VERTIV™

Wireless Sensor Network (WSN)

Installer/User Guide

WSN Flex V2 and WSN Gateway V2

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Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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1 Important Safety Instructions

SAVE THESE INSTRUCTIONS

This manual contains important safety instructions. Follow all of these instructions during installation and maintenance of the Vertiv™ Wireless Sensor Network (WSN). Read this manual thoroughly before attempting to install or operate this unit.

Only properly trained and qualified personnel should move, install, or service this equipment.

Adhere to all warnings, cautions, installation, operating, and safety instructions on the unit and within this manual. Follow all operating and user instructions.

⚠ **WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ controller.**

Installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers' specifications. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.

⚠ **WARNING! Risk of short circuits and electric shock. Can cause serious injury or death. Building and equipment damage can result from cut insulation or damaged wires. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel, and loss of power to fans. Verify that all wiring connections are tight and that all wiring is contained within the junction box prior to closing and securing the cover.**

Insert CSA-certified or UL-listed bushings into holes and/or knockouts used to route wiring through metal panels to protect the wire insulation from contact with sheet metal edges.

⚠ **WARNING! Risk of improper wire sizing/rating and loose electrical connections causing overheated wire and electrical connection terminals resulting in smoke or fire. Can cause serious injury or death. Building and equipment damage may also result. Use correctly sized copper wire only and verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.**

NOTE: Installation outside of approved methods of the Vertiv™ WSN Gateway or Vertiv™ WSN Flex Sensor will void warranty.

NOTICE

Risk of improper control circuits. Can cause equipment damage.

When using jumpers for troubleshooting, always remove jumpers when maintenance is complete. Jumpers left connected could override controls and cause equipment damage.

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2 Overview

2.1 Introduction

The Vertiv™ Wireless Sensor Network (WSN) uses a gateway and sensor nodes that use a direct sensor to gateway communication path for environmental monitoring and control. Each application is different in that the final installed system performance is dependent on a number of factors that are not within Vertiv's control.

The sensor nodes contain multiple on-board or connected sensors allowing for multiple data points to be communicated wirelessly back to the gateway to be aggregated and displayed. Selected data is communicated out of the gateway to connected systems using wired means. The system can be controlled or monitored with system or user configuration values.

This solution offers a join process where advanced sensor nodes can be easily and securely added to the gateway using auto-discovery—programming cables are not required. After sensor nodes have been added securely, the network can be locked down to prevent unknown devices from entering the network. The gateway can support connectivity and communication with up to 300 sensor nodes on a fully populated system.

For enhanced environmental sensing capabilities, Vertiv™ WSN FLEX sensor nodes provide:

- Temperature and humidity measurement
- Digital/analog IO
- A Piezo buzzer

The sensor nodes can be powered using two methods with automatic failover between all power methods to increase up time and availability, prioritized in the following order:

1. Standard local USB-C power source
2. Internal batteries

When sensors are joined to the gateway, communication begins automatically and data is made available via SNMP or Modbus TCP protocol and to an API to externally connected clients.

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3 List of Components

Components included in each order are provided below.

Table 3.1 Vertiv™ WSN Gateway Components

Quantity	Description
1	Vertiv™ WSN Gateway
1	Wall Wart with 6.6 ft. (2 m) Cable to Barrel Plug
1	2.2 dBi Dipole Antenna with RP SMA Plug
1	12 ft Antenna Cable assembly with Mounting Bracket

Table 3.2 Vertiv™ WSN Flex Sensor

Quantity	Description
1	Vertiv™ WSN Flex T/H/Buzzer sensor
2	AA Energizer Ultimate Lithium Batteries
1	Sensor Mounting Kit includes: • Sensor Hook Loop Mounting Plate (with Embedded Magnet and Rubber Feet) • Two 4 in. Zip Ties • Two Wall Mount Screws • Two Plastic Wall Anchors

NOTE: The Vertiv™ WSN Flex Sensor can also be powered locally with or without batteries using a USB-C cable (not included with order).

3.1 Receiving and Handling

Upon receipt of the Vertiv™ WSN solution components:

- Verify that the labeled equipment matches the bill of lading.
- Inspect all items for visible and concealed damage. If damage is noted:
  - Report damage immediately to the carrier.
  - Send a copy of the filed damage claim to Vertiv or your sales representative.

NOTE: Optional items may be shipped separately or loose. These items will be indicated on the packing list.

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4 System Requirements

The PC or laptop used to configure the gateway must meet the following requirements:

- Chrome version 76.0.3808 or higher or Microsoft Edge version 90 or higher.
- 10/100/1000 base-TX Ethernet communication protocol.

NOTE: Vertiv recommends the use of the Chrome browser.

4.1 Preparing the PC or Laptop

To connect the gateway, the connecting PC or laptop must first be placed on the corresponding network that lines up with **Table 4.1** below .

Table 4.1 Default Gateway Network Settings

Connection	IPv4 Address	Subnet Mask	Default Gateway
Ethernet port 1	192.168.1.10	255.255.255.0	None
Ethernet port 2	192.168.2.10	255.255.255.0	None

Use the following procedure to change the PC or laptop network settings. See **Figure 4.1** below .

1. Open *Windows Control Panel* and select **Network and Internet**, then select **Network and Sharing Center**.
2. Click ***Change Adapter Settings*** .
3. Right click the Ethernet connection that is being use and select *Properties*.
4. Select *Internet Protocol Version 4 (TCP/IPv4)* and click **Properties**.
5. Select **Use the following IP address.**
6. Enter an **IP address** that is on the same subnet as the gateway port that is being accessed. Do not use the same IP address as the gateway port itself. Examples:
   - An IP address of 192.168.1.11 on the PC or laptop allows access to port 1 of the gateway.
   - An IP address of 192.168.2.11 on the PC or laptop will allow access to port 2 of the gateway.
7. Enter this **subnet mask**: 255.255.255.0.

Figure 4.1 PC or Laptop IP Settings Connecting Port 1 to the Gateway

Proprietary and Confidential ©2025 Vertiv Group Corp.
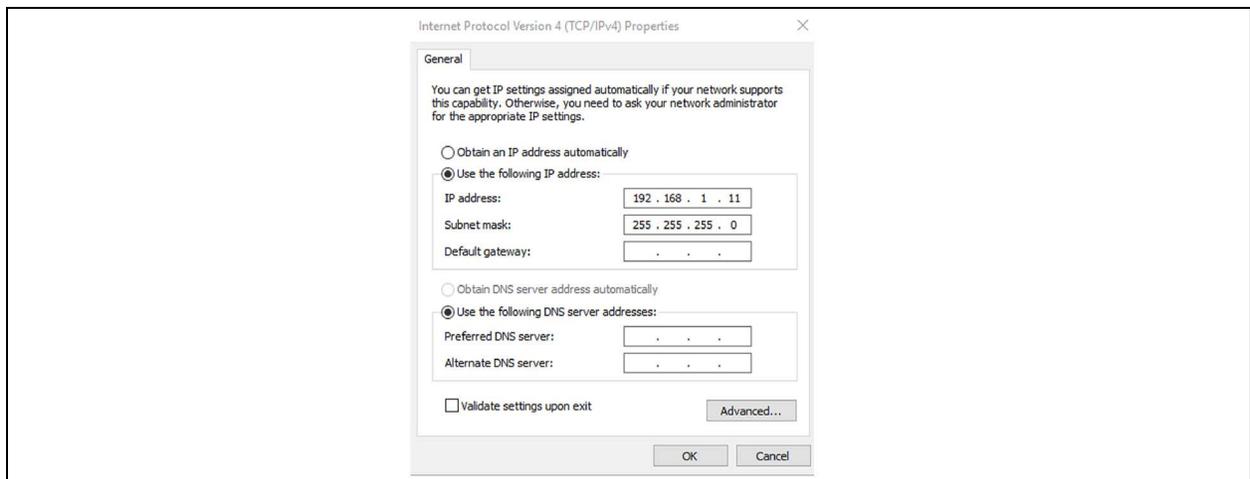
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5 Hardware Installation

⚠️ **WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The Vertiv™ Liebert® iCOM™ controller does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "unit off" mode of the Liebert® iCOM™ controller.**

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5.1 Overview

NOTE: Read this manual thoroughly before installing or operating this unit. Only properly trained and qualified personnel should move, install, or service this equipment.

The following subsections provide detailed instructions and information regarding connecting and configuring the gateway.

See **Figure 5.1** on the next page , **Figure 5.3** on page 11 and **Figure 5.4** on page 12 for the illustrations of each of the components.

NOTE: Some gateways are used in standalone applications and do not reside on a network. In these cases, it is still important to configure the items outlined in this section.

Figure 5.1 Gateway, Front View

Figure 5.2 Gateway, Rear View

Figure 5.3 Sensor with Mounting Kit

Item	Description
1	Sensor
2	Sensor mounting kit on back

5.2 Equipment Installation and Recommendations

NOTE: The technology used in the Vertiv™ WSN is a direct sensor to gateway communication path. Every application is different in that final installed system performance is dependent on a significant number of factors not within the control of Vertiv. The guidelines provided in this section are recommendations only and Vertiv makes no guarantee for system performance in every application.

NOTE: Gateways and sensors are intended for indoor use only.

5.3 Gateway Installation

5.3.1 Location

- The final location should be near the center of the final installed sensor field.
- Mount at a height that minimizes the number of obstructions near the antenna, between the gateway and sensor nodes.
- Align the sensor to gateway antenna communication paths in a parallel alignment to the direction of rack rows as much as possible to reduce perpendicular obstructions to the wireless signal.
- In high density data center environments, a maximum diameter of roughly 300 ft. (with gateway at the center) is recommended. Open environments and applications with clear line of sight support longer distances.
- The gateway antenna should be adjusted such that it is perpendicular to the floor.

5.3.2 Gateway Physical Description

The gateway electronics are enclosed in a steel casing. The enclosure has connections for Power, Ethernet and an antenna. The unit is designed to be mounted in a 1U rack next to another gateway or Vertiv's RDU301 gateway. The gateway can also be wall mounted with the available holes or DIN rail.

