SENSING
LABS

SenlabO

PTL-LAB-41NS©

FIRMWARE VERSIONS 1.3 / 2.1

User guide

SENSING-LABS

VERSION 02 - REV E / JULY 2021

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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 Occupancy (SenlabO) sensor is a smart LoRaWAN™ radio device with 4 functionalities «All in One» (temperature, humidity, luminosity and presence detection).

SenlabO logs these 4 measures and transmit periodic logs (up to 12 logs) and "all in one" transmission

For example, if log is set to 15min: you "presence detection" will tell you if someone (or something that have moved) has been detected during the last 15min. The information is the same if there was only one activity or many activities during the last 15 min.

Also, SenlabO will return you the temperature, humidity, luminosity and ratio that have been measures at the log period (15min for example).

The luminosity is measured "in front of the area of the sensor" (in the room), not only the light focused on the sensor.

"ratio" is the ratio between "global measured light" and "artificial detected light".

The concept allows to know if the light in the room is more "artificial" or "natural".

The indoor version is designed for office comfort monitoring and space optimization.

Advanced threshold detection is available since v2.0 (see Thresholds overrun (FW >= V2.x.x)).

Check "SenlabV2" Application Note for V2.0 full specs: network migration, re-join…

Part number	4 sensors	Measure *Ranges*	Casing type	Protection level	Dimension
PTL-LAB-41NS	Inside	*0°C to +55°C* 20%RH to +80 %RH	Indoor v2	IP30	91.5x50x25mm

Part number	Measure	Typical accurancy	Conditions
PTL-LAB-41NS	Temperature	±0.3°C	0°C to +55°C
	Relative Humidity	±2 %RH	10°C to +55°C and 20%RH to +80 %RH
	Luminosity	±10 %	0 lux to 60K lux
	Ratio (of luminosity)	-	0 lux to 60K lux
	Presence	(See **Detection sensor**)	

> ⚠ Warning, take care to respect the operating conditions of the senlab itself:
> - 0°C to +55°C and 20%RH to 80%RH (non-condensing)
> Warning, not for use in salt water or other corrosive environments.

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

Provisioning of the device	→	On-site installation	→	Activation of the device
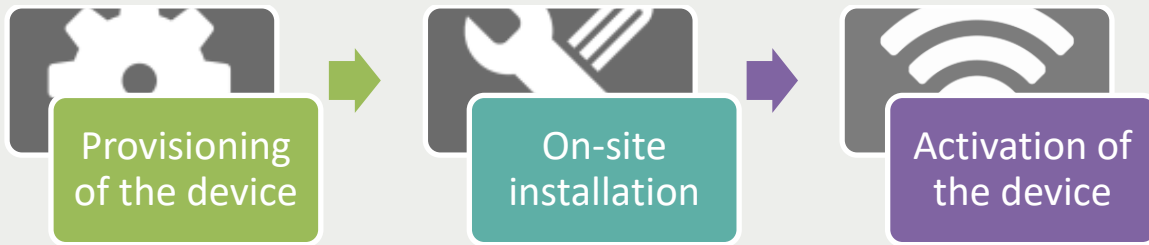
Provisioning of the device

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
Case 1 : OTAA / PUBLIC Typical configuration for Network Operator based architecture	X	required	required				
Case 2 : ABP / PUBLIC Typical configuration for Private mono gateway network	X			required	required		required
Case 3 : OTAA / PUBLIC 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:
 - o At factory (for minimal batch of 1000 devices)

- o   By your distributor (more often)
- o   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

