RANGER AirQ Manual

The RANGER AirQ is a modular emission monitoring platform with integrated cellular communications. It monitors the presence of a gas and transmits the measurement wirelessly over LTE-M/NB-IoT cellular networks.

- Powers integrated MEMS transducer for detection of methane leaks and emissions
- Configurable from the SignalFire Cloud website signal-fire.cloud
- SignalFire Cloud allows for data visualization, trending, and alarming
- Supports continuous or scheduled monitoring and report by exception when gas is detected
- Supports MQTT Sparkplug communication protocol for connection to other servers
- Compact and simple to install and maintain
- Local configuration and diagnostics available using the micro-USB port and the SignalFire RANGER
- Internal backlog of 200,000 datapoints with automated store/forward functionality
- Class 1 Division 2 certified (pending)
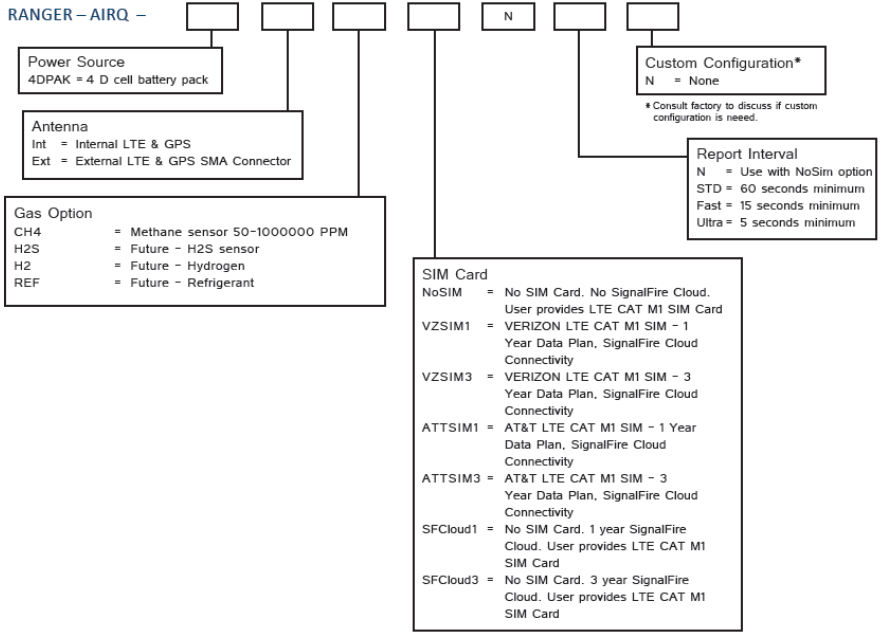
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Product Description

The RANGER AirQ is a modular wireless emission monitoring platform with integrated cellular communication. It monitors the presence of a gas and transmits the measurement wirelessly over LTE-M/NB-IoT cellular networks. The data is transmitted to the SignalFire Cloud and can be sent using MQTT/SparkPlug to a private cloud platform supporting this messaging standard. The gas detection sensor is powered from the built-in 72Ah battery. The measurements are also pinpointed geographically by the GPS module inside the RANGER AirQ. The smart gas sensor uses the latest in smart gas sensor technology providing for low power demand, stable and accurate measurement as well as long term stability with little to no calibration required. It automatically compensates for temperature and humidity when sampling a measurement and therefore delivers accurate measurements with low drift. It's low power requirements allow for long battery life.

Specifications

Enclosure Size	7.1" tall × 4.6" diameter
Power Source	Internal Lithium battery pack (SignalFire Part Number: 4DPak)
Temperature	-40DegF to 168DegF (-40°C to +75°C)
Rating Enclosure	IP67 rated. Polycarbonate
SIM Slot	Nano (4FF) SIM card (LTE Cat-M1 or NB-IoT provisioned SIM with data plan required)
Local config port	Standard micro-USB connector
Gas Sensor	• See table for details

Gas Sensor	Specifications	Details
CH4 Methane	Technology:	MEMS transducer
	Detection Range:	50 - 1,000,000 PPM 2 SCFH @ 30' (10m) distance
	Resolution:	1 PPM
	Calibration:	Factory Calibrated
	Accuracy:	+/-10% > 300PPM (typical @ 20DegC / 50% RH)
	Temperature:	-40DegC to +75DegC
	Atmospheric:	80kPa – 120kPa
	Measurements Provided:	PPM, Temperature, Atmospheric Pressure, Absolute Humidity, Relative Humidity
	Damp Heat-Steady State:	500 hours @ 40°C/93% RH
	Temperature Cycling:	From -40°C to 85°C for 200 cycles
	Sand/Dust:	Sand: 150-850 µm SiO2 particle size, 23 m/s nom. velocity, 1.5 hrs @ 70°C per axis, 3 axes Dust: Red China Clay, 1.5 m/s nom. velocity, 6 hrs @ 20°C and 6 hrs @ 70°C
	Battery Life:	15 Months in Continuous Sampling Mode 36 Months in Emissions Mode (Sampling @ 15 min) 48 Months in Emissions Mode (Sampling @ 30 min)
Key Features	Built-in environmental compensation · Inherently poison resistant · No calibration required · Supports 15+ year lifetimes	