Figure 5.4 Gateway

Item	Description
1	Front Gateway
2	Back Gateway
3	Side Gateway

5.3.3 Gateway Mounting Considerations

This section provides information to properly mount the gateway and make electrical connections, including the wiring, grounding, and host system connections.

The unit itself is not designed for outdoor mounting without a suitable enclosure. The gateway should be mounted in an approved electrical enclosure inside of a building and in a location that allows convenient access to the host system network process control network, and to the wireless field device network. The location of the unit must protect the gateway from contamination and moisture.

5.3.4 Mounting the Gateway

The gateway can be placed inside a rack or snapped onto a standard 35 mm DIN rail system.

To use a rack mount:

1. Undo the six screws on the side of the gateway.
2. Place the rack mount on the sides of the gateway and re-add the six screws into place.

To clip the unit onto the DIN rail:

3. Tilt the unit at a slight angle to allow the lower lip of the chassis to catch the bottom of the DIN rail.
4. Apply simultaneous pressure up and towards the DIN rail to snap the back of the unit securely onto the rail.

To remove the unit:

1. Lift the gateway base station while also pulling the top away from the DIN rail.
2. Once the unit is released from the DIN rail, slide the entire unit down until the bottom hooks are clear of the DIN rail.

NOTE: Follow FCC recommendations for RF exposure warning to maintain a minimum of 7.9 in. (20 cm) clearance for bystanders and antenna co-location.

Screw the antenna into the SMA plug on top of the gateway. Ensure the antenna is perpendicular to the ground for best reception.

5.3.5 Application

Once power is applied to the gateway, the gateway will boot up and be ready to access either of the RJ45 CAT5/6 Ethernet ports on the side of the gateway. The gateway is available when the blue status LED on the front is active.

5.4 Electrical Grounding

The DIN rail should always be grounded in accordance with national and local electrical codes. The most effective grounding method is a direct connection to earth ground with minimal impedance. Grounding to the gateway is accomplished through the DIN rail clip on the back of the gateway. The negative power lead on the DC input cable is also internally connected to the gateway enclosure.

5.5 Connecting and Powering the Gateway

Physically connect the PC or laptop to the gateway with an Ethernet cable and power the gateway using these steps:

1. Connect one end to the Ethernet port of the PC or laptop.

NOTE: Make sure the PC or laptop Ethernet port's IP is set correctly. See Preparing the PC or Laptop on page 7 for more details.

2. Connect the other end to one of the Ethernet ports on the gateway.
3. Connect the IEC C13 power cord into the gateway.

NOTE: The gateway also supports Power On Ethernet (PoE) on either port 1 or port 2.

NOTE: The auxiliary power cable may also be used. If using the auxiliary power cable, see the Using the Auxiliary Power Cable on page 1.

4. Plug the power supply into a standard 110/120 VAC receptacle.

5.6 Ethernet Connections

The Gateway is equipped with two 10/100/1000 base-TX Ethernet communication ports. These connections can be used to access the gateway's web interface. In addition, these ports can be used to communicate BMS protocols like SNMP and Modbus TCP.

NOTE: The gateway also supports Power over Ethernet (PoE) on either port 1 or port 2.

5.7 Configuring the Gateway

The gateway boot-up takes approximately 2-1/2 minutes to complete.

After powering the gateway on, the green power LED will be illuminated but the blue status LED will not be lit until the boot-up sequence is complete.

Once the blue status LED is lit, you can log onto the gateway for the first time and begin configuration. The following items need to be configured:

1. Log into the gateway for the first time using:

   User = admin

   Password = admin (Depending on the current firmware, the password could be blank.)

   Changing this default password is required to first access the gateway for any viewing/configuration.

   Password requirements are: Minimum 8 characters, required upper, lower alpha numeric with 1 special character.

2. Login again with your Username and new Password.
3. Time settings. Gateway time settings and time stamps are stored internally as UTC time. The gateway allows time setting via manual entry in the configuration web page. See Resetting the Time and Date on page 23 for more information on setting the time and date correctly.
4. IP network settings. Prior to the gateway being installed and connected to a live network, it should be configured with an IP address if the network requires an IP address other than the defaults provided in Table 4.1 on page 7 . See Reconfiguring a Port on page 24 for more information on configuring the IP Config page.

NOTE: Initial access to the gateway must occur using one of the default IP addresses. Once the gateway's IP address has been changed, communications to the web interface will be lost if it is connected to the port that is being changed. If this occurs, the PC or laptop connected to the gateway must be moved to the same subnet that the gateway was moved to before access can be re-gained.

5.8 Orienting the Antenna

The antenna is a dipole. The antenna should always be adjusted such that it is perpendicular to the ground. In this orientation, the transmit and receive pattern allows it to essentially function as an omnidirectional antenna.

Table 5.1 Antenna Specifications

| Model Specification	Specification
Model	RFA-ZW-C55-U-B70-1
Frequency	865-928 MHz
Peak Gain	2.2 dBi
Average Gain	0.2 dBi
VSWR	3.0 : 1 Max
Polarization	Linear, vertical
Connector	RP-SMA PLUG
Dimensions	137 mm

5.9 Resetting to Factory Defaults

In the event that the IP addresses of the gateway ports are lost, the gateway can be restored to factory defaults by pressing and holding the reset button until the blue status light turns off.

The reset button can be accessed on the front of the gateway.

Performing a reset on the gateway only resets the IP addresses on the ports and leaves all other sensor data and system configuration intact.

Figure 5.5 Antenna Reset Location
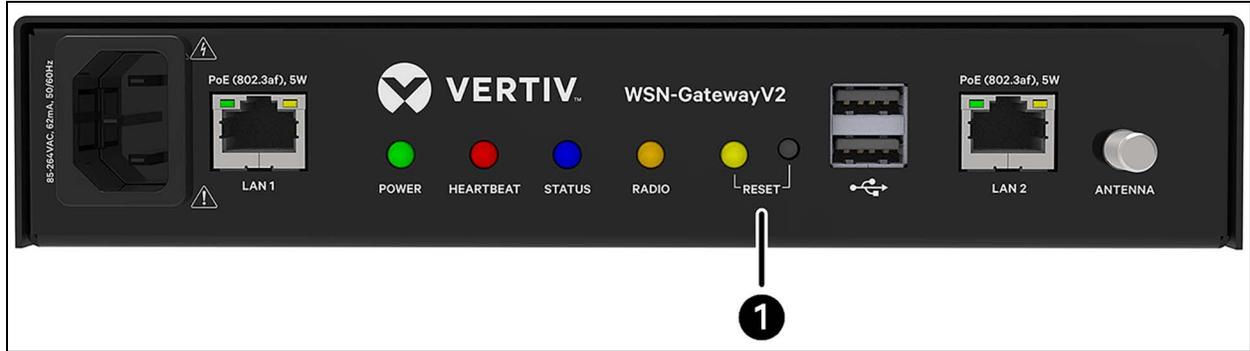
Item	Description
1	Reset

6 Sensor

The Vertiv™ WSN FLEX sensor is a LoRa-enabled wireless temperature and humidity sensor providing an ultra low power, long-range solution for your wireless sensor needs.

The WSN FLEX sensor incorporates long-range LoRa wireless radio technology which combines ultra long range spread spectrum communications with high interference immunity while minimizing power consumption.

6.1 Sensor Features

- Accurate temperature and humidity sensing (self-calibrating), +/- 0.3 °C, +/- 2% relative humidity.

- Dynamic power throttling for optimizing performance and battery life.

- Cable-free sensor to gateway auto-discovery.

- E-ink Display for low-power visuals.

- Automatic power source switching between available power sources for no downtime.

- The USB-C port can provide constant power for the sensor, if needed.

- Bidirectional communication between sensor and gateway.

- Custom sensor enclosure with sensor element airflow optimization.

- Configurable sensor polling rates.

- The built-in internal batteries provide support for the smaller sensor footprint when frequent data updates are not needed.

- Status LED lights. Red, blue, and green are used to indicate user notifications. When LED lights are lit individually, each color indicates the following, see to **Table 6.1** below .

Table 6.1 Status Light Colors and Notifications

Color	Time LED Is Lit	Notification
Red	2 seconds	Sensor is powering down
Blue	2 seconds	Sensor has joined network
Green	1 second	Sensor has transmitted data

- Locate Sensor Mode - Users can select a sensor they wish to find and the sensor will flash all three LEDs and beep for an entire sensor update duration. When the sensor is located, it can be silenced through the press of a button.

