DNET-IP2 Serial Communication System

Designed and Manufactured in Australia by
Ampcontrol CSM Pty Limited
ABN 35 000 770 141
Phone: +61 2 4903 4800
Fax: +61 2 4903 4888
www.ampcontrolgroup.com

USER MANUAL

118626 ISSUE 4 06/11/08

DNET-IP2_Manual_Issue_4_118626_061108.pdf

Copyright Notice

Disclaimer

Ampcontrol CSM Pty Ltd will make no warranties as to the contents of this documentation and specifically disclaims any implied warranties or fitness for any particular purpose.

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

Before You Begin

We would like to take a moment to thank you for purchasing the DNET-IP2 Serial Communication System.

To become completely familiar with this equipment and to ensure correct operation, we recommend that you take the time to read this user manual thoroughly.

CRN: 7144 – Issue 4

The IPD translation table added to the manual, the HPB translation table was updated.

1. Description

The DNET-IP2 serial communication system provides condition monitoring and supervisory control of the Ampcontrol range of Integrated Protection Relays. The system consists of an IP2 Protocol Converter, Serial Interface (IPSI-IP) Modules.

Electrical installations utilising Ampcontrol Integrated Protection Relays and the DNET-IP2 communication system can transfer information from a Distribution Control Box (DCB) or substation to a remote location. The DNET-IP2 Protocol Converter transfers data and commands between the Host System and the modules using RS232, RS422 and RS485 protocols.

Through machine communication, which forms part of the IPC, IPB and HPB Integrated Protection System, the identity of the machine can be transferred via serial communications to a PLC. This allows the PLC to arrange sequencing particularly on a longwall installation.

Each Integrated Protection Relay is connected to a Serial Interface Module (IPSI-IP), which has its output drop connected to a DNET-IP2 Protocol Converter. The Protocol Converter provides the communications link to a PLC. The PLC can be either located within the flameproof enclosure or can be connected via an intrinsically safe link to a remote location. Multiple DNET-IP2 Systems can be monitored using a single PLC communication port (See Drawing DNET-E-010, Page 22)

2. Protocol Converter

The DNET-IP2 Protocol Converter is the heart of the system. It is a DIN rail mounted module with LED indication for fault diagnosis (See Drawing DNET-A-057, Page 23). Power to the Protocol Converter is supplied from the DNET-IP2 Power Supply, 110V/20V-0V-20V 15 VA (See Drawing DNET-E-009, Page 21).

There are three LEDs located on the front of the Protocol Converter.

2.1 Line LED

Slow Flash - Communication Line to IPSI-IP Modules is healthy.

Fast Flash - Communication Line to IPSI-IP Modules is short-circuited. After the short circuit is removed Fast Flash continues until the next IPSI-IP is polled.

2.2 Communication LEDs

Flashing LEDs indicates Tx, Rx communication traffic is occurring between the Protocol Converter and the PLC.

- **Rx LED** will flash if the RS232/485 port is receiving data from a Host system. The IP2 Protocol Converter has no control over this LED. The length of the flash and its apparent brightness indicates the amount of data that the IP2 Protocol Converter is receiving from the Host system.

- **Tx LED** will flash if the RS232/485 port transmitter is active. The length of the flash and its apparent brightness indicates the amount of data that the IP2 Protocol Converter is transmitting to the Host system.

2.3 Serial Port

The serial communication port is electrically isolated and supports RS232, RS422 and RS485 protocols with a selectable baud rate of 1200 to 9600.

The four user selectable protocols are:
- Modbus Master RTU
- Modbus Slave RTU
- DNET-IP2
- DNET-IP

2.4 L1 Line Driver

The IP2 Line Driver drives a two-wire communication line, which delivers power and exchanges data with a **maximum of nine (9)** IPSI-IP Modules.

3. Serial Interface Module

The Serial Interface Module (IPSI-IP) has four connections to the Integrated Protection Relay and two connections that drop connect to the DNET-IP2 Protocol Converter (See Drawing DNET-E-008, Page 24). The IPSI-IP Module is down line powered from the Protocol Converter.

The IPSI-IP Module plugs into an eleven-pin relay base. Care should be taken in removing the module to prevent damage to the location

spigot. Pull directly out without twisting or deflecting the module.

Each Serial Interface Module must be given a unique address between 1 and 15. To set the address a rotary switch is used which is accessible through the top of the module by lifting and rotating the label.

Two LEDs indicate the status of the line and the communications transfer from the Integrated Protection Relay.

Line LED - Flashes if the IPSI-IP Module is powered from the line and a block of data is being sent in response to a command from the Protocol Converter. The scanning rate of the IPSI-IP Modules is dependent on the protocol being used. **No Flash** indicates an open or short-circuited line between the Module and the Protocol Converter.

IPA LED - Flashes each time a block of data is being read from the integrated protection relay. **No Flash** indicates connection to the Integrated Protection Relay is incorrect or the relay has no power.

Provided the IPSI-IP Module is powered it will communicate with the Integrated Protection Relay, regardless of the 'Line' communication.

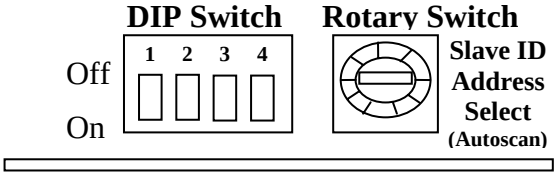
3.1 Connections

A twisted pair should be used to connect terminals 5 and 7 to the Protocol Converter.

Terminals 1, 2, 10 and 11 are intrinsically safe terminations and should be wired in accordance with AS 2381.7. Twisted conductors or overall screened cable should be used. The screen should be connected to 0V at both the Integrated Protection Relay and the IPSI-IP Module. **Note: Do not earth the screen**.

4. Communication Protocols

The four DNET-IP2 user selectable protocols, Master Modbus RTU, Slave Modbus RTU, DNET-IP2 and DNET-IP are selected via the Dip Switch located under the front cover:



DIP Switch Selection

Baud Rate Select			Protocol Select		
Baud	**1**	**2**	**3**	**4**	**Protocol**
9600	off	off	off	off	Spare
4800	off	on	off	on	IP2 (IP Protocol)
2400	on	off	on	off	Slave Modbus (Autoscan)
1200	on	on	on	on	Master Modbus (Autoscan)

4.1 MASTER MODBUS RTU

Master Modbus RTU mode is selected by placing switches 3 and 4 to the 'ON' position on the Dip Switch.

Switches 1 and 2 of Dip Switch set the Baud Rate. The available rates are 1200, 2400, 4800 and 9600.

In Master Modbus Mode the DNET-IP2 Protocol Converter scans for IPSI-IP Modules and sends the data to a Slave Modbus Device. The module data is written to the Slave Modbus Device using command 16, 'Write Multiple Holding Registers' using Modbus RTU Protocol, even parity, 8 bit data with 1 stop bit. Data is written to the Slave ID address at the Slave Data Address.

The Slave ID Address 1 to 15 is selected via the Rotary Switch. If the Slave ID address is zero then the Autoscan Mode is selected.

The command sent to the Host consists of the following:

The Master Modbus command format:

Byte #	Description
1	Slave ID
2	Command = 16
3	Address_high
4	Address_low
5	Size n high
6	Size n low
7	Byte_size

Byte#	Description
8	Data 0 high
9	Data 0 low
…	…
8+2n	Data n high
9+2n	Data n low
10+2n	CRC_high
11+2n	CRC_low

An IPSI-IP Module returns 59 data words. See the translation table for a complete description. The first data word returned is in the following format:

First Data Word: <000000EE 0000AAAA> binary
Where:
EE = 00-IPSI-IP is offline
EE = 01-IPSI-IP online IPA/IPB/IPC offline
EE = 11-IPSI-IP online IPA/IPB/IPC online
AAAA = IPSI-IP address (1…15)

LED Indication – Master Modbus RTU

In Master Modbus mode the IPSI-IP Module is scanned on a regular basis and data is sent to the Host system via the serial port.
IPSI-IP 'Line' LEDs - flash at a regular rate. If the Host system does not reply to the commands sent from the DNET-IP2 Protocol Converter, there is a 1 second time out. If this time out is occurring the scanning of the IPSI-IP Modules will be slow. If the Host system replies the scanning will be faster but not as fast as Autoscan for the same number of IPSI-IP Modules.

IPSI-IP 'IPA' LEDs - flashes each time a block of data is being read from the Integrated Protection Relay.

DNET-IP2 Tx LED - flash at the same rate as the IPSI-IP Module.

DNET-IP2 Rx LED - flashes if the Host system replies.

4.2 SLAVE MODBUS RTU

Slave Modbus RTU mode is selected by placing switch 3 to the 'ON' position and switch 4 to the 'OFF' position on the Dip Switch.

Switches 1 and 2 of the Dip Switch set the Baud Rate. The available rates are 1200, 2400, 4800 and 9600.

In Slave Modbus Mode the DNET-IP2 Protocol Converter waits for commands from the Host Modbus Device.

When a correctly addressed read command is received, the specified IPSI-IP Module is scanned, the data is processed, and returned to the Host Master Modbus Device using RTU Modbus Protocol, Even parity, 8 bit data with 1 stop bit. If a command is not supported, or an invalid address is used, the Host Device will receive an exception response from the DNET-IP2 Protocol Converter.

The Slave ID Address 1 to 15 is selected via the Rotary Switch. If the Slave ID address is zero then the Autoscan Mode is selected.

The IP2 Protocol Converter supports the following commands:

- CMD=3 Read Holding Registers
- CMD=4 Read Input Registers
- CMD=6 Write Holding Register
- CMD=7 Read Exception Status
- CMD=16 Write Multiple Holding Registers
- CMD=17 Read Slave ID

Valid addresses are as follows:

IPSI-IP- ID	Modbus Address	Description
	0000 – 000F	Read/Write
1	0100 – 013F	Read
2	0200 – 023F	Read
3	0300 – 033F	Read
4	0400 – 043F	Read
5	0500 – 053F	Read
6	0600 – 063F	Read
7	0700 – 073F	Read
8	0800 – 083F	Read
9	0900 – 093F	Read
10	0A00 – 0A3F	Read
11	0B00 – 0B3F	Read
12	0C00 – 0C3F	Read
13	0D00 – 0D3F	Read
14	0E00 – 0E3F	Read
15	0F00 – 0F3F	Read

Read commands must not exceed 64 words.

IPSI-IP Module returns 59 data words but any size from 1 to 64 is valid. Data beyond word 59 will be random. See the translation table for a complete description. The first data word returned is in the following format:

First Data Word: <000000EE 0000AAAA> binary
Where:
EE = 00-IPSI-IP is offline
EE = 01-IPSI-IP online IPA/IPB/IPC offline
EE = 11-IPSI-IP online IPA/IPB/IPC online
AAAA = IPSI-IP address (1…15)

LED Indication – Slave Modbus RTU

In Slave Modbus mode the IPSI-IP Modules are scanned only on direct request from the Host system.

IPSI-IP 'Line' LEDs - flash only if the IPSI-IP Module is requested from the Master Host system.

IPSI-IP 'IPA' LEDs - flash each time a block of data is being read from the integrated protection relay.

DNET-IP2 Rx LED - flash every time a command is received from the Master Host system.

DNET-IP2 Tx LED - flashes when or whenever the DNET-IP2 Protocol Converter responds to a Master Host command.

4.3 MODBUS AUTOSCAN

Autoscan is selected in either Modbus Master or Slave Protocol by selecting **ID Address = 0** to isolate a DNET-IP2 Protocol Converter from a Modbus network for the purpose of fault finding.

In this mode the DNET-IP2 Protocol Converter sequentially scans for IPSI-IP Modules connected to the L1 communication line regardless of any host commands. The serial communication port is disabled, but the Rx LED will still flash if data is received from a Host Device.

LED Indication - Autoscan

In Autoscan the IPSI-IP Modules are scanned on a regular basis but no data is transferred to the serial port.

IPSI-IP 'Line' LEDs – flash at a regular rate.

IPSI-IP 'IPA' LEDs - flash each time a block of data is being read from the Integrated Protection Relay.

IP2 Tx LED - should not flash.

IP2 Rx LED - flash if data is being received, but the data is ignored in Autoscan Mode.

4.4 IP PROTOCOL

(IP2 Protocol Mode with Slave ID Address = 0)

IP Protocol mode is selected by placing switch 3 to the 'OFF' position and switch 4 to the 'ON' position on the Dip Switch and selecting Slave ID Address = 0 on the rotary switch.

Switches 1 and 2 of the Dip Switch set the Baud Rate. The available rates are 1200, 2400, 4800 and 9600.

In IP Protocol Mode the DNET-IP2 Protocol Converter waits for a command from the Host system. When a correctly addressed command is received, the corresponding IPSI-IP Module is scanned; its data is processed, and returned to the Host Device in a block of 64 bytes. There are no write commands available.

The Host system sends a single byte command: <IPSI-IP-ID> no CR or LF)
Where:
<IPSI-IP-ID> is ASCII 'A' to 'O' = IPSI-IP-ID address 1 to 15.

The response is identical to the IP2 protocol description in the following section.

4.5 IP2 PROTOCOL

(IP2 Protocol Mode with Slave ID Address = 1…8)

IP2 Protocol mode is selected by placing switch 3 to the 'OFF' position and switch 4 to the 'ON' position on the Dip Switch and selecting Slave ID = 1…8 on the rotary switch.

