

User Manual

Data Acquisition Modules/ Distributed IO Modules



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Tel: +886-2-27861299
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If you contact us in reference to this manual, please include the following document number

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For New product: This product is warranted against defects in materials and workmanship for a period of 12 months from the date of shipment to Buyer. **For Rectified Products:** Any product that will be replaced will have Warranty for 6 months or up to Original Product Warranty period whichever is greater. The warranty is limited to repair or replacement of the defective unit at the option of the manufacturer. This warranty is void if the product has been altered, misused, dismantled, or otherwise abused.

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1. AN OVERVIEW OF THE IO SYSTEM

1.1 Introduction

Modular IO system from Brainchild is innovative which provides a simple low cost solution for distributed I/O requirements.

The IO system consists of stand-alone Digital and Analog - Input/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 turn around times. Multiple baud rates are selectable from 2400 to 115200 baud.

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

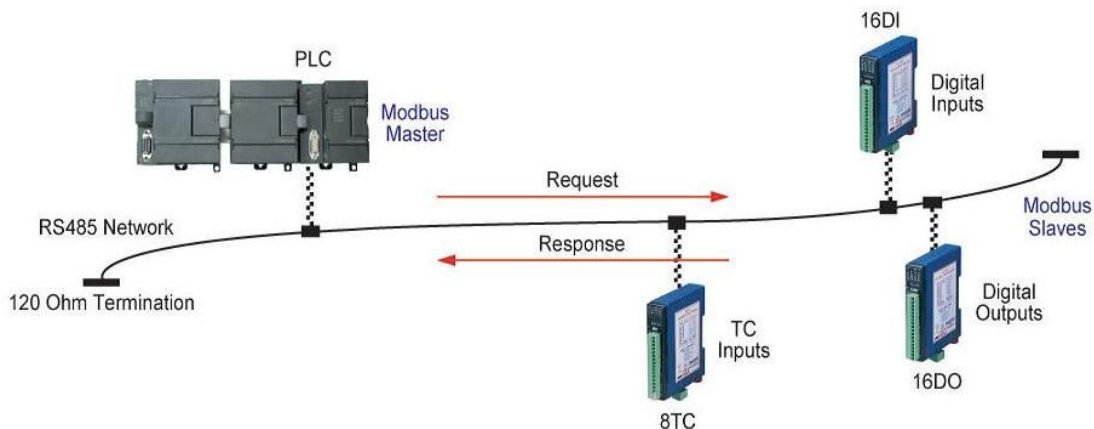
The modules have been equipped with status led's which are used to indicate the status of the Inputs or outputs. This visual indication assists with fault finding and diagnostics.

1.2 Application Configurations

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

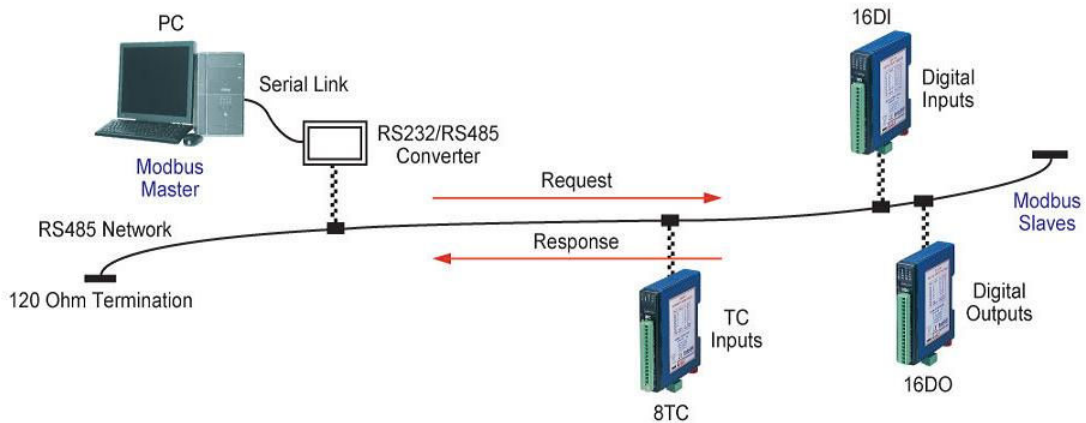
1.2.1 I/O Expansion.

There are a number of devices such as **PLC's** (Programmable Logic Controllers) and **HMI** (Human machine interface) which have a MODBUS Communications facility available. Many PLC and HMI manufacturers provide Modbus Master and Modbus slave drivers to communicate directly with third party devices using Modbus protocol using different kind of hardware connection. PLC/HMI can be configured as a MODBUS Master. IO modules are attached to the RS485 network and configured as RTU slaves. The address setting is via dip switches on the IO module itself. The PLC/HMI system use IO modules as remote I/O reducing cabling costs and increasing the I/O capability of the control system.



1.2.2 Data Acquisition

Another use of the IO 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.



1.3 Module Selection Table

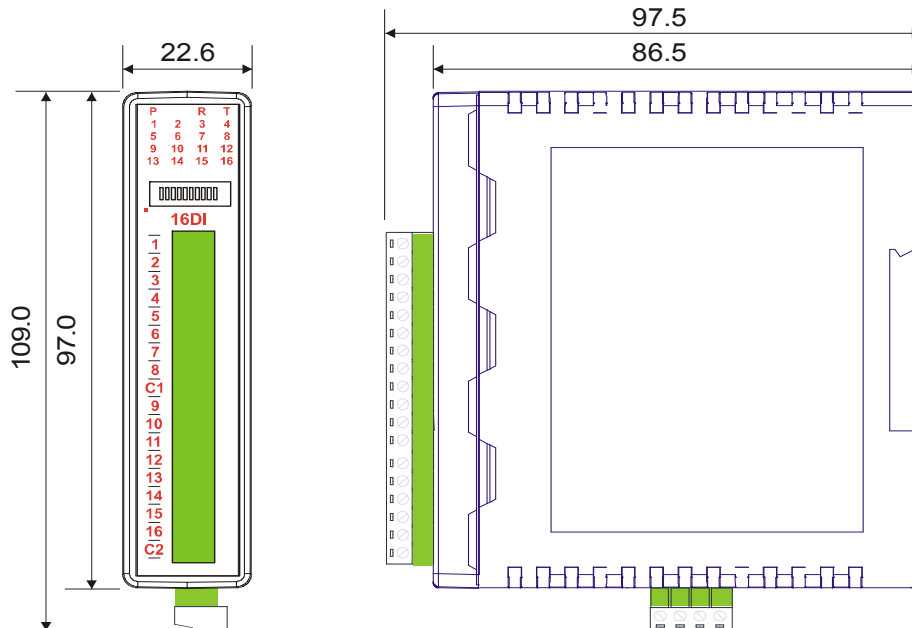
| MODEL | MODULE TYPE |
|--------------------|---|
| I/O MODULES | |
| IO-16DI | 16 DIGITAL INPUT MODULE INCLUDING COUNTERS |
| IO-16DO | 16 DIGITAL OUTPUT MODULE |
| IO-4RO | 4 RELAY OUTPUT MODULE |
| IO-8DIO | 8 DIGITAL INPUT / 8 DIGITAL OUTPUT MODULE |
| IO-8AI | 8 ANALOG INPUT 0 - 20mA / 4 - 20mA |
| IO-8AIV | 8 ANALOG INPUT 0 - 5V / 1 - 5V / 0 - 10V / 2 - 10V |
| IO-8AIIS | 8 ANALOG INPUT 0 - 20mA / 4 - 20mA / ± 20 mA FULLY ISOLATED |
| IO-8AIVS | 8 ANALOG INPUT 0 - 1V / 0 - 10V / ± 1 V / ± 10 V FULLY ISOLATED |
| IO-8TC | 8 THERMOCOUPLE INPUT MODULE INCL. 0 - 50mV & ± 100 mV I/P |
| IO-8TCS | 8 TC INPUT MODULE INCL. 0 - 50mV & ± 100 mV I/P FULLY ISOLATED |
| IO-6RTD | 6 RTD INPUT MODULE - PT100, Ni120, PT1000, Ni1000, Ni1000LG & Ohms |
| IO-DAIO | 2 RTD I/P, 2 ANALOG INPUT 0(4) - 20mA / 0(2) - 10V, 1 ANALOG OUTPUT 0(4) - 20mA / 0(2) - 10V, 4 DIGITAL INPUTS, 2 DIGITAL OUTPUTS |
| IO-8AOI | 8 ANALOG OUTPUT MODULE 0(4) - 20mA |
| IO-8AOV | 8 ANALOG OUTPUT MODULE 0(2) - 10V |

2. IO GENERAL INFORMATION

2.1 Physical Dimensions

The IO 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 bottom side of the housing.

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



2.2 Grounding/Shielding

In most cases, IO 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 Networking

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

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 **100 ohm 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 isolated RS485 repeater

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 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.

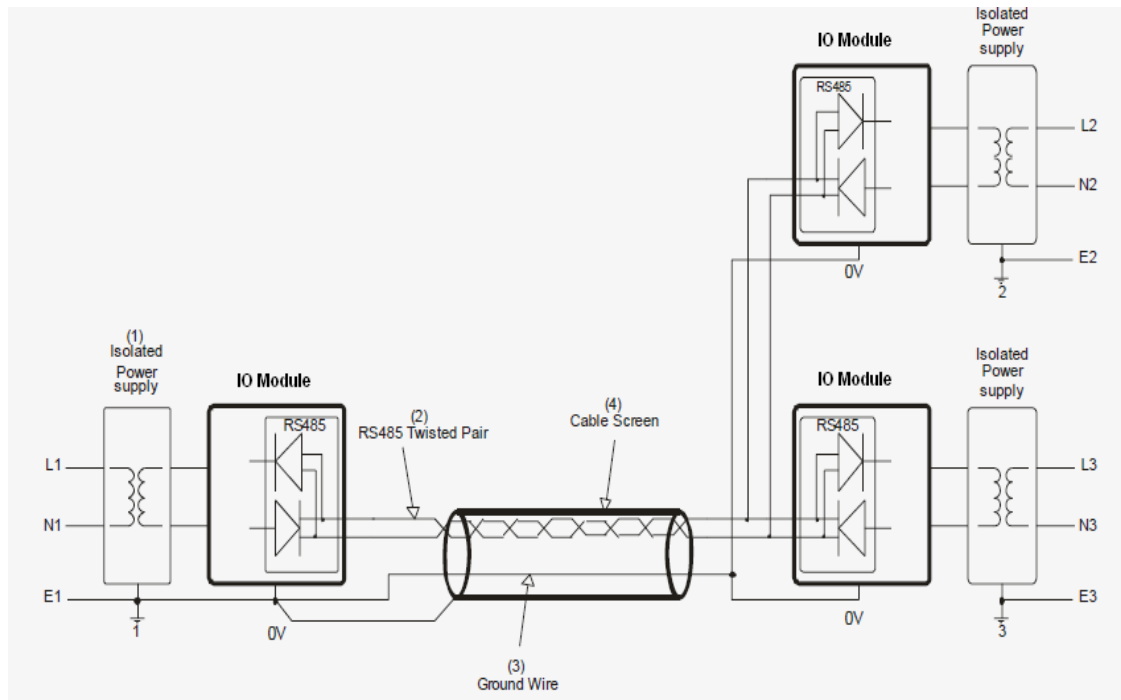
Method-3, Shielded single twisted pair cable

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.

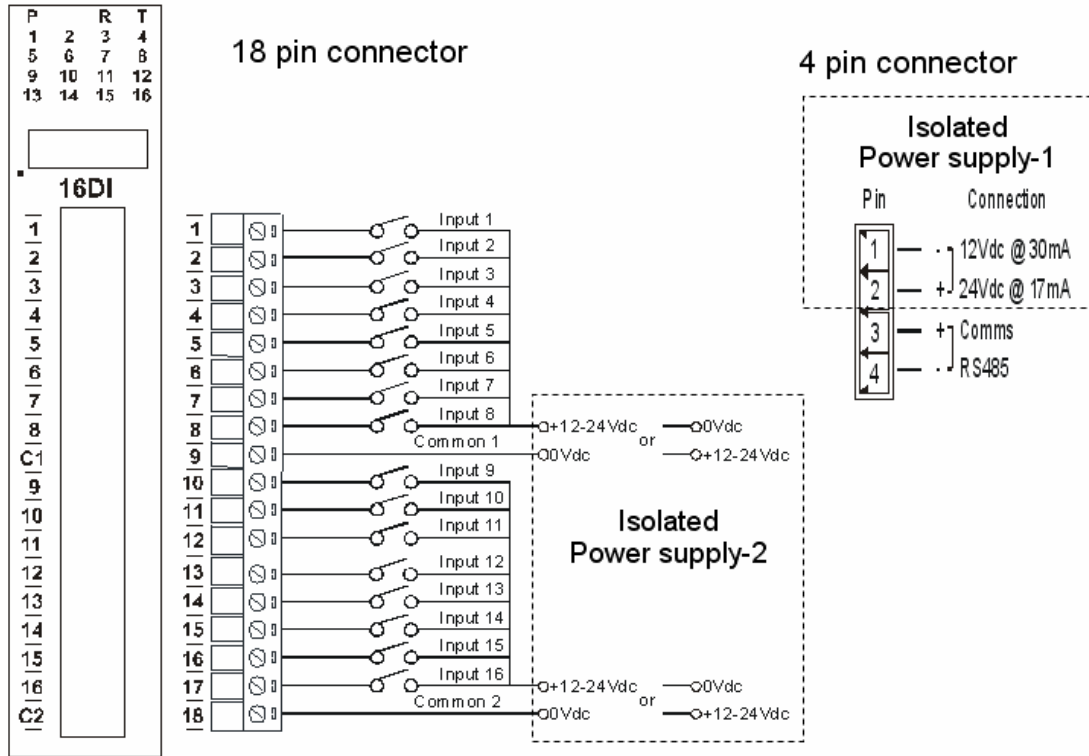


Note: Ground on IO module is Pin1 at 4 pin connector which is 0V or “-“V, Power supply

Good installation practice for RS485 systems:

1. Use isolated power supplies to ensure that the IO modules are not earthed. Only one module on the network should be earthed. (Module1).
2. Use RS485 shielded twisted cable to prevent electrical noise pickup.
3. Use a ground wire to connect all of the 0V terminals on the modules together. This will ensure 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 dedicated Instrumentation ground system to be used with RS485 devices



Note: Use separate isolated 24V DC power supply for Power supply and field inputs

Note: Ground on IO module is Pin1 at 4 pin connector which is 0V or “-“V, Power supply



Warning: Failure to follow improper installation practice of RS485 wiring and power supply wiring may cause failure of IO modules, specifically communication failures

2.5 Setting the Modbus Node ID

2.5.1 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 |
| 42 | OFF | ON | OFF | ON | OFF | ON | OFF |
| 43 | ON | ON | OFF | ON | OFF | ON | OFF |
| 44 | OFF | OFF | ON | ON | OFF | ON | OFF |

| NODE ID | DIP SWITCH SETTINGS | | | | | | |
|---------|---------------------|-----|-----|-----|-----|-----|-----|
| | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 |
| 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 |
| 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 |

| NODE ID | DIP SWITCH SETTINGS | | | | | | |
|---------|---------------------|-----|-----|-----|-----|-----|-----|
| | SW1 | SW2 | SW3 | SW4 | SW5 | SW6 | SW7 |
| 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 |

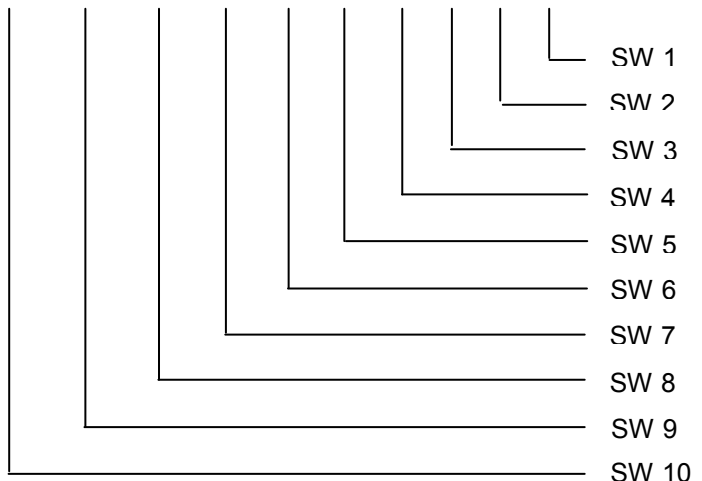
All modules will respond to a default Node ID of 254.

