SENSING LABS SAS
Cap Oméga
Rond-point Benjamin Franklin
CS 39521
34960 - Montpellier Cedex 2
France

www.sensing-labs.com
www.support.sensing-labs.com

# SenlabV

# SVC-LAB-13NS©

*FIRMWARE VERSIONS 1.3*

# User guide

**SENSING-LABS**

*V2.0 REV A / JULY 2020*

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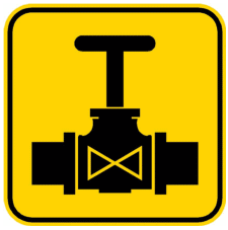
Thank you for your choosing our Senlab product!
We hope you will find the instructions on this user manual clear and easy to follow.

# General overview

The Senlab SVC (SenlabV) is a smart DC latch solenoid valves driver LoRaWAN™ radio device.



**SenlabV can drive one or two 12V DC latch solenoid(s)** (see table below for compatibility), associated with a water meter.

In addition to valve control feature (open & close), SenlabV allows to get the status of valve via a connected pressure switch, and the index of a connected meter.

- Periodic transmission of status of DC latch solenoid(s) and meter index
- Configuration of valve open cycle via **periodic pattern mode**
- **A direct drive mode** allows to send orders to open/close the valve that will be transmitted after an uplink transmission (LoRaWan class A rule).

SLcodec is mandatory to encode/decode SenlabV messages.

| | |
|---|---|
| Valve compatibility ? | The valve must have a **6-9V** or **9-12V DC latch solenoid** (refer "Solenoid valves compatibility list" below) |
| | Validated on most common models of this brands: Bermad, Netafin, Baccara, Toro, Tecnidro, Rainbird, Hunter. |
| | A validation test with yours valves is strongly advise before massive deployed. |

| Part number | Casing type | Protection level | Dimension | Cable |
|---|---|---|---|---|
| **SVC-LAB-13NS** | Outdoor | IP66 | 102x56x35mm<br>Antenna: 8.5cm | Length 50cm<br>Ø6.8mm<br>10 wires 22 AWG |

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

## Solenoid valves compatibility list

| Brand | Reference |
|---|---|
| **BERMAD** | S-392-2W |
| **BERMAD** | S-402-3W |
| **TECNIDRO** | EL-BI (red and black wires) |
| **NETAFIM** | Equivalent to S92-2 |
| **BACCARA** | GEVA 75 9VDC latch 2 wires 3 ways / NO 4 ohms PN16 |
| **BACCARA** | GEVA 75 9VDC latch 2 wires 3 ways / NC 4 ohms PN10 |
| **BACCARA** | GEM-SOL 9VDC latch (GEM-B-9 -IL+) 5 ohms |
| **BACCARA** | GEM-SOL 12VDC latch 3 ways / NO 13 ohms |
| **NETAFIM** | aquaNET plus 1'' DC latch |
| **BERMAD** | S-392-T-2W |
| **BERMAD** | S-392-T-3W |
| **BERMAD** | S-982-3W |
| **BACCARA** | GEVA 75 9VDC latch 2 wires 3 ways / NO 4 ohms PN10 |
| **HUNTER** | DC latching solenoid P/N 458200 |
| **RAINBIRD** | TBOSPSOL |
| **TORO / Irritrol - richdel** | DCLS-P /DCL |
| **BACCARA** | 24VDC latch 3 wires 3 ways NO 23 ohms |
| **BERMAD** | S-985-3W |
| **BACCARA** | 16VDC latch 2 wires 12 ohms 3 ways NO |

This list of latch solenoid valves is not exhaustive and corresponds only to solenoid tested by Sensing-Labs.

