YOSENSI.IO

YO Pure Pro

User guide v1.3

Release notes

Released	Version	Key changes
05.09.2022	1.0	Initial release.
31.01.2022	1.1	Parameter description changed, overview description changed, added new figure describing threshold of measurements. Added configuration instructions using Yosensi Management Platform for firmware 3.4.0 and newer. Changed chart for CO sensor.
26.04.2023	1.2	Minor layout changes, text errors fixed, changed chart for CO sensor – Figure 6, improved readability, added PMx sensor marking on Figure 1, Measured Values descriptions changed, changeable sensor information added and possible senstype parameter value fixed, Figure 25, 22, 19 update, new device parameters (v3.3.0).
25.10.2023	1.3	Added configuration with Yosensi Mobile App.
28.08.2024	1.4	Added information about downlink message

Content

Product description

Overview

The YO Pure Pro device measures indoor environmental conditions, including concentrations of particulate matter (PM2.5, PM4, PM10), carbon monoxide (CO), carbon dioxide (CO_2), and total volatile organic compounds (TVOC). The included sensors also monitor atmospheric pressure, illumination, temperature, humidity, and noise level. YO Pure Pro may be ordered with the default CO sensor or customised to measure instead 0_3, ETOH, H_2S, SO_2, or NO_2.

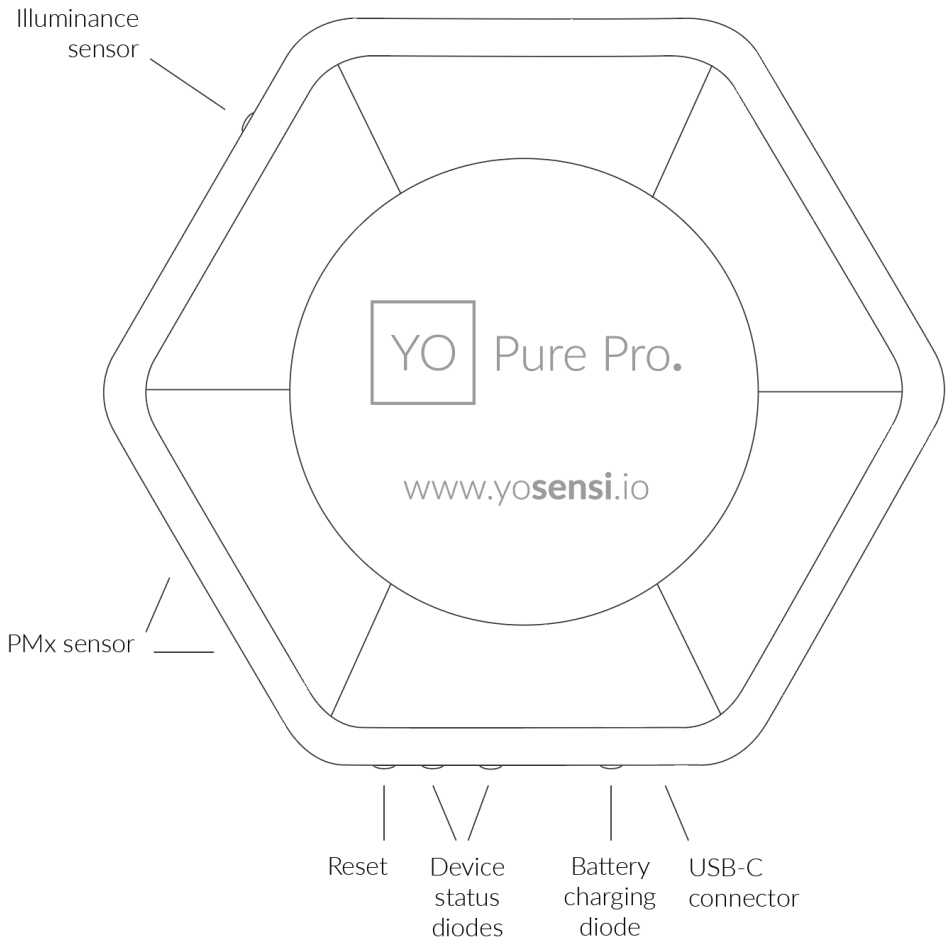

Figure 1 Device top view.

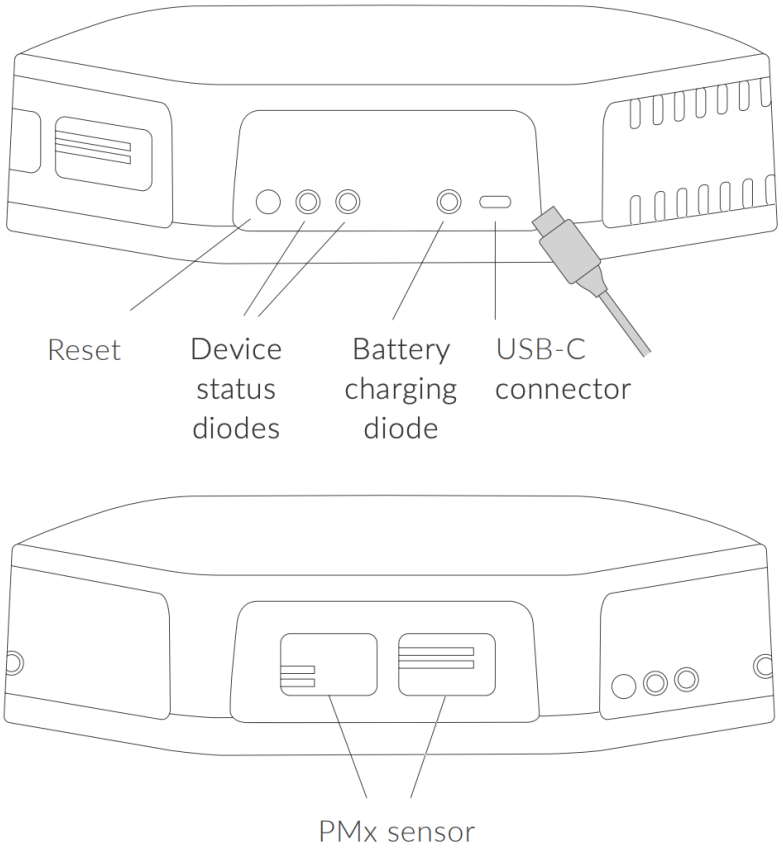

Figure 2 Device side views.

Device sticker placed on the bottom of the device enclosure contains information about model, version, LoRaWAN region and 3 parameters important in case of device identification and configuration:

- **DEV EUI:** 64-bit unique device identifier in a LoRaWAN network,
- **DEV ADDR:** address required to connect via ABP activation type to LoRaWAN,
- **BLE MAC:** bluetooth physical address.

Figure 3 Device sticker.

Physical interfaces

LEDs

YO Pure Pro is equipped with RGBW LED to indicate the operating status and also battery charging diode – both placed next to the USB-C connector (see *Figure 2*).

DIODE STATUES INTERPRETATION

BEHAVIOUR	COLOUR	DEVICE STATUS
Single flash	Green	**General:** device is working correctly (power and memory).
Single flash	Red	**General:** device is working incorrectly (power and memory). **LoRaWAN communication:** failed to receive an acknowledgement from LoRaWAN Server within specified timeout.
Single flash	White	**LoRaWAN communication:** LoRaWAN frame sent\confirmation from LoRaWAN Server after receiving the frame.
Slow flashing	Blue	**BLE communication:** connection to the device via BLE (configuration).
Rapid flashing	Blue	**LoRaWAN communication:** connecting to LoRaWAN network.
Constant	Orange	**General:** battery charging process in progress.

Buttons

YO Pure Pro is equipped with one reset button placed next to the RGBW LED diode (see *Figure 2*).

USB-C

YO Pure Pro is equipped with a USB-C connector used for powering the device placed next to the battery charging diode (see *Figure 2*).

Specifications

Physical

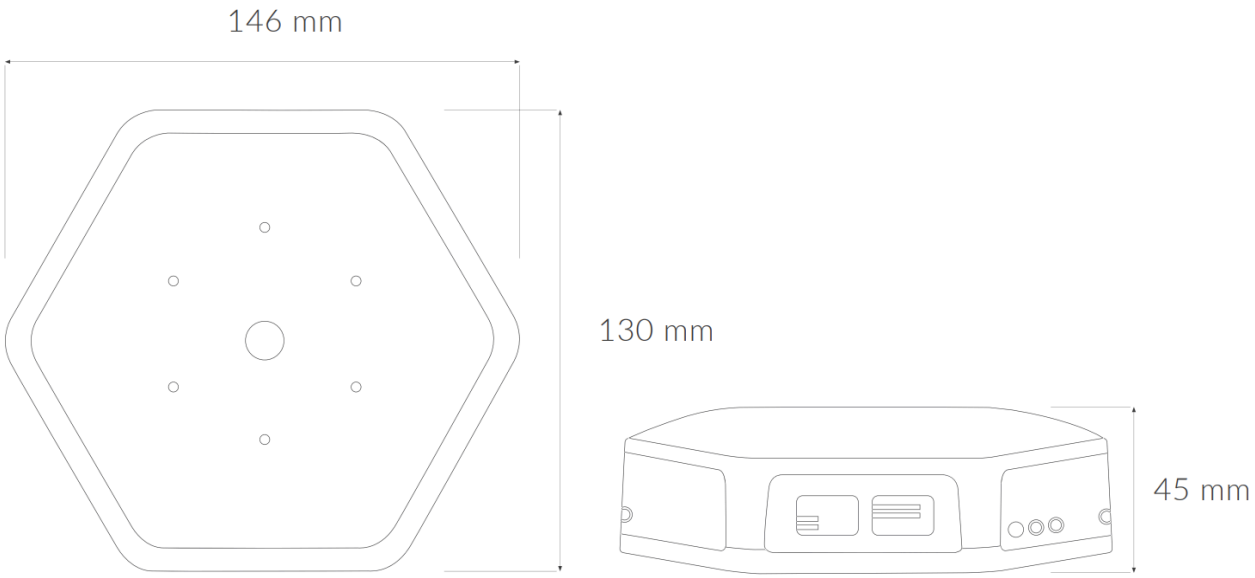

Figure 4 Dimensions of the device.

PHYSICAL SPECIFICATION	
Dimensions	Height: 45 mm Width: 130 mm Depth: 146 mm
Colour	White
Mounting method	Horizontal Vertical (can be screwed to the wall)
Enclosure material	ABS (FR)
Level of protection	IP40
Weight	260 g

Operating conditions

OPERATING CONDITIONS	
Temperature	0° to 70°C
Humidity	0 to 90%
Placement	Indoor use
Power supply	USB-C 5 V DC 6 to 30 V DC 5 to 21 V AC 2x backup battery Li-Ion 18650 (2x 3,6 V DC)
Power consumption	Maximum: 1,1 A (12 V DC)

Measured values

MEASUREMENT RANGES

Parameter	Measurement range	Accuracy
PM2.5 pre-calibrated	0 to 1000 µg/m^3 Recommended working conditions: 10° to 40°C (all PMx measurements)	±10 µg/m^3 at 25°C
PM4	0 to 1000 µg/m^3	±25 µg/m^3 at 25°C
PM10	0 to 1000 µg/m^3	±25 µg/m^3 at 25°C
CO (default)	0 to 1000 ppm Recommended working conditions: -20°C to 40°C (default and all optional sensors)	±15% of reading
SO_2 (optional)	0 to 20 ppm	±15% of reading
ETOH (optional)	0 to 800 ppm	±15% of reading
H_2S (optional)	0 to 10 ppm	±15% of reading
NO_2 (optional)	0 to 20 ppm	±15% of reading
O_3 (optional)	0 to 5 ppm	±15% of reading
CO_2	0 to 40 000 ppm Recommended working conditions: -10° to 60 °C	±(40 ppm+5%) from 400 ppm to 5000 ppm
Total volatile organic compounds (TVOC) pre-calibrated	0 to 20 mg/m^3	±15% of reading
Atmospheric pressure	10 to 1200 hPa	±1.5 hPa at 25°C
Illuminance	0 to 120 klx	±10% at 25°C
Sound Pressure Level	45 to 110 dB SPL	-42 dBV/Pa
Relative humidity	0% to 100%	±2% (20% to 80%)
Temperature	-40°C to 125°C	±0,2°C (from 5°C to 60°C)

PM2.5, PM4 and PM10

The particulate matter (PM) sensor informs users about the quantity of particles in diameters equal to or less than 2.5 µm, 4 µm, and 10 µm, respectively. Additional information about surrounding air pollution may be obtained by analyzing these measurements.

