

SenlabT

TEM-LAB-xxNS<sup>©</sup>

*FIRMWARE VERSIONS 1.2.X / 1.3.X*

User guide

SENSING-LABS

*VERSION 02 - REV K / JUNE 2018*

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Thank you for your choosing our Senlab product!  
We hope you will find the instructions on this user manual clear and easy to follow.

## General overview

The Senlab TEM (SenlabT) sensor is a smart LoRaWAN™ radio device with a high precision temperature sensor (see table for accuracy).

**SenlabT logs the temperature and allows 2 functional modes** (see Understand the 2 SenlabT functional modes section for more details):

- **Basic** (also called “Standard”): Periodic “log and transmit”
- **Datalog**: Periodic logs (up to 24 logs) and “all in one” transmission




The indoor version is designed for office comfort monitoring, whereas, the outdoor version is made for harsh environment use.

The probe can be embedded inside the casing, on the casing or with an extension cable. It depends of the version (table below).

Threshold detection is available (refer to **Threshold overrun** section).

Part number	Temperature probe	Measure Range	Accuracy	Casing type	Protection level	Dimension
<b>TEM-LAB-13NS</b>	Compact	-20°C to +70°C	± 0.2°C	Outdoor	IP67	102x56x35mm
<b>TEM-LAB-14NS</b>	External 1m cable	-45°C to +125°C	± 0.5°C -10°C to +70°C else ± 2°C	Outdoor	IP67	102x56x35mm probe: 30mm Ø6±0.1mm
<b>TEM-LAB-21NS</b>	Inside	0°C to +55°C	± 0.2°C	Indoor v1	IP30	85x53x25mm
<b>TEM-LAB-41NS</b>	Inside	0°C to +55°C	± 0.2°C	Indoor v2	IP30	91.5x50x25mm

 Warning, take care to respect the operating temperature of the senlab (the device itself):  
-20°C to +70°C for outdoor and 0°C to +55°C for indoor version



Indoor v1




Indoor v2



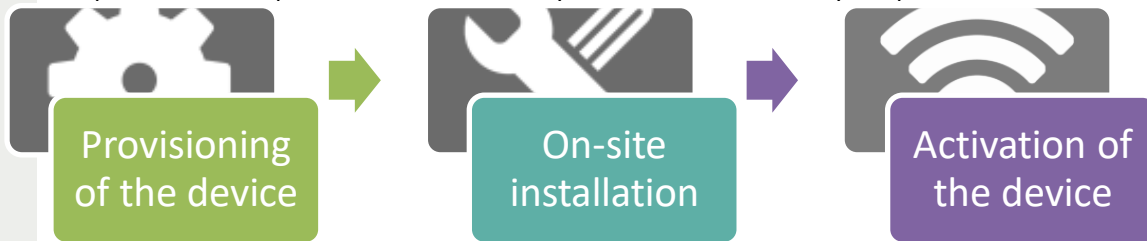
Outdoor



Outdoor with external probe

 Warning, not for use in salt water or other corrosive environments.

3 steps are required to make your SenlabT fully operational, described below.



## Provisioning of the device

You have to be sure that your **Senlab device has been well commissioned** to be able to reach your LoRaWAN network.

- ✓ Contact if needed your distributor to get your Senlab configuration
- ✓ Required information for provisioning the device into your LoRa system are listed in the following table:



Warning, don't unprovision device from your system before stopping it!  
(refer application features to stop the application via RF)

	devEUI	appEUI	appKey	appSkey	NwkSkey	netId	devAddress
<b>Case 1 : OTAA / PUBLIC</b> Typical configuration for Network Operator based architecture	X	required	required				
<b>Case 2 : ABP / PUBLIC</b> Typical configuration for Private mono gateway network	X			required	required		required
<b>Case 3 : ABP / PUBLIC</b> Sensing-Labs SLgateway V2 configuration (local network)	X	Optional*		Optional*	Optional*	Optional*	Optional*

(\*) If asked when ordering, devices are already provisioned into your SLgateway. If not, you need these parameters.

