Radar RANGER Manual



Specifications

Overall Size	7.7” x 4.6” (19.55cm x 11.68cm)
Power Source	Internal (4) D cell 72Ah Battery Pack. Field replaceable.
Housing Material	IP67; UV-rated industrial polycarbonate
Process Connection	1½-inch male NPT; PEEK material
Temperature Rating	-40°C ≤ T_{amb} ≤ +85°C (-40°F to +185°F)
Pressure Rating	No Pressure Rating
Mounting	Threaded process fitting or optional L-bracket
Radar Sensor	**Sensor Range**: 8 m (26.2 ft) **Sensor Technology**: Pulsed Coherent Radar Dielectric Constant Range: 10 – 100 **Frequency:** 60GHz **Accuracy**: ±7mm (±0.28 in) at 25°C (77°F) **Resolution:** 2.5 mm (0.10 in) **Blocking Distance:** Configurable; Minimum: 0cm, Maximum: 7cm (2.75”) **Beam Angle:** 12° **Reported Values:** Distance, Level, Percent Full, Radar Echo Strength, Wireless Signal Strength **Strapping Table:** up to 128 points
Hazardous Area Approvals	Class 1 Division 2, Groups A, B, C, D; T5. - ***pending***
Estimated Battery Life	2 Years at 1-Minute Reporting/Sampling* 5 Years at 5-Minute Reporting/Sampling* **Battery life specifications are estimations only and depend on temperature, cellular coverage, configuration settings, and exception reports*

Radio Power	23 dBm
Wireless Connectivity	Cellular; 4G LTE-M / NB-IoT
Cellular Carriers	**United States:** Verizon, AT&T **Canada:** Bell **Outside North America:** Consult Factory
Data Integration	MQTT/Sparkplug, SignalFire Cloud, Ignition SCADA, Third-Party Cloud Platforms
Sampling Interval	Configurable; as fast as 5 seconds
Reporting Interval	Configurable; 5 seconds** to 12 hours
Report on Exception	Configurable measurement threshold

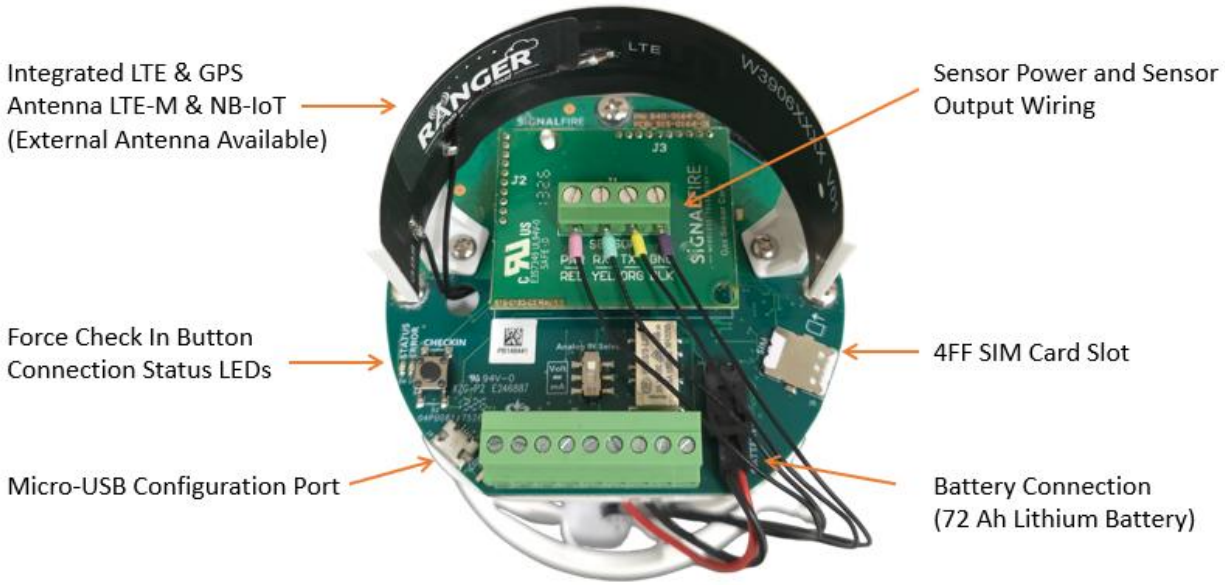
** *5-second "Reporting Interval" requires "Ultra" subscription to SignalFire Cloud*

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Connections and Components



Micro-USB Configuration Port

- A Micro-USB cable comes included with a RANGER for initial configuration

Force Check In Button

- **Quick Press:** Provides RANGER connection status
- **Long Press:** Forces RANGER to report to SignalFire Cloud

Connection Status LEDs

- The RANGER will blink (3) times to indicate its connection status
- The **STATUS LED** (**green**) will blink to indicate successful connection
- The **ERROR LED** (**red**) will blink to indicate an error condition.