# Provisioning of the device

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

- ✓ If you want specific configuration (appEUI, appKey), please contact your distributor
- ✓ 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**<br>Typical configuration for Network Operator based architecture or Sensing-Labs SLgateway V2 configuration | X | required | required | | | | |
| **Case 2 : ABP / PUBLIC**<br>Typical configuration for Private mono gateway network | X | | | required | required | | Required* |

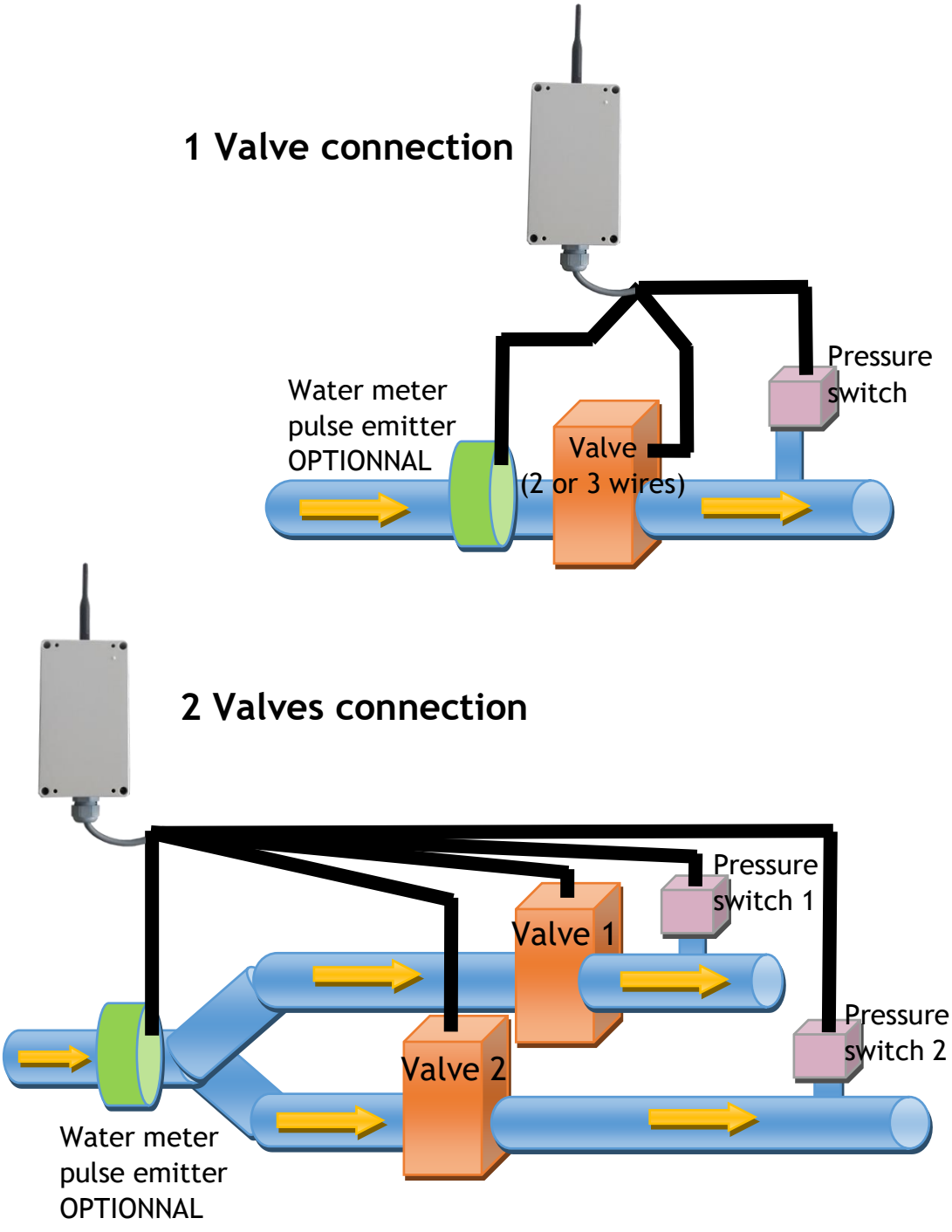
(*) You have to be sure that the associated devAddress is unique for the device into your network.

