Interface Manual
Sentinel Node Analog

SignalFire Model: Sentinel-Analog-DC

The SignalFire Sentinel Node is a device with the following features:

- Powers a single 4-20mA at 13.5V or a single 1-5V sensor at 12.5 or 18.0V (software selectable)
- Low power operation from an onboard DC-DC power supply
- Sends data to a SignalFire Buffered Modbus Gateway
- Settable Modbus ID
- AES 128bit Encryption

Specifications

Enclosure	3.5" tall × 5.0" wide × 5.0" deep
Ingress	Type 3
Power Source	DC-DC converter
Supply Voltage Range	9-36V DC
Compliance	Certified for use in Class I, Division 2 groups A,B,C and D. T4 FCC/IC Certified.
Location	Indoor and Outdoor use, Wet location
Temperature Rating	-40°C to +85°C
Relative Humidity	Operating and storage humidity 0-100%
Altitude	2000m Max
Pollution Degree	Pollution Degree II
Radio Frequency	902-928MHz ISM Band, FHSS radio, internal antenna

⚠ **WARNING: Use of this equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment.**

L'utilisation du produit d'une manière différente telle que décrite par la manufacturier compromettra la protection intrinsèque de l'équipement.

⚠ **WARNING: The use of any parts not supplied by the manufacturer violates the safety rating of the equipment.**

L'utilisation de toute composantes différentes du manufacturier élimine la sécurité intrinsèque du produit

Device Label

DC Converter

Connections and Components

DC-DC Module

Scan/Check-in Switch

Config/Debug Connector

Status LEDs

Sensor Connector

Radio LEDs

Radio LEDs
- The Radio TX LED (green) flashes each time a radio packet is sent. This LED will blink rapidly while searching for the radio network.
- The Radio RX LED (red) blinks on each received radio packet.

Status LEDs
- The Active LED (green) will blink at boot up and will blink rapidly when the sensor is being powered.
- The ERROR LED (red) will blink to indicate an error condition.

Scan/Checkin Button
- If this button is pressed the Sentinel will apply power to the sensor for the configured sensor on time, read the analog sensor value and send the collected sensor data to the gateway.

Setup

5

The nodes need to be set up for correct operation before being fielded. The configurable items include:
- Network selection
- Check-in period selection
- Modbus ID setting
- Sensor on time/supply voltage

All settings are made using the SignalFire Toolkit PC application and a serial programming cable. The Modbus ID can also be set using the DIP switch (in older models only).

⚠️ **WARNING: Perform the steps in this section (Setup) in a safe location only.**

Using the SignalFire Toolkit

The SignalFire Toolkit application can be downloaded at www.signal-fire.com/customer. After installation, launch the software and the main toolkit window will open:
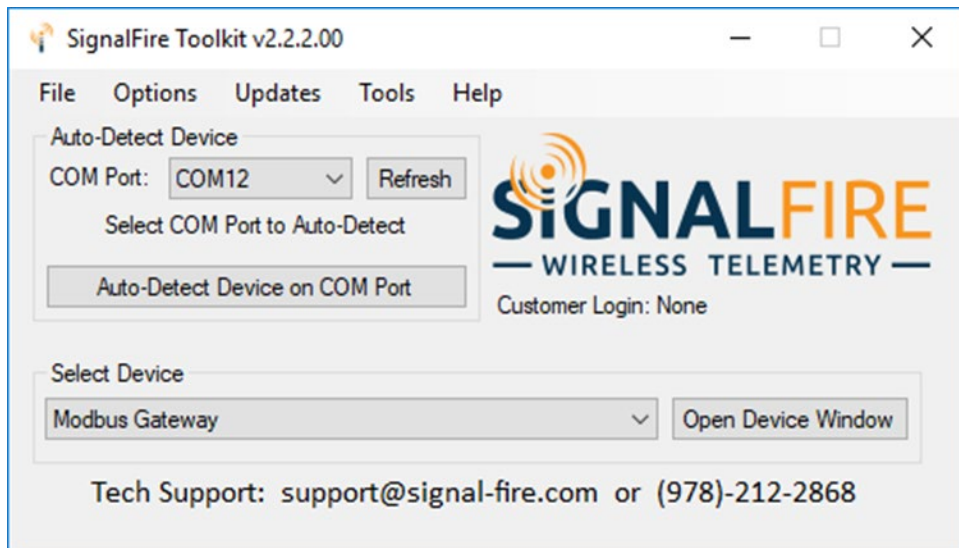
Select the COM port associated with the Sentinel Node and click "Auto-Detect Device on COM Port." This will open the device configuration window, where all device settings can be configured.