Switches 1 and 2 of the Dip Switch set the Baud Rate. The available rates are 1200, 2400, 4800 and 9600.

In IP2 Protocol Mode the DNET-IP2 Protocol Converter waits for a command from the Host system. When a correctly addressed command is received the corresponding IPSI-IP Module is scanned, its data is processed, and returned to the Host Device in a block of 64 bytes. There are no write commands available.

The IP2 Protocol is a multi drop protocol where a maximum of eight (8) DNET-IP2 Protocol Converters can be addressed on the same RS485/RS422 network (See Drawing DNET-E-011, Page 26)

The IP2 Protocol Mode is a very low overhead protocol and is an Ampcontrol proprietary protocol. It is designed for implementation in 'ladder logic drivers' in PLC's where processing is limited.

The Slave ID Address 1 to 8 is selected via the Rotary Switch. If the Slave ID address is zero then the IP Protocol Mode is selected.

The Host system sends a two-byte command:
<Slave-ID><IPSI-IP-ID> (no CR or LF)
Where:
<Slave-ID> is ASCII '1' to '8' = Protocol Converter Slave ID 1 to 8.
<IPSI-IP-D> is ASCII 'A' to 'O' = IPSI-IP address 1 to 15.

The DNET-IP2 Protocol Converter responds with a block of data or an error code (35 Hex) is returned.

The IPSI-IP Datablock consists of 64 bytes:

Byte #	Description
0	Header Byte
1	Data
2	Data
…	
62	Data
63	Checksum

The Header Byte consists of 4 bit size and 4 bit address.
<size:addr>
The 'addr' is the IPSI-IP number being scanned.
The 'size' = 1010 – 64 byte IPSI-IP block.
The Checksum is the low 8 bits of the sum of bytes 1…63.

See translation tables for a complete description of the data bytes.

LED Indication – IP2 Protocol

In IP2 and IP Protocol modes the IPSI-IP Modules are scanned only on direct request from the Host system.

IPSI-IP 'Line' LEDs - flash only if the IPSI-IP Module is requested from the Master Host system.

IPSI-IP 'IPA' LEDs - flash each time a block of data is being read from the Integrated Protection Relay.

DNET-IP2 Rx LED - flash every time a command is received from the Master Host system.

DNET-IP2 Tx LED - flash when or whenever DNET-IP2 Protocol Converter responds to a Master Host command.

5. TRANSLATION TABLES

5.1 IPD TRANSLATION TABLES

Modbus Word	IP Byte	Description
	0	**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15)
1		**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15) Bit 8 = IPSI Online Bit 9 = IPD Online
	1	**Digital Inputs (DIG_INPUTS)** Bit 0 = Reserved Bit 1 = IPSI to IPD Comms OK Bit 2 = Fan Interlock Read Bit 3 = IPD Stop digital Input Bit 4 = IPD Reset Digital Input Bit 5 = IPD Lock Digital Input Bit 6 = IPD MCI Digital Input Bit 7 = IPD Start Digital Input
	2	**Opto Status (OPTOSTAT)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Conttactor Fail Bit 6 = Insulation Fail Bit 7 = Running
2		**Opto Status/Digital Inputs (OPTOSTAT+DIG_INPUTS)** Bit 0 = Earth leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = Earth Fault Lockout Bit 3 = Overload Bit 4 = Short circuit Bit 5 = MCF Bit Bit 6 = Insulation Fail Bit 7 = Outlet Run Bit 8 = Reserved Bit 9 = IPSI to IPD Comms OK Bit 10 = Fan Interlock Read Bit 11 = IPD Stop digital Input Bit 12 = IPD Reset Digital Input Bit 13 = IPD Lock Digital Input Bit 14 = IPD MCI Digital Input Bit 15 = IPD Start Digital Input
3	3	**Earth Leakage Current (EL_CUR)** Range 0-100%
4	4	**Pilot Series Resistance (PILOT_FWD)** Range 0-200%
5	5	**Pilot Leakage Resistance (PILOT_REV)** Range 0-120%
6	6	**Cable Fault Lockout Leakage (CFLR_LEAK)** Range 0-100%
7	7,8	**A Phase Current (CUR_A_BCD_HIGH)** Range 0-999%
8	9,10	**B Phase Current (CUR_B_BCD_HIGH)** Range 0-999%
9	11,12	**C Phase Current (CUR_C_BCD_HIGH)** Range 0-999%
10	13	**Over Current Trip (OC TRIP_HIGH)** Range 0-120%
11	14	**Current Balance (CURRENT_BAL)** Range 0-100%
12	15	**A Phase Volts (VOLTS_A)** Range 0-120%
13	16	**B Phase Volts (VOLTS_B)** Range 0-120%
14	17	**C Phase Volts (VOLTS_C)** Range 0-120%
15	18	**Trip Status (TRIP_STAT2)** Bit 0 = IPD Memory Error Bit 1 = RTU Memory Error Bit 2 = Trip - RTU Offline Bit 3 = Stopped - RTU PTC Bit 4 = Stopped - RTU Bit 5 = I Balance Trip Bit 6 = Locked Out - Fan Bit 7 = Stopped IPD
16	19	**Reserved**
17	20	**IPD Software Version (IPD_SW_VER)** 30 = IPD1 V01 2008

Modbus Word	IP Byte	Description
18	21	**Current Range Setting (CUR_RANGE PARAM)** **OC I Range A** 1 = 60 2 = 64 3 = 68 4 = 72 5 = 76 6 = 80 7 = 84 8 = 88 9 = 92 10 = 96 11 = 100 12 = 104 13 = 108 14 = 112 15 = 116
19	22	**Current Multiplier Setting (CUR_MUL_PARAM)** **OC I Mult** 1 = 1/8 2 = 1/4 3 = 1/2 4 = 1 5 = 2 6 = 4
20	23	**Over Current Curve Setting (OC_CURVE_PARM)** **Curve Type** 1 = Vinv 2 = m-OL
21	24	**Over Current Time Multiplier (TIME_MULT_PARM)** **OC Time Multiplier** 1 = 0.05 2 = 0.075 3 = 0.1 4 = 0.15 5 = 0.2 6 = 0.3 7 = 0.4 8 = 0.5 9 = 0.6 10 = 0.7 11 = 0.8 12 = 1.0 13 = 0.04 14 = 0.03 15 = 0.02 16 = 0.015 17 = 0.01 18 = 0.005

Modbus Word	IP Byte	Description
22	25	**Cool Multiplier Setting (COOL_MUL_PARAM)** **Cool Mult** 1 = 0.2 2 = 0.3 3 = 0.4 4 = 0.5 5 = 0.8 6 = 1.0 7 = 2.0 8 = 5.0 9 = 10 10 = 20 11 = 50
23	26	**Current Balance Setting (CUR_BAL_PARAM)** **Cur Bal Trip%** 1 = 5 2 = 10 3 = 20 4 = 50 5 = Off
24	27	**Short Circuit Setting (SHORT_CCT_PARAM)** **SC I Trip Mult** 1 = 3.0 2 = 3.5 3 = 4.0 4 = 4.5 5 = 5.0 6 = 5.5 7 = 6.0 8 = 6.5 9 = 7.0 10 = 7.5 11 = 8.0 12 = 8.5 13 = 9.0 14 = 9.5 15 = 10.0
25	28	**Short Circuit Trip Time Setting (SC_TRP_TM_PARAM)** **SC Trip Time – mS** 1 = 20 2 = 40 3 = 60 4 = 80 5 = 100 6 = 120 7 = 160
26	29	**Short Circuit Output Relay Selection (SC_OUT_PARAM)** **SC Relay)** 1 = CBR 2 = MCR

Modbus Word	IP Byte	Description
27	30	**Earth Leakage Sensitivity Setting (EL_SENS)** **EL Sens – mA** 1 < 100 2 < 150 3 < 200 4 < 250 5 < 300 6 < 350 7 < 400 8 < 450 9 < 500
28	31	**Earth Leakage Trip time Setting (EL_TIME)** **EL Time – mS** 1 = ins 2 = 100 3 = 150 4 = 190 5 = 230 6 = 270 7 = 310 8 = 350 9 = 390 10 = 430 11 = 470
29	32	**Pilot Mode Selection (PILOT MODE)** **Pilot Type** 1 = RTU 2 = -| >|-
30	33	**CCM Selection (VOLTS_SELECT)** **(EFLO: CCM Volts** 1 = D415 2 = D1k 3 = D3k3 4 = A415 5 = A1k 6 = A3k3 7 = A110 8 = None
31	34	**Back EMF Timer Selection (B_EMF_TIME)** **B emf Time – Sec** 1 = 2 2 = 5 3 = 10 4 = 15 5 = 20
32	35	**Insulation Test Trip Setting (MEG_LEVEL)** **Ins. TstT - MΩ** 1 = 0.1 2 = 0.2 3 = 0.5 4 = 1.0 5 = 2.0 6 = 5.0 7 = 10 8 = 15 9 = None

Modbus Word	IP Byte	Description
33	36	**Relay 3 Function Setting (RELAY_3_FUNC)** **Relay 3 Status** 1 = OFF 2 = FID 3 = FIR
34	37	**Machine Type Setting (MACHINE_TYPE)** 1 = Belt - Conveyor Belt 2 = SHRr – Shearer 3 = S-Ld - Stage Loader 4 = Hpmp - Hydraulic Pump 5 = Wpmp - Water Pump 6 = cMnr - Continuous Miner 7 = SCar - Shuttle Car 8 = Bk/F - Breaker Feeder 9 = Crsh – Crusher 10 = Fan 11 = DCB 12 = Blank 13 = iFan - Interlocking Fan 14 = AFCm - AFC Main Gate 15 = AFCt - AFC Tail Gate 16 = M-BE -Moveable Boot End 17 = Bolt – Bolter 18 = HRMr - Hard Rock Miner 19 = Winc – Winch 20 = J-bo - Jumbo 21 = bBelt - Belly Belt 22 = Stak - Stacker 23 = aCar Add-Car 24 = IGG - Inert Gas 25 = tBlt - Transfer Belt 26 = Dplg - Dummy Plug
35	38	**Machine Number Setting (MACHINE_NUM)** 1 – 40 Sets the RTU MC Number
36	39	**Under Voltage Trip Setting (UV_TRIP_PARAM)** **U/V Trip %** 1 = 20 2 = 30 3 = 40 4 = 50 5 = 60 6 = 70 7 = 80
37	40	**Pilot Latch Setting (PILOT_LATCH)** 1 = On 2 = Off
38	41	**Fan Current Level Setting (FAN_LEVEL)** **Fan I Level %** 1 = 32 2 = 40 3 = 48 4 = 56 5 = 64 6 = 72 7 = 80 8 = 88 9 = 96

Modbus Word	IP Byte	Description
39	**42**	**RTU RTD1 Temperature** 0 to 200 °C, 255 = Offline
40	**43**	**RTU RTD 2 Temperature** 0 to 200 °C, 255 = Offline
41	**44**	**RTU RTD 3 Temperature** 0 to 200 °C, 255 = Offline
42	**45**	**RTU RTD 4 Temperature** 0 to 200 °C, 255 = Offline
43	**46**	**Reserved**
44	**47**	**Reserved**
45	**48**	**RTU Digital Inputs (RTU_DIG_IN)** Bit 0 = RTU Start (1=Start) Bit 1 = RTU Stop (1=Stop, 0=Allow start) Bit 2 = RTU PTC Bit 3 = PLC Data OK
46	**49**	**Relay Status (RELAT_STAT)** Bit 0 = RELAY 4 (closed if bit set) Bit 1 = CBR RELAY (closed if bit set) Bit 2 = MCR RELAY (closed if bit set) Bit 3 = RL3 RELAY (closed if bit set) Bit 4 = Reserved Bit 5 = Fan Interlock Drive (on if bit is set) Bit 6 = Reserved Bit 7 = Reserved
47	**50**	**RTU Software Version (RTU_SW_VER)** 6 = RTUD1 V06
48	**51**	**Remote Start Setting (REMOTE_CONTROL)** 1 = No 2 = Yes
49	**52**	**IPD Status (IPD_STAT_BYTE)** Bit 0 = Need IPD start Bit 1 = Need RTU Start Bit 2 = Outlet Paused Bit 3 = Closing Main Contactor Bit 4 = EFLO Testing Bit 5 = Insulation Testing Bit 6 = Manual Insulation Testing Bit 7 = Spare
50	**53**	**Earth Continuity Time Delay Setting (ECTIME_ADJ)** **EC Time - mS** 1 = 80 2 = 120 3 = 160 4 = 200 5 = 300 6 = 400 7 = 500
51	**54**	**Insulation Test Result (MEG_RESULT)** Range = 0-250 for 0 to 25 Meg Ohms Result is minimum measured for all three phases A, B and C 255 = Insulation Test has not been performed
52	**55**	**CT Check Signal Level (EL_CT_SIG)** Range = 0-160%
53	**56**	**IPD Alarm Status (IPD_ALARM_BYTE)** Bit 0 = Tripped-No Volts Bit 1 = MC Close Fail Bit 2 = External MC Open Bit 3 = Insulation Alarm Bit 4 = CT Trip Bit 5 = Spare Bit 6 = Spare Bit 7 = Reserved: Do not use
54	**57**	**Reserved**
55	**58**	**Reserved**
56	**59**	**Reserved**
57	**60**	**Reserved**
58	**61**	**Reserved**
59	**62**	**Reserved**
60	**63**	**Checksum (Low order byte of sum of all IP bytes**

