IPD 11 kV INTEGRATED PROTECTION RELAY - USER MANUAL

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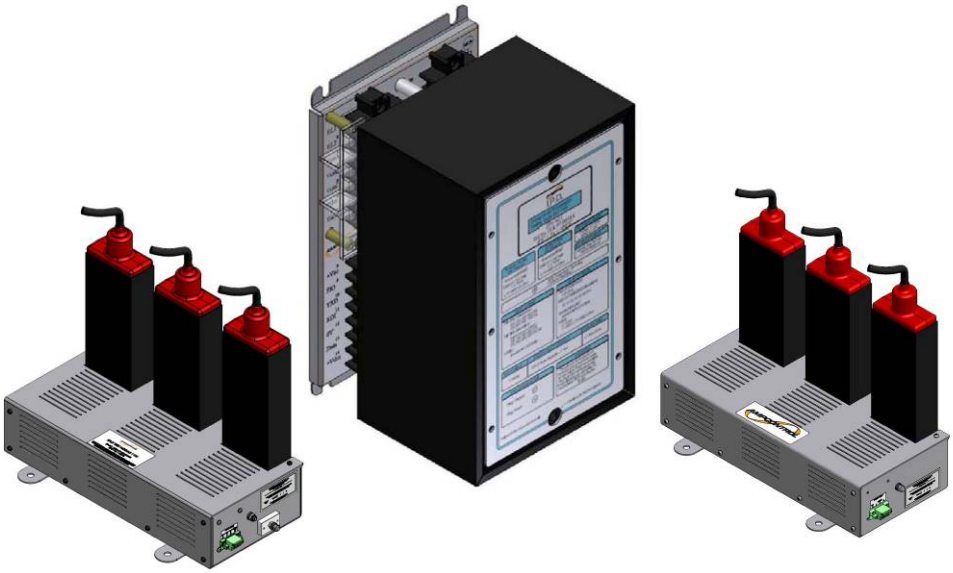

AMPCONTROL®

Ampcontrol CSM Contact details:

7 Billbrooke Close, Cameron Park, NSW, 2285
P +61 2 4903 4800 | F +61 2 4903 4888

EMAIL: electronicsorders@ampcontrolgroup.com
WEB: www.ampcontrolgroup.com

Safety and other Warnings

WARNING! 	**This safety alert symbol identifies important safety messages in this manual and indicates a potential risk of injury or even death to the personnel. When you see this symbol, be alert, your safety is involved, carefully read the message that follows, and inform other operators.**

CAUTION! 	**This safety alert symbol identifies important information to be read in order to ensure the correct sequence of work and to avoid damage or even destruction of the equipment, and reduce any potential risk of injury or death to the personnel.**

	Supplementary information not directly affecting safety or damage to equipment. Carefully read the message that follows, and inform other relevant personnel.

	**Information concerning possible impact on the environment and actions required for prevention and proper response.**

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Ampcontrol further reserves the right to alter the specification of the system and/or manual without obligation to notify any person or organisation of these changes.

Before You Begin

We would like to take a moment to thank you for purchasing the IPD 11kV Integrated Protection Relay.

WARNING! 	**To ensure the correct and safe operation of this equipment the user is to become completely familiar with the safety requirements and correct operating procedures detailed in this user manual.**

Table of Contents:

1 Receiving, Storage & Maintenance

1.1 Receiving

All possible precautions are taken to protect the equipment against damage or losses during shipment, however before accepting delivery, check all items against the packing list or Bill of Lading. If there are shortages or evidence of physical damage, notify Ampcontrol immediately.

Notify Ampcontrol within 7 days (maximum) in case of shortages or discrepancies, according to the packing list. This action will help ensure a speedy resolution to any perceived problems. Keep a record of all claims and correspondence. Photographs are recommended.

Where practicable do not remove protective covers prior to installation unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them, especially if the wrappings are to be discarded.

1.2 Storage after Delivery

When the equipment is not to be installed immediately, proper storage is important to ensure protection of equipment and validity of warranty.

All equipment should be stored indoors protected from the elements in a cool dry area. If storing on the ground, ensure that the storage area is not an area where water will collect.

1.3 Unpacking of Equipment

The method of packing used will depend on the size and quantity of the equipment. The following cautions should be interpreted as appropriate.

CAUTION! 	**Take care when unpacking crates as the contents may have shifted during transport.** **Make sure that cable drums are securely attached to their shipping pallets before attempting to move them.**

 *ENVIRONMENTAL ALERT*	The disposal of packaging materials, replaced parts, or components must comply with environmental restrictions without polluting the soil, air or water. Ensure that any timber and cardboard used as packaging is disposed of in a safe and environmentally responsible manner. Where possible, dispose of all waste products i.e. oils, metals, plastic and rubber products by using an approved recycling service centre.

2 Safety

2.1 Personnel Safety Warnings

2.1.1 Relevant Personnel

Ensure all personnel directly responsible or involved with the installation, operation and maintenance of the equipment reference this manual in conjunction with any relevant risk assessments to identify all foreseeable hazards.

2.1.2 Safety Communication

All safety instructions and design requirements within this manual must be communicated to all users. These requirements are necessary to identify and control any foreseeable risk associated with this piece of equipment. In the event of any damage or malfunction that results in the potential to harm the health or safety of any person; the owner/operator should notify the manufacturer immediately.

2.2 Safe Use of Equipment

Equipment supplied has been manufactured within the guide lines of the relevant Australian Standards and state legislative requirements. Equipment identified within this manual has been designed for a specific intended purpose; therefore any modification or damage must be reported to the manufacturer for repair.

The instructions within this manual must be observed as an aid towards achieving maximum safety during operation.

2.2.1 Changes to Equipment

Changes in the design and modifications to the equipment are not permitted

2.2.2 Work in Hazardous Areas

No work on the equipment shall be carried out in a hazardous area unless that work complies with the guide lines contained in HB13-2007 (Standards Australia Handbook-Electrical equipment for hazardous areas) and any relevant standards referenced therein.

2.2.3 Equipment Knowledge

Experience with, or understanding of, this equipment is essential for the safe installation and removal of the equipment. If in doubt, contact Ampcontrol immediately.

Mechanical and or Electrical installation, and maintenance of plant and equipment, must only be carried out by appropriately trained, qualified and competent personnel.

3 Overview of Equipment

The Ampcontrol IPD Integrated Protection Relay (IPD-11kV) is an intelligent protection relay based on microprocessor technology.

The Installation, Operation and Maintenance Manual is intended for technical and non-technical personnel to assist in the day to day operation of the IPD-11kV as well as installation.

3.1 Introduction

The integrated relay provides the necessary functions required for protecting electrical outlets supplying underground mining machinery. 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 IPD Relay can provide machine communication through the use of a Remote Termination Unit (RTU-D) connected between the pilot and earth at the machine end of the trailing cable. Through the use of the RTU-D Remote Termination Unit the relay parameters are automatically up loaded from a remote machine when a cable is inserted into a power outlet.

The earth fault lockout function tests the resistance of the 3 phase lines to earth by applying an intrinsically safe signal prior to the closure of the main contactor in accordance with AS/NZS 2081.4 2002. The test is initiated once all starting conditions are met. If the resistance is above the preset level then an automatic high voltage DC "Insulation Test" to earth can be carried out. If the result of the Insulation Test is above the preset resistance level, the IPD's MCR relay energises, which in turn closes the main contactor. A manual "Insulation Test" is provided as a maintenance/fault finding tool. (When this test is performed the MCR relay does not close at completion of a healthy test).

The Insulation Test allows cable insulation levels to be trended as an aid to preventative maintenance.

The IPD Relay has 5 Digital inputs, which feed into a microprocessor unit. The microprocessor has been programmed to control four output relays. Relay MCR for the main contactor and Relay CBR for the circuit breaker. Relay RL3 is not used in the 11kV IPD. Relay RL4 when closed applies 110V to the HV Test Module for the Insulation Test. All of the tripping logic and outlet control is performed by the microprocessor, so that virtually no external control is required (See Typical Connection Diagram IPD-E-015).

Extensive information display and monitoring features are included to facilitate fault finding and system trending. This information can be read locally on the Remote Display Module (RDM-D) or remotely via a communication link.

Opto isolated outputs are available for connection to optional LED or Relay Modules to provide additional "run and trip" indications. The Ampcontrol Relay Output Module (ROU) enables these indications to be interfaced with a PLC. Direct connections to the Opto isolated outputs can also be made for remote monitoring with no additional interfacing required. The maximum voltage for these outputs is 30V with an internal impedance of 4.7kΩ.

The protection functions provided by the IPD are:

Earth Leakage	Section 5.1
Earth Fault Lockout-	Section 5.2
Earth Continuity	Section 5.3
Over Current/Overload	Section 6
Short Circuit	Section 6.4
Contactor Fail	Section 7.1

Protection trips are stored in a non-volatile memory requiring a reset function before power can be restored to the load. This remains the case even if a power down occurs following a trip condition.

3.2 Remote Display Module

This module (Ampcontrol RDM-D) consists of a two line - 16 character LCD display, LED status indicators and a tactile keypad.

The display **level** is changed with the Up/Down arrow keys and the display **position** is changed with the Left/Right arrow keys. The display map (Drawing IPD-B-009) shows the layout of the various display screens. The module is approved to Ex ia Intrinsic Safety Standards so that it can be installed outside of a flameproof enclosure.

The healthy LED located top centre of the module flashes at 3 Hz to indicate healthy communications with the relay. (A flash rate of 1 Hz indicates that the module is powered, but is not receiving data).

The module displays the following information:

1. IPD Status.
2. Software version and serial number.
3. Operational information from the protection functions, e.g. earth leakage current, earth continuity resistance etc.
4. System information including the line voltage and current.
5. Status of digital inputs and relay outputs.
6. Protection trip settings, which can be viewed at any time. Authorised personnel can modify these settings via the RDM, thus eliminating the need to open the flameproof enclosure.
7. Data logging information. The 120 most recent events are logged, with time and date, in a non-volatile memory, for example power-up, trip, reset, close etc.

	**A review of the first few log events is a useful tool for fault finding.**

The IPD status display is one of the most useful features of the relay's display system and should be viewed as the first step in fault finding. The Status display is the default screen on power up and indicates what the IPD Relay requires in order to allow the outlet to close. These messages are useful to unskilled personnel. If more than one message is active the display cycles around all active messages showing them for 1 second each.

Through the use of the serial communications port, PLC's and SCADA Systems can be configured to display the same messages that appear on the Remote Display Module. This helps to provide consistent information to operators.

3.2.1 Trip / Status Messages:

The following table shows a list of the twenty-eight status messages and the type of message (category). Messages are cleared according to their message category.

Type 1

Messages are cleared by either pressing the <ENT> key while on the Status Display Page or by starting a new starting sequence i.e. EFLO test started.

Type 2

Messages are enabled and cleared automatically.

Type 3

Messages are triggered by the respective trip functions and are cleared by resetting the trip function.

Message	Type	Explanation
Tripped-No Volts	1	Voltage on load side of contactor is too low
MC Close Fail	1	MCI input did not close within 5 Sec of MCR relay closing
External MC Open	1	IPD detected (via MCI input) that MC was opened – not initiated by the IPD relay
Insulation Alarm	1	Test result at alarm level (1.5 x selected trip level)
Last T: ---------	1	Shows 'Last Trip' record
Need IPD Start	2	Awaiting IPD start digital input
Need RTU Start	2	Awaiting RTU start digital input
Outlet Paused	2	IPD waits 10 Sec between running (or testing) and re-testing
Closing MainCont	2	MCR closed, waiting for MCI feedback (5 Sec max)
. . EFLO Testing	2	In process of EFLO Test (3 seconds)
Insulat. Testing	2	In process of Insulation Test (4 seconds)
Manual Ins. Test	2	In process of manual Insulation Test
IPD Memory Error	3	Corrupted memory in relay's stored settings
RTU Memory Error	3	IPD detected errors in set up data received from RTU
Trip-RTU Offline	3	IPD can't communicate with RTU
Stopped-RTU PTC	3	RTU PTC input Tripped (open)
I Balance Trip	3	Phase Current Balance Function Tripped
Locked Out - Fan	3	Fan interlock system is locking out IPD
Stopped IPD	3	IPD Stop Digital input activated (closed)
Earth Leak. CT Fail	3	Earth Leakage CT/Connection fail Trip
Earth Leak. Trip	2	Earth Leakage Function Tripped
Earth Cont. Trip	3	Earth Continuity Function Tripped
E/F Lockout Trip	3	Earth Fault Lockout Function Tripped
OverCurrent Trip	3	Over Current Function Tripped
Short Circ. Trip	3	Short Circuit Function Tripped
Main Cont. Fail	3	Main Contactor Fail Function Tripped
Insulation Fail	3	Insulation Test Function Tripped
Running: ----Amps	3	Outlet Closed: shows average of 3 phase currents (in amps)

3.2.2 Last Trip Status Messages:

The IPD Relay has several functions which can stop/trip the outlet and then self-clear. The IPD Relay therefore saves the non-latched trip codes in a register and displays the 'Last Trip' messages in the Status Message Page.

Note that the stop/trip record also appears in the Event Log.

There are 10 Messages that are displayed **at Last T: ---------**

Message	Explanation
`EC Leak T`	E/C Leakage Trip that provides additional information for E/C Trip
`EC Ω Trip`	E/C Ohms Trip that provides additional information for E/C Trip
`Fan I Stop`	Fan interlock Stop
`I bal-Trp`	Current Balance Trip – Differentiates balance trip from basic over current trip
`MC Opened`	Main contactor opened – opening not initiated by the IPD Relay
`RTU mem. E`	RTU Memory error – Errors in set up data from RTU
`RTU Off L`	RTU Off Line – IPD can't communicate with RTU
`RTU ptc T`	RTU PTC input tripped
`Stopped`	IPD Stop Input Tripped
`UVOLT Trp`	Under Voltage trip – voltage on load side too low

4 Machine Communication

4.1 Remote Termination Unit

The Remote Termination unit is a microprocessor based fully encapsulated module that replaces the diode at the end of the pilot conductor of the trailing cable. It is powered by and communicates via the pilot line. Its non-volatile memory stores the parameters to configure the outlet as appropriate for that machine.

All terminals are fully shrouded, with the pilot and earth terminals being kept segregated from the other terminals. (See RTU-D General Case Dimensions on Drawing IPD-A-015)

The Remote Termination Unit (RTU-D) provides remote stop, start facilities of the IPD Relay's controlled outlet. The circuitry involved for these functions are self-diagnostic and will cause the outlet to turn off if the circuits are earthed or interconnected. This reduces the chance of the outlet operating when not required to do so due to wiring faults.

WARNING! 	**It should be noted that these functions are operational only, and that any emergency stops should be wired direct into the pilot circuit.**

PTC terminals are provided for a semiconductor thermistor connection. These terminals are protected in a similar manner to the stop and start circuits.

CAUTION! 	**If the remote stop, start and PTC functions are not required, each set of terminals must be bridged, or the IPD Relay will not energise.**

Four RTD inputs are provided for PT 100 temperature measuring devices. These terminals could also be used with resistor networks to provide digital information back at the IPD Relay.

RX, TX and 0V terminals are no longer required.

On/Off Line Status, machine type, machine number, software version and input status of the Remote Termination Unit can be examined by selecting "Machine Module Information" (Level 2, Positions 1-2). RTD temperature is available, Level 2, Position 4.

4.2 Machine Type Codes

There are 26 selectable machine type codes available for use in the Remote Termination Unit. The descriptive code is transmitted to the IPD Relay to identify the type of machine connected to the outlet. The codes are selected using the Remote Display Module (Level 9, Position 1).

Message	Explanation
Belt	Conveyor
SHRr	Shearer
S-Ld	Stage Loader
Hpmp	Hydraulic Pump
Wpmp	Water Pump
cMnr	Continuous Miner
sCar	Shuttle Car
Bk/F	Breakfast Feeder
Crsh	Crusher
Fan	Fan
DCB	Distribution Control Box
	BLANK
iFan	Fan with Interlocking
AFCm	Armoured Face Conveyor Main Gate
AFCt	Armoured Face Conveyor Tail Gate
M-BE	Mobile Boot End
Bolt	Bolter
HRMr	Hard Rock Miner
Winc	Winch
J-bo	Face Boring Machine
bBlt	Transfer Belt
Stak	Stacker
aCar	Add Car
IGG	Inert Gas Generator
tBlt	Transfer Belt
Dplg	Dummy Plug

4.3 Machine Type Number

Machine numbers 1 to 40 can be assigned to machines. These numbers are programmed using the Remote Display Module (Level 9, Position 2).

5 Earth Protection Functions

5.1 Earth Leakage

The earth leakage protection function uses an Ampcontrol EL500 series toroid to measure the earth fault current. This function is tested to AS/NZS 2081.3 - 2002. A definite time operating characteristic is provided with adjustable trip sensitivity and an adjustable time delay.

When a fault occurs and the trip level and time delay are exceeded a trip occurs. The trip acts in the Main Contactor Relay (MCR) logic and is latched. An earth leakage trip is treated as a special fault and requires an authorised person to perform the reset function. This is achieved by operating and holding the lock button closed and then closing the reset button.

When a trip occurs, the "EL" LED on the remote display module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required.

The leakage current (EL) is displayed on the RDM "Earth Fault Information" page as a % of the trip level. When the leakage reaches 100% for the selected time delay a trip occurs.

The trip level is adjustable in 100 mA increments. Range 200 to 1000 mA.

The time delay is adjustable. Range: Instantaneous (<50mS) 100mS, then 150 to 470mS in 40mS increments.

The IPD generates a CT Detection Signal continuously to test the integrity of earth leakage circuit. The CT Detection signal continually tests the toroidal current transformer, the wiring loop to the toroid and the input to the protection relay, as required by AS/NZS 2081.3 - 2002.

The signal is generated by pins 32 and 33 as a 40mA signal at 200Hz. It must be fed from pin 32, three loops through the toroid then back to pin 33. The Ct detectection signal can be monitored by pushing the 'Enter' switch when viewing the 'Earth FaultInformation' on Level 3 position 1 of the Remote Digital Unit. When the trip occurs the remote display module "EL" LED will flash and the open collector output on the relay is switched on to provide remote monitoring if required.

	**The CT detect signal level can be displayed by pressing <ENT> on the RDM – while the key is active, the CT level will appear instead of the EL current level.**

The trip time is derived from the main EL trip time, but is constrained to a minimum of 80mS (4 x 20mS cycles).

CAUTION! 	**The loop resistance of the CT Detection Signal circuit connected to pins 32 and 33 must remain below 0.5Ω.**

5.2 Earth Fault Lockout

The IPD Relay can provide a two-step insulation test as part of the Earth Fault Lockout protection function. The initial test is the mandatory intrinsically safe test and can be followed by an automatic High Voltage 'Insulation Test'. A manual 'Insulation Test' is also provided.

An EFLO Test Module 11kV is a resistive isolation device used to interface the power conductors to the IPD relay. This allows the IPD to measure the line voltages and to perform line insulation tests.

The HV Test Module 11kV is a high voltage generator (5000V) which is used in conjunction with the EFLO Test Module 11kV to perform high voltage line insulation tests. The HV Test Module 11kV must be used when the 'Insulation Test' function is required.

When EFLO-11kV None is selected the IPD Relay does not provide an EFLO or a HV Test', or any of the voltage functions, including under voltage checking.

WARNING! 	**The 'EFLO-11kV: None' Mode MUST NOT BE USED in applications where EFLO is required by mining regulations.**

5.2.1 Intrinsically Safe EFLO Test

The initial earth fault lockout function tests the resistance of the 3 phase lines to earth by applying an intrinsically safe signal prior to the closure of the main contactor in accordance with AS/NZS 2081.4 2002. The test is initiated by closure of the start button once all starting conditions are met (See Section 10.5, Operational Sequence). This test takes 3 seconds.

