

# PROMUX

Distributed MODBUS I/O Modules



Catalog and Design Guide



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## 1. AN OVERVIEW OF THE PROMUX SYSTEM

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### 1.1 Introduction

PROMUX is an innovative modular I/O system which provides a simple low cost solution for distributed I/O requirements.

The PROMUX system consists of stand-alone Digital and Analog Input and Output modules which are connected together on a RS485 two wire multi-drop network.

The modules communicate using the MODBUS RTU protocol. A 32bit ARM CPU is used in the modules to provide high speed data processing and fast communications turnaround times. Multiple baud rates are selectable from 2400 to 115200 baud.

All PROMUX modules plug directly onto an industry standard DIN rail. All modules have a minimum isolation of 1000VAC rms between the field and logic.

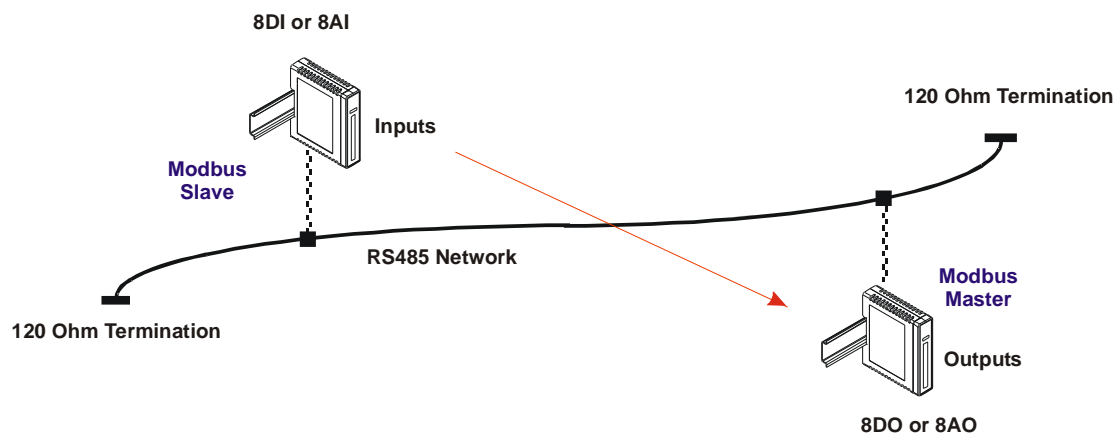
**The modules have been equipped with status led's which are used to indicate the status of the Inputs or outputs.** This visual indication assists with fault finding and diagnostics.

### 1.2 Application Configurations

There are a number of different configurations in which the PROMUX modules may be used in a system. Some are listed as follows:

#### 1.2.1 Simple Point to Point I/O.

This is the basic configuration where a maximum of 8 Digital or Analog Inputs will be transmitted to 8 Digital or Analog Outputs at a remote location on the network. The primary advantage of this configuration is cost saving where 9 wires are replaced by a single twisted pair. It may also be used on existing installations to avoid having to install additional cabling for expansion purposes. When the PM8DIO modules are used bi-directional data is sent between the modules.

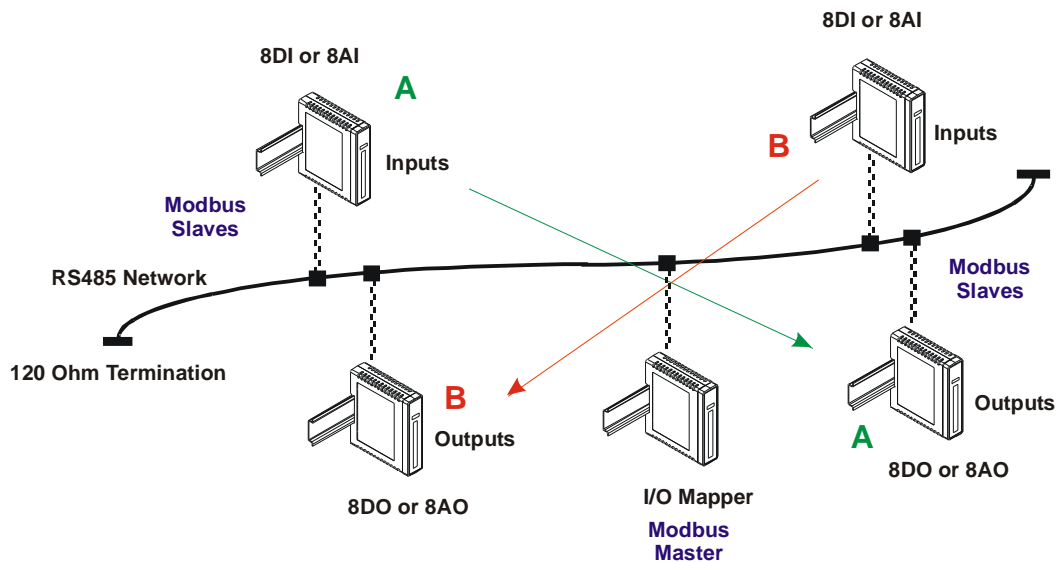


Modules that support the point to point mode are:

1. PM16DI to PM16DO
2. PM16DI to 4 x PM4RO
3. PM8DIO to PM8DIO
4. PM8AI/I (or PM8AI/V) to PM8AO
5. PM8AI/I (or PM8AI/V) to PM8VO
6. PMDAIO2 to PMDAIO2

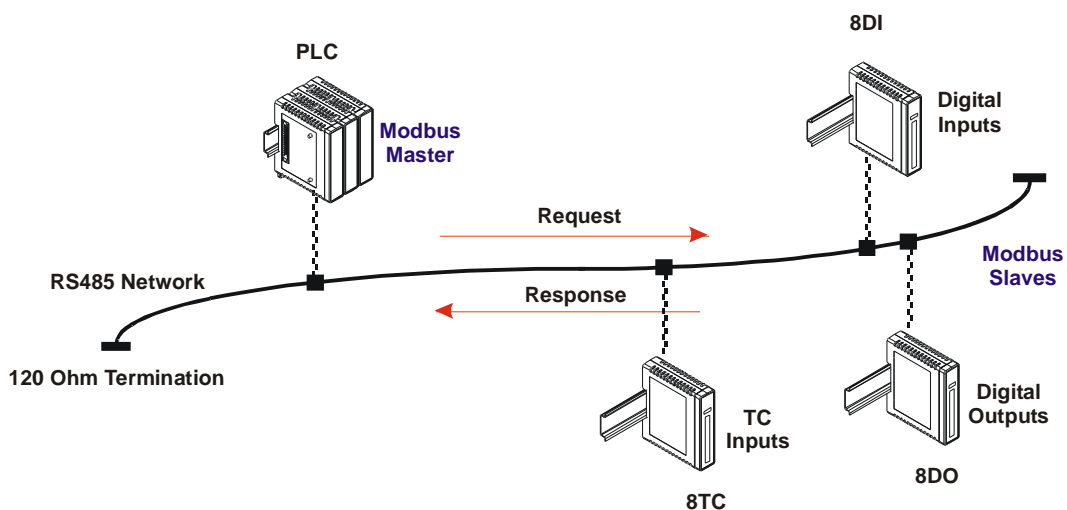
### 1.2.2 Complex Point to Point I/O.

This configuration allows for a larger number of I/O to be connected to the network at random points on the network. A maximum of 16 Digital Input Modules and 8 Analog Modules may be placed on the network, and the inputs are transmitted to a corresponding number of Digital or Analog Output Modules. In this configuration the Modules are set to operate in the MODBUS Slave mode and a Master Module called an I/O MAPPER is used to transmit the Inputs from the Input Modules to the Outputs on the Output Modules.



### 1.2.3 I/O Expansion.

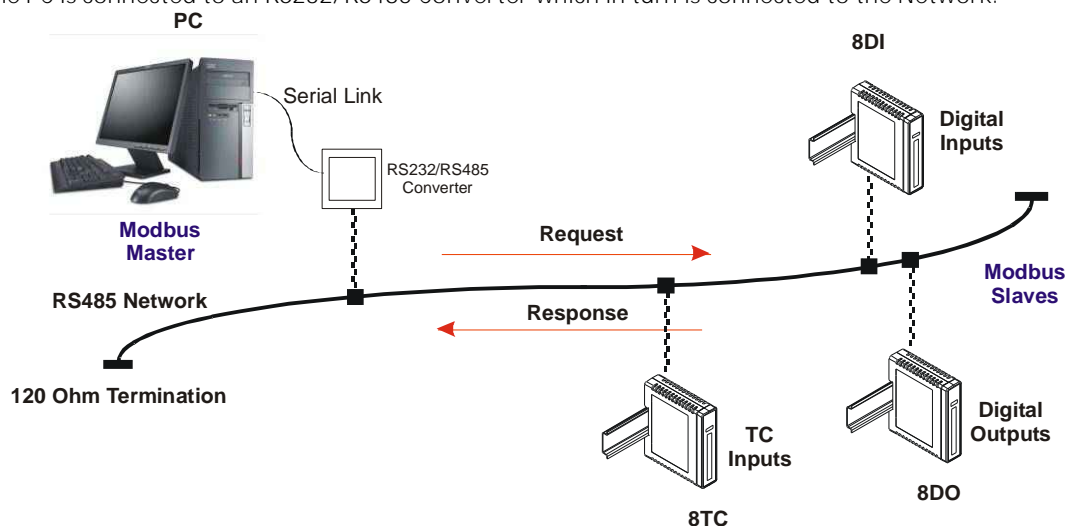
There are a number of devices such as PLC's (Programmable Logic Controllers) which have a MODBUS Communications facility available. When configured as a MODBUS Master, and attached to the RS485 network, the PLC can use the PROMUX Modules as remote I/O reducing cabling costs and increasing the I/O capability of the PLC.





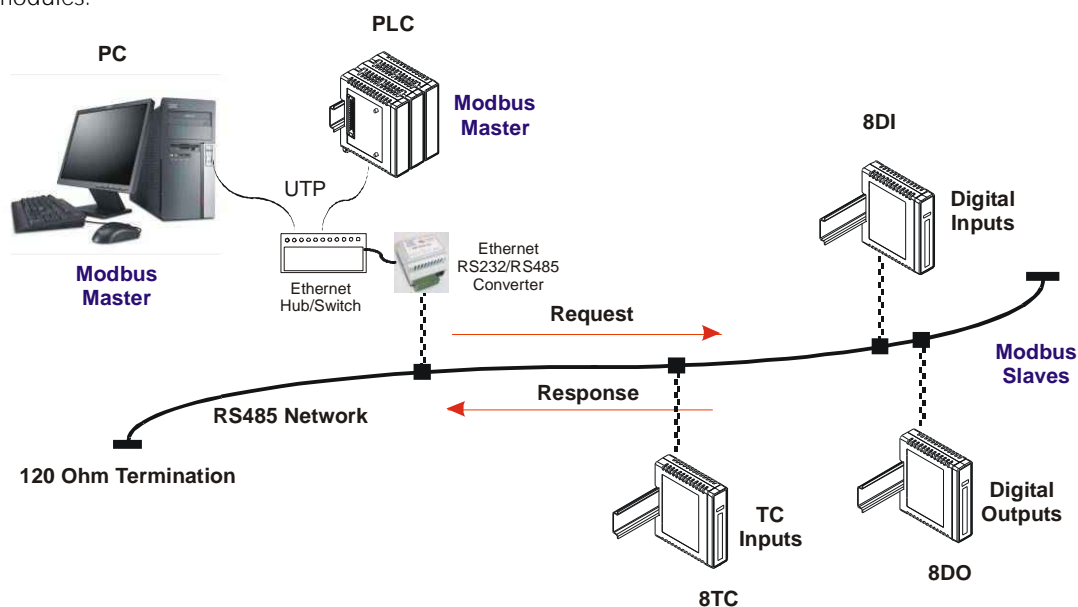
### 1.2.4 Data Acquisition.

Another use of the PROMUX Modules is for Data Acquisition where a PC (Personal Computer) is connected to the Network. Many SCADA software packages support the MODBUS Master Protocol and can hence retrieve data from Input Modules or send data to Output Modules. The serial port of the PC is connected to an RS232/RS485 Converter which in turn is connected to the Network.



### 1.2.5 Ethernet.

Procon has developed a Converter which connects to a standard 10/100BaseT Ethernet network. The Converter is given a network IP address and can be accessed by up to 4 PC's at a time. The converter enables PC's and PLC's using the MODBUS/TCP protocol to communicate with the range of PROMUX modules.



### 1.2.6 Other Applications.

PROMUX Modules can be connected to a PC or PLC for remote monitoring and control via radio telemetry using third party RF transceivers, Dial-up modems or GPRS modems.

### 1.3 Module Selection Table

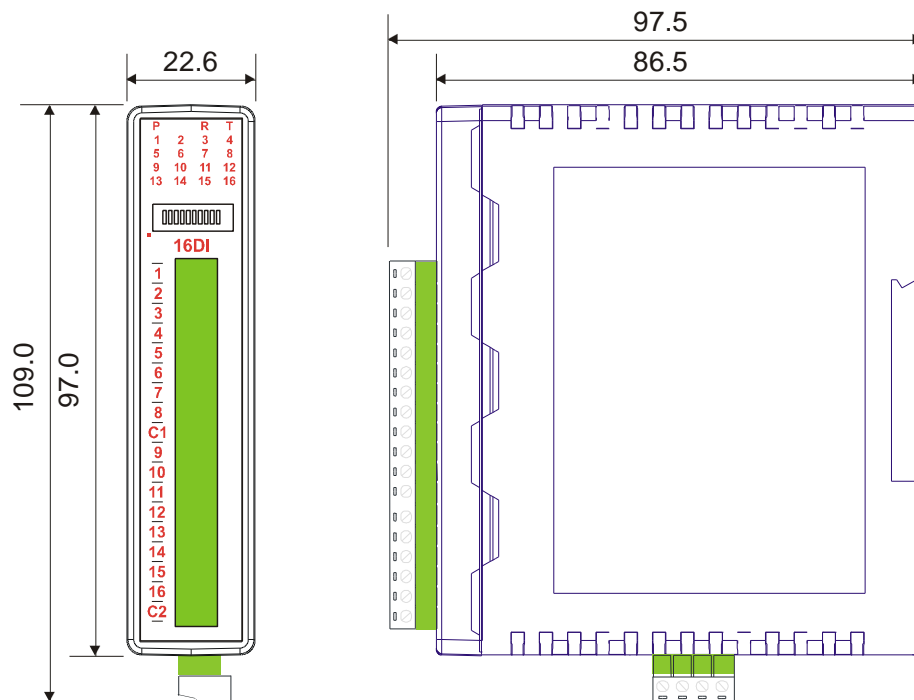
| MODEL          | MODULE TYPE   |
|----------------|---|
| I/O MODULES    |   |
| PM16DI         | 16 DIGITAL INPUT MODULE INCLUDING COUNTERS  |
| PM16DI-110     | 16 DIGITAL INPUT MODULE INCLUDING COUNTERS (110VAC I/P)   |
| PM16DI-220     | 16 DIGITAL INPUT MODULE INCLUDING COUNTERS (220VAC I/P)   |
| PM16DO         | 16 DIGITAL OUTPUT MODULE  |
| PM4RO          | 4 RELAY OUTPUT MODULE   |
| PM8DIO         | 8 DIGITAL INPUT / 8 DIGITAL OUTPUT MODULE   |
| PM8AI/I        | 8 ANALOG INPUT 0 - 20mA / 4 - 20mA  |
| PM8AI/V        | 8 ANALOG INPUT 0 - 5V / 1 - 5V / 0 - 10V / 2 - 10V  |
| PM8AI/I ISO    | 8 ANALOG INPUT 0 - 20mA / 4 - 20mA / $\pm 20$ mA FULLY ISOLATED   |
| PM8AI/V ISO    | 8 ANALOG INPUT 0 - 1V / 0 - 10V / $\pm 1$ V / $\pm 10$ V FULLY ISOLATED   |
| PM8TC          | 8 THERMOCOUPLE INPUT MODULE INCL. 0 - 50mV & $\pm 100$ mV I/P   |
| PM8TCISO       | 8 TC INPUT MODULE INCL. 0 - 50mV & $\pm 100$ mV I/P FULLY ISOLATED  |
| PM6RTD         | 6 RTD INPUT MODULE - PT100, Ni120, PT1000, Ni1000, Ni1000LG & Ohms  |
| PMDAIO         | 2 RTD I/P, 2 ANALOG INPUT 0 - 20mA / 0 - 10V, 1 ANALOG OUTPUT 0 - 20mA / 0 - 10V, 4 DIGITAL INPUTS, 2 DIGITAL OUTPUTS |
| PMDAIO2        | 2 ANALOG INPUT 0 - 20mA / 0 - 10V, 2 ANALOG OUTPUT 0 - 20mA, 4 DIGITAL INPUTS, 4 DIGITAL OUTPUTS                      |
| PM8AO          | 8 ANALOG OUTPUT MODULE 0(4) – 20mA  |
| PM8VO          | 8 ANALOG OUTPUT MODULE 0(2) – 10V   |
| PM485REP       | ISOLATED RS232/RS485 TO RS485 REPEATER  |
| PMFIBRE        | RS232/RS485 TO FIBRE OPTICS   |
| MODBUS MASTERS |   |
| PMIOMAP        | I/O MAPPER  |
| PMIOMAPTYPE2   | I/O MAPPER - ADVANCED   |

## 2. PROMUX GENERAL INFORMATION

### 2.1 Physical Dimensions

The PROMUX enclosure is shown below. The module clips directly onto an industry standard DIN rail. Field wiring is on the front of the module via a separate plug in connector. The module power and RS485 communications wiring is on a separate plug in connector on the underside of the housing.

Allow at least 25mm on front and below the module to accommodate the wiring. Ensure that enough space is kept above and below the module for good ventilation.



### 2.2 Grounding/Shielding

In most cases, PROMUX modules will be installed in an enclosure along with other devices which generate electromagnetic radiation. Examples of these devices are relays and contactors, transformers, motor controllers etc. This electromagnetic radiation can induce electrical noise into both power and signal lines, as well as direct radiation into the module causing negative effects on the system. Appropriate grounding, shielding and other protective steps should be taken at the installation stage to prevent these effects. These protective steps include control cabinet grounding, module grounding, cable shield grounding, protective elements for electromagnetic switching devices, correct wiring as well as consideration of cable types and their cross sections.

### 2.3 Network Termination

Transmission line effects often present a problem on data communication networks. These problems include reflections and signal attenuation.

To eliminate the presence of reflections from the end of the cable, the cable must be terminated at both ends with a resistor across the line equal to its characteristic impedance. Both ends must be terminated since the direction of propagation is bi-directional. In the case of an RS485 twisted pair cable this termination is typically 120 ohms.

## 2.4 RS485 Network Wiring

RS485 is designed to be used with a single twisted pair cable. One of the restrictions of this system is that the common mode voltages of the nodes on the network should not exceed -7V or +10V. In order to ensure that this condition is met, it is recommended that the 0V connections on the modules be connected together. For modules that are far apart, a second twisted pair should be used as the 0V link.

In certain applications where there are strong possibilities of an earth loop being caused by the 0V link, the link should be tied to the 0V terminal on each module through a 100ohm resistor, to limit the earth loop current.

Where earth loop problems exist, it may be necessary to isolate the RS485 network either using optical fiber or an isolated RS485 repeater such as the PM485REP module.

### RS485 Cabling Methodology

#### Method-1, Single Twisted pair, No shield

In this case, "Earth" is ground and it is inexpensive, easy to install. This kind of cabling is suitable if conduits are used for communication cables, power supply cables are not available and the environment is free from electrical noise. This method is not recommended for industrial applications.

#### Method-2, Shielded single twisted pair + Earth wire

One pair is used for RS-485 communications and extra wire used specifically for a ground wire.

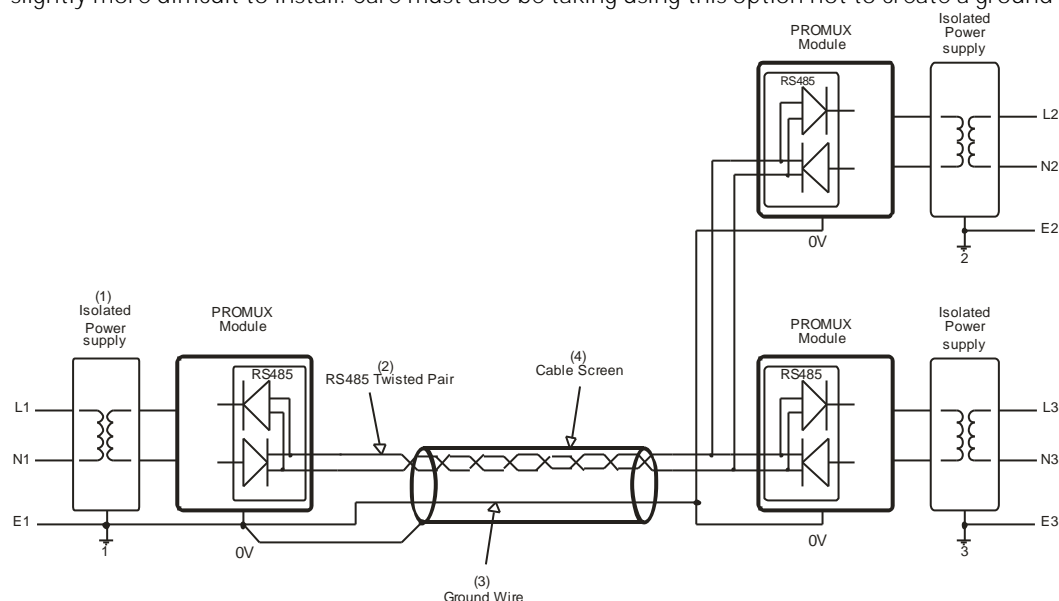
#### Method-3, Shielded single twisted pair cable

One pair is used for RS-485 communications and shield is used for return.

#### Method-4, Shielded twisted pair, 2 pairs

One pair is used for the RS-485 communications and another pair is used for ground.

Method 2 to 4 would reduce noise induced through ground potential differences. This is the preferred option in areas where there is a potential for high electrical noise or if cabling lacks the cleanliness of conduit or wire trays. The drawback of the three conductor option is elevated cable pricing and is slightly more difficult to install. Care must also be taking using this option not to create a ground loop.



Note: Pin1 at 4 pin connector is 0V terminal in IO modules

Good installation practice for RS485 systems:

1. Use isolated power supplies to ensure that the PROMUX modules are not earthed. Only one module on the network should be earthed. (Module1).
2. Use RS485 twisted cable to prevent electrical noise pickup.
3. Use a ground wire to connect all of the 0V terminals on the modules together. This ensures that all of the modules are at the same potential. The ground wire must be earthed at Module1 only.
4. Use a screened cable to prevent electrical noise pickup. This screen must be earthed at one end only, Module1. If a ground wire is not available then the screen can be used instead. To get the best performance this is not recommended.
5. The RS485 and power supply is wired correctly.
6. Do not carry RS485 and 24V DC power supply in same cables.
7. Use Separate isolated 24V DC for RS485 devices power supply and field inputs.
8. The 0V of the power supply must be earthed.
9. The screen of the RS485 cable must be earthed.
10. The RS485 devices must be at the same earth potential.
11. Use optical isolators in RS485 line to provide protection from low frequency interference from ground loops.
12. Do proper termination and/or shielding to provide isolation from high frequency interference, RFI, and transients.
13. The power supply must have good filters and protection on the 220V/110V side.
14. The RS485 line should have external over voltage protection to protect from high voltage electrical noise being induced into the RS485 cable.
15. Make sure there is a dedicated Instrumentation ground system to be used with RS485 devices.

## 2.5 RS485 Network Protection

Being used in an industrial environment, the RS485 network could pick up electrical noise from other machinery or even lightening. In this case it is advised that an RS485 network protection device be used at the entry point to the panel where the PROMUX modules are housed.

## 2.6 Setting the Modbus Node ID

### 2.6.1 Node ID Table

The following table assists with the setting up of DIP switches for the required NODE ID.

| NODE ID |     | DIP SWITCH SETTINGS |     |     |     |     |     |
|---------|-----|---------------------|-----|-----|-----|-----|-----|
|         | SW1 | SW2                 | SW3 | SW4 | SW5 | SW6 | SW7 |
| 0       | OFF | OFF                 | OFF | OFF | OFF | OFF | OFF |
| 1       | ON  | OFF                 | OFF | OFF | OFF | OFF | OFF |
| 2       | OFF | ON                  | OFF | OFF | OFF | OFF | OFF |
| 3       | ON  | ON                  | OFF | OFF | OFF | OFF | OFF |
| 4       | OFF | OFF                 | ON  | OFF | OFF | OFF | OFF |
| 5       | ON  | OFF                 | ON  | OFF | OFF | OFF | OFF |
| 6       | OFF | ON                  | ON  | OFF | OFF | OFF | OFF |
| 7       | ON  | ON                  | ON  | OFF | OFF | OFF | OFF |
| 8       | OFF | OFF                 | OFF | ON  | OFF | OFF | OFF |
| 9       | ON  | OFF                 | OFF | ON  | OFF | OFF | OFF |
| 10      | OFF | ON                  | OFF | ON  | OFF | OFF | OFF |
| 11      | ON  | ON                  | OFF | ON  | OFF | OFF | OFF |
| 12      | OFF | OFF                 | ON  | ON  | OFF | OFF | OFF |
| 13      | ON  | OFF                 | ON  | ON  | OFF | OFF | OFF |
| 14      | OFF | ON                  | ON  | ON  | OFF | OFF | OFF |
| 15      | ON  | ON                  | ON  | ON  | OFF | OFF | OFF |
| 16      | OFF | OFF                 | OFF | OFF | ON  | OFF | OFF |
| 17      | ON  | OFF                 | OFF | OFF | ON  | OFF | OFF |
| 18      | OFF | ON                  | OFF | OFF | ON  | OFF | OFF |
| 19      | ON  | ON                  | OFF | OFF | ON  | OFF | OFF |
| 20      | OFF | OFF                 | ON  | OFF | ON  | OFF | OFF |
| 21      | ON  | OFF                 | ON  | OFF | ON  | OFF | OFF |
| 22      | OFF | ON                  | ON  | OFF | ON  | OFF | OFF |
| 23      | ON  | ON                  | ON  | OFF | ON  | OFF | OFF |
| 24      | OFF | OFF                 | OFF | ON  | ON  | OFF | OFF |
| 25      | ON  | OFF                 | OFF | ON  | ON  | OFF | OFF |
| 26      | OFF | ON                  | OFF | ON  | ON  | OFF | OFF |
| 27      | ON  | ON                  | OFF | ON  | ON  | OFF | OFF |
| 28      | OFF | OFF                 | ON  | ON  | ON  | OFF | OFF |
| 29      | ON  | OFF                 | ON  | ON  | ON  | OFF | OFF |
| 30      | OFF | ON                  | ON  | ON  | ON  | OFF | OFF |
| 31      | ON  | ON                  | ON  | ON  | ON  | OFF | OFF |
| 32      | OFF | OFF                 | OFF | OFF | OFF | ON  | OFF |
| 33      | ON  | OFF                 | OFF | OFF | OFF | ON  | OFF |
| 34      | OFF | ON                  | OFF | OFF | OFF | ON  | OFF |
| 35      | ON  | ON                  | OFF | OFF | OFF | ON  | OFF |
| 36      | OFF | OFF                 | ON  | OFF | OFF | ON  | OFF |
| 37      | ON  | OFF                 | ON  | OFF | OFF | ON  | OFF |
| 38      | OFF | ON                  | ON  | OFF | OFF | ON  | OFF |
| 39      | ON  | ON                  | ON  | OFF | OFF | ON  | OFF |
| 40      | OFF | OFF                 | OFF | ON  | OFF | ON  | OFF |
| 41      | ON  | OFF                 | OFF | ON  | OFF | ON  | OFF |

| NODE ID |     | DIP SWITCH SETTINGS |     |     |     |     |     |
|---------|-----|---------------------|-----|-----|-----|-----|-----|
|         | SW1 | SW2                 | SW3 | SW4 | SW5 | SW6 | SW7 |
|         |     |                     |     |     |     |     |     |
| 42      | OFF | ON                  | OFF | ON  | OFF | ON  | OFF |
| 43      | ON  | ON                  | OFF | ON  | OFF | ON  | OFF |
| 44      | OFF | OFF                 | ON  | ON  | OFF | ON  | OFF |
| 45      | ON  | OFF                 | ON  | ON  | OFF | ON  | OFF |
| 46      | OFF | ON                  | ON  | ON  | OFF | ON  | OFF |
| 47      | ON  | ON                  | ON  | ON  | OFF | ON  | OFF |
| 48      | OFF | OFF                 | OFF | OFF | ON  | ON  | OFF |
| 49      | ON  | OFF                 | OFF | OFF | ON  | ON  | OFF |
| 50      | OFF | ON                  | OFF | OFF | ON  | ON  | OFF |
| 51      | ON  | ON                  | OFF | OFF | ON  | ON  | OFF |
| 52      | OFF | OFF                 | ON  | OFF | ON  | ON  | OFF |
| 53      | ON  | OFF                 | ON  | OFF | ON  | ON  | OFF |
| 54      | OFF | ON                  | ON  | OFF | ON  | ON  | OFF |
| 55      | ON  | ON                  | ON  | OFF | ON  | ON  | OFF |
| 56      | OFF | OFF                 | OFF | ON  | ON  | ON  | OFF |
| 57      | ON  | OFF                 | OFF | ON  | ON  | ON  | OFF |
| 58      | OFF | ON                  | OFF | ON  | ON  | ON  | OFF |
| 59      | ON  | ON                  | OFF | ON  | ON  | ON  | OFF |
| 60      | OFF | OFF                 | ON  | ON  | ON  | ON  | OFF |
| 61      | ON  | OFF                 | ON  | ON  | ON  | ON  | OFF |
| 62      | OFF | ON                  | ON  | ON  | ON  | ON  | OFF |
| 63      | ON  | ON                  | ON  | ON  | ON  | ON  | OFF |
| 64      | OFF | OFF                 | OFF | OFF | OFF | OFF | ON  |
| 65      | ON  | OFF                 | OFF | OFF | OFF | OFF | ON  |
| 66      | OFF | ON                  | OFF | OFF | OFF | OFF | ON  |
| 67      | ON  | ON                  | OFF | OFF | OFF | OFF | ON  |
| 68      | OFF | OFF                 | ON  | OFF | OFF | OFF | ON  |
| 69      | ON  | OFF                 | ON  | OFF | OFF | OFF | ON  |
| 70      | OFF | ON                  | ON  | OFF | OFF | OFF | ON  |
| 71      | ON  | ON                  | ON  | OFF | OFF | OFF | ON  |
| 72      | OFF | OFF                 | OFF | ON  | OFF | OFF | ON  |
| 73      | ON  | OFF                 | OFF | ON  | OFF | OFF | ON  |
| 74      | OFF | ON                  | OFF | ON  | OFF | OFF | ON  |
| 75      | ON  | ON                  | OFF | ON  | OFF | OFF | ON  |
| 76      | OFF | OFF                 | ON  | ON  | OFF | OFF | ON  |
| 77      | ON  | OFF                 | ON  | ON  | OFF | OFF | ON  |
| 78      | OFF | ON                  | ON  | ON  | OFF | OFF | ON  |
| 79      | ON  | ON                  | ON  | ON  | OFF | OFF | ON  |
| 80      | OFF | OFF                 | OFF | OFF | ON  | OFF | ON  |
| 81      | ON  | OFF                 | OFF | OFF | ON  | OFF | ON  |
| 82      | OFF | ON                  | OFF | OFF | ON  | OFF | ON  |
| 83      | ON  | ON                  | OFF | OFF | ON  | OFF | ON  |
| 84      | OFF | OFF                 | ON  | OFF | ON  | OFF | ON  |
| 85      | ON  | OFF                 | ON  | OFF | ON  | OFF | ON  |
| 86      | OFF | ON                  | ON  | OFF | ON  | OFF | ON  |
| 87      | ON  | ON                  | ON  | OFF | ON  | OFF | ON  |
| 88      | OFF | OFF                 | OFF | ON  | ON  | OFF | ON  |
| 89      | ON  | OFF                 | OFF | ON  | ON  | OFF | ON  |
| 90      | OFF | ON                  | OFF | ON  | ON  | OFF | ON  |

