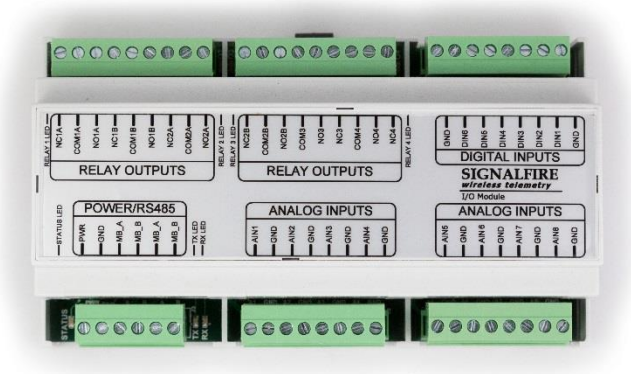
Interface Manual

Modbus Multi I/O Module

SignalFire Number: MIOM



The SignalFire Modbus Multi I/O Module has the following features:

- Standard Modbus RTU server device
- Can be read with a SignalFire Modbus Stick or another Modbus client
- 8 analog inputs (0-20mA or 0-5V)
- 6 digital inputs (state, counter, and frequency up to 2kHz)
- 4 relay outputs (2 DPDT, 2 SPST)
- Internal relay control logic for shutdown applications
- Wide range DC power input. 6 to 36VDC
- Very low power consumption
- DIN Rail mount with pluggable screw terminal blocks
- Status LEDs
- Analog scaling configuration

Specifications

Power	6-36 VDC 5mA max @12V no relays energized, 40mA max @12V with all relays energized. (excludes current for attached analog sensors)
Operating Temp	-40°C to +80°C
Analog Inputs	0-10V Max
Digital Inputs	Dry Contact or 30 Volts Max
Modbus Comm	Modbus RTU Server
Relay Rating	30 VDC @ 2 Amps 250 VAC @ 0.25 Amps

Connections and Components

Modbus Multi I/O Module Connections

The Modbus Multi I/O module provides screw terminals for connection to a RS485 Modbus RTU Client's A and B terminals. A second set of A/B RS485 terminals are available for daisy chaining multiply modules or other Modbus devices.

Power must be provided by the Power Input screw terminals (10-30VDC). At 12VDC, the Module requires only 2mA plus 7.5mA per energized relay channel.

