

INSTALLATION AND OPERATING MANUAL

AI2800 4-20mA Input Module

ASL, Pharmagraph Division

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REVISION HISTORY

Date	Revision	Updated by	Detail
12 Feb 2010	1.00	J. McCollin	Created.
09-Sep-2010	1.10	J.Wallingford	Series 2000 Interconnects added
18-May-2011	1.11	J.McCollin	Series 2000 Retransmit Mode Corrected
<i>Document location: C:\Documents and Settings\johnmccollin\My Documents\AI2800-IOM.doc</i>			

1 **INTRODUCTION**

This document constitutes the Installation and Operating Manual for the AI2800 4-20mA Input Module. It should be read in conjunction with the enVigil software manual that describes the configuration and operation of the monitoring software.

The AI2800 4-20mA Input Module provides:

- 8 x 4-20mA analog input channels.

Each analog input has a current limited 24Vdc supply for the energisation of sensors and contains all the circuitry for measuring the current. The inputs are therefore particularly suited to loop powered instruments and instruments requiring a 24Vdc supply. They are not as suitable for monitoring existing loops.

Calibration constants are held in flash memory within the unit.

The modules are connected to a computer using an RS485 link. Two ports are supplied, a host and an auxiliary port. The host port is generally used for connection to a host computer.

The second (Aux) RS485 bus may be used for:

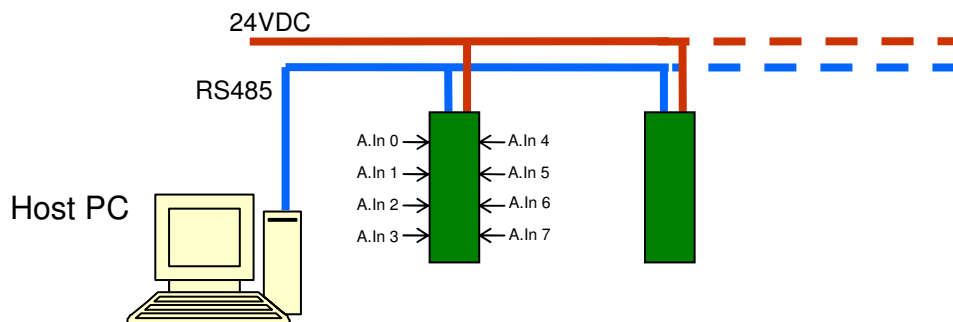
- Calibration of the module.
- Connection to a slave PC if used as part of a dual-redundant system.

2 **SPECIFICATION**

- 8 Analog inputs for 4-20mA sensors
 - Loop powered
 - 24Vdc powered, current limited
- DIN rail mounted enclosure:
 - Width 23mm
 - Height 85mm
 - Depth 105mm
 - Weight 85g
- Power supply
 - 24VDC $\pm 10\%$
 - 100mA (typ.), 200mA (max.)
- Interfaces
 - RS485 host, 19k2 baud, 1.2km
 - RS485 aux, 19k2 baud, 1.2km
- Environmental
 - Operating temperature 0 to 50 °C
 - Storage temperature -20 to 60 °C
- Measurement
 - DC setting accuracy $\pm 0.05\%$
 - Temperature coefficient 25ppm/°C
 - Series mode rejection 65dB

3 AN OVERVIEW OF THE AI2800

The general arrangement of a system using AI2800 modules is shown below:



3.1 Power Supply

A suitable 24Vdc supply should be provided to the AI2800 enclosure.

3.2 Communications Interfaces

An RS485 bus from the enVigil Server PC should be connected to the AI2800 host port. If required, a second PC can be connected to the Aux port. (See section 5 for further details).

3.3 Analog Inputs

Each module has eight 4-20mA analog inputs which are designed to energise and monitor a range of 4-20mA sensors. The module provides a nominal current limited 24VDC energisation voltage and can monitor the current from the sensor. It is therefore suitable for both loop powered sensors and sensors with separate power inputs and current outputs.

4 **AI2800 OPERATION**

4.1 **Address Selection**

Two binary-coded-decimal address switches define the *host* RS485 address, and must be set in the range 0 to 31 to correspond with each device used in the configuration software. SW1 are the 'Units' and SW2 are the 'Tens'.

NOTE: The address switches are also used to configure some special mode selections such as 'Self-test' and 'Re-transmit' modes (see section 6).

4.2 **Mode Selection**

The mode selection switch SW3 can be accessed by removing the top cover of the module.

Switch SW3 position 1 can be used to modify the behaviour of the module in overload situations.

- With switch SW3/1 off (default), values greater than 105% or less than -5% are set to error values when returned to the enVigil software.
- With switch SW3/1 on, values are not set to error, e.g. 0mA will result in a value of -25% being returned to the enVigil software.