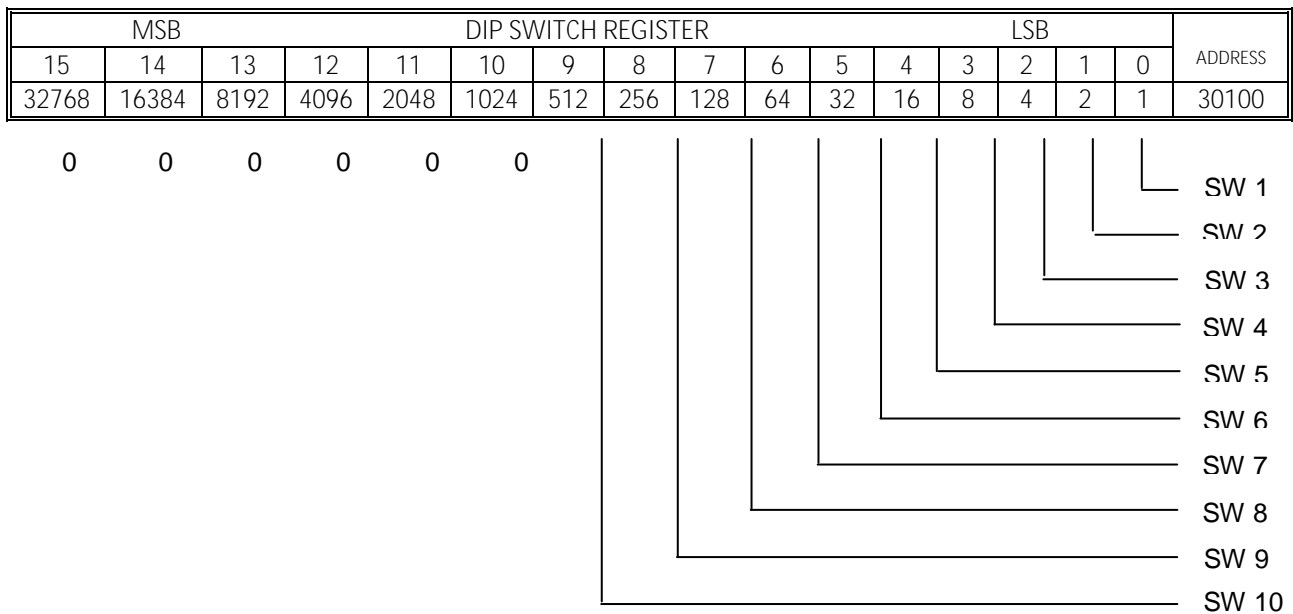
| NODE ID |     | DIP SWITCH SETTINGS |     |     |     |     |     |
|---------|-----|---------------------|-----|-----|-----|-----|-----|
|         | SW1 | SW2                 | SW3 | SW4 | SW5 | SW6 | SW7 |
| 91      | ON  | ON                  | OFF | ON  | ON  | OFF | ON  |
| 92      | OFF | OFF                 | ON  | ON  | ON  | OFF | ON  |
| 93      | ON  | OFF                 | ON  | ON  | ON  | OFF | ON  |
| 94      | OFF | ON                  | ON  | ON  | ON  | OFF | ON  |
| 95      | ON  | ON                  | ON  | ON  | ON  | OFF | ON  |
| 96      | OFF | OFF                 | OFF | OFF | OFF | ON  | ON  |
| 97      | ON  | OFF                 | OFF | OFF | OFF | ON  | ON  |
| 98      | OFF | ON                  | OFF | OFF | OFF | ON  | ON  |
| 99      | ON  | ON                  | OFF | OFF | OFF | ON  | ON  |
| 100     | OFF | OFF                 | ON  | OFF | OFF | ON  | ON  |
| 101     | ON  | OFF                 | ON  | OFF | OFF | ON  | ON  |
| 102     | OFF | ON                  | ON  | OFF | OFF | ON  | ON  |
| 103     | ON  | ON                  | ON  | OFF | OFF | ON  | ON  |
| 104     | OFF | OFF                 | OFF | ON  | OFF | ON  | ON  |
| 105     | ON  | OFF                 | OFF | ON  | OFF | ON  | ON  |
| 106     | OFF | ON                  | OFF | ON  | OFF | ON  | ON  |
| 107     | ON  | ON                  | OFF | ON  | OFF | ON  | ON  |
| 108     | OFF | OFF                 | ON  | ON  | OFF | ON  | ON  |
| 109     | ON  | OFF                 | ON  | ON  | OFF | ON  | ON  |
| 110     | OFF | ON                  | ON  | ON  | OFF | ON  | ON  |
| 111     | ON  | ON                  | ON  | ON  | OFF | ON  | ON  |
| 112     | OFF | OFF                 | OFF | OFF | ON  | ON  | ON  |
| 113     | ON  | OFF                 | OFF | OFF | ON  | ON  | ON  |
| 114     | OFF | ON                  | OFF | OFF | ON  | ON  | ON  |
| 115     | ON  | ON                  | OFF | OFF | ON  | ON  | ON  |
| 116     | OFF | OFF                 | ON  | OFF | ON  | ON  | ON  |
| 117     | ON  | OFF                 | ON  | OFF | ON  | ON  | ON  |
| 118     | OFF | ON                  | ON  | OFF | ON  | ON  | ON  |
| 119     | ON  | ON                  | ON  | OFF | ON  | ON  | ON  |
| 120     | OFF | OFF                 | OFF | ON  | ON  | ON  | ON  |
| 121     | ON  | OFF                 | OFF | ON  | ON  | ON  | ON  |
| 122     | OFF | ON                  | OFF | ON  | ON  | ON  | ON  |
| 123     | ON  | ON                  | OFF | ON  | ON  | ON  | ON  |
| 124     | OFF | OFF                 | ON  | ON  | ON  | ON  | ON  |
| 125     | ON  | OFF                 | ON  | ON  | ON  | ON  | ON  |
| 126     | OFF | ON                  | ON  | ON  | ON  | ON  | ON  |
| 127     | ON  | ON                  | ON  | ON  | ON  | ON  | ON  |

All modules will respond to a default Node ID of 254.



## 2.6.2 DIP Switch Status Register.

Each module uses register 30100 to store the status of the DIP switches.



## 2.7 Communications Settings

The data in the modules is stored in 16 bit registers. These registers are accessed over the network using the MODBUS RTU communication protocol.

### 2.7.1 Communications Settings with DIP Switch 10 Off (Default)

|           |      |
|-----------|------|
| BAUD RATE | 9600 |
| DATA BITS | 8    |
| PARITY    | NONE |
| STOP BITS | 1    |

### 2.7.2 Communications Settings with DIP Switch 10 On (Programmed Baud Rate)

|           |   |
|-----------|---|
| BAUD RATE | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| DATA BITS | 8   |
| PARITY    | None, Even, Odd                                       |
| STOP BITS | 1, 2  |

### 2.7.3 Communications Settings Registers

|       |             |      |       |     |   |
|-------|-------------|------|-------|-----|---|
| 40121 | Baud Rate   | 2400 | 18750 | R/W | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122 | Parity      | 0    | 2     | R/W | 0 = none, 1 = even, 2 = odd                           |
| 40123 | Stop Bits   | 1    | 2     | R/W | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124 | Reply Delay | 0    | 255   | R/W | (x10ms)   |

### 2.7.3.1 Baud Rate Register (40121)

The baud rate value is programmed directly into the baud rate register. The only exception is the 115200 baud rate where the value 11520 is used and 187500 baud where the value 18750 is used.

### 2.7.3.2 Parity Register (40122)

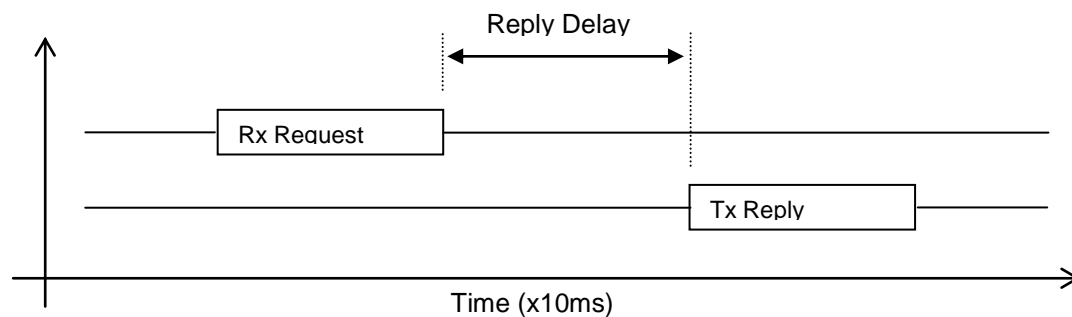
The parity can be set to none by writing a 0 to the parity register, set to even by writing a 1 to the parity Register or set to odd by writing a 2 to the parity register.

### 2.7.3.3 Stop Bits Register (40123)

The number of stop bits can be set to 1 by writing a 1 to the stop bits register or set to 2 by writing a 2 to the stop bits Register.

### 2.7.3.4 Reply Delay Register (40124)

The reply delay is a time delay between the Modbus message received to the reply being sent. In some applications where a modem or radio is used in the RS485 network, it may be necessary to add a reply delay due to turn around delays in the equipment.



## 2.7.4 Modbus Register Types

There are 4 types of variables which can be accessed from the module. Each module has one or more of these data variables.

| <u>Type</u> | <u>Start Address</u> | <u>Variable</u>           | <u>Access</u> |
|-------------|----------------------|---------------------------|---------------|
| 1           | 00001                | Digital Outputs           | Read & Write  |
| 2           | 10001                | Digital Inputs            | Read Only     |
| 3           | 30001                | Input registers (Analog)  | Read Only     |
| 4           | 40001                | Output registers (Analog) | Read & Write  |

Note: The Modbus message length must be limited to 100 consecutive read or write registers. If more registers are required then a new poll group must be added for the next xxx registers.

## 2.7.5 Modbus Functions

The PROMUX modules will respond to the following Modbus functions:

- Function 1 – Read I/O status (Digital Inputs and Outputs)
- Function 2 – Read I/O status (Digital Inputs and Outputs)
- Function 3 – Read Register (Analog Inputs and Outputs)
- Function 4 – Read Register (Analog Inputs and Outputs)
- Function 5 – Write Single Digital Output (Digital Outputs)
- Function 6 – Write Single Register (Analog Outputs)
- Function 15 – Write Multiple Digital Outputs (Digital Outputs)
- Function 16 – Write Multiple Registers (Analog Outputs)

## 3. PROMUX MODULES

### 3.1 PM16DI - DIGITAL INPUTS WITH COUNTERS

#### 3.1.1 Description

The PM16DI module is a 16 channel digital input module. The inputs are isolated from the logic by bi-directional opto-couplers. The inputs are divided into 2 isolated groups of 8 inputs each. This allows for many configurations in which the input module may be used. One such configuration could be where one group is connected as common positive and the second group connected as common negative.

The counters operate in three modes:  
In mode 0: All the counters are disabled.

In mode 1: The counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In mode 2: The inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1. In the same way, inputs 3&4 operate counter 2, inputs 5&6 operate counter 3 and inputs 7&8 operate counter 4, etc.

When the input filter is configured for > 10ms (Input Filter > 1), the 16 counters are saved in non-volatile memory and the count value will be saved when power fails.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.



#### 3.1.2 Technical Specification of PM16DI

|                            |                         |                                      |
|----------------------------|-------------------------|--------------------------------------|
| Power Supply               | Logic Supply Voltage    | 12 -24 Vdc                           |
|                            | Logic Supply Current    | 30mA @ 12V / 17mA @ 24V              |
| Digital Inputs             | Input Points            | 16                                   |
|                            | Input Voltage Range     | 12 - 24 Vdc                          |
|                            | Input Current per input | 5mA @ 12Vdc / 11mA @ 24Vdc           |
|                            | Isolation               | 1500Vrms between field and logic     |
| Counters (Filter disabled) | Inputs                  | 1 to 16                              |
|                            | Resolution              | 32 Bits                              |
|                            | Frequency               | 1KHz (max)                           |
|                            | Pulse Width             | 500us (min)                          |
| Counters (Filter > 1)      | Inputs                  | 1 to 16                              |
|                            | Resolution              | 32 Bits                              |
|                            | Frequency               | 25Hz (max)                           |
|                            | Pulse Width             | 20ms (min)                           |
| Temperature                | Operating Temperature.  | -40°C to + 80°C                      |
|                            | Storage Temperature     | -40°C to + 85°C                      |
| Connectors                 | Logic Power and Comms.  | 4 Pin Connector on underside of unit |
|                            | Inputs                  | 18 Way screw connector on front      |

Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.

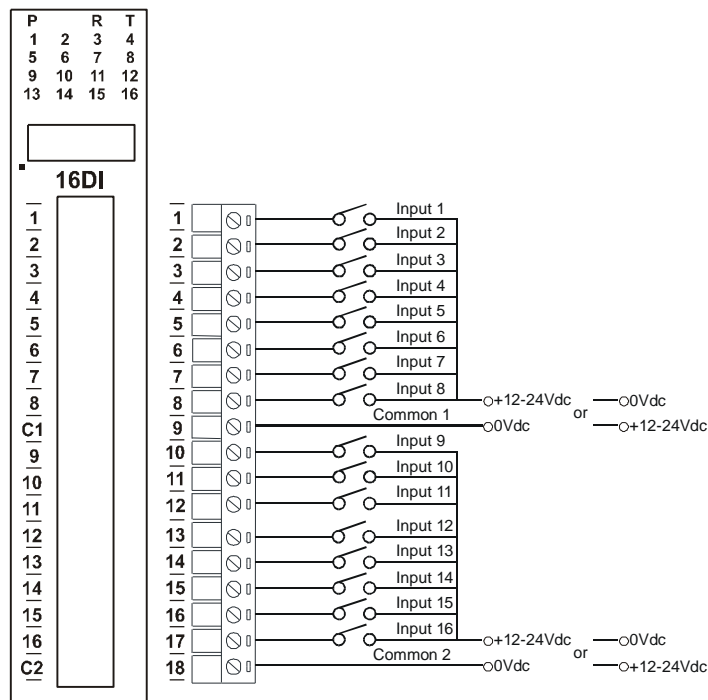
### 3.1.3 Status Indicators

|               |  |
|---------------|--|
| Power:        | Flashes to indicate the CPU is running.                                  |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.        |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.                  |
| Input Status: | <b>"OFF" when the input is off.</b><br><b>"ON" when the input is on.</b> |

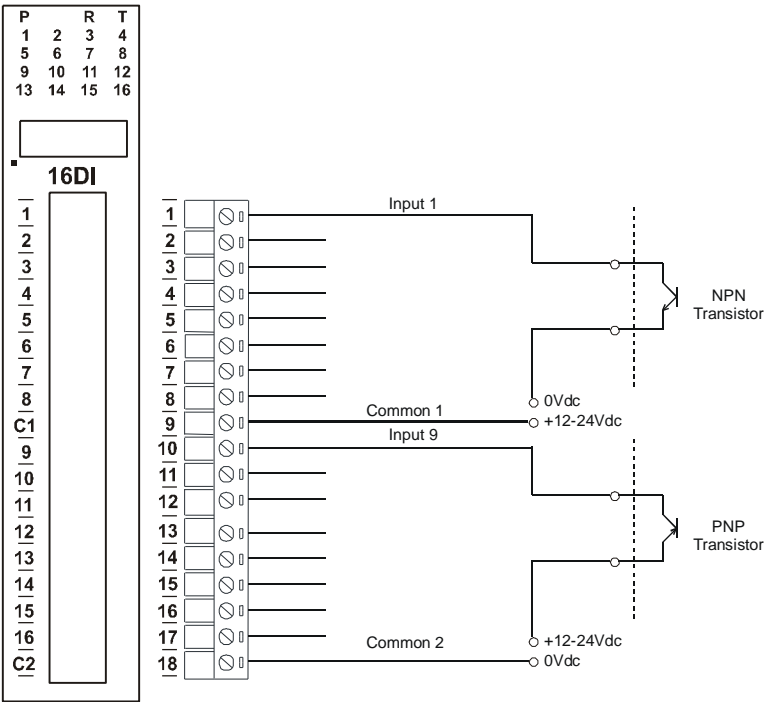


### 3.1.4 Wiring

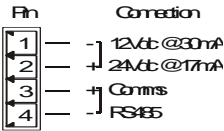
The following diagram shows how the digital inputs are connected to potential free switches. The common can be connected to positive or negative as indicated.



The following diagram shows how the digital inputs are connected a NPN transistor or a PNP transistor.



The following diagram shows the wiring for the power and RS485 communications.



### 3.1.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7                                      |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | INVERT      | When switched ON the status of the inputs are inverted in the Modbus status register (30002). |
| 9      | -           | Not Used.   |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.1.6 PM16DI Data Registers ( MODULE TYPE = 100)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description  |
|----------------|---------------------------|-----------|------------|--------|--|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.  |
| 10002          | Digital Input 2           | 0         | 1          | R      |  |
| 10003          | Digital Input 3           | 0         | 1          | R      |  |
| 10004          | Digital Input 4           | 0         | 1          | R      |  |
| 10005          | Digital Input 5           | 0         | 1          | R      |  |
| 10006          | Digital Input 6           | 0         | 1          | R      |  |
| 10007          | Digital Input 7           | 0         | 1          | R      |  |
| 10008          | Digital Input 8           | 0         | 1          | R      |  |
| 10009          | Digital Input 9           | 0         | 1          | R      |  |
| 10010          | Digital Input 10          | 0         | 1          | R      |  |
| 10011          | Digital Input 11          | 0         | 1          | R      |  |
| 10012          | Digital Input 12          | 0         | 1          | R      |  |
| 10013          | Digital Input 13          | 0         | 1          | R      |  |
| 10014          | Digital Input 14          | 0         | 1          | R      |  |
| 10015          | Digital Input 15          | 0         | 1          | R      |  |
| 10016          | Digital Input 16          | 0         | 1          | R      |  |
|                |                           |           |            |        |  |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 100                                   |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in 16 bits. 16 - 1.   |
| 40003          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit Counter with range 0 to 4294967295. |
| 40004          | Counter 1 LSB             | 0         | 65535      | R/W    |  |
| 40005          | Counter 2 MSB             | 0         | 65535      | R/W    | "  |
| 40006          | Counter 2 LSB             | 0         | 65535      | R/W    | "  |
| 40007          | Counter 3 MSB             | 0         | 65535      | R/W    | "  |
| 40008          | Counter 3 LSB             | 0         | 65535      | R/W    | "  |
| 40009          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40010          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40011          | Counter 5 MSB             | 0         | 65535      | R/W    | "  |
| 40012          | Counter 5 LSB             | 0         | 65535      | R/W    | "  |
| 40013          | Counter 6 MSB             | 0         | 65535      | R/W    | "  |
| 40014          | Counter 6 LSB             | 0         | 65535      | R/W    | "  |
| 40015          | Counter 7 MSB             | 0         | 65535      | R/W    | "  |
| 40016          | Counter 7 LSB             | 0         | 65535      | R/W    | "  |
| 40017          | Counter 8 MSB             | 0         | 65535      | R/W    | "  |
| 40018          | Counter 8 LSB             | 0         | 65535      | R/W    | "  |
| 40019          | Counter 9 MSB             | 0         | 65535      | R/W    | "  |
| 40020          | Counter 9 LSB             | 0         | 65535      | R/W    | "  |
| 40021          | Counter 10MSB             | 0         | 65535      | R/W    | "  |
| 40022          | Counter 10LSB             | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name   | Low Limit | High Limit | Access | Description  |
|----------------|-----------------|-----------|------------|--------|--|
| 40023          | Counter 11MSB   | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit                     |
| 40024          | Counter 11LSB   | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40025          | Counter 12MSB   | 0         | 65535      | R/W    | "  |
| 40026          | Counter 12LSB   | 0         | 65535      | R/W    | "  |
| 40027          | Counter 13MSB   | 0         | 65535      | R/W    | "  |
| 40028          | Counter 13LSB   | 0         | 65535      | R/W    | "  |
| 40029          | Counter 14MSB   | 0         | 65535      | R/W    | "  |
| 40030          | Counter 14LSB   | 0         | 65535      | R/W    | "  |
| 40031          | Counter 15MSB   | 0         | 65535      | R/W    | "  |
| 40032          | Counter 15LSB   | 0         | 65535      | R/W    | "  |
| 40033          | Counter 16MSB   | 0         | 65535      | R/W    | "  |
| 40034          | Counter 16LSB   | 0         | 65535      | R/W    | "  |
| 40035          | Counter Capture | 0         | 65535      | R/W    | Bit1 = 1 to Capture Counter1, Bit2 = 1 to Capture Counter2, etc. |
| 40036          | CCounter 1 MSB  | 0         | 65535      | R/W    | Capture Counter Registers. MSB and LSB                           |
| 40037          | CCounter 1 LSB  | 0         | 65535      | R/W    | combine to give a 32 bit Value.                                  |
| 40038          | CCounter 2 MSB  | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40039          | CCounter 2 LSB  | 0         | 65535      | R/W    |  |
| 40040          | CCounter 3 MSB  | 0         | 65535      | R/W    | "  |
| 40041          | CCounter 3 LSB  | 0         | 65535      | R/W    | "  |
| 40042          | CCounter 4 MSB  | 0         | 65535      | R/W    | "  |
| 40043          | CCounter 4 LSB  | 0         | 65535      | R/W    | "  |
| 40044          | CCounter 5 MSB  | 0         | 65535      | R/W    | "  |
| 40045          | CCounter 5 LSB  | 0         | 65535      | R/W    | "  |
| 40046          | CCounter 6 MSB  | 0         | 65535      | R/W    | "  |
| 40047          | CCounter 6 LSB  | 0         | 65535      | R/W    | "  |
| 40048          | CCounter 7 MSB  | 0         | 65535      | R/W    | "  |
| 40049          | CCounter 7 LSB  | 0         | 65535      | R/W    | "  |
| 40050          | CCounter 8 MSB  | 0         | 65535      | R/W    | "  |
| 40051          | CCounter 8 LSB  | 0         | 65535      | R/W    | "  |
| 40052          | CCounter 9 MSB  | 0         | 65535      | R/W    | "  |
| 40053          | CCounter 9 LSB  | 0         | 65535      | R/W    | "  |
| 40054          | CCounter 10MSB  | 0         | 65535      | R/W    | "  |
| 40055          | CCounter 10LSB  | 0         | 65535      | R/W    | "  |
| 40056          | CCounter 11MSB  | 0         | 65535      | R/W    | "  |
| 40057          | CCounter 11LSB  | 0         | 65535      | R/W    | "  |
| 40058          | CCounter 12MSB  | 0         | 65535      | R/W    | "  |
| 40059          | CCounter 12LSB  | 0         | 65535      | R/W    | "  |
| 40060          | CCounter 13MSB  | 0         | 65535      | R/W    | "  |
| 40061          | CCounter 13LSB  | 0         | 65535      | R/W    | "  |
| 40062          | CCounter 14MSB  | 0         | 65535      | R/W    | "  |
| 40063          | CCounter 14LSB  | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name  | Low Limit | High Limit | Access | Description   |
|----------------|----------------|-----------|------------|--------|---|
| 40064          | CCounter 15MSB | 0         | 65535      | R/W    | "   |
| 40065          | CCounter 15LSB | 0         | 65535      | R/W    | "   |
| 40066          | CCounter 16MSB | 0         | 65535      | R/W    | "   |
| 40067          | CCounter 16LSB | 0         | 65535      | R/W    | "   |
| 30100          | DIP Switch     | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | Counter Mode   | 0         | 2          | R/W    | 0=Disable, 1=Up Counting, 2=Up/Down Count             |
| 40102          | Input Filter   | 0         | 65535      | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |
| 40103          | Capture Zero   | 0         | 65535      | R/W    | 0 = Disabled, bit1 = auto zero counter 1.             |
| 40121          | Baud Rate      | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity         | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits      | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay    | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.1.6.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

| MSB                  |       |      | PM16DI DIGITAL INPUTS |      |      |     |     |     |    |    |    |   |   |   | LSB |       |  | ADDRESS |
|----------------------|-------|------|-----------------------|------|------|-----|-----|-----|----|----|----|---|---|---|-----|-------|--|---------|
| 15                   | 14    | 13   | 12                    | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0   |       |  |         |
| 32768                | 16384 | 8192 | 4096                  | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1   | 30002 |  |         |
| 16                   | 15    | 14   | 13                    | 12   | 11   | 10  | 9   | 8   | 7  | 6  | 5  | 4 | 3 | 2 | 1   |       |  |         |
| Digital Input Number |       |      |                       |      |      |     |     |     |    |    |    |   |   |   |     |       |  |         |

### 3.1.6.2 Counter Registers.

The counters are stored as two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.

Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

### 3.1.6.3 Counter Capture.

To capture a counter a 1 must be written to the corresponding bit position in the Counter Capture Register 40035. For example:

1. Writing 1 to Register 40035 results in Counter 1 value being captured to Counter Capture 1.
2. Writing 2 to Register 40035 results in Counter 2 value being captured to Counter Capture 2.
3. Writing 3 to Register 40035 results in Counter 1 value being captured to Counter Capture 1 and Counter 2 value being captured to Counter Capture 2.



Once the module has Captured the counters, the Counter Capture Register 40035 is cleared to zero. It is possible to read this register to get confirmation that the capture is complete before reading the captured counter values.

#### 3.1.6.4 Counter Auto Zero.

The counter being captured can be auto zeroed. The purpose of this function is to let the module zero the counter so that no counts get lost due to delays from communication latency, etc.

To ensure that a counter is auto zeroed, a 1 must be written to the corresponding bit position in the Capture Zero Register 40103. For example:

Writing 1 to Register 40103 results in Counter 1 value being zeroed when the Counter Capture bit is 1.

The value in the Capture Zero Register 40103 is permanently stored in memory and only has to be configured once.



## 3.2 PM16DI110 - DIGITAL INPUTS WITH COUNTERS

### 3.2.1 Description

The PM16DI110 module is a 16 channel digital input module. The inputs are isolated from the logic by bi-directional opto-couplers. The inputs are divided into 2 isolated groups of 8 inputs each. The inputs are designed for 110VAC input voltages.

The counters operate in three modes.

In mode 0: All the counters are disabled.

In mode 1: The counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In mode 2: The inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1. In the same way, inputs 3&4 operate counter 2, inputs 5&6 operate counter 3 and inputs 7&8 operate counter 4,etc.

Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.



### 3.2.2 Technical Specification of PM16DI110

|                |                         |                                      |
|----------------|-------------------------|--------------------------------------|
| Power Supply   | Logic Supply Voltage    | 12 -24 Vdc                           |
|                | Logic Supply Current    | 30mA @ 12V / 17mA @ 24V              |
| Digital Inputs | Input Points            | 16                                   |
|                | Input Voltage Range     | 100 – 130VAC 50/60Hz                 |
|                | Input Current per input | 2mA                                  |
|                | Isolation               | 1500Vrms between field and logic     |
| Counters       | Inputs                  | 1 to 16                              |
|                | Resolution              | 32 Bits                              |
|                | Frequency               | 10Hz (max)                           |
|                | Pulse Width             | 50ms (min)                           |
| Temperature    | Operating Temperature   | -40°C to + 80°C                      |
|                | Storage Temperature     | -40°C to + 85°C                      |
| Connectors     | Logic Power and Comms.  | 4 Pin Connector on underside of unit |
|                | Inputs                  | 18 Way screw connector on front      |
|                |                         |                                      |
|                |                         |                                      |

Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.

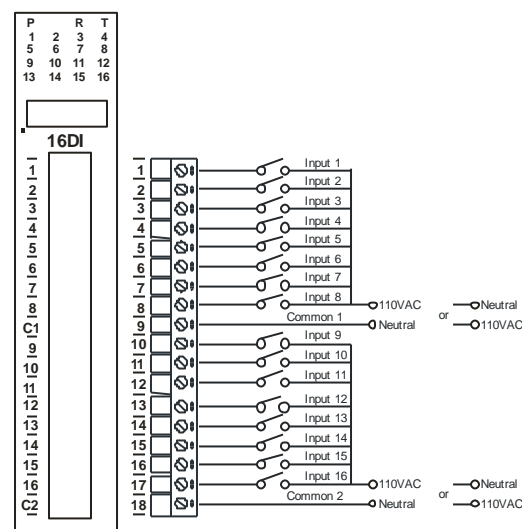
### 3.2.3 Status Indicators

|               |   |
|---------------|---|
| Power:        | Flashes to indicate the CPU is running.                               |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.     |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.               |
| Input Status: | <p>“OFF” when the input is off.</p> <p>“ON” when the input is on.</p> |

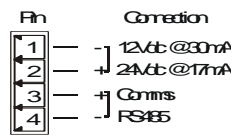


### 3.2.4 Wiring

The following diagram shows how the digital inputs are connected to potential free switches. The common can be connected to live or neutral as indicated.



The following diagram shows the wiring for the power and RS485 communications.