5.2 IPC TRANSLATION TABLES

Modbus Word	IP Byte	Description
1	0	**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15)
	1	**Digital Inputs (DIG_INPUTS)** Bit 0 = Main Contactor fail Flag Bit 1 = Reserved Bit 2 = IPC Start Input Bit 3 = Fan Interlock Read: 0 = Ok to run Bit 4 = IPC Lock Digital Input: 0 = Input closed Bit 5 = IPC Reset Digital Input: 0 = Input closed Bit 6 = MCI Digital Input: 0 = Input closed
	2	**Opto Status (OPTOSTAT)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Conttactor Fail Bit 6 = Insulation Fail Bit 7 = Running ----Amps
2		**Opto Status/Digital Inputs (OPTOSTAT+DIG_INPUTS)** Bit 0 = Earth leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = Earth Fault Lockout Bit 3 = Overload Bit 4 = Short circuit Bit 5 = MCF Bit Bit 6 = Insulation Fail Bit 7 = Outlet Run Bit 8 = IP2 to IPSI Comms OK Bit 9 = IPSI to IPC Comms OK Bit 10 = Fan Interlock Read Bit 11 = IPC Stop digital Input Bit 12 = IPC Reset Digital Input Bit 13 = IPC Lock Digital Input Bit 14 = IPC MCI Digital Input Bit 15 = IPC Start Digital Input
3	3	**Earth Leakage Current (EL_CUR)** Range 0-100%
4	4	**Pilot Series Resistance (PILOT_FWD)** Range 0-200%
5	5	**Pilot Leakage Resistance (PILOT_REV)** Range 0-120%
6	6	**Cable Fault Lockout Leakage (CFLR_LEAK)** Range 0-100%
7	7,8	**A Phase Current (CUR_A_BCD_HIGH)** Range 0-999%
8	9,10	**B Phase Current (CUR_B_BCD_HIGH)** Range 0-999%
9	11,12	**C Phase Current (CUR_C_BCD_HIGH)** Range 0-999%
10	13	**Over Current Trip (OC TRIP_HIGH)** Range 0-120%
11	14	**Current Balance (CURRENT_BAL)** Range 0-100%
12	15	**A Phase Volts (VOLTS_A)** Range 0-120%
13	16	**B Phase Volts (VOLTS_B)** Range 0-120%
14	17	**C Phase Volts (VOLTS_C)** Range 0-120%
15	18	**Trip Status (TRIP_STAT2)** Bit 0 = IPC Memory Error Bit 1 = RTU Memory Error Bit 2 = Trip - RTU Offline Bit 3 = Stopped - RTU PTC Bit 4 = Stopped - RTU Bit 5 = I Balance Trip Bit 6 = Locked Out - Fan Bit 7 = Stopped IPC
16	19	**Reserved**
17	20	**IPC Software Version (IPC_SW_VER)** 1 = IPB3 V0.1 1994 2 = IPB3 V0.2 1995 3 =IPB4 V0.2 1994, IPB 4 V0.1 1995 5 = IPB5 V 02 1997, IPB4 X 02 1996 6 = IPB5 V 03 1997 7 = IPB5 V 04 1997 8 = IPB6 V 01 1998 9 = IPB6 V 01a 1998 10-19 = Reserved 20 = IPC1 V 01 2001 21 = IPC1 V 02 2002 22 = IPC1 V 03 2004

Modbus Word	IP Byte	Description
18	21	**Current Range Setting (CUR_RANGE PARAM)** **OC I Range A** 1 = 60 2 = 64 3 = 68 4 = 72 5 = 76 6 = 80 7 = 84 8 = 88 9 = 92 10 = 96 11 = 100 12 = 104 13 = 108 14 = 112 15 = 116
19	22	**Current Multiplier Setting (CUR_MUL_PARAM)** **OC I Mult** 1 = 1/8 2 = 1/4 3 = 1/2 4 = 1 5 = 2 6 = 4
20	23	**Over Current Curve Setting (OC_CURVE_PARM)** **Curve Type** 1 = Vinv 2 = m-OL

Modbus Word	IP Byte	Description
21	24	**Over Current Time Multiplier (TIME_MULT_PARM)** **OC Time Multiplier** 1 = 0.05 2 = 0.075 3 = 0.1 4 = 0.15 5 = 0.2 6 = 0.3 7 = 0.4 8 = 0.5 9 = 0.6 10 = 0.7 11 = 0.9 12 = 1.0 13 = 0.04 14 = 0.03 15 = 0.02 16 = 0.015 17 = 0.01 18 = 0.005
22	25	**Cool Multiplier Setting (COOL_MUL_PARAM)** **Cool Mult** 1 = 0.2 2 = 0.3 3 = 0.4 4 = 0.5 5 = 0.8 6 = 1.0 7 = 2.0 8 = 5.0 9 = 10 10 = 20 11 = 50
23	26	**Current Balance Setting (CUR_BAL_PARAM)** **Cur Bal Trip%** 1 = 5 2 = 10 3 = 20 4 = 50 5 = Off

Modbus Word	IP Byte	Description
24	**27**	**Short Circuit Setting (SHORT_CCT_PARAM)** **SC I Trip Mult** 1 = 3.0 2 = 3.5 3 = 4.0 4 = 4.5 5 = 5.0 6 = 5.5 7 = 6.0 8 = 6.5 9 = 7.0 10 = 7.5 11 = 8.0 12 = 8.5 13 = 9.0 14 = 9.5 15 = 10.0
25	**28**	**Short Circuit Trip Time Setting (SC_TRP_TM_PARAM)** **SC Trip Time – mS** 1 = 20 2 = 40 3 = 60 4 = 80 5 = 100 6 = 20 7 = 160
26	**29**	**Short Circuit Output Relay Selection (SC_OUT_PARAM)** **SC Relay)** 1 = CBR 2 = MCR
27	**30**	**Earth Leakage Sensitivity Setting (EL_SENS)** **EL Sens – mA** 1 = 100 2 = 150 3 = 200 4 = 250 5 = 300 6 = 350 7 = 400 8 = 450 9 = 500

Modbus Word	IP Byte	Description
28	**31**	**Earth Leakage Trip time Setting (EL_TIME)** **EL Time – mS** 1 = ins 2 = 150 3 = 190 4 = 230 5 = 270 6 = 310 7 = 350 8 = 390 9 = 430 10 = 470
29	**32**	**Pilot Mode Selection (PILOT MODE)** **Pilot Type** 1 = RTU 2 = | >|-
30	**33**	**CCM Selection (VOLTS_SELECT)** **(EFLO: CCM Volts** 1 = C415 2 = C1k 3 = C3k3 4 = A415 5 = A1k 6 = A3k3 7 = A110 8 = None
31	**34**	**Back EMF Timer Selection (B_EMF_TIME)** **B emf Time – Sec** 1 = 2 2 = 5 3 = 10 4 = 15 5 = 20
32	**35**	**Insulation Test Trip Setting (MEG_LEVEL)** **Ins. TstT - MΩ** 1 = 0.1 2 = 0.2 3 = 0.5 4 = 1.0 5 = 2.0 6 = 5.0 7 = 10 8 = 15 9 = None

Modbus Word	IP Byte	Description
33	36	**Relay 3 Function Setting (RELAY_3_FUNC)** **Relay 3 Status** 1 = OFF 2 = FID
34	37	**Machine Type Setting (MACHINE_TYPE)** 1 = Belt - Conveyor Belt 2 = SHRr – Shearer 3 = S-Ld - Stage Loader 4 = Hpmp - Hydraulic Pump 5 = Wpmp - Water Pump 6 = cMnr - Continuous Miner 7 = Scar - Shuttle Car 8 = Bk/F - Breaker Feeder 9 = CRsh – Crusher 10 = Fan 11 = DCB 12 = Blank 13 = iFan - Interlocking Fan 14 = AFCm - AFC Main Gate 15 = AFCt - AFC Tail Gate 16 = M-BE -Moveable Boot End 17 = Bolt – Bolter 18 = HRMr - Hard Rock Miner 19 = Winc – Winch 20 = J-bo - Jumbo 21 = bBelt - Belly Belt 22 = Stak - Stacker 23 = aCar Add-Car 24 = IGG - Inert Gas 25 = tBlt - Transfer Belt 26 = Dplg - Dummy Plug
35	38	**Machine Number Setting (MACHINE_NUM)** 1 – 40 Sets the RTU MC Number
36	39	**Under Voltage Trip Setting (UV_TRIP_PARAM)** **U/V Trip %** 1 = 20 2 = 30 3 = 40 4 = 50 5 = 60 6 = 70 7 = 80

Modbus Word	IP Byte	Description
37	40	**Pilot Latch Setting (PILOT_LATCH)** 1 = On 2 = Off
38	41	**Fan Current Level Setting (FAN_LEVEL)** **Fan I Level %** 1 = 32 2 = 40 3 = 48 4 = 56 5 = 64 6 = 72 7 = 80 8 = 88 9 = 96
39	42	**RTU RTD1 Temperature** 0 to 200 °C, 255 = Offline
40	43	**RTU RTD 2 Temperature** 0 to 200 °C, 255 = Offline
41	44	**RTU RTD 3 Temperature** 0 to 200 °C, 255 = Offline
42	45	**RTU RTD 4 Temperature** 0 to 200 °C, 255 = Offline
43	46	**RTU CIU Data Byte 0** Range = 0-255, 255 = Offline
44	47	**RTU CIU Data Byte 1** Range = 0-255, 255 = Offline
45	48	**RTU Digital Inputs (RTU_DIG_IN)** Bit 0 = RTU Start (1=Start) Bit 1 = RTU Stop (1=Stop, 0=Allow start) Bit 2 = RTU PTC Bit 3 = PLC Data OK
46	49	**Relay Status (RELAT_STAT)** Bit 0 = RELAY 4 (closed if bit set) Bit 1 = CBR RELAY (closed if bit set) Bit 2 = MCR RELAY (closed if bit set) Bit 3 = RL3 RELAY (closed if bit set) Bit 4 = Reserved Bit 5 = Fan Interlock Drive (on if bit is set) Bit 6 = Reserved Bit 7 = Reserved
47	50	**RTU Software Version (RTU_SW_VER)** 1 = RTU4V4.1 2 = Reserved 3 = RTU4V4.2, RTU5V01 4 = RTU5V02
48	51	**Remote Start Setting (REMOTE_CONTROL)** 1 = No 2 = Yes

Modbus Word	IP Byte	Description
49	**52**	**IPC Status (IPC_STAT_BYTE)** Bit 0 = Need IPC start Bit 1 = Need RTU Start Bit 2 = Outlet Paused Bit 3 = Closing Main Contactor Bit 4 = EFLO Testing Bit 5 = Insulation Testing Bit 6 = Manual Insulation Testing Bit 7 = Spare
50	**53**	**Earth Continuity Time Delay Setting (ECTIME_ADJ)** **EC Time - mS** 1 = 80 2 = 120 3 = 160 4 = 200 5 = 300 6 = 400 7 = 500
51	**54**	**Insulation Test Result (MEG_RESULT)** Range = 0-250 for 0 to 25 Meg Ohms Result is minimum measured for all three phases A, B and C 255 = Insulation Test has not been performed
52	**55**	**Reserved**
53	**56**	**IPC Alarm Status (IPC_ALARM_BYTE)** Bit 0 = Tripped-No Volts Bit 1 = MC Close Fail Bit 2 = External MC Open Bit 3 = Insulation Alarm Bit 4 = Spare Bit 5 = Spare Bit 6 = Spare Bit 7 = Reserved: Do not use
54	**57**	**RTU CIU Data Byte 2** Range = 0-255, 255 = Offline
55	**58**	**RTU CIU Data Byte 3** Range = 0-255, 255 = Offline
56	**59**	**RTU CIU Data Byte 4** Range = 0-255, 255 = Offline
57	**60**	**RTU CIU Data Byte 5** Range = 0-255, 255 = Offline
58	**61**	**RTU CIU Data Byte 6** Range = 0-255, 255 = Offline
59	**62**	**RTU CIU Data Byte 7** Range = 0-255, 255 = Offline
60	**63**	**Checksum (Low order byte of sum of all IP bytes**

