

SenlabM

PUL-LAB-xxNS[®]

FIRMWARE VERSIONS 1.2.X / 1.3.X

User guide

SENSING-LABS

VERSION 02 - REV J / JUNE 2018

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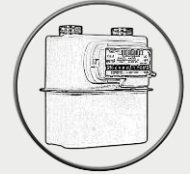
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Thank you for your choosing our Senlab product!

We hope you will find the instructions on this user manual clear and easy to follow.

General overview

The Senlab Metering (SenlabM) sensor is a smart LoRaWAN™ radio device with pulse input for monitoring pulse emitter counter: dry contact (by default) or specific electronic switching (see compatibility table).



SenlabM logs the number of pulse and allows 3 functional modes (see *Understand the 3 SenlabM (PUL) 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
- **Stream** (since FW v1.3): transmission of current raw_index with each pulse timestamp (for profile consumption analysis)



A pulse is defined as performing a closed contact between two wires for a given duration (see below).

Interface compatibility ?
(dry contact)

The minimal duration for both the open and closed states is 65ms.
Since FW v1.3, a specific configuration allow 32ms and lower impedance sensitivity. Contact us for more information.

The maximal closed state load resistor is defined as $R_c = 1k\Omega$ (during a pulse)

The minimal open state load resistor is defined as $R_o = 1M\Omega$

Interface compatibility ?
(elect. switching)
Since FW v1.3

The minimal duration for both the open and closed states is 32ms.

The switching output must be "open collector" type (transistor).

This use (electronic switching) need a specif configuration, contact us.

Any question about your meter compatibility? Please contact your distributor.

Part number	Casing type	Protection level	Dimension
PUL-LAB-13NS	Outdoor	IP67	102x56x35mm
PUL-LAB-13XS	Outdoor	IP67 / ATEX	102x56x35mm
PUL-LAB-21NS	Indoor v1	IP30	85x53x25mm
PUL-LAB-41NS	Indoor v2	IP30	91.5x50x25mm



Outdoor

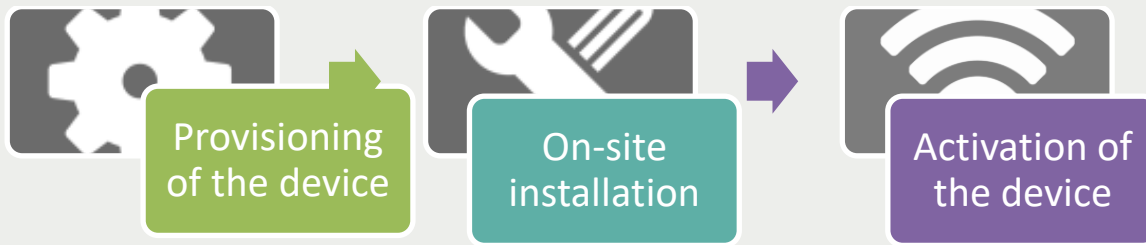


Indoor v1



Indoor v2

3 steps are required to make your SenlabM 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	Dev Address
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 : ABP / 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.

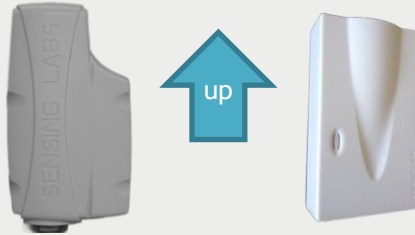
- Network & Application configuration of Senlab device can be done:
 - At factory (for minimal batch of 1000 devices)
 - By your distributor (more often)
 - By yourself (if you have your own SLsetting tool)
- Please refer to parameter list described into the Application features chapter to fit to your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

