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SLgateway© V2.5.x

User Guide

SENSING-LABS

VERSION 02 – REV I / OCTOBER 2020

Support & docs

Table des matières

Thank you for choosing our SLgateway product!

General overview

SLgateway is an IoT station developed with the aim to reduce the cost of deploying a radio network for small and medium size applications.

Figure 1 : SLGateway basic diagram

The gateway integrates the SLbase software designed to meet the need for a plug and play LoRaWAN™ local network solution:

- All in one LoRaWan solution with RF modem, Network & Application layers
- Graphical user interface for managing LoRa devices, accessing to application data (measures, payloads) and RF network information, and secured access to gateway
- Various types of API to access device data (Rest API, HTTP Callback, Modbus, MQTT)

The Gateways range

All gateways references embed SLGatewayV2.

Part number	Gateway name	Modem	Channels	Protection level	Dimensions / Weight (without accessories)
PIC-LAB-63NS	Pico GPRS	GPRS	3 CH	IP30 (indoor use)	101x74x35 mm / 135 gr
GAT-LAB-6NN3	Gateway-8CH	No	8 CH	IP30 (indoor use)	126x80x46 mm / 290 gr

Pico GPRS

Gateway-8CH

SLgateway main features

LoRaWan

- ✓ Support of LoRaWan 868MHz devices, configurable in ABP / OTAA for PUBLIC network with configurable AppEUI
- ✓ Network level supervision with highlight of disconnected devices
- ✓ Up to 200 devices with 1 message transmission every hour
- ✓ Storage of all received data for 100 days

For more information about the LoRaWAN concept and technology, we advise you to read these documents:

- General overview: LoRaWAN™ What is it?
- Technical description: LoRaWAN™ 101 – A Technical Introduction
  (source: lora-alliance.org)

Graphical user interface (GUI)

- ✓ Add/ Import/Remove devices
- ✓ Quick visualization of current device measures
- ✓ Quick visualization of current device network state
- ✓ Export all displayed data in CSV format file
- ✓ Export all stored data in CSV format file (since V2.3.0)
- ✓ Remotely downlink message management (reconfiguration for Senlab)
- ✓ Graphical configuration of system (IP network, log access, …)
- ✓ Backup/restore services configuration
- ✓ RF range test dashboard and results export: SLtester tool
- ✓ Same GUI for all SLgateway references

Data APIs access

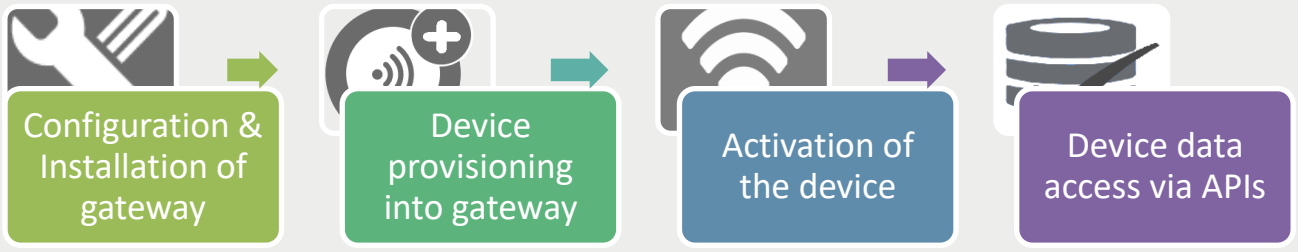
- ✓ REST API: SLbase HTTP standard API for accessing all data in application/xml or application/json formats
- ✓ HTTP Callback(s): Real time customer listener notification of received data/payload/status in json or xml format
- ✓ Modbus API: Gateway as a TCP Modbus slave for getting data threw a PLC system
- ✓ CSV to FTP: Periodic transfer of CSV format file on an FTP/SFTP server of last received data (for Senlab only)
- ✓ MQTT: Subscription management to services, real time data notification to customer server
- ✓ Elasticsearch: RESTful search and analytics engine capable of solving a growing number of use cases (www.elastic.co)
- ✓ Sentilo: open source sensor and actuator platform designed to fit in the Smart City architecture (www.sentilo.io)

(refer to section "STEP 4" for more details and "how to use" for each APIs)

SLgateway specification

Specification	Description
Operating system (OS)	Linux Debian
Ethernet	RJ45 plug
GSM/GPRS (picoGW only)	GPRS modem (full-size SIM card)
Database	Storage of last 100 days data
Data APIs access **IoT platform compatibility**	Rest API, HTTP Callback(s), CSV to FTP, Modbus TCP DEXCell(Dexma), Sentilo MQTT, Elasticsearch
Graphical User Interface	Light GUI for gateway configuration & management
Security	Login/Password authentication (HTTP security) Firewall rules
RTC (picoGW only)	Hold current clock/date without external power supply.
Software maintenance	Easy update from GUI (or SFTP) Advanced configuration processes (SFTP)
Backup/Restore	Backup and restore all service configuration of the SLgateway For massive SLgateway configuration
CSV data export	Export all data or from selected days to CSV file
Remote access	**VPN**: Easy activation for remote access for SL support team (you can also to connect to your own OpenVPN server) **DynDNS**: need dynDNS account and a public IP **Ngrok:** need ngrok account, work with private or public IP
Remote management ***(since V2.4.x)***	Embedded tools and features for GW fleet management: (with REST API, MQTT, HTTP callback, or ngrok): - automatic send of gateway and device status - remote reconfiguration for gateway and devices
RF	ISM 868Mhz band (Power +14dBm / Sensitivity -137dBm)
RF Range tester	Local LoRaWAN network coverage test dashboard (required a Senlab Test devices)
LoRaWan network server	ABP or OTAA activation mode PUBLIC (default since V2.0.2) or PRIVATE network type Downlink acknowledge option picoGW: 3 channels (868.1,868.3,868.5MHz)mono datarate (SF12) Gateway-8CH: 8 channels - ADR from DR0 (SF12) to DR5 (SF7)
LoRaWan application server	Application messages Decryption & Encryption Integrates SLcodec for Senlab messages decoding

Before starting, remember the 4 steps to make the global system fully operational:



STEP 1 **STEP 2** **STEP 3** **STEP 4**

This document describes all these 4 steps.

We strongly advise to back up the full gateway configuration after the on-site deployment step, after first data (Refer to Maintenance - Services section)

STEP 1: Configuration & Installation of gateway

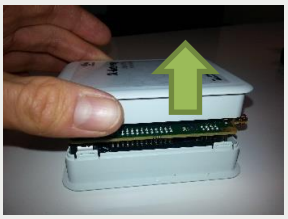
SLgateway assembly (picoGW)

The delivered package includes:

1. A GSM/GPRS antenna (**the smaller**)
2. An 868MHz LoRa antenna (**the longer**)
3. An ethernet cable (Cat 5.e - 1m)
4. A 230V power adapter
5. The SLgateway
6. The "Getting started" document

Assembly of the SLgateway (picoGW)

1. Insert SIM card:
   - ✓ open the upper side of the gateway casing
   - ✓ LOCK the grey cap by pushing it outwards
   - ✓ Close the upper side of the gateway casing
2. Screw both antennas
3. Plug the power supply
   - ✓ To prevent electronic damage:
     the gateway must not be powered without antennas



SLgateway assembly (Gateway-8CH)

The delivered package includes:

1. An 868MHz LoRa antenna
2. An ethernet cable (Cat 5.e - 1m)
3. A 230V power adapter (microUSB)
4. The SLgateway
5. The "Getting started" document

Assembly of the SLgateway (Gateway-8CH)

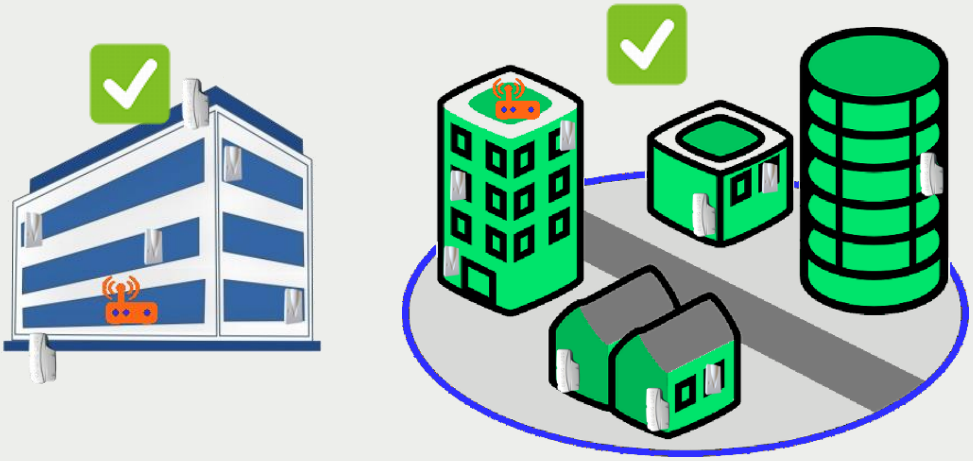
1. Screw the antenna
2. Plug the power supply on micro USB port (see photo)
   - ✓ To prevent electronic damage:
     the gateway must not be powered without antenna

SLgateway positioning

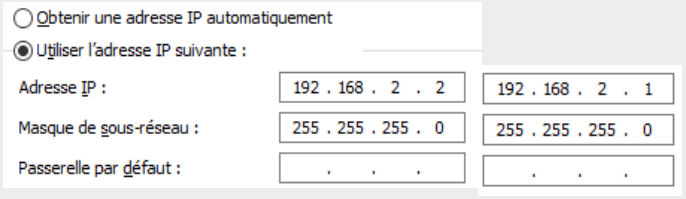
- Position both antenna with 90° elbow and its main part upwardly (vertical) in free space area
- Avoid positioning the SLgateway against or inside metallic/electric elements
  - If not possible, use RF cable extension to position outside the LoRa antenna

(see photos on next page)

- If LoRa devices are in a different building than or outside the building where the gateway is installed, it is recommended to deport antennas (at least LoRa antenna) and/or SLgateway on a higher position.



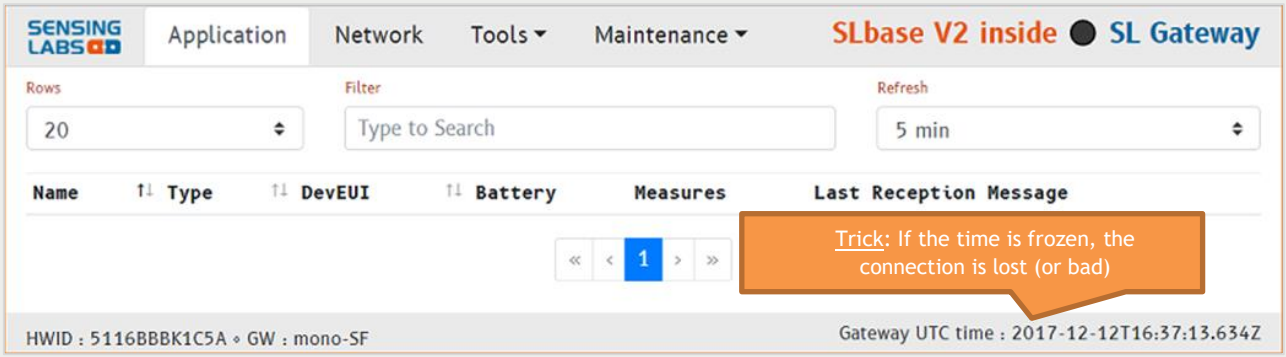
First access to the GUI (over ethernet on 192.168.2.1)



Steps to follow with default configuration[1]:

1. Start your SLgateway (power up)
2. Configure your computer[1]
   IPv4 static address: 192.168.2.2
   subnet mask 255.255.255.0
   (PC network Ethernet properties)
3. Connect your computer to SLgateway using the Ethernet cable
4. Access to http://192.168.2.1 (check this FAQ here about browsers compatibility)
5. Enter default user/password when asked: ***public*/*public***

Congratulations! You are now connected to the SLgateway.



