

## S-GATEWAY EU

Picocell indoor gateway including a GPS receiver for advanced timekeeping

### Quick Installation Guide



Author  
Hardware Release  
Quick Install Guide Version  
Date  
Covering Product code

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## 2 Revision History

Revision	Reason	Author	Date
1.2	First version for comments	IvL	28 March 2019
1.3	Updated after comments from Tom Jansen. Included changes to software update 1.1.1. Software update 1.1.1 includes the 'activate' command and a fix for losing the DHCP lease.	IvL	1 April 2019

### 3 Introduction

The S-gateway is a Picocell, indoor LoRa gateway for enterprise and lightweight industrial applications that require Always On connectivity for Internet of Things (IoT) applications. It is very low cost and it is very easy to setup making it ideal for zero-touch high volume deployments. LoRa provides a low-cost way to connect battery operated devices to the network infrastructure.

LoRa® RF technology has been pioneered by Semtech and is a 2-way wireless solution, operating in the license exempt ISM bands, that complements M2M cellular infrastructure. It provides a low-cost way to connect battery operated and mobile devices to the network infrastructure.

The S-gateway uses a command line management system whereby you can configure the unit through the command line interface using SSH.

This document provides information on the following topics:

- S-gateway hardware identification.
- S-gateway hardware installation.
- S-gateway logging into the command line interface using SSH.
- Configuring a LoRaWAN server

#### 3.1 Check Your Package Contents

These are the items included with your S-gateway purchase:



S-gateway with 3dBi omni antenna



5V mains adapter with interchangeable heads for use in different countries

## 4 Connecting the S-gateway to your network

Connecting the S-gateway to your network is done in a number of steps. All connections are made to the back of the S-gateway.

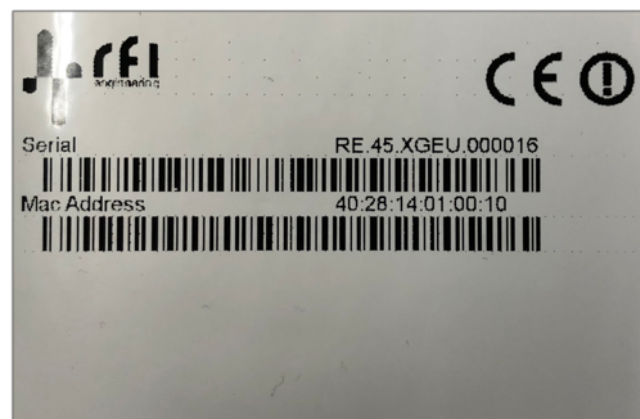
1. Connect the 3dBi omni antenna to the back of the S-gateway by screwing the antenna to the port labelled: "LoRa".
2. (Optionally) Connect a GPS antenna to the port labelled "GPS". GPS antenna not included.
3. Connect the Ethernet port of the S-gateway to an Ethernet network. For example, to your home or office network.
4. Connect the power supply to the port labelled "power".

After the power is applied the blue LED labelled "Power" on the front of the unit will be on. After a few seconds the Ethernet LEDs on the Ethernet port will also turn on. The unit is ready for use when the green LED labelled "LoRa Rx" is switched on.

**The S-gateway has been set to receive an IP address from a DHCP server on your network.**

If you need to know the IP address of your S-gateway and local network on the Internet, you cannot find this information from within Windows, which only shows your computer's IP address on the local network. Usually you can view the IP address assigned to your S-gateway via DHCP from your router's Web-based administration interface. You will have to look up the MAC address of the S-gateway in the DHCP table of your router.

All S-gateways will have a MAC address looking similar to: 40:28:14.xx.xx.xx, where the xx.xx.xx part will be specific to your unit. The MAC address of the S-gateway is also printed at the label attached to the bottom of the unit.



*Figure 1: Label showing the serial number and MAC address of your S-gateway*

## 5 Logging in to the S-gateway

The S-gateway has been designed to have (almost) zero touch configuration. All configuration is done via the command line interface that can be accessed over Secure Shell (SSH). In order to log in you will have to open a Secure Shell Connection to the IP address of the S-gateway.

