eICIS/ICON ANALOG/DIGITAL I/O MODCOMBO
(Digital1 Module)

Introduction

Features unique to this board:
- 1.2" tall.
- Maximum power draw (0.5A @ 5V).
- 10 inputs with LED status.
- 8 outputs with LED status.

Inputs:
- First 8 inputs can be selected for digital input or analog input on a per channel basis.
- The state of all 10 digital inputs are contained in 10 Modbus registers which can be read as digital or analog inputs.
- Additionally, the number of high to low transitions (event counts) are maintained in 10 additional Modbus input registers.
- The event counter maximum rate is 10 Hz (slow speed) on the first 8 digital inputs and 10KHz (high speed) for inputs 9 and 10.
- The last two digital inputs 9 and 10 also measure the frequency with results stored in two additional Modbus registers.
- Analog inputs can be in the range of 0-5V or 4 (or 0) to 20 mA and values are converted with a 10 bit resolution.

Outputs:
- 8 Digital outputs.
- Outputs are mechanical single pole single throw relays.
- Each pair of relays have one common.
- The four pairs of relays are completely isolated from each other and the common or ground of the board.
- Maximum switched current is 3 amps per relay.
- Maximum voltage is 30VDC or 120VAC.
- Solid state over current protection fuse and over voltage suppression on each relay.

Installation

Mounting:
If your board is not already mounted it must be attached to an appropriate mounting surface using 4-40 screws and 1/4" standoffs in the four mounting holes. These mounting holes are electrically connected to the board's ground (GND) which is the 5 volt power supply negative. The boards may be stacked with standoffs of 1.25".

Switch configuration:

Switch block SW1 configures the Modbus slave address, baud rate and parity used for the serial communications. Use switches 1-8 as shown in the table below to select the slave address.

Modbus Slave Address	1	2	3	4	5	6	7	8
1	On	Off	Off	Off	Off	Off	Off	Off
2	Off	On	Off	Off	Off	Off	Off	Off
3	On	On	Off	Off	Off	Off	Off	Off
4	Off	Off	On	Off	Off	Off	Off	Off
5	On	Off	On	Off	Off	Off	Off	Off
6	Off	On	On	Off	Off	Off	Off	Off
7	On	On	On	Off	Off	Off	Off	Off
8	Off	Off	Off	On	Off	Off	Off	Off
9	On	Off	Off	On	Off	Off	Off	Off
10	Off	On	Off	On	Off	Off	Off	Off
11 Etc.	-	-	-	-	-	-	-	-

Set switch 9 off for no parity and on for odd parity. (Odd parity is normally selected.)
Set switch 10 off for 9600 baud and on for 19200 baud. (19200 baud is normally selected.)

Power and Modbus communication bus:
Connect the Modbus communication and power supply wiring to connector CON9:

Pin Number	Description
1	Gnd
2	RS485 B+
3	RS485 A-
4	Power +5V regulated

Use one twisted wire pair for GND and +5V and a second pair for B+ and A-. If the Modbus RS485 communication bus is to continue to additional I/O cards, wire a daisy chain communication cable to connector CON8 (immediately to the left of CON9) and route to the appropriate connector on the next I/O board. (Connectors CON8 and CON9 are interchangeable.)

Modbus requires that the first and last boards in the Modbus bus cabling have 120ohm terminating resistors. Therefore, jumpers JP11 and JP12 should be inserted if the board is the first or last in the daisy chain. For all other I/O boards, these two jumpers should be removed.

There are two communication LEDs labeled RX (yellow) and TX (red). These lights are useful in troubleshooting the fieldbus wiring. Every time a message is sent from the controller to the I/O module the RX light will flash. If the message was addressed to this board the TX light will flash as the I/O module sends the data to the controller.

There is a third green Watch Dog (WD) LED that flashes on every second to indicate power is present and that the uProcessor is running and the board is ready to accept Modbus Commands.

Connector CON10 may be used to supply +5V power to accessories if needed. Two connections provide GND or COM (common) and 2 connections provide +5V.

Inputs:
You may connect the following types of sensors to the inputs:
- Contact closures (examples include float switches and tipping bucket rain gages.)
- Any sensor that outputs a voltage between 0 and 5V and can be referenced to the common (GND) of this board.
- Any sensor that outputs a 4 (or 0) to 20 mA current.