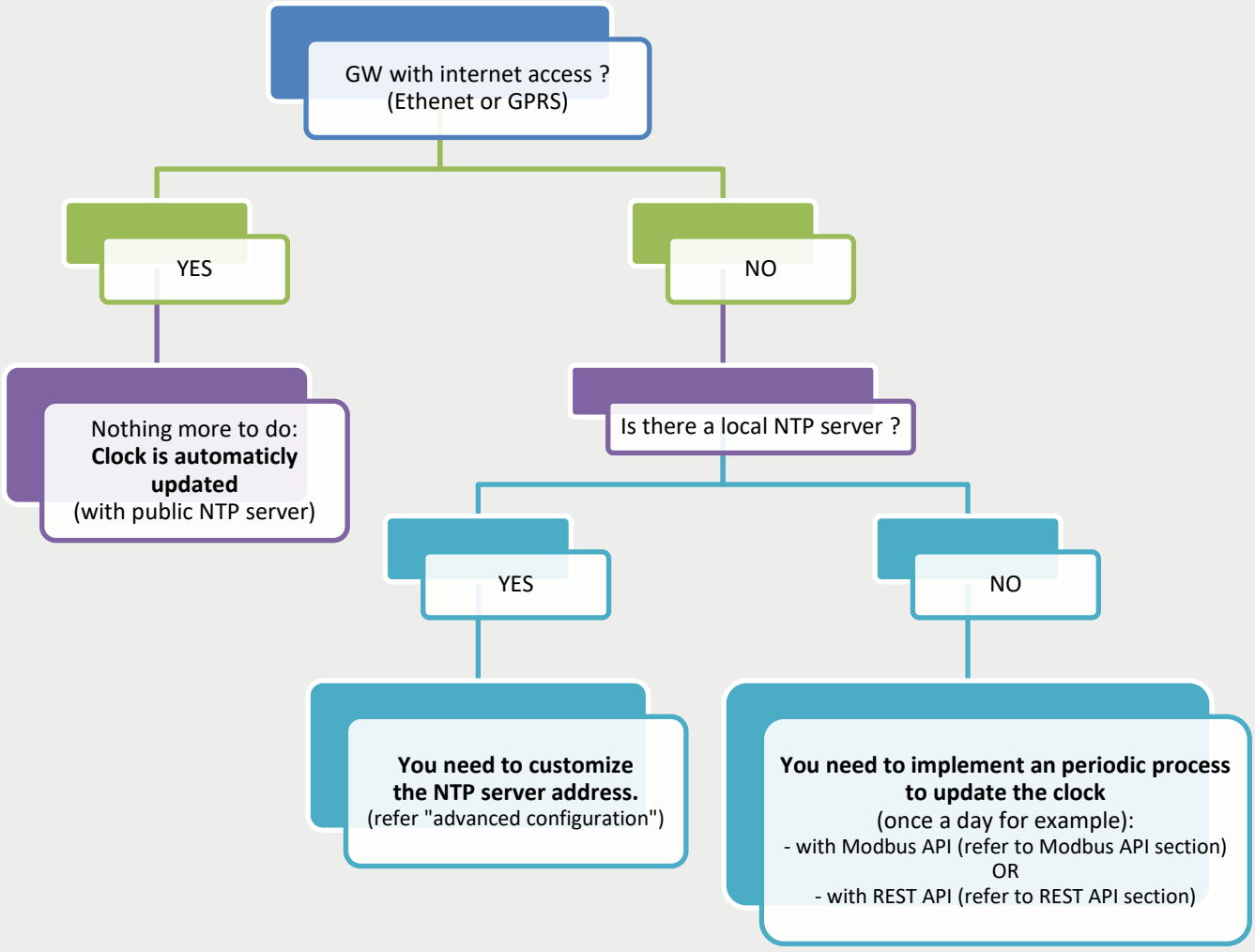
[1] Default configuration of SLGateway is static IP 192.168.2.1

Set SLgateway local time

After 1st boot, you have to synchronize the timestamp of the gateway:

1. Check if your computer local time is OK?
2. Access to the "Maintenance → System" page
3. Click Sync Date Time and confirm at the pop-up screen.
4. Check the new SLgateway UTC time in the right bottom part of the GUI screen.

Some important points to know about SLgateway clock:
- because of the hardware clock drift, and because all data are timestamped with this clock, you need to be sure the clock is often updated.
- you need to update it manually ("Sync Date Time" button) before to start any communication with devices
- "PicoGW" hold the current clock (with drift) even if not powered
- "Gateway-8CH" don't have internal self-powered RTC: it will restart with the last clock



Authentication password configuration

We advise you to replace the default password from "Maintenance → GUI Settings"

- In case of password lost, please create an online ticket here
- You can also change the friendly System Name into the same page

Ethernet interface configuration

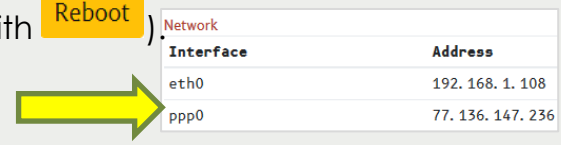
You can change the default Ethernet configuration to fit to your local network from "Maintenance → System", with button Change Ethernet IP config

- If you lost the current IP address, you can use the Over USB connection, refer to troubleshooting section: I have forgotten the current IP network gateway configuration
- If you need to configure Ethernet to a static IP on a local network, refer to troubleshooting section:How to configure my SLgateway to static IP address (Ethernet)?
- You can "ping" a server to check your configuration (result is in "Network log")

GSM/GPRS configuration (picoGW only)

1. Check the SIM card and GSM/GPRS antenna are well installed (cf. "STEP1")
2. Access to "Maintenance → System" page
3. In section "GSM configuration", fill the fields with GSM/GPRS information (given by your SIM card provider):
   - ✓ **PIN code** (optional)
   - ✓ **APN** (required)
   - ✓ **Username** and **password** (for PAP or CHAP authentication)
4. Apply new configuration with Start GPRS (see "network log" screen for detail) (if you enter a PIN code, you will need to reboot with Reboot).

If successful, "ppp0" appears in IP network interface.



5. Once the settings are OK reboot with Reboot to save
6. definitely into the gateway.

After a boot or reboot, all configuration and stored data can take 2 minutes to be fully loaded.

You can check the GSM/GPRS quality level 

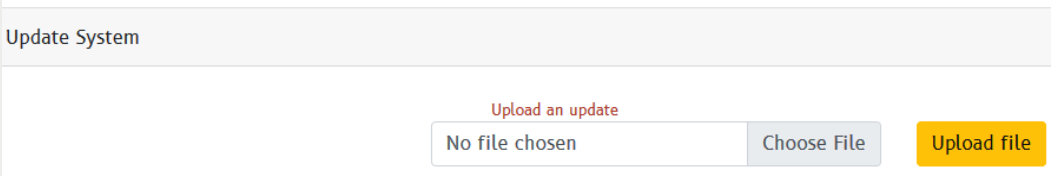
(updated only after Start GPRS).

You can stop the GSM/GPRS connection when you want with button Stop GPRS.

Easy gateway update from GUI (from V2.3.0)

The update file must be:
- lower than 10 MB (V2.3.x) (a patch is available to expand this limit to 150MB)
- lower than 150 MB (V2.4.1)
If you need to load a larger file, please use SFTP process.

1. Get your update file (extracted from zip)
2. Access to "Maintenance → Update" page
3. Load the update file (generally named *update.run.enc*) – can take up to 1 min.
4. Reboot & Wait some minutes (up to 6 minutes for major update)
5. Connect to GUI and check version number (footer)



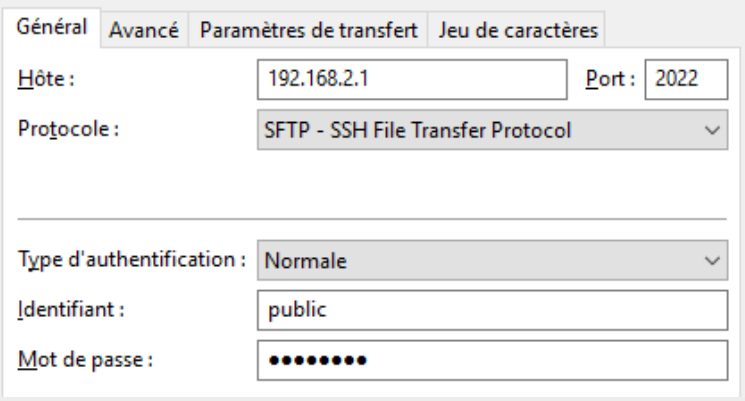
SFTP access (for Update & advanced configuration)
(for expert in network management only)

Requirement:

- Local access to the SLgateway (with Ethernet cable)
  default Gw IP 192.168.2.1 --> Check your Computer is on the same subnetwork
  Also possible with GPRS connection in some cases (not for update)
- *Filezilla-client* software installed on your computer
- The "sshpass" (different for each gateway), please ask us here: send us the Gateway ID (xxxBBBKxxxx format)

Launch Filezilla software:

1. "File→Site Manager"
2. Create a new site with:
   - ✓ Host: 192.168.2.1(default)
   - ✓ Port: 2022
   - ✓ Protocol: SFTP
   - ✓ Logon Type: normal
   - ✓ User: public
   - ✓ Password: your_ GW_sshpass
3. Save and connect



You can now have an access to several directories and file for updating or advanced configuring (see next section).

Advanced configuration
(for expert in network management only)

In case of SLgateway massive deployment, you can configure all in one (for all SLgateways) in the same process, only for these configurations:

- NTP server
- DNS server
- Host (only specifics server addresses)
- Firewall rules

DynDNS

You can use the DynDNS service to connect remotely to your SLgateway if the IP change (require an PUBLIC IP).

Since V2.4.2, this function is disabled by default.

Contact us if you want activate this function.

NTP server

You can customize the NTP server by filling your own NTP server address.

Requirement:

- Active GPRS or local ethernet connection
- SFTP access (see SFTP access (for Update & advanced configuration))

Process:

1. Connect to the picogw via SFTP protocol (with Filezilla software)
2. Copy the files **timesyncd.conf** from /update/templates/ to your computer
3. Edit the **timesyncd.conf** file and replace the default NTP server address
4. Save and copy the new file to /update via SFTP
5. Reboot SLgateway (GUI: "Maintenance→System→Reboot") to load the file
6. Reboot one more time to apply new settings

Hostname/hosts customization

You can change the hostname of your SLgateway, useful in a DHCP configuration. You can also add your specifics server address in hosts file.

Requirement:

- Active GPRS or local ethernet connection
- SFTP access (see SFTP access (for Update & advanced configuration))

Process:

1. Connect to the picogw via SFTP protocol (with Filezilla software)
2. Copy the files **hostname** and **hosts** from /update/templates/ to your computer
3. Edit the **hostname** file and replace the default hostname (*slbasev2inside*)
4. Edit the **hosts** file and replace the default hostname in the first line
   OPTIONNAL: add your specifics server addresses after the last line
5. Save and copy the new files to /update via SFTP
6. Reboot SLgateway (GUI: "Maintenance→System→Reboot") to load the files
7. Reboot one more time to apply new settings

DNS server customization

You can change/add DNS server(s) of your SLgateway, useful in a "Static IP" configuration and local network.

Requirement:

- Active local ethernet connection
- No GPRS connection (the GPRS connection will rebuild a new **resolv.conf** file)
- SFTP access (see SFTP access (for Update & advanced configuration))

Process:

1. Connect to the picogw via SFTP protocol (with Filezilla software)
2. Copy the files **resolv.conf** from /update/templates/ to your computer
3. Edit the **resolv.conf** file and add/replace the DNS server(s) you want to use (keeping the format the format *nameserver* x.x.x.x)
4. Save and copy the new files to /update via SFTP
5. Reboot SLgateway (GUI: "Maintenance→System→Reboot") to load the files
6. Reboot one more time to apply new settings

Custom OpenVPN client

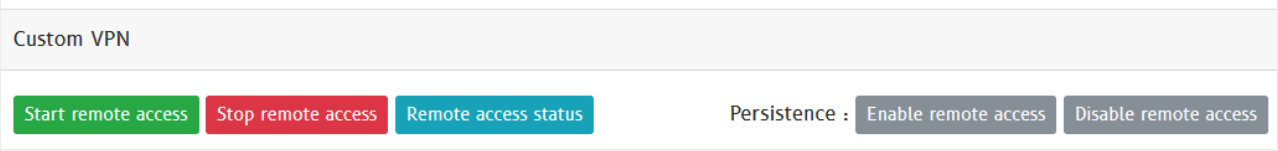
You can configure SLgateway to connect to your own OpenVPN server.

Requirement:

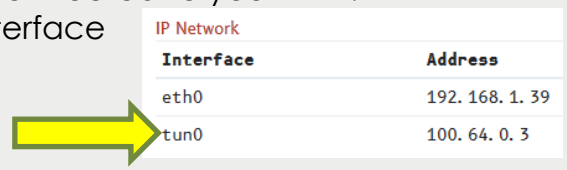
- OpenVPN server reachable from public IP address
- OpenVPN client configuration file (rename xxxx.ovpn to **custom.conf**)
  IPV6 is not supported by SLgateway (ask us for more detail)
  You need to add
- Internet access, from GPRS or ethernet connection
- **customvpn.redis** file (ask for it on support.sensing-labs.com)
- SFTP access (see SFTP access (for Update & advanced configuration))

Process:

1. Load **customvpn.redis** in SLgateway (GUI: "Maintenance→Services→Restore a service backup). Confirm with "Yes" when pop up ask it.
2. Wait one minute (services will restart)
3. Check "Custom VPN" menu appears (GUI: "Tools→Remote management)
   If not, refresh the page (press F5 on keyboard)



4. Connect to the picogw via SFTP protocol (with Filezilla software)
5. Copy the files **custom.conf** to /openvpn
6. Press Start remote access and check your GW is connected to your VPN:
   If successful, "tun0" appears in IP network interface
   (GUI: "Maintenance→System)



7. If you want to force VPN connection when GW restart, active with (by default, persistence is Enable remote access disable)
8. Reboot and check VPN connection is automatically started.