5.3 IPB TRANSLATION TABLES

Modbus Word	IP Byte	Description
	0	**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15)
1		**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15) Bit 8 = IPSI Online Bit 9 = IPB Online
	1	**Digital Inputs (DIG_INPUTS)** Bit 0 = 1 Indicates IPB Relay Bit 1 = Communications to IPB: 0 = Error Bit 2 = Fan interlock Read: 0 = Not ready Bit 3 = IPB Stop Digital Input: 1 = Input closed Bit 4 = IPB Reset Digital Input: 1 = Input closed Bit 5 = IPB Lock Digital Input: 1 = Input closed Bit 6 = MCI Digital Input: 1 = Input closed Bit 7 = IPB Start Digital Input: 1 = Input closed
	2	**Opto Status (OPTOSTAT)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Contactor Fail Bit 6 = Unused Bit 7 = Running
2		**Opto Status/Digital Inputs (OPTOSTAT+DIG_INPUTS)** Bit 0 = Earth leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = Earth Fault Lockout Bit 3 = Overload Bit 4 = Short circuit Bit 5 = MCF Bit Bit 6 = Reserved Bit 7 = Outlet Run Bit 8 = Relay Type (1=IPB or HPB 0=IPA) Bit 9 = IPSI to IPB Comms OK Bit 10 = Fan Interlock Read Bit 11 = IPB Stop digital Input Bit 12 = IPB Reset Digital Input Bit 13 = IPB Lock Digital Input Bit 14 = IPB MCI Digital Input Bit 15 = IPB Start Digital Input
3	3	**Earth Leakage Current (EL_CUR)** Range 0-160%
4	4	**Pilot Series Resistance (PILOT_FWD)** Range 0-120%
5	5	**Pilot Leakage Resistance (PILOT_REV)** Range 0-120%
6	6	**Cable Fault Lockout Leakage (CFLR_LEAK)** Range 0-100%
7	7,8	**A Phase Current (CUR_A_BCD_HIGH)** Range 0-999%
8	9,10	**B Phase Current (CUR_B_BCD_HIGH)** Range 0-999%
9	11,12	**C Phase Current (CUR_C_BCD_HIGH)** Range 0-999%
10	13	**Over Current Trip (OC TRIP_HIGH)** Range 0-120%
11	14	**Current Balance (CURRENT_BAL)** Range 0-100%
12	15	**A Phase Volts (VOLTS_A)** Range 0-120%
13	16	**B Phase Volts (VOLTS_B)** Range 0-120%
14	17	**C Phase Volts (VOLTS_C)** Range 0-120%
15	18	**Trip Status (TRIP_STAT)** Bit 0 = IPB Memory Error = 1 Bit 1 = RTU Memory Error = 1 Bit 2 = 0 Bit 3 = 0 Bit 4 = 0 Bit 5 = 0 Bit 6 = 0 Bit 7 = 0
16	19	**Reserved**
17	20	**Reserved**

Modbus Word	IP Byte	Description
18	**21**	**Current Range Setting (CUR_RANGE PARAM)** **OC I Range A** 1 = 60 2 = 64 3 = 68 4 = 72 5 = 76 6 = 80 7 = 84 8 = 88 9 = 92 10 = 96 11 = 100 12 = 104 13 = 108 14 = 112 15 = 116
19	**22**	**Current Multiplier Setting (CUR_MUL_PARAM)** **OC I Mult** 1 = 1/8 2 = ¼ 3 = ½ 4 = 1 5 = 2 6 = 4
20	**23**	**Over Current Curve Setting (OC_CURVE_PARM)** **Curve Type** 1 = Vinv 2 = m-OL

Modbus Word	IP Byte	Description
21	**24**	**Over Current Time Multiplier (TIME_MULT_PARM)** **OC Time Multiplier** 1 = 0.05 2 = 0.075 3 = 0.1 4 = 0.15 5 = 0.2 6 = 0.3 7 = 0.4 8 = 0.5 9 = 0.6 10 = 0.7 11 = 0.9 12 = 1.0 13 = 0.04 14 = 0.03 15 = 0.02 16 = 0.015 17 = 0.01 18 = 0.005
22	**25**	**Cool Multiplier Setting (COOL_MUL_PARAM)** **Cool Mult** 1 = 0.2 2 = 0.3 3 = 0.4 4 = 0.5 5 = 0.8 6 = 1.0 7 = 2.0 8 = 5.0 9 = 10 10 = 20 11 = 50
23	**26**	**Current Balance Setting (CUR_BAL_PARAM)** **Cur Bal Trip%** 1 = 5 2 = 10 3 = 20 4 = 50 5 = Off

Modbus Word	IP Byte	Description
29	**32**	**Pilot Mode Selection** **(PILOT MODE)** **Pilot Type** 1 = RTU 2 = | >|-
30	**33**	**CCM Selection** **(VOLTS_SELECT)** **(EFLO: CCM Volts** 1 = 415 2 = 1k 3 = 3k3 4 = 110
31	**34**	**Back EMF Timer Selection** **(B_EMF_TIME)** **B emf Time – Sec** 1 = 2 2 = 5 3 = 10 4 = 15 5 = 20
32	**35**	**Reserved**
33	**36**	**Relay 3 Function Setting** **(RELAY_3_FUNC)** **Relay 3 Status** 1 = OFF 2 = FID
34	**37**	**Machine Type Setting** **(MACHINE_TYPE)** 1 = Belt - Conveyor Belt 2 = SHRr - Shearer 3 = S-Ld - Stage Loader 4 = Hpmp - Hydraulic Pump 5 = Wpmp - Water Pump 6 = cMnr - Continuous Miner 7 = Scar - Shuttle Car 8 = Bk/F - Breaker Feeder 9 = CRsh - Crusher 10 = Fan 11 = DCB 12 = Blank 13 = iFan - Interlocking Fan 14 = AFCm - AFC Main Gate 15 = AFCt - AFC Tail Gate 16 = M-BE -Moveable Boot End 17 = Bolt - Bolter 18 = HRMr - Hard Rock Miner 19 = Winc - Winch 20 = J-bo - Jumbo 21 = bBelt - Belly Belt 22 = Stak - Stacker 23 = aCar Add-Car
		24 = IGG - Inert Gas 25 = tBlt - Transfer Belt 26 = Dplg - Dummy Plug

Modbus Word	IP Byte	Description
35	**38**	**Machine Number Setting** **(MACHINE_NUM)** 1 – 40 Sets the RTU MC Number
36	**39**	**Under Voltage Trip Setting** **(UV_TRIP_PARAM)** **U/V Trip %** 1 = 20 2 = 30 3 = 40 4 = 50 5 = 60 6 = 70 7 = 80
37	**40**	**Pilot Latch Setting (PILOT_LATCH)** 1 = On 2 = Off
38	**41**	**Fan Current Level Setting** **(FAN_LEVEL)** **Fan I Level %** 1 = 32 2 = 40 3 = 48 4 = 56 5 = 64 6 = 72 7 = 80 8 = 88 9 = 96
39	**42**	**RTU RTD1 Temperature** 0 to 200 °C, 255 = Offline
40	**43**	**RTU RTD 2 Temperature** 0 to 200 °C, 255 = Offline
41	**44**	**RTU RTD 3 Temperature** 0 to 200 °C, 255 = Offline
42	**45**	**RTU RTD 4 Temperature** 0 to 200 °C, 255 = Offline
43	**46**	**RTU CIU Data Byte 0** Range = 0-255, 255 = Offline
44	**47**	**RTU CIU Data Byte 1** Range = 0-255, 255 = Offline
45	**48**	**RTU Digital Inputs (RTU_DIG_IN)** Bit 0 = RTU Start: 0 = Closed Bit 1 = RTU Stop: 0 = Closed Bit 2 = RTU PTC: 0 = Closed Bit 3 – 7 = 0

Modbus Word	IP Byte	Description
46	**49**	**Relay Status (RELAT_STAT)** Bit 0 = RELAY 4 (closed if bit set) Bit 1 = CBR RELAY (closed if bit set) Bit 2 = MCR RELAY (closed if bit set) Bit 3 = RL3 RELAY (closed if bit set) Bit 4 = Reserved Bit 5 = Fan Interlock Drive (on if bit is set) Bit 6 = Reserved Bit 7 = Reserved
47	**50**	**Reserved**
48	**51**	**Remote Start Setting (REMOTE_CONTROL)** 1 = No 2 = Yes
49	**52**	**Reserved**
50	**53**	**Earth Continuity Time Delay Setting (ECTIME_ADJ)** **EC Time – mS** 1 = 80 2 = 120 3 = 160 4 = 200 5 = 300 6 = 400 7 = 500
51	**54**	**Reserved**
52	**55**	**Reserved**
53	**56**	**Reserved**
54	**57**	**RTU CIU Data Byte 2** Range = 0-255, 255 = Offline
55	**58**	**RTU CIU Data Byte 3** Range = 0-255, 255 = Offline
56	**59**	**RTU CIU Data Byte 4** Range = 0-255, 255 = Offline
57	**60**	**RTU CIU Data Byte 5** Range = 0-255, 255 = Offline
58	**61**	**RTU CIU Data Byte 6** Range = 0-255, 255 = Offline
59	**62**	**RTU CIU Data Byte 7** Range = 0-255, 255 = Offline
60	**63**	**Checksum (Low order byte of sum of all IP bytes**

5.4 IPA V4/5.1TRANSLATION TABLES

Modbus Word	IP Byte	Description
1	1	**Digital Inputs (DIG_INPUTS)** Bit 0 = 1 Indicates IPA Relay Bit 1 = Communications to IPA: 0 = Error Bit 2 = Fan interlock Read: 0 = Not ready Bit 3 = IPA Stop Digital Input: 1 = Input closed Bit 4 = IPA Reset Digital Input: 1 = Input closed Bit 5 = IPA Lock Digital Input: 1 = Input closed Bit 6 = MCI Digital Input: 1 = Input closed Bit 7 = IPA Start Digital Input: 1 = Input closed
2	2	**Opto Status (OPTOSTAT)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Contactor Fail Bit 6 = Unused Bit 7 = Running
3	3	**Earth Leakage Current (EL_CUR)** Range 0-160%
4	4	**Pilot Series Resistance (PILOT_FWD)** Range 0-120%
5	5	**Pilot Leakage Resistance (PILOT_REV)** Range 0-120%
6	6	**Cable Fault Lockout Leakage (CFLR_LEAK)** Range 0-100%
7	7,8	**A Phase Current (CUR_A_BCD_HIGH)** Range 0-999%
8	9,10	**B Phase Current (CUR_B_BCD_HIGH)** Range 0-999%
9	11,12	**C Phase Current (CUR_C_BCD_HIGH)** Range 0-999%
10	13	**Over Current Trip (OC TRIP_HIGH)** Range 0-120%
11	14	**Current Balance (CURRENT_BAL)** Range 0-100%
12	15	**A Phase Volts (VOLTS_A)** Range 0-120%
13	16	**B Phase Volts (VOLTS_B)** Range 0-120%
14	17	**C Phase Volts (VOLTS_C)** Range 0-120%
15	18	**Trip Status (TRIP_STAT)** Bit 0 = IPB Memory Error = 1 Bit 1 = RTU Memory Error = 1 Bit 2 = 0 Bit 3 = 0 Bit 4 = 0 Bit 5 = 0 Bit 6 = 0 Bit 7 = 0
16	19	**Reserved**
17	20	**Reserved**
18	21	**Current Range Setting (CUR_RANGE PARAM)** **OC I Range A** 1 = 60 2 = 64 3 = 68 4 = 72 5 = 76 6 = 80 7 = 84 8 = 88 9 = 92 10 = 96 11 = 100 12 = 104 13 = 108 14 = 112 15 = 116
19	22	**Current Multiplier Setting (CUR_MUL_PARAM)** **OC I Mult** 1 = 1/8 2 = 1/4 3 = 1/2 4 = 1 5 = 2 6 = 4
20	23	**Over Current Curve Setting (OC_CURVE_PARM)** **Curve Type** 1 = Vinv 2 = m-OL

Modbus Word	IP Byte	Description
21	24	**Over Current Time Multiplier (TIME_MULT_PARM)** **OC Time Multiplier** 1 = 0.05 2 = 0.075 3 = 0.1 4 = 0.15 5 = 0.2 6 = 0.3 7 = 0.4 8 = 0.5 9 = 0.6 10 = 0.7 11 = 0.9 12 = 1.0 13 = 0.04 14 = 0.03 15 = 0.02 16 = 0.015 17 = 0.01 18 = 0.005
22	25	**Cool Multiplier Setting (COOL_MUL_PARAM)** **Cool Mult** 1 = 0.2 2 = 0.3 3 = 0.4 4 = 0.5 5 = 0.8 6 = 1.0 7 = 2.0 8 = 5.0 9 = 10 10 = 20 11 = 50
23	26	**Current Balance Setting (CUR_BAL_PARAM)** **Cur Bal Trip%** 1 = 5 2 = 10 3 = 20 4 = 50 5 = Off

Modbus Word	IP Byte	Description
24	27	**Short Circuit Setting (SHORT_CCT_PARAM)** **SC I Trip Mult** 1 = 3.0 2 = 3.5 3 = 4.0 4 = 4.5 5 = 5.0 6 = 5.5 7 = 6.0 8 = 6.5 9 = 7.0 10 = 7.5 11 = 8.0 12 = 8.5 13 = 9.0 14 = 9.5 15 = 10.0
25	28	**Short Circuit Trip Time Setting (SC_TRP_TM_PARAM)** **SC Trip Time – mS** 1 = 20 2 = 40 3 = 60 4 = 80 5 = 100
26	29	**Short Circuit Output Relay Selection (SC_OUT_PARAM)** **SC Relay)** 1 = CBR 2 = MCR
27	30	**Earth Leakage Sensitivity Setting (EL_SENS)** **EL Sens – mA** 1 = 100 2 = 150 3 = 200 4 = 250 5 = 300 6 = 350 7 = 400 8 = 450 9 = 500
28	31	**Earth Leakage Trip time Setting (EL_TIME)** **EL Time – mS** 1 = ins 2 = 150 3 = 190 4 = 230 5 = 270 6 = 310 7 = 350 8 = 390 9 = 430 10 = 470

