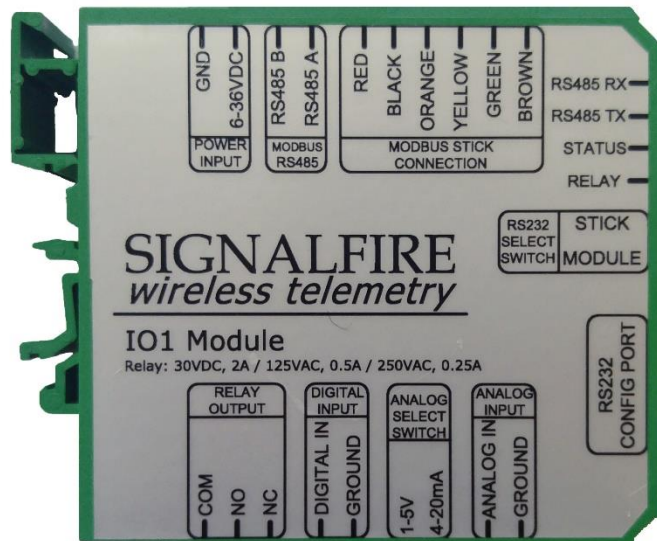# Interface Manual

Modbus IO1 Module

SignalFire Number: IO1

The SignalFire Modbus IO1 Module has the following features:

- Standard Modbus RTU slave device
- Can be read with a SignalFire Modbus Stick or other Modbus master
- 1 analog input (4-20mA, 1-5V)
- 1 digital input (state, counter, and frequency up to 2kHz)
- 1 relay output (SPDT)
- Optional relay failsafe timer
- 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 (3mA max @12V relay off, 10mA max @12V with relay energized)
Operating Temp	-40°C to +80°C
Analog Input	0-10V Max
Digital Input	Dry Contact or 30 Volts Max
Modbus Comm	Standard 3.3V RS485 RTU Slave Device

Connections and Components

Modbus IO1 Module Connections

The Modbus IO1 module provides screw terminals for connection to a SignalFire Modbus-in-a-Stick. A second set of A/B RS485 terminals are available for daisy chaining multiple modules or connection to other Modbus devices.

Power must be provided by the Power Input screw terminals (6-36VDC). At 12VDC, the Module requires only 3mA plus 7mA with relay energized.

A DB9 RS232 serial port is provided that allows configuration of the IO1 Module using the SignalFire ToolKit. There is a slide switch that allows this port to configure either the IO1 Module, or an attached Modbus-in-a-Stick.

Status LEDs

The Modbus IO1 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 master.

The relay output also has a small green LED located near the connector which turns on while the relay is energized.

SignalFire Toolkit Configuration

Connect to the DB9 connector and set the slide switch to "Module". The module can then be auto-detected by the Toolkit. Clicking on **Update Reported Sensor Values** will cause the data to be refreshed and displayed. The relay channel has an **Energize** and **De-Energize** button which can be used to toggle the relay state for testing. In addition, the counter can be zeroed using the tools menu.

Operation

The SignalFire Modbus IO1 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 Output

There are two ways to control the relay:

- **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. If the relay is energized when this command is received it will stay energized for the duration of the pulse command, then be automatically de-energized.

Analog Scaling

The Analog Input can be scaled so that it 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.

Configuration

Slave ID

The Modbus IO1 module requires that the Modbus slave ID be configured using the SignalFire Toolkit software.

Analog Inputs

The compliance voltage for a 4-20mA device must be provided externally. The analog input type can be switched to 1-5V using the slide switch next to the input terminal.
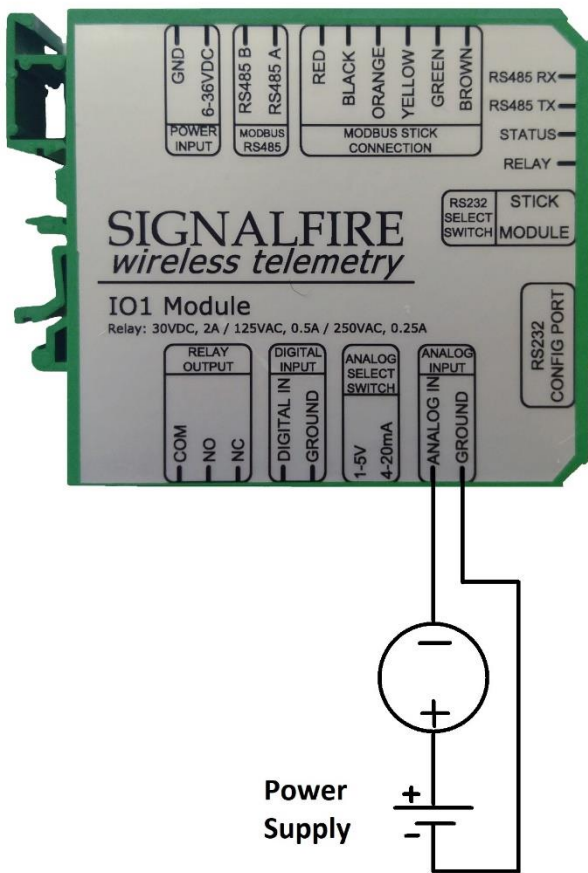
Connection for 4-20mA Input
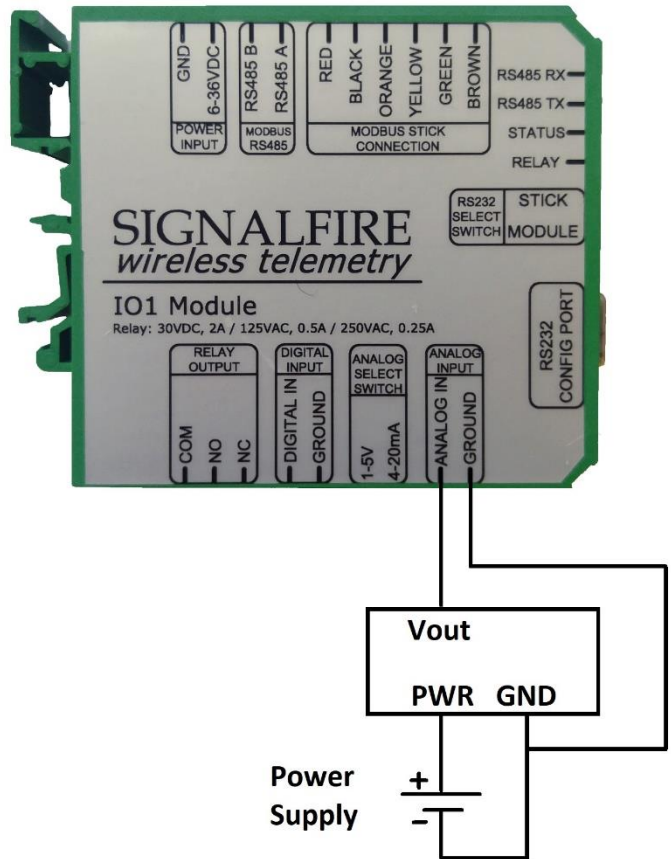
Connection for 1-5V Input

