RSTAR Affinity Gateway
Installation and Commissioning Guide

Document Number: PSM0004C
Release Date: 05 December 2025

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REVISION HISTORY

Rev.	Revision History	Date	Prepared By	Approved By
A	Initial Release	15 August 2022	DH	JS
B	Updated figures of: Fig. 5 AC Junction Box Internal Layout Fig. 6 Solar Junction Box Internal Layout Fig. 7 AC Junction Box Terminator Assignment Fig. 8 Solar Junction Box Terminator Assignment	18 September 2023	SM	JS
	Added Relative Humidity, Altitude, and Intended Use to General Specifications. Added Power Supply PoE Input to Power Specifications. Included section about IP67 rating. Included installation disclaimer regarding safety and proper functioning. Included Maintenance and Repair section. Included Risk Assessment section. Changed voltage of input charging regulator for Solar and AC junction box to "15 V DC to 50 V DC"	25 September 2023	SM	JS
	Section 1.5, removed "while still offering easy access for simple maintenance such as battery replacement" Removed Relative	13 October 2023	SM	GL

	Humidity from General Specifications	17 October 2023	SM	GL
C	Enhanced documentation with updated **contact details** and **product visuals**. Expanded coverage to include **DT series loggers** and **optional indoor installation guidance**. Improved clarity with updated **system architecture overview**, **data flow**, and **API integration details**. Added **installation guidance for solar-powered configurations**. Refined **commissioning requirements** for accuracy and ease of use. Streamlined content for better usability and removed outdated references.	5 December 2025	SM	SP, AB, GL

1 INTENDED AUDIENCE

This guide is for the service personnel responsible for installing and commissioning an RSTAR Affinity Gateway.

2 ICONS AND CONVENTIONS USED IN THIS GUIDE

This guide uses the following icons to call attention to important information.

⬣	**WARNING**: This icon appears when an operating procedure or practice, if not correctly followed, could result in personal injury or loss of life.
⚠	**CAUTION:** This icon appears when an operating procedure or practice, if not strictly observed, could result in damage to or destruction of equipment.
☑	**CHECK:** This icon appears to remind you of quality-related features.
→|	**NOTE:** This icon appears to highlight specific non-safety related information.
Cmd	This style shows commands or responses on the SSH terminal.

3 ABBREVIATIONS AND ACRONYMS

This section lists abbreviations and acronyms used in the document.

Abbreviation or acronym	Definition
AES	Advanced Encryption Standard is an encryption technique that uses a 128, 192, or 256-bit key to encrypt data.
AWG	American Wire Gauge is the standard wire size in North America. In AWG, the larger the number, the smaller the wire diameter and thickness. The largest standard size is 0000 AWG, and 40 AWG is the smallest standard size.
DHCP	Dynamic Host Configuration Protocol is a network management protocol used to automate the process of configuring devices on IP networks, allowing them to use network services such as DNS, NTP, and any communication protocol based on UDP or TCP.
GUID	Globally Unique Identification Number is a unique 128-bit identification number that RSTAR Affinity incorporates in all data communication between the Gateway, data loggers, and server endpoints.

Abbreviation or acronym	Definition
LoRa	From the term "long range" is a proprietary low-power wide-area network modulation technique which allows a Gateway to communicate with data loggers.
LoRaWAN	Long Range Wide Area Network is a networking communication stack based on the LoRa wireless technology.
LTE	Long Term Evolution is a standard for wireless data transmission commonly used by cellular providers worldwide. It is often referred to as the 4G cellular with speeds much faster than 3G (UMTS/CDMA) cellular technology.
LTE-FDD	Frequency Division Duplex (frequencies for LTE) is a pair of frequencies – one for uplink and another for downlink.
LTE-TDD	Time Division Duplex (frequency band) is a transmission scheme that requires only a single band for both the uplink and downlink.
MAC	Media Access Control address is a unique identifier on a network interface controller used for networking address in a network.
Metric	The networking route metric specifies the networking priorities of each network interface. The metric value is assigned to each network interface where the network traffic is routed through an active network interface with the smallest metric value.
MQTT	MQ Telemetry Transport is a common lightweight, reliable, and secure data transfer technology between computers. The MQTT publish and subscribe architecture is commonly used in IIoT systems.
PoE	Power over Ethernet is an electrical interface that combines both an ethernet and power interface into one RJ45 connector. RSTAR Affinity is connected to a power junction box through a single PoE interface for both power and ethernet networking
SSH	Secure Shell is a network protocol that gives a user a secure way to access a computer over an unsecured network. The RSTAR Affinity Gateway computer is accessed through a secure shell protocol.
SSID	Service Set Identifier is the Wi-Fi network access name.
SSL	Secure Sockets Layer is security technology used to secure server to browser transactions.

4   INTRODUCTION

4.1   RSTAR AFFINITY CONNECTIVITY SOLUTION

The RSTAR Connectivity Solution from RST Instruments Ltd. is a comprehensive industrial internet of things (IIoT) platform designed for reliable, real-time data acquisition and telemetry across diverse geotechnical and environmental monitoring applications. It integrates RSTAR Affinity Gateways, Affinity Data Loggers, and DT Series data loggers, along with secure communications infrastructure and user-friendly mobile and desktop applications.

Near Real-Time Data Streaming and Reliability

Instrument measurements and device telemetry are streamed in near real time as they are received. If the Affinity Gateway experiences a connectivity or power outage, data is temporarily queued within the gateway and transmitted reliably once the connection is restored, using the MQTT protocol. This ensures data integrity and continuity even in challenging field conditions.

RST Affinity Data Loggers, DT Loggers and Gateways

RSTAR Affinity Data Loggers are designed for seamless integration with RSTAR Affinity Gateways, enabling high-frequency data collection and transmission over cellular or LoRaWAN networks. This flexibility allows users to deploy the system in complex environments with varying connectivity needs, while maintaining reliable data flow from field instruments to centralized platforms. Affinity components are optimized for low-power operation, secure data handling, and robust performance in remote or harsh environments. Additionally, DT Loggers are compatible with the RSTAR Affinity data collection system. When equipped with radios, DT loggers must be installed above ground to maintain a clear line-of-sight between the antenna and the remote hub, ensuring optimal wireless performance.

Feature	RSTAR Affinity Data Loggers	DT Series Data Loggers
Primary use	Near real-time IIoT data acquisition with integrated gateway support	Wireless and standalone data logging with optional radio modules
Wireless Compatibility	Native support for LoRaWAN and cellular via Affinity Gateway	Compatible with RSTAR Affinity and DT Link wireless systems
Data Transmission Protocol	MQTT via Affinity Gateway	Wireless retrieval via radio modules
Offline Data Handling	Queues data in Gateway during outages	Stores data locally; retrieval depends on system configuration
Mounting Options	Integrated with Gateway or custom enclosures	Pole-mounted, wall-mounted, secondary and custom enclosures
Environmental Suitability	Designed for harsh industrial environments	Suitable for outdoor use with secondary enclosures; indoor use requires no ventilation

| Feature	RSTAR Affinity Data Loggers	DT Series Data Loggers
Installation Considerations	Optimized for IIoT networks	Must be installed above ground for wireless use; avoid well covers and flood-prone areas
Sensor Compatibility	Variety of field digital and analog sensors	Supports vibrating wire sensors and thermistors
Scalability	High – designed for large, distributed IIoT deployments	Moderate – suitable for site-specific or modular deployments
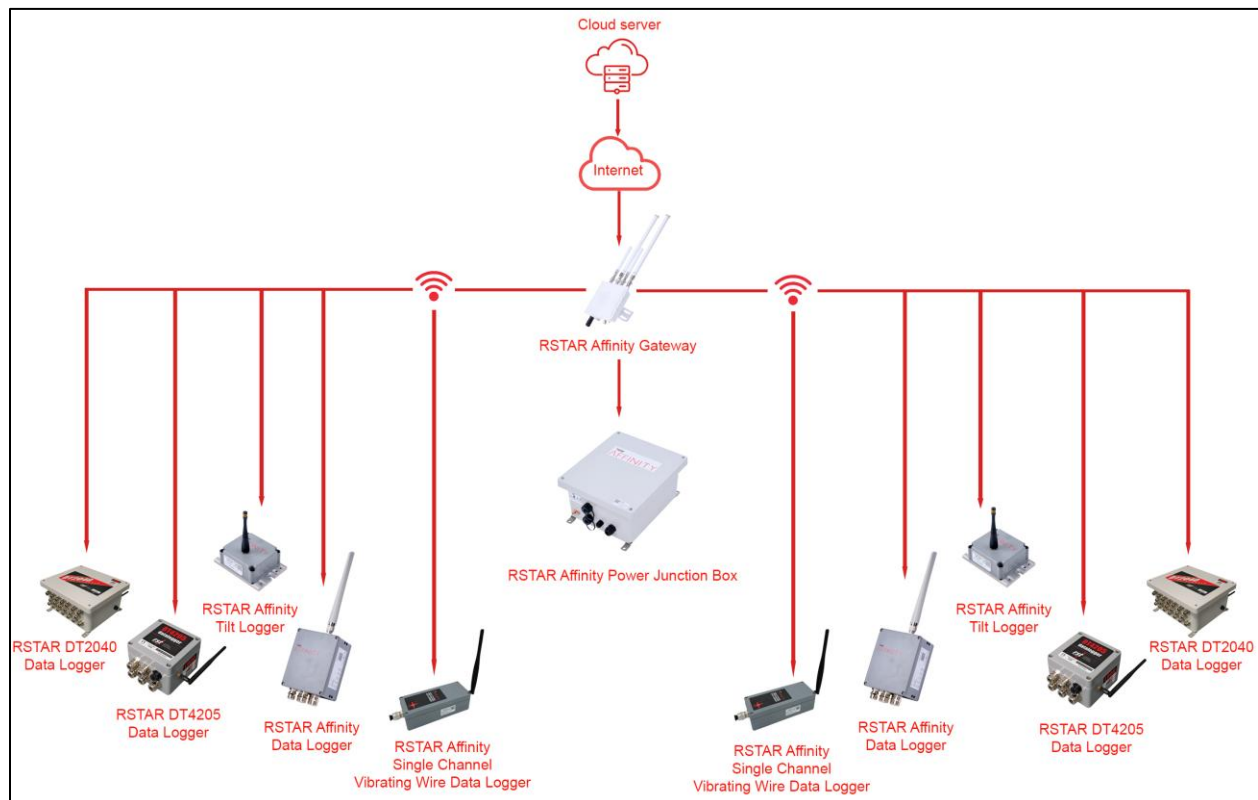
Figure 1: RSTAR Affinity Cloud Solution Architectural Diagram

4.2   RSTAR AFFINITY GATEWAY

The RSTAR Affinity Gateway allows for steady data transmission using cellular signal to our secure cloud environment. Bi-directional communications push firmware and sensor settings over the air.