2.5.2 DIP Switch Status Register.

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

| DIP SWITCH REGISTER | | | | | | | | | | | | | | | ADDRESS | |
|---------------------|-------|------|------|------|------|-----|-----|-----|----|----|----|---|---|---|---------|-------|
| MSB | | | | | | | | | | | | | | | | LSB |
| 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 | 30100 |

0 0 0 0 0 0



2.6 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.

2.6.1 Communications Settings with DIP Switch 10 OFF (Default)

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

2.6.2 Communications Settings with DIP Switch 10 ON (Programmed Baud Rate)

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

Note: These settings are done from IO Studio PC software or Modbus Master device.
For ex: If you are planning to use HMI (Brainchild) as Master device, then it is possible to set above parameters writing a small application program in HMI. During this mode, DIP switch10 should be OFF such that, Master device can communicate with IO module on default communication settings.

2.6.3 Communications Settings Registers

| | | | | | |
|-------|-------------|------|-------|-----|--|
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,11520 |
| 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 | 65535 | R/W | (x10ms) |

2.6.3.1 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.

2.6.3.2 Parity Register (40122)

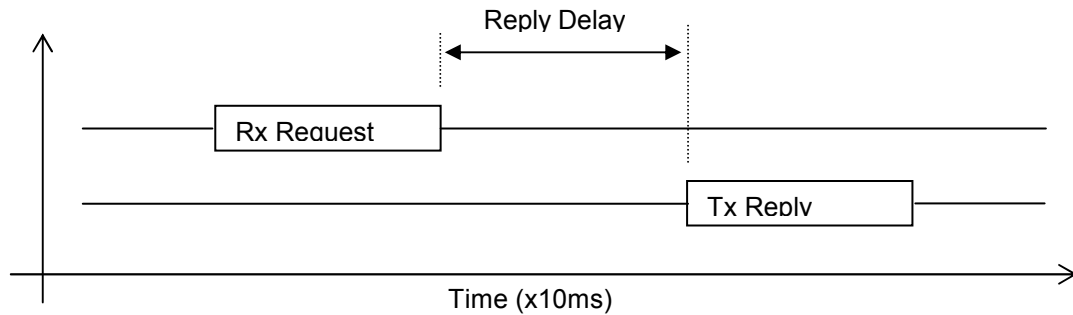
The parity can be set to none by writing a 0 to the parity register, set to even by writing a 1 to the parity Register or set to odd by writing a 2 to the parity register.

2.6.3.3 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.

2.6.3.4 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.



2.6.4 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) (Holding type) | 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.

3. IO MODULES

3.1 IO-16DI - DIGITAL INPUTS WITH COUNTERS

3.1.1 Description

The IO-16DI 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 while 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 (Filter > 1, Ex: Value at 40102 register is 2 i.e., 2 X 10 msec. = 20 msec.), then the 16 counters are saved in non-volatile memory and the count value will be saved when the 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 IO-16DI

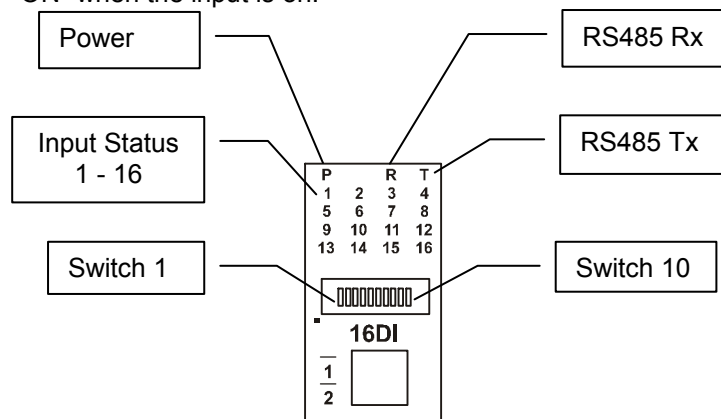
| | | |
|-----------------------------------|-------------------------|--|
| Power Supply | Logic Supply Voltage | 12 -24 Vdc |
| | Logic Supply Current | 30mA @ 12V / 17mA @ 24V |
| Digital Inputs | Input Points | 16 |
| | Input Voltage Range | 12 - 24 Vdc |
| | Input Current per input | 5mA @ 12Vdc / 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. | -10°C to + 50°C |
| | Storage Temperature | -40°C to + 85°C |
| Connectors | Logic Power and Comms. | 4 Pin Connector on bottom side of unit |
| | Inputs | 18 Way screw connector on front |

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

*** Version V09 onwards**

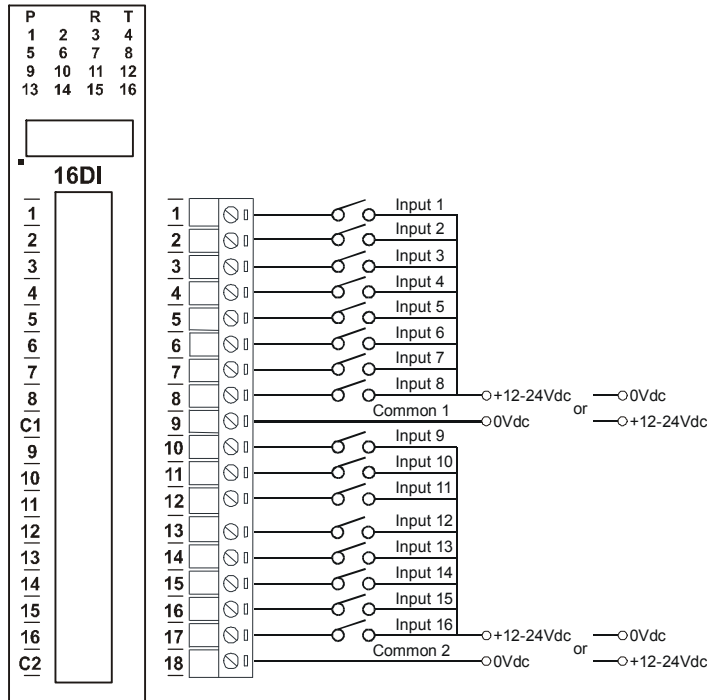
3.1.3 Status Indicators

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: "OFF" when the input is off.
 "ON" when the input is on.

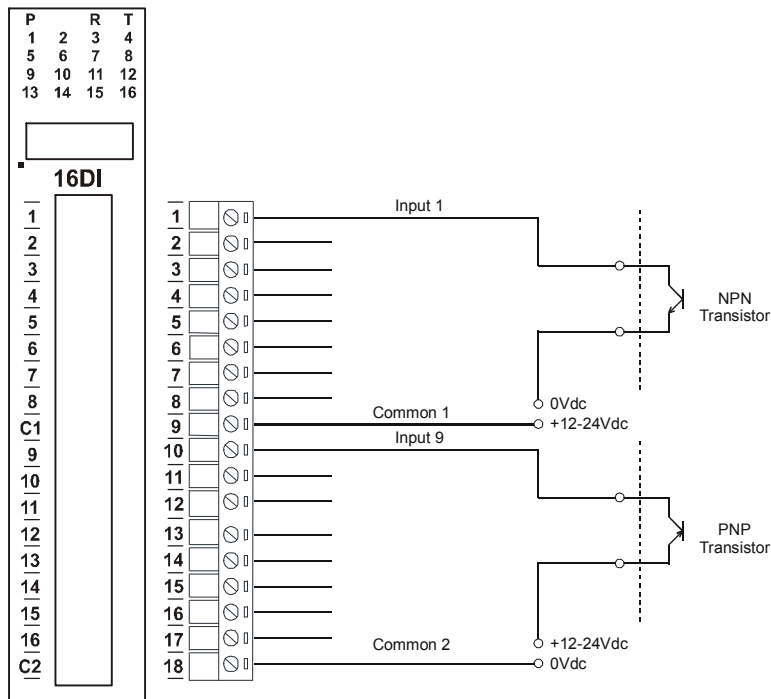


3.1.4 Wiring

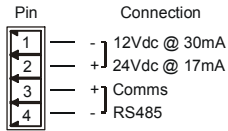
The following diagram shows how the digital inputs are connected to potential free switches. The common can be connected to positive or negative as indicated.



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.



Note: If power/communication connections are reversed, module may become faulty.

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 is inverted in the Modbus status register (30002). |
| 9 | - | Not Used. |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.1.6 IO-16DI 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 | " |

| 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 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 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 | " |
| 40023 | Counter 11MSB | 0 | 65535 | R/W | " |
| 40024 | Counter 11LSB | 0 | 65535 | R/W | Counter MSB and LSB combine to give a 32 bit |
| 40025 | Counter 12MSB | 0 | 65535 | R/W | Counter with range 0 to 4294967295. |
| 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 combine to give a 32 bit Value. |
| 40037 | CCounter 1 LSB | 0 | 65535 | R/W | |
| 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 | " |
| | | | | | |

| Modbus Address | Register Name | Low Limit | High Limit | Access | Description |
|----------------|----------------|-----------|------------|--------|---|
| 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 | " |
| 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 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | 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:

| IO-6DI DIGITAL INPUTS | | | | | | | | | | | | | | | 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 | 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 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.

3.1.6.3 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 IO-16DO - DIGITAL OUTPUTS

3.2.1 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. When switch 9 is off, the module is configured as a slave module for the Modbus master device such as a PC / PLC / HMI.

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

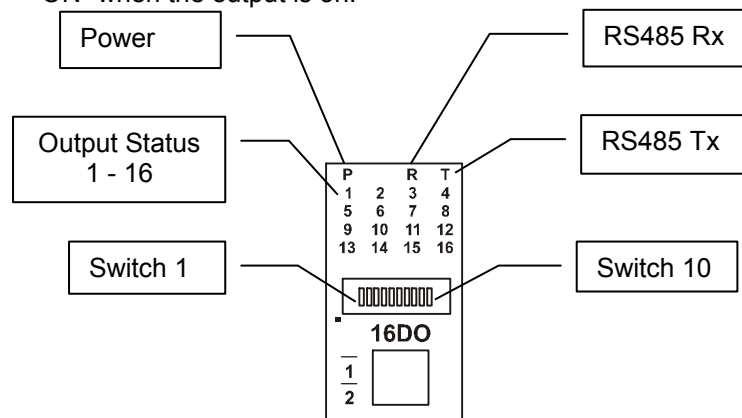
An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.

3.2.2 Technical Specification of IO-16DO

| | | |
|------------------------|------------------------|--------------------------------------|
| 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. | -10°C to + 50°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 |

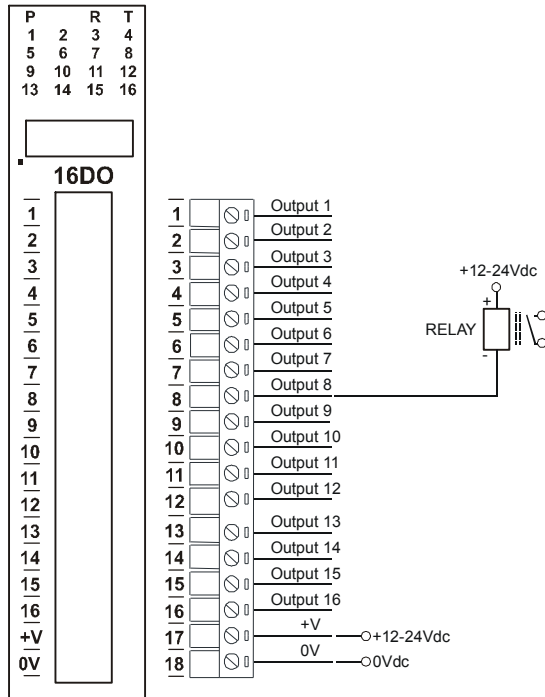
3.2.3 Status Indicators

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

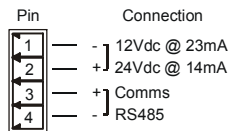


3.2.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

3.2.5 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 | Slave (Off) |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.2.6 IO-16DO 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 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. |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600,19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.2.6.1 Digital Output Register.

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

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

Digital Output

3.2.6.2 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.

3.3 IO-4RO - RELAY OUTPUTS

3.3.1 Description

The IO-4RO 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.

When switch 9 is off, the module is configured as a slave module for the Modbus master device such as a PC / PLC / HMI. When used as a slave module, the outputs are written to by the Modbus master device such as a PC/PLC/HMI. 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.