The first 8 input types are controlled by a separate jumper (JP1 to JP8) that may be in one of two positions or removed. The last two inputs (FREQ1 and FREQ2) use jumpers JP9 and JP10 and have only two positions, inserted or removed. Place jumpers as follows:
- Completely remove the jumper if the sensor provides the voltage and no loading of the input signal is desired.
- Place the jumper between pins 2 and 3 to enable the on-board 330 ohm pullup resistor for use with contact closure inputs.
- You may also jumper between pins 2 and 3 even if the input is driven by a digital voltage source. But the external driving source must be able to sink 10mA when in the 0 V state to turn the LED on.
- Place the jumper between pins 1 and 2 to enable the measurement of 4 (or 0) to 20mA current inputs. This places a 250 ohm resistor in series with the input pin and COM to convert 0 to 20mA to 0 to +5V for the voltage measurement.
- For inputs 9 and 10 (FREQ1 and FREQ2) the jumper is either inserted between the two pins for contact closures or completely removed if the sensor provides the voltage input. There is no analog measurement capability for these two inputs.

Connect the inputs to connectors CON3 (inputs 1-4), CON2 (inputs 5-8) and CON1 (inputs 9 and 10). Observe the following:
- Connect your sensor to the appropriate input position IN1 to IN8 for inputs 1-8 and FRE1 and FRE2 for inputs 9 and 10.
- Connect the sensor common to any convenient COM position or GND position on any connector CON1-CON3.

There are 10 LED input lights, one for each channel. If an input channel is jumpered 2 to 3, then the LED is off when the contact closure is open (input voltage is +5V) and the LED is lit when the contact closure is closed (input voltage is 0V).

Outputs:

The outputs behave just like light switches, they are either on or off. Each pair of outputs has a single common which means that one side of each relay (switch) is connected together. Unlike the inputs, the outputs are not polarity sensitive. Each output has an LED light which is lit when the relay is closed and off when the relay is open.

Relays 1-4 are wired to connector CON6 and relays 5-8 are wired to connector CON7. Note on each connector that there is a COM connection between two output connections. Outputs DO1 and DO2 share the COM common between them. The other three pairs are configured the same.

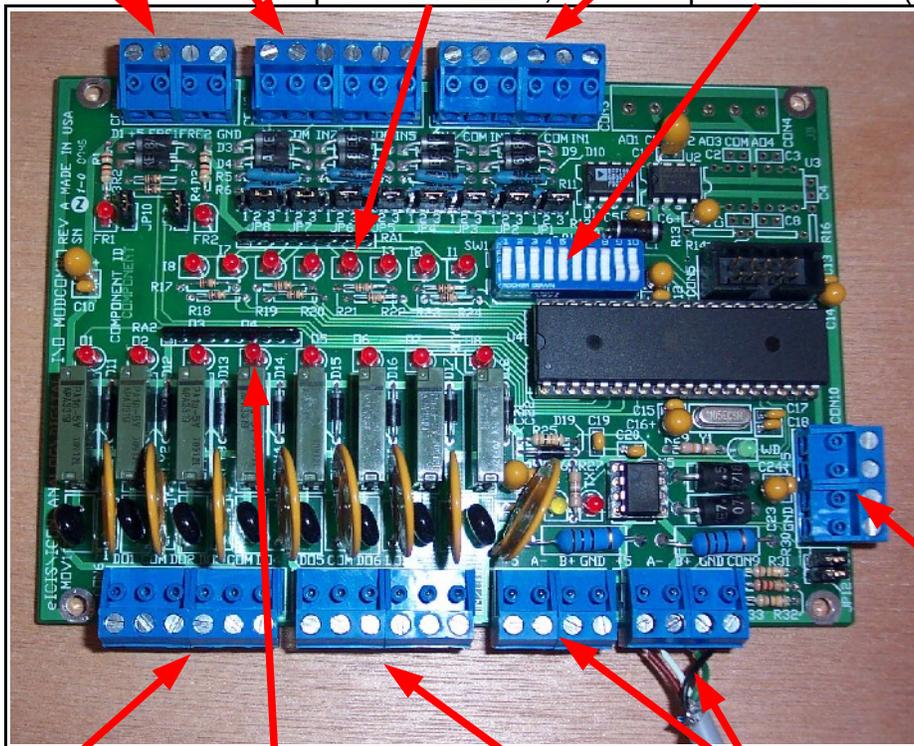Frequency Inputs (Digital 9 and 10)
      Digital Inputs (5-8);   Digital Inputs (1-4)
        Input Status LEDs;   Option Switches (SW1)