Compliance	• Contains FCC ID: 2ANPO00NRF9160 and IC ID: 24529-NRF9160 • AT&T, AT&T FirstNET, Verizon Network Certified Certified for use in Class I, Division 2, Groups A, B, C, D areas. Temperature Code T5 EXi [EXi][UL 121201:2017 Ed.9+R:26Aug2019], [CSA C22.2#213:2017 Ed.3+U1;U2] **(Pending)**

Model Numbers

RANGER – AIRQ – [ ] [ ] [ ] [ ] [N] [ ] [ ]

Power Source
4DPAK = 4 D cell battery pack

Antenna
Int = Internal LTE & GPS
Ext = External LTE & GPS SMA Connector

Gas Option
CH4   = Methane sensor 50-1000000 PPM
H2S   = Future – H2S sensor
H2   = Future – Hydrogen
REF   = Future – Refrigerant

SIM Card
NoSIM   = No SIM Card. No SignalFire Cloud.
            User provides LTE CAT M1 SIM Card
VZSIM1   = VERIZON LTE CAT M1 SIM – 1
            Year Data Plan, SignalFire Cloud
            Connectivity
VZSIM3   = VERIZON LTE CAT M1 SIM – 3
            Year Data Plan, SignalFire Cloud
            Connectivity
ATTSIM1   = AT&T LTE CAT M1 SIM – 1 Year
            Data Plan, SignalFire Cloud
            Connectivity
ATTSIM3   = AT&T LTE CAT M1 SIM – 3
            Year Data Plan, SignalFire Cloud
            Connectivity
SFCloud1 = No SIM Card. 1 year SignalFire
            Cloud. User provides LTE CAT M1
            SIM Card
SFCloud3 = No SIM Card. 3 year SignalFire
            Cloud. User provides LTE CAT M1
            SIM Card

Custom Configuration*
N   = None

* Consult factory to discuss if custom
  configuration is neeed.

Report Interval
N   = Use with NoSim option
STD = 60 seconds minimum
Fast = 15 seconds minimum
Ultra = 5 seconds minimum

Hazardous Location Certification (Pending)

The RANGER AirQ is rated Class 1 Division 2 non-incendive when powered by its internal battery pack.

⚠ **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 materiel 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 – All wiring methods must be in accordance with the NEC**
AVERTISSEMENT - Toutes les méthodes de Essorez doivent être en conformité avec la NEC

⚠ **WARNING - EXPLOSION HAZARD. Do not remove or replace while the circuit is live unless the area is free of ignitable concentrations.**
AVERTISSEMENT - RISQUE D'EXPLOSION. Ne pas enlever ou remplacer pendant que le circuit est vivant à moins que la zone soit exempt de concentrations ignitibles.

⚠ **WARNING – EXPLOSION HAZARD. Do not remove or replace lamps, fuses, or plug-in modules (as applicable) unless power has been disconnected or the area is free of ignitable concentrations.**
AVERTISSEMENT - RISQUE D'EXPLOSION. Ne retirez ni ne remplacez les lampes, les fusibles ou les modules enfichables (le cas échéant) à moins que l'alimentation ait été coupée ou que la zone soit exempte de concentrations inflammables.
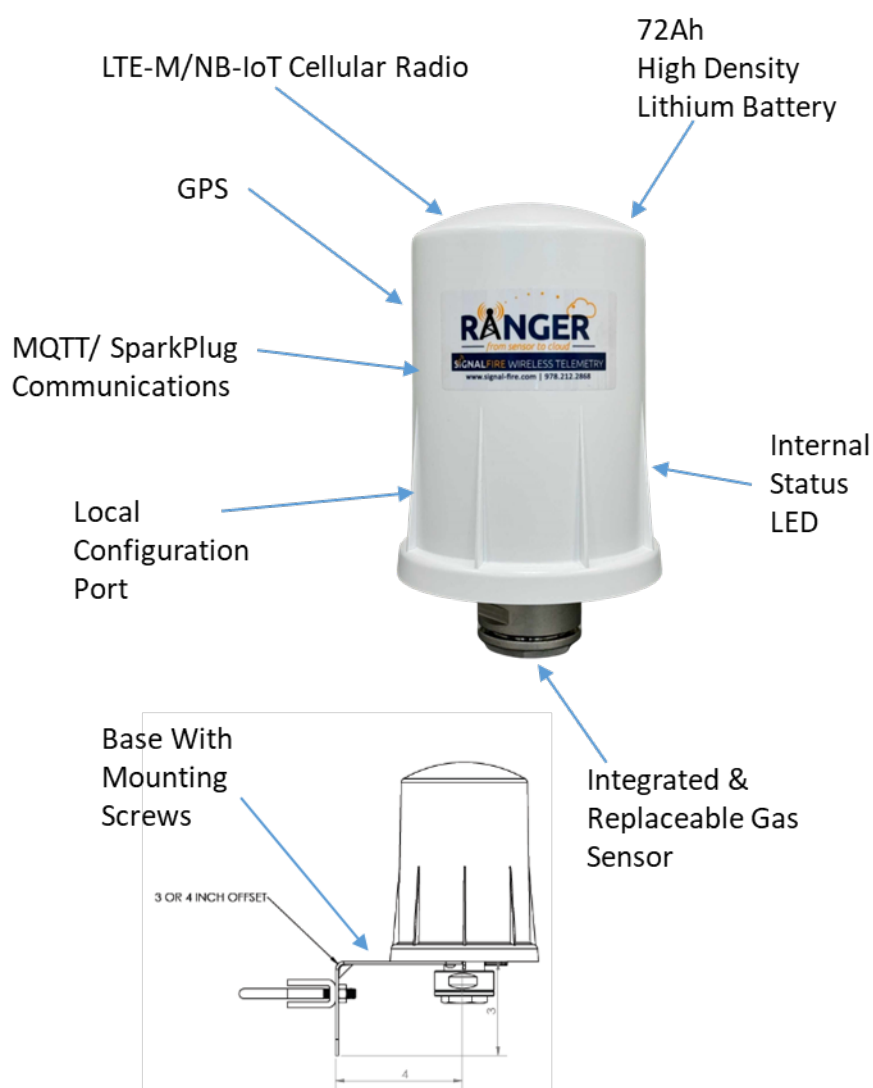
Connections and Components