You can login using your favorite SSH client. SSH clients for most operating systems can be downloaded from for example <https://www.ssh.com> (OpenSSH)

In our examples the Mac OSX SSH client will be used. Consult your SSH client documentation if you use a different SSH client. In our example below the S-gateway has been assigned an IP address of 10.1.4.133

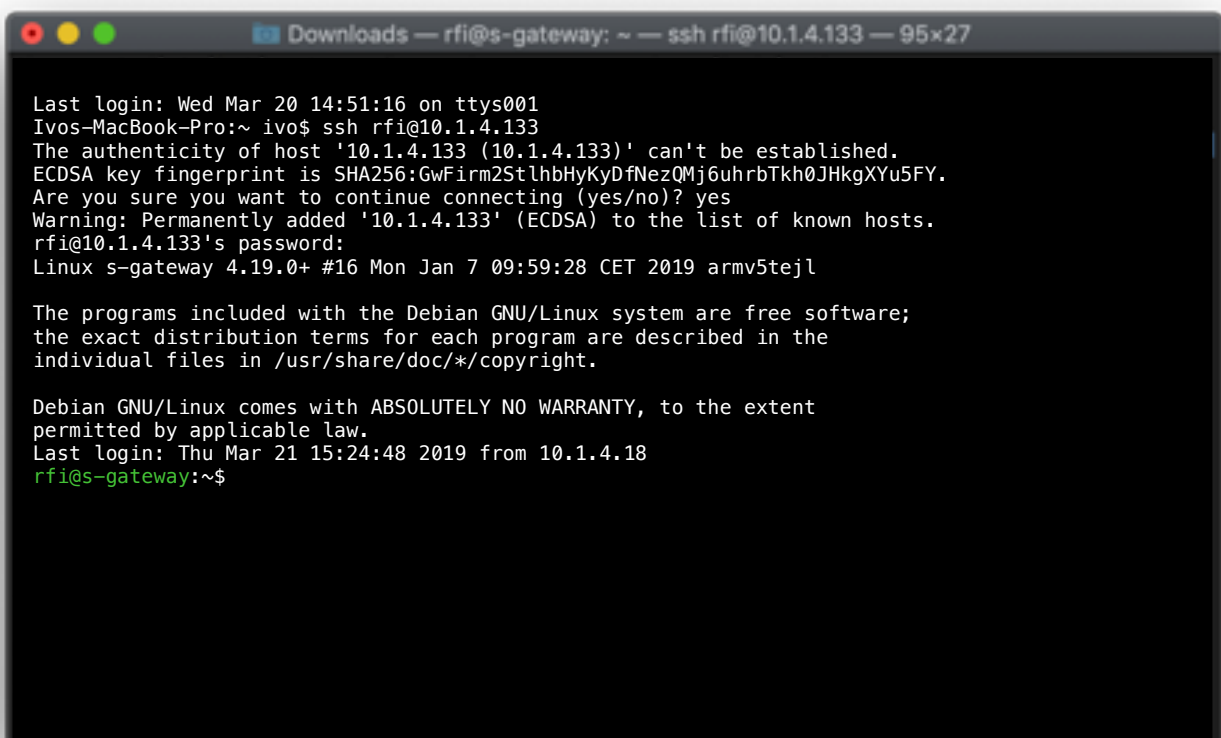
To connect to your S-gateway for the first time start your SSH client. Enter the IP address, User Name (rfi) and port number (22) for the S-gateway:

```
Host Name: 10.1.4.133
User Name: rfi
Port Number: 22
```

When connected the unit prompts you to enter a password:

```
rfi@10.1.4.133's password:
```

The default password of the unit is set to '**rfi123**'.



```
Downloads — rfi@s-gateway: ~ — ssh rfi@10.1.4.133 — 95x27

Last login: Wed Mar 20 14:51:16 on ttys001
Ivos-MacBook-Pro:~ ivo$ ssh rfi@10.1.4.133
The authenticity of host '10.1.4.133 (10.1.4.133)' can't be established.
ECDSA key fingerprint is SHA256:GwFirm2StlhbHyKyDfNezQMj6uhrbTkh0JHkgXYu5FY.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '10.1.4.133' (ECDSA) to the list of known hosts.
rfi@10.1.4.133's password:
Linux s-gateway 4.19.0+ #16 Mon Jan 7 09:59:28 CET 2019 armv5tejl

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Thu Mar 21 15:24:48 2019 from 10.1.4.18
rfi@s-gateway:~$
```