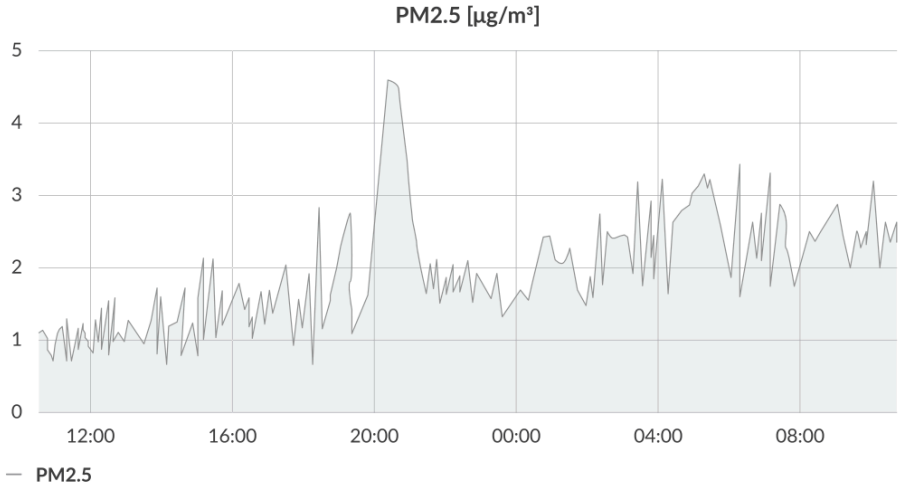

Figure 5 Example of PM2.5 monitoring chart.

CO sensor

Monitoring the CO concentration value is considered a critical indoor environmental parameter because of its odourless character and the potential for serious impact on human health when levels exceed a threshold. Collected data is used to inform the proper amount of ventilation for an indoor environment.

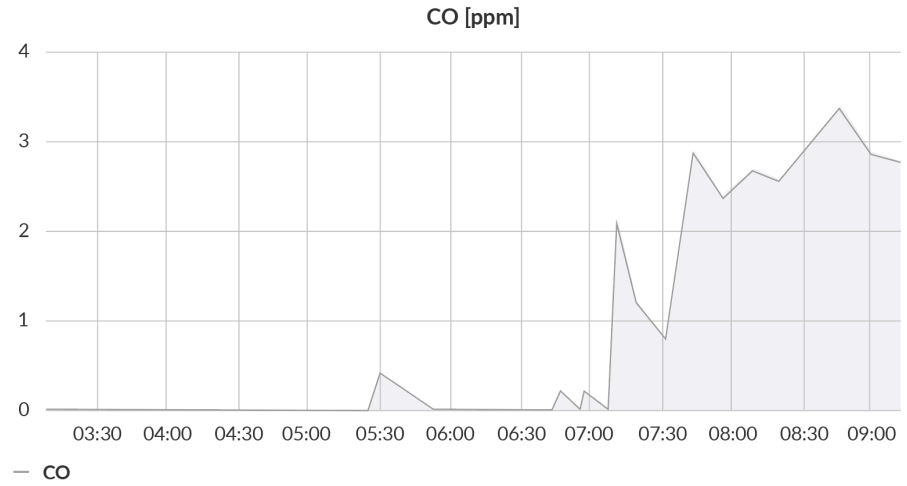

Figure 6 Example of CO monitoring chart.

CO_2 sensor

Monitoring the CO_2 level is an important indoor environment parameter that affects human health. High levels within a short duration can cause, for example, poor concentration, loss of attention, and an increased heart rate.

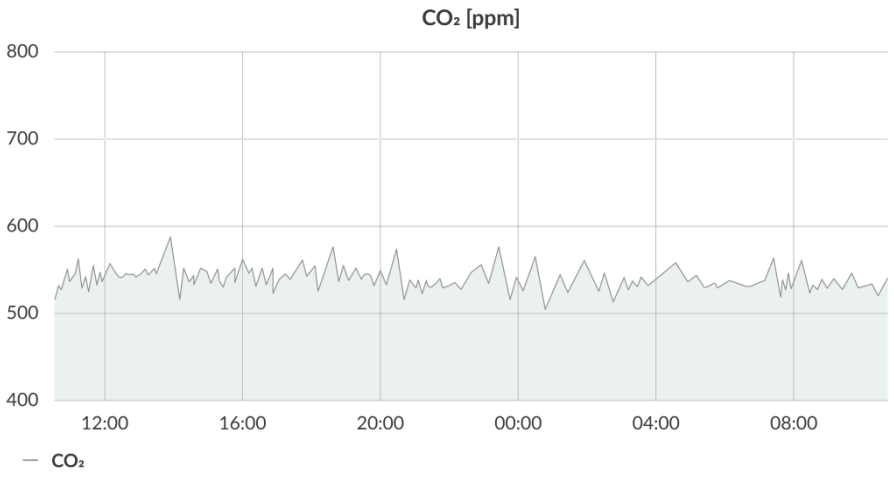

Figure 7 Example of CO_2 monitoring chart.

TVOC sensor

TVOC (total volatile organic compounds) is an important indicator of indoor hygiene and air quality. This sensor measures the amount of compounds that can affect human health and comfort.

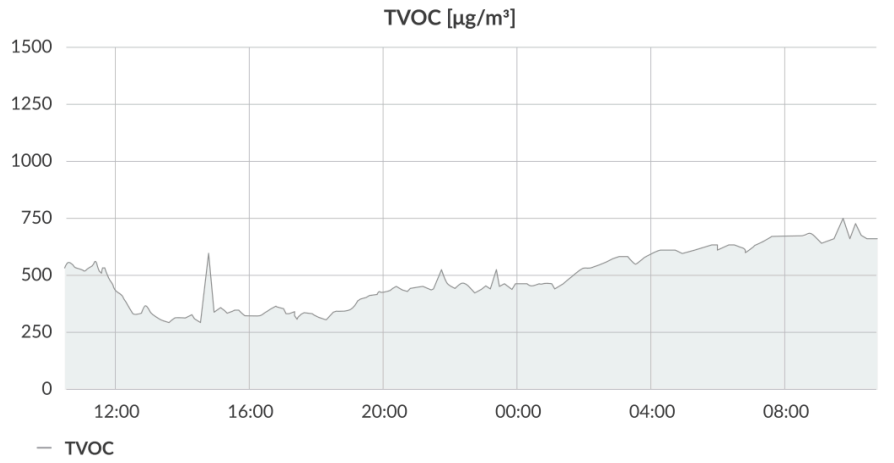

Figure 8 Example of TVOC monitoring chart.

Atmospheric Pressure

By tracking changes in atmospheric pressure it's possible to predict how the value/difference might affect human mood.

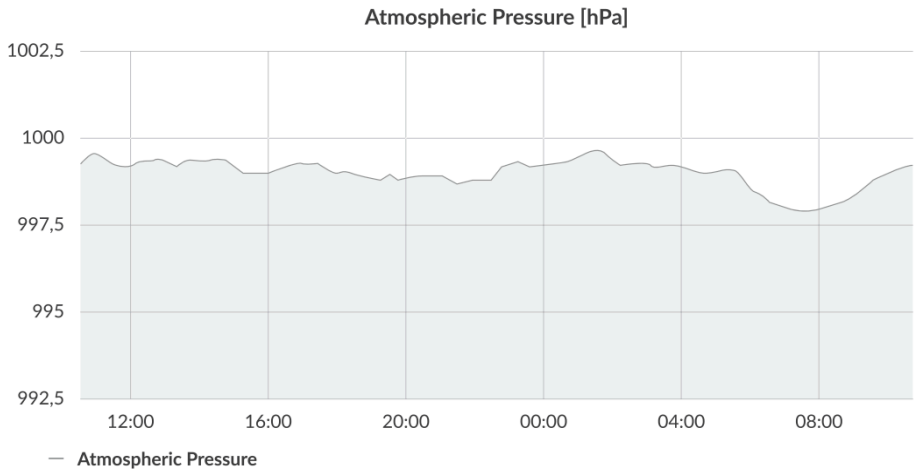

Figure 9 Example of atmospheric pressure monitoring chart.

Illuminance

Illuminance sensor measures the value of light intensity. It can tell if there's a proper amount of light in the room.

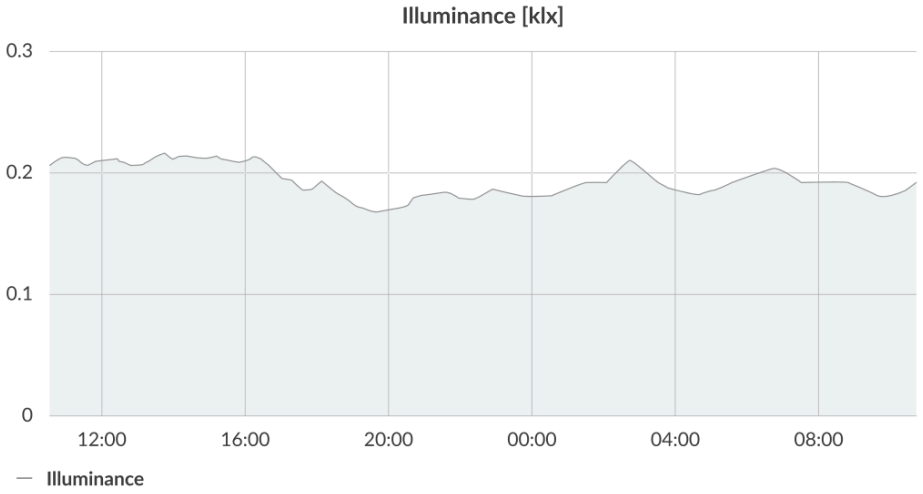

Figure 10 Example of illuminance monitoring chart.

Temperature and relative humidity

Temperature and relative humidity are measured by sensors placed inside the device enclosure. These measurements can be used to monitor ambient conditions (see recommended conditions).