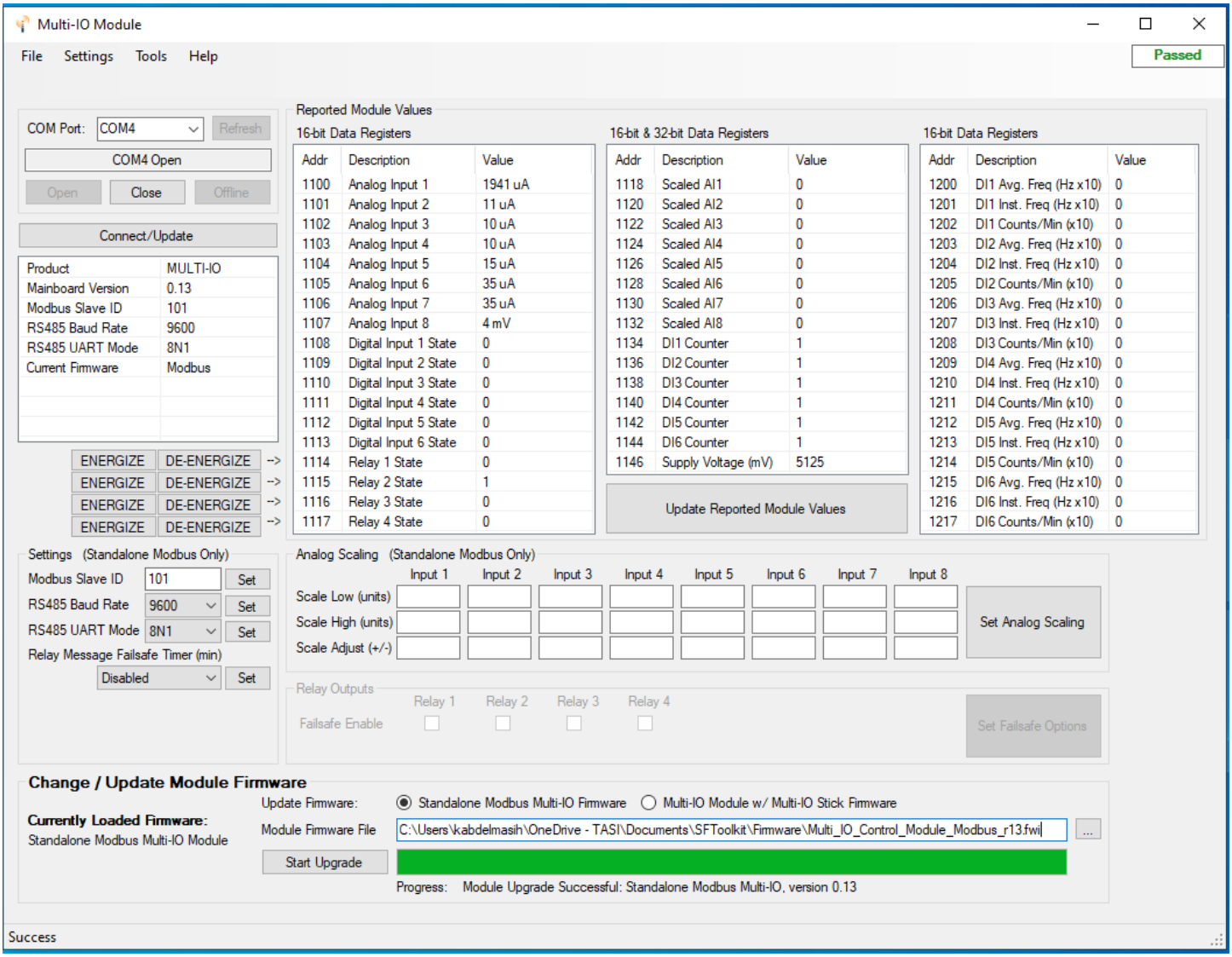
Status LEDs

The Modbus Multi I/O has a green status LED which blinks indicating the module is running. In addition there are TX/RX LEDs to indicate RS485 messages to/from the Modbus Client.

Each relay output also has a green LED which turns on while the relay is energized.

SignalFire Toolkit Configuration

Connect to the internal 4-pin connection using a SignalFire USB adapter cable. The module will be auto-detected by the Toolkit. *If the module is running "Multi IO System" firmware it must be loaded with the "Modbus Multi IO Module" to support Modbus functionality.* Clicking on **Update Reported Sensor Values** will can the data to be refreshed and displayed. Each relay channel has an **Energize** and **De-Energize** button which can be used to toggle the relay state for testing. In addition, the counters may be zeroed using the tools menu.



*Select Standalone **Modbus Multi-I/O Firmware** and click **Start Upgrade** to load the Modbus firmware into the module.*

Operation

5

The SignalFire Modbus Multi I/O Module is intended to be used as a Modbus interfaced analog and digital input/output (I/O) unit. It allows the user to interface to a variety of sensor or control devices from a single Modbus port. It is DIN rail mounted and designed to be easy to use.

Relay Outputs

The four digital outputs will be relays, with two of them being SPDT and two being DPDT.

There are two ways to control the relays:

- **Direct control**: The PLC writes to a coil register to energize or de-energize the relay.
- **Pulse control**: The PLC writes to a holding register with a number of seconds to energize the relay. For example, if you write a 5 to this register, the relay will be energized for 5 seconds and then automatically de-energized.

Analog Scaling

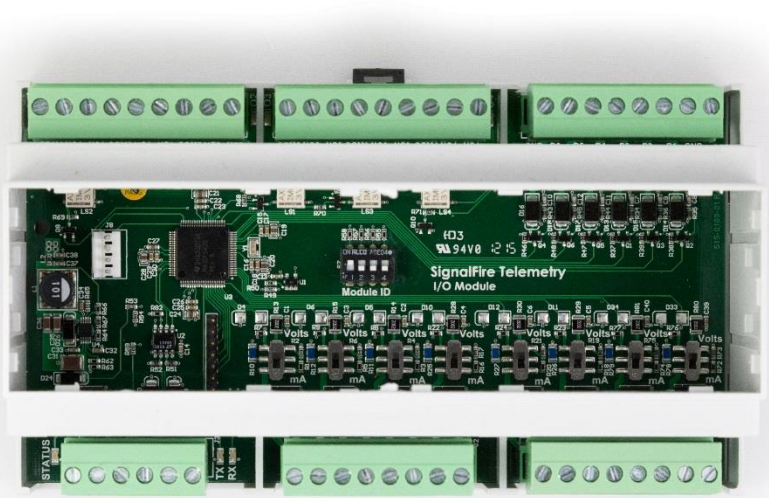
The Analog Inputs can be scaled so that they will report a 32 bit floating point number. For example, a 4-20mA analog input could be scaled from 0.0 to 5000.0 PSI. In addition each scaled value has an option offset value (positive or negative) that can be entered and will be applied to the scaled value result.