### 3.2.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7                                      |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | INVERT      | When switched ON the status of the inputs are inverted in the Modbus status register (30002). |
| 9      | -           | Not Used.   |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.2.6 PM16DI110 Data Registers ( MODULE TYPE = 115)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description  |
|----------------|---------------------------|-----------|------------|--------|--|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.  |
| 10002          | Digital Input 2           | 0         | 1          | R      |  |
| 10003          | Digital Input 3           | 0         | 1          | R      |  |
| 10004          | Digital Input 4           | 0         | 1          | R      |  |
| 10005          | Digital Input 5           | 0         | 1          | R      |  |
| 10006          | Digital Input 6           | 0         | 1          | R      |  |
| 10007          | Digital Input 7           | 0         | 1          | R      |  |
| 10008          | Digital Input 8           | 0         | 1          | R      |  |
| 10009          | Digital Input 9           | 0         | 1          | R      |  |
| 10010          | Digital Input 10          | 0         | 1          | R      |  |
| 10011          | Digital Input 11          | 0         | 1          | R      |  |
| 10012          | Digital Input 12          | 0         | 1          | R      |  |
| 10013          | Digital Input 13          | 0         | 1          | R      |  |
| 10014          | Digital Input 14          | 0         | 1          | R      |  |
| 10015          | Digital Input 15          | 0         | 1          | R      |  |
| 10016          | Digital Input 16          | 0         | 1          | R      |  |
|                |                           |           |            |        |  |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 115                                   |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in 16 bits. 16 - 1.   |
| 40003          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit Counter with range 0 to 4294967295. |
| 40004          | Counter 1 LSB             | 0         | 65535      | R/W    |  |
| 40005          | Counter 2 MSB             | 0         | 65535      | R/W    | "  |
| 40006          | Counter 2 LSB             | 0         | 65535      | R/W    | "  |
| 40007          | Counter 3 MSB             | 0         | 65535      | R/W    | "  |
| 40008          | Counter 3 LSB             | 0         | 65535      | R/W    | "  |
| 40009          | Counter 4 MSB             | 0         | 65535      | R/W    | "  |
| 40010          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40011          | Counter 5 MSB             | 0         | 65535      | R/W    | "  |
| 40012          | Counter 5 LSB             | 0         | 65535      | R/W    | "  |
| 40013          | Counter 6 MSB             | 0         | 65535      | R/W    | "  |
| 40014          | Counter 6 LSB             | 0         | 65535      | R/W    | "  |
| 40015          | Counter 7 MSB             | 0         | 65535      | R/W    | "  |
| 40016          | Counter 7 LSB             | 0         | 65535      | R/W    | "  |
| 40017          | Counter 8 MSB             | 0         | 65535      | R/W    | "  |
| 40018          | Counter 8 LSB             | 0         | 65535      | R/W    | "  |
| 40019          | Counter 9 MSB             | 0         | 65535      | R/W    | "  |
| 40020          | Counter 9 LSB             | 0         | 65535      | R/W    | "  |
| 40021          | Counter 10MSB             | 0         | 65535      | R/W    | "  |
| 40022          | Counter 10LSB             | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name   | Low Limit | High Limit | Access | Description  |
|----------------|-----------------|-----------|------------|--------|--|
| 40023          | Counter 11MSB   | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit                     |
| 40024          | Counter 11LSB   | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40025          | Counter 12MSB   | 0         | 65535      | R/W    | "  |
| 40026          | Counter 12LSB   | 0         | 65535      | R/W    | "  |
| 40027          | Counter 13MSB   | 0         | 65535      | R/W    | "  |
| 40028          | Counter 13LSB   | 0         | 65535      | R/W    | "  |
| 40029          | Counter 14MSB   | 0         | 65535      | R/W    | "  |
| 40030          | Counter 14LSB   | 0         | 65535      | R/W    | "  |
| 40031          | Counter 15MSB   | 0         | 65535      | R/W    | "  |
| 40032          | Counter 15LSB   | 0         | 65535      | R/W    | "  |
| 40033          | Counter 16MSB   | 0         | 65535      | R/W    | "  |
| 40034          | Counter 16LSB   | 0         | 65535      | R/W    | "  |
| 40035          | Counter Capture | 0         | 65535      | R/W    | Bit1 = 1 to Capture Counter1, Bit2 = 1 to Capture Counter2, etc. |
| 40036          | CCounter 1 MSB  | 0         | 65535      | R/W    | Capture Counter Registers. MSB and LSB                           |
| 40037          | CCounter 1 LSB  | 0         | 65535      | R/W    | combine to give a 32 bit Value.                                  |
| 40038          | CCounter 2 MSB  | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40039          | CCounter 2 LSB  | 0         | 65535      | R/W    |  |
| 40040          | CCounter 3 MSB  | 0         | 65535      | R/W    | "  |
| 40041          | CCounter 3 LSB  | 0         | 65535      | R/W    | "  |
| 40042          | CCounter 4 MSB  | 0         | 65535      | R/W    | "  |
| 40043          | CCounter 4 LSB  | 0         | 65535      | R/W    | "  |
| 40044          | CCounter 5 MSB  | 0         | 65535      | R/W    | "  |
| 40045          | CCounter 5 LSB  | 0         | 65535      | R/W    | "  |
| 40046          | CCounter 6 MSB  | 0         | 65535      | R/W    | "  |
| 40047          | CCounter 6 LSB  | 0         | 65535      | R/W    | "  |
| 40048          | CCounter 7 MSB  | 0         | 65535      | R/W    | "  |
| 40049          | CCounter 7 LSB  | 0         | 65535      | R/W    | "  |
| 40050          | CCounter 8 MSB  | 0         | 65535      | R/W    | "  |
| 40051          | CCounter 8 LSB  | 0         | 65535      | R/W    | "  |
| 40052          | CCounter 9 MSB  | 0         | 65535      | R/W    | "  |
| 40053          | CCounter 9 LSB  | 0         | 65535      | R/W    | "  |
| 40054          | CCounter 10MSB  | 0         | 65535      | R/W    | "  |
| 40055          | CCounter 10LSB  | 0         | 65535      | R/W    | "  |
| 40056          | CCounter 11MSB  | 0         | 65535      | R/W    | "  |
| 40057          | CCounter 11LSB  | 0         | 65535      | R/W    | "  |
| 40058          | CCounter 12MSB  | 0         | 65535      | R/W    | "  |
| 40059          | CCounter 12LSB  | 0         | 65535      | R/W    | "  |
| 40060          | CCounter 13MSB  | 0         | 65535      | R/W    | "  |
| 40061          | CCounter 13LSB  | 0         | 65535      | R/W    | "  |
| 40062          | CCounter 14MSB  | 0         | 65535      | R/W    | "  |
| 40063          | CCounter 14LSB  | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name  | Low Limit | High Limit | Access | Description   |
|----------------|----------------|-----------|------------|--------|---|
| 40064          | CCounter 15MSB | 0         | 65535      | R/W    | "   |
| 40065          | CCounter 15LSB | 0         | 65535      | R/W    | "   |
| 40066          | CCounter 16MSB | 0         | 65535      | R/W    | "   |
| 40067          | CCounter 16LSB | 0         | 65535      | R/W    | "   |
| 30100          | DIP Switch     | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | Counter Mode   | 0         | 2          | R/W    | 0=Disable, 1=Up Counting, 2=Up/Down Count             |
| 40102          | Input Filter   | 0         | 65535      | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |
| 40103          | Capture Zero   | 0         | 65535      | R/W    | 0 = Disabled, bit1 = auto zero counter 1.             |
| 40121          | Baud Rate      | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity         | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits      | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay    | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.2.6.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

| MSB                  |       |      | PM16DI DIGITAL INPUTS |      |      |     |     |     |    |    |    |   |   |   | LSB |       |  | ADDRESS |
|----------------------|-------|------|-----------------------|------|------|-----|-----|-----|----|----|----|---|---|---|-----|-------|--|---------|
| 15                   | 14    | 13   | 12                    | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0   |       |  |         |
| 32768                | 16384 | 8192 | 4096                  | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1   | 30002 |  |         |
| 16                   | 15    | 14   | 13                    | 12   | 11   | 10  | 9   | 8   | 7  | 6  | 5  | 4 | 3 | 2 | 1   |       |  |         |
| Digital Input Number |       |      |                       |      |      |     |     |     |    |    |    |   |   |   |     |       |  |         |

### 3.2.6.2 Counter Registers.

The counters are stored as two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.

Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

### 3.2.6.3 Counter Capture.

To capture a counter a 1 must be written to the corresponding bit position in the Counter Capture Register 40035. For example:

1. Writing 1 to Register 40035 results in Counter 1 value being captured to Counter Capture 1.
2. Writing 2 to Register 40035 results in Counter 2 value being captured to Counter Capture 2.
3. Writing 3 to Register 40035 results in Counter 1 value being captured to Counter Capture 1 and Counter 2 value being captured to Counter Capture 2.



Once the module has Captured the counters the Counter Capture Register 40035 is cleared to zero. It is possible to read this register to get confirmation that the capture is complete before reading the captured counter values.

#### 3.2.6.4 Counter Auto Zero.

The counter being captured can be auto zeroed. The purpose of this function is to let the module zero the counter so that no counts get lost due to delays from communication latency, etc.

To ensure that a counter is auto zeroed, a 1 must be written to the corresponding bit position in the Capture Zero Register 40103. For example:

Writing 1 to Register 40103 results in Counter 1 value being zeroed when the Counter Capture bit is 1.

The value in the Capture Zero Register 40103 is permanently stored in memory and only has to be configured once.



### 3.3 PM16DI220 - DIGITAL INPUTS WITH COUNTERS

#### 3.3.1 Description

The PM16DI220 module is a 16 channel digital input module. The inputs are isolated from the logic by bi-directional opto-couplers. The inputs are divided into 2 isolated groups of 8 inputs each. The inputs are designed for 220VAC input voltages.

The counters operate in three modes.

In mode 0: All the counters are disabled.

In mode 1: The counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In mode 2: The inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1. In the same way, inputs 3&4 operate counter 2, inputs 5&6 operate counter 3 and inputs 7&8 operate counter 4,etc.



Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.

#### 3.3.2 Technical Specification of PM16DI220

|                |                         |                                      |
|----------------|-------------------------|--------------------------------------|
| Power Supply   | Logic Supply Voltage    | 12 -24 Vdc                           |
|                | Logic Supply Current    | 30mA @ 12V / 17mA @ 24V              |
| Digital Inputs | Input Points            | 16                                   |
|                | Input Voltage Range     | 200 – 260VAC                         |
|                | Input Current per input | 1mA                                  |
|                | Isolation               | 1500Vrms between field and logic     |
| Counters       | Inputs                  | 1 to 16                              |
|                | Resolution              | 32 Bits                              |
|                | Frequency               | 10Hz (max)                           |
|                | Pulse Width             | 50ms (min)                           |
| Temperature    | Operating Temperature   | -40°C to + 80°C                      |
|                | Storage Temperature     | -40°C to + 85°C                      |
| Connectors     | Logic Power and Comms.  | 4 Pin Connector on underside of unit |
|                | Inputs                  | 18 Way screw connector on front      |
|                |                         |                                      |
|                |                         |                                      |

Note: Inputs 1 to 16 are used as both digital inputs and counter inputs.

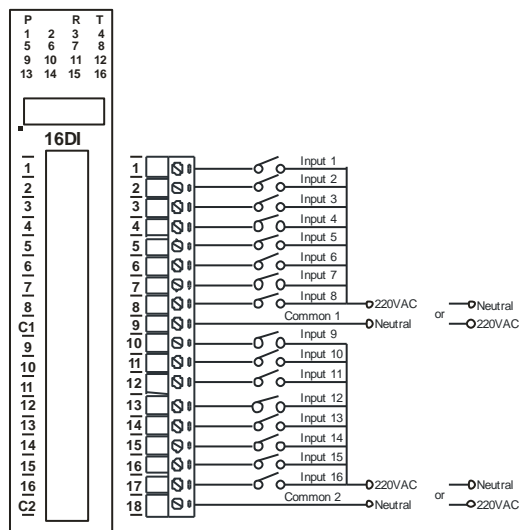
### 3.3.3 Status Indicators

|               |  |
|---------------|--|
| Power:        | Flashes to indicate the CPU is running.                                  |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.        |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.                  |
| Input Status: | <b>"OFF" when the input is off.</b><br><b>"ON" when the input is on.</b> |



### 3.3.4 Wiring

The following diagram shows how the digital inputs are connected to potential free switches. The common can be connected to live or neutral as indicated.



The following diagram shows the wiring for the power and RS485 communications.



### 3.3.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7                                      |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | INVERT      | When switched ON the status of the inputs are inverted in the Modbus status register (30002). |
| 9      | -           | Not Used.   |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.3.6 PM16DI220 Data Registers ( MODULE TYPE = 116)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description  |
|----------------|---------------------------|-----------|------------|--------|--|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.  |
| 10002          | Digital Input 2           | 0         | 1          | R      |  |
| 10003          | Digital Input 3           | 0         | 1          | R      |  |
| 10004          | Digital Input 4           | 0         | 1          | R      |  |
| 10005          | Digital Input 5           | 0         | 1          | R      |  |
| 10006          | Digital Input 6           | 0         | 1          | R      |  |
| 10007          | Digital Input 7           | 0         | 1          | R      |  |
| 10008          | Digital Input 8           | 0         | 1          | R      |  |
| 10009          | Digital Input 9           | 0         | 1          | R      |  |
| 10010          | Digital Input 10          | 0         | 1          | R      |  |
| 10011          | Digital Input 11          | 0         | 1          | R      |  |
| 10012          | Digital Input 12          | 0         | 1          | R      |  |
| 10013          | Digital Input 13          | 0         | 1          | R      |  |
| 10014          | Digital Input 14          | 0         | 1          | R      |  |
| 10015          | Digital Input 15          | 0         | 1          | R      |  |
| 10016          | Digital Input 16          | 0         | 1          | R      |  |
|                |                           |           |            |        |  |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 116                                   |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in 16 bits. 16 - 1.   |
| 40003          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit Counter with range 0 to 4294967295. |
| 40004          | Counter 1 LSB             | 0         | 65535      | R/W    |  |
| 40005          | Counter 2 MSB             | 0         | 65535      | R/W    | "  |
| 40006          | Counter 2 LSB             | 0         | 65535      | R/W    | "  |
| 40007          | Counter 3 MSB             | 0         | 65535      | R/W    | "  |
| 40008          | Counter 3 LSB             | 0         | 65535      | R/W    | "  |
| 40009          | Counter 4 MSB             | 0         | 65535      | R/W    | "  |
| 40010          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40011          | Counter 5 MSB             | 0         | 65535      | R/W    | "  |
| 40012          | Counter 5 LSB             | 0         | 65535      | R/W    | "  |
| 40013          | Counter 6 MSB             | 0         | 65535      | R/W    | "  |
| 40014          | Counter 6 LSB             | 0         | 65535      | R/W    | "  |
| 40015          | Counter 7 MSB             | 0         | 65535      | R/W    | "  |
| 40016          | Counter 7 LSB             | 0         | 65535      | R/W    | "  |
| 40017          | Counter 8 MSB             | 0         | 65535      | R/W    | "  |
| 40018          | Counter 8 LSB             | 0         | 65535      | R/W    | "  |
| 40019          | Counter 9 MSB             | 0         | 65535      | R/W    | "  |
| 40020          | Counter 9 LSB             | 0         | 65535      | R/W    | "  |
| 40021          | Counter 10MSB             | 0         | 65535      | R/W    | "  |
| 40022          | Counter 10LSB             | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name   | Low Limit | High Limit | Access | Description  |
|----------------|-----------------|-----------|------------|--------|--|
| 40023          | Counter 11MSB   | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit                     |
| 40024          | Counter 11LSB   | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40025          | Counter 12MSB   | 0         | 65535      | R/W    | "  |
| 40026          | Counter 12LSB   | 0         | 65535      | R/W    | "  |
| 40027          | Counter 13MSB   | 0         | 65535      | R/W    | "  |
| 40028          | Counter 13LSB   | 0         | 65535      | R/W    | "  |
| 40029          | Counter 14MSB   | 0         | 65535      | R/W    | "  |
| 40030          | Counter 14LSB   | 0         | 65535      | R/W    | "  |
| 40031          | Counter 15MSB   | 0         | 65535      | R/W    | "  |
| 40032          | Counter 15LSB   | 0         | 65535      | R/W    | "  |
| 40033          | Counter 16MSB   | 0         | 65535      | R/W    | "  |
| 40034          | Counter 16LSB   | 0         | 65535      | R/W    | "  |
| 40035          | Counter Capture | 0         | 65535      | R/W    | Bit1 = 1 to Capture Counter1, Bit2 = 1 to Capture Counter2, etc. |
| 40036          | CCounter 1 MSB  | 0         | 65535      | R/W    | Capture Counter Registers. MSB and LSB                           |
| 40037          | CCounter 1 LSB  | 0         | 65535      | R/W    | combine to give a 32 bit Value.                                  |
| 40038          | CCounter 2 MSB  | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                              |
| 40039          | CCounter 2 LSB  | 0         | 65535      | R/W    |  |
| 40040          | CCounter 3 MSB  | 0         | 65535      | R/W    | "  |
| 40041          | CCounter 3 LSB  | 0         | 65535      | R/W    | "  |
| 40042          | CCounter 4 MSB  | 0         | 65535      | R/W    | "  |
| 40043          | CCounter 4 LSB  | 0         | 65535      | R/W    | "  |
| 40044          | CCounter 5 MSB  | 0         | 65535      | R/W    | "  |
| 40045          | CCounter 5 LSB  | 0         | 65535      | R/W    | "  |
| 40046          | CCounter 6 MSB  | 0         | 65535      | R/W    | "  |
| 40047          | CCounter 6 LSB  | 0         | 65535      | R/W    | "  |
| 40048          | CCounter 7 MSB  | 0         | 65535      | R/W    | "  |
| 40049          | CCounter 7 LSB  | 0         | 65535      | R/W    | "  |
| 40050          | CCounter 8 MSB  | 0         | 65535      | R/W    | "  |
| 40051          | CCounter 8 LSB  | 0         | 65535      | R/W    | "  |
| 40052          | CCounter 9 MSB  | 0         | 65535      | R/W    | "  |
| 40053          | CCounter 9 LSB  | 0         | 65535      | R/W    | "  |
| 40054          | CCounter 10MSB  | 0         | 65535      | R/W    | "  |
| 40055          | CCounter 10LSB  | 0         | 65535      | R/W    | "  |
| 40056          | CCounter 11MSB  | 0         | 65535      | R/W    | "  |
| 40057          | CCounter 11LSB  | 0         | 65535      | R/W    | "  |
| 40058          | CCounter 12MSB  | 0         | 65535      | R/W    | "  |
| 40059          | CCounter 12LSB  | 0         | 65535      | R/W    | "  |
| 40060          | CCounter 13MSB  | 0         | 65535      | R/W    | "  |
| 40061          | CCounter 13LSB  | 0         | 65535      | R/W    | "  |
| 40062          | CCounter 14MSB  | 0         | 65535      | R/W    | "  |
| 40063          | CCounter 14LSB  | 0         | 65535      | R/W    | "  |

| Modbus Address | Register Name  | Low Limit | High Limit | Access | Description   |
|----------------|----------------|-----------|------------|--------|---|
| 40064          | CCounter 15MSB | 0         | 65535      | R/W    | "   |
| 40065          | CCounter 15LSB | 0         | 65535      | R/W    | "   |
| 40066          | CCounter 16MSB | 0         | 65535      | R/W    | "   |
| 40067          | CCounter 16LSB | 0         | 65535      | R/W    | "   |
| 30100          | DIP Switch     | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | Counter Mode   | 0         | 2          | R/W    | 0=Disable, 1=Up Counting, 2=Up/Down Count             |
| 40102          | Input Filter   | 0         | 65535      | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |
| 40103          | Capture Zero   | 0         | 65535      | R/W    | 0 = Disabled, bit1 = auto zero counter 1.             |
| 40121          | Baud Rate      | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity         | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits      | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay    | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.3.6.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

| MSB   |       |      | PM16DI DIGITAL INPUTS |      |      |     |     |     |    |    |    |   |   |   |   | LSB |  |  | ADDRESS |
|-------|-------|------|-----------------------|------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|--|---------|
| 15    | 14    | 13   | 12                    | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |  |         |
| 32768 | 16384 | 8192 | 4096                  | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  |  | 30002   |
| 16    | 15    | 14   | 13                    | 12   | 11   | 10  | 9   | 8   | 7  | 6  | 5  | 4 | 3 | 2 | 1 |     |  |  |         |

**Digital Input Number**

### 3.3.6.2 Counter Registers.

The counters are stored as two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.

Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

### 3.3.6.3 Counter Capture.

To capture a counter a 1 must be written to the corresponding bit position in the Counter Capture Register 40035. For example:

1. Writing 1 to Register 40035 results in Counter 1 value being captured to Counter Capture 1.
2. Writing 2 to Register 40035 results in Counter 2 value being captured to Counter Capture 2.
3. Writing 3 to Register 40035 results in Counter 1 value being captured to Counter Capture 1 and Counter 2 value being captured to Counter Capture 2.



Once the module has Captured the counters the Counter Capture Register 40035 is cleared to zero. It is possible to read this register to get confirmation that the capture is complete before reading the captured counter values.

#### 3.3.6.4 Counter Auto Zero.

The counter being captured can be auto zeroed. The purpose of this function is to let the module zero the counter so that no counts get lost due to delays from communication latency, etc.

To ensure that a counter is auto zeroed, a 1 must be written to the corresponding bit position in the Capture Zero Register 40103. For example:

Writing 1 to Register 40103 results in Counter 1 value being zeroed when the Counter Capture bit is 1.

The value in the Capture Zero Register 40103 is permanently stored in memory and only has to be configured once.



## 3.4 PM16DO - DIGITAL OUTPUTS

### 3.4.1 Description

This module has 16 open collector (NPN) digital outputs. The outputs may be used to drive lamps or external relays when more drive capability is required. The outputs are isolated from the logic and they share a common negative terminal.

The module may be used as either a slave or master on the Modbus network. When used with a PC or PLC the module will be configured as a slave. When used with a PM16DI module in a point-to-point configuration, the DIP switch 9 must be turned on to set the module up as a master. In this mode the PM16DO module will automatically read the information from the PM16DI module and write the input status to the outputs.

When used as a slave module, the outputs are written to by the Modbus master device such as a PC or PLC. Each output can be individually switched on or off, or all outputs can be set up at the same time by writing a single number to the output register which represents the status of all outputs.

An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.



### 3.4.2 Technical Specification of PM16DO

|                 |                        |                                      |
|-----------------|------------------------|--------------------------------------|
| Power Supply    | Logic Supply Voltage   | 12 -24 Vdc                           |
|                 | Logic Supply Current   | 23mA @ 12V / 14mA @ 24V              |
|                 | Field Supply Voltage   | 12 -24 Vdc                           |
|                 | Field Supply Current   | 6mA @ 12V / 6mA @ 24V                |
| Digital Outputs | Output Points          | 16                                   |
|                 | Maximum Voltage        | 36 Vdc                               |
|                 | Maximum Current        | 100 mA per output                    |
|                 | Vceon                  | 1.1V Max.                            |
|                 | Isolation              | 1500Vrms between field and logic     |
| Temperature     | Operating Temperature. | -40°C to + 80°C                      |
|                 | Storage Temperature    | -40°C to + 85°C                      |
| Connectors      | Logic Power and Comms. | 4 Pin Connector on underside of unit |
|                 | Outputs                | 18 Way screw connector on front      |
|                 |                        |                                      |
|                 |                        |                                      |

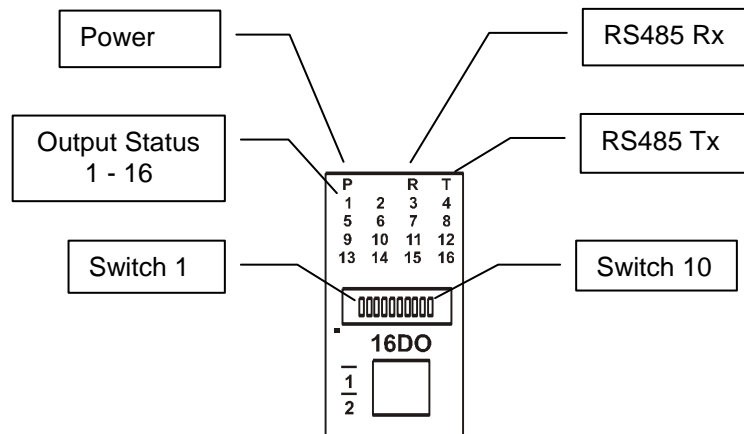
### 3.4.3 Status Indicators

Power: Flashes to indicate the CPU is running.

RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.

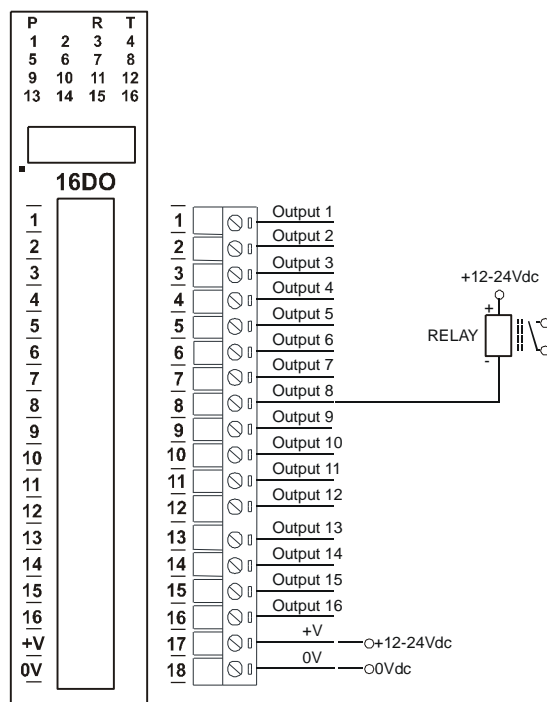
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.

Output Status: **"OFF"** when the output is off.  
**"ON"** when the output is on.

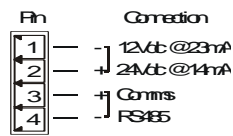


### 3.4.4 Wiring

The following diagram shows how the digital outputs are connected to the coil of a relay. The coil is connected to positive and switched to negative.



The following diagram shows the wiring for the power and RS485 communications.



### 3.4.5 Switch Setting

| SWITCH | FUNCTION    | DESCRIPTION  |
|--------|-------------|--|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2      | NODE ID +2  |  |
| 3      | NODE ID +4  |  |
| 4      | NODE ID +8  |  |
| 5      | NODE ID +16 |  |
| 6      | NODE ID +32 |  |
| 7      | NODE ID +64 |  |
| 8      | -           | Not Used.  |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to a single digital input module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)  |

### 3.4.6 PM16DO Data Registers ( MODULE TYPE = 101)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 00001          | Digital Output 1          | 0         | 1          | R/W    | Status of Digital Outputs.                            |
| 00002          | Digital Output 2          | 0         | 1          | R/W    | "   |
| 00003          | Digital Output 3          | 0         | 1          | R/W    | "   |
| 00004          | Digital Output 4          | 0         | 1          | R/W    | "   |
| 00005          | Digital Output 5          | 0         | 1          | R/W    | "   |
| 00006          | Digital Output 6          | 0         | 1          | R/W    | "   |
| 00007          | Digital Output 7          | 0         | 1          | R/W    | "   |
| 00008          | Digital Output 8          | 0         | 1          | R/W    | "   |
| 00009          | Digital Output 9          | 0         | 1          | R/W    | "   |
| 00010          | Digital Output 10         | 0         | 1          | R/W    | "   |
| 00011          | Digital Output 11         | 0         | 1          | R/W    | "   |
| 00012          | Digital Output 12         | 0         | 1          | R/W    | "   |
| 00013          | Digital Output 13         | 0         | 1          | R/W    | "   |
| 00014          | Digital Output 14         | 0         | 1          | R/W    | "   |
| 00015          | Digital Output 15         | 0         | 1          | R/W    | "   |
| 00016          | Digital Output 16         | 0         | 1          | R/W    | "   |
|                |                           |           |            |        |   |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 101        |
| 40002          | Digital Outputs           | N/A       | N/A        | R/W    | Digital Outputs in bits. 16(msb) – 1(lsb).            |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 - 255 = enabled.    |
| 40102          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)                         |
| 40103          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)                       |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

#### 3.4.6.1 Digital Output Register.

The digital outputs can be read/written in a single register as follows:

| MSB   |       |      |      | PM16DO DIGITAL OUTPUTS |      |     |     |     |    |    |    |   |   |   |   | LSB |  |  |  | ADDRESS |
|-------|-------|------|------|------------------------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|--|--|---------|
| 15    | 14    | 13   | 12   | 11                     | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |  |  |         |
| 32768 | 16384 | 8192 | 4096 | 2048                   | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  |  |  | 40002   |
| 16    | 15    | 14   | 13   | 12                     | 11   | 10  | 9   | 8   | 7  | 6  | 5  | 4 | 3 | 2 | 1 |     |  |  |  |         |

Digital Output

#### 3.4.6.2 Output Watchdog Timer.

The watchdog timer is used to switch off all of the outputs in the event of a communications failure. When set to zero (register 40101) the watchdog timer is disabled.

#### 3.4.7 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PM16DO reads digital inputs from a PM16DI module and writes the information to the outputs. The two modules must have the same network ID and these must be the only modules on the network.

##### 3.4.7.1 Modbus Master Poll Rate.

The rate at which the PM16DO polls the PM16DI is configured using this register (40103). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM16DI due to turn around delays in the equipment.

##### 3.4.7.2 Modbus Master Timeout.

The PM16DO polls the PM16DI to get the input data. If there is a problem and the message is corrupted or gets lost, then the PM16DO communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.





## 3.5 PM4RO - RELAY OUTPUTS

### 3.5.1 Description

The MM4RO module has 4 normally open/ normally closed relay outputs. These modules may be used when a higher drive capability is required, or when isolation between outputs are required.

The module may be used as either a slave or master on the Modbus network. When used with a PC or PLC the module will be configured as a slave. When used with a PM16DI module in a point-to-point configuration, the DIP switch 9 must be turned on to set the module up as a master. In this mode the PM4RO module will automatically read the information from the PM16DI module and write the input status to the outputs.

When used as a slave module, the outputs are written to by the Modbus master device such as a PC or PLC. Each output can be individually switched on or off, or all outputs can be set up at the same time by writing a single number to the output register which represents the status of all outputs.

An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.



### 3.5.2 Technical Specification of PM4RO

|               |                        |  |
|---------------|------------------------|--|
| Power Supply  | Logic Supply Voltage   | 24 Vdc   |
|               | Logic Supply Current   | 42 mA  |
| Relay Outputs | Output Points          | 4  |
|               | Maximum Current        | 0.5A @ 220VAC / 1A @ 28VDC                                   |
|               | Isolation              | 1000Vrms between field and logic<br>1000Vrms between outputs |
|               |                        |  |
| Temperature   | Operating Temperature. | -40°C to + 80°C  |
|               | Storage Temperature    | -40°C to + 85°C  |
| Connectors    | Logic Power and Comms. | 4 Pin Connector on underside of unit                         |
|               | Outputs                | 18 Way screw connector on front                              |
|               |                        |  |
|               |                        |  |

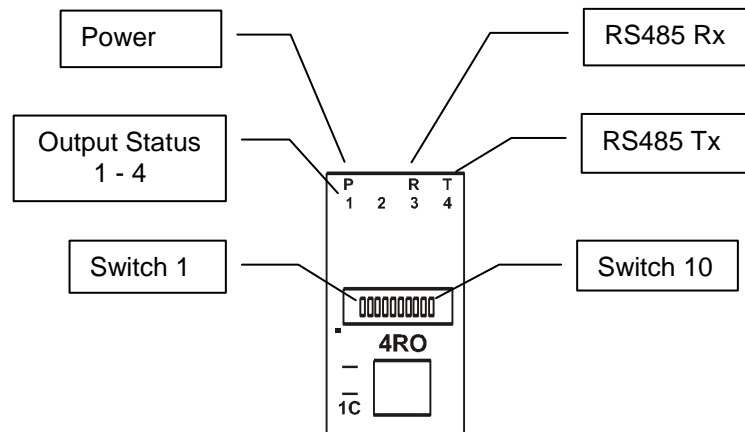
### 3.5.3 Status Indicators

Power: Flashes to indicate the CPU is running.

RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.

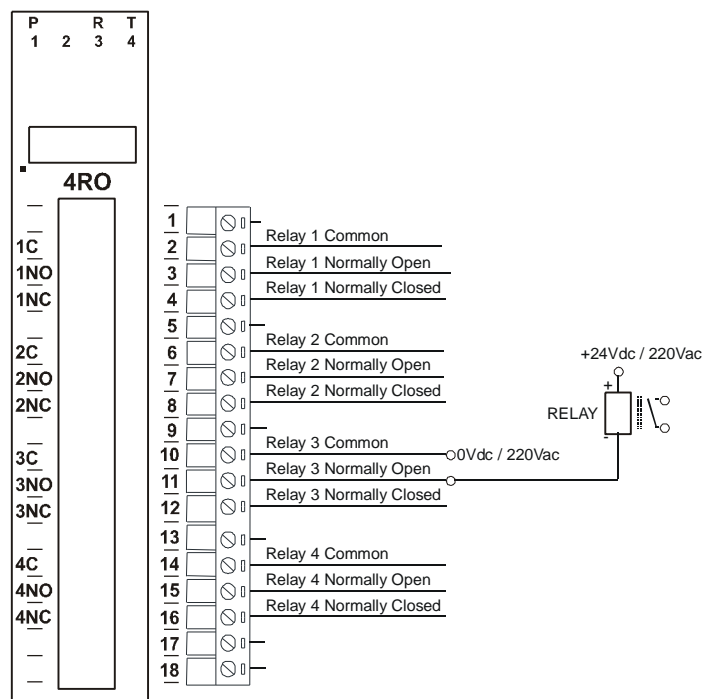
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.