Firewall rules

Warning:
In case of bad firewall rules, you can lose communication with SLgateway

You can customize firewall rules to increase the security level.

Requirement:

- Active local ethernet connection
- SFTP access (see SFTP access (for Update & advanced configuration))
- UFW knowledge (online documentation here)

Remember: Port 80 = GUI and REST API port 2022 = SFTP/SSH port 502 = Modbus

Process:

1. Connect to the picogw via SFTP protocol (with Filezilla software)
2. Copy the files **template_fw.rules** from /update/templates/ to your computer
3. Edit the file and add the rules you want
   (allow port 502 and 5020 if Modbus)

```
delete allow in on eth0 to any port 80 proto tcp
delete allow in on eth0 to any port 2022 proto tcp
delete allow in on eth0 to any port 502 proto tcp
delete allow in on eth0 to any port 5020 proto tcp
delete allow in on ppp0 to any port 80 proto tcp
delete allow in on ppp0 to any port 2022 proto tcp
allow from <your_ip_or_network> to any port 2022 proto tcp
allow from <your_ip_or_network> to any port 502 proto tcp
allow from <your_ip_or_network> to any port 5020 proto tcp
allow from <your_ip_or_network> to any port 80 proto tcp
```

4. Save as **firewall.rules** and copy the file to /update via SFTP
5. Reboot SLgateway (GUI: "Maintenance→System→Reboot") to load the files
6. Reboot one more time to apply new settings

You can check the current FW rules and check previous UFW actions:
/update/update.log

To restore the initial FW rules, you need to delete allowed IP you had before (edit and reboot).
For example remove 192.168.1.247 (old IPs can be retrieved in sftp update.log file):

```
allow in on eth0 to any port 80 proto tcp
allow in on eth0 to any port 502 proto tcp
allow in on eth0 to any port 5020 proto tcp
allow in on eth0 to any port 2022 proto tcp
delete allow from 192.168.1.247 to any port 2022 proto tcp
delete allow from 192.168.1.247 to any port 80 proto tcp
```

STEP 2: Device provisioning into gateway

SLgatewayV2 is configured in PUBLIC LoRaWan network with appEUI 70B3D580A0000000

- It supports both OTAA & ABP activation type.
- You have to check that your devices are commissioned in PUBLIC mode (with SLsetting tool for Senlab)
- **For any other configuration, please create an online ticket here:**

Add a new device

1. Access to "Network" page & click on button Add a new device
2. Enter device provisioning information
   - Name: friendly name of device displayed into GUI
   - Activation: OTAA or ABP
   - DevEUI: Unique identifier of LoRa device (IEEE EUI64 address)
   - For ABP: devAddress, NwkSKey & AppSKey
   - For OTAA: Application key
3. Confirm with button Add

The new device will appear into "Application" and "Network" page.

You can now immediately install and activate it! (see device User Guide)

If you don't have the device keys, contact your distributor/reseller with devEUI.

Add multiple devices at once

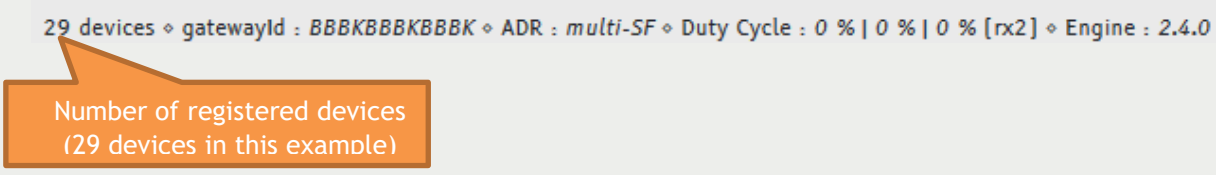
For importing multiple devices at once, you have to use the SLsetting import feature. It allows you to add all new devices contained into a CSV file (generated with SLsetting).

1. Access to "Tools → SLSetting import" page
2. Choose the csv file to import using button Choose File
3. Check device list (Fw type, Activation, …) and add them with button Add All

The new device will appear into "Application" and "Network" page.

You can now immediately install and activate it! (see devices User Guide)

Since V2.4.2, you can see the number of registered devices in the footer:
(you could need to refresh the page with F5 key if you add/remove device)



Remove a device

To remove a device, you have to go into **Network device detail** page, and to confirm the suppression with button Delete

When you remove a device in SLgateway, the device still "keeps" the NetworkSessionKey and if OTAA, you will need to "disconnect" the device itself or recommission it again.
You can also send a "STOP application" request to the Senlab before to remove it from SLgateway.

Before to remove device, check device behaviour in this case, especially if you want to move the device to another network. Check the FAQ here.

STEP 3: Activation of device

You have now to install & activate your device

- Do not activate devices too close to the gateway
  - keep a minimum distance of 1 meter
- For Senlab activation process, refer to Senlab User Guide

Device network activation process

Activation status is displayed in column "RF Level" of "Network" view (since V2.4.2)

- **Status** `Registered` **:** device is provisioned and no message has been received yet
- **Status** `Join accepted` **:** the device "activation/join request" has been received and accepted by the gateway ("join accept" has been transmitted to the device)

For previous SLgateway version, activation status are not displayed.

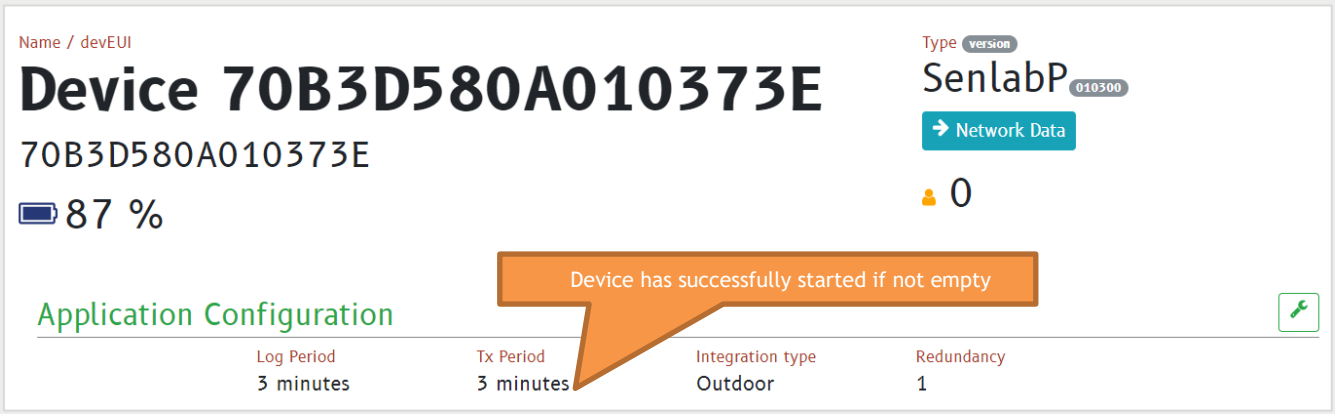
Important: Network activation is successful only if the device has received the "join accept" (LED ON 2sec)

Device application start

After network activation, device send an application "start message" (contains the current configuration), before sending the first data (with sensor measures).

- For picoGw: "Start message" will be sent 2 min after the "join" (3ch limitation)
- For 8-CH, "Start message" will be sent a few second after the "join"

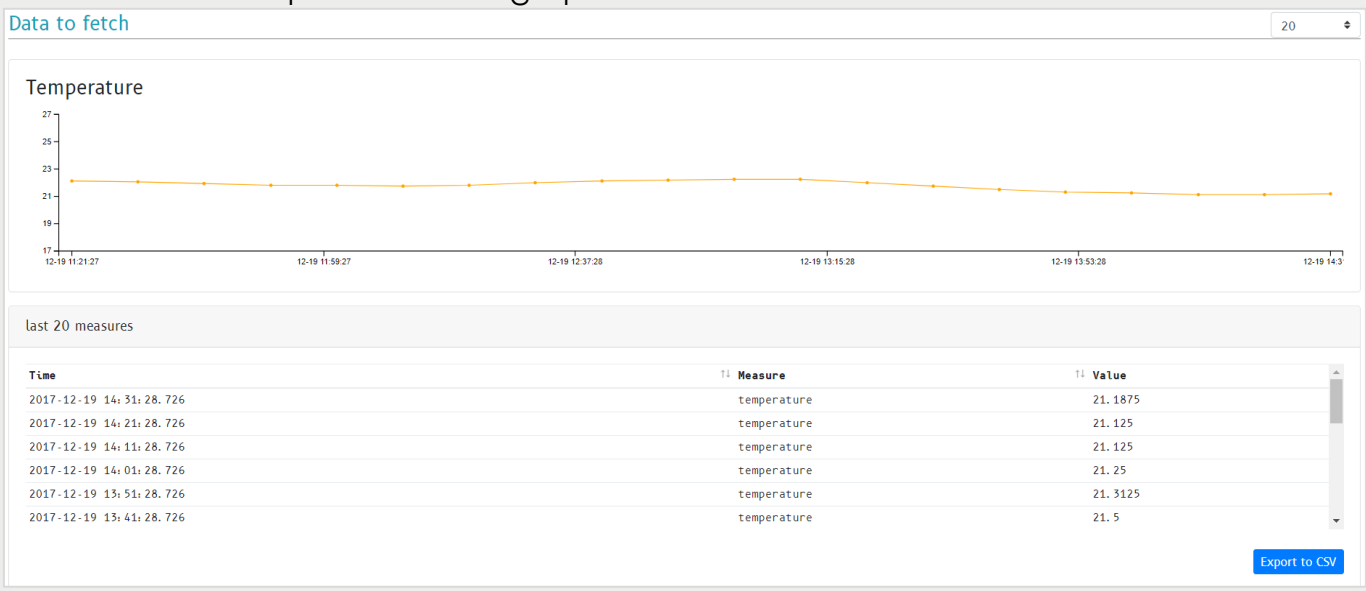
Senlab current configuration will be displayed in the "Application device detail" view



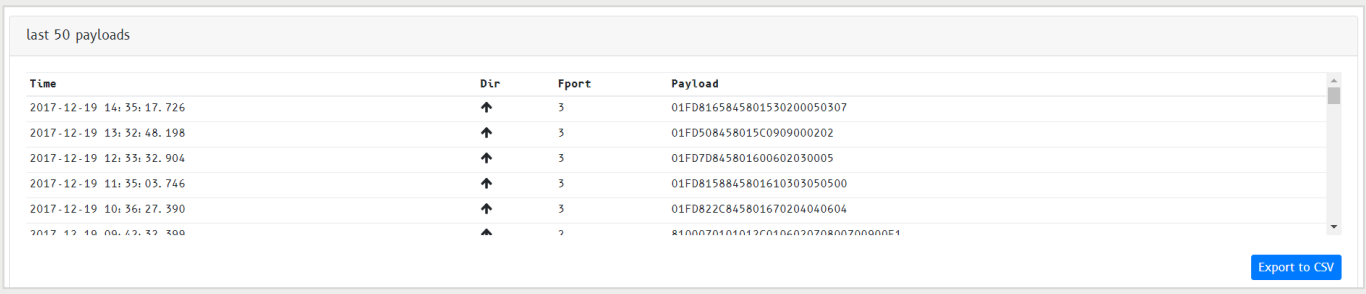
Device data transmission

Depending of the data transmission period of the device, device messages will be automatically decoded and accessible into the "Application device detail" view

- Last measure is displayed into the list of devices int the "Application" view
- Measures are presented via graphics & tables into the device detail view



- For non Senlab devices, received payload are available into the "Network device detail" view.



STEP 4: Device data access via APIs

The following APIs are available for recovering application data from SLgateway:

- Rest API
- HTTP Callback
- MQTT
- CST-to-FTP
- Elacticsearch
- Sentilo
- Modbus API

More than one API type can be used at the same time (for test or dev for example).

We strongly advise to study all possibilities and to choose the best API that fit with your use case and your IT environment:

- Do you have an IP access to the SLgateway?
- Does the GW is connected to a PLC or a webservice?
- Do you want a one-way or bidirectional API?
- Do you want a "on request" or "send only" API?
- Does your use case need a "real-time" or a "post-processing use" (see table)?