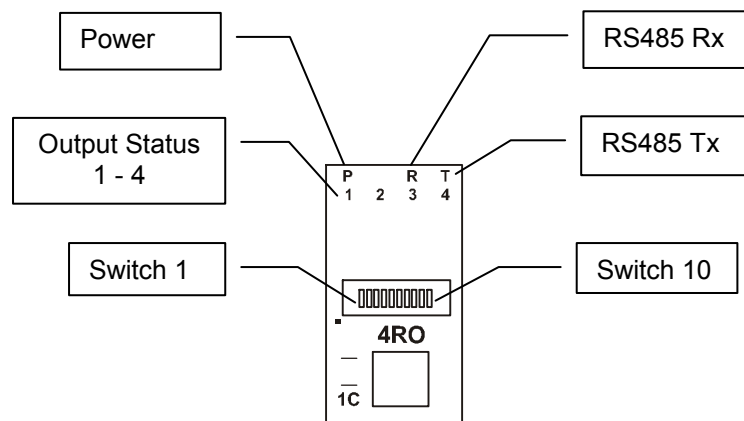
An output watchdog timer can be configured to switch off all the outputs if there has been no communications with the module for up to 255 seconds. A value of 0 seconds will disable this timer and the outputs will remain in the last programmed state.

3.3.2 Technical Specification of IO-4RO

| | | |
|----------------------|------------------------|--|
| 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 1000Vrms between outputs |
| Temperature | Operating Temperature. | -10°C to + 50°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 |

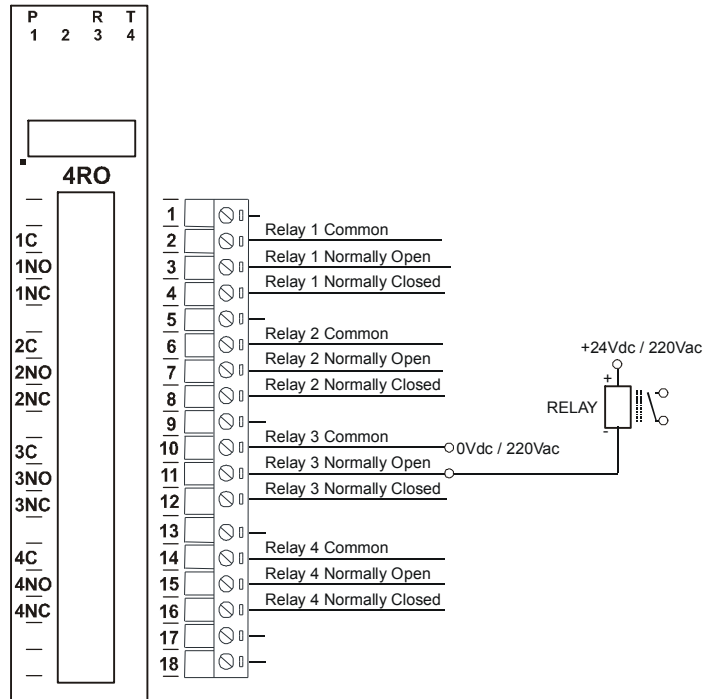
3.3.3 Status Indicators

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

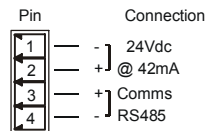


3.3.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

3.3.5 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 | Slave (Off) |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.3.6 IO-4RO 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 Low Byte = 113 |
| 40002 | Digital Outputs | N/A | N/A | R/W | Digital Outputs in bits. 4(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. |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600,19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |
| | | | | | |

3.3.6.1 Relay Output Register

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

| MSB | | IO-4RO 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

3.3.6.2 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 IO-8DIO - DIGITAL INPUTS / OUTPUTS

3.4.1 Description

The IO-8DIO 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. The counters can also be reset automatically when read. This is done by setting on DIP switch 9 on the front panel.

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 configured as slave, where PC/ PLC/ HMI acting as master on the Modbus network. Dip switch 9 should be switched off to make this module as slave. Each output on the module 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.

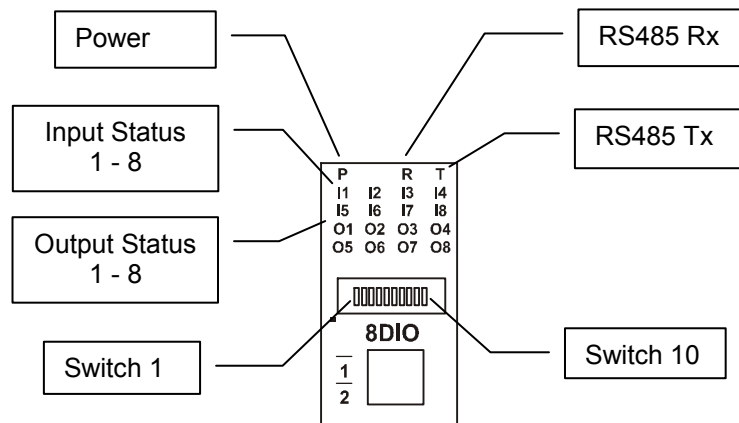
3.4.2 Technical Specification of IO-DIO

| | | |
|------------------------|-------------------------|--------------------------------------|
| 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. | -10°C to + 50°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.

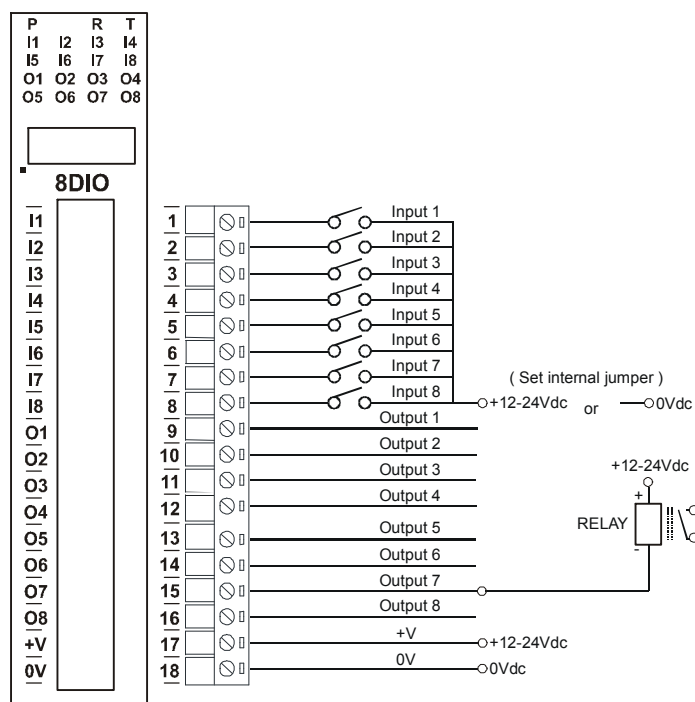
3.4.3 Status Indicators

- 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.
- 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.

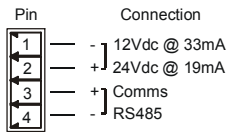


3.4.4 Wiring

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



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



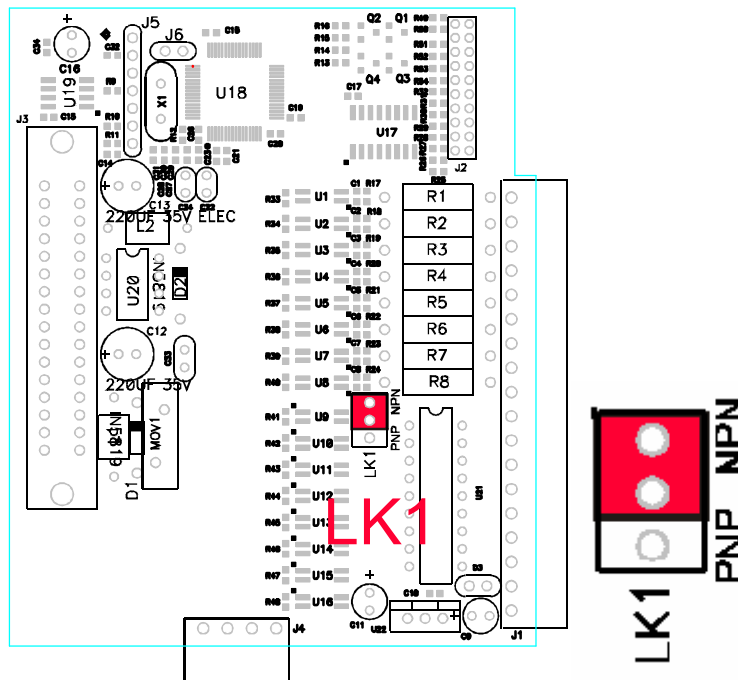
Note: If power/communication connections are reversed, module may become faulty.

3.4.5 Switch Settings

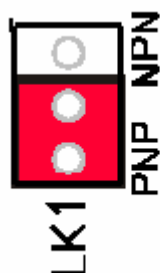
| SWITCH | FUNCTION | DESCRIPTION |
|--------|-------------|--|
| 1 | NODE ID +1 | Node ID's from 0 to 127 are set up using switches 1 to 7 |
| 2 | NODE ID +2 | " |
| 3 | NODE ID +4 | " |
| 4 | NODE ID +8 | " |
| 5 | NODE ID +16 | " |
| 6 | NODE ID +32 | " |
| 7 | NODE ID +64 | " |
| 8 | INVERT | When switched ON the status of the inputs is inverted in the Modbus status register (30002). |
| 9 | MODE | Off (Slave) |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.4.6 Jumper Settings

The Digital inputs can be configured as NPN inputs. This means that the inputs can be operated by switching to 0V. Open the IO Module. Change the link **LK1** to the NPN position as shown below.



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



3.4.7 IO-8DIO 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 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. |
| 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 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.4.7.1 Digital Input Register.

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

| IO-8DIO DIGITAL INPUTS | | | | | | | | | | | | | | | MSB | 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 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | |

Digital Input Number

3.4.7.2 Digital Output Register

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

| IO-8DIO DIGITAL OUTPUTS | | | | | | | | | | | | | | | MSB | 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 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | | |

Digital Output Number

3.4.7.3 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.

3.4.7.4 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.

3.5 IO-8AI and IO-8AIV - ANALOG INPUTS

3.5.1 Description

The Analog Input modules are supplied as either a current input module (IO8AI) or a voltage input module (IO-AIV). The inputs are isolated from the logic and share a common negative terminal.

The standard setting for the IO-8AI 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 IO-8AIV 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 analogue board inside the enclosure.

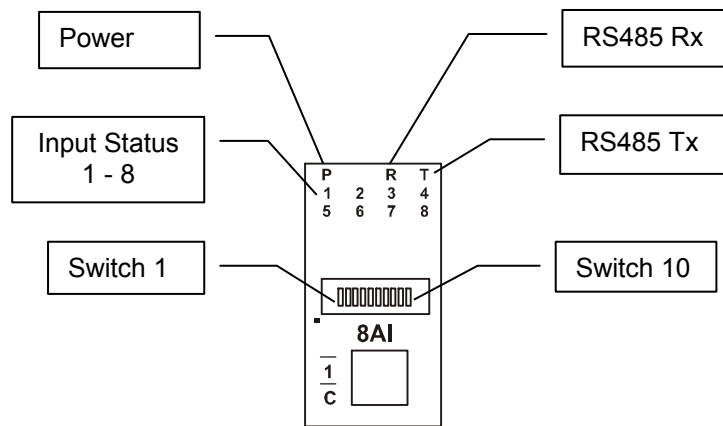
3.5.2 Technical Specification of IO-8AI

| | | |
|---------------------------------|------------------------|--------------------------------------|
| 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 – IO-8AIV | 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 |
| | Isolation | 1500Vrms between field and logic |
| Current Inputs – IO-8AI | Input Points | 8 |
| | Input Current | 0(4) - 20 mA |
| | Input Resistance | 250ohms |
| | Resolution | 12 bits |
| | Drift | 50ppm/°C |
| | Accuracy | 0.2% of span |
| | Isolation | 1500Vrms between field and logic |
| Temperature | Operating Temperature. | -10°C to + 50°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 |

3.5.3 Status Indicators

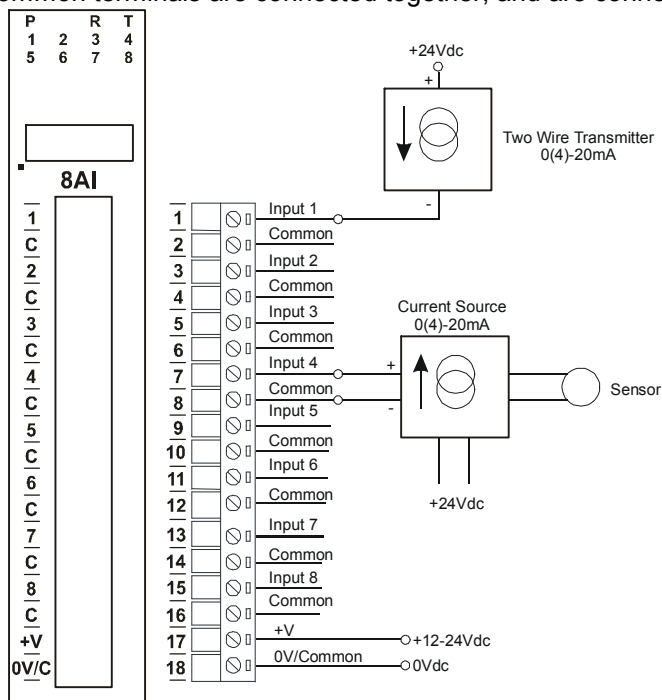
Power: Flashes to indicate the CPU is running.
RS485 Rx: Flashes to indicate the unit has received a valid Modbus message.
RS485 Tx: Flashes to indicate the unit has sent a Modbus message.

Input Status: “ON” when the input is zero.
 “OFF” when the input is greater than zero and less than 4095.
 “Flashing” when the input is over range, greater or equal to 4095

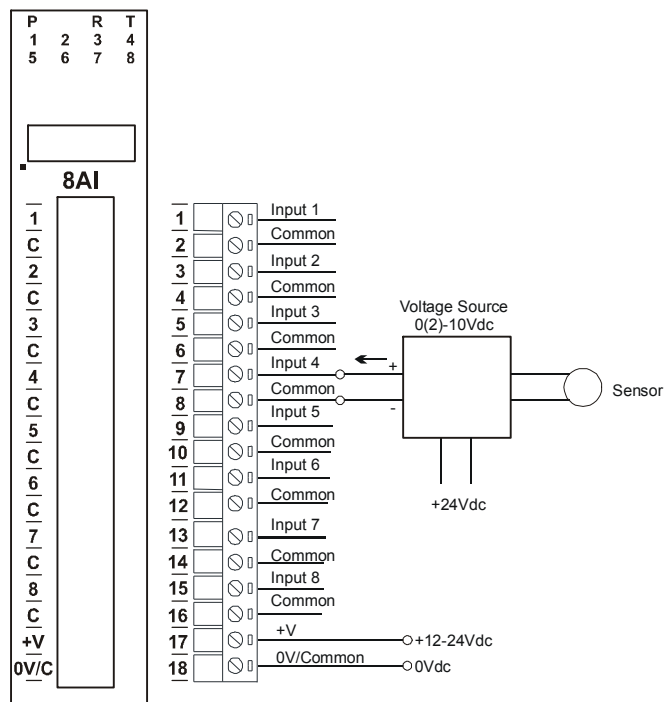


3.5.4 Wiring

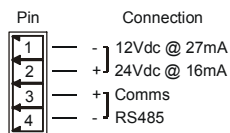
The following diagram shows how the analog inputs are connected to a 0(4)-20mA source. All of the common terminals are connected together, and are connected to 0V internally.