Output Status: **"OFF"** when the output is off  
**"ON"** when the output is on.

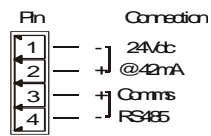


### 3.5.4 Wiring

The following diagram shows how the digital outputs are connected to the coil of a relay. The coil is connected to positive and switched to negative.



The following diagram shows the wiring for the power and RS485 communications.



### 3.5.5 Switch Setting

| SWITCH | FUNCTION    | DESCRIPTION  |
|--------|-------------|--|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2      | NODE ID +2  |  |
| 3      | NODE ID +4  |  |
| 4      | NODE ID +8  |  |
| 5      | NODE ID +16 |  |
| 6      | NODE ID +32 |  |
| 7      | NODE ID +64 |  |
| 8      | -           | Not Used.  |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to a single digital input module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)  |

### 3.5.6 PM4RO Data Registers ( MODULE TYPE = 113)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 00001          | Relay Output 1            | 0         | 1          | R/W    | Status of Digital Outputs.  |
| 00002          | Relay Output 2            | 0         | 1          | R/W    | "   |
| 00003          | Relay Output 3            | 0         | 1          | R/W    | "   |
| 00004          | Relay Output 4            | 0         | 1          | R/W    | "   |
|                |                           |           |            |        |   |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 113                              |
| 40002          | Digital Outputs           | N/A       | N/A        | R/W    | Digital Outputs in bits. xxxx xxxx xxxx 4,3,2,1<br>bit4(msb) – bit1(lsb).   |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel   |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 - 255 = enabled.                          |
| 40102          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)   |
| 40103          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)   |
| 40104          | Output Mode               | 0         | 3          | R/W    | 0=bits 1-4, 1=bits 5-8, 2=bits9-12, 3=bits 13-16<br>From version 3 upwards. |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500                       |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd   |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits   |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)   |

#### 3.5.6.1 Relay Output Register.

The relay outputs can be read/written in a single register as follows:

| MSB   |       | PM4RO DIGITAL OUTPUTS |      |      |      |     |     |     |    |    |    |   |   | LSB |   | ADDRESS |
|-------|-------|-----------------------|------|------|------|-----|-----|-----|----|----|----|---|---|-----|---|---------|
| 15    | 14    | 13                    | 12   | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1   | 0 |         |
| 32768 | 16384 | 8192                  | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2   | 1 | 40002   |
| -     | -     | -                     | -    | -    | -    | -   | -   | -   | -  | -  | -  | - | 4 | 3   | 2 | 1       |

Relay Output

#### 3.5.6.2 Output Watchdog Timer.

The watchdog timer is used to switch off all of the outputs in the event of a communications failure. When set to zero (register 40101) the watchdog timer is disabled.

### 3.5.7 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PM4RO reads digital inputs from a PM16DI module and writes the information to the outputs. The two modules must have the same network ID and these must be the only modules on the network.

#### 3.5.7.1 Modbus Master Poll Rate.

The rate at which the PM4RO polls the PM16DI is configured using this register (40103). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM16DI due to turn around delays in the equipment.

#### 3.5.7.2 Modbus Master Timeout.

The PM4RO polls the PM16DI to get the input data. If there is a problem and the message is corrupted or gets lost, then the PM4RO communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.



## 3.6 PM8DIO - DIGITAL INPUTS / OUTPUTS

### 3.6.1 Description

The PM8DIO module is an 8 channel digital input and 8 channel digital output module.

The inputs are isolated from the logic by bi-directional opto-couplers. The common is connected internally to either the -volts or +volts field power supply terminals using a jumper link which is situated inside the housing.

The inputs have internal counters associated with them. These counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.

The 8 digital outputs are open collector (NPN). The outputs may be used to drive lamps or external relays when more drive capability is required. The outputs are isolated from the logic and they share a common negative terminal.

The module may be used as either a slave or master on the Modbus network. When used with a PC or PLC the module will be configured as a slave. When used with another PM8DIO module in a point-to-point configuration, the DIP switch 9 must be turned on to set the module up as a master. In this mode the PM8DIO module will automatically read/write the information from/to the other PM8DIO module.

When used as a slave module, the outputs are written to by the Modbus master device such as a PC or PLC. Each output can be individually switched on or off, or all outputs can be set up at the same time by writing a single number to the output register which represents the status of all outputs.



### 3.6.2 Technical Specification of PM8DIO

|                 |                         |                                      |
|-----------------|-------------------------|--------------------------------------|
| Power Supply    | Logic Supply Voltage    | 12 -24 Vdc                           |
|                 | Logic Supply Current    | 33mA @ 12V / 19mA @ 24V              |
|                 | Field Supply Voltage    | 12 -24 Vdc                           |
|                 | Field Supply Current    | 6mA @ 12V / 6mA @ 24V                |
| Digital Inputs  | Input Points            | 8                                    |
|                 | Input Voltage Range     | 12 -24 Vdc                           |
|                 | Input Current per input | 5mA@12Vdc / 11mA @24Vdc              |
|                 | Isolation               | 1500Vrms between field and logic     |
| Digital Outputs | Output Points           | 8                                    |
|                 | Maximum Voltage         | 36 Vdc                               |
|                 | Maximum Current         | 100 mA per output                    |
|                 | Vceon                   | 1.1V Max.                            |
|                 | Isolation               | 1500Vrms between field and logic     |
| Counters        | Inputs                  | 1 to 16                              |
|                 | Resolution              | 32 Bits                              |
|                 | Frequency               | 1KHz (max)                           |
|                 | Pulse Width             | 500us (min)                          |
| Temperature     | Operating Temperature.  | -40°C to + 80°C                      |
|                 | Storage Temperature     | -40°C to + 85°C                      |
| Connectors      | Logic Power and Comms.  | 4 Pin Connector on underside of unit |
|                 | Outputs                 | 18 Way screw connector on front      |
|                 |                         |                                      |
|                 |                         |                                      |

Note: Inputs 1 to 8 are used as both digital inputs and counter inputs.

### 3.6.3 Status Indicators

Power: Flashes to indicate the CPU is running.

RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.

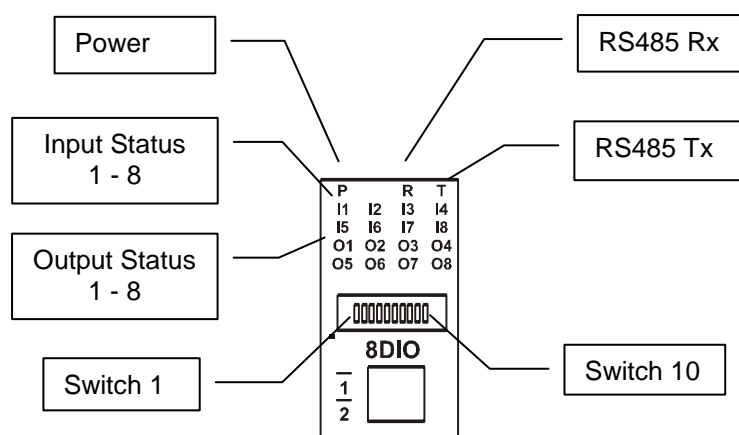
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.

Input Status: "OFF" when the input is off

"ON" when the input is on.

Output Status: "OFF" when the output is off

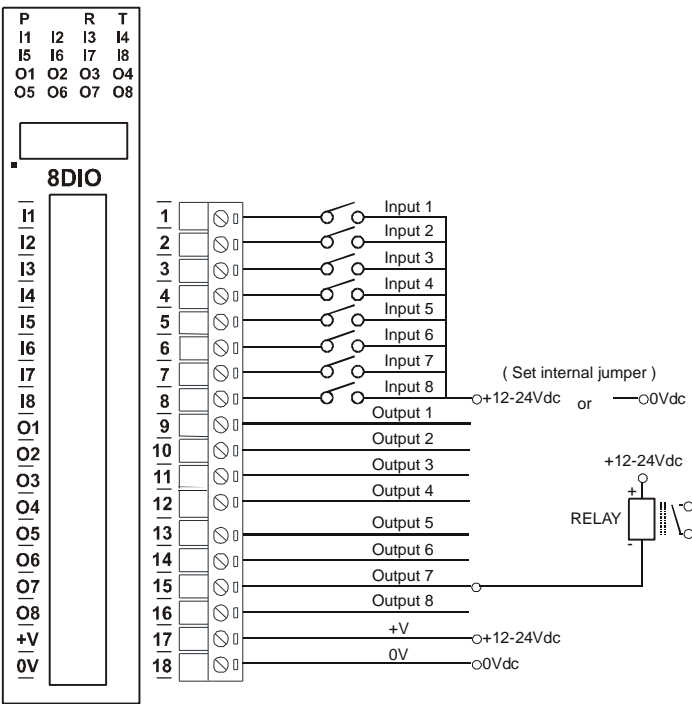
"ON" when the output is on.



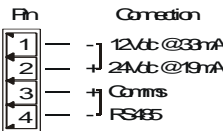


3.6.4 Wiring

The following diagram shows how the digital inputs and outputs are connected.



The following diagram shows the wiring for the power and RS485 communications.

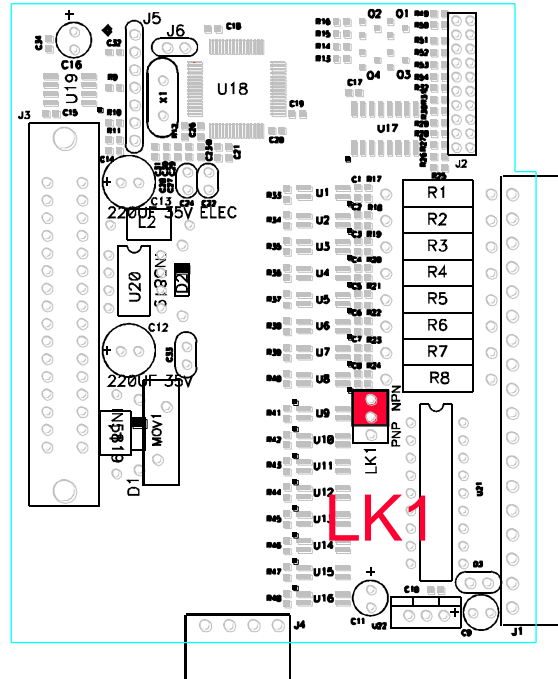


3.6.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION  |
|--------|-------------|--|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2      | NODE ID +2  |  |
| 3      | NODE ID +4  |  |
| 4      | NODE ID +8  |  |
| 5      | NODE ID +16 |  |
| 6      | NODE ID +32 |  |
| 7      | NODE ID +64 |  |
| 8      | INVERT      | When switched ON the status of the inputs are inverted in the Modbus status register (30002).  |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to a single digital input module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)  |

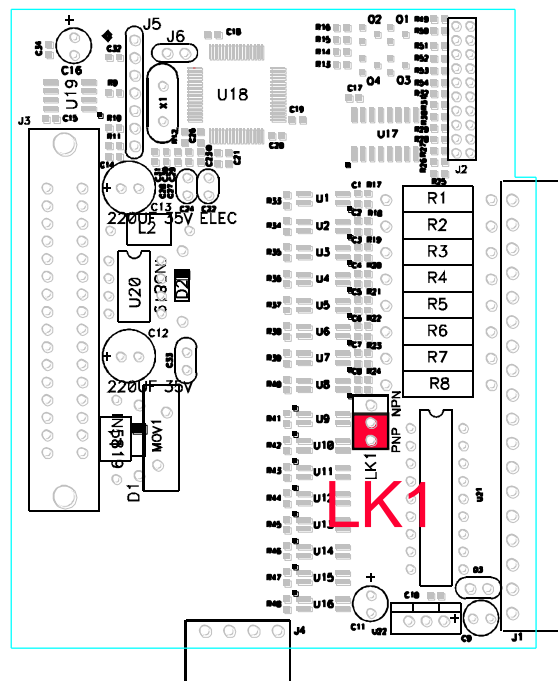
### 3.6.6 Setting the jumpers for NPN inputs.

The Digital inputs can be configured as NPN inputs. This means that the inputs can be operated by switching to 0V. Change the link LK1 to the NPN position.



### 3.6.7 Setting the jumpers for PNP inputs.

The Digital inputs can be configured as PNP inputs. This means that the inputs can be operated by switching to +12V to +24V. Change the link LK1 to the PNP position.



### 3.6.8 PM8DIO Data Registers (MODULE TYPE = 102)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments   |
|----------------|---------------------------|-----------|------------|--------|--|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.                          |
| 10002          | Digital Input 2           | 0         | 1          | R      | "  |
| 10003          | Digital Input 3           | 0         | 1          | R      | "  |
| 10004          | Digital Input 4           | 0         | 1          | R      | "  |
| 10005          | Digital Input 5           | 0         | 1          | R      | "  |
| 10006          | Digital Input 6           | 0         | 1          | R      | "  |
| 10007          | Digital Input 7           | 0         | 1          | R      | "  |
| 10008          | Digital Input 8           | 0         | 1          | R      | "  |
| 00017          | Digital Output 1          | 0         | 1          | R/W    | Status of Digital Outputs.                         |
| 00018          | Digital Output 2          | 0         | 1          | R/W    | "  |
| 00019          | Digital Output 3          | 0         | 1          | R/W    | "  |
| 00020          | Digital Output 4          | 0         | 1          | R/W    | "  |
| 00021          | Digital Output 5          | 0         | 1          | R/W    | "  |
| 00022          | Digital Output 6          | 0         | 1          | R/W    | "  |
| 00023          | Digital Output 7          | 0         | 1          | R/W    | "  |
| 00024          | Digital Output 8          | 0         | 1          | R/W    | "  |
|                |                           |           |            |        |  |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 102     |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in lower 8 bits. 8 - 1.             |
| 40003          | Digital Outputs           | N/A       | N/A        | R/W    | Digital Outputs in lower 8 bits. 8 - 1.            |
| 40004          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit       |
| 40005          | Counter 1 LSB             | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.                |
| 40006          | Counter 2 MSB             | 0         | 65535      | R/W    | "  |
| 40007          | Counter 2 LSB             | 0         | 65535      | R/W    | "  |
| 40008          | Counter 3 MSB             | 0         | 65535      | R/W    | "  |
| 40009          | Counter 3 LSB             | 0         | 65535      | R/W    | "  |
| 40010          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40011          | Counter 4 LSB             | 0         | 65535      | R/W    | "  |
| 40012          | Counter 5 MSB             | 0         | 65535      | R/W    | "  |
| 40013          | Counter 5 LSB             | 0         | 65535      | R/W    | "  |
| 40014          | Counter 6 MSB             | 0         | 65535      | R/W    | "  |
| 40015          | Counter 6 LSB             | 0         | 65535      | R/W    | "  |
| 40016          | Counter 7 MSB             | 0         | 65535      | R/W    | "  |
| 40017          | Counter 7 LSB             | 0         | 65535      | R/W    | "  |
| 40018          | Counter 8 MSB             | 0         | 65535      | R/W    | "  |
| 40019          | Counter 8 LSB             | 0         | 65535      | R/W    | "  |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 - 255 = enabled. |
| 40102          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)                      |

|       |                 |      |       |     |   |
|-------|-----------------|------|-------|-----|---|
| 40103 | Master PollRate | 0    | 65535 | R/W | Modbus Master Poll Rate (X10ms)                       |
| 40105 | Counter Mode    | 0    | 2     | R/W | 0=Disable, 1=Up Counting, 2=Up/Down Count             |
| 40106 | Input Filter    | 0    | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms)                     |
| 40121 | Baud Rate       | 2400 | 18750 | R/W | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122 | Parity          | 0    | 2     | R/W | 0 = none, 1 = even, 2 = odd                           |
| 40123 | Stop Bits       | 1    | 2     | R/W | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124 | Reply Delay     | 0    | 255   | R/W | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.6.8.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

| MSB                  |       |      |      | PM8DIO DIGITAL INPUTS |      |     |     |     |    |    |    | LSB |   |   |   | ADDRESS |
|----------------------|-------|------|------|-----------------------|------|-----|-----|-----|----|----|----|-----|---|---|---|---------|
| 15                   | 14    | 13   | 12   | 11                    | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3   | 2 | 1 | 0 |         |
| 32768                | 16384 | 8192 | 4096 | 2048                  | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8   | 4 | 2 | 1 |         |
| 0                    | 0     | 0    | 0    | 0                     | 0    | 0   | 0   | 8   | 7  | 6  | 5  | 4   | 3 | 2 | 1 |         |
| Digital Input Number |       |      |      |                       |      |     |     |     |    |    |    |     |   |   |   |         |

### 3.6.8.2 Digital Output Register.

The digital outputs can be read/written in a single register as follows:

| MSB                   |       |      |      | PM8DIO DIGITAL OUTPUTS |      |     |     |     |    |    |    |   |   |   |   | LSB |  |  |  | ADDRESS |
|-----------------------|-------|------|------|------------------------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|--|--|---------|
| 15                    | 14    | 13   | 12   | 11                     | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |  |  |         |
| 32768                 | 16384 | 8192 | 4096 | 2048                   | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  |  |  |         |
| 0                     | 0     | 0    | 0    | 0                      | 0    | 0   | 0   | 0   | 8  | 7  | 6  | 5 | 4 | 3 | 2 | 1   |  |  |  |         |
| Digital Output Number |       |      |      |                        |      |     |     |     |    |    |    |   |   |   |   |     |  |  |  |         |

### 3.6.8.3 Counter Registers.

The counters are stored a two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40003.

Counter Low Value = Register 40004.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

#### 3.6.8.4 Output Watchdog Timer.

The watchdog timer is used to switch off all of the outputs in the event of a communications failure. When set to zero (register 40101) the watchdog timer is disabled.

#### 3.6.9 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PM8DIO reads digital inputs from a second PM8DIO module and writes the information to the outputs. The PM8DIO also writes digital inputs to the a second PM8DIO module. This results in data being transferred on both directions between the two PM8DIO modules. The two modules must have the same network ID and these must be the only modules on the network.

##### 3.6.9.1 Modbus Master Poll Rate.

The rate at which the PM8DIO polls the second PM8DIO is configured using this register (40103). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM8DIO due to turn around delays in the equipment.

##### 3.6.9.2 Modbus Master Timeout.

The PM8DIO polls the second PM8DIO to get the input data. If there is a problem and the message is corrupted or gets lost, then the PM8DIO communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.



## 3.7 PM8AI/I and PM8AI/V - ANALOG INPUTS

### 3.7.1 Description

The Analog Input modules are supplied as either a current input module (PM8AI/I) or a voltage input module (PM8AI/V). The inputs are isolated from the logic and share a common negative terminal.

The standard setting for the PM8AI/I module is 0 - 20mA input current which represents an output value of 0 - 4095 (12 bits) in the corresponding Modbus register. To obtain an output value of 0 to 4095 for an input signal of 4 to 20mA the offset switch is switched on.

The same applies to the PM8AI/V module. An input voltage of 0 - 10Volts represents an output of 0 - 4095 and 2 volts would give a reading of  $819 \pm 1\text{LSB}$ . To obtain an output value of 0 to 4095 for an input signal of 2 to 10V the offset switch is switched on. An input range of 0(1) to 5Vdc is available by removing the jumper link located on the analog board inside the enclosure.

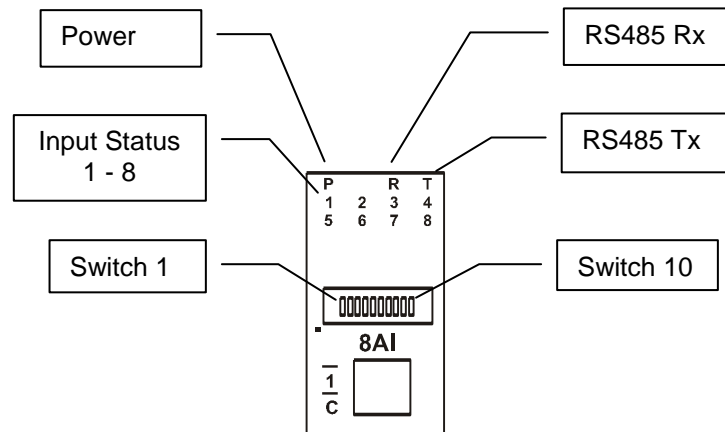


### 3.7.2 Technical Specification of PM8AI

|                          |                        |                                      |
|--------------------------|------------------------|--------------------------------------|
| Power Supply             | Logic Supply Voltage   | 12 - 24 Vdc                          |
|                          | Logic Supply Current   | 27mA @ 12V / 16mA @ 24V              |
|                          | Field Supply Voltage   | 12 - 24 Vdc                          |
|                          | Field Supply Current   | 8mA @ 12V / 15mA @ 24V               |
| Voltage Inputs – PM8AI/V | Input Points           | 8                                    |
|                          | Input Voltage          | 0(2) - 10 Vdc or 0(1) - 5 Vdc        |
|                          | Input Resistance       | 20kohms                              |
|                          | Resolution             | 12 bits                              |
|                          | Drift                  | 50ppm/°C                             |
|                          | Accuracy               | 0.2% of span                         |
| Current Inputs – PM8AI/I | Isolation              | 1500Vrms between field and logic     |
|                          | Input Points           | 8                                    |
|                          | Input Current          | 0(4) - 20 mA                         |
|                          | Input Resistance       | 250ohms                              |
|                          | Resolution             | 12 bits                              |
|                          | Drift                  | 50ppm/°C                             |
| Temperature              | Accuracy               | 0.2% of span                         |
|                          | Isolation              | 1500Vrms between field and logic     |
|                          | Operating Temperature. | -40°C to + 80°C                      |
| Connectors               | Storage Temperature    | -40°C to + 85°C                      |
|                          | Logic Power and Comms. | 4 Pin Connector on underside of unit |
|                          | Inputs                 | 18 Way screw connector on front      |

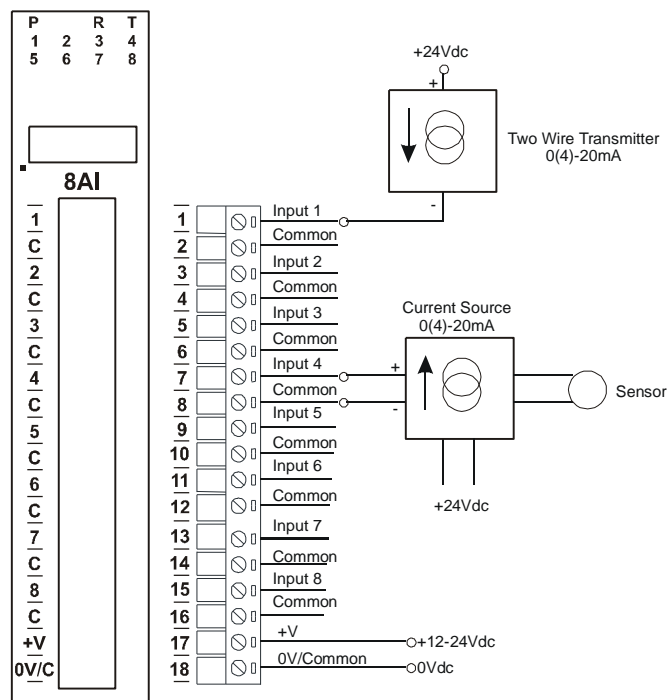
### 3.7.3 Status Indicators

|               |  |
|---------------|--|
| Power:        | Flashes to indicate the CPU is running.  |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.  |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.  |
| Input Status: | <p>“ON” when the input is zero.</p> <p>“OFF” when the input is greater than zero and less than 4095.</p> <p>“Flashing” when the input is over range, greater or equal to 4095.</p> |



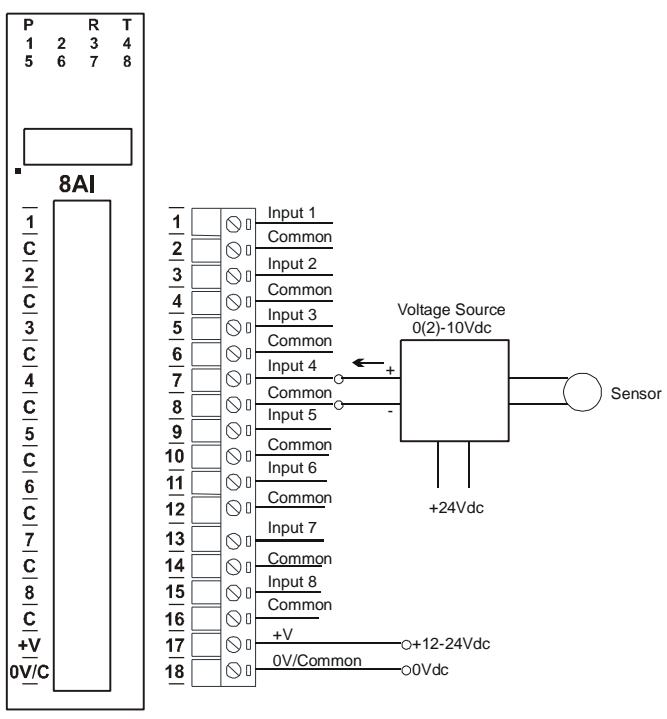
### 3.7.4 Wiring

The following diagram shows how the analog inputs are connected to a 0(4)-20mA source. All of the common terminals are connected together, and are connected to 0V internally.

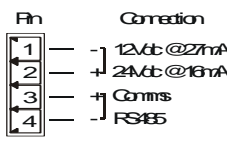




The following diagram shows how the analog inputs are connected to a 0(2)-10Vdc source. All of the common terminals are connected together, and are connected to 0V internally.



The following diagram shows the wiring for the power and RS485 communications.



### 3.7.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7          |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | -           | Not used.   |
| 9      | OFFSET      | When switched ON the inputs scaled to accept a 2V or 4mA offset . |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)                   |

### 3.7.6 PM8AI Data Registers ( PM8AI/I TYPE = 103 / PM8AI/V TYPE = 104)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description   |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 103(PM8AI/I) or 104(PM8AI/V)             |
| 30002          | Analog Input 1            | 0         | 4095       | R      | Analog Input lower 12 Bits  |
| 30003          | Analog Input 2            | 0         | 4095       | R      | "   |
| 30004          | Analog Input 3            | 0         | 4095       | R      | "   |
| 30005          | Analog Input 4            | 0         | 4095       | R      | "   |
| 30006          | Analog Input 5            | 0         | 4095       | R      | "   |
| 30007          | Analog Input 6            | 0         | 4095       | R      | "   |
| 30008          | Analog Input 7            | 0         | 4095       | R      | "   |
| 30009          | Analog Input 8            | 0         | 4095       | R      | "   |
| 30010          | Input Status              | 0         | 65535      | R      | bit2 = 0(open circuit or < 2), bit2 = 1(over range)<br>bit1 = 0(OK),bit1 = 1(error) |
| 30011          | Input Alarm Status        | 0         | 255        | R      | bit1 = 0(OK),bit1 = 1(input < 2mA)<br>(version 6 onwards)                           |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel   |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500                               |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd   |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits   |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)   |

#### 3.7.6.1 Analog Input Registers.

The analog inputs are read as a 12 bit value in the registers as follows:

| MSB   |       |      |      | PM8AI ANALOG INPUTS |      |     |     |     |    |    |    |   |   |   |   | LSB |  |  |  | ADDRESS |
|-------|-------|------|------|---------------------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|--|--|---------|
| 15    | 14    | 13   | 12   | 11                  | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |  |  |         |
| 32768 | 16384 | 8192 | 4096 | 2048                | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  |  |  | 300XX   |
| 0     | 0     | 0    | 0    |                     | x    | x   | x   | x   | x  | x  | x  | x | x | x | x |     |  |  |  |         |

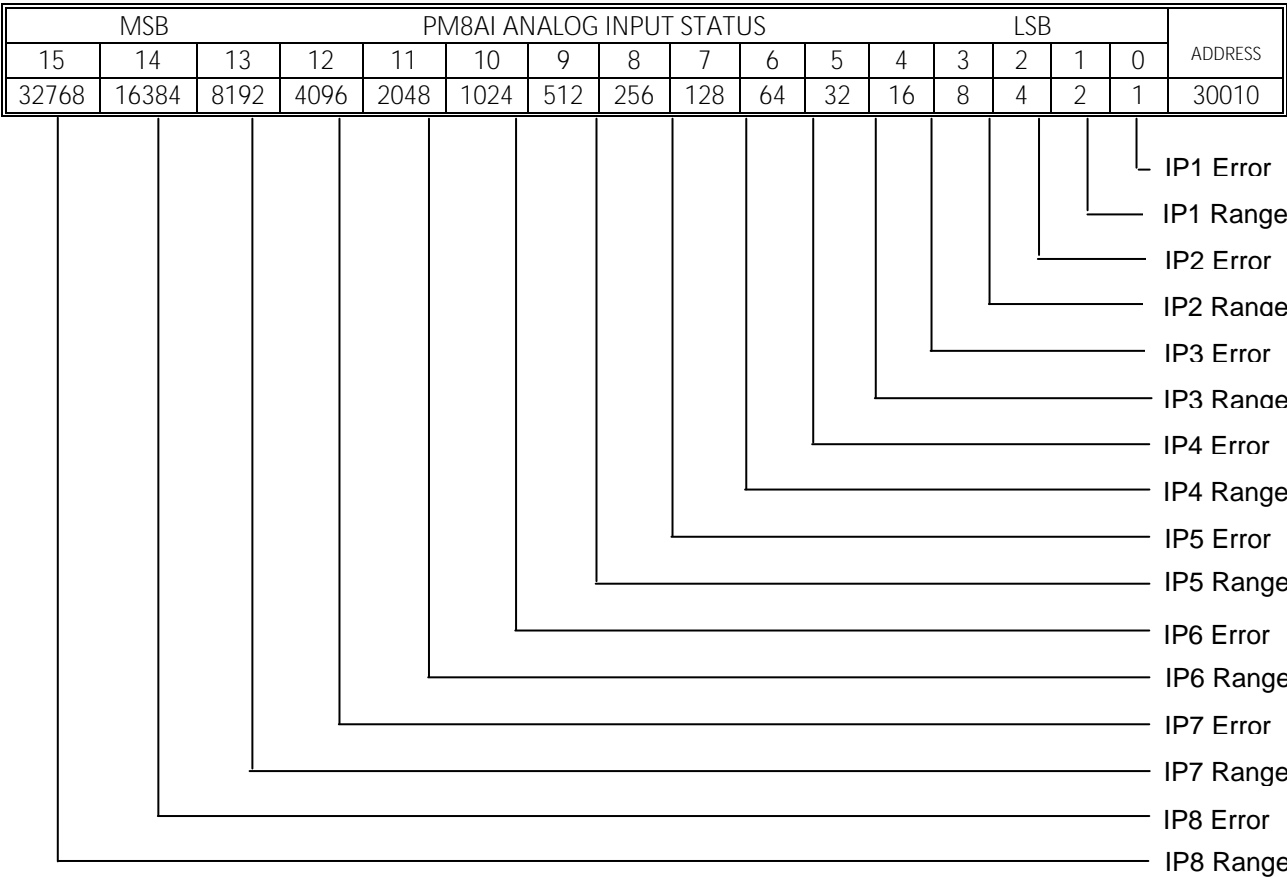
Analog Input: 12 Bit Value (0 - 4095)

3.7.6.2 Analog Input Status.

There are two status bits associated with each analog input. These bits are used to indicate if the input is zero or open circuit , in the working range 0-4095, or over range. If the input is open circuit or over range, then the error bit will be set. When the error bit is set, the range bit is zero if the input is open circuit and set if the input is over range, ie:

| <u>Bit 1- Error</u> | <u>Bit 2-Range</u> | <u>Condition</u>            | <u>Status LED</u> |
|---------------------|--------------------|-----------------------------|-------------------|
| 0                   | <b>don't care</b>  | Input working OK.           | (LED OFF)         |
| 1                   | 0                  | Input Open circuit or zero. | (LED ON)          |
| 1                   | 1                  | Input Over range.           | (LED FLASH)       |

The analog input status can be read in a single register as follows:



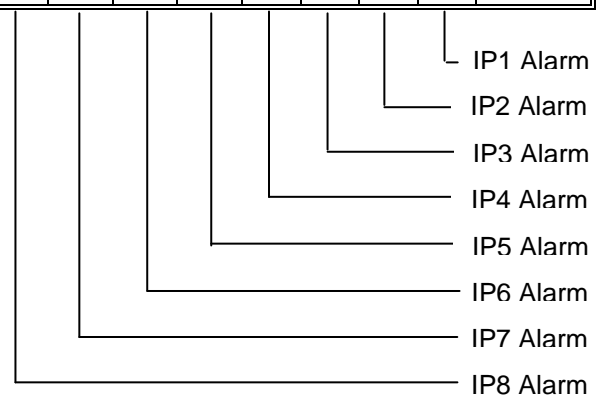
### 3.7.6.3 Analog Input Alarm Status.