Modbus ID

The Modbus Multi I/O module requires that the Modbus Server ID be configured either with the DIP switch or via software. If the DIP switch is set to zero then the Server ID must be configured in software using either the SignalFire Toolkit or a Modbus write. The DIP switch must be set to 0 to be configured with the SignalFire Toolkit.

Analog Inputs

The analog inputs may operate in either current (0-20mA/4-20mA) or voltage (0-5V/1-5V). The input mode must be set by slide switches inside the module. Slide the switch corresponding to the input channel up to **Volts** for a voltage input, or down to **mA** for a current input. To do this, first remove the cover using a small flathead screwdriver. The cover is held on by clips.



Multi I/O Module with cover removed

Wire the analog voltage or current to the 8 individual sets of screw terminals.

The compliance voltage for a 4-20mA device must be provided externally. The analog current inputs are passive.

Digital Inputs

The digital inputs (6 total) can be dry contact or voltage (30 Volts max). Be sure to connect the ground bus from the module to either the ground of the voltage device or the dry contact.

The frequency of the digital inputs is calculated over a 2-second time period for the Instantaneous Frequency and calculated over a 60-second window for the Average Frequency. For example the Average Frequency register will be updated every 60-seconds and will contain the average frequency of the previous 60-second period.

Digital Input Debounce

In cases where it is desired to accurately totalize digital input counts it may necessary to enable the "digital input debounce" timer. The debounce timer is useful when dealing with dry contacts that may otherwise produce extra counts when they close. To enable the digital debounce select "Digital Input Debounce" from the settings pull-down menu. A typical value for a dry contact would be 100mS. Any extra counts due to contact bounce within the debounce time setting will be ignored.

Digital (Relay) Outputs

There are four relay outputs. Two of the relays are SPDT and two are DPDT relays. The relays are rated for the following:

30 VDC @ 2 Amps
250 VAC @ 0.25 Amps

Relay Failsafe Timers

The MIOM supports a configurable failsafe timer which is used to de-energize selected relays in event of a communication failure.

Relay Message Failsafe Timer – This timer is reset anytime a coil write for any Modbus relay coil write is received. Each relay can be individually enabled for failsafe operation.

If any timer expires all relays selected for "Failsafe Enable" will be de-energized.

When any relay is de-energized from a failsafe timer it will only be energized when a valid coil write is received or the relay is commanded on from the Toolkit.

Hazardous Location Certification

The MIOM Module is rated Class 1 Division 2 non-incendive.

SignalFire Telemetry	Hudson, MA www.signal-fire.com
Model: MIOM	S/N: 00000001
Class I, Division 2 **Groups C, D T4** Intertek 4003827	Voltage: 6 – 36 VDC Current: 100 mA Max Temperature: –40ºC to +85ºC
Certified to CSA C22.2 No. 142 and CSA C22.2 No. 213 Conforms to ISA 12.12.01 and UL 916	
WARNING – EXPLOSION HAZARD **Substitution of components may impair suitability for Class I, Division 2** **AVERTISSEMENT - RISQUE D'EXPLOSION. La substitution de composants peut rendre ce materiel inacceptable pour les emplacements de classe I, division 2**	**WARNING – EXPLOSION HAZARD** **Do not connect while circuit is live unless area is know to be nonhazardous** **AVERTISSEMENT - RISQUE D'EXPLOSION. Ne pas debrancher tant que le circuit est sous tension, a moins qu'il ne s'agisse d'un emplacement non dangereux.**

WARNING: Exposure to some chemicals may degrade the sealing properties of materials used in the output relays.