If the value is less than the preset level (See Specifications, Section 16) a trip occurs. The "EF" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required. To reset the relay following an earth fault lockout trip, operate the reset button.

The earth fault leakage level (EF) of the three phases is displayed on the RDM "Earth Fault Information" page as a % of the trip level and relates to the last earth fault lockout test performed

5.2.2 Automatic Insulation Test

If 'EFLO-11kV : Yes' Mode has been selected, in the Group 1 Settings, an automatic High Voltage DC 'Insulation Test' is carried out following a successful Intrinsically Safe Earth Fault Lockout Test.

The HV 'Insulation Test' is initiated when the IPD Relay closes its relay output, RL4, - for 4 seconds. This applies 110VAC to the HV Test Module 11kV which generates 5000Vdc that is applied between each phase and earth.

The IPD Relay measures the combined line leakage current and calculates the meg-ohm resistance to earth. At the end of the test the result is stored in the Event Log as **'it -- . - MΩ'**. If the resistance value is above the preset threshold the MCR Relay picks up allowing the outlet to be energised. Additionally, if the result is equal to or below an Alarm Level (typically 1.5 times the selected trip level, see Table 5.2.2.i, following) the status message 'Insulation Alarm' is displayed on the Status Page (level 0, position 0). The alarm message is displayed until a new EFLO Test is initiated or the **<ENT>** key is pressed while on the status page. **'Insul. Alm'** is also recorded in the Event Log.

Ins . TstT: Selection **MΩ**	Alarm Level **MΩ**
15	25
20	35
25	40
30	45
35	50
50	80
80	120
100	150
None	None

Table 5.2.2.i

If the value is less than the preset trip level a trip occurs and is latched and saved in non-volatile memory. The "EF" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required. An Insulation Trip shares the "EF" LED on the Remote Display Module with an EFLO trip but has dedicated trip messages on the Status Page. To reset the relay following an insulation test fail trip, operate the reset button.

At the completion of a test the leakage is retained in memory until the next test is carried out. This can be viewed on the Remote Display Module RDM (Level 3, Position 3).

Resistance readings between 10MΩ and 200MΩ will be displayed. A fault condition (e.g. HV Test Module not working) is displayed as 0MΩ.

If the 'Insulation Test' is not selected by either selecting 'EFLO-11kV None' or setting **'Ins.TstT:'** value to 'None' then the MCR Relay closes at the completion of a healthy EFLO Test.

The accuracy of the insulation test and expected trip ranges are outlined in table 5.2.2.ii following. The results from insulation test should only be used as a guide to confirm that insulation remains above the preset threshold. Insulation tests apart from the generated insulation test via the IPD should be still carried out on a regular basis for maintenance purposes.

	Actual Fault Resistance (MΩ)	
Trip Setting	Minimum	Maximum
15	13.5	16.5
20	18	22
25	22.5	27.5
30	27	33
35	31.5	38.5
50	45	55
80	72	88
100	90	110

Table 5.2.2.ii

The values in the expected fault resistance range (up to 100MΩ) represent ±10% of the nominal value. This tolerance is not guaranteed above 100MΩ.

Trip settings above 100MΩ are not supported. Values above 100MΩ are for indication only and should not be considered accurate.

	**The start input must be held closed for the duration of the test.**

5.2.3 Manual Insulation Test

A manual "Insulation Test" is provided as a maintenance/fault finding tool. The manual test can only be carried out when the load is not energized. When this test is performed the MCR relay is prevented from closing at the completion of a healthy test.

Before a manual Insulation Test can be performed the following conditions must apply:

1. The Remote Display Module must be online with the Insulation Test page being displayed. This is located on the **'EARTH FAULT INFORMATION'** Page, level 3, position 2.
2. Pilot must be healthy (and any previous trips reset).
3. EFLO function must not be tripped.
4. Insulation Test function must not be tripped.
5. Outlet must not be running.
6. Outlet must not be in the process of 'closing'.
7. Outlet must not be 'Paused'
8. The 'Lock' digital input must be closed.

When the above conditions are met the **<ENT>** key must be pressed and held (for the duration of the test). After 3 seconds the EFLO test will commence. If the test result is healthy the manual insulation test is initiated. The test voltage is applied to the outgoing feeder while ever the above conditions are held (including holding the **<ENT>** key). The test results are continuously calculated and displayed. The operator should maintain the test at least long enough for the readings to stabilize, this being a function of the cable length. When the test is completed (usually by releasing the **<ENT>** key) the results are held in memory until another insulation test is commenced, which may be as part of the starting sequence, manually, or because IPD control power is lost.

	**The manual test can be carried out even if the 'Ins.TstT:' selection is set to 'none' (i.e. the automatic insulation test in the starting sequence is turned off).**

The status of the manual insulation test is shown on the Insulation Test Information Page (level 3, position 3). A single letter following 'Mt:' indicates the status of the test:

Mt:x: Manual Test is blocked - by any one or more of the conditions 1 to 8 above.

Mt:e: Only the <ENT> key is required to initiate the manual test.

Mt:t: The manual test is timing through the enabling period (3 seconds).

Mt:A: The manual test is Active. The display will show measured values.

5.3 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. This is in accordance with AS/NZS 2081.2 2002. The pilot core is also used to transfer data when a Remote Termination Unit is used to achieve machine communication.

The IPD relay can be configured to operate in either diode or RTU mode. The mode is selected in "Pilot Type", (Level 8, Position 1) and determines what terminating device the relay is looking for on the pilot.

CAUTION! 	**The Remote Termination Unit will only be recognised by an IPD Relay and will not be seen as a diode by other earth continuity devices.**
CAUTION! 	**Cable parameters are important to the correct operation of the Pilot E/C function Resistance & capacitance values can determine the length of the cable that the relay can drive. (See Specifications, section 16. IPD specifications)**

The relay measures the resistance of the pilot - earth loop and the leakage between the pilot and earth conductors. The leakage measurement ensures that pilot to earth faults are detected. If the pilot - earth loop is not healthy a trip occurs (See Specifications, Section 16) which in turn opens the main contactor control circuit. The fault can be configured as latching or non-latching. This allows the user to determine if the fault is manually or automatically reset once the pilot - earth loop is healthy. The selection is either "Pilot Latch: On" or "Pilot Latch: Off" (Level 9, Position 11). To manually reset the relay, operate the reset button.

The "EC" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required.

The earth continuity resistance (**ECR**) of the pilot – earth loop and the leakage (**L**) between the pilot and earth conductors is displayed on the RDM "Earth Fault Information" page as a % of the trip levels. When either value reaches 100% a trip occurs.

The trip level of the earth continuity resistance is available in the following resistances: 10, 15, 20, 25, 30 and 45Ω.

Pilot Trip Time is adjustable to allow for operation in noisy electrical environments. The following trip times are available: 80,120, 160, 200, 300, 400 and 500mS.

A setting of 120mS should be suitable for most installations. Long time delays (>200 ms) should only be used where necessary.

WARNING! 	**Consequence of long trip times should be thoroughly assessed from a safety point of view before using the higher values.**

6 Current Related Functions

6.1 Basic Over-current Protection Functions

Two current transformers are used to measure the three line currents. The measured currents are used to implement the following protection functions:

(a) Over-current or Motor Overload
(b) Short Circuit
(c) Phase Current Balance

Full load settings cover a range from 7.5 Amps to 464 Amps. A current range and current multiplier are utilised to select and store the full load current value in the non-volatile memory. This forms the basic reference level for the over current protection functions.

The current range is selectable in 4 Amp increments between 60 and 116 Amps. The current multiplier is selectable at 1/8, 1/4, 1/2, 1, 2, 4 times (See Section 9.1, Parameter Groups).

Example - Over-current Setting:

To obtain a full load current of 152 Amps select a current range of 76 Amps and a multiplier of 2.

Two curve types can be selected and a time multiplier modifies the basic trip time characteristic. There are eighteen (18) multiplier settings that can be selected ranging from 0.005 times to 1.0 times (See Section 7.1, Fan Interlocking).

It should be noted that settings 0.005, 0.01, 0.015, 0.02, 0.03 and 0.04 are positioned after setting 1.0 in the stored setting's list (Level 9, Position 4).

The instantaneous current in each of the three phases can be displayed on the RDM (Level 5, Position 1). The three phase currents are displayed, as a % of the overload set current. The average current value is expressed in Amps and is displayed at Level 5 and the Status Page (Level 0, Position 0).

Following a trip condition the following conditions must be met to achieve a reset:

(a) The IPD reset input must be closed
(b) The trip accumulator must be less than 80%

6.2 Over-current Characteristics

If the selected over current type is "vInv", then a very inverse over current characteristic set of curves are available for selection. (See "vInv" Curves, Drawing IPC-B-004).

The three phase currents are compared and the highest current is used to calculate the trip time. If the current exceeds the selected full load current an "over current trip accumulator" increases at a rate determined by the current and the selected curve. This can be displayed on the RDM (Level 5, Position 2). When the current falls below the selected full load current the trip accumulator reduces towards zero rapidly, however, if the over current condition persists so that the trip accumulator reaches 100% then a trip occurs. If viewed during start up the trip accumulator can help determine if over current settings are correct.

If a trip occurs the "OC" LED on the Remote Display Module is illuminated and concurrently the open collector output on the relay is switched on to provide remote monitoring if required.

To reset the relay following an over current trip, operate the reset button.

6.3 Motor Overload Characteristic

The over current type “m-OL” is used when a motor overload characteristic is required (See “m-OL” Curves, Drawing IPC-B-005). This characteristic uses a thermal model of the motor to determine the tripping characteristic. The motor overload curves are shown for both cold and hot conditions. The hot curve corresponds to the trip time after the motor has been running at the selected full load current indefinitely.

The motor manufacturer’s data should be consulted to select the time multiplier appropriate for the motor being protected. Typically, the capacity of a cold motor is given at six times its rated current. The IPD trip curves can be used to select the time multiplier, which best suits the motors overload capacity.

Thermal Model

Thermal modelling is based on a thermal time constant of 30 minutes (time multiplier setting of 1.0 times). The time multiplier can reduce this value to a minimum thermal time constant of 1.5 minutes (time multiplier setting of 0.05 times).

The three measured phase currents are squared and added together to provide the heating input into the thermal model.

While the main contactor is closed, the cooling output from the thermal model is calculated to achieve the necessary time constants.

When the main contactor is open a “Cooling Multiplier” is used to modify the basic time constant. This can be used to account for the reduced cooling capacity while the motor is not running (when applicable). This multiplier is selectable at 0.2, 0.3, 0.4, 0.5, 0.8, 1.0, 2, 5, 10, 20, and 50 times.

A selection of 1.0 times sets the motor off cooling rate equal to motor running cooling rate. This selection is appropriate where cooling is maintained even when the motor is stopped, e.g. water cooled motors.

When 0.2 times is selected the motor off cooling rate is reduced to 20% of the motor running cooling rate.

A selection of 50 times effectively disables the thermal memory. With this selection, as soon as the main contactor opens, the thermal model resets quickly so that a cold restart is achieved.

CAUTION! 	**Repeated restart attempts in this condition may damage the motor.**

Typical fan cooled motor protection is based on a setting of 0.4, however, for the best protection consult your motor manufacturer.

The thermal model continues to simulate the motors thermal behaviour even if the power is removed from the relay (using the relay’s internal real time clock). When power is restored the thermal memory would be at the same level as if there had been no loss of power.

The “OC Trip” Accumulator shows the state of the thermal model: 0% = Cold, 100% = Trip.

When a trip occurs the IPD Relay cannot be reset, by operation of the reset button, until the accumulator is less than 80%. To allow an emergency restart on a hot motor to be achieved a reset of the thermal memory is possible by selecting Level 5, Position 3 on the Remote Display Module. The display shows:

```
ZERO THERM MEM?
RESET + LOCK[100]
```

The [100] indicates the current value of the trip accumulator. Operating the lock and reset buttons simultaneously while the above display is being shown will zero the OC Trip Accumulator after 1.5 seconds.

Indication of the trip condition for motor overload is the same that occurs for an over current trip.

6.4 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 "SC" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide monitoring if required.

To reset the relay following a short circuit trip it is necessary to operate and hold the lock button closed and then close the reset button.

The relay can be programmed so that a short circuit condition can trip either the "CBR" relay or the "MCR relay. This can be achieved by selecting either relay at the "SC Relay" selection in the non-volatile memory (Level 8, Position 5) on the Remote Display Module. Normally the "CBR" selection would be used. If "MCR" is selected then the user must ensure that the interrupting device that is operated by the short circuit trip output of the relay has sufficient current interrupting capacity at the system voltage for the situation in which it is installed.

The short circuit trip level is adjustable from 3 to 10 times (full load current) in 0.5 increments. The trip time is selectable from 20 to 160mS.

CAUTION! 	**When "CBR" is selected for the Short Circuit trip it is important to consider the S/C trip time in relation to the trip times for faults that trip the "MCR" and could occur at the same time as the S/C. (e.g. Earth Leakage and Earth Continuity)**

6.5 Phase Current Balance

Phase current balance protection is selected via the "Cur Bal Trp" selection (See Section 7.1, Fan Interlocking). The current balance measurement is displayed on the Remote Display Module and is calculated as:

$$Ibal = \frac{MAX\ \Delta\ I \times 100\%}{Iave}$$

Where:

Iave = Average of the 3 phase currents

MAX Δ I = The maximum deviation of a phase current from the average

The trip level is selectable at 5%, 10%, 20%, 50% and off.

The phase current balance protection is inhibited until the average current exceeds both 20% of the selected full load current and the selected balance trip level.

If the trip level is exceeded, a timer is triggered. If the imbalance remains above the set level for more than two seconds the relay trips. The event log records "Ibal" to differentiate it from a true over current trip.

The status of the timer is displayed adjacent to the "Ibal" value (Level 5, Position 2). A trip condition occurs when the timer reaches 100%.

7 Voltage Related Functions

7.1 Main Contactor Fail Protection

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

1. Failing to open when required. This is achieved by comparing the state of the main contactor (via the Main Contactor Input MCI) against the state of the MCR relay output. This check provides "Frozen Contactor Protection".
2. Failing to maintain insulation across the contacts when the contactor is open. The EFLO Test Module is used to measure the voltage on the load side of the contactor. If this exceeds 10% of the rated line voltage, a trip will occur. This check provides "Loss of Vacuum Protection". This function is inhibited immediately after the main contactor opens to allow for back EMF voltages generated by some motors to dissipate. The inbuilt time is adjustable from 2 to 20 seconds (See Section 9.1, Parameter Groups).

A main contactor fail trip causes the CBR relay to de-energise, which trips the circuit breaker. An internal battery backed flag in the IPD Relay is also tripped. A LED on the front panel of the IPD Relay begins to flash.

The "MCF" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required.

To reset the flag, access to the relay is necessary. AS/NZS 4871.2:2002 clause 2.6.2.9 mandates that this type of protection must **NOT** be resettable from the exterior of the enclosure. The reset button is accessible through the front fascia of the relay and must be pressed for 1 second.

7.2 Under Voltage Trip

Under voltage protection is enabled as soon as the main contactor is closed (indicated by closing the MCI input). If any of the phase voltages drop below the selected trip setting of the nominal line voltage for 800mS then the outlet is stopped. This is recorded in the event log as “uVOLT Trp”.

The trip level is selectable from 20% to 80% in 10% increments (Level 8, Position 4) on the Remote Display Module.

7.3 Voltage Metering

The EFLO Test Module 11kV is also used to provide line voltage metering.

The outgoing line voltages for each of the 3 phases are displayed as a % of the selected rated line voltage on the Remote Display Module (Level 4, Position 1). The maximum reading is 120%

8 Fan Control

8.1 Fan Interlocking

A fan interlocking facility can be selected to prevent outlets from being energised until a mine section ventilation fan is operational. This facility eliminates the need for dedicated outlets. The configuration of the fan interlocking system is shown on Drawing IPD-B-003.

Each relay is linked together via the “FIO” (Fan Interlock Input/Output Terminal).

For single fan operation a 100Ω resistor is connected between this link and earth. This causes all relays in the system to default to a “Slave” mode waiting to receive an interlocking signal before they can run.

For dual fan operation it is necessary to connect two 100Ω resistors in parallel to the FIO Terminal, otherwise all FIR Inputs will read as off and the slave outlets will not run.

When an IPD Relay detects a Remote Termination Unit that has been programmed with the special machine type identifier “iFan” that particular relay switches to a “Master” configuration. This relay controls the slave outlets allowing them to run when the fan current is above the selected threshold setting.

Each relay has the ability to read and drive the FIO link via the Fan Input Read (FIR) processor input and the Fan Interlock Drive (FID) processor output. The status of the input/output can be viewed on the Remote Display Module - “Relay and Digital Input Status” Section (Level 6, Position 4).

The outlet control in each IPD Relay has been designed so that an outlet will not run unless either:

(a) The FIR input is “ON”, or

(b) The Remote Termination Unit connected to that IPD has been programmed with machine type “iFan”.

The result of these conditions is reflected in an internal Fan Run Status (FRS) bit. The status of this can be viewed on the Remote Display Module. If the FRS is on, then the fan interlocking system will allow the associated outlet to run.

8.2 Interlocking Sequence

The fan interlocking operates as follows:

1. Each IPD powers up with the FID output turned off. At this point the FIR input on all IPD Relays will read, as off, therefore no outlet will run.
2. When a machine is plugged into an outlet that has its Remote Termination Unit programmed "iFan" then that relay will be allowed to run when requested. (Provided there are no protection trips, stops etc preventing its operation).
3. When that outlet is running **and** the current is above the preselected current threshold, a 5 second time delay is initiated. At the completion of this delay, that IPD Relay turns on its FID output. The fan current threshold is adjustable from 32% to 96% of full load current in 8% increments (See Section 9.1, Parameter Groups).
4. Detecting the interlocking signal via their FIR inputs then enables all other IPD Relays on the FIO link.
5. If at any stage, the fan current drops below the threshold or the fan is stopped, the master IPD Relay turns off the FID output. This causes all slave IPD Relays to stop.

If fan interlocking is not required, the system can be disabled by connecting a 10kΩ/1W resistor from the FIO Terminal (Terminal 9) to OV (Terminal 12) on each relay. In this case the FIO Terminals are not interlinked. This causes the FIR inputs to read high at all times.

An auxiliary fan being used in this situation would have its Remote Termination Unit programmed with machine type "Fan".

9 User Adjustable Settings

9.1 Parameter Groups

There are two groups of adjustable settings contained in the IPD Relay's non-volatile memory. Both groups can be viewed and modified via the Remote Display Module.

The first group of settings is always stored in the relay and relates to parameters, which are linked to the system rather than the particular load connected to the outlet.

Group 1 Settings:

Pilot Mode:	Determines if the pilot is to be terminated with a diode or remote termination unit
EL Time:	Sets the trip time for the earth leakage protection
EL Sens:	Sets the sensitivity trip level for the earth leakage protection
EFLO:	Selects if the EFLO Test Module 11kV is being used
U/V Trip:	Selects the under voltage trip threshold as a % of line volts
SC Relay:	Selects which output relay (MCR or CBR) is tripped in event of a short circuit trip
EC Time:	Sets the trip time for the earth continuity protection
EC Level	Sets the trip level for the earth continuity protection

The second group of settings consists of parameters that are related to the load connected to the protected outlet. These settings are stored, retrieved to/from the memory in the IPD Relay or the memory in the Remote Termination Unit, depending on the "Pilot Mode" setting. Figure 9.1 shows how the memory is "switched". If a diode pilot mode is selected the IPD Relay reads and writes to and from the relay's internal memory for the group 2 settings.