6.2 Location in Data Centers

Figure 6.1 Sensor Locations
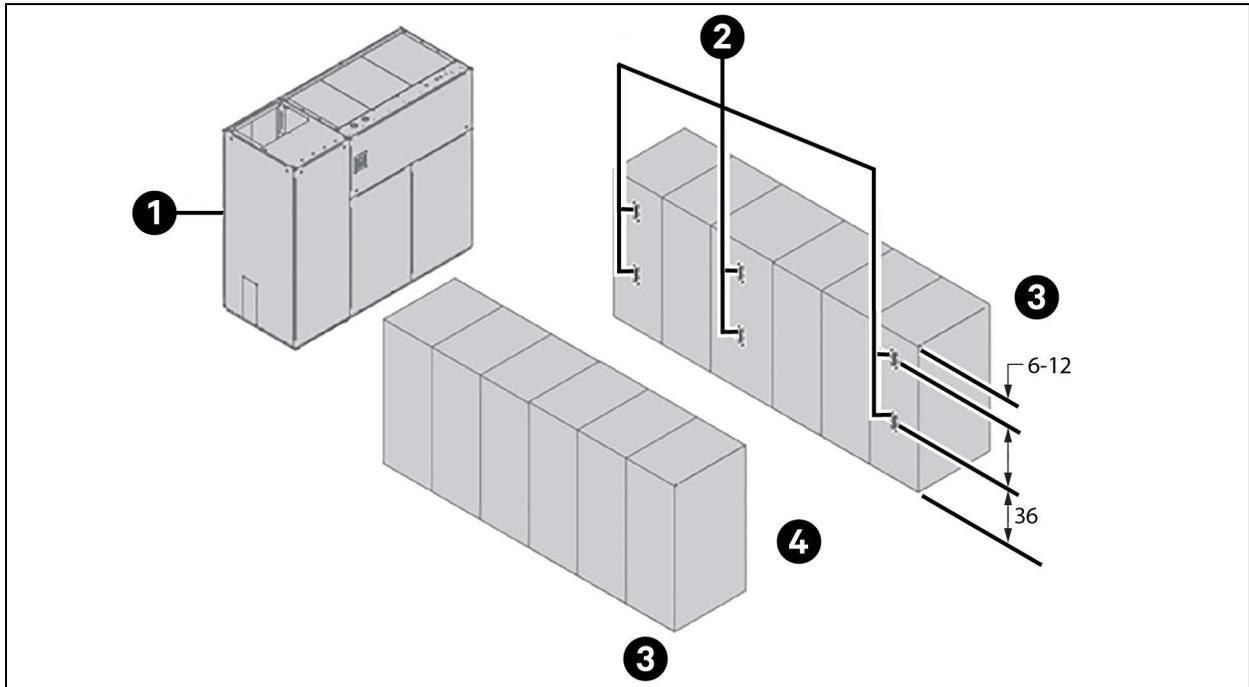
Item	Description
1	Thermal management unit
2	Wireless sensor
3	Non-controlled aisle (can be monitored)
4	Controlled aisle
NOTE: All Dimensions are in inch (in.)	

Table 6.2 Sensor Locations in Data Centers

Application	Recommendation
Non-contained aisle control applications	• Minimum of two sensors per controlled standard rack face • Each third rack has sensors
Contained aisle control applications	• Minimum of two sensors per controlled standard rack face • Each fourth rack has sensors
End racks on rows	• Has sensors to detect wrap-around air flow • Racks in between should use guidelines above
Standard rack face	• Typical locations are 6 in. to 12 in. from top of rack (depending upon the location of rack equipment) • Halfway (typically 36 in.)
Additional sensors can be used as needed for more granular control or monitoring.	

6.3 Sensor Mounting Considerations

Sensors are shipped with a mounting bracket and accessories to support magnetic, zip tie and wall mount applications. The mounting bracket uses a hook assembly that aligns with the back of the sensor and the extended battery pack. The hook assembly can be used for either.

Table 6.3 Sensor Mounting Considerations

Installation Mounting Consideration	Installation Action
Mounting to perforated metal door	• Locate and place mounting bracket on rack face. • While magnetized, use the zip ties to securely attach bracket to perforated door. • Once attached, slide sensor onto the mounting bracket until it clicks.
Mounting to ferrous surface	• Slide the sensor onto the mounting bracket until it clicks. • Place the completed assembly onto the metal surface.
Mounting to a solid wall or surface	• Use the included screws or anchors as needed to attach the mounting bracket to the surface. • Once attached, slide the sensor onto the mounting bracket until it clicks.

Figure 6.2 Mounting Bracket Detail

⚠️ **CAUTION: Using mounting methods that are not listed in Table 6.3 above may result in communicator or sensor issues. This may result in no communication to gateway, reduced battery lifespan, safety hazards, damage to batteries, and other issues. Using methods other than those listed in Table 6.3 above constitute a voided warranty and Vertiv is not liable for damages resulting from improper installation methods.**

6.4 Sensor Start Up

The sensor does not have a power switch, so initially it can only power up when internal batteries are inserted into the sensor.

When the internal batteries are inserted into the sensor or the Select button (middle button) is pressed on the front of the sensor, the red, blue, and green LED lights will light together for three seconds.

During this three second period, pressing the Select button again turns the red LED on for two seconds and then the sensor enters a deep sleep mode.

If the Select button is not pressed and the three second time period expires, the red, blue, and green LED lights will strobe for up to 30 seconds while the sensor tries to join the Vertiv™ WSN.

If the sensor is able to connect to the gateway, it will beep twice and the blue LED will turn on for two seconds to signify a successful connection. After the sensor is connected, it will begin to send payload data to the LoRa server on its programmed update rate.

When the sensor initially sends its payload, the green LED is lit for one second each time the payload is sent. This repeats for five payload cycles and the sensor will go into a dark mode where the LEDs no longer light in order to maximize battery life.

If the sensor is unable to connect to the gateway, then the red, blue, and green LEDs turn off and the sensor will go into deep sleep mode until the Select button is pressed again to try to join the network.

6.5 Sensor Power Down

To power down the sensor, follow these instructions.

1. Insert the batteries into the sensor or press the **Select button** on the front of the sensor.
2. The red, blue, and green LEDs will all be lit solid for three seconds.

During this three second time period, if the Select button is pressed again, the red LED will be solid for two seconds and the sensor power will be turned off. The sensor is then in a deep sleep mode and can be stored long-term with minimum power draw.

6.6 Sensor Characteristics

6.6.1 Sensor Default Configuration

The sensor firmware provides default operation for all configurable parameters. These parameters may be changed by the user when a sensor is deployed and in active operation. Changes in parameters are not remembered across power cycles because non-volatile memory is not used in the sensor. If a sensor reset (cold start) is performed or if the batteries are replaced, the configurable parameters will revert to the defaults as listed in **Table 6.4** below .

Table 6.4 Sensor Default Parameters

Configurable Parameter	Value
Sensor Update Rate	30 seconds
Temperature Units	°F
Beeper	On

6.6.2   Sensor Restart (Cold Start)

The sensor current draw is extremely low while the sensor is sleeping between payload transmission. There is enough capacitance to keep the processor alive for up to a minute when the processor is sleeping. If batteries are removed and then reinstalled before the sensor tries to send a payload, the sensor does not have knowledge of the battery removal and no notification will be communicated.

To completely reset the device and perform a cold start:

1. Remove batteries from the sensor.
2. Momentarily press the **Select button** on the front of the sensor.
   - This immediately discharges the energy from the internal capacitors.
3. Reinstall the batteries.
   - When batteries are fully reinstalled, the normal power up sequence occurs.

6.6.3 Low Battery Voltage

The sensor has a built-in power supply that converts the battery voltage to that which is required by the internal circuitry. The sensor is designed to operate with a battery voltage range of approximately 2.0 V to 3.7 V. If the battery voltage falls below approximately 2.0 V (approximately 1.0 V on each cell), the batteries do not have enough capacity to support an RF transmission and the voltage will collapse when this process is attempted.

If a sensor is operating with batteries in this state, the following sequence occurs:

1. The sensor powers up as indicated by all three LEDs solidly displaying for three seconds.
2. Depending on the battery capacity, the following scenarios may occur:
   - The sensor may join the network as indicated by two beeps and a solid blue LED for two seconds. However, the sensor typically will not have enough capacity to transmit the first payload, which happens five seconds after a successful join. At this point, a short green LED blip will occur as the sensor tries to transmit the first payload but the battery voltage collapses enough to cause the processor to reset.
   - If the batteries are extremely low, the battery voltage will collapse while the sensor is trying to join the network and cause the processor to reset. In this situation, the three LEDs come on solid, which is what happens after a processor reset. The three LEDs may cause the battery voltage to sag or the subsequent light strobing and sensor join process may cause the battery voltage to sag and the processor will reset.
   - This cycle of processor resets followed by some activity on the sensor continues until the batteries are completely depleted.

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7 Software Setup

7.1 Accessing the Software

To access the internal web page:

- Type the **IP address** of the gateway into the address bar of the browser. After entering the IP address, a security page may display. Click on the *Advance link* on the security page to access to the login page.

NOTE: Vertiv recommends the use of the Chrome browser.

The first page to load is the Devices page. See **Figure 7.1** below .The first time that a gateway is powered up, the Devices list will be empty. **Figure 7.1** below shows a system after 10 sensors have been connected.

Figure 7.1 Devices Page

7.1.1 Resetting the Time and Date

The gateway ships from the factory with the time and date already set. The gateway has a real-time clock with a battery backup which will retain the time and date for seven years. If the time and date need to be reset for any reason, use the following procedure.

NOTE: If the gateway is not connected to a host system which can set the date and time using the RESTful API, the time and date must be set manually using these procedures.

NOTE: Gateway time must be set using Universal Coordinated Time.

1. Navigate to the **System—Date and Time** page. See **Figure 7.2** on the next page .
2. Click into the *System Date and Time field*.
   - Each element within this field (MM/DD/YY HH:MM:SS AM/PM) can be selected and manually edited.
   - Click *Submit* to save the new values.

Figure 7.2 System—Date and Time Page
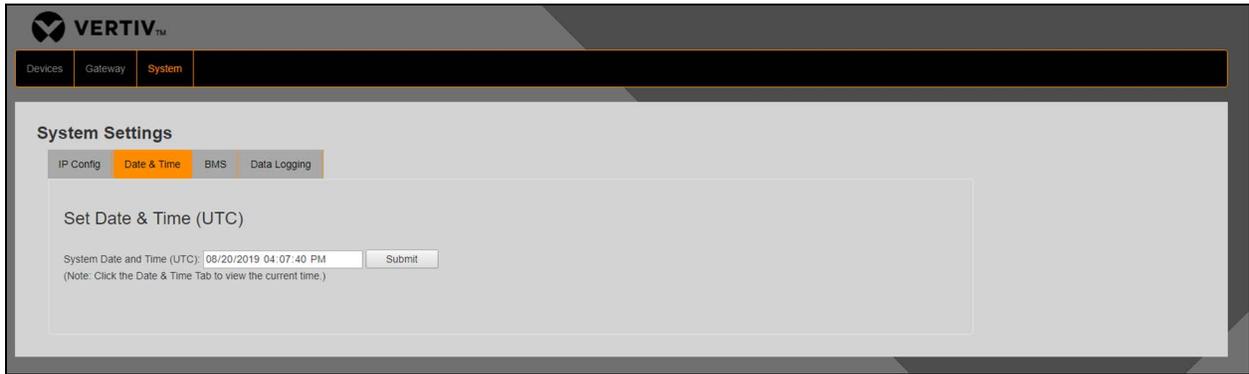
The clock does not increment the display on this page in real time. Each time the page is refreshed, it will display the actual time on the gateway. Refreshing this page can be used as confirmation that the clock has been set and is advancing properly.