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

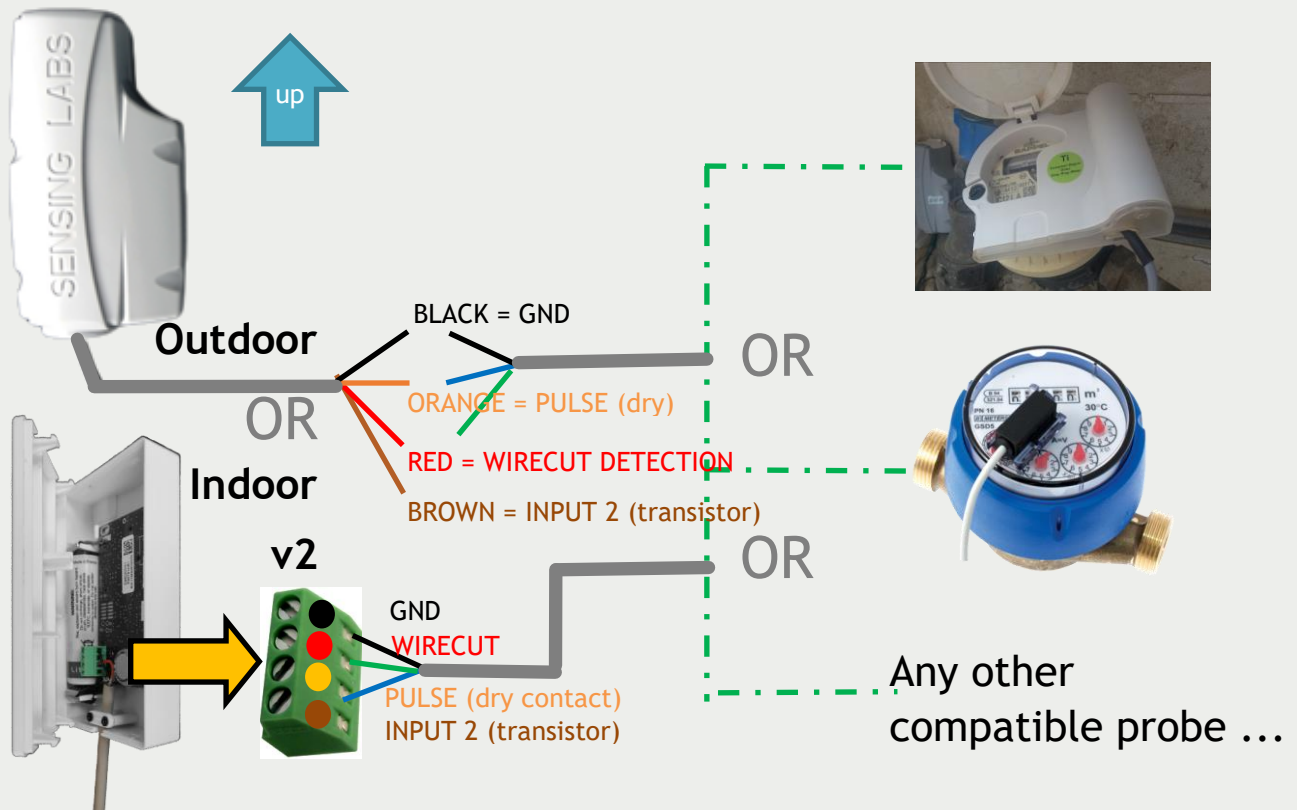
DEVICE MOUNTING

Device type	Device mounting
All versions	Stick the product to the wall or cabinet with a double-sided adhesive tape
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
Outdoor versions	Use plastic cable ties with screw mount

