

RSTAR Affinity Gateway Installation and Commissioning Guide



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1 INTRODUCTION

1.1 RSTAR AFFINITY CONNECTIVITY SOLUTION

The RSTAR Affinity Connectivity Solution comprises data loggers, gateways, secure communications for data telemetry, and mobile and desktop applications. RSTAR Affinity is a complete industrial internet of things (IIoT) solution for reliable, real-time data flow from your worksite to your desktop – all from a single vendor.

The RSTAR Affinity Connectivity Solution is a scalable and flexible system that can be customized to satisfy the complex and demanding requirements for data collection. The topology and communications options including cell and LoRaWAN radio protocol (for better signal and range), cover all on-site and remote monitoring scenarios.

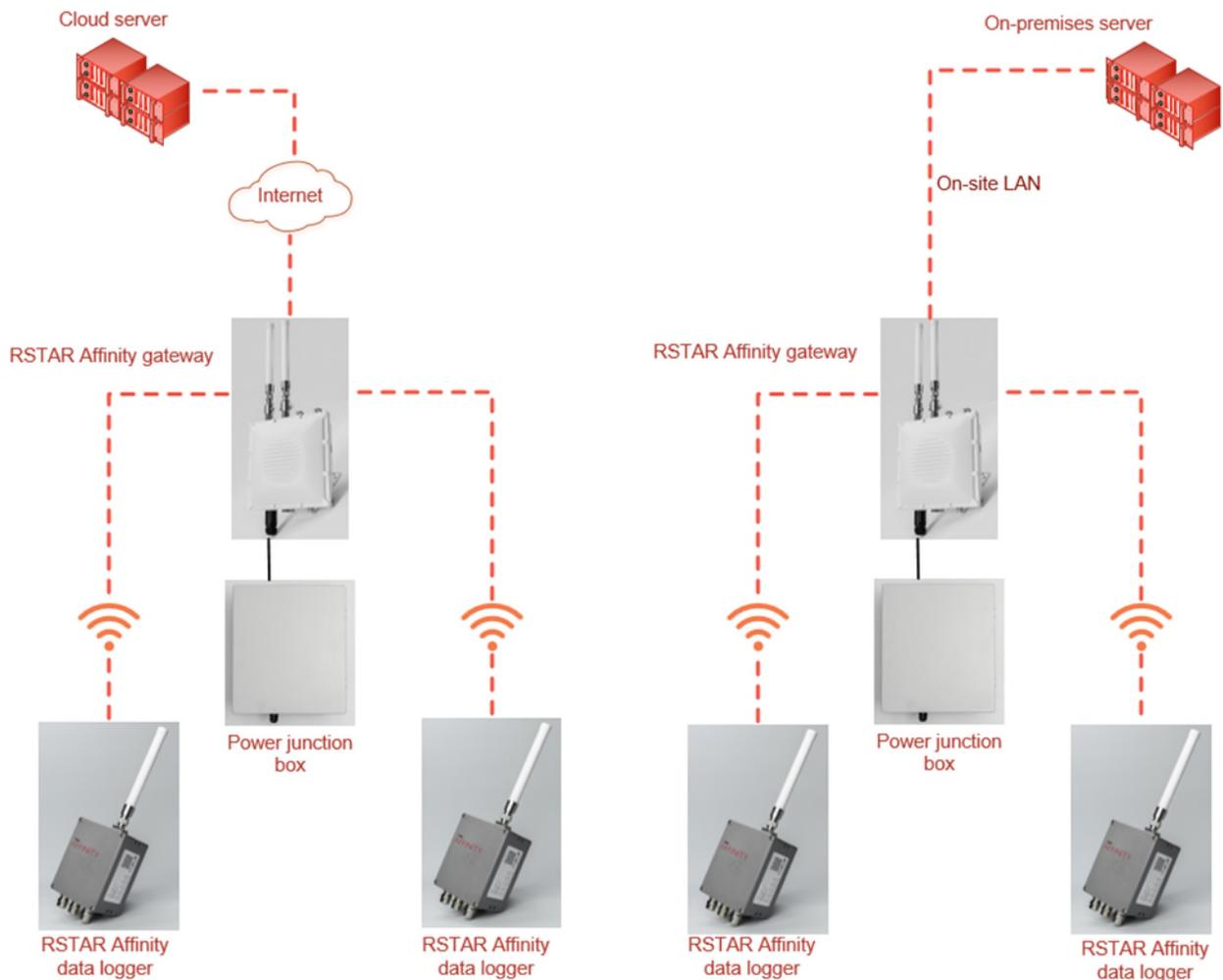


Figure 1: RSTAR Affinity Cloud and On-Premises Solution Diagram

1.2 INTENDED AUDIENCE

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

1.3 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.

1.4 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.
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.

Abbreviation or acronym	Definition
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.

1.5 RSTAR AFFINITY GATEWAY

The RSTAR Affinity gateway allows for steady data transmission using cellular signal to our secure cloud environment or straight to your own server. 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 -40°C to 60°C. The unique compartmentalized design separates power and instrument connections to keep moisture out while still offering easy access for simple maintenance such as battery replacement.

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 or an on-premises 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.

1.6 RSTAR AFFINITY DASHBOARD

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.

1.7 SECURITY

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

1.8 CONNECTIVITY SOLUTION

The RSTAR Affinity Connectivity Solution supports a variety of configurations to meet complex operational challenges. Solutions include:

- host environment options which can be on premise or in the cloud,
- wireless telemetry using LoRaWAN,
- gateway networking options include ethernet, built-in cellular, and Wi-Fi

1.9 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.

The on-premises solution is available for customers who wish to host their own environment. This solution offers customers the option to manage their own deployments, upgrades, redundancy, and security. This solution is recommended for customers with their own IT team capable of supporting technical challenges.

1.10 WIRELESS TELEMETRY

The RSTAR Affinity Connectivity Solution uses LoRaWAN for wireless telemetry (for communication network) between gateways and data loggers. The LoRaWAN wireless technology is used to build a private wireless network for applications where small-sized payload is transmitted over long distances (in the range of kilometers) with low-power consumption. This technology is ideal for sending low bandwidth sensor data.

1.11 NETWORKING OPTIONS

The RSTAR Affinity Connectivity Solution is equipped with numerous networking options between the RSTAR Affinity gateway and the cloud or on-premises hosts, 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.

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.

2 SYSTEM OVERVIEW

2.1 OVERVIEW

The RSTAR Affinity gateway has an IP65 rated waterproof enclosure than can be mounted using pole or wall mount options.