- ✓ Network & Application configuration of Senlab device can be done:
  - ➢ 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 be dynamically adjusted Over The Air** (via downlink request)

# On-site installation

You can drive 1 or 2 SOLENOID valves, and connect an optional water meter pulse emitter

- ✓ Each valve can be connected with it own pressure switch to check if water pipe is under pressure or not
- ✓ In case, the valve is a 3 wires control, you can connect only 1 valve



## Wiring diagram

Please follow the wiring plan below depending on your configuration

*Advise*:

- cut/protect wire(s) you don't use, to avoid shortcut and humidity entrance
- pay attention to keep IP protection on the connection box

| | |
|---|---|
| BROWN | Valve1 - |
| BLUE | Vave1 + |
| ORANGE | Valve2 - / Valve 1 **N** |
| GREEN | Valve2 + |
| PURPLE | Pressure switch 1 - |
| YELLOW | Pressure switch 1 + |
| WHITE | Pressure switch 2 - |
| GREY | Pressure switch 2 + |
| BLACK | Water meter **Ground** |
| RED | Water meter **Pulse** |

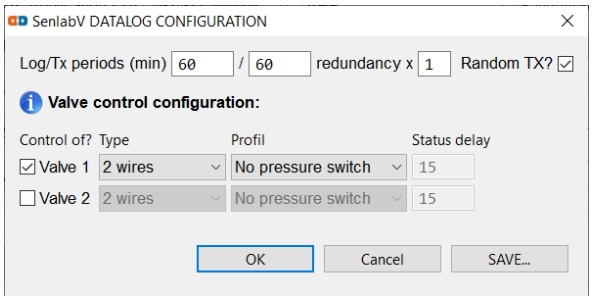
| | |
|---|---|
| Pressure switch compatibility ? (dry contact) | The maximal closed state load resistor is defined as Rc = 1kΩ |
| | The minimal open state load resistor is defined as Ro = 1MΩ |

| | |
|---|---|
| Water Meter compatibility ? (dry contact) | The minimal duration for both the open and closed states is 65ms. |
| | The maximal closed state load resistor is defined as Rc = 1kΩ (during a pulse) |
| | The minimal open state load resistor is defined as Ro = 1MΩ |

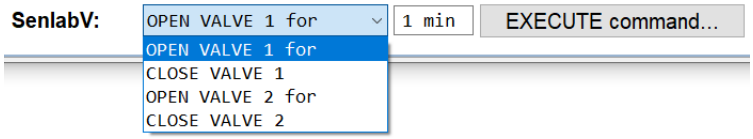
## Wiring configuration & validation

We advise to use SLsetting tool to configure your device and check that the wiring is OK.

Select type **SenlabV** to configure your device in applicative settings and launch the commissioning as for a standard Senlab.




You can use open & close command in Maintenance tab to validate the control of your valve(s).



## 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

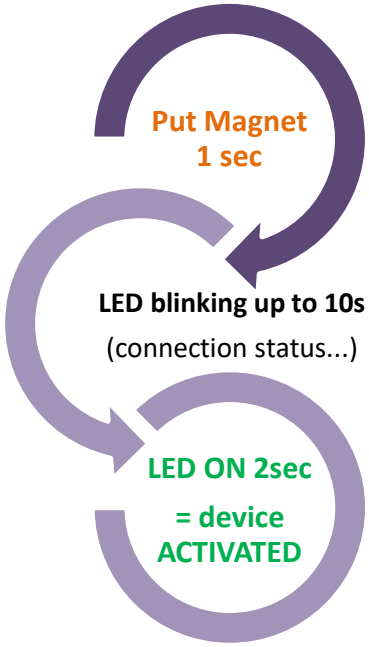
| Device type | Device mounting |
|---|---|
| **Outdoor versions** | Use plastic cable ties with screw mount<br>You can also remove black plastic cap and fix the device with M3.5 (max) screws with maximal head diameter of 8mm |