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

WIRING DIAGRAM

- The Senlab must be plugged to meter as follow

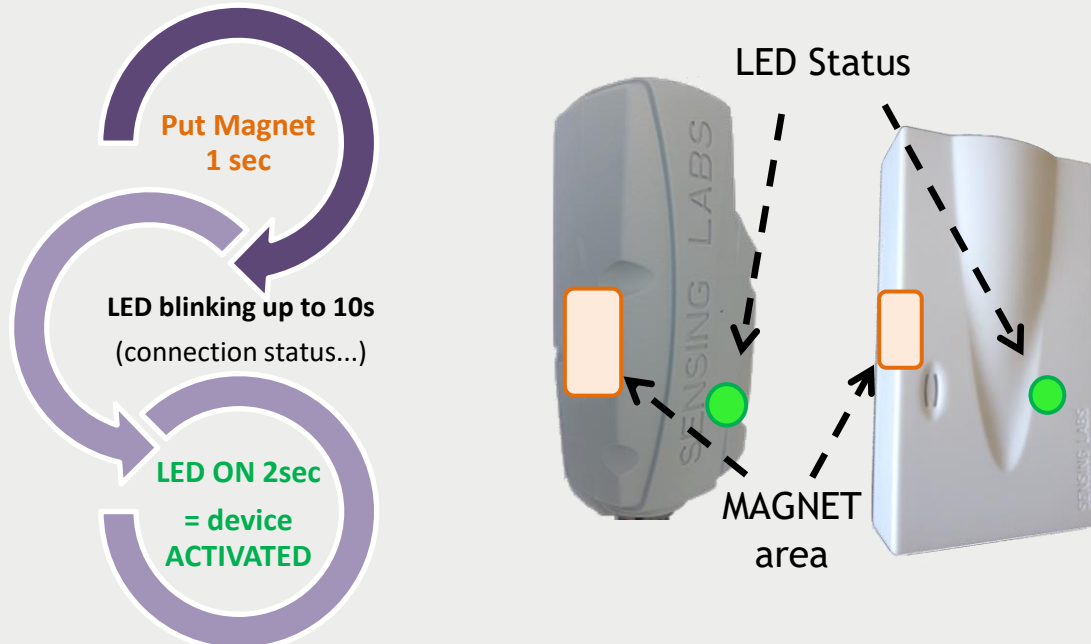


Now the device is well physically installed and plugged, you can start the activation process.

- Pairing to meter can be done with a default raw index before the activation step by using SLsetting tool. Please contact your distributor for more information.

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 activate 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 3 SenlabM (PUL) functional modes

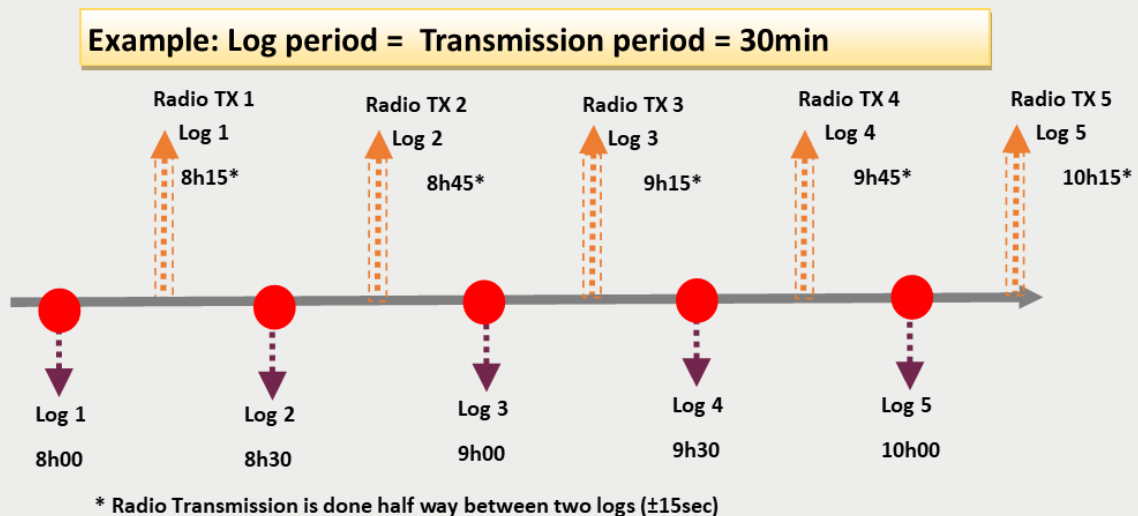
It is important to understand all modes in order to choose the best one to fit with your use case and environment.

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 (raw index):

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



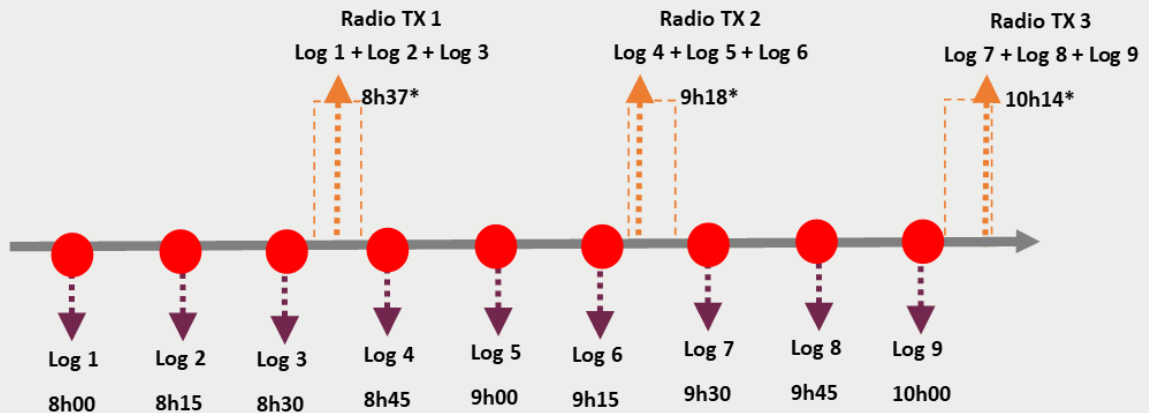
Availability	All firmware versions
Compatibility	<ul style="list-style-type: none"> ✓ Operated network ✓ SLgatewayV1 or V2 ✓ Third part gateway with SLcodecs or manual decoding
Advantages	<ul style="list-style-type: none"> ✓ "Manual" decoding possible (without SLcodecs) ✓ Over The Air reconfiguration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