Figure 2: Example of logging in using SSH

## 6 Configuring the S-gateway to work with your LoRaWAN server

The S-gateway contains a pre-compiled packet forwarder that forwards received LoRa packets from LoRa sensors to the LoRaWAN back office server. Included on the default software image is the Semtech UDP Packet Forwarder with the following versions.

```
*** Beacon Packet Forwarder for Lora Gateway ***  
Version: 4.0.1  
*** Lora concentrator HAL library version info ***  
Version: 5.0.1;  
***
```

The packet forwarder starts automatically after the S-gateway boots and is under control of a process called: **rfi-daemon**. The rfi-daemon controls a number of processes on the S-gateway and (amongst other things) makes sure that the packet forwarder is (re)started after a configuration change takes place. This also means that you cannot start the packet forwarder manually, because the packet forwarder will be automatically started by the rfi-daemon. Only one packet forwarder process can run at any one time on the S-gateway. The configuration of the packet forwarder is done through a client utility that allows you to change the **server address**, the **port number** and the **gateway EUI**

This chapter explains how to configure your S-gateway to communicate with your LoRaWAN server.


The configuration of the packet forwarder can be retrieved and changed by giving commands on the command line.

### 6.1 Listing your Packet Forwarder Configuration

For showing the packet forwarder configuration(s) you type

```
client lora list [ENTER]
```

This will list the LoRa configuration(s) that are available on the system.



```
Downloads — rfi@s-gateway: ~ — ssh rfi@10.1.4.133 — 95x14  
rfi@s-gateway:~$ client lora list  
* LoRa gateway configuration "838240281401000e"  
  Forwarder address: "router.eu.thethings.network":1700  
rfi@s-gateway:~$
```

Figure 3: Example of listing your LoRaWAN server configurations

In the example above there is one configuration available, in this case the S-gateway is communicating with the LoRaWAN server of the Things Network (TTN).

## 6.2 Configuring a different LoRaWAN server

The default configuration of the Packet Forwarder on the S-gateway is for communicating with the TTN LoRaWAN servers. You can change this configuration using the build-in '**client**' utility. In order to add a configuration, you type:

```
client lora add -s <server address> -i <gateway EUI> -p <port number> [ENTER]
```

Where:

```
<server address> = the address of the LoRa WAN server
<gateway EUI> = the identification of the gateway on the LoRa WAN server
<port number> = the port number on which the LoRaWAN server is communicating
```

For example; we can add a configuration to have the S-gateway communicate with the LoRaWAN servers from Lorient by giving the following command:

```
client lora add -s eu1.loriot.io -i 402814FFFF01001E -p 1780 [ENTER]
```

The command should give you a message saying:

```
LoRa configuration added
```


You can verify the command by listing the available LoRa configurations again using:

```
client lora list [ENTER]
```

This should give you a list of the configured LoRaWAN servers. For example:

```
* LoRa gateway configuration "402814FFFF01001E"
  Forwarder address: "eu1.loriot.io":1780
LoRa gateway configuration "838240281401000e"
  Forwarder address: "router.eu.thethings.network":1700
```

In the example above there are two LoRaWAN servers configured. The one listed with \* is the active configuration. Meaning; the S-gateway is currently forwarding the received LoRa packets to the servers of Lorient.



```
Downloads — rfi@s-gateway: ~ — ssh rfi@10.1.4.133 — 95x14
rfi@s-gateway:~$ client lora add -s eu1.loriot.io -p 1780 -i 402814FFFF01001E
LoRa configuration added
rfi@s-gateway:~$ client lora list
* LoRa gateway configuration "402814FFFF01001E"
  Forwarder address: "eu1.loriot.io":1780
LoRa gateway configuration "838240281401000e"
  Forwarder address: "router.eu.thethings.network":1700
```