STATUS LED
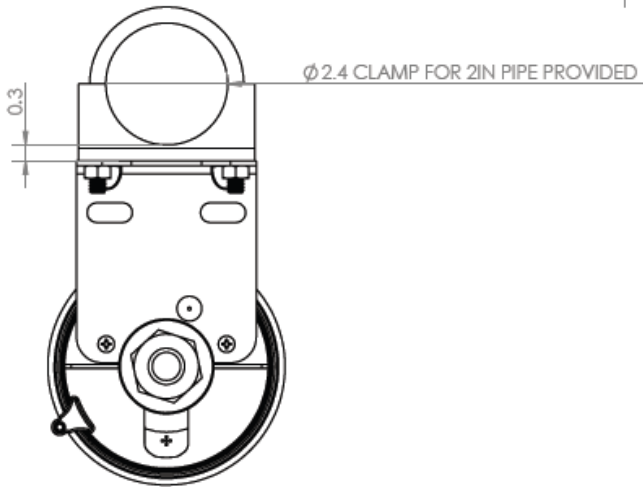- The STATUS LED (green) will flash 3 times on a successful data transmission to the server
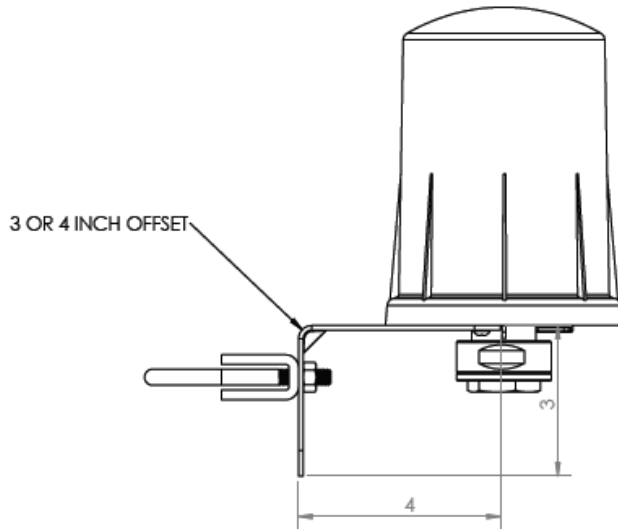
ERROR LED
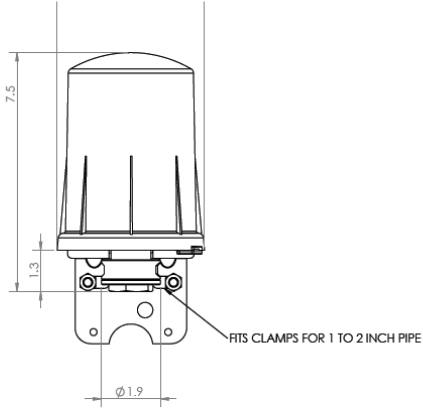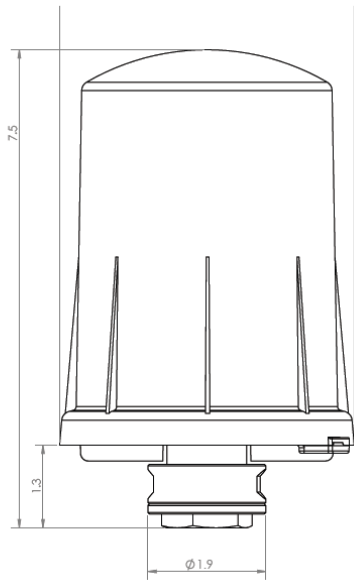- The ERROR LED (red) will blink 3 times to indicate that an attempted data transmission failed

Check-in Button
- If this button is pressed the RANGER AirQ will blink the Green or Red status LED 3 times to indicate the status of the last transmission to the server. If the Checkin button is pressed and held for more than 1 second, the RANGER AirQ will take readings from the attached sensor and send the readings to the server.