There is one alarm status bit associated with each analog input. The alarm bits are used to indicate if the 4-20mA current loop is broken and the bit will be set if the loop current is less than 2mA.

For the voltage module there is one alarm status bit associated with each voltage input. The alarm bits are used to indicate if the 2-10V voltage input is broken and the bit will be set if the input voltage is less than 1V.

The analog input alarm status can be read in a single register as follows:

| PM8AI ANALOG INPUT ALARM STATUS |       |       |      |      |      |      |     |     |     |    |    |    |   |   | ADDRESS |   |       |
|---------------------------------|-------|-------|------|------|------|------|-----|-----|-----|----|----|----|---|---|---------|---|-------|
| MSB                             | 15    | 14    | 13   | 12   | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 |         | 1 | 0     |
|                                 | 32768 | 16384 | 8192 | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2       | 1 | 30011 |



## 3.8 PM8AI/I ISO and PM8AI/V ISO - ISOLATED ANALOG INPUTS

### 3.8.1 Description

The Analog Input modules are supplied as either a current input module (PM8AI/I ISO) or a voltage input module (PM8AI/V ISO). The inputs are fully isolated from input to logic and between inputs. This module is ideal for monitoring existing 4-20mA current loops which are isolated from each other and cannot be connected to a common point of reference.

The standard setting for the PM8AI/I ISO module is 0 - 20mA input current which represents an output value of 0 - 4095 (12 bits) in the corresponding Modbus register. To obtain an output value of 0 to 4095 for an input signal of 4 to 20mA the offset switch is switched on. This module can also be configured for a 0 – 20.000mA input range or +/- 20.000mA input. The module also supports 14 bit and 16 bit ranges.



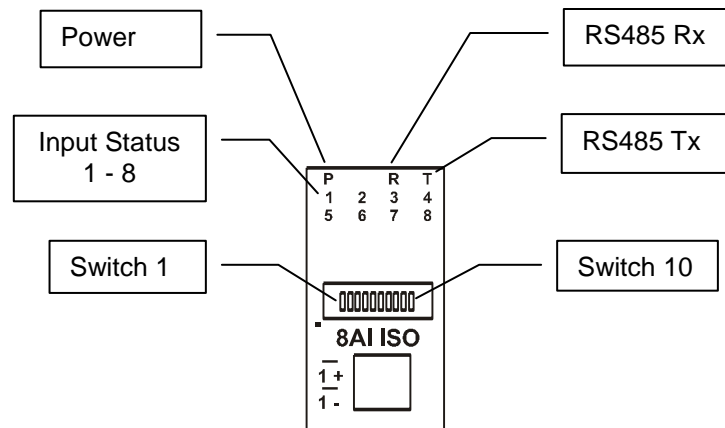
The same applies to the PM8AI/V ISO module. An input voltage of 0 - 10Volts represents an output of 0 - 4095 and 2 volts would give a reading of 819 ± 1LSB. To obtain an output value of 0 to 4095 for an input signal of 2 to 10V the offset switch is switched on. This module can also be configured for a 0 – 10.000V input range or +/- 10.000V input.

### 3.8.2 Technical Specification of PM8AI/I ISO and PM8AI/V ISO

|                              |                              |   |   |
|------------------------------|------------------------------|---|---|
| Power Supply                 | Logic Supply Voltage         |   | 12 -24 Vdc  |
|                              | Logic Supply Current         |   | 58mA @ 12V / 31mA @ 24V   |
| Voltage Inputs – PM8AI/V ISO | Input Points                 |   | 8   |
|                              | Input Voltage                |   | 0(2) - 10 Vdc   |
|                              | InputType                    | Range   | Resolution  |
|                              | 1                            | 0 – 4095  | 12 bits   |
|                              | 2                            | 0 – 10.000 V  | 1mV   |
|                              | 3                            | +/- 10.000 V  | 1mV   |
|                              | 4                            | 0 – 1.0000 V  | 0.1mV   |
|                              | 5                            | +/- 1.0000 V  | 0.1mV   |
|                              | 6                            | 0 - 16383   | 14 bits (version 8 onwards)                                     |
|                              | 7                            | 0 - 65535   | 16 bits (version 8 onwards)                                     |
|                              | Drift                        |   | 100ppm/°C   |
|                              | Isolation                    |   | 1500Vrms between field and logic<br>350Vpeak between each input |
|                              | Current Inputs – PM8AI/I ISO | Input Points  |   |
| Input Current                |                              | 0(4) - 20 mA  |   |
| InputType                    |                              | Range   | Resolution  |
| 1                            |                              | 0 – 4095  | 12 bits   |
| 2                            |                              | 0–20.000mA  | 1uA   |
| 3                            |                              | +/-20.000mA   | 1uA   |
| 4                            |                              | 0 - 16383   | 14 bits (version 8 onwards)                                     |
| 5                            |                              | 0 - 65535   | 16 bits (version 8 onwards)                                     |
| Drift                        |                              | 100ppm/°C   |   |
| Isolation                    |                              | 1500Vrms between field and logic<br>350Vpeak between each input |   |
| Temperature                  | Operating Temperature.       |   | -40°C to + 80°C   |
|                              | Storage Temperature          |   | -40°C to + 85°C   |
| Connectors                   | Logic Power and Comms.       |   | 4 Pin Connector on underside of unit                            |
|                              | Inputs                       |   | 18 Way screw connector on front                                 |
|                              |                              |   |   |

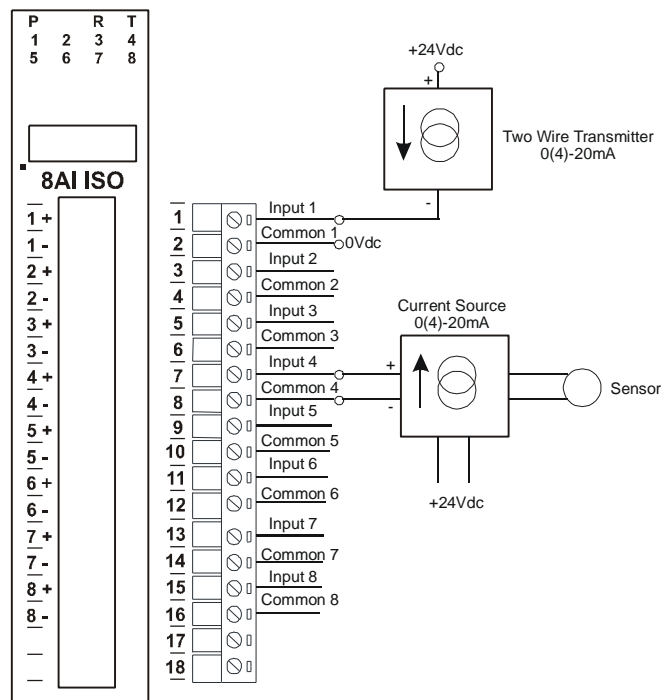
### 3.8.3 Status Indicators

|               |  |
|---------------|--|
| Power:        | Flashes to indicate the CPU is running.  |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.  |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.  |
| Input Status: | <b>"ON" when the input is zero.</b><br><b>"OFF" when the input is greater than zero and less than 4095.</b><br><b>"Flashing" when the input is over range, greater or equal to 4095.</b> |

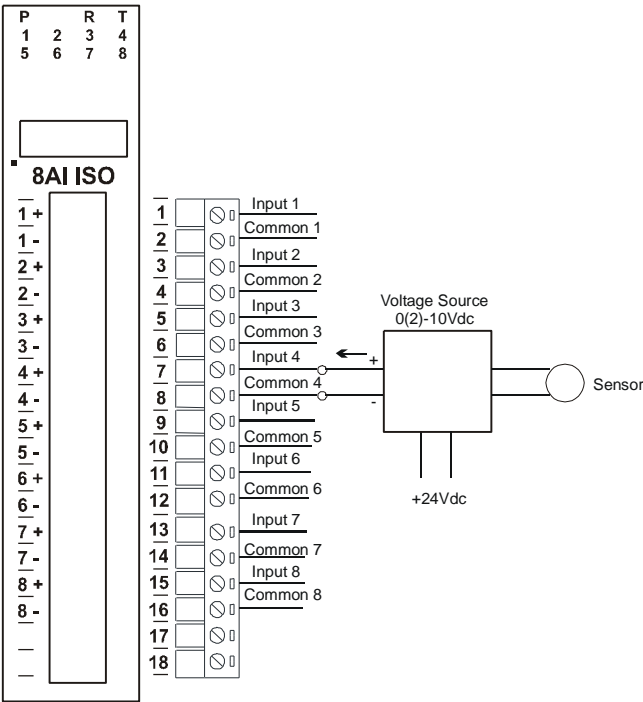


### 3.8.4 Wiring

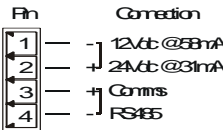
The following diagram shows how the analog inputs are connected to a 0(4)-20mA source. All of the common terminals are isolated from each other.



The following diagram shows how the analog inputs are connected to a 0(2)-10Vdc source. All of the common terminals are isolated from each other.



The following diagram shows the wiring for the power and RS485 communications.



### 3.8.5 Switch Settings

| SWITCH | FUNCTION     | DESCRIPTION  |
|--------|--------------|--|
| 1      | NODE ID +1   | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2      | NODE ID +2   |  |
| 3      | NODE ID +4   |  |
| 4      | NODE ID +8   |  |
| 5      | NODE ID +16  |  |
| 6      | NODE ID +32  |  |
| 7      | NODE ID +64  |  |
| 8      | OFFSET       | When switched ON the inputs are scaled to accept a 2V or 4mA offset .  |
| 9      | OUT OF RANGE | An out of range is given when the input is too negative or too positive. When switched off the analog value will be loaded with -32767 when out of range. When switched on the analog value will be loaded with 32768 when out of range. |
| 10     | BAUD RATE    | Selects 9600 (off) or Programmed Baud Rate (on)  |



### 3.8.6 PM8AI ISO Data Registers (8AI/I TYPE = 107/8AI/V TYPE = 108)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description   |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 107(PM8AI/I) or 108(PM8AI/V)             |
| 30002          | Analog Input 1            | 0         | 65535      | R      | Analog Input lower 16 Bits  |
| 30003          | Analog Input 2            | 0         | 65535      | R      | "   |
| 30004          | Analog Input 3            | 0         | 65535      | R      | "   |
| 30005          | Analog Input 4            | 0         | 65535      | R      | "   |
| 30006          | Analog Input 5            | 0         | 65535      | R      | "   |
| 30007          | Analog Input 6            | 0         | 65535      | R      | "   |
| 30008          | Analog Input 7            | 0         | 65535      | R      | "   |
| 30009          | Analog Input 8            | 0         | 65535      | R      | "   |
| 30010          | Input Status              | 0         | 65535      | R      | bit2 = 0(open circuit or < 2), bit2 = 1(over range)<br>bit1 = 0(OK),bit1 = 1(error) |
| 30011          | Input Alarm Status        | 0         | 255        | R      | bit1 = 0(OK),bit1 = 1(input < 2mA)<br>(version 8 onwards)                           |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel   |
| 40101          | Input Type                | 1         | 7          | R/W    | See specification table.  |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500                               |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd   |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits   |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)   |

### 3.8.6.1 Analog Input Registers.

The analog inputs are read as a 12 bit value in the registers as follows:

| MSB   |       |      |      | PM8AI ANALOG INPUTS |      |     |     |     |    |    |    |   |   |   |   | LSB |  | ADDRESS |
|-------|-------|------|------|---------------------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|---------|
| 15    | 14    | 13   | 12   | 11                  | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |         |
| 32768 | 16384 | 8192 | 4096 | 2048                | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  | 300XX   |
| 0     | 0     | 0    | 0    |                     | x    | x   | x   | x   | x  | x  | x  | x | x | x | x | x   |  |         |

Analog Input: 12 Bit Value (0 - 4095)

### 3.8.6.2 Analog Input Status.

There are two status bits associated with each analog input. These bits are used to indicate if the input is zero or open circuit , in the working range 0-4095, or over range. If the input is open circuit or over range, then the error bit will be set. When the error bit is set, the range bit is zero if the input is open circuit and set if the input is over range, ie:

| <u>Bit 1- Error</u> | <u>Bit 2-Range</u> | <u>Condition</u>            | <u>Status LED</u> |
|---------------------|--------------------|-----------------------------|-------------------|
| 0                   | <b>don't care</b>  | Input working OK.           | (LED OFF)         |
| 1                   | 0                  | Input Open circuit or zero. | (LED ON)          |
| 1                   | 1                  | Input Over range.           | (LED FLASH)       |

The analog input status can be read in a single register as follows:

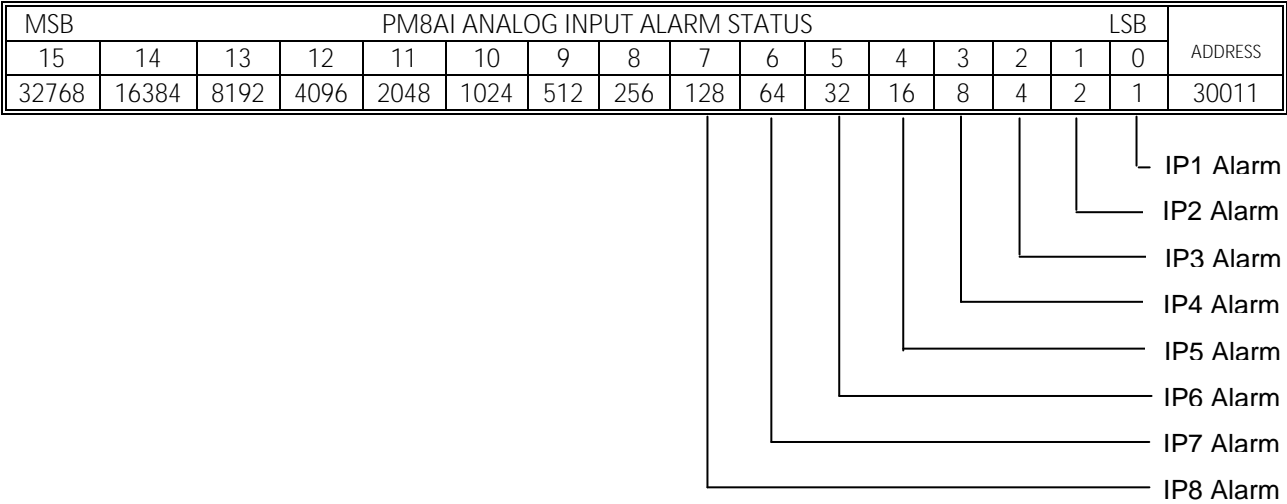
| MSB   |       |      |      | PM8AI ANALOG INPUT STATUS |      |     |     |     |    |    |    |   |   |   |   | LSB |  | ADDRESS   |
|-------|-------|------|------|---------------------------|------|-----|-----|-----|----|----|----|---|---|---|---|-----|--|-----------|
| 15    | 14    | 13   | 12   | 11                        | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1 | 0 |     |  |           |
| 32768 | 16384 | 8192 | 4096 | 2048                      | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |     |  | 30010     |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  |           |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP1 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP1 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP2 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP2 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP3 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP3 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP4 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP4 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP5 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP5 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP6 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP6 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP7 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP7 Range |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP8 Error |
|       |       |      |      |                           |      |     |     |     |    |    |    |   |   |   |   |     |  | IP8 Range |

3.8.6.3 Analog Input Alarm Status.

There is one alarm status bit associated with each analog input. The alarm bits are used to indicate if the 4-20mA current loop is broken and the bit will be set if the loop current is less than 2mA.

For the voltage module there is one alarm status bit associated with each voltage input. The alarm bits are used to indicate if the 2-10V voltage input is broken and the bit will be set if the input voltage is less than 1V.

The analog input alarm status can be read in a single register as follows:





## 3.9 PM8TC - THERMOCOUPLE INPUTS

### 3.9.1 Description

The PM8TC module is a 8 thermocouple input module. The module uses differential inputs to reduce effects of electrical noise and mains pickup. The thermocouple inputs are isolated from the logic. If inter channel isolation is required then the PM8TCISO should be used.

The thermocouple voltage is read by the module circuitry, linearised and converted to degrees Centigrade. No ranging is required as the module covers the full range as indicated in the table of TC types. The value that is read from the Modbus register is the actual temperature in degrees centigrade to 0.1°C resolution. ie: a value of 3451 corresponds to a temperature of 345.1°C.

The thermocouple type is setup by writing a value to the TC Type register. The value is obtained from the table below. For example to select type K thermocouples, the value "2" must be written to the TC Type register. All 8 thermocouple inputs adopt the same TC type.

The DIP switch 9 is used to select upscale or downscale burnout. A value of 32768 is used to indicate upscale burnout and a value of -32767 is used to indicate downscale burnout.

The module has built in Cold Junction Compensation. Use must be made of the correct thermocouple extension wire to avoid reading errors.

The thermocouple module can also be configured for a 0 - 50mV input range. The TC Type register must be set to 9 for this option. The value in the register which is read back over the network is 0 - 50,000.

Note: As there is no inter-channel isolation, isolated thermocouples must be used in order to prevent ground loops and reading errors.



| Switch | Function   | ON     | OFF    |
|--------|------------|--------|--------|
| SW1    | TC Type    | +1     | -1     |
| SW2    | TC Type    | +2     | -2     |
| SW3    | TC Type    | +3     | -3     |
| SW4    | TC Type    | +4     | -4     |
| SW5    | TC Type    | +5     | -5     |
| SW6    | TC Type    | +6     | -6     |
| SW7    | TC Type    | +7     | -7     |
| SW8    | TC Type    | +8     | -8     |
| SW9    | TC Burnout | UP     | DOWN   |
| SW10   | Modbus     | Config | Normal |

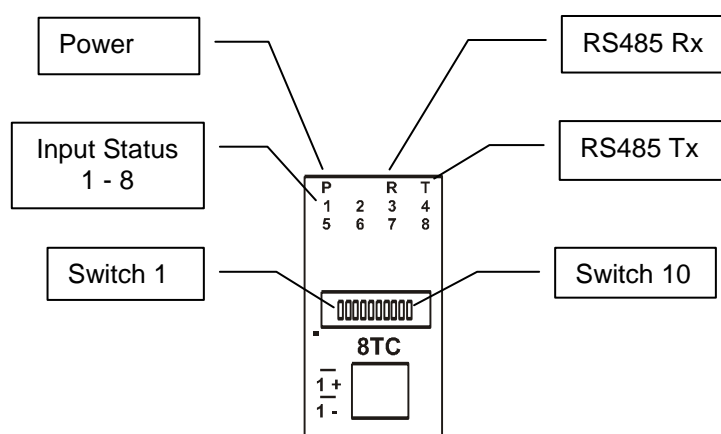
WIRING CONNECTIONS  
CONNECTION PIN  
1. 0V to GND 1  
2. 24V to GND 2  
3. 0V to GND 3  
4. 0V to GND 4  
5. 0V to GND 5  
6. 0V to GND 6  
7. 0V to GND 7  
8. 0V to GND 8

### 3.9.2 Technical Specification of PM8TC

|               |                        |      |  |          |
|---------------|------------------------|------|--|----------|
| Power Supply  | Logic Supply Voltage   |      | 12 -24 Vdc                                 |          |
|               | Logic Supply Current   |      | 62mA @ 12V / 33mA @ 24V                    |          |
| TC Inputs     | Input Points           |      | 8  |          |
|               | Resolution             |      | 0.1°C                                      |          |
|               | Drift                  |      | 100ppm/°C Typ.                             |          |
|               | Isolation              |      | 1500Vrms between field and logic           |          |
| TC Type       | Number                 | Type | Range                                      | Accuracy |
|               | 1                      | J    | -150 to 760 °C                             | 0.2°C    |
|               | 2                      | K    | -200 to 1370 °C                            | 0.3°C    |
|               | 3                      | E    | -200 to 1000 °C                            | 0.1°C    |
|               | 4                      | T    | -200 to 400 °C                             | 0.3°C    |
|               | 5                      | N    | 0 to 1300 °C                               | 0.3°C    |
|               | 6                      | B    | 400 to 1820 °C                             | 0.5°C    |
|               | 7                      | S    | -50 to 1767 °C                             | 0.6°C    |
|               | 8                      | R    | -50 to 1767 °C                             | 0.7°C    |
|               | 9                      | mV   | 0 to 50mV                                  | 0.1%     |
|               | 10                     | C    | 0 to 2315.5 °C                             | 0.7°C    |
|               | 11                     | D    | 0 to 2315.5 °C                             | 0.7°C    |
|               | 12                     | G    | 0 to 2315.5 °C                             | 0.9°C    |
|               | 13                     | m V  | +/- 100mV                                  | 0.1%     |
| Cold Junction | CJC Error              |      | ±0.5°C Typ. After 30 Minutes warm up time. |          |
| Temperature   | Operating Temperature. |      | -30°C to + 80°C                            |          |
|               | Storage Temperature    |      | -40°C to + 85°C                            |          |
| Connectors    | Logic Power and Comms. |      | 4 Pin Connector on underside of unit       |          |
|               | Inputs                 |      | 18 Way screw connector on front            |          |
|               |                        |      |  |          |
|               |                        |      |  |          |

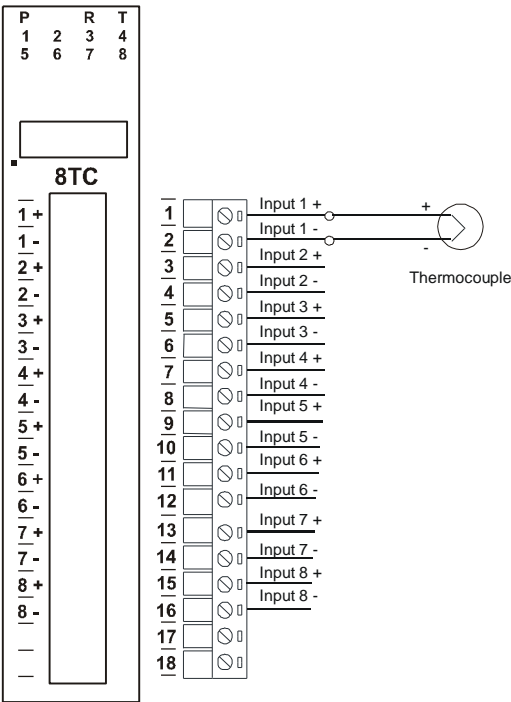
### 3.9.3 Status Indicators

|               |  |
|---------------|--|
| Power:        | Flashes to indicate the CPU is running.  |
| RS485 Rx:     | Flashes to indicate the unit has received a valid Modbus message.                        |
| RS485 Tx:     | Flashes to indicate the unit has sent a Modbus message.                                  |
| Input Status: | "ON" when the thermocouple is open circuit.<br>"OFF" when the thermocouple is connected. |

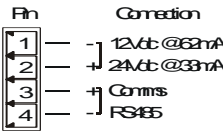


### 3.9.4 Wiring

The following diagram shows how the inputs are connected to a thermocouple.



The following diagram shows the wiring for the power and RS485 communications.



### 3.9.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION  |
|--------|-------------|--|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2      | NODE ID +2  |  |
| 3      | NODE ID +4  |  |
| 4      | NODE ID +8  |  |
| 5      | NODE ID +16 |  |
| 6      | NODE ID +32 |  |
| 7      | NODE ID +64 |  |
| 8      | -           | Not used.  |
| 9      | BREAK       | TC break. When switched off the TC value will be loaded with - 32767 when the TC is faulty. When switched on the TC value will be loaded with 32768. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)  |

### 3.9.6 PM8TC Data Registers (MODULE TYPE = 105)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description   |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 105        |
| 30002          | TC Input 1                | -xxx.x    | yyy.y      | R      | Thermocouple Inputs. See table for range.             |
| 30003          | TC Input 2                | -xxx.x    | yyy.y      | R      | Resolution in 0.1°C.                                  |
| 30004          | TC Input 3                | -xxx.x    | yyy.y      | R      | "   |
| 30005          | TC Input 4                | -xxx.x    | yyy.y      | R      | "   |
| 30006          | TC Input 5                | -xxx.x    | yyy.y      | R      | "   |
| 30007          | TC Input 6                | -xxx.x    | yyy.y      | R      | "   |
| 30008          | TC Input 7                | -xxx.x    | yyy.y      | R      | "   |
| 30009          | TC Input 8                | -xxx.x    | yyy.y      | R      | "   |
| 30010          | CJC Temp.                 | -xxx.x    | yyy.y      | R      | CJC Temperature in 0.1°C resolution.                  |
| 30011          | Input Status              | 0         | 65535      | R      | bit1 = 0(OK), bit1 = 1(error or open circuit)         |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | TC Type                   | 1         | 13         | R/W    | See TC Tables.  |
| 40102          | Line Frequency            | 50        | 60         | R/W    | Line Frequency  |
| 40103          | CJC Offset                | 1         | 199        | R/W    | 100 = zero offset (0.0)                               |
| 40104          | Units Type                | 1         | 2          | R/W    | 1=°C, 2=°F  |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |



## 3.10 PM8TCISO - ISOLATED THERMOCOUPLE INPUTS

### 3.10.1 Description

The PM8TCISO module is a 8 isolated thermocouple input module. The module uses differential inputs to reduce effects of electrical noise and mains pickup. The thermocouple inputs are isolated from the logic and from each other. This module is operated in an identical way to the PM8TC module and is fully interchangeable.

The thermocouple voltage is read by the module circuitry, linearised and converted to degrees Centigrade. No ranging is required as the module covers the full range as indicated in the TC table. The value that is read from the Modbus register is the actual temperature in degrees centigrade to 0.1°C resolution. ie: a value of 3451 corresponds to a temperature of 345.1°C.

The thermocouple type is setup by writing a value to the TC Type register. The value is obtained from the table below. For example to select type K thermocouples, the value "2" must be written to the TC Type register. All 8 thermocouple inputs adopt the same TC type.

The DIP switch 9 is used to select upscale or downscale burnout. A value of 32768 is used to indicate upscale burnout and a value of -32767 is used to indicate downscale burnout.

The module has built in Cold Junction Compensation. Use must be made of the correct thermocouple extension wire to avoid reading errors.

The thermocouple module can also be configured for a 0 - 50mV input range. The TC Type register must be set to 9 for this option. The value in the register which is read back over the network is 0 - 50,000.

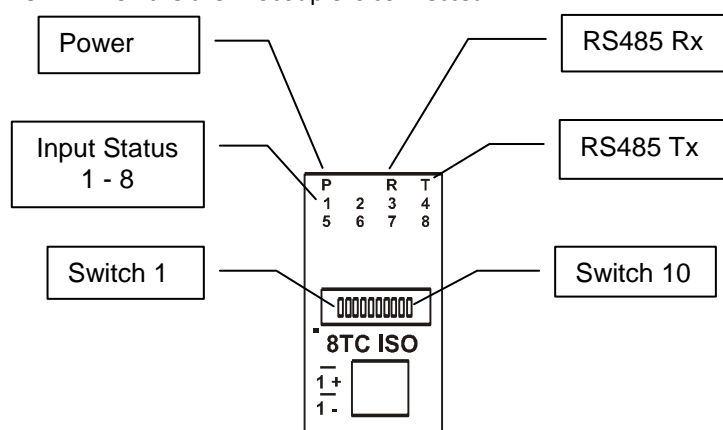


### 3.10.2 Technical Specification of PM8TC

|               |                        |      |  |          |
|---------------|------------------------|------|--|----------|
| Power Supply  | Logic Supply Voltage   |      | 12 -24 Vdc   |          |
|               | Logic Supply Current   |      | 58mA @ 12V / 31mA @ 24V  |          |
| TC Inputs     | Input Points           |      | 8  |          |
|               | Resolution             |      | 0.1°C  |          |
|               | Drift                  |      | 100ppm/°C Typ.   |          |
|               | Isolation              |      | 1500Vrms between field and logic<br>350Vpeak between each TC input |          |
| TC Type       | Number                 | Type | Range  | Accuracy |
|               | 1                      | J    | -150 to 760 °C   | 0.2°C    |
|               | 2                      | K    | -200 to 1370 °C  | 0.3°C    |
|               | 3                      | E    | -200 to 1000 °C  | 0.1°C    |
|               | 4                      | T    | -200 to 400 °C   | 0.3°C    |
|               | 5                      | N    | 0 to 1300 °C   | 0.3°C    |
|               | 6                      | B    | 400 to 1820 °C   | 0.5°C    |
|               | 7                      | S    | -50 to 1767 °C   | 0.6°C    |
|               | 8                      | R    | -50 to 1767 °C   | 0.7°C    |
|               | 9                      | mV   | 0 to 50mV  | 0.1%     |
|               | 10                     | C    | 0 to 2315.5 °C   | 0.7°C    |
|               | 11                     | D    | 0 to 2315.5 °C   | 0.7°C    |
|               | 12                     | G    | 0 to 2315.5 °C   | 0.9°C    |
|               | 13                     | m V  | +/- 100mV  | 0.1%     |
| Cold Junction | CJC Error              |      | ±0.5°C Typ. After 30 Minutes warm up time.                         |          |
| Temperature   | Operating Temperature. |      | -30°C to + 80°C  |          |
|               | Storage Temperature    |      | -40°C to + 85°C  |          |
| Connectors    | Logic Power and Comms. |      | 4 Pin Connector on underside of unit                               |          |
|               | Inputs                 |      | 18 Way screw connector on front                                    |          |
|               |                        |      |  |          |
|               |                        |      |  |          |

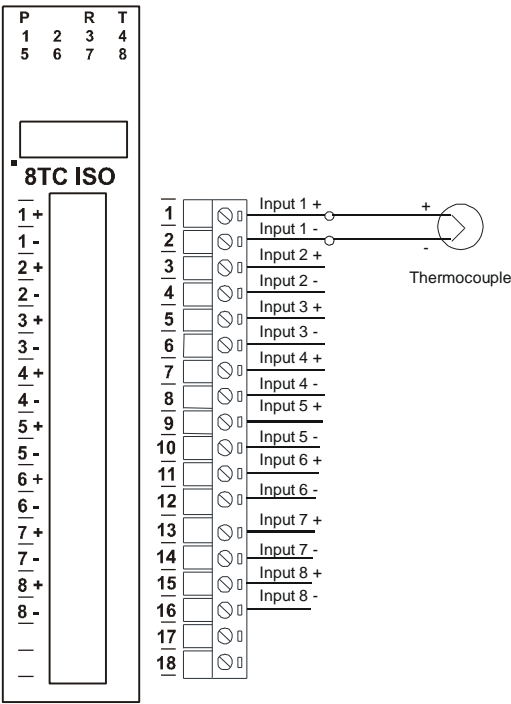
### 3.10.3 Status Indicators

Power: Flashes to indicate the CPU is running.  
 RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.  
 RS485 Tx: Flashes to indicate the unit has sent a Modbus message.  
 Input Status: "ON" when the thermocouple is open circuit.  
 "OFF" when the thermocouple is connected.