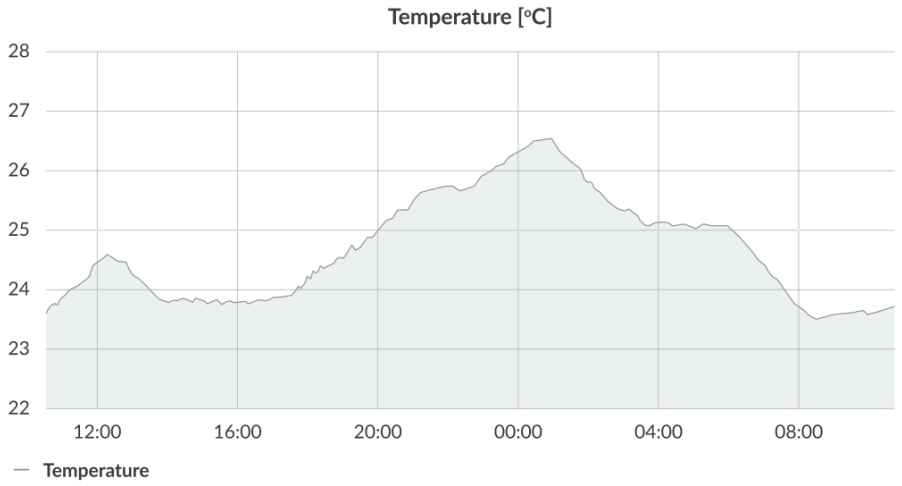

Figure 11 Example of temperature monitoring chart.

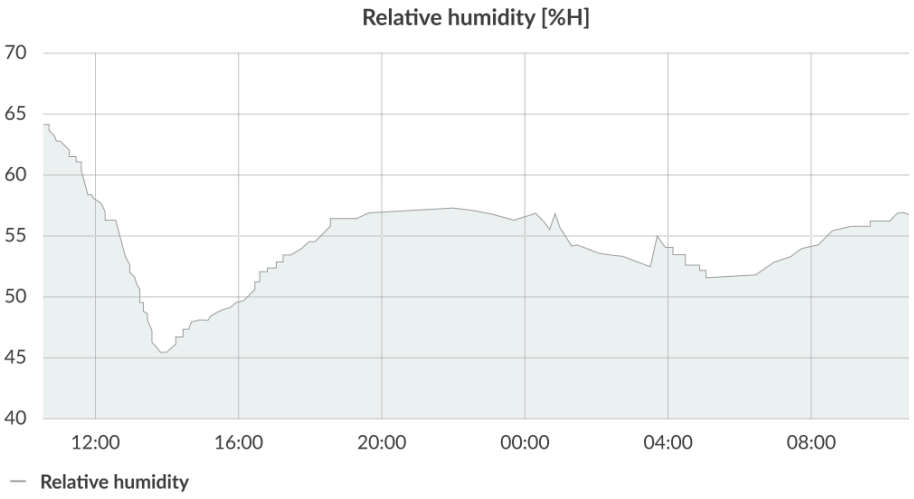

Figure 12 Example of relative humidity monitoring chart.

Sound Pressure Level

Sensor for measuring sound pressure level in the room. It can be used for monitoring the noise in the building.

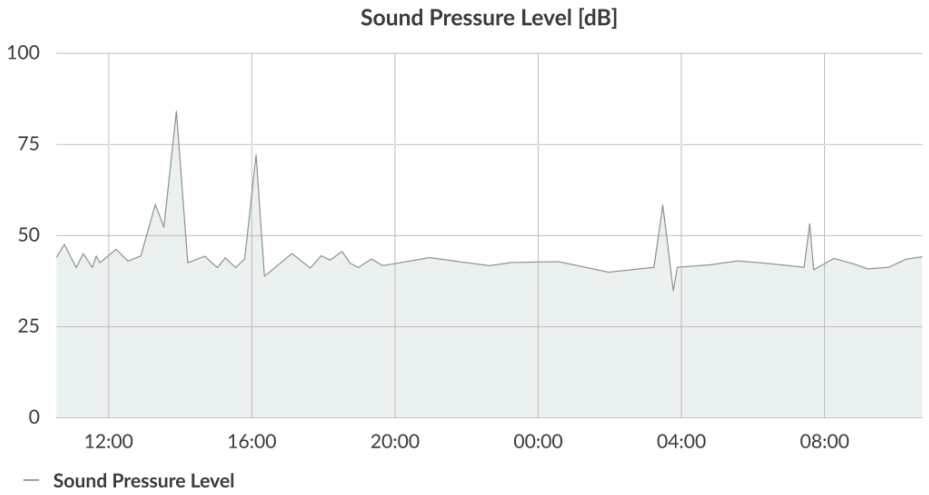

Figure 13 Example of sound pressure level monitoring chart.

Installation

Package contents

1. Device (without batteries).
2. Warranty card.
3. Mounting bracket.
4. Battery lock.
5. External power supply connector.

Safety precautions

SAFETY PRECAUTIONS

SYMBOL	DESCRIPTION
	Device is marked with a symbol saying that electrical and electronic products may not be mixed with unsorted household waste. Remember that batteries used to power the device must be treated at a specialized treatment facility.
	Remember about possible electrostatic discharge when replacing battery, connecting input or doing some other operations near inside electronics. Battery powered (Li-ion) as this may cause damage. The equipment should be kept in a controlled environment. CAUTION: Batteries are at risk of exploding if incorrectly replaced. Replace only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
	Be careful while handling the device – dropping it may cause damage that will affect the sensors and other electronics inside.
	When installing the device on the wall remember to wear adequate protective equipment.
	To maintain the level of protection device cover screws must be properly tightened. Device shouldn't be used without cover.
	Any actions inside the device's enclosure (excluding replacing batteries) must be performed by trained personnel only.
	Clean the device only with damp cloth.

Device is intended for indoor use.

Installation guide

I. The device can be powered via a USB-C connector, an external power supply, or Li-Ion 18650 batteries.

1. **USB-C connector 5 V DC.** Plug the USB-C cable into the socket on the enclosure. If the LED indicating the status of the device flashes blue, then the device is successfully connected to the power supply.

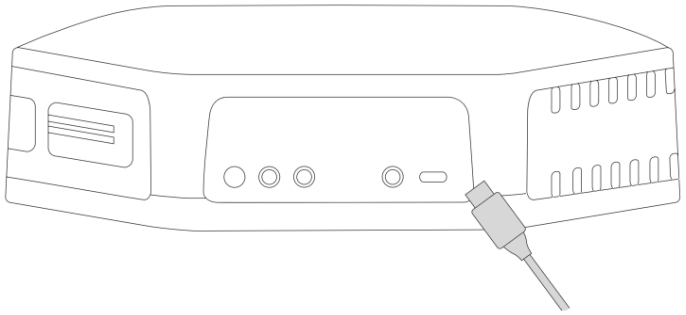

Figure 14 Connecting USB-C cable to the device.

2. **Power supply 6-30 V DC or 5-21 V AC.** Remove the protective cap located at the bottom of the enclosure to access the socket. Screw the external power supply wires into the plug of the connector. Next, insert the connector into the socket located at the bottom of the device. If the device status LED flashes blue, then the device is successfully connected to the power supply.

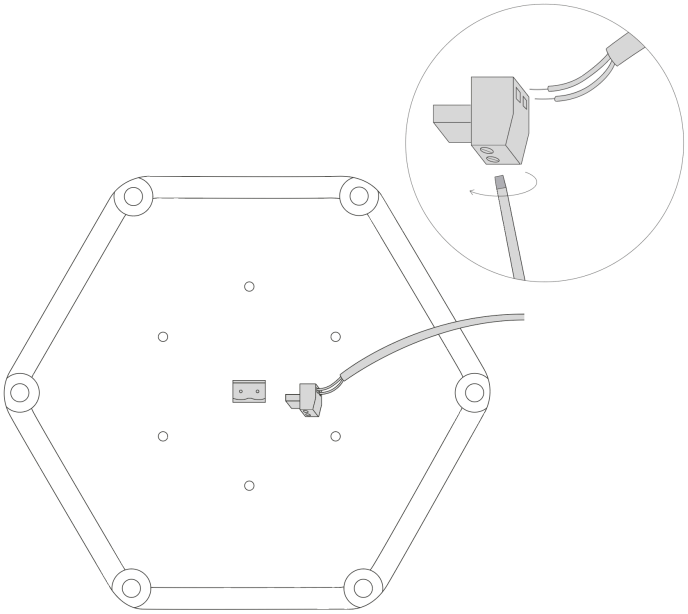

Figure 15 Connecting the power supply to the device.

3. **Backup batteries Li-Ion 18650.** Remove the three screws located on the bottom of the device's enclosure (3 out of 6 places marked with +) to remove the top of the enclosure. Remove the battery lock and insert two Li-Ion 18650 batteries.

   IMPORTANT! Align the batteries with the correct +/- polarity before re-inserting the battery lock. When the batteries are inserted correctly, the charging process begins, and the battery charging LED illuminates orange.

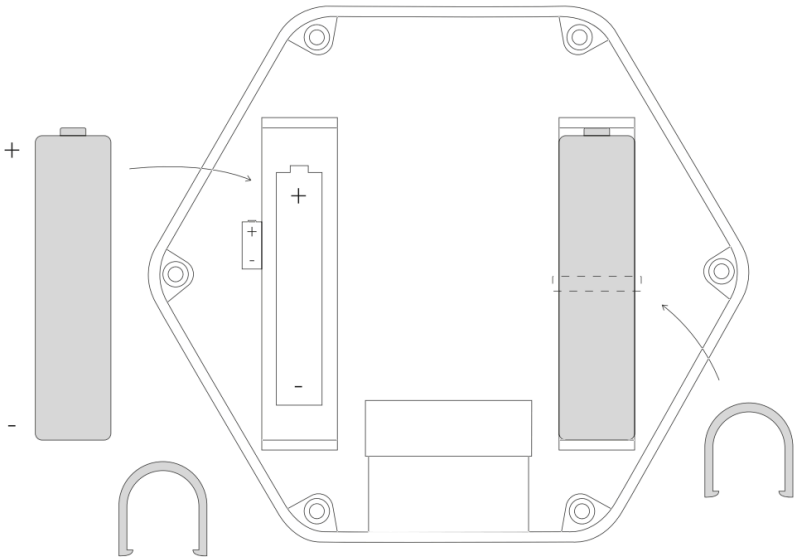

Figure 16 Inserting two batteries into the device.

II. There are 3 ways to install the device:

1. **Place on a desk.** Install the rubber feet (installed by default) and connect the power supply.

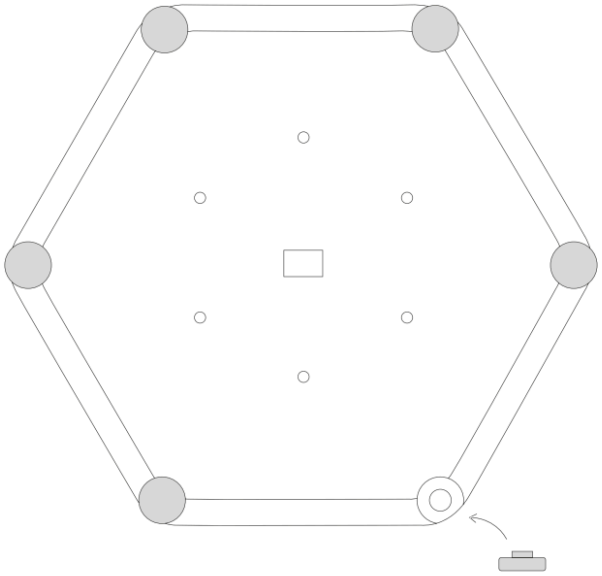

Figure 17 Installation of the rubber feet for a desk placement.

1. **Mount on a wall.**
   A. Screw the mounting nuts into the enclosure (see *Figure 18*).