DIMENSIONS

7.5

1.3

Ø1.9

7.5

1.3

Ø1.9

FITS CLAMPS FOR 1 TO 2 INCH PIPE

3 OR 4 INCH OFFSET

3

4

0.3

Ø2.4 CLAMP FOR 2IN PIPE PROVIDED

Measurement Modes

Sensor	Measurement Mode	Sensor Power & Measurement Frequency	Values Reported
CH4	Continuous	Sensor continuously powered, Values reported every 15 min or by exception.	PPM Atmospheric Pressure
	Emissions	Sensor powered for 15 minutes at a set report interval. Values reported at the end of the 5 min sensor measurement time.	Ambient Temperature Relative Humidity Absolute Humidity
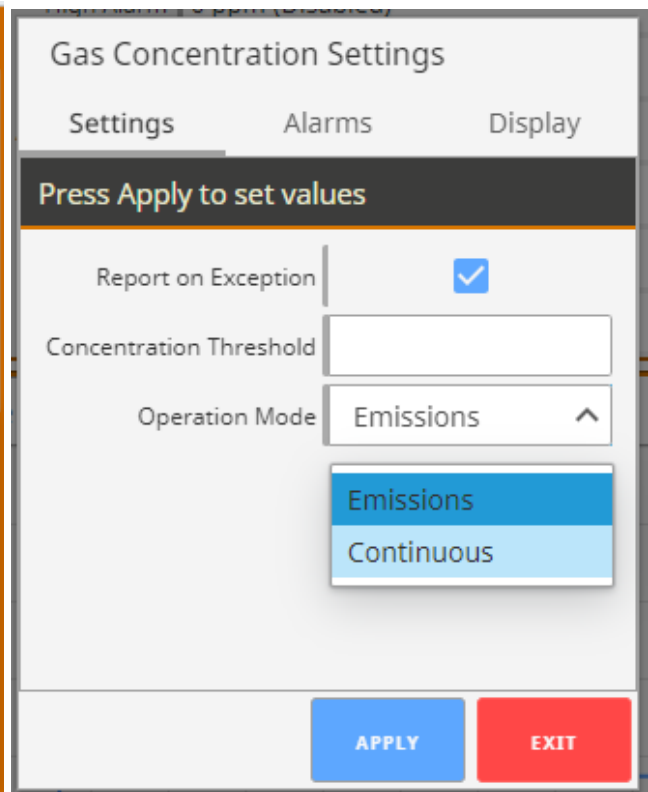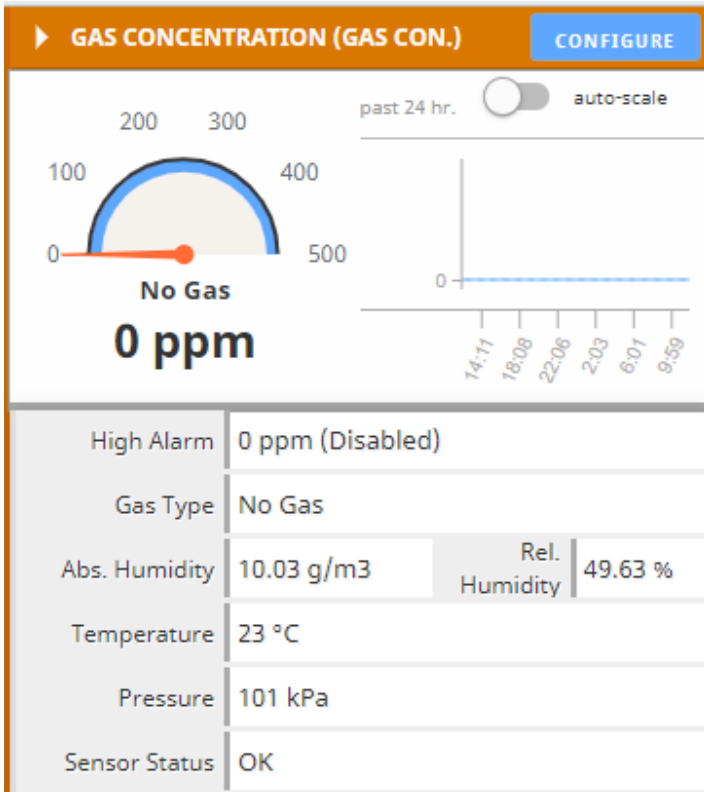
Initial Setup

After the RANGER AirQ has been claimed into the Signal Fire Cloud you will have to set the Operation Mode, the Concentration Threshold, and Report on Exception.