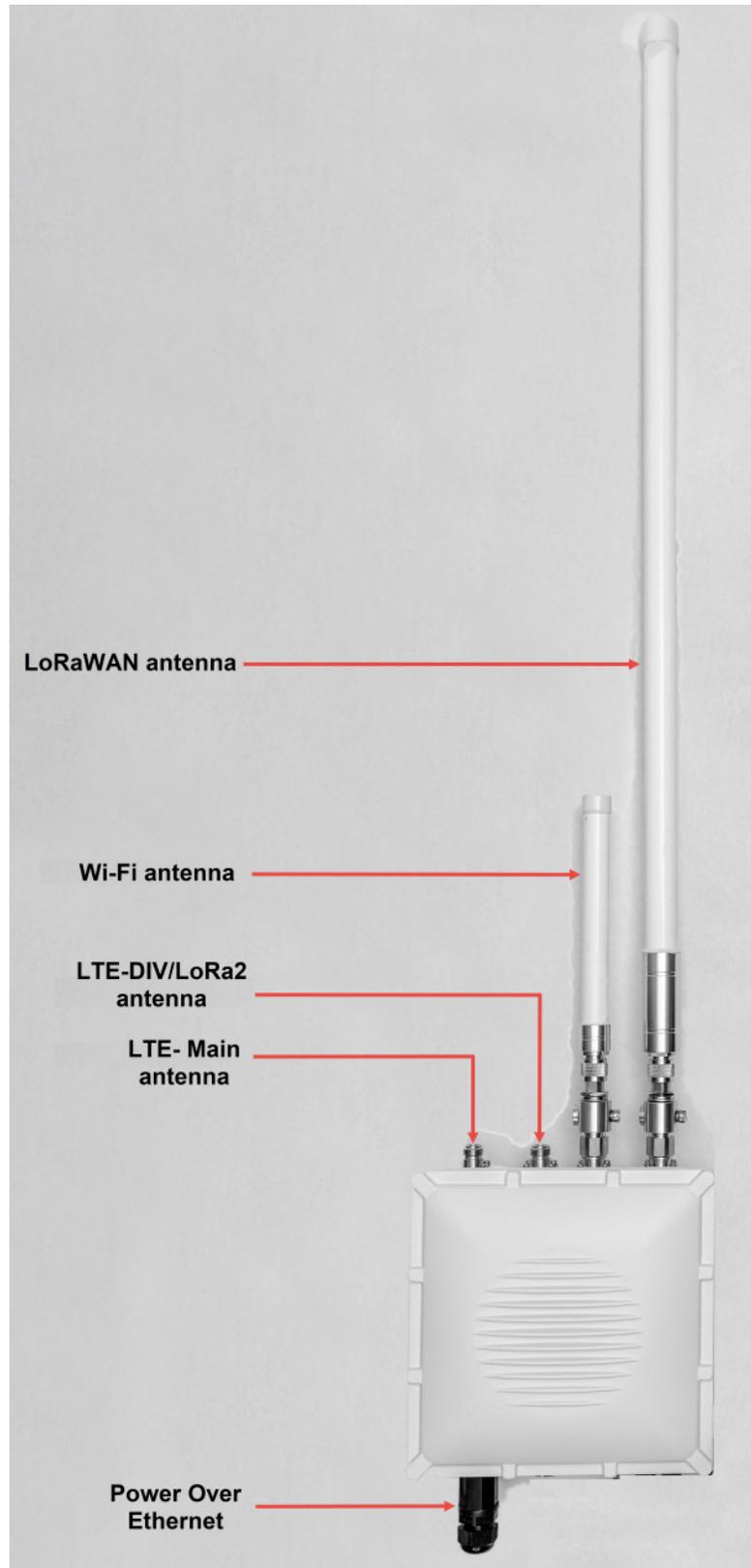


Figure 2: RSTAR Affinity Gateway Device Overview

2.2 HARDWARE INTERFACES

The gateway features hardware interfaces on the top and bottom panels as shown in the following pictures. Note that LTE/DIV is currently not used.



Figure 3: Gateway Hardware Interfaces – Top

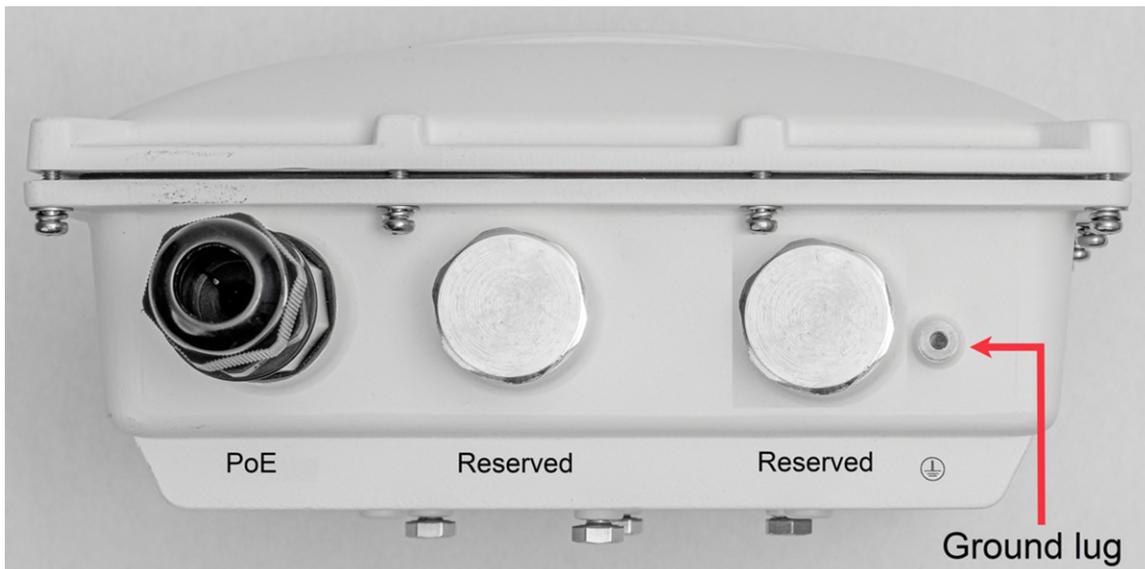


Figure 4: Gateway Hardware Interfaces – Bottom

2.3 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.



NOTE: Error! Reference source not found. and Error! Reference source not found. show the typical configuration of a power junction box with the 120/220V AC power option. Diagrams of the solar power option will be available in the future.