After the time and date have been set on the gateway, the IP address of each Ethernet port should be set if add, something other than the default settings are desired.

7.1.2 Reconfiguring a Port

To reconfigure a port, navigate to the **System—IP Configuration page**. See Figure 7.3 below .

Figure 7.3 System—IP Configuration Page
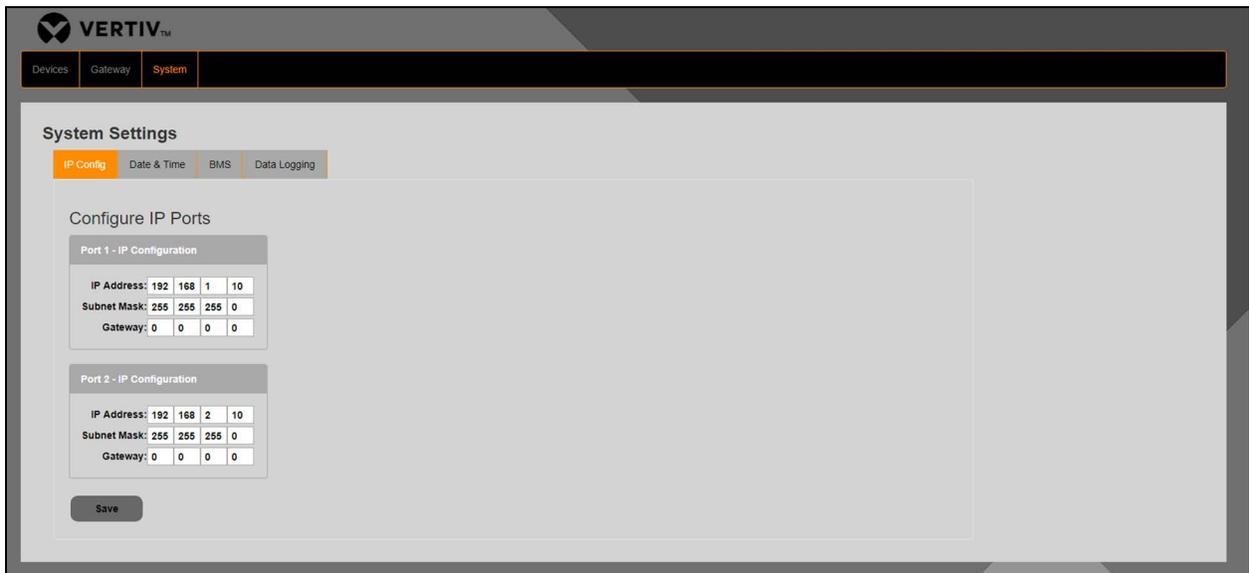
To reconfigure either port, enter the new values for the I**P Address, Subnet Mask,** and **Gateway** and click *Save*.

If the port configuration is changed for the same port that the PC or laptop is connected to, the PC or laptop Ethernet settings will need to be updated to match the same subnet before access to this configuration page can be restored.

7.2 Adding Sensors to the Network

After the gateway system is configured, sensors can be added to the network using the WSNConnect feature. This feature automates all of the network join requirements so to avoid having to manually enter sensor data into the gateway before it will join the network.

To add sensors, follow this procedure:

1. Navigate to the Devices web page. See to **Figure 7.1** on page 23 .
2. Click the *WSNConnect slide* bar to turn the feature on.
3. When the WSNConnect feature is on, install the batteries in a sensor or press the Select button on the front of the sensor to start the join process.
4. The Devices web page will refresh when the gateway detects a new sensor join request.

Figure 7.4 Sensor and Mount, Select Button Location

Item	Description
1	Select Button

NOTE: Sensors are automatically named using the next sequential number available.

7.2.1 Sensor Devices Editor

This feature allows the user to add and/or remove sensors in the Devices list. This feature is helpful for the following actions:

- To group sections of the room and add a new gateway later.
- To key on specific object identifiers (OIDs) associated with sensors for BMS clients who have set up monitoring software.
- To replace a sensor in the list, while all OIDs are left intact for the remainder of the system.

To remove the sensor device and leave a space, follow the below steps:

Figure 7.5 Removal of the Sensor Device
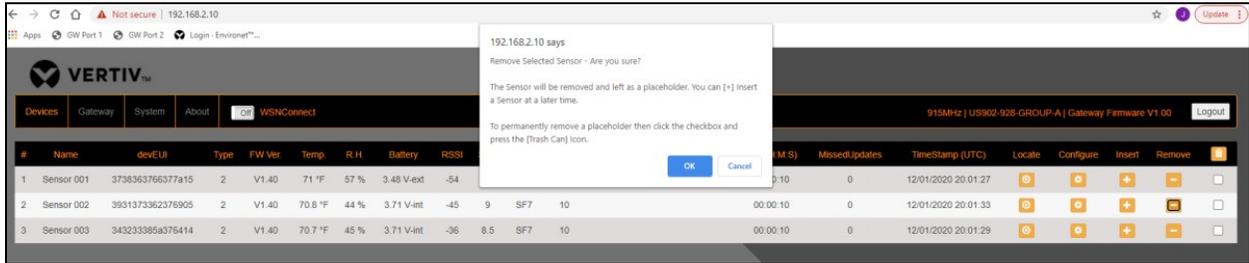
1. Press the minus (-) icon on the line, under the Remove column to remove a sensor and leave a space.
2. Click *OK* to remove the column and confirm the action.

NOTE: After confirming, the sensor name and index number are retained, but the device has been removed from the database and there will be no live data.

To insert a new sensor device where a previous space has been created, follow the below steps:

Figure 7.6 Addition of the Sensor Device
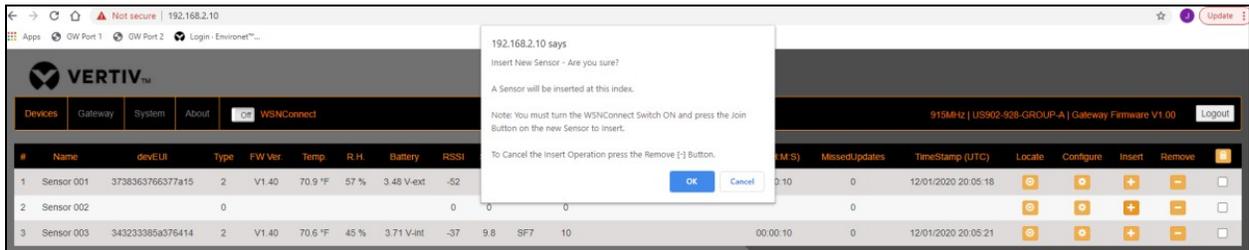
NOTE: When a sensor device is removed, a space is created on the line.

1. Click the plus (+) icon on the line, under the Insert column to insert a new sensor where the sensor has been previously removed.
2. Click *OK* to confirm the action.

NOTE: A green highlighted message will instruct you to join a new sensor.

3. At this point, turn on WSNConnect and press the V button on the new sensor that needs to be added. The new sensor will be inserted at the selected index.

To insert a new sensor device between two existing sensors, follow the below steps:

Figure 7.7 Addition of the Sensor Device between Existing Sensors
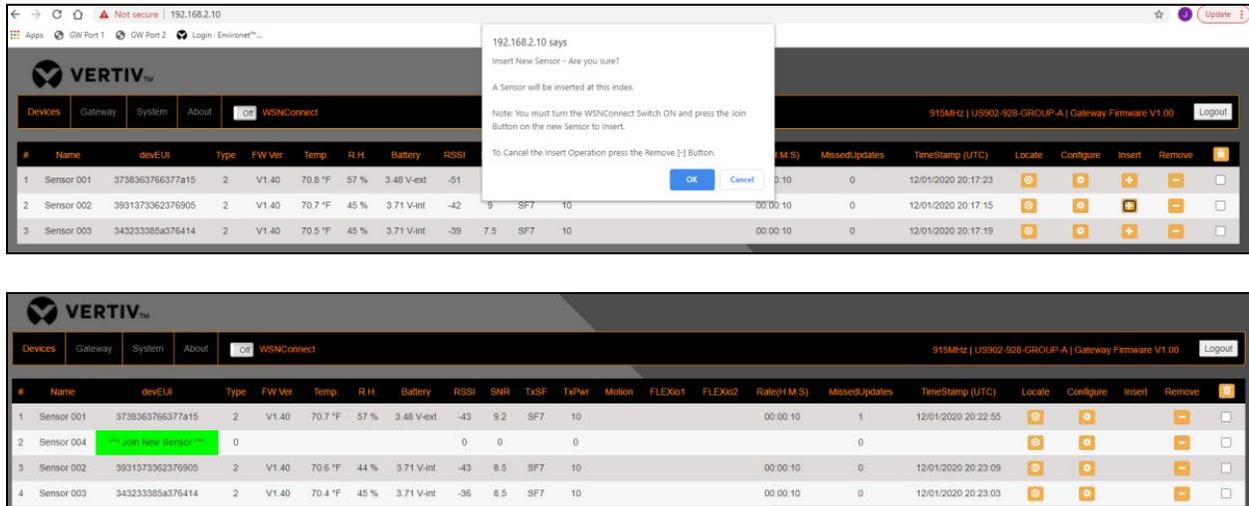
1. Press the plus (+) icon on the index line, under the Insert column where you want to add the new sensor. A new sensor will be inserted at index #2.
2. Click OK to confirm the action. After confirming, index #2 will be inserted and everything below that line will be incremented by one index number.