Report on Exception Threshold – How to configure

If Report on Exception is enabled, the RANGER AirQ will transmit data to the cloud when this threshold is crossed even if the Report Interval has not yet passed. It will continue to report every minute while the gas concentration is over the configured Concentration Threshold.

Concentration Threshold
The PPM (Parts Per Million) concentration of the gas detected to trigger Report on Exception

Operation Mode

Continuous Exception Report OFF

Continuous Exception Report ON
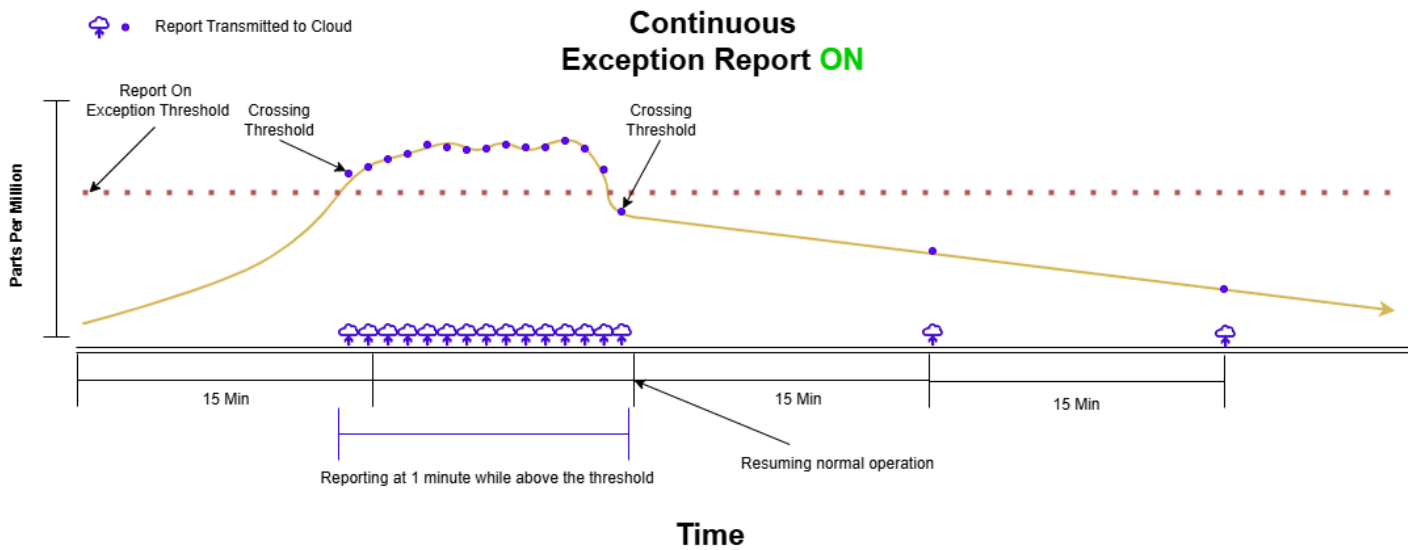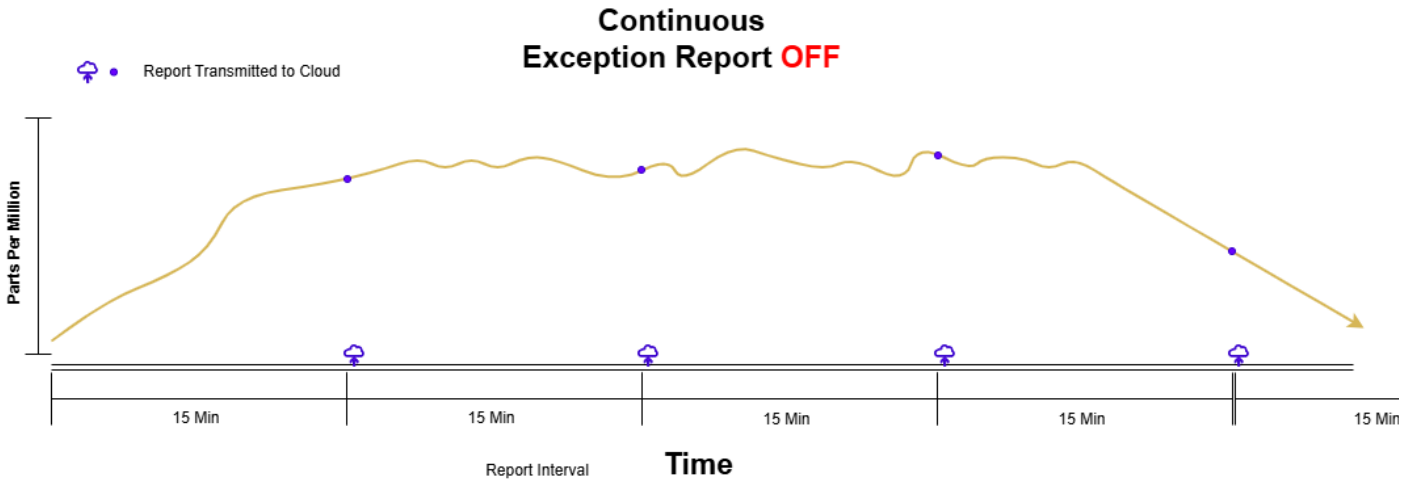
Continuous