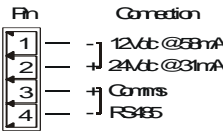


3.10.4 Wiring

The following diagram shows how the inputs are connected to a thermocouple.



The following diagram shows the wiring for the power and RS485 communications.



3.10.5 Switch Settings

| <u>SWITCH</u> | <u>FUNCTION</u> | <u>DESCRIPTION</u>   |
|---------------|-----------------|--|
|               |                 |  |
| 1             | NODE ID +1      | Node ID's from 0 to 127 are set up using switches 1 to 7   |
| 2             | NODE ID +2      | "  |
| 3             | NODE ID +4      | "  |
| 4             | NODE ID +8      | "  |
| 5             | NODE ID +16     | "  |
| 6             | NODE ID +32     | "  |
| 7             | NODE ID +64     | "  |
| 8             | -               | Not used.  |
| 9             | BREAK           | TC break. When switched off the TC value will be loaded with - 32767 when the TC is faulty. When switched on the TC value will be loaded with 32768. |
| 10            | BAUD RATE       | Selects 9600 (off) or Programmed Baud Rate (on)  |

### 3.10.6 PM8TCISO Data Registers (MODULE TYPE = 106)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description   |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 106        |
| 30002          | TC Input 1                | -xxx.x    | yyy.y      | R      | Thermocouple Inputs. See table for range.             |
| 30003          | TC Input 2                | -xxx.x    | yyy.y      | R      | Resolution in 0.1°C.                                  |
| 30004          | TC Input 3                | -xxx.x    | yyy.y      | R      | "   |
| 30005          | TC Input 4                | -xxx.x    | yyy.y      | R      | "   |
| 30006          | TC Input 5                | -xxx.x    | yyy.y      | R      | "   |
| 30007          | TC Input 6                | -xxx.x    | yyy.y      | R      | "   |
| 30008          | TC Input 7                | -xxx.x    | yyy.y      | R      | "   |
| 30009          | TC Input 8                | -xxx.x    | yyy.y      | R      | "   |
| 30010          | CJC Temp.                 | -xxx.x    | yyy.y      | R      | CJC Temperature in 0.1°C resolution.                  |
| 30011          | Input Status              | 0         | 65535      | R      | bit1 = 0(OK), bit1 = 1(error or open circuit)         |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | TC Type                   | 1         | 13         | R/W    | See TC Tables.  |
| 40102          | Line Frequency            | 50        | 60         | R/W    | Line Frequency  |
| 40103          | CJC Offset                | 1         | 199        | R/W    | 100 = zero offset (0.0)                               |
| 40104          | Units Type                | 1         | 2          | R/W    | 1=°C, 2=°F  |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

## 3.11 PM6RTD - RTD INPUTS

### 3.11.1 Description

The PM6RTD module is a 6 RTD input module. The module can accommodate either 2 or 3 wire RTD sensors. The RTD inputs are isolated from the logic.

The RTD resistance is read by the module circuitry, linearised and converted to degrees Centigrade. No ranging is required as the module covers the full range of the RTD as indicated in the RTD table. The value that is read from the Modbus register is the actual temperature in degrees centigrade to 0.1°C resolution. ie: a value of 3451 corresponds to a temperature of 345.1°C.

The RTD type is setup by writing a value to the RTD Type register. The value is obtained from the table below. For example to select a PT100 RTD, the value "1" must be written to the RTD Type register. All 6 RTD inputs adopt the same RTD type.



The DIP switch 9 is used to select upscale or downscale burnout for break detection. A value of 32768 is used to indicate upscale burnout and a value of -32767 is used to indicate downscale burnout.

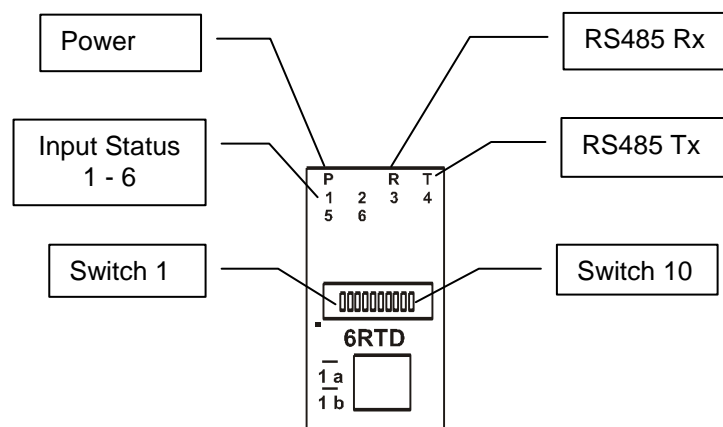
Note: As there is no inter-channel isolation, isolated RTD's must be used in order to prevent ground loops and reading errors.

### 3.11.2 Technical Specification of PM6RTD

|              |                        |                       |                                      |                   |
|--------------|------------------------|-----------------------|--------------------------------------|-------------------|
| Power Supply | Logic Supply Voltage   |                       | 12 -24 Vdc                           |                   |
|              | Logic Supply Current   |                       | 87mA @ 12V / 45mA @ 24V              |                   |
| RTD Inputs   | Input Points           |                       | 6                                    |                   |
|              | RTD Configuration      |                       | 2 or 3 Wire                          |                   |
|              | Resolution             |                       | 0.1°C                                |                   |
|              | Drift                  |                       | 100ppm/°C Typ.                       |                   |
|              | Line resistance effect |                       | < 0.1°C balanced                     |                   |
|              | Max. line resistance   |                       | 100ohms                              |                   |
|              | Isolation              |                       | 1500Vrms between field and logic     |                   |
| RTD Type     | Number                 | Type                  | Range                                | Accuracy          |
|              | 1                      | PT100                 | -200 to 850°C                        | 0.3°CIEC 751:1983 |
|              | 2                      | Ni120                 | -80 to 320°C                         | 0.3°C             |
|              | 3                      | PT1000                | -200 to 850°C                        | 0.3°C             |
|              | 4                      | Ni1000-DIN            | -200 to 850°C                        | 0.3°C             |
|              | 5                      | Ni1000-<br>Landys&Gyr | -200 to 850°C                        | 0.3°C             |
|              | 6                      | Ohms                  | 10 - 400 ohms                        |                   |
|              | 7                      | Ohms                  | 100-4000ohms                         |                   |
| Temperature  | Operating Temperature. |                       | -40°C to + 80°C                      |                   |
|              | Storage Temperature    |                       | -40°C to + 85°C                      |                   |
| Connectors   | Logic Power and Comms. |                       | 4 Pin Connector on underside of unit |                   |
|              | Inputs                 |                       | 18 Way screw connector on front      |                   |
|              |                        |                       |                                      |                   |
|              |                        |                       |                                      |                   |

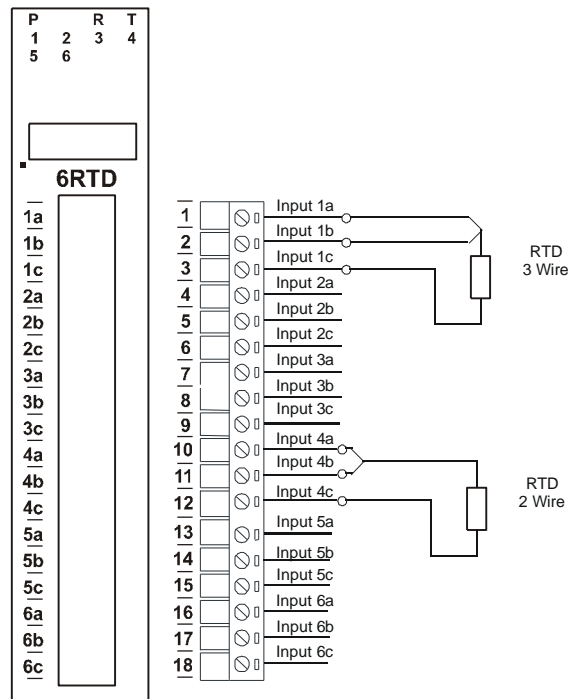
### 3.11.3 Status Indicators

Power: Flashes to indicate the CPU is running.  
 RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.  
 RS485 Tx: Flashes to indicate the unit has sent a Modbus message.  
 Input Status: "ON" when the RTD is open circuit.  
 "OFF" when the RTD is connected.

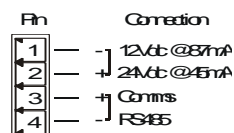


### 3.11.4 Wiring

The following diagram shows how the inputs are connected to a 2 and 3 wire RTD.



The following diagram shows the wiring for the power and RS485 communications.



### 3.11.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7  |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | -           | Not used.   |
| 9      | BREAK       | RTD break. When switched off the RTD value will loaded with - 32767 when the RTD is faulty. When switched on the RTD value will be loaded with 32768. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.11.6 PM6RTD Data Registers (MODULE TYPE = 109)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Description   |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 109        |
| 30002          | RTD Input 1               | -xxx.x    | yyyy.y     | R      | Thermocouple Inputs. See table for range.             |
| 30003          | RTD Input 2               | -xxx.x    | yyyy.y     | R      | Resolution in 0.1°C.                                  |
| 30004          | RTD Input 3               | -xxx.x    | yyyy.y     | R      | "   |
| 30005          | RTD Input 4               | -xxx.x    | yyyy.y     | R      | "   |
| 30006          | RTD Input 5               | -xxx.x    | yyyy.y     | R      | "   |
| 30007          | RTD Input 6               | -xxx.x    | yyyy.y     | R      | "   |
| 30008          | Input Status              | 0         | 65535      | R      | bit1 = 0(OK),bit1 = 1(error or open circuit)          |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | RTD Type                  | 1         | 7          | R/W    | See RTD Tables.                                       |
| 40102          | Line Frequency            | 50        | 60         | R/W    | Line Frequency  |
| 40103          | Units Type                | 1         | 2          | R/W    | 1=°C, 2=°F  |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

#### 3.11.6.1 RTD Input Status.

There is one status bits associated with each RTD input. These bits are used to indicate if the input is open circuit or over range. If the input is open circuit or over range, then the error bit will be set.

| <u>Bit 1- Error</u> | <u>Bit 2-Not Used</u> | <u>Condition</u>           | <u>Status LED</u> |
|---------------------|-----------------------|----------------------------|-------------------|
| 0                   | 0                     | Input working OK.          | (LED OFF)         |
| 1                   | 0                     | Open circuit / Over range. | (LED ON)          |

The analog input status can be read in a single register as follows:

| MSB   |       | PM6RTD ANALOG INPUT STATUS |      |      |      |     |     |     |    |    |    |   |   | LSB |   | ADDRESS |
|-------|-------|----------------------------|------|------|------|-----|-----|-----|----|----|----|---|---|-----|---|---------|
| 15    | 14    | 13                         | 12   | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1   | 0 |         |
| 32768 | 16384 | 8192                       | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2   | 1 | 30008   |

IP1 Error  
IP2 Error  
IP3 Error  
IP4 Error  
IP5 Error  
IP6 Error



## 3.12 PMDAIO – DIGITAL + ANALOG INPUTS AND OUTPUTS

### 3.12.1 Description

The PMDAIO module is a multipurpose combination of inputs and outputs. The module can accommodate either 2 or 3 wire RTD sensors, current (0-20mA) and voltage (0-10V) inputs, current (0-20mA) or voltage (0-10V) output, and digital inputs and outputs.

#### RTD INPUTS:

There are 2 RTD inputs on the module. The RTD resistance is read by the module circuitry, linearised and converted to degrees Centigrade. No ranging is required as the module covers the full range of the RTD as indicated in the RTD table. The value that is read from the Modbus register is the actual temperature in degrees centigrade to 0.1°C resolution. ie: a value of 3451 corresponds to a temperature of 345.1°C.

The RTD type is setup by writing a value to the RTD Type register. The value is obtained from the table below. For example to select a PT100 RTD, the value "1" must be written to the RTD Type register.

A value of -32767 is used to indicate downscale burnout.

Note: As there is no inter-channel isolation, isolated RTD's must be used in order to prevent ground loops and reading errors.

#### ANALOG INPUTS:

The Analog Inputs (2) can be configured by internal jumpers as either a current input (0-20mA) or a voltage input (0-10V).

An input of 0 - 20mA input current or 0 – 10V input voltage represents an output value of 0 - 4095 (12 bits) in the corresponding Modbus register.

#### ANALOG OUTPUT:

There is a single analog output which can be configured with internal jumpers for a current output (0-20mA) or voltage output (0-10V).

The resolution is 12 bits, so writing a value to the Modbus register for each output of 0 - 4095 would give an output current of 0 - 20mA. A value of  $819 \pm 1\text{LSB}$  will give a current output of 4mA.



### DIGITAL INPUTS:

There are 4 digital inputs on the module. The inputs share a common terminal and can be configured for common positive or common negative.

The inputs have got counters associated with them. The counters operate in three modes.

In mode 0 all the counters are disabled.

In mode 1 all counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In mode 2 the inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1.

Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.

### DIGITAL OUTPUTS:

The module has 2 open collector (NPN) digital outputs. The outputs may be used to drive lamps or external relays when more drive capability is required.

The outputs are written to by the Modbus master device such as a PC or PLC. Each output can be individually switched on or off, or all outputs can be set up at the same time by writing a single number to the output register which represents the status of all outputs.

An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.

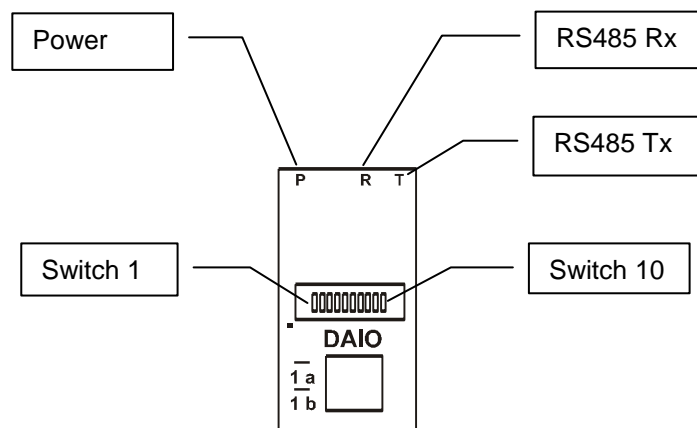
### 3.12.2 Technical Specification of PMDAIO

|                |                        |                   |   |                   |
|----------------|------------------------|-------------------|---|-------------------|
| Power Supply   | Logic Supply Voltage   |                   | 12 -24 Vdc                                      |                   |
|                | Logic Supply Current   |                   | 115mA @ 12V / 58mA @ 24V                        |                   |
|                | Field Supply Voltage   |                   | 24 Vdc  |                   |
|                | Field Supply Current   |                   | 25mA  |                   |
| RTD Inputs     | Input Points           |                   | 2   |                   |
|                | RTD Configuration      |                   | 2 or 3 Wire                                     |                   |
|                | Resolution             |                   | 0.1°C   |                   |
|                | Drift                  |                   | 100ppm/°C Typ.                                  |                   |
|                | Line resistance effect |                   | < 0.1°C balanced                                |                   |
|                | Max. line resistance   |                   | 100ohms   |                   |
|                | Isolation              |                   | 1500Vrms between field and logic                |                   |
| RTD Type       | Number                 | Type              | Range   | Accuracy          |
|                | 1                      | PT100             | -200 to 850°C                                   | 0.3°CIEC 751:1983 |
|                | 2                      | Ni120             | -80 to 320°C                                    | 0.3°C             |
|                | 3                      | PT1000            | -200 to 850°C                                   | 0.3°C             |
|                | 4                      | Ni1000-DIN        | -200 to 850°C                                   | 0.3°C             |
|                | 5                      | Ni1000-Landys&Gyr | -200 to 850°C                                   | 0.3°C             |
|                | 6                      | Ohms              | 10 - 400 ohms                                   |                   |
|                | 7                      | Ohms              | 100-4000ohms                                    |                   |
| Current Inputs | Input Points           |                   | 2   |                   |
|                | Input Current          |                   | 0 - 20 mA                                       |                   |
|                | Input Resistance       |                   | 250ohms   |                   |
|                | InputType              | Range             | Resolution                                      |                   |
|                | 1                      | 0 – 4095          | 12 bits   |                   |
|                | 2                      | 0–20.000mA        | 1uA   |                   |
|                | 3                      | +/-20.000mA       | 1uA   |                   |
|                | Drift                  |                   | 100ppm/°C                                       |                   |
|                | Accuracy               |                   | 0.2% of span                                    |                   |
|                | Isolation              |                   | 1000Vrms between field and logic                |                   |
| Voltage Inputs | Input Points           |                   | 2   |                   |
|                | Input Voltage          |                   | 0 - 1 Vdc or 0 – 10 Vdc                         |                   |
|                | Input Resistance       |                   | 190kohms  |                   |
|                | InputType              | Range             | Resolution                                      |                   |
|                | 4                      | 0 – 4095          | 12 bits   |                   |
|                | 5                      | 0 – 10.000 V      | 1mV   |                   |
|                | 6                      | +/- 10.000 V      | 1mV   |                   |
|                | 7                      | 0 – 1.0000 V      | 0.1mV   |                   |
|                | 8                      | +/- 1.0000 V      | 0.1mV   |                   |
|                | Drift                  |                   | 100ppm/°C                                       |                   |
|                | Accuracy               |                   | 0.2% of span                                    |                   |
|                | Isolation              |                   | 1000Vrms between field and logic                |                   |
| Current Output | Output Points          |                   | 1   |                   |
|                | Output Current         |                   | 0 - 20 mA                                       |                   |
|                | OutputType             | Range             | Resolution                                      |                   |
|                | 1                      | 0 – 4095          | 12 bits   |                   |
|                | Drift                  |                   | 100ppm/°C                                       |                   |
|                | Accuracy               |                   | 0.05% of span                                   |                   |
|                | Compliance             |                   | 1000 ohms max. @ 24Vdc<br>500 ohms max. @ 12Vdc |                   |

|                 |                         |          |                                      |
|-----------------|-------------------------|----------|--------------------------------------|
| Voltage Output  | Output Points           |          | 1                                    |
|                 | Output Voltage          |          | 0 - 10 V                             |
|                 | OutputType              | Range    | Resolution                           |
|                 | 2                       | 0 – 4095 | 12 bits                              |
|                 | Drift                   |          | 100ppm/°C                            |
|                 | Accuracy                |          | 0.05% of span                        |
|                 | Compliance              |          | 2000 ohms min. load                  |
| Digital Inputs  | Input Points            |          | 4                                    |
|                 | Input Voltage Range     |          | 10 - 26 Vdc                          |
|                 | Input Current per input |          | 4mA@12Vdc / 8mA @24Vdc               |
| Counters        | Inputs                  |          | 1 to 4                               |
|                 | Resolution              |          | 32 Bits                              |
|                 | Frequency               |          | 1KHz (max)                           |
|                 | Pulse Width             |          | 500us (min)                          |
| Digital Outputs | Output Points           |          | 2                                    |
|                 | Maximum Voltage         |          | 36 Vdc                               |
|                 | Maximum Current         |          | 100 mA per output                    |
|                 | Vceon                   |          | 1.1V Max.                            |
| Isolation       | Between field and logic |          | 1500Vrms between field and logic     |
| Temperature     | Operating Temperature.  |          | -40°C to + 80°C                      |
|                 | Storage Temperature     |          | -40°C to + 85°C                      |
| Connectors      | Logic Power and Comms.  |          | 4 Pin Connector on underside of unit |
|                 | I/O                     |          | 18 Way screw connector on front      |
|                 |                         |          |                                      |
|                 |                         |          |                                      |

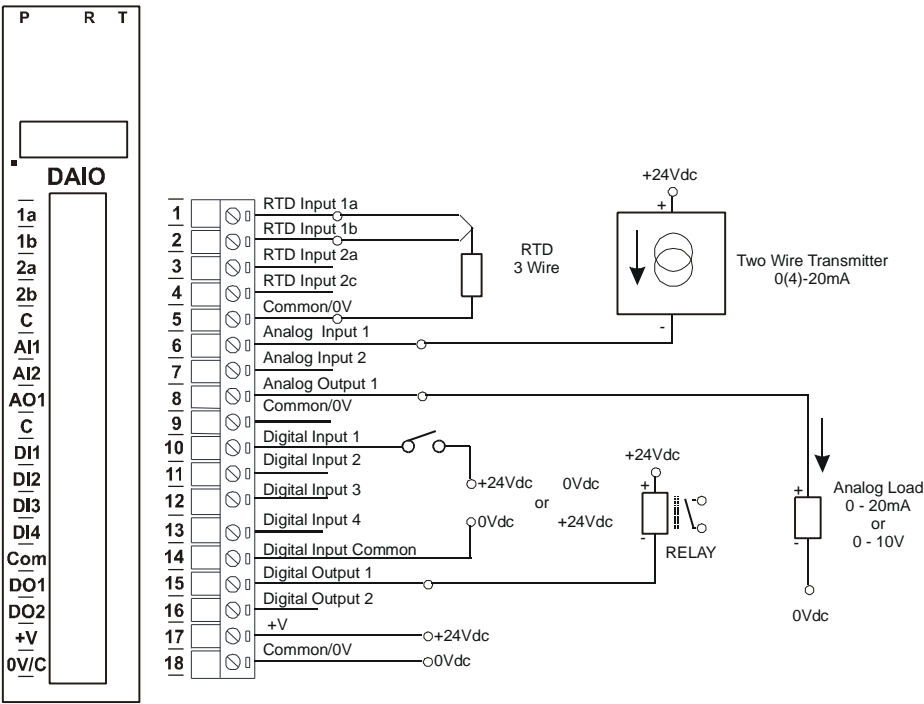
### 3.12.3 Status Indicators

Power: "ON" when module has power.  
RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.  
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.

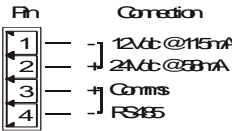


3.12.4 Wiring

The following diagram shows how the inputs and outputs are connected to the DAIO module.



The following diagram shows the wiring for the power and RS485 communications.



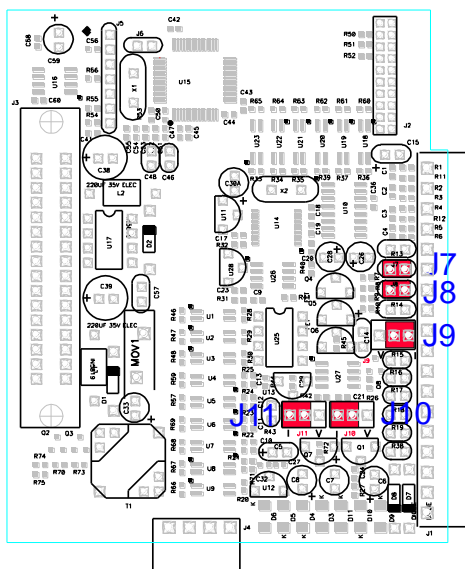
3.12.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION  |
|--------|-------------|--|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7 |
| 2      | NODE ID +2  |  |
| 3      | NODE ID +4  |  |
| 4      | NODE ID +8  |  |
| 5      | NODE ID +16 |  |
| 6      | NODE ID +32 |  |
| 7      | NODE ID +64 |  |
| 8      | -           | Not used.  |
| 9      | -           | Not used.  |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)          |

### 3.12.6 Setting the jumpers for Current Input and Output.

The Analog inputs can be configured as a current 0(4)-20mA input by placing the jumper on J7 for AI1 and J8 for AI2.

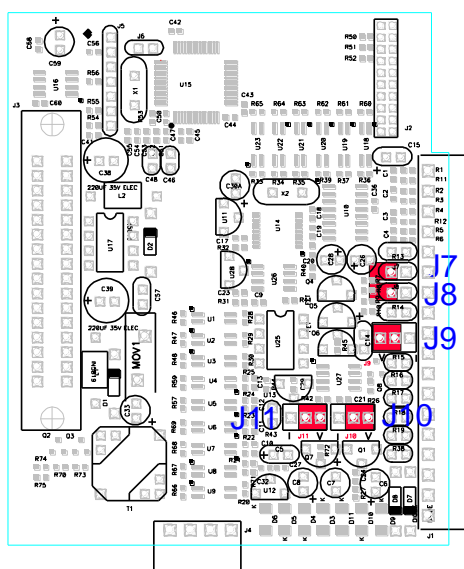
The Analog output can be configured as a current 0(4)-20mA output by placing the jumpers J9, J10 and J11 on the “I” position as shown below.



### 3.12.7 Setting the jumpers for Voltage Input and Output.

The Analog inputs can be configured as a voltage 0-10V input by removing the jumper from J7 for AI1 and J8 for AI2.

The Analog output can be configured as a voltage 0-10V output by placing the jumpers J9, J10 and J11 on the “V” position as shown below.



Note: Remember to change the input and output type in the Modbus registers if you change the jumper settings.

### 3.12.8 PMDAIO Data Registers (MODULE TYPE = 112)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.   |
| 10002          | Digital Input 2           | 0         | 1          | R      | "   |
| 10003          | Digital Input 3           | 0         | 1          | R      | "   |
| 10004          | Digital Input 4           | 0         | 1          | R      | "   |
| 00017          | Digital Output 1          | 0         | 1          | R/W    | Status of Digital Outputs.  |
| 00018          | Digital Output 2          | 0         | 1          | R/W    | "   |
|                |                           |           |            |        |   |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 112  |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in lower 8 bits. 8 - 1.  |
| 40003          | Digital Outputs           | N/A       | N/A        | R/W    | Digital Outputs in lower 8 bits. 8 - 1.   |
| 40004          | RTD Input 1               | -xxx.x    | yyyy.y     | R      | RTD Inputs. See table for range.  |
| 40005          | RTD Input 2               | -xxx.x    | yyyy.y     | R      | Resolution in 0.1°C.  |
| 40006          | Analog Input 1            | 0         | 4095       | R      | Analog Input lower 12 Bits  |
| 40007          | Analog Input 2            | 0         | 4095       | R      | Analog Input lower 12 Bits  |
| 40008          | Analog Output 1           | 0         | 4095       | R/W    | Analog Output lower 12 Bits   |
| 40009          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32 bit  |
| 40010          | Counter 1 LSB             | 0         | 65535      | R/W    | Counter with range 0 to 4294967295.   |
| 40011          | Counter 2 MSB             | 0         | 65535      | R/W    | "   |
| 40012          | Counter 2 LSB             | 0         | 65535      | R/W    | "   |
| 40013          | Counter 3 MSB             | 0         | 65535      | R/W    | "   |
| 40014          | Counter 3 LSB             | 0         | 65535      | R/W    | "   |
| 40015          | Counter 4 MSB             | 0         | 65535      | R/W    | "   |
| 40016          | Counter 4 LSB             | 0         | 65535      | R/W    | "   |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel   |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 - 255 = enabled.  |
| 40102          | Counter Mode              | 0         | 2          | R/W    | 0=Disable, 1=Up Counting, 2=Up/Down Count   |
| 40103          | Input Filter              | 0         | 65535      | R/W    | 0 = Disable, >0 = Enable. (x10ms)   |
| 40104          | RTD 1 Type                | 1         | 7          | R/W    | See RTD Tables.   |
| 40105          | RTD 2 Type                | 1         | 7          | R/W    | See RTD Tables.   |
| 40106          | AI 1 Type                 | 1         | 8          | R/W    | 1 = 0 – 4095 (mA)<br>2 = 0 – 20.000mA<br>3 = +/- 20.000mA<br>4 = 0 – 4095 (V)<br>5 = 0 – 10.000V<br>6 = +/- 10.000V<br>7 = 0 – 1.0000V<br>8 = +/- 1.0000V |
| 40107          | AI 2 Type                 | 1         | 2          | R/W    | "   |
| 40108          | AO Type                   | 1         | 2          | R/W    | 1 = 0-20mA, 2 = 0-10V   |
| 40109          | Line Frequency            | 50        | 60         | R/W    | Line Frequency  |
| 40110          | Units Type                | 1         | 2          | R/W    | 1=°C, 2=°F  |

|       |             |      |       |     |   |
|-------|-------------|------|-------|-----|---|
| 40121 | Baud Rate   | 2400 | 18750 | R/W | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122 | Parity      | 0    | 2     | R/W | 0 = none, 1 = even, 2 = odd                           |
| 40123 | Stop Bits   | 1    | 2     | R/W | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124 | Reply Delay | 0    | 255   | R/W | 0 = Disable, >0 = Enable. (x10ms)                     |



### 3.13 PMDAIO2 – DIGITAL + ANALOG INPUTS AND OUTPUTS TYPE 2

#### 3.13.1 Description

The PMDAIO2 module is a multipurpose combination of inputs and outputs. The module can accommodate either current (0-20mA) or voltage (0-10V) inputs, current (0-20mA) outputs, and digital inputs and outputs.

##### ANALOG INPUTS:

The Analog Inputs (2) can be configured by internal jumpers as either a current input (0-20mA) or a voltage input (0-10V).

An input of 0 - 20mA input current or 0 – 10V input voltage represents an output value of 0 - 4095 (12 bits) in the corresponding Modbus register.

##### ANALOG OUTPUTS:

The analog outputs are current outputs (0-20mA)

The resolution is 12 bits, so writing a value to the Modbus register for each output of 0 - 4095 would give an output current of 0 - 20mA. A value of  $819 \pm 1\text{LSB}$  will give a current output of 4mA.

##### DIGITAL INPUTS:

There are 4 digital inputs on the module. The inputs share a common terminal and can be configured for common positive or common negative. The inputs have got counters associated with them. The counters operate in three modes.

In mode 0 all the counters are disabled.

In mode 1 all counters are 32 bit counters allowing a count value from 0 to 4294967295. The count value can be cleared by writing a zero to the associated registers or preset to any other value using the same method.

In mode 2 the inputs are connected as up/down counters. Input 1 will increment counter 1 whilst input 2 decrements counter1.

Note: The count values are not battery backed-up and will be lost if power is turned off.

The format of the registers allows the status of the inputs to be read as either single bits or all at once as a single register on the Modbus network.

##### DIGITAL OUTPUTS:

The module has 4 open collector (NPN) digital outputs. The outputs may be used to drive lamps or external relays when more drive capability is required.

The outputs are written to by the Modbus master device such as a PC or PLC. Each output can be individually switched on or off, or all outputs can be set up at the same time by writing a single number to the output register which represents the status of all outputs.



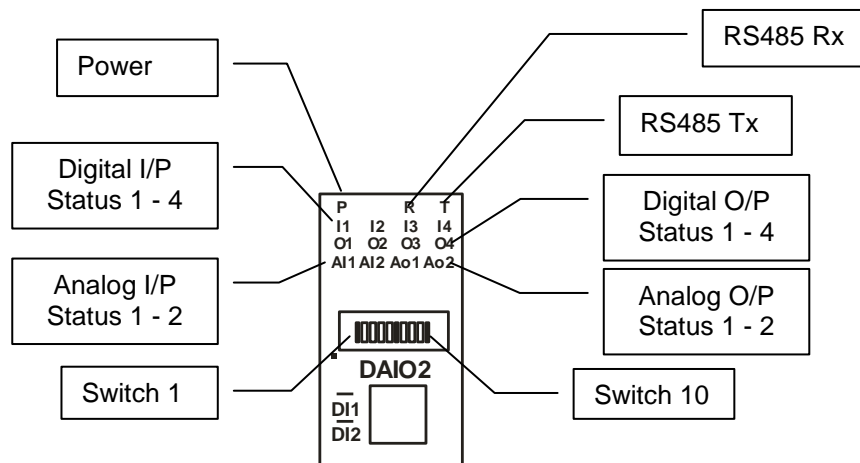
An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.

