

IPM Version 2 Integrated Protection Relay

1. Description

1.1 Introduction

The Ampcontrol IPM Integrated Protection Relay (Version IPM V2.0) is an intelligent protection relay based on microprocessor technology. All of the tripping logic and outlet control is performed by the microprocessor, so that virtually no external control is required.

The IPM Integrated Relay provides the necessary functions required for protecting electrical outlets supplying underground mining machinery, powered by reeling or trailing cables, in the metalliferous industry. The relay can also be used to provide optimum overload protection of motors used on conveyors, pumps, fans and compressors. All of the protection functions are combined into a compact, plug-in unit, which can be easily changed out to minimise down time in the event of a problem with the relay.

The IPM Integrated Protection Relay can provide Machine Data Transfer through the use of a Remote Termination Module (RTM) connected between the pilot and earth at the machine end of the trailing cable. Through the use of the RTM the relay parameters are automatically up loaded from a remote machine when a cable is inserted into a power outlet. The IPM's remote start capability can also be access by use of the Ampcontrol's Remote Termination Module.

A RS485 Modbus communication port is available that can be connected to Motor Starter PLC's or a central monitoring system for continuous monitoring and fault-finding.

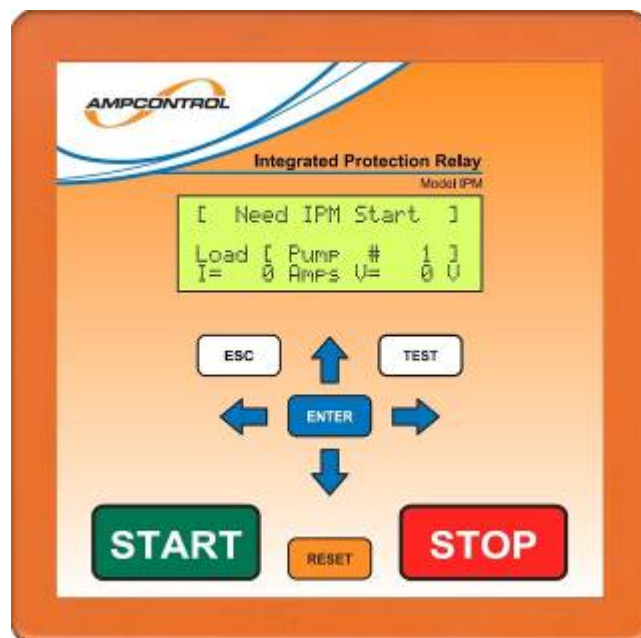
The IPM Relay provides an isolated 4-20mA analogue output to continuously monitor Average Current, Overload, Earth Leakage and the Insulation level of the relay.

An automatic Insulation Test can be initiated once all starting conditions are met. A high voltage DC "Insulation Test" to earth of the cable is carried out. If the result of the Insulation Test is above the preset resistance level, the IPM's MCR relay energises, which in turn closes the main contactor. A manual "Insulation Test" is provided as a maintenance/fault finding tool.

A Burp Function allows for the progressive inflation of ventilation bags (tubes) by pulsing the motor contactor controlling a ventilation fan, several times at start up.

The standard current transformers supplied with the IPM Integrated Protection Relay enables protection of motors with full load currents ranging from 0.5A to 640A. The selected full load current can be set to one of 224 values across the range. The IPM Relay can be set to automatically reset or require a manual reset, by pressing the keypad 'RESET' button or activating the 'RESET' digital input, following an overload trip condition once the thermal accumulator falls below the set value.

The IPM Relay's 50 event log and adjustable settings are battery backed.



A four-line 20 character backlit LCD display combining with a keypad provides an easy to operate user interface. The display provides easy access to all available information. A simple procedure allows adjustment of the relay's settings.

The IPM Relay is housed in an enclosure suitable for flush mounting in a 135mm square cut out and has robust plug in connectors on the rear of the relay. **Note: Torque setting for mounting screws on Main Mounting Bracket – 0.8Nm**

2. Protection Functions

The Ampcontrol IPM Integrated Protection Relay provides protection functions for:

- Earth Leakage
- Earth Continuity
- Overload
- Short Circuit
- Contactor Fail
- Residual Current
- Phase Current Balance
- Under Voltage / Under Current

3. Features

- Automatic and Manual High Voltage Insulation Test
- Machine Recognition
- RS485 communication port interfaces to SCADA system via Modbus protocol
- 4-20mA Analogue output
- Thermal modelling
- User friendly. Relay and Remote Termination Module are programmed from the IPM Display
- Status messages to indicate what is required to energise the outlet
- Microprocessor based
- Diode or Remote Termination Module operation
- 50 Event Log with real time clock
- Relay & Digital Input Status to aid fault finding
- Local or remote operation
- Plug-in for quick change out
- Burp Function for controlled fan starting
- Remote Start Capability

4. Application

The IPM Integrated Protection Relay provides all the necessary protection functions to control the various types of mining machinery. The default Status Screen allows unskilled personnel to determine what is required to apply power to the machine. (See IPM User Manual 121549 for full details).