The Gateway has a certified uptime of 99.9% built to withstand the harsh, real-world field conditions, and is rated for temperatures of -40ºC to 60ºC. The unique compartmentalized design separates power and instrument connections to keep moisture out.

An RSTAR Affinity Gateway in the LoRaWAN network has advanced communication capability to store logged data locally and update the server through a back-haul network. The Gateway using LoRaWAN receives telemetry from RST Affinity data loggers and tilt sensors (both using LoRaWAN) through LoRa radio. The data is forwarded to the RST Affinity cloud server through wired internet, Wi-Fi, or cellular data.

Smart power saving modes allow the Gateway to minimize power use in Solar-powered battery configuration.

4.3   RSTAR AFFINITY DASHBOARD

The mobile app also connects to Affinity Data Loggers via Bluetooth (BLE) for configuration and data retrieval, secured by a shared key.
The RSTAR Affinity Dashboard is the browser-based user-interface that has an essential suite of mapping, graphing, data visualization, and reporting utilities developed specifically for the geotechnical space.

The dashboard also has automatic and transparent field calculations, alarm functionality, and a unique relative elevation mapping feature, along with user management. The open API supports integration with third-party data management and presentation software.

> → **NOTE:** Please see the complete video walkthrough of the RSTAR Affinity Dashboard software for more information.

4.4   SECURITY

The reverse HTTPS tunnel allows remote diagnostics and updates without requiring inbound firewall rules, simplifying customer IT configuration.
The RSTAR Affinity Gateway is designed with the following security measures to prevent data breaches:

- The Gateway and the RSTAR Affinity field app incorporates MQTT authentication and authorization security algorithms
- LoRaWAN wireless data packets are encrypted using Advanced Encryption Standard (AES) 128 keys
- RSTAR Affinity-managed remote access to the Gateway software uses Secure Shell (SSH) protocol over a private SSL tunnel
- Local access to the Gateway software uses SSH protocol and customer-configurable password

4.5 FIREWALL CONFIGURATION

To ensure proper operation of the RSTAR Affinity Gateway and its secure communication with cloud services and support infrastructure, the following firewall ports must be opened on the customer's network:

Purpose	Protocol	Port(s)
Gateway to Azure IoT Hub (encrypted MQTT)	TCP	8883
Gateway to RST File Server (FTP for logs and firmware updates)	TCP	20, 21
Gateway to Secure Remote Access Portal	TCP	443, 80
DNS Resolution	UDP	53
Time Synchronization (NTP)	UDP	123

4.6 SYSTEM ARCHITECTURE OVERVIEW
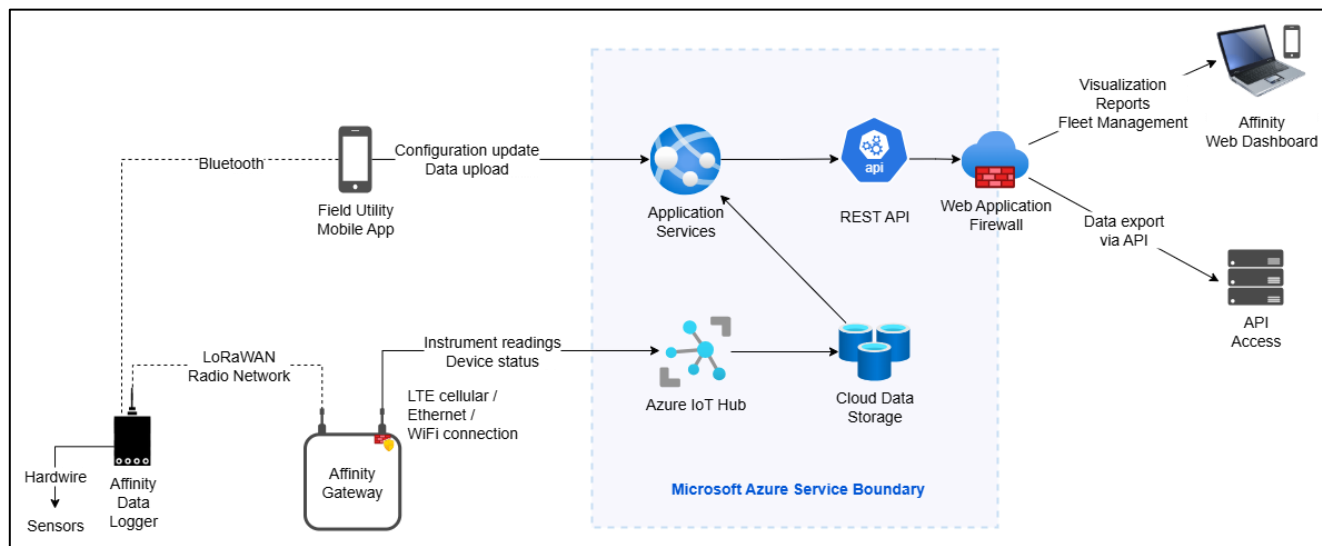
Instrument data are collected and stored locally in the Affinity Data Logger (ADL) non-volatile memory.

ADL sends data and status telemetry to the Affinity Gateway via a low power, long range LoRa radio network. At setup time, the logger is securely paired to the gateway using unique key exchange. Gateways accept data only from loggers that are paired with them.

The Affinity Gateway is locked at the factory to the Azure IoT Hub interface. The lock ensures that data and control commands are sent only to Affinity servers. Communication is encrypted using industry-standard TLS 1.2. On-site, customers register gateways to their dashboard with a PIN and optionally assign geographic coordinates.

A remote management interface exists for performing diagnostics and software updates on the gateway. A reverse HTTPS tunnel is maintained to listen for incoming connection requests. The tunnel allows connectivity without opening inbound ports in the gateway firewall.

Web browsers and mobile apps communicate with the Affinity dashboard using secure HTTPS connections. After initial authentication, user sessions are maintained with short lived access tokens. User credentials are never transmitted unencrypted.

The mobile app connects to Affinity Data Loggers using Bluetooth (BLE). After initially claiming the logger, a shared security key is required to access logger configuration or download instrument data. User access to the logger fleet is managed through the Affinity web dashboard.

4.6.1　Data Flow and API Integration

> **→** | **NOTE:** Please see the Bitbucket instructions for Affinity API QuickStart.

Instrument measurements and device telemetry are streamed in real time as they are received. If the Affinity Gateway is offline due to a connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol.

Data loggers have internal storage and can retain very long periods of measurements in case of interruptions with LoRa connectivity.

Data processing, including conversion from raw measurements to engineering units takes place within Affinity Application Services. The data is then available instantly via the Affinity web-based dashboard or via a REST API for integrating into third-party systems.

4.7　CONNECTIVITY SOLUTION

Instrument measurements and device telemetry are streamed in near real time as they are received. If the Affinity Gateway is offline due to a connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol. The RSTAR Affinity Connectivity Solution supports a variety of configurations to meet complex operational challenges. Solutions include:

- Instrument measurements and device telemetry are streamed in real time as they are received. If the Affinity Gateway is offline due to a connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol.
- Wireless telemetry using LoRaWAN,
- Gateway networking options include ethernet, built-in cellular, and Wi-Fi

4.8   HOST ENVIRONMENT

The RSTAR Affinity Connectivity Solution is hosted on Microsoft Azure cloud. The cloud service is managed by RST which allows customers to be up and running without the need for their own dedicated IT support team. The Azure environment offers the benefits of computing redundancy, high security, and high availability.

Instrument measurements and device telemetry are streamed in real time as they are received. If the Affinity Gateway is offline due to a connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol.

4.9   WIRELESS TELEMETRY

The RSTAR Affinity Connectivity Solution uses LoRaWAN for wireless telemetry between Gateways and data loggers. LoRaWAN technology enables the creation of a private wireless network for applications where small payloads are transmitted over long distances (kilometers) with low power consumption. This makes it ideal for sending low-bandwidth sensor data.

Instrument measurements and device telemetry are streamed in real time as they are received. If the Affinity Gateway is offline due to connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol once connectivity is restored.

The Gateway can communicate with legacy data loggers (e.g., DT2011B, DT2055B) using a built-in L900 RTU, which employs an XBee module for wireless communication with these loggers.

For wireless-enabled DT loggers, configuration and management are handled through the DT Logger Host software. When operating in RSTAR mode, the system uses a star topology with an RTU hub acting as the master and RSTAR nodes as slaves. Nodes wake from low-power sleep, collect sensor data (e.g., vibrating wire piezometers), and transmit packets to the RTU hub. Each packet includes module address, hub address, sensor serial number, diagnostics, data, and CRC check. The RTU hub acknowledges receipt and may synchronize clocks or update logging rates. Data is temporarily stored at the hub and ultimately logged by the FlexDAQ system.

Wireless communication operates in the 900 MHz, 868 MHz, or 2.4 GHz spread spectrum bands (depending on region) and uses simple dipole antennas for extended range. RSTAR settings, including hub assignment and synchronization, can be managed via the Wireless Settings dialog in DT Logger Host. Advanced configuration options (e.g., pinging RTU hubs, querying logger status, and adjusting device settings) are password-protected and should only be modified with RST technical support.

> **NOTE:** For detailed instructions on configuring RSTAR wireless communication for DT Loggers, please refer to Section 7.1 of the RST DT Logger Host Instruction Manual.

4.10   NETWORKING OPTIONS

The RSTAR Affinity Connectivity Solution is equipped with numerous networking options between the RSTAR Affinity Gateway and the cloud, making it capable of working with data collection equipment in a variety of challenging environments. The Gateway may be configured to connect to the network through ethernet, Wi-Fi or cellular.

Instrument measurements and device telemetry are streamed in real time as they are received. If the Affinity Gateway is offline due to a connectivity or power outage, data is queued within the gateway and sent reliably via the MQTT protocol.
By default, the Gateway will choose a network option based on the least cost and highest bandwidth option available. These network options, in order of preference, are ethernet, Wi-Fi, and cellular.

5   SYSTEM OVERVIEW

5.1   OVERVIEW

The RSTAR Affinity Gateway has an IP67 rated waterproof enclosure than can be mounted using pole or wall mount options.
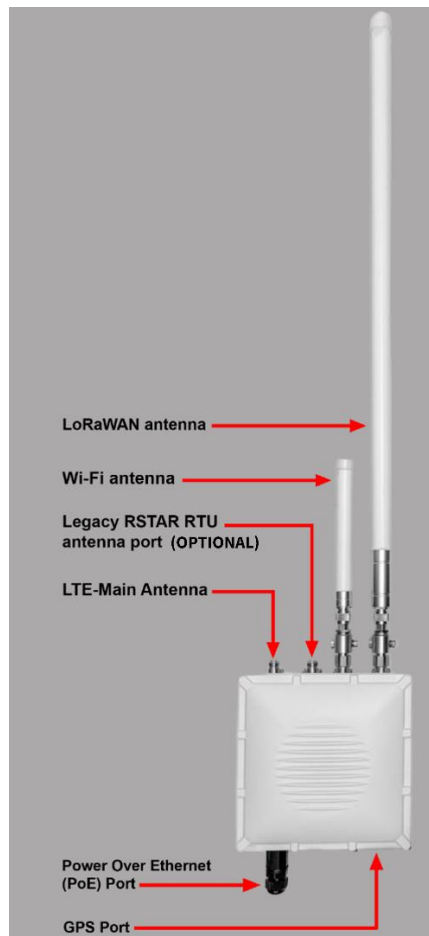
Figure 2: RSTAR Affinity Gateway Device Overview

5.2   HARDWARE INTERFACES

The Gateway features hardware interfaces on the top and bottom Panels as shown in the following pictures.