NOTE: The name of the inserted sensor will be the next available sensor number in the list. A green highlighted message *** Join New Sensor *** displays on the screen.

3. Enable WSNConnect and join a new sensor, and it will be inserted at that index.

7.2.2 Mass Configuration of the Sensors

In the User Interface (UI), some settings for the Flex sensor allow mass configuration.

Figure 7.8 Mass Configuration of the Sensors

To mass configure the sensors, follow the below steps:

1. Click on the gear icon on the line, under the Configure column. The Edit Sensor Configuration dialogue box will display on the screen.

Figure 7.9 Edit Mass Configuration

2. Fill in the configuration details for the following:
   - Sensor Update Rate
   - Beeper mode
   - Temperature Units (Fahrenheit or Celsius)
3. Click Battery Saver Mode to improve the battery life.
4. After these updates are done, click Apply above setting to all Sensors.
5. Click Save button at the bottom to apply all the settings to all the sensors on the Gateway.

7.2.3 Using the Gateway in Conjunction with a Building Management System

If the gateway is to be used in conjunction with a BMS, the appropriate protocol must be enabled. To accomplish this, navigate to Systems—BMS. See **Figure 7.10** on the facing page .

Figure 7.10 System—BMS Page
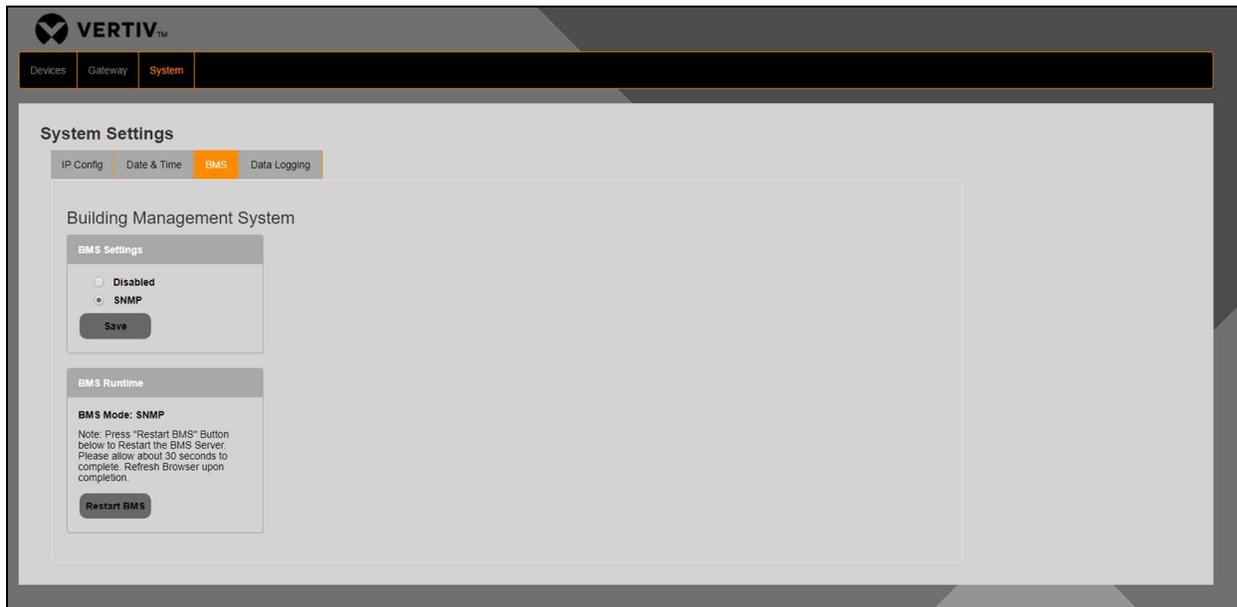
When SNMP or Modbus TCP is enabled, the interface is active on either port on the gateway. Select **SNMP**, **Modbus TCP** or **Disabled** and then click *Save* to change the status of the protocol.

If a BMS protocol is being used, the BMS server must be restarted following any configuration changes to the gateway. These changes can include:

- Adding new sensors
- Sensor names are changed
- Features on the sensors are changed

When gateway configuration changes occur, these items are not available to the BMS communications until the BMS server is restarted. To restart the BMS server, follow this procedure:

1. Click *Restart BMS* on the System—BMS page.
2. After the BMS server is restarted:
    - The web page will display. This site cannot be reached.
    - The blue status LED on the gateway will turn off.
    - The blue status LED on the gateway will illuminate approximately 30 seconds later.

When the blue status LED on the gateway is illuminated again, the BMS server has restarted and is ready for connection again. Refreshing the web page will restore access to the configuration items.

7.2.4 Updating the Gateway Firmware

Gateway settings can be viewed by navigating to the *Gateway* tab. See **Figure 7.11** on the next page . This tab provides the following information:

- Assigned name of the gateway
- MAC ID of the Picocell Radio inside of the gateway
- Current firmware version

Figure 7.11 Gateway Settings
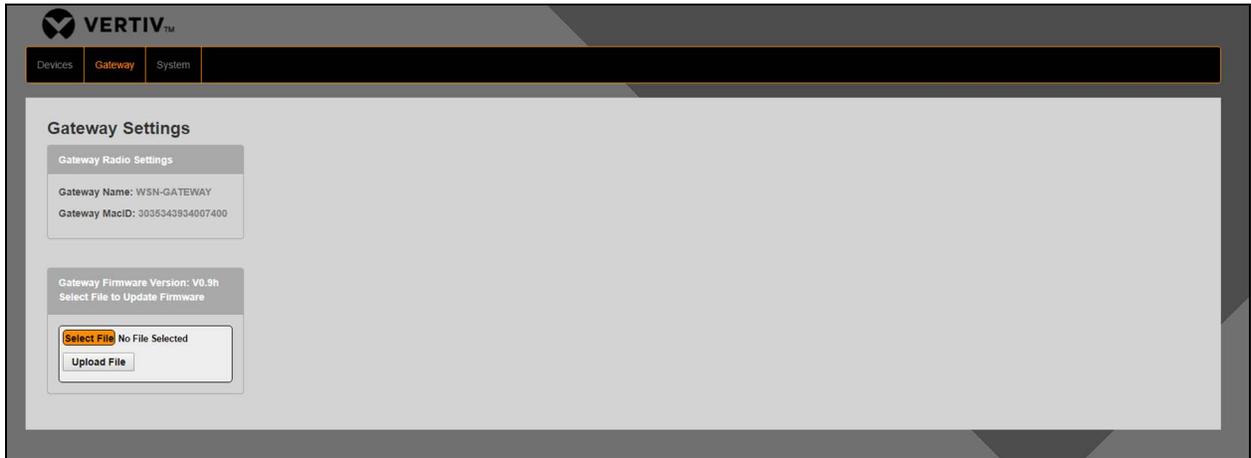
If the gateway firmware needs to be updated, follow this procedure:

1. Click *Select File*.

2. Navigate to find and choose the correct firmware zip file provided by Vertiv. See Updating the Gateway Firmware on the previous page

   NOTE: The firmware zip file is an encrypted file and it cannot be unzipped by any Windows utility.

3. Select the encrypted zip file and upload.

7.2.5 Updating the Sensor Firmware (FOTA)

Sensor firmware can be updated over the air (FOTA) in the Devices menu, by selecting the devices and the Up Arrow.

Figure 7.12 Update Sensor Firmware OTA (Over-the-Air)
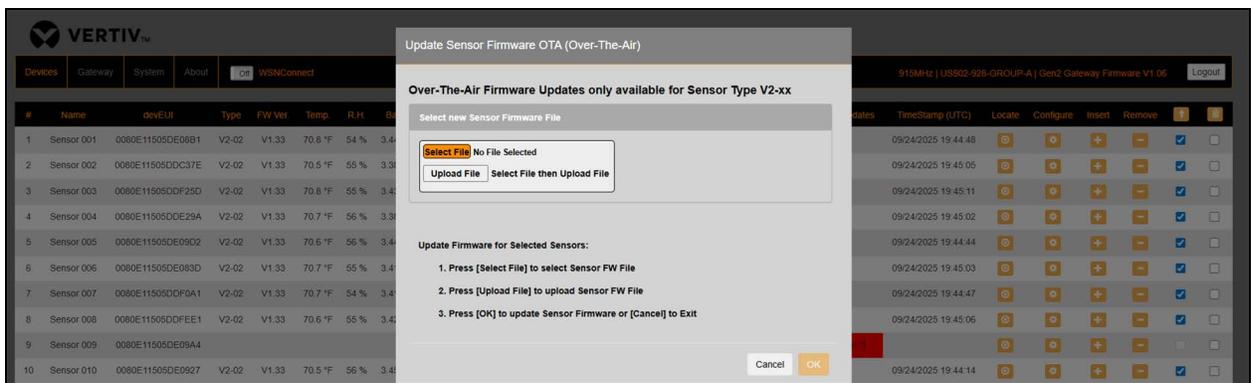
1. Press [Select File] to select Sensor FW File.

2. Press [Upload File] to upload Sensor FW File.

3. Press [OK] to update Sensor Firmware or [Cancel] to Exit.

8 Product Certification and Regulatory Statements

8.1 FCC

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

NOTICE

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 or more of the following measures:

- Reorient or locate 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.

NOTE: 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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

8.2 IC

This radio transmitter, IC: 24956-1001003, has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Le présent émetteur radio, IC: 24956-1001003, a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué pour tout type figurant sur la liste, sont strictement interdits pour l'exploitation de l'émetteur.

8.3 RF Exposure Warning

IMPORTANT! The Federal Communications Commission warns that changes or modifications of the radio module within this device not expressly approved by WaveFlex, Inc. could void the user's authority to operate the equipment.

The minimum safe distance for people from this module has conservatively been determined to be 20 cm for all allowable antenna types.