If a RTU Mode is selected the settings are sent to and retrieved from the memory in the Remote Termination Unit.

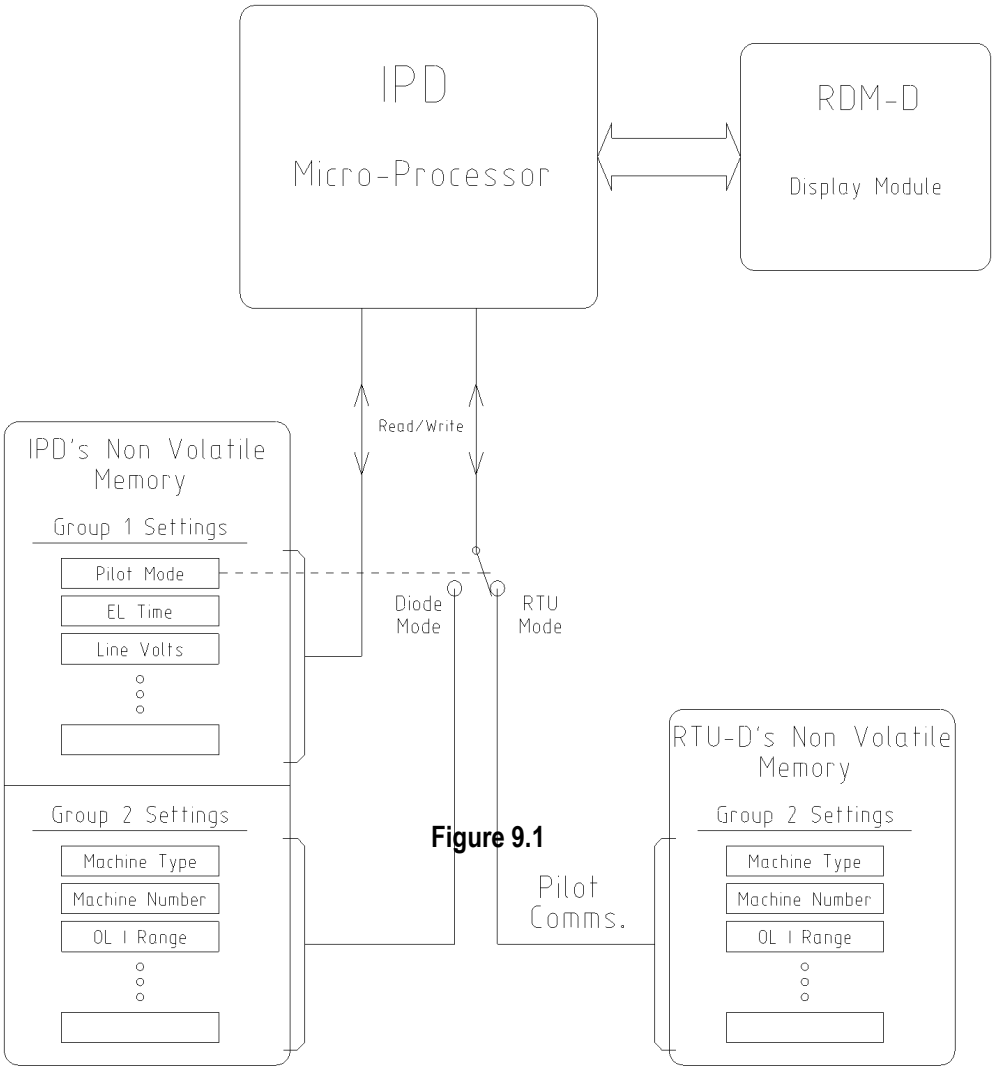


Figure 9.1

Group 2 Settings:

RTU MC Type:	Selects the RTU descriptive code transmitted to identify the machine connected to the outlet.
RTU MC No:	Selects the assigned machine number to be transmitted by the Remote termination Unit.
OC I range:	Sets the basic current range
OC I mul:	Combines with OC range to define the full load current
OC Type:	Selects either very inverse over current or motor overload protection
OC t mul:	Modifies the basic over current time curves to achieve the desired trip times
Cool mul:	Allows the cooling rate of the thermal model to be modified
Cur Bal Trp:	Adjusts current phase balance trip
SC I trip:	Sets the short circuit trip level
SC Trip t:	Sets the trip time for the short circuit function
Pilot Latch:	Determines whether earth continuity trips are self resetting or not
B-emf TIME:	Adjustable time delay to inhibit main contactor fail following opening of main contactor
Fan i Level:	Sets the fan current threshold at which other outlets are allowed to run
Remote Start:	When “Yes” is selected the IPD Relay ignores the local start input. When “No” is selected the local start/stop inputs control the relay
Ins . TstT:	Sets the trip threshold or disables the HV test function

9.2 Changing Settings

The procedure for adjusting the settings is independent of where the values are stored. The pilot mode should be checked prior to making any other adjustments to be certain the changes are made to the desired memory.

1. Ensure the outlet is stopped.
2. For Group 2 Settings in RTU Mode, ensure RTU is on line.
3. Display the parameter that has to be changed on the Remote Display Module’s liquid crystal display.
4. Momentarily operate the lock push button. A warning message appears.
5. Press the enter button to acknowledge the warning message and to confirm that a change is desired.
6. Use the left and right arrows to step through the allowable values until the desired new setting is displayed. If the right arrow key is pressed when viewing the last parameter the display wraps back around to show the first parameter.
7. Press the enter button to indicate that the value is the required setting.
8. Momentarily operate the lock push button. The display will show a confirming message, then return to the viewing level.

If the up or down keys are operated during the procedure the IPD Relay aborts the modifying sequence.

When changes have been made to the stored values, the old value and the new value are stored in the event log.

A separate log immediately proceeds this recording the time and date that the change was made.

Notes	
	**1. While in the diode mode the IPD Relay can be preset with operating values in the Group 2 memory prior to switching to the RTU mode. When in this mode the relay uses the Remote Termination Unit settings. If the Remote Termination Unit is replaced with a diode and the "Pilot Mode" switched back to diode, the settings will revert back to the values preset in the IPD Relay.** **2. When the relay has been selected for RTU Mode the RTU must be on line before the RTU set up mode can be entered.**

10 System Control

10.1 Digital Inputs

The IPD Relay has five digital inputs, which are all voltage free contact inputs. Shorting the two input terminals together activates them. The inputs are MCI, start, stop, lock and reset.

The status of inputs can be displayed on the Remote Display Module (Level 6, Positions 2 and 3).

10.2 Output Relays

The IPD Relay has output relays to control the main contactor (MCR) and the circuit breaker (CBR). Both relays are fail safe with respect to power supply loss and are controlled on the basis of protection functions.

Relay 3 is not used. RL4 controls the 110V supply for the Insulation Test. (See section 5.2.2, Automatic Insulation Test).

The status of the relays can be displayed on the Remote Display Module (Level 6, Position 1).

10.3 Open Collector Outputs

The IPD Relay has eight open collector outputs, which are driven through opto couplers to provide additional indication if required. These can be used to drive LED's, or additional relays (with appropriate drive circuitry). The eight outputs correspond to the LED's on the display module, turning on whenever the corresponding LED is flashing. The signals are available on the IPD Relay's base pins 35-42, and the common is on pin 34.

Contact Ampcontrol if further information is required about these outputs.

10.4 Outlet Control

The outlet can be energised by local or remote operation depending on the "Remote Start" option. The selection is "Yes" or "No" (Level 9, Position 14).

10.4.1 RTU Mode:

If "Yes" is selected the relay ignores the local start input thus allowing operation of the outlet from the remote machine. Both the remote and local stop buttons will turn off the outlet.

CAUTION! 	**If "No" is selected the local start/stop buttons control the outlet. The Remote Termination Unit's start, stop and PTC terminals must be bridged to energise the outlet.**

10.4.2 Remote Operation in Diode Mode:

In this mode the stop/start station is connected in the pilot. (See Typical Connection Diagram IPD-E-015). The pilot has a hysteresis of 100Ω. This is to allow a 100Ω resistor to be connected across the start button. The hysteresis is linked to the main contactor input (MCI). If MCI is open, then the earth continuity will trip at 45Ω. If the MCI is closed, the earth continuity trips at 145Ω.

It is also necessary to bridge the local start button or start input on the relay, on the outlet controlled by this method.

Both the remote and local stop buttons will turn off the outlet.

Stop/Start functions are operational only.

WARNING! 	**Emergency stops must be wired direct into the pilot circuit.**

10.5 Operational Sequence

Before an outlet can be energised the following conditions must apply:

(a) No protection faults present
(b) Fan interlocking enabled
(c) Stop input open
(d) Local and remote start inputs closed
(e) RTU stop and PTC inputs closed

Once these conditions are obtained a cable fault lock out test is performed automatically, followed by a HV insulation test (if enabled). This takes 3 seconds. If the results of these tests are satisfactory, the IPD Relay goes into the run mode and the MCR relay picks up.

The "RUN" LED on the Remote Display Module is illuminated and the open collector output on the relay is switched on to provide remote monitoring if required.

CAUTION! 	**A time delay of 5 seconds is allowed for the Main Contactor Interlock (MCI) to close.** If it does not close within this time the run mode will be exited.

If a stop input is closed while the relay is in run mode, the run is cleared, and the MCR relay de-energises. The event log reads "Stopped". If a stop input is closed during a cable fault lockout test, then the test is aborted.

While the main contactor is closed, the MCI input is continuously monitored. If it opens, the run is cleared and the MCR relay de-energises. In this case the event log records "MC Opened" which indicates that the outlet was turned off by something other than the IPD Relay, e.g. open circuited main contactor coil or control supply.

It should be noted that if the main contactor does not close when the MCR relay closes and the start/stop conditions are maintained, then the IPD will cycle through the following start sequence: testing, run, stopped, pause then repeat the sequence while ever the start input is closed.

11 Event Log

A real time clock/calendar is included in the IPD Relay. This combines with the non-volatile memory to provide a data-logging feature. This log sequentially records the time, date and details of the most recent event. A chronological list of the previous 120 events is stored.

The event log can be automatically scrolled so as to view the entire log. To achieve this press "Enter" followed by the "Right or Left" arrow keys to commence the scroll. The log will scroll one log per second in the direction of the arrow key pressed. Press "Enter" to stop the scroll at the desired log.

A typical display shows:

```
LOG 10: ELTRIP
MO 15/05 09:46:21
```

This records that an earth leakage fault caused a trip condition on Monday, 15 May at 9.46am. Log 10 indicates that it is the 10th log in the list. Log 1 is always the most recent event. Each time a new log is recorded, the 120th log is removed from the list.

The following events are logged:

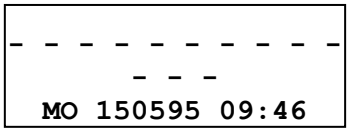
Power Up	The instant that power is applied to the relay
Pwr Down	Removal of power from the relay
MCR Close	Closure of the Main Contactor Relay
Stopped	Stopping of the outlet by operation of the local stop button
RTU Stop	Stopping of the outlet by operation of the remote stop button
MC Opened	Main Contactor has opened but not initiated by the IPD Relay
MC Fail	Main Contactor Fail Function Trip
CloseFail	Indicates that the MCI Input did not close within 5 seconds of MCR closing
EC Ω Trip	Pilot/Earth continuity loop exceeds the preset level
EC Leak T	Leakage resistance between the pilot and earth is less than 1500Ω
EL Trip	Earth leakage protection tripped
EFLR Fail	Earth fault lock out test has failed
EL CT Fail	Earth fault current transformer has failed
SC Trip	Trip condition of short circuit protection
OC Trip	Trip condition of over current or overload protection
I bal-Trp	Current balance trip condition
RESET	Records resetting of a protection trip function

Setup Mod	Records that set up data has been modified
Fan I Stp	Outlet stopped by fan interlock
uVOLT Trp	Records that voltage was not present on at least one outgoing phase when the main contactor was closed
MCF F Trp	Internal battery backed main contactor fail trip
RTU ptc T	Operation of the remote termination units PTC
T-mem Rst	Thermal memory has been manually reset to zero
Mem.ERROR	Records that the relay's non-volatile parameter memory has been corrupted
μ- P reset	Internal microprocessor reset
Tmem Loss	The thermal memory data has been corrupted
RTU mem. E	Records that the remote termination unit's non-volatile memory has been corrupted or remote termination unit has gone off line while the outlet is running.
Outlet On	Records RTU machine code and number when main contactor is closed (proceeded by MCR closed). This log only appears when in RTU mode.
RTU Off L	Indicates a loss of communications with the RTU.
Meg Ω Trp	Insulation Test failed
IT: -- . -MΩ	Records the result of the Insulation Test
Insul . Alm	Result of Insulation Test is equal to or less than the alarm level

12 Time & Date

If there is a need to adjust the real time clock, carry out the following procedure:

1. Using the Remote Display Module select the time and date information page (Level 7, Position 1) to display the Day, Month, Year, Hours and Minutes.



2. Press the enter key. A "v" will appear in the top line above the minute section. This indicates the number to be changed.

3. Use the left and right arrow keys to move the "v" to the desired position.
4. Press the enter key. The "v" now changes to a "?" The right arrow key is used to increment the allowable values, once the desired value is obtained, press the enter key again. The "?" returns to a "v".
5. Repeat steps 3 and 4 until the correct time and date is displayed.
6. With the "v" showing press the lock push button. The "v" then changes to "E". (This is a prompt to press the enter key).
7. Press the enter key. At that instant, the seconds are zeroed and the selected time/date information is transferred to the internal clock.

If the battery voltage is too low the time will zero and the date will reset to 1st January on power up. Additionally, if the battery is flat or faulty the relay is likely to trip on main contactor fail on power up.

	**The date and time are used only to time stamp the events in the log (which are recorded sequentially regardless of the date/time). Date and time data is not used for any control functions, except to calculate the 'cooling' in the motor overload thermal model while power is absent.**

13 Remote Data Communications

The IPD Integrated Protection Relay has the facility for connecting remote monitoring equipment. This can be in the form of either the Remote Display Module or other peripheral equipment such as PLC's.

For PLC applications each integrated protection relay is connected to a Serial Interface Module (IPSI-D), which has its output drop connected to a DNET-IP2 Protocol Converter. The Protocol Converter provides the communications link to a PLC (See User Manual 118626 for further details).

The Ampcontrol DNET-IP2 Serial Communication System transfers data and commands between the Host System and the modules using RS232, RS422 and RS485 protocols.

14 Installation & Wiring Instructions

The IPD Integrated Protection Relay is a microprocessor based protection relay that has the facility for connecting intrinsically safe remote monitoring equipment. This can be in the form of either the Remote Display Module or other peripheral equipment such as PLC's.

These instructions have been designed to assist users of the IPD Relay with installation and special wiring techniques required maintaining the integrity of the intrinsically safe circuits.

14.1 Installation

14.1.1 IPD Integrated Protection Relay

The IPD Relay has a powder coated sheet steel enclosure designed to be mounted into existing enclosures, i.e. flameproof equipment or other enclosures of adequate IP rating.

The relay is designed to operate when mounted either laid down flat or in a vertical position. Vent holes are provided at both the top and bottom of the relay to assist in the cooling of the electronics inside the relay. These vents should not be blocked or restricted in any way.

When installing the IPD Relay care should be taken to ensure sufficient space is allowed around the relay for the ease of change out during routine maintenance.

Connections to the IPD Relay are made via a plug in base. This base is to be securely fastened to the enclosure in which it is being installed. The base is clearly labelled for ease of terminal location and identification. The base sockets are factory adjusted so that they are able to move to assist in alignment when the relay is inserted. For installation mounting see drawing IPD-A-03.

CAUTION! 	**Do not tighten socket mounting screws.**

14.1.2 Remote Display Module (RDM)

The Remote Display Module is an intrinsically safe device (Exia), designed to be mounted into the cut out of an IP54 enclosure and can therefore be mounted external to the switchgear it is controlling. To provide maximum benefit to the operator, one RDM is normally used per relay. This allows information from several relays to be simultaneously accessed and compared. However, if space restrictions preclude this, a compromise is to use one (1) RDM-D to monitor and control more than one IPD Relay. In these circumstances the following wiring arrangement is recommended:

The 3 pole change over switch must have sufficient creepage and clearance between IPD Relay channels in accordance with Intrinsic safety installation requirements.

14.1.3 EFLO Test Module 11kV & HV Test Module 11kV

The EFLO Test Module 11kV is a resistor-diode barrier, which interfaces between the power circuit and the IPD Relay. Used in conjunction with the HV Test Module 11kV it also provides an automatic High Voltage DC 'Insulation Test' following a successful Intrinsically Safe Earth Fault Lockout Test. Both modules are housed in stainless steel enclosures with anodised aluminium resistor modules.

Installation Guide Lines

1. These modules must be installed in an up-right position, as shown in drawing IPD-A-029 and Handling & Installation Manual IPDB013 .
2. Secure the units with 4 x M10 bolts with spring washers. (Torque to approximately 15Nm).
3. The low voltage cables are connected to the unit by screw terminals. Additional strain relief should be provided adjacent to the terminals.
4. The high voltage cables should NOT be installed in close proximity to Earth. Ideally the cables will be suspended in air and run directly from the 11kV line to the resistor module.
5. At no time should there be any strain on the high voltage leads. The units should be installed in such a way that there is no tension on the cables and no sharp bends. The minimum bend radius of the cable is 60mm
6. A typical wiring diagram is shown in drawing IPD-E-015.

WARNING! 	**Ensure that the earth connections are reliably installed, as this is the basis of protection, for all barriers, including the EFLO Test Module 11kV.** **Note 1: The EFLO Test Module 11kV has a separate connection for the IS earth and enclosure earth.** **Note2: These modules both contain exposed aluminium. Precautions may be needed to comply with site regulations when transporting or installing these devices.**

14.1.4 Overload & Earth Leakage Toroids

Current transformers are not ideal devices and if correct procedures are not followed during installation, nuisance tripping can result.

If, for example, we consider a single phase earth leakage system where active and neutral pass through a toroid, then at all times currents in the two wires are equal and opposite so that the net current through the toroid is zero. An ideal current transformer would have all the flux from each wire contained in the core and so would accurately add the opposing fluxes to get a net result to zero. A real current transformer has “leakage fluxes”. That is, a very small proportion of the total flux from each cable is not contained in the core, but in the space outside it and as result it may link some turns but not others, depending on the positioning of the cables.

The effect of this is that a small output may be obtained from the CT where none would arise if the device were ideal.

The size of the error will vary from CT to CT of the same type because of slight differences in the core and the symmetry of the winding.

Problems caused in this way become worse as CT sizes increase, as currents increase and a decrease occurs in the symmetry of the cables. Nuisance tripping tends to occur when the total current rises, such as when a large motor is started.

This is not normally a problem with the current levels found in flameproof enclosure applications. To help avoid problems in other applications, select the smallest internal diameter CT, to suit the cable size.

14.1.5 Toroid Installation Guide Lines

1. Keep cables as close to the centre of the toroid as possible. Do not tie them to one side of the toroid. Remember to aim at symmetry.
2. Do not bring the cables back past the toroid within one diameter of the CT, trying to cram cables into a small space reduces symmetry and may lead to problems, which are difficult to solve.
3. Avoid placing the CT near any device, which produces magnetic fields - whether it is a transformer or other cables. Try to maintain several CT diameters clearance.
4. Many small cables tend to be worse than say three large ones. Try to position the CT in the circuit with this in mind.