1	Serial Port Settings	2	Sentinel Information
3	Set Corporate ID / Encryption Key	4	Status of Last Operation
5	Reported Sensor and HART Values	6	Sentinel Settings
7	Alarm Threshold Settings		

Network Setting

The network is set using the SignalFire Toolkit. The network, network group, and corporate ID/encryption key settings must match those of the gateway for them to communicate.
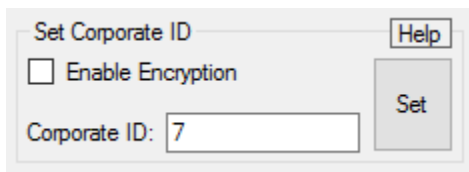
Encryption

To protect your over-the-air data and prevent tampering, SignalFire networks come with encryption. Legacy products use a Corporate ID, but can be switched over to use an encryption key if the firmware and ToolKit are up to date.

To set up a legacy Sentinel to use encryption, click the checkbox labeled **Enable Encryption** inside the **Set Corporate ID** box. All newer Sentinels come with this option enabled with "signalfire" as the default encryption key.
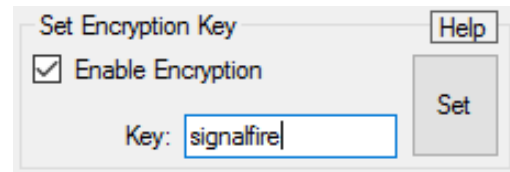
Corporate ID

Encryption Enabled

The box will then change into a **Set Encryption Key** box, and it will prompt instead for the encryption key you would like to use. Note that keys may not contain spaces or angle brackets. Enter it and then press **Set**. If you are setting up a new network, you will need to set the encryption key on all of your devices. If you are adding a Sentinel to a legacy network, you can simply set the Corporate ID without clicking the Enable Encryption box, and it will remain compatible with the older system.

It is also possible to hide your encryption key 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.
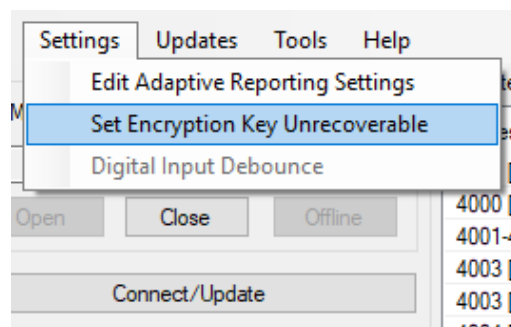
Setting the encryption key to be unrecoverable.

Modbus ID

The Modbus ID can be set with the SignalFire Toolkit.

Sensor Settings

The Sentinel Node will supply either 18.0 Volts (**HIGH**) of 12.5 Volts (**LOW**) in 1-5V mode, selectable in the SignalFire Toolkit. In 4-20mA mode **HIGH** is automatically selected and is the only option, it will supply a minimum of 13.0V to the sensor at full load of 20mA. The sensor warm-up time must also be configured. The default is 2 seconds which is used for most pressure and other simple sensors. Radar sensors often require a longer warm-up time. Contact your sensor manufacturer or SignalFire for details.

Selecting a sensor voltage of **LOW** (12.5V) in 1-5V mode will result in lower power consumption; however some sensors require higher voltage.

The Scale A values can also be configured. The **Scaling A Low Value** will correspond with lowest reading from the sensor, either 4mA or 1V depending on the mode. The **Scaling A High Value** will correspond with the highest reading from the sensor, either 20mA or 5V depending on the mode. The **Scale A type** should always be set to the current mode of the sensor.

Configuring the sensor settings.