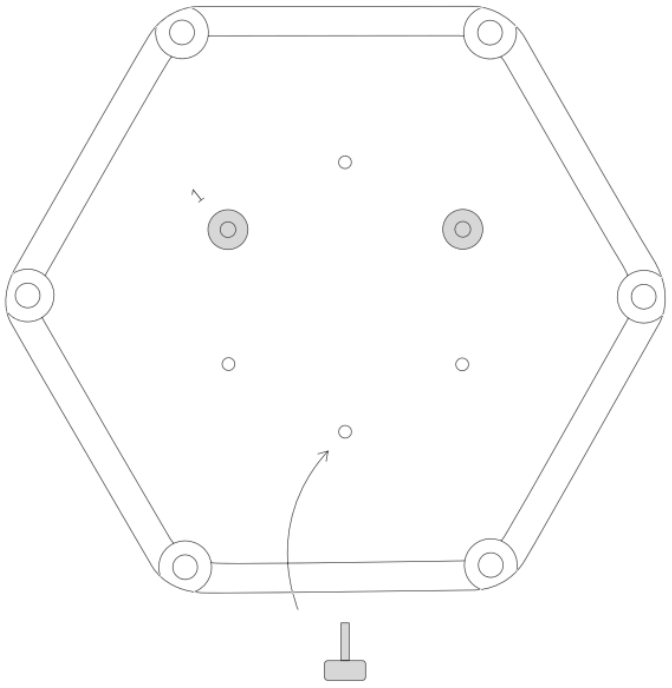

Figure 18 Screw the mounting nuts into the device for a wall installation.

   B. Install the mounting bracket on the wall using screws (see *Figure 19*). Screw the bracket to the wall using your preferred mounting holes.

C. When using a 6-30 V DC or 5-21 V AC power supply, the centre plastic circle labelled PUSH must be snapped out of the mounting bracket before installation. Next, route the cable through the centre hole of the bracket.

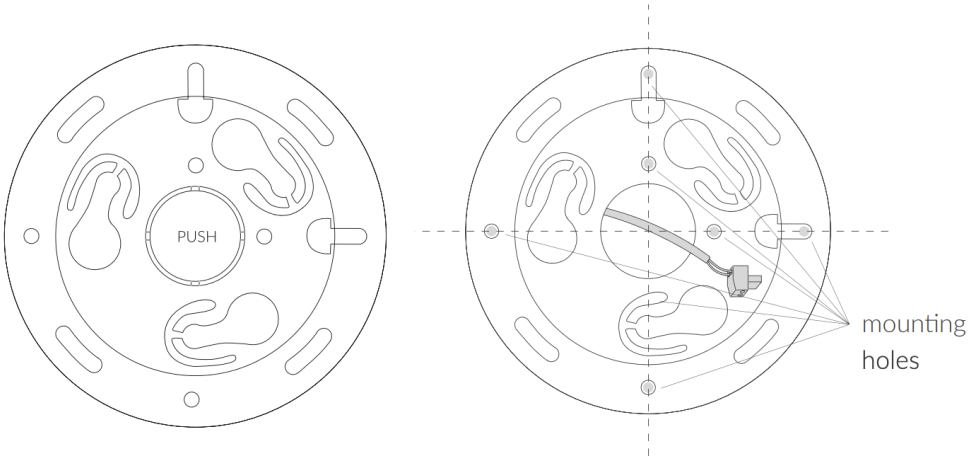

Figure 19 Install the wall-mount bracket onto the device.

D. Attach the device to the mounting bracket by first fitting the mounting nuts on the device into the mounting holes of the bracket. Next, turn the device clockwise (see *Figure 20*) until aligned to its final orientation (see *Figure 21*).

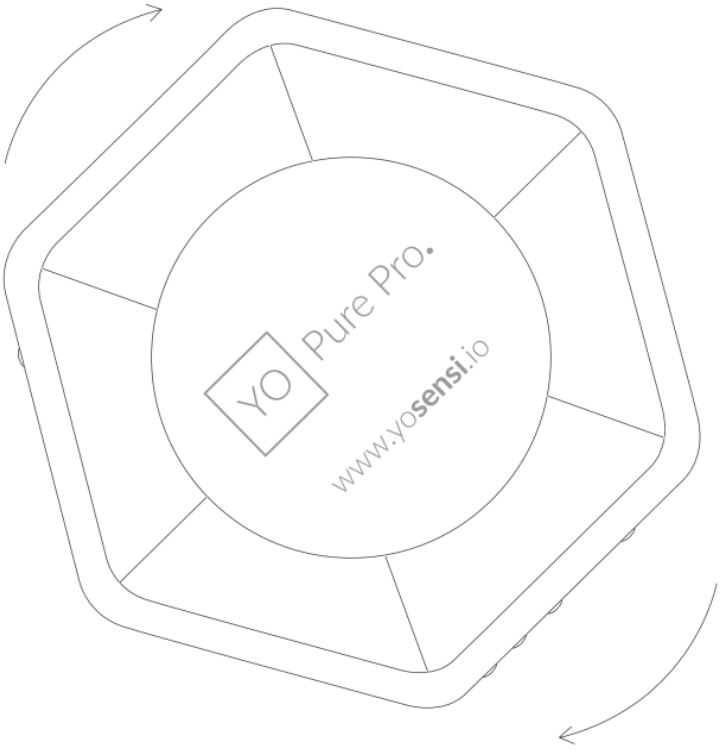

Figure 20 Turn the device clockwise after inserting into the bracket for mounting on a wall.

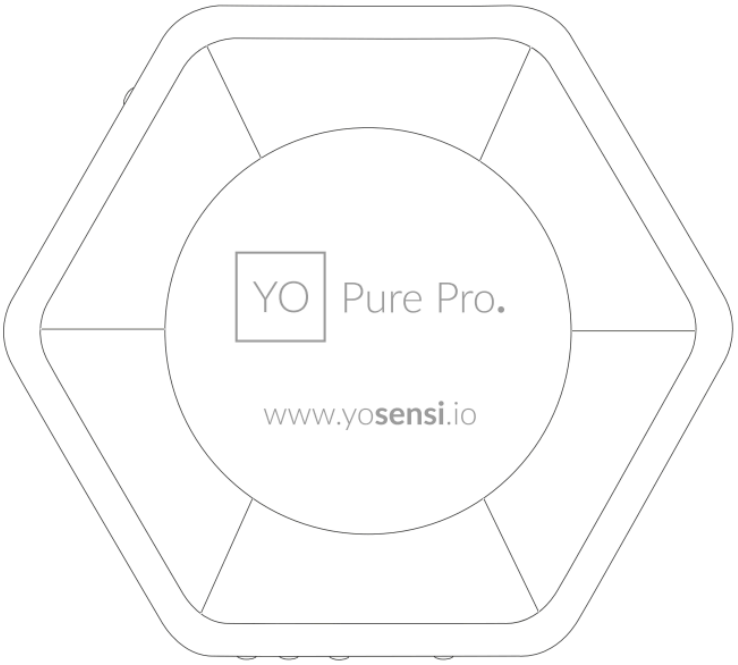

Figure 21 The final position of the device after properly mounting on a wall.

1. **Mount on a ceiling.**
   Installation of the device on a ceiling is similar to a wall mount described in section II.2. For a ceiling mount, the PMx sensor must be turned upside down to function correctly. Unscrew the enclosure, remove the sensor, rotate it upside down, and re-insert it to the same location (see *Figure 22*).

   IMPORTANT! If the sensor is not turned upside down, then it cannot measure PMx correctly. This instruction only applies to the ceiling mount option.

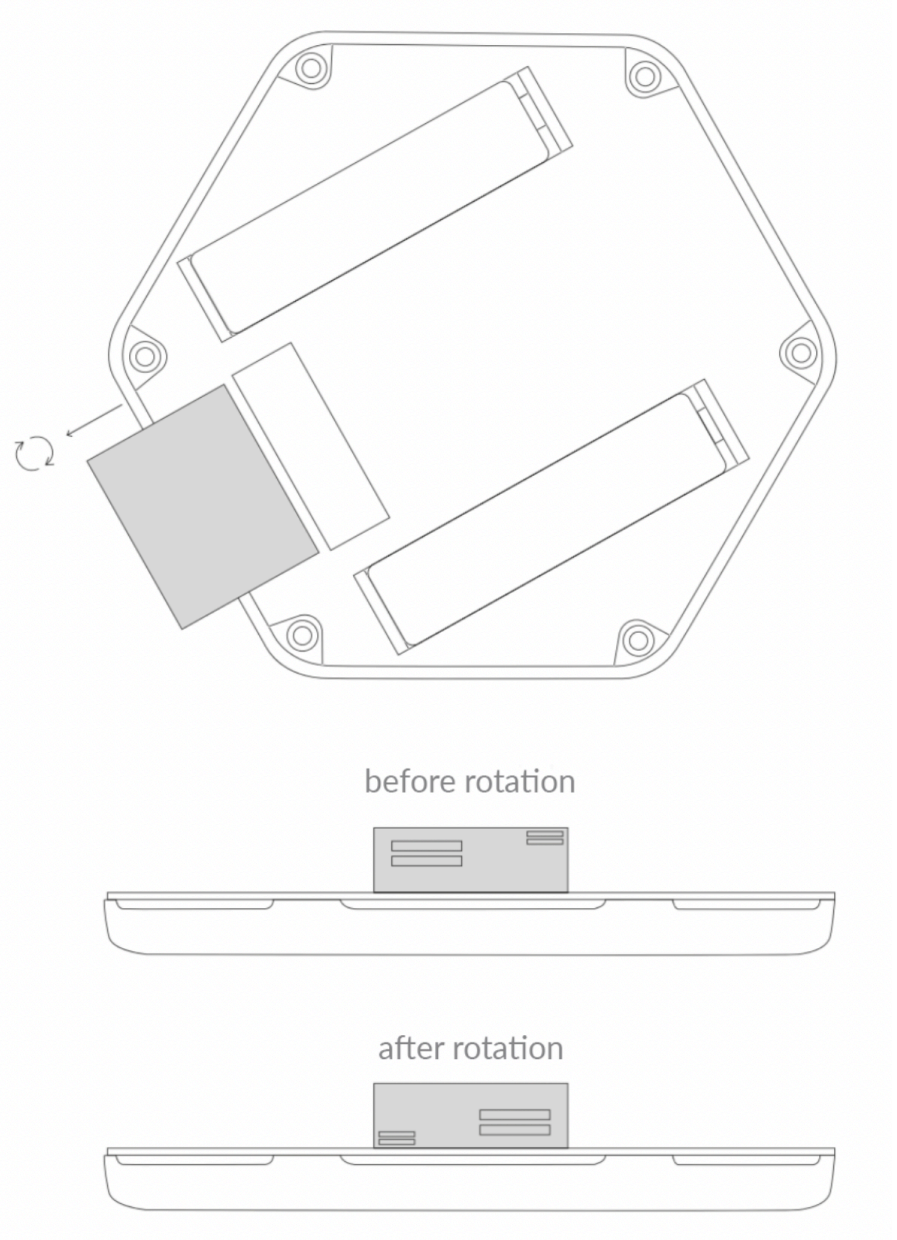

Figure 22 Rotating the PM sensor to prepare for a ceiling mount installation.

Operation

IoT system components

Typical IoT systems consist of 3 main elements *(Figure 23)*, brief described below. In order to set communication, each element must be properly configured.

1. **Node** – device with sensors and a wireless communication module that gathers data, forms the payload and sends it to the gateway.
2. **Gateway** – device similar to routers, equipped with a LoRa concentrator, that receives LoRa packets and sends them to the Internet-connected server.
3. **Server** – in most cases, a cloud-based service where data is processed, stored, analysed, and presented in user-friendly ways (via a user interface); Yosensi default and recommended tools are Yosensi Management Platform (for IoT structure management) and Grafana (for data presentation).

