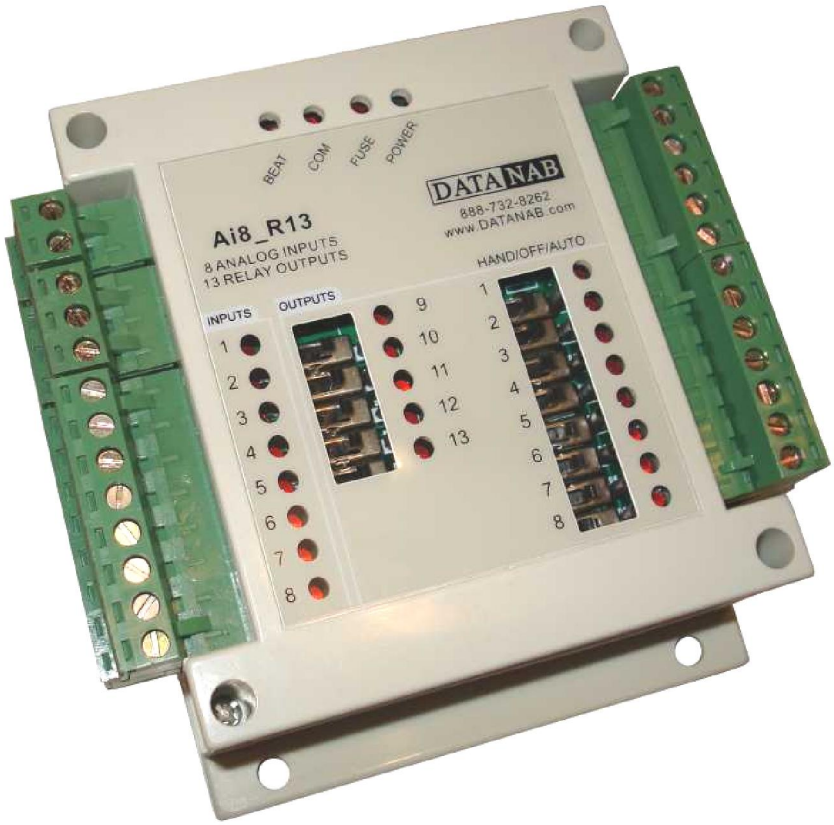
**DataNab Ai8_R13: Modbus 8Ch Analog In / 13Ch Relay Out Module: Configuration Manual**
(v2 software with dual registers)




**Inputs**
Each input of the Ai8_R13 Module can be jumper-configured with hardware jumpers inside of the cover in 1 of 3 ways:
- 0-5V signal (jumper removed completely)
- 0-20mA signal (jumper on the 2 right side pins)
- Dry contact / Thermistor (jumper on the 2 left side pins)
  - When Jumper-configured in the dry contact /thermistor position, each input can also be used as a high speed pulse counter.

To access the hardware jumpers, the 4 corner screws must be removed so that you can remove the cover of the module. Then the LED piggy-back board must be pulled off in order to see the jumpers. A diagram is shown on the base PCB that explains each jumper position. By default, the jumpers are in the Dry contact / Thermistor position.

The value of each input is stored as a 10-bit number in the respective modbus register. A closed contact, 0V, or 0mA signal will result in a raw 10-bit value of 0. An open contact, 5V, or 20mA signal will give a raw 10-bit value of 1023. Each input has a corresponding LED which will light up if the raw 10-bit value from the A/D converter is greater than 512.

Each input can also be used to track high-speed pulses if desired. In this case, the pulse count value is stored as a 32-bit number in a pair of modbus registers.