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.



Note: If power/communication connections are reversed, module may become faulty.

3.5.5 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) |

3.5.6 IO-8AI Data Registers (IO8AI TYPE = 103 / IO-8AIV 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 Low Byte = 103(IO-8AI) or 104(IO-8AIV) |
| 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) bit1 = 0(OK),bit1 = 1(error) |
| 30100 | DIP Switch | 0 | 65535 | R | Status of DIP Switch on Front Panel |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.5.6.1 Analog Input Registers.

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

| IO-8AI ANALOG INPUTS | | | | | | | | | | | | | | | MSB | 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 | | |

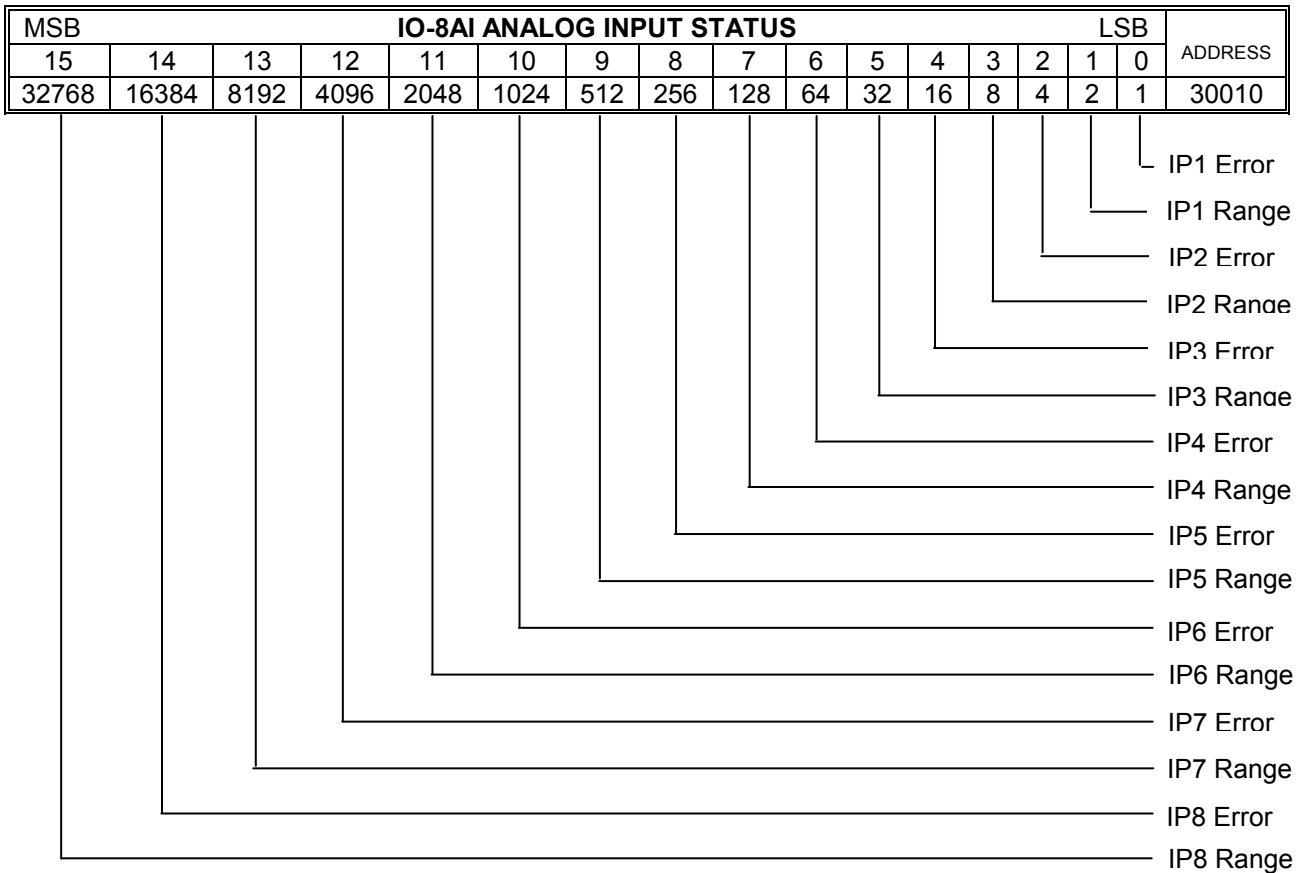
Analog Input: 12 Bit Value (0 - 4095)

3.5.6.2 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 | don't care | 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:



3.6 IO-8AIIS and IO-8AIVS - ISOLATED ANALOG INPUTS

3.6.1 Description

The Analog Input modules are supplied as either a current input module (IO-8AIIS) or a voltage input module (IO-8AIVS). 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 IO-8AIIS 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.

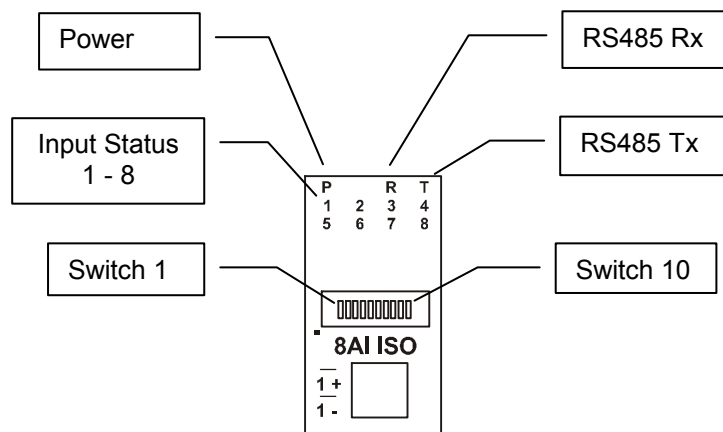
The same applies to the IO-8AIV module. An input voltage of 0 - 10Volts represents an output of 0 - 4095 and 2 volts would give a reading of $819 \pm 1\text{LSB}$. To obtain an output value of 0 to 4095 for an input signal of 2 to 10V the offset switch is switched on. This module can also be configured for a 0 – 10.000V input range or +/- 10.000V input.

3.6.2 Technical Specification of IO-8AIIS and IO-8AIVS

| | | | |
|----------------------------------|---|---|-------------------|
| Power Supply | Logic Supply Voltage | 12 -24 Vdc | |
| | Logic Supply Current | 58mA @ 12V / 31mA @ 24V | |
| Voltage Inputs – IO-8AIVS | 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 |
| | Drift | 100ppm/°C | |
| | Isolation | 1500Vrms between field and logic 350Vpeak between each input | |
| Current Inputs – IO-8AIIS | Input Points | 8 | |
| | Input Current | 0(4) - 20 mA | |
| | InputType | Range | Resolution |
| | 1 | 0 – 4095 | 12 bits |
| | 2 | 0–20.000mA | 1uA |
| | 3 | +/-20.000mA | 1uA |
| | Drift | 100ppm/°C | |
| Isolation | 1000Vrms between field and logic 350Vpeak between each input | | |
| Temperature | Operating Temperature. | -10°C to + 50°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 | |

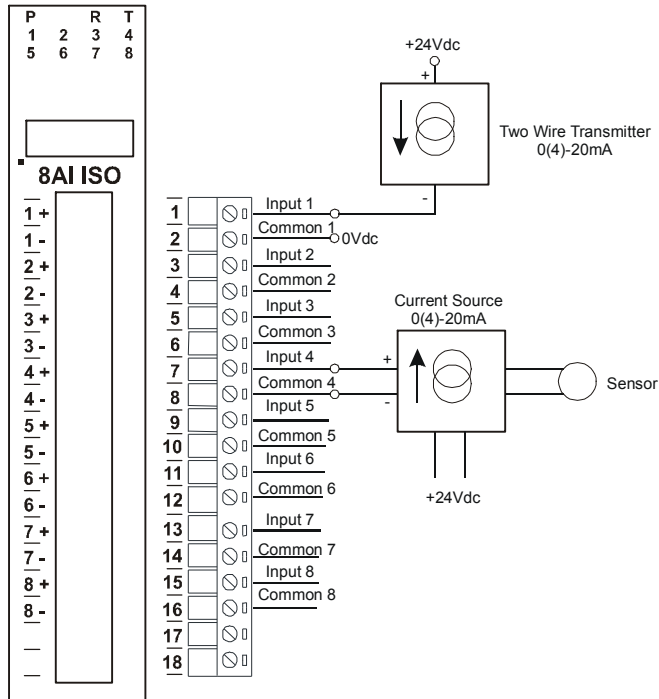
3.6.3 Status Indicators

- 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:** “ON” when the input is zero.
“OFF” when the input is greater than zero and less than 4095.
“Flashing” when the input is over range, greater or equal to 4095

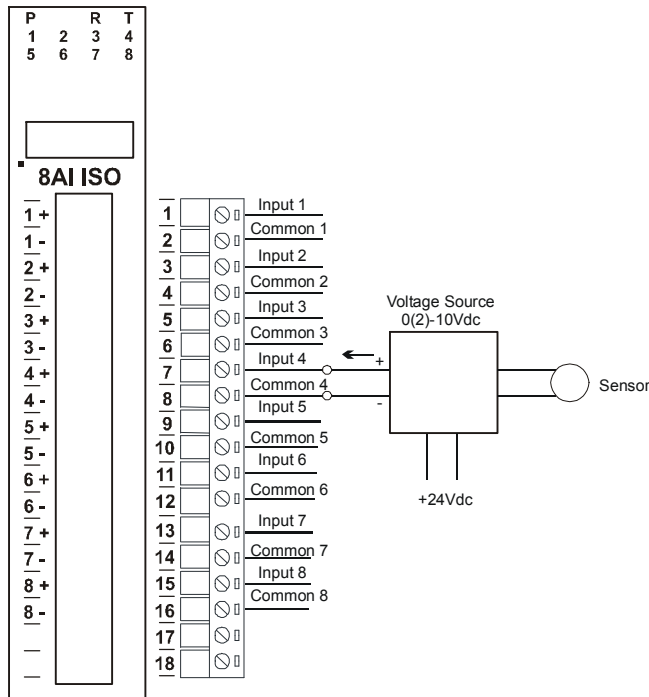


3.6.4 Wiring

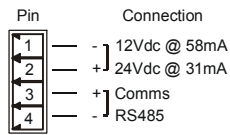
The following diagram shows how the analog inputs are connected to a 0(4)-20mA source. All of the common terminals are isolated from each other.



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.



Note: If power/communication connections are reversed, module may become faulty.

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 | OFF SET | When switched ON the inputs 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) |

3.6.6 IO-8AIIS Data Registers (8AI TYPE = 107/8AIV 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 Low Byte = 107(IO8AI) or 108(IO8AIV) |
| 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) bit1 = 0(OK),bit1 = 1(error) |
| 30100 | DIP Switch | 0 | 65535 | R | Status of DIP Switch on Front Panel |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.6.6.1 Analog Input Registers.

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

| IO-8AI ANALOG INPUTS | | | | | | | | | | | | | | MSB | 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)

3.6.6.2 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 | don't care | 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:

| IO-8AI ANALOG INPUT STATUS | | | | | | | | | | | | | | MSB | 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 | |

3.7 IO-8TC - THERMOCOUPLE INPUTS

3.7.1 Description

The IO-8TC 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 IO-8TCS 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.

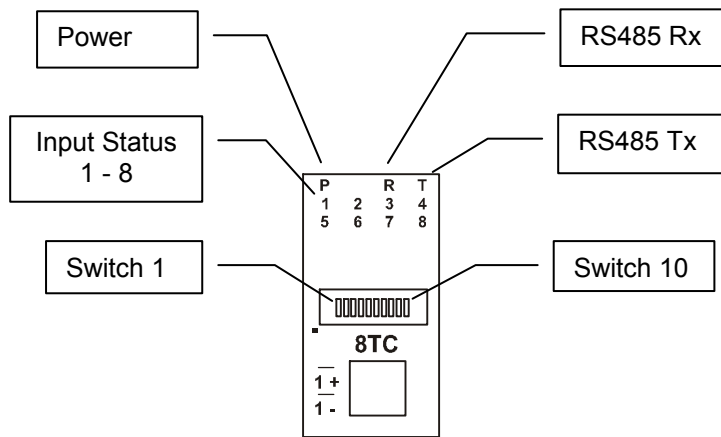
3.7.2 Technical Specification of IO-8TC

| | | | | |
|---------------------|----------------------|-------------|----------------------------------|-----------------|
| 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 | 0 to 600 °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. | -10°C to + 50°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 |

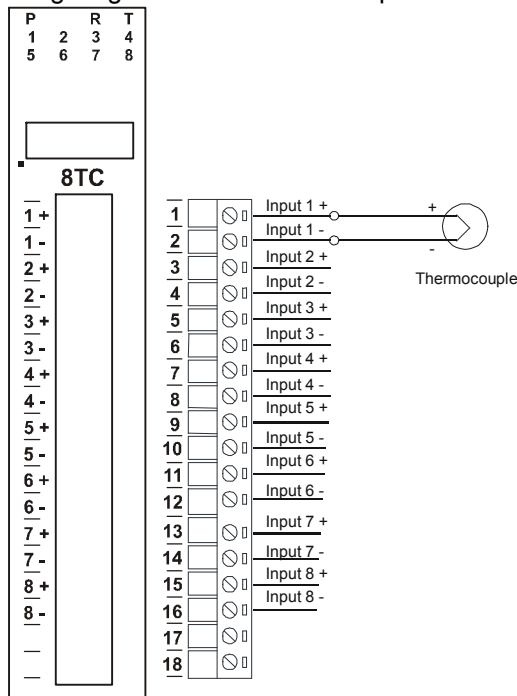
3.7.3 Status Indicators

- 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:** "ON" when the thermocouple is open circuit.
"OFF" when the thermocouple is connected.

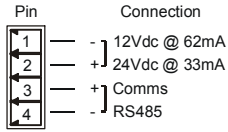


3.7.4 Wiring

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



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



Note: If power/communication connections are reversed, module may become faulty.