LED blink	Connection checked	Green	Red
1st	Cell Tower Connection	Connected	Connection fault
2nd	Internet Connection	Connected	Connection fault
3rd	MQTT Broker Connection	Connected	Connection fault

NOTE: *Three green blinks indicate the Radar RANGER has full network connection to the configured host server*

Operation

The radar sensor is powered by the 72 Ah internal lithium battery at user-specified intervals to conserve battery life. The Radar RANGER powers its sensor and reports the measured distance which can be converted into level (height) or percent full readings.

The strapping table, which allows for up to 128 points of scaling, provides users with the ability to use the Radar RANGER for open channel flow, oddly shaped or horizontal tanks.

Smart Radar Sensor

The Radar RANGER utilizes an integrated smart "pulsed coherent radar" sensor designed for industrial level and open channel flow monitoring applications. The sensor combines 60GHz technology with phase compensation for increased accuracy and stability.

The sensor is integrated directly to the RANGER ensuring consistently accurate readings with no analog drift. The RANGER then applies advanced filtering and logic to ignore any noise or false echoes.

Smart Sensor Benefits

The smart sensor architecture provides several advantages for users:

- **Minimal Power Consumption**
  Since the Radar RANGER is a battery-powered unit, the sensor was designed to be extremely energy efficient which is ideal for remote installations allowing for frequent level updates
- **Digital Signal Integrity**
  Digital communication between the sensor and the Radar RANGER eliminates analog signal drift, false readings and improves long-term measurement stability.
- **24/7 Process Visibility**
  Connecting the Radar RANGER to SignalFire Cloud allows users to have visibility over their process from any internet connected device

Installing Radar RANGER

The Radar RANGER gets installed using the 1½-inch male NPT fitting which is made entirely of PEEK for added durability and chemical compatibility in the field. The face of the sensor should be free of contaminant, condensation, or any debris that could impact the reflected measurements

Prior to installation be sure to:

- Confirm dielectric constant of material being measured is between 10 – 100
- Confirm any surface disturbance such as foam, turbulence, boiling, or any other surface agitation
- Confirm how tank is filled and/or emptied; confirm location of filling on tank
- Confirm total measurable distance does not exceed 8m (26.2 feet)

During installation be sure to:

- Avoid center of the tank – position 1/6 to 1/4 of tank diameter from wall
- Ensure clear line of site between sensor face and process surface
- Check orientation – sensor should be mounted perpendicular to process surface
- Avoid foam on process surface
- Configure the blocking distance to ignore any reflections near the Ranger such as a nozzle

