Interface Manual

Sentinel Float Scout

SignalFire Model: Sentinel-FS-3BIS

The SignalFire Sentinel Float Stick Node is an Intrinsically Safe device with the following features:

- Standard SignalFire Sentinel RS485-Modbus Node
- RS485 connection to internal Float Stick Interface Board
- 1 or 2 floats with temperature(s) supported
- Low power operation from an intrinsically safe high capacity lithium primary battery pack
- Optional solar battery system for routing nodes or rapid data collection
- Sends data to a SignalFire Buffered Modbus Gateway
- AES 128bit encryption

Specifications

Enclosure Size	3.5" tall × 5.0" wide × 5.0" deep
Power Source	Internal IS Lithium battery pack *SignalFire Part Number: 3BIS* External Solar battery system *SignalFire Part Number: Sentinel-HCSolar* DC-DC Converter *SignalFire Part Number: DCDC-Sentinel* Other external power supply meeting the power entity parameters from the control drawing.
Temperature Rating	-40°C to +60°C
Radio Frequency	902-928MHz Ism Band, FHSS radio, internal antenna
Compliance	Certified for use in Class I, Division 1 groups C and D. EXi [EXi] FCC/IC *(Certification Pending)*.
Measurement Resolution	0.0001"

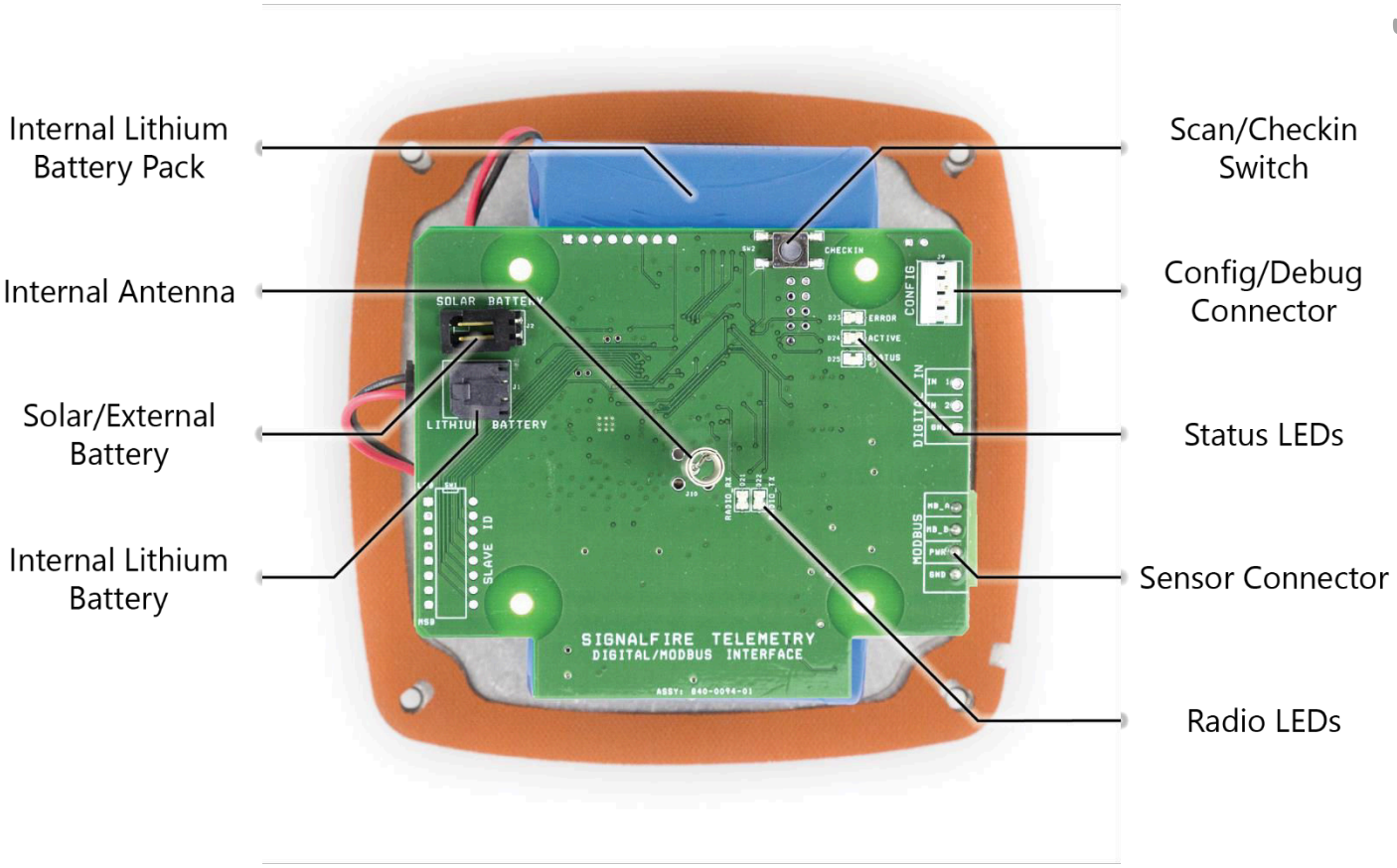
WARNING: Use of this equipment in a manner not specified by the manufacturer may impair the protection provided by the equipment.