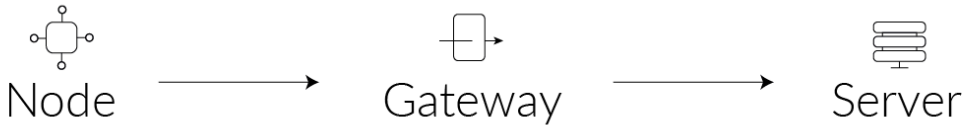

Figure 23 IoT system components.

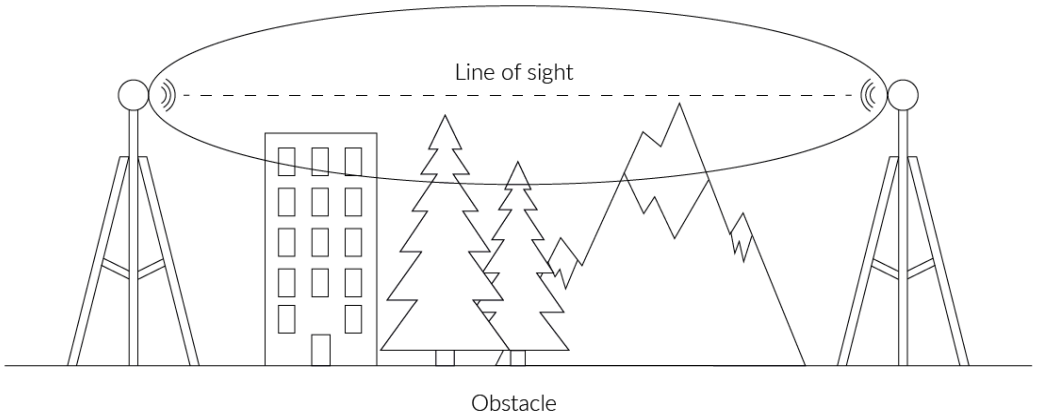

Figure 24 Fresnel zone where communication between two antennas can occur.

Device configuration

Configurable parameters

A few parameters must be set in order to send data to the gateway. The default firmware is configured in OTAA connection type with predefined *deveui*, *appkey* (OTAA) and *devaddr*, *appskey*, *nwkskey* (ABP).

Configuration of the device is stored in a JSON format file divided into sections:

- **info** (generic, read only): information about the device,
- **lorawan** (generic): configuration data required to connect to the LoRaWAN,
- **ble** (generic): bluetooth settings,
- **device** (dynamic): individual configuration for a specific device (the structure of this section is different for each device),
- **mainsens** (dynamic): main sensors used for measurement of temperature, humidity, atmospheric pressure, total volatile organic compounds (TVOC), illuminance, carbon dioxide (CO_2), sound pressure level (SPL), differences in percentage value,
- **pmxsense** (dynamic): configuration of particulate matter sensor PM2.5, PM4 and PM10,
- **intgassens** (dynamic): configuration of replaceable sensor (see **senstype** parameter) measuring different types of gas, by default it is CO sensor,
- **extgassens** (dynamic)**:** configuration of additional custom sensor that can be plugged directly to the device I2C bus using a 5 pin socket on the PCB (disabled by default); for more information contact us on support@yosensi.io.

Sample configuration file for the YO Pure Pro device.


```
{
        "info": {
                "devmodel": "LNPP",
                "fwver": "3.5.0",
                "loraradio": "SX1261",
                "lorawanver": "1.0.2",
                "loraregion": "EU868",
                "blemacaddr": "0123456789ab"
        },
        "lorawan": {
                "subband": 1,
                "nwktype": "public",
                "acttype": "otaa",
                "otaa": {
                        "deveui": "0123456789abcdef",
                        "appeui": "fedcba9876543210",
                        "appkey": "000102030405060708090a0b0c0d0e0f",
                        "trials": 3
                },
                "abp": {
                        "devaddr": "01234567",
                        "nwkskey": "0123456789abcdef0123456789abcdef",
                        "appskey": "000102030405060708090a0b0c0d0e0f"
                }
        },
        "ble": {
                "power": 0,
                "interval": 1600
        },
        "device": {
                "measinterval": 600
        },
        "mainsens": {
                "tempdiffpct": 20,
                "humdiffpct": 20,
                "pressdiffpct": 20,
                "lightdiffpct": 200,
                "tvocdiffpct": 200,
                "co2diffpct": 50,
                "spldiffpct": 50,
                "tempoffset": 0
        },
        "pmxsens": {
                "enable": true,
                "pm25diffpct": 50,
                "pm4diffpct": 50,
                "pm10diffpct": 50
        },
        "intgassens": {
                "enable": true,
                "senstype": "CO",
                "sensdiffpct": 500,
                "calibval": 230,
                "vrefval": 1060
        },
        "extgassens": {
                "enable": false,
                "senstype": "CO",
                "sensdiffpct": 500,
                "calibval": 1,
                "vrefval": 1060
        }

}
```

GENERICS PARAMETERS

SECTION	NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
info	devmodel	Device name	-	LNPP	R
	fwver	Firmware version	-	3.5.0	R
	loraradio	Radio chipset model	-	SX1261[1]	R
	lorawanver	LoRaWAN stack version	-	1.0.2	R
	loraregion	LoRaWAN region	-	EU868[1]	R
	blemacaddr	Bluetooth LE address	-	predefined	R
lorawan	subband	Uplink subband number	Table[2]	predefined	R/W
	nwktype	Network type	public, private	public	R/W
	acttype	Activation type	otaa, abp	otaa	R/W
lorawan -otaa	deveui	Device EUI (Extended Unique Identifier)	8 B (HEX)	predefined	R/W
	appeui	Application EUI	8 B (HEX)	predefined	R/W
	appkey	Application Key	16 B (HEX)	predefined	R/W
	trials	Join request trials	1-9	3	R/W
lorawan -abp	devaddr	Device Address	4 B (HEX)	predefined	R/W
	nwkskey	Network Session Key	16 B (HEX)	predefined	R/W
	appskey	Application Session Key	16 B (HEX)	predefined	R/W
ble	power	Bluetooth LE transmit power [dBm]	0[4]	0	R/W
	interval	Bluetooth LE advertising interval [ms]	MS_INPUT[3]	1600	R/W

[1] LoRa radio chipset used defines the LoRaWAN region: SX1261 - EU868; SX1262 - AU915, US915, AS923
[2] Uplink subband list for specific LoRaWAN regions - UPLINK SUBBAND Table.
[3] Calculation formula: MS_INPUT = INTERVAL_MS × 1.6.
[4] Change currently not supported.

DEVICE PARAMETERS

NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
measinterval	Measuring and sending interval LoRa [s]	1 - 999999	600	R/W
tempdiffpct	Measuring temperature threshold in %	0 - 9999	20	R/W
humdiffpct	Measuring humidity threshold in %	0 - 9999	20	R/W
pressdiffpct	Measuring pressure threshold in %	0 - 9999	20	R/W
lightdiffpct	Measuring luminosity threshold in %	0 - 9999	200	R/W
tvocdiffpct	Measuring Total volatile organic compound threshold in %	0 - 9999	200	R/W
co2diffpct	Measuring CO_2 threshold in %	0 - 9999	50	R/W
spldiffpct	Measuring sound pressure level threshold in %	0 - 9999	50	R/W
tempoffset	Temperature offset in °C	-999.9 - 999.9	0	R/W
enable[1]	Enable or disable additional sensors suchs as PMx (default true), internal sensor (default true) and external (default false).	true, false	true	R/W
pm25diffpct	Measuring PM2.5 threshold in %	0 - 9999	50	R/W
pm4diffpct	Measuring PM4 threshold in %	0 - 9999	50	R/W
pm10diffpct	Measuring PM10 threshold in %	0 - 9999	50	R/W
senstype[2]	Type of sensor	CO, O3, EtOH, H2S, SO2, NO2	CO	R/W
sensdiffpct[2]	Measuring threshold of the additional sensor, value in [%]	0 - 9999	1	R/W
calibval[2]	Calibration value of additional sensor, value should not be changed by user	0 - 999999	1	R/W
vrefval[2]	Calibration electronic zero value of addition sensor, value should not be changed by user	0 - 9999	1060	R/W

[1] Default value 'true' for the enable parameter is assigned to the PM2.5,PM4,PM10 sensor type and to replaceable sensor in 'intgassens' section. Additional sensor in 'extgassens' section is disabled by default with value 'false'.

[2] Parameters senstype, sensdiffpct, calibval, vrefval are assigned to the 'intgassens' section and 'extgassens' section.

Parameter descriptions

- ***tempdiffpct, … , pm10diffpct:*** the sensor measurement minimum percentage difference based on the previous two consecutive data points.
- ***tempoffset:*** the offset value **subtracted** from the temperature measurement.
- ***enable:*** an activation/deactivation indicator for a specific sensor i.e. PMx sensor, additional internal sensor. Default value 'true' is assigned to the PMx sensor and internal sensor. Additional external sensor has a default value false.
- ***senstype:*** corresponds to the alternate optional sensors connected to the internal socket, which is the CO sensor by default.
- ***sensdiffpct:*** for the sensor defined in *senstype*, the minimum percentage difference based on the previous two consecutive data points. Parameter is assigned to the section of internal sensor and external sensor.

WARNING! The *calibval* and *vrefval* parameters are pre-set to measure the values correctly. Changes to these values will affect measurements.

- ***calibval:*** the calibration value (i.e., sensitivity) of the additional gas sensor installed in the device, which is unique for each sensor and should not be adjusted until the sensor changes.
- ***vrefval:*** the calibration value (i.e., offset) of the additional gas sensor installed in the device, which is unique for each sensor circuit and should not be adjusted until the sensor changes.

Outlier detection mechanism

The ***xdiffpct*** configuration parameters set in the ***mainsens*** section define the sensitivity range for each data point used to determine if the subsequent measurement should be placed in the payload and sent to the server. If all values are within range, then only the first and last values remain (see the left side of *Figure 25*). If measurements are out of range, then the payload includes more than two points (see the right side of *Figure 25*). The scenario where too many data points exist such that they do not fit in one payload is possible, so they are sent in subsequent payloads with a reduced sending time despite the value configured in ***measinterval***.

