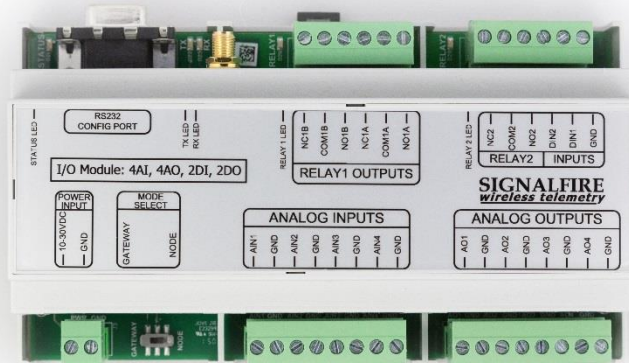


# Interface Manual

## Wireless I/O Module

*SignalFire Number: Wireless-IO-WHIP  
Wireless-IO-EXT*



The SignalFire Wireless I/O Module can send analog and digital I/O to a SignalFire Gateway, or mirror them wirelessly as outputs to another Wireless I/O Module, acting as a wire replacement.

The SignalFire Wireless I/O Module has the following features:

- 4 Analog inputs (0-20mA or 0-5V)
- 4 Analog outputs (0-20mA or 0-5V)
- 2 Digital inputs
- 2 Relay outputs (1 DPDT, 1 SPDT)
- Wide range DC power input, 10-30 VDC
- Low power consumption
- DIN rail mount with pluggable screw terminal blocks
- Status LEDs

## Specifications

# 2

Power	10-30 VDC (25mA average @12V no relays energized, additional 15mA max for each energized relay, plus any analog output current)
Temperature Rating	-40°C to +65°C
Analog Inputs	0-10V Max, 0-24mA Max
Digital Inputs	Dry Contact or 30 Volts Max (push-pull), 2kHz maximum frequency
Radio Frequency	902-928MHz ISM Band, FHSS radio, RP-SMA connector FCC and IC Certified
Compliance	Class 1 Division 2 Certified, Groups C&D, Temperature Code T5. Certified to CSA C22.2 No. 213, Conforms to ISA 12.12.01

## Hazardous Location Certification

# 3

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



**WARNING: EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE COMPONENTS UNLESS POWER HAS BEEN DISCONNECTED OR THE AREA IS FREE OF IGNITIBLE CONCENTRATIONS.**

*AVERTISSEMENT : RISQUE D'EXPLOSION . NE PAS RETIRER OU REMPLACER LES COMPOSANTS QUE L'ALIMENTATION EST DÉBRANCHÉ OU ZONE EST LIBRE DE CONCENTRATIONS IGNITIBLE.*



**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 matériel inacceptable pour les emplacements de classe I, division 2



**WARNING – EXPLOSION HAZARD Do not disconnect while circuit is live unless area is known to be nonhazardous**

AVERTISSEMENT - RISQUE D'EXPLOSION. Ne débranchez pas lorsque le circuit est en direct , sauf si la zone est connue pour être nonhazardous



**WARNING – The Wireless IO Module must be installed in a suitable enclosure for intended environment**

AVERTISSEMENT - Le module IO sans fil doit être installé dans une enceinte appropriée pour l'environnement prévu



**WARNING – All wiring methods must be in accordance with the NEC**

AVERTISSEMENT - Toutes les méthodes de Essorez doivent être en conformité avec la NEC

## Connections and Components

# 4

### Power

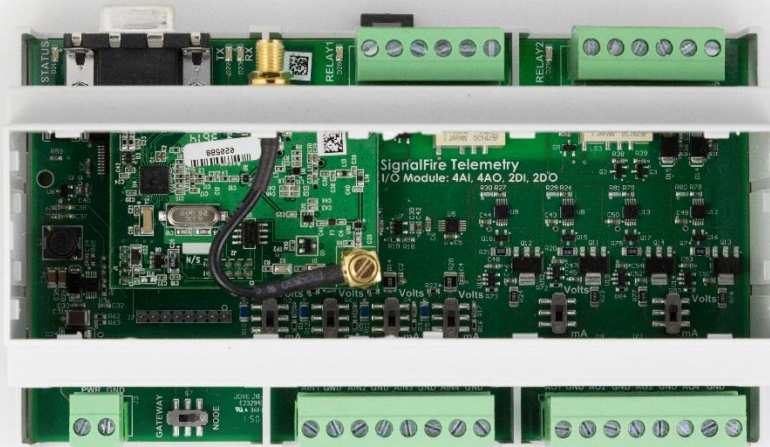
Power must be provided by the Power Input screw terminals (10-30VDC). The module power requirements at 12VDC is 25mA average plus 15mA per energized relay channel.