14.2 Wiring Installation

The connections to the IPD Relay consist of a mix of intrinsically safe circuits through to “high” voltage supplies and relay contact circuits. To ensure the integrity of the intrinsic safety is maintained and to reduce induction from high voltages, care needs to be taken in the layout of the wiring and the installation.

It is advisable to install a power supply filter, e.g. Schaffner FN612-1106 (1A, 250VAC chassis mounted filter) adjacent to the IPD Relay. The earth should be connected to Pin 7 on the relay as directly as possible.

The IPD Relay’s approval requires that the relay is installed in accordance with the Australian Standard for Intrinsic Safety Installation AS2381.7. Anyone installing IPD Relays should therefore have a good understanding of AS2381.7.

14.2.1 Earthing

The IPD must be infallibly connected to the main system earth via the three earth terminals provided on pins 2, 7 and 12. To maintain the intrinsically safe properties of the relay it is vital that the earth pins 2, 7 and 12 are all individually connected with a minimum earth conductor size of 1.5mm2. The intrinsic safety circuits have been tested to IEC60079.11 and require at least three independent connecting elements for ‘ia’ circuits to maintain the intrinsic safety properties. These three earth connections shall be connected in parallel back to the main earth point and are not to be connected in series.

The IKD interface must be infallibly connected to the main system earth via at least one of the earthed mounting bolts on the chassis.

The EFLO Test Module must be infallibly connected to the main system earth via the IS earth stud which can be recognised by the insulation between the earth stud and the chassis.

The earth on pin 29 connects to the core of the IPD Relay’s internal transformer. This earth is a protection earth and is not an intrinsic safety earth.

14.2.2 Intrinsically Safe Circuits:

CAUTION! 	**It is recommended that these circuits be separately loomed from all non-IS circuits.**

14.2.3 Low Voltage Signals

Although these signals are not IS signals themselves, care must be taken to ensure these circuits cannot come into contact with higher voltages (e.g. via insulation breakdown, or broken wires etc). It is recommended that these circuits be run in a separate loom from both the IS circuits and the "high" voltage circuits. To ensure that interference is kept to a minimum, the following cabling is recommended.

Duty	Pins	Signal	Recommended Cable Type
Earth Leakage Toroid	1, 2	EL1, El2	Two core screened: Screen = Earth
Earth Leakage Toroid Test	32, 33	EL Test, EL Test	Single core, not screened. Loop Resistance < 0.5Ω
Current Protection Transformers	15, 16, 17, 18	Ia1, Ia2, Ic1, Ic2	2xTwo core screened: Screen = Earth
Local Stop Button (digital input)	19, 20	SpDig+, SpDig-	*Two core screened: Screen = Earth
Lock Switch (Digital Input)	21, 22	Lock+, Lock-	*Two core screened: Screen = Earth
Reset Switch (Digital Input)	23, 24	Reset+, Reset-	*Two core screened: Screen = Earth
Start Switch (Digital Input)	25, 26	Start+, Start-	*Two core screened: Screen = Earth
Motor Contactor Aux Contact (Digital Input)	27, 28	MCI+, MCI-	*Two core screened: Screen = Earth

*The IPD's digital inputs could alternatively be run in a screened multi-core cable. (Separate cable for each IPD Relay in multiple installations.)

Where these "low voltage" circuits need to connect near the power circuits (e.g. current transformers, cable connection module, main contactor auxiliaries etc), care needs to be taken to ensure that the circuits are adequately separated and restrained so that the separation is maintained, even if a wire termination comes loose etc.

14.2.4 High Voltage Circuits

The "high" voltage circuits of the IPD Relay are the 110VAC supply (pins 30, 31) and the relay contacts. Apart from keeping these separate from the other wiring to the relay there are no special requirements.

WARNING!	**In accordance with Australian Standards the relay contacts of the IPD Relay must not be used to switch more than 190VAC, 5A or 100VA; the intrinsic safety will be compromised if any of these values are exceeded.**

Duty	Pins	Signal	Recommended Cable Type
EFLO Test Module 11kV	3, 4, 5, 7	VcmA, VcmB, VcmC, Earth	Three core screened: Screen = Earth
Pilot Core	6, 7	Pilot, Earth	Single core screened: Screen = Earth
Serial Comms Port	15, 16, 17, 18	+Vsc, TXD, RDI, Earth	Four core screened: Screen = Earth
Remote Display	19, 20	Data, +Vdm, Earth	Two core screened: Screen = Earth

15 IPD Equipment List

112464	Integrated Protection Relay IPD-11kV
112463	IPD Base Plate
110141	IPD Remote Display Module RDM-D
110145	IPD Remote Termination Unit RTU-D
112444	EFLO Test Module 11kV
112443	HV Test Module 11kV
141559	IPD-11kV User Manual
141590	IPD-11kV Handling And Installation Manual
101296	Fuse Holder C/W 3A/660V Fuse
117139	Fuse 3A/660V (Spare Item)

16 IPD-11kV Specifications

Auxiliary Supply Volts:	110vac ± 10% 10VA, 50Hz ± 2 Hz
Earth Leakage Protection:	Trip Setting 200-1000 mA in 100 mA increments Time Delay Instantaneous (<50mS) 100mS, then 150 to 470mS in 40mS increments.
Earth Continuity Protection:	Trip Setting 10, 15, 20, 25, 30 and 45Ω Reset if resistance < Trip Setting Trip if resistance > Trip Setting Shunt Leakage Trip if < 1500Ω Operating Time 80, 120, 160, 200, 300, 400, 500mS
Pilot Cable Parameters:	**C < 0.3µF, L < 10mH, L/R<600uH/Ω**
Earth Fault Lockout Protection	
Lockout Resistance (IS Test):	< 110kΩ Test Time: 3 seconds
Lockout Resistance (Insulation Test):	Selectable at 15, 20, 25, 30, 35, 50, 80 and 100MΩ and off Test Time: 4 seconds
Alarm Settings:	Insulation Test Trip setting x 1.5
Over-current/Overload Protection	
Current Range:	7.5 to 464 Amps (60 to 116 Amps in 4 Amp increments, times current multiplier)
Current Multiplier:	1/8, 1/4, 1/2, 1, 2, 4 times
Time Multiplier:	0.005, 0.01, 0.015, 0.02, 0.03, 0.04, 0.05, 0.075, 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 1.0 times
Cooling Multiplier:	0.2, 0.3, 0.4, 0.5, 0.8, 1.0, 2.0, 5.0, 10, 20, 50 times
Current Balance	
Trip Settings:	5%, 10%, 20%, 50% and off
Short Circuit Protection	
Trip Setting:	3.0 to 10.0 times in 0.5 increments (times full load current)
Trip Time:	20, 40, 60, 80, 100, 120, 160mSec
Back EMF Timer	
Trip Delay Settings:	2, 5, 10, 20 seconds
Machine Numbers:	Can be allocated from 1 to 40
Fan Current	
Threshold Level:	32% to 96% in 8% increments (% of full load current)
Under voltage Protection:	Selectable from 20% to 80% in 10% increments Trip delay 800mSec
Serial Communications:	For information on Protocol and hardware requirements see *DNET-IP2 Serial Communication System User Manual.*
Relay Contacts:	MCR, CBR, : 1 x N/0 5A/190VAC 100VA maximum, & 1 x C/0 5A/190VAC 100VA maximum RL3 (Not Used), RL4 : 1 x N/0 5A/190VAC 100VA maximum

17 Trouble Shooting

If a problem is experienced with the relay, use the following tables to fault find the problem. Should the fault persist, remove the relay and return the relay, plus a description of the fault, to Ampcontrol for repairs.

Checking the Status page (level 0, position 0) should be the first step in troubleshooting. This displays what the relay requires to make it operate. Also check the first six event logs.

Symptom	Cause	Remedy	Ref.
Remote Display shows a blank screen. The RDM Healthy LED indicator located on the top of the RDM module is off	Loss of power to the Display	Check there is power to the relay and it is correctly plugged in. The Relay supplies 15v dc to RDM. Check cable between RDM and the relay.	1
	Faulty Display Module.	Replace module.	
Remote Display shows a blank screen. The RDM Healthy LED flashes at 1 Hz.	Power to RDM is healthy but there is no data	Check data connection between the relay and the RDM.	1
Status Message: IPD Memory Error When in diode pilot mode	Corruption in the Group 1 or 2 Settings, stored in the IPD Relay	Examine the Group 1 and 2 Settings (level 8 and 9) to check the stored parameters in the non-volatile memory. Machine type and number are irrelevant and should be ignored. One or several settings will show '???'. Re-program lost settings into the memory.	7,8
Status Message: IPD Memory Error When in RTU pilot mode	Corruption in the Group 1 Settings in the IPD Relay	Examine the Group 1 Settings (level 8) to check the stored parameters in the non-volatile memory. One or several other settings will show '???'. Re-program lost settings into the memory.	7
Status Message: RTU Memory Error	Either the RTU is not on line or the RTU's non - volatile memory has been corrupted	Check that the RTU is on line (level 3, position 1) i.e.., a healthy pilot loop. If the RTU is on line examine the Group 2 Settings stored in the RTU (level 9). One or several other settings will show '???'. Re-program lost settings into the RTU memory.	8
Relay will not close. EC fault indicated.	Faulty pilot circuit (open or high resistance or shorted to earth)	Check pilot circuit e.g.., operate relay with a dummy plug if in diode mode. If still faulty replace the relay.	3
		Check pilot fuse	
Status Message: Need RTU Start or Stopped - RTU or Stopped - RTU PTC	Relay is waiting for the RTU digital inputs to be closed	Ensure all three RTU digital inputs are closed.	2

Symptom	Cause	Remedy	Ref.
Status Message: "Locked Out - Fan"	Relay is waiting for fan interlocking system.	If interlocking is not required then a 10kΩ resistor must be connected between terminals 9 and 12.	6
		If fan interlocking is used ensure that the fan is running and the current threshold setting in the fan outlet's RTU is correct. The Fan Outlet IPD should pick up its FID (Fan Interlock Drive) signal, which causes all other relays to pick up their FIR (Fan Interlock Read). Check these conditions level 6, position 4.	
		If fan interlocking is not correct check the wiring between the fan relay and other relays (terminal 9).	
Relay displays ' Outlet Close Fail' message after start is pressed.	The relay's MCI input is not closing within 5 Sec of MCR relay pickup (level 6 position 2).	Check that main contactor is closing. If not check circuit or replace main contactor. Check auxiliary contacts and wiring.	10
RDM displays 'Tripped-No Volts' message.	Relay not receiving/lost voltage feedback on one or all three outlet phases when contactor closed.	Check system voltage display (level 4, position 1) as contactor closes. Compare this with the under voltage threshold.	6
		Check continuity from the relay, through the EFLO Test Module to power conductors. This can be achieved by testing each phase to earth at the outlet, provided the circuit is isolated. Typical reading: 2655kΩ	17
Relay Trips on MCF on power up.	Main contactor fail condition.	Check main contactor for leakage across terminals on frozen contactor condition.	6
	Flat or faulty battery.	It is recommended that the relay be returned to Ampcontrol for battery replacement and full testing.	11
Time and date incorrect. Resets to 1/01/9? on power up.	Low IS battery	It is recommended that the relay be returned to Ampcontrol for battery replacement and full testing.	11

18 Maintenance & Disposal

18.1 Equipment Maintenance

WARNING! 	**The IPD 11kV Relay and modules have no user serviceable parts. All repairs must be carried out by Ampcontrol personnel only. If a fault develops return these components to Ampcontrol for repair. It is essential that no attempt be made to repair these components as any attempt to dismantle or repair these components can seriously compromise the safety of the system and the consequence can be fatal.**

The IPD 11kV Relay does not have any customer serviceable parts and is not provided with any user adjustments.

18.2 Disposal of System Parts

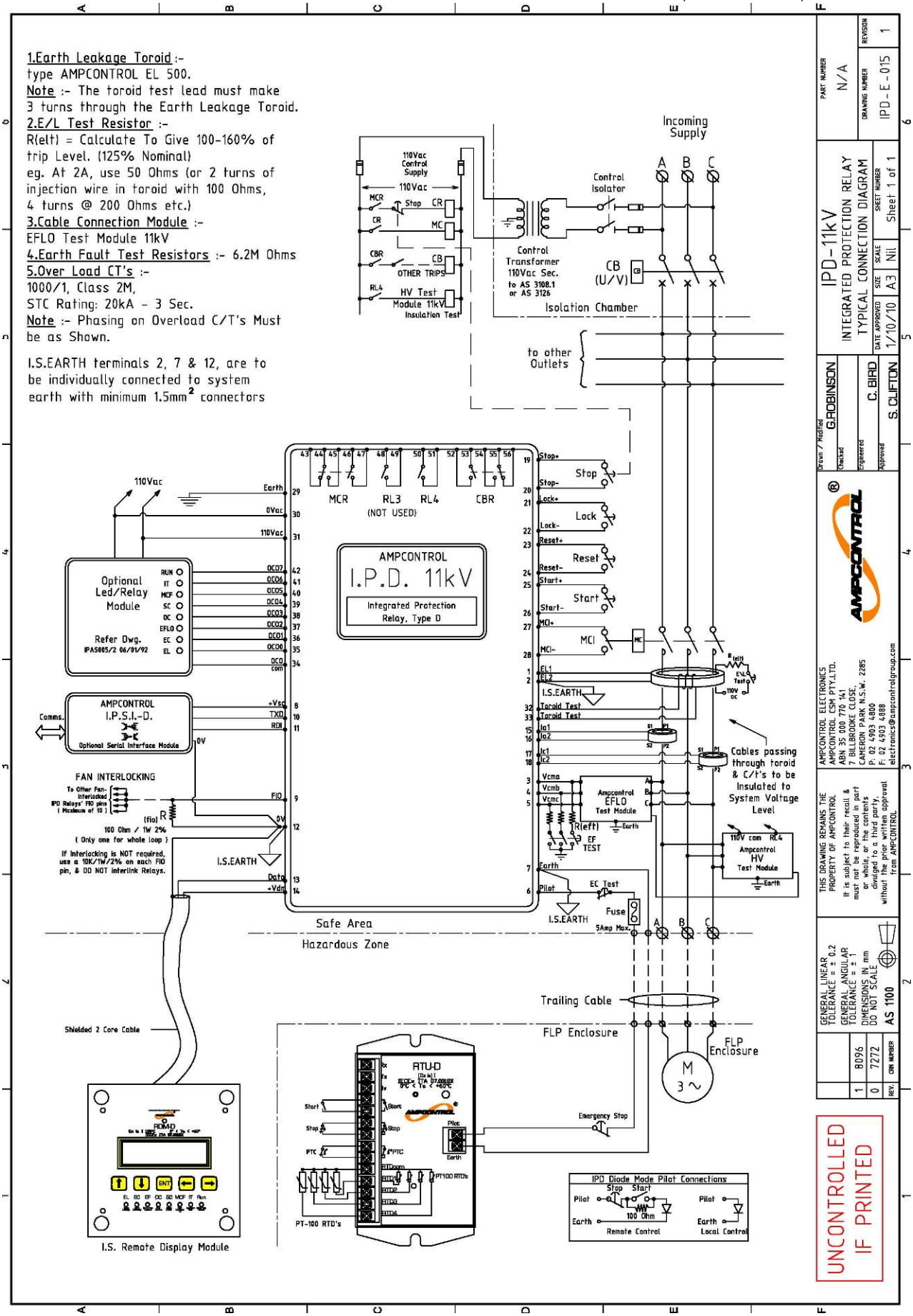
	The electronic equipment discussed in this manual must not be treated as general waste. By ensuring that this product is disposed of correctly you will be helping to prevent potentially negative consequences for the environment and human health which could otherwise be caused by incorrect waste handling of this product.

19 Drawings – Appendix A

Drawing No.	Description
IPD-E-015	Typical Connection Diagram
IPD-E-011	IPD 11 kV EFLO & HV Test System Typical Connection Diagram
IPD-B-009	Display Map
IPC-B-018	Over Current Curve & Short Circuit Curves, Very Intense Curve
IPC-B-019	Overload Curves
IPD-B-003	Fan Interlocking System
IPD-A-037	IPD Relay & Base Mounting & Dimension Details
IPD-A-015	Remote Termination Unit - General Arrangement
IPD-A-016	Remote Display Module RDM-D - G A & Mounting Details
IPD-A-036	IPD 11 kV Base Plate Mounting & Dimension Details
IPD-A-040	EFLO Test Module 11 kV Overall Dimensions
IPA-A-031	IPD 11kV HV Test Module Circuit Boards Components Overlay

The drawings appear in the following pages in the same order in which they are listed in the table above.

This list is also hyperlinked to the drawings and holding the curser on the required drawing number whilst pressing “Control” will take the reader to that drawing.