Figure 3: Gateway Hardware Interfaces – Top

Ground lug

Figure 4: Gateway Hardware Interfaces – Bottom

> **NOTE:** GPS hardware is not included in this package and must be procured separately. The application is designed exclusively for time synchronization and does not provide positioning or navigation functionality.

5.3   POWER JUNCTION BOX

The Gateway power junction box supplies the 12V DC power to the Gateway. The input power to the junction box may be a 120/220V AC line power, or a Solar Panel or battery. See Appendix A for the power junction box specifications.

The power junction box does not contain any serviceable parts, but the following diagrams show the internal components for your reference.

Figure 5 shows the typical configuration of a power junction box with the 120/220V AC power option. Figure 6 shows the Solar power option.

NOTE:

The charging regulator (component of both AC and solar-powered configurations) has an ON/OFF switch, which is important due to the following:

1. Isolation and Safety

It allows the user to disconnect the regulator from the battery and power source without physically removing wires. This is important for maintenance or troubleshooting.

Prevents accidental short circuits or sparks when working on the system.

2. Power Management

When the system is not in use (e.g., during storage or transport), turning the regulator off stops any parasitic drain on the battery.

Protects the battery from unnecessary discharge and extends its life.

3. Controlled Charging

The switch ensures zero current flow when off to preserve battery life.

This is useful for systems where it is necessary to manually control when charging occurs, such as intermittent solar setups.

4. Emergency Shutdown

Provides a quick way to stop charging if there is an overvoltage, overheating, or wiring issue without disconnecting cables.

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15 V DC to 50 V DC charging regulator

PSK45-24-DIN 120/240V AC/DC to 24V DC converter

PoE Injector

Terminal Blocks

DIN Rail Fuse Holder

Surge Protector

Ethernet (Data)

POE to Gateway

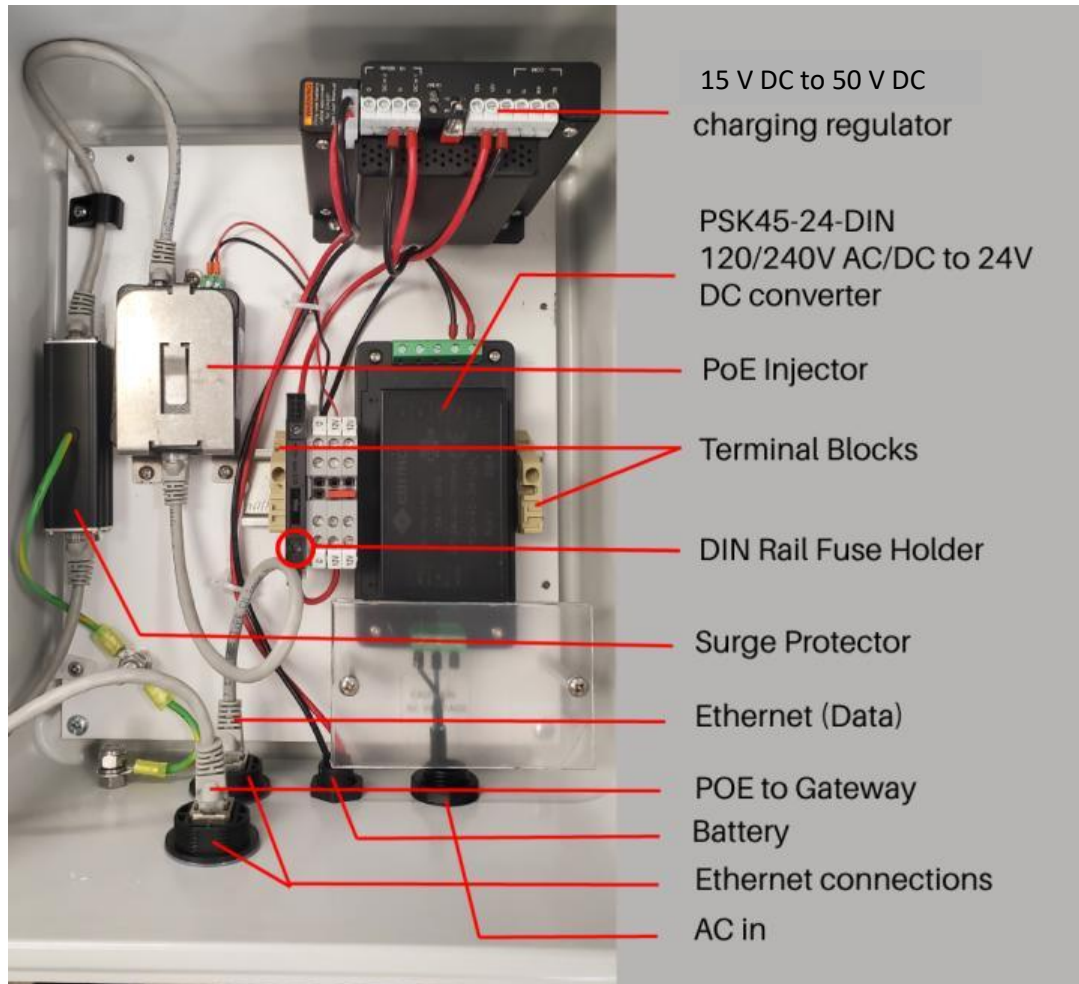Battery

Ethernet connections

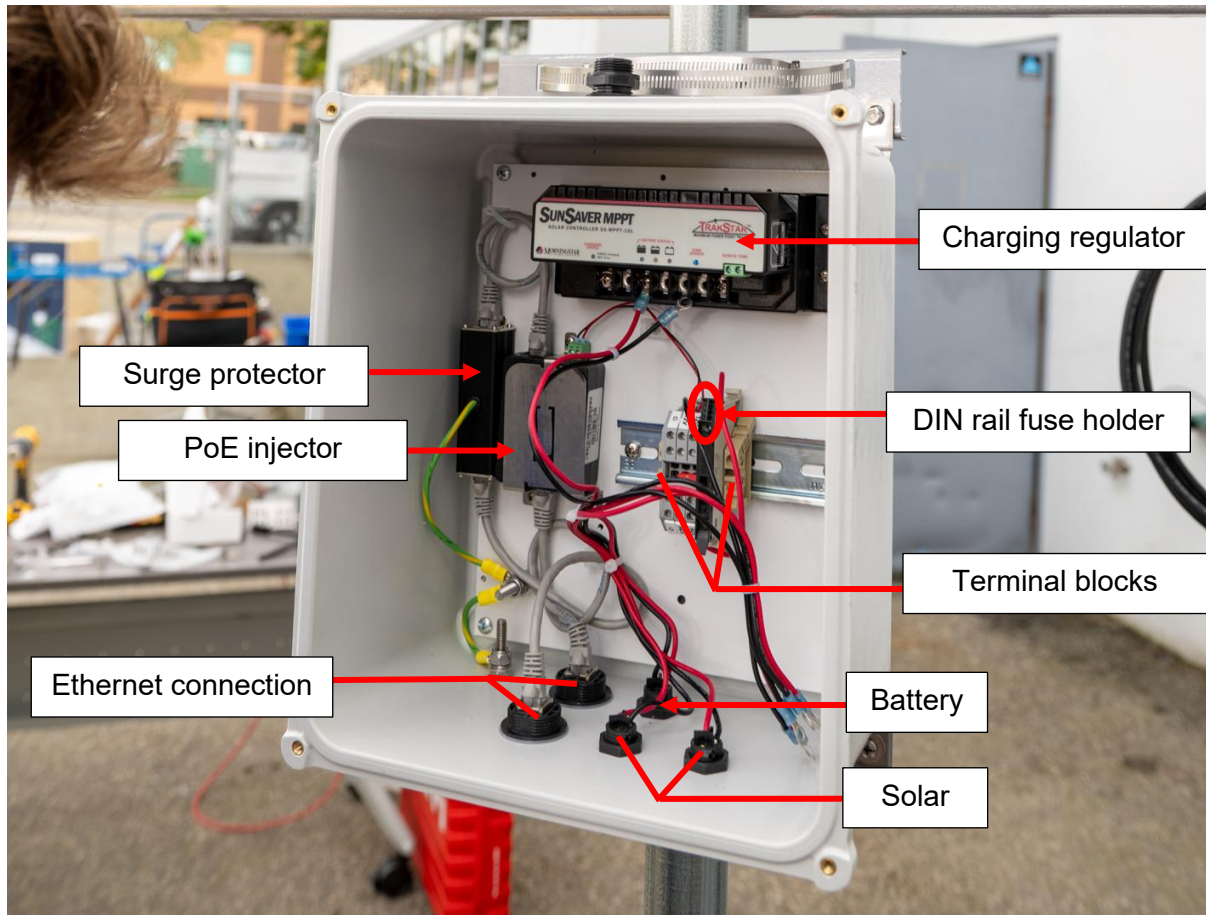AC in

Figure 5: Typical Junction Box Internal Layout

Figure 6: Typical Solar Junction Box Internal Layout

The junction box has connectors at the bottom of the junction box as shown below.