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

The associated apparatus provides intrinsically safe outputs.
L'appareil associé fournit des sorties à sécurité intrinsèque.

Refer to control drawing "Sentinel – Control Drawing – Modbus, Thermocouple, RTD, and Float Stick for requirements when used in a Class I Division 1 area.

Connections and Components



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 and read.
- The ERROR LED (red) will blink to indicate an error condition.

Scan/Checkin Button

- If this button is pressed the Sentinel will take a reading from the Float Stick and send those values to the gateway.

Setup

The nodes need to be set up for correct operation before being fielded. The configurable items include:

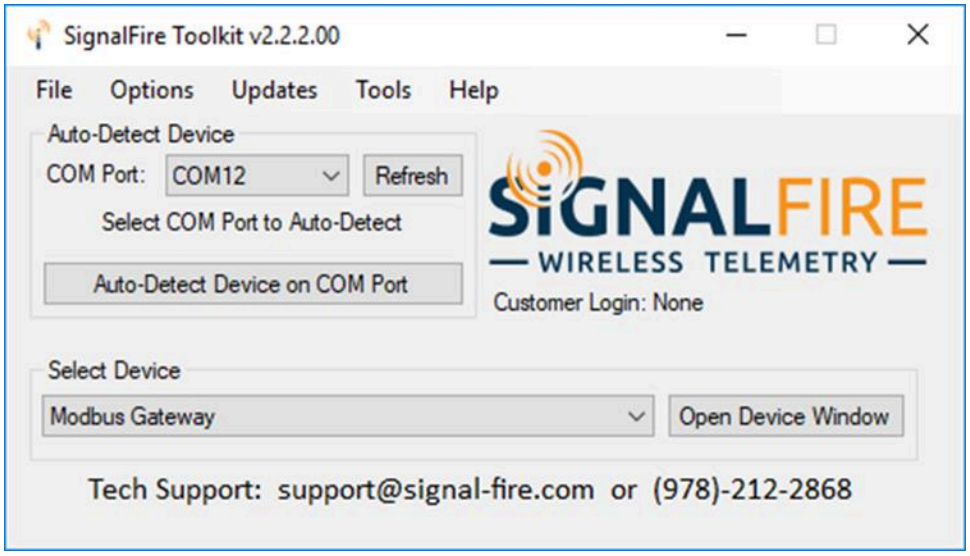
- Network selection/Encryption settings
- Check-in period selection
- Float Stick mode enable

All settings are made using the SignalFire Toolkit PC application and a serial programming cable.