Sensor continuously powered and sampled every 5-seconds. Values reported every 15 min or immediately by exception. This mode should be used where rapid detection of gas detection is necessary

Emissions Mode
Exception Report OFF

Emissions Mode
Exception Report ON
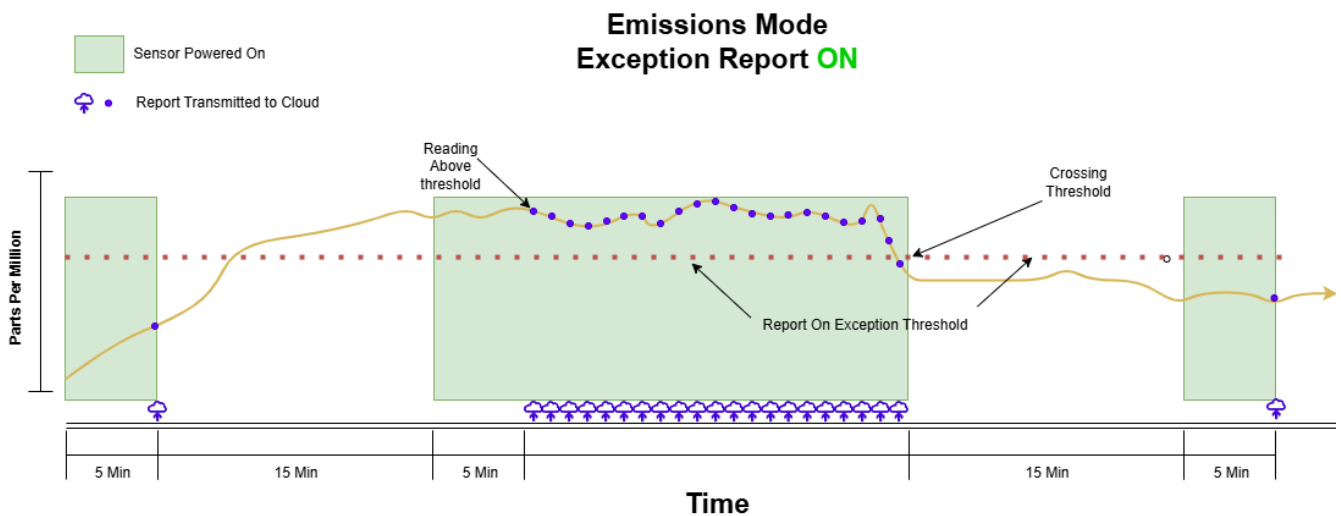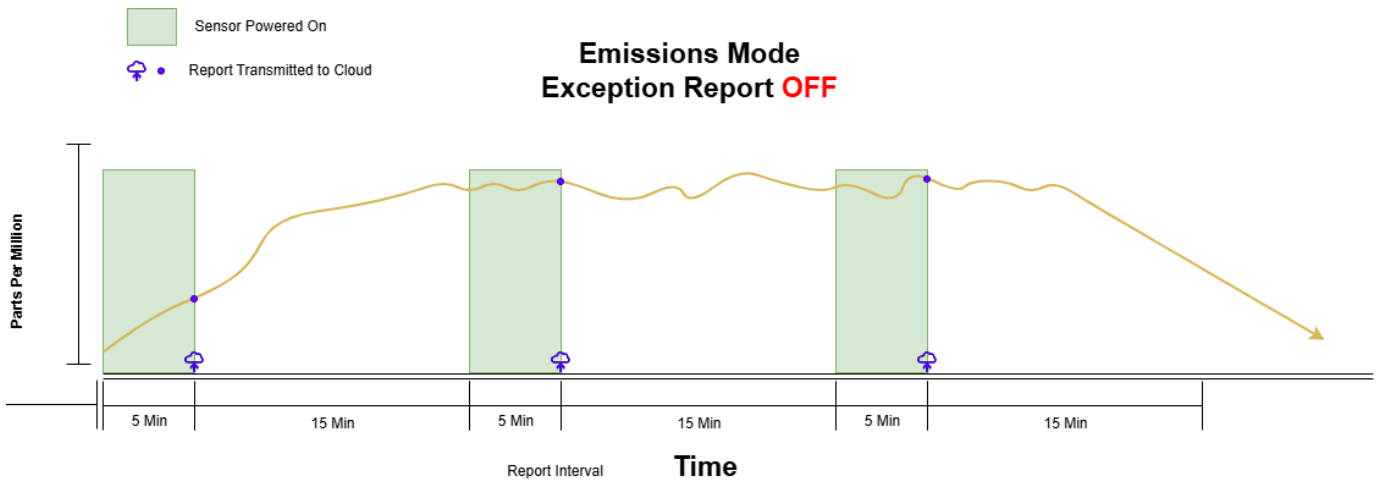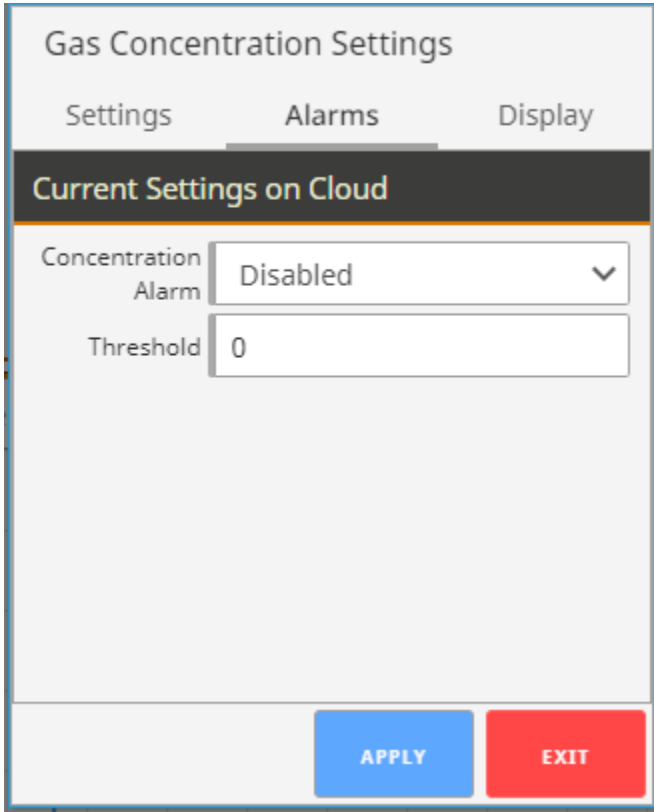
Emissions