### 3.13.2 Technical Specification of PMDAIO2

|                 |                         |              |   |
|-----------------|-------------------------|--------------|---|
| Power Supply    | Logic Supply Voltage    |              | 12 -24 Vdc                                      |
|                 | Logic Supply Current    |              | 95mA @ 12V / 48mA @ 24V                         |
|                 | Field Supply Voltage    |              | 24 Vdc  |
|                 | Field Supply Current    |              | 45mA  |
| Current Inputs  | Input Points            |              | 2   |
|                 | Input Current           |              | 0 - 20 mA                                       |
|                 | Input Resistance        |              | 250ohms   |
|                 | InputType               | Range        | Resolution                                      |
|                 | 1                       | 0 – 4095     | 12 bits   |
|                 | 2                       | 0–20.000mA   | 1uA   |
|                 | 3                       | +/-20.000mA  | 1uA   |
|                 | Drift                   |              | 100ppm/°C                                       |
|                 | Accuracy                |              | 0.2% of span                                    |
| Voltage Inputs  | Isolation               |              | 1000Vrms between field and logic                |
|                 | Input Points            |              | 2   |
|                 | Input Voltage           |              | 0 - 1 Vdc or 0 – 10 Vdc                         |
|                 | Input Resistance        |              | 190kohms  |
|                 | InputType               | Range        | Resolution                                      |
|                 | 4                       | 0 – 4095     | 12 bits   |
|                 | 5                       | 0 – 10.000 V | 1mV   |
|                 | 6                       | +/- 10.000 V | 1mV   |
|                 | 7                       | 0 – 1.0000 V | 0.1mV   |
| Current Outputs | 8                       | +/- 1.0000 V | 0.1mV   |
|                 | Drift                   |              | 100ppm/°C                                       |
|                 | Accuracy                |              | 0.2% of span                                    |
|                 | Isolation               |              | 1000Vrms between field and logic                |
|                 | Output Points           |              | 2   |
|                 | Output Current          |              | 0 - 20 mA                                       |
|                 | OutputType              | Range        | Resolution                                      |
|                 | 1                       | 0 – 4095     | 12 bits   |
|                 | Drift                   |              | 100ppm/°C                                       |
| Digital Inputs  | Accuracy                |              | 0.05% of span                                   |
|                 | Compliance              |              | 1000 ohms max. @ 24Vdc<br>500 ohms max. @ 12Vdc |
|                 | Isolation               |              | 1000Vrms between field and logic                |
| Counters        | Input Points            |              | 4   |
|                 | Input Voltage Range     |              | 10 - 26 Vdc                                     |
|                 | Input Current per input |              | 4mA@12Vdc / 8mA @24Vdc                          |
| Digital Outputs | Inputs                  |              | 1 to 4  |
|                 | Resolution              |              | 32 Bits   |
|                 | Frequency               |              | 1KHz (max)                                      |
|                 | Pulse Width             |              | 500us (min)                                     |
| Isolation       | Output Points           |              | 4   |
|                 | Maximum Voltage         |              | 36 Vdc  |
|                 | Maximum Current         |              | 100 mA per output                               |
|                 | Vceon                   |              | 1.1V Max.                                       |
| Temperature     | Between field and logic |              | 1500Vrms between field and logic                |
|                 | Operating Temperature.  |              | -40°C to + 80°C                                 |
| Connectors      | Storage Temperature     |              | -40°C to + 85°C                                 |
|                 | Logic Power and Comms.  |              | 4 Pin Connector on underside of unit            |
|                 | I/O                     |              | 18 Way screw connector on front                 |

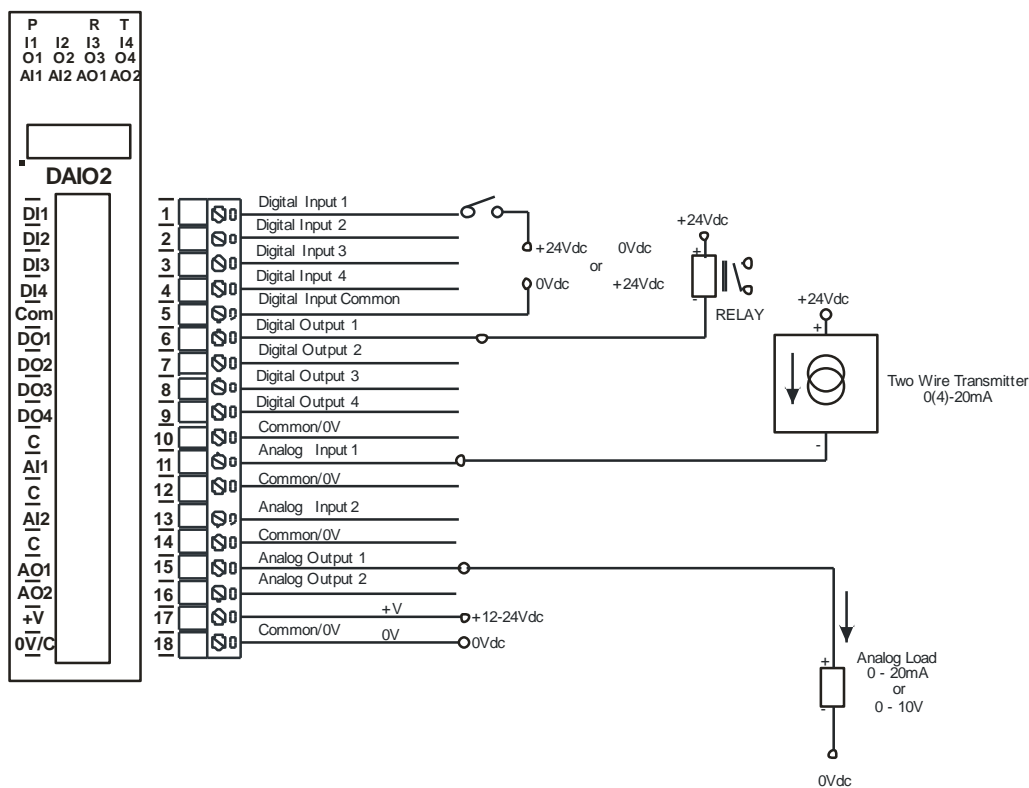
### 3.13.3 Status Indicators

|                     |   |
|---------------------|---|
| Power:              | "ON" when module has power.   |
| RS485 Rx:           | Flashes to indicate the unit has received a valid Modbus message.   |
| RS485 Tx:           | Flashes to indicate the unit has sent a Modbus message.   |
| Digital I/P Status: | "OFF" when the input is off<br>"ON" when the input is on.   |
| Digital O/P Status: | "OFF" when the output is off<br>"ON" when the output is on.   |
| Analog I/P Status:  | "ON" when the input is zero.<br>"OFF" when the input is greater than zero and less than 4095.<br>"Flashing" when the input is over range, greater or equal to 4095. |
| Analog O/P Status:  | "ON" when the input is zero.<br>"OFF" when the input is greater than zero and less than 4095.<br>"Flashing" when the input is over range, greater or equal to 4095. |

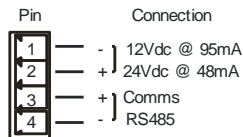


3.13.4 Wiring

The following diagram shows how the inputs and outputs are connected to the DAIO2 module.



The following diagram shows the wiring for the power and RS485 communications.

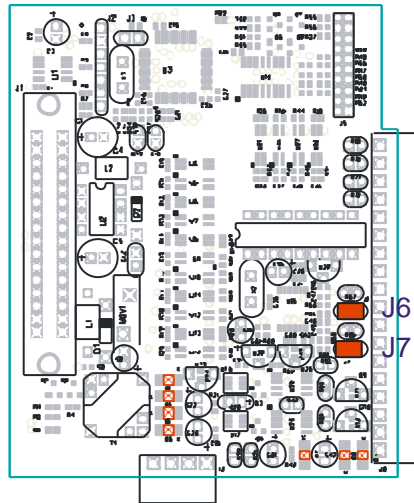


3.13.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7  |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | -           | Not used.   |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to another PMDAIO2 module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

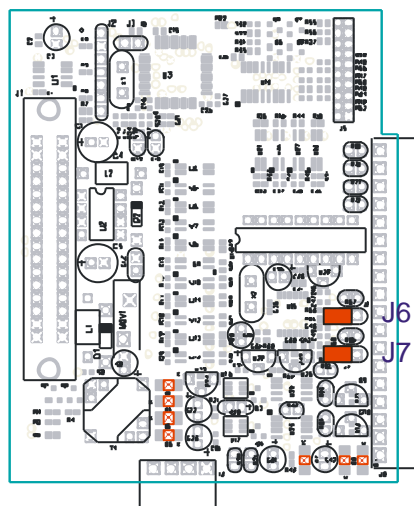
### 3.13.6 Setting the jumpers for Current Input.

The Analog inputs can be configured as a current 0(4)-20mA input by placing the jumper on J6 for AI1 and J7 for AI2.



### 3.13.7 Setting the jumpers for Voltage Input.

The Analog inputs can be configured as a voltage 0-10V input by removing the jumper from J6 for AI1 and J7 for AI2.



Note: Remember to change the input type in the Modbus registers if you change the jumper settings.

### 3.13.8 PMDAIO2 Data Registers (MODULE TYPE = 119)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 10001          | Digital Input 1           | 0         | 1          | R      | Status of Digital Inputs.   |
| 10002          | Digital Input 2           | 0         | 1          | R      | "   |
| 10003          | Digital Input 3           | 0         | 1          | R      | "   |
| 10004          | Digital Input 4           | 0         | 1          | R      | "   |
| 00017          | Digital Output 1          | 0         | 1          | R/W    | Status of Digital Outputs.  |
| 00018          | Digital Output 2          | 0         | 1          | R/W    | "   |
| 00019          | Digital Output 3          | 0         | 1          | R/W    | "   |
| 00020          | Digital Output 4          | 0         | 1          | R/W    | "   |
|                |                           |           |            |        |   |
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 119  |
| 30002          | Digital Inputs            | N/A       | N/A        | R      | Digital Inputs in lower 8 bits. 4 - 1.  |
| 40003          | Digital Outputs           | N/A       | N/A        | R/W    | Digital Outputs in lower 8 bits. 4 - 1.   |
| 30004          | Analog Input 1            | 0         | 4095       | R      | Analog Input lower 12 Bits  |
| 30005          | Analog Input 2            | 0         | 4095       | R      | Analog Input lower 12 Bits  |
| 40006          | Analog Output 1           | 0         | 4095       | R/W    | Analog Output lower 12 Bits   |
| 40007          | Analog Output 2           | 0         | 4095       | R/W    | Analog Output lower 12 Bits   |
| 40008          | Counter 1 MSB             | 0         | 65535      | R/W    | Counter MSB and LSB combine to give a 32bit counter with range 0 to 4294967295.   |
| 40009          | Counter 1 LSB             | 0         | 65535      | R/W    | "   |
| 40010          | Counter 2 MSB             | 0         | 65535      | R/W    | "   |
| 40011          | Counter 2 LSB             | 0         | 65535      | R/W    | "   |
| 40012          | Counter 3 MSB             | 0         | 65535      | R/W    | "   |
| 40013          | Counter 3 LSB             | 0         | 65535      | R/W    | "   |
| 40014          | Counter 4 MSB             | 0         | 65535      | R/W    | "   |
| 40015          | Counter 4 LSB             | 0         | 65535      | R/W    | "   |
| 30016          | Analog Input Status       | 0         | 65535      | R      | bit2 = 0(open circuit or < 2), bit2 = 1(over range)<br>bit1 = 0(OK),bit1 = 1(error)   |
| 30017          | Analog Output Status      | 0         | 65535      | R      | bit2 = 0(0), bit2 = 1(4095)<br>bit1 = 0(OK),bit1 = 1(error)   |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel   |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 - 255 = enabled.  |
| 40102          | Counter Mode              | 0         | 2          | R/W    | 0=Disable, 1=Up Counting, 2=Up/Down Count   |
| 40103          | Input Filter              | 0         | 65535      | R/W    | 0 = Disable, >0 = Enable. (x10ms)   |
| 40104          | AI 1 Type                 | 1         | 8          | R/W    | 1 = 0 – 4095 (mA)<br>2 = 0 – 20.000mA<br>3 = +/- 20.000mA<br>4 = 0 – 4095 (V)<br>5 = 0 – 10.000V<br>6 = +/- 10.000V<br>7 = 0 – 1.0000V<br>8 = +/- 1.0000V |
| 40105          | AI 2 Type                 | 1         | 8          | R/W    | "   |

|       |                  |      |       |     |   |
|-------|------------------|------|-------|-----|---|
| 40106 | Line Frequency   | 50   | 60    | R/W | Line Frequency (Hz)                                   |
| 40107 | Master Timeout   | 0    | 65535 | R/W | Modbus Master Timeout (X10ms)                         |
| 40108 | Master Poll Rate | 0    | 65535 | R/W | Modbus Master Poll Rate (X10ms)                       |
| 40121 | Baud Rate        | 2400 | 18750 | R/W | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122 | Parity           | 0    | 2     | R/W | 0 = none, 1 = even, 2 = odd                           |
| 40123 | Stop Bits        | 1    | 2     | R/W | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124 | Reply Delay      | 0    | 255   | R/W | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.13.8.1 Digital Input Register.

The digital inputs can be read in a single register as follows:

| MSB   |       | PMDAIO2 DIGITAL INPUTS |      |      |      |     |     |     |    |    |    |   |   | LSB |   | ADDRESS |
|-------|-------|------------------------|------|------|------|-----|-----|-----|----|----|----|---|---|-----|---|---------|
| 15    | 14    | 13                     | 12   | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1   | 0 |         |
| 32768 | 16384 | 8192                   | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2   | 1 | 30002   |
| 0     | 0     | 0                      | 0    | 0    | 0    | 0   | 0   | 0   | 0  | 0  | 0  | 0 | 4 | 3   | 2 | 1       |

**Digital Input Number**

### 3.13.8.2 Digital Output Register.

The digital outputs can be read/written in a single register as follows:

| MSB   |       | PMDAIO2 DIGITAL OUTPUTS |      |      |      |     |     |     |    |    |    |   |   | LSB |   | ADDRESS |
|-------|-------|-------------------------|------|------|------|-----|-----|-----|----|----|----|---|---|-----|---|---------|
| 15    | 14    | 13                      | 12   | 11   | 10   | 9   | 8   | 7   | 6  | 5  | 4  | 3 | 2 | 1   | 0 |         |
| 32768 | 16384 | 8192                    | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2   | 1 | 40003   |
| 0     | 0     | 0                       | 0    | 0    | 0    | 0   | 0   | 0   | 0  | 0  | 0  | 0 | 4 | 3   | 2 | 1       |

**Digital Output Number**

### 3.13.8.3 Counter Registers.

The counters are stored a two 16 bit registers. The first register is the High Register and the second register is the Low Register. To get the actual 32 bit count value the registers must be combined as follows:

Counter High Value = Register 40008.

Counter Low Value = Register 40009.

Counter Value = (Counter High Value X 65535) + Counter Low Value.

### 3.13.8.4 Output Watchdog Timer.





### 3.13.9 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PMDAIO2 reads digital inputs from a second PMDAIO2 module and writes the information to the outputs. The PMDAIO2 also writes digital inputs to the second PMDAIO2 module. The same applies to the analog I/O. This results in data being transferred on both directions between the two PMDAIO2 modules. The two modules must have the same network ID and these must be the only modules on the network.

#### 3.13.9.1 Modbus Master Poll Rate.

The rate at which the PMDAIO2 polls the second PMDAIO2 is configured using this register (40108). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PMDAIO2 due to turn around delays in the equipment.

#### 3.13.9.2 Modbus Master Timeout.

The PMDAIO2 polls the second PMDAIO2 to get the input data. If there is a problem and the message is corrupted or gets lost, then the PMDAIO2 communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.

## 3.14 PM8AO - ANALOG OUTPUTS

### 3.14.1 Description

The PM8AO is an 8 channel current output module. Each channel can be set to output a current in the range 0 - 20mA. The outputs are isolated from the logic and share a common negative terminal.

The resolution is 12 bits, so writing a value to the Modbus register for each output of 0 - 4095 would give an output current of 0 - 20mA. A value of  $819 \pm 1\text{LSB}$  will give a current output of 4mA.

The module may be used as either a slave or master on the Modbus network. When used with a PC or PLC the module will be configured as a slave. When used with a PM8AI module in a point-to-point configuration, the DIP switch 9 must be turned on to set the module up as a master. In this mode the PM8AO module will automatically read the information from the PM8AI module and write the input status to the outputs.

When used as a slave module, the outputs are written to by the Modbus master device such as a PC or PLC.

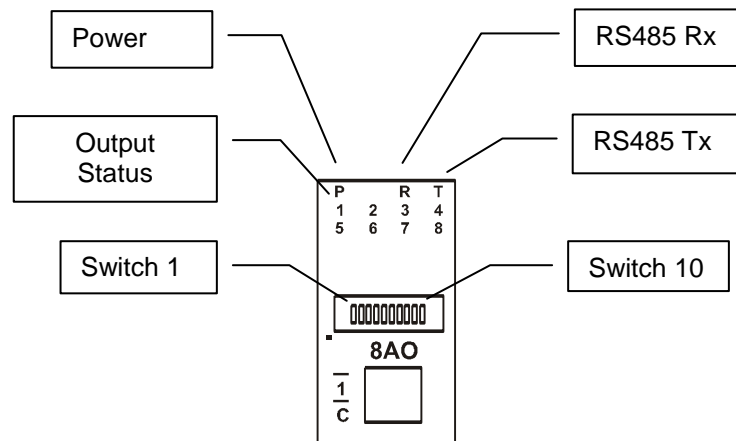


### 3.14.2 Technical Specification of PM8AO

|                |                         |   |
|----------------|-------------------------|---|
| Power Supply   | Logic Supply Voltage    | 12 -24 Vdc                                      |
|                | Logic Supply Current    | 32mA @ 12V / 18mA @ 24V                         |
|                | Field Supply Voltage    | 24 Vdc  |
|                | Field Supply Current    | 175mA   |
| Current Output | Output Points           | 8   |
|                | Output Current          | 0(4) - 20 mA                                    |
|                | Resolution              | 12 bits   |
|                | Drift                   | 100ppm/°C                                       |
|                | Accuracy                | 0.05% of span                                   |
|                | Compliance              | 1000 ohms max. @ 24Vdc<br>500 ohms max. @ 12Vdc |
| Isolation      | Between field and logic | 1500Vrms between field and logic                |
| Temperature    | Operating Temperature.  | -40°C to + 80°C                                 |
|                | Storage Temperature     | -40°C to + 85°C                                 |
| Connectors     | Logic Power and Comms.  | 4 Pin Connector on underside of unit            |
|                | Inputs                  | 18 Way screw connector on front                 |

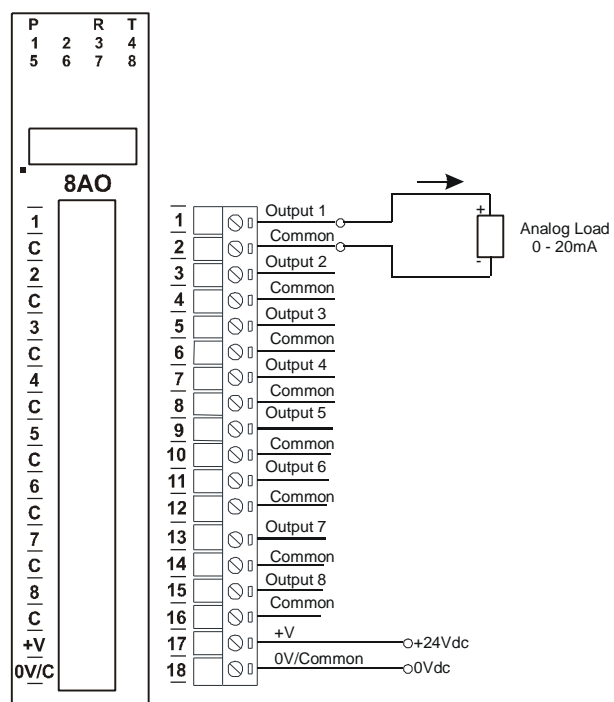
### 3.14.3 Status Indicators

|                |   |
|----------------|---|
| Power:         | Flashes to indicate the CPU is running.   |
| RS485 Rx:      | Flashes to indicate the unit has received a valid Modbus message.   |
| RS485 Tx:      | Flashes to indicate the unit has sent a Modbus message.   |
| Output Status: | <b>"ON"</b> when the output is zero.<br><b>"OFF"</b> when the output is between zero and full scale.<br><b>"Flashing"</b> when the output is at full scale. |

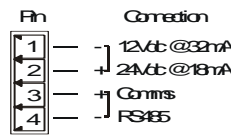


### 3.14.4 Wiring

The following diagram shows how the analog outputs are connected to a load.



The following diagram shows the wiring for the power and RS485 communications.



### 3.14.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7  |
| 2      | NODE ID +2  | "   |
| 3      | NODE ID +4  | "   |
| 4      | NODE ID +8  | "   |
| 5      | NODE ID +16 | "   |
| 6      | NODE ID +32 | "   |
| 7      | NODE ID +64 | "   |
| 8      | OFFSET      | When switched ON the outputs are scaled to accept a 4mA offset .  |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to a single Analog input module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.14.6 PM8AO Data Registers (MODULE TYPE = 110)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments   |
|----------------|---------------------------|-----------|------------|--------|--|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 110               |
| 40002          | Current Output 1          | 0         | 4095       | R/W    | Current Outputs. 0 - 4095 = 0(4) - 20mA.                     |
| 40003          | Current Output 2          | 0         | 4095       | R/W    | "  |
| 40004          | Current Output 3          | 0         | 4095       | R/W    | "  |
| 40005          | Current Output 4          | 0         | 4095       | R/W    | "  |
| 40006          | Current Output 5          | 0         | 4095       | R/W    | "  |
| 40007          | Current Output 6          | 0         | 4095       | R/W    | "  |
| 40008          | Current Output 7          | 0         | 4095       | R/W    | "  |
| 40009          | Current Output 8          | 0         | 4095       | R/W    | "  |
| 40010          | Output Status             | 0         | 65535      | R      | bit2 = 0(0), bit2 = 1(4095)<br>bit1 = 0(OK), bit1 = 1(error) |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                          |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 -255 = enabled.            |
| 40102          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)                                |
| 40103          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)                              |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500        |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                                  |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                              |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                            |

### 3.14.7 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PM8AO reads digital inputs from a PM8AI/I module and writes the information to the outputs. The two modules must have the same network ID and these must be the only modules on the network.

#### 3.14.7.1 Modbus Master Poll Rate.

The rate at which the PM8AO polls the PM8AI is configured using this register (40103). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM8AI due to turn around delays in the equipment.

#### 3.14.7.2 Modbus Master Timeout.

The PM8AO polls the PM8AI to get the input data. If there is a problem and the message is corrupted or gets lost, then the PM8AO communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.

## 3.15 PM8VO - ANALOG OUTPUTS

### 3.15.1 Description

The PM8VO is an 8 channel voltage output module. Each channel can be set to output a voltage in the range 0 – 10V. The outputs are isolated from the logic and share a common negative terminal.

The resolution is 12 bits, so writing a value to the Modbus register for each output of 0 - 4095 would give an output current of 0 – 10V. A value of  $819 \pm 1\text{LSB}$  will give a current output of 2V.

The module may be used as either a slave or master on the Modbus network. When used with a PC or PLC the module will be configured as a slave. When used with a PM8AI module in a point-to-point configuration, the DIP switch 9 must be turned on to set the module up as a master. In this mode the PM8VO module will automatically read the information from the PM8AI module and write the input status to the outputs.

When used as a slave module, the outputs are written to by the Modbus master device such as a PC or PLC.

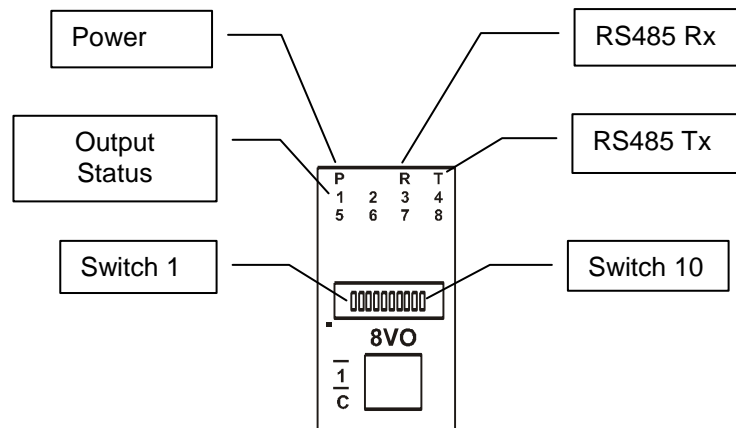


### 3.15.2 Technical Specification of PM8VO

|                |                         |                                      |
|----------------|-------------------------|--------------------------------------|
| Power Supply   | Logic Supply Voltage    | 12 -24 Vdc                           |
|                | Logic Supply Current    | 32mA @ 12V / 18mA @ 24V              |
|                | Field Supply Voltage    | 24 Vdc                               |
|                | Field Supply Current    | 85 mA max.                           |
| Voltage Output | Output Points           | 8                                    |
|                | Output Voltage          | 0(2) - 10 V                          |
|                | Resolution              | 12 bits                              |
|                | Drift                   | 100ppm/°C                            |
|                | Accuracy                | 0.05% of span                        |
|                | Compliance              | 2000 ohms min. load                  |
| Isolation      | Between field and logic | 1500Vrms between field and logic     |
| Temperature    | Operating Temperature.  | -40°C to + 80°C                      |
|                | Storage Temperature     | -40°C to + 85°C                      |
| Connectors     | Logic Power and Comms.  | 4 Pin Connector on underside of unit |
|                | Outputs                 | 18 Way screw connector on front      |
|                |                         |                                      |

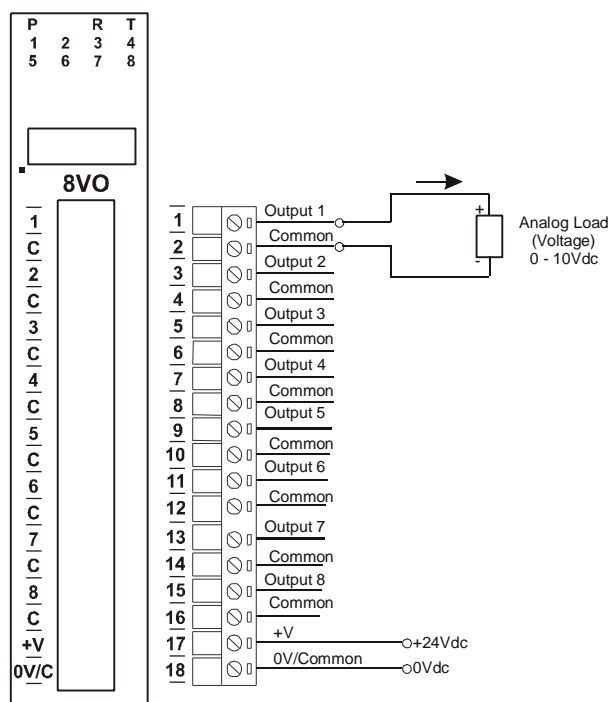
### 3.15.3 Status Indicators

|                |   |
|----------------|---|
| Power:         | Flashes to indicate the CPU is running.   |
| RS485 Rx:      | Flashes to indicate the unit has received a valid Modbus message.   |
| RS485 Tx:      | Flashes to indicate the unit has sent a Modbus message.   |
| Output Status: | <b>"ON"</b> when the output is zero.<br><b>"OFF"</b> when the output is between zero and full scale.<br><b>"Flashing"</b> when the output is at full scale. |



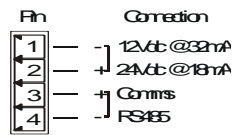
### 3.15.4 Wiring

The following diagram shows how the analog outputs are connected to a load.





The following diagram shows the wiring for the power and RS485 communications.



### 3.15.5 Switch Settings

| SWITCH | FUNCTION    | DESCRIPTION   |
|--------|-------------|---|
| 1      | NODE ID +1  | Node ID's from 0 to 127 are set up using switches 1 to 7  |
| 2      | NODE ID +2  |   |
| 3      | NODE ID +4  |   |
| 4      | NODE ID +8  |   |
| 5      | NODE ID +16 |   |
| 6      | NODE ID +32 |   |
| 7      | NODE ID +64 |   |
| 8      | OFFSET      | When switched ON the outputs are scaled to accept a 2V offset .   |
| 9      | MODE        | Selects Master or Slave Mode. Master mode is used when the module is connected to a single Analog input module. Slave mode is used when the module is to be polled either by the I/O Mapper or by a PC. |
| 10     | BAUD RATE   | Selects 9600 (off) or Programmed Baud Rate (on)   |

### 3.15.6 PM8VO Data Registers (MODULE TYPE = 111)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 111                |
| 40002          | Voltage Output 1          | 0         | 4095       | R/W    | Voltage Outputs. 0 - 4095 = 0 - 10V.                          |
| 40003          | Voltage Output 2          | 0         | 4095       | R/W    | "   |
| 40004          | Voltage Output 3          | 0         | 4095       | R/W    | "   |
| 40005          | Voltage Output 4          | 0         | 4095       | R/W    | "   |
| 40006          | Voltage Output 5          | 0         | 4095       | R/W    | "   |
| 40007          | Voltage Output 6          | 0         | 4095       | R/W    | "   |
| 40008          | Voltage Output 7          | 0         | 4095       | R/W    | "   |
| 40009          | Voltage Output 8          | 0         | 4095       | R/W    | "   |
| 40010          | Output Status             | 0         | 65535      | R      | bit2 = 0(OK), bit2 = 1(4095)<br>bit1 = 0(OK), bit1 = 1(error) |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                           |
| 40101          | Watchdog Timer            | 0         | 255        | R/W    | Timer in seconds. 0 = disabled. 1 -255 = enabled.             |
| 40102          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)                                 |
| 40103          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)                               |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500         |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                                   |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                               |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                             |

### 3.15.7 Modbus Master Setup.

The module is configured as a Modbus master when switch 9 is on. The PM8VO reads digital inputs from a PM8AI/V module and writes the information to the outputs. The two modules must have the same network ID and these must be the only modules on the network.

#### 3.15.7.1 Modbus Master Poll Rate.

The rate at which the PM8VO polls the PM8AI is configured using this register (40103). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM8AI due to turn around delays in the equipment.

#### 3.15.7.2 Modbus Master Timeout.

The PM8VO polls the PM8AI to get the input data. If there is a problem and the message is corrupted or gets lost, then the PM8VO communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.

## 3.16 PMIOMAP - I/O MAPPER

### 3.16.1 Description

The I/O Mapper is used for point-to-point communications where it is required to send input information from a PM16DI or PM8AI input module to a PM16DO or PM8AO output module over the network. The I/O Mapper is the Modbus master and all I/O modules must be set up as slaves. The I/O Mapper is only required if there is more than one pair of modules on the network.

When the I/O Mapper is used, The ID's of the Digital modules must be set up in the range 0 to 31 and the Analog modules must be set up in the range 32 to 47, starting at the bottom of the range. The Output module must be set to have the same ID as the input module.