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

Using the SignalFire Toolkit

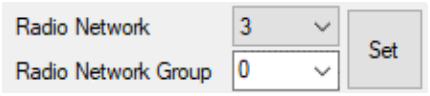
The SignalFire Toolkit application can be downloaded at www.signal-fire.com/customer. After installation, launch the software and the main toolkit window will open:



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.

Network Setting

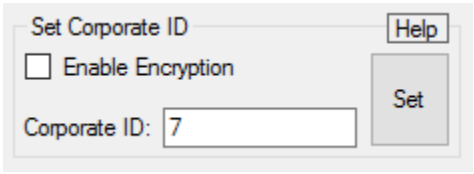
The network is set using the SignalFire Toolkit. **The network, network group, and corporate ID/encryption key settings must match those of the gateway for them to communicate**.



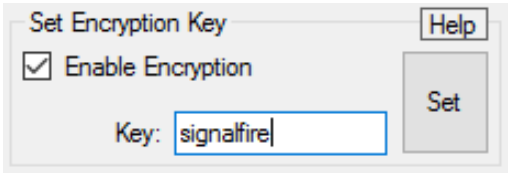
Encryption

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.



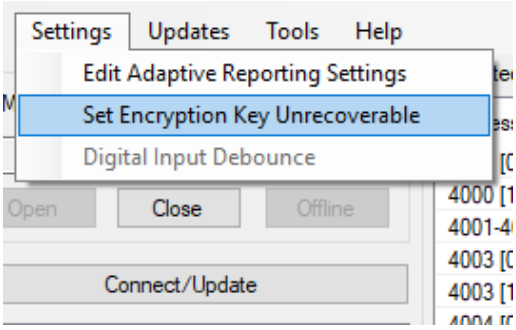
Corporate ID



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.

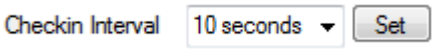
It is also possible to hide your encryption key so it cannot be read. This is the most secure option, but if you forget your key, there is no way to recover it – you have to reset the key on every device on its network. To enable this option, select **Set Encryption Key Unrecoverable** under the **Settings**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



Setting the encryption key to be unrecoverable.

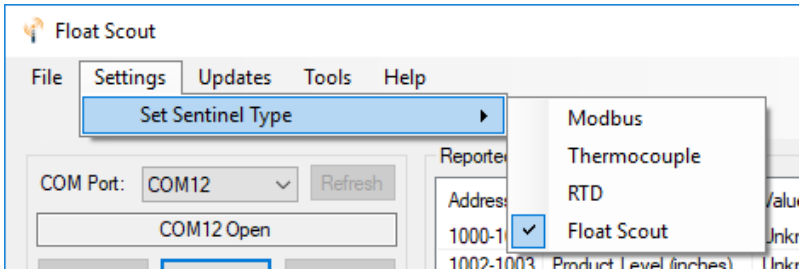
System Check-In Period

This setting controls how often the node will read the Modbus device and forward the register data to the gateway.



Configuration

Since the Sentinel Float Stick uses a standard Sentinel Modbus Node with the Float Stick interface card it is necessary to set the Sentinel type for Float Stick operation if it is in the default Modbus mode. To do this, select **Float Stick** in the **Set Sentinel Type** option under the **Settings** pull down menu.