Modbus Word	IP Byte	Description
29	**32**	**Pilot Mode Selection** **(PILOT MODE)** **Pilot Type** 1 = RTU 2 = | >|-
30	**33**	**CCM Selection** **(VOLTS_SELECT)** **(EFLO: CCM Volts** 1 = 415 2 = 1k 3 = 3k3 4 = 110
31	**34**	**Back EMF Timer Selection** **(B_EMF_TIME)** **B emf Time –Sec** 1 = 2 2 = 5 3 = 10 4 = 15 5 = 20
32	**35**	**Main Contactor Mode Selection** **(IPA V5.1 Only)** 1 = Normal 2 = Dual
33	**36**	**Relay 3 Function Setting** **(RELAY_3_FUNC)** **Relay 3 Status** 1 = OFF 2 = CTR

5.5 HPB TRANSLATION TABLES

Modbus Word	IP Byte	Description
	0	**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15)
1		**IPSI Address** Bits 0..3 = IPSI Address (Range 1-15) Bit 8 = IPSI Online Bit 9 = HPB Online
	1	**Digital Inputs (DIG_INPUTS)** Bit 0 = 1 Indicates HPB Relay Bit 1 = Communications to HPB: 0 = Error Bit 2 = Undefined Bit 3 = HPB Stop Digital Input: 1 = Input closed Bit 4 = HPB Reset Digital Input: 1 = Input closed Bit 5 = HPB Lock Digital Input: 1 = Input closed Bit 6 = MCI Digital Input: 1 = Input closed Bit 7 = HPB Start Digital Input: 1 = Input closed
	2	**Opto Status (OPTOSTAT)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Contactor Fail Bit 6 = Unused Bit 7 = Running
2		**Opto Status/Digital Inputs (OPTOSTAT+DIG_INPUTS)** Bit 0 = Earth Leakage Trip Bit 1 = Earth Continuity Trip Bit 2 = E/F Lockout Trip Bit 3 = Over Current Trip Bit 4 = Short Circuit Trip Bit 5 = Main Contactor Fail Bit 6 = Unused Bit 7 = Running Bit 8 = 1 Indicates HPB Relay Bit 9 = Communications to HPB: 0 = Error Bit 10 = Undefined Bit 11 = HPB Stop Digital Input: 1 = Input closed Bit 12 = HPB Reset Digital Input: 1 = Input closed Bit 13 = HPB Lock Digital Input: 1 = Input closed Bit 14 = MCI Digital Input: 1 = Input closed Bit 15 = HPB Start Digital Input: 1 = Input closed
3	**3**	**Earth Leakage Current (EL_CUR)** Range 0-110%
4	**4**	**Pilot Series Resistance (PILOT_FWD)** Range 0-150%
5	**5**	**Pilot Leakage Resistance (PILOT_REV)**
		Range 0-120%
6	**6**	**Phase A Leakage Level** Range 0-100 MΩ
7	**7,8**	**A Phase Current (CUR_A_BCD_HIGH)** Range 0-999%
8	**9,10**	**B Phase Current (CUR_B_BCD_HIGH)** Range 0-999%
9	**11,12**	**C Phase Current (CUR_C_BCD_HIGH)** Range 0-999%
10	**13**	**Over Current Trip (OC TRIP_HIGH)** Range 0-120%
11	**14**	**Current Balance (CURRENT_BAL)** Range 0-100%
12	**15**	**A Phase Volts (VOLTS_A)** Range 0-140%
13	**16**	**B Phase Volts (VOLTS_B)** Range 0-140%
14	**17**	**C Phase Volts (VOLTS_C)** Range 0-140%
15	**18**	**Trip Status (TRIP_STAT)**
		Bit 0 = HPB Memory: 1 = Error
		Bit 1 = RTU Memory: 1 = Error
16	**19**	**Reserved**
17	**20**	**Reserved**
18	**21**	**Current Range Setting (CUR_RANGE PARAM)** **OC I Range A** 1 = 60 2 = 64 3 = 68 4 = 72 5 = 76 6 = 80 7 = 84 8 = 88 9 = 92 10 = 96 11 = 100 12 = 104 13 = 108 14 = 112 15 = 116
19	**22**	**Current Multiplier Setting (CUR_MUL_PARAM)** **OC I Mult** 1 = 1/8 2 = 1/4 3 = 1/2 4 = 1 5 = 2 6 = 4
20	**23**	**Over Current Curve Setting (OC_CURVE_PARM)** **Curve Type** 1 = Vinv 2 = xInv

Modbus Word	IP Byte	Description
21	**24**	**Over Current Time Multiplier (TIME_MULT_PARM)** 1 = 0.05 2 = 0.075 3 = 0.1 4 = 0.15 5 = 0.2 6 = 0.3 7 = 0.4 8 = 0.5 9 = 0.6 10 = 0.7 11 = 0.8 12 = 0.9 13 = 1.0
22	**25**	**Reserved**
23	**26**	**Current Balance Setting (CUR_BAL_PARAM)** **Cur Bal Trip%** 1 = 5 2 = 10 3 = 20 4 = 50 5 = Off
24	**27**	**Short Circuit Setting (SHORT_CCT_PARAM)** **SC I Trip Mult** 1 = 3.0 2 = 3.5 3 = 4.0 4 = 4.5 5 = 5.0 6 = 5.5 7 = 6.0 8 = 6.5 9 = 7.0 10 = 7.5 11 = 8.0 12 = 8.5 13 = 9.0 14 = 9.5 15 = 10
25	**28**	**Short Circuit Trip Time Setting (SC_TRP_TM_PARAM)** **SC Trip Time – mS** 1 = 40 2 = 60 3 = 80 4 = 100 5 = 120 6 = 160
26	**29**	**Short Circuit Output Relay Selection (SC_OUT_PARAM)** **SC Relay)** 1 = CBR 2 = MCR

Modbus Word	IP Byte	Description
27	**30**	**Earth Leakage Sensitivity Setting (EL_SENS)** **EL Sens – mA** 1 < 200 2 < 300 3 < 400 4 < 500 5 < 600 6 < 700 7 < 800 8 < 900 9 < 1000
28	**31**	**Earth Leakage Trip time Setting (EL_TIME)** **EL Time – mS** 1 = ins 2 = 150 3 = 190 4 = 230 5 = 270 6 = 310 7 = 350 8 = 390 9 = 430 10 = 470
29	**32**	**Pilot Mode Selection (PILOT MODE)** **Pilot Type** 1 = HTU 2 = Res
30	**33**	**EFLO Select (EFLO_SELECT)** **EF - M Ohm** 1 = 2 2 = 5 3 = 10 4 = 20 5 = 50 6 = Off
31	**34**	**Back EMF Timer Selection (B_EMF_TIME)** **B emf Time – Sec** 1 = 2 2 = 5 3 = 10 4 = 15 5 = 20 6 = 25 7 = 30 8 = 35 9 = 40
32	**35**	**Phase B Leakage Level** Range 0-100 MΩ
33	**36**	**Phase C Leakage Level** Range 0-100 MΩ

Modbus Word	IP Byte	Description
34	**37**	**Machine Type Setting (MACHINE_TYPE)** 1 = DrgL - Dragline 2 = Shvl - Shovel 3 = Dril - Drill 4 = pSTx – Portable Starting Transformer 5 = Wpmp - Water Pump 6 = Blank
35	**38**	**Machine Number Setting (MACHINE_NUM)** 1 – 40 Sets the RTU MC Number
36	**39**	**Under Voltage Trip Setting (UV_TRIP_PARAM)** **U/V Trip %** 1 = None 2 = 30 3 = 40 4 = 50 5 = 60 6 = 70 7 = 80
37	**40**	**Pilot Latch Setting (PILOT_LATCH)** 1 = On 2 = Off
38	**41**	**Earth Fault Lockout Time Setting (EF_LOCKOUT_TIME)** **EF Lockout Time Seconds** 1 = 10 2 = 15 3 = 20 4 = 25
39	**42**	**Reserved**
40	**43**	**Reserved**
41	**44**	**Reserved**
42	**45**	**Reserved**
43	**46**	**Reserved**
44	**47**	**Reserved**
45	**48**	**RTU Digital Inputs (RTU_DIG_IN)** Bit 0 = HTU Run Bit 1 = HTU Online
46	**49**	**Relay Status (RELAT_STAT)** Bit 0 = RELAY 4 (closed if bit set) Bit 1 = CBR RELAY (closed if bit set) Bit 2 = MCR RELAY (closed if bit set) Bit 3 = RL3 RELAY (closed if bit set) Bit 4 = Reserved Bit 5 = Undefined Bit 6 = Heart Beat LED Drive Bit 7 = MCF Trip Flag
47	**50**	**Reserved**
48	**51**	**Reserved**
49	**52**	**Reserved**

Modbus Word	IP Byte	Description
50	**53**	**EC Time (ECTIME_ADJ)** 1 = 300ms 2 = 400ms 3 = 500ms 4 = 600ms 5 = 800ms 6 = 1s 7 = 1.2s 8 = 1.5s 9 = 2s
51	**54**	**Reserved**
52	**55**	**Reserved**
53	**56**	**Reserved**
54	**57**	**Reserved**
55	**58**	**Reserved**
56	**59**	**Reserved**
57	**60**	**Reserved**
58	**61**	**Reserved**
59	**62**	**Reserved**
60	**63**	**Checksum (Low order byte of sum of all IP bytes**

6. I.S. Communications

An intrinsically safe link consisting of approved IS Barriers is required to allow Integrated Protection Relays to transmit their data from a hazardous area to a remote PLC. The equipment in the hazardous area must be enclosed in a flameproof enclosure.

6.1 PLC RS232 IS Link

The IS link consists of two MTL 3058 general purpose serial data interfaces and associated MTL 3991 24V DC power supplies. (See Connection Diagram, Drawing DNET-E-012, Page 25).

A standard Belden type cable, connected between the two serial data interfaces would allow communications up to a distance of 2 kilometres at the communication rate of 9600 baud.

6.2 PLC RS485/RS422 IS Link

The IS link consists of two MTL 776AC or P&F 955 passive IS Barriers per DNET-IP2 System. Multiple DNET-IP2 Systems may be able to be multi drop connected in hazardous areas depending on cable parameters.

A standard Belden type cable, connected between the IS Barriers would allow communications up to a distance of 500 metres at the communication rate of 9600 baud (See Drawing DNET-E-011, Page 26).

7. Specifications

Controller

Supply Volts:
20V-0V-20V AC ± 10%, 15VA

L1 Operating Range:

Series resistance 250 ohms
Shunt Resistance 1000 ohms
Capacitance 0.1 μf

Communications:

Baud Rate 1200, 2400, 4800, 9600
Protocol – Modbus, IP2 and IP

Dimensions:

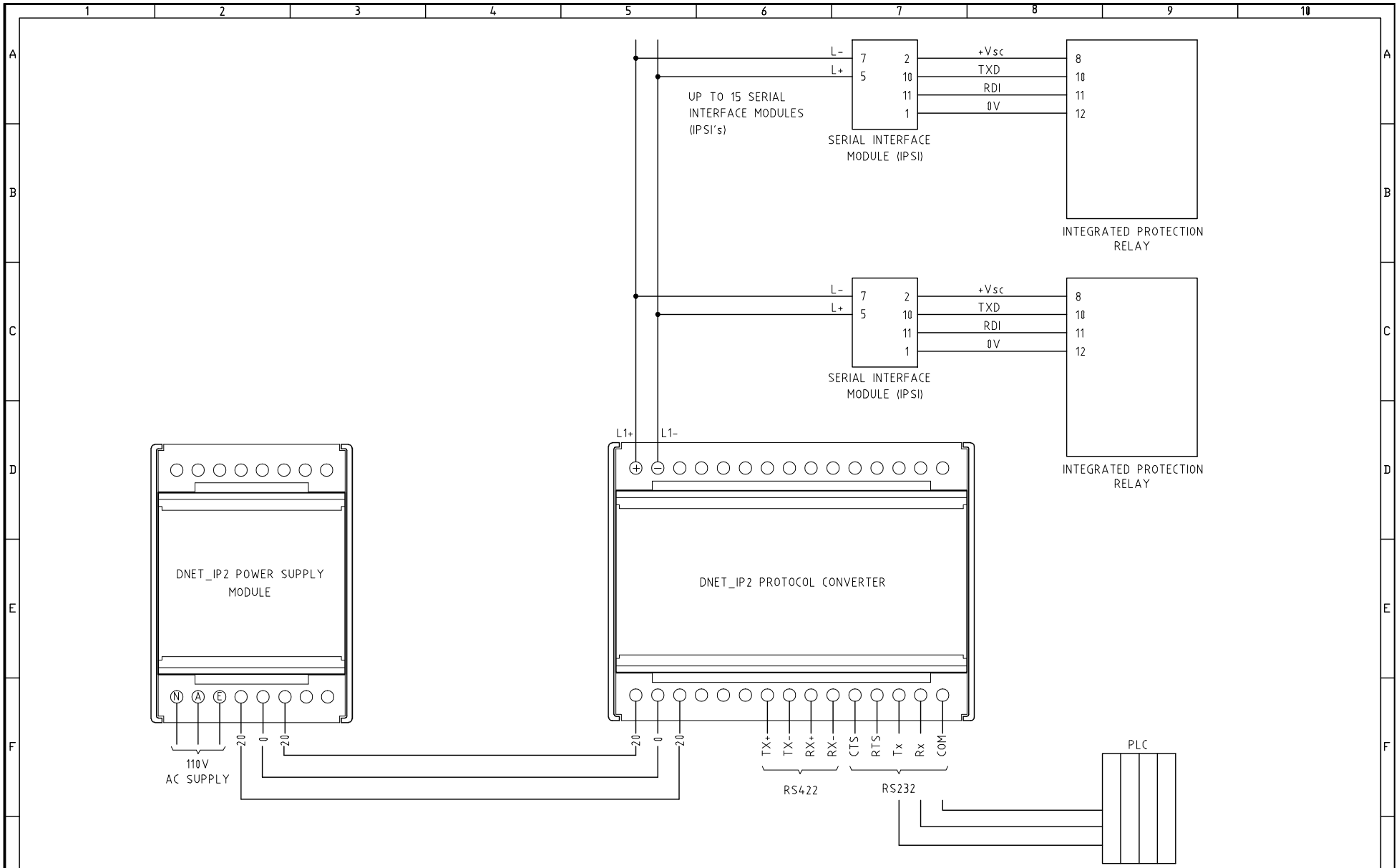
100 W x 75 D x 110 H mm (DIN Rail Mount)