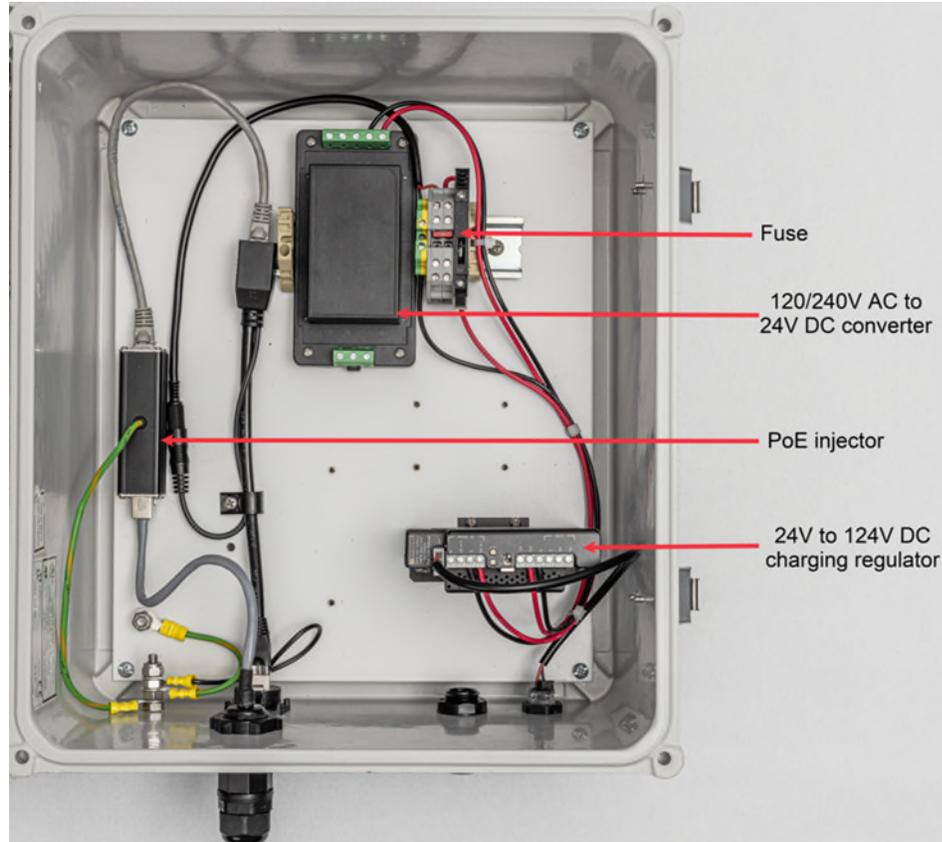


Figure 5: Typical Junction Box Internal Layout

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

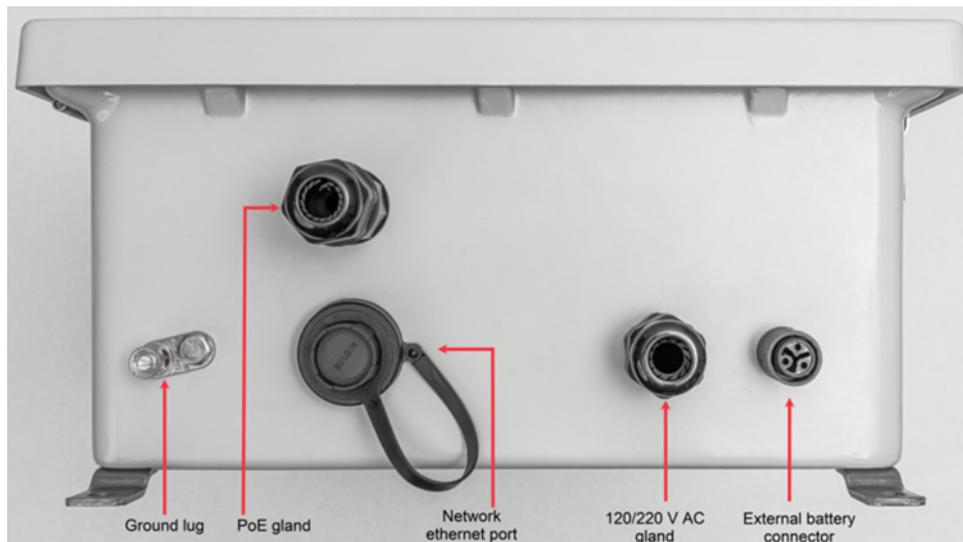


Figure 6: Junction Box Terminator Assignment

2.4 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.

3 INSTALLATION PROCEDURES

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).

3.1 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 antenna. If you need additional height to the antenna, you must use low-loss antenna extension cables.
- 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 either a cloud or on-premises 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 14 AWG and attach to an earth ground.

3.2 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) screwdriver
- Phillips head screwdriver

3.3 BOX CONTENTS

The gateway and power junction box are shipped with the parts and components listed in the table below and shown in Figure 7.



Figure 7: RSTAR Affinity Gateway Box Contents (standard options)

Item number	Quantity	Description
1	1	Gateway
2	1	Wall or pole mounting bracket and mounting screws
3	1	LoRaWAN antenna*
4	1	Power junction box with mounting brackets
6	1	Cellular antenna and lightning arrestor *
7	1	Wi-Fi antenna and lightning arrestor *
10	1	Power over Ethernet (PoE) cable
11	1	Solar panel and kit *

→ **NOTE:** Items with an asterisk (*) are optional accessories.

3.4 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”).

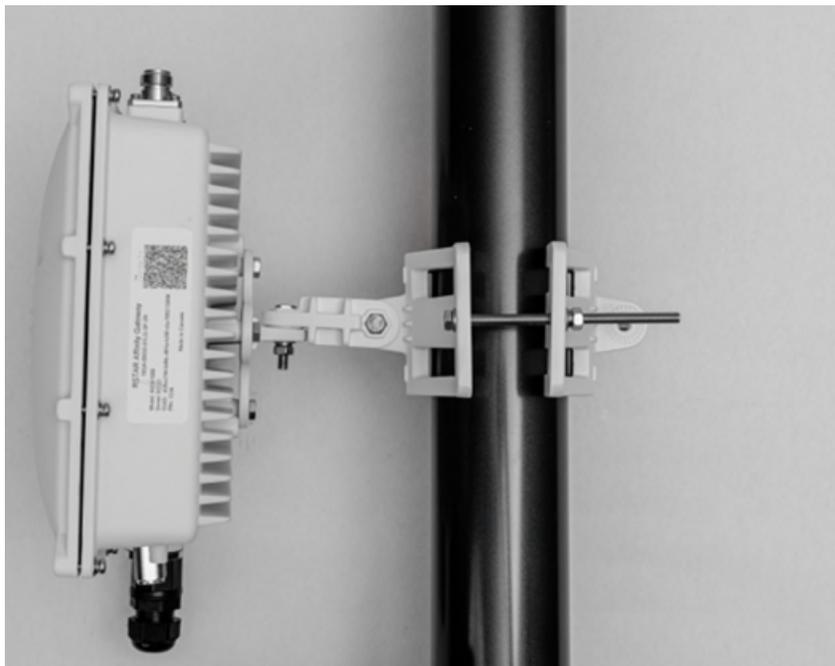


Figure 8: Pole Mount Option

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.

3.5 INSTALL GATEWAY WITH WALL OR PANEL MOUNT OPTION

This installation option uses the gateway wall mount assembly for mounting to a metal wall plate or a wall. You will need to supply your own screws to install the gateway mounting plate to the wall.



CAUTION: Ensure the screws can support the weight of the gateway and antennas.



Figure 9: 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.

3.6 INSTALL ANTENNA

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

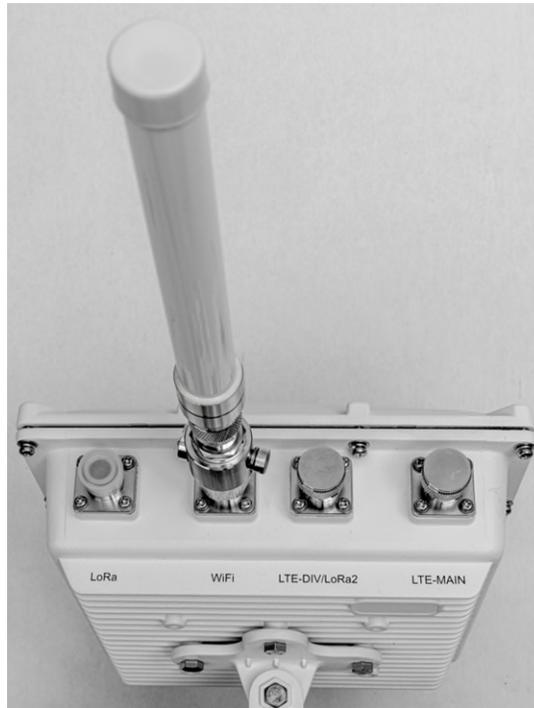


Figure 10: Antenna Port

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.