Datalog mode

This mode allows to transmit up to 24 periodic measures (raw_index) 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

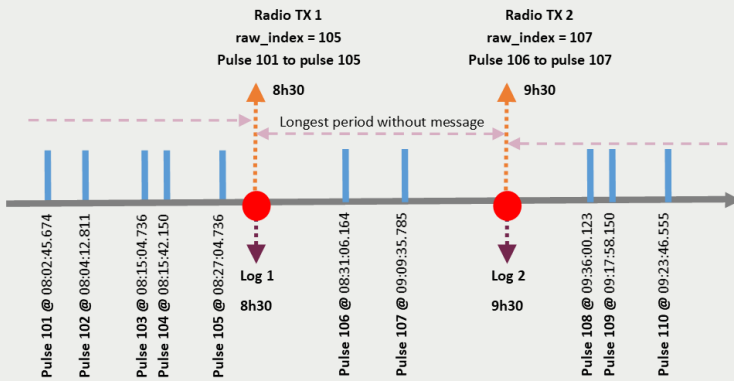
Availability	All firmware versions
Compatibility	<ul style="list-style-type: none"> ✓ Operated network ✓ SLgatewayV1 or V2 ✓ Third part gateway with SLcodecs
Advantages	<ul style="list-style-type: none"> ✓ Log precision up to 1 log every minute and transmission by “datalog” to optimized battery life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

Stream mode

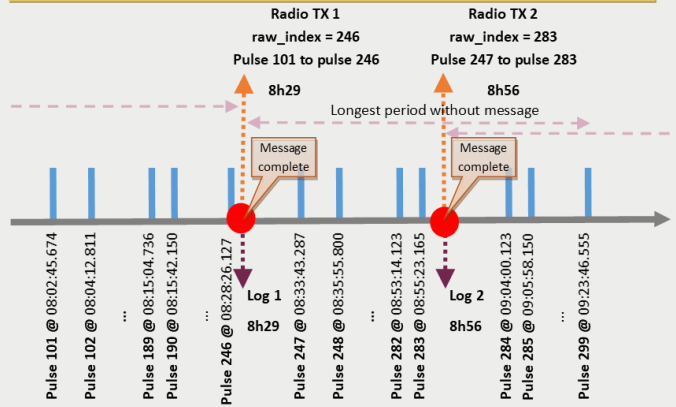
This mode allows to monitor each pulse timestamp and is designed for residential monitoring (typical rate of flow of 1000 pulses per day)

- ✓ Senlab will store pulse timestamp and will transmit them when message is full compressed or at least every X minutes (configurable from 10min to 12h);
- ✓ Transmitted message will also contain the current raw index and battery level;
- ✓ This mode is not adapted if rate of flow is more than 10 pulses / minutes in continuous.

Example 1: Message transmitted at longest cfg. period (1h)



Example 2: Message transmitted before longest cfg. period (1h)



Availability	Since v1.3 firmware
Compatibility	<ul style="list-style-type: none"> ✓ Operated network ✓ SLgatewayV2
Advantages	<ul style="list-style-type: none"> ✓ Very rich transmitted data (timestamp of each pulse) Over The Air reconfiguration
Typical use cases	<ul style="list-style-type: none"> ✓ Profile consumption analysis process ✓ « Real-time monitoring » of temporal evolution of water consumption
What to configure?	<ul style="list-style-type: none"> ✓ The longest period without message. « long period » will improve battery life time.
How to get applicative data?	<ul style="list-style-type: none"> ✓ SLgateway V2 : CSV to FTP (format 1 for millisecond precision) ✓ SLcodecs : refer to SLcodecs help

Application features (datalog or stream mode)

This chapter describes the SenlabM application features available in datalog or stream mode (accessible via SLgateway or SLcodecs details)