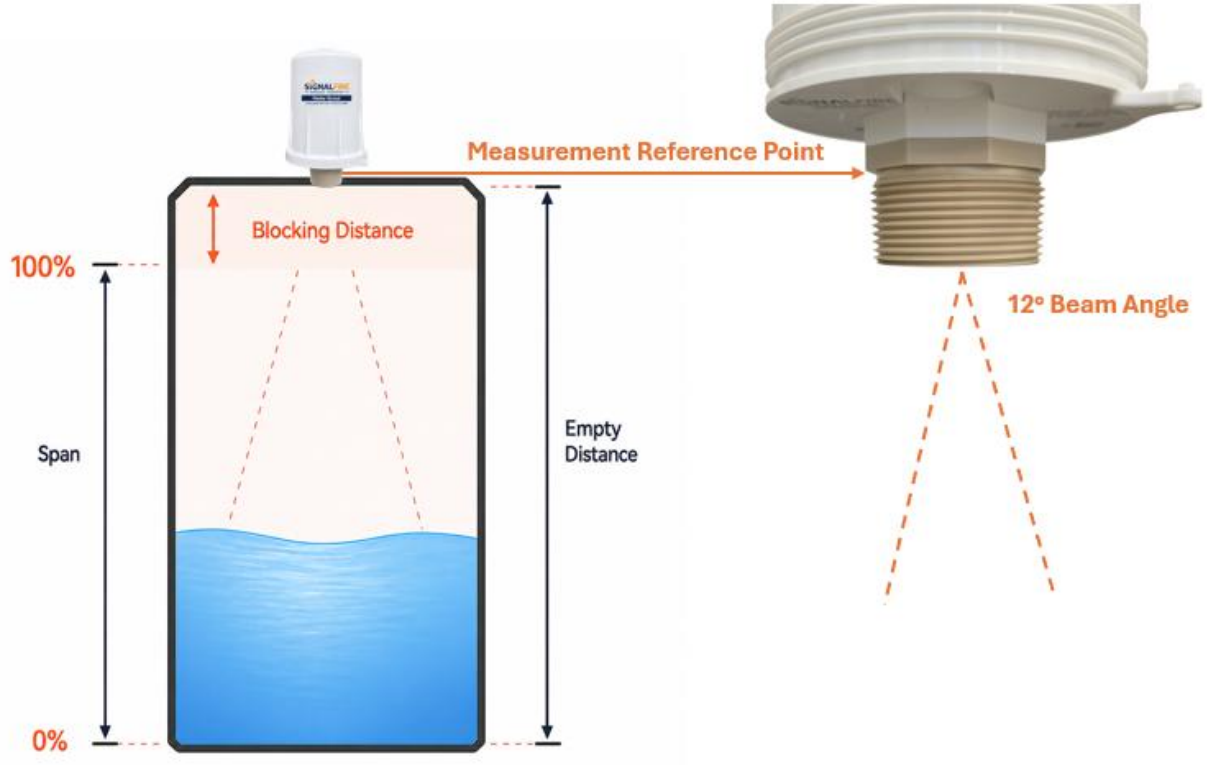


Image not to scale, for visual reference only

Setup

The Radar RANGER needs to be set up for correct operation before being installed. The configurable items include:

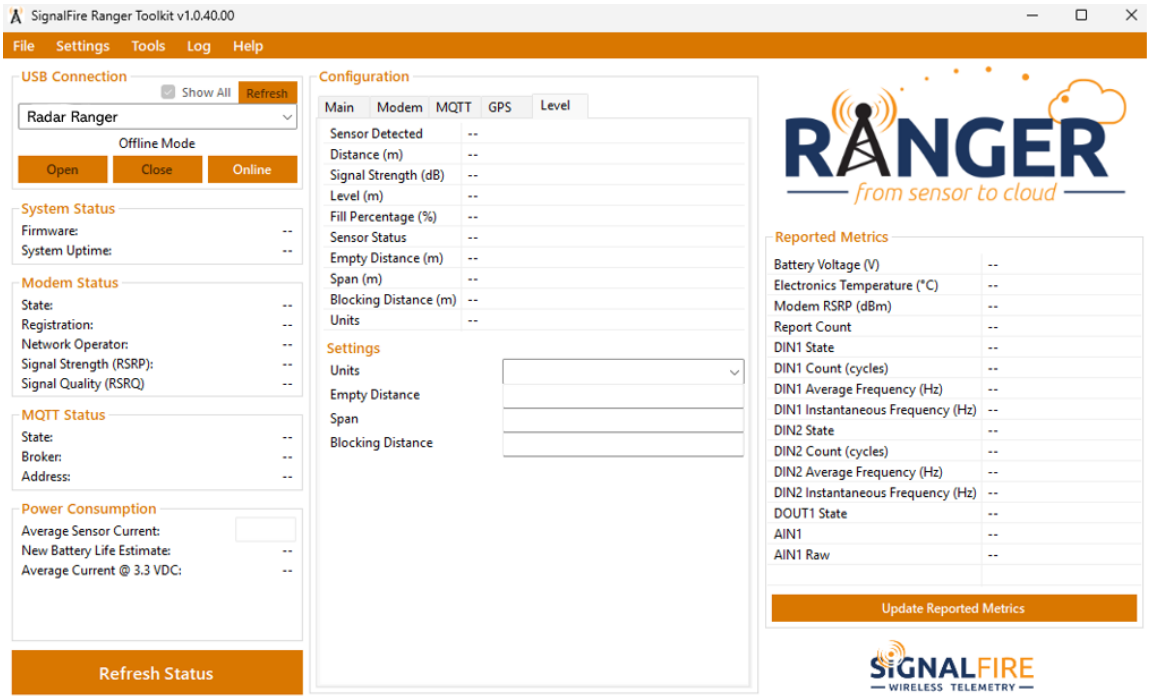
- Engineering Units
- Empty Distance
- Span
- Blocking Distance
- Strapping Chart

All settings can be made using the RANGER Toolkit PC application and a Micro-USB cable (included with Radar RANGER device).