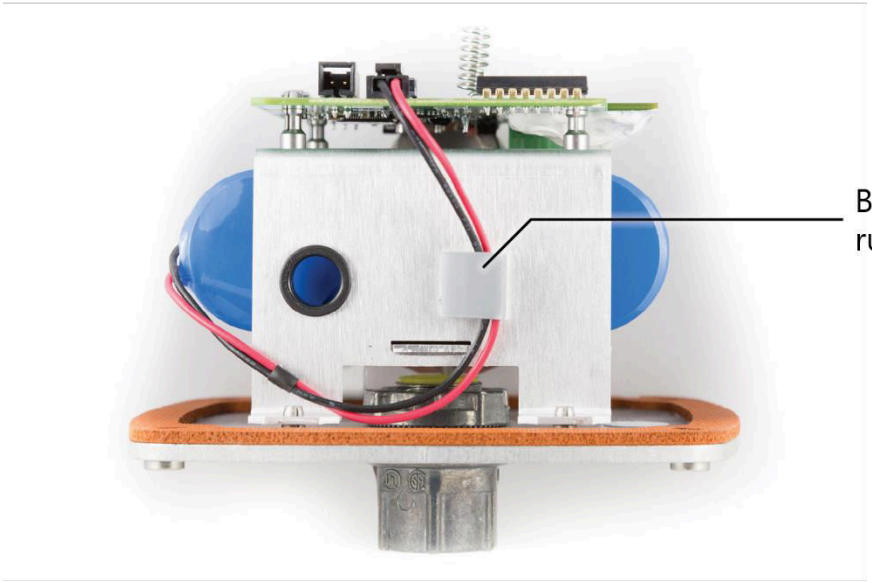


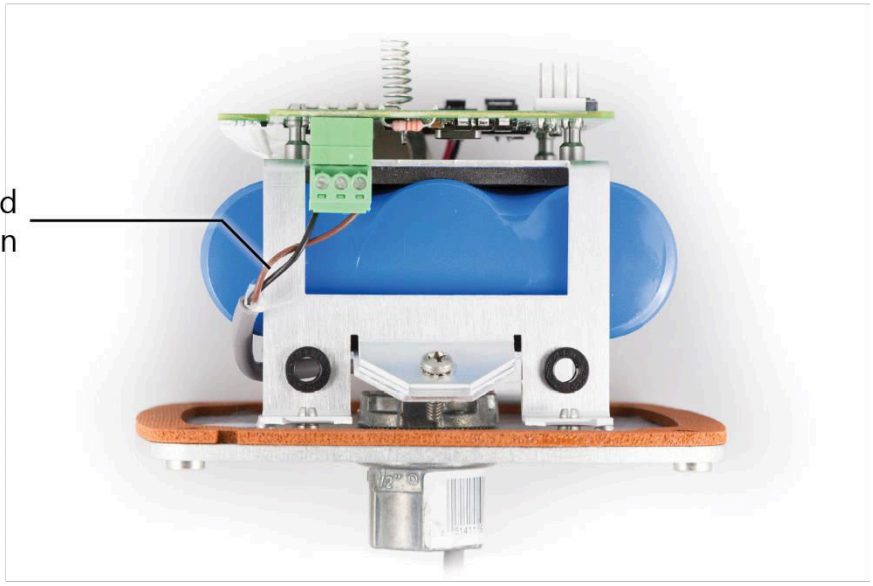
Sensor Connections

Wiring Requirements

To ensure intrinsic safety is maintained it is required that the installer follow these guidelines when connecting sensors to the SignalFire node. See pictures for proper wire routing examples.

- Strip the wires so that there is minimal exposed un-insulated wire when inserted into the screw terminal.
- All wiring should be neat and orderly.





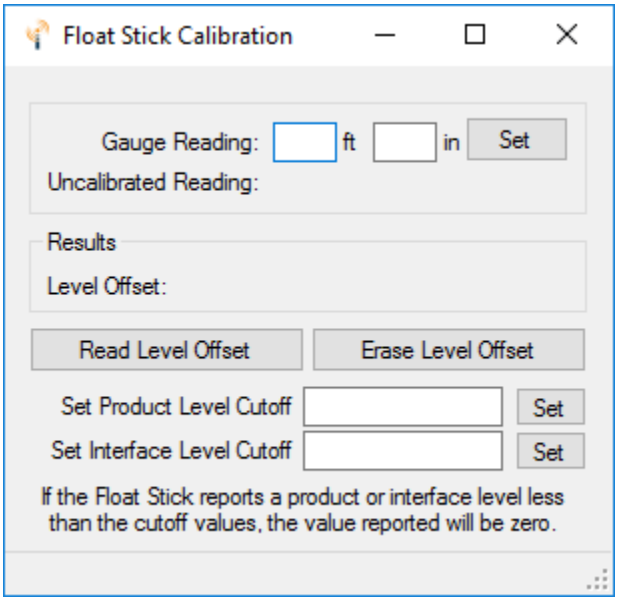
The Float Stick interface board is plugged into the Modbus connector on the Sentinel and has a 3-position screw terminal block that is labeled with the wire colors from the Float Stick. Connect the Red, White and Black wires to the correct terminals.