3.7 INSTALL A POE CABLE

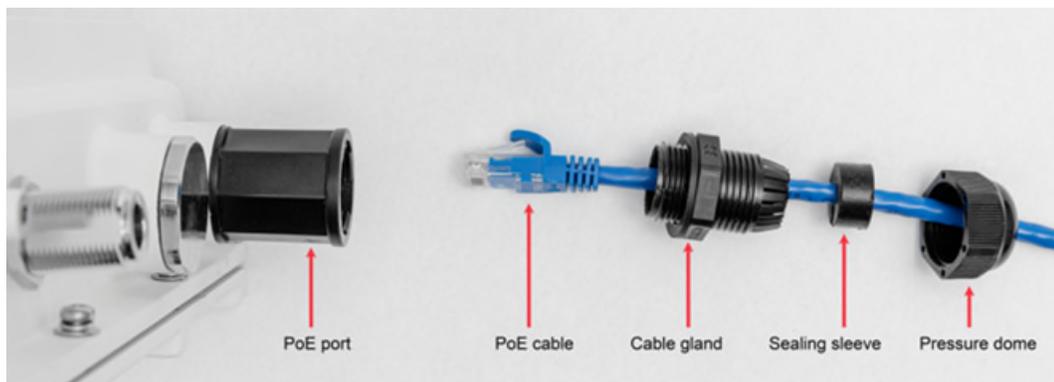


Figure 11: PoE Cable Installation Order

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.

3.8 MOUNT THE POWER JUNCTION BOX TO A WALL

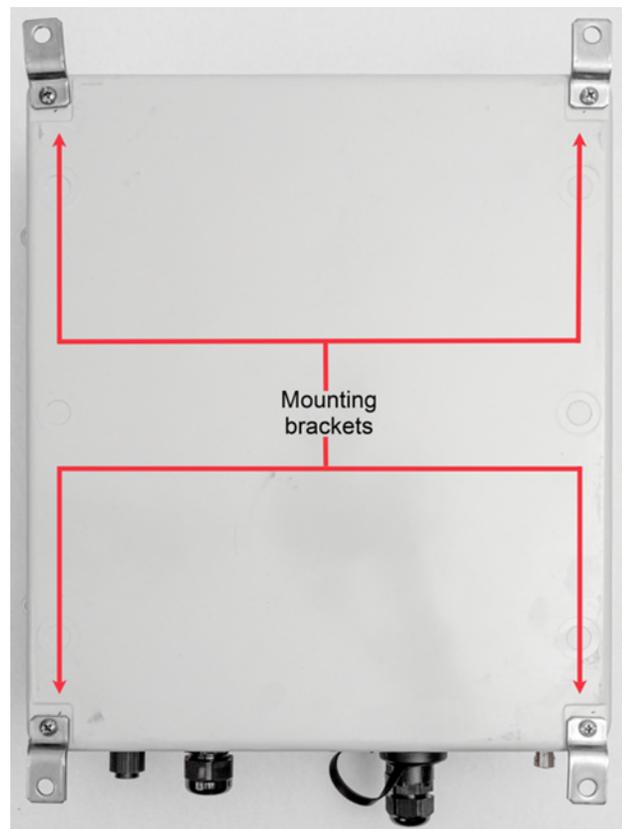


Figure 12: Power Junction Box Mounting Brackets

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.

3.9 INSTALL OPTIONAL COMPONENTS

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

- grounding cable



CAUTION: You will need to supply your own grounding cable. Ensure to use a grounding cable that is 14 AWG or thicker.

- network ethernet cable
- AC line cable
- fiberglass antenna mounting solution for outdoor setup
- solar panel and battery pack

3.9.1 Install the Grounding Cable (Optional)



Figure 13: 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.

3.9.2 Install the PoE Cable (Optional)

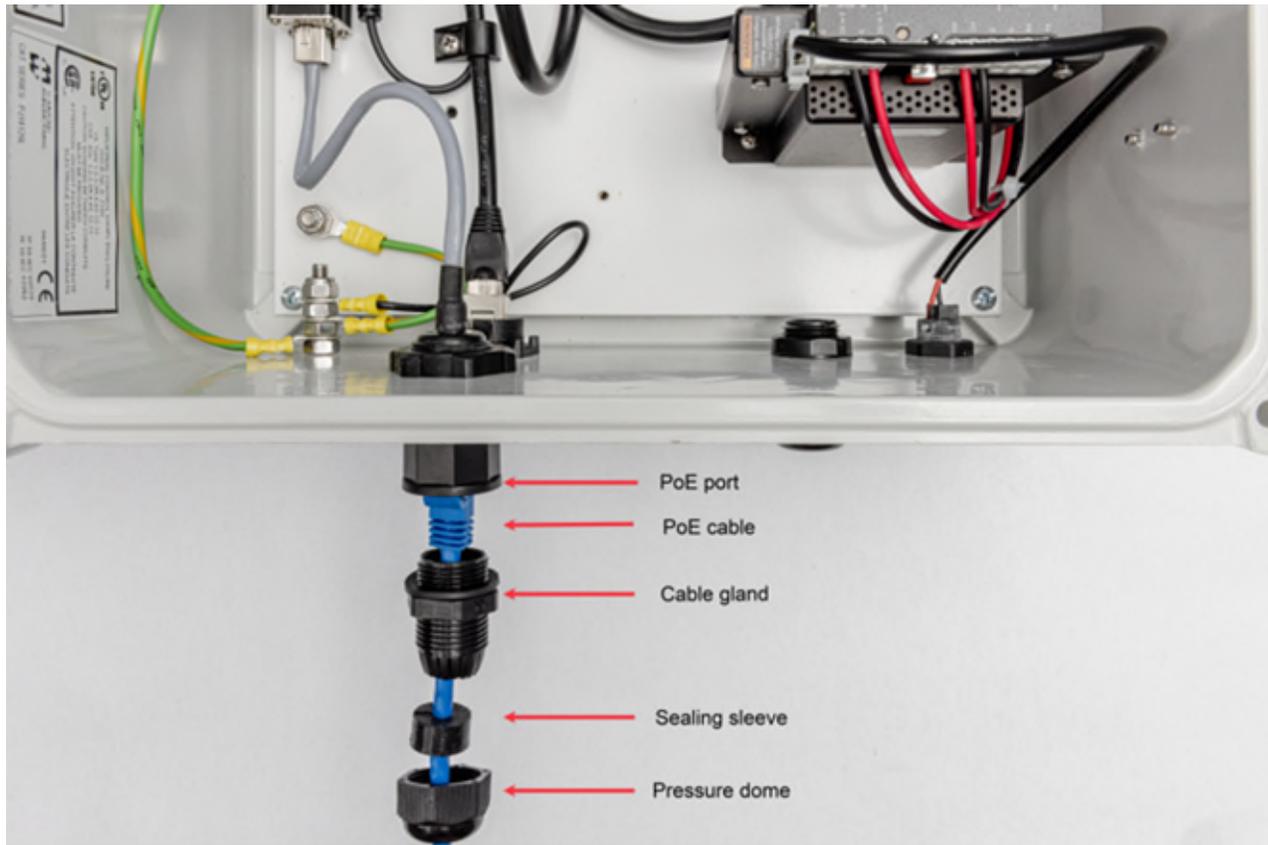


Figure 14: Power Junction Box Optional PoE Cable

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.