Digital Input

The digital input can be dry contact or voltage (30 Volts max, push/pull). Be sure to connect the ground bus from the module to either the ground of the voltage device or the dry contact. The average frequency register is the average frequency updated once a minute, while the instantaneous frequency register is updated every 2 seconds.

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 Input Latch

In cases where it is desired to detect a short duration digital input change, the digital input latch feature can be enabled. This feature will cause the digital input state register to be "latched" to the input state for a configurable number of seconds. For example if the detection of a button press is required, the latch feature would be configured so that a quick button press will result in the digital input state register reading a 1 for the configured number of seconds.

Digital (Relay) Output

The relay is a SPDT and is rated for the following:

> 30 VDC @ 2 Amps
> 250 VAC @ 0.25 Amps

Relay Failsafe Timer

The IO1 Module supports a configurable failsafe timer which is used to de-energize the relay in event of a communication failure.

Relay Message Failsafe Timer – This timer is reset anytime a coil write for the relay coil register is received.

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

Register Number	Register Address	Description	Function Codes
Coils (0xxxx)			
Read/Write			
00102	101	Relay1 Coil	01, 05
Write-only			
00112	111	Counter1 Reset Coil	05
Holding Registers (4xxxxx)			
Write-only			
40122	121	Relay1 Pulse (0 = Off, 1-255 = Pulse Time (sec))	06
Read-only			
41001	1000	AI Current Reading (Unsigned int, uA)	03, 04
41002	1001	AI Voltage Reading (Unsigned int, mV)	03, 04
41003	1002	DI State (Unsigned int, 1 = Closed or 0 = Open)	03, 04
41004	1003	Relay State (Unsigned int, 1 = ON or 0 = OFF)	03, 04
41005	1004	AI Scaled Reading (Float, High Word)	03, 04
41006	1005	AI Scaled Reading (Float, Low Word)	03, 04
41007	1006	DI Total Counts (Unsigned int, High Word)	03, 04
41008	1007	DI Total Counts (Unsigned int, Low Word)	03, 04
41009	1008	DI Average Freq. (Unsigned int, Hz x10)	03, 04
41010	1009	DI Instantaneous Freq. (Unsigned int, Hz x10)	03, 04
41011	1010	DI Counts/Minute (Unsigned int, x10)	03, 04
41012	1011	Supply Voltage (Unsigned int, mV)	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			
41101	1100	Modbus Slave ID (1 - 240)	03, 04, 06, 16
41102	1101	RS485 Baud Rate (1200,2400,4800,9600,19200,38400,57600)	03, 04, 06, 16
41103	1102	RS485 UART Mode (see below for values, 0x00 = 8N1)	03, 04, 06, 16
41104	1103	Relay Failsafe Timer (Unsigned int, minutes, 0=disabled)	03, 04, 06, 16
41105	1104	Debounce Timer (Unsigned int, milliseconds, 0=disabled)	03, 04, 06, 16
41106	1105	State Latch Duration (Unsigned int, seconds, 0=disabled)	03, 04, 06, 16
41107	1106	State Latch State (Unsigned int, 0=open, 1=closed)	03, 04, 06, 16
41108	1107	AI Scale Range Low (Float, High Word)	03, 04, 06, 16
41109	1108	AI Scale Range Low (Float, Low Word)	03, 04, 06, 16
41110	1109	AI Scale Range High (Float, High Word)	03, 04, 06, 16
41111	1110	AI Scale Range High (Float, Low Word)	03, 04, 06, 16
41112	1111	AI Scale Adjustment (Float, High Word)	03, 04, 06, 16
41113	1112	AI Scale Adjustment (Float, Low Word)	03, 04, 06, 16

RS485 UART Mode	Register Code
8N1	0x00
8E1	0xC0
8O1	0x80
8N2	0x08
8E2	0xC8
8O2	0x88