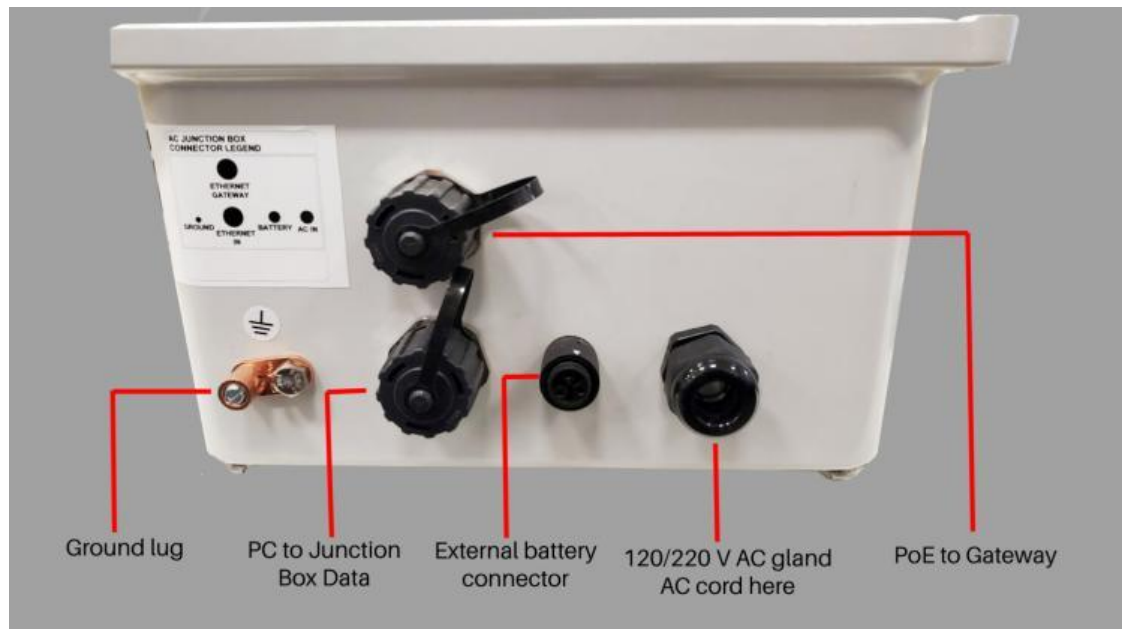The Solar power junction box terminator assignment is shown in figure 8.

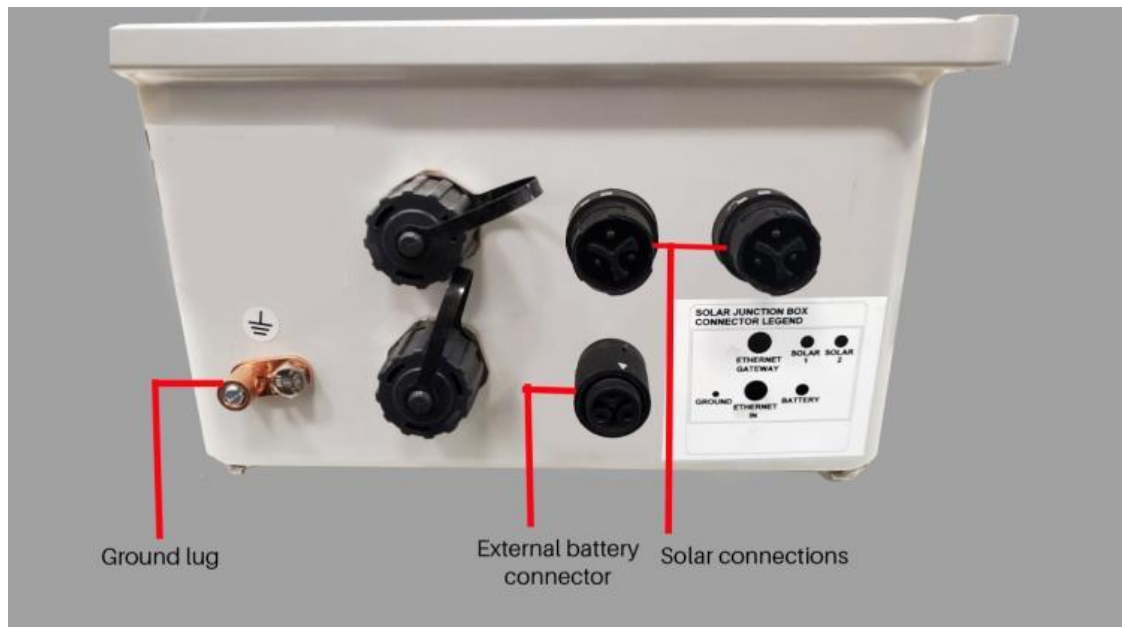Figure 7: AC Junction Box Terminator Assignment

Figure 8: Solar Junction Box Terminator Assignment

5.4 PRE-CONFIGURED OPTIONS

The Gateway and its power junction box are pre-configured by RST with options specific to customers. Pre-configured options include LoRaWAN radio module (433, 868, or 915 MHz), with 120/220V AC power source or solar panel and battery pack.

6 INSTALLATION PROCEDURES

⚠	**CAUTION:** Safety protection is impacted if the installation is not followed per the installation guidelines or installed improperly. RST Instruments cannot be held responsible for damages or loss of the Gateway. The proper installation must follow this manual.

This guide details the installation of the Gateway and its power junction box. There are multiple ways to install the equipment in the field, and you may deviate from the installation prescribed here based on environmental conditions, corporate policies, or preferences.

You can install the Gateway and its power junction box using either the installation kit with a pole mount assembly for poles with diameter between 40 mm (1.5") and 120 mm (5.0") or the wall mount assembly (for mounting to a metal wall plate or a wall).

6.1 INSTALLATION SAFETY AND GUIDELINES

Observe the following when installing the Gateway and its power junction box:

✋	**WARNING**: When selecting an installation site, always be aware of electric power lines and assume that they can cause bodily harm or death.

- Avoid installing the Gateway and power junction box in locations where they are exposed to theft and vandalism. If you cannot avoid these locations, secure them in a suitable secondary enclosure. If you are placing the Gateway's antennas inside a secondary enclosure, make sure the enclosure material is electrically non-conductive.
- Ensure the Gateway and power junction box are installed in an upright position where the antennas are pointed upwards to maximize antenna reception quality.
- The Gateway's matching antennas terminate with type-N connectors designed to be attached directly to the provided surge protectors which in turn attach to the Gateway antenna ports.
- Prevent exposure to high pressure water spray or potential water immersion if installing the Gateway and power junction box outdoors or in a location where they can be exposed to wet environments.
- The Gateway can be connected to several primary networking interface options to a cloud server. The networking options include ethernet, Wi-Fi, and cellular. The RSTAR Affinity field app requires port 1883 to be open on the network for the Gateway to communicate over this port.

- Ensure proper grounding for the power junction box using the ground lug located at the bottom of the box. Attach a grounding wire with a minimum gauge of 10 AWG and attach to an earth ground.

6.2   IP67 – DEGREES OF PROTECTION PROVIDED BY ENCLOSURE

The AGW2168 is rated IP67 only for the following configuration:

- Lightning arrestors are installed in between the antenna and the gateway's port
- All 4 antenna ports must be occupied with an antenna and lightning arrestor
- The antennas on the Gateway must point vertically, towards the sky
- Rated at 1 m submerged in water for up to 30 minutes

6.3   INSTALLATION TOOLS

The following are the tools you need to install the Gateway and its power junction box:

- 10 mm wrench
- gland wrench
- mini slot (flat head) screwdriver
- non-mini slot (flat head) screwdriver – for installing the Junction Box with supplied mounting kit
- Adjustable wrench
- Phillips head screwdriver

6.4   BOX CONTENTS

The Gateway and power junction box are shipped with the parts and components listed in the table below and shown in the figure below:

Figure 9: RSTAR Affinity Gateway Box Contents (standard options)

Item number	Quantity	Description
1	1	RSTAR Affinity Gateway
2	1	RSTAR Affinity Power Junction Box
3	4	Antennas (from left to right) *: RTU RSTAR OMNI antenna, LTE-MAIN antenna, Wi-Fi antenna, LoRaWAN antenna *Note: Each antenna is labeled for identification. Please check the label to ensure it is connected to the correct port.* *Quantity of supplied antennas depends on the ordered configuration for the Gateway.*
4	-	Wall/pole mounting brackets with screws and washers
5	1	Power over Ethernet (PoE) cable

6.5   INSTALL GATEWAY WITH POLE MOUNT OPTION

This installation option uses the pole mount assembly for installations to poles with a diameter between 40 mm (1.5") and 120 mm (5.0").
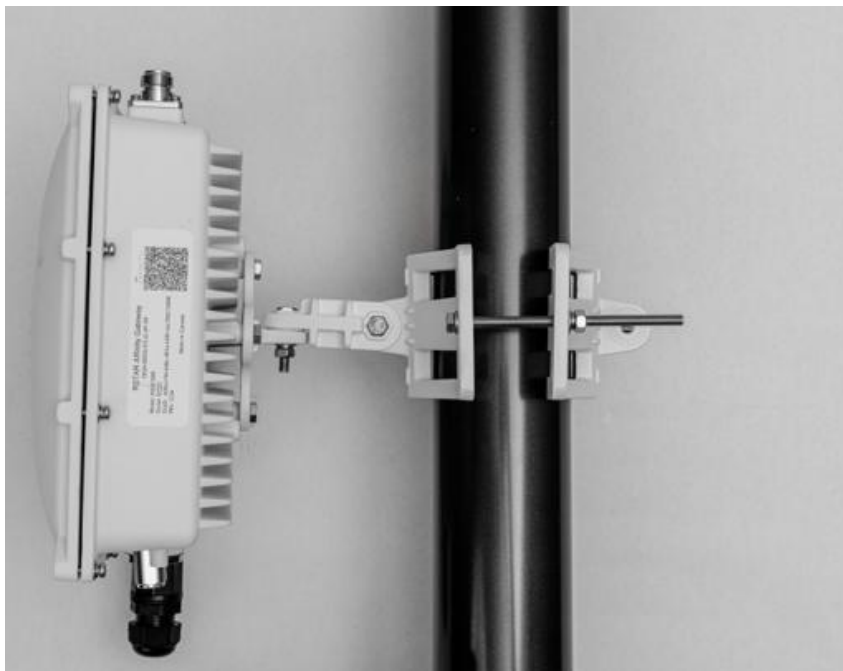
Figure 10: Pole Mount Option

To install the Gateway using the pole mount, complete the following steps:

1. Screw the mounting bracket to the back of the Gateway. Tighten the screws.

2. Mount the pole bracket to the pole. Tighten the screws.

3. Attach the Gateway to the pole bracket.

4. Attach the antenna to the correct port as shown on the labels on the Gateway.

6.6   INSTALL GATEWAY WITH WALL OR PANEL MOUNT OPTION

This installation option uses one half of the Gateway wall mount assembly for mounting to a metal wall plate or a wall. The customer will need to source their own screws to install the Gateway mounting plate to a wall.

→| **NOTE:** It is the customer's responsibility to source wall mounting fixings.