- ✓ **Free space in front of device and on its sides**, and avoid external wall
    - o   It will improve the airflow required to get the representative temperature and humidity of the office.
- ✓ **Central position in front of detection location and at the height of human activity** (desktop for ex)
    - o   Presence detection range up to 5m
    - o   Large horizontal viewing angle (121°)
    - o   Vertical viewing angle (77°)
- ✓ **Avoid position the SenlabO on an electronic or electric product (computer, freezer…)**
- ✓ **We advise to set the log period to 15min (standard office use)**
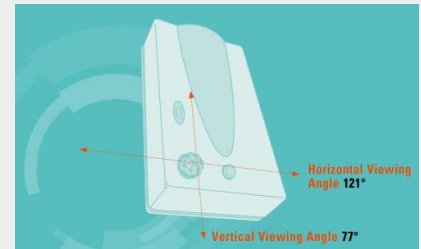
Device installation
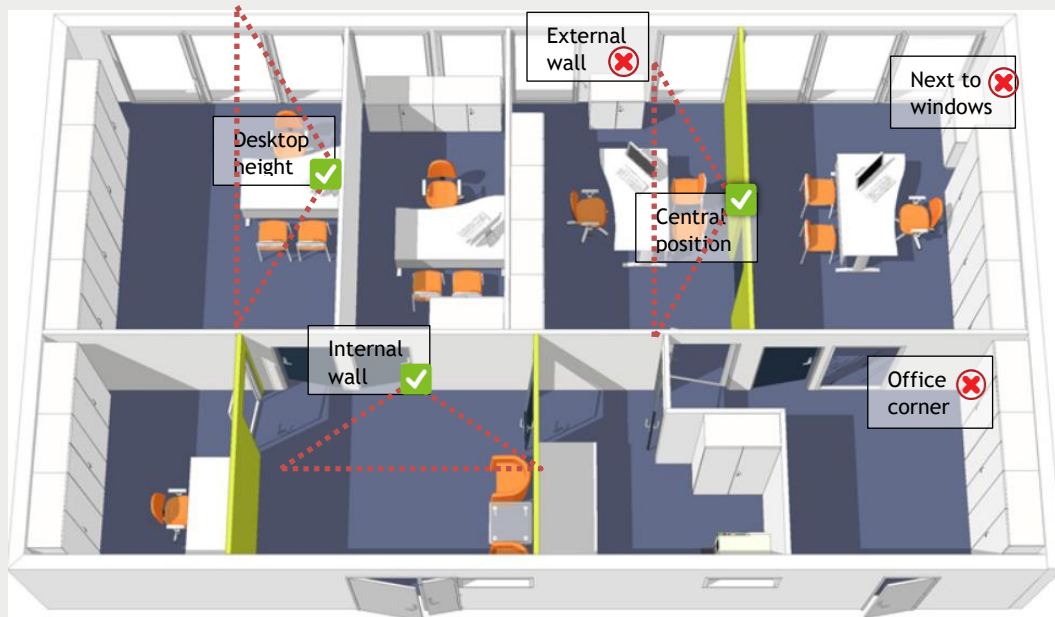
Device positioning

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
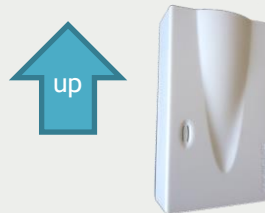
⚠	Device is not designed for an installation above 2 meters.

Device type	Device mounting
Indoor versions	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

Refer to « Application Note Senlab installation » for full recommendation.
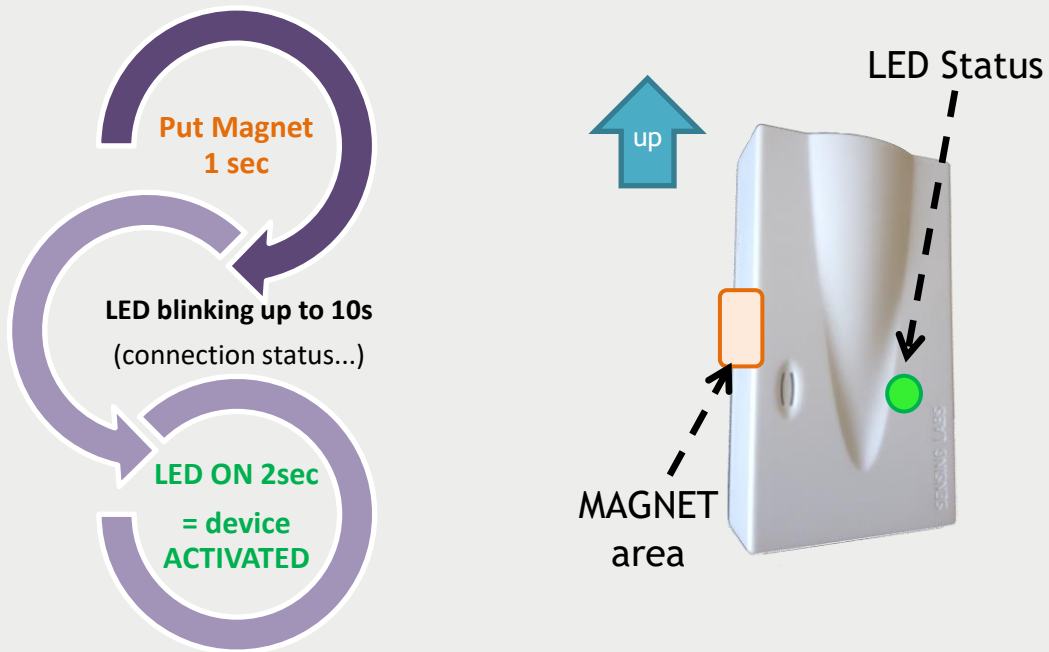
⚠	For best radio performance:
	- Positioned the upper part of the device upwardly in a free space area
	- avoid positioning the Senlab against a metallic element