- ✓ Network & Application configuration of Senlab device can be done:
  - At factory (for minimal batch of 1000 devices)
  - By your distributor (more often)
  - By yourself (if you have your own SLsetting tool)
- Please refer to parameter list described into the Application features chapter to fit to your use case and get a "Plug&Play" device.

- **All application configuration can also be dynamically adjusted Over The Air** (via downlink request)

## On-site installation

### INDOOR INSTALLATION (TEM-LAB-41NS)



### EXTERNAL PROBE INSTALLATION (TEM-LAB-14NS)

For pipe temperature monitoring, we recommend to use a perforated hose clamp to ensure a good temperature transfer between pipe and probe.



## DEVICE POSITIONING

You have first to find the best position to your Senlab:

- ✓ Prefer vertical position (**antenna part upwards** as on following pictures)
- ✓ Avoid positioning the external cable pulled vertically under the device (prefer coiled positioning or use the rear gutters for outdoor version)
- ✓ Avoid direct sun light exposure or heater system proximity



For best radio performance:

- Positioned the upper part of the device upwardly in a free space area
- avoid positioning the Senlab against a metallic element



## DEVICE MOUNTING

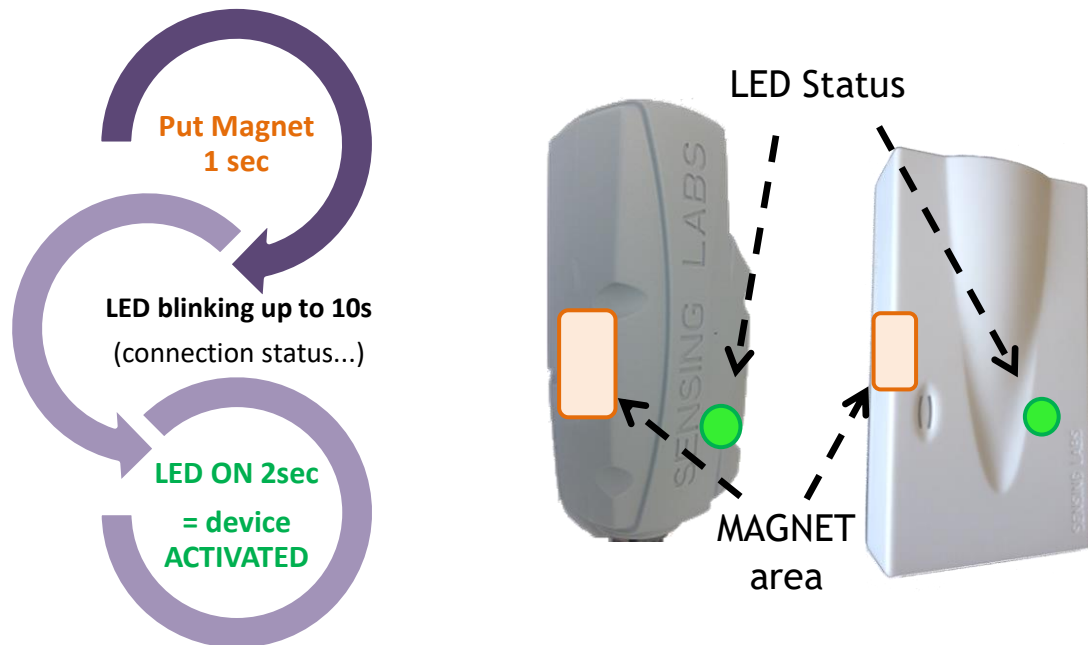
Device type	Device mounting
<b>All versions</b>	Stick the product to the wall or cabinet with a double-sided adhesive tape
<b>Indoor versions</b>	Screw the rear side of the product to the wall with countersunk screws make sure the screw heads don't exceed from the plastic side once installed
<b>Outdoor versions</b>	Use plastic cable ties with screw mount

Refer to « Application Note Senlab installation » ([download link](#)) for full recommendation.

Now the device is well physically installed and plugged, you can start the activation process.

## Activation of the device

To activate the Senlab device, you have to use a magnet (min pulling force 1Kg).