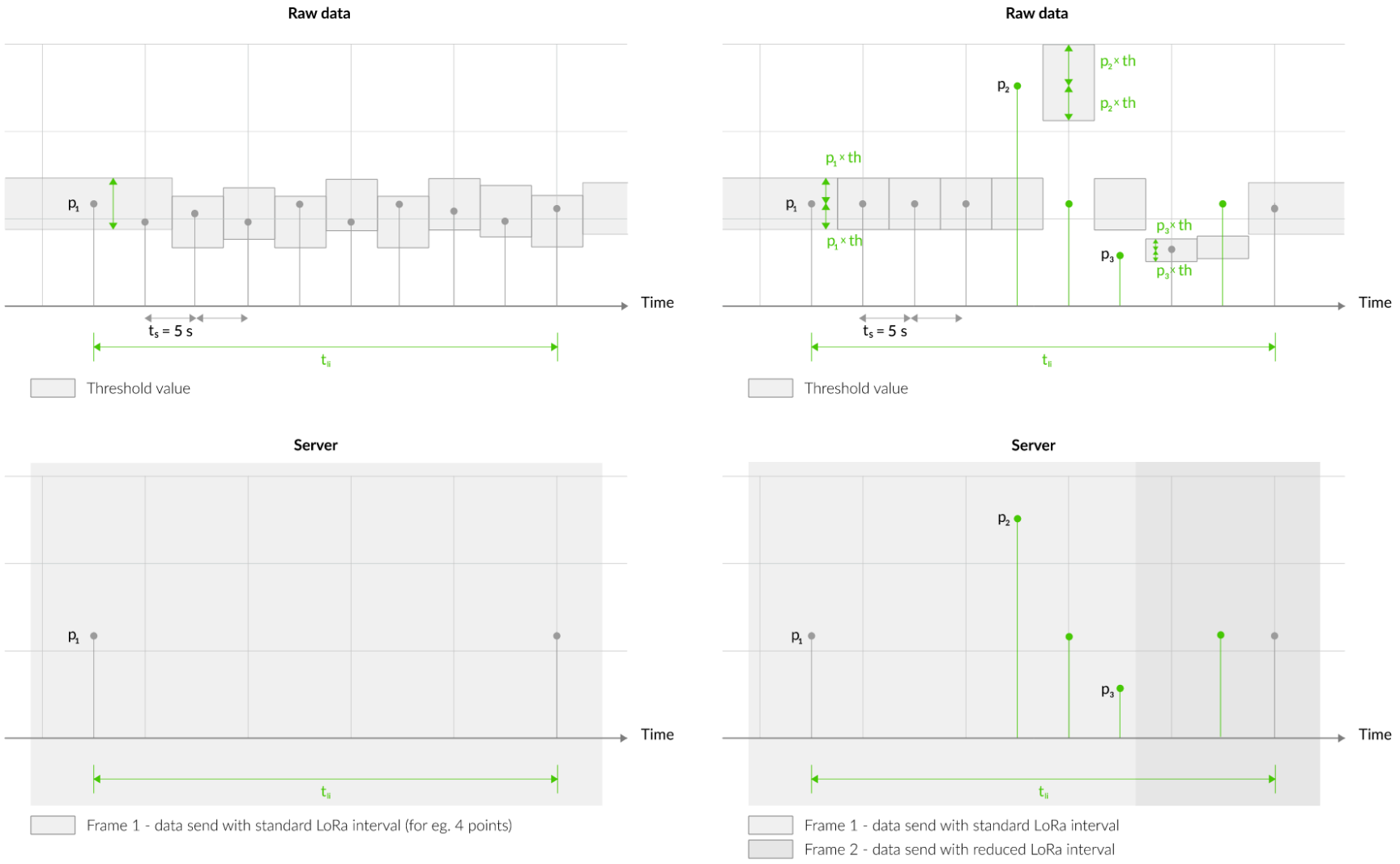

Figure 25 The outlier detection mechanism using a configurable threshold value.

UPLINK SUBBAND

REGION	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
EU868	Sub-band 1; 867.1 - 868.5 MHz; channels 0-7	1	1	R
US915	Sub-band 1; 902.3 - 903.7 MHz; channels 0-7	1	2	R/W
	Sub-band 2; 903.9 - 905.3 MHz; channels 8-15	2		
	Sub-band 3; 905.5 - 906.9 MHz; channels 16-23	3		
	Sub-band 4; 907.1 - 908.5 MHz; channels 24-31	4		
	Sub-band 5; 908.7 - 910.1 MHz; channels 32-39	5		
	Sub-band 6; 910.3 - 911.7 MHz; channels 40-47	6		
	Sub-band 7; 911.9 - 913.3 MHz; channels 48-55	7		
	Sub-band 8; 915.5 - 914.9 MHz; channels 56-63	8		
AU915	Sub-band 1; 915.2 -916.6 MHz; channels 0-7	1	2	R/W
	Sub-band 2; 916.8 - 918.2 MHz; channels 8-15	2		
	Sub-band 3; 918.4 - 919.8 MHz; channels 16-23	3		
	Sub-band 4; 920.0 - 921.4 MHz; channels 24-31	4		
	Sub-band 5; 921.6 - 923.0 MHz; channels 32-39	5		
	Sub-band 6; 923.2 - 924.6MHz; channels 40-47	6		
	Sub-band 7; 924.8 - 926.2 MHz; channels 48-55	7		
	Sub-band 8; 926.4 - 927.8 MHz; channels 56-63	8		
AS923	Sub-band 1; 922.0 -923.2 MHz; channels 0-8	1	1	R/W
	Sub-band 2; 923.2 - 924.5 MHz; channels 9-17	2*		

2 change not supported*

Downlink message

It is possible to change the measurement interval (***measinterval***) by using downlink. Information about changing parameter will be sent from server via gateway when Example of downlink message must include:

- Prefix: 0x03
- Measurement index: 0x00
- Data up to 4 bytes in hex:
    - Interval range: 60 to 999999

0x03000258 - sample downlink with 600 seconds [10 min] measurement interval.

Update Temperature Difference Percentage Threshold (*tempdiffpct*)
Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x01
- Data up to 2 bytes in hex:
    - Temperature range: 0 to 9999

0x03010064 - sample downlink to set temperature threshold to 100 [%]

Update Humidity Difference Percentage Threshold (*humdiffpct*)
Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x02
- Data up to 2 bytes in hex:
    - Humidity range: 0 to 9999

0x03020064 - sample downlink to set humidity threshold to 100 [%]

Update Atm. Pressure Difference Percentage Threshold (*pressdiffpct*)
Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x03
- Data up to 2 bytes in hex:
    - Atm. pressure range: 0 to 9999

0x03030064 - sample downlink to set atm. pressure threshold to 100 [%]

Update Illuminance Difference Percentage Threshold (*lightdiffpct*)
Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x04
- Data up to 2 bytes in hex:
    - Illuminance range: 0 to 9999

0x03040064 - sample downlink to set illuminance threshold to 100 [%]

Update TVOC Difference Percentage Threshold (*tvocdiffpct*)

Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x05
- Data up to 2 bytes in hex:
    - TVOC range: 0 to 9999

0x03050064 - sample downlink to set TVOC threshold to 100 [%]

Update CO_2 Difference Percentage Threshold (*co2diffpct*)

Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x06
- Data up to 2 bytes in hex:
    - CO_2 range: 0 to 9999

0x03060064 - sample downlink to set CO_2 threshold to 100 [%]

Update SPL Difference Percentage Threshold (*spldiffpct*)

Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x07
- Data up to 2 bytes in hex:
    - SPL range: 0 to 9999

0x03070064 - sample downlink to set SPL threshold to 100 [%]

Update Temperature offset (*tempoffset*)

Example of downlink message include:

- Prefix: 0x03
- Measurement index: 0x08
- String data converted to hex:
    - Offset range: -999.9 to 999.9

0x0308322E33 - sample downlink to set temperature offset to 2.3 [°C]

Configuration via CLI

IMPORTANT!
Using the CLI tool, make sure that firmware of the device is **3.3.0 or older**. For newer firmware use configuration via Yosensi Management Platform.

Connect to the device following these instructions:

1. Read the macBLE address from the sticker on the device. Alternatively, you can identify the device by RSSI parameter (which correlates with distance between transmitter and receiver).
2. Make sure you have your Bluetooth LE adapter turned on and working properly.
3. Download and run the CLI tool in the terminal/console application.
4. Make sure you have placed batteries in the YO Pure Pro device.
5. Run `yosensi-cli-tool_vX.X.X_WIN.exe list` to scan for Bluetooth devices. You can see all commands by typing `yosensi-cli-tool_vX.X.X_WIN.exe --help` or add `-h` to your current command to see all needed parameters.
6. If you find your MAC address in the `list` command results, you can connect and reconfigure the device by using one of the available commands. You should use the *upload_dev_config* subcommand to change device settings. Additional information, including the commands supported by the CLI, are available at https://yosensi.io/support/CLI_datasheet.pdf.

Command help view:

```
.\yosensi-cli-tool_v3.3.0_win.exe upload_dev_config --help
usage: yosensi-cli-tool upload_dev_config [-h] mac

positional arguments: mac Bluetooth public MAC address

optional arguments: -h, --help show this help message and exit
```

Example of use:

```
.\yosensi-cli-tool_v3.3.0_win.exe upload_dev_config 80:e1:26:1c:f9:e9
It will take up to 120s to find and start uploading configuration data to the device from file, please
wait ...
Searching for a device ...
Trying to connect to the device LNPP-3.3.0 ...
Downloading the configuration file ...
Downloading the configuration file is complete.
Checksum of the downloaded configuration data is correct.
The configuration data has been written to the file.
```

After node reconfiguration, you need to have access to the gateway and server.

NOTE **The firmware update process is described in CLI tool manual, *firmware_upload subcommand* section. Visit https://yosensi.io/support to see all available documentation.**

Configuration node via Yosensi Management platform

Connect to the device as follows:

1. Log in at app.yosensi.io.
2. You'll see the dashboard organization view. Go to the Application section in the sidebar.
3. Select application, locate and select the device by looking for the DEV EUI on the device label.
4. Select the Firmware section. For the configuration of the device you can see three different buttons:
    - Configure – here, you can change and upload the device parameters.
    - Update firmware – here, you can update the firmware to version 3.4.0 and newer.
    - Recover device – this section restore the firmware of the device. This button helps if you lose the connection while uploading firmware.
5. Once the "Configure" button has been selected and the node has been paired with the computer, the next step is configuring parameters. You will see 2 different display options for the configuration. The first recommended is "Form-based-editor" and the second is "Text editor". Possible values with the description of each parameter can be found in the device configuration.

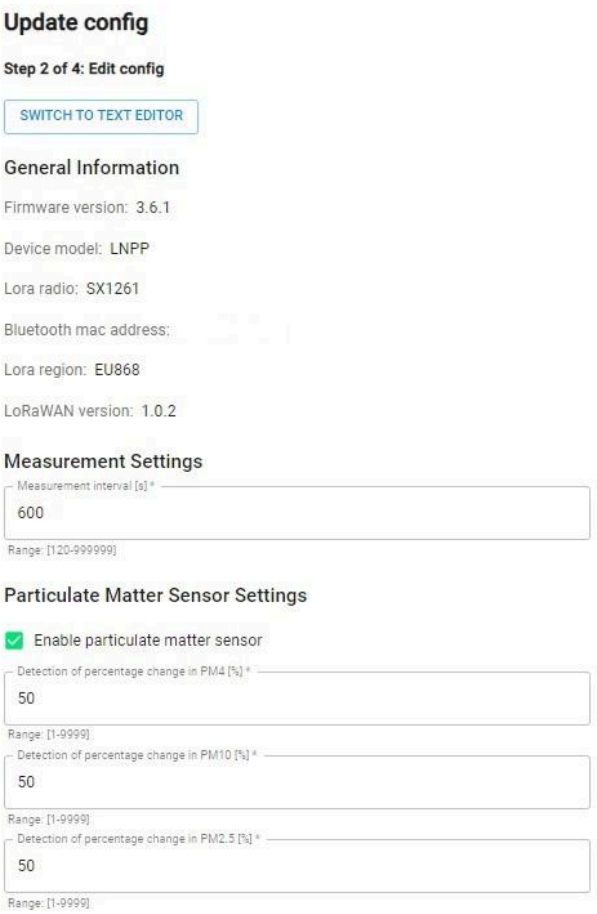

Figure 26 Firmware section and update configuration section form.

6. Press the Upload button and wait.

NOTE **Additional information including device configuration can be found in Yosensi configuration web tool.**

Configuration node with Yosensi mobile app

Connect to the device using Yosensi app as follows:

1. Login to Yosensi App using your credentials.
2. Go to the Devices section and choose the device you want to configure. If you can not see the device ensure that you are in the correct organization. Alternatively you can also scan the QR code placed on the node. It will redirect you right to the device details.
3. After selecting the device go to the "configuration" option in device details. Now wait, your mobile will pair with the node.
4. You will see 2 different display options of the configuration, first recommended is "Form-based-editor" second "Text editor". Possible values with description of each parameter can be found in the device configuration.