Float Stick Calibration Settings

After the Float Stick System is installed in a tank it will be necessary to calibrate the system to compensate for the exact position of the device relative to the fluid level.

To calibrate the Float Stick System to match the level gauged in a tank, open the **Float Stick Calibration** window from the Tools menu and enter the measured tank level in feet and inches and click **Set.** This will save an offset value that will be applied to both the level and interface (for two float systems).

Optionally a "Level Cutoff" setting can be set for the product and/or level readings. Any reading at or below the configured cutoff setting will be reported as zero. This is useful as the float cannot reach the actual bottom of the tank due to the weight and required spacing.



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.

The following data is sent to the Gateway:

Register Number	Register Address (offset)	Description
41001-41002	1000-1001	Float Stick Span (inches)
41003-41004	1002-1003	Product Level (inches)
41005-41006	1004-1005	Interface Level (inches
41007-41008	1006-1007	Temperature 1 (°C)
41009-41010	1008-1009	Temperature 2 (°C)
41011-41012	1010-1011	Temperature 3 (°C)
41013-41014	1012-1013	Temperature 4 (°C)
41015-41016	1014-1015	Temperature 5 (°C)
41017-41018	1016-1017	Communication Status (0=No errors; 1=No data received; 2=Only partial data received; 3=Checksum error; 4=Float Stick internal error reported
49987	9986 or 65523	Low Battery Alarm (0 = battery above 3.0V, 1 = battery below 3.0V)
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	Slave ID readback
49995	9994 or 65531	Received signal strength of last packet from the slave
49996	9995 or 65532	Battery voltage of the Sentinel-Float Stick, in millivolts
49997	9996 or 65533	Minutes until this slave will time out, unless new data is received
49998	9997 or 65534	Number of registers cached for this slave device
49999	9998 or 65535	Remote device type. 0x34 (52) for Sentinel Float Stick