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 | 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) |

3.7.6 IO-8TC 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 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 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400, 57600, 115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.8 IO-8TCS - ISOLATED THERMOCOUPLE INPUTS

3.8.1 Description

The IO-8TCS 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 IO-8TC 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.

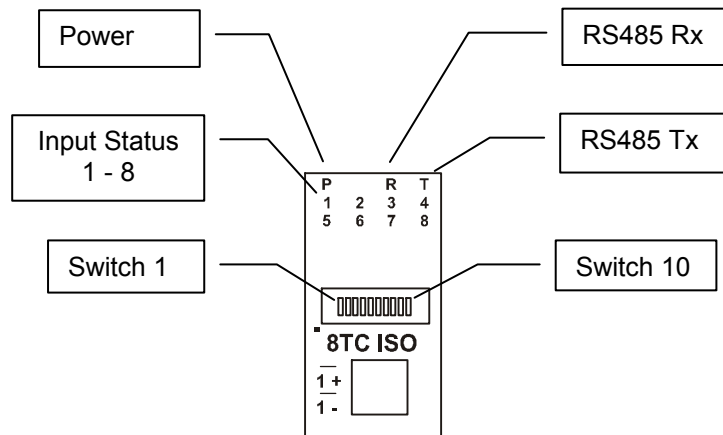
3.8.2 Technical Specification of IO-8TCS

| | | | | |
|---------------------|----------------------|-------------|--|-----------------|
| 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 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 | 0 to 600 °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. | -10°C to + 50°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 |
| | | |
| | | |

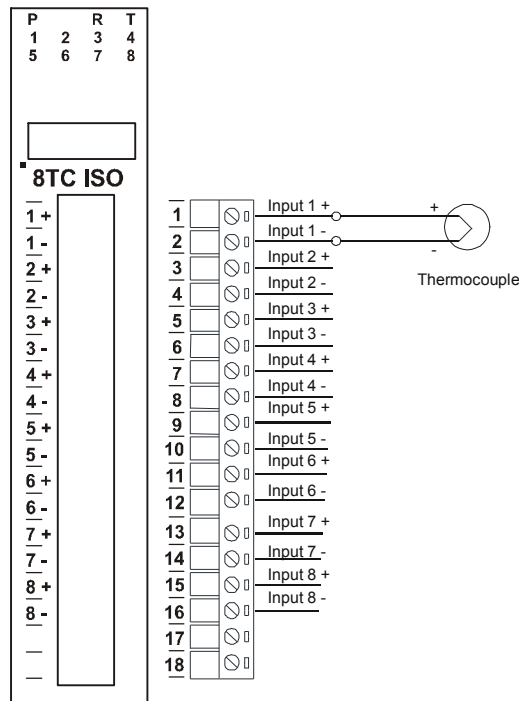
3.8.3 Status Indicators

- 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:** "ON" when the thermocouple is open circuit.
"OFF" when the thermocouple is connected.

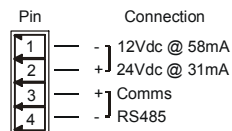


3.8.4 Wiring

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



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



Note: If power/communication connections are reversed, module may become faulty.

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 | - | 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) |

3.8.6 IO-8TCS 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 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 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.9 IO-6RTD - RTD INPUTS

3.9.1 Description

The IO-6RTD 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.

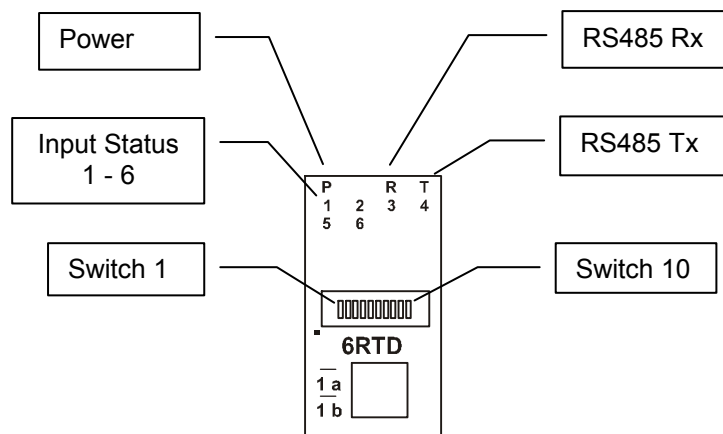
Note: As there is no inter-channel isolation, isolated RTD's must be used in order to prevent ground loops and reading errors.

3.9.2 Technical Specification of IO-6RTD

| | | | | |
|---------------------|------------------------|--------------------------------------|---------------|----------------------|
| 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 |
| 1 | | PT100 | -200 to 850°C | ± 0.3°C,IEC 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 | ± 0.05% |
| 7 | | Ohms | 100-4000ohms | ± 0.05% |
| Temperature | Operating Temperature. | -10°C to + 50°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 | | |
| | | | | |
| | | | | |

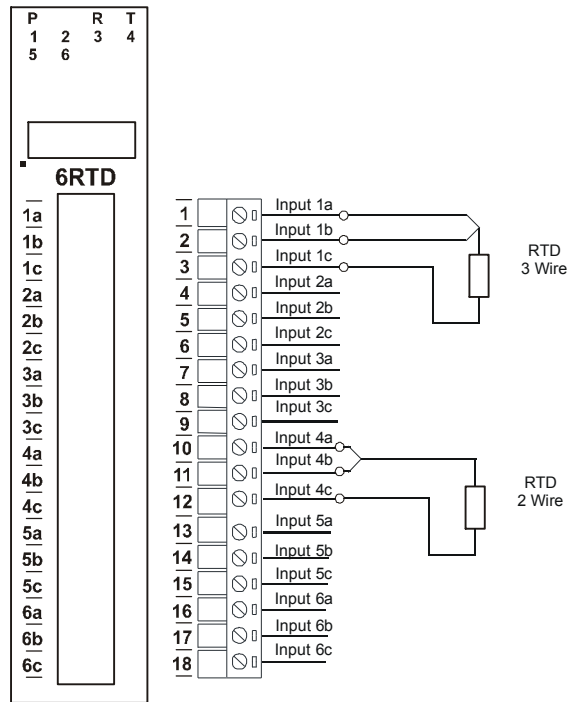
3.9.3 Status Indicators

- 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 RTD is open circuit.
"OFF" when the RTD is connected.

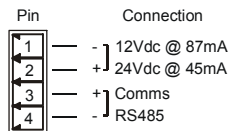


3.9.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

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 | 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) |

3.9.6 IO-6RTD 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 Low Byte = 109 |
| 30002 | RTD Input 1 | -xxx.x | yyy.y | R | RTD Inputs. See table for range. |
| 30003 | RTD Input 2 | -xxx.x | yyy.y | R | Resolution in 0.1°C. |
| 30004 | RTD Input 3 | -xxx.x | yyy.y | R | " |
| 30005 | RTD Input 4 | -xxx.x | yyy.y | R | " |
| 30006 | RTD Input 5 | -xxx.x | yyy.y | R | " |
| 30007 | RTD Input 6 | -xxx.x | yyy.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 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

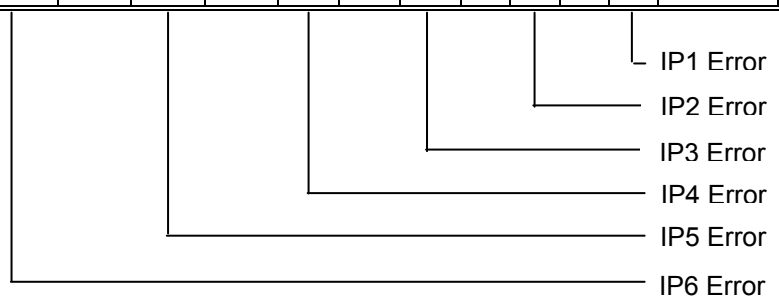
3.9.6.1 RTD Input Status.

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

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



3.10 IO-DAIO – DIGITAL + ANALOG INPUTS AND OUTPUTS

3.10.1 Description

The IO-DAIO 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 while 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/ PLC/ HMI. 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.

3.10.2 Technical Specification of IO-DAIO

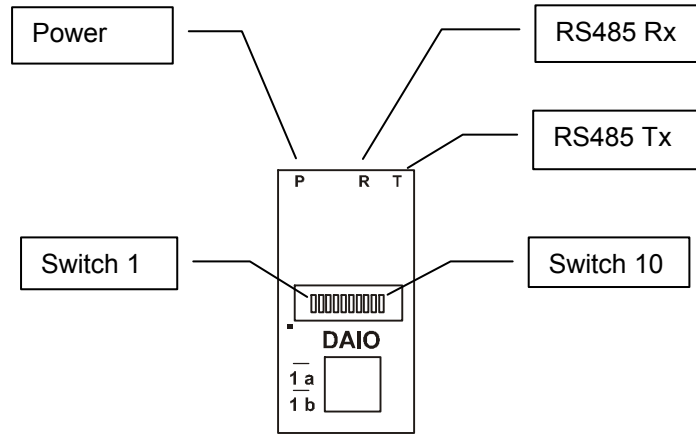
| | | | | |
|-----------------------|------------------------|-----------------------|----------------------------------|------------------------|
| Power Supply | Logic Supply Voltage | | 12 -24 Vdc | |
| | Logic Supply Current | | 115mA @ 12V / 58mA @ 24V | |
| | Field Supply Voltage | | 24 Vdc | |
| | 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 | ± 0.05% |
| | 7 | Ohms | 100-4000ohms | ± 0.05% |
| Current Inputs | Input Points | | 2 | |
| | Input Current | | 0 - 20 mA | |
| | Input Resistance | | 250ohms | |
| | Input Type | 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 |
| | Input Type | 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 |
| | Output Type | Range | Resolution |
| | 1 | 0 – 4095 | 12 bits |
| | Drift | | 100ppm/°C |
| | Accuracy | | 0.05% of span |
| | Compliance | | 1000 ohms max. @ 24Vdc 500 ohms max. @ 12Vdc |
| Voltage Output | Output Points | | 1 |
| | Output Voltage | | 0 - 10 V |
| | Output Type | 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 | | 50 Hz (max) |
| | Pulse Width | | 20 ms (min) |
| Digital Outputs | Output Points | | 2 |
| | Maximum Voltage | | 36 Vdc |
| | Maximum Current | | 100 mA per output |
| | Vceon | | 1.1V Max. |
| | Isolation | | 1500Vrms between field and logic |
| Temperature | Operating Temperature. | | -10°C to + 50°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

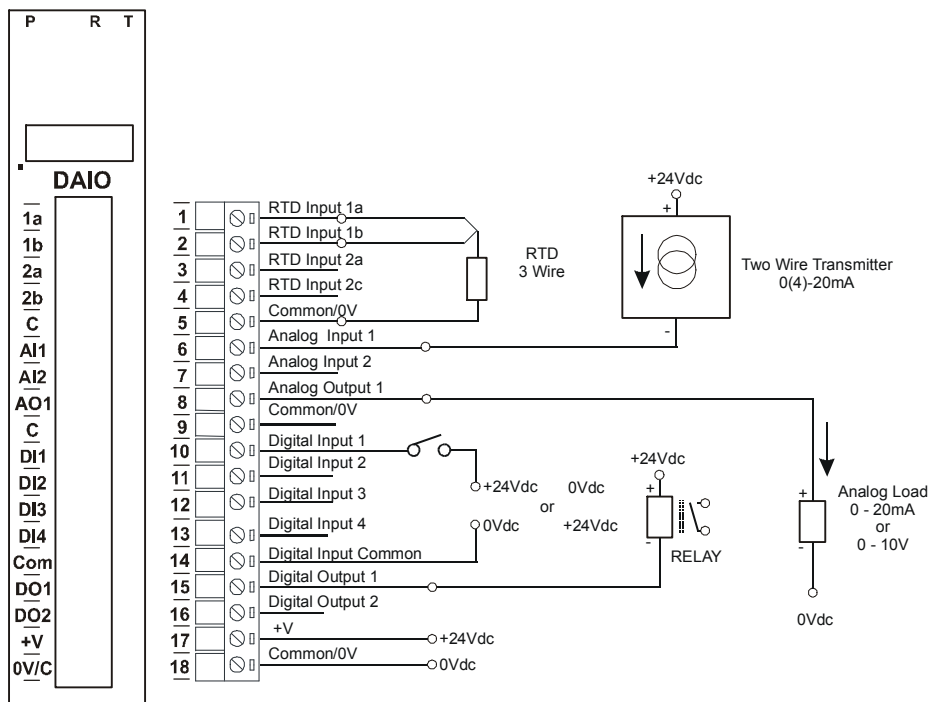
- Power:** "ON" when module has power.
- RS485 Rx:** Flashes to indicate the unit has received a valid Modbus message.
- RS485 Tx:** Flashes to indicate the unit has sent a Modbus message.

* Please note that LED status is not available for Digital and Analog IO's in IO-DAIO Module

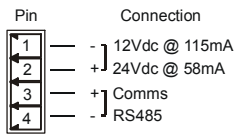


3.10.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

3.10.5 Switch Settings

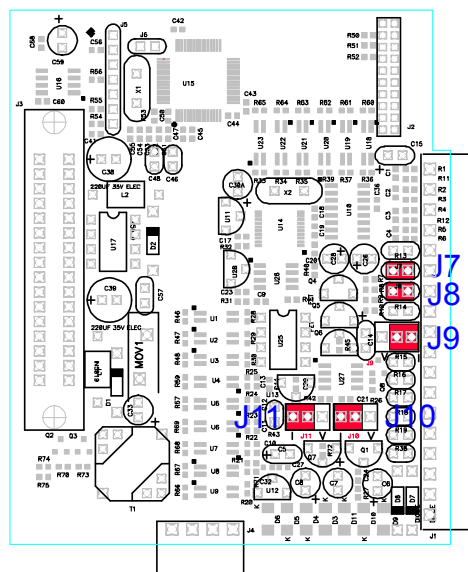
| SWITCH | FUNCTION | DESCRIPTION |
|--------|-------------|--|
| 1 | NODE ID +1 | Node ID's from 0 to 127 are set up using switches 1 to 7 |
| 2 | NODE ID +2 | " |
| 3 | NODE ID +4 | " |
| 4 | NODE ID +8 | " |
| 5 | NODE ID +16 | " |
| 6 | NODE ID +32 | " |
| 7 | NODE ID +64 | " |
| 8 | - | Not used.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

3.10.6 Jumper Settings

3.10.6.1 Current Input and Output

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

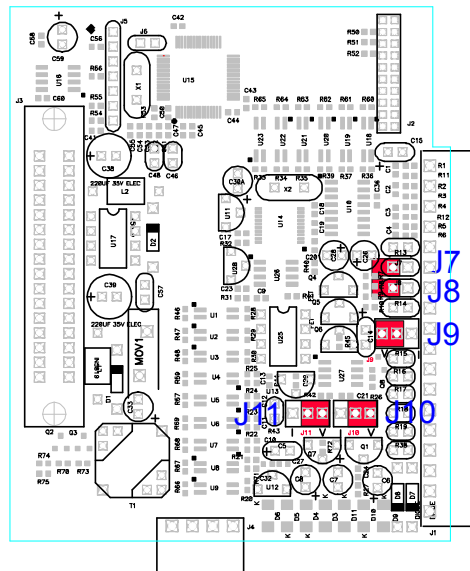
The Analog output can be configured as a current 0-20mA output by placing the jumpers **J9**, **J10** and **J11** on the "I" position as shown below.