SLGateway API	Real-time use	Post-processing use
HTTP Rest API	Limited (need a high freq. request process VS log freq)	Yes
HTTP Callback API	Yes	Yes
MQTT	Yes	Yes
CSV-to-FTP	No	Yes
Elasticseach	No	Yes
Sentilo	Yes	Yes
Modbus API	Limited (need a high freq. request process VS log freq)	Yes

Don't hesitate to ask our support for an advise about how to choose the API.

How to check APIs, devices and SLgateway version compatibility ?

We provide a document (link here) with compatibility table between:

- Senlab FW
- SLgateway version
- SLgateway APIs
- LoRaWan feature

Rest API

SLgateway Rest API is natively available on all SLgateway, and is always available.

- You will be able to choose your language & see how to interface with the API.
- If you want to test easily the API with Postman tool, you can download the *API_REST_SLgateway_V2_tools.zip* here and follow *README* file instructions.
- All HTTP responses are GZIP encoded.
- The default authentication ("Basic auth" type) is the same as the GUI access: *public/public*
- HTTP Methods: **GET**, **PUT**, **DELETE**, **POST**
- Main format of the Rest API url:
  http:{{gwIP}}/com.sl.application.server/V1.0/{{devEUI}}/{{applicationId}}/{{measureId}}
- Main requests:
  - Get list of devices (GET)
  - Get device measureId values (GET)
  - Get all device measures values (GET)
  - Get device eventId value (GET)
  - Get device payloads hexadecimal values (GET)
  - Send Senlab downlink request (POST)

Full Rest documentation and requests are available online.

Rest API also allows powerful features like devices and GW management (refer GW app notes support website).

HTTP Callback

"HTTP callback" service allows the SLgateway to push received data to an HTTP listener deployed onto your own server, in "real time".

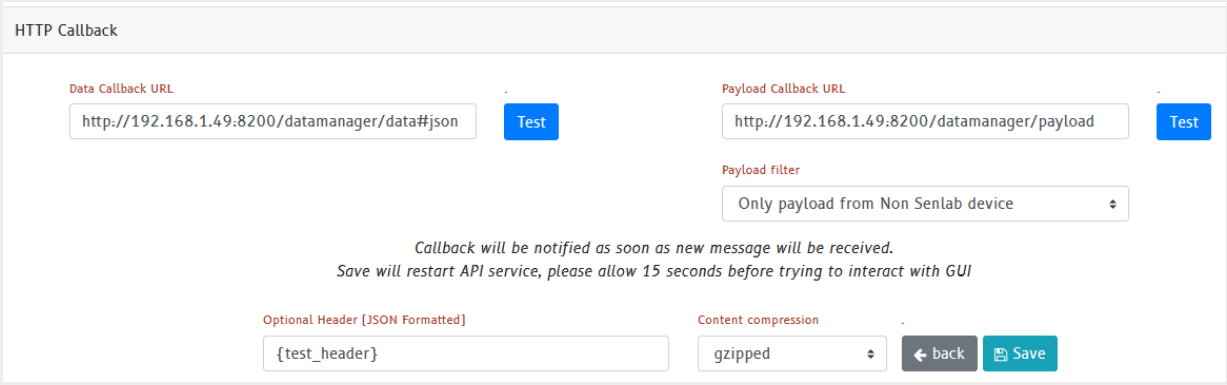
- Two formats are available:
  - xml
  - json (same as SLcodec)

Two types of callbacks can be configured:

- **Data Callback** notifies decoded data (measures/events) for Senlab devices only
- **Payload Callback** notifies hexadecimal payload for non-Senlab devices and Senlab (you can choose to receive payload only for non-Senlab devices)

HTTP Callback configuration (SLgateway side)

Access to "APIs → HTTP Callback" page



1. Choose options:
   - **Content-compression**: gzipped (by default) or plain
   - **Payload filter**: notification with or without Senlab devices
2. **Optional header** (only for json format): if you want your header into each json
3. Enter the **callback URL(s)** (the 2 servers URL + format can be the same or different)

Sample url	Description of the sample url
http://192.168.1.68:8000/callback#json	Json with specific port
http://192.168.1.68/callback#json	Json with default port (80) non authentified server
http://192.168.1.68/callback#xml	xml format with default port (80)
https://username:password@www yourdomain.com/callback#json	Json with https with authentication

4. You can test the Callback URL accessibility using the button Test.
5. Save configuration with button Save (modification will be applied in 30'' max)

To disable the callback function, just empty the form and click SAVE button

In case of GPRS connection, we strongly advise you to:
- edit the "hosts file" by SFTP connection and add the line (refer to "advanced configuration"):
188.23.222.432 yourweburl.com
(that will decrease the request delay and the GPRS data consumption)

Callback format

Refer to "SLgw APIs formats" Application note

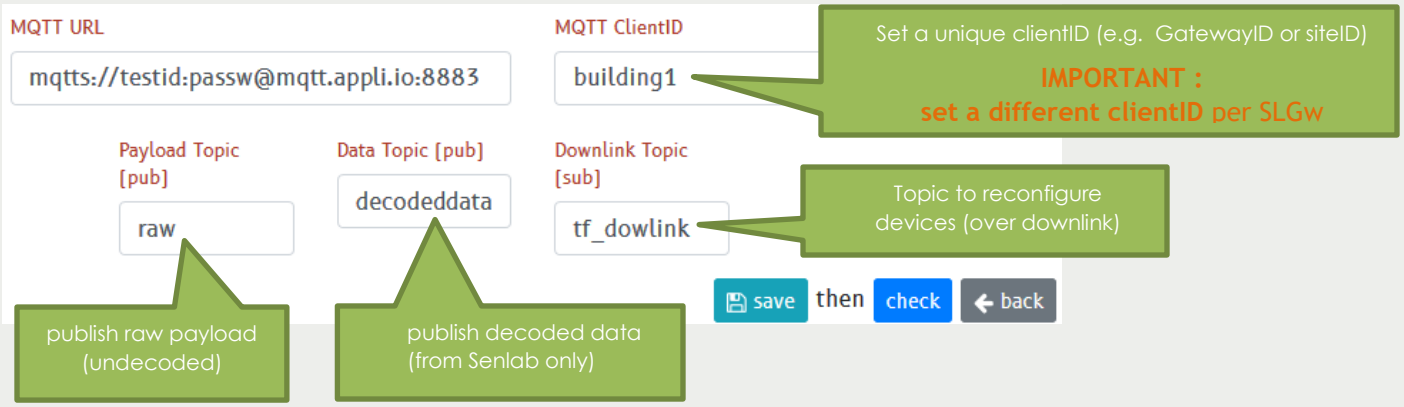
MQTT

SLgateway MQTT integrated client allows to publish data and/or payload to an external broker and to subscribe to a downlink topic (for device reconfiguration). It supports MQTTS and private certificate can be specified.

Data (or payload) are published as soon as the radio message is received by the GW.

MQTT configuration (SLgateway side)

1. Access to "APIs → MQTT" page to configure your *MQTT URL*, *ClientID* and pub/sub *topic*



2. After, save, then check your configuration is working.
   - Once configuration is OK, you need to restart service "API Server"

Information:

   - Standard MQTT port is 1883 and (port 8883 for MQTTS)
   - MQTT protocol version is 3.1.1
   - QoS (Quality of Service) of MQTT published messages:
     - QoS 0 (V2.3.x only)
     - QoS 1 (possible on V2.4.x and 2.5.x with a patch ➔ ask us)
     - QoS 2 (since V2.4.2)
   - MQTT auto resubscribe after disconnect/reconnect

3. If you have private MQTTS certificate, you will have to upload the following files into SFTP /certs repository, and relaunch the check
   - CA : /certs/ca.crt
   - Cert : /certs/cert.pem
   - Key : /certs/private.key
4. Pay attention that "**Google Cloud IoT Core**" don't use standard MQTT protocol, so it is not compatible with SLgateway. Rather, "**AWS IoT Core**" is standard and Is compliant with SLgateway MQTT API.

We advise some useful link to test and dev with MQTT : see FAQ.

In case of GPRS connection, we strongly advise you to:
- edit the "hosts" file by SFTP connection (contact us for more details) and add the line:
188.23.222.432 yourweburl.com
(that will limit the request delay and decrease the GPRS data consumption)

The same MQTT connection can be used for "fleet management": SLgateway App. Note page.

MQTT format

Refer to "SLgw APIs formats" Application note

CSV to FTP

"CSV to FTP" service allows the SLgateway to push periodically all measures (only Senlab decoded "measure", no "event", no "payload" from generic device) received since the previous transmission, in a CSV format, to an FTP/SFTP/FTPS server.

The retention size is 4000 lines (FIFO) or 100 days.

Four CSV formats are proposed:

- **"Generic": default format**
- "DK": specific use (name was "*format 3*" until V2.2.0)
- "DT": specific use (name was "*format 2*" until V2.2.0)
- "Dexma": format for *DEXCell Energy Manager* platform

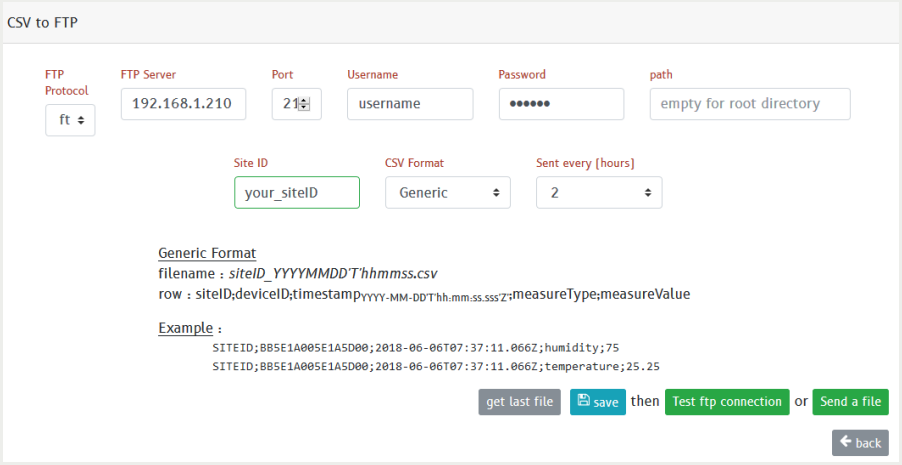
File format

Refer to "SLgw APIs formats" Application note

Contact us for another format customization.

CSV to FTP configuration

access to "APIs → CSV to FTP" page



1. Enter your server configuration and validate with button save
   a. Site ID can be used to identify your gateway ID
   b. Periodicity off (Sent every (hours)) → Service deactivated
2. Use button Test ftp connection to check the connection to your server
3. Use button Send a file to force the transmission of a csv file

The \ (backslash) character is not authorized in the password

After first CSVtoFTP configuration, all stored data are sent, by batch of 2000 lines.

Tricks: Once your FTP connection is valid You can check and compare CSV format with Send a file and check file on your server side.

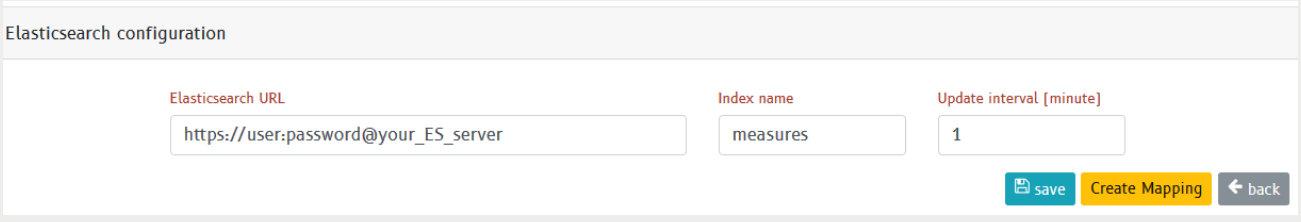
Elasticseach

SLgateway embed a native API to push periodically all measures received since the previous transmission to the Elasticsearch platform.

You need an active Elasticsearch account and a valid server (refer to www.elastic.co)

Elasticseach configuration (SLgateway side)

access to "APIs → Elasticsearch" page



1. Fill the forms:
   a. Elasticsearch URL: user & password & your ES server

URL format is: **https://user:password@your_ES_server**

b. Index name: "*measures*" or any name fitting to your ES configuration
c. Update interval (minute): periodicity of the sending process to ES server

2. Save configuration with button Save and activate with Create Mapping

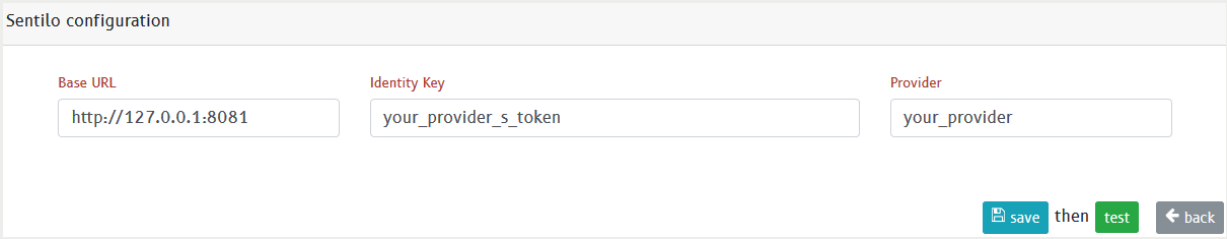
Sentilo

SLgateway embed a native API to push all measures the Sentilo platform.