ADVERTISSEMENT: L'exposition à certains produits chimiques peut degrader les propriétés d'étanchéité de MATERIALS utilizes dans les dispositifs suivants:

- **Relais de sortie**

Register Number	Register Address	Description	Function Codes
Coils (0xxxx)			
Read/Write			
00102	101	Relay1 Coil	01, 05, 15
00103	102	Relay2 Coil	01, 05, 15
00104	103	Relay3 Coil	01, 05, 15
00105	104	Relay4 Coil	01, 05, 15
Write-only			
00112	111	Counter1 Reset Coil	05, 15
00113	112	Counter2 Reset Coil	05, 15
00114	113	Counter3 Reset Coil	05, 15
00115	114	Counter4 Reset Coil	05, 15
00116	115	Counter5 Reset Coil	05, 15
00117	116	Counter6 Reset Coil	05, 15
Discretes (1xxxx)			
Read-only			
11109	1108	DI1 State	02,
11110	1109	DI2 State	02,
11111	1110	DI3 State	02,
11112	1111	DI4 State	02,
11113	1112	DI5 State	02,
11114	1113	DI6 State	02,

Register Number	Register Address	Description	Function Codes
Holding Registers (4xxxxx)			
Write-only			
40122	121	Relay1 Pulse (0 = Off, 1-255 = Pulse Time (sec))	06, 16
40123	122	Relay2 Pulse	06, 16
40124	123	Relay3 Pulse	06, 16
40125	124	Relay4 Pulse	06, 16
Read-only			
41101	1100	AI1: Current or Voltage (Unsigned int, µA or mV)	03, 04
41102	1101	AI2: Current or Voltage Reading	03, 04
41103	1102	AI3: Current or Voltage Reading	03, 04
41104	1103	AI4: Current or Voltage Reading	03, 04
41105	1104	AI5: Current or Voltage Reading	03, 04
41106	1105	AI6: Current or Voltage Reading	03, 04
41107	1106	AI7: Current or Voltage Reading	03, 04
41108	1107	AI8: Current or Voltage Reading	03, 04
41109	1108	DI1: State (Unsigned int, 1 = Closed or 0 = Open)	03, 04
41110	1109	DI2: State	03, 04
41111	1110	DI3: State	03, 04
41112	1111	DI4: State	03, 04
41113	1112	DI5: State	03, 04
41114	1113	DI6: State	03, 04
41115	1114	Relay #1 State (Unsigned int, 1 = ON or 0 = OFF)	03, 04
41116	1115	Relay #2 State	03, 04
41117	1116	Relay #3 State	03, 04
41118	1117	Relay #4 State	03, 04
41119	1118	AI1: Scaled Reading (Float, High Word)	03, 04
41120	1119	AI1: Scaled Reading (Float, Low Word)	03, 04
41121	1120	AI2: Scaled Reading	03, 04
41122	1121	AI2: Scaled Reading	03, 04
41123	1122	AI3: Scaled Reading	03, 04
41124	1123	AI3: Scaled Reading	03, 04
41125	1124	AI4: Scaled Reading	03, 04
41126	1125	AI4: Scaled Reading	03, 04
41127	1126	AI5: Scaled Reading	03, 04
41128	1127	AI5: Scaled Reading	03, 04
41129	1128	AI6: Scaled Reading	03, 04
41130	1129	AI6: Scaled Reading	03, 04
41131	1130	AI7: Scale Reading	03, 04