### Antenna

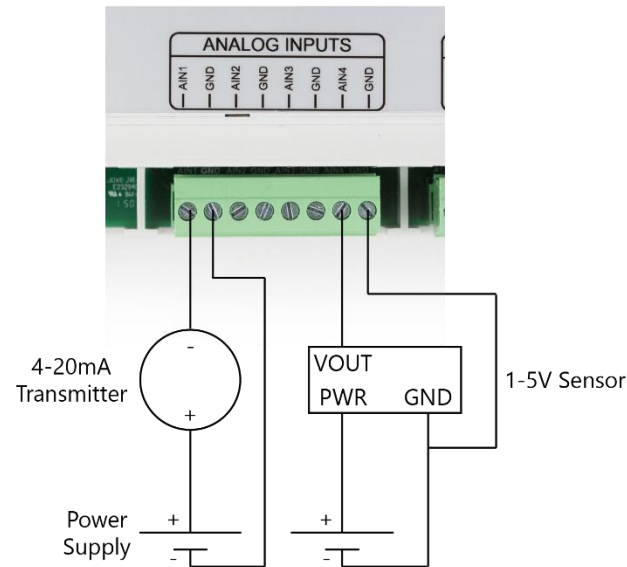
The antenna port is standard RP-SMA connector. Connect this port to a suitable 900MHz antenna. SignalFire can supply a enclosure mounted antenna with the modules.

### Analog Inputs

The analog inputs can 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.



Wire the analog voltage or current to the set of screw terminals. Maximum input voltage is 10 Volts. The compliance voltage for a 4-20mA device must be provided externally. See wiring diagram for details.



*Analog Inputs Example Wiring Diagram*

An example of a 4-20mA transmitter connected to AIN1 and a 1-5V sensor connected to AIN4 is shown above. Note that generally the same power supply being used to power the Wireless IO System would be used to provide power for the attached sensors.

### Analog Outputs

Each switch controls the output mode for a pair of outputs. For example, the switch on the left sets both output 1 and output 2 to either mA or Volts. Slide the switch up for a voltage output or down for a mA output. In mA output mode the loop compliance voltage will be the node supply voltage.

Note that the analog output Modbus register values are always written in  $\mu\text{A}$  even when the switch is set for a 1-5V output. It is up to the PLC to convert the readings to voltage. To convert a voltage output to  $\mu\text{A}$  simply multiply by 4000, for example for a 3V output write a value of 12000.

### Digital Inputs

The digital inputs (2 total) can be dry contact or voltage (must be push-pull, 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 digital inputs report their current state, as well as input frequency. The DI pulse counter increments only when the state changes from 0 to 1. The Instantaneous Frequency registers are the number of pulses per second within 2 seconds of check-in multiplied by 10. The Average Frequency registers are the number of pulses per second over the period between two check-ins multiplied by 10. The Counts/Min registers are the total number of pulses per minute between two check-ins multiplied by 10.

## Digital (Relay) Outputs

There are two relay outputs. Relay 1 is DPDT and relay 2 is a SPDT relay. The relays are rated for the following:

30 VDC @ 2 Amps

250 VAC @ 0.25 Amps

Be sure to use a flyback diode as needed for inductive loads such as solenoids.

## Status LEDs

The Wireless I/O node has a green status LED which blinks indicating the module is running. The status LED also indicates the signal strength between it and its module pair. In addition, there are TX/RX LEDs to indicate radio messages to/from the module.

The status LED will blink once a second if it is not connected to another module. If the node is connected to its paired module, it will blink a link quality code every 3 seconds.