3.10.6.2 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



3.10.7 IO-DAIO 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 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 | yyy.y | R | RTD Inputs. See table for range. |
| 40005 | RTD Input 2 | -xxx.x | yyy.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 input) 2 = 0-20 mA 3=+/- 20 mA 4 = 0-4095 (V input) 5=0-10.000 V 6=+/- 10.000 V 7=0 -1.0000 V 8=+/- 1.0000 V |
| 40107 | AI 2 Type | 1 | 8 | R/W | " |
| 40108 | AO Type | 1 | 2 | R/W | 1 = 0-20 mA, 2 = 0-10 V |
| 40109 | Line Frequency | 50 | 60 | R/W | Line Frequency |
| 40110 | Units Type | 1 | 2 | R/W | 1=°C, 2=°F |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400, 4800, 9600, 19200, 38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.11 IO-8AOI - ANALOG OUTPUTS

3.11.1 Description

The IO-8AOI is a 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.

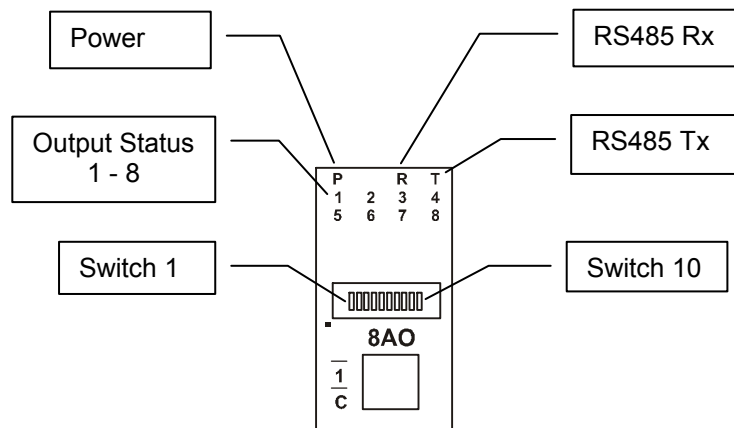
The module configured as slave, where PC/ PLC/ HMI act as Master in the Modbus network. DIP switch 9 should be switched off to make this module as slave. The outputs are written to by the Modbus master device such as a PC/ PLC/ HMI.

3.11.2 Technical Specification of IO-8AOI

| | | |
|-----------------------|-------------------------|---|
| 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 500 ohms max. @ 12Vdc |
| Isolation | Between field and logic | 1500Vrms between field and logic |
| Temperature | Operating Temperature. | -10°C to + 50°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 |
| | | |

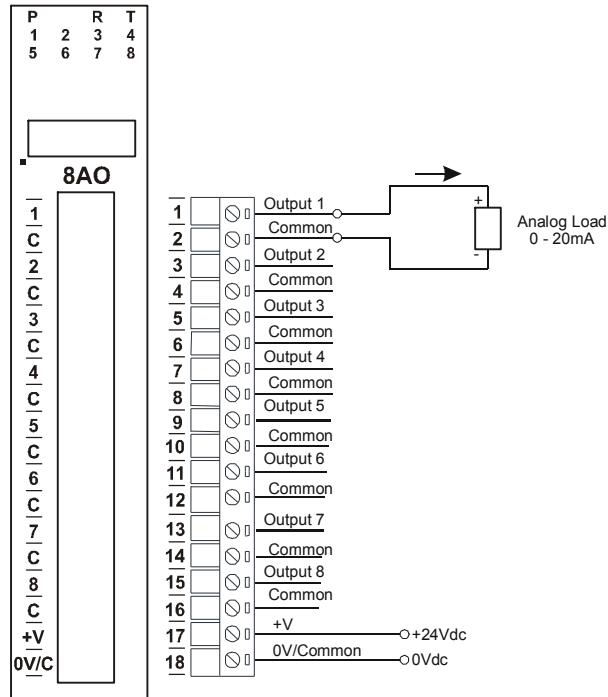
3.11.3 Status Indicators

- 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.
- Output Status:** "ON" when the output is zero
"OFF" when the output is between zero and full scale.
"Flashing" when the output is at full scale

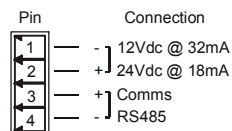


3.11.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

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 | - | When switched ON the outputs are scaled to accept a 4mA offset |
| 9 | MODE | Slave (Off) |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.11.6 IO-8AOI 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 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) 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. |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400,4800,9600,19200,38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

3.12 IO-8AOV - ANALOG OUTPUTS

3.12.1 Description

The IO-8AOV is a 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.

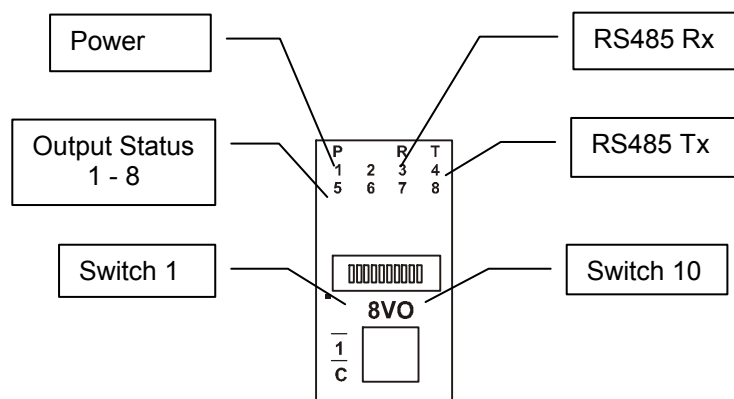
The module configured as slave, where PC/ PLC/ HMI act as Master in the Modbus network. DIP switch 9 should be switched off to make this module as slave. The outputs are written to by the Modbus master device such as a PC/ PLC/ HMI.

3.12.2 Technical Specification of IO-8AOV

| | | |
|-----------------------|-------------------------|--------------------------------------|
| 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. | -10°C to + 50°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 |
| | | |

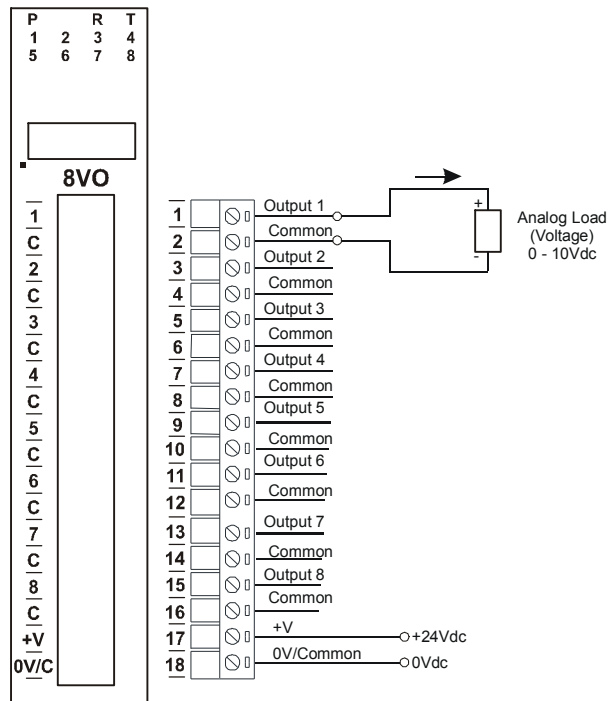
3.12.3 Status Indicators

- 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:** "ON" when the output is zero
"OFF" when the output is between zero and full scale.
"Flashing" when the output is at full scale

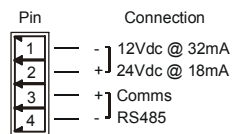


3.12.4 Wiring

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.



Note: If power/communication connections are reversed, module may become faulty.

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 | - | When switched ON the outputs are scaled to accept a 2V offset |
| 9 | MODE | Off (Slave) |
| 10 | BAUD RATE | Selects 9600 (off) or Programmed Baud Rate (on) |

3.12.6 IO-8AOV Data Registers (MODULE TYPE = 111)

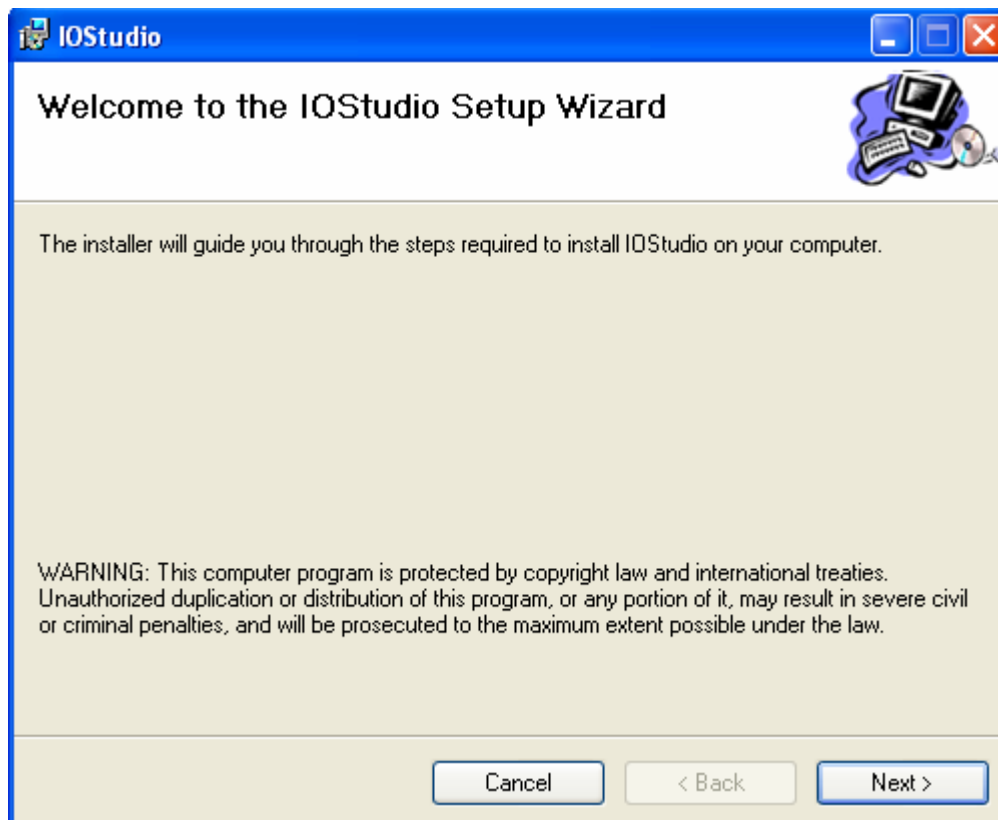
| Modbus Address | Register Name | Low Limit | High Limit | Access | Comments |
|----------------|---------------------------|-----------|------------|--------|---|
| 30001 | S/W Version / Module Type | N/A | N/A | R | High Byte = Software Version Low Byte = 111 |
| 40002 | Voltage Output 1 | 0 | 4095 | 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(0), bit2 = 1(4095) 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. |
| 40121 | Baud Rate | 2400 | 11520 | R/W | 2400,4800,9600,19200,38400,57600,115200 |
| 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 | 65535 | R/W | 0 = Disable, >0 = Enable. (x10ms) |