Alarm Thresholds
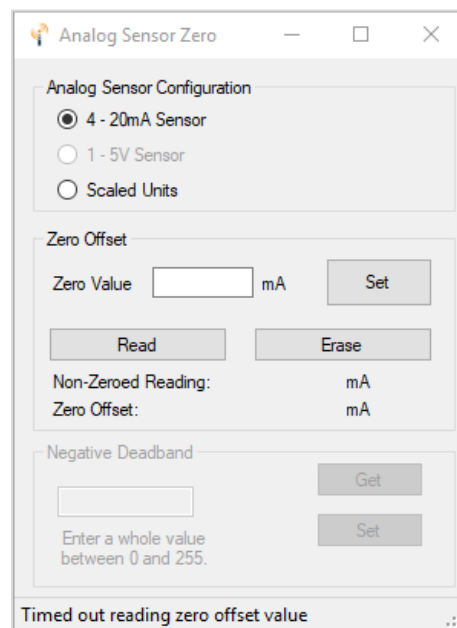
The Sentinel-Analog optionally has alarm threshold registers that when configured will indicate if the most recent analog reading is above or below the configured threshold. If the Sentinel is in 1-5V mode the thresholds are configured in mV, if the Sentinel is in 4-20mA mode the thresholds are configured in uA. For example, for a 4-20mA sensor with the Alarm High threshold configured for 18000uA, any reading above 18mA will cause the Alarm High Notification Register to read 1.

Analog Sensor Zero Settings

The sensor can be zeroed and/or a negative deadband configured via the Analog Sensor Zero menu under the Tools dropdown. A zero offset is applied to the raw analog sensor reading. The default is "0". The current zero offset can be read or erased. It can also be reset with the "Set" button.

Zero Offset and Negative Deadband settings

A negative deadband zone can be applied to the scaled floating point reading to remove small negative values. The default is "0". The deadband zone can be set in whole number increments which works as follows: Any negative reading within the defined "deadband" will be reported as zero. Any values below the deadband will be reported as the actual value.

Wiring Requirements

Follow these guidelines when connecting sensors to the SignalFire node. See pictures for proper wire routing examples.

- Cables entering the enclosure must be run as pictured.
- DC power cable should be run through the cable gland and gland should be tightened.
- The DC-DC adapter wire must be routed through the cable hold-down clamp.
- Strip all wires so that there is minimal exposed un-insulated wire when inserted into the screw terminal.
- All field wiring must have a 18-16 AWG, with a minimum rating of 36VDC, 85°C.
- All wiring should be neat and orderly.
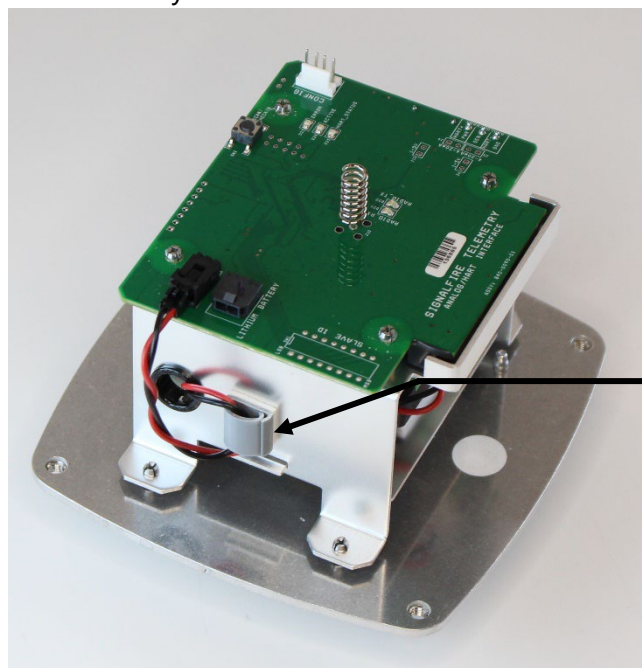
DC-DC cable must run through clamp
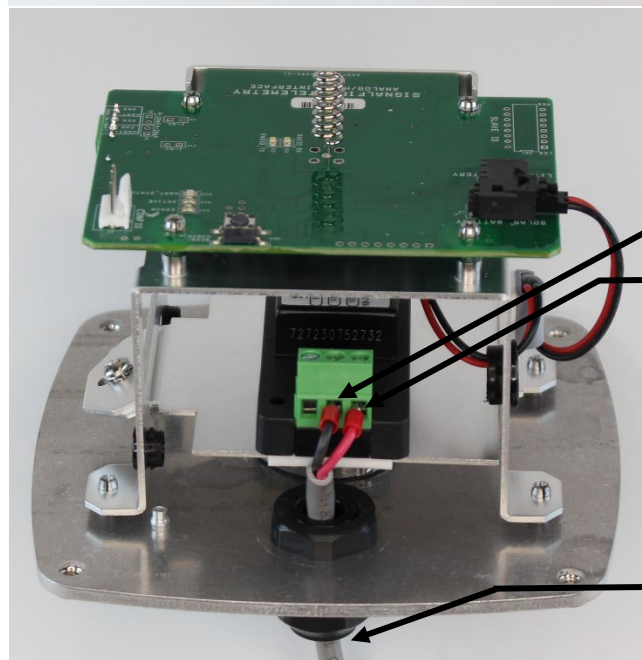
Vin-

Vin+

Tighten Gland, Follow terminal markings on module

Tightening torque:
max 0.4 N*m

Sensor cable should
be routed as shown

4-20mA Mode

To set the Sentinel Analog to 4-20mA mode: install the jumpers on the pins labeled "4-20mA" and leave the pins labeled "1-5V" open as pictured below, then power cycle the system.