You need an active Sentilo account and a valid server (refer to www.sentilo.io)

Sentilo configuration (SLgateway side)

access to "APIs → Sentilo" page



1. Fill the forms:
   a. Your Sentilo server URL
   b. Your identity key ("your provider's token")
   c. Provider ("your provider"), linked to your token
2. Save configuration with button Save and check all is working with button test

Measures are forwarded as soon as they are received (sentilo "push mode").

For more information about Sentilo: Quick start with Sentilo

Modbus API

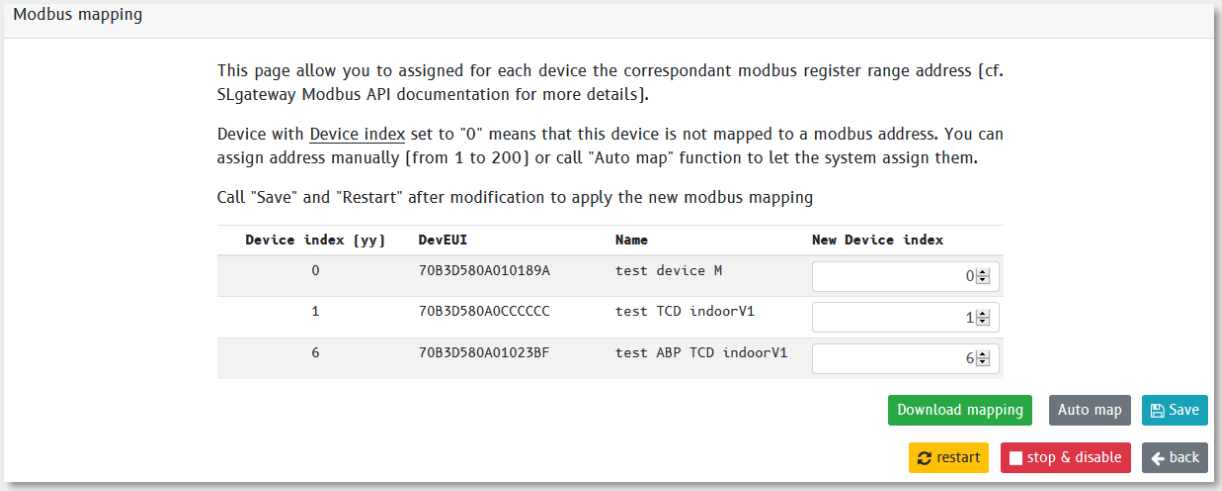
"Modbus API" service allows the SLgateway to be exposed as a TCP Modbus Server.

In this mode, last payload & decoded data are exposed into specific Modbus registers.

- **Modbus is not activated by default** (see process bellow to config and activate it)
- Only the last received payload or decoded measures are exposed into Modbus registers. You have to set your request period to the device transmission periodicity (minimum requests period is "one minute")
- Need at least one valid value per device before to "read" this device with Modbus.
- Maximum number of managed devices: 200 (Modbus API)

This step must be executed only once devices are provisioned into the gateway, and anytime you change your device list.

Modbus mapping configuration



access to "Tools → Modbus mapping" page.

Device with "*Device index* = 0" means that the device is not mapped to a Modbus register.
By default, all new devices are affected to "*Device index* = 0".

1. You can assign *device index* manually (from 1 to 200) or call Auto map to let the system assign them.
2. Valid the mapping with save
3. You can download in a csv file the current mapping with Download mapping
4. To apply the new mapping, you have to restart Modbus service with restart

Next step:

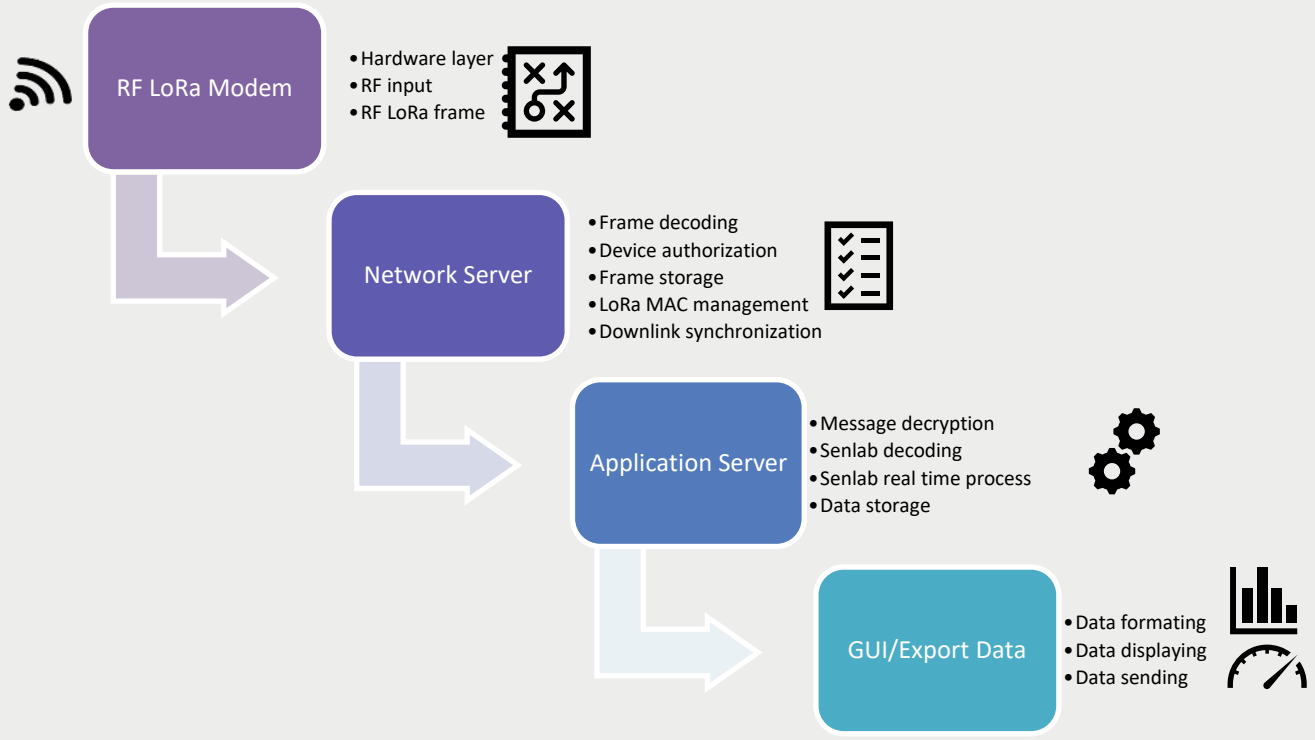
Once the Modbus API is well configured and activated on SLgateway, you can refer to the Modbus Register Table to find useful information to configure your Modbus software or PLC to get SLgateway Modbus data.

Troubleshooting

I don't succeed to activate my device onto the gateway

Keep in mind the following process of radio message reception to try to found where the issue comes from?

✓ You can activate real time "logs" (into "Maintenance→ Services" page) to observe received and sent frames when you try to activate your device



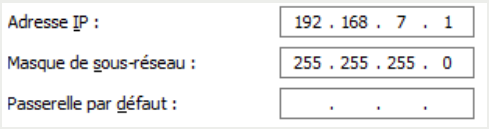
I have forgotten the current IP network gateway configuration

You can access to a permanent Ethernet interface of the gateway by using a USB cable.

- ✓ You need:
  - ✓ a "Type A to mini-B USB cable"
  - ✓ To install USB/virtual Ethernet driver:

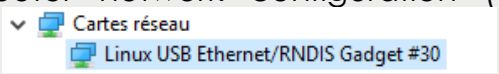
OS	Link for driver
Windows 64 bits	Download here
Windows 32 bits	Download here
MacOSX	Download 1 here and Download 2 here and read help here

  - ✓ In some cases, you would need to set your local emulated ethernet IPv4 to 192.168.7.1 (sub network 255.255.255.0). If you have "driver signature trouble", help is here.



Follow this process:

1. Turn ON the SLgateway (with power supply plug)
2. Wait for the 2 leds blinking (under LoRa antenna)
3. Plug the USB cable between computer and gateway
4. Wait for Linux USB ethernet / RNDIS connection into your computer network configuration (driver self-extracting)



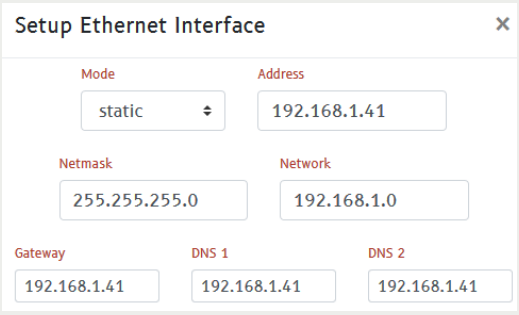
5. Access to http://192.168.7.2 with your internet browser and check your IP network configuration into "Maintenance → System" page
   On MacOSX, you may need to access to http://192.168.6.2 instead.

You can also come back to the default configuration: refer to "How to come back to the default Ethernet configuration (static 192.168.2.1)?"

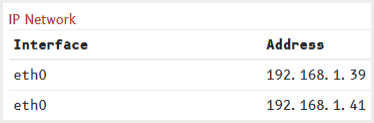
I have forgotten the user and/or password to access to the GUI

Follow the process described in SLgateway FAQ page to restore "*public/public*".

How to configure my SLgateway to static IP address (Ethernet)?



1. Connect to the gateway using Ethernet (current configuration) or USB cable.
2. Access to the config page: "Maintenance → System", with button Change Ethernet IP config
3. Choose "static"
4. Fill all the forms
   (Since V2.4.2, IP value suggestion appears after you fill the "Address").
   If you are already using the ethernet connection, you could see two "eth0". The two addresses are available until next reboot.
   Reboot with Reboot (check cable is connected to the new local network)



5. Your gateway is now reachable only on new IP address!

Tricks:

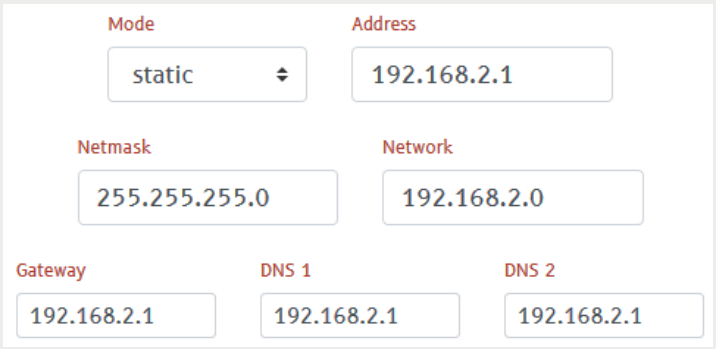
- If you have problem with DNS (when you try to reach an URL, not an IP), you can "fix DNS" with button Fix DNS and try to reach the URL again.
  You can also try to use this DNS servers: 1.1.1.1 and 1.0.0.1 (contact us for more details)
- if you don't know what to put in "gateway", "DNS1" and "DNS2" form, repeat your static IP address)

Using ethernet static IP and GPRS connection on the same time is technically possible but you can have DNS trouble (because the GPRS connection will replace the "manual" DNS). It is better to choose GPRS only OR static IP only.

How to come back to the default Ethernet configuration (static 192.168.2.1)?

You can change the default Ethernet configuration to fit to your local network from "Maintenance → System", with button Change Ethernet IP config

Fill the form as below:

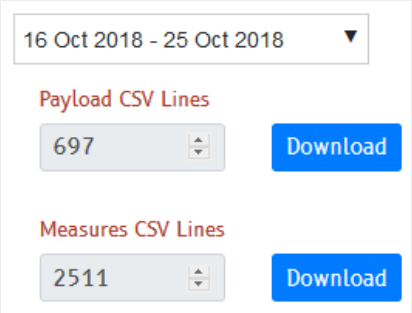


How to recover all data stored in my SLgateway?

You can download all data stored in SLgateway (until 100 days) in on CSV file.

You can choose from date to date, and the type of data: Measures or Payloads.

1. Access to the page: "Tools → CSV Export",
2. Choose first and last dates
   You can check the number of lines
3. Download CSV file you need.



Some function (downlink queue) can be delayed or cancelled during the "Export process", up to a few minutes in case a many data to export.