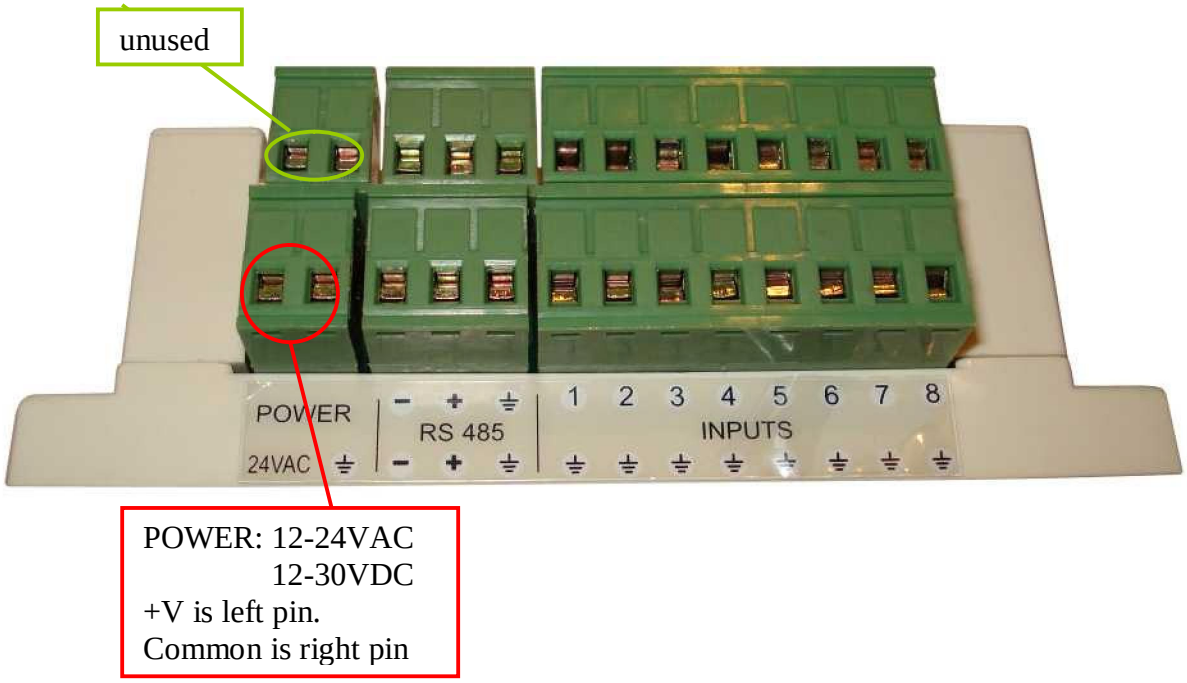
Please see the following page for details on how to configure each input and where to find the corresponding values.

## OUTPUTS

The state of each Relay output is determined by its corresponding switch position. The switches have 3 states – 'hand', 'off', and 'auto'. When switched to 'hand', the corresponding Relay output will turn on (close). When switched to 'off', the Relay will turn off (open). When switched to 'auto', the Relays will be set based on the value stored in the corresponding MODBUS output registers. The register addresses for the outputs are 100 – 112. See next page for details.

The relay output registers can be changed using the RS485 serial interface. For the Relays, a value of 501 or higher will turn the relay on (close the relay). A value of 500 or lower will turn the relay off (open the relay). The output registers are stored in RAM, thus the contents of each register will be lost upon power-off. Each relay output has a corresponding LED which will light up when the Relay is on (closed).

**LEFT SIDE CONNECTORS** (Power, RS485, Inputs)




**RIGHT SIDE CONNECTORS** (Relays 1-13)

**RS485 Communication Parameters:**

**Baudrate:**

The Ai8_R13 baudrate can be set by in MODBUS register 15. The default baudrate is 19.2kbps
A value of 1 will set the baud to 19200bps. A value 0 will set the baud to 9600bps.

**Other:**

Default RS485 Address: 254
8 Data Bits, No Parity, 1 Stop Bit

## Accessing Ai8_R13 Registers Via Serial Communications

The Ai8_R13 has a built-in RS485 serial interface for network communications using the Modbus RTU Protocol.