Figure 4: Adding a LoRaWAN server and listing the available configurations



### 6.3 Deleting a LoRaWAN server configuration

Deleting a LoRaWAN server configuration is done using the following command:

```
client lora delete -i <gateway EUI> [ENTER]
```

This will delete the configuration based on the gateway EUI. For example, if we want to delete the configuration we just added for LoRiot in the previous paragraph you would give the following command:

```
client lora delete -i 402814FFFF01001E [ENTER]
```

The command should give the following output message:

```
LoRa configuration successfully deleted
```

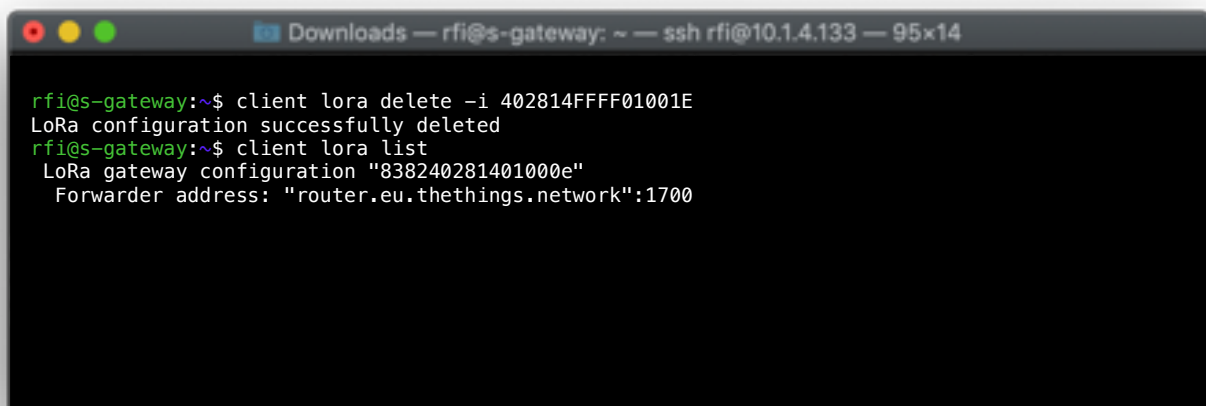
You can list the available configurations to verify that the delete operation was actually performed by giving the following command:

```
client lora list [ENTER]
```

Which should give you an output similar to:

```
LoRa gateway configuration "838240281401000e"  
Forwarder address: "router.eu.thethings.network":1700
```

**Please note:** in the above example the packet forwarder will be stopped because now there is no active configuration defined. You will have to configure the active LoRaWAN server after you have deleted an active configuration.



```
Downloads — rfi@s-gateway: ~ — ssh rfi@10.1.4.133 — 95x14  
rfi@s-gateway:~$ client lora delete -i 402814FFFF01001E  
LoRa configuration successfully deleted  
rfi@s-gateway:~$ client lora list  
LoRa gateway configuration "838240281401000e"  
Forwarder address: "router.eu.thethings.network":1700
```

Figure 5: Deleting a LoRaWAN server configuration

#### 6.4 Activating a LoRaWAN server configuration

When you want to switch to another LoRaWAN server configuration you must do so by activating another configuration. This is done using the following command:

```
client lora activate -i <gateway EUI> [ENTER]
```

This will activate the configuration based on the gateway EUI. For example, if want to activate the configuration for TTN from the previous paragraphs you would give the following command:

```
client lora activate -i 838240281401000e
```

The command should give you a message saying:

```
LoRa configuration successfully activated
```

You can verify the command by listing the available LoRa configurations again using:

```
client lora list [ENTER]
```

This should give you a list of the configured LoRaWAN servers. For example:

```
LoRa gateway configuration "402814FFFF01001E"  
Forwarder address: "eu1.loriot.io":1780  
* LoRa gateway configuration "838240281401000e"  
Forwarder address: "router.eu.thethings.network":1700
```