1.Earth Leakage Toroid :-
type AMPCONTROL EL 500.
Note :- The toroid test lead must make 3 turns through the Earth Leakage Toroid.
2.E/L Test Resistor :-
R(elt) = Calculate To Give 100-160% of trip Level. (125% Nominal)
eg. At 2A, use 50 Ohms (or 2 turns of injection wire in toroid with 100 Ohms, 4 turns @ 200 Ohms etc.)
3.Cable Connection Module :-
EFLO Test Module 11kV
4.Earth Fault Test Resistors :- 6.2M Ohms
5.Over Load CT's :-
1000/1, Class 2M,
STC Rating: 20kA - 3 Sec.
Note :- Phasing on Overload C/T's Must be as Shown.
I.S.EARTH terminals 2, 7 & 12, are to be individually connected to system earth with minimum 1.5mm² connectors
Incoming Supply
A B C
110Vac Control Supply
110Vac
MCR
Stop
CR
MC
CBR
CB
OTHER TRIPS
RL4
HV Test
Module 11kV
Insulation Test
Control Isolator
Control Transformer 110Vac Sec. to AS 3108.1 or AS 3126
CB (U/V)
Isolation Chamber
to other Outlets
AMPCONTROL
I.P.D. 11kV
Integrated Protection Relay, Type D
MCR RL3 RL4 CBR
(NOT USED)
Stop
Lock
Reset
Start
MCI
110Vac
Earth
0Vac
Optional Led/Relay Module
Refer Dwg. IPAS805/2 06/01/92
RUN IT MCF SC OC EFLO EC EL
OCO7 OCO6 OCO5 OCO4 OCO3 OCO2 OCO1 OCO0 OCO com
AMPCONTROL
I.P.S.I.-D.
Optional Serial Interface Module
Comms.
+Vsc TXD RDI 0V
FAN INTERLOCKING
To Other Fan-Interlocked IPD Relays' FIO pins (Maximum of 10)
FIO
R (fio) 100 Ohm / 1W 2%
(Only one for whole loop)
If Interlocking is NOT required, use a 10K/1W/2% on each FIO pin, & DO NOT interlink Relays.
I.S.EARTH
Data
+Vdc
R(elt)
EL Test
I.S.EARTH
Toroid Test
Toroid Test
Ia1 Ia2 Ic1 Ic2
Cables passing through toroid & C/T's to be Insulated to System Voltage Level
Vcma Vcmb Vcmc
Ampcontrol EFLO Test Module
EF TEST
110V com RL4
Ampcontrol HV Test Module
Earth
Pilot
EC Test
Fuse 5Amp Max.
I.S.EARTH
Safe Area
Hazardous Zone
Trailing Cable
FLP Enclosure
FLP Enclosure
M 3~
Shielded 2 Core Cable
RDM-D
I.S. Remote Display Module
RTU-D
Start
Stop
PTC
PT-100 RTD's
PT100 RTDs
Emergency Stop
IPD Diode Mode Pilot Connections
Stop Start
Pilot
100 Ohm
Earth
Remote Control
Local Control
PART NUMBER N/A
DRAWING NUMBER IPD-E-015
REVISION 1
IPD-11kV
INTEGRATED PROTECTION RELAY
TYPICAL CONNECTION DIAGRAM
SHEET NUMBER Sheet 1 of 1
SIZE A3
SCALE Nil
DATE APPROVED 1/10/10
Drawn / Modified G.ROBINSON
Checked
Engineered C. BIRD
Approved S. CLIFTON
AMPCONTROL ELECTRONICS
AMPCONTROL CSM PTY.LTD.
ABN 35 000 770 141
7 BILLBROOKE CLOSE,
CAMERON PARK N.S.W. 2285
P: 02 4903 4800
F: 02 4903 4888
electronics@ampcontrolgroup.com
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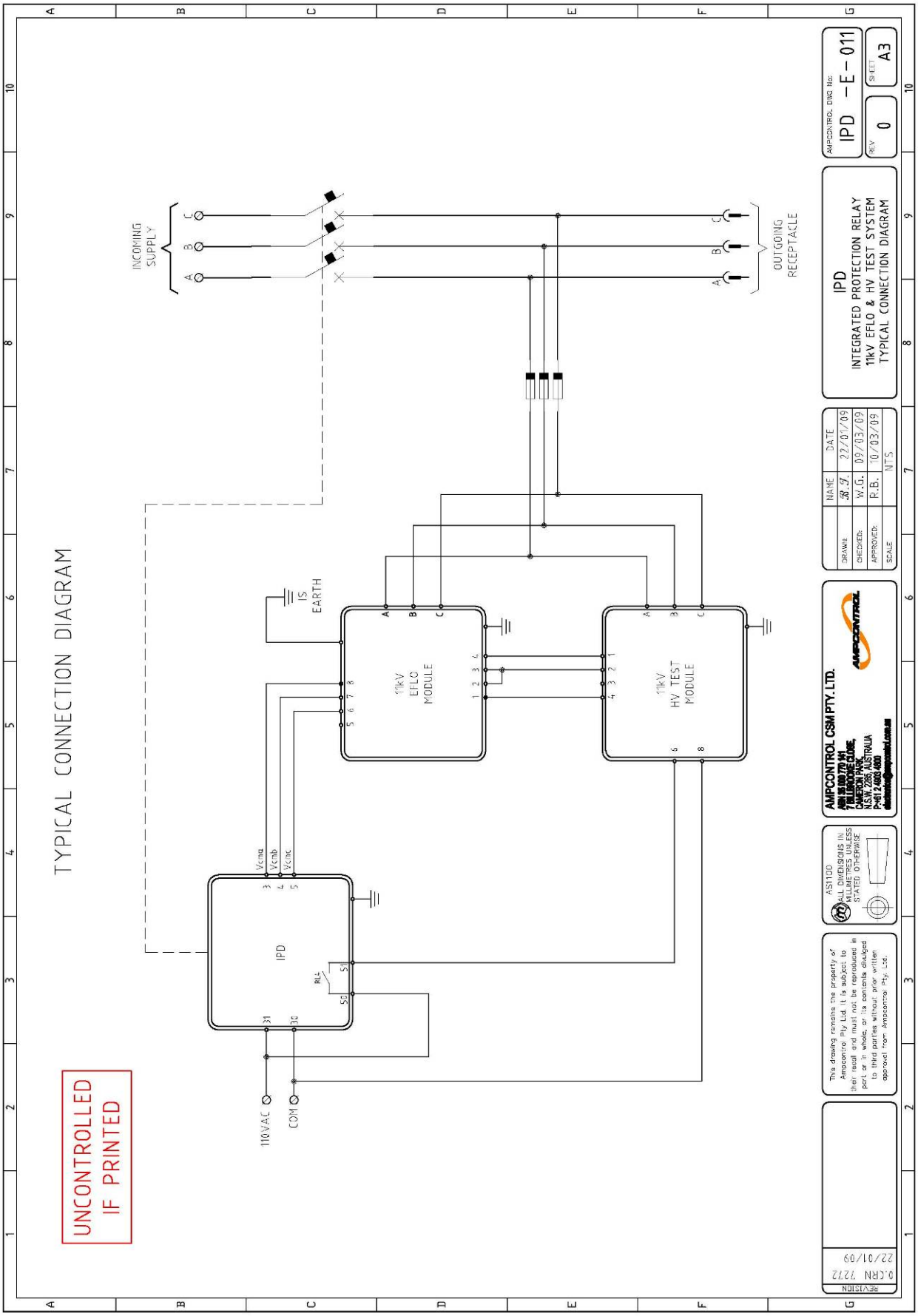
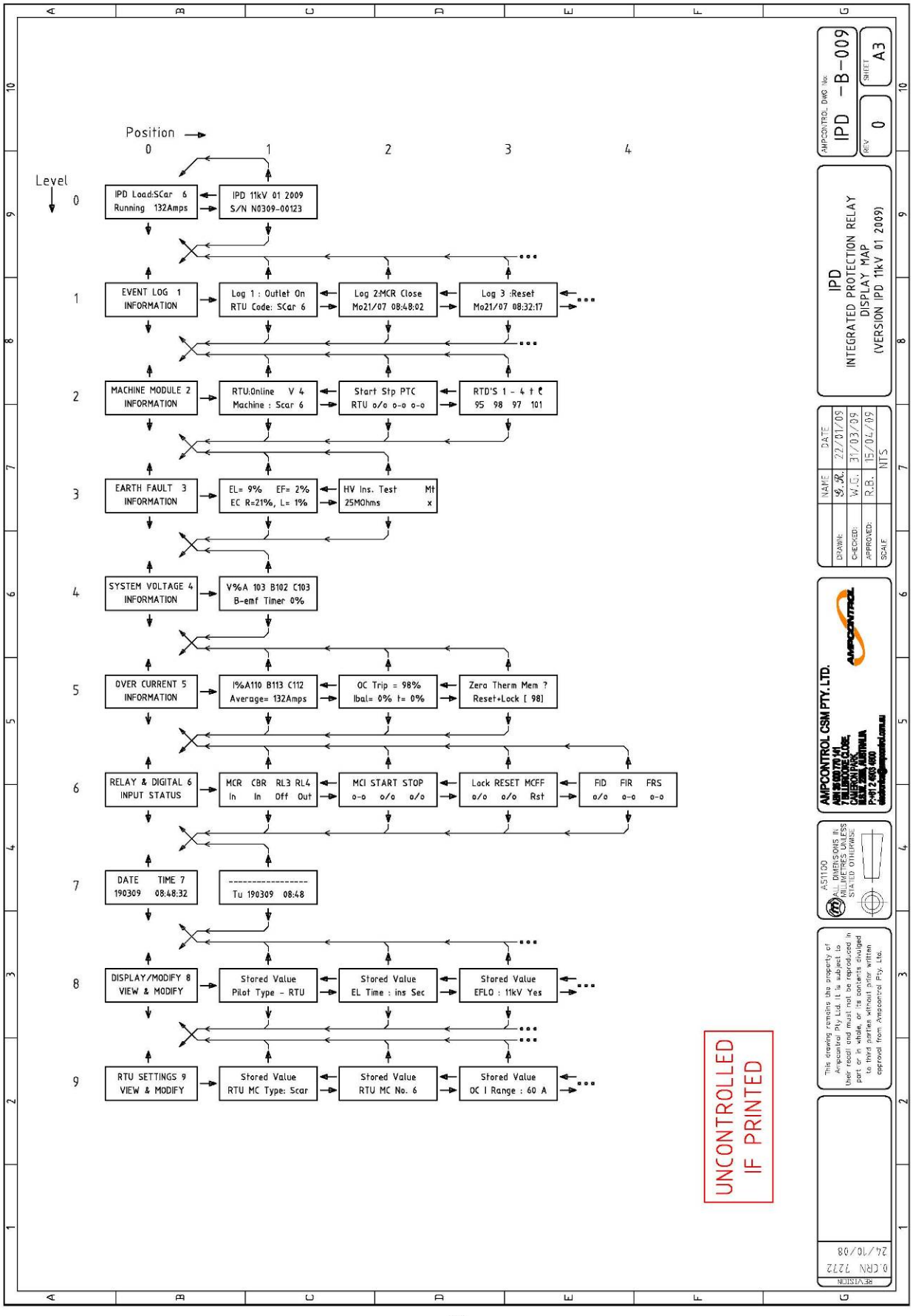
GENERAL LINEAR TOLERANCE = ± 0.2
GENERAL ANGULAR TOLERANCE = ± 1
DIMENSIONS IN mm DO NOT SCALE
AS 1100
REV. CRN NUMBER
1 8096
0 7272
UNCONTROLLED IF PRINTED


TYPICAL CONNECTION DIAGRAM
INCOMING SUPPLY
OUTGOING RECEPTACLE
IS EARTH
11KV EFLO MODULE
11KV HV TEST MODULE
IPD
110VAC
COM
UNCONTROLLED IF PRINTED
IPD INTEGRATED PROTECTION RELAY
11kV EFLO & HV TEST SYSTEM
TYPICAL CONNECTION DIAGRAM
AMPCONTROL CSM PTY. LTD.
IPD -E- 011
A3


Position
0
1
2
3
4
Level
0
IPD Load:SCar 6
Running 132Amps
IPD 11kV 01 2009
S/N N0309-00123
1
EVENT LOG 1
INFORMATION
Log 1 : Outlet On
RTU Code: SCar 6
Log 2:MCR Close
Mo21/07 08:48:02
Log 3 :Reset
Mo21/07 08:32:17
2
MACHINE MODULE 2
INFORMATION
RTU:Online V 4
Machine : Scar 6
Start Stp PTC
RTU o/o o-o o-o
RTD'S 1 - 4 t °C
95 98 97 101
3
EARTH FAULT 3
INFORMATION
EL= 9% EF= 2%
EC R=21%, L= 1%
HV Ins. Test Mt
25MOhms x
4
SYSTEM VOLTAGE 4
INFORMATION
V%A 103 B102 C103
B-emf Timer 0%
5
OVER CURRENT 5
INFORMATION
I%A110 B113 C112
Average= 132Amps
OC Trip = 98%
Ibal= 0% t= 0%
Zero Therm Mem ?
Reset+Lock [98]
6
RELAY & DIGITAL 6
INPUT STATUS
MCR CBR RL3 RL4
In In Off Out
MCI START STOP
o-o o/o o/o
Lock RESET MCFF
o/o o/o Rst
FID FIR FRS
o/o o-o o-o
7
DATE TIME 7
190309 08:48:32

Tu 190309 08:48
8
DISPLAY/MODIFY 8
VIEW & MODIFY
Stored Value
Pilot Type - RTU
Stored Value
EL Time : ins Sec
Stored Value
EFLO : 11kV Yes
9
RTU SETTINGS 9
VIEW & MODIFY
Stored Value
RTU MC Type: Scar
Stored Value
RTU MC No. 6
Stored Value
OC I Range : 60 A
UNCONTROLLED
IF PRINTED
AMPCONTROL DWG No.
IPD -B-009
SHEET
A3
REV
0
IPD
INTEGRATED PROTECTION RELAY
DISPLAY MAP
(VERSION IPD 11kV 01 2009)
NAME
DATE
DRAWN:
S.R.
22/01/09
CHECKED:
W.J.
31/03/09
APPROVED:
R.R.
15/04/09
SCALE
NTS
AMPCONTROL CSM PTY. LTD.
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE
A51100
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D.CRN 7272
24/10/08
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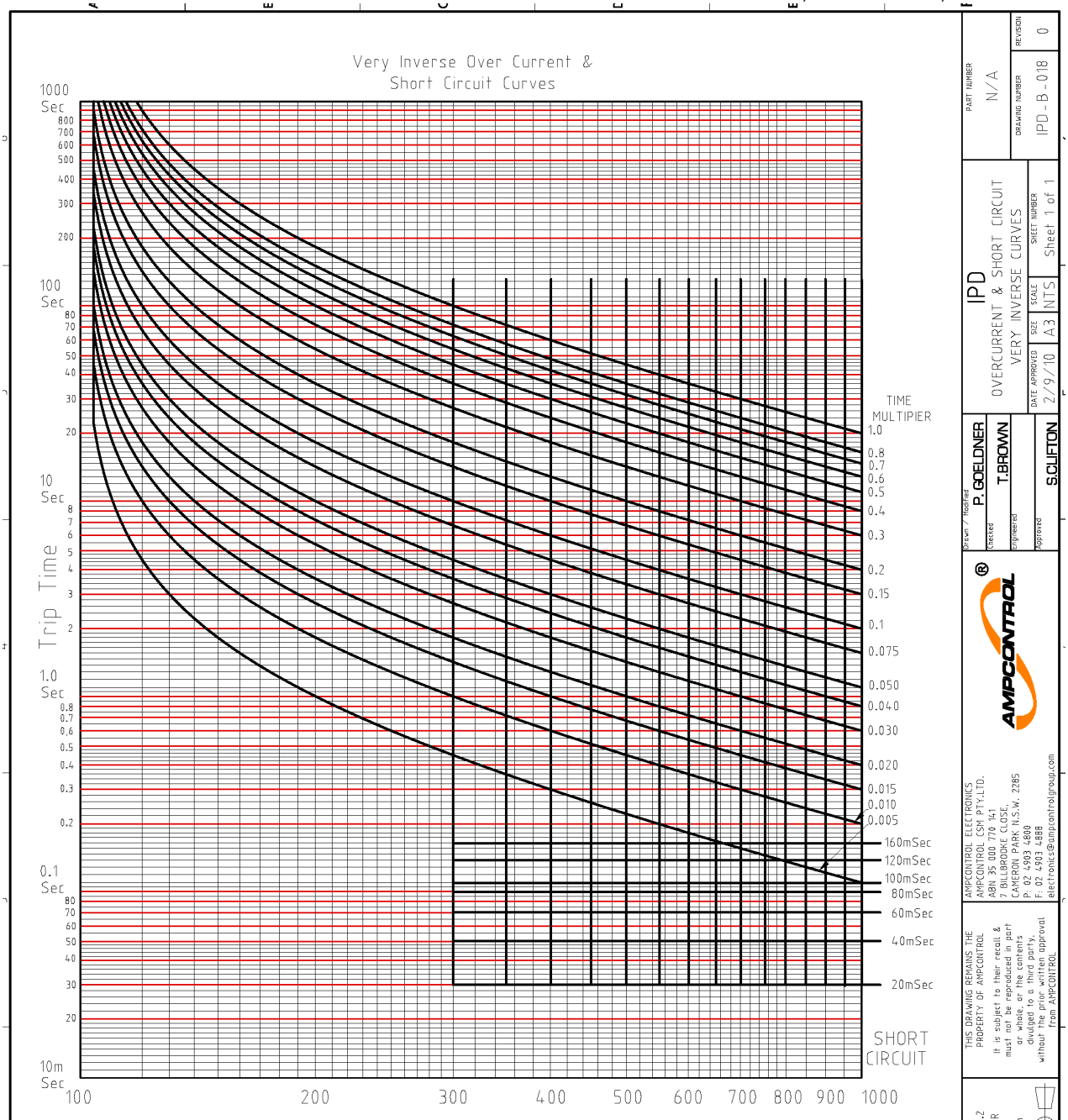

Selected Full Load Current (SFLC)						
Cur Range	Cur Mul					
	1/8*	1/4*	1/2*	1.0*	2.0*	4.0*
60A	7.5A	15A	30A	60A	120A	240A
64A	8 A	16A	32A	64A	128A	256A
68A	8.5A	17A	34A	68A	136A	272A
72A	9 A	18A	36A	72A	144A	288A
76A	9.5A	19A	38A	76A	152A	304A
80A	10 A	20A	40A	80A	160A	320A
84A	10.5A	21A	42A	84A	168A	336A
88A	11 A	22A	44A	88A	176A	352A
92A	11.5A	23A	46A	92A	184A	368A
96A	12 A	24A	48A	96A	192A	364A
100A	12.5A	25A	50A	100A	200A	400A
104A	13 A	26A	52A	104A	208A	416A
108A	13.5A	27A	54A	108A	216A	432A
112A	14 A	28A	56A	112A	224A	448A
116A	14.5A	29A	58A	116A	232A	464A

Over Current Trip time :-

$$t(sec) = \frac{180 \times m}{(I - 1)} *$$

m = time Multiplier

$$I = \frac{\text{Fault Current}}{\text{Selected Full Load Current}}$$

Short Circuit Selectable at - :

3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5,
7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0
Times Selected Full Load Current

Times Selectable at 20, 40, 60, 80,
100, 120 & 160 mSec.

* REFERENCE: IEC 60255-151

PART NUMBER N/A
DRAWING NUMBER IPD-B-018
REVISION 0
IPD
OVERCURRENT & SHORT CIRCUIT
VERY INVERSE CURVES
DATE APPROVED 2/9/10
SIZE A3
SCALE NTS
SHEET NUMBER Sheet 1 of 1
Drawn / Modified P. GOELDNER
Checked T.BROWN
Engineered
Approved S.CLIFTON
AMPCONTROL ELECTRONICS
AMPCONTROL CSM PTY.LTD.
ABN 35 000 770 141
7 BILLBROOKE CLOSE,
CAMERON PARK N.S.W. 2285
P. 02 4903 4800
F. 02 4903 4888
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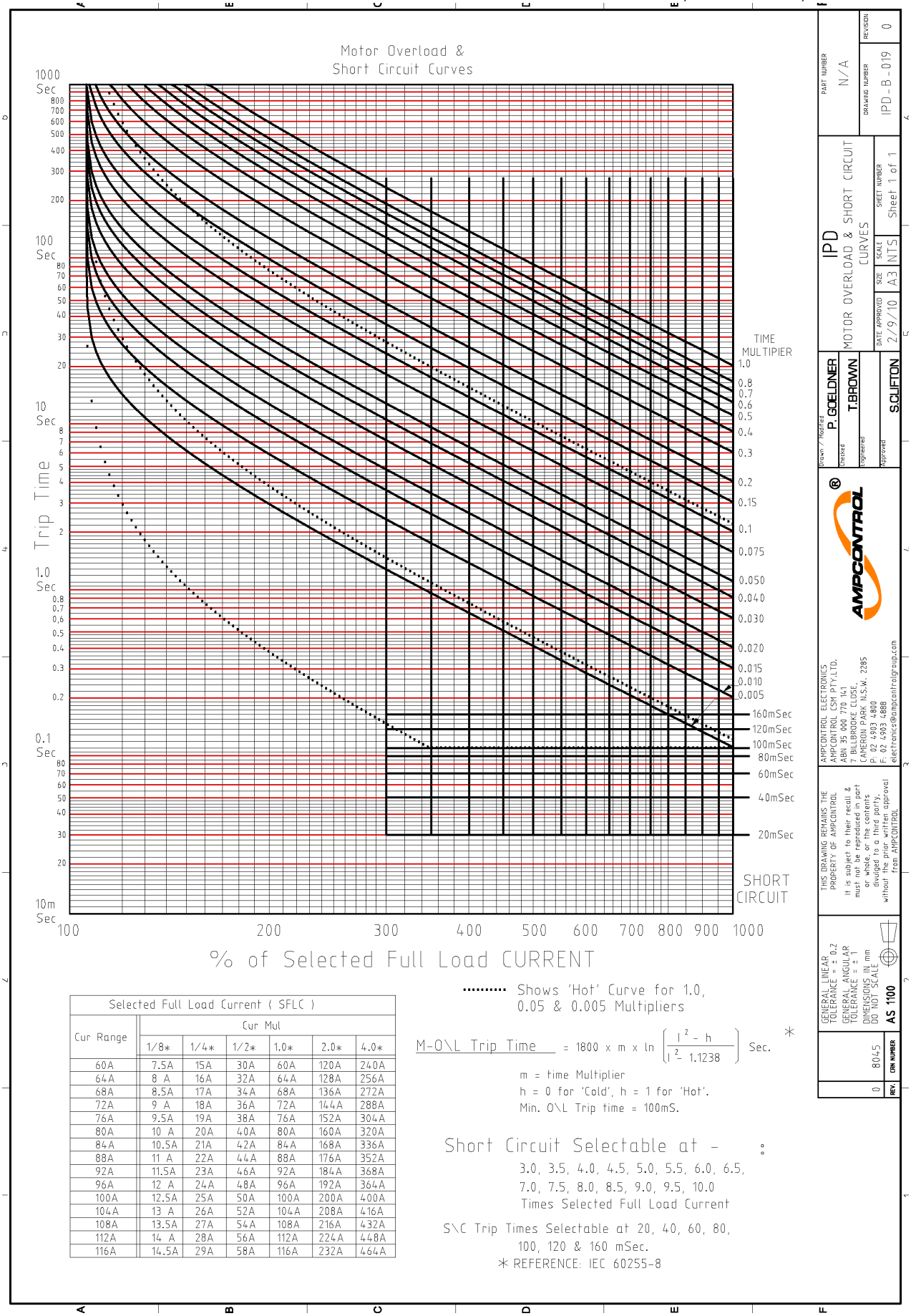
GENERAL LINEAR TOLERANCE = ± 0.2
GENERAL ANGULAR TOLERANCE = ± 1
DIMENSIONS IN mm
DO NOT SCALE
AS 1100
REV. 0
CRN NUMBER 8045