Do you have any other questions?

You can check SLgateway FAQ page and read useful answers.

How to get technical support?

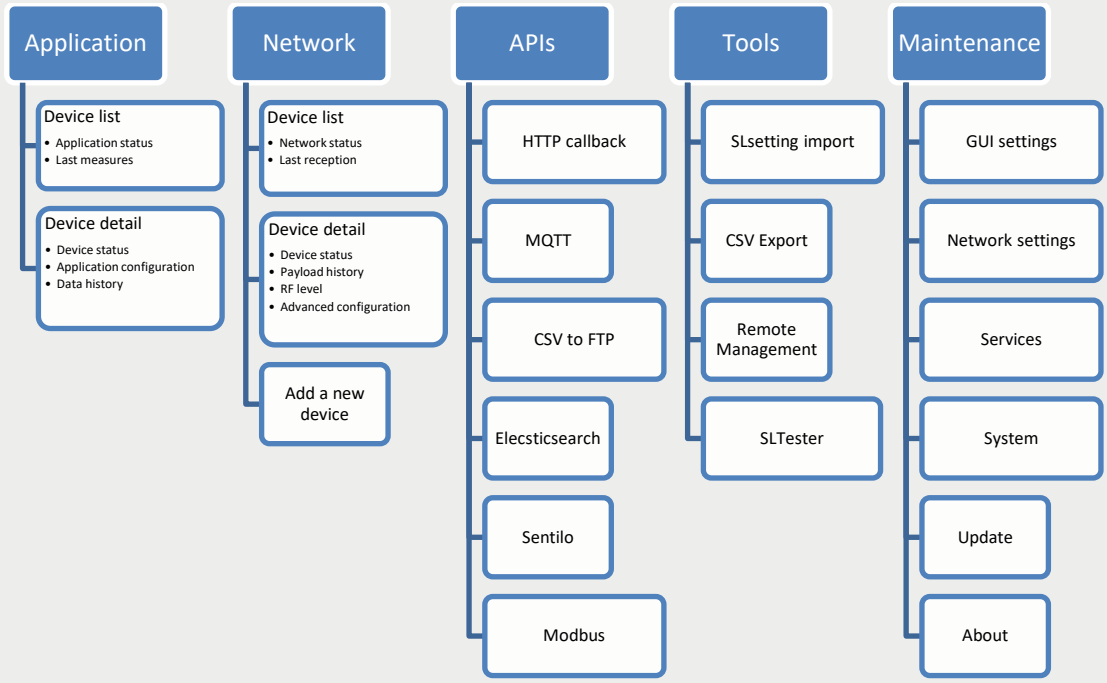
More information (tutorials, FAQ, document, news), are available on the SLgateway V2 support website.

- ✓ You will have to register first here
- ✓ If you have as specific question, or doesn't found the solution to an issue, please create an online ticket here

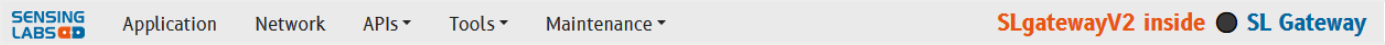
Thank you for given maximum information about the issue to get a faster response from support
(services logs, device ID / type, APIs configuration / Remote access support)

Annex - GUI

GUI structure (V2.4.x)



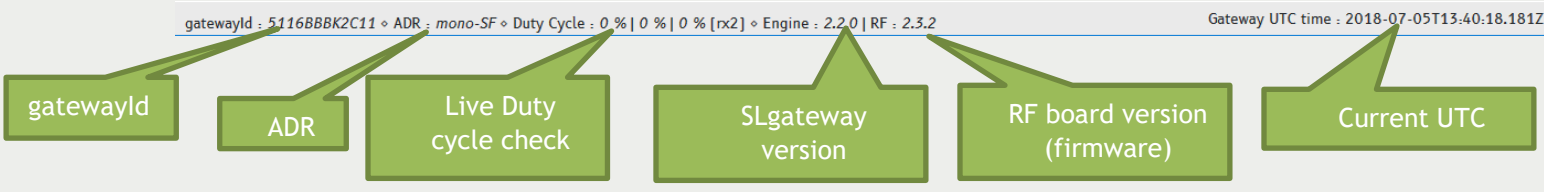
Header contains the global menu to access to all pages and displays the gateway friendly name.



Footer indicates:

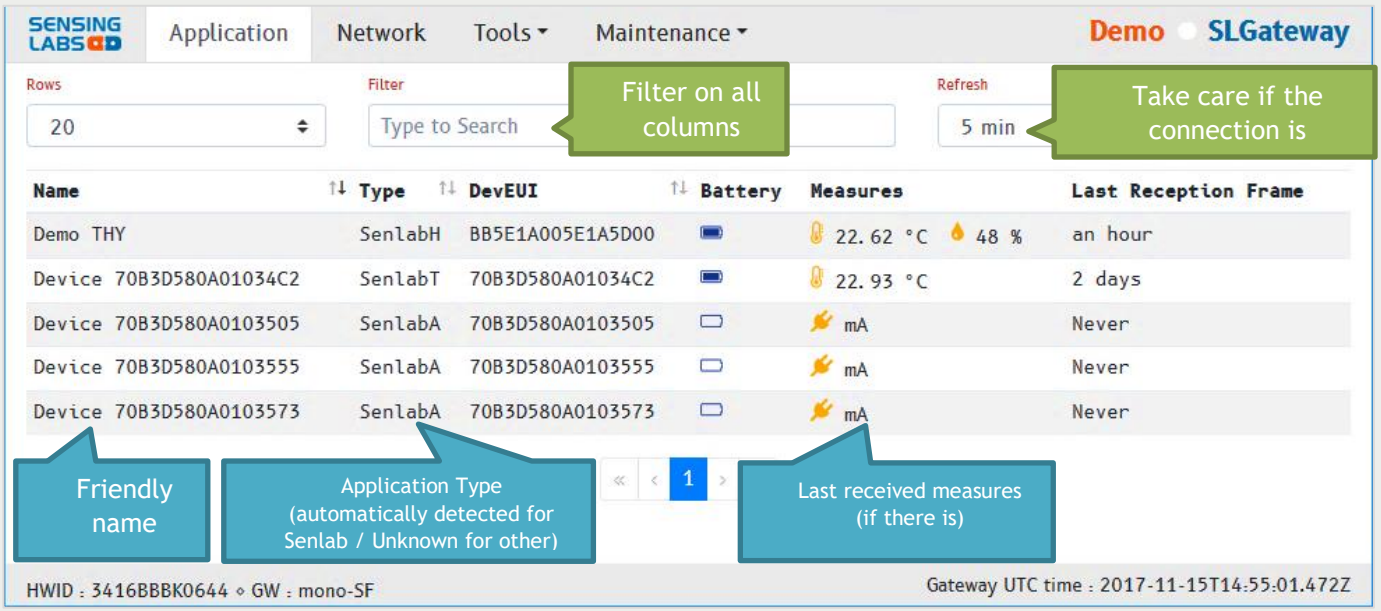
- ✓ The unique identifier of the gateway "gatewayId (also on the back label)
- ✓ ADR: **mono-SF** (picoGW) or **multi-SF** (Gateway-8CH)
- ✓ The last hour Duty Cycle counter (%), for each channel
- ✓ The version of the engine (also called SLgateway version)
- ✓ The Radio Frequency Board Firmware version
- ✓ The current gateway UTC time.

All this information can be useful when you ask for technical support



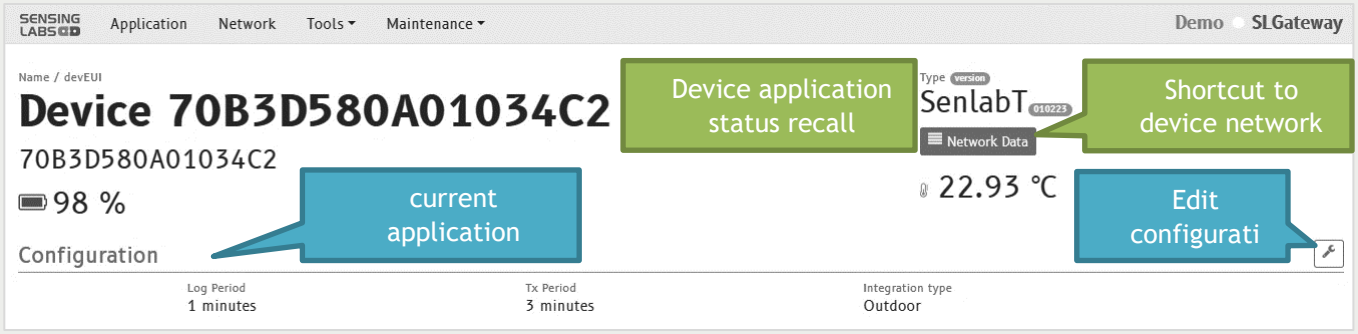
Application – device list

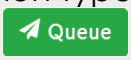
This page gives an overview of application status for all device:



- Click on a "device row" to access to device application detail
- For "Unknown" application Type, you will be redirect to device network detail

Application – device detail

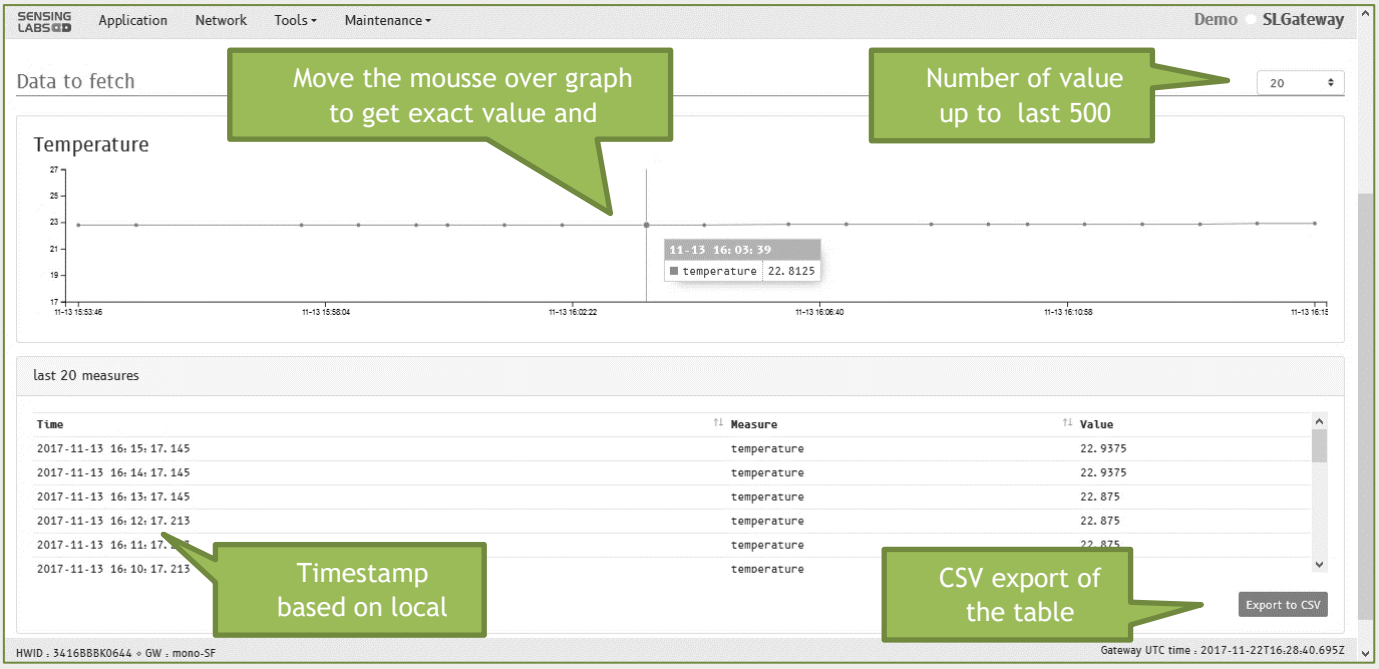


- to Edit application configuration, click on button 
  - Configuration field depends on application Type
  - Send the new configuration with button 

New configuration will be transmitted as soon as new uplink message will be received.