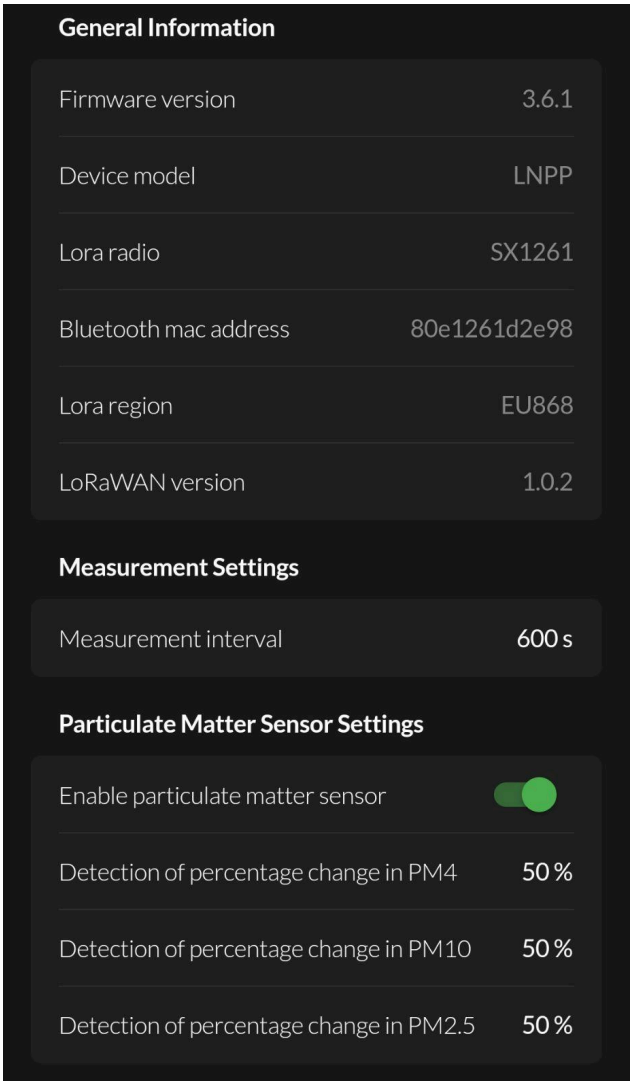

Figure 27 Configuration view in mobile app.

5. After changing parameters, press the "Save" button.

Connecting node with network

The LoRaWAN architecture requires a configured Gateway and Network Server. We'll go through an example in our recommended Yosensi Management Platform software.

Yosensi Management Platform configuration

Before you can make the node visible, you'll need an **organization** and an **application**. The organization is your own space, at the highest level of IoT systems management (like the root directory in operating systems). It can be created only by Yosensi staff, and all clients using Yosensi Management Platform have one created for them by default. In case of any questions, you can find us at support@yosensi.io. The application is a representation of each system and, together with the node definitions, is created by customers. The basic integration of a node into the Yosensi Management Platform is described below. Nodes can be added manually or via Bluetooth. .

NOTE **A subscription is needed to use Yosensi Management Platform (see here). Contact us on contact@yosensi.io for more information and pricing.**

Adding a node manually

Yosensi Management Platform integration instructions:

1. Go to app.yosensi.io and log in.
2. You'll see the default organization view. To switch to another organization, click on the user avatar in the right top corner and select 'Switch Organization'.
3. To create an application, press the bottom right '+' button. Fill in the 'Name' and 'Description' fields and 'Select Application Profile' which is the region definition.

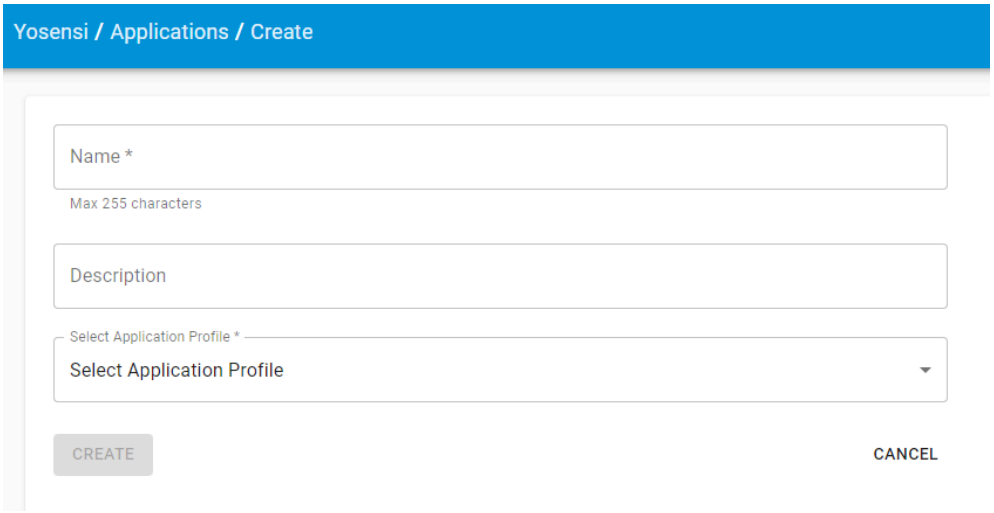

Figure 28 Application creation form.

4. Proceed to the application by clicking its name on the list, then press the '≡' button to add a node. Click '**Add manually**'. Set the node's 'Name' and 'Description' fields, Description' fields, and fill in 'DEV EUI' and 'OTAA Key' (otaa section – *appkey*). **All device identifiers are provided by Yosensi Support when you order the nodes.**

   Select a model that is compatible with your device — this choice affects the number of charts and data source (YO Pure Pro). You can also set the node's 'Location', if locations have been pre-defined. If you haven't defined a suitable location, leave this field set at <None>.

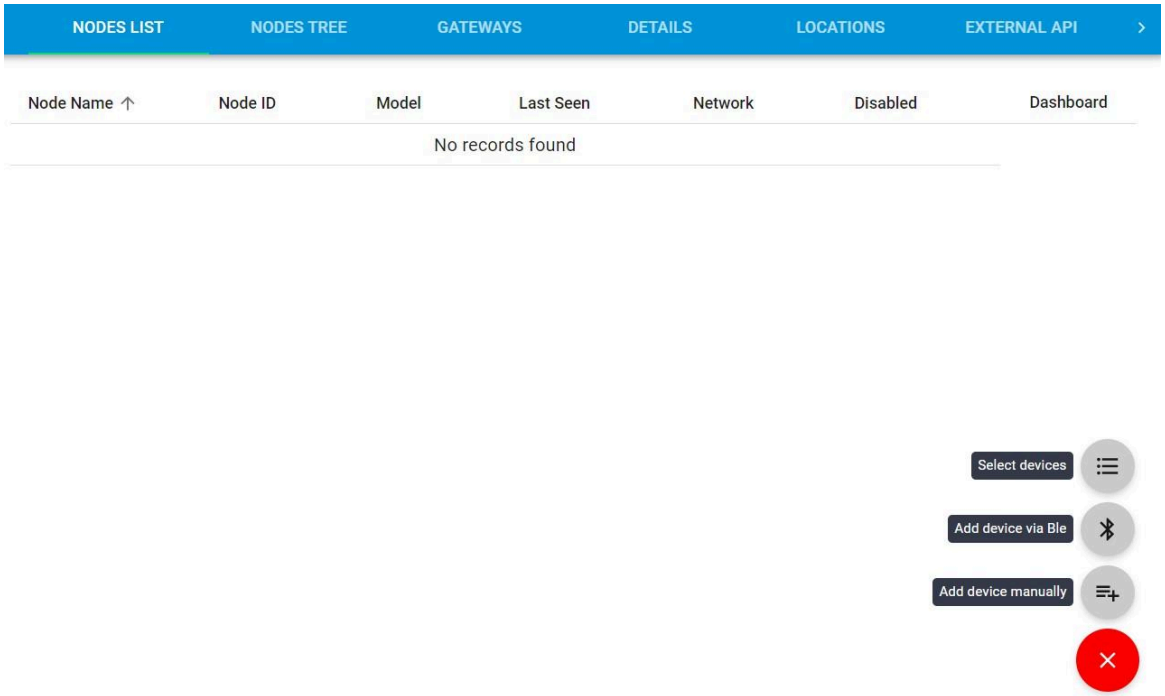

Figure 29 Adding node to the Yosensi Management Platform section view.

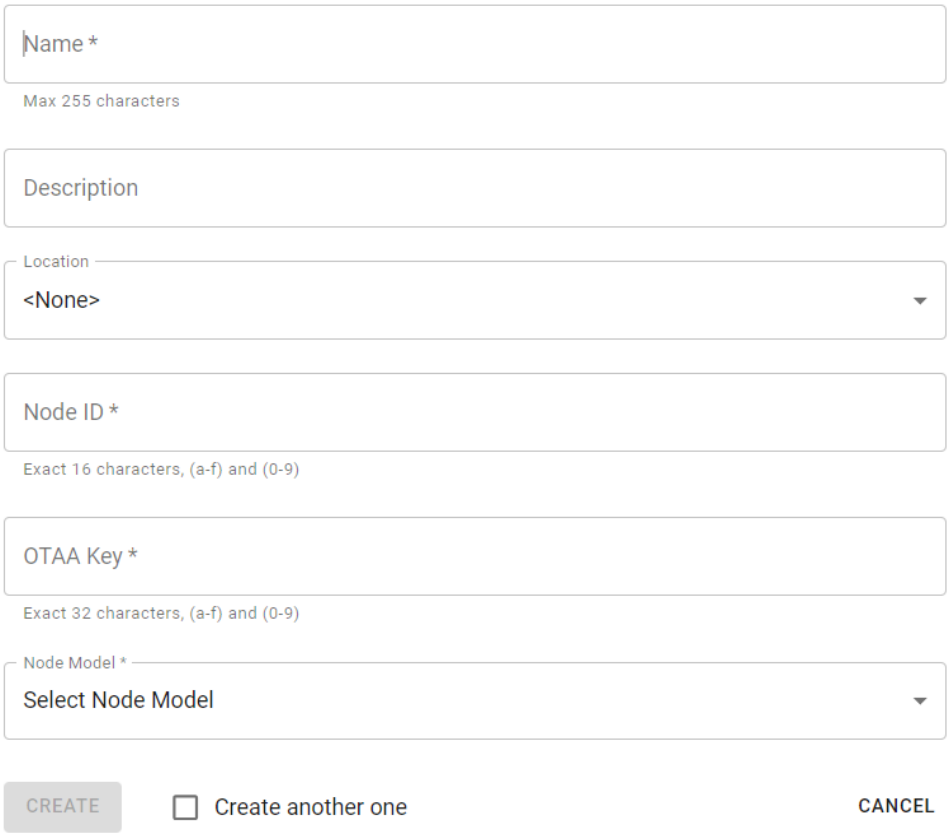

Figure 30 Node creation form.

5. **New nodes must be added in OTAA mode**. Nodes can be switched to ABP mode after activation in the Yosensi Management Platform by changing the Node configuration.

   Click on the link in the 'Node Name' column. Go to the 'KEYS' tab and switch 'LoRa Type' from OTAA to ABP and fill in the blank spaces, then press update. The identifiers 'Device Address' (*devaddr*), 'Application Session Key' (*appskey*) and 'Network Session Key' (*nwkskey*) are provided by Support, or can be found in the device's configuration pane while connected to the node in the firmware section.