⚠ **CAUTION**: Ensure the screws can support the weight of the Gateway and antennas.
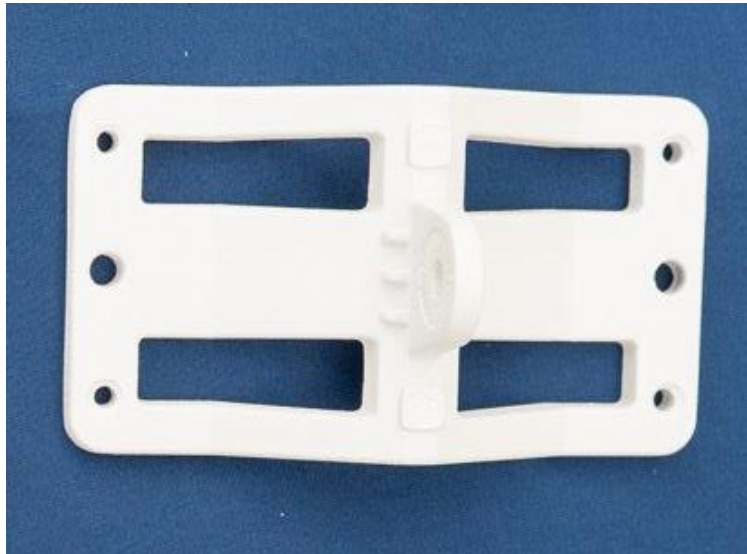
Figure 11: Mounting Bracket

To install the Gateway using the wall or Panel mount, complete the following steps:

1. Screw the wall bracket to the back of the Gateway. Tighten the screws.

2. Attach the mounting plate to a wall using appropriate screws.

3. Attach the Gateway to the wall or Panel mount. Tighten the screws.

4. Attach the antenna to the correct port as shown on the labels on the Gateway.

6.7   INSTALL ANTENNA

To install an antenna to the Gateway, complete the following steps:

Figure 12: Antenna Port

1. Unscrew the antenna port cover found on top of the enclosure.

2. Attach the wireless antenna.

⚠	**CAUTION:** Make sure to attach the antenna to the correct antenna port as shown on the labels on the enclosure.

⚠	**CAUTION:** Please install antenna surge arrestor and employ grounding procedures if lightning is a concern for installation location.

6.8   INSTALL A POE CABLE
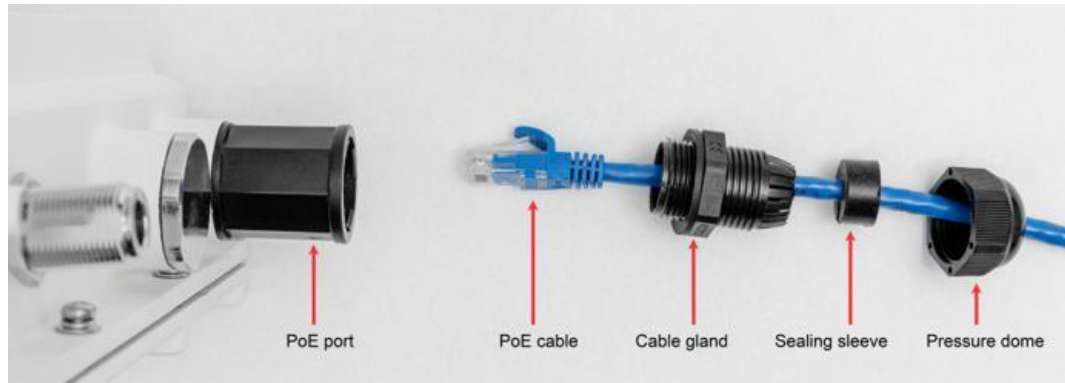
Figure 13: PoE Cable Installation Order

To install a PoE cable on the Gateway, complete the following steps:

1. Unscrew the cable gland from the bottom of the Gateway.

2. Unscrew the pressure dome and remove the sealing sleeve.

3. Insert the PoE cable through the pressure dome and cable gland. Clip the sealing sleeve onto the cable.

4. Plug the PoE cable into the ethernet jack.

5. Insert the sealing sleeve into the cable gland and screw the gland back to the Gateway.

6. Screw the pressure dome back to the gland.

7. Plug the other end of the ethernet cable to an ethernet outlet.

⚠ **CAUTION:** Please ensure that the PoE cable is not being twisted.

6.9   MOUNT THE POWER JUNCTION BOX TO A WALL
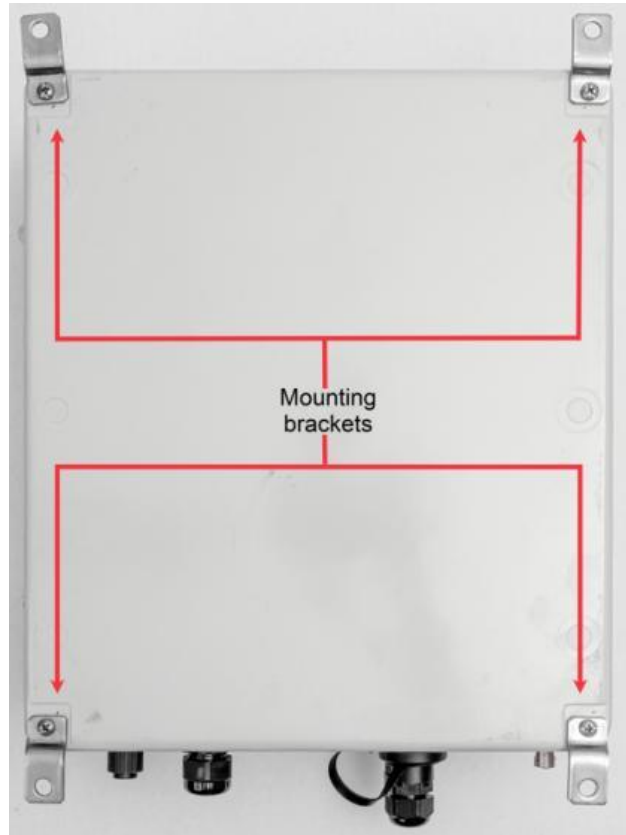
Figure 14: Power Junction Box Mounting Brackets

To mount the Gateway's power junction box, complete the following steps:

1. Screw the mounting brackets to the power junction box.

2. Screw the mounting brackets to the wall.

6.10   INSTALL COMPONENTS

The following are optional components you can install in the power junction box to support the Gateway:

REQUIRED

- grounding cable

⚠️ **CAUTION:** You will need to supply your own grounding cable. Ensure to use a grounding cable that is 10 AWG or thicker.

- network ethernet cable
- AC line cable (for AC-powered Junction Box)
- Solar Panel and battery pack (for solar-powered Junction Box)

6.10.1 Install the Grounding Cable (Optional)

Figure 15: Power Junction Box Ground Lug

To install the optional grounding cable, complete the following steps:

1. Attach an appropriately sized grounding cable to the ground lug.

2. Connect the opposite end of the cable to a grounding electrode.

6.10.2   Install the PoE Cable (Optional)
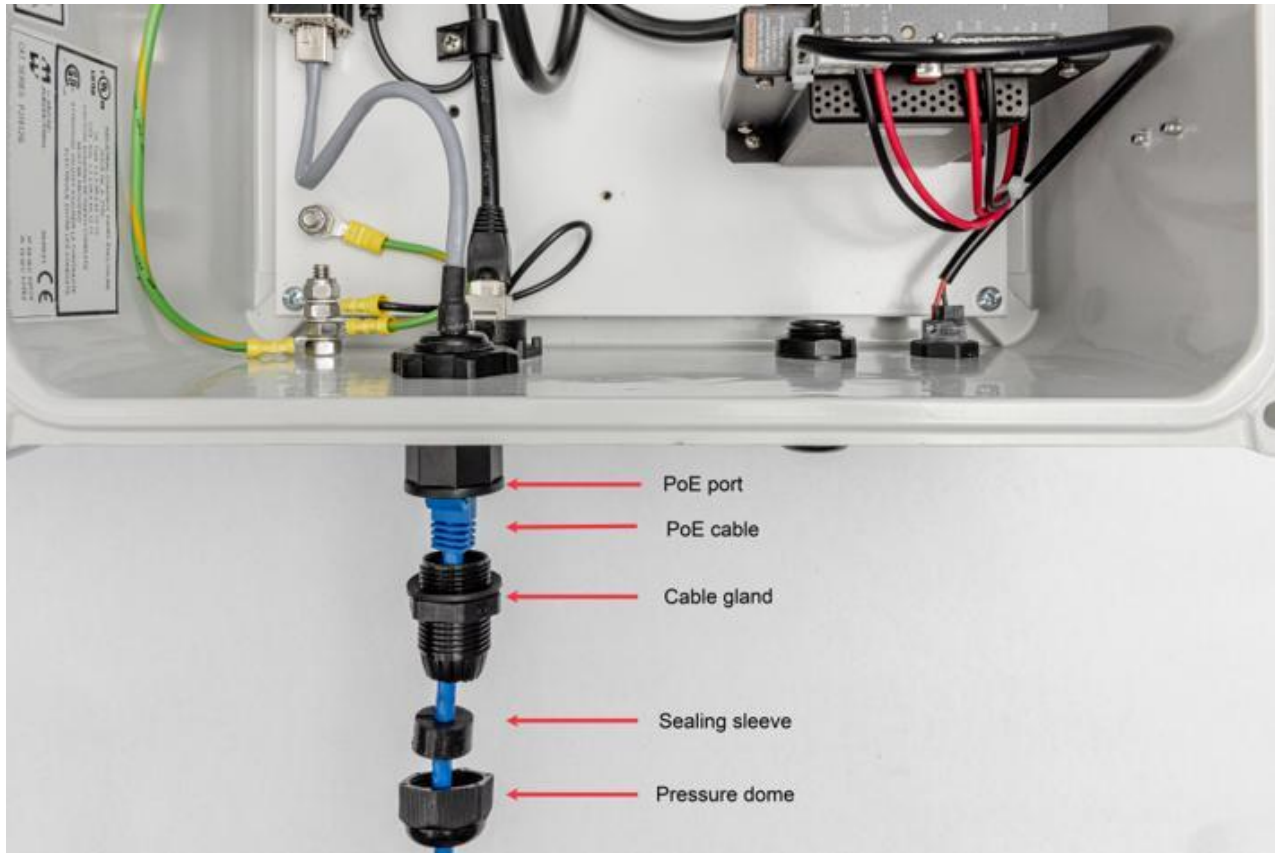
Figure 16: Power Junction Box Optional PoE Cable

To install an optional PoE cable to the power junction box, complete the following steps:

1.   Unscrew the cable gland assembly from the bottom of the power junction box.

2.   Insert the ethernet cable through the pressure dome and cable gland. Clip the sealing sleeve onto the cable.

3.   Plug the cable into the ethernet jack.

4.   Insert the sealing sleeve into the cable gland and screw the gland back to the Gateway.

5.   Hand-tighten the pressure dome back to the gland.

6.   Plug the opposite end of the ethernet cable to the network router or switch.

6.10.3 Install the AC Line Cable (if using AC power)
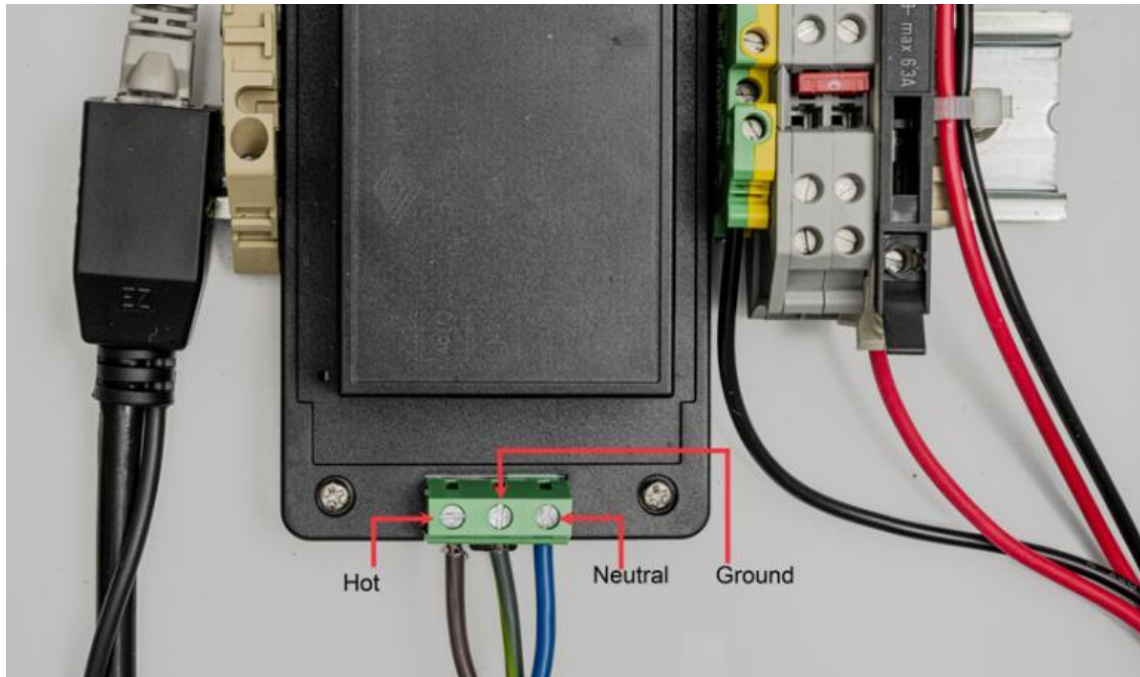
Figure 17: Power Junction Box Optional AC Line Cable

To install the optional AC line cable, complete the following steps:

> ⚠️ **CAUTION:** The 120/220V AC line has three conductors – hot, neutral, and ground. Refer to the diagram above and ensure proper wiring.

1. Strip the insulation on the power cord to expose approximately 10 mm or 3/8 inches of conductor.

2. Remove the 120/220V AC cable gland.

3. Thread the 120/220V AC line through the gland until the conductors reach the power line terminal block.

4. Insert the conductors into the terminal block and tighten with a screwdriver.

5. Tighten the cable gland.

6. Plug the power cable to a power outlet.

6.10.4 Optional Direct PoE-to-AC Power

For indoor installations, customers may optionally use a PoE-to-AC power adapter. This method is not recommended for permanent deployments due to potential reliability issues and the absence of backup power capability. However, it may be acceptable for demonstration or training purposes.

RST recommends the TL-POE4824G PoE adapter for this configuration. Alternatively, customers may use an equivalent 48VDC passive PoE injector. For further guidance or approved alternatives, please contact RST Technical Support.

Figure 18: Optional PoE-to-AC Power Adapters for Indoor Installations

6.10.5 Install the Solar Panel and Battery Pack (if using Solar power)

Installing the optional Solar Panel and battery pack is subject to many environmental variables. RST recommends consulting with a qualified technician familiar with DC and AC circuits on installation including grounding and positioning in a location with good Solar exposure for maximum sunlight.

7 COMMISSIONING PROCEDURES

Commissioning the Gateway is typically completed during the initial installation. This one-time configuration and verification ensure that the networking features specific to your Gateway works correctly. You would also typically commission the Gateway before the RSTAR Affinity data logger. This means that the wireless telemetry between the Gateway and data logger won't be verified while commissioning the Gateway. Whenever feasible, RST recommends pre-staging the Gateway with the data logger.

7.1 RSTAR AFFINITY GATEWAY IDENTIFICATION SHEET

An identification sheet is included in each Gateway with the following information:

Item	Description
Date of assembly	Date when the Gateway was assembled
Product serial number	The Gateway serial number
Globally Unique Identifier (GUID)	Unique ID for registration
Identification PIN	PIN to use for registration
Username and password	Allows the user to access the software configuration.
Secure Shell (SSH) ethernet IP	IP address for local link IP address for local SSH console
RSTAR Affinity server domain address	Domain name of the cloud environment
Cellular service activation status	Shows the cellular service as either enabled or disabled.
Configuration option	The build option ordered with the Gateway such as LoRaWAN wireless module ID, region, and sub-band

Table 1: Gateway Identification Sheet

7.2 COMMISSIONING PRE-REQUISITES

The following are the pre-requisites for commissioning the Gateway:

- Computer with an internet browser that can connect to the RSTAR Affinity dashboard server
- Log in credentials to access the fleet management features on the RSTAR Affinity dashboard

Additionally

Wi-Fi Setup

- Wi-Fi access point SSID and password for systems with Wi-Fi as the primary network

Ethernet Setup

- Ethernet Cat 6 cable to connect the computer and the Gateway junction box ethernet port
- DHCP server available on the network for systems with ethernet as the primary network

Cellular Setup

- Computer (laptop or desktop) pre-loaded with Tera Term or HyperTerminal

7.3 ADVANCED CONFIGURATION – QUALIFIED PROFESSIONALS ONLY

IMPORTANT NOTE AND DISCLAIMER

Accessing Advanced Mode and performing internal gateway programming requires specialized technical knowledge. Improper use may result in system instability, data loss, or security vulnerabilities.

🛑	**WARNING**: Proceed only if you are an experienced professional with a solid understanding of Linux systems and embedded hardware. RST recommends presetting these features in-house prior to shipping the Gateway to customer site or using RST's service team expertise to complete the configuration. RST assumes no liability for any damage or operational issues caused by unauthorized or incorrect use of these commands.

7.3.1 Linux Command Access

The Gateway operates on the Yocto Project, a Linux distribution tailored for embedded hardware. To commission or configure the Gateway at an advanced level, you must have:

- Basic to intermediate Linux knowledge

- Familiarity with console commands and network configuration

Below are sample commands for reference. These commands should only be executed by qualified personnel:

Command	Description
ls	List files and directory
cd	Change current directory. Note that directory and file names are case sensitive in Linux
passwd	Change password
ping	Test the network connectivity
journalctl	View system log files
logout	Log out of the current SSH session

Table 2: Common Linux Console Commands

7.4 SHELL SCRIPTS

The Gateway uses pre-defined shell scripts to execute functions. Shell scripts are small computer programs that are executed from the SSH command line interpreter. They require the user to enter the full or relative path. Below are two examples of how to execute a shell script.

Example 1: Execute the **gw_status.sh** script by entering the full path:

```
/opt/affinitygw/script/gw_status.sh
```

Example 2: Execute the **gw_status.sh** from the working directory /opt/affinitygw/script:

```
./gw_status.sh
```

You can find the following shell scripts in the directory **/opt/affinitygw/script**.

Script Name	Description
gw-uplink	Configure the network interface configuration
gw-uplink-show	Show the network interface that is presently active. Show the route and metric information to determine network interface priorities.
gw-reg	Show the Gateway registration status in the RSTAR Affinity software server.
gw-pow	Configure the Gateway power management services
gw-pow-show	Show the Gateway power management operational status
gw_status.sh	Show the Gateway's status.

Table 3: Custom Shell Scripts Commands

7.5   COMMISSION THE RSTAR AFFINITY GATEWAY

The following is the typical sequence of steps when commissioning a Gateway:

- access console from Secure Shell (SSH)
- change password (optional)
- configure network with RSTAR Affinity software (required)
- verify network settings
- claim or add Gateway to a site
- log out from the console

7.5.1   Access Console from Secure Shell

As the installer, you must configure and verify operation during commissioning. Because of the different operational parameters, some configurations are required to be uniquely configured for each Gateway. To allow on-site (local) configuration, you must log in to the Gateway using its local console connection. This commissioning step involves establishing an SSH console session to prepare the Gateway for operation.

The Gateway's factory setting is configured to use ethernet as the primary connection to access and configure the Gateway. The Gateway is assigned the IP address 169.254.0.0 as the static local link to ensure the Gateway can be accessed by a laptop or desktop computer directly connected to it. To access the SSH local console session, you need a laptop or desktop computer and an ethernet cable.

To access the SSH local console session, complete the following steps:

1. Connect a Cat 6 ethernet cable to the ethernet port on a laptop or desktop computer.

2. Connect the other end of the ethernet cable to the power junction box ethernet port.

3. Turn on power on the junction box.

4. Connect to the Gateway using Tera Term on your computer or a similar terminal emulator program.

> **→|**   **NOTE**: PuTTY is currently incompatible as a terminal emulator for the Gateway.

5. On Tera Term or the terminal emulator program, select SSH as the connection method.

   - You will be prompted to enter the TCP/IP address or host name and port number.

6. Enter "**169.254.0.0**" for TCP/IP address or host name, and "**22**" for TCP port number.

When the SSH connection is established, a **>** symbol appears on the Command prompt on the SSH console.

```
>
```

7. Enter "user" as the username and the password shown in the identification sheet.

After logging into the SSH, a **$** sign appears on the Command prompt on the console.

```
$
```

You have successfully logged into the Gateway and have privileges to the Linux operating system.

7.5.2   Change Password (Optional)

The default user password is uniquely generated by RST. You may change this default password during commissioning or at any time after.

To change the user's password, complete the following steps:

1. On the SSH console, in the Command prompt, type "passwd" and press **Enter**.

```
passwd
```

The console prompts for the old password.

```
Changing password for user
Old password:
```

2. Enter your old password.

The console prompts for the new password.

```
New password:
Re-enter new password:
```

3. Enter and re-enter a new password.

The message **Passwd: password changed** appears.

```
Passwd: password changed
```

→| **NOTE**: Make sure to keep or remember the new password and share with technicians who may need it.

7.5.3   Configure Network with RSTAR Affinity Software (Required)

The Gateway network interface defines the network configuration to communicate with the RSTAR Affinity software. The Gateway connects to the RSTAR Affinity software using the following network routing options:

- ethernet (highest priority)
- Wi-Fi (medium priority)
- cellular (lowest priority)

The Gateway routes network traffic to the available network option with the higher priority. If ethernet is available, the Gateway routes network traffic according to the connection priority settings.

7.6 ETHERNET

The Gateway ethernet interface is assigned to a static IP of **169.254.0.0**. This local link address requires you to connect a laptop or desktop computer to establish the initial SSH connection. In this configuration, communication is limited to a direct connection between a laptop or desktop computer and the Gateway.

If you use the ethernet as a networking option to the RSTAR Affinity software cloud solution, you must change the ethernet interface from the static local link address (169.254.0.0) to either a dynamic IP or a static IP address available on the network.