**Modbus registers in the Ai8_R13**

| Address | Bytes | Register and Description |
|---|---|---|
| 0 to 4 | 5 | RESERVED |
| 5 | 1 | Current CPU Firmware Version (should be 14 for V2 software with dual registers) |
| 6 | 1 | ADDRESS, Modbus device address |
| 7 | 1 | Product Model: (20=Ai8_R13, 21=AiO8, 22=Ai32) |
| 9 | 1 | Current PIC Firmware Version |
| 15 | 1 | Baudrate: 0 will set 9600bps, 1 will set 19200bps |
| | | |
| 100 | 2 | Relay 1 Register |
| 101 | 2 | Relay 2 Register |
| 102 | 2 | Relay 3 Register |
| 103 | 2 | Relay 4 Register |
| 104 | 2 | Relay 5 Register |
| 105 | 2 | Relay 6 Register |
| 106 | 2 | Relay 7 Register |
| 107 | 2 | Relay 8 Register |
| 108 | 2 | Relay 9 Register |
| 109 | 2 | Relay 10 Register |
| 110 | 2 | Relay 11 Register |
| 111 | 2 | Relay 12 Register |
| 112 | 2 | Relay 13 Register |
| 116 | 2 | Switch Bank Register for relays 1-8. (Hand/Off/Auto switch Position) |
| 117 | 2 | Switch Bank Register for relays 9-13. 00=off, 01=hand, 10=auto |
| | | |
| 118-119 | 4 | In Normal Mode: R119 contains Scaled Input Value for Ch1. In Counter Mode: R118 & R119 = Pulse CNT HI / LO for Ch1. |
| 120-121 | 4 | In Normal Mode: R121 contains Scaled Input Value for Ch2. In Counter Mode: R120 & R121 = Pulse CNT HI / LO for Ch2. |
| 122-123 | 4 | In Normal Mode: R123 contains Scaled Input Value for Ch3. In Counter Mode: R122 & R123 = Pulse CNT HI / LO for Ch3. |
| 124-125 | 4 | In Normal Mode: R125 contains Scaled Input Value for Ch4. In Counter Mode: R124 & R125 = Pulse CNT HI / LO for Ch4. |
| 126-127 | 4 | In Normal Mode: R127 contains Scaled Input Value for Ch5. In Counter Mode: R126 & R127 = Pulse CNT HI / LO for Ch5. |
| 128-129 | 4 | In Normal Mode: R129 contains Scaled Input Value for Ch6. In Counter Mode: R128 & R129 = Pulse CNT HI / LO for Ch6. |
| 130-131 | 4 | In Normal Mode: R131 contains Scaled Input Value for Ch7. In Counter Mode: R130 & R131 = Pulse CNT HI / LO for Ch7. |
| 132-133 | 4 | In Normal Mode: R133 contains Scaled Input Value for Ch8. In Counter Mode: R132 & R133 = Pulse CNT HI / LO for Ch8. |
| | | **Writing to each channel's Year register (134 for ch1, 139 for ch2, etc...) will reset the counters back to zero.** |
| 134-138 | 10 | Date stamp of Channel 1: Year, Month, Day, Hour, Minute respectively. |
| 139-143 | 10 | Date stamp of Channel 2: Year, Month, Day, Hour, Minute respectively. |
| 144-148 | 10 | Date stamp of Channel 3: Year, Month, Day, Hour, Minute respectively. |
| 149-153 | 10 | Date stamp of Channel 4: Year, Month, Day, Hour, Minute respectively. |
| 154-158 | 10 | Date stamp of Channel 5: Year, Month, Day, Hour, Minute respectively. |
| 159-163 | 10 | Date stamp of Channel 6: Year, Month, Day, Hour, Minute respectively. |
| 164-168 | 10 | Date stamp of Channel 7: Year, Month, Day, Hour, Minute respectively. |
| 169-173 | 10 | Date stamp of Channel 8: Year, Month, Day, Hour, Minute respectively. |
| | | |
| 174 | 2 | Sets each channel to Counter mode or to Scaled Input Value mode. LSB sets in1 & MSB sets in8. Setting the bit to 1 makes it a pulse counter. Setting the bit to 0 makes it a Scaled Input Value that is defined by Registers 183 thru 190. (see below) |
| 175-182 | 2 each | These registers always show the current raw A/D value of each analog input. |
| 183-190 | 1 each | These registers are used to define the Scaled Input Values for each of the analog inputs. (R183 for ch1, R184 for ch2, etc…) 0 = raw data from 0-1024. 1 = 10k thermister in DegC. 2 = 10k thermister in DegF. 3 = 0-100%. 4 = On/Off. 5 = Off/On |

**High Speed Counter Example:**

- register 118 reads 0
- register 119 reads 138 (hex 8A)
- The Pulse Count for Channel-1 is then 138 (hex 8A)

**or**

- register 118 reads 1 (hex 0001)
- register 119 reads 16528 (hex 4090)
- The Pulse Count for Channel-1 is then 82064 (hex 00014090)

**To clear**

- Writing any value (1 for instance) to register 134 will clear registers 118 and 119. Subsequent registers 135 to 138 are optional memory to store date and time at which Pulse Counts have been cleared.

**NOTE:** The counters are incremented on the falling edge of a state change.

**Modbus Poll examples:**

If we would like to read the 2nd input register from an Ai8_R13 module that has a node address of 1:

| Slave Address | Function | Starting Address Hi | Starting Address Lo | No. of Points Hi | No. of Points Lo | CRC Hi Byte | CRC Lo Byte |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 0 | 121 | 0 | 1 | xx | Xx |

Or we read the 8th input register from module # 1:

| Slave Address | Function | Starting Address Hi | Starting Address Lo | No. of Points Hi | No. of Points Lo | CRC Hi Byte | CRC Hi Byte |
|---|---|---|---|---|---|---|---|
| 1 | 3 | 0 | 133 | 0 | 1 | xx | xx |

Or we want to turn ON Relay output 4 in module 1: (write a value of 1000 to register 103 to turn on the 4th relay)

| Slave Address | Function | Starting Address Hi | Starting Address Lo | Data Hi Byte | Data Lo Byte | CRC Hi Byte | CRC Lo Byte |
|---|---|---|---|---|---|---|---|
| 1 | 6 | 0 | 103 | 3 | 232 | xx | xx |

Or we want to turn OFF Relay output 4 in module 1: (write a value of 0 to register 103 to turn off the 4th relay)

| Slave Address | Function | Starting Address Hi | Starting Address Lo | Data Hi Byte | Data Lo Byte | CRC Hi Byte | CRC Lo Byte |
|---|---|---|---|---|---|---|---|
| 1 | 6 | 0 | 103 | 0 | 0 | xx | xx |