Note that SW3 positions are 'ON' when the slider is away from the position number, towards the 'ON' legend.

5 **CONNECTING THE AI2800**

5.1 **DC Power Connection**

Connect the DC supply to **JP1** via a two pin header plug.

JP1 Pin No.	Description
1 (nearest to module corner)	+24Vdc
2	0V

Immediately after power is applied the LEDs D3 (red) and D4 (green) flash to indicate the firmware version. For example, two red flashes followed by one green flash indicates firmware version 2.1 (also known as 'BA').

Two yellow LEDs should also turn on.

- D2 (located adjacent to the power connector but inboard) indicates that the on-board power supply is operating correctly.
- D7 (located adjacent to the power connector) turns on if all the energisation supplies are operating within limits.

D7 flashes if any energisation supply is in current limit, i.e. too much current is being drawn.

5.2 **Host RS485 Connection**

Connect the RS485 bus from the host PC to the host port via a three pin header plug.

JP2 Pin no.	Signal Description
1	RS485A
2	RS485B
3	Screen

When using RS485 over long distances, the bus may need to be terminated and biased. This can be done by switching SW3/3 and SW3/4 to 'ON' on the PCB of the last module in the line. It can also be done by fitting a suitable terminator to the last module in the line.

The Host RS485 port has two diagnostic LEDs to assist in on-site fault finding. The red LED (D3) pulses for 10ms for each *received* character and the green LED (D4) pulses for each *transmitted* character.

5.3 Aux RS485 Connection

The 'Aux' RS485 interface can be used in one of two ways; as a connection to a second PC as part of a fault-tolerant system, or more commonly as an RS485 re-transmitter that acts as a bus extender for the host RS485 interface. When acting as a re-transmitter, the Aux RS485 bus allows greater distances and/or greater number of modules to be accommodated.

JP3 Pin no.	Signal Description
1	RS485A
2	RS485B
3	Screen

The Aux RS485 port has two diagnostic LEDs to assist in on-site fault finding. The red LED (D5) pulses for 10ms for each *received* character and the green LED (D6) pulses for each *transmitted* character.

5.3.1 Aux Interface as part of a fault-tolerant system

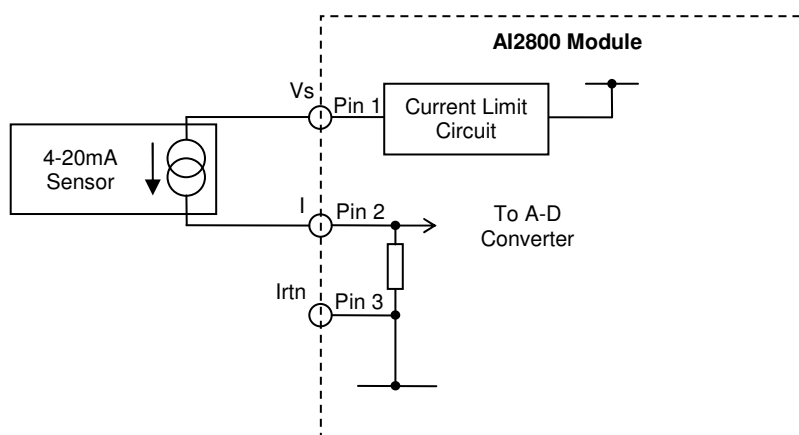
The auxiliary RS485 bus from the second PC (or Serial Device Server if used) should be looped into and out of each module in turn, until the last module is reached. Only the final module in the chain can have the aux RS485 bus terminated by switching S3/6 to 'ON' on the controller PCB. It should be noted that termination should only be necessary for extremely long cable lengths and that not all RS485 interfaces (or Serial Device Servers) are capable of driving terminated busses.

In this mode JP3 is used for Aux RS485 in and out.