7.6.1 Topology

The diagram below shows a typical ethernet topology for the cloud-based RSTAR Affinity software server environment. The diagram also shows that the SSH console access is available only from a router or switch on the local area network.
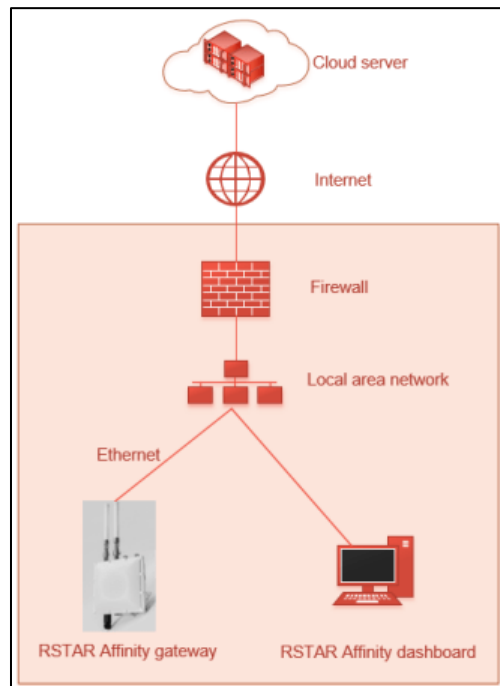

Figure 19: Ethernet Topology Diagram

7.6.2 Set Up Ethernet Connection

The Gateway's firmware is configured to use a static IP with an address of 169.254.0.0. Modifying the configuration will delete the current setting and cause the Gateway's SSH console to be inaccessible through the local link address 169.254.0.0. A local link is a network address valid only for communications within the network or the broadcast domain that the host is connected to.

If modified, the Gateway console can only be accessed through the static or dynamic IP address assigned to the Gateway.

To configure the Gateway with a static or dynamic IP, complete the following steps:

1. The shell script **gw-uplink** with the argument "eth" specifies the configuration for the ethernet adapter. This script prompts the user to specify the following parameters:

    - Device – on board device number (eth0 or eth1)
    - Address type – static or dynamic IP addressing type (DHCP or static)
    - Autoconnect priority – assigns priority level of this adapter (-999 = lowest, 999 = highest)
    - Metric – this parameter sets the ethernet adapter connection priority against the other available networking adapter such as the Wi-Fi and cellular
    - IP/Mask – static IP and mask*
    - Gateway – Gateway IP address and mask*
    - DNS server – DNS server IP address

> → | **NOTE:** Items marked with an asterisk (*) means it is applicable only for static IP address type.

Run the shell script **gw-uplink** with the argument "eth" to specify the ethernet option.

```
./gw-uplink eth
```

2. The script prompts for the device selection:

```
1, eth1
2, eth0
Device[1]:
```

Enter "1" to select eth1 (ethernet adapter 1). Ethernet adapter 1 is for reserved for the local area network ethernet option and eth0 (ethernet adapter 2) is reserved for a specialized ISM radio.

3. The script prompts for the ethernet IP address type:

```
1, DHCP
2, static
address type[1]:
```

DHCP (Dynamic Host Configuration Protocol) is used to assign a dynamic IP address to the Gateway by the DHCP server. Select this option if the desired local

network automatically assigns dynamic IP to network devices. The Gateway's MAC address can be displayed from the Linux command ifconfig. From this MAC address, the DHCP's assigned IP address can be cross referenced with the MAC address found in the Gateway's identification sheet.

Static is used to assign a static IPv4 address to the Gateway. Select this option to assign a fixed IP address that does not change, unique and assessable within the network addressing space.

4. The script prompts for the autoconnect priority.

```
Autoconnect-priority[0]:
```

This parameter prioritizes the auto connection between eth0 and eth1. The valid range of values ranges from -999 to 999. The ethernet adapter (eth0 or eth1) with the highest number is connected first upon boot up. The recommended setting is to leave this value at 0 when configuring eth0 or eth1.

5. The script prompts for the Metric.

```
Metric[default]:
```

This parameter sets the ethernet adapter connection priority against the other available networking adapter such as the Wi-Fi and cellular. The Gateway connects with the highest priority adapter. The default interface metric is defined in Table 4: Interface Metric, where 0 = highest priority and 999 = lowest priority.

Interface	Metric Value
Ethernet	100
Wi-Fi	600
Cellular	700

Table 4: Interface Metric

6. For static IP address type, the script prompts for the Gateway IPv4 address.

```
IP/mask:
```

This IP assignment specifies the static IP address.

The static IP address must be unique on the network.

7. For static IP address type, the script prompts for the Gateway IP of the network/router.

```
Gateway:
```

This Gateway IP assignment specifies the Gateway IP address.

8. For static IP address type, the script prompts for the DNS server IP address.

```
DNS server:
```

The DNS server IP assignment specifies the DNS IP address.

7.7 WI-FI

The Gateway's Wi-Fi network adapter can be configured to connect to a Wi-Fi access point that supports the AES 256-bit encryption standard. The Wi-Fi access point must be able to route network traffic to the RSTAR Affinity software's cloud services through the internet.

7.7.1 Topology

The diagram below shows a typical Wi-Fi topology for the cloud-based RSTAR Affinity software server environment.
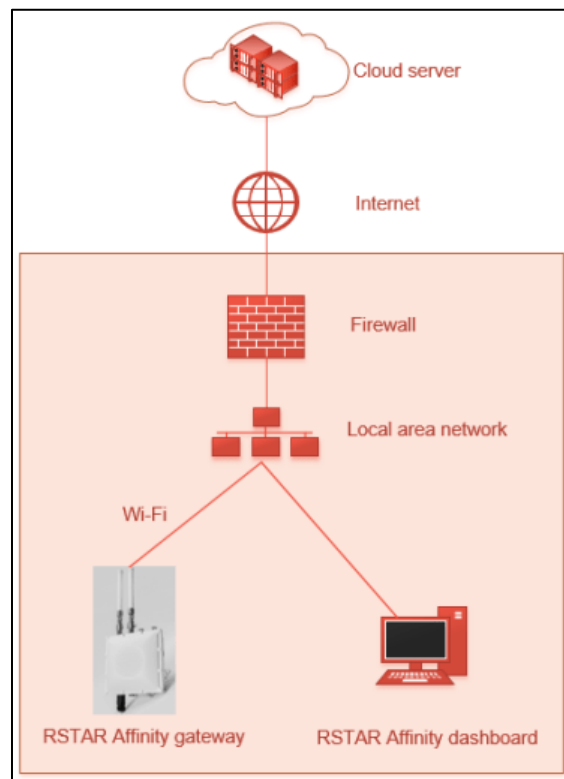

Figure 20: Wi-Fi Topology Diagram

7.7.2 Set Up Wi-Fi Connection

To configure the Gateway's Wi-Fi interface as a static or dynamic IP interface, complete the following steps:

1. The shell script **gw-uplink** with the argument "wifi" specifies the configuration for the Wi-Fi adapter. This script prompts the user to specify the following parameters:

   - Device – on board device number (wlan0 or p2p-dev-wlan0)
   - SSID – name of the Wi-Fi wireless network name
   - Password – password for the Wi-Fi wireless network

- Autoconnect priority – assigns priority level of this adapter (-999 = lowest, 999 = highest)
- Metric – network priority metric defines the priority level of the metric
- IP/Mask – static IP and mask*
- Gateway – Gateway IP address and mask*
- DNS server – DNS server IP address

→ | **NOTE:** Items marked with an asterisk (*) means it is applicable only for static IP address type.

Run the shell script **gw-uplink** with the argument "wifi" to specify the Wi-Fi option.

```
./gw-uplink wifi
```

2. The script prompts for the device selection:

```
1, wlan0
2, p2p-dev-wlan0
Device[1]:
```

Enter "1" to select wlan0 (wireless LAN adapter 0). The p2p-dev-wlan0 specifies the point-to-point WLAN which is not applicable for setting a Wi-Fi network connection.

3. The script prompts for SSID:

```
SSID:
```

Enter the Wi-Fi network Service Set Identifier (SSID) that supports the RSTAR Affinity network. The Wi-Fi SSID is the name assigned to the wireless network. This name is visible when scanning for a visible wireless network. Wi-Fi SSID is case sensitive.

4. The script prompts for the Wi-Fi adapter IP address type:

```
1, DHCP
2, static
address type[1]:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

The script prompts for the autoconnect priority.

```
Autoconnect-priority[0]:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

5. The script prompts for the Metric.

```
Metric[default]:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

6. For static IP address type, the script prompts for the RSTAR Affinity Gateway IPv4 address.

```
IP/mask:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

7. For static IP address type, the script prompts for the Gateway IP of the network/router.

```
Gateway:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

8. For static IP address type, the script prompts for the DNS server IP address.

```
DNS server:
```

This parameter is identical to ethernet configuration. Refer to section 7.6.2.

After completing the configuration, the script will attempt to connect to the Wi-Fi access point. This typically takes less than 10 seconds. The connection status will be displayed.

7.8   CELLULAR

The on-board cellular adapter is a 3G or 4G data modem with a factory-installed SIM card that you may activate as primary or back-up network connection. Although the Gateway comes with a factory-installed SIM card, you must confirm carrier service availability and network compatibility for your installation.

7.8.1   Topology

The diagram below shows a typical cellular network topology for the cloud-based RSTAR Affinity software server environment.
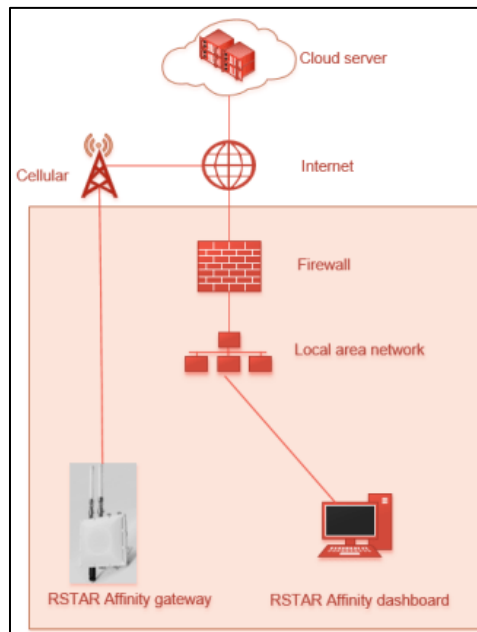

Figure 21: Cellular Topology Diagram

7.8.2 Set Up Cellular Connection

To configure the Gateway's cellular interface, complete the following steps:

1. The shell script **gw-uplink** with the argument "gsm" specifies the configuration for the cellular modem. This script prompts the user to specify the following parameters:

   - APN – Access Point Name to use specific to the sim card's access point
   - Metric – network priority metric defines the priority level of the metric

   Run the shell script **gw-uplink** with the argument "gsm" to specify the cellular option.

   ```
   ./gw-uplink gsm
   ```

2. The script prompts for the access point name:

   ```
   APN:
   ```

   The access point name (APN) is the name of the Gateway between the mobile network and the internet. The APN is presented to the carrier to determine what kind of network connection should be created. The APN is mandatory for establishing a cellular network connection. The factory-installed sim card APN name is "globaldata.net".

3. The script prompts for the metric.

   ```
   Metric[default]:
   ```

   This parameter is identical to ethernet configuration. Refer to section 7.6.2.

7.8.3 Verify Network Settings

Verify the network to ensure that the configured settings work by completing a network ping test.

Ping to a reliable server on the internet such as 8.8.8.8 (google DNS server) using the SSH console command **ping 8.8.8.8.**

A successful ping response shows the sequence number, time to live (TTL), and response time in milliseconds.