Measure data

<u>ID</u>	<u>Description</u>	<u>Type</u>	<u>Unit</u>	<u>Range</u>
<i>raw_index</i>	Number of detected passage Initialized at 0 when the device is delivered	UINT32	Pulse	0...2 ³²
<i>battery_current_level</i>	Battery level of the device	UINT8	%	1...100
<i>wirecut</i> (if wirecut activated)	Wirecut detection status (since FW V1.3) (Reset to 0 only after downlink reception – at least after the daily link check)	UINT8	-	0: not detected 1: detected
<i>max_interpulse</i> (if leakage activated)	Maximum duration between 2 pulse detection since the last transmission (since FW V1.3)	FLOAT	second	0 if no pulse precision 100ms
<i>pulse</i> (stream mode only)	Detected pulse (since FW V1.3) Timestamp (in ms) is available for each pulse	UINT8	-	1: detected

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>
Datalog configuration (ID = request_write_datalog_cfg)				
<i>log_period</i>	Device will measure every X minutes	UINT16	Minute	1...1440
<i>log_tx_period</i>	Device will send logged measure every X minutes (must be a multiple of log_period)	UINT16	Minute	3...1440 (24h)
<i>log_tx_random_activation</i>	Maximize device datalog reliability (optional)	BOOL	-	-
<i>redundancy_factor</i>	Log-redundancy (since FW V1.3) Send the X n-1 last log(s) with the last log(s)	UINT8	-	1-12
SenlabM configuration (ID = request_senlabm_options) (since FW V1.3)				
<i>max_interpulse_tx</i>	Leakage activation (if activated, the max_interpulse will be send in all transmission messages)	BOOL	-	-
<i>wirecut_detection</i>	Wirecut detection activation	BOOL	-	-
Stream configuration (ID = request_write_stream_cfg) (since FW V1.3)				
<i>keep_alive</i>	Longest period without message transmission			x10min
Get FW version (ID = request_get_version) (since FW V1.3)				
NO PARAMETERS				
Reset battery level (after battery change) (ID = request_reset_battery_level)				
NO PARAMETERS				
Reset raw index (to 0) (ID = request_reset_raw_index)				

NO PARAMETERS

Stop application (ID = request_stop_application) → Reactivation with magnet will be mandatory!