3 Blinks = Strong Signal

2 Blinks = Good Signal

1 Blink = Weak Signal

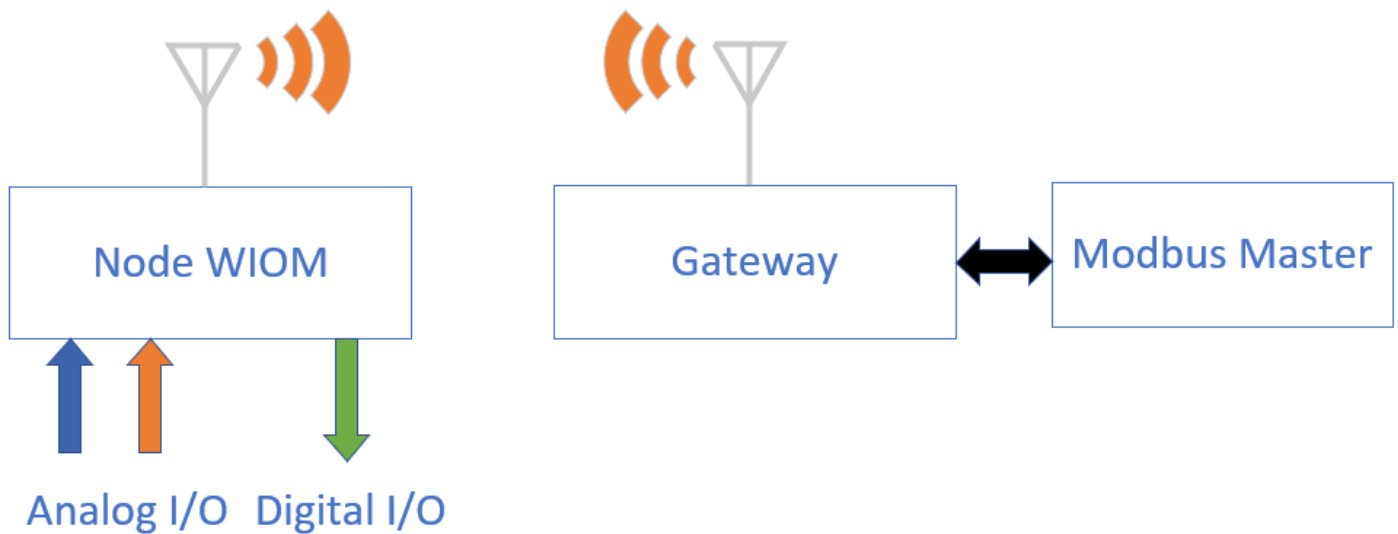
Each relay output also has a green LED which turns on while the relay is energized.

## Modes of Operation

The Wireless I/O Modules (WIOM) can be run in two “system modes”: **Node**, and **Point-to-Point**. To run in Node mode (to connect to a SignalFire Gateway), set the slide switch on all WIOMs to Node. To run in Point-to-Point mode, set the slide switch on one to Gateway, and the slide switch on the other to Node. Any time the slide switch is changed, the module must be power cycled for the setting to take effect.

### Node Mode

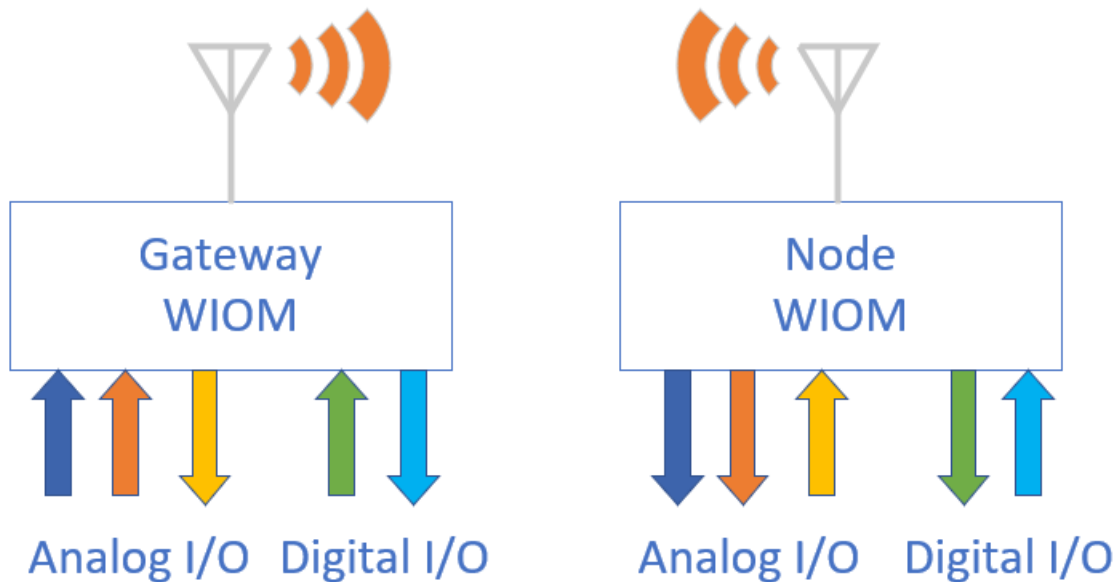
In Node mode, the WIOM will send its analog and digital inputs/outputs to the Gateway. All IO and then be read/set from a PLC via Modbus.