The default operating mode is emissions mode. In Emissions mode the RANGER will power the gas sensor every 15 minutes for 5-minutes and take 5-second samples during that period. The sensor values will be reported at the end of the 5-minute sample period, then the sensor will be powered off until the next report interval. When Report on Exception is enabled, if during the 5-minute sample period the gas concentration crosses the configured threshold, the concentration will be reported immediately and then once a minute for as long as the concentration remains above the threshold. The report interval is configurable. This mode is useful for periodic sniffing for leaks and emissions.

Alarms

Alarms can be sent via SMS and/or Email to users when the Alarm conditions are met. The Threshold is set in Parts Per Million.

The alarm threshold can be different than the concentration threshold for report by exception.

CH4 Methane Sensor

Built-in environmental compensation · Inherently poison resistant · No calibration required · Supports 15+ year lifetimes

Values Reported

PPM – Parts per million of CH4 Detection Range: 50 - 1,000,000 PPM 2 SCFH @ 30' (10m) distance
Atmospheric Pressure - 80kPa – 120kPa
Ambient Temperature
Relative Humidity
Absolute Humidity

The sensor internally runs through a number of self diagnostics and will report an error code should a problem be detected. While in error the gas concentration will be reported as -100ppm. See table 1 for details.

Fault	Explanation
0x00	No Errors
0x01	Failed Checksum
0x02	Illegal or Bad Parameter
0x03	Execution Failed
0x04	Insufficient Memory
0x05	Unknown Command
0x07	Incomplete Command
0x21	Internal Voltage Out of Range
0x22	Voltage Out of Range
0x24	Env Sensor Malfunction
0x25	Microcontroller Error
0x26	Sensor in Initialization Mode
0x32	Gas Sensing Element Malfunction

Table 1 – Gas Sensor Error Codes

MQTT/SparkPlug Topics

Topics can be subscribed to using MQTT/SparkPlug protocol. The RANGER AirQ can provide its topic to subscribers other than the SignalFire Cloud. The list of topics can be found in the Document Center on signal-fire.com. Consult with SignalFire for more information on subscribing to the MQTT broker or to setup the RANGER AirQ to publish to a different MQTT Broker.

Mounting Information

The RANGER AirQ comes with a mounting bracket and U-Bolt for mounting to a vertical 2" pipe