3.9.3 Install the AC Line Cable (if using AC power)

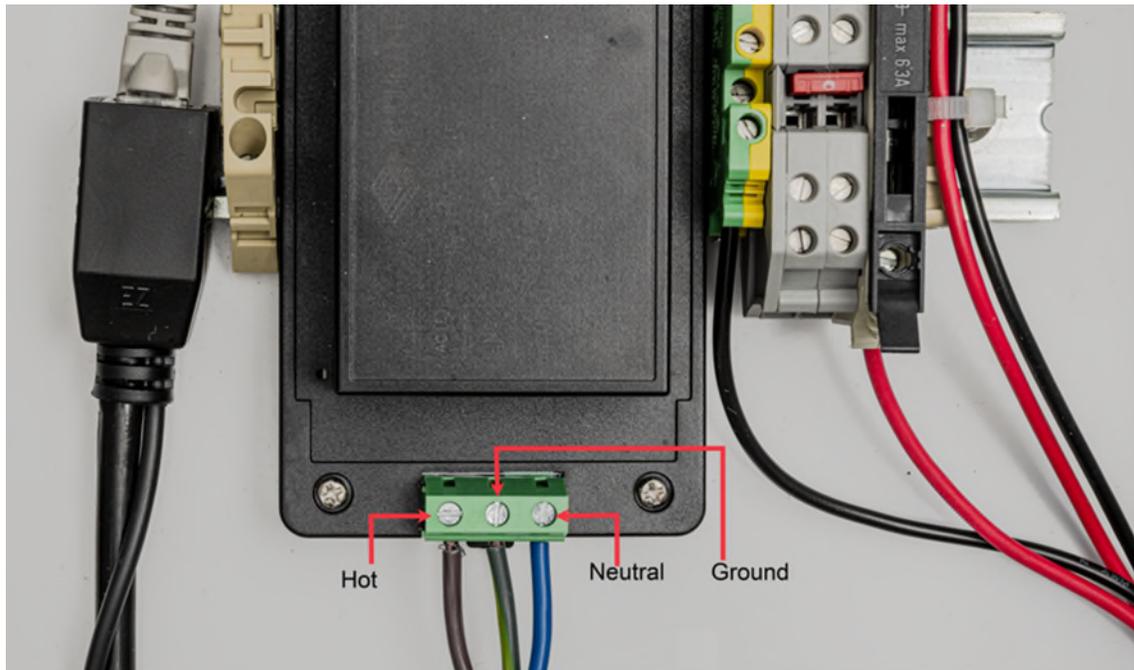


Figure 15: Power Junction Box Optional AC Line Cable

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.

3.9.4 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.

3.9.5 Install the Fiberglass Antenna for Outdoor Setup (Optional)

To install the optional fiberglass antenna mounting for an outdoor setup, complete the following steps:

1. Install the gateway using the pole or wall mount option.
2. Mount the fiberglass antenna to the top of pole using the A-fix bracket kit.
3. Unscrew the antenna port cover found on top of the enclosure.
4. Connect the coax cable to the fiberglass antenna.



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

4 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.

4.1 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

4.2 COMMISSIONING PRE-REQUISITES

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

- computer (laptop or desktop) pre-loaded with Tera Term or HyperTerminal
- 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
- ethernet Cat 6 cable to connect the computer and the gateway junction box ethernet port
- Wi-Fi access point SSID and password for systems with Wi-Fi as the primary network
- DHCP server available on the network for systems with ethernet as the primary network



NOTE: A network switch is required to allow the gateway to connect to the server.

- a network firewall configured to permit traffic from network port 8883 (MQTT-encrypted port) from the gateway to the server
- RSTAR Affinity software installed on a server computer and connected to the network for an on-premises system. The gateway must be on the same network
- traffic permitted from the RSTAR Affinity primary network to the internet for Azure cloud system

4.3 LINUX COMMANDS

The gateway runs the Yocto Project (a Linux distribution for embedded hardware). You must have a basic understanding of Linux and the console commands to commission the gateway. Below are some sample commands.

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

4.4 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-reg-local	Register the gateway to an on-premises 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

4.5 COMMISSION THE RSTAR AFFINITY GATEWAY

The cloud or on-premises commissioning procedure may differ based on administrative policies, network equipment installation, and other factors. 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
- register gateway for use in an on-premises environment
- claim or add gateway to a site
- log out from the console

4.5.1 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.

4.5.2 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.

4.5.3 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.

4.6 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 on-premises or 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.

4.6.1 Topology

The diagram below shows a typical ethernet topology for either a cloud or on-premises 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.

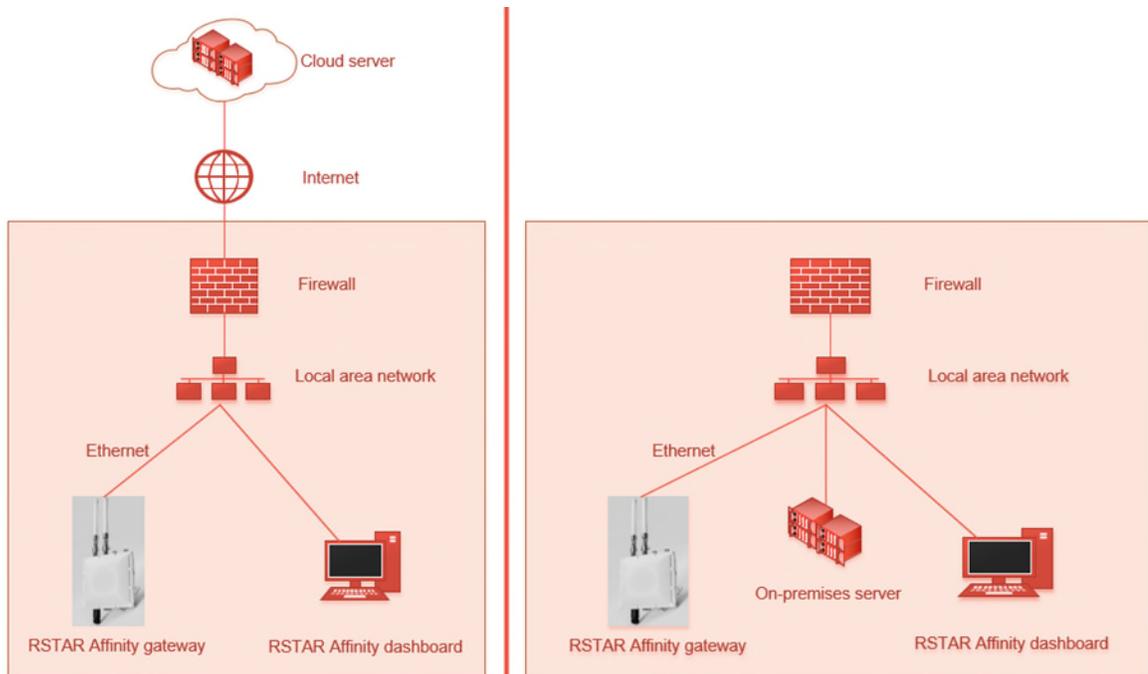


Figure 16: Ethernet Topology Diagram

4.6.2 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 and mask*

→ **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 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.