To comply with FCC's RF radiation exposure requirements, the antenna(s) used for this transmitter must be installed such that a minimum separation distance of 20 cm is maintained between the radiating element (antenna) and any users or bystander at all times and must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTICE

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 or more 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 assistance.

8.4 RSS Gen 8.4

This device contains license-exempt transmitters/receivers that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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;
2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

8.5 Labels and Markings

When installing the USB gateway radio inside of a host product in accordance with Single Module Approved radio rules, the following sticker must be permanently placed on the exterior of the host product:

Figure 8.1 Sticker to be Permanently Placed on Exterior of Host Products

Contains FCCID:2ASYA-1001003
Contains IC: 24956-1001003
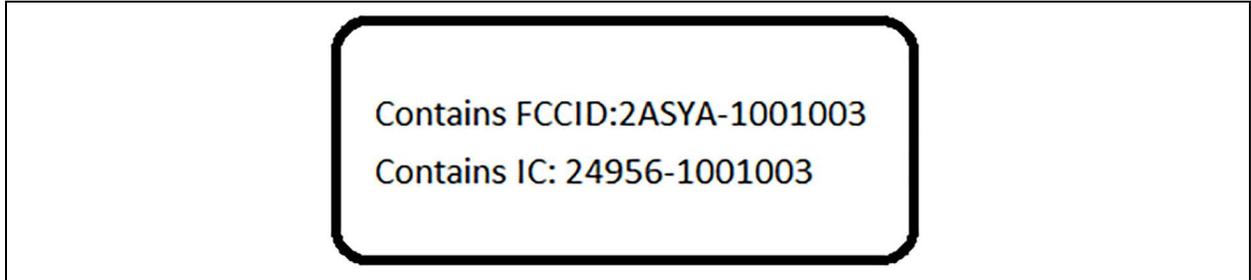
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9 Troubleshooting

NOTICE

Risk of improper control circuits. Can cause equipment damage.

When using jumpers for troubleshooting, always remove jumpers when maintenance is complete. Jumpers left connected could override controls and cause equipment damage.

Table 9.1 Vertiv™ Wireless Sensor Network-Troubleshooting Scenarios v. 1.0

	Issue	Possible Cause	Explanation and/or Possible Solution
☐	• LEDs do not illuminate when pressing the sensor button. • LEDs on sensor flash, go off, flash again and repeat. • Sensor is continuously beeping as if joining over and over.	Dead or dying batteries.	Check and replace batteries.
☐	Sensor shows up in WebUI, but data is missing or inconsistent. 	Sensor was joined to multiple gateways.	Having multiple gateways within range of the sensor when joining and WSNConnect is enabled on other gateways, it is possible the sensor joined more than one gateway. If this is the case, then the sensor data will be inconsistent. View the WebUIs of all gateways in range and look for the sensor in question. Delete this sensor from all other gateways. Then rejoin the sensor to the correct gateway. It is important to only have WSNConnect turned on for one gateway at a time when setting up a system.
☐	The remote temperature probe reading disappears.	Remote temperature probe unplugged or defective.	Check remote temperature probe connection and orientation or replace probe.
☐	The sensor has an external battery pack but is currently running on internal batteries. Look at the battery voltage in the WebUI and if last three characters are "int" then the sensor is running on internal battery instead of "ext" external battery pack.	External batteries are dead.	Check and replace batteries if dead. If this solved the problem, when you check the battery voltage you will now see "ext" external battery pack at the end of the battery voltage.
		Internal spring fingers are not making contact with the external battery.	Inspect the external battery spring fingers inside the rear slots on the sensor. Using a small tool, lift the spring fingers and try reconnecting the external battery. Repeat this process until a connection is made. Verify batteries are not depleted first.
☐	Sensor data is not showing up in WebUI after a gateway has been without power for an extended period of time. 	System is reinitializing after long gateway shutdown. Sensors have entered a 3- minute update mode to preserve batteries.	When the gateway is without power for long periods of time, the sensors will reduce their update rate to three minutes and their transmit power to conserve battery life. When the gateway is powered back on, it could take several cycles at the three-minute update rate before the system is restored. Therefore, the solution may be to simply wait longer for the sensors to re-establish communication after this extended gateway outage. Recommended to turn sensors off if it's known the gateway is going to be powered off for extended period of time.
☐	Sensor data not showing in WebUI after gateway maintenance or system reconfiguration.	Sensor is not properly activated.	Press the button on the sensor to rejoin and re-activate the sensor.
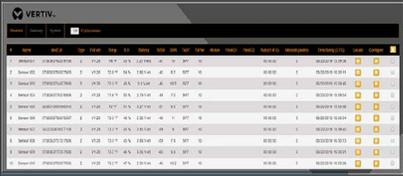
Table 9.1 Vertiv™ Wireless Sensor Network-Troubleshooting Scenarios v. 1.0 (continued)

	Issue	Possible Cause	Explanation and/or Possible Solution
☐	Sensor data packets are not being received by the gateway. This indicates that data packets have been dropped. The missed updates counter in the WebUI indicates how many consecutive sensor data packets have been dropped. It is normal for the missed updates counter to count up to 1 or 2. If it continues to count up higher it could indicate collisions between sensor data or packets.	RF Collisions.	If sensor data packets are being dropped, there could be RF collisions preventing the messages from reaching the gateway. The gateway will tune the system to prevent these collisions. Give the system several hours to autotune. If this problem persists, check for optimum sensor radio power (TxSF = sf7 and TxPwr = 10). If these values are not present, the sensor may need to be relocated because it may be out of range. If sensor location is critical, an additional gateway may be required.
☐	Sensor is not transmitting data at the configured update rate.	Battery Saver Mode is Enabled.	If battery saver mode is enabled and the sensor is in a stable temperature environment, the sensor will skip up to two payloads. Therefore, the update rate could be 3x the system setting in stable temperature environments.
☐	Sensor batteries are draining at a high rate.	The sensor may be operating in a high-power mode or battery saver mode is not enabled.	The system incorporates an Adaptive Data Rate (ADR) algorithm which will automatically increase the sensor's transmit power if the signal strength at the gateway is low. If the sensor is too far from the gateway, it will cause high power draw and intermittent communication. The optimum power setting in the WebUI for each sensor is TxSF = sf7 and TxPwr = 10. Relocate sensor for better battery performance. For optimum battery performance enable Battery Saver Mode.
☐	The sensor will not join the gateway.	WSNConnect is turned off.	If the sensor has not been previously joined to a gateway network, then WSNConnect needs to be enabled. Go to the WebUI and click the WSNConnect slider button. The WSNConnect slider should only be turned on in one gateway at a time when configuring an installation with multiple gateways.
☐	No green or blue LEDs on the front gateway panel.	No power.	Check the input power connection. The AC/DC adapter could be defective, or an alternate power source is not turned on.
☐	The Green Power LED is on, but the Blue Status LED is off.	Gateway is not fully booted yet.	After gateway power up or reboot, can take up to 2.5 minutes for the gateway to fully boot and be ready to collect sensor data. At this point the blue status LED should be on to indicate that the system is running.
☐	The Green Power LED is on, but the Blue Status LED is off after 2.5 minutes has elapsed.	The gateway application program is not running.	The blue status LED only comes on when all services are up and running. If the appropriate amount of time from power up has elapsed (more than 2.5 minutes), then a full power cycle can be performed to see if the gateway will boot after reset. If this does not work, please contact the factory.

Table 9.1 Vertiv™ Wireless Sensor Network-Troubleshooting Scenarios v. 1.0 (continued)

	Issue	Possible Cause	Explanation and/or Possible Solution
☐	A new sensor will not join the network.	WSNConnect is turned off. Gateway is configured for the wrong region.	If a new network is being set up, the WSNConnect slider has to be turned on in the WebUI before a new sensor will connect. The WSNConnect slider should only be turned on in one gateway at a time when configuring an installation with multiple gateways. Navigate to the System > Region tab and make sure the Channel Plan Setting matches the physical sensors you are trying to connect.
☐	The blue status LED on the gateway is flashing.	WSNConnect is on.	The blue Status LED will flash when WSNConnect is enabled to alert technicians that the gateway will allow new sensors to join the network. The gateway must be in this mode to allow any new sensors to join the network. The WSNConnect mode will time out after 10 minutes if no new sensors have been joined.
☐	There is no Modbus data available to external monitoring systems.	Modbus is not enabled or Ethernet cable is not connected.	Navigate to System > BMS-MODBUS, click the Enable checkbox and press the save button. If this does not fix the problem, then check the Ethernet port connection on the gateway.
☐	There is no SNMP data available to external monitoring systems.	SNMP is not enabled or Ethernet cable is not connected.	Navigate to System > BMS-SNMP, click the Enable checkbox and enter system information, then press the save button. If this does not fix the problem, then check the Ethernet port connection on the gateway.
☐	Upon first log in to the gateway WebUI, Username: admin and Password: admin does not work.	Gateway has not been initialized to factory default settings.	After the gateway has fully booted and the blue status LED is on, press and hold the reset button (under the antenna on the gateway) for 10 seconds until the blue status LED turns off. You can now release the reset button and the gateway will perform a factory reset and restart. Once the blue LED comes back on, the initial log in credentials of admin/admin will work.
☐	Changed gateway port IP addresses and user doesn't remember what they are.	Gateway needs factory reset.	After the gateway has fully booted and the blue status LED is on, press and hold the reset button (under the antenna on the gateway) for 10 seconds until the blue status LED turns off. You can now release the reset button and the gateway will perform a factory reset and restart. Once the blue LED comes back on, the initial log in credentials of admin/admin will work.
☐	A system that was previously working has lost all real time sensor data.	The system time was changed by too large an amount.	The LoRa radio in the gateway syncs with the system clock at start up. If the system clock is changed by a large amount, the built-in security will deactivate sensors because it appears that replay attacks are being attempted. To fix this, be sure the system clock is set to the current UTC time, then reboot the gateway by performing a "Restart App" on the gateway web page. After the system reboots, blue Status LED turns on and all sensors rejoin.