5.3.2 Aux Interface as a host RS485 re-transmitter

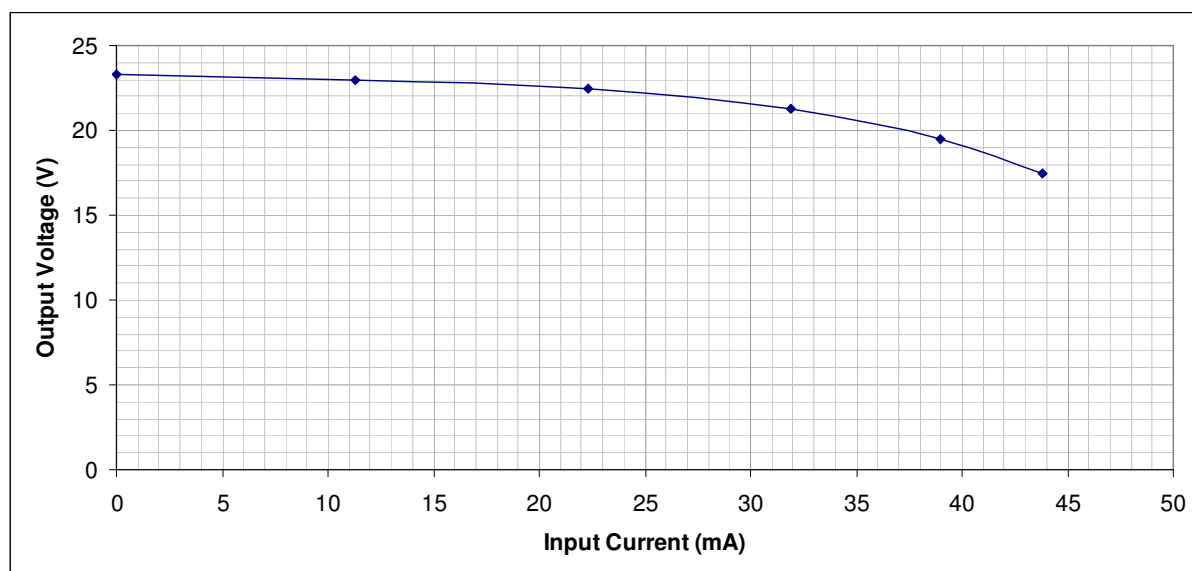
When used as a re-transmitter for the host RS485 bus, the *last* module that forms part of the first bus segment should be set to 'Re-transmit' mode (see section 6.1) and the Aux 485 interface from that module should be connected to the host RS485 of the *first* module that forms part of the second bus segment.

5.4 Analog Input Connection – Loop Powered Sensor



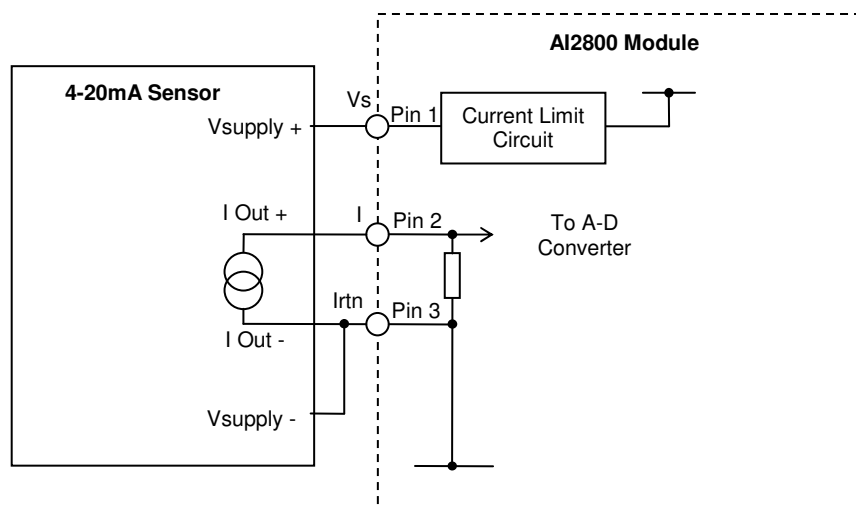
The current inputs have a built-in current limited supply for powering loop powered sensors. The sensor therefore only needs to be connected between the Vs terminal and the I terminal.

The energisation supply has the following characteristic:



If the current drawn is greater than approx 40mA, the module turns the supply off and flashes LED D7. The supply is re-tried every 10 sec.

5.5 Analog Input Connection – Independently Powered Sensors



The module can be used to monitor sensors which have separate 24Vdc power inputs provided they do not required more than 40mA of supply current.

6 **MODE SELECTION**

6.1 **Re-transmit Mode Selection**

To enable or disable 'Re-transmit' mode or to enable 'Self-test' mode, some special addresses are used once at power-up only:

Address at power-up	Meaning
0 thru 31	Normal operation
97	Disable 'Re-transmit' mode
98	Enable 'Re-transmit' mode

For example, to enable 'Re-transmit' mode you must first set the switches to 98 then power the module off then on again. You must then set the address switches to the desired address, then power the module off and on again before beginning normal operation.

The Re-transmit mode is non-volatile and will be retained through power cycles since it is stored in flash memory internal to the module.

6.2 **Self-Test Mode Selection**

Self test is normally reserved for factory use and is enabled by selecting address 99.