4.7 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 or to the software's server on the on-premises solution.

4.7.1 Topology

The diagram below shows a typical Wi-Fi topology for either a cloud or on-premises RSTAR Affinity software server environment.

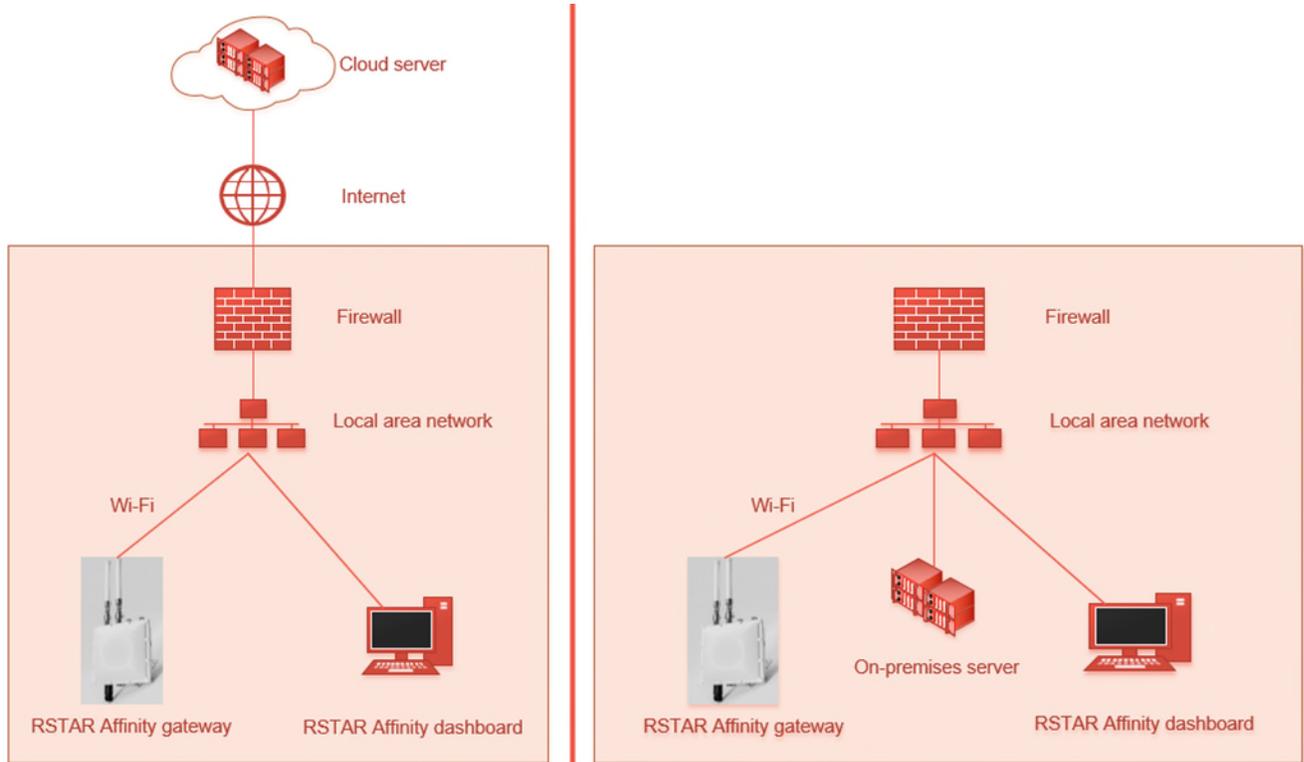


Figure 17: Wi-Fi Topology Diagram

4.7.2 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 and mask (*)

➔ **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 4.6.2.

The script prompts for the autoconnect priority.

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

This parameter is identical to ethernet configuration. Refer to section 4.6.2.

5. The script prompts for the Metric.

```
Metric[default]:
```

This parameter is identical to ethernet configuration. Refer to section 4.6.2.

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 4.6.2.

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 4.6.2.

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 4.6.2.

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.

4.8 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.

4.8.1 Topology

The diagram below shows a typical cellular network topology for either a cloud or on-premises RSTAR Affinity software server environment.

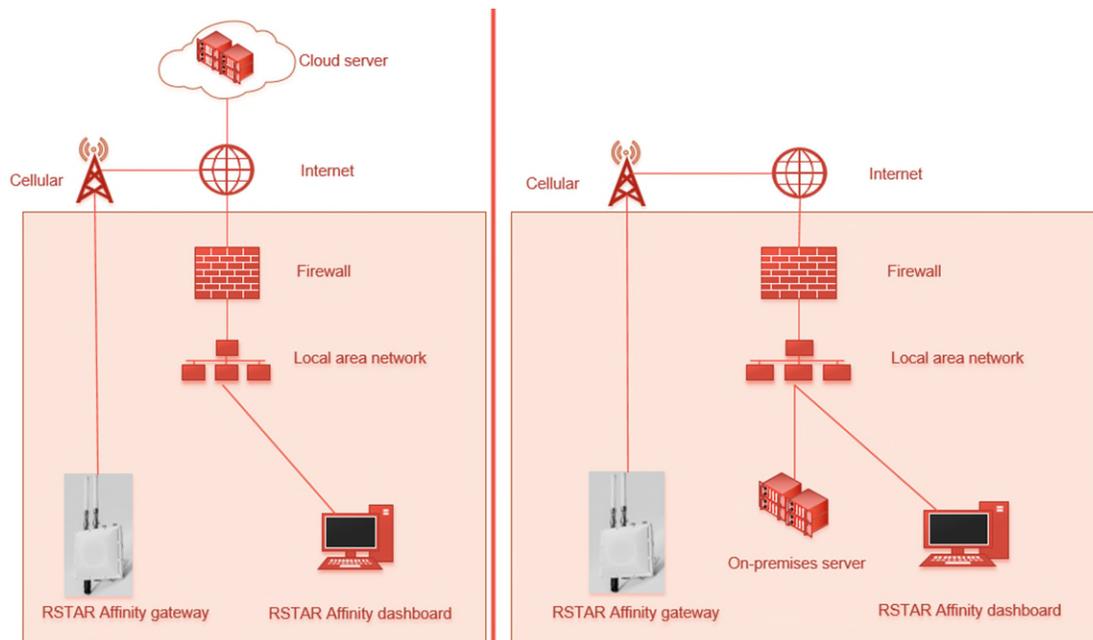


Figure 18: Cellular Topology Diagram

4.8.2 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 4.6.2.

4.8.3 Verify Network Settings

Verify the network to ensure that the configured settings work by completing a network ping test. The server address is dependent on whether the RSTAR Affinity software is in a cloud or on-premises environment.