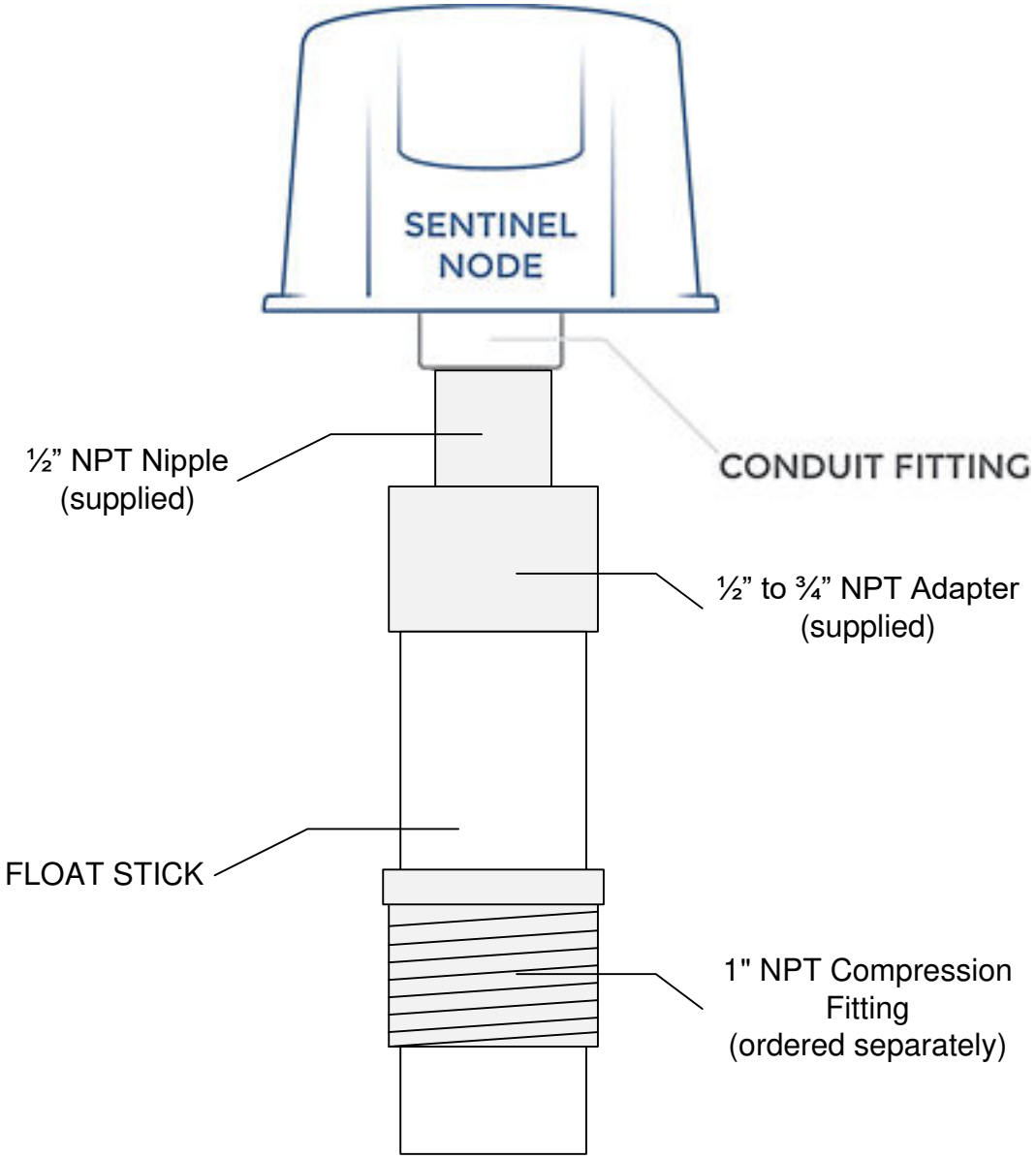
Float Sticks configured for only one float will return 0 for the Interface Level. Float Sticks with only one temperature sensor will return the same temperature reading for all five temperatures.