3 OR 4 INCH OFFSET

[76mm]
3.0in

[102mm]
4.0in
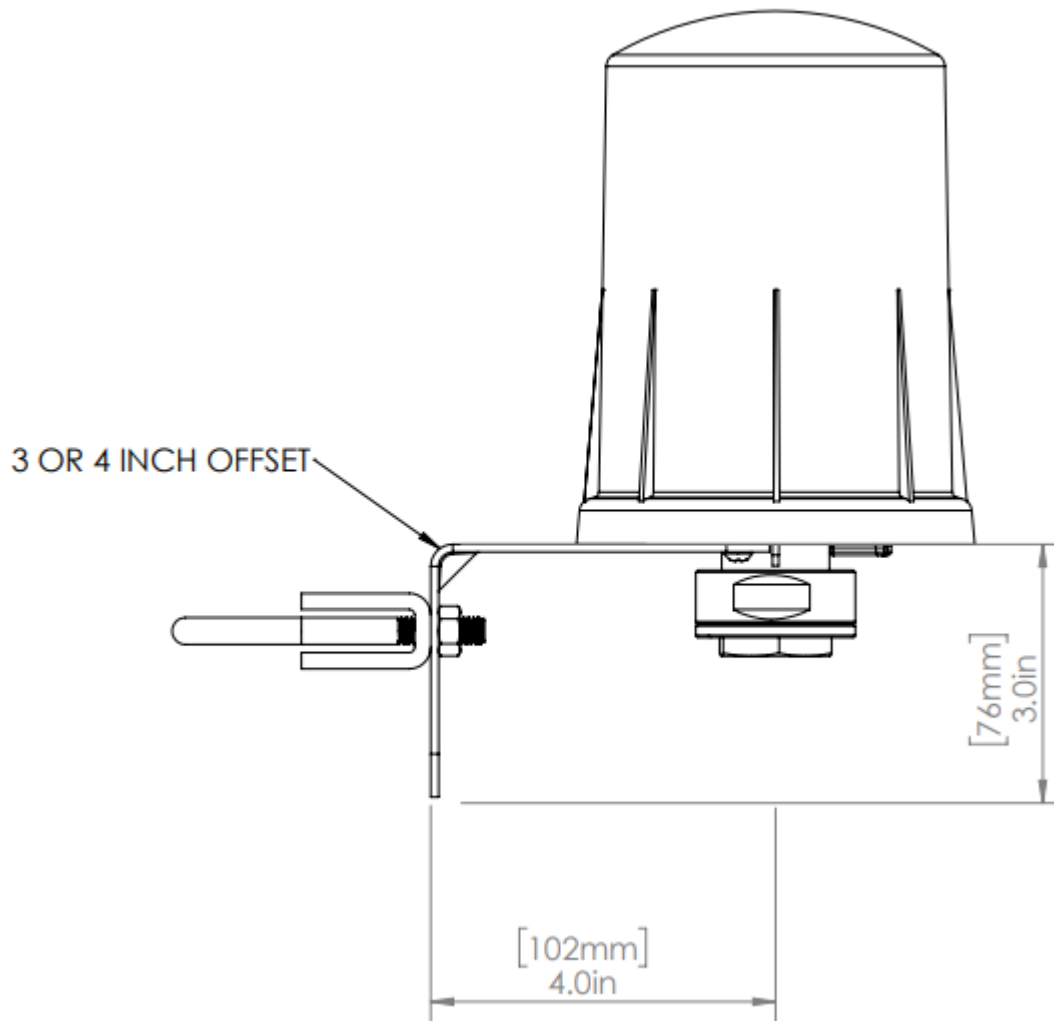
⚠ **WARNING: The RANGER must be mounted in a location free of high vibrations. Over time vibrations can damage the RANGER or battery pack, which could impair its safety ratings. Do not mount directly to continuous vibrating equipment such as pumps or compressors.**

Sensor Zero and Calibration

The MEMS sensor is factory calibrated and does not require in field calibration

Power Options

Lithium Battery Pack (4DPak)

The internal lithium battery pack is the default power source for the RANGER AirQ, simply plug the battery pack into the RANGER AirQ PCB battery connector to power the RANGER AirQ on.

Internal Lithium Battery Replacement

Battery Packs can be changed with the node in place.
1. Unscrew the cover from the base.
2. Unplug the battery from the PCB, by depressing the locking clip on the connector.
3. **Loosen the three screws that attach the circuit board assembly to the base. Do not remove the two screws that attach the antenna assembly**
4. Remove/replace battery
5. Re-install circuit board assembly. Do not overtighten the screws
6. Connect the battery to the main PCB battery connector.
7. Install the enclosure cover.

Product Disposal Information

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.

Cloud Setup and Information

Full documentation on using the SignalFire Cloud features and how to remotely configure your RANGER is available in an online knowledge base. The 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.

https://www.signal-fire.com/cloud-manual/

Link to SF Cloud

Link to SF Cloud Account Creation

Devices purchased with the SignalFire Cloud service come with a pre-installed SIM card. Customers will require a login to access the SignalFire Cloud server. Please fill out the request form using the button on the right below to set up your company site.

Adding the RANGER to your SignalFire Cloud Group

1. Plug in the battery so the RANGER can connect to the cellular network.

2. Verify that the RANGER is connected to the cellular network by pressing the "CHECKIN" button on the device and observe 3 strobes of the green status light.

3. Login to the SignalFire Cloud with your account login/password

4. From the Home page click "Add Device"

5. Enter the RANGER serial number and click "Claim". The serial number is located on the bottom of the RANGER with a format of "RA" followed by 6 numbers. (e.g. RA123456)

6. A message will be sent to the RANGER to claim it to your group account

7. Within approximately one minute the device will connect to your account, and you will be automatically redirected to the device status page

Technical Support and Contact Information

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(978) 212-2868
support@signal-fire.com

Revision History

Revision	Date	Changes/Updates/Author
1.0	10/29/2024	Initial release