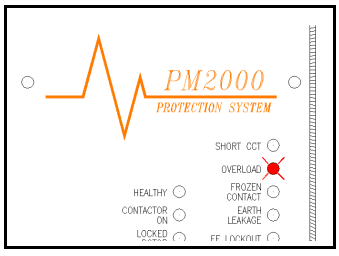
Overload.

Since the PM2000 is intended for 3-wire balanced power systems, only two of the three phases are monitored.

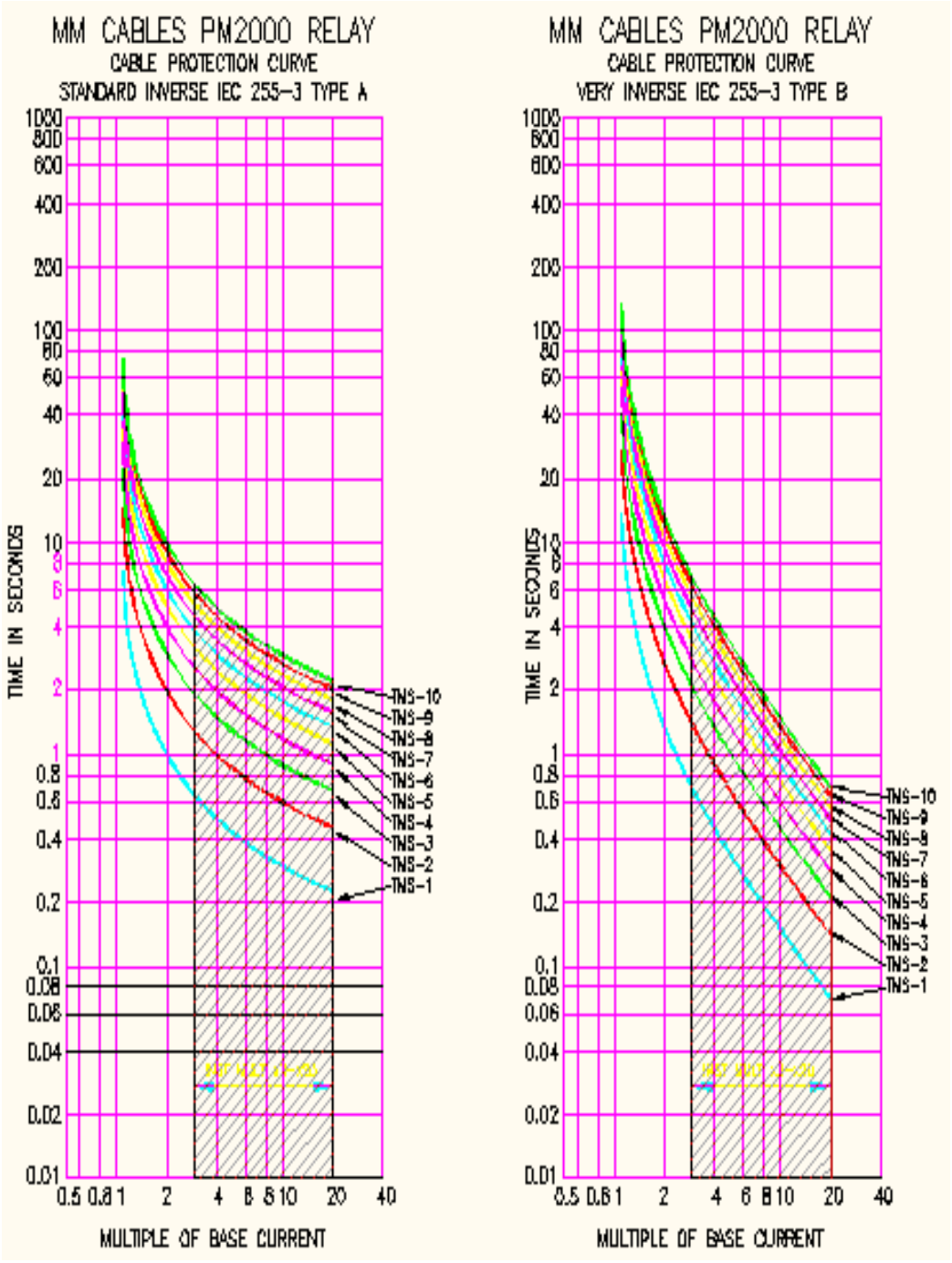
For all current ranges, a 1200:1 current transformer ATF Mining Electrics Type NM1101 is used. This ratio permits protection of motors and other loads from 2 amp full load current to 450 amps full load current.

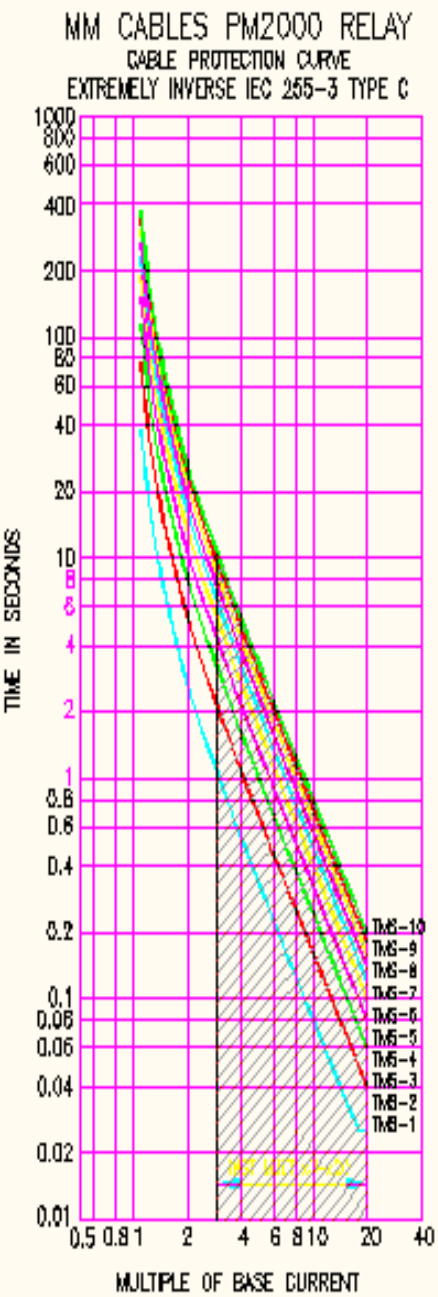
An overload trip is detected by comparing the motor operating current with the protection curve and the time multiplier settings from the IMT parameters. There are 3 standard curves, being Inverse, Very Inverse and Extremely Inverse as well as a Motor Extremely Inverse and an Ultra Inverse curve. These curves and operating times are shown in the graphs shown on the following pages.