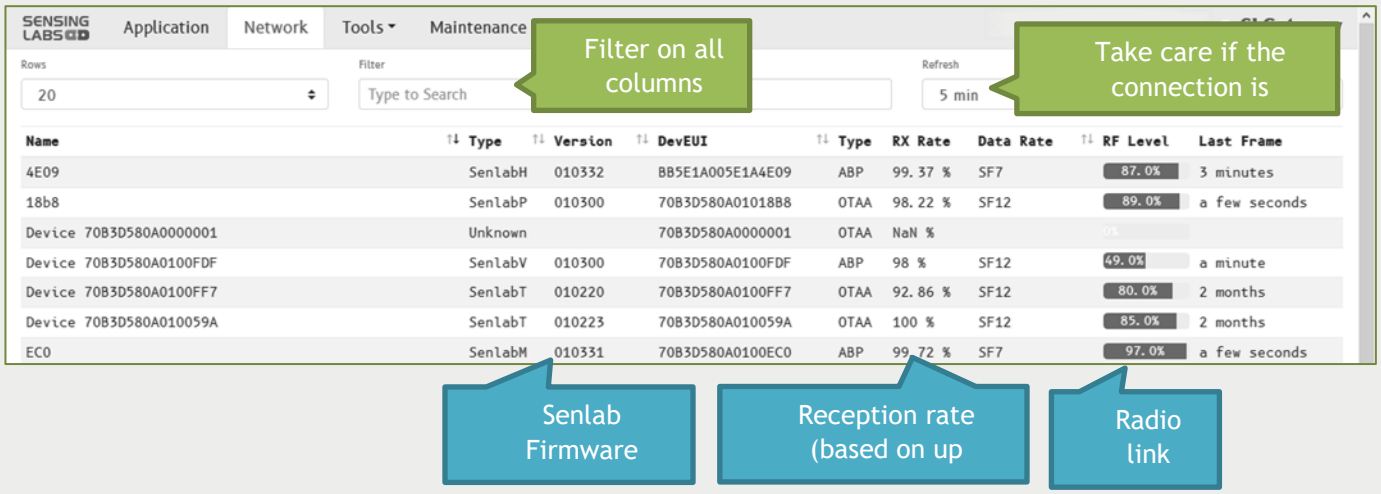
You can follow downlink status into Network detail page.

➢ Data history are visible into a graphical & a table



Network – device list

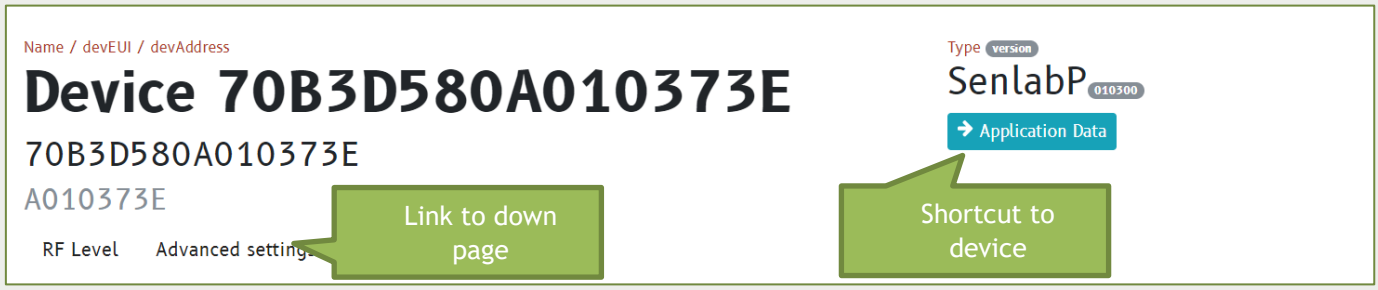
This page gives an overview of network status for all device:



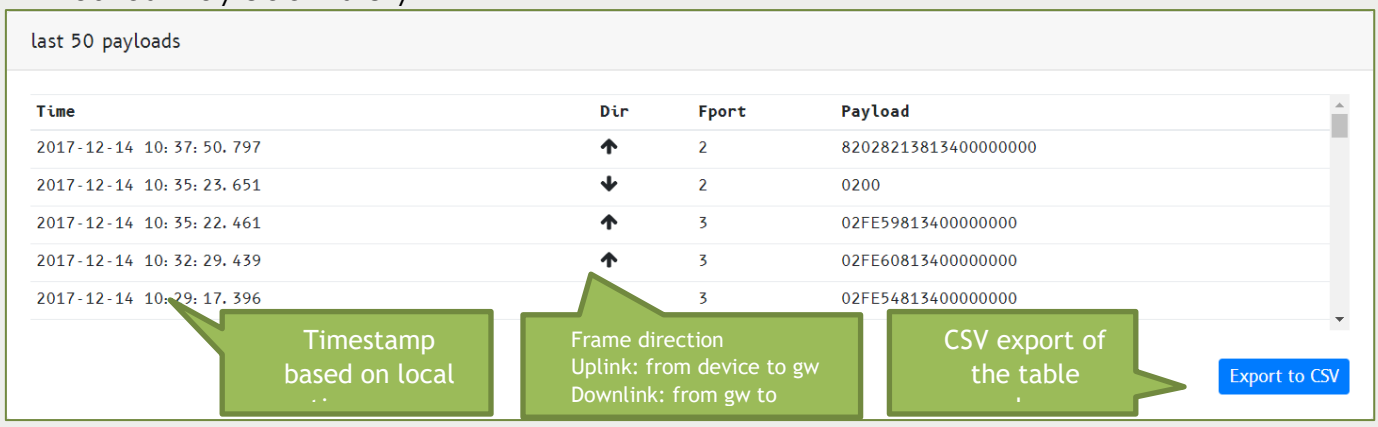
➢ Click on a "device row" to access to device network detail

Network – device detail

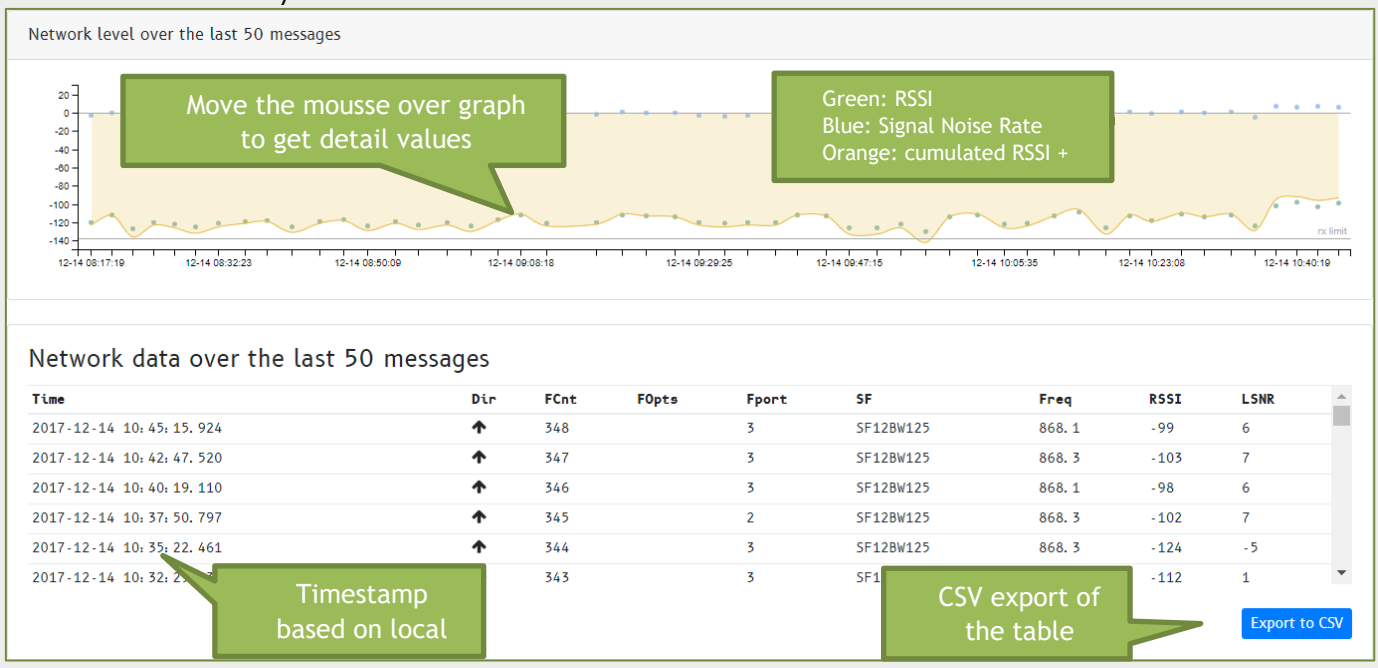
- Device status



- 50 last Payload history



- RF level history

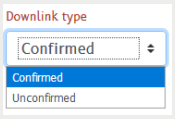


Refer to RF LEVEL RESULT INTERPRETATION section for interpretation of RF level data.

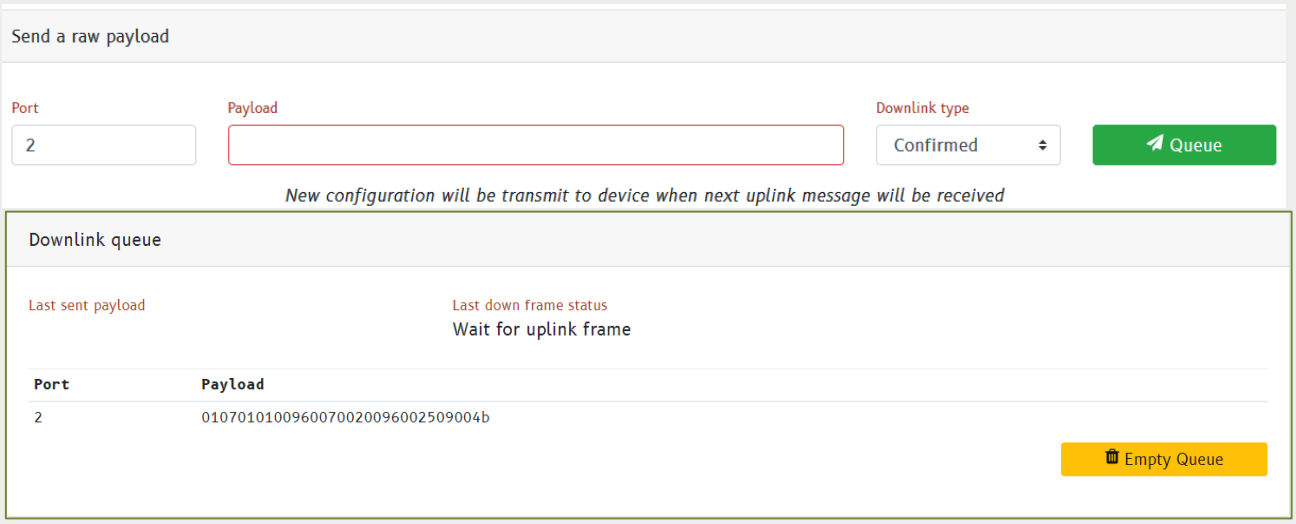
- Downlink payload can be sent to device

- Send the hexadecimal payload with button Queue
- Sending status can be follow into "Downlink queue"
  - Waiting for uplink frame / Sent to device / Success / Failed
- You can remove all "Not sent" frame using button Empty Queue

You can choose the type of downlink:

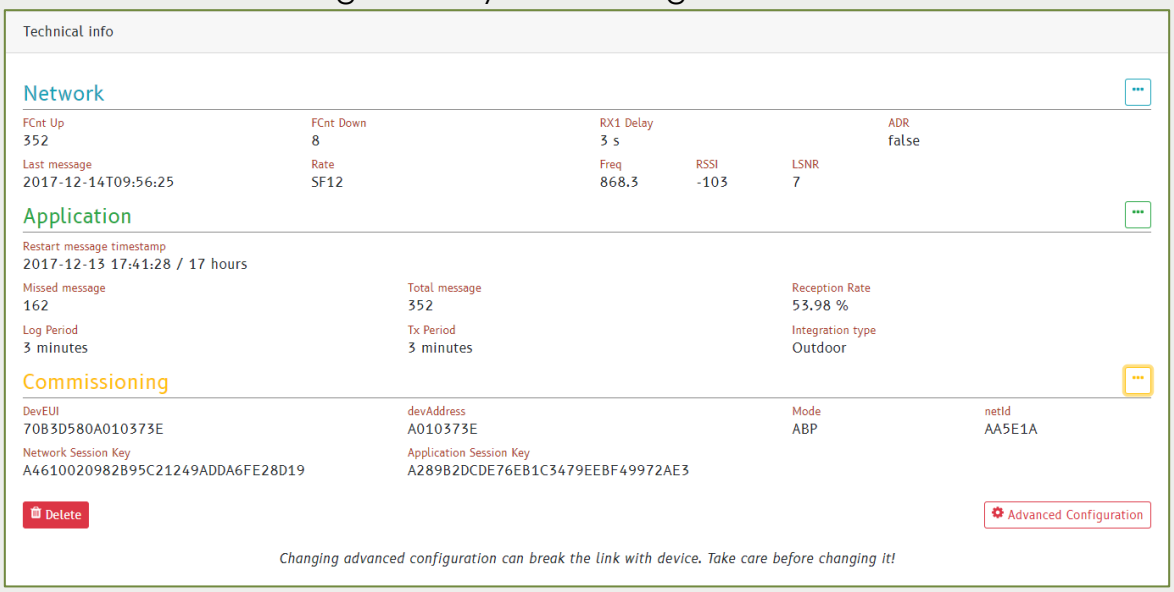


- "**Confirmed**": downlink is sent until acknowledgement from device (number of retry can be set in Maintenance - Network settings)
- "**Unconfirmed**": no retry in case of unconfirmed status



➢ Advanced settings for experts : Network, Application & Commissioning

- You can change friendly name using Advanced Configuration



- **(Gateway-8CH only)** You can also disable ADR (enable by default)
- Network advanced configuration must not be changed (only for experts)

Any bad setting in Network advanced configuration can definitely lost the connection with device.