Selected Full Load Current (SFLC)						
Cur Range	Cur Mul					
	1/8*	1/4*	1/2*	1.0*	2.0*	4.0*
60A	7.5A	15A	30A	60A	120A	240A
64A	8 A	16A	32A	64A	128A	256A
68A	8.5A	17A	34A	68A	136A	272A
72A	9 A	18A	36A	72A	144A	288A
76A	9.5A	19A	38A	76A	152A	304A
80A	10 A	20A	40A	80A	160A	320A
84A	10.5A	21A	42A	84A	168A	336A
88A	11 A	22A	44A	88A	176A	352A
92A	11.5A	23A	46A	92A	184A	368A
96A	12 A	24A	48A	96A	192A	364A
100A	12.5A	25A	50A	100A	200A	400A
104A	13 A	26A	52A	104A	208A	416A
108A	13.5A	27A	54A	108A	216A	432A
112A	14 A	28A	56A	112A	224A	448A
116A	14.5A	29A	58A	116A	232A	464A

..... Shows 'Hot' Curve for 1.0, 0.05 & 0.005 Multipliers

$$\text{M-O\L Trip Time} = 1800 \times m \times \ln\left(\frac{I^2 - h}{I^2 - 1.1238}\right) \text{ Sec.} \ *$$

m = time Multiplier
h = 0 for 'Cold', h = 1 for 'Hot'.
Min. O\L Trip time = 100mS.

Short Circuit Selectable at - :
3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0
Times Selected Full Load Current

S\C Trip Times Selectable at 20, 40, 60, 80, 100, 120 & 160 mSec.

* REFERENCE: IEC 60255-8

PART NUMBER N/A | DRAWING NUMBER IPD_B-019 | REVISION 0
IPD MOTOR OVERLOAD & SHORT CIRCUIT CURVES
DATE APPROVED 2/9/10 | SIZE A3 | SCALE NTS | SHEET NUMBER Sheet 1 of 1
Drawn / Modified P.GOELDNER | Checked T.BROWN | Engineered | Approved S.CLIFTON
AMPCONTROL ELECTRONICS
AMPCONTROL CSM PTY.LTD.
ABN 35 000 770 141
7 BULLBROOKE CLOSE,
CAMERON PARK N.S.W. 2285
P: 02 4903 4800
F: 02 4903 4888
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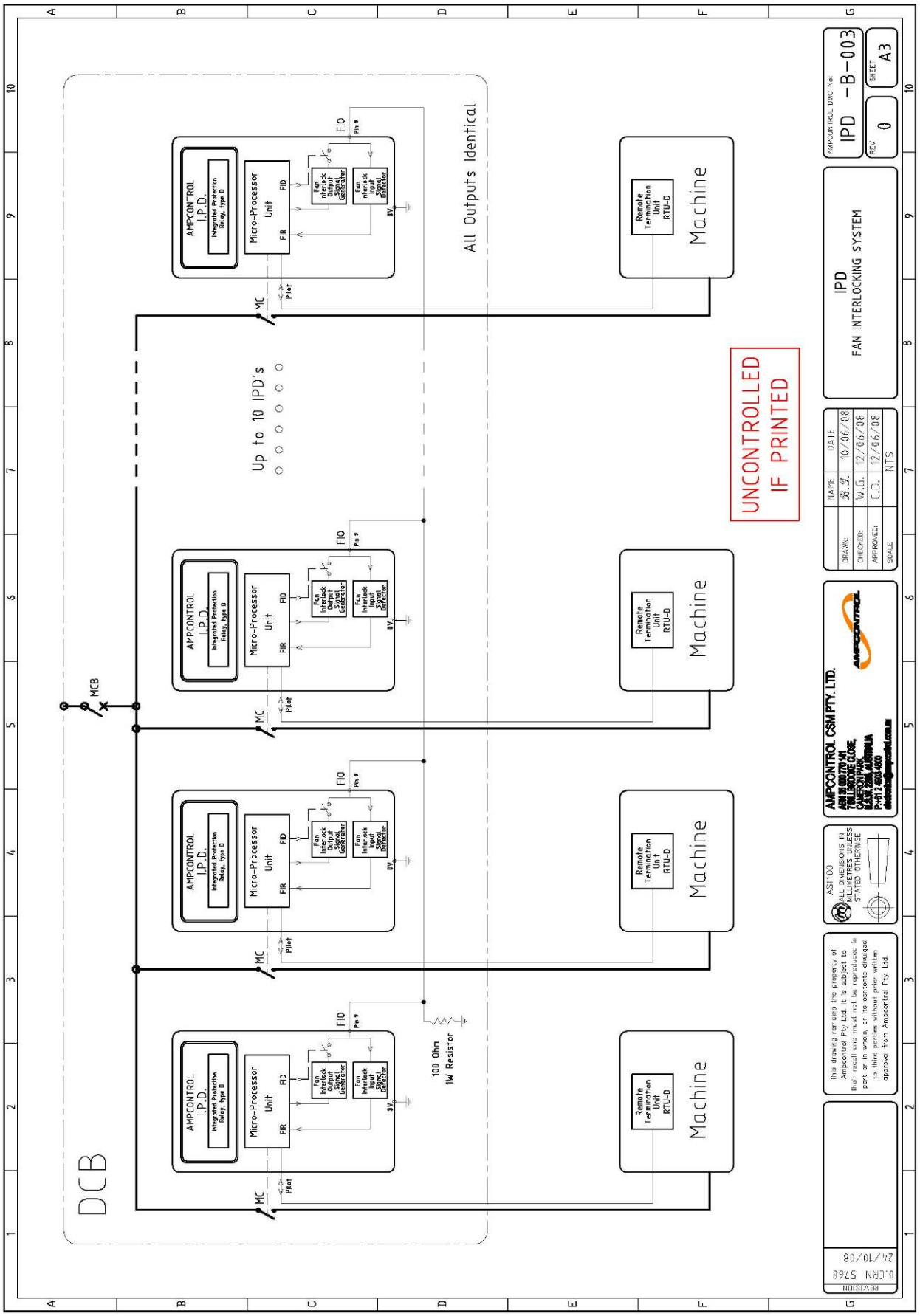
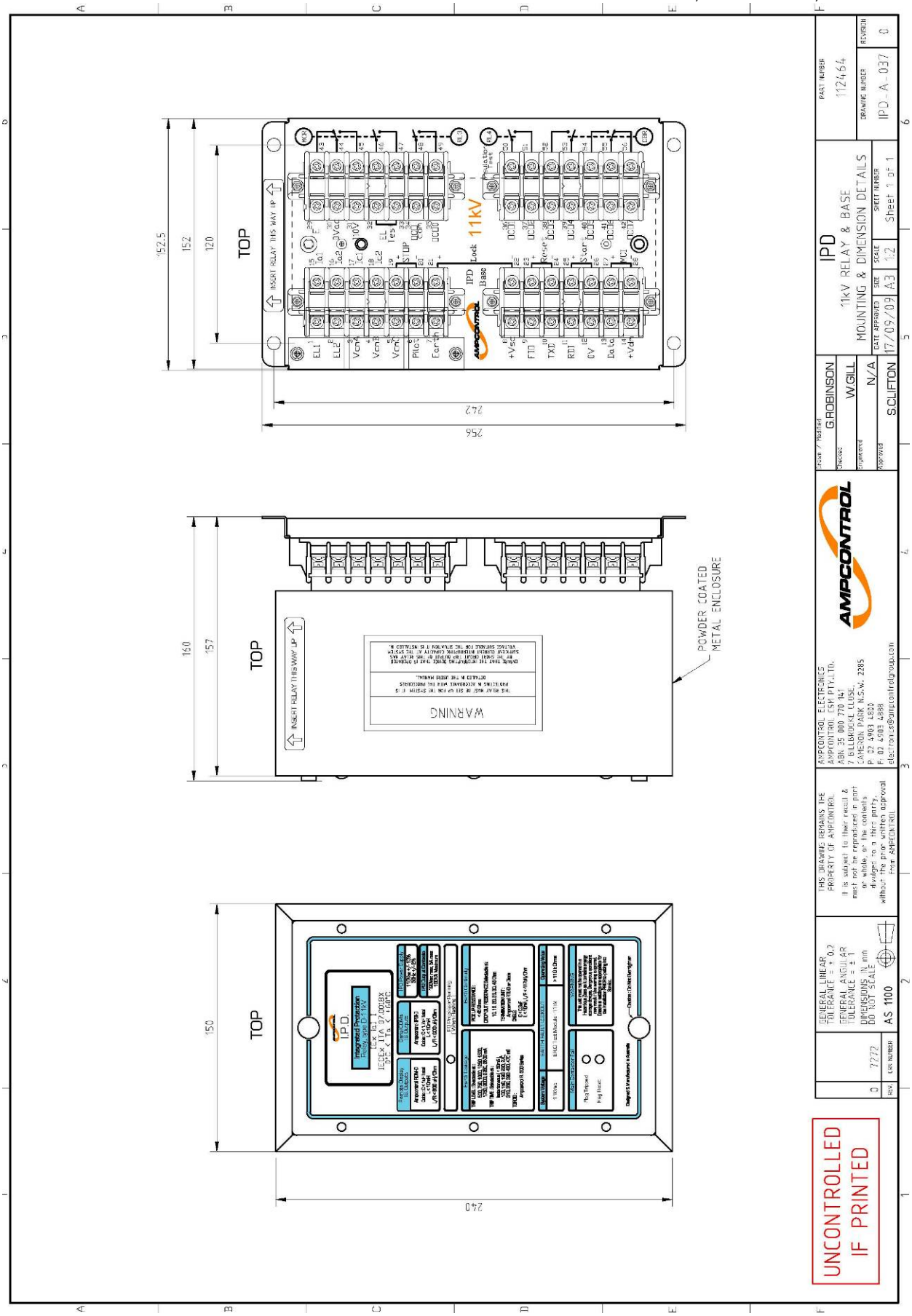
GENERAL LINEAR TOLERANCE = ± 0.2
GENERAL ANGULAR TOLERANCE = ± 1
DIMENSIONS IN mm DO NOT SCALE
AS 1100
REV. 0 | CRN NUMBER 8045


DCB
MCB
All Outputs Identical
Up to 10 IPD's
AMPCONTROL I.P.D.
Integrated Protection Relay, Type D
Micro-Processor Unit
FID
FIR
Fan Interlock Output Signal Generator
Fan Interlock Input Signal Detector
FIO
Pin 9
8V
Pilot
MC
100 Ohm 1W Resistor
Remote Termination Unit RTU-D
Machine
UNCONTROLLED IF PRINTED
IPD
FAN INTERLOCKING SYSTEM
AMPCONTROL CSM PTY. LTD.
DRAWN
CHECKED
APPROVED
SCALE
NTS
IPD -B-003
REV 0
SHEET A3
REVISION
D.CRN 5768
24/10/08


TOP
INSERT RELAY THIS WAY UP
152.5
152
120
242
256
IPD
11kV
Lock
Base
POWDER COATED
METAL ENCLOSURE
160
157
WARNING
150
240
IPD
11kV RELAY & BASE
MOUNTING & DIMENSION DETAILS
AMPCONTROL ELECTRONICS
AMPCONTROL ENG PTY LTD.
ABN 35 000 770 147
7 BILLBOROKE CLOSE,
CAMERON PARK N.S.W. 2285
P. 02 4903 4800
F. 02 4903 4888
electronics@ampcontrolgroup.com
AS 1100
GENERAL LINEAR TOLERANCE ± 0.2
GENERAL ANGULAR TOLERANCE ± 1
DIMENSIONS IN mm
DO NOT SCALE
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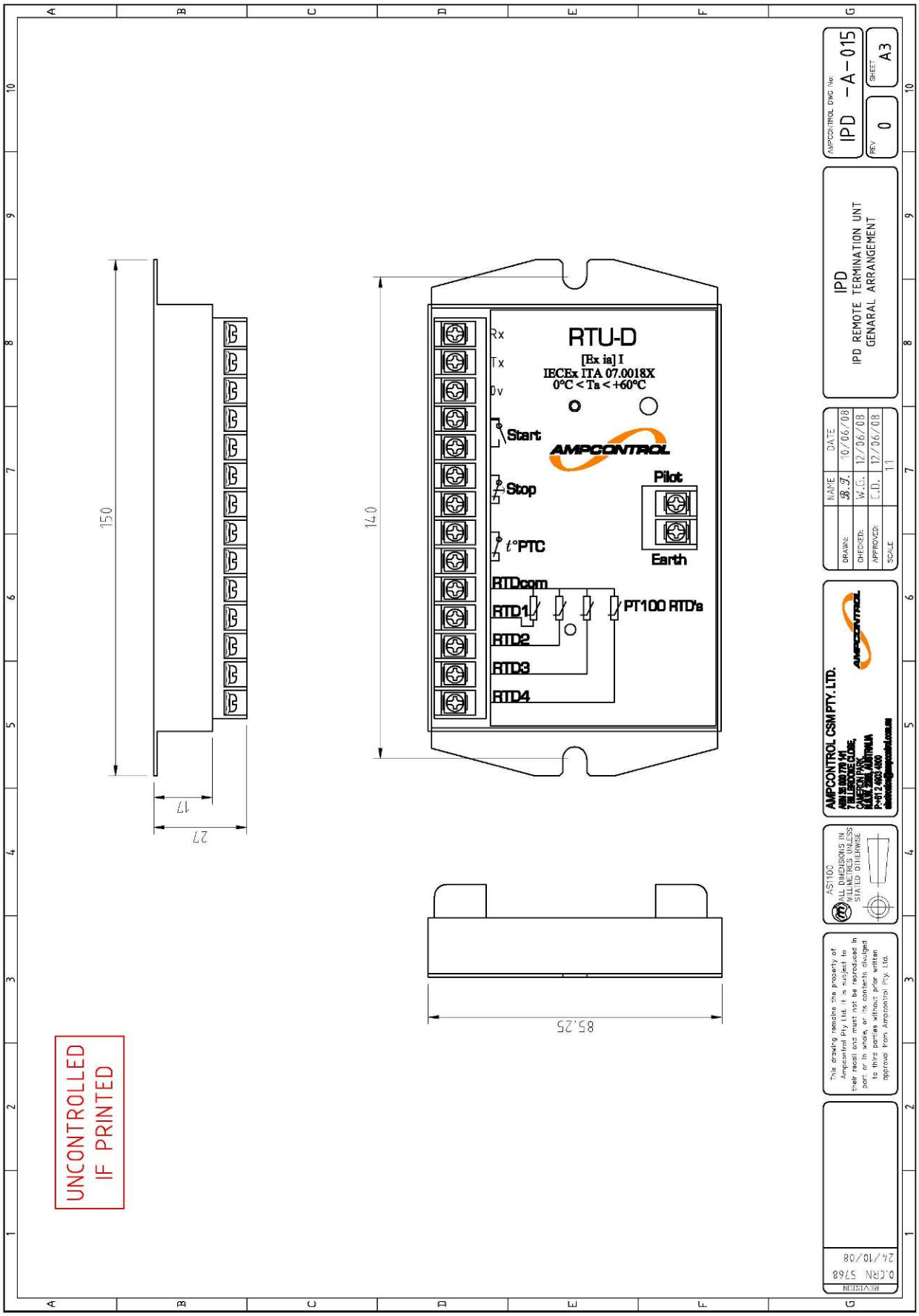
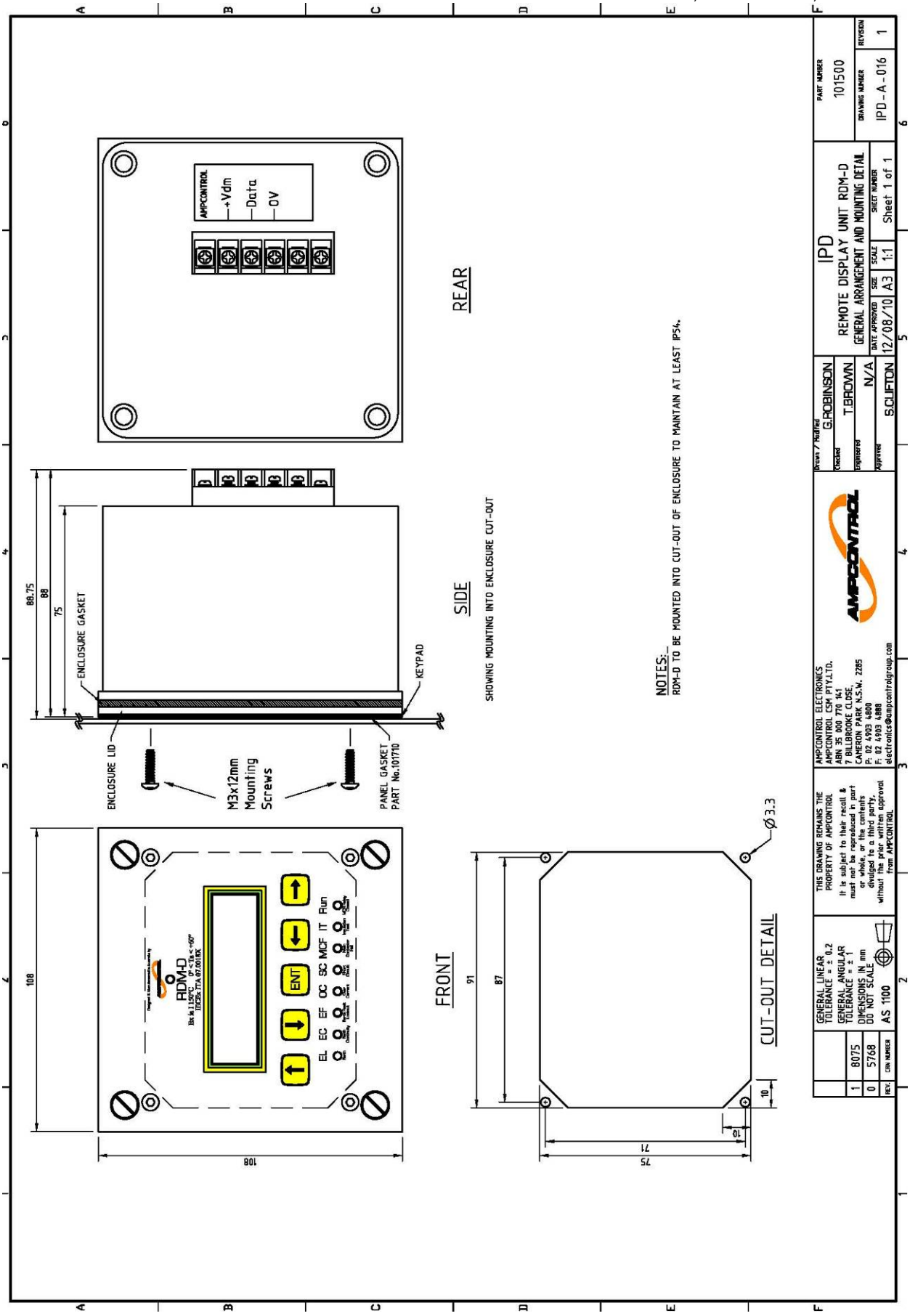
UNCONTROLLED IF PRINTED
G.ROBINSON
W.GILL
N/A
S.CLIFTON
17/09/09
A3
1:2
Sheet 1 of 1
IPD_A_037
112464
7272