Address at power-up	Meaning
0 thru 31	Normal operation
99	Self-test mode:

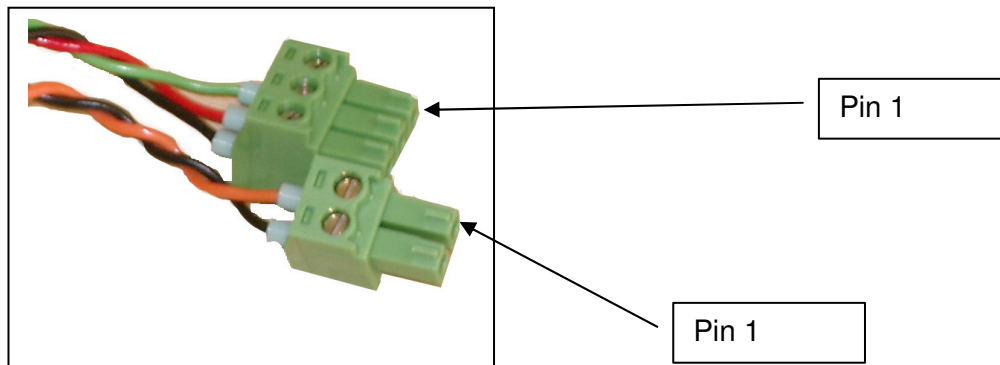
Setting the address to 99 will make the AI2800 cycle through a self-test routine designed to allow the module to be functionally tested. Self-test cycle comprises:

- Outputting in ASCII readable format to both the Host and Aux RS485 ports:
 - Module address.
 - Firmware version.
 - Switch settings.
 - Analog Input values.
 - Energisation values.
- LEDs D2 thru D7 are each lit in turn for half a second. During this period, any characters received will be echoed at the end of this period.

7 **ORIENTATION OF HEADER CONNECTORS**

To improve ease of installation, two part headers are used for all external connections to the module.

It is however, vital that the correct orientation of the two part connectors is observed. Pin 1 of the header on the PCB is always at the *left* when looking into the header with the PCB viewed from the edge. Failure to observe the correct orientation may result in damage to the module or failure to operate correctly.

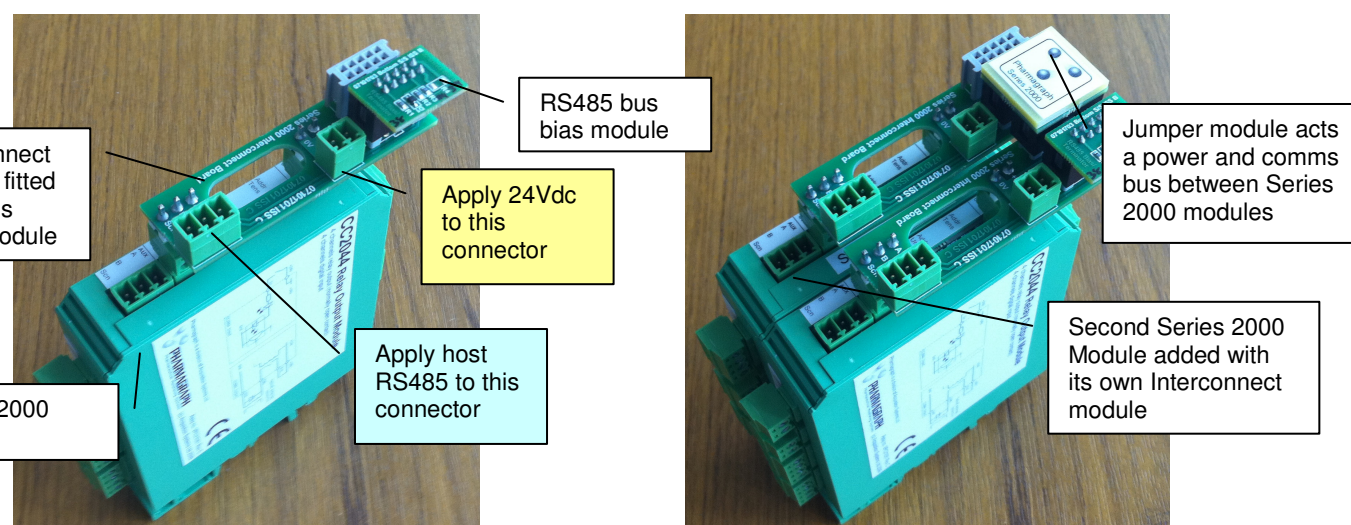


Orientation of pin 1 on two-part headers

8 USING SERIES 2000 INTERCONNECT MODULES

Where multiple Series 2000 modules are adjacent, the Series 2000 Interconnect Modules help provide a simple and convenient method of delivering 24V power via a self-resetting (1 Amp) fuse and the host RS485 bus to each module. The Series 2000 Interconnect also provides a mechanism for attaching a RS485 bus bias module. This is often used to improve the reliability of RS485 by defining the signals levels on the RS485 bus when no device is driving it. The address switches and diagnostic LEDs remain accessible through an aperture in the Interconnect Module.

Each Series 2000 Module ships with an 'Interconnect Module' and a 'Jumper module' that may be used to connect to the previous Series 2000 module as shown below:



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