If using the RSTAR Affinity software on the cloud, 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**.

If using the RSTAR Affinity software on-premises, ping the RSTAR Affinity software server IP address using the SSH console command **ping <RSTAR Affinity software Server IP address>**.

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
```

4.8.4 Register a Gateway (On-premises only)

The RSTAR Affinity software may operate on either on-premises or cloud environments. The gateway is factory-registered for the RSTAR Affinity software cloud platform with the domain name **rstaraffinity.cloud**. However, the gateway may be re-configured for on-premises environments. This requires the gateway to be registered to the specific on-premises RSTAR Affinity software endpoint.

Enter the following parameters to register the gateway to an on-premises endpoint:

- Endpoint IP address – IP address of the workstation where the on-premises RSTAR Affinity software resides.
- Endpoint administration username – This is the same username (email) used when installing the RSTAR Affinity software on-premises system. This

username is unique to each organization. Consult with the system administrator.

- Endpoint administration password – This is the same password used when installing the RSTAR Affinity software on-premises system. Consult with the system administrator.

Registration is a one-time set up that should only be changed if the on-premises workstation IP, username, or password credential is changed. The registration process requires that the gateway already has a networking interface established between the gateway and the on-premises server.

Use the SSH console command **gw-reg-local** for on-premises gateway registration.

```
./gw-reg-local
```

The script prompts for the gateway's global unique identifier (GUID).

```
GUID[4074dcdo-5191-43c6-aa07-7020664a1b53]:
```

The gateway displays its internal GUID. Do not change the GUID. Always press the **Enter** key to use the internally generated GUID.

The script prompts for the gateway's serial number:

```
Serial Number[123456]:
```

Enter the serial number of the gateway. The serial number is a 4 to 6-digit number printed on the product label on the gateway.

The script prompts for the gateway's PIN number:

```
PIN[1234]:
```

Enter the PIN of the gateway. The PIN is a four-digit number used by the RSTAR Affinity software to authenticate the gateway. The recommended PIN is 1234.

The script prompts for the RSTAR Affinity software log in endpoint path:

```
Northbound Login Endpoint[https://192.168.0.179/api/Auth/SignIn]:
```

Enter the full path of the log in request. The full path includes the IP address of the RSTAR Affinity software workstation.

The full path must be entered exactly as: **https://xxx.xxx.xxx.xxx/api/Auth/SignIn**. Incorrectly entering the endpoint information will result in errors.

The script prompts for the RSTAR Affinity software log in username:

```
Northbound Login username[mail@company.com]:
```

Enter the username (email) of the workstation. The username is the administration username that the administrator entered during the initial installation of the RSTAR Affinity software instance. The username is typically an email address available from the administration department or whoever first installed the RSTAR Affinity software.

The script prompts for the RSTAR Affinity log in password:

```
Northbound Login username[Pwd12345!!]:
```

Enter the password associated with the username.

The script prompts for the RSTAR Affinity registration endpoint path:

```
Northbound Registration  
Endpoint[https://192.168.0.179/api/Gateways/RegisterDevice]:
```

Enter the full path of the registration request. The full path includes the IP address of the RSTAR Affinity software workstation.

The full path must be entered exactly as:

<https://xxx.xxx.xxx.xxx/api/Gateways/RegisterDevice>. Incorrectly entering the endpoint information will result in errors.

Upon entering the registration endpoint information, the gateway immediately commences the registration process with the RSTAR Affinity on-premises server over the networking interface. A series of connection message appears on the SSH console, ending with the message “Done”.

```
update xxxxxxxx-xxxx-xxxx-xxx-xxxxxxxxxxxx related information  
into local database  
INSERT 0 1  
Login to . . .  
. . .  
. . .  
Updating configuration file . . .  
Restarting Affinity Services . . .  
Done
```

If the gateway registration is unsuccessful, an error message appears. Repeat the process until the registration is successful.

4.8.5 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
```

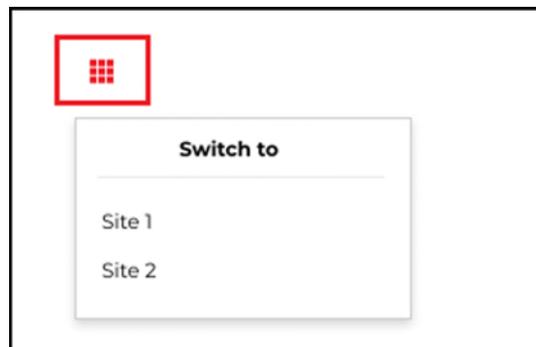
Register the GUID on the RSTAR Affinity database before adding the gateway to a site using the RSTAR Affinity software.

4.8.6 Claim or Add Gateway to a Site

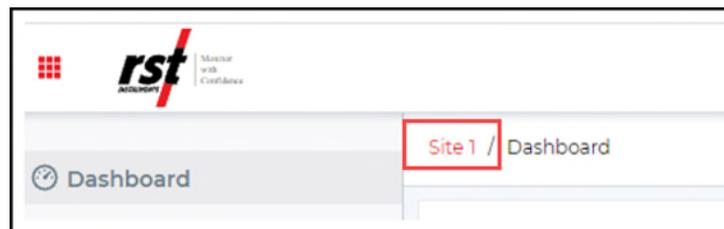
You must register the gateway's GUID to the RSTAR Affinity software before you can add it to a site.

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 4.8.3.
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 to** button on the top-left corner of the screen and select the site where you want to add the gateway to.



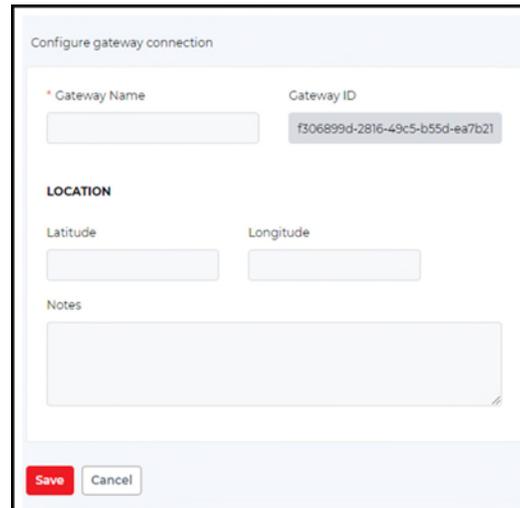
- The site name appears on the header.



4. Click **Fleet Management** and then click **Add a Gateway**.

- The Enter Gateway Connection Code and PIN screen appears.

5. Enter the 36-character gateway GUID and four-digit PIN from completing [Register a Gateway for Use in On-Premises Environment](#) (section 4.8.4).
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.

4.8.7 Set Up a Gateway Power Modes (Optional)

The power management option allows the installer to configure the RSTAR Affinity gateway to minimize power consumption. Enabling power management means the gateway wakes up at time intervals synchronized with the RSTAR Affinity data logger’s wake-up time intervals. Power management should be enabled for gateways installed where power is supplied from a re-chargeable battery system.



NOTE: The gateway’s factory setting is typically shipped with power management disabled.