41132	1131	AI7: Scaled Reading	03, 04
41133	1132	AI8: Scaled Reading	03, 04
41134	1133	AI8: Scaled Reading	03, 04
41135	1134	DI1: Total Counts (Unsigned int, High Word)	03, 04
41136	1135	DI1: Total Counts (Unsigned int, Low Word)	03, 04
41137	1136	DI2: Total Counts	03, 04
41138	1137	DI2: Total Counts	03, 04
41139	1138	DI3: Total Counts	03, 04
41140	1139	DI3: Total Counts	03, 04
41141	1140	DI4: Total Counts	03, 04
41142	1141	DI4: Total Counts	03, 04
41143	1142	DI5: Total Counts	03, 04
41144	1143	DI5: Total Counts	03, 04
41145	1144	DI6: Total Counts	03, 04
41146	1145	DI6: Total Counts	03, 04
41147	1146	Supply Voltage (mV) 16-bit Max value of ~26000mV	03, 04
41201	1200	DI1: Average Frequency over 60 seconds (Hz x 10)	03, 04
41202	1201	DI1: Instantaneous Frequency over 2 seconds (Hz x 10)	03, 04
41203	1202	DI1: Counts per minute (x 10)	03, 04
41204	1203	DI2: Average Frequency (Hz x 10)	03, 04
41205	1204	DI2: Instantaneous Frequency (Hz x 10)	03, 04
41206	1205	DI2: Counts per minute (x 10)	03, 04
41207	1206	DI3: Average Frequency (Hz x 10)	03, 04
41208	1207	DI3: Instantaneous Frequency (Hz x 10)	03, 04
41209	1208	DI3: Counts per minute (x 10)	03, 04
41210	1209	DI4: Average Frequency (Hz x 10)	03, 04
41211	1210	DI4: Instantaneous Frequency (Hz x 10)	03, 04
41212	1211	DI4: Counts per minute (x 10)	03, 04
41213	1212	DI5: Average Frequency (Hz x 10)	03, 04
41214	1213	DI5: Instantaneous Frequency (Hz x 10)	03, 04
41215	1214	DI5: Counts per minute (x 10)	03, 04
41216	1215	DI6: Average Frequency (Hz x 10)	03, 04
41217	1216	DI6: Instantaneous Frequency (Hz x 10)	03, 04
41218	1217	DI6: Counts per minute (x 10)	03, 04

Configuration via Modbus

In addition to configuring/reading the module settings using the Toolkit, the settings can be viewed and changed via Modbus. See the register map below for details.