Power Supply

Supply Volts:
110V / 20V-0V-20V 15 VA (DIN Rail Mount)
Dimensions:
55 W x 75 D x 110 H mm

8. Equipment List

101270	DNET-IP2 Protocol Converter
101539	DNET-IP2 Power Supply 110V/20V-0V-20V, 15 VA
101501	IPSI-IP Serial Interface Module



REVISION	
0.CRN 4271 02/09/98	

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ACN 26 000 770 141
7 BILLINGDON CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4033 4000

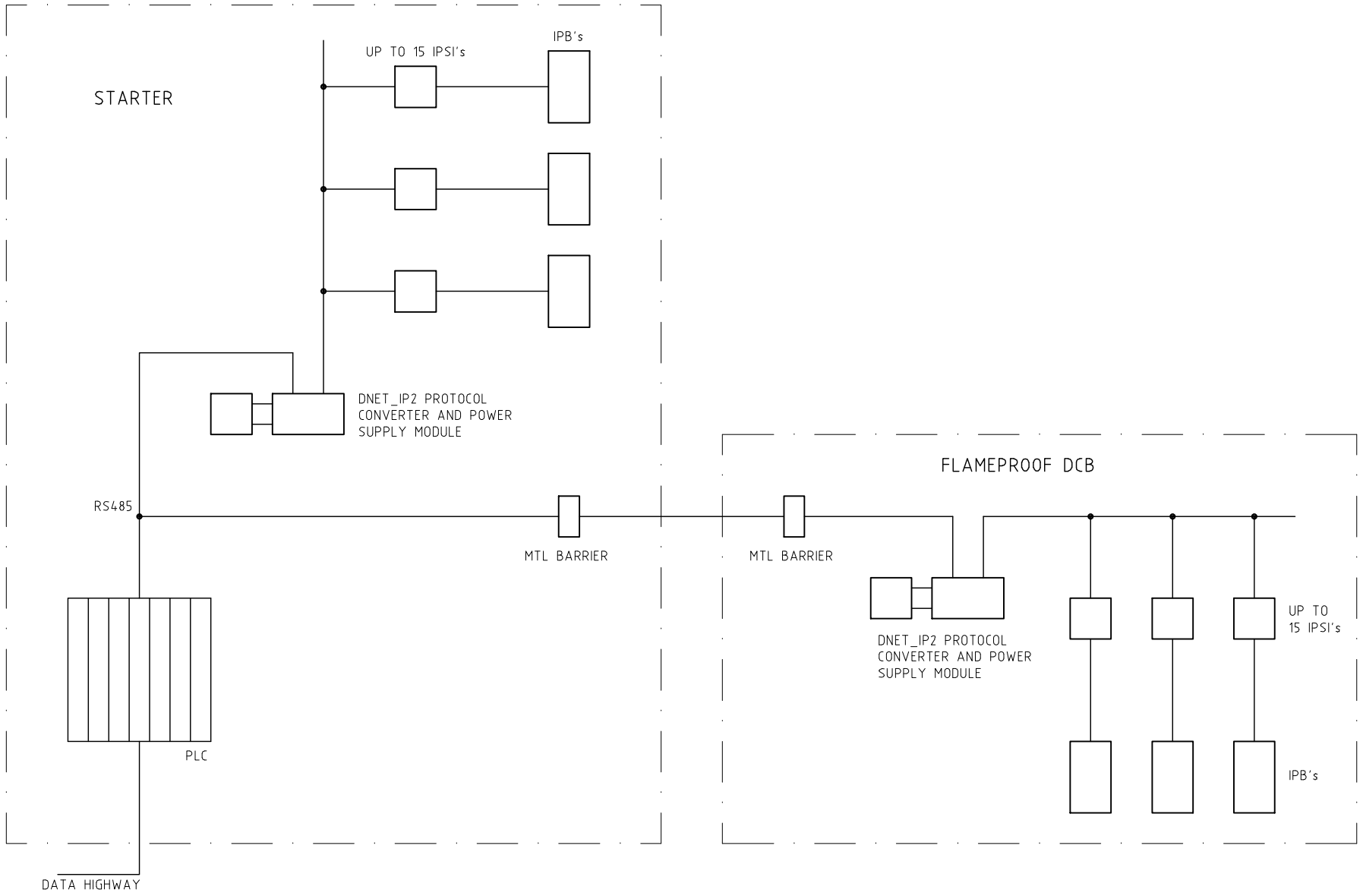
	NAME	DATE
DRAWN:	G.R.	02/09/98
CHECKED:		
APPROVED:		
SCALE	Nil	

DNET
DNET_IP2
CONNECTION DIAGRAM
FOR STANDALONE IPA/B MONITORING

AMPCONTROL DWG No: DNET -E-009

REV 0

SHEET A3



REVISION	
0.CRN 4271 02/09/98	

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ABN 58 000 770 141
7 BILLBROOKE CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4903 4000
electronics@ampcontrol.com.au

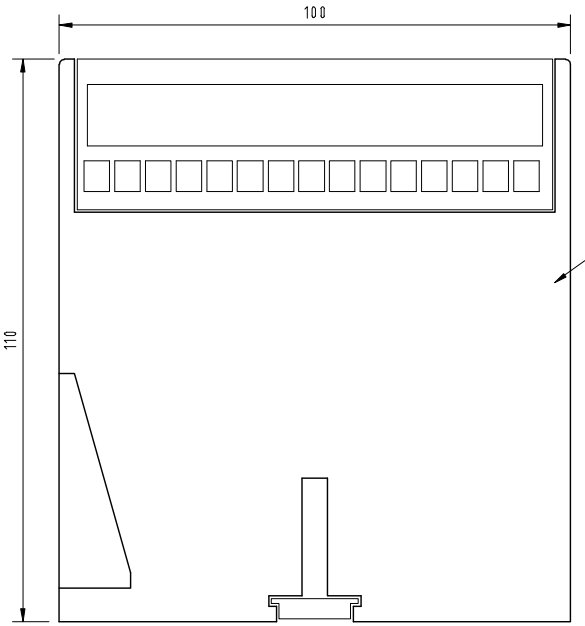
	NAME	DATE
DRAWN:	G.R.	03/09/98
CHECKED:		
APPROVED:		
SCALE	Nil	

DNET
MONITORING MULTIPLE DNET_IP2 SYSTEMS WITH A SINGLE PLC COMMUNICATIONS PORT

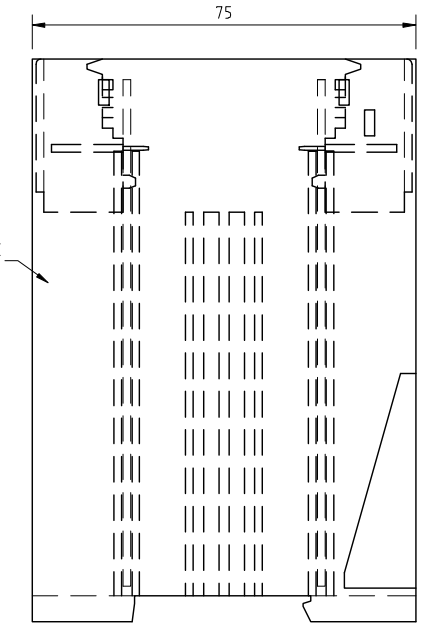
AMPCONTROL DWG No: DNET -E-010

REV 0

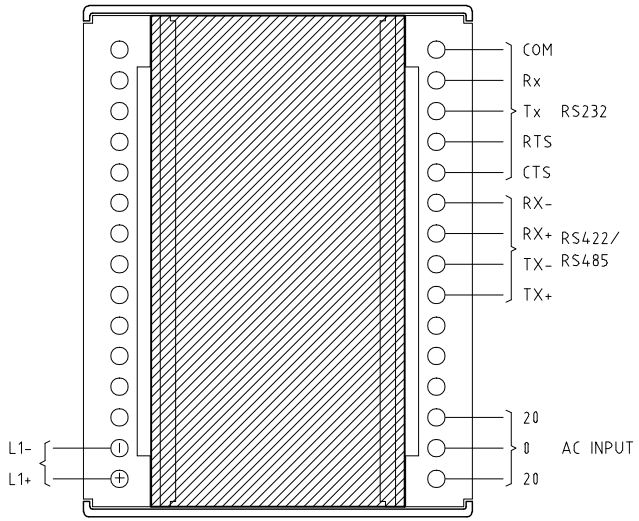
SHEET A3

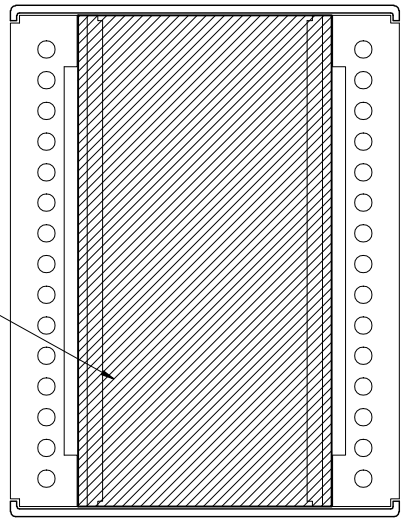


FRONT VIEW

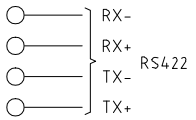


SIDE VIEW

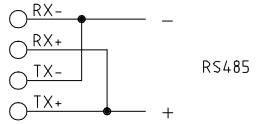




TOP VIEW



RS422 CONNECTIONS



RS485 CONNECTIONS

REVISION	
0.CRN 4271 02/09/98	

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ACN 26 000 770 141
7 BILLBROOKE CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4035 4000
electronics@ampcontrol.com.au

	NAME	DATE
DRAWN:	G.R.	02/09/98
CHECKED:		
APPROVED:		
SCALE	1:1	

DNET
IP2 PROTOCOL CONVERTER CASE DIMENSIONS & EXTERNAL DIMENSIONS

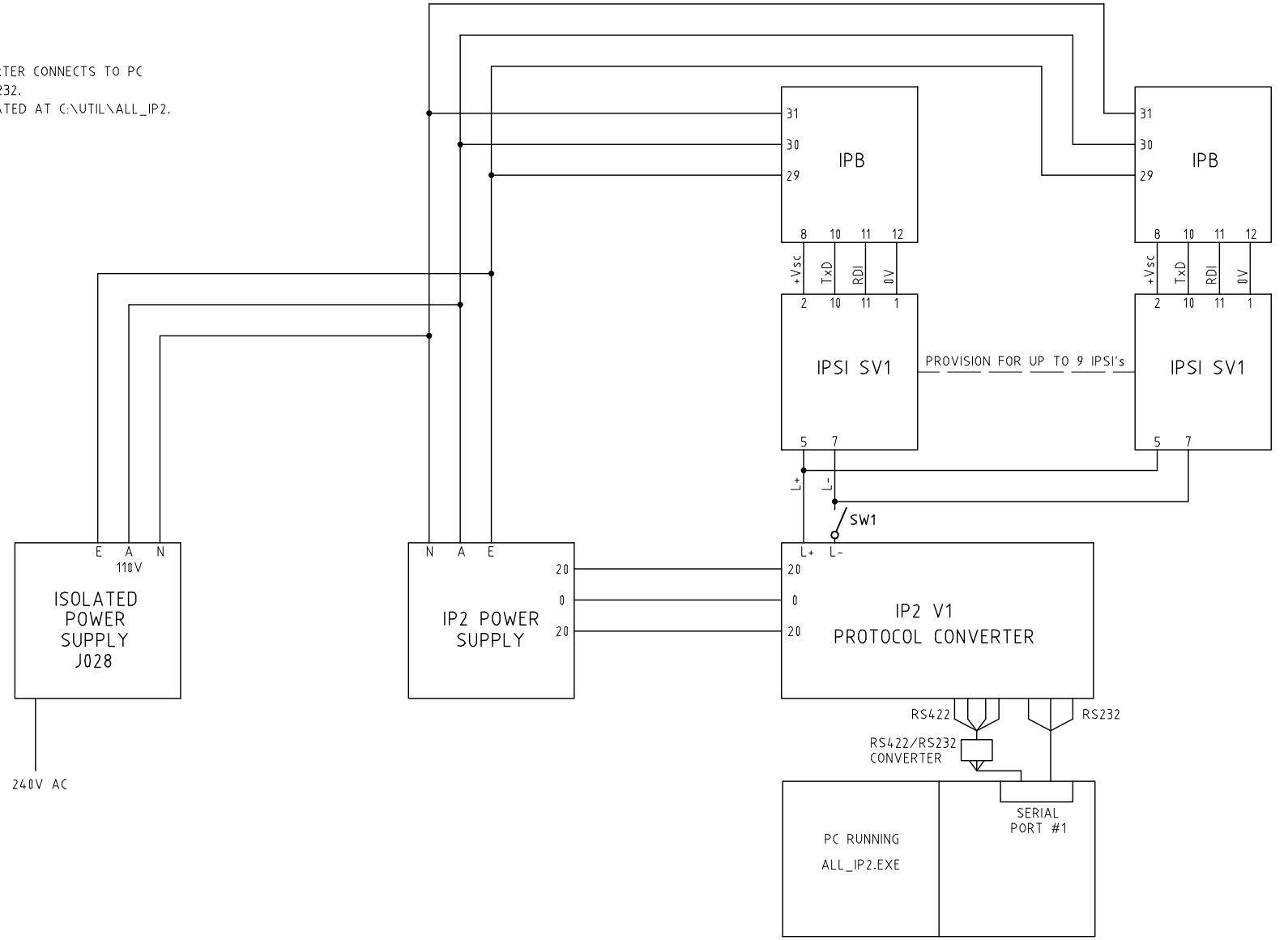
AMPCONTROL DWG No: DNET -A-057

REV 0

SHEET A3

NOTES

1. PROTOCOL CONVERTER CONNECTS TO PC VIA RS422 OR RS232.
2. ALL_IP2.EXE LOCATED AT C:\UTIL\ALL_IP2.



REVISION	
0.CRN 4089	30/09/97
1.CRN 4271	02/09/98
2.CRN 4965	20/06/03

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ACN 26 000 770 141
7 BILLBROOKE CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4033 4000