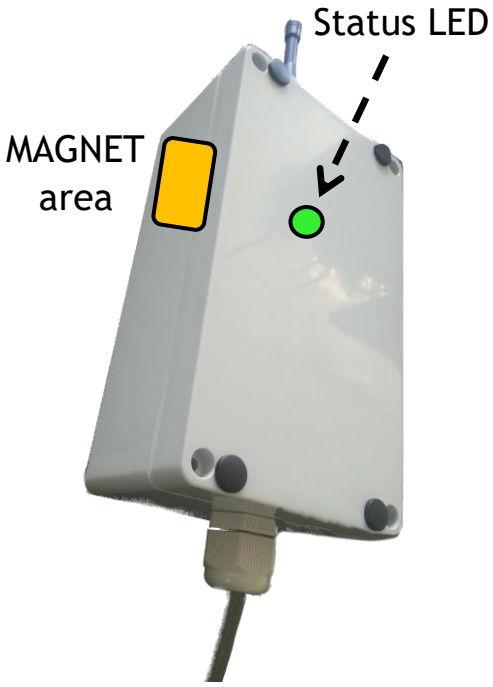
Refer to « Application Note Senlab installation » (download link) for full recommendation.

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 already 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 if "Magnet switch off" has been activated)**: By holding the magnet during 20 seconds until the LED stay ON for 5 seconds.

# Generic requests

## Measure data

The following measure are sent periodically in the "datalog_transmission" message.

| ID | Description | Type | Unit | Range |
|---|---|---|---|---|
| *raw_index* | Number of detected pulses<br>Initialized at 0 when the device is delivered | UINT32 | Pulse | 0…$2^{32}$ |
| *valve_1_state* | State of valve 1 (if pressure switch activated) | UINT8 | | 0: Close<br>1: Open |
| *valve_2_state* | State of valve 2 (if pressure switch activated) | UINT8 | | 0: Close<br>1: Open |
| *battery_current_level* | Battery level of the device | UINT8 | % | 1…100 |

## Event data

Valve events (*valve_1_xxx or valve_2_xxx*) are transmitted when the valve state change, with the source of change state (uhf, direct or scheduler command). A recall of the last valve event is included in the periodic "datalog_transmission".

- Dependant from the pressure switch activation, "valve_X_unverified", "valve_X_retry" or "valve_X_error" events might also be present.

| ID | Description | Type | Range |
|---|---|---|---|
| *start_event* | Happens when device is restarted on the field | BOOL | - |
| | | | |
| *valve_1_cmdstate* | New state of valve 1<br>Happens each time the valve 1 state change | UINT8 | 0: Close<br>1: Open |
| *valve_1_source* | Reason of valve 1 state change action<br>(present if valve_1_cmdstate notified) | STRING | scheduler,<br>direct, uhf |
| *valve_1_unverified* | Event notified if valve 1 has no pressure switch | BOOL | |
| *valve_1_error* | Event notified if valve 1 action doesn't succeed to change the valve state (if pressure switch activated) | BOOL | |
| *valve_1_retry* | Number of try of the valve action if 1st try doesn't succeed | UINT8 | 2..3 |
| | | | |
| *valve_2_cmdstate* | New state of valve 2<br>Happens each time the valve 2 state change | UINT8 | 0: Close<br>1: Open |
| *valve_2_source* | Reason of valve 2 state change action<br>(present if valve_2_cmdstate notified) | STRING | uhf, direct,<br>scheduler |
| *valve_2_unverified* | Event notified if valve 2 has no pressure switch | BOOL | |
| *valve_2_error* | Event notified if valve 2 action doesn't succeed to change the valve state (if pressure switch activated) | BOOL | |
| *valve_2_retry* | Number of retry of valve action if 1st try doesn't succeed | UINT8 | 2..3 |