Using the RANGER Toolkit

The RANGER Toolkit application can be downloaded and installed on any compatible Windows PC

After installation, launch the software and the main toolkit window will open:



Click to Download RANGER Toolkit

Engineering Units

The Radar RANGER's sensor measures distance (in meters) by default and then converts the distance into other engineering units to make it easier to interpret.

- meters (m)
- centimeters (cm)
- millimeters (mm)
- feet (ft)
- inches (in)

Empty Distance

The "empty distance" is the total distance from the measurement reference point to the bottom of the vessel when no material is present

Span

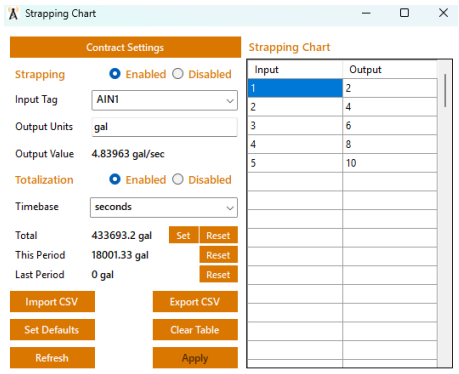
The "span" setting is the total distance the user wants to measure. It excludes any readings above the blocking distance. Span is adjustable and can be configured to report an empty tank even if material may still be present

Blocking Distance

The "blocking distance", often referred to as "blanking distance", is the total distance from the measurement reference point to the top of the process surface when the tank is considered full. Any reading sensed above this point is ignored by the Radar RANGER.

Strapping Chart

The "strapping chart" can be found under the "Settings" tab and it allows a user to rescale their level readings into a custom scale. The chart allows for up to 128 input points of scaling which can be input manually or imported using a .csv file. Optionally, by enabling "Totalization" and selecting a Timebase, the Radar RANGER will totalize the output value of the strapping chart over time and allow for automatic hourly or daily "Contract Periods". Current and previous period totals can be displayed on a Tile on SignalFire Cloud



Using SignalFire Cloud

Configuration settings on the Radar RANGER can be made or changed with your SignalFire Cloud account from any internet connected device.



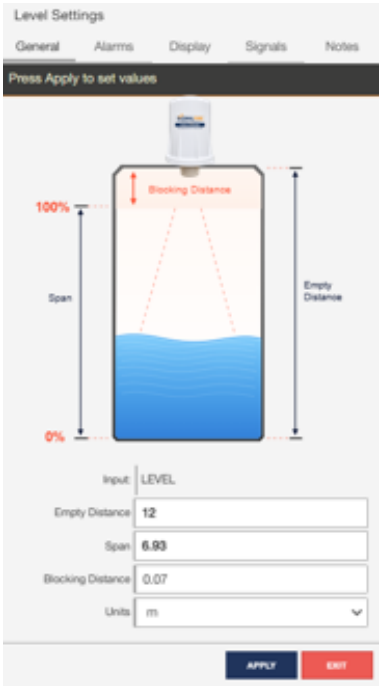
Level Settings

Once the Radar RANGER has been connected to SignalFire Cloud and claimed to your Group, you can remotely configure or adjust sensor settings, high/low level alarms, and view real-time sensor reflections

General

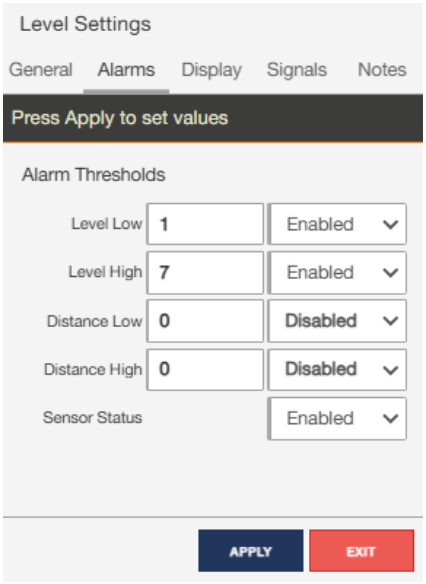
Under the General tab of the Level Settings, you can configure:

- **Empty Distance**
- **Span**
- **Blocking Distance**
- **Units**



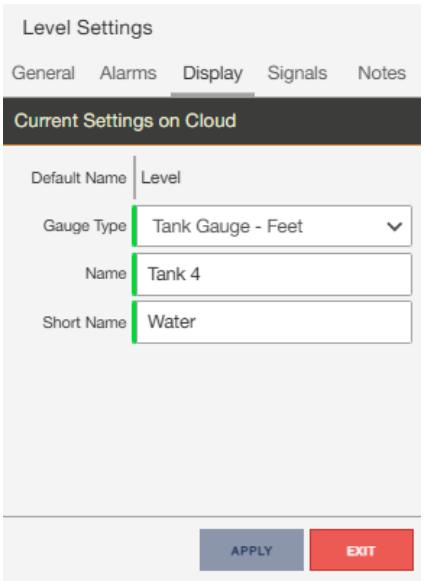
Alarms

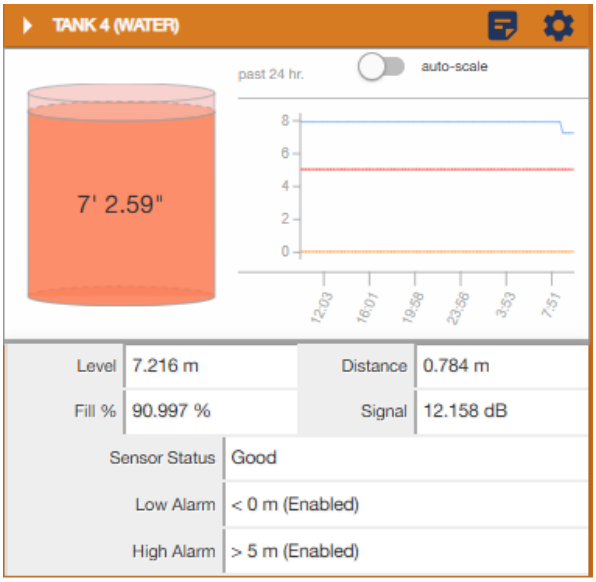
Three independent alarms can be configured in the Level Settings menu. These alarms are different from the low battery and offline alarms that are configured in the “Configure Node” screen.



Display

The display tab under “Level Settings” allows you to configure how your level reading(s) will display on the level “Tile”. You can choose from predefined tank gauging graphics and customize how the Tile is labeled and scaled