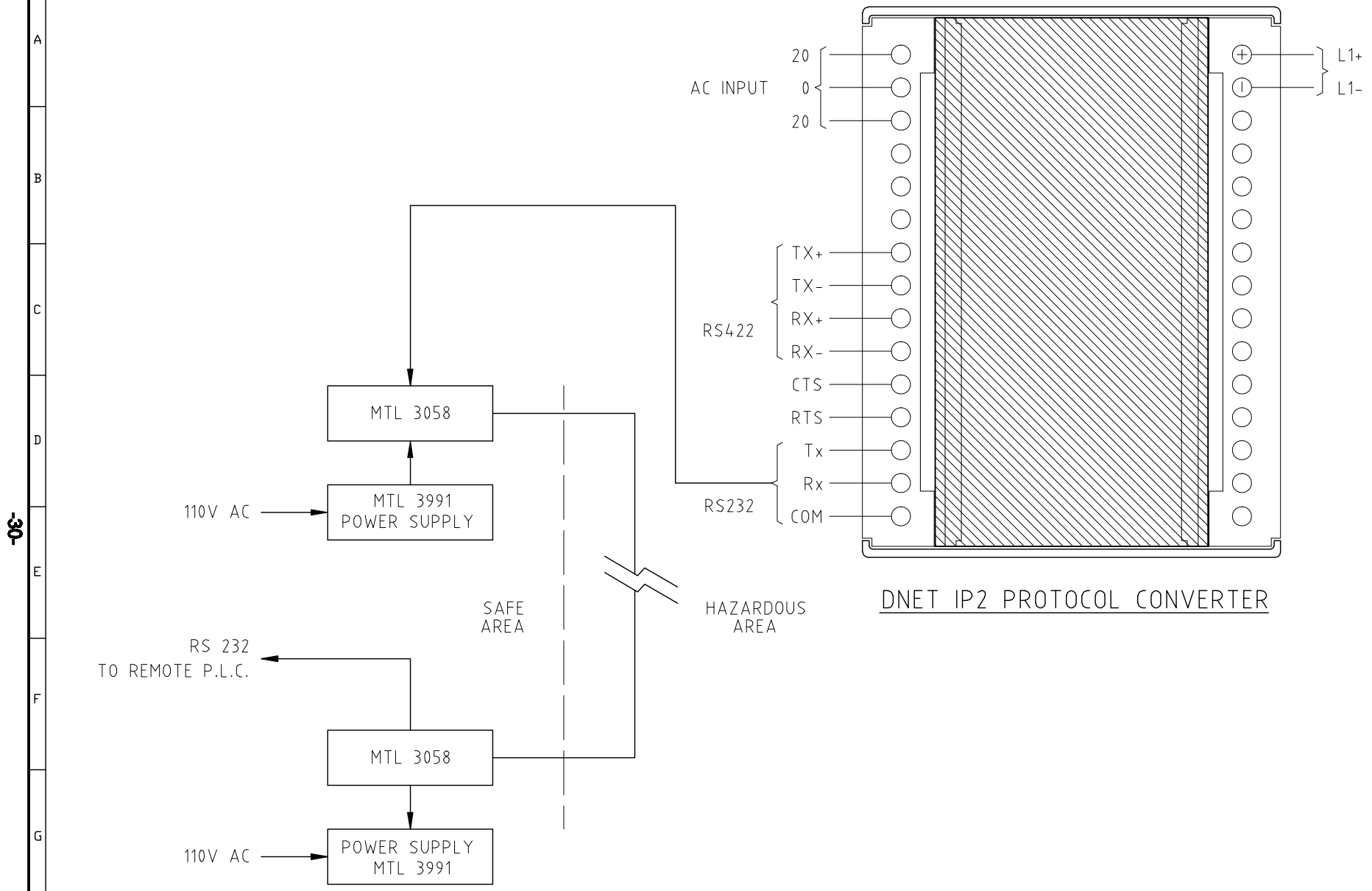
	NAME	DATE
DRAWN:	G.R.	15/1/98
CHECKED:		
APPROVED:		
SCALE	Nil	

DNET
DNET_IP2 SYSTEM
BLOCK DIAGRAM

AMPCONTROL DWG No: DNET -E-008

REV 2

SHEET A3



-03-

REVISION
0.CRN 4271
02/09/98

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ABN 35 088 778 141
7 BILLBROOKE CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4903 4600

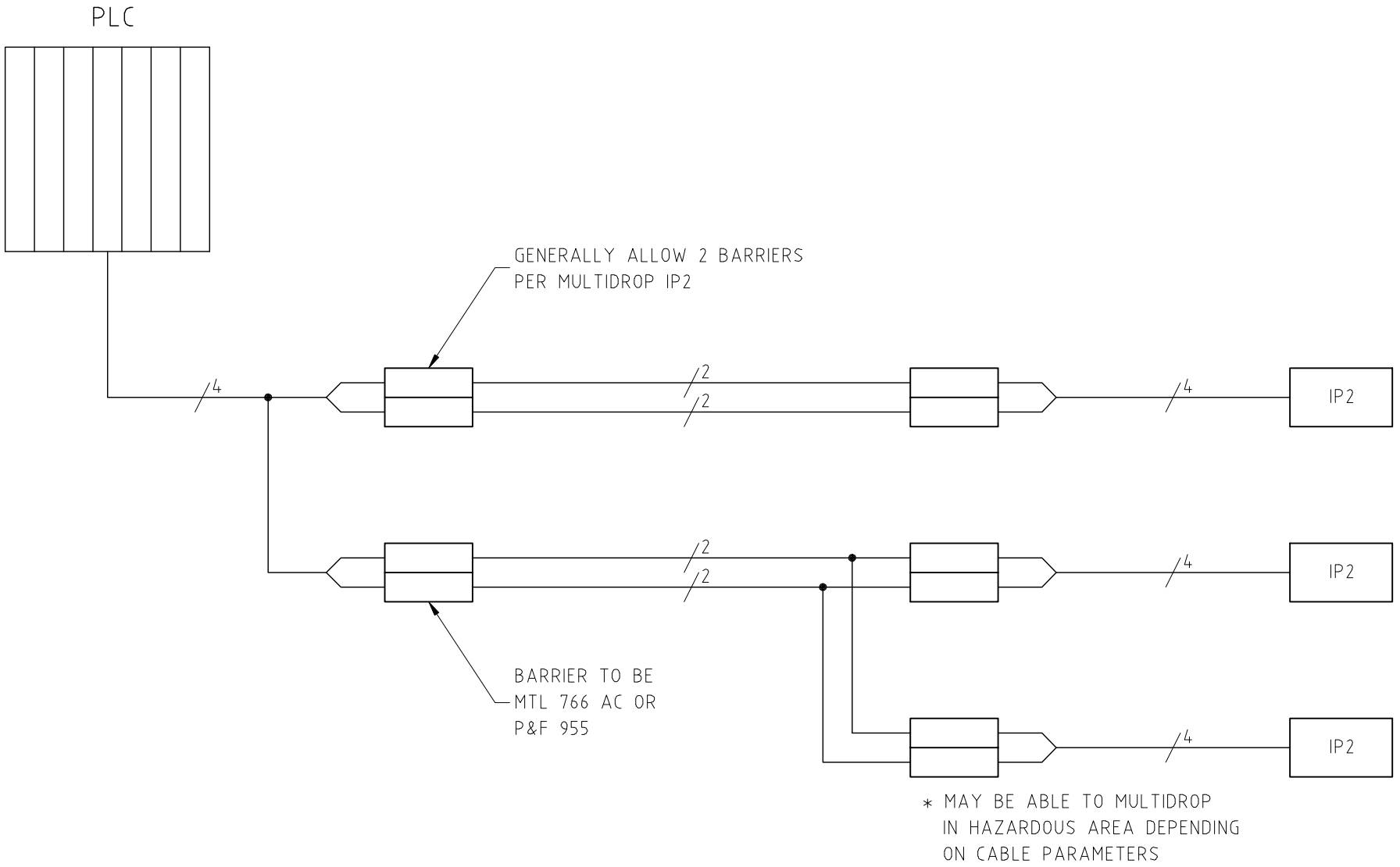
	NAME	DATE
DRAWN:	G.R.	03/11/98
CHECKED:		
APPROVED:		
SCALE	Nil	

DNET
DNET_IP2
RS232 IS LINK TO PLC
CONNECTION DIAGRAM

AMPCONTROL DWG No:
DNET -E -012

REV 0

SHEET A4



REVISION	
D.CRN 4271 02/09/98	

AS1100
ALL DIMENSIONS IN MILLIMETRES UNLESS STATED OTHERWISE

AMPCONTROL CSM PTY. LTD.
ABN 35 088 778 141
7 BILLBROOKE CLOSE,
CAMERON PARK,
N.S.W. 2285, AUSTRALIA
P:+61 2 4903 4600
clsbsales@ampcontrol.com.au

	NAME	DATE
DRAWN:	G.R.	3/9/98
CHECKED:		
APPROVED:		
SCALE	Nil	

DNET
PLC/DNET_IP2
MULTIDROP SYSTEM C/W BARRIERS
LAYOUT DIAGRAM

AMPCONTROL DWG No: DNET -E -011
REV 0
SHEET A4

SYSTEMS APPROVALS PTY. LTD.

Postal Address: P.O.Box 45,
BOOLAROO. N.S.W. 2284.

A.C.N. 054191347.

Private Address: 14 Raymond St,
SPEERS POINT. N.S.W. 2284.
Phone: (049) 58 6811.
Fax: (049) 58 6827.
Mobile: 0418 685252.

The Manager,
Ampcontrol CSM Pty. Ltd.
P.O. Box 304,
WARNERS BAY. N.S.W. 2282.

OUR REF: **SA1079.**

FILE REF No.: **C94/0418.**

ATTENTION: **BOB BROADFOOT.**

ITEM SUPPLEMENTARY APPROVAL

Dear Sir,

ITEM: **MONITORING CONTROL & MESSAGE DISSEMINATION SYSTEM.**

IDENTIFICATION: **DNET.**

ORIGINAL APPROVAL No: **Ex.ia.14067.**

PREVIOUS APPROVAL No: **Ex.ia.14067. ISSUE A2508-1.**

ORIGINAL APPROVAL HOLDER: **AMPCONTROL CSM PTY. LTD.**

SUPPLEMENTARY APPROVAL No: **Ex.ia.14067. ISSUE A2507-2.**

DESCRIPTION OF APPROVAL ITEM

Provision to use alternate DNET Line Drivers not fitted with batteries.

Please find enclosed herewith the attached schedule, Approval Document, Approval Drawings, and relevant Supplementary Documentation.

Yours Faithfully,

Albert Weeks
Accredited Assessing Authority - MDA - A-2507.
FOR CHIEF INSPECTOR OF COAL MINES

New South Wales
Department of Mineral Resources
Accredited Assessing Authority MDA-A2507

NOTICE OF SUPPLEMENTARY APPROVAL

SUPPLEMENTARY APPROVAL No: **Ex.ia.14067**
FILE REF No: **C94/0418**
DATE: **11/04/1997**

It is hereby notified that the Approved Item listed herein has been assessed for compliance with the Coal Mines Regulation Act and appropriate standards or requirements, and is hereby **APPROVED** in accordance with the requirements of the COAL MINES REGULATION ACT 1982. This approval is issued pursuant to the provisions of Clause 6 and 7A of the Coal Mines Regulation (Approval of Items) Regulation, 1984.

This APPROVAL is issued to: **AMPCONTROL CSM PTY. LTD.**
Address of Approval Holder: **P.O. BOX 304, WARNERS BAY. N.S.W. 2282.**

Description of Item: **MONITORING CONTROL AND MESSAGE DISSEMINATION SYSTEM**

Identification: **DNET**

C.M.R.A. Approval Clause: **27(b). EXPLOSION PROTECTED**

Specific Approval Category: **INTRINSICALLY SAFE. Ex.ia.**

This Approval is issued subject to compliance with the requirements of the Occupational Health and Safety Act 1983, with particular reference to Sections 15 to 17 of the said Act as it applies to USERS of Approved Items, and to Section 18 of the said Act as it applies to the MANUFACTURERS and/or SUPPLIERS of Approved Items.