```
64 bytes from 8.8.8.8: seq=0 ttl=117 time=16.822 ms
64 bytes from 8.8.8.8: seq=1 ttl=117 time=16.005 ms
64 bytes from 8.8.8.8: seq=2 ttl=117 time=15.514 ms
--- google.com.8 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max = 15.514/16.113/16.822 ms
```

7.8.4 Retrieve the GUID and PIN from a Gateway

An RSTAR Affinity Gateway has a factory-assigned 128-bit globally unique identification number (GUID) that cannot be changed. It is on the product label and can also be found by running the SSH console command from the **/opt/affinity_gw/script** directory.

```
./gw-info
```

The script displays the Gateway's GUID, and PIN number as shown in the example below.

```
Key            | Value
***********Gateway General************
Version        | V3-R1
GUID    | 73c979cd-5232-441a-b0b9-03f62094efcd
PIN     | 1234
```

Register the GUID on the RSTAR Affinity database before adding the Gateway to a site using the RSTAR Affinity software.

7.8.5   Claim or Add Gateway to a Site

You must register the Gateway's GUID to the RSTAR Affinity software before you can add it to a site.

To register a Gateway to the RSTAR Affinity dashboard, complete the following steps:

1. Make sure the Gateway is online, and the network is verified to be operational as detailed in section 7.8.3.

2. From your web browser, log in to the dashboard with the username and password assigned by your RSTAR Affinity administrator.

3. Click the **Switch site** button on the top-left corner of the screen and select the site where you want to add the Gateway to.
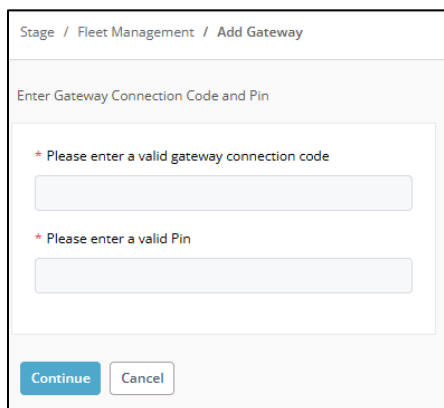

- The site name appears on the header (see below):
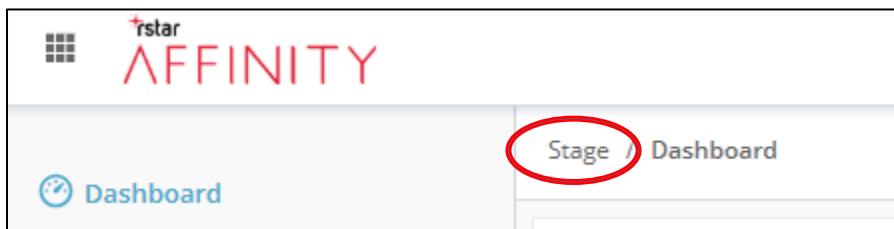
4. Click **Fleet Management** and then click **Add Gateway**.
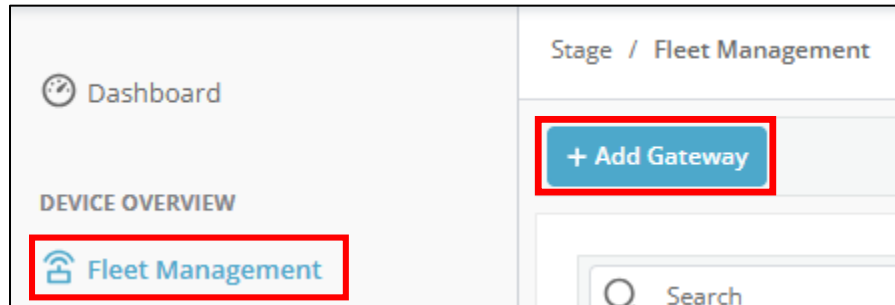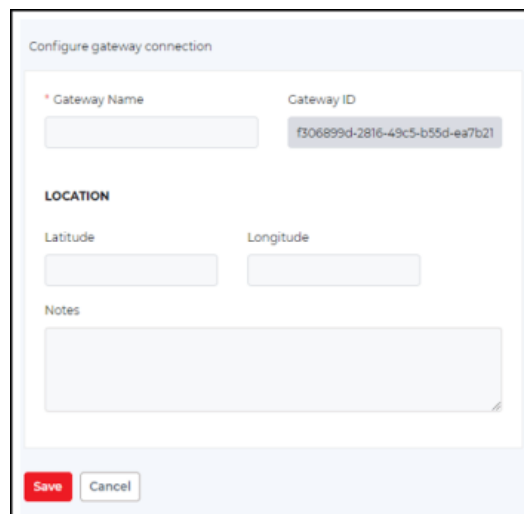

- The Enter Gateway Connection Code and PIN screen appears.

5. Enter the 36-character Gateway GUID and four-digit PIN.

6. Click **Continue** to add the Gateway to the site.

- The Configure Gateway connection screen appears.

7. Complete the following fields:

- Gateway Name – enter a user-friendly name to identify the Gateway
- Latitude – enter the Gateway's location latitude for the dashboard map view
- Longitude – enter the Gateway's location longitude for the dashboard map view
- Notes – enter notes to help identify the Gateway

8. Click **Save**.

- The claim status appears on the banner in the header. A green banner indicates a successful claim while a red banner indicates an error was detected. If an error is detected, repeat the claim process and ensure that the Gateway is operational and is network-connected to the RSTAR Affinity dashboard server.

8   MAINTENANCE AND REPAIR

8.1   FIRMWARE UPDATES

The RSTAR Affinity Gateway firmware is managed and updated remotely by RST Instruments support staff. Customers do not currently perform firmware updates themselves, and the procedure is not publicly shared.

Firmware updates are typically applied via secure remote access. In future releases, updates may be available through integration with the Azure portal, allowing for direct cloud-based deployment.

For consistency and reliability, all firmware maintenance is handled by RST support to ensure each gateway remains up to date and fully functional. If you have questions about firmware status or update scheduling, please contact RST Instruments support.

There is a minimal requirement for maintenance for the Affinity Gateway and accessories. Please contact RST Instruments for any clarification.

8.2   SAFETY ACCESSORIES

Use the following equipment when handling the AGW2168 & Junction Boxes:

- Gloves
- Steel-toed boots
- Hardhat
- Safety glasses

8.3   GENERAL MAINTENANCE GUIDELINES

Below are the recommended maintenance guidelines:

- Routinely ensure all antennas and ethernet cable gland have been securely fastened on.
- Ensure there is no physical damage caused by external forces
- Clean the outer housing when necessary, using a soft cloth. If using a cleaner, ensure it will not react with aluminium.

⚠️ **CAUTION:** Do not open the Gateway or it will void warranty.

8.4 SOLAR AND AC JUNCTION BOX MAINTENANCE AND REPAIR

Required tools:

- Digital Multimeter

To perform maintenance, follow the instructions below:

1. Open the lid of the Junction Box with a Phillips screwdriver.

2. If using an AC Junction Box, unplug the external AC power cord.
   If using a Solar Junction Box, unplug the external Solar Panel cord(s).

   a. Inspect the AC cord or Solar Panel cord(s) for damage.
   b. Contact RST Instruments if a new connector is required.

3. Turn OFF the charge controller.

4. Open the enclosure of the 100Ahr battery.

5. Measure the voltage of the terminals.

   a. If the voltage of the battery is 10.5 V or less, changing the battery is required.
   b. The batter should be approximately 12 V for good status.

6. Remove the battery connector from the Junction Box and inspect the connector for any damage.

   a. Contact RST Instruments if a new connector is required.

7. Re-plug the battery connector back into the Junction Box battery port.

8. Turn on the charge controller to test if the battery powers ON the Gateway.

   a. Measure the output of the Charge Controller. It should be approximately 12-13 V.
   b. Check if the Gateway powers ON and comes online. If the Gateway does not turn ON, a new battery may be required. Check if any fuses are blown.

9. Re-plug the AC Plug or Solar connector and measure the voltage on charge controller G and DC IN 1 or DC IN 2.

   a. The input will be approximately 24 V DC for AC power.
   b. The input will vary for the Solar Panels depending on sunlight (up to 18.73 V).

10. Ensure the Ethernet connectors are not damaged.

8.5 REPLACING EXTERNAL 12 V – 100AHR LEAD ACID BATTERY – AC OR SOLAR JUNCTION BOX

If the 100 Ahr battery needs to be replaced, contact RST Instruments for a new battery.

Follow the instructions below to replace the 100 Ahr battery:

1. Unplug the connector from the Junction Box to the battery.

2. Open the battery enclosure.

3. Disconnect the internal cables from the terminals.

4. Remove the battery from the enclosure.

> **WARNING**: Battery weighs 67.5 lbs. / 30.6 kg. Use correct lifting techniques and wear steel-toed boots.

5. Replace the old battery with the new battery and reconnect the battery terminals.

6. Close the battery enclosure and reconnect the battery.

7. To test proper functioning, remove the AC plug or Solar Panel plug. The Gateway should still be powered via the battery. Check online to see the status of the Gateway.

> **WARNING**: Follow local laws and regulations of your region for battery disposal.

9 SERVICE, REPAIR AND CONTACT INFORMATION

This product does not contain any user-serviceable parts.

Contact RST for product services or repairs.

- For sales information: RST_sales@orica.com
- For technical support: RST_support@orica.com
- Create a support ticket:
  https://support.rstinstruments.com/support/tickets/new
- Website: www.rstinstruments.com
- Toll free: 1-800-665-5599

RST Canada Office (Head Quarters)

Address: 11545 Kingston Street, Maple Ridge, BC, Canada V2X 0Z5

Telephone: 604-540-1100

Fax: 604-540-1005

Business hours: 8:00 a.m. to 4:30 p.m. (PST) Monday to Friday, except holidays

RST UK Office

Address: Unit 4 Charles Industrial Estate Stowupland Road, Stowmarket Suffolk, UK, IP14 5AH

Telephone: +44 1449 706680

Business hours: 9:00 a.m. to 6:30 p.m. (GMT) Monday to Friday except holidays

Appendix A PRODUCT SPECIFICATIONS

> **NOTE**: For a complete and most recent list of product specifications, visit the product page for the RSTAR Affinity Gateway.