4.1 Alarms

Alarms can be programmed to warn of a pending trip condition.

4.2 Earth Leakage

The earth leakage protection function uses a 1000:1 core balance toroid to measure the earth fault current. A Residual Current Device (RCD) operating characteristic is provided with adjustable trip sensitivity and time delay. If the earth leakage signal exceeds the trip level for the selected trip time, a trip occurs, tripping the MCR relay. The fault is latched.

4.3 Earth Continuity

The earth continuity function tests for the continuity of the earthing between the outlet and the machine, via the pilot core in the trailing cable. The pilot core is also used to transfer data when a Remote Termination Module is used to achieve Machine Data Transfer.

4.4 Short Circuit

The short circuit function has a definite time characteristic. If the current exceeds the selected level for the pre-set time then a trip occurs. The short circuit function trips the CBR relay, which in turn can trip the main circuit breaker.

4.5 Main Contactor Fail

The Main Contactor Fail (MCF) protection operates if the Main Contactor (MC) fails to function by either:

1. Failing to open when required.
2. Failing to maintain insulation across the contacts when the contactor is open.

4.6 Residual Current

The three phase current signals are summed electronically in the IPM Relay to produce a residual current signal that can be used to detect earth fault currents. (See User Manual 121549 for full details).

4.7 Remote Start

This functionality is similar to that of the IPB/C/D. The remote start can be set in two modes. In one mode it is always active and in the other mode it is active only when the auxiliary digital input is closed.

4.8 Overload Protection

Optional CT's can extend the relays current range.

- 1:100 0.5A – 64A
- 1: 1000 5.125A – 640A

5. Specifications

Auxiliary Supply Volts:

24VAC / DC \pm 20%
Power consumption < 10W

Earth Leakage Protection:

Trip setting 25-500mA and off
Time Delay – Instantaneous (<80ms), 50ms - 150ms

Earth Continuity Protection:

Reset if resistance is <45 ohms
Trip if resistance is > 45 ohms
Trip Time Delay: 80, 120, 160, 200, 300, 400, 500ms
Shunt Leakage Trip if <1500 ohms

Overload Protection:

Current Range: 0.5 to 640 (224 steps) – See Part 4 for details.
Trip time @ 6x FLC: 3, 4, 5, 6, 7, 8, 10, 12, 14, 16, 20, 24, 28, 32, 40s
Overload Reset Level: 30%, 40%, 50%, 60%, 70%, 80%, 90%, A-30%, A-40%, A-50%, A-60%, A-70%, A-80%, A-90%
Cooling Multiplier 1, 1.5, 2, 2.5, 3, 4, 5

Short Circuit Protection:

Trip Setting: 3 to 10 times in 0.5 increments (times full load)
Trip Time: 20, 40, 60, 80, 100, 120, 160ms

Insulation Test:

Lockout resistance is selectable at 1, 2, 5, 10, 20 Meg Ohm and none

Current Balance:

Trip Settings: 5%, 10%, 20%, 50% and off
Trip Delay: 2s

Residual Current:

Trip Setting: 10% to 250% and off
Trip Time: 100ms to 5s

Back EMF Timer:

Trip Delay Settings: 2, 5, 10, 15 and 20s

Machine Numbers: Can be allocated from 1 to 40

Under Voltage Protection:

Selectable from 20% to 80% in 10% increments
Trip Delay 800ms

Under Current Protection:

Selectable from 32% to 96% in 8% increments and none
Trip Delay 800ms

Burp Function:

No Pulses Setting: 1 to 6 any none
Time On/Time Off Setting: 0.6, 0.8, 1.0, 1.2, 1.5, 2.0, 2.5 and 3.0s

Communications:

RS485 Slave Modbus
Baud Rate: 1200 to 19200

Monitoring:

4-20mA Analogue Output – Iave, O/L, E/L, M Ω

Relay Contacts:

MCR (1/NO, 1 C/O), CBR and ALM (1 C/O)
5A/190VAC 100VA max

6. Equipment List

121503 IPM Integrated Protection Relay 24V
121504 ITM-415 Insulation Test Module
121505 ITM-1000V Insulation Test Module
121506 RTM Remote termination Module
121507 Earth leakage Toroid
101272 Current Transformer (1000:1)
121549 IPM User Manual

AMPCONTROL ELECTRONICS

Ampcontrol CSM Pty Ltd - ABN 35 000 770 141
7 Billbrooke Close CAMERON PARK NSW 2285

Phone: (02) 4903 4800

Fax: (02) 4903 4888

E-mail: electronics@ampcontrol.com.au

Web site: ampcontrolgroup.com