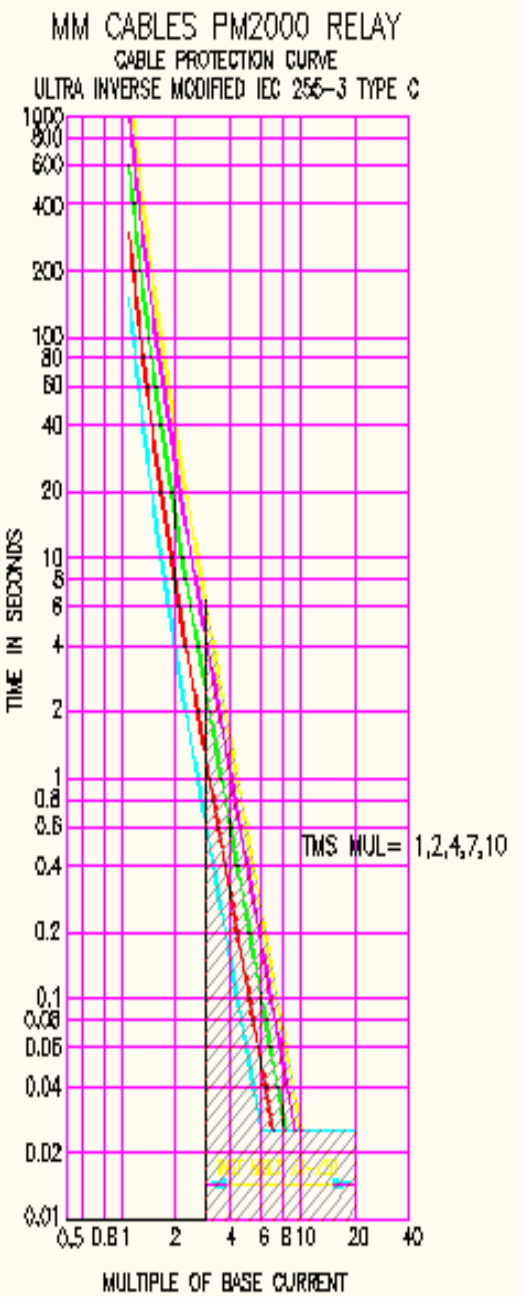
As well as the curve being programmed into the IMT there is also a time multiplier base burnt. Three DIP switches in the IMT allow the curve to be selected from a time multiplier of unity up to a maximum of 10. This vast range allows complete tailoring of the curve to suit any protection application.