*Node Mode. The Gateway reads all inputs from all nodes, and can control any output of any node as commanded by a PLC*

## Point-to-Point Mode

In Point-to-Point mode, a WIOM that is set to Gateway mode will mirror its inputs to the outputs of a Module set to Node, and vice-versa. Point-to-Point mode is only valid for a pair of WIOM modules. For example, if the Gateway WIOM has 15mA going into Analog Input 1, the Node WIOM will set Analog Output 1 to 15mA.



*Point-to-Point Mode. Inputs from one module are mirrored as outputs on the other*

When set to Point-to-Point mode, the WIOMs will not be viewable through a SignalFire Gateway. The module that is set to Gateway will be locked to Slave ID 1.

## WIOM-Mini to WIOM Mode

A WIOM Mini and a regular WIOM can also operate in Point-to-Point mode with each other. In this configuration the WIOM will mirror the WIOM Mini A's analog input to its analog output 1. The DI's will be mirrored in both directions. The WIOM must be configured in Gateway mode while the WIOM-mini must be in node mode.



## Configuration

Using the SignalFire Toolkit

The SignalFire Toolkit application can be downloaded at [www.signal-fire.com/customer](http://www.signal-fire.com/customer). After installation, launch the software and the main toolkit window will open:



Select the COM port associated with the Wireless IO Module and click "Auto-Detect Device on COM Port." This will open the device configuration window, where all device settings can be configured.

### Network Settings

The network is set using the SignalFire Toolkit. To join a SignalFire network in Node mode, all Wireless I/O Modules must have the same Radio Network, Radio Network Group, and Corporate ID/Encryption Key as the Gateway Stick/DIN Gateway. For two Wireless I/O Modules to communicate in Point-to-Point mode, they must share the same Radio Network, Radio Network Group, and Corporate ID/Encryption but not share those settings with any other SignalFire network.

To use an Encryption Key in lieu of a Corporate ID, check off the "Enable Encryption" box under the Corporate ID. The Corporate ID field will switch over to an Encryption Key field.

The encryption key can be hidden so it cannot be read. This is the most secure option, but if you forget your key, there is no way to recover it – you have to reset the key on every device on its network. To enable this option, select **Set Encryption Key Unrecoverable** under the **Settings** menu.



### Failsafe Operations

In the event of a loss of communication between the node and the gateway, it may be desirable for the outputs to go to a fail state. This is accomplished by setting one or both of the failsafe timers.

**Communication Failsafe Timer** – If the node loses its wireless communications link to the gateway for greater than this time, any failsafe enabled relay will be put into a non-energized state. The relay will remain in this “safe” state until a Modbus command is sent from the Modbus master through the Gateway to energize the coil. In addition, any failsafe enabled analog output will be set to its configured fail value until a new value is written from the PLC. This option is disabled for the Gateway WIOM in Point-to-Point mode.

**Message Failsafe Timer** – This is similar to the previous timer, but this indicates the time since a valid Modbus coil write message or analog output write has been sent from the Modbus master through the SignalFire Gateway. If used this must be set higher than the Modbus coil write and analog output write frequency of the Modbus master device. This option is available for both Point-to-Point and Node mode.

Any analog output with a fail value enabled will go to the fail value at boot, any analog output without a fail value will go to 0 at boot.