In the example above there are two LoRaWAN servers configured. The one listed with \* is the active configuration. Meaning; the S-gateway is currently forwarding the received LoRa packets to the servers of thethingsnetwork (TTN).



```
Downloads — rfi@s-gateway: ~ — ssh rfi@10.1.4.133 — 95x14  
rfi@s-gateway:~$ client lora activate -i 838240281401000e  
LoRa configuration successfully activated  
rfi@s-gateway:~$ client lora list  
LoRa gateway configuration "402814FFFF01001E"  
Forwarder address: "eu1.loriot.io":1780  
* LoRa gateway configuration "838240281401000e"  
Forwarder address: "router.eu.thethings.network":1700
```

Figure 6: Activating a LoRaWAN server configuration and listing the available configurations

## 7 Upgrading the S-gateway firmware

RFI Engineering is keeping a repository with the latest S-gateway software as an Aptitude repository. You can upgrade your system by giving the following command:

```
sudo apt-get update [ENTER]
```

This command doesn't actually install new versions of software. Instead, it updates the package lists for upgrades for packages that need upgrading, as well as new packages that have just come to the repositories.

The output of the command should give an output similar to:

```
Ign:1 http://cdn-fastly.deb.debian.org/debian stretch InRelease
Get:2 http://cdn-fastly.deb.debian.org/debian stretch Release [118 kB]
Get:3 http://apt.rfi-engineering.com/apt/debian stretch InRelease [1,625 B]
Get:4 http://cdn-fastly.deb.debian.org/debian stretch Release.gpg [2,434 B]
Get:5 http://apt.rfi-engineering.com/apt/debian stretch/embedded armel Packages [827 B]
Get:6 http://cdn-fastly.deb.debian.org/debian stretch/main armel Packages [6,884 kB]
Get:7 http://cdn-fastly.deb.debian.org/debian stretch/main Translation-en [5,384 kB]
Fetched 12.4 MB in 1min 19s (156 kB/s)
Reading package lists... Done
```

Now that the package list is updated, you can install the latest S-gateway software by giving the following command:

```
sudo apt-get install s-gateway-rfi-build [ENTER]
```

This fetches the latest S-gateway software from RFI Engineering's servers and installs this on the gateway. The output should be similar to:

```
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be upgraded:
  s-gateway-rfi-build
1 upgraded, 0 newly installed, 0 to remove and 29 not upgraded.
Need to get 1,039 kB of archives.
After this operation, 21.5 kB of additional disk space will be used.
Get:1 http://apt.rfi-engineering.com/apt/debian stretch/embedded armel s-gateway-rfi-build armel 1.1.0 [1,039 kB]
Fetched 1,039 kB in 0s (1,090 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
(Reading database ... 13677 files and directories currently installed.)
Preparing to unpack .../s-gateway-rfi-build_1.1.0_armel.deb ...
Unpacking s-gateway-rfi-build (1.1.0) over (1.0.6) ...
Setting up s-gateway-rfi-build (1.1.0) ...
```

In the example above the S-gateway software has been updated from 1.0.6 to 1.1.0.

### 7.1 Showing your current S-gateway software version

You can show the currently installed S-gateway software version by giving the following command:

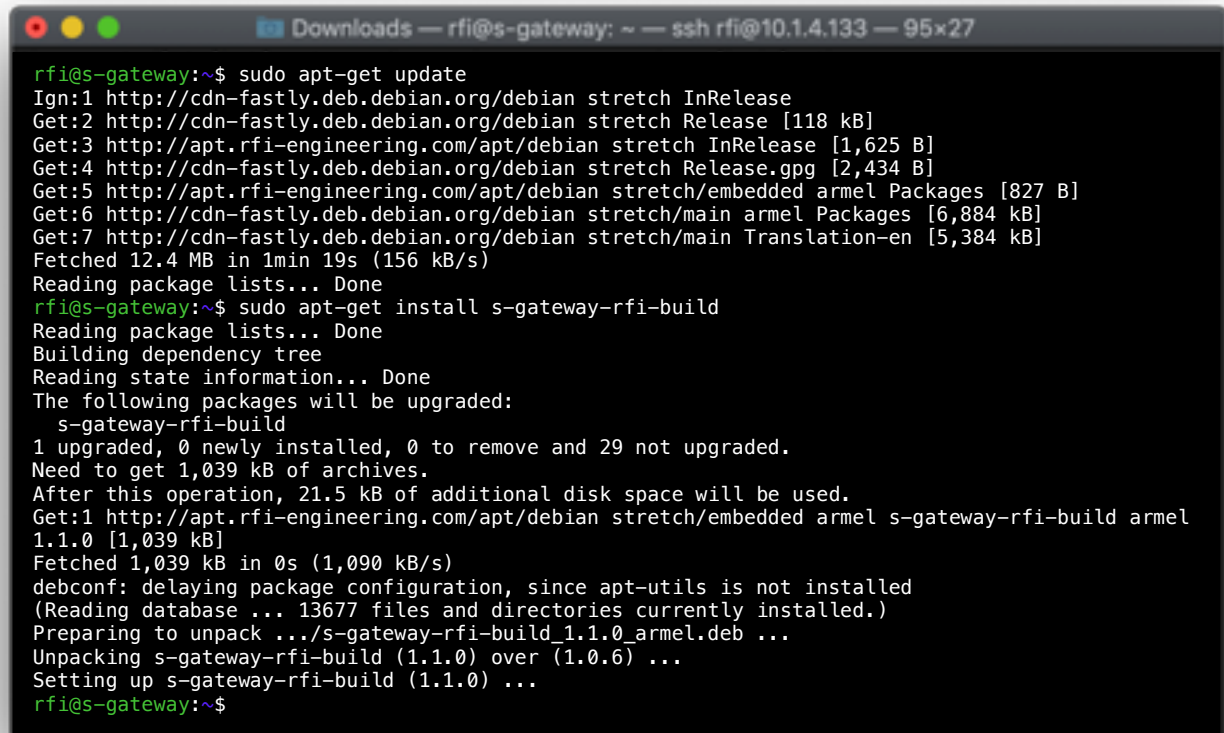
```
sudo apt show s-gateway-rfi-build [ENTER]
```

This will give you an output similar to:

```
Package: s-gateway-rfi-build
Version: 1.1.0
Priority: optional
Section: utility
Maintainer: Seb Renauld <srenauld@rfi-engineering.com>
Installed-Size: 4,814 kB
Depends:
Standards-Version: 3.9.4
Download-Size: 1,039 kB
```

```
APT-Manual-Installed: no
APT-Sources: http://apt.rfi-engineering.com/apt/debian stretch/embedded armel Packages
Description: [generated from Rust crate s-gateway-rfi-build]
Test
```

Below is an example of a full software upgrade performed on an S-gateway.



```
rfi@s-gateway:~$ sudo apt-get update
Ign:1 http://cdn-fastly.deb.debian.org/debian stretch InRelease
Get:2 http://cdn-fastly.deb.debian.org/debian stretch Release [118 kB]
Get:3 http://apt.rfi-engineering.com/apt/debian stretch InRelease [1,625 B]
Get:4 http://cdn-fastly.deb.debian.org/debian stretch Release.gpg [2,434 B]
Get:5 http://apt.rfi-engineering.com/apt/debian stretch/embedded armel Packages [827 B]
Get:6 http://cdn-fastly.deb.debian.org/debian stretch/main armel Packages [6,884 kB]
Get:7 http://cdn-fastly.deb.debian.org/debian stretch/main Translation-en [5,384 kB]
Fetched 12.4 MB in 1min 19s (156 kB/s)
Reading package lists... Done
rfi@s-gateway:~$ sudo apt-get install s-gateway-rfi-build
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be upgraded:
  s-gateway-rfi-build
1 upgraded, 0 newly installed, 0 to remove and 29 not upgraded.
Need to get 1,039 kB of archives.
After this operation, 21.5 kB of additional disk space will be used.
Get:1 http://apt.rfi-engineering.com/apt/debian stretch/embedded armel s-gateway-rfi-build armel
1.1.0 [1,039 kB]
Fetched 1,039 kB in 0s (1,090 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
(Reading database ... 13677 files and directories currently installed.)
Preparing to unpack .../s-gateway-rfi-build_1.1.0_armel.deb ...
Unpacking s-gateway-rfi-build (1.1.0) over (1.0.6) ...
Setting up s-gateway-rfi-build (1.1.0) ...
rfi@s-gateway:~$
```

Figure 7: Example of a successful upgrade of an S-gateway