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).

Put Magnet 1 sec

LED blinking up to 10s

(connection status...)

LED ON 2sec

= device ACTIVATED

up

LED Status

MAGNET area

- ✓ 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
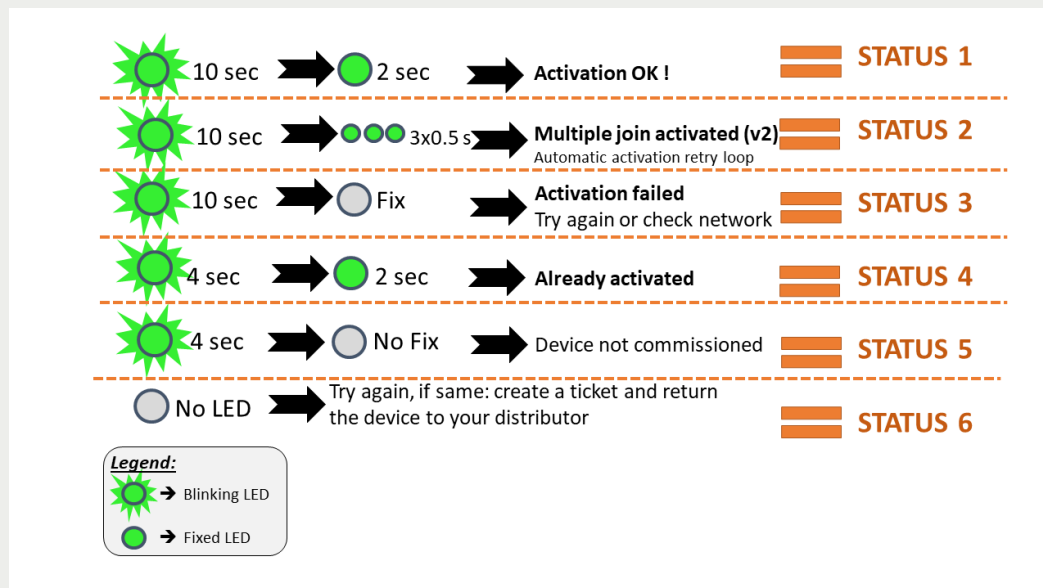
⚠ Once activated, the PIR sensor will initialized during 12'' (LED burst blinking). *After that and during 1 hour, the LED will turn ON 3'' when presence is detected (1 time per log period).*

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

LED Status meaning

10 sec ➡ 2 sec ➡	**Activation OK !**	STATUS 1
10 sec ➡ ●●● 3x0.5 s ➡	**Multiple join activated (v2)** Automatic activation retry loop	STATUS 2
10 sec ➡ Fix ➡	**Activation failed** Try again or check network	STATUS 3
4 sec ➡ 2 sec ➡	**Already activated**	STATUS 4
4 sec ➡ No Fix ➡	Device not commissioned	STATUS 5
No LED ➡	Try again, if same: create a ticket and return the device to your distributor	STATUS 6

Legend:

➔ Blinking LED

➔ Fixed LED

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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 preconfigured test devices)**: By holding the magnet during 20 seconds until the LED stay ON for 5 seconds.