### Analog Scaling (Node Mode only)

Analog scaling can be used to scale an analog input to engineering units. For example, for a 0-1000psi sensor set the scale low to 0 and scale high to 1000. The scaled value will now be displayed in the Toolkit and reported to the gateway as a floating point number.

### Digital Input Debounce

In cases where it is desired to accurately totalize digital input counts it may be necessary to enable the digital input debounce timer. The debounce timer is useful when dealing with dry contacts that may otherwise produce extra count 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.

Wireless-IO Module
Passed

File Settings Updates Tools Help

COM Port: COM6 Refresh

COM6 Open

Open
Close
Offline

Connect/Update

Product	WIRELESS-IO
Slave ID	23
Node Name	WIOM_GW
Radio Connectivity	Connected -68d...
Mainboard Version	0.18
Radio Version	2.50
Radio Address	51920
Corporate ID	<Encrypted>
Radio Mode	Node
Radio Network	6
Radio Network Group	5
Radio Power (dBm)	0
Radio Range	Long Range
Checkin Interval	1 minute
State Change Checkin	On

Set Encryption Key Help

Enable Encryption Set

Key: scorpion Set

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Settings

Radio Range Long Range Set

Slave ID 23 Set

Node Name WIOM\_GW Set

Radio Network 6 Set

Radio Network Group 5 Set

Checkin Interval 1 minute Set

State Change Checkin On Set

Communication Failsafe Timer (min) 15 Set

Message Failsafe Timer (min) 30 Set

Reported Module Values

16-bit Data Registers

Addr	Description	Value
1100	Analog Input 1 (uA)	0
1101	Analog Input 2 (uA)	0
1102	Analog Input 3 (uA)	0
1103	Analog Input 4 (uA)	0
1104	Analog Input 1 (mV)	2
1105	Analog Input 2 (mV)	0
1106	Analog Input 3 (mV)	0
1107	Analog Input 4 (mV)	0
1108	Analog Output 1 (uA)	0
1109	Analog Output 2 (uA)	0
1110	Analog Output 3 (uA)	0
1111	Analog Output 4 (uA)	0
1112	Digital Input 1 State	0
1113	Digital Input 2 State	0
1114	Relay 1 State	1
1115	Relay 2 State	1
1128	DI1 Avg. Freq (Hz x 10)	0
1129	DI1 Inst. Freq (Hz x 10)	0
1130	DI1 Counts/Min (x 10)	0
1131	DI2 Avg. Freq (Hz x 10)	0
1132	DI2 Inst. Freq (Hz x 10)	0
1133	DI2 Counts/Min (x 10)	0

32-bit Data Registers

Addr	Description	Value
1116	Scaled AI1	0
1118	Scaled AI2	0
1120	Scaled AI3	0
1122	Scaled AI4	0
1124	DI1 Counter	0
1126	DI2 Counter	0

Set Output 1  uA

Set Output 2  uA

Set Output 3  uA

Set Output 4  uA

Relay 1 ENERGIZE DE-ENERGIZE

Relay 2 ENERGIZE DE-ENERGIZE

Update Reported Module Values

Analog Scaling

	Input 1	Input 2	Input 3	Input 4	
Scale Low (units)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	Set Analog Scaling
Scale High (units)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Scale Adjust (+/-)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	

Relay Outputs

	Relay 1	Relay 2	
Failsafe Enable	<input type="checkbox"/>	<input type="checkbox"/>	Set Failsafe Options

Analog Outputs

	Output 1	Output 2	Output 3	Output 4	
Fail Value Enable	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Set Fail Output Value
Fail with Output Value...	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> (uA)	