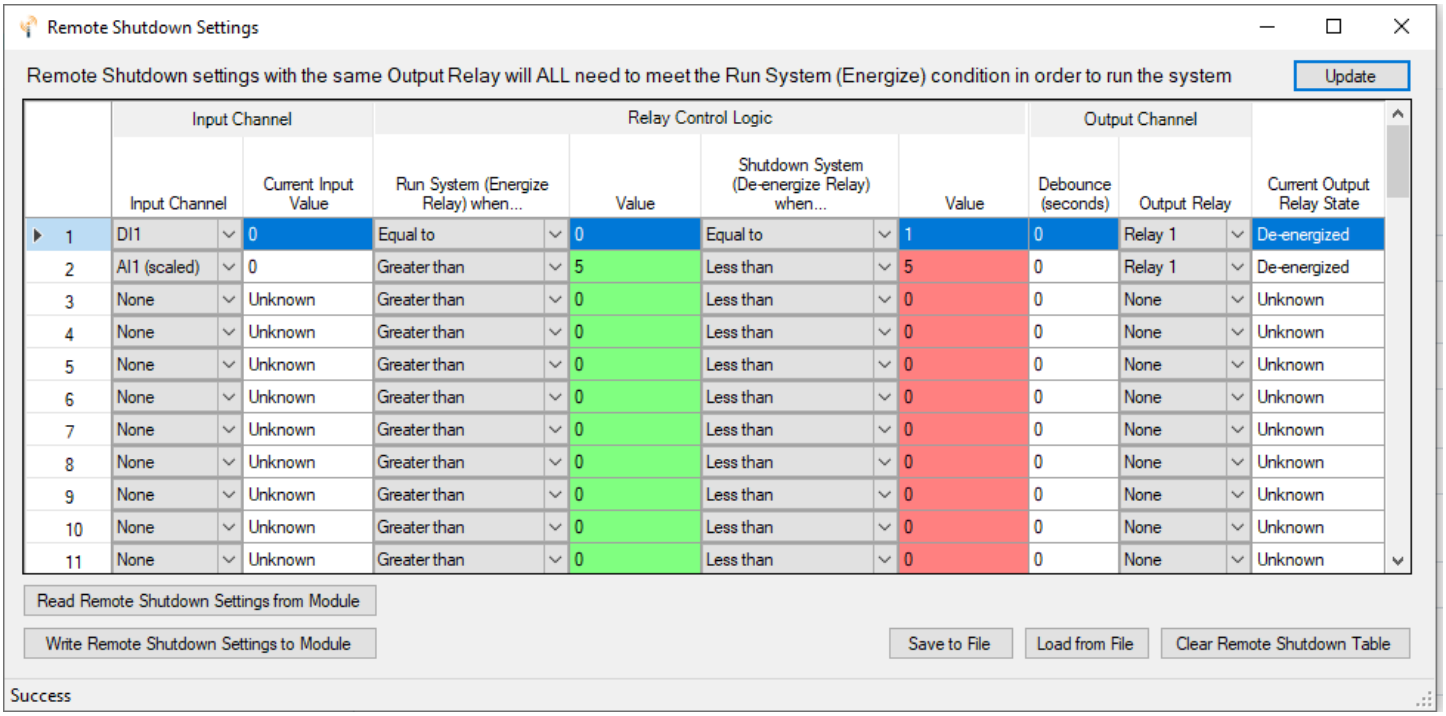
Register Number	Register Address	Description	Function Codes
Read/Write			
41160	1159	AI1: Scale Low (signed int, Ex. 0 psi)	03, 04, 06, 16
41161	1160	AI1: Scale High (signed int, 3000 psi)	03, 04, 06, 16
41162	1161	AI2: Scale Low (Low = 0 and High = 0 disables scaling)	03, 04, 06, 16
41163	1162	AI2: Scale High	03, 04, 06, 16
41164	1163	AI3: Scale Low	03, 04, 06, 16
41165	1164	AI3: Scale High	03, 04, 06, 16
41166	1165	AI4: Scale Low	03, 04, 06, 16
41167	1166	AI4: Scale High	03, 04, 06, 16
41168	1167	AI5: Scale Low	03, 04, 06, 16
41169	1168	AI5: Scale High	03, 04, 06, 16
41170	1169	AI6: Scale Low	03, 04, 06, 16
41171	1170	AI6: Scale High	03, 04, 06, 16
41172	1171	AI7: Scale Low	03, 04, 06, 16
41173	1172	AI7: Scale High	03, 04, 06, 16
41174	1173	AI8: Scale Low	03, 04, 06, 16
41175	1174	AI8: Scale High	03, 04, 06, 16
41176	1175	Modbus Server ID (1-240) (Set DIP switch to 0 to use)	03, 04, 06
41177	1176	RS485 Baud Rate (1200, 2400, 4800, 9600, 19200, 38400, 57600)	03, 04, 06
41178	1177	RS485 UART Mode 8N1=0x00, 8E1=0xC0, 8O1=0x80, 8N2=0x08, 8E2=0xC8, 8O2=0x88	03, 04, 06
41179	1178	Mesg. Failsafe Timer (0 = disabled, 1-255 = duration (minutes))	03, 04, 06, 16
41180	1179	Relay #1 Failsafe Enable (0 = disabled, 1 = enabled)	03, 04, 06, 16
41181	1180	Relay #2 Failsafe Enable	03, 04, 06, 16
41182	1181	Relay #3 Failsafe Enable	03, 04, 06, 16
41183	1182	Relay #4 Failsafe Enable	03, 04, 06, 16
41184	1183	DI1 Debounce Time in mS (0 = disabled)	03, 04, 06, 16
41185	1184	DI2 Debounce Time in mS	03, 04, 06, 16
41186	1185	DI3 Debounce Time in mS	03, 04, 06, 16
41187	1186	DI4 Debounce Time in mS	03, 04, 06, 16
41188	1187	DI5 Debounce Time in mS	03, 04, 06, 16
41189	1188	DI6 Debounce Time in mS	03, 04, 06, 16