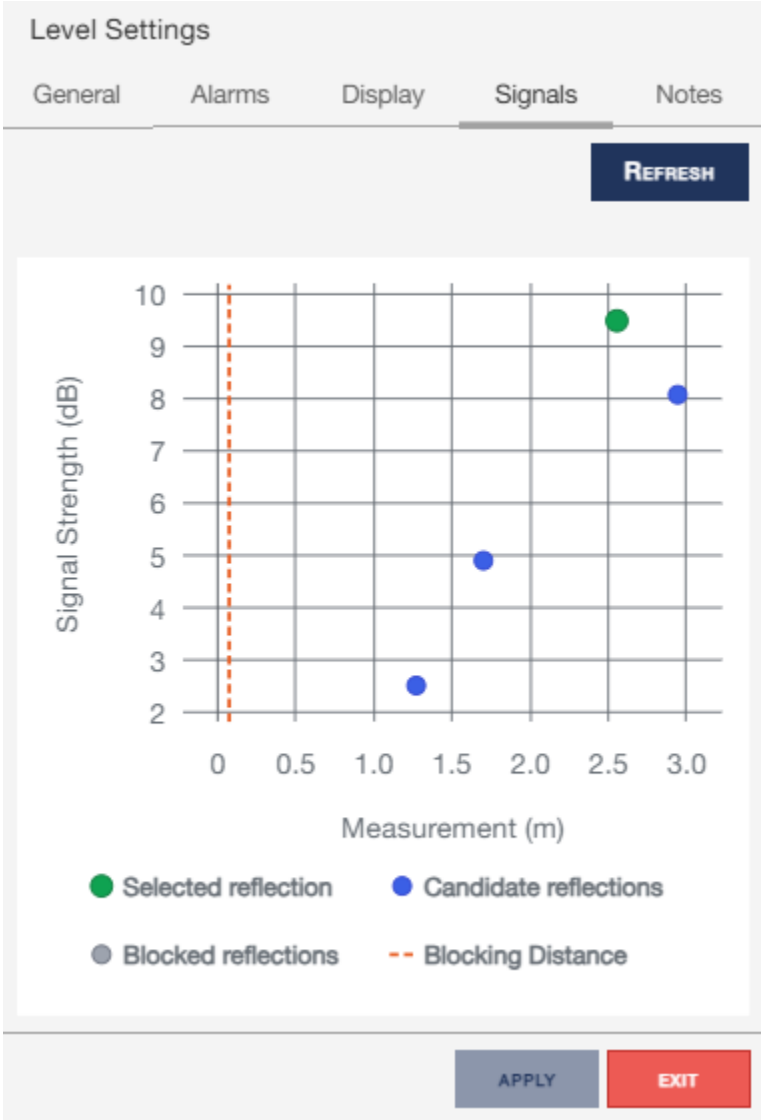


Signals

To ensure the Radar RANGER is not interpreting false echoes as your level measurement, the signals tab under "Level Settings" provides you with a convenient chart which displays all reflections the Radar RANGER can see in real-time.

A dashed red line indicates your configured "Blocking Distance" to ensure the Radar RANGER is blocking any reflections above it.

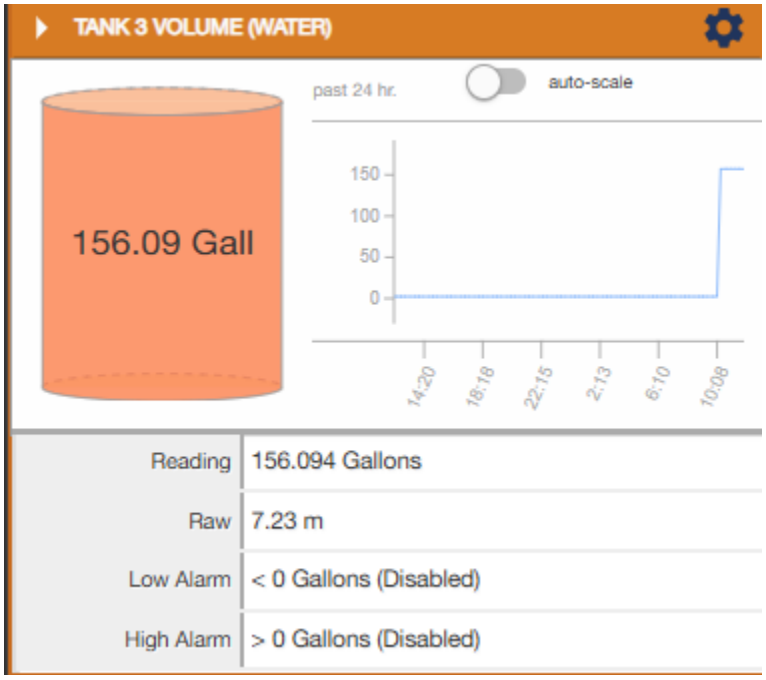
The chart shows the measured distance (in meters) on the X-axis while signal strength (in dB) is represented on the Y-axis.



Strapping Table

The strapping table allows you to rescale your “level”, “distance”, or “fill percentage” readings to display level in volume or any custom unit of measure. The Radar RANGER provides up to 128 points of scaling which is beneficial for horizontal cylindrical tanks, tanks with curved or conical bottoms, or irregular vessels which require non-linear scaling.

The Strapping Chart must be enabled in Radar RANGER Configuration window under the “General” tab by clicking “Configure Node” on the device page



Once enabled, click the settings icon on the Tile to configure settings

General

Under the “General” tab, you select which level metric you want to rescale

- **Level**
- **Distance**
- **Fill Percentage**

“Units” is a text field where you can enter whichever unit of measure you prefer

Alarms

Alarms are “Disabled” by default. To enable alarms, enter the “Low” and “High” alarm values based on the custom scale from the strapping table then select “Enable”

Display

Adjust how the Strapping Table will be displayed on its Tile when viewing your level data. You can choose between a Tank Gauge, Dial Guage, Value Gauge, or Linear Scale Gauge.