The 4-20mA sensor is a 2-wire interface between the Sentinel Node and the sensor. The positive (Sensor+) at the sensor is connected to the top terminal on the Sentinel Node. The negative terminal (Sensor-) is connected to the center terminal of the Sentinel Node. The left/bottom terminal (Ground) may be left unconnected, or if the shielded cable is used it may be connected to the shield.
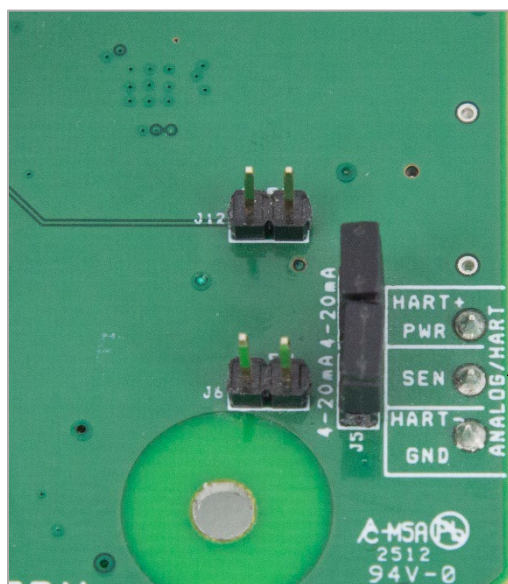
SENSOR +

SENSOR -

NAMUR Mode

The Sentinel Analog can be used to operate with NAMUR low-power switches when in 4-20mA mode. To enable this function, select **Configure for NAMUR** under the Settings toolbar menu. When in this mode, the Sentinel outputs a lower voltage, and is configured to alarm at a threshold of 1400uA.

When the switch is covered, it will output ~2200uA or greater and set register 3005 to a 1. When the switch is uncovered, it will output ~1000uA or less and set register 3005 to a 0.

To disable this feature, select **Set Sensor Power Mode HIGH** under Settings. This only sets the Sensor Power Mode back to High and does not disable the 1400mA alarm threshold.

This option is not available in 1-5V mode.

1-5V Mode

To set the Sentinel Analog to 1-5V mode: install the jumpers on the pins labeled "1-5V" and leave the pins labeled "4-20mA" open as pictured below, then power cycle the system.

The 1-5V sensor is a 3-wire interface between the Sentinel Node and the sensor. The positive (**Sensor Power**) at the sensor is connected to the top terminal on the Sentinel Node. The negative (**Sensor Ground**) is connected to the bottom terminal of the Sentinel Node. The middle terminal (**Sensor V Out**) is connected to the voltage signal output from the sensor.

SENSOR Power

SENSOR Signal

SENSOR Ground
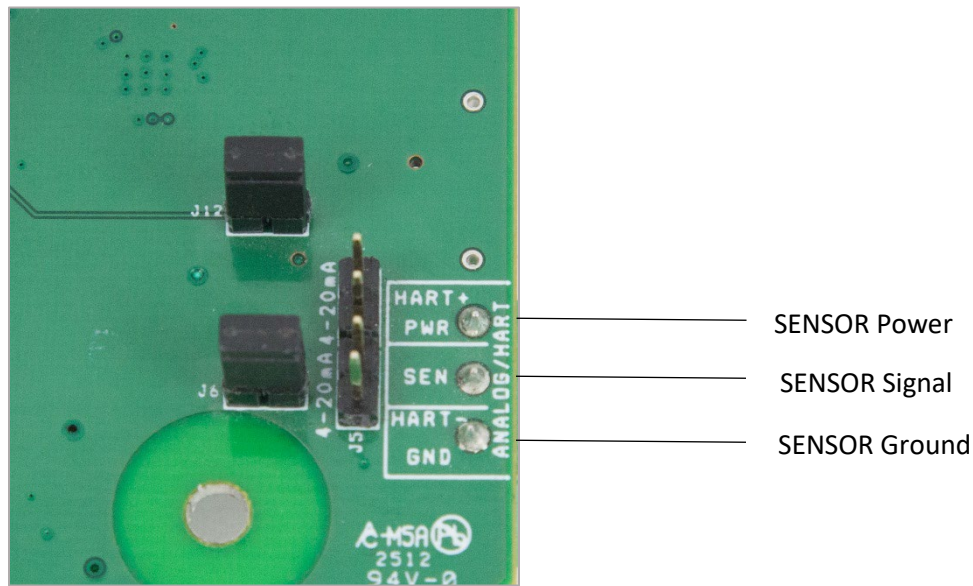
Remote Modbus Register Mapping