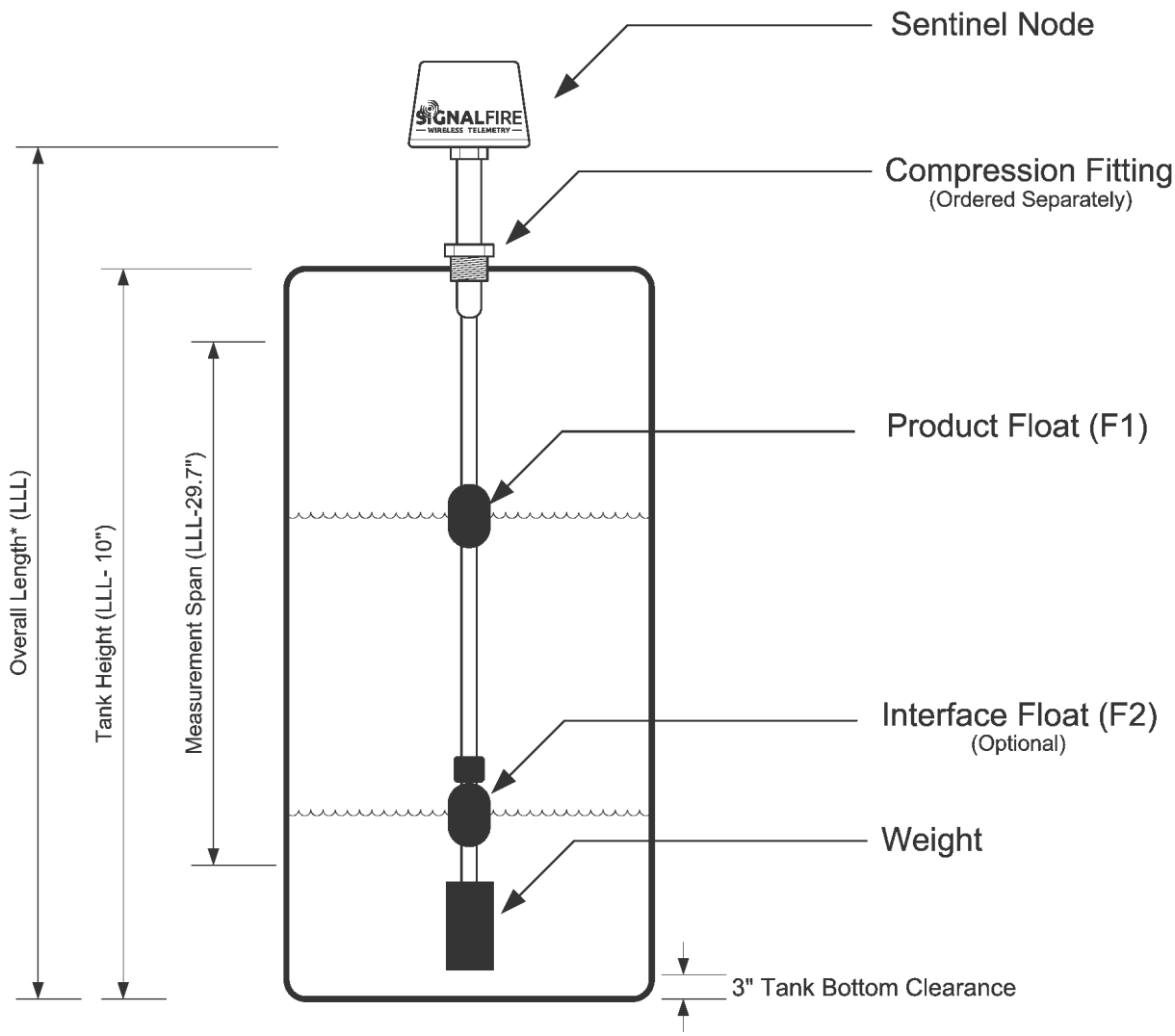
If there is any error communicating with the Float Stick all readings will return 999.9999.
Additionally, if there is an error the communication status register will contain additional information on the cause of the error.

Mounting and Care

The unit comes with a watertight ½" NPT conduit fitting on the bottom mounting plate. The Sentinel Float Stick also includes 2 NPT fittings for adapting the Sentinel to the Float Stick. Mounting is pictured below.
In addition, a ¾" NPT compression fitting is supplied for mounting the assembly to a tank.

Sentinel Mounting to Float Stick





Note: For dual float systems the lower float is marked with an "I" and the upper float is marked with a "P". For dual floats the foam float spacer is required between the floats.

Internal Lithium Battery Replacement

Battery Packs can be changed with the node in place.

1. Open the cover from the enclosure.
2. Unplug the battery from the PCB, by depressing the locking clip on the connector.
3. Loosen the screw holding the battery door and slide the old battery out.
4. Slide in the new battery pack and tighten the battery door screw.
5. Connect the battery to the main PCB battery connector.
6. Install the enclosure cover.

WARNING: Use of any battery other than the SignalFire part number 810-0008-02 will impair the protection provided by the equipment.

WARNING: If the internal battery is installed the external solar battery system or other power source may not be connected!

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.

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

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

Revision	Date	Changes/Updates
1.0	12/15/15	Initial release
1.1	8/3/16	Updated diagrams, added section on encryption
1.2	2/8/19	Updated screenshots, descriptions Minor format updates

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.