The power management features allow you to access the features using SSH commands:

Feature	SSH command
Enable power management service	gw-pow set
Disable power management service	gw-pow clear
Show power management settings	gw-pow show
Pause power management service	gw-pow pause
Resume power management service	gw-pow resume

The following parameters are specific to each installation.

Parameter	Description
Sleep voltage	The threshold voltage where the logger immediately enters sleep mode. If the internal voltage falls below this threshold, the gateway automatically enters sleep mode. For power management, an internal voltage setting of 10.0 is the recommended setting.
Awake duration (minutes)	The total number of minutes the gateway is powered up in one wake-up cycle. This duration should be long enough to accommodate the gateway's delay to boot up (offset) and sufficient time for the gateway to transmit its accumulated data to the RSTAR Affinity dashboard.
Gateway Wakeup/Sleep Cycle (hours)	The periodic wake up hour setting.
Gateway Wakeup/Sleep Cycle (minutes)	The periodic wake up minute setting.
Gateway Minute Offset	The number of minutes to wake up prior to the wakeup/sleep cycle. The gateway should be in operational mode prior to the wakeup/sleep cycle so that all services are available for operation. Typically, the gateway minute offset should be set to 2 minutes as a minimum setting.

Wake Up Cycle Example #1:

All RSTAR Affinity data loggers are configured to wake up every 30 minutes and remain operational for 5 minutes. Below is the prescribed setting.

- Awake duration (minutes): 8
- Gateway Wakeup/Sleep Cycle(hours): 0
- Gateway Wakeup/Sleep Cycle(minutes): 30
- Gateway Minute Offset: 2

Wake Up Cycle Example #2:

All RSTAR Affinity data loggers are configured to wake up every 4 hours minutes and remain operational for 9 minutes. Below is the prescribed setting.

- Awake duration (minutes): 14

- Gateway Wakeup/Sleep Cycle(hours): 4
- Gateway Wakeup/Sleep Cycle(minutes): 0
- Gateway Minute Offset: 2

4.8.8 Enable Power Management Service

To enable the gateway's power management service, complete the following steps:

1. Run **gw-pow set** to specify the power management options.

```
./gw-pow set
```

The script prompts for the sleep voltage.

```
Sleep voltage[11.5]:
```

2. Enter the sleep voltage threshold in volts.

The script prompts for the awake duration.

```
Awake duration(minutes)[5]:
```

3. Enter the awake duration ensuring that there is sufficient time to include the gateway power up time (typically 2 minutes) and the gateway data upload time (typically 3 minutes).

The script prompts for the gateway wakeup/sleep cycle in hours.

```
Gateway wakeup/Sleep cycle(hours)[1]:
```

4. Enter the data logger's data hourly sampling.

If the data logger's data sampling interval is less than 1 hour, set this to 0.

The script prompts for the gateway wakeup/sleep cycle in minutes.

```
Gateway wakeup/Sleep cycle(minutes)[0]:
```

5. Enter the data logger's data sampling in minutes.

If the data logger's data sampling interval is greater or equal to 1 hour, set this to 0.

The script prompts for the gateway wakeup minute offset in minutes.

```
wakeup Minute offset[0]:
```

6. Enter the number of minutes that the gateway should wake up before the data logger's sampling interval. The typical setting should be set to 2 minutes.

4.8.9 Disable Power Management Service

To disable the gateway's power management service, run **gw-pow clear**.

```
./gw-pow clear
```

After disabling power management, the gateway would remain in operational state indefinitely.

4.8.10 Pause Power Management Service

Pausing the gateway's power management services may help extend an active console session. To pause the gateway's power management services, run **gw-pow pause**.

```
./gw-pow pause
```

After pausing power management services, the gateway would remain in operational state indefinitely until power management is resumed or changed, or if the gateway is powered off and on.

4.8.11 Resume Power Management Service

You can only resume power management services on the gateway if the service was previously paused. To resume the gateway's power management services, run **gw-pow resume**.

```
./gw-pow resume
```

4.8.12 Show Power Management Service

The show management state displays the status of the next wake-up time and the number of minutes remaining before the next scheduled wake up time. To show the gateway's power management services, run **gw-pow show**.

```
./gw-pow-show
```

4.8.13 Log Out

You must log out after completing an SSH console session to terminate the SSH session. To log out, on the SSH console, type the command **logout** and press **Enter**.

```
logout
```

Appendix A RSTAR AFFINITY GATEWAY SPECIFICATIONS

PHYSICAL SPECIFICATIONS						
Dimensions Excluding Antenna(s)		220 mm (L) x 220 mm (W) x 104 mm (H)				
Dimensions Including Antenna(s)		1150 mm (L) x 220 mm (W) x 104 mm (H)				
Housing Material		Die-cast aluminum				
Weight		4.5 kg				
Ingress Protection Marking		IP67 rated				
Mounting Options		Pole or wall mount				
ISM Antenna Options		868 MHz: 3dBi antenna 900 MHz: 5.8dBi antenna 900 MHz: 8dBi antenna				
GENERAL SPECIFICATIONS						
Temperature Operating Range		Ambient temperatures from -40°C to 60°C				
AVAILABLE GATEWAY CONFIGURATIONS						
REGION	STANDARD CONFIGURATION			INTERNET OPTIONS	POWER OPTIONS	OTHER OPTIONS
	LoRaWAN	INTERNET	POWER			
North America	915 MHz	LTE/Wi-Fi	AC adapter	Radio LAN or geostationary sat	Back-up battery or solar power	RSTAR
Europe	868 MHz or 433 MHz	LTE/Wi-Fi	AC adapter	Radio LAN or geostationary sat	Back-up battery or solar power	RSTAR
Brazil	915 MHz	LTE/Wi-Fi	AC adapter	Radio LAN or geostationary sat	Back-up battery or solar power	RSTAR
CELLULAR SPECIFICATIONS						
Frequency Bands for LTE-FDD		B1, B2, B3, B4, B5, B7, B8, B12, B13, B18, B19, B20, B25, B26, B28				
Frequency Bands for LTE-TDD		B38, B39, B40, B41				
Frequency Bands for WCDMA		B1, B2, B4, B5, B6, B8, B19				
Frequency Bands for GSM		B2, B3, B5, B8				
Output Power		23~33dBm ± 2dB				

Maximum Antenna Gain	3 dBi
RSTAR RADIO SPECIFICATIONS	
Operating Frequency (Country-dependent)	900 MHz, 868 MHz, 2.4 GHz spread spectrum band
Outdoor Range	Up to 14 km (at 900 MHz) in open country, depending on frequency and antenna
Maximum Nodes	255
POWER SPECIFICATIONS	
Power Supply	12 V DC from junction box via PoE

Appendix B RSTAR AFFINITY JUNCTION BOX SPECIFICATIONS

PHYSICAL SPECIFICATIONS	
Dimensions	359 mm (H) x 311 mm (W) x 156 mm (D)
Housing Material	Fibreglass
Ingress Protection Marking	IP66 rated
Mounting Options	Wall mount
Body Color	Grey
Weight	3 kg
POWER SPECIFICATIONS	
AC Power	120V AC/2 Amp or 240 V AC/1 Amp*
Solar Panel and Charger	Single or dual panel*

Items marked with an asterisk (*) are factory configuration.