The I/O Mapper can be configured as a Modbus Slave when the DIP switches are all off. This corresponds to an ID of zero (ID=0).

As soon as one of the switches is put on, the I/O Mapper becomes a Modbus master and starts sending out requests on the RS485 network.

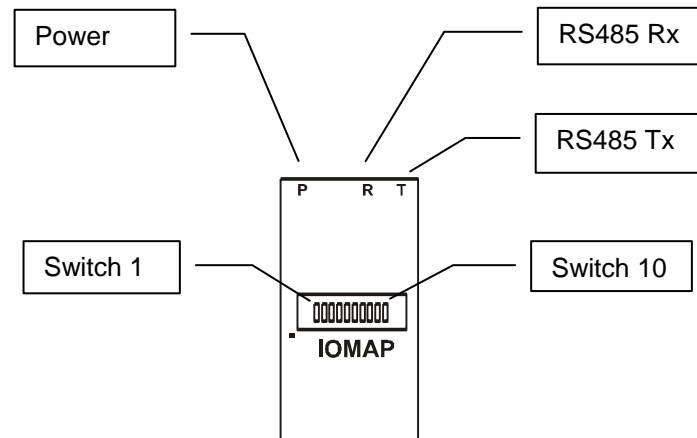


### 3.16.2 Technical Specification of PMIOMAP

|              |                        |                                      |
|--------------|------------------------|--------------------------------------|
| Power Supply | Logic Supply Voltage   | 12 -24 Vdc                           |
|              | Logic Supply Current   | 21mA @ 12V / 13mA @ 24V              |
| Temperature  | Operating Temperature. | -40°C to + 80°C                      |
|              | Storage Temperature    | -40°C to + 85°C                      |
| Connectors   | Logic Power and Comms. | 4 Pin Connector on underside of unit |
|              |                        |                                      |

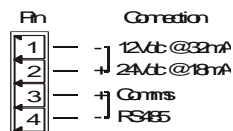
### 3.16.3 Status Indicators

Power: Flashes to indicate the CPU is running.  
 RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.  
 RS485 Tx: Flashes to indicate the unit has sent a Modbus message.



### 3.16.4 Wiring

The following diagram shows the wiring for the power and RS485 communications.



### 3.16.5 Switch Setting

| SWITCH | FUNCTION               | DESCRIPTION   |
|--------|------------------------|---|
| 1      | No. of Digital Modules | The number of digital input/output pairs to be mapped           |
| 2      | No. of Digital Modules | <b>are set up with switches 1 to 5 inclusive. Node ID's for</b> |
| 3      | No. of Digital Modules | digital modules are from 0 to 31.                               |
| 4      | No. of Digital Modules |   |
| 5      | No. of Digital Modules |   |
| 6      | No. of Analog Modules  | The number of Analog input/output pairs to be mapped            |
| 7      | No. of Analog Modules  | <b>are set up with switches 6 to 9 inclusive. Node ID's for</b> |
| 8      | No. of Analog Modules  | Analog modules are from 32 to 47.                               |
| 9      | No. of Analog Modules  |   |
| 10     | BAUD RATE              | Selects 9600 (off) or Programmed Baud Rate (on)                 |

### 3.16.6 PMIOMAP Data Registers ( MODULE TYPE = 114)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments  |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 114        |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel                   |
| 40101          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)                         |
| 40102          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)                       |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd                           |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits                       |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)                     |

### 3.16.7 Modbus Master Setup.

The module is configured as a Modbus master when any of the switches from 1 to 9 is on. The PMIOMAP reads digital inputs from a PM16DI module or reads analog inputs from a PM8AI module. The replies from the input modules are picked up by the output modules. This technique enables multiple output modules to pick up the input information from the same input module. The two modules must have the same network ID.

#### 3.16.7.1 Modbus Master Poll Rate.

The rate at which the PMIOMAP polls the PM input modules is configured using this register (40102). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM input modules due to turn around delays in the equipment.

#### 3.16.7.2 Modbus Master Timeout.

The PMIOMAP polls the PM input modules to get the input data. If there is a problem and the message is corrupted or gets lost, then the PMIOMAP communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.



## 3.17 PMIOMAPTYPE2 - I/O MAPPER Type 2

### 3.17.1 Description

The I/O Mapper is used for point-to-point communications where it is required to send information from a PM16DI to PM16DO, PM8AI to a PM8AO, between 2 PM8DIO modules, between 2 PMDAIO modules or between 2 PMDAIO2 modules over the network. The I/O Mapper is the Modbus master and all I/O modules must be set up as slaves.

The I/O Mapper can be configured as a Modbus Slave when the DIP switches are all off. This corresponds to an ID of zero (ID=0).

The I/O MapperType2 is configured by setting up the Modbus registers. This can be done using the PC software utility program IOSTudio.

As soon as one of the switches is put on, the I/O Mapper becomes a Modbus master and starts sending out requests on the RS485 network.

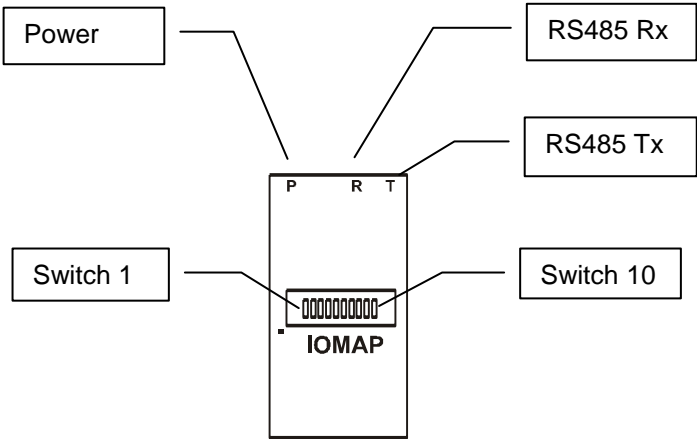


### 3.17.2 Technical Specification of PMIOMAPTYPE2

|              |                        |                                      |
|--------------|------------------------|--------------------------------------|
| Power Supply | Logic Supply Voltage   | 12 -24 Vdc                           |
|              | Logic Supply Current   | 21mA @ 12V / 13mA @ 24V              |
| Temperature  | Operating Temperature. | -40°C to + 80°C                      |
|              | Storage Temperature    | -40°C to + 85°C                      |
| Connectors   | Logic Power and Comms. | 4 Pin Connector on underside of unit |
|              |                        |                                      |

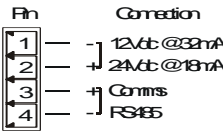
3.17.3 Status Indicators

Power: Flashes to indicate the CPU is running.  
RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.  
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.



3.17.4 Wiring

The following diagram shows the wiring for the power and RS485 communications.



3.17.5 Switch Setting

| <u>SWITCH</u> | <u>FUNCTION</u> | <u>DESCRIPTION</u>                              |
|---------------|-----------------|---|
| 1             | MODE            | Off = Slave, On = Master.                       |
| 2             | -               | -   |
| 3             | -               | -   |
| 4             | -               | -   |
| 5             | -               | -   |
| 6             | -               | -   |
| 7             | -               | -   |
| 8             | -               | -   |
| 9             | -               | -   |
| 10            | BAUD RATE       | Selects 9600 (off) or Programmed Baud Rate (on) |



### 3.17.6 PMIOMAPTYPE2 Data Registers ( MODULE TYPE = 117)

| Modbus Address | Register Name             | Low Limit | High Limit | Access | Comments   |
|----------------|---------------------------|-----------|------------|--------|--|
| 30001          | S/W Version / Module Type | N/A       | N/A        | R      | High Byte = Software Version<br>Low Byte = 117   |
| 30100          | DIP Switch                | 0         | 65535      | R      | Status of DIP Switch on Front Panel  |
| 40101          | Master Timeout            | 0         | 65535      | R/W    | Modbus Master Timeout (X10ms)  |
| 40102          | Master Poll Rate          | 0         | 65535      | R/W    | Modbus Master Poll Rate (X10ms)  |
| 40121          | Baud Rate                 | 2400      | 18750      | R/W    | 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500  |
| 40122          | Parity                    | 0         | 2          | R/W    | 0 = none, 1 = even, 2 = odd  |
| 40123          | Stop Bits                 | 1         | 2          | R/W    | 1 = 1 stop bit, 2 = 2 stop bits  |
| 40124          | Reply Delay               | 0         | 255        | R/W    | 0 = Disable, >0 = Enable. (x10ms)  |
| 40131          | Module Pair 1             | 0         | 5          | R/W    | <b>Slave Module ID's = 1(input) &amp; 2(output)</b><br>0 = Disable<br>1 = PM16DI to PM16DO<br>2 = PM8DIO to PM8DIO<br>3 = PMDAIO to PMDAIO<br>4 = PM8AI to PM8AO or PM8AI to PM8VO<br>5 = PMDAIO2 to PMDAIO2 |
| 40132          | Module Pair 2             | 0         | 5          | R/W    | <b>Slave Module ID's = 3(input) &amp; 4(output)</b>  |
| 40133          | Module Pair 3             | 0         | 5          | R/W    | <b>Slave Module ID's = 5(input) &amp; 6(output)</b>  |
| 40134          | Module Pair 4             | 0         | 5          | R/W    | <b>Slave Module ID's = 7(input) &amp; 8(output)</b>  |
| 40135          | Module Pair 5             | 0         | 5          | R/W    | <b>Slave Module ID's = 9(input) &amp; 10(output)</b>   |
| 40136          | Module Pair 6             | 0         | 5          | R/W    | <b>Slave Module ID's = 11(input) &amp; 12(output)</b>  |
| 40137          | Module Pair 7             | 0         | 5          | R/W    | <b>Slave Module ID's = 13(input) &amp; 14(output)</b>  |
| 40138          | Module Pair 8             | 0         | 5          | R/W    | <b>Slave Module ID's = 15(input) &amp; 16(output)</b>  |
| 40139          | Module Pair 9             | 0         | 5          | R/W    | <b>Slave Module ID's = 17(input) &amp; 18(output)</b>  |
| 40140          | Module Pair 10            | 0         | 5          | R/W    | <b>Slave Module ID's = 19(input) &amp; 20(output)</b>  |
| -              | -                         | 0         | 5          | R/W    | -  |
| 40180          | Module Pair 50            | 0         | 5          | R/W    | <b>Slave Module ID's = 99(input) &amp; 100(output)</b>   |

### 3.17.7 Modbus Master Setup.

The module is configured as a Modbus master when switch 1 is on. The PMIOMAP reads digital inputs from a PM16DI module or reads analog inputs from a PM8AI module. The replies from the input modules are then sent to the output modules. The ID of the input module is 1 less than the ID of the output module. Refer to the table above.

#### 3.17.7.1 Modbus Master Poll Rate.

The rate at which the PMIOMAP polls the PM input modules is configured using this register (40102). In some applications where a modem or radio is used in the RS485 network, it may be necessary to slow down the polling of the PM input modules due to turn around delays in the equipment.

#### 3.17.7.2 Modbus Master Timeout.

The PMIOMAP polls the PM input modules to get the input data. If there is a problem and the message is corrupted or gets lost, then the PMIOMAP communications routine will timeout and try again. This parameter should be set to a larger value than the poll rate value.

### 3.18 PM485REP – Isolated RS232/RS485 to RS485 Repeater

#### 3.18.1 Description

The PM485REP unit is a bi-direction isolated serial repeater unit used to convert 2 wire RS485 twisted pair (or 3 wire RS232) data communications signals to another isolated 2 wire RS485 twisted pair cable. The unit is fully configurable via DIP switches for baud rate, parity, data bits and stop bits. The repeater can be used to extend a RS485 network up to a further 1000 metres. The isolation also prevents ground loops between different parts of the network.

The PM485REP is the ideal unit to use for isolating Promux modules housed in an electrical panel from long RS485 networks which could suffer from ground loop problems.

The PM485REP can also be used as a RS232 to RS485 isolated converter.

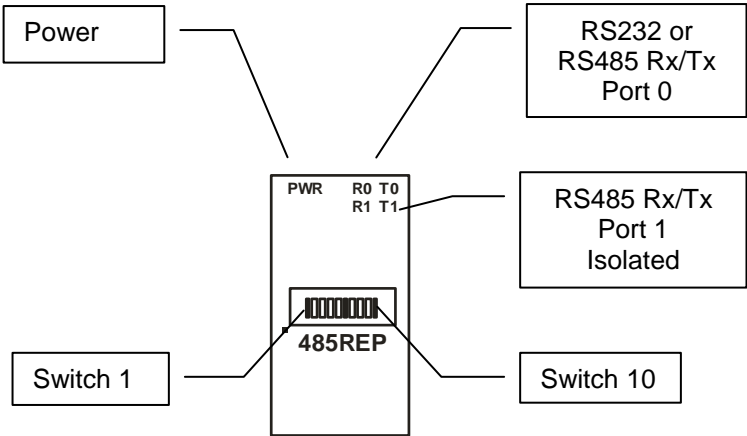


#### 3.18.2 Technical Specification of PM485REP

|  |   |  |
|--|---|--|
| Power Supply                                   | Logic Supply Voltage                              | 12 -24 Vdc                                       |
|  | Logic Supply Current                              | 50mA @ 12V / 25mA @ 24V                          |
| Communications Settings<br>(Switch Selectable) | Baud Rate   | 2400, 4800, 9600, 19200,<br>38400, 57600, 115200 |
|  | Data Bits   | 7 or 8   |
|  | Stop Bits   | 1 or 2   |
|  | Parity  | None, Even or Odd                                |
| PORT 0   | RS232 or RS485 (selected internally with jumpers) | Two wire twisted pair + earth wire               |
| PORT 1   | RS485   | Two wire twisted pair + earth wire               |
| Transmission Distance                          | RS485   | Up to 1Km  |
| Isolation                                      | RS485   | Transformer/OptoCoupler 1500VACrms               |
| Propagation Delay                              | RS485   | One Character                                    |
| Temperature                                    | Operating Temperature.                            | -40°C to + 80°C                                  |
|  | Storage Temperature                               | -40°C to + 85°C                                  |
| Connectors                                     | Logic Power and Comms.                            | 4 Pin Connector on underside of unit             |
|  | Isolated RS485 Comms.                             | 4 Pin Connector on front of unit.                |
|  |   |  |

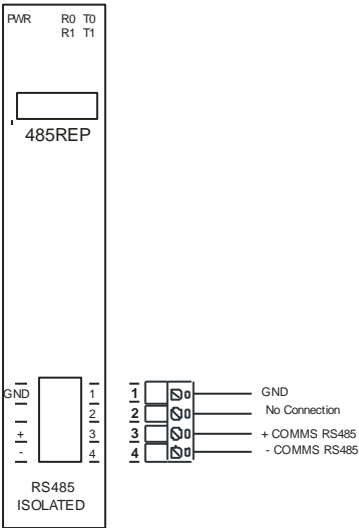
3.18.3 Status Indicators

- Power:
- Flashes to indicate the CPU is running.
- RS485 Rx:
- Flashes to indicate the unit has received a valid Modbus message.
- RS485 Tx:
- Flashes to indicate the unit has sent a Modbus message.

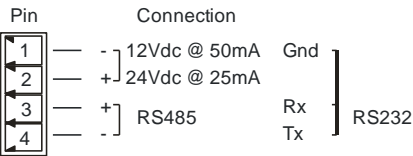


3.18.4 Wiring

The following diagram shows how the isolated RS485 (Port 1) network is connected to the repeater. The GND terminal is used as the third wire to ensure the common mode voltage on the RS485 network is kept within limits.



The following diagram shows the wiring for the power and RS232 or RS485 communications Port 0.

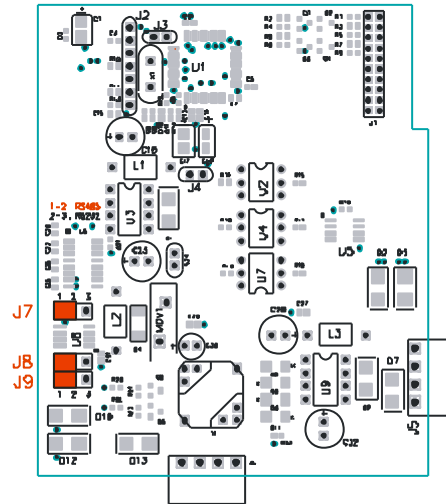


### 3.18.5 Switch Setting

| <u>SWITCH</u> | <u>FUNCTION</u>  | <u>ON</u> | <u>OFF</u> |
|---------------|------------------|-----------|------------|
|               |                  |           |            |
| 1/2/3         | Baud Rate 9600   | -         | S1/S2/S3   |
| 1/2/3         | Baud Rate 2400   | S1        | S2/S3      |
| 1/2/3         | Baud Rate 4800   | S2        | S1/S3      |
| 1/2/3         | Baud Rate 9600   | S1/S2     | S3         |
| 1/2/3         | Baud Rate 19200  | S3        | S1/S2      |
| 1/2/3         | Baud Rate 38400  | S1/S3     | S2         |
| 1/2/3         | Baud Rate 57600  | S2/S3     | S1         |
| 1/2/3         | Baud Rate 115200 | S1/S2/S3  | -          |
| 4/5           | Parity None      | -         | S4/S5      |
| 4/5           | Parity Even      | S4        | S5         |
| 4/5           | Parity Odd       | S5        | S4         |
| 6             | Stop Bits - 1    | -         | S6         |
| 6             | Stop Bits - 2    | S6        | -          |
| 7             | Data Bits - 8    | -         | S7         |
| 7             | Data Bits - 7    | S7        | -          |
| 8             | -                | -         |            |
| 9             | -                | -         |            |
| 10            | -                | -         |            |

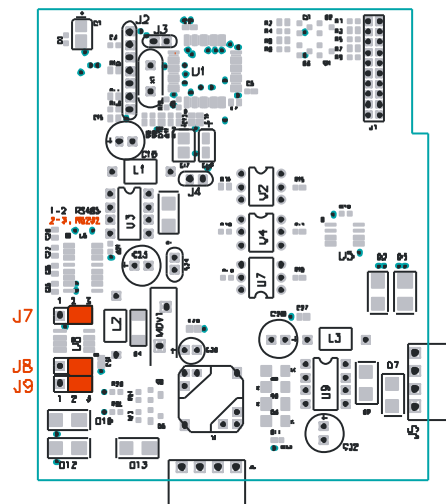
### 3.18.6 Setting the jumpers for RS485.

The communications Port 0 can be configured as a RS485 port by placing the jumpers for J7, J8 & J9 on position 1-2.



### 3.18.7 Setting the jumpers for RS232.

The communications Port 0 can be configured as a RS232 port by placing the jumpers for J7, J8 & J9 on position 2-3.



## 3.19 PMFIBRE – RS232/RS485 to FIBRE

### 3.19.1 Description

The PMFibre Optic converter unit is a bi-direction fibre optic unit used to convert 2-wire RS485 twisted pair (or 3 wire RS232) data communications signals for transmission over multi-mode fibre optic cables.

The converters can be used to extend the limited distance capabilities of RS485 devices for up to two kilometres. The PMFibre Optic converter is ideal for extending RS485 signals through areas of high electrical noise due to the EMI immunity of fibre.

The unit is also ideal for isolating Promux modules housed in an electrical panel from long RS485 networks which could suffer from ground loop problems.

The unit is fully configurable via DIP switches for baud rate, parity, data bits and stop bits. The isolation also prevents ground loops between different parts of the network.

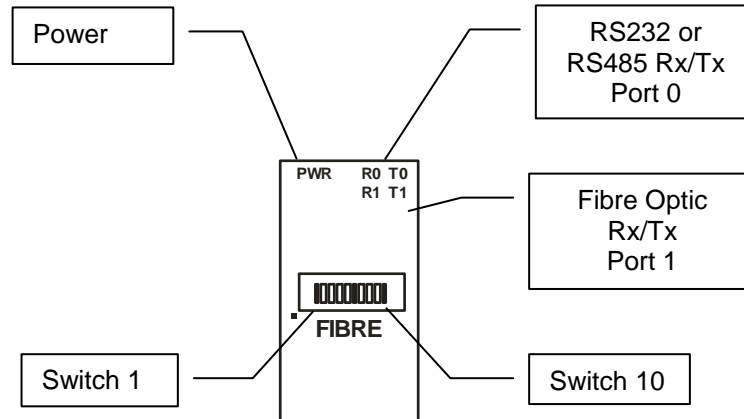


### 3.19.2 Technical Specification of PMFIBRE

|  |   |  |
|--|---|--|
| Power Supply                                   | Logic Supply Voltage                              | 12 -24 Vdc   |
|  | Logic Supply Current                              | 50mA @ 12V / 25mA @ 24V                            |
| Communications Settings<br>(Switch Selectable) | Baud Rate   | 2400, 4800, 9600, 19200,<br>38400, 57600, 115200   |
|  | Data Bits   | 7 or 8   |
|  | Stop Bits   | 1 or 2   |
|  | Parity  | None, Even or Odd                                  |
| PORT 0   | RS232 or RS485 (selected internally with jumpers) | Two wire twisted pair + earth wire                 |
| PORT 1   | Fibre Optic                                       | 50/125µm, 62.5/125µm, and 100/140µm.               |
|  | Transmission Wavelength                           | 850 Nanometre. <u>Multi-Mode</u> .                 |
| Transmission Distance                          | RS485   | Up to 1Km  |
|  | Fibre   | Up to 2 Km depending on attenuation of fibre used. |
| Propagation Delay                              | RS232/RS485 to Fibre                              | One Character                                      |
| Temperature                                    | Operating Temperature.                            | -40°C to + 80°C                                    |
|  | Storage Temperature                               | -40°C to + 85°C                                    |
| Connectors                                     | Logic Power and Comms.                            | 4 Pin Connector on underside of unit               |
|  | Isolated RS485 Comms.                             | 4 Pin Connector on front of unit.                  |
|  | Fibre connectors                                  | Supplied with either SMA or ST connectors.         |

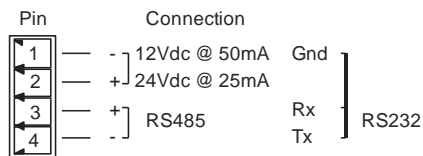
### 3.19.3 Status Indicators

Power: Flashes to indicate the CPU is running.  
 Rx: Flashes to indicate the unit has received a valid Modbus message.  
 Tx: Flashes to indicate the unit has sent a Modbus message.



### 3.19.4 Wiring

The following diagram shows the wiring for the power and RS232 or RS485 communications Port 0.



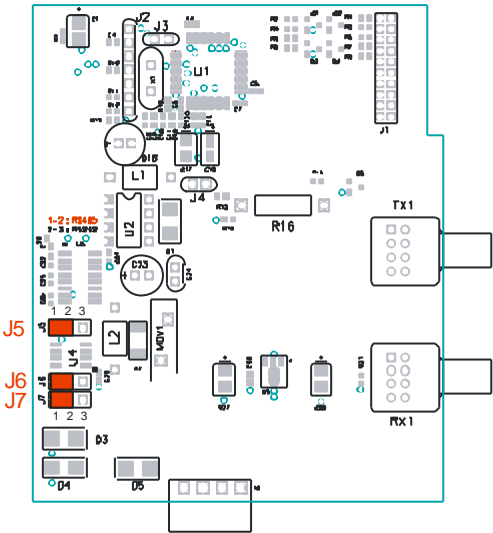
### 3.19.5 Switch Setting

| SWITCH | FUNCTION         | ON       | OFF      |
|--------|------------------|----------|----------|
| 1/2/3  | Baud Rate 9600   | -        | S1/S2/S3 |
| 1/2/3  | Baud Rate 2400   | S1       | S2/S3    |
| 1/2/3  | Baud Rate 4800   | S2       | S1/S3    |
| 1/2/3  | Baud Rate 9600   | S1/S2    | S3       |
| 1/2/3  | Baud Rate 19200  | S3       | S1/S2    |
| 1/2/3  | Baud Rate 38400  | S1/S3    | S2       |
| 1/2/3  | Baud Rate 57600  | S2/S3    | S1       |
| 1/2/3  | Baud Rate 115200 | S1/S2/S3 | -        |
| 4/5    | Parity None      | -        | S4/S5    |
| 4/5    | Parity Even      | S4       | S5       |
| 4/5    | Parity Odd       | S5       | S4       |
| 6      | Stop Bits - 1    | -        | S6       |
| 6      | Stop Bits - 2    | S6       | -        |
| 7      | Data Bits - 8    | -        | S7       |
| 7      | Data Bits - 7    | S7       | -        |
| 8      | -                | -        | -        |
| 9      | -                | -        | -        |
| 10     | -                | -        | -        |



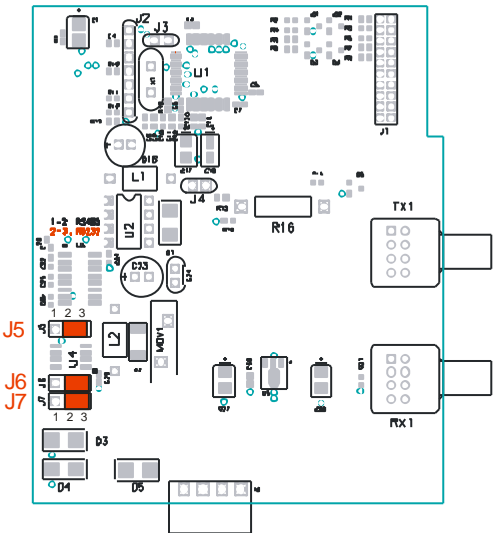
3.19.6 Setting the jumpers for RS485.

The communications Port 0 can be configured as a RS485 port by placing the jumpers for J5, J6 & J7 on position 1-2.



3.19.7 Setting the jumpers for RS232.

The communications Port 0 can be configured as a RS232 port by placing the jumpers for J5, J6 & J7 on position 2-3.



3.19.8 Order Codes.

Order Code

Description

PM485FIBRE/SMA  
MM485FIBRE/ST

RS232 / RS485 FIBRE OPTIC CONVERTER SMA CONNECTOR 850nm  
RS232/RS485 FIBRE OPTIC CONVERTER ST CONNECTOR 850nm

## 4. SPECIFICATIONS

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### 4.1 ENVIRONMENTAL

|                       |                           |
|-----------------------|---------------------------|
| Operating Temperature | -30°C to +80°C            |
| Storage Temperature   | -40°C to +85°C            |
| Humidity              | Up to 95% non condensing. |

### 4.2 EMC INSTALLATION INSTRUCTIONS

1. Screened twisted pair RS485 cable must be used with the screen grounded at one point only.
2. The RS485 cable must be terminated at both ends using a 120 ohm resistor.
3. Use should be made of screened I/O, T/C, RTD cable with the screens grounded at one point as close to the PROMUX module as possible.
4. The PROMUX modules must be installed in an appropriate enclosure inaccessible to the operator during normal use.

#### 4.3 CONFORMITY CERTIFICATE

| DECLARATION OF CONFORMITY<br>according to EN 45014  |   |
|---|---|
| <b>Manufacturer's Name:</b>   | Procon Electronics CC   |
| <b>Manufacturer's Address:</b>  | 26 Wareing Park<br>2 Wareing Road<br>Pinetown 3610<br>South Africa  |
| declares that the product   |   |
| Product Name:   | PROMUX  |
| Model Number(s):  | PM16DI, PM16DI110, PM16DI220, PM16DO, PM8DIO,<br>PM4RO, PM8AI/I, PM8AI/V, PM8AI/IISO, PM8AI/VISO,<br>PM8AO, PM8VO, PM8TC, PM8TCISO, PM6RTD, PMDAIO,<br>PMDAIO2, PMI/OMAP, PMI/OMATYPE2, PM485REP. |
| complies with EMC Directive 89/336/EEC and Low Voltage Equipment Directive 73/23/EEC and<br>conforms to the following Product specifications: |   |
| EMC:  | EN 61326-1 Electrical Equipment for measurement,<br>control and laboratory use.   |
| <u>Pinetown, SA</u><br>Location   | <u>August 2006</u><br>Date  |
| D.Ruddock   |   |

#### 4.4 EMC Test Results

| PROMUX EMC Test Results                      |                |                  |                                |      |     |      |      |             |      |
|--|----------------|------------------|--------------------------------|------|-----|------|------|-------------|------|
| Test   | Standard       | Test Value       | PROMUX Product Compliance (PM) |      |     |      |      |             |      |
| Immunity Test Results<br>EN 61326-1          |                |                  | 16DI                           | 16DO | 4RO | 8DIO | 8AII | 8AII<br>ISO | 8AIV |
| Electrostatic<br>Discharge                   | IEC 61000-4-2  | 8KV Air          | A                              | A    | A   | A    | A    | B           | A    |
|  |                | 4KV Contact      | A                              | A    | A   | A    | A    | A           | A    |
| Radiated Field                               | IEC 61000-4-3  | 10V/m            | A                              | A    | A   | A    | A    | A           | A    |
| Fast<br>Transients                           | IEC 61000-4-4  | Power 2KV        | A                              | A    | A   | A    | A    | B           | A    |
|  |                | I/O 1KV          | A                              | A    | A   | A    | A    | B           | A    |
| Surge  | IEC 61000-4-5  | Power<br>1KV/2KV | A                              | A    | A   | A    | A    | A           | A    |
| RF Conducted                                 | IEC 61000-4-6  | Power<br>3 Vrms  | A                              | A    | A   | A    | A    | A           | A    |
| Voltage<br>Interrupt                         | IEC 61000-4-11 | 0.5cycle<br>100% | A                              | A    | A   | A    | A    | A           | A    |
| Emissions Test Results<br>EN 61326-1 Class A |                |                  |                                |      |     |      |      |             |      |
| Radiated<br>Emissions                        | CISPR 22       | Class A          | ✓                              | ✓    | ✓   | ✓    | ✓    | ✓           | ✓    |
| Conducted<br>Emissions                       | CISPR 22       | Class B          | ✓                              | ✓    | ✓   | ✓    | ✓    | ✓           | ✓    |

| Test   | Standard       | Test Value       | PROMUX Product Compliance (PM) |     |            |      |      |     |     |
|--|----------------|------------------|--------------------------------|-----|------------|------|------|-----|-----|
| Immunity Test Results<br>EN 61326-1          |                |                  | 8AIV<br>ISO                    | 8TC | 8TC<br>ISO | 6RTD | DAIO | 8AO | 8VO |
| Electrostatic<br>Discharge                   | IEC 61000-4-2  | 8KV Air          | B                              | A   | B          | A    | A    | A   | B   |
|  |                | 4KV Contact      | A                              | A   | A          | A    | A    | A   | A   |
| Radiated Field                               | IEC 61000-4-3  | 10V/m            | A                              | A   | A          | A    | A    | A   | A   |
| Fast<br>Transients                           | IEC 61000-4-4  | Power 2KV        | B                              | A   | B          | A    | A    | A   | A   |
|  |                | I/O 1KV          | B                              | A   | B          | A    | A    | A   | A   |
| Surge  | IEC 61000-4-5  | Power<br>1KV/2KV | A                              | A   | A          | A    | A    | A   | A   |
| RF Conducted                                 | IEC 61000-4-6  | Power<br>3 Vrms  | A                              | A   | A          | A    | A    | A   | A   |
| Voltage<br>Interrupt                         | IEC 61000-4-11 | 0.5cycle<br>100% | A                              | A   | A          | A    | A    | A   | A   |
| Emissions Test Results<br>EN 61326-1 Class A |                |                  |                                |     |            |      |      |     |     |
| Radiated<br>Emissions                        | CISPR 22       | Class A          | ✓                              | ✓   | ✓          | ✓    | ✓    | ✓   | ✓   |
| Conducted<br>Emissions                       | CISPR 22       | Class B          | ✓                              | ✓   | ✓          | ✓    | ✓    | ✓   | ✓   |