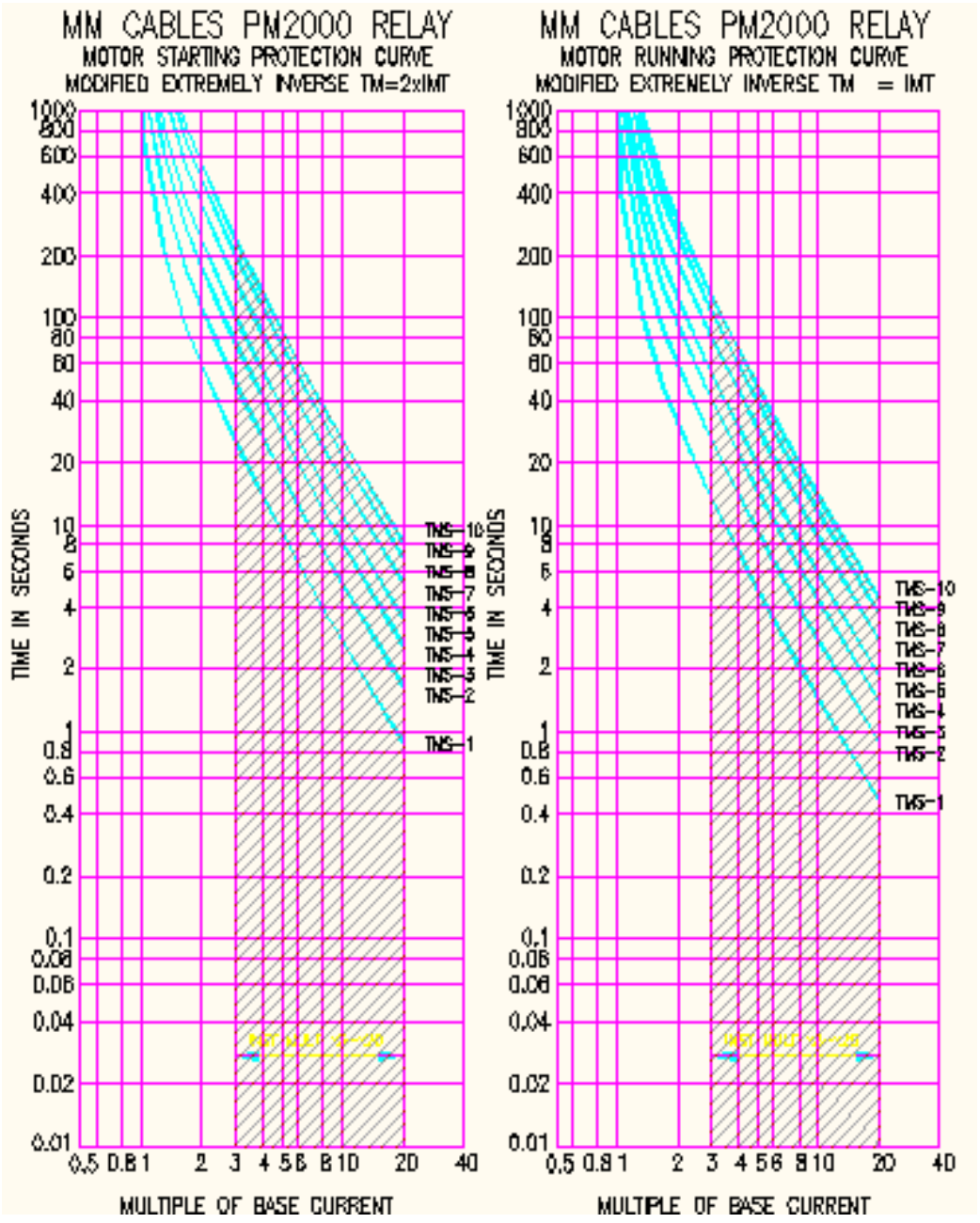


When an overload current is detected the overload LED on the front fascia of the PM2000 module will begin to flash indicating that the unit is in an overload condition and that a trip will occur. The flashing rate will increase with the amount of overload. When the unit trips the LED will be on continuously.

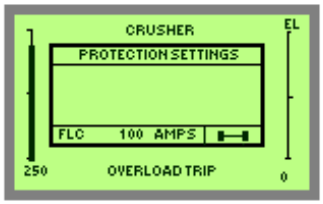

MM CABLES PM2000 RELAY
CABLE PROTECTION CURVE
STANDARD INVERSE IEC 255-3 TYPE A
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
TMS-10
TMS-9
TMS-8
TMS-7
TMS-6
TMS-5
TMS-4
TMS-3
TMS-2
TMS-1
MM CABLES PM2000 RELAY
CABLE PROTECTION CURVE
VERY INVERSE IEC 255-3 TYPE B
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
TMS-10
TMS-9
TMS-8
TMS-7
TMS-6
TMS-5
TMS-4
TMS-3
TMS-2
TMS-1


MM CABLES PM2000 RELAY
CABLE PROTECTION CURVE
EXTREMELY INVERSE IEC 255-3 TYPE C
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
TMS-10
TMS-9
TMS-8
TMS-7
TMS-6
TMS-5
TMS-4
TMS-3
TMS-2
TMS-1


MM CABLES PM2000 RELAY
CABLE PROTECTION CURVE
ULTRA INVERSE MODIFIED IEC 255-3 TYPE C
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
TMS MUL= 1,2,4,7,10

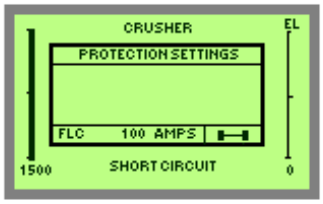

MM CABLES PM2000 RELAY
MOTOR STARTING PROTECTION CURVE
MODIFIED EXTREMELY INVERSE TM=2xIMT
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
MM CABLES PM2000 RELAY
MOTOR RUNNING PROTECTION CURVE
MODIFIED EXTREMELY INVERSE TM = IMT
TIME IN SECONDS
MULTIPLE OF BASE CURRENT
TMS-10
TMS-9
TMS-8
TMS-7
TMS-6
TMS-5
TMS-4
TMS-3
TMS-2
TMS-1

As well the LCD display will display an overload trip. The relay will remain in this tripped condition until either the soft or hard reset push-button is pressed. The actual current that the drive was experiencing at the time of the trip is displayed on the current bar graph located on the left hand side of the LCD display.



Start/ **Run** Option for Overload Curves
Any of the curves may optionally be selected by the IMT to have a different starting and running characteristic. This is achieved by automatically halving the time multiplier after a start has been detected. This feature will allow high inertia loads to be started while improving the level of thermal protection afforded to the motor.

Short Circuit
Short Circuit tripping is initiated if the current exceeds the trip value. The Main Contactor Auxiliary relay MCA will de-energise within 15 milliseconds of a short circuit fault. If the short circuit current exceeds 4kA, the FCT relay will be energised to trip the main circuit breaker, the MCA relay is held closed for a time sufficient for the main circuit breaker to trip.
The short circuit setting is burnt as a base value in the IMT. This is in terms of multiples of full load current. That is if the base value is 6 times and the full load current is 100 amps then the short circuit will be initiated at a current value of 600amps.

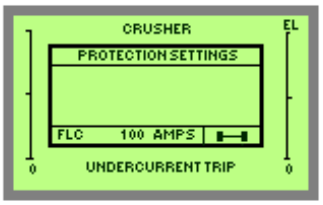


A base value of 3 to 13 times may be burnt into the IMT. As well as this DIP switches located in the IMT allow the short circuit value to be set for a particular application up to 7 settings above the base value. This means that if a base value of 6 is burnt into the IMT then the value may be tailored between 6 and 13 times full load current.

When a short circuit trip occurs the LED for short circuit will be lit and the LCD display will show a short circuit trip. The actual value of the trip current is displayed below the bar graph. Following a short circuit trip the relay can only be reset using the hard reset push-button.