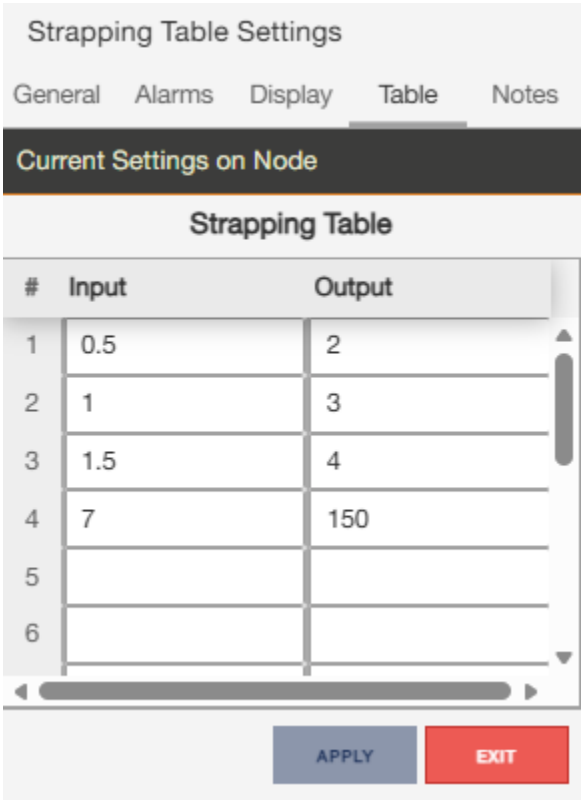
The display name(s) of the Tile can also be configured to add identifying labels such as tank number and material being measured for ease of use.

Table

The “Table” tab is where the input and output values are entered.

The “Input” will be the reported value for whichever metric was configured as the “Source Metric”. If the Source Metric is “Fill Percentage”, then the input values on the strapping table will be in percentage. For “Level” or “Distance”, the input values on the strapping table will be in meters (m).

The “Output” will be the desired volumetric output that will be displayed on the Tile.



128-Point Strapping Table on SignalFire Cloud

Cloud Account Setup and Information

Full documentation on using the SignalFire Cloud features and how to remotely configure your Radar RANGER is available in an online knowledge base. The SignalFire Cloud Manual provides instructions on user management, configuring alarms, generating reports, and more. Whether you are a new or experienced user, this manual serves as a valuable resource to maximize the platform's capabilities.



Click image for SignalFire Cloud Account Setup

Devices purchased with the SignalFire Cloud service come with a pre-installed SIM and a one-year subscription to SignalFire Cloud. Customers will require a login to access the SignalFire Cloud server. Please fill out the request form by clicking the image above.

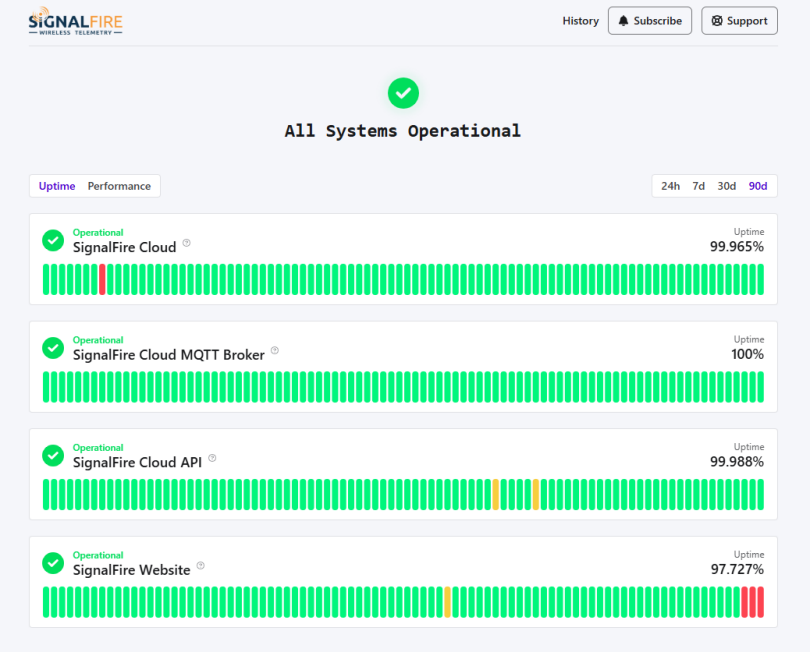
Adding the Radar RANGER to Your SignalFire Cloud Group