RTU-D
[Ex ia] I
IECEx ITA 07.0018X
0°C < Ta < +60°C
Rx
Tx
0v
Start
Stop
t°PTC
Pilot
Earth
RTDcom
RTD1
RTD2
RTD3
RTD4
PT100 RTD's
150
140
17
27
85.25
IPD
IPD REMOTE TERMINATION UNT
GENARAL ARRANGEMENT
IPD -A-015
AMPCONTROL CSM PTY. LTD.
UNCONTROLLED
IF PRINTED


REAR
AMPCONTROL
+Vdm
Data
0V
SIDE
SHOWING MOUNTING INTO ENCLOSURE CUT-OUT
88.75
88
75
ENCLOSURE GASKET
KEYPAD
ENCLOSURE LID
M3x12mm Mounting Screws
PANEL GASKET PART No.101710
NOTES:-
RDM-D TO BE MOUNTED INTO CUT-OUT OF ENCLOSURE TO MAINTAIN AT LEAST IP54.
FRONT
RDM-D
ENT
EL EC EF OC SC MCF IT Run
108
91
87
CUT-OUT DETAIL
Ø3.3
10
71
75
IPD
REMOTE DISPLAY UNIT RDM-D
GENERAL ARRANGEMENT AND MOUNTING DETAIL
PART NUMBER 101500
DRAWING NUMBER IPD-A-016
REVISION 1
SHEET NUMBER Sheet 1 of 1
SCALE 1:1
SIZE A3
DATE APPROVED 12/08/10
Drawn / Modified G.ROBINSON
Checked T.BROWN
Engineered N/A
Approved S.CLIFTON
AMPCONTROL ELECTRONICS
AMPCONTROL CSM PTY.LTD.
ABN 35 008 779 141
7 BILLBROOKE CLOSE
CAMERON PARK N.S.W. 2285
P: 02 4903 4800
F: 02 4903 4888
electronics@ampcontrolgroup.com
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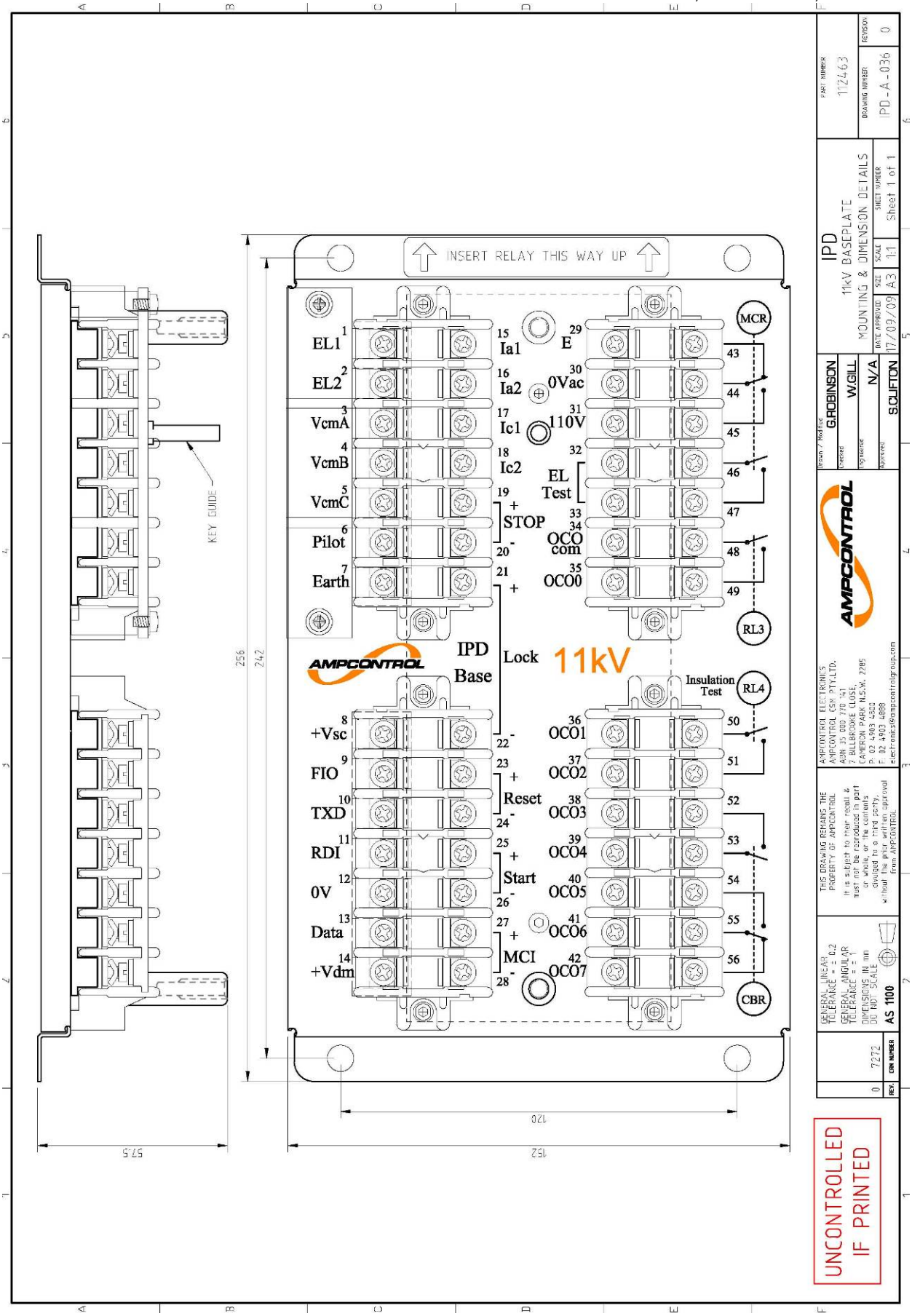
GENERAL LINEAR TOLERANCE = ± 0.2
GENERAL ANGULAR TOLERANCE = ± 1
DIMENSIONS IN mm
DO NOT SCALE
AS 1100
CRN NUMBER
REV.
1 8075
0 5768


INSERT RELAY THIS WAY UP
KEY GUIDE
EL1
EL2
VcmA
VcmB
VcmC
Pilot
Earth
Ia1
Ia2
Ic1
Ic2
STOP
Lock
Reset
Start
MCI
E
0Vac
110V
EL Test
OCO com
OCO0
OCO1
OCO2
OCO3
OCO4
OCO5
OCO6
OCO7
+Vsc
FIO
TXD
RDI
0V
Data
+Vdm
IPD Base
11kV
Insulation Test
MCR
RL3
RL4
CBR
256
242
120
152
57.5
IPD
11kV BASEPLATE
MOUNTING & DIMENSION DETAILS
PART NUMBER 11263
DRAWING NUMBER IPD-A-036
REVISION 0
SHEET NUMBER Sheet 1 of 1
SCALE 1:1
SIZE A3
DATE APPROVED 17/09/09
G.ROBINSON
W.GILL
N/A
S.CLIFTON
AMPCONTROL ELECTRONICS
AMPCONTROL PTY LTD.
ACN 15 001 771 141
2 BILBROOKE CLOSE
CAMPBELL PARK N.S.W. 2285
P. 02 4903 4300
F. 02 4903 4088
electronics@ampcontrolgroup.com
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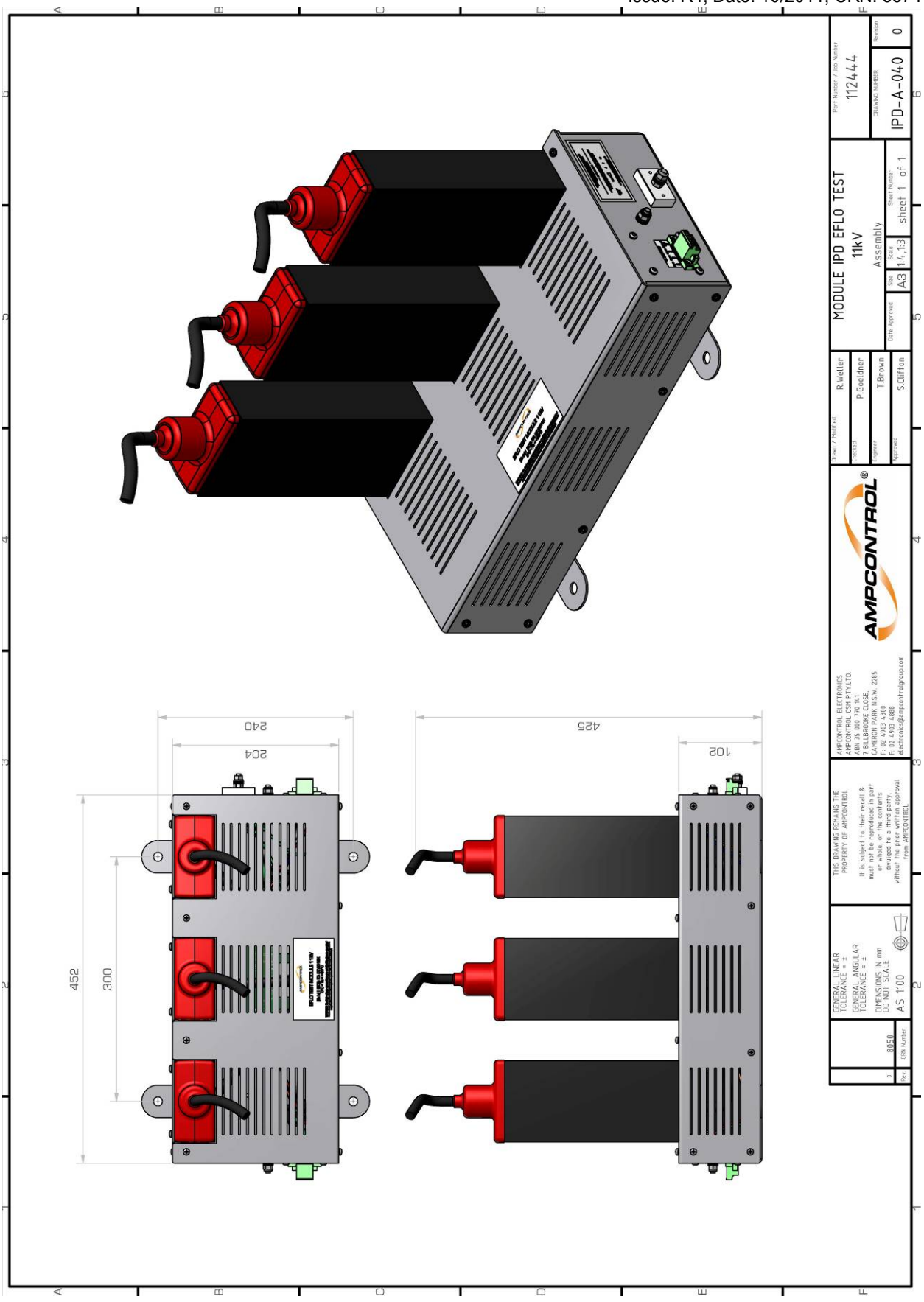
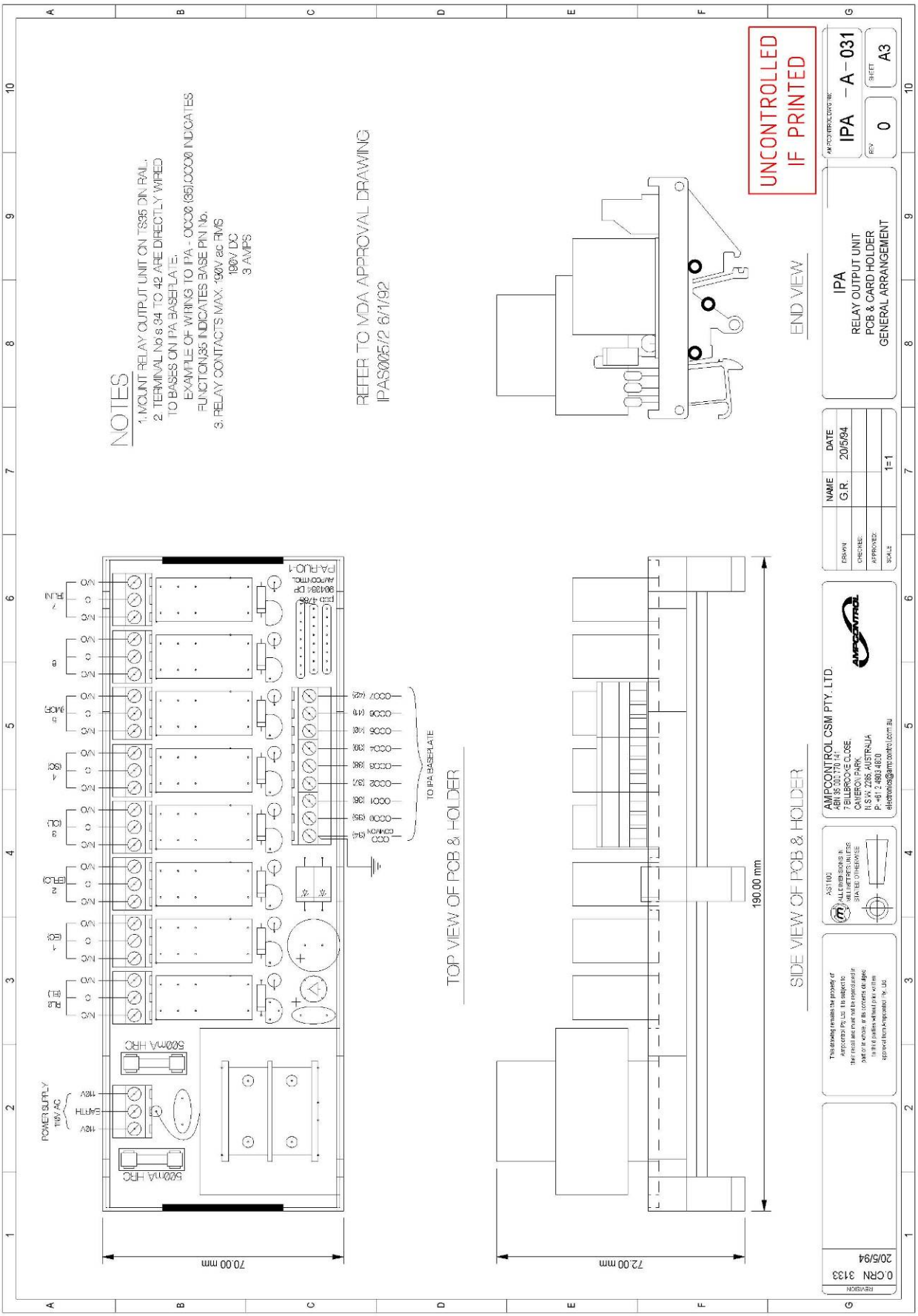
GENERAL LINEAR TOLERANCE = ± 0.2
GENERAL ANGULAR TOLERANCE = ± 1
DIMENSIONS IN mm DO NOT SCALE
AS 1100
REV 0
CRN NUMBER 7272
UNCONTROLLED IF PRINTED


240
204
425
102
452
300
MODULE IPD EFLO TEST
11kV
Assembly
IPD-A-040
112444
AMPCONTROL
AS 1100
8050


NOTES
1. MOUNT RELAY OUTPUT UNIT ON TS35 DIN RAIL.
2. TERMINAL Nos 8 34 TO 42 ARE DIRECTLY WIRED TO BASES ON IPA BASEPLATE.
EXAMPLE OF WIRING TO IPA - CCC08 (35),CCC08 INDICATES FUNCTION35 INDICATES BASE PIN No.
3. RELAY CONTACTS MAX. 190V ac RMS
190V DC
3 AMPS
REFER TO MDA APPROVAL DRAWING
IPAS0025/2 6/1/92
UNCONTROLLED IF PRINTED
END VIEW
IPA
RELAY OUTPUT UNIT
PCB & CARD HOLDER
GENERAL ARRANGEMENT
IPA – A – 031
REV 0
SHEET A3
DRAWN G.R. 20/5/94
CHECKED
APPROVED
SCALE 1=1
TOP VIEW OF PCB & HOLDER
SIDE VIEW OF PCB & HOLDER
190.00 mm
70.00 mm
72.00 mm
TO IPA BASEPLATE
POWER SUPPLY 110V AC
500mA HRC
AMPCONTROL CSM PTY. LTD.
ABN 35 001 170 141
7 BILLBROOKE CLOSE,
CANTERBURY PARK,
N.S.W. 2285 AUSTRALIA
P. +61 2 4903 4810
electronics@ampcontrol.com.au
0.CRN 8133
20/5/94

20 Approvals – Appendix B

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres
for rules and details of the IECEx Scheme visit www.iecex.com

Certificate No.:	IECEx ITA 07.0018X issue No.:1	Certificate history: Issue No. 1 (2009-4-20) Issue No. 0 (2008-7-7)
Status:	**Current**	
Date of Issue:	**2009-04-20** Page 1 of 4	
Applicant:	**AMPCONTROL CSM Pty Ltd** 7 Billbrooke Close, Cameron Park, NSW, 2285 **Australia**	
Electrical Apparatus: *Optional accessory:*	**Integrated Protection Relay IS System Type IPD**	
Type of Protection:	**Ex ia**	
Marking:	**[Ex ia] I** **IECEx ITA 07.0018X** **0C < ta < +60C** **Ex ia I -20C < ta < +60C** **IECEx ITA 07.0018X**	
Approved for issue on behalf of the IECEx Certification Body:	D Gray	
Position:	Certificatiion Authority	
Signature: *(for printed version)*		
Date:	20 APRIL 2009	

1. This certificate and schedule may only be reproduced in full.
2. This certificate is not transferable and remains the property of the issuing body.
3. The Status and authenticity of this certificate may be verified by visiting the Official IECEx Website.

Certificate issued by:

International Testing and Certification Services Pty. Ltd
4 - 6 Second Street
Bowden SA 5007
Australia

ITACS

IECEx Certificate of Conformity

Certificate No.: IECEx ITA 07.0018X

Date of Issue: **2009-04-20** Issue No.: **1**

Page 2 of 4

Manufacturer: **AMPCONTROL CSM Pty Ltd**
7 Billbrooke Close,
Cameron Park, NSW, 2285
Australia

Manufacturing location(s):

This certificate is issued as verification that a sample(s), representative of production, was assessed and tested and found to comply with the IEC Standard list below and that the manufacturer's quality system, relating to the Ex products covered by this certificate, was assessed and found to comply with the IECEx Quality system requirements. This certificate is granted subject to the conditions as set out in IECEx Scheme Rules, IECEx 02 and Operational Documents as amended.