Success

## Modbus Register Map

Register Number	Register Address	Description	Function Code	Register Type
<b>Coils (0xxxx)</b>				
<i>Write-only</i>				
00102	101	Relay1 Coil	01, 05	Read/Write
00103	102	Relay2 Coil	01, 05	Read/Write
00112	111	Counter1 Reset Coil	05	Write Only
00113	112	Counter2 Reset Coil	05	Write Only
<b>Holding Registers (4xxxx)</b>				
40122	121	Relay1 Pulse (0 = Off, 1 – 65,535 = Pulse Time (sec))	06,	Write Only
40123	122	Relay2 Pulse	06,	Write Only
41101	1100	AI1: Current Reading (Unsigned int, $\mu$ A)	03, 04	Read Only
41102	1101	AI2: Current Reading	03, 04	Read Only
41103	1102	AI3: Current Reading	03, 04	Read Only
41104	1103	AI4: Current Reading	03, 04	Read Only
41105	1104	AI1: Voltage Reading (Unsigned int, mV)	03, 04	Read Only
41106	1105	AI2: Voltage Reading	03, 04	Read Only
41107	1106	AI3: Voltage Reading	03, 04	Read Only
41108	1107	AI4: Voltage Reading	03, 04	Read Only
41109	1108	AO1: Current Output (Unsigned in, $\mu$ A)	03, 04, 06	Read/Write
41110	1109	AO2: Current Output	03, 04, 06	Read/Write
41111	1110	AO3: Current Output	03, 04, 06	Read/Write
41112	1111	AO4: Current Output	03, 04, 06	Read/Write
41113	1112	DI1: State (Unsigned int, 1 = Closed or 0 = Open)	03, 04	Read Only
41114	1113	DI2: State	03, 04	Read Only
41115	1114	Relay #1 State (Unsigned int, 1 = ON or 0 = OFF)	03, 04	Read Only
41116	1115	Relay #2 State	03, 04	Read Only
41117	1116	AI1: Scaled Reading (Float High Word)	03, 04	Read Only
41118	1117	AI1: Scaled Reading (Float Low, Word)	03, 04	Read Only
41119	1118	AI2: Scaled Reading	03, 04	Read Only
41120	1119	AI2: Scaled Reading	03, 04	Read Only
41121	1120	AI3: Scaled Reading	03, 04	Read Only
41122	1121	AI3: Scaled Reading	03, 04	Read Only
41123	1122	AI4: Scaled Reading	03, 04	Read Only
41124	1123	AI4: Scaled Reading	03, 04	Read Only
41125	1124	DI1: Total Counts (Unsigned int, High Word)	03, 04	Read Only
41126	1125	DI1: Total Counts (Unsigned int, Low Word)	03, 04	Read Only
41127	1126	DI2: Total Counts (Unsigned int, High Word)	03, 04	Read Only
41128	1127	DI2: Total Counts (Unsigned int, Low Word)	03, 04	Read Only
41129	1128	DI1: Average Frequency (Hz x 10)	03, 04	Read Only
41130	1129	DI1: Instantaneous Frequency (Hz x 10)	03, 04	Read Only
41131	1130	DI1: Counts per minute (x 10)	03, 04	Read Only
41132	1131	DI2: Average Frequency (Hz x 10)	03, 04	Read Only
41133	1132	DI2: Instantaneous Frequency (Hz x 10)	03, 04	Read Only
41134	1133	DI1: Counts per minute (x 10)	03, 04	Read Only

49988	9987 or 65524	Major revision number for the mainboard	03, 04	Read Only
49989	9988 or 65525	Minor revision number for the mainboard	03, 04	Read Only
49990	9989 or 65526	Major revision number for the radio	03, 04	Read Only
49991	9990 or 65527	Minor revision number for the radio	03, 04	Read Only
49992	9991 or 65528	High 16 bits of SFTS node address	03, 04	Read Only
49993	9992 or 65529	Low 16 bits of SFTS node address (the radio ID)	03, 04	Read Only
49994	9993 or 65530	Slave ID readback	03, 04	Read Only
49995	9994 or 65531	Received signal strength of last packet from the slave	03, 04	Read Only
49996	9995 or 65532	Battery voltage of the Modbus client, in millivolts	03, 04	Read Only
49997	9996 or 65533	Minutes until this slave will time out (TTL), unless new data is received	03, 04	Read Only
49998	9997 or 65534	Number of registers cached for this slave device	03, 04	Read Only
49999	9998 or 65535	Remote device type. 21 for WIOM	03, 04	Read Only

## Technical Support and Contact Information

### SignalFire Telemetry

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### *Revision History*

Revision	Date	Changes/Updates
1.7	4/3/18	Initial release of combined manual
1.8	4/24/19	Added detail on mirror mode
1.9	10/11/21	Added generic device registers
1.10	11/3/2021	Corrected register map