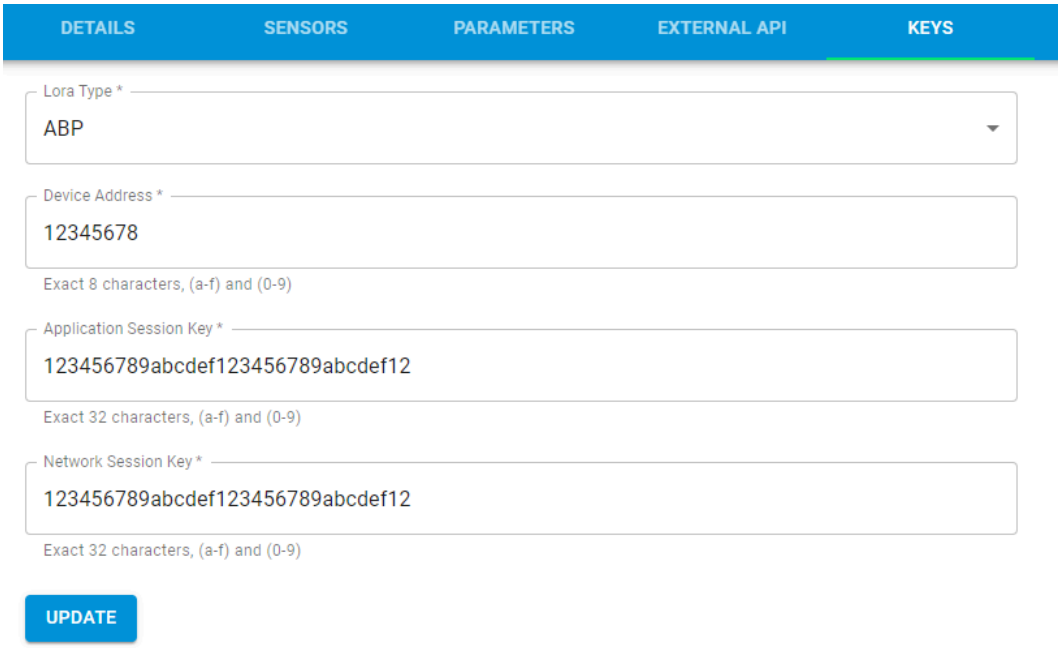

Figure 30 Node LoRa type configuration form.

6. When the server receives data from the device, you'll notice that the 'Last Seen' column ('NODES LIST' tab) status changes from 'never' to a few 'seconds ago'.
7. Open charts by clicking on the 'OPEN' button in Dashboard columns or by entering the node's 'DETAILS' tab ('Node Name' column link) and clicking 'CHARTS'.

Adding node via Bluetooth

1. Log in at app.yosensi.io.
2. You'll see the default organization view. To switch to another organization, click on the user avatar in the right top corner and select 'Switch Organization'.
3. To create an application, click the bottom right '+' button. Fill in the 'Name' and 'Description' fields and select the 'Application Profile', which is the region definition.
4. Proceed to the application by clicking its name on the list, and press the '≡" button to add a node. Click '**Add via Ble**'. Select the device to add. Then, the list with devices available to connect to the application will appear. The name of the node will be generated automatically from the device model and DEV EUI, with OTAA key and DEV EUI filled in, press create.
5. When the server receives data, you'll notice that the 'Last Seen' column (NODES LIST' tab) status changes from 'never' to a few 'seconds ago'.
6. Open charts by clicking on the 'OPEN' button in Dashboard columns or by entering the node's 'DETAILS' tab ('Node Name' column link) and clicking 'CHARTS'.

Payload description

If you want to connect to your own server you have to decode the payload specific to each device. To do this you need a payload decoder which can be downloaded from Payload decoder. Extended documentation of the protocol can be found at Payload description. An exemplary payload produced by YO Pure Pro is presented below with division into each measurement marked together with decoded values whose interpretation is described in the Payload description document.

Example of YO Pure Pro payload with description:

1fst frame:

02:10:00:c8:0d:00:01:01:09:10:00:00:33:15:00:01:26:8d:1a:00:01:00:14:22:00:03:00:00:00:02:69:00:01:5a:33:6c:00:01:03:f2:70:00:01:00:33

Payload header

0x02	0x10	0x00	0xC8
ver = 2	cnt = 16	pct [s] = 200	

First measurement (temperature)

0x0D	0x00	0x01	0x01	0x09
type = 3 prec = 1	md [s] = 0	addr_len = 0 meas_len = 2	val = 265 (26,5 [°C])	

Second measurement (relative humidity)

0x10	0x00	0x00	0x33
type = 4 prec = 0	md [s] = 0	addr_len = 0 meas_len = 1	val = 51 (51 [%])

Third measurement (pressure)

0x15	0x00	0x01	0x26	0x8D
type = 5 prec = 1	md [s] = 0	addr_len = 0 meas_len = 2	val = 9869 (986,9 [hPa])	

Fourth measurement (illuminance)

0x1A	0x00	0x01	0x00	0x14
type = 6 prec = 2	md [s] = 0	addr_len = 0 meas_len = 2	val=20 (0.2 [lux])	

Fifth measurement (TVOC concentration)

0x22	0x00	0x03	0x00	0x00	0x00	0x02
type = 8 prec = 2	md [s] = 0	addr_len = 0 meas_len = 4	val = 2 (0,02 [µg/m^3])			

Sixth measurement (CO_2 concentration)

0x69	0x00	0x01	0x5A	0x33
type = 26 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 23091 (2309,1 [ppm])	

Seventh measurement (CO_2 concentration)

0x6C	0x00	0x01	0x03	0xF2
type = 27 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 1010 (1010 [ppm])	

Eight measurement (sound pressure level)

0x70	0x00	0x01	0x00	0x33
type = 28 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 51 (51 [dB])	

Second frame:

02:01:00:3d:25:00:11:02:00:1c:25:00:11:03:00:1c:25:00:11:04:00:1c

Payload header | **First measurement (dust concentration [PM 2,5])**

0x02	0x01	0x00	0x3D	0x25	0x00	0x11	0x02	0x00	0x1C
ver = 2	cnt = 1	pct [s] = 61		type = 9 prec = 1	md [s] = 0	addr_len = 1 meas_len = 2	address= 2	val = 28 (2,8 [µg/m^3])	

Second measurement (dust concentration [PM 4)

0x25	0x00	0x11	0x03	0x00	0x1C
type = 9 prec = 0	md [s] = 0	addr_len = 1 meas_len = 2	address=3	val =28 (2,8 [µg/m^3])	

Second measurement (dust concentration [PM 10)

0x25	0x00	0x11	0x04	0x00	0x1C
type = 9 prec = 0	md [s] = 0	addr_len = 1 meas_len = 2	address=4	val =28 (2,8 [µg/m^3])	

Compliance statements

CE

UNITED KINGDOM CONFORMITY ASSESSED
No. 01/2021/UKCA

with the European Directives: EMC 2014/30/UE; RED 2014/53/UE; RoHS 2011/65/UE

Yosensi Sp. z o.o., ul. Żurawia 71A, lok.1.50, 15-540 Białystok

On our sole responsibility, we hereby declare that the product:

Name	**YO Pure Pro v.3.0**
Technical data	**Voltage 6÷30 V DC/5÷21V AC; current max 1,1A; 50/60Hz(for AC); IP40**

to which this declaration of conformity applies is consistent with legal acts:

The Directive EMC 2014/30/UE	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (Official Journal of the European Union L 96/79 of 29.3.2014)
The Directive RED 2014/53/UE	Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC(Official Journal of the European Union L 153/62of 22.5.2014)
The Directive RoHS 2011/65/EU and 2015/863/EU	Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (Official Journal of the European Union L 174/88 of 1.7.2011) and Commission Delegated Directive (EU) 2015/863 of 31 March 2015 amending Annex II to Directive 2011/65/EU

Harmonized standards applied to the product to which this Declaration of Conformity relates:

BS EN 50401:2017	Product standard to demonstrate the compliance of base station equipment with radiofrequency electromagnetic field exposure limits (110 MHz - 100 GHz), when put into service
BS EN IEC 61326-1: 2021	Electrical equipment for measurement, control and laboratory use -- EMC requirements -- Part 1: General requirements (IEC 61326-1:2020)
BS EN IEC 61000-6-1: 2019	Electromagnetic compatibility (EMC) -- Part 6-1: Generic standards -- Immunity standard for residential, commercial and light-industrial environments (IEC 61000-6-1:2016)
BS EN IEC 61000-6-3: 2021	Electromagnetic compatibility (EMC) -- Part 6-3: Generic standards -- Emission standard for equipment in residential environments (IEC 61000-6-3:2020)
BS EN IEC 61000-6-2: 2019	Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards -- Immunity standard for industrial environments (IEC 61000-6-2:2016)
BS EN IEC 61000-6-4: 2019	Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards -- Emission standard for industrial environments (IEC 61000-6-4:2018)
ETSI EN 301 489-3 V2.1.1:2019	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
ETSI EN 300 220-2 V3.2.1:2018	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard for access to radio spectrum for non specific radio equipment
ETSI EN 300 328 V2.2.2:2019	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum
BS EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The last two digits of the year in which the CE marking was affixed to the product: 21

Founder/R&D Director
Paweł Popławski

Białystok, 2021-11-18

Place and date of issue

Name, surname and signature of the authorized person

YOSENSI.IO

CE

EC DECLARATION OF CONFORMITY
No. 01/2021/EN

with the European Directives: EMC 2014/30/UE; RED 2014/53/UE; RoHS 2011/65/UE

Yosensi Sp. z o.o., ul. Żurawia 71A, lok.1.50, 15-540 Białystok

On our sole responsibility, we hereby declare that the product:

Name	**YO Pure Pro v.3.0**
Technical data	**Voltage 6÷30 V DC/5÷21V AC; current max 1,1A; 50/60Hz(for AC); IP40**

to which this declaration of conformity applies is consistent with legal acts:

The Directive EMC 2014/30/UE	Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (Official Journal of the European Union L 96/79 of 29.3.2014)
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EN IEC 61000-6-1: 2019	Electromagnetic compatibility (EMC) -- Part 6-1: Generic standards -- Immunity standard for residential, commercial and light-industrial environments (IEC 61000-6-1:2016)
EN IEC 61000-6-3: 2021	Electromagnetic compatibility (EMC) -- Part 6-3: Generic standards -- Emission standard for equipment in residential environments (IEC 61000-6-3:2020)
EN IEC 61000-6-2: 2019	Electromagnetic compatibility (EMC) -- Part 6-2: Generic standards -- Immunity standard for industrial environments (IEC 61000-6-2:2016)
EN IEC 61000-6-4: 2019	Electromagnetic compatibility (EMC) -- Part 6-4: Generic standards -- Emission standard for industrial environments (IEC 61000-6-4:2018)
ETSI EN 301 489-3 V2.1.1:2019	ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 3: Specific conditions for Short-Range Devices (SRD) operating on frequencies between 9 kHz and 246 GHz; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
ETSI EN 300 220-2 V3.2.1:2018	Short Range Devices (SRD) operating in the frequency range 25 MHz to 1 000 MHz; Part 2: Harmonised Standard for access to radio spectrum for non specific radio equipment
ETSI EN 300 328 V2.2.2:2019	Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz band; Harmonised Standard for access to radio spectrum
EN IEC 63000:2018	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

The last two digits of the year in which the CE marking was affixed to the product: 21

Founder/R&D Director
Paweł Popławski

Białystok, 2021-11-18

Place and date of issue

Name, surname and signature of the authorized person

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