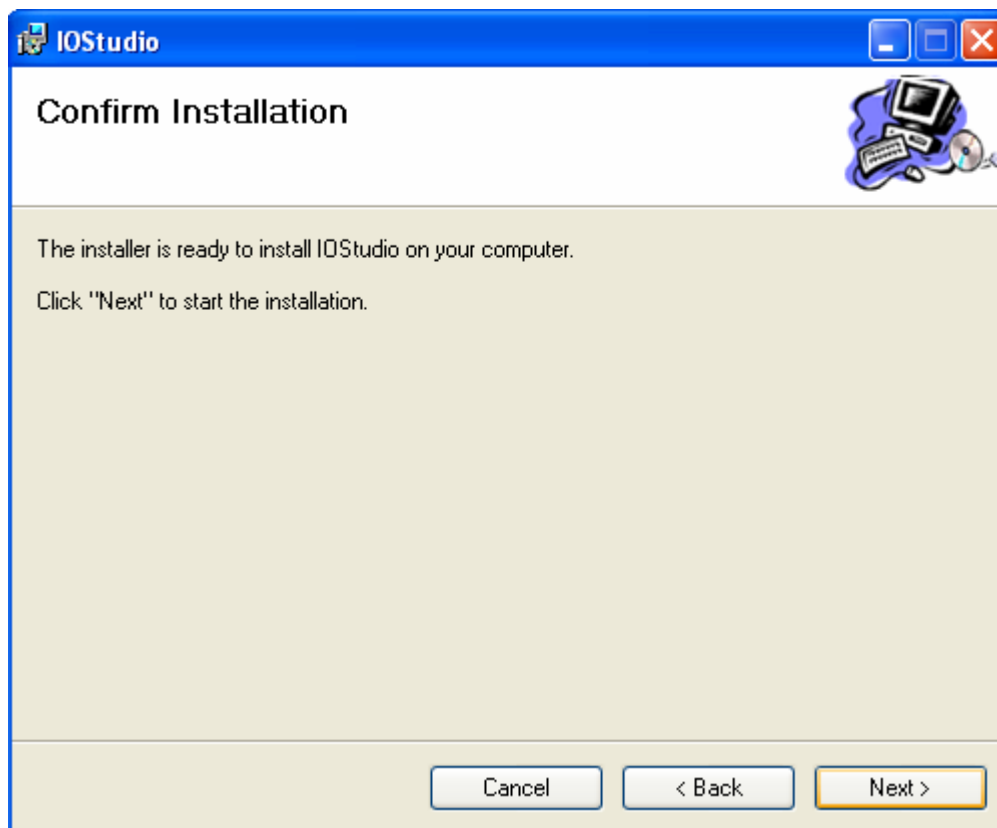
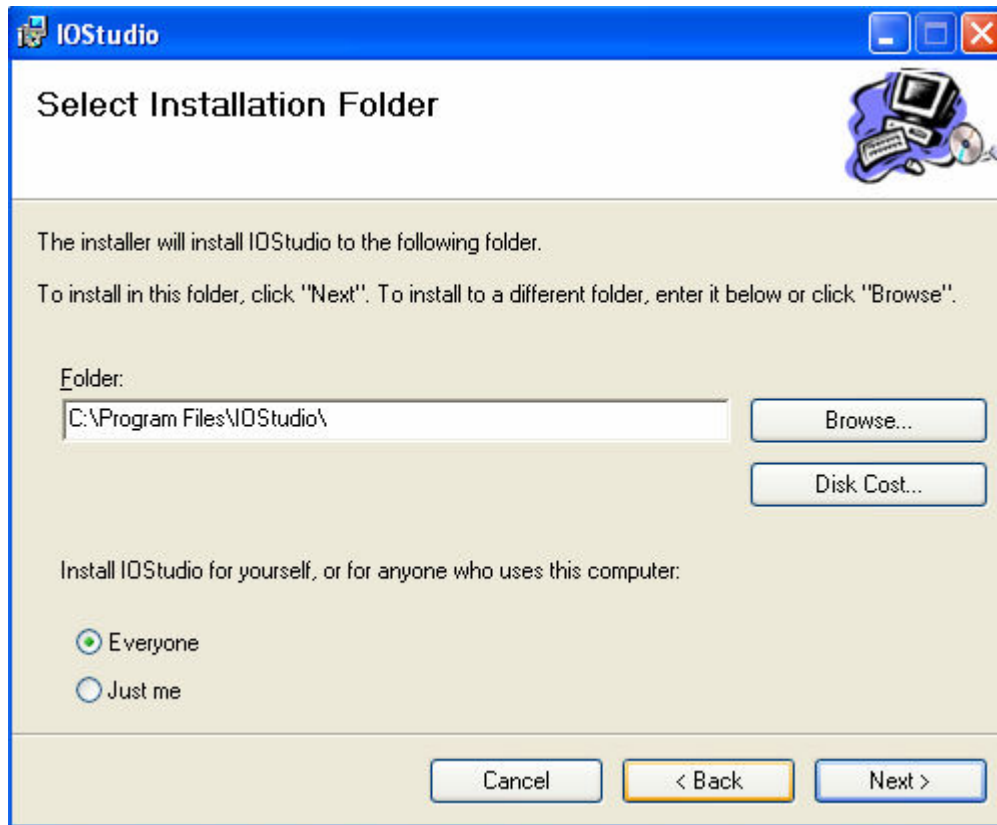
4. IO STUDIO

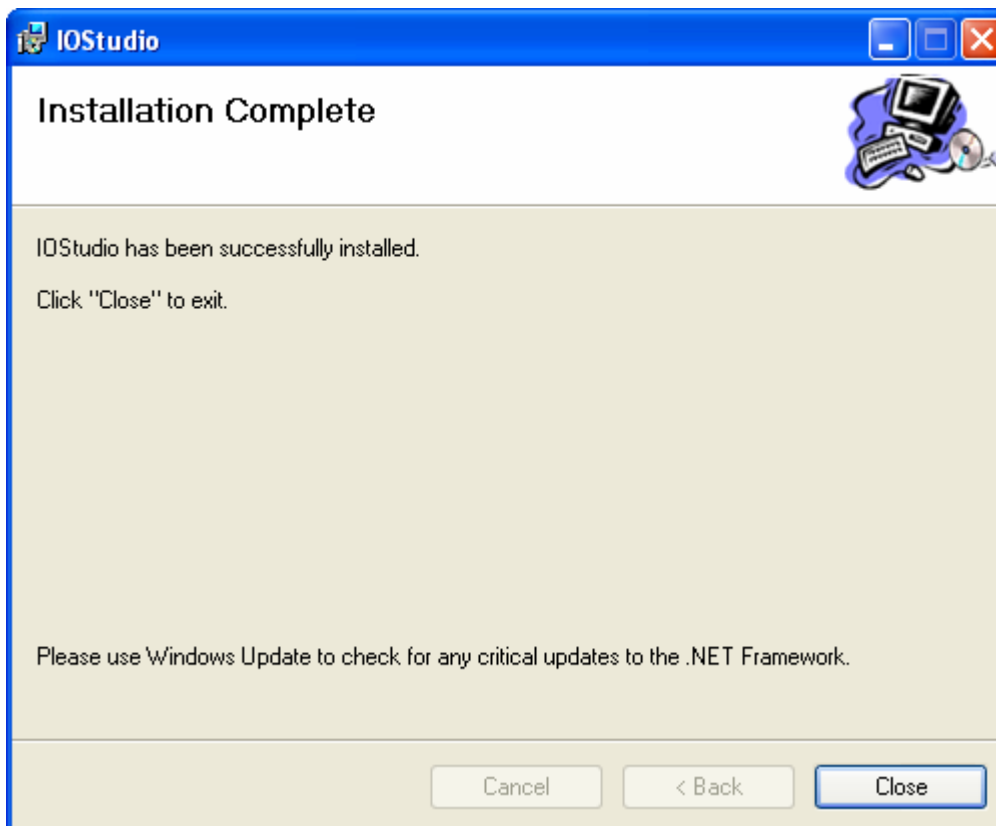
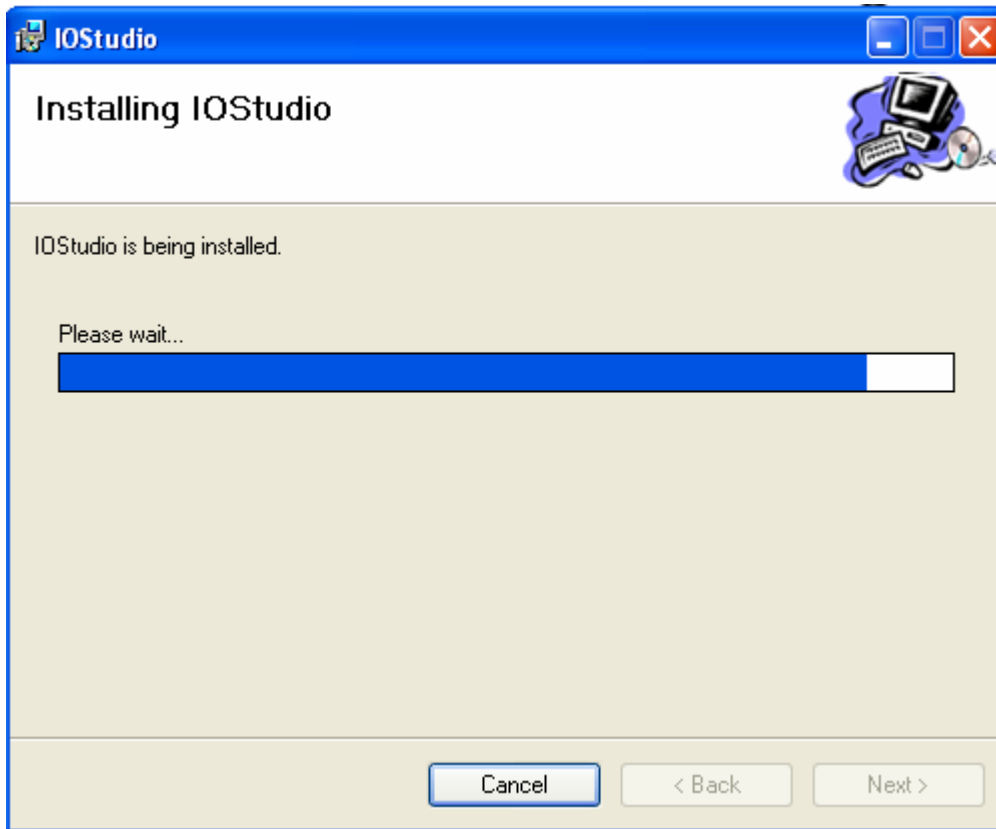
This is PC software used for setting communication parameters of the IO module, Read IO status directly in PC, Force Outputs to test the module and used as tool for module diagnostic purpose.



Install IO Studio software in PC.



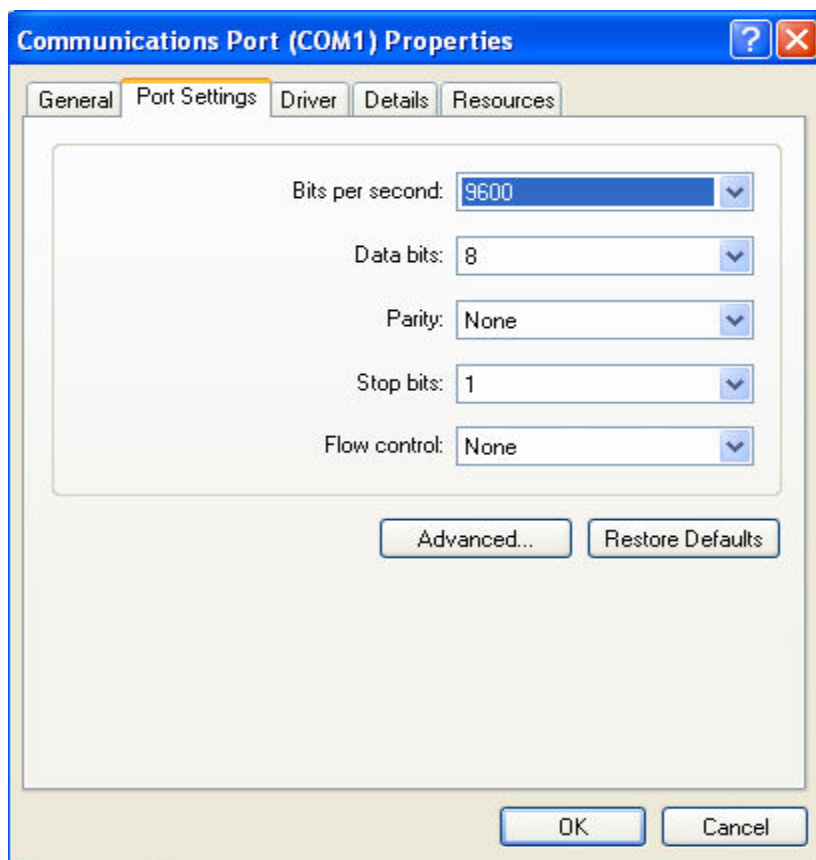


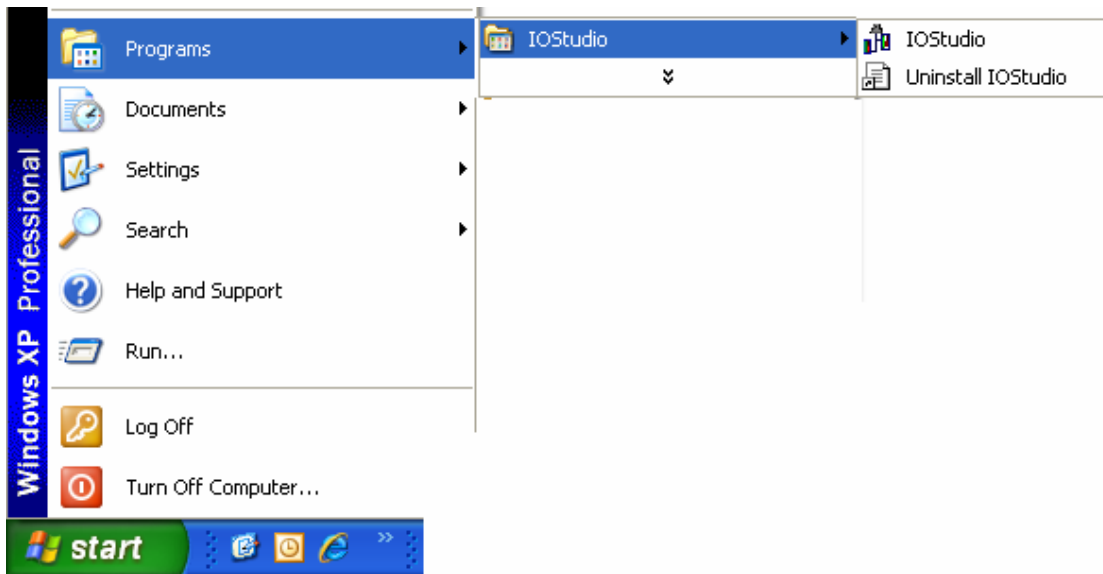


IO Module: Set address say 1 for the IO Module using DIP switches on the Module itself. Connect 24V DC Power supply and make sure that Dip switch10 is Off to allow communication of IO Module with other devices on Default communication settings. If you are using RS232/RS485 converter like SNA10A from Brainchild make sure that you have selected all the communication settings properly as follows.

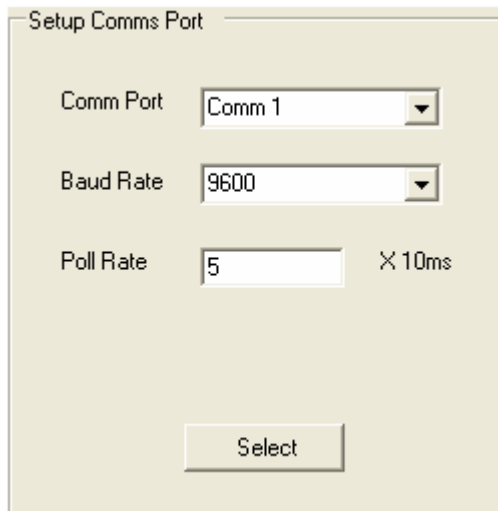
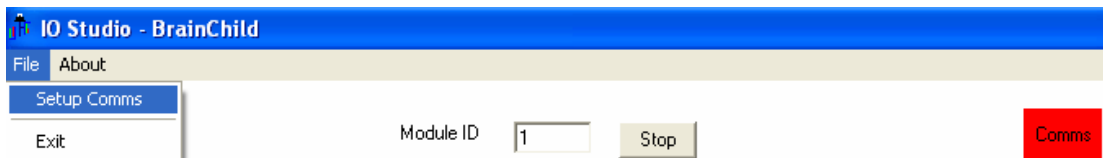
| | |
|-----------|------|
| BAUD RATE | 9600 |
| DATA BITS | 8 |
| PARITY | NONE |
| STOP BITS | 1 |

In the PC, select above settings at the COM port.
Right click on Mycomputer –Properties - Hardware-Device Manager- COM ports





Start the IO Studio software as shown above.