Undercurrent

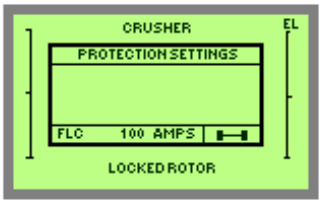
Undercurrent is detected by comparing the value of running current with a value set by the IMT which represents the unloaded current of the protected motor. Undercurrent may be enabled or disabled by DIP switches in the IMT.



When an undercurrent trip occurs the undercurrent LED will be lit and the LCD display will read indicate that an undercurrent trip has occurred. It is necessary to use the hard reset push-button following an undercurrent trip.

Locked Rotor

Locked Rotor is detected by comparing successive current readings during the first 2 seconds after closing the Main Contactor. If the current does not decrease during this time as would occur if a motor did not start to turn, the Main Contactor is de-energised.

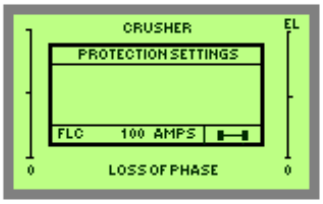


If a locked rotor trip occurs the locked rotor LED will light and the LCD will show that there has been a locked rotor trip. To reset the PM-2000 unit following a locked rotor condition it is necessary to use the hard reset push button.

Single Phase

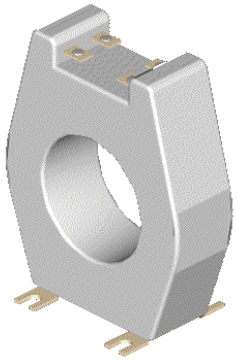
Phase Loss (single-phasing) is detected in two ways, firstly by comparing the values of the two phase currents, secondly by comparing the phase relationship between the two phase currents.

When the Motor is operating at greater than 25% FLC a ‘phase loss’ trip is allowed. A difference in current values of 25% FLC will initiate a ‘Phase Loss’ TRIP. If the phase currents are not 120 degrees offset, that is, if the non-measured phase fails, a Phase Loss trip is initiated.



A single phase trip is indicated by the LED and the LCD display. Following a single phase trip it is necessary to reset the PM2000 relay using the hard reset push-button.

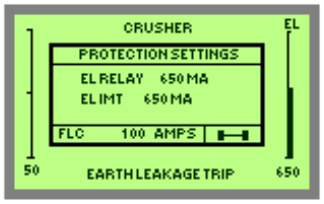
Earth Leakage



A core balance toroid ATF Mining Electrics Type NM2831 is used for earth leakage current measurement. The circuit arrangement is intended for use in power systems with earth fault limitation.

Earth leakage current is measured in increments of 20 mA, and time delay settings (from IMT) are set in Eight increments from a base trip time of 50 milliseconds. The increments can be programmed to be 20mS or 50mS giving a maximum delay of 160 milliseconds or 400 milliseconds respectively.

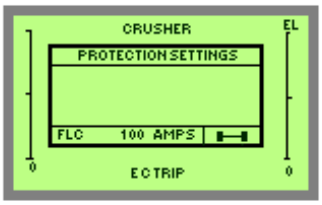
Differential earth fault measurement is provided by an earth leakage measurement in the IMT which is in most respects identical to that detailed above. The earth leakage toroid must be an identical type to that used for the PM2000 module.



Both main and IMT earth leakage currents are displayed on the scrolled data display on the PM2000 during normal running and the fault current levels are displayed after an earth fault trip. The difference in fault currents can indicate whether the earth fault was in the motor or the cable.

Only the PM2000 module earth leakage current is indicated on the bar graph at the right-hand side of the LCD screen and only the PM2000 module earth leakage current can cause a trip. The IMT earth leakage current is for indication only. After an earth leakage trip it is necessary to reset the PM2000 unit by operating the hard reset facility.

Earth Continuity



The pilot is regarded as an intrinsically safe circuit and protection is provided in accordance with AS 2380.7.
The pilot is intended to be terminated by a diode as is current practice.

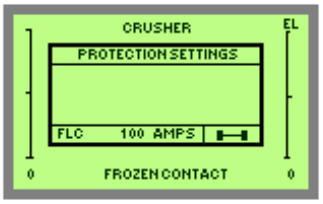
An earth continuity trip will occur if the pilot loop resistance raises above 45 ohms. Indication will be displayed by the LED for earth continuity being lit and the LCD display showing the trip. An earth continuity trip can be reset by pressing either the soft reset or the hard rest push-button.

Frozen Contactor / Loss Of Vacuum

A voltage detected on any phase with reference to earth is read continuously whilst ever the Main Contactor Auxiliary Relay is not energised. Should any voltage be detected, the Frozen Contactor Trip Relay FCT is energised, which will then trip the main circuit breaker in the distribution control box. The trip is recorded and relay FCT latched such that if power to the PM2000 is turned off, relay FCT drops out, but picks up again when power is restored. The relay can only be un-latched by pressing the hard reset push-button.

Frozen contactor trip is blocked by a time delay of approximately 15 seconds after the motor contactor is de-energised. This prevents a false trip due to voltage generated as the motor runs down.

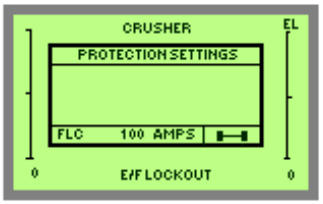
Provision is made for circuit breaker shunt trip as well as under voltage release. The shunt trip must be of the same control circuit voltage as the Main Contactor, since these circuits share a common pin on the PM2000 connector. The Under voltage trip contact is potential-free. The 'Frozen Contactor Trip' is a priority TRIP and will over ride any other existing TRIPS.



Indication of a frozen contact trip is on both the LED and the LCD display. Only a hard reset can reset the PM2000 following a frozen contact trip.

Earth Fault Lockout

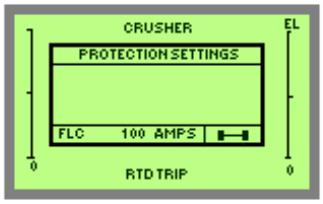
Earth fault lockout detection is achieved by injecting a small DC current from the PM2000 relay through the external intrinsically safe barrier onto the three power phases. This function is only in operation whenever the main contactor is de-energised.



If there is a short circuit to earth on any combination of power phases an earth fault lockout is indicated on the LCD screen. The contactor is prevented from being closed until the fault is cleared and the PM2000 is reset. It is necessary to press the hard reset push-button to reset this trip.

Temperature

Motor winding temperature can be monitored using three Pt100 type RTD's. The RTD's are read and compared with the preset trip level in the IMT which reflects the insulation class of the motor being monitored. If no RTD's are fitted, or if winding temperature protection is not required, the RTD inputs must be bridged. Three winding temperature flags are sent back to the PM2000 module. If any flag is zero, the Main Contactor Auxiliary Relay MCA is de-energised and a "Thermistor" trip is recorded. A hard reset is needed following a temperature trip.

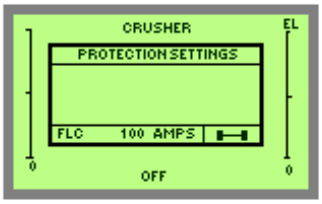


Operation of the PM2000

Power Up

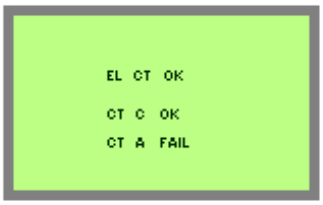
When no pilot is connected on power-up, the PM2000 LCD displays the message "**LOOKING FOR CONNECTION**".

Several seconds after the pilot connection is established, the LCD displays the relay parameters received from the IMT transmission. The equipment identification is displayed on the top line. Other setting data is scrolled through a window in the centre of the LCD screen.



Since the information is pre-programmed into the IMT, identification, characteristic curve, full load current and earth fault current setting data cannot be changed without changing out the IMT chip. This information is specific to the machine for which it is burnt and does not vary regardless of where it is installed and from what power source. There are some settings which may vary depending on the location of the installation. These are generally fault levels and upstream protection. In order for the PM-2000 to be correctly graded into a protection

scheme there are some adjustable features on the PM2000 system. These include time delays for both overload (time multiplier) and earth fault, short circuit multiplier and options including undercurrent and pilot start/stop. These functions can be tailored to a particular system by DIP switches located in the IMT. Once set, these settings are the ones transmitted from the IMT to the PM-2000 control relay.



Self Test on Power Up

The PM2000 includes a self-test function whereby at power-up or reset a current is injected through the primary of the main current transformers and the earth leakage toroid.

This current injection is controlled by the PM2000 and is energised for only a fraction of a second, just long enough for the PM2000 to read the current value from the CT inputs. If no current is detected on any of the three inputs, the PM2000 indicates a CT failure, identifies the faulty CT and prevents any further operation. A hard reset is necessary before the PM-2000 can be used.

Settings

The IMT transmits the following setting information specific to the machine in which it is installed:

Equipment identification
Full load current in amps
Earth fault current in milliamps
Protection curve (inverse, very inverse, extremely inverse, ultra inverse)
Short circuit trip level in per unit
Overload time multiplier
Earth fault trip delay in milliseconds
Undercurrent selected on/off
Pilot start/stop selected on/off

DIP switches on the IMT Board allow setting of short circuit trip multiplier, overload trip curve time multiplier, earth leakage trip time delay, pilot start/stop, remote start/stop and undercurrent trip enable/disable.

Switches and their functions are as follows:

S1.1 Short Circuit Trip Multiplier Bit 0 = Base Value + 1
S1.2 Short Circuit Trip Multiplier Bit 1 = Base Value + 2

S1.3	Short Circuit Trip Multiplier	Bit 2 = Base Value + 4
S1.4	Pilot Start/Stop	ON=enabled OFF=disabled
S1.5	Remote Start/Stop	ON=enabled OFF=disabled
S1.6	Undercurrent Trip	ON=enabled OFF=disabled

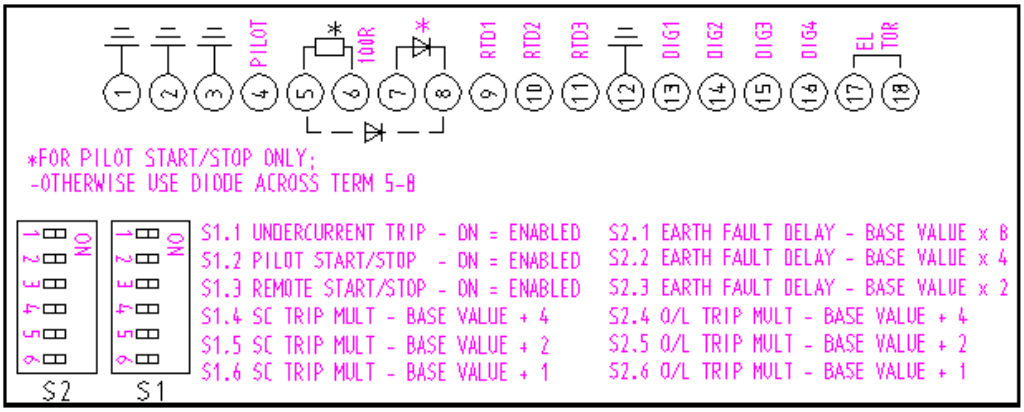
S2.1	Overload Trip Time Multiplier	Bit 0 = Base Value + 1
S2.2	Overload Trip Time Multiplier	Bit 1 = Base Value + 2
S2.3	Overload Trip Time Multiplier	Bit 2 = Base Value + 4
S2.4	Earth Fault Trip Delay	Bit 0 = Base Value + 2xBV msec
S2.5	Earth Fault Trip Delay	Bit 1 = Base Value + 4xBV msec
S2.6	Earth Fault Trip Delay	Bit 2 = Base Value + 8xBV msec

Note to Base values:
A Short Circuit Trip Multiplier Base Value burnt at 3 will give a multiplier range of 3 to 10. Minimum base value is 1. Maximum base value is 13.

Overload Trip Time Multiplier Base Value burnt at 1 will give a multiplier range of 1 to 8. Minimum base value is 1. Maximum base value is 3.

Earth Fault Trip Delay Base Value burnt at 50 milliseconds will give a delay range in 50 msec increments up to 400 msec. Minimum possible base value is 20 msec. Maximum possible base value is 500 msec.

Fig 1. Large IMT showing DIP switches



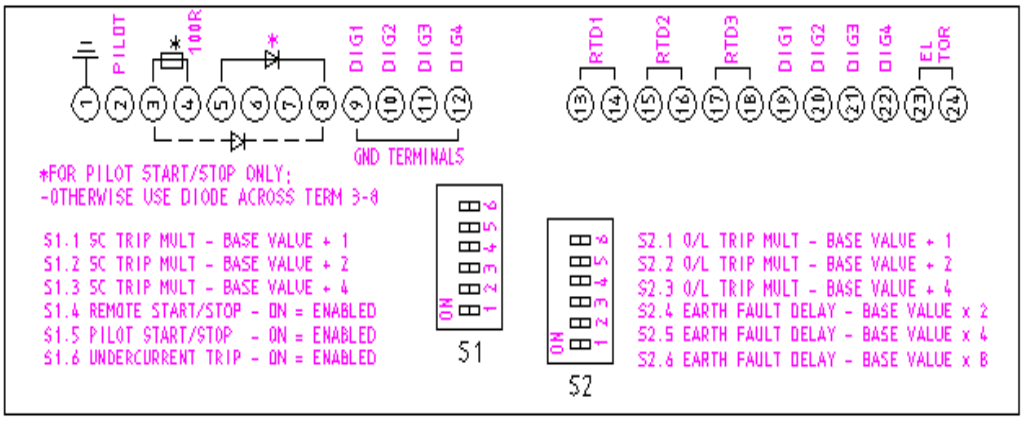
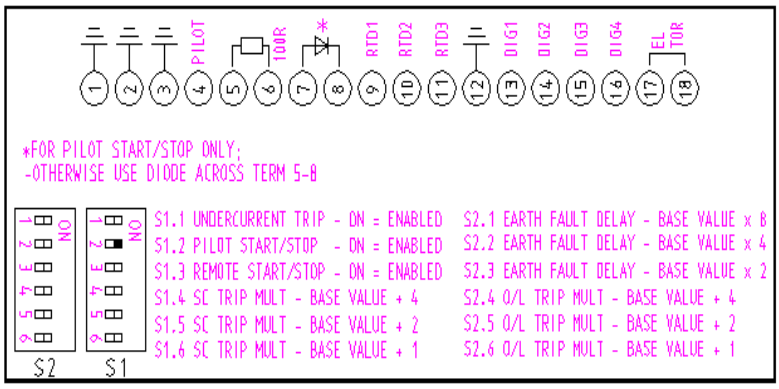


Fig 2. Small IMT showing DIP switches.



Control of the PM2000

Starting

The start input is for connection to a Start push-button. When the Start push-button is pressed the Main Contactor Auxiliary Relay MCA energises and the LCD status displays ON. The main contactor input on the PM2000 must energise to retain the contactor "on". If the Main Contactor does not energise, the Main Contactor relay will drop out when the Start push-button is released. Starting/stopping may also be controlled by a switch or PLC with a suitable circuit arrangement.

Pilot Control

If pilot start/stop is required a 100 ohm resistor is connected in series with the diode and a means of shorting out this resistor for starting provided.

The DIP switch located in the IMT must be enabled for Pilot Start control functions to operate. When in pilot control mode the PM-2000 must see the 100 ohm resistor for the time taken for the IMT to read the protection settings prior to the 100 ohm resistor being shorted out. This is to prevent uncontrolled starting in the case of the start button being jammed in.
If the PM2000 sees an IMT and not a 100 ohm resistor when the valid pilot connection is made then the LCD display will read EC TRIP, the most common cause of this problem is for an IMT to be set for Pilot stop/start and there not to be a 100 ohm resistor in circuit.
Whilst in pilot start/stop control, the pilot must be seen to drop below 45 ohms for a "Start" command. For a "Stop" command, the pilot must be open circuited.
The PM2000 regards all open circuited pilots to be a valid stop command since it could not tell the difference between a stop command and an unintentional open circuit. When this occurs the PM2000 LCD display indicates ‘Looking For Connection’. An automatic reset is then generated in this mode to enable a subsequent "Start" command.
When pilot start/stop is enabled, local start is disabled.
Note: When operated in this mode the PM2000 relay cannot display an earth continuity fault if the pilot circuit goes open circuit as this is seen be the relay to be a normal stop function. The relay will still indicate and trip if the pilot circuit is short circuited.

Resetting after Trip

Inputs for two reset pushbuttons are provided.

The soft reset is for resetting Earth Continuity and Overload trips only. The hard reset is for a total reset of all trips. Neither reset input is operative while the Main Contactor Auxiliary Relay MCA is energised.

Digital Inputs to IMT
Four additional digital inputs are provided for general use. These are sent as flags to the PM2000 module where they are simply stored. These flags are then available to be accessed by the serial communications. They cannot cause the PM2000 to trip.

Communications

Provision is made for serial communication of PM2000 information to an external device. An industry-standard RS232 line driver is used. Baud rate is 9600**.**

Where more than one PM2000 is connected to a single serial port on a computer or PLC, the RX and TX serial lines should be connected to a serial interface (such as ATF Mining Electrics OSI board) such that instruction bytes from the host device and data bytes from the PM2000 relays are passed back and forth.

Eight PM2000 relays can be connected to a single OSI board. With suitable software, the host device can indicate how many PM2000 relays are connected and can identify which relay is connected to which outlet. Hence it is not necessary to provide a unique identification to any PM2000 in a multi-outlet situation, and PM2000 modules may be changed around without alteration or adjustment.

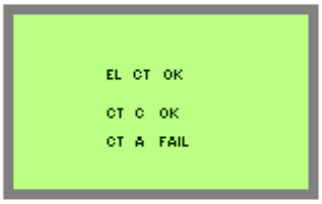
The RX and TX input/output lines are not intrinsically safe. If these lines are to be run to auxiliary equipment they should pass through a suitable approved intrinsically safe barrier.

Display and Indication

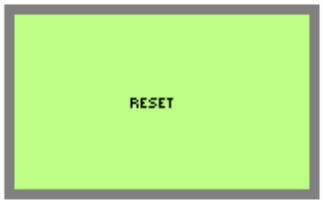
Status and trip information are displayed on the front panel of the PM2000 module by LEDS and an LCD graphic display screen. These displays are completely separate.

LED Indicators
Twelve red LED indicators are provided as follows:

Healthy status	ON when micro controller is running and Relay Board power supplies and voltage reference are healthy.
Contactor status	OFF when Main Contactor is off. BLINKING when Main Contactor Auxiliary Relay MCA is energised but Main Contactor is off. ON when Main Contactor is on.
Trip functions	ON when trip recorded. Frozen Contactor Earth Fault Lockout Earth Continuity Earth Fault Overload Short Circuit Locked Rotor Undercurrent Phase Loss Thermistor (Winding Temperature)



LCD Display



The display contains status and alarm messages relating to the PM2000 itself and to the connected equipment.

Single messages are displayed during certain events as follows:

When the Hard Reset or Soft Reset push-button is pressed.

When the PM2000 is trying to establish a valid pilot connection. When a pilot connection is made, the PM2000 module can communicate with the IMT. No setting data can be stored or displayed and no operation can be performed until information is received from the IMT. It takes a few seconds for this information to be displayed once connection is established.

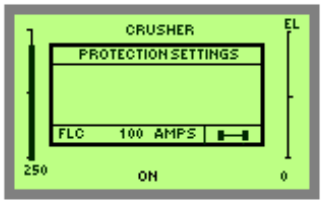
A valid pilot connection has been established but no information (or corrupt data) has been received from the IMT within a reasonable time.

When the PM2000 is powered up, the CT Test function is carried out. If no current
reading is received in one or more CT inputs, the error message is displayed. The message indicates which CT is not responding.

Main Display Screen

The following information received from the IMT is displayed on the screen. The first item is always displayed on the top line. The other items are scrolled through in the middle window. Scrolling is faster when the Main Contactor is energised:

- Connected machinery identification by name e.g. "CRUSHER"
- Full Load Current
- Protection Curve type
- Short Circuit trip multiplier
- Overload trip time multiplier
- Earth leakage trip current
- Earth leakage trip time delay
- Pilot resistance
- Earth leakage current - machine + cable (from PM2000)
- Earth leakage current - machine only (from IMT)



Bar graphs are located at each side of the data window.
Load current in %FLC is displayed on the left hand side bar graph and earth leakage current is displayed on the right hand side. The trip point is the small notch at the centre of the bar graph.

Digital values are displayed beneath each bar graph respectively and is displayed as actual current values.

The centre portion of the bottom line contains status and trip information.

A small segment on the right portion of the screen known as the “dumbbell” indicates the state of data communication with the IMT when the Main Contactor Auxiliary Relay MCA is energised.

Ordering Details

Part No.	Description
PM2000	Protection Relay
N2801	Supply transformer for PM2000.(is essential for powering PM2000 however one transformer can supply 4 PM2000 units) Supply Voltage 110 V a.c.
N2802	Supply transformer for PM2000 (as above but with the supply voltage of 240 V a.c.
N2806	Supply transformer for PM2000 (as above but with the supply voltage of 415 V a.c.
NM1101	Protection C/T (2 required for each PM2000)
N2831-68	Earth Leakage Toroid (comes with 68mm diameter window)
N2831-45	Earth Leakage Toroid (comes with 45mm diameter window)
N2831-112	Earth Leakage Toroid (comes with 112mm diameter window)
N2834	Intrinsically safe barrier assembly (for earth fault lockout detection on 1kV systems)
NM1043	Intrinsically safe barrier assembly (for earth fault lockout and loss of vacuum detection on 3.3kV systems - needs to be used in conjunction with N2850)
N2850	Three phase reactor (used in conjunction with NM1043 barrier to provide loss of vacuum and earth fault lockout protection on 3.3kV systems)
WPF02	Plug for PM2000 (connects PM2000 to external circuitry, necessary for all PM2000 installations)
OSI	Output serial interface (allows up to 8 PM2000 units to be connected to a PLC)
PMIMT	Intelligent Motor Terminator (one IMT is required for each

PM2000 circuit, unit is sold without programmed chip)

PMIMT-M Magnetic Intelligent Motor Terminator (as above except that IMT is magnetic and requires no extra mounting when used on ferrous metal enclosures)

PMIMT-C Programmed IMT chip (chip is programmed to customer requirements and is suitable for both types of IMT)

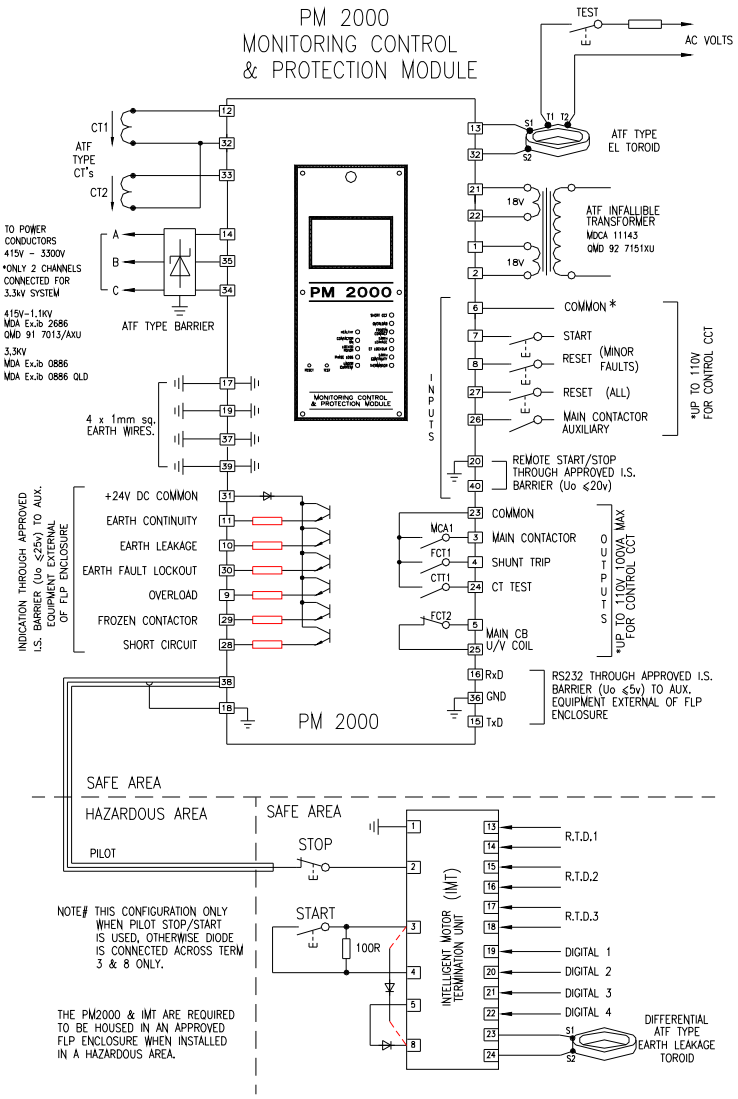
IMT-D Dummy Plug for restrained outlets (comes fitted with IMT)

Connection Diagram

A connection diagram is shown on the following page. The diagram shows the connections for a large IMT connected both for normal use and for Pilot Control Mode.

If a small magnetic IMT is used then the connections are as shown on page 12.

Copies of the IMT connections are shown on the label inside the lid of the IMT.


PM 2000
MONITORING CONTROL
& PROTECTION MODULE
TEST
AC VOLTS
CT1
ATF TYPE CT's
CT2
TO POWER CONDUCTORS
415V - 3300V
*ONLY 2 CHANNELS CONNECTED FOR 3.3kV SYSTEM
415V-1.1KV
MDA Ex.ib 2686
QMD 91 7013/AXU
3.3KV
MDA Ex.ib 0886
MDA Ex.ib 0886 QLD
ATF TYPE BARRIER
4 x 1mm sq. EARTH WIRES.
ATF TYPE EL TOROID
ATF INFALLIBLE TRANSFORMER
MDCA 11143
QMD 92 7151XU
18V
18V
PM 2000
MONITORING CONTROL & PROTECTION MODULE
INPUTS
COMMON *
START
RESET (MINOR FAULTS)
RESET (ALL)
MAIN CONTACTOR AUXILIARY
*UP TO 110V FOR CONTROL CCT
REMOTE START/STOP THROUGH APPROVED I.S. BARRIER (Uo ≤20v)
INDICATION THROUGH APPROVED I.S. BARRIER (Uo ≤25v) TO AUX. EQUIPMENT EXTERNAL OF FLP ENCLOSURE
+24V DC COMMON
EARTH CONTINUITY
EARTH LEAKAGE
EARTH FAULT LOCKOUT
OVERLOAD
FROZEN CONTACTOR
SHORT CIRCUIT
OUTPUTS
COMMON
MCA1
MAIN CONTACTOR
FCT1
SHUNT TRIP
CTT1
CT TEST
FCT2
MAIN CB U/V COIL
*UP TO 110V, 100VA MAX FOR CONTROL CCT
RxD
GND
TxD
RS232 THROUGH APPROVED I.S. BARRIER (Uo ≤5v) TO AUX. EQUIPMENT EXTERNAL OF FLP ENCLOSURE
PM 2000
SAFE AREA
HAZARDOUS AREA
PILOT
SAFE AREA
STOP
START
100R
INTELLIGENT MOTOR TERMINATION UNIT (IMT)
R.T.D.1
R.T.D.2
R.T.D.3
DIGITAL 1
DIGITAL 2
DIGITAL 3
DIGITAL 4
DIFFERENTIAL ATF TYPE EARTH LEAKAGE TOROID
NOTE# THIS CONFIGURATION ONLY WHEN PILOT STOP/START IS USED, OTHERWISE DIODE IS CONNECTED ACROSS TERM 3 & 8 ONLY.
THE PM2000 & IMT ARE REQUIRED TO BE HOUSED IN AN APPROVED FLP ENCLOSURE WHEN INSTALLED IN A HAZARDOUS AREA.