SenlabO functional mode

It is important to understand how to detection sensor work to choose the best configuration to fit with your use case and environment.
Device is reconfigurable Over The Air or with SLsetting tool.

Detection sensor

SenlabO is equipped with a PIR sensor that will detect immediately a human entering in its viewing range (Horizontal 121° / Vertical 77° / distance 5m).
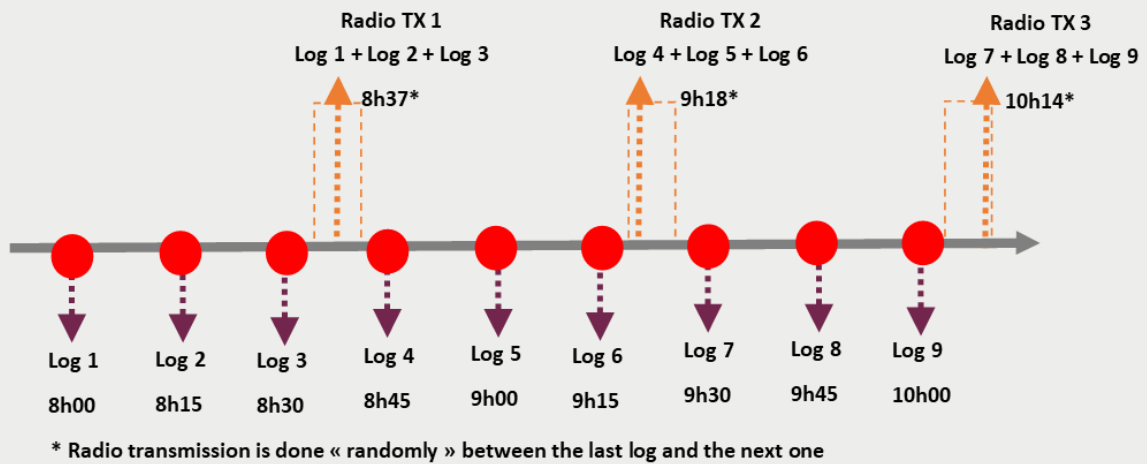 ✓ If a human stay without any motion during the detection time (refer Measure period below), it will not be detected.
  ✓ **So it's very important to configure an adapted measure period (typically 15 min for a standard office)**

Datalog mode

Datalog mode allows to transmit up to 12 periodic measures (temperature, humidity, luminosity and presence) in each message:

  ✓ Measure period (corresponded to detection period) can be configured from 5min to 1h
  ✓ Transmission period can be configured from 5min to 12h (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 TX 1	Radio TX 2	Radio TX 3
Log 1 + Log 2 + Log 3	Log 4 + Log 5 + Log 6	Log 7 + Log 8 + Log 9
8h37*	9h18*	10h14*

Log 1	Log 2	Log 3	Log 4	Log 5	Log 6	Log 7	Log 8	Log 9
8h00	8h15	8h30	8h45	9h00	9h15	9h30	9h45	10h00

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

Availability	All firmware versions
Compatibility	✓ Operated network ✓ SLgatewayV2 ✓ Third part gateway with SLcodecs
Advantages	✓ Log precision up to 1 log every minute and transmission by "datalog" to optimized battery life time ✓ Log redundancy feature to recover not received message Over The Air reconfiguration
Typical use cases	✓ Monitoring of physical value(s) with fast variation ✓ Important battery life time
What to configure?	✓ Measure period ✓ Transmission period (multiple of measure period)
How to get applicative data?	✓ All SLgateway's APIs: refer to SLgateway user guide ✓ SLcodec: refer to SLcodec help

Application features (datalog mode)

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

Measure data

ID	Description	Type	Unit	Range
temperature	Measured temperature	FLOAT	°C	-47...+128
humidity	Measured relative humidity	INT8	%	0...100
luminosity	Measured ambient luminosity	INT8	lux	0..60K
presence	Presence detection status during last period	UINT8	Bool	0..1
battery_current_level	Battery level of the device	UINT8	%	1...100