Tools – Remote management

How to connect remotely to SLgateway?

How to manage a fleet of SLgateway and devices ?

You can check SLgateway App. Note page and read useful answers.

Tools – SLTester

SLtester allows to test your local LoRaWAN network coverage with high reliability.

Why using SLtester ?

- Radio Range validation before deployment
- Same RF performance as deployment site
- Devices and gateway position validation
- Indoor and/or Outdoor test devices
- Simple status interpretation

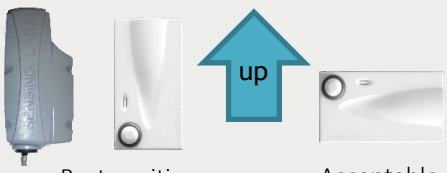
If you get the package SLtester kit:

- You can register your mobile phone to receive each test status in live by SMS
- Your Senlab Test device(s) are already associated with the gateway
- Test can be made in standalone mode (no need to access to GUI during test)

You need to get at least one Senlab Test device(s) to make test coverage. Contact us if needed.
You need to be sure your Test device is not already registered into another SLgateway.

STEPS to follow for making a test session (without SMS option)?

1. Install your gateway
   - ✓ Respect installation recommendation
   - ✓ Turn it ON (with power supply) and wait for starting (1min)
2. Access to "Tools → SLTester" page to add your Test device Add
   - ✓ The Senlab ID is on the front sticker of the device casing
   - ✓ At the end of the Test session, Test device must be removed and RESET
3. Position your Senlab Test device at the expected location (*without holding the device with hand*)
   - ✓ Prefer vertical position (antenna part upwards) in a free space area (higher place if possible)
   - ✓ Avoid positioning the Senlab Test device against a metallic element



4. Press the device push button 2 seconds (until LED starts blinking)
   - ✓ Wait for 20 seconds during range test processing (LED blinking)
5. Check Quality level on "SLtester" page

Senlab ID [devAddress]	Test	Quality	Date / Time
A0100C01	1	fair	2018-03-21 16:09:18

- ✓ If level is **GOOD** → **you can go to the next place test** and start from step 5
- ✓ If level is **FAIR** → you **can try to improve the sensor position** and **launch a new test point** and start from step 5
- ✓ If level is **BAD** → **you have to improve the gateway position** and **launch a new TEST session from the beginning** (step 1)

- ✓ If Senlab LED blinking doesn't finished by 2" ON or if you didn't receive the TEST status
  -> TEST status has to be considered **BAD**
- ✓ If you received a **BAD** status, it's recommended to launch a new TEST to confirm the result
- ✓ The gateway must be kept in the same position during all this test session.

Using SLtester collecting field form is recommended for an easy coupling of location and quality, for each Test in a single document.

1. Describe the exact place and position of the SLgateway in top part of the "SLtester collecting field form".

SENSING LABS

SL tester collecting field form

People (name/company)	Sam J. / XXXX corp
Date	22 march 2018
Site name	Sam J. / XXXX corp
Test Environment (inside, outside, weather)	Outside, raining
Gateway environment (location, position, antenna)	GW on top of Bob's desktop Classic antennas

2. For each test, fill a new line table with
   - ✓ *Test Location (more precise is better)*
   - ✓ *Time* for easy post-processing interpretation
   - ✓ *Test device ID* (devAddress printed onto the device)
   - ✓ *Test Number & Quality level (*appears in the report page)

		DevAddr			
		3C03	186A		
Tests Location (description)	Time	Senlab INDOOR	Senlab OUTDOOR	Test ID	Quality
Corner north/west of parking	15:06	X		4	Fair
2 meters from main door	15:07		X	5	Good
Building 2 : 4st floor (room 45)	15:24	X		6	Good
Top of the door (indoor side)	15:25		X	7	Good
Cross "paradise street" and "jones street"	15:43	X		8	Bad
Under the tree	15:44		X	9	Fair

Senlab Test device location

Test number (= Test ID)

For OUTDOOR RANGE TEST, we recommand to use a GPS tracking tool

You can use the Android free app "Quick Position Save" with this process:

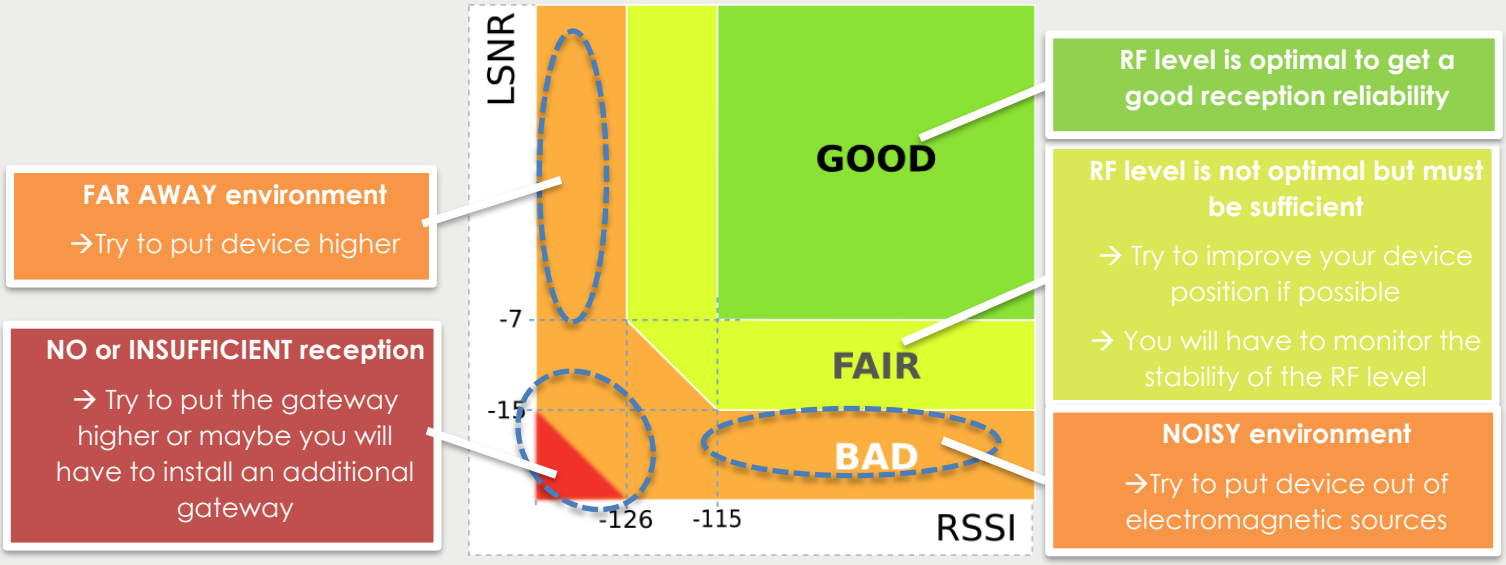
- ➢ Name the point with Test number

- Export kmz file at the end of the TEST session
- Display GPS point on a map and associate to Test points

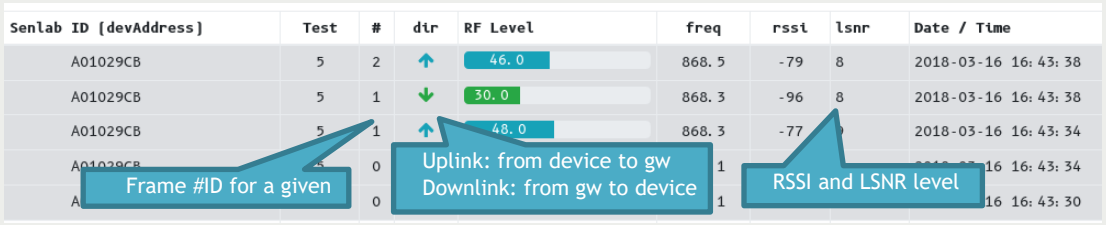
RF LEVEL RESULT INTERPRETATION

Into "Tools → SLTester" page, choose your Test Senlab ID to filter results for this ID

- **A Quick interpretation status is indicated based** on multiples uplink and downlink received level during each Test point.



- **Details RF levels for each Test point are** available into bottom part.



- **You can export table result with** Export details to CSV to process them with your own tools.

- ✓ Don't change the friendly name of Senlab Test device
- ✓ If you want to remove a Test device from your gateway (Network tab), you will have to RESET it before the association with another gateway → Keep the magnet 20'' until LED stay ON 5''

Maintenance - Network settings

You can customize the LoRaWan **appEUI** and **netID** code for your local radio network from "Maintenance → Network Settings" page

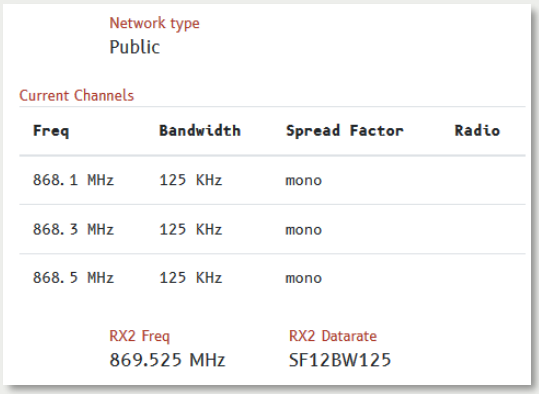
- Be sure you have your own LoRaWan alliance codes to use them.

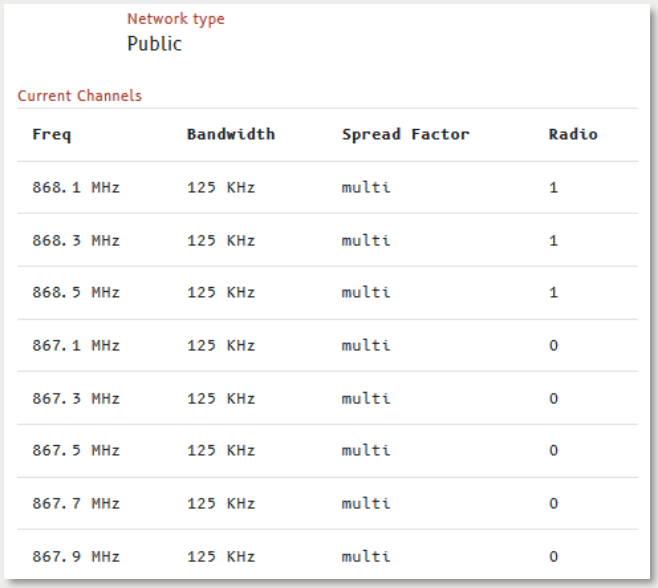
You can also change the number of **downlinks retry**.

New network configuration will be applied to new devices only

You can check the **network type**: PUBLIC (by default) or PRIVATE (PicoGW only) and the **current channels** of the gateway (frequency, bandwidth, Spread Factor).

- (PicoGW only) These parameters can by customize by uploading of a new config file.
  For any other configuration, please please create an online ticket here
- Typical "Frequency plan" (left screen= PicoGW, right screen= Gateway-8CH):





Theses parameters need to be change only BEFORE a new installation (communication with previous attached devices will be lost).

Maintenance - Services

The "Maintenance → Services" page give status of SLbase services

- In case of trouble, you can check if they are active and the uptime.
- "Backup / Restore" allows you to save full configuration and data to a file, and to load it in another SLgateway.
  - To backup, use button Download config backup and save the "*redis file*" to your computer
  - To restore, use button Choose File and choose "*redis file*" in your computer, then use button Restore config backup to load it into your SLgateway

If you use "CSV to FTP", contact us to reinitialize for "CSV initialization".
If you need to restore configuration in a new gateway, check FAQ .

- "Network & Applications logs" allows to see in real time services logs
  - Use buttons Start Stop Clear to activate them
  - You can also download logs to send them to support with button Get all services logs

We recommend you to let the default "Logging – console level" configuration

Maintenance - System

In addition, with "IP network" & "GSM configuration", the "Support remote access "in page "Maintenance → System" allows you to activate remote access for support investigation:

1. Buttons Start remote access Stop remote access will activate/deactivate the remote access until the next gateway reboot
2. Buttons Enable remote access Disable remote access will register/unregister the remote access when gateway is turn ON.

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