1. Plug in the battery so the Radar RANGER can connect to the cellular network
2. Verify the Radar RANGER is connected to the cellular network by pressing the "CHECKIN" button on the device and observe 3 blinks of the **green** Status LED
3. Login to SignalFire Cloud with your login credentials
4. From the Home page, click "Add Device"
5. Enter the serial number of the Radar RANGER and click "Claim". The serial number is located on the bottom of the device with a two-letter prefix followed by six numbers (e.g. RA123456)
6. A message will be sent to the Radar RANGER to claim it to your group account
7. After approximately 60 seconds, the device will connect to your account, and you will be automatically redirected to the device status page

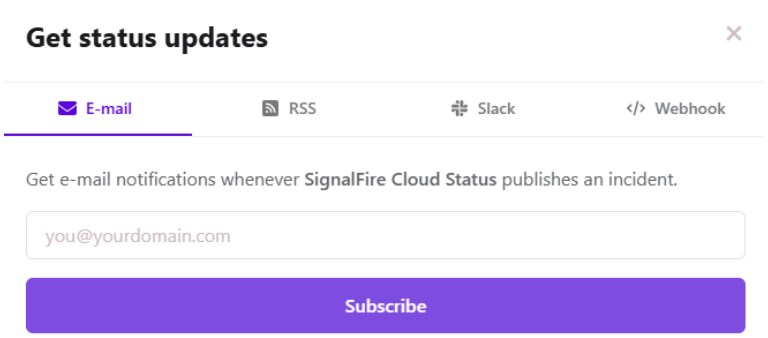
SignalFire Cloud Diagnostics

The Radar RANGER may appear offline from time to time, and in most cases it is due to a network issue outside of the user's control. If a Radar RANGER is on the Verizon 4G LTE-M network while Verizon is having connectivity issues, then the Radar RANGER will also have connectivity issues.

To determine if the root cause of the connectivity issue is on the SignalFire Cloud side of things, please visit st www.status.signal-fire.com to get a real-time status update for SignalFire Cloud, SignalFire's MQTT broker, SignalFire Cloud API, and the SignalFire Website itself.



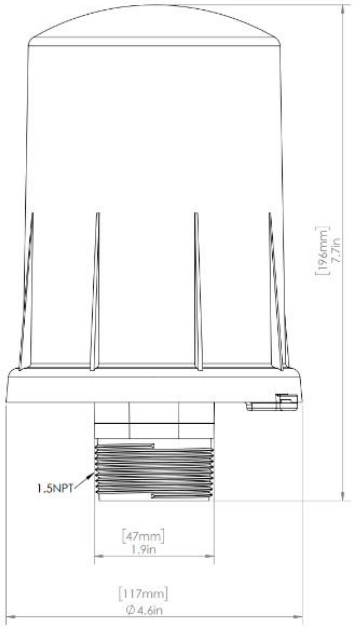
Click to View SignalFire Cloud Status



Optionally, users can elect to subscribe to updates from the SignalFire Cloud Status page via email, RSS feed, Slack, or a Webhook.

Mounting and Care

The Radar RANGER has a 1½" NPT fitting for mounting. Mount device so the sensor is perpendicular with process surface. Ensure the device is not mounted directly in the center of the tank and is at least ¼ to 1/6 the diameter away from any wall.



WARNING: The Radar RANGER must be mounted in a location free of high vibrations. Over time vibrations can damage the device or battery pack, which could impair its safety ratings. Do not mount directly to continuous vibrating equipment such as pumps or compressors.

Internal Lithium Battery Replacement

Battery Packs can be changed without removing the Radar RANGER from the process

1. Open the cover of the Radar RANGER
1. Unplug the battery from the PCB, by depressing the locking clip on the connector.
2. Remove the two screws holding the battery strap to the battery bracket
3. Remove/Replace the battery.
4. Reinstall the batter strap and screws
5. Connect the battery to the main PCB battery connector
6. Close the enclosure cover, use care to ensure that the wires are not pinched by the cover.

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.

Configuration / Debug

Debug and configuration information is available if a connection is made via the debug port on the main board. A Micro-USB cable must be used for this interface.

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

Disposal

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

Lithium Primary Battery:

This product contains lithium primary batteries, which must be removed before disposal. Lithium batteries must be recycled through specialized facilities due to their fire risk. Do not place batteries in regular trash.

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
1.0	11/2/26	Initial release

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.

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.

Technical Support And Contact Information

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SIGNALFIRE
WIRELESS TELEMETRY