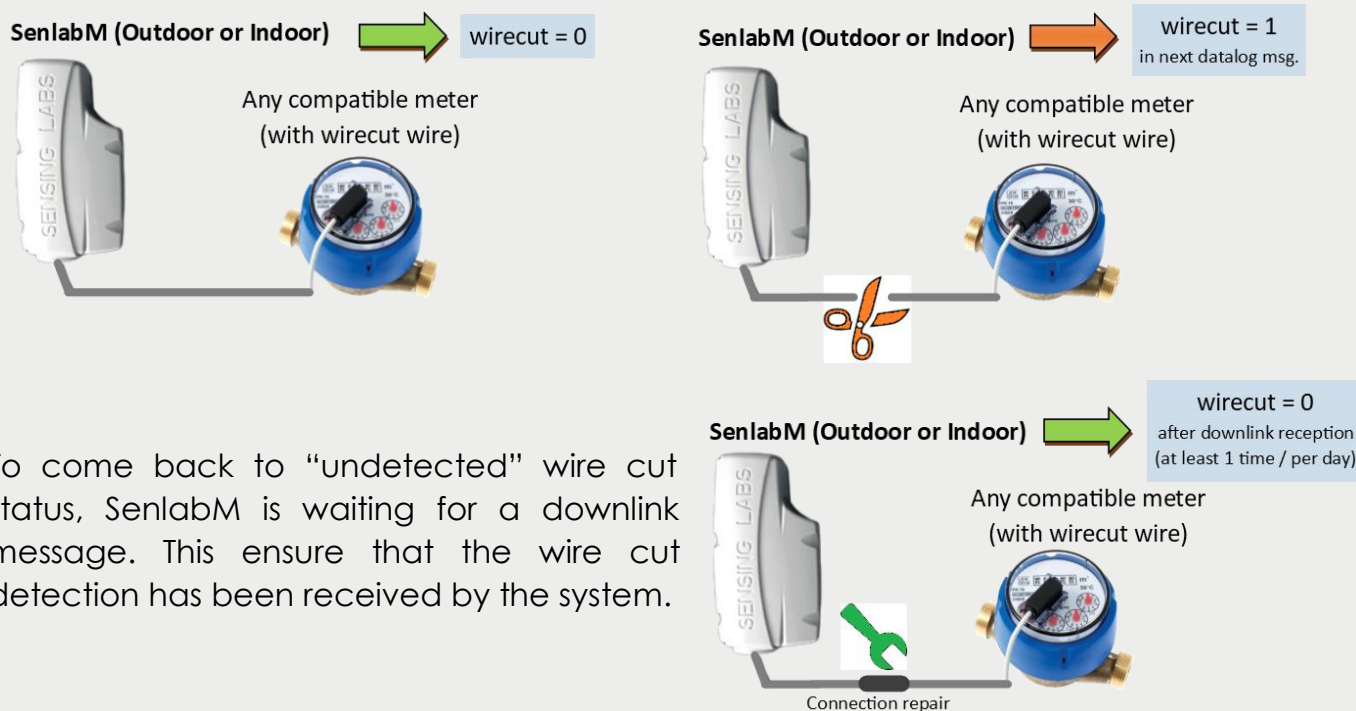
NO PARAMETERS



In order to take advantage of Senlab datalog mode, you need to use SLcodecs tool. Refer to the “SLCodecs Application Note” or contact us to get more information about SLcodecs integration and usage.

Understand the “wirecut” feature

If configured, SenlabM will transmit the wire cut status into each datalog message.

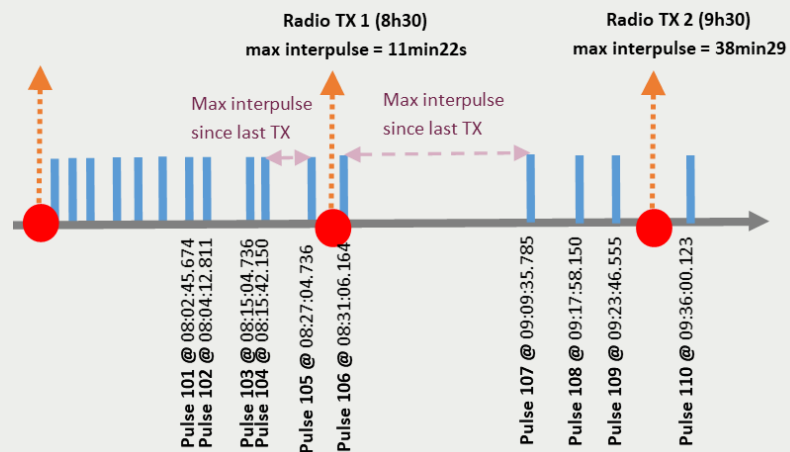


To come back to “undetected” wire cut status, SenlabM is waiting for a downlink message. This ensure that the wire cut detection has been received by the system.

Understand the “max interpulse” feature (also called “leakage detection”)

If configured, SenlabM will transmit the max interpulse duration since the last datalog message transmission. This information is useful to check if a leak is present on a meter.

- ✓ Leakage is present if max interpulse value never raise the expected duration without consumption for a given meter (ex: Night period for a residential meter)
- ✓ If no pulse is counted between 2 transmissions, value 0 will be send.



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 lost 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

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

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 (non-ATEX)	From -20°C to +70°C
Outdoor version (ATEX)	From -20°C to +40°C

ATEX (PUL-LAB-13XS)

Protection

The Ex apparatus, protection mode 'ic', usable in hazardous area for zone 2, is built in accordance to the European standards which are applicable:

- EN 60079-0 : 2012 + A11 : 2013
- EN 60079-11 : 2012


Marking

The marking is composed of two stickers:

The first one, which is generic includes the following information:

- serial number
- CE logo
- Optionally the year of manufacturing

The second one, which is ATEX specific includes the following information:

- Manufacturer:
Sensing Labs
- Address:
F-34960 Montpellier
- Type designation:
Senlab M
- Directive marking code:
 II 3 G
 - Complementary marking code:
Ex ic IIB T4 Gc
 - Reference of certificate
INERIS 17ATEX3003

Electrical characteristics

Maximum output parameters (ATEX):

- $U_o = 3.9V$
- $I_o = 3.04 A$
- $P_o = 0.98 W$

Particular conditions for safe use

Electrical circuits that can be connected to the device must be of a certified type for use in explosive atmosphere for IIC or IIB gas groups and their maximum input characteristics must not be greater than the following parameters:

- $C_i = 500 \mu F$
- $L_i = 12.59 \mu H$ for the cable version (2 meters maximum length)
- $L_i = 14.59 \mu H$ for the connector version

The interconnections of these apparatuses must be compliant from an intrinsic safety point of view.

Complementary documents

Each apparatus will be delivered with an original copy of this user guide. This document will be accompanied by their translation into the language of the country of use.

Legals

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