42019	1218	AI1:Scale Low (float, High Word)	03, 04, 06, 16
42020	1219	AI1:Scale Low (float, Low Word)	03, 04, 06, 16
42021	1220	AI1:Scale High (float, High Word)	03, 04, 06, 16
42022	1221	AI1:Scale High (float, Low Word)	03, 04, 06, 16
42023	1222	AI2:Scale Low	03, 04, 06, 16
42024	1223	AI2:Scale Low	03, 04, 06, 16
42025	1224	AI2:Scale High	03, 04, 06, 16
42026	1225	AI2:Scale High	03, 04, 06, 16
42027	1226	AI3:Scale Low	03, 04, 06, 16
42028	1227	AI3:Scale Low	03, 04, 06, 16
42029	1228	AI3:Scale High	03, 04, 06, 16
42030	1229	AI3:Scale High	03, 04, 06, 16
42031	1230	AI4:Scale Low	03, 04, 06, 16
42032	1231	AI4:Scale Low	03, 04, 06, 16
42033	1232	AI4:Scale High	03, 04, 06, 16
42034	1233	AI4:Scale High	03, 04, 06, 16
42035	1234	AI5:Scale Low	03, 04, 06, 16
42036	1235	AI5:Scale Low	03, 04, 06, 16
42037	1236	AI5:Scale High	03, 04, 06, 16
42038	1237	AI5:Scale High	03, 04, 06, 16
42039	1238	AI6:Scale Low	03, 04, 06, 16
42040	1239	AI6:Scale Low	03, 04, 06, 16
42041	1240	AI6:Scale High	03, 04, 06, 16
42042	1241	AI6:Scale High	03, 04, 06, 16
42043	1242	AI7:Scale Low	03, 04, 06, 16
42044	1243	AI7:Scale Low	03, 04, 06, 16
42045	1244	AI7:Scale High	03, 04, 06, 16
42046	1245	AI7:Scale High	03, 04, 06, 16
42047	1246	AI8:Scale Low	03, 04, 06, 16
42048	1247	AI8:Scale Low	03, 04, 06, 16
42049	1248	AI8:Scale High	03, 04, 06, 16
42050	1249	AI8:Scale High	03, 04, 06, 16
42051	1250	AI1:Scale Adjust (float, High Word)	03, 04, 06, 16
42052	1251	AI1:Scale Adjust (float, Low Word)	03, 04, 06, 16
42053	1252	AI2:Scale Adjust	03, 04, 06, 16
42054	1253	AI2:Scale Adjust	03, 04, 06, 16
42055	1254	AI3:Scale Adjust	03, 04, 06, 16
42056	1255	AI3:Scale Adjust	03, 04, 06, 16
42057	1256	AI4:Scale Adjust	03, 04, 06, 16
42058	1257	AI4:Scale Adjust	03, 04, 06, 16

42059	1258	AI5:Scale Adjust	03, 04, 06, 16
42060	1259	AI5:Scale Adjust	03, 04, 06, 16
42061	1260	AI6:Scale Adjust	03, 04, 06, 16
42062	1261	AI6:Scale Adjust	03, 04, 06, 16
42063	1262	AI7:Scale Adjust	03, 04, 06, 16
42064	1263	AI7:Scale Adjust	03, 04, 06, 16
42065	1264	AI8:Scale Adjust	03, 04, 06, 16
42066	1265	AI8:Scale Adjust	03, 04, 06, 16

Relay Control Logic

The Modbus MIOM supports local relay control logic if it is running firmware version r7 or later. The logic is similar to the RSD control logic in the SignalFire Gateway.



Note: **If more than one rule is assigned to the same Output Relay, then all of the rules must meet the energize condition for the relay to be energized.**

Alternatively, this means that if any one of the input channels logic results in the "de-energize" condition being true the relay will be de-energized.

Input Channel Section

The input channel section is used to select the source register for the logic rule.

Input Channel – One of the Analog or Digital input channels on the MIOM module is selected for each rule line.

Current Input Value – Once the rules are write to the MIOM this column shows the current value of the input. Click the **Update** button to refresh.

Relay Control Logic Section

The relay control logic section is used to trigger thresholds for the selected source data.

Energize Relay When… – Select the logic operand to use for the **energize** logic evaluation.

Value – The value that the relay will be energized. Note that the energized state is the normal "operating" state of the relay.

De-Energize Relay When… – The logic operand to use for the **de-energize** logic evaluation. This will automatically be the opposite of the selection for the energize case. Note that the de-energized state is the SAFE state of the relay.

Value – The value that the relay will be de-energized. Note the de-energized state is the "safe" state of the relay.

Debounce (seconds) – This field contains the number of seconds that the source data must meet the de-energize threshold before the relay is de-energized. This is useful so that a single (possibly a glitch) reading does not cause the relay to de-energize. A single reading that meets the energize criteria will result in the relay being energized. The default is 0 where each reading will cause the rule to be evaluated with no delay.

Output Channel Section

Output Relay – Select the relay to control (1 through 4).

After filling out the table, click **Write Remote Shutdown Settings to Gateway** to store the settings in the Gateway Stick.