Table 9.1 Vertiv™ Wireless Sensor Network-Troubleshooting Scenarios v. 1.0 (continued)

	Issue	Possible Cause	Explanation and/or Possible Solution
☐	An Ethernet port is not working.	The IP address is not correct.	If you are able to connect to one of the Ethernet ports, navigate to System > IP Config and be sure the port is set to what you are trying to use for connection. If it is not correct, change the address and save changes. If you cannot connect to either Ethernet port, then you will need to perform a factory reset on the gateway to gain access to the default IP addresses.
☐	An Ethernet port is not working.	Loose cable or damaged hardware.	If problem is not resolved after verifying the IP address of the port you are attempting to connect to, correcting any loose or damaged cable issues, and performing a factory reset, this issue may be related to internal damage in the gateway.
☐	The firmware upgrade isn't working.	Using incorrect procedure.	Be sure to navigate to the gateway tab and perform the "Select File" to select the new firmware file and then press the "Upload File" button on this page. No need to upzip firmware file.
☐	The Import System Settings feature isn't working.	Using incorrect procedure.	Be sure to navigate to the System > Import/Export tab and perform the select file to select the system settings and press the upload file button to import the system settings.
☐	Insufficient power.	Insufficient power.	

Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv™ Wireless Sensor Network (WSN)

na.wsnsupport@vertiv.com

Vertiv™ Liebert® iCOM™-S Support

na.icomssupport@vertiv.com

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2778

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH 43082

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road

Wanchai, Hong Kong

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Appendix B: FOSS Compliance

Product Name: Vertiv WSN Gateway Web UI - 2/19/2020

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The WSN Gateway Web UI was written using the Node.js JavaScript asynchronous event-driven runtime environment which is built on Chrome's V8 JavaScript Engine. The npm Module Package Manager is used for managing the modules that are used for our Node.js Development.

WaveFlex, Inc. FOSS Statement of Compliance

Each npm Module that was used in the WSN Gateway Web UI is stored in the "node_modules" sub-directory along with its License and Copyright information. This method of documentation meets the compliance requirements for the open software modules used for development which utilize the MIT License, Apache License and ISC License.

All Node.js npm Modules and documentation are available here:

https://www.npmjs.com/get-npm

The Open Source resources that were used for developing this product and their License Agreements are listed below.

HTML Resource Licenses

jQuery v3.4.1
https://jquery.org/license/
MIT License
(c) JS Foundation and other contributors

Socket.IO v2.3.0
MIT License
(c) 2014-2019 Guillermo Rauch

Below is a list of npm Modules that are used in the WSN Gateway Web UI and the License information for each npm Module.

npm Modules Resource Licenses

Module Name: "atob": "^2.1.2",
MIT License
Copyright 2012-2018 AJ ONeal

Module Name: "basic-auth": "^2.0.1",
MIT License
Copyright (c) 2013 TJ Holowaychuk
Copyright (c) 2014 Jonathan Ong <me@jongleberry.com>
Copyright (c) 2015-2016 Douglas Christopher Wilson <doug@somethingdoug.com>

Module Name: "body-parser": "^1.19.0",

41

MIT License
Copyright (c) 2014 Jonathan Ong <me@jongleberry.com>
Copyright (c) 2014-2015 Douglas Christopher Wilson <doug@somethingdoug.com>

Module Name: "bootstrap": "^4.4.1",
MIT License
Copyright (c) 2011-2019 Twitter, Inc.
Copyright (c) 2011-2019 The Bootstrap Authors

Module Name: "cors": "^2.8.4",
MIT License
Copyright (c) 2013 Troy Goode <troygoode@gmail.com>

Module Name: "express": "^4.17.1",
MIT License
Copyright (c) 2009-2014 TJ Holowaychuk <tj@vision-media.ca>
Copyright (c) 2013-2014 Roman Shtylman <shtylman+expressjs@gmail.com>
Copyright (c) 2014-2015 Douglas Christopher Wilson <doug@somethingdoug.com>

Module Name: "express-jwt": "^5.3.1",
MIT License
Copyright (c) 2015 Auth0, Inc. <support@auth0.com> (http://auth0.com)

Module Name: "hex2dec": "^1.1.2",
Apache License Version 2.0, January 2004

Module Name: "jquery": "^3.4.1",
MIT License
Copyright JS Foundation and other contributors, https://js.foundation/

Module Name: "jsonwebtoken": "^8.2.2",
MIT License
Copyright (c) 2015 Auth0, Inc. <support@auth0.com> (http://auth0.com)

Module Name: "jwt"
MIT License
Copyright (c) 2018 Jason Watmore

Module Name: "mqtt": "^3.0.0",
MIT License
Copyright (c) 2015-2016 MQTT.js contributors
MQTT.js contributors listed at <https://github.com/mqttjs/MQTT.js#contributors>
Copyright 2011-2014 by Adam Rudd

Module Name: "multer": "^1.4.2",
MIT License
Copyright (c) 2014 Hage Yaapa <http://www.hacksparrow.com>

Module Name: "network-config": "^2.0.0",
MIT License
Copyright (c) 2015 Redsmin

Module Name: "onoff": "^5.0.0",
MIT License

Module Name: "popper.js": "^1.16.0",
MIT License
Copyright (c) 2016 Federico Zivolo and contributors

Module Name: "redis": "^2.8.0",
MIT License
Copyright (c) 2016 by NodeRedis

Module Name: "request": "^2.88.0",
Apache License Version 2.0, January 2004
Copyright 2010-2012 Mikeal Rogers

Module Name: "shelljs.exec": "^1.1.8",
ISC License

Module Name: "snmpjs": "^0.1.8",
MIT License
Copyright (c) 2012, Joyent, Inc. All rights reserved.

Module Name: "socket.io": "^2.3.0",
MIT License
Copyright (c) 2014-2018 Automattic <dev@cloudup.com>

Module Name: "tsscmp": "^1.0.6"
MIT License
Copyright (c) 2016

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    "Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

    "Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

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Appendix C: WSN Gateway BMS - Modbus Interface Map

The WSN Gateway Modbus Map is divided into several tables based on the Modbus Register Type and whether the data is Realtime Data or Configuration Data.

The Realtime Data is data that changes on a regular basis and should not be updated any faster than the current Sensor Update Rate. The default Sensor Update Rate is 30 seconds.

The Configuration Data is data that changes only when the system configuration values change. The Configuration values should only be read by the Modbus Client at start-up or when the *Update Config Data bit 11501 is set. This bit will be set when any configuration values change and it will remain set until new configuration data is read by the Modbus Client.

Table C.1 Modbus Analog Input Registers – Realtime Data

Data Point	Input Register	Data Type	Number of Registers	Scale	Units	Notes
Temperature 1	30001	16 bits signed	1	0.1	°F or °C	Multiply value by 0.1
to	to					
Temperature 300	30300					
Remote Temp 1	30501	16 bits signed	1	0.1	°F or °C	Multiply value by 0.1
to	to					
Remote Temp 300	30800					
Humidity 1	31001	16 bits unsigned	1	1	%	Range 0-100%
to	to					
Humidity 300	31300					
Battery Voltage 1	31501	16 bits unsigned	1	0.01	Volts	Multiply value by 0.01
to	to					
Battery Voltage 300	31800					

Table C.2 Modbus Discrete Input Contact Bits – Realtime Data

Data Point	Input Contacts	Data Type	Number of Bits	Scale	Units	Notes
Sensor Status 1	10001	Boolean	300	--	--	0 = Online, 1 = Offline
to	to					
Sensor Status 300	10300					
Battery Low Alarm 1	10501	Boolean	300	--	--	0 = Ok, 1 = Alarm
to	to					

Table C.2 Modbus Discrete Input Contact Bits – Realtime Data (continued)

Data Point	Input Contacts	Data Type	Number of Bits	Scale	Units	Notes
Battery Low Alarm 300	10800					
Sensor In-Motion 1	11001	Boolean	300	--	--	0=No Motion, 1 = Motion
to	to					
Sensor In-Motion 300	11300					
* Update Config Data	11501	Boolean	1	--	--	0 = Ok, 1 = Update Data

Table C.3 Modbus Analog Output Holding Registers – Configuration Data

Data Point	Output Register	Data Type	Number of Registers	Scale	Units	Notes
Sensor Name 1	40001	16 bits unsigned	15	1	--	H, L (Char 1, Char 2)
30 Characters Max	40002	16 bits unsigned				H, L (Char 3, Char 4)
Hex ASCII Values	40003	16 bits unsigned				H, L (Char 5, Char 6)
Example: "Sensor 1"	40004	16 bits unsigned				H, L (Char 7, Char 8)
H, L (53, 65)	40005	16 bits unsigned				H, L (Char 9, Char 10)
H, L (6E, 73)	40006	16 bits unsigned				H, L (Char 11, Char 12)
H, L (6F, 72)	40007	16 bits unsigned				H, L (Char 13, Char 14)
H, L (20, 31)	40008	16 bits unsigned				H, L (Char 15, Char 16)
H, L (00, 00)	40009	16 bits unsigned				H, L (Char 17, Char 18)
The remaining 10	40010	16 bits unsigned				H, L (Char 19, Char 20)
Registers are all nulls	40011	16 bits unsigned				H, L (Char 21, Char 22)
(00, 00)	40012	16 bits unsigned				H, L (Char 23, Char 24)
	40013	16 bits unsigned				H, L (Char 25, Char 26)
	40014	16 bits unsigned				H, L (Char 27, Char 28)
	40015	16 bits unsigned				H, L (Char 29, Char 30)
to						
Sensor Name 300	44486	16 bits unsigned	15	1	--	H, L (Char 1, Char 2)
	to					to
	44500					H, L (Char 29, Char 30)

Table C.3 Modbus Analog Output Holding Registers – Configuration Data (continued)