## General & Configuration requests (for all modes)

| Parameter ID | Description | Type | Unit | Range |
|---|---|---|---|---|
| **Datalog configuration** (ID = request_write_datalog_cfg) | | | | |
| *log_period* | Device will measure every X minutes | UINT16 | Minute | 1...1440 (1440= 24h) |
| *log_tx_period* | Device will send logged measure every X minutes (must be a multiple of log_period) | UINT16 | Minute | 3...1440 |
| *log_tx_random_activation* (optional) | Maximize device datalog reliability | BOOL | - | - |
| *redundancy_factor* | Log-redundancy 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: activation with magnet will be mandatory to reactivate the device*** | | | | |
| *NO PARAMETERS* | | | | |
| **Get Version** (ID = request_get_version) | | | | |
| *NO PARAMETERS* | Ask the device to return it configuration and FW version | | | |
| **Write valve profile** (ID = request_profile_configuration) | | | | |
| *valve_1_profile* | Add this element to configure valve 1 profile | | | |
| *num_wires* | Number of valve wires (2 or 3) | UINT8 | - | 2..3 |
| *pressure_switch* | Pressure switch valve type (optional) | STRING | - | normally_open normally_closed |
| *status_delay* | Valve delay for reading the valve status (if pressure switch is set) | UINT8 | Second | 0..255 |
| *valve_2_profile* | Add this element to configure valve 2 profile | | | |
| *num_wires* | Number of valve wires (2 or 3) | UINT8 | - | 2..3 |
| *pressure_switch* | Pressure switch valve type (optional) | STRING | - | normally_open normally_closed |
| *status_delay* | Valve delay for reading the valve status (if pressure switch is set) | UINT8 | Second | 0..255 |

# Mode configuration requests

## Direct drive mode

***This mode reserved for tests and Proof-Of-Concept only***

The direct drive method allow to transmit a downlink order for changing the DC latch solenoid valves state. Order can be transmitted each time the system receives an uplink message from the SenlabV. The precision and latency of the opened/closed periods are tightly linked to the uplink transmission frequency, and downlink rules allowed by your operator.

| Parameter ID | Description | Type | Unit | Range |
|---|---|---|---|---|
| **Execute direct command valve** (ID = request_valve_command) | | | | |
| *valve_1_command* | Add this element to request an order for valve 1 | | | |
| *valve_state* | logical state of valve (1 for open, 0 for closed) | UINT8 | - | 0..1 |
| *duration* | duration of valve state maintain (for open cmd) | UINT16 | Minute | 1...65535 |
| *valve_2_command* | Add this element to request an order for valve 2 | | | |
| *valve_state* | logical state of valve (1 for open, 0 for closed) | UINT8 | - | 0..1 |
| *duration* | duration of valve state maintain (for open cmd) | UINT16 | Minute | 1...65535 |

→ If a pattern is running, it will be "suspended" during the direct command execution, and will continue after.

## Periodic pattern mode

This mode allows to repeat a programmed pattern of "valve open/close" cycle from the reception of the order (ex: to open and close 3 times a day a valve, every day).

| Parameter ID | Description | Type | Unit | Range |
|---|---|---|---|---|
| **Program a pattern of open slots for a given valve** (ID = request_pattern_configuration) | | | | |
| *valve_id* | valve id (1 for valve1, 2 for valve2) | UINT8 | - | 1..2 |
| *count* | pattern repetition count (0 for infinite) | UINT8 | Minute | 1...255 |
| *duration* | pattern duration before repeatition | UINT16 | Minute | 1...65535 |
| *slots[offset, duration]* | Array of open slot (start offset & duration)<br>Sum of offset & duration <= pattern duration | | | |
| *offset* | offset time to open valve (since the previous slot) | UINT16 | Minute | 1...65535 |
| *duration* | duration of valve open maintain state | UINT16 | Minute | 1...65535 |
| **Cancel current scheduled pattern for a valve** (ID = request_cancel_pattern) | | | | |
| *valve_id* | valve id (1 for valve1, 2 for valve2) | UINT8 | - | 1..2 |

→ When a pattern is cancelled, the corresponding valve will be immediately closed.

# Battery replacement

**Replacement battery must by a Lithium 3,6V D type**

→ Contact your distributor to get original battery reference.

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

1. Open the casing (**important: use a screwdriver, not a screw gun**)
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.

## 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

From -20°C to +55°C

# Legals

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Headquarters:
SENSING LABS SAS.
CAP OMEGA,
rond point Benjamin Franklin
34960 Montpellier cedex 02 – France