The Sentinel Node sends data to a SignalFire Telemetry Modbus Gateway. The data that is sent to the gateway is available at the gateway in registers where it can then be read by a Modbus RTU. Consequently, the node needs to have a unique (to the network it is in) Modbus ID which the gateway will use to store its unique data.

Modbus Registers

Every check-in period, the sensors are read and data is sent to the gateway. The gateway will save the data under the set Modbus ID in 16-bit registers. The register map for this system is below.

Register Map

Register Number	Register Address (Offset)	Description
43001	3000	A/D Counts (12bit legacy format)
43002	3001	Loop current in µA (Reported as 0 if set to 1-5V mode)
43003	3002	Loop voltage in mV (Reported as 0 if set to 4-20mA mode)
43004-43005	3003-3004	Custom Scaling of Loop (two registers) (32bit Float)
43006	3005	Alarm High Notification (0=no alarm, 1=in alarm)
43007	3006	Alarm Low Notification (0=no alarm, 1=in alarm)
43008	3007	Alarm High Setpoint in mV or uA
43009	3008	Alarm Low Setpoint in mV or uA
49987	9986 or 65523	Status (0=no errors, 1=low power, 2=failed sensor read, 3=low power and failed sensor read)
49988	9987 or 65524	Major revision number for the mainboard
49989	9988 or 65525	Minor revision number for the mainboard
49990	9989 or 65526	Major revision number for the radio
49991	9990 or 65527	Minor revision number for the radio
49992	9991 or 65528	High 16 bits of SFTS node address
49993	9992 or 65529	Low 16 bits of SFTS node address (the radio ID)
49994	9993 or 65530	Modbus ID readback
49995	9994 or 65531	Received signal strength of last packet from the Sentinel
49996	9995 or 65532	Supply voltage of the Modbus client, in millivolts
49997	9996 or 65533	Minutes until this device will time out, unless new data is received
49998	9997 or 65534	Number of registers cached for this device
49999	9998 or 65535	Remote device type. 42 for Sentinel Analog

Mounting and Care

The unit comes with a watertight ½" NPT conduit fitting on the bottom mounting plate. The Sentinel is then directly mounted to the sensor with a short section of conduit.
Tighten cover screws to 8 in-lbs. Do not use power tools. Anti-seize recommended.

Direct Mount to Sensor with Short Conduit

This mounting method uses a short conduit run from the sensor and the unit is held in place by the conduit.
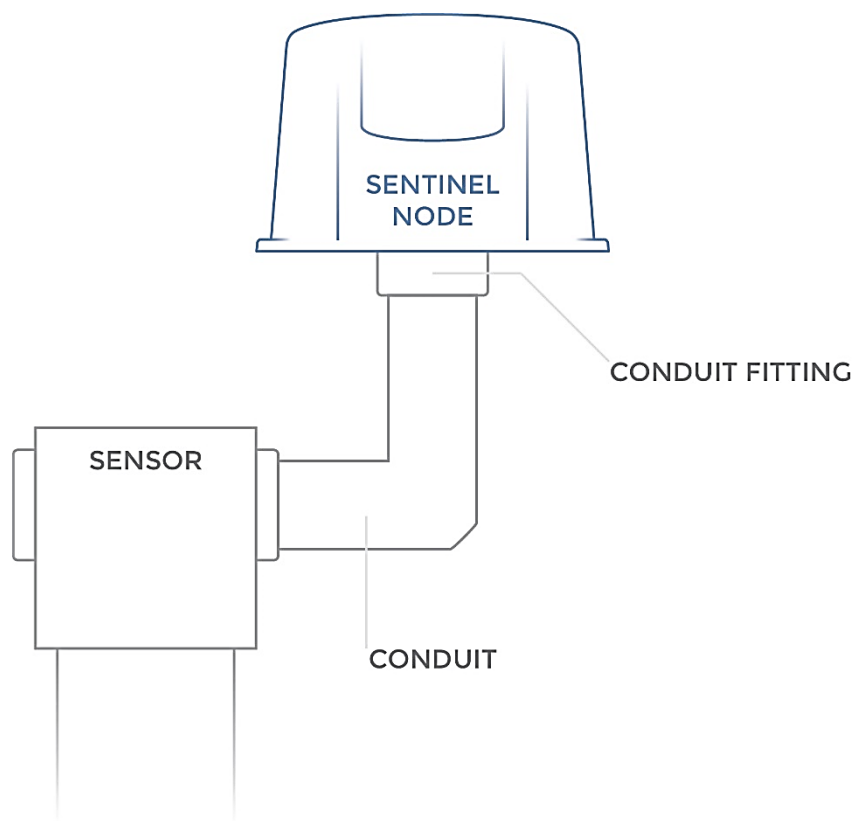
WARNING: The Sentinel must be mounted in a location free of high vibrations. Over time vibrations can damage the Sentinel, which could impair its safety ratings. Do not mount directly to continuous vibrating equipment such as pumps or compressors.