STANDARDS:
The electrical apparatus and any acceptable variations to it specified in the schedule of this certificate and the identified documents, was found to comply with the following standards:

IEC 60079-0 : 2000 Edition: 3.1	Electrical apparatus for explosive gas atmospheres - Part 0: General requirements
IEC 60079-11 : 1999 Edition: 4	Electrical apparatus for explosive gas atmospheres - Part 11: Intrinsic safety 'i'

*This Certificate **does not** indicate compliance with electrical safety and performance requirements other than those expressly included in the Standards listed above.*

TEST & ASSESSMENT REPORTS:
A sample(s) of the equipment listed has successfully met the examination and test requirements as recorded in

Test Report:

AU/ITA/ExTR08.0015/00
AU/ITA/ExTR08.0015/01

Quality Assessment Report:
AU/TSA/QAR06.0007/02

IECEx Certificate of Conformity

Certificate No.: IECEx ITA 07.0018X

Date of Issue: **2009-04-20** Issue No.: **1**

Page 3 of 4

Schedule

EQUIPMENT:
Equipment and systems covered by this certificate are as follows:

The IPD System comprises of the following items of equipment which are to be located in a non-hazardous area;
1. Integrated Protection Relay Type IPD.
2. CCMA or CCMD interface module
3. IKD Interface
4. IPSI-D module
5. RTU-D module
6. EFLO Test Module 11KV

Connected to the non-hazardous area equipment listed above are the following equipment which may be located in a hazardous area;
1. RDM-D Module
2. IKD Keypad

Refer to the attachment to this IECEx Certificate of Conformity, available for download, at the end of this On-Line IECEx Certificate of Conformity, for full product details. If viewing a copy this certificate in paper form, refer to the the IECEx website www.iecex.com for full product description details.

CONDITIONS OF CERTIFICATION: YES as shown below:

Refer to the attachment to this IECEx Certificate of Conformity, available for download, at the end of this On-Line IECEx Certificate of Conformity for full details of Conditions of Safe Use that MUST be met in order for this to remain valid. If viewing a copy this certificate in paper form, refer to the the IECEx website www.iecex.com to download the certificate attachment.

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

Equipment Description

Items 1 + 2 Below apply to both the original Issue of the Certificate IECEx ITA 07.0018X Issue 0 and IECEx ITA 07.0018X Issue 1

1. Associated Intrinsically Safe Apparatus:

The Integrated Protection Relay Type IPD comprises 5 printed wiring boards (PWBs) upon which electronic components are mounted, including a lithium manganese dioxide battery. The pwbs are enclosed within a metallic enclosure fitted with plugs and sockets for connections of external circuits. The apparatus is designed to restrict the transfer of energy from the non-hazardous area to the hazardous area by limitation of the voltage and current to intrinsically safe levels with the application of 2 faults applied. External connections are made via terminal blocks mounted on the rear of the apparatus.

The CCMA modules comprise of a single printed wiring board upon which are mounted resistors and zener diodes. The modules are designed to restrict the transfer of energy from the non-hazardous area to the hazardous area by limitation of the voltage and current to intrinsically safe levels with the application of 2 faults applied. The modules come in three different versions namely, the 110V, the 415V and the 1000V. External connections are made via screw connections located on the top of the apparatus.

The CCMD Interface modules comprise up to 4 printed wiring boards upon which are mounted resistors, zener diodes and other electronic components. The modules are designed to restrict the transfer of energy from the non-hazardous area to the hazardous area by limitation of the voltage and current to intrinsically safe levels with the application of 2 faults applied. The modules come in three different versions namely, the 415V, the 1000V and the 3.3kV. External connections are made via screw connections or integral cables.

The IKD Interface module comprises of a single printed wiring board upon which electronic components are mounted. The pwb is partially enclosed within a steel or stainless steel enclosure fitted with four terminal blocks for connections of external circuits. The apparatus is designed to restrict the transfer of energy from the non-hazardous area to the hazardous area by limitation of the voltage and current to intrinsically safe levels with the application of 2 faults applied. External connections are made via terminal blocks mounted on the apparatus.

The IPSI-D module comprises of a single printed wiring board upon which electronic components are mounted. The pwb is enclosed within a plastic enclosure fitted with terminal blocks for connections of external circuits. The modules are designed to prevent the transfer of energy from the non-hazardous area to the hazardous via galvanically isolating opto couplers with the application of 2 faults applied.

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

The RTU-D module comprises of a single printed wiring board upon which electronic components are mounted. The pwb is enclosed within a steel enclosure fitted with a terminal blocks mounted on the top of the enclosure for connections of external circuits.

The Integrated Protection Relay Type IPD, CCMA, CCMD, IKD Interface, IPSI-D and RTU-D modules must be located either in a non-hazardous area or within a suitably certified Group I flameproof enclosure.

2 Hazardous Area Intrinsically Safe Apparatus

The RDM-D module comprises of a single printed wiring board upon which electronic components are mounted. The pwb is partially enclosed within an enclosure made from a steel fascia and a plastic box fitted with a terminal block mounted on the rear wall of the enclosure for connections of external circuits. The front of the enclosure is fitted with 5 membrane switches with 8 indicating Light Emitting Diodes (LED's) and a Liquid Crystal Display (LCD).

The IKD Keypad comprises of a single printed wiring board upon which electronic components are mounted. The pwb is enclosed within plastic enclosure fitted with a terminal block mounted on the rear wall of the enclosure for connections of external circuits. The front of the enclosure is fitted with 8 membrane switches with indicating 8 Light Emitting Diodes (LED's)

Equipment Description, Item 3 below applies only to Certificate IECEx ITA 07.0018X Issue 1 and constitutes a change to the original Issue 0.

3. Change introduced by Issue 1 of the Certificate

The addition of the 'EFLO Test Module 11kV' allows the IPD to be used on 11kV systems. Refer to Equipment Description on Certificate IECEx ITA 07.0018X Issue 1 for details.

Conditions of Certification

The following conditions listed under A and B Groups apply to certificate IECEx ITA 07.0018X Issue 0 and IECEx ITA 07.0018X Issue 1:

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

A. Conditions of manufacture

1. The apparatus must be manufactured in accordance with the certified drawings.

B. Conditions of safe use

1.0 Input and Out Parameters not to be exceeded according to 1.1 and 1.2 below:

1.1 The following parameters are not exceeded for product covered by IECEx ITA 07.018X Issue 0

Input Parameters (IECEx ITA 07.0018X Issue 0)

Apparatus	Terminals	U_m (V)
Integrated Protection Relay Type IPD	1,2, & 15 to 56	132 V
IKD Interface	J2, J4	132 V
IKD Interface	Pilot	5 A.
IPSI-D	DNIP+, DNIP	250 V
CCMA 110 V	A, B, C	132 V
CCMA 415 V	A, B, C	415 V
CCMA 1000 V	A, B, C	1000 V
CCMD 415 V,	Va, Vb, Vc	415 V
CCMD 1kV	Va, Vb, Vc	1000 V
CCMD 3.3kV	Va, Vb, Vc	3300 V

Terminal ID	U_i (V)	I_i (mA)	P_i (mW)	C_i (µF)	L_i (µH)
RDM-D	18	60	700	8	Negligible
IKD Keypad	16	100	700	10	Negligible
IPSI-D	18	78.3	352	Negligible	Negligible
RTU-D	20.4	144	737	3	Negligible

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

Output Parameters (IECEx ITA 07.0018X Issue 0)

	U_o (V)	I_o (mA)	P_o (mW)	C_o[1] (µF)	L_o[2] (mH)	L/R (µH/Ω)
IPD +Vsc, RDI, TXD, & 0V	18	78.3	352	9	76	1325
IPD +Vdm, Data, & 0V	18	60	267	9	129	1749
IPD FIO & 0V	18	19.35	87.1	9	1246	5359
IPD Pilot & Earth	20.4	144	737	6.74	22.5	417
CCMA (110V) A, B, C	19.62*	11	54	7.8	3,000	1,000
CCMA (415V) A, B, C	19.62*	3	13	7.8	3,000	1,000
CCMA (1000V) A, B, C	19.62*	2	6	7.8	3,000	1,000
CCMD (415V) Va, Vb, Vc	19.62*	< 0.01	< 0.01	7.8	3,000	1,000
CCMD (1kV) Va, Vb, Vc	19.62*	< 0.01	< 0.01	7.8	3,000	1,000
CCMD (3.3kV) Va, Vb, Vc	19.62*	< 0.01	< 0.01	7.8	3,000	1,000
IKD Interface A, B, C, EFT, +Vkp, Data, Earth	7.14	0.75	1.35	1,000	1,000	6,000
IKD Interface +Vkp, Data, Earth	15.78	53	176	13.9	166	1700
IKD Interface Pilot, Earth	0	0	0	0	0	N/A
IPSI-D module	0	0	0	0	0	N/A
RTU-D module	0	0	0	N/A	N/A	N/A

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

1.2 The following parameters are not exceeded for product covered by IECEx ITA 07.018X Issue 1

Input Parameters (IECEx ITA 07.0018X Issue 1)

Apparatus	Connection	U_m (V)
EFLO Test Module 11kV	Integral cables Va, Vb, Vc	13200 V max phase to phase 7,622 V max phase to earth
EFLO Test Module 11kV	Terminals 1 to 4	250 V
EFLO Test Module 11kV	Terminals 5 to 8	The connections to these terminals must be directly connected to the IPD Relay module terminals 3,4,5

Output Parameters (IECEx ITA 07.0018X Issue 1)

	U_o (V)	I_o (mA)	P_o (mW)	C_o[1] (µF)	L_o[2] (mH)	L/R (µH/Ω)
EFLO Test Module 11kV Va, Vb, Vc	19.62*	< 0.01	< 0.01	7.8	3,000	1,000

The following apply to the above Tables for both 1.1 and 1.2 above

* Maximum output voltage determined by IPD Relay module.
Note: The above load parameters apply where:

a. The external circuit contains no combined lumped inductance Li and capacitance Ci greater than 1% of the above values. or
b. The inductance and capacitance are distributed as in a cable. or
c. The external circuit contains only lumped inductance or only lumped capacitance in combination with a cable.

In all other situations, e.g. the external circuit contains combined lumped inductance and capacitance, up to 50% of each of the inductance and capacitance values is allowed.

2. The IKD Interface must be infallibly connected to the main system earth via at least one of the earthed mounting bolts on the chassis.

3. The Integrated Protection Relay Type IPD must be infallibly connected to the main system earth via the earth terminals provided (J2, J7 and J12).

4. The pilot circuit connections of the IPD Integrated Protection Relay and the IKD Interface module must not be connected to a power source where the nominal pilot to earth fault current may exceed 5A r.m.s unless protected by a fuse. The fuse must be suitable for the system voltage, having a breaking capacity not less than 1,500 A and have a maximum rating of 3A.

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

This Attachment forms an Integral Part of the IECEx Certificate and all pages MUST be presented and read whenever the IECEx ITA 07.0018X Issue 1 Certificate is presented.

5. The following modules are to be mounted such that the connection facilities have a minimum ingress protection level of not less than IP20;
   a. Integrated Protection Relay Type IPD
   b. CCMA and CCMD
   c. RDM-D
   d. IKD Keypad
   e. RTU-D module
   f.. IPSI-D
   g. IKD Interface
   h. EFLO Test Module 11KV

6. The RDM-D module shall be installed such that the exposed area of the front membrane is less than 100cm^2.

7. The IPD module contains a single non-rechargeable non user replaceable cell. This must be taken in to account when the apparatus is installed within a flameproof (Ex d) enclosure.

8. The IPD Module contains significant amount of capacitance that may be considered as becoming charged to the supply voltage (U_m = 132 V) under fault conditions. When the IPD module is installed within a suitably certified flameproof enclosure the enclosure is to be durably marked with the text "**Warning – Do not open when an explosive atmosphere may be present**"

9. The High voltage connections of the CCMD Modules are NOT Intrinsically Safe while terminals RL 4 and 110Vcom are energized.

10. The High voltage connections of the EFLO Test Module 11kV are NOT Intrinsically Safe while terminals 1 to 4 are energized.

11. The EFLO Test Module 11kV must be infallibly connected to the main system earth via the dedicated connection.

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

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DRAWINGS. The following list of drawings apply to Both Issues 0 and 1 of this Certificate.

IECEx ITA 07.0018X Issue 0 : Table 1 Drawing list associated with
ExTR: **AU/ITA/ExTR08.0015/00**

Table 1

Document No.	Document Title	Issue	Date (yyyy/mm/dd)
IPD-Z-009	IPD Integrated Protection Relay Typical IS System Diagram	2	2007/12/06
IPD-Z-037	IPD Parallel Feeder Configuration General Arrangement	0	2007/02/20
IPD-Z-001 Sheets 1 to 6	IPD Analogue Board PCB Artwork	5	2005/09/27
IPD-Z-002 Sheet 1	IPD Analog Board Main	6	2007/11/23
IPD-Z-002 Sheet 2	IPD Analog Board Earth Leakage & CCM Inputs	6	2007/11/23
IPD-Z-002 Sheet 3	IPD Analog Board Comms and Fan Interlock	6	2007/11/23
IPD-Z-002 Sheet 4	IPD Analog Board Earth Continuity Pilot	6	2007/11/23
IPD-Z-004 Sheets 1 to 5	IPD Processor Board PCB Artwork	3	2005/08/05
IPD-Z-005 Sheet 1	IPD Processor Board Schematic Diagram Main	2	2007/11/23
IPD-Z-005 Sheet 2	IPD Processor Board Schematic Diagram Inputs	2	2007/11/23
IPD-Z-005 Sheet 3	IPD Processor Board Schematic Diagram CPU	2	2007/11/23
IPD-Z-005 Sheet 4	IPD Processor Board Schematic Diagram ADC	2	2007/11/23
IPD-Z-005 Sheet 5	IPD Processor Board Schematic Diagram Battery, RTC, RAM	2	2007/11/23
IPD-Z-007	IPD Integrated Protection Relay Fascia Plate Marking Details	0	2007/12/12
IPD-Z-030	IPD Integrated Protection Relay Enclosure Details PCB Mounted Detail and Clearance	0	2007/04/11
IPD-Z-031	IPD Power Board Schematic Diagram	1	2006/12/18
IPD-Z-032	IPD Relay Board Schematic Diagram	0	2006/10/13
IPD-Z-033	IPD Top Level Schematic Diagram	2	2007/11/23
IPD-Z-034	IPD IPD BASE IS CIRCUIT PROTECTIVE	1	2008/05/21

ATTACHMENT To IECEx CERTIFICATE
IECEx ITA 07.0018X Issue 1

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Table 1			
Document No.	**Document Title**	**Issue**	**Date (yyyy/mm/dd)**
	BARRIERS		
IPD-Z-011	IPD RDM-D Enclosure & Marking Details	3	2007/11/26
IPD-Z-012	IPD RDM-D Schematic Diagram	2	2006/12/14
IPD-Z-013	IPD RDM-D Marking Details	3	2007/11/26
IPD-Z-017	IPD IPSI-D Schematic Diagram	6	2008/06/30
IPD-Z-018 Sheets 1 to 3	IPSI-D PCB Artwork	5	2008/07/03
IPD-Z-019	IPD IPSI-D Enclosure and Marking Details	5	2008/05/12
IPD-Z-022	IPD CCMD 3.3kV Dimension & Marking Details	4	2008/06/18
IPD-Z-024	IPD CCMD 3.3kV Construction Details	2	2007/02/27
IPD-Z-025 Sheets 1 to 3	CCMD 1 kV & 415 V PCB Artwork	3	2005/10/14
IPD-Z-026 Sheets 1 to 3	CCMD 3.3 kV PCB Artwork	4	2005/10/14
IPD-Z-029	IPD CCMD 3.3kV Schematic Diagram	2	2007/02/26
IKD-Z-001	IKD IKD Interface Schematic Diagram	6	2008/06/17
IKD-Z-002 Sheets 1 to 4	IKD Interface Artwork	3	2005/08/08
IKD-Z-003	IKD IKD Interface Enclosure & Marking Details	3	2007/11/27
IKD-Z-004	IKD IKD Keypad Enclosure Details	1	2006/12/13
IKD-Z-005	IKD IKD Keypad Schematid Diagram	1	2006/12/13
IKD-Z-006	IKD IKD Keypad Marking Details	3	2007/11/27
IPD-Z-014 Sheet 1	IPD RTU-D Schematic Processor and Line Interface	3	2007/11/26
IPD-Z-014 Sheet 2	IPD RTU-D Schematic Inputs and ADC	3	2007/11/26
IPD-Z-015 Sheets 1 to 5	RTU-D Artwork	1	2005/10/12
IPD-Z-016	IPD RTU-D Enclosure Details	2	2006/12/04
IPD-Z-020	IPD CCMD 415 V Dimension & Marking Details	4	2008/06/17
IPD-Z-021	IPD CCMD 1 kV Dimension & Marking Details	4	2008/06/17
IPD-Z-023	IPD CCMD 1 kV & 415 V Construction Details	3	2007/11/28
IPD-Z-027	IPD CCMD 415 V Schematic Diagram	2	2007/02/26

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Table 1			
Document No.	**Document Title**	**Issue**	**Date (yyyy/mm/dd)**
IPD-Z-028	IPD CCMD 1 kV Schematic Diagram	2	2007/02/26
CCMA-Z-001	CABLE CONNECTION MODULE, TYPE A, 1000V ARTWORK	0	2004/05/18
CCMA-Z-002	CABLE CONNECTION MODULE, TYPE A, 1000V CONTRUCTION DETAILS	0	2004/05/18
CCMA-Z-003	CABLE CONNECTION MODULE, TYPE A, 1 kV DIMENSIONS AND MARKING	2	2007/12/12
CCMA-Z-004	CABLE CONNECTION MODULE, TYPE A, 415V ARTWORK	0	2004/05/18
CCMA-Z-005	CABLE CONNECTION MODULE, TYPE A, 415V CONTRUCTION DETAILS	0	2004/05/18
CCMA-Z-006	CABLE CONNECTION MODULE, TYPE A, 415V DIMENSIONS AND MARKING	2	2007/12/12
CCMA-Z-007	CABLE CONNECTION MODULE, TYPE A, 110V ARTWORK	0	2004/05/18
CCMA-Z-008	CABLE CONNECTION MODULE, TYPE A, 110V CONTRUCTION DETAILS	0	2004/05/18
CCMA-Z-009	CABLE CONNECTION MODULE, TYPE A, 110V DIMENSIONS AND MARKING	2	2007/12/12

IECEx ITA 07.0018X Issue 1 : Table 2 Drawing list associated with
ExTR: **AU/ITA/ExTR08.0015/01**

Table 2			
Title:	**Drawing No.:**	**Rev.**	**Date:**
IPD Integrated Protection Relay Typical IS System Diagram	IPD-Z-009	3	2009/03/09
IPD 11kV EFLO Module Mechanical Certification Detail	IPD-Z-035 Sheets 1-2	0	2009/03/09
IPD 11kV EFLO Module Schematic	IPD-Z-036	2	2009/03/09
IPD 11kV EFLO PCB Artwork	IPD-Z-037 Sheets 1 to 4	0	2009/03/09
IPD 11kV HV Resistor PCB Artwork	IPD-Z-038 Sheets 1 to 3	1	2009/03/09
IPD 11kV Relay Marking Details	IPD-Z-040	1	2009/03/09