The Authority issuing this Approval may, for the purposes of the Occupational Health and Safety Act, 1983, append a list of recommendations, (including drawings, documents, etc.) that are applicable to this approved item, as identified during test and/or assessment, to assist the Approval Holder and User to comply with the obligations of the Occupational Health and Safety Act, 1983. The onus is on the Supplier and/or User to ensure the Approved Item, and any deviation from the list of recommendations, in reference to that item is not inferior in any way to the item tested and/or assessed, this includes the supply, installation and continuing use of the Approved Item.

The Approval Number shall appear in a conspicuous place in a legible manner on each approved item, unless specifically excluded.

A copy of this Approval Document together with a copy of the recommendations from the Issuing Authority shall be supplied to each user of the Approved Item.

Any Maintenance, Repair or Overhaul of Approved Items shall be carried out in accordance with the requirements of the Coal Mines Regulation Act, 1983.

Albert Weeks
Accredited Assessing Authority - MDA - A-2507.
FOR CHIEF INSPECTOR OF COAL MINES

SYSTEMS APPROVALS PTY. LTD.

Postal Address: **P.O. Box 45,**
BOOLAROO. N.S.W. 2284.

Private Address: **14 Raymond St,**
SPEERS POINT. N.S.W. 2284.

SUPPLEMENTARY APPROVAL No.: **Ex.ia.14067**

FILE REF No.: **C94/0418**

DATE: **11/04/1997**

DESCRIPTION OF APPROVED ITEM

Provision to use alternate DNET Line Drivers not fitted with batteries on the safe area side of the line interface barrier.

Maximum Input Voltage for Drivers - 240V a.c.

Designated Line Drivers covered by this approval;

1. **DNET SL-IP Protocol Convertor**
2. **DNET IP Protocol Convertor**
3. **DNET IP2 Protocol Convertor**
4. **DNET Line Driver**

SCHEDULE 1 - DRAWINGS

DNET - Z - 036 Original Dated 20/08/1996
DNET - Z - 037 Original Dated 20/08/1996

PREVIOUSLY APPROVED DRAWING

DNET - Z - 012 Rev O Dated 20/06/1994

SCHEDULE 2 - CABLE PARAMETERS

Maximum Capacitance C_o = 7uF
Maximum Inductance L_o = 2mH
Maximum L/R Ratio = 200uH/ohm

Albert Weeks
Accredited Assessing Authority - MDA - A-2507.
FOR CHIEF INSPECTOR OF COAL MINES.

SYSTEMS APPROVALS PTY. LTD.

Postal Address: **P.O. Box 45,**
BOOLAROO. N.S.W. 2284.

Private Address: **14 Raymond St,**
SPEERS POINT. N.S.W. 2284.

SUPPLEMENTARY APPROVAL No.: **Ex.ia.14067**

FILE REF No.: **C94/0418**

DATE: **11/04/1997**

SCHEDULE 3 - CONDITIONS OF MANUFACTURE AND USE

1. It is a condition of safe use that the equipment be installed and maintained in accordance with drawing **DNET-Z-036 Original Dated 20/08/1996**

2. It is a condition of safe use that the hand held terminal must only be taken into the hazardous area within its leather carry case.

3. It is a condition of safe use that the battery fitted hand held terminal shall not be removed nor recharged in a hazardous area.

4. It is a condition of safe use that no apparatus connected to the safe area terminals of the Line Interface or Slave Interface Units shall be supplied from nor contain, under normal or abnormal conditions, a source of potential with respect to earth in excess of 250 Volts rms or 250 Volts d.c.

5. It is a condition of safe use that only segregated potential-free contacts shall be connected to the status inputs of the D12 module.

MARKINGS ON APPARATUS

The manufacturers' name or mark, and the approval number **MDA Ex.ia.14067** shall be inscribed in a durable manner in a prominent position on the apparatus.

Albert Weeks
Accredited Assessing Authority - MDA - A-2507.
FOR CHIEF INSPECTOR OF COAL MINES.

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Certificate of Conformity

Certificate No: AUS Ex 3109X

Issue 0: Original Issue 15/10/1995
Issue 1: 12/12/1995

Date of Expiry: 15/10/2004

Certificate Holder:
AMP Control Pty Ltd
250 Macquarie Street
WARNERS BAY NSW 2113

Electrical Equipment: 'DNET' Monitoring, Control and Message Dissemination System

Type of Protection and Marking Code:

DI2 Input Modules:	Ex ia I/IIC T5 Class I Zone 0
Hand Held Terminal:	Ex ia I/IIC T5 IP65 Class I Zone 0
Interface Units:	Ex (ia) I/IIC Safe Area
Controller/Converter:	Ex (ia) I/IIC (see schedule)

Manufactured By:
AMP Control Pty Ltd
250 Macquarie Street
WARNERS BAY NSW 2113

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Standards Australia Quality Assurance Services Pty Limited A.C.N. 050 611 642

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

This certificate is granted subject to the conditions as set out in Standards Australia Miscellaneous Publication MP 69 and the Procedures (Doc Q7134) of the scheme.

The electrical equipment and any acceptable variation to it specified in the schedule to this certificate and the identified documents, was found to comply with the following standards:

AS 2380.1-1989 Electrical Equipment for Explosive Atmospheres - Explosion-protection Techniques - General Requirements
AS 2380.7-1987 Electrical Equipment for Explosive Atmospheres - Explosion-protection Techniques - Intrinsic Safety 'i'
AS 1939-1990 Degrees of Protection Provided by Enclosures of Electrical Equipment (IP Code)

The equipment listed has successfully met the examination and test requirements as recorded in

Test Report No: LOSC 13916

File Reference: LOSC 94/6530

K. J. Tisle
Signed for and on behalf of issuing authority

Coordinator, Approvals + Certification
Position

12/12/1995
Date of issue

This certificate and schedule may not be reproduced except in full.

This certificate is not transferable and remains the property of Standards Australia Quality Assurance Services and must be returned in the event of its being revoked or not renewed.

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Standards Australia Quality Assurance Services Pty Limited A.C.N. 050 611 642

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Schedule

Certificate No: AUS Ex 3109X Issue: 1 Date of Issue: 12/12/1995

Certified Equipment:

The 'DNET' Monitoring, Control and Message Dissemination System is a distributed, two-wire monitoring, supervisory control and message dissemination network. being designed to monitor the status of segregated potential-free switch contacts in hazardous areas. The system conveys information to users in the field via the display on a DNET Controller or a Hand Held Terminal.

The two-wire line on which the input and output modules communicate is driven by a DNET Controller Unit located in a safe area and interfaced via a Line Interface Unit . Additional safe area controllers and monitoring devices can be interfaced to the two-wire line via a Slave Interface Unit. The DI2 module, which is the only part of the system normally located in the hazardous area, is powered from the two-wire line and monitors the condition of up to 2 potential-free switch contacts communicating this information to a controller via the two-wire line.

The DNET Controller and Protocol Converter, normally located in a safe area, incorporate 3.6 Volt rechargeable batteries which are used to maintain volatile memory in the event of a power interruption. The arrangement of the battery, together with the driven circuits, are Intrinsically Safe to category ia under this condition.

The Hand Held Terminal is a battery powered device, operating from an in-built 9 Volt rechargeable batteries, which can communicate with any DI2 module via an infra-red data link to provide information communication channel to mimic the information as displayed on a Controller.

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Ex: 3109X-1
Addendum to Certificate No.....

Conditions of Certification:

1. It is a condition of safe use that the equipment be installed and maintained in accordance with drawing DNET-Z-012
2. It is a condition of safe use that only Line Interface Model LG2-A shall be utilised in Group II installations.
3. It is condition of safe use that the hand held terminal only be taken into the hazardous area within its leather carry ca
4. The battery fitted to the hand held terminal shall not be removed nor recharged in a hazardous area.
5. No apparatus connected to the safe area terminals of the Line Interface or Slave Interface Units shall be supplied from nor contain, under normal or abnormal conditions, a source of potential with respect to earth in excess of 250 Volts rms or 250 Volts dc.
6. Only segregated potential-free contacts shall be connected to the status inputs of the DI2 module.
7. The equipment has been assessed as a complete system and accordingly the cable parameters specified in Table 1 shall be taken into account during installation.

Table 1: Allowable Cable Parameters

Cable Parameter	Gas Group	
	I	IIC
Maximum Capacitance (μF)	7	0.3
Maximum Inductance (mH)	2	4
Maximum L/R Ratio (μH/Ω)	200	53

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Standards Australia Quality Assurance Services Pty Limited A.C.N. 050 611 642

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Ex: 3109X-1
Addendum to Certificate No.....

Drawing Schedule

Drawing No	Drawing Title	Revision/ Issue	Dated
DNET-Z-007 Shts 1-10	Explanation of IS System	0	17/6/94
DNET-Z-008	DNET LG1 Parts List	0	9/8/94
DNET-Z-009	DNET LG2 Parts List	0	9/8/94
DNET-Z-011	Casting and Coating Compounds	1	23/9/94
DNET-Z-019	Document Schedule	0	9/8/94
DNET-Z-020	DI2 Electrostatic Hazard	0	11/7/94
DNET-Z-022	Terminal Parts List	1	22/9/94
DNET-Z-028	Controller/PC Parts List	1	23/9/94
DNET-Z-033	DNET SIU Parts List	0	16/9/94
DNET-Z-001	DNET Controller Case General Arrangement	0	10/6/94
DNET-Z-002	DNET Protocol Convertor General Arrangement	0	10/6/94
DNET-Z-003	DNET DI2 VF Processor Board General Arrangement	0	10/6/94
DNET-Z-004	DNET DI2 VF General Arrangement	0	15/6/94
DNET-Z-005	DNET DI2 VF PCB Tracks IS Area Component Side	0	17/6/94
DNET-Z-006	DNET DI2 VF PCB Tracks IS Area Solder Side	0	17/6/94
DNET-Z-012	DNET IS System Schematic Layout	0	20/6/94
DNET-Z-013 Shts 1 & 2	DNET IS Stickers	1	30/9/94
DNET-Z-014 Shts 1 & 2	DNET IS Hand Held Terminal Circuit Diagram	1	22/9/94
DNET-Z-015	DNET Controller/Protocol Converter Internal Battery	1	22/9/94
DNET-Z-016	Hand Held Terminal PCB IS Areas on PCB	0	27/6/94
DNET-Z-017	Terminal Back Cover Battery, Fuse, Plug and Lugs	1	21/9/94
DNET-Z-021	DNET Terminal Carry Case	0	27/7/94
DNET-Z-023	DNET DI2 Dual Digital Inputs	0	7/2/94
DNET-Z-024	DNET DI2 VF Mounting Arrangement	0	29/7/94

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Drawing Schedule (continued)

Drawing No	Drawing Title	Revision/ Issue	Dated
DNET-Z-025 Shts 1 & 2	DNET Line Interface Module	0	1/8/94
DNET-Z-026	DNET Line Interface Module Printed Circuit Board	0	1/8/94
DNET-Z-027	DNET Line Interface Module Assembly	1	30/9/94
DNET-Z-029	DNET Slave Interface Unit Circuit Diagram	0	16/9/94
DNET-Z-030	DNET Slave Interface Printed Circuit Board	0	22/9/94
DNET-Z-031	DNET Slave Interface PCB and Terminal Arrangement	0	15/9/94
DNET-Z-034	DNET Controller Block Circuit Diagram	0	16/9/94
DNET-Z-035	DNET Optocoupler OPI110C	0	21/9/94

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA

Certification of

EXPLOSION PROTECTED ELECTRICAL EQUIPMENT

Administered by: Standards Australia Quality Assurance Services

Ex:3109X-1
Addendum to Certificate No.....

Schedule of Variations

Variation 1:

1. Minor alterations to the Line Interface Module involving changes to fuses F1 and F2 and alterations to the conformal coating applied to the printed circuit board.

2. Minor changes to the Hand Held Terminal involving a reduction in circuit capacitance.

Drawing Schedule for Variation 1

Drawing No	Drawing Title	Revision/ Issue	Dated
DNET-Y-013 Sht 1	DNET IS Stickers	3	30/11/95
DNET-Z-013 Sht 2	DNET IS Trafolyte Lables	3	30/11/95
DNET-Z-014 Shts 1 & 2	DNET Handheld Terminal Circuit Diagram	2	10/8/95
DNET-Z-016	DNET Handheld Terminal PCB IS Areas on PCB	2	28/11/95
DNET-Z-017	DNET Terminal Back Cover Battery	3	28/11/95
DNET-Z-025 Sht 1	DNET Line Interface Module Group I Circuit Diagram	1	30/1/95
DNET-Z-025 Sht 2	Line Interface Module Group II Circuit Diagram	1	30/1/95
DNET-Z-026	Line Interface Module Printed Circuit Board	1	27/1/95
DNET-Z-027	DNET Master Interface PCB and Terminal Arrangement	2	27/1/95

Issued by:

WORKCOVER AUTHORITY

Londonderry Occupational Safety Centre

132 Londonderry Road LONDONDERRY NSW 2753
Phone: (047) 244 900 Fax: (047) 244 999

STANDARDS AUSTRALIA