ATTENTION: Le produit Sentinel doit être installé dans un endroit libre de hautes vibrations. Sans quoi avec le temps, des possibles dommages pourraient compromettre la sécurité intrinsèque du produit. Les installations sur équipement en vibration constante (pompes, compresseurs) doit à tout prix être éviter.

Cleaning Instructions

The outside of the enclosure may be cleaned with water, mild soap, and a damp cloth as needed. High pressure washing is not recommended.

WARNING: Electrostatic Discharge Hazard! Care must be taken to avoid the potential of creating a change on the enclosure or antenna. Do not wipe with a dry cloth. Do not brush against the enclosure with clothing or gloves.

ATTENTION : Décharge électrostatique ! Il faut prendre soin d'éviter l'accumulation de charge électrostatique sur le boitier ou l'antenne du produit. Ne pas essuyer le produit avec un chiffon sec. Ne pas frotter le boitier avec des vêtements ou des gants

Configuration / Debug

WARNING: Only connect to the debug port in a safe area!

ATTENTION : La connexion sur le port de déboggage doit être faite que dans un endroit classifier non-dangereux

Debug and configuration information is available if a connection is made via the debug port on the main board. A USB converter cable (available from SignalFire) must be used for this interface.

Debug and advanced configuration may be done using the SignalFire Toolkit PC application.

Technical Support and Contact Information

SignalFire Telemetry
140 Locke Dr, Suite B
Marlborough, MA 01752
(978) 212-2868
support@signal-fire.com

Product Disposal Information

To ensure environmental safety and compliance, please follow these disposal instructions for the product and its components:

Electronic Components:
This product contains electronics that must be recycled through approved e-waste recycling programs. Electronics can contain harmful materials and should be prevented from entering landfills. Do not place electronics in regular trash.

Metal Parts:
Any metal components can be separated and recycled through your local metal recycling facility.

Packaging Materials:
Recycle or reuse packaging materials such as cardboard or plastics, following local recycling guidelines.

For local disposal sites refer to:

- Call2Recycle (USA, Canada)
- Earth911 (USA, Canada)
- SERI (International)

In the USA or more information, visit:

- EPA's battery disposal guide
- EPA's electronics recycling page

By following these guidelines, you help reduce waste and support environmental sustainability.

Revision History

Revision	Date	Changes/Updates
1.13	5/2/2024	Initial release – forked from Sentinel-Analog manual
1.14	11/1/2024	Add disposal information

APPENDIX - FCC and IC Statements

Changes or modifications not expressly approved by SignalFire Telemetry, Inc could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

-- Reorient or relocate the receiving antenna.
-- Increase the separation between the equipment and receiver.
-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
-- Consult the dealer or an experienced radio/TV technician for help.

Only the supplied coil antenna (Part number 810-0012-01) which is permanently soldered to the PCB may be used. This antenna has a maximum gain of 3dB.

WARNING!
FCC and IC Radiation Exposure Statement:
This equipment complies with FCC's and IC's RF radiation exposure limits set forth for an uncontrolled environment under the following conditions:

1. This equipment should be installed and operated such that a minimum separation distance of 20cm is maintained between the radiator (antenna) & user's/nearby person's body at all times.
2. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a maximum (or lesser) gain approved for this transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.r.i.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.