Event data

ID	Description	Type	Unit	Range
start_event	Happens when device is restarted on the field	BOOL	-	-

Configuration requests

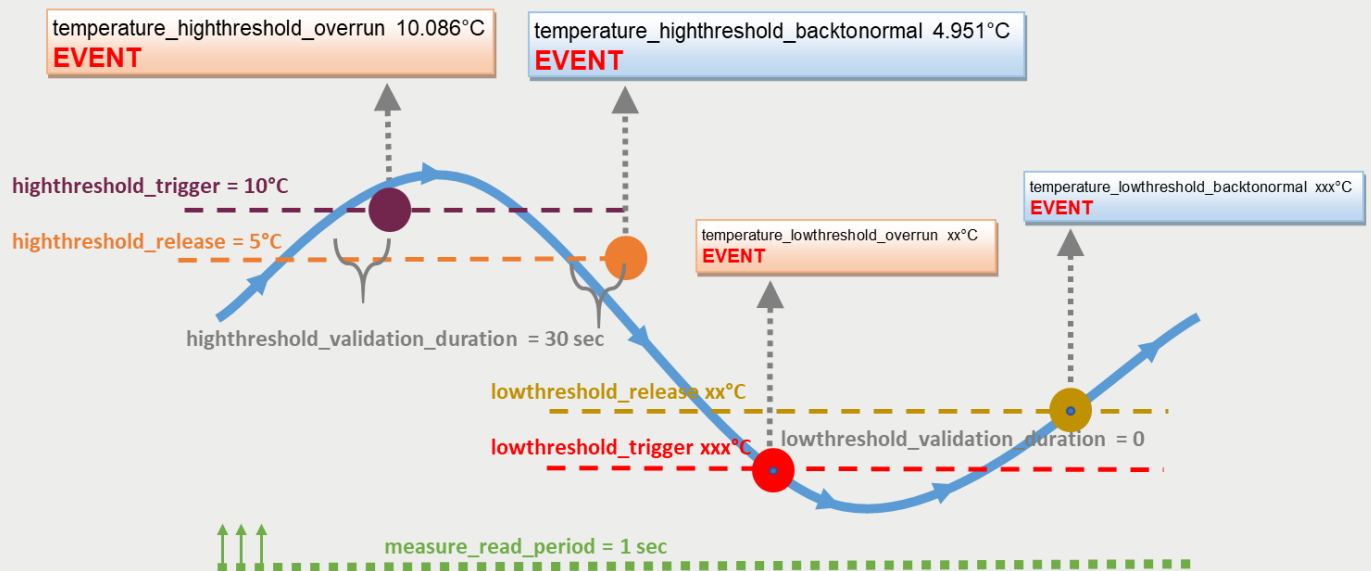| Parameter ID	Description	Type	Unit	Range
Datalog configuration (ID = request_write_datalog_cfg)				
log_period	Device will measure every X minutes (typically log is **15 min** for a standard office)	UINT16	Minute	5...60
log_tx_period	Device will send logged measure every X minutes (must be a multiple of log_period)	UINT16	Minute	5...720 (=12h)
log_tx_random_activation (optional)	Maximize device datalog reliability	BOOL	-	-
redundancy_factor	Log-redundancy *(since FW V1.3)* Send the X n-1 last log(s) with the last log(s)	UINT8	-	1-12
Reset battery level (ID = request_reset_battery_level) *Must be used after battery replacement only*				
NO PARAMETERS				
Stop application (ID = request_stop_application) *Warning: Reactivation with magnet will be required after*				
NO PARAMETERS				
Get Version *(since FW V1.3)* (ID = request_get_version)				
NO PARAMETERS	Ask the device to return it configuration and FW version			

Thresholds overrun (FW >= V2.x.x)

(Refer to old User Guide for FW V1.X)

SenlabH embed a feature to monitor thresholds overrun. You can activate independently a high and a low threshold, with specific trigger & release temperature/humidity values.