                                      Auxiliary Power

      Output Status LEDs
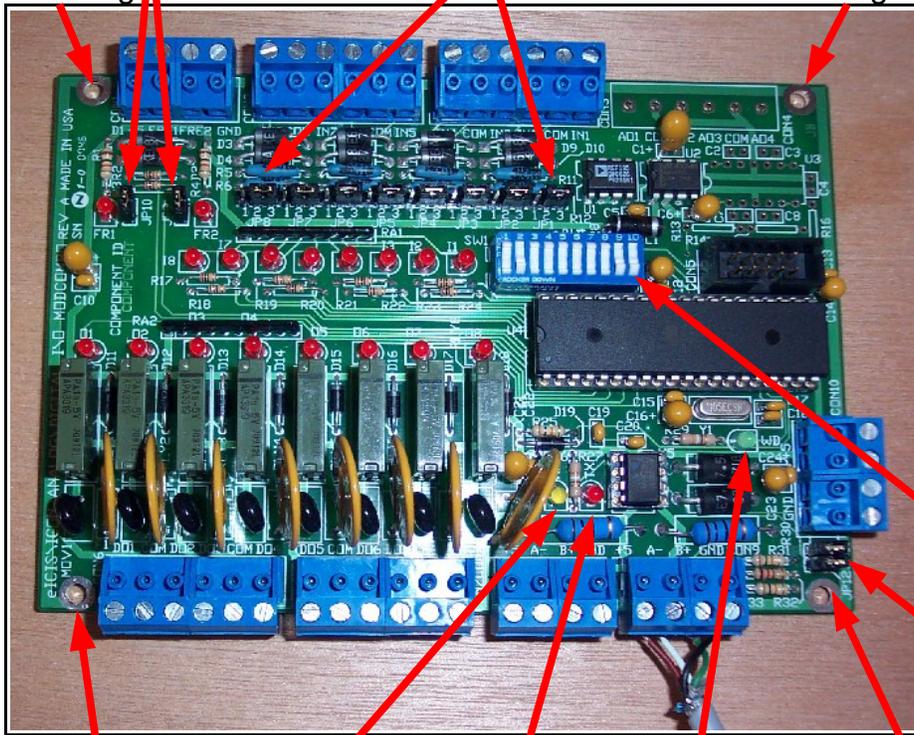Digital Outputs (1-4);   Digital Outputs (5-8);   Modbus RS485 Field Bus Cabling

Frequency Jumpers JP9 and JP10

Analog/Digital Selection Jumpers JP1-JP8

Mounting Hole

Mounting hole

Switch Off Position

Mounting Hole

Communication Receive and Transmit LEDs;

Watchdog LED

Mounting Hole

RS485 termination Jumpers JP11 and JP12

Modbus Programming Commands

Operation	Modbus command	Starting address	Length	Value
Set configuration (registers).	6 or 16	4097	8	0=Digital input, 1=Analog input. Address 1 configures input 1, address 2, input 2, etc.
Read configuration (registers).	3	4097	8	Reads back the configuration set above.
Read digital (discrete) inputs.	2	1	10	Reads the state of the 10 digital inputs. If an input has been set for analog, the bit value is meaningless for that channel.
Read all input (registers).	4	1	22	Address locations 1-10 contain the digital state or analog reading for the 10 inputs. Addresses 11-20 contain the event counts

				for the 10 inputs and addresses 21 and 22 contain the frequency readings for the FREQ1 AND FREQ 2 (9 and 10) digital inputs. For analog inputs a value of 0 represents 0V up to a value of 1023 which represents an input of +5V. On a 4-20mA input a reading of 204 represents a reading of 4 mA and 1023 a reading of 20mA.
Set digital outputs (coils).	5 or 15	1	8	Set the state of the output relays. Address 1 controls relay 1, address 2 relay 2, etc. A 0 value turns the relay off. A non-zero value turns the relay on.
Read state of outputs.	1	1	8	Read state of outputs
Set digital outputs (coils).	6 or 16	1	8	An alternate way to set the state of the output relays. Address 1 controls relay 1, address 2 relay 2, etc. A 0 value turns the relay off. A non-zero value turns the relay on.
Read state of outputs.	3	1	8	An alternate way to read state of outputs.
Clear event counters	5, 6,15 and 16	9	10	Writing a 1 or setting a coil will clear the appropriate event count. Address 9 clears event counter 1 to address 18 clears event counter 10. The register or coil is automatically reset to 0 after the event counter value is cleared.

In the above you may set the starting address to any valid address in the range. For instance, for the command to read all inputs, you may use any starting address between 1 and 22. The length must be set such that the command does not try to read data beyond the last address. For instance, if the address is set at 22, the length could only be 1 because there is only data input to be read.