Data Point	Output Register	Data Type	Number of Registers	Scale	Units	Notes
Sensor Firmware 1	47501	16 bits unsigned	1	1	--	High Byte – Major FW
to	to					Low Byte – Minor FW
Sensor Firmware 300	47800					FW (V1.41 = 0141)
Total Sensors	48001	16 bits unsigned	1	1	--	Total Sensors (0 to 300)
Gateway Firmware	48002	16 bits unsigned	1	1	--	GW FW (V2.03 = 0203)
GW Radio Firmware	48003	16 bits unsigned	1	1	--	Radio FW (V1.23 = 0123)

Table C.4 Modbus Discrete Output Coil Bits – Configuration Data

Data Point	Output Coils	Data Type	Number of Bits	Scale	Units	Notes
Temperature Units 1	00001	Boolean	300	--	--	0 = Celsius,1 = Fahrenheit
to	to					
Temperature Units 300	00300					
Battery Saver Mode 1	00501	Boolean	300	--	--	0 = Disabled, 1 = Enabled
to	to					
Battery Saver Mode 300	00800					

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Appendix D: Vertiv™ Liebert® iCOM™-S Device Parameters

Parameter	Description	Notes	Configurable?
#	Sensor Index		No
Name	Sensor Name	Defaults to Sensor 1, Sensor 2, etc. Maximum configurable characters = 30	Yes
devEUI	Unique sensor identifier		No
Type	Sensor Type	See **Table D.1** on the next page	No
FW Ver.	Current firmware version loaded		Updateable
Temp	Last polled temperature sensor reading		Yes - °C or °F
R.H.	Last polled humidity sensor reading		No
Battery	Current sensor battery voltage	V-int = Internal sensor battery if no external battery pack installed V-ext = External battery voltage – this will be the default reading if installed V-usb = Sensor is powered by the micro-USB port.	Existence of external battery determines view displayed
RSSI	Received Signal Strength Indicator	Useful RSSI will range from a low of -120 to a high of 0. This is the received power level at the gateway, and it is measured in dB. The closer the value is to 0 – the better the signal. Values can occur even down in the -130 range and lower because the receive sensitivity is extremely good with LoRa. However, once below -120, the performance will be spotty. It is best to position sensors and gateways so that all RSSI values are -120 or higher. Best practice is to shoot for somewhere between -100 and -110 and better for best performance.	No
SNR	Signal to Noise Ratio	Value = Signal Power/Noise Power SNR will range from -20dB to +10dB. When operating at 0dB or above, this means the LoRa signal power is above the noise floor power level, and this is the ideal range. LoRa has a unique ability to operate very well even when the signal level is below the noise, which correlates to a SNR of 0dB down to -20dB. When SNR is negative, you can still achieve great performance but there will be more lost packets in this range because there is a lot of forward error correction taking place and the mechanics are just stretched to the limit trying to pick the signal out of the noise.	No
TxSF	Transmit Spreading Factor of the Sensor	Spreading Factor is a LoRa parameter that gets adjusted by the Adaptive Data Rate (ADR) algorithms to maximize both performance and battery life. The higher the Spreading Factor, the longer the sensor will spend in the transmit state which equates to higher power draw and lower battery life. The Spreading Factor will be high during the first few minutes after the sensor joins the network. ADR in the gateway will adjust the sensor down to the lowest Spreading Factor possible while maintaining sufficient link margin. The lowest Spreading Factor which yields the best battery life is 7. The range will be 7 to 9.	No
TxPwr	Sensor Transmit Power	The range is 0 (highest) to 10 (lowest). Sensor transmit power is a LoRa parameter that gets adjusted by the Adaptive Data Rate (ADR) algorithms to maximize both performance and battery life. The higher the transmit power, the further the sensor will be able to transmit, but the battery life will suffer. The transmit power will be the highest when the sensor first joins. ADR in the gateway will continue to turn down the transmit power of the sensor and will go as low as possible to maintain sufficient link margin. The ideal transmit power for the best battery life is 10.	No

Parameter	Description	Notes	Configurable?
Motion	Sensor Motion Detector	Reported digitally as 0 or 1 0 = No motion 1 = Motion	Yes – Enabled (Low, Med, High)/Disabled
FLEXio1	Configurable input/output interface pins located on the front of the sensor.	Disabled Digital Input Digital Output Analog Input Analog Output Remote Temperature Probe Remote Door Switch	Yes
FLEXio2	Additional - Same as FLEXio1		Same as FLEXio1
Rate (H:M:S)	Polling Rate Frequency	10 seconds is the lowest polling rate that can be set. This is not recommended because battery life will suffer since the sensor will be transmitting often and sleeping less. Polling rates less than 30 seconds are not recommended unless the sensor is powered by an external 5V supply through the micro-USB port.	Yes
MissedUpdates	Count of polling transmissions missed from sensor	If 4 updates are missed the field will read [*Tuning*] After 10 missed updates the field will read [*Offline*]	No
TimeStamp (UTC)	UTC time of last successful sensor transmission		No

Table D.1 Sensor Type

Vertiv Model #	WaveFlex P/N	Sensor Type	Description	Location	Location	Location
WSN-FLEX	MASM-100-1000-00	02	US/CAN - 915MHz Group A	US	Canada	SOUTH AMERICA: Bolivia, Colombia, Ecuador, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela
		03	US/CAN - 915MHz Group B			
		04	US/CAN - 915MHz Group C			
		05	US/CAN - 915MHz Group D			
		06	US/CAN - 915MHz Group E			
		07	US/CAN - 915MHz Group F			
		08	US/CAN - 915MHz Group G			
		09	US/CAN - 915MHz Group H			

Table D.1 Sensor Type (continued)

Vertiv Model #	WaveFlex P/N	Sensor Type	Description	Location	Location	Location
WSN-FLEX-010	MASM-100-1000-10	10	AS/NZS - 915MHz Group A	Australia	New Zealand	SOUTH AMERICA: Argentina, Brazil, Chile
		11	AS/NZS - 915MHz Group B			
		12	AS/NZS - 915MHz Group C			
		13	AS/NZS - 915MHz Group D			
		14	AS/NZS - 915MHz Group E			
		15	AS/NZS - 915MHz Group F			
		16	AS/NZS - 915MHz Group G			
		17	AS/NZS - 915MHz Group H			
WSN-FLEX-018	MASM-100-1000-18	18	EU863-870			
	MASM-100-1000-19	19	AS920-923	Singapore	Malaysia	
	MASM-100-1000-20	20	AS923-925	Hong Kong		
	MASM-100-1000-21	21	IN865-867	India		

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Appendix E: WSN Gen1 Product Specifications

This section provides the product specifications for the Vertiv™ WSN.

Table E.1 Vertiv™ WSN Gateway Specifications

Item	Description	Specification
Voltage Input	2.1 mm ID x 5.5 mm OD Locking Barrel Plug	(1) Universal AC Input: 85-264VAC (2) PoE, IEEE 802.3af, 48VDC
Power	Current drawn 12 VDC	5W
Input Current		62mA @ 85VAC 104mA @ 48VDC
Ethernet	Dual Ethernet ports	2 x 10/100/1000 base-TX Ethernet RJ45 Cat5/6
Physical Parameters	Outside Dimension	8.5 x 9.6 x 1.6 in (215 x 245 x 41 mm)
	Total Weight	4 lb. 2 oz. (1,871 g)
Mounting	Mounting	(1) Wall Mount: 150 mm (5.9 in) Hole Pattern (2) Optional 19" 1U Rack Mount Bracket (One or Two Gateways)
Operating Temperature	Operating temperature	32°F to 140°F (0°C to 60°C)
RF Characteristics	Maximum RF input levels	-10 dBm
	Maximum RF output levels for US/CAN/AS-NZ	+27.8 dBm
	Maximum RF output level for EU	+20 dBm
	Receiver sensitivity	-139 dBm at SF12 BW 125 kHz
		-125 dBm at SF7 BW 125 kHz
	Frequency range—US/CAN/AS-NZ	915 MHz ISM Band (902 MHz to 928 MHz)
	Max ERP	24.9 mW at 867.1 MHz at 32°F (0°C)
Agency Approvals	Certifications	FCC/IC

Table E.2 Vertiv™ WSN Gateway Antenna Specifications

Item	Specification
Frequency	865 to 928 MHz
Peak Gain	2.2 dBi
Average Gain	0.2 dBi
VSWR	3.0:1 max
Polarization	Linear, vertical
Connector	RP-SMA Plug
Dimensions	137 mm

Table E.3 Vertiv™ WSN FLEX Sensor Specifications

Item	Specification
Power	Two AA Energizer L92 Ultimate Lithium Batteries
USB-C Port	USB-C Port as optional power source for sensor, 5VDC
Device Dimensions	1.9 x 3.5 x 1.1 in (50.2 x 89.7 x 28.9 mm)- with mounting bracket
Temperature	Typical temperature accuracy +/- 0.3 °C
	Ambient operating temperature range - 40 °C to 60 °C
Relative Humidity	Typical relative humidity accuracy +/- 2%
	Humidity operating range 0 to 100% relative humidity
Response Time	Thermal response time to 63% of final value: 90 sec (2m/s air flow)
Calibration Required?	No
RF Frequencies	Supported frequencies: 915 Hz ISM Band (902 to 928 Hz)
LoRa Protocol	Supports LoRa Class A End Device protocol
FLEXio	Supported through USB-C port and optional accessories

Table E.4 Vertiv™ WSN Extended Battery Pack Specifications

Item	Specification
Power	Two AA Energizer L91 Ultimate Lithium Batteries
Device Dimensions	83.8 mm x 43.2 mm x 55.9 mm (3.3 in.x 1.7 in.x 2.2 in.) – With WSN FLEX Sensor

Table E.5 Vertiv™ WSN Extended Battery Pack Mounting Bracket Specifications

Item	Specification
Mounting Options	Tie wraps, wall screws, integrated magnetic mount
Device Dimensions	66 mmx 33 mmx 4 mm (2.6 in.x 1.3 in.x 0.16 in.) – With WSN FLEX Sensor

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