➢ Check measure period and duration of threshold overrun are configurable
➢ The measure is transmitted in the alarm (nb of retransmission is configurable)
➢ Threshold overrun feature can be configured via SLsetting tool or over-the-air (downlink payload)
➢ Each measure (temperature and humidity) have is own threshold configuration

SenlabT FW 2.x Example : Differents Temperature detections

⇨ **The concept of "detection" is the same for the "humidity"**

Configuration requests

Online describe on http://codec.slbase.io/senlabO

Parameter ID	Description	Type	Unit	Range
	REQUEST ALARMS CONFIGURATION (ID = request_alarms_configuration)			
measure_read_period*	Temperature(s) read period for alarm detection *low value (<10sec) impacts battery life duration*	UINT16	sec	1..600
alarms_retransmissions_number*	Alarms retransmissions number	UINT8	-	0..3
temperature_highthreshold_activation*	Temperature high threshold activation	BOOL	-	
temperature_highthreshold_validation_duration	Temperature high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
temperature_highthreshold_trigger	Temperature high threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
temperature_highthreshold_release	Temperature to release high threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128
temperature_lowthreshold_activation*	Temperature high threshold activation	BOOL	-	
temperature_lowthreshold_validation_duration	Temperature high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
temperature_lowthreshold_trigger	Temperature high threshold value that must be maintain the validation duration to trigger the alarm	FLOAT	°C	-47…+128
temperature_lowthreshold_release	Temperature to release high threshold overrun (< to high trigger value and > to low release value)	FLOAT	°C	-47…+128
humidity_highthreshold_activation*	Humidity high threshold activation	BOOL	-	
humidity_highthreshold_validation_duration	Humidity high threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
humidity_highthreshold_trigger	Humidity high threshold value that must be maintain the validation duration to trigger the alarm	UINT8	%RH	0…100
humidity_highthreshold_release	Humidity to release high threshold overrun (< to high trigger value and > to low release value)	UINT8	%RH	0…100
Humidity_lowthreshold_activation*	Humidity low threshold activation	BOOL	-	
Humidity_lowthreshold_validation_duration	Humidity low threshold validation duration *Must be a multiple of measure_read_period*	UINT16	sec	1…65535
Humidity_lowthreshold_trigger	Humidity low threshold value that must be maintain the validation duration to trigger the alarm	UINT8	%RH	0…100
Humidity_lowthreshold_release	Humidity to release low threshold overrun (< to high trigger value and > to low release value)	UINT8	%RH	0…100

(*) mandatory parameters

Event data (Alarm)

ID	Description	Type	Unit	Range
temperature_highthreshold_overrun	Notified if high threshold condition is triggered (temperature & duration)	FLOAT	°C	-45...+125
temperature_highthreshold_backtonormal	Notified if high threshold condition is released (temperature & duration)	FLOAT	°C	-45...+125
temperature_lowthreshold_overrun	Notified if low threshold condition is triggered (temperature & duration)	FLOAT	°C	-45...+125
temperature_lowthreshold_backtonormal	Notified if low threshold condition is released (temperature & duration)	FLOAT	°C	-45...+125
humidity_highthreshold_overrun	Notified if high threshold condition is triggered (humidity & duration)	UINT8	%RH	0...100
humidity_highthreshold_backtonormal	Notified if high threshold condition is released (humidity & duration)	UINT8	%RH	0...100
humidity_lowthreshold_overrun	Notified if low threshold condition is triggered (humidity & duration)	UINT8	%RH	0...100
humidity_lowthreshold_backtonormal	Notified if low threshold condition is released (humidity & duration)	UINT8	%RH	0...100

Battery replacement (Indoor version only)

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

Senlab indoor 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
1. 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

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.

V1.0.3 LoRaWan stack compliant

Senlab FW	LoRaWan stack compliant
1.1.X	V1.0.0
1.2.X / 1.3.X / 1.4.X	V1.0.1
2.0.X	V1.0.3

Nothing to configure for the user, no change for the application layer, but this information could be useful if you need to connect Senlab device to LoRaWan network.

More information on **LoRa Alliance®**

LoRaWan Adaptive Data Rate (ADR)

Senlab devices are compatible with ADR and support from DR0 (SF12) to DR5 (SF7).
For any problem with ADR, check the FAQ Senlab on Help Center.

Electrical safety

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

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

Legals

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