- ✓ Remove the magnet as soon as the LED flashes!
- ✓ If activation fails (No solid LED ON 2sec), Senlab will come back in storage mode.
- ✓ After successful activation, device will automatically send its START message



Once activated, if you pass the magnet one more time, the device will indicate its activation status after 3s LED blinking:

--> Solid LED ON 2sec will confirm that device is activated

## Deactivation of the device

If you decide to deactivate Senlab, no more transmissions will be sent → That means that you need a physical access to the Senlab to active it again.

Many ways are possible:

- **Over the Air:** by sending the downlink request “STOP application” (via your LoRaWAN system)
- **With physical access (with SLsetting tool):** by using SLsetting “disconnect” action
- **With physical access (only for test devices):** By holding the magnet during 20 seconds until the LED stay ON for 5 seconds.

## Understand the 2 SenlabT functional modes

It is important to understand all modes in order to choose the best one to fit with your use case and environment.

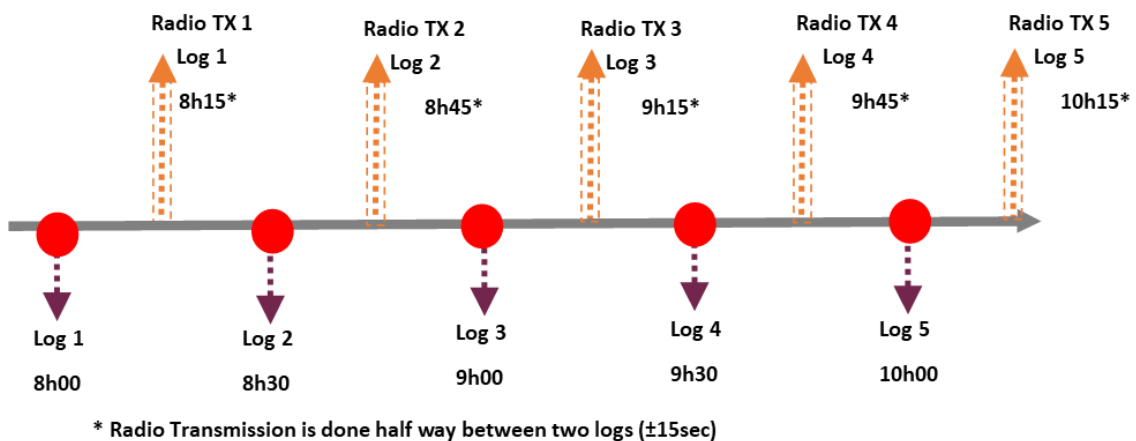
All modes are switchable from one to each other Over The Air or with SLsetting tool.

### Basic mode (or standard mode)

This mode allows to transmit periodically 1 measure (temperature):

- ✓ Measure period can be configured from 3min to 24h (Tx < 10min is for test only)

**Example: Log period = Transmission period = 30min**



### Availability

### All firmware versions

<b>Compatibility</b>	<ul style="list-style-type: none"> <li>✓ Operated network</li> <li>✓ SLgatewayV1 or V2</li> <li>✓ Third part gateway with SLcodecs or manual decoding</li> </ul>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>✓ "Manual" decoding possible (without SLcodecs)</li> <li>✓ Over The Air reconfiguration</li> </ul>
<b>Typical use cases</b>	<ul style="list-style-type: none"> <li>✓ Monitoring of physical value(s) with slow variation</li> </ul>
<b>What to configure?</b>	<ul style="list-style-type: none"> <li>✓ Measure period (the transmission period will be the same)</li> </ul>
<b>How to get applicative data?</b>	<ul style="list-style-type: none"> <li>✓ All SLgateway's APIs : refer to SLgateway user guide</li> <li>✓ SLcodec : refer to SLcodec help</li> <li>✓ By decoding payload yourself: <a href="#">Refer to « Application Note SenlabMessageFormat »</a></li> </ul>

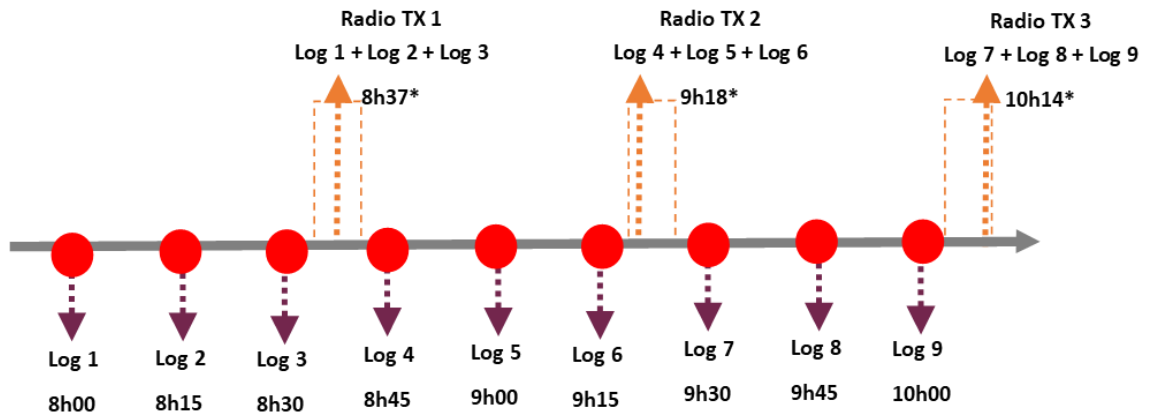
### Datalog mode



This mode allows to transmit up to 24 periodic measures (temperature) in each message:

- ✓ Measure period can be configured from 1min to 24h
- ✓ Transmission period can be configured from 3min to 24h (Tx < 10min is for test only)
- ✓ Possibility to activate a “log redundancy” feature to integrate previous logs in current transmission (ex: TX2 will contains logs n°1 to 6 and TX3 logs n°4 to 9)

**Example: Log period = 15min / Transmission every 3 logs (≈45min)**



\* Radio transmission is done « randomly » between the last log and the next one

**Availability All firmware versions**

<b>Compatibility</b>	<ul style="list-style-type: none"> <li>✓ Operated network</li> <li>✓ SLgatewayV1 or V2</li> <li>✓ Third part gateway with SLcodecs</li> </ul>
<b>Advantages</b>	<ul style="list-style-type: none"> <li>✓ Log precision up to 1 log every minute and transmission by “datalog” to optimized battery life time</li> <li>✓ Log redundancy feature to recover not received message Over The Air reconfiguration</li> </ul>
<b>Typical use cases</b>	<ul style="list-style-type: none"> <li>✓ Monitoring of physical value(s) with fast variation</li> <li>✓ Important battery life time</li> </ul>
<b>What to configure?</b>	<ul style="list-style-type: none"> <li>✓ Measure period</li> <li>✓ Transmission period (multiple of measure period)</li> </ul>
<b>How to get applicative data?</b>	<ul style="list-style-type: none"> <li>✓ All SLgateway's APIs : refer to SLgateway user guide</li> <li>✓ SLcodec : refer to SLcodec help</li> </ul>

## Application features (datalog mode)

This chapter describes the SenlabT application features available in datalog mode (accessible via SLgateway or SLcodec – refer respective User Guide for more details)

### Measure data

<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
<i>temperature</i>	Measured temperature	FLOAT	°C	-45...+125
<i>battery_current_level</i>	Battery level of the device	UINT8	%	1...100

### Event data

<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
<i>start_event</i>	Happens when device is restarted on the field	BOOL	-	-

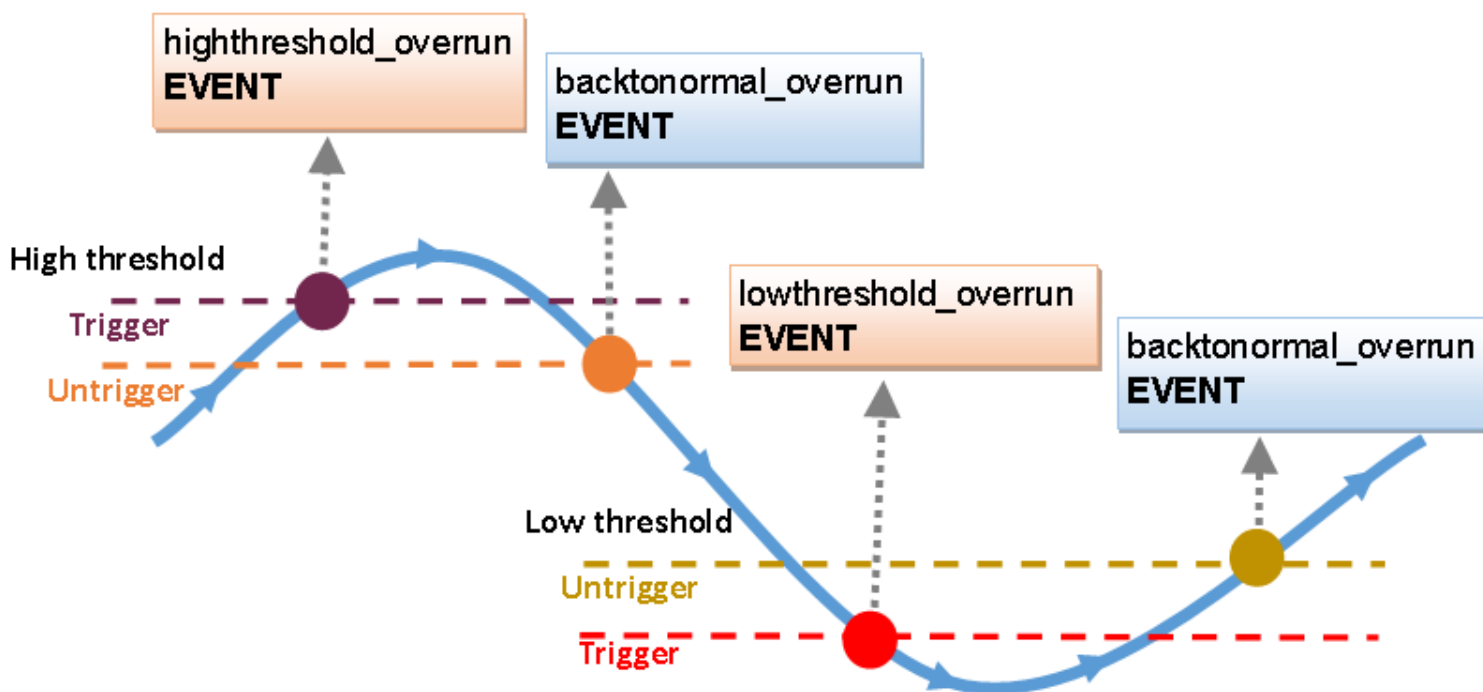
### Configuration requests

<u>Parameter ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
<b>Datalog configuration</b> (ID = request_write_datalog_cfg)				
<i>log_period</i>	Device will measure every X minutes	UINT16	Minute	1...1440 (1440=24h)
<i>log_tx_period</i>	Device will send logged measure every X minutes (must be a multiple of log_period)	UINT16	Minute	3...1440
<i>log_tx_random_activation</i> (optional)	Maximize device datalog reliability	BOOL	-	-
<i>redundancy_factor</i>	Log-redundancy ( <b>since FW V1.3</b> ) Send the X n-1 last log(s) with the last log(s)	UINT8	-	1-12
<b>Reset battery level</b> (ID = request_reset_battery_level) <i>Must be used after battery replacement only</i>				
NO PARAMETERS				
<b>Stop application</b> (ID = request_stop_application) <b>Warning: activation with magnet will be mandatory to reactivate the device</b>				
NO PARAMETERS				

## Threshold overrun

SenlabT embed a feature to monitor thresholds overrun. You can activate independently a high and a low thresholds, with specific trigger & untrigger temperature values.

- ✓ **Important: Threshold overrun is checked only at log measurement period**
  - It's recommended to configure device with a small log period ( $\leq 10$ min) and an important transmission period ( $> 10$  log per transmission)
  - ex: log every 1 min and tx every 20 min **or** log every 5 min & tx every hour
- ✓ Threshold overrun feature is available for all SenlabT devices:
  - Since V1.1 version for TEM-LAB-21NS / TEM-LAB-41NS / TEM-LAB-13NS
  - Since V1.3.1 version for TEM-LAB-14NS (external Dallas probe)
  - Threshold overrun can be configured directly into SenlabT during commissioning step (SLsetting) since V1.3 firmware.



## Configuration requests

<u>Parameter ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
	<b>Start High Threshold detection</b> (ID = request_start_highthreshold_detection)			
highthreshold_trigger_temp	Temperature value to detect high threshold overrun	FLOAT	°C	-47...+128
highthreshold_untrigger_temp	Temperature value to detect high threshold overrun (< to high trigger value and > to low untrigger value)	FLOAT	°C	-47...+128
	<b>Start Low Threshold detection</b> (ID = request_start_lowthreshold_detection)			
lowthreshold_trigger_temp	Temperature value to detect low threshold overrun	FLOAT	°C	-47...+128
lowthreshold_untrigger_temp	Temp. value to undetect low threshold overrun (> to low trigger value and < high untrigger value)	FLOAT	°C	-47...+128
	<b>Stop High Threshold detection</b> (ID = request_stop_highthreshold_detection)			
NO PARAMETERS				
	<b>Stop Low Threshold detection</b> (ID = request_stop_lowthreshold_detection)			
NO PARAMETERS				

## Event data

<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
highthreshold_overrun	Event notified if high threshold value has been overrun	BOOL	-	true
lowthreshold_overrun	Event notified if low threshold value has been overrun	BOOL	-	true
backtonormal_overrun	Event notified if temperature come back under high untrigger value or upper low untrigger value	BOOL	-	true

## Battery replacement (Indoor version only)

Replacement battery must be a Lithium 3,6V AA type with 50mA min of supported continuous current → Contact your distributor to get original battery reference.

**Indoor V1** will lose the activation status during the battery replacement, so the process is:

1. Open the casing
2. Remove the old battery
3. Put the new battery
4. Close the casing
5. Activate the device (see "Activation of the device" chapter)
6. Send the configuration request "request\_reset\_battery\_level" to the device, using your application

**Indoor V2** have the capability to keep activation status during a few minutes, so the process is:

1. Open the casing
2. Remove the old battery and, **during the same minute**, put the new battery
3. Check if the device activation is still OK (see "Activation of the device" chapter)
4. In case activation lost, you need to activate the device again
5. Close the casing
7. Send the configuration request "request\_reset\_battery\_level" to the device, using your application

### ATTENTION:

EN: There is a risk of explosion if the battery is replaced by an incorrect type. Dispose of used batteries according to instructions.

FR: Il y a risque d'explosion si la batterie est remplacée par une batterie de type incorrect. Mettre au rebut les batteries usagées conformément aux instructions.

## Technical characteristics

### ISM Radio bands usage

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Senlab globally communicates over frequencies in the 865-870MHz radio band with a maximum transmission power of 25mW e.r.p (+14dBm e.r.p).

More precisely, the following table describes the different sub-bands, as defined per Annex 1 of ERC Recommendation 70-03 (13 October 2017), which can be used by Senlab:

Frequency Band		Power	Spectrum Access
h1.3	865-868MHz	25mW e.r.p	1% duty-cycle
h1.4	868-868.6MHz	25mW e.r.p	1% duty-cycle

Note that 1% duty-cycle for sub-band h1.3 is allowed by ERC/REC 70-03 Annex 1 Note 5 as its usage is limited to 865-868MHz.

### Electrical safety

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All circuits are SELV (Safety extra low voltage), including interface circuits which are only used for measurement (signals without power, these circuits are considered LPS).

### Ambient temperature of use

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The ambient temperature of use depends of the version:

Indoor version	From 0°C to +55°C
Outdoor version	From -20°C to +70°C

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