If every thing is proper, IO Studio will read the IO Module and show the status of the IO registers. If it shows RED indication as above, then please check the dip switch status on the IO Module, RS232/RS485 converter settings and COM settings in the PC and also check the cable that is used between PC and RS232/RS485 converter. Many times, you might have more than one COM port on your PC, You should make sure that which COM port is using for this purpose and select the correct COM port in the above shown setup.

IO-16DI

Module Type: 100
Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|-----------------|
| 10001 | 0 | Digital Input 1 |
| 10002 | 0 | Digital Input 2 |
| 10003 | 0 | Digital Input 3 |
| 10004 | 0 | Digital Input 4 |
| 10005 | 0 | Digital Input 5 |
| 10006 | 0 | Digital Input 6 |
| 10007 | 0 | Digital Input 7 |
| 10008 | 0 | Digital Input 8 |
| 10009 | 0 | Digital Input 9 |
| 10010 | 0 | Digital Input10 |
| 10011 | 0 | Digital Input11 |
| 10012 | 0 | Digital Input12 |
| 10013 | 0 | Digital Input13 |
| 10014 | 0 | Digital Input14 |
| 10015 | 0 | Digital Input15 |
| 10016 | 0 | Digital Input16 |
| 30001 | 356 | Type/SW Version |
| 30002 | 0 | Input Status |
| 40003 | 0 | Counter 1 |
| 40005 | 0 | Counter 2 |

Description of Modbus Register

Status of Digital Input 1.

Red (0) = OFF
Green (1) = ON

Move Mouse pointer over Value for Description

IO-16DO

Module Type: 101
Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|-----------------------|
| 1 | 1 | Digital Output 1 |
| 2 | 1 | Digital Output 2 |
| 3 | 1 | Digital Output 3 |
| 4 | 1 | Digital Output 4 |
| 5 | 1 | Digital Output 5 |
| 6 | 1 | Digital Output 6 |
| 7 | 1 | Digital Output 7 |
| 8 | 1 | Digital Output 8 |
| 9 | 0 | Digital Output 9 |
| 10 | 0 | Digital Output10 |
| 11 | 0 | Digital Output11 |
| 12 | 0 | Digital Output12 |
| 13 | 0 | Digital Output13 |
| 14 | 0 | Digital Output14 |
| 15 | 0 | Digital Output15 |
| 16 | 0 | Digital Output16 |
| 30001 | 357 | Type/SW Version |
| 40002 | 255 | Output Status |
| 30100 | 1 | DIP Switch |
| 40101 | 0 | Output Watchdog Timer |

Description of Modbus Register

Status of Digital Output 8.

Red (0) = OFF
Green (1) = ON

Double Click to change

Move Mouse pointer over Value for Description

IO-4RO

Module Type: 113
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|-----------------------|
| 1 | 1 | Relay Output 1 |
| 2 | 1 | Relay Output 2 |
| 3 | 0 | Relay Output 3 |
| 4 | 0 | Relay Output 4 |
| 30001 | 369 | Type/SW Version |
| 40002 | 3 | Output Status |
| 30100 | 1 | DIP Switch |
| 40101 | 0 | Output Watchdog Timer |
| 40102 | 0 | Modbus Master Timeout |
| 40103 | 0 | Modbus Master Rate |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |
| 40123 | 0 | Stop Bit |
| 40124 | 0 | Reply Delay |

Description of Modbus Register

Status of Relay Output 2.

Red (0) = OFF
 Green (1) = ON

Double Click to change

Move Mouse pointer over Value for Description

IO-8DIO

Module Type: 102
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|------------------|
| 10001 | 0 | Digital Input 1 |
| 10002 | 0 | Digital Input 2 |
| 10003 | 0 | Digital Input 3 |
| 10004 | 0 | Digital Input 4 |
| 10005 | 0 | Digital Input 5 |
| 10006 | 0 | Digital Input 6 |
| 10007 | 0 | Digital Input 7 |
| 10008 | 0 | Digital Input 8 |
| 17 | 1 | Digital Output 1 |
| 18 | 1 | Digital Output 2 |
| 19 | 1 | Digital Output 3 |
| 20 | 1 | Digital Output 4 |
| 21 | 0 | Digital Output 5 |
| 22 | 0 | Digital Output 6 |
| 23 | 0 | Digital Output 7 |
| 24 | 0 | Digital Output 8 |
| 30001 | 358 | Type/SW Version |
| 30002 | 0 | Input Status |
| 40003 | 15 | Output Status |
| 40004 | 0 | Counter 1 |

Description of Modbus Register

Status of Digital Output 4.

Red (0) = OFF
 Green (1) = ON

Double Click to change

Move Mouse pointer over Value for Description

IO-8AI

Module Type: 103
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|-----------------|
| 30001 | 359 | Type/SW Version |
| 30002 | 0 | Current Input 1 |
| 30003 | 0 | Current Input 2 |
| 30004 | 0 | Current Input 3 |
| 30005 | 0 | Current Input 4 |
| 30006 | 0 | Current Input 5 |
| 30007 | 0 | Current Input 6 |
| 30008 | 0 | Current Input 7 |
| 30009 | 0 | Current Input 8 |
| 30010 | 21845 | Input Status |
| 30100 | 1 | DIP Switch |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |
| 40123 | 0 | Stop Bit |
| 40124 | 0 | Reply Delay |

Description of Modbus Register

0 - 20mA Current Input 1
 Range = 0 - 4095 (12 bits)

Move Mouse pointer over Value
 for Description

IO-8AIV

Module Type: 104
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|-----------------|
| 30001 | 360 | Type/SW Version |
| 30002 | 0 | Analog Input 1 |
| 30003 | 0 | Analog Input 2 |
| 30004 | 0 | Analog Input 3 |
| 30005 | 0 | Analog Input 4 |
| 30006 | 0 | Analog Input 5 |
| 30007 | 0 | Analog Input 6 |
| 30008 | 0 | Analog Input 7 |
| 30009 | 0 | Analog Input 8 |
| 30010 | 21845 | Input Status |
| 30100 | 1 | DIP Switch |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |
| 40123 | 0 | Stop Bit |
| 40124 | 0 | Reply Delay |

Description of Modbus Register

0 - 10V Voltage Input 1
 Range = 0 - 4095 (12 bits)

Move Mouse pointer over Value
 for Description

IO-8TC

Module Type: 105
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|--------|----------------------|
| 30001 | 361 | Type/SW Version |
| 30002 | 166 | Thermocouple Input 1 |
| 30003 | -32768 | Thermocouple Input 2 |
| 30004 | -32768 | Thermocouple Input 3 |
| 30005 | -32768 | Thermocouple Input 4 |
| 30006 | -32768 | Thermocouple Input 5 |
| 30007 | -32768 | Thermocouple Input 6 |
| 30008 | -32768 | Thermocouple Input 7 |
| 30009 | -32768 | Thermocouple Input 8 |
| 30010 | 215 | CJC Temperature |
| 30011 | 21844 | Input Status |
| 30016 | 65415 | Calibrate Raw Data |
| 40017 | 0 | Calibrate Control |
| 30100 | 1 | DIP Switch |
| 40101 | 1 | Thermocouple Type |
| 40102 | 50 | Line Frequency |
| 40103 | 100 | CJC Offset |
| 40104 | 1 | Display Units °C/°F |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |

Description of Modbus Register

Thermocouple Input 1

Range = -xxx.x to +yyyy.y

Example: 101.4°C will be read back as 1014

Move Mouse pointer over Value for Description

IO-6RTD

Module Type: 109
 Software Version: 1

| Modbus Address | Value | Label |
|----------------|--------|---------------------|
| 30001 | 365 | Type/SW Version |
| 30002 | 8500 | RTD Input 1 |
| 30003 | -32768 | RTD Input 2 |
| 30004 | -32768 | RTD Input 3 |
| 30005 | -32768 | RTD Input 4 |
| 30006 | -32768 | RTD Input 5 |
| 30007 | -32768 | RTD Input 6 |
| 30008 | 1364 | Input Status |
| 30016 | 34423 | Calibrate Raw Data |
| 40017 | 0 | Calibrate Control |
| 30100 | 1 | DIP Switch |
| 40101 | 1 | RTD Type |
| 40102 | 50 | Line Frequency |
| 40103 | 0 | Display Units °C/°F |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |
| 40123 | 0 | Stop Bit |
| 40124 | 0 | Reply Delay |

Description of Modbus Register

RTD Input 1

Range = -xxx.x to +yyyy.y

Example: 101.4°C will be read back as 1014

Move Mouse pointer over Value for Description

IO-DA10

Module Type: 112
Software Version: 1

| Modbus Address | Value | Label |
|----------------|--------|--------------------|
| 10001 | 0 | Digital Input 1 |
| 10002 | 0 | Digital Input 2 |
| 10003 | 0 | Digital Input 3 |
| 10004 | 0 | Digital Input 4 |
| 17 | 1 | Digital Output 1 |
| 18 | 0 | Digital Output 2 |
| 30001 | 368 | Type/SW Version |
| 30002 | 0 | Input Status |
| 40003 | 1 | Output Status |
| 30004 | -32768 | RTD Input 1 |
| 30005 | -32768 | RTD Input 2 |
| 30006 | 0 | Analog Input 1 |
| 30007 | 0 | Analog Input 2 |
| 40008 | 0 | Analog Output 1 |
| 40009 | 0 | Counter 1 |
| 40011 | 0 | Counter 2 |
| 40013 | 0 | Counter 3 |
| 40015 | 0 | Counter 4 |
| 30091 | 0 | Calibrate Raw Data |
| 40092 | 0 | Calibrate Channel |

Description of Modbus Register

Status of Digital Output 1.

Red (0) = OFF
Green (1) = ON

Double Click to change

Move Mouse pointer over Value for Description

IO Studio - BrainChild

File About

Module ID

IO-16DI

Module Type: 100
Software Version: 1

| Modbus Address | Value | Label |
|----------------|-------|--------------------|
| 40044 | 0 | Counter Capture 5 |
| 40046 | 0 | Counter Capture 6 |
| 40048 | 0 | Counter Capture 7 |
| 40050 | 0 | Counter Capture 8 |
| 40052 | 0 | Counter Capture 9 |
| 40054 | 0 | Counter Capture 10 |
| 40056 | 0 | Counter Capture 11 |
| 40058 | 0 | Counter Capture 12 |
| 40060 | 0 | Counter Capture 13 |
| 40062 | 0 | Counter Capture 14 |
| 40064 | 0 | Counter Capture 15 |
| 40066 | 0 | Counter Capture 16 |
| 30100 | 1 | DIP Switch |
| 40101 | 1 | Counter Mode |
| 40102 | 0 | Input Filter |
| 40103 | 0 | Counter Zero |
| 40121 | 1 | Baud Rate |
| 40122 | 0 | Parity |
| 40123 | 0 | Stop Bit |
| 40124 | 0 | Reply Delay |

Description of Modbus Register

Baud Rate - Enter one of the following values, then switch on SW10 to enable

2400
4800
9600
19200
38400
57600
11520

Move Mouse pointer over Value for Description

Configuration:

For ex: If you want set baud rate, enter the required value in the register 40121, then press enter in the PC keyboard. Set all the parameters once and then switch off the power supply to the IO Module. Now switch on the Dip switch 10 on the module to make above settings effective. After power on, the IO Module will have new Communication settings. Please note that at this point of time, IO module may not communicate with PC because you may have different settings at RS232/RS485 converter and also COM port settings in the PC.

Testing the IO Module:

For ex: If you want to test IO-16DO module. It contains total 16 digital outputs. You can connect IO module with PC as explained above via RS232/RS485 converter. You can force digital output from low to high and check its status at the IO module and also u can observe LED status on the IO Module itself.

5. SPECIFICATIONS

5.1 ENVIRONMENTAL

| | |
|-----------------------|--------------------------|
| Operating Temperature | -10°C to +50°C |
| Storage Temperature | -40°C to +85°C |
| Humidity | Up to 95% non condensing |

5.2 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 120ohm 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 IO module as possible.

5.3 CONFORMITY CERTIFICATE

DECLARATION OF CONFORMITY
according to EN 45014

Manufacturer's Name: Brainchild Electronic. Co. Ltd.,

Manufacturer's Address: No. 209, Chung Yong Road
Nan Kang District
Taipei, Taiwan, R.O.C

declares that the following IO products

Model Number(s): IO-16DI, IO-16DO, IO-DIO, IO-4RO, IO-8AII, IO-8AIV,
IO-8AIIS, IO-8AIVS, IO-8AO, IO-8VO, IO-8TC,
IO-8TCS, IO-6RTD, IO-DAIO

complies with EMC Directive 89/336/EEC and Low Voltage Equipment Directive 73/23/EEC and conforms to the following Product specifications:

Safety: IEC 950

EMC: IEC 61000-4-2-A1 Level 2

IEC 61000-4-3-A1 Level 2

IEC 61000-4-4 Level 3

CISPR 11:1997-A1 / EN 55011:1998 Group 1 Class A

TAIPEI, TAIWAN
Location

April 2007
Date

Mr. Peter Lio
Vice President

5.4 EMC Test Results

| EMC Test Results | | | | | | | | | |
|--|----------------|---------------|-------------------------|------|-----|------|------|-------|------|
| Test | Standard | Test Value | Product Compliance (IO) | | | | | | |
| Immunity Test Results EN 61326-1 | | | 16DI | 16DO | 4RO | 8DIO | 8AII | 8AIIS | 8AIV |
| Electrostatic 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 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 1KV/2KV | A | A | A | A | A | A | A |
| RF Conducted | IEC 61000-4-6 | Power 3 Vrms | A | A | A | A | A | A | A |
| Voltage Interrupt | IEC 61000-4-11 | 0.5cycle 100% | A | A | A | A | A | A | A |
| Emissions Test Results EN 61326-1 Class A | | | | | | | | | |
| Radiated Emissions | CISPR 22 | Class A | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Conducted Emissions | CISPR 22 | Class B | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

| Test | Standard | Test Value | Product Compliance (IO) | | | | | | |
|--|----------------|---------------|-------------------------|-----|------|------|------|------|------|
| Immunity Test Results EN 61326-1 | | | 8AIVS | 8TC | 8TCS | 6RTD | DAIO | 8AOI | 8AOV |
| Electrostatic 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 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 1KV/2KV | A | A | A | A | A | A | A |
| RF Conducted | IEC 61000-4-6 | Power 3 Vrms | A | A | A | A | A | A | A |
| Voltage Interrupt | IEC 61000-4-11 | 0.5cycle 100% | A | A | A | A | A | A | A |
| Emissions Test Results EN 61326-1 Class A | | | | | | | | | |
| Radiated Emissions | CISPR 22 | Class A | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Conducted Emissions | CISPR 22 | Class B | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |