YOSENSI.IO

YO Vibration Monitor

User guide v1.0

Release notes

Released	Version	Key changes
17.05.2024	1.0	Initial release.

Content

Product description

Overview

YO Vibration Monitor is a device for monitoring vibrations in electric motors. The vibration sensor includes an accelerometer and a temperature sensor. Additionally, the device is equipped with internal temperature and relative humidity sensors.
The device uses 3-axis composite measurements to detect vibrations and transmits data via LoRaWAN. Its installation is non-invasive as it is battery-powered and does not require additional cables.
The device is used in predictive maintenance for monitoring the condition of machines, production lines, and similar applications. YO Vibration Monitor replaces traditional inspections, enabling remote detection and continuous monitoring.

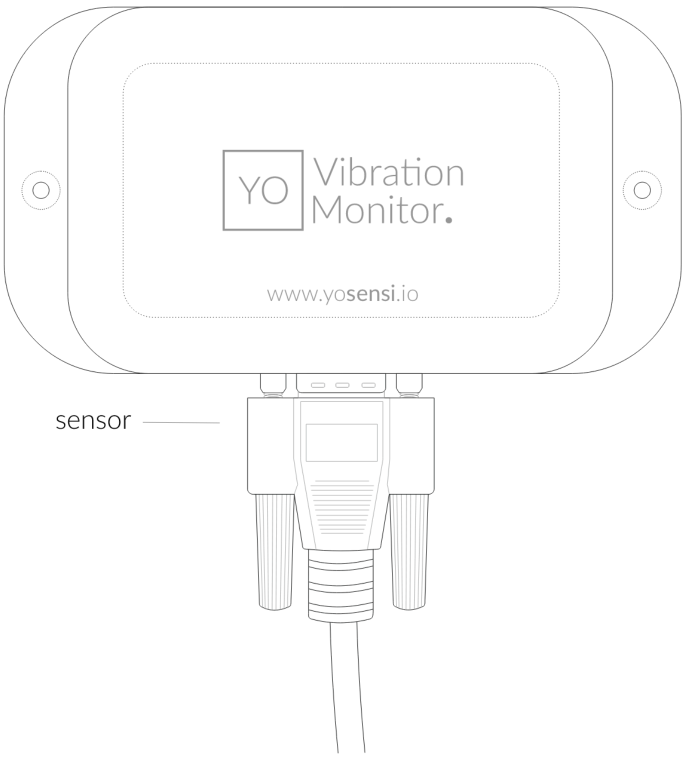


Figure 1 Device top view.

Device sticker placed on the right side 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.

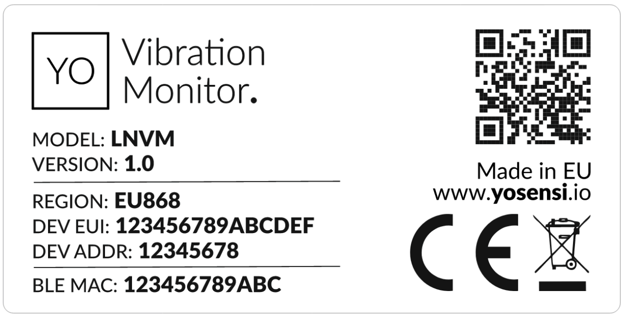


Figure 2 Device sticker.

Physical interfaces

LEDs

YO Vibration Monitor communicates its current behaviour to the user by RGBW LED placed on the side panel.

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.

Buttons

The YO Vibration Monitor has a button for resetting the device. Figure 3 shows its placement (next to the LED). To reboot the device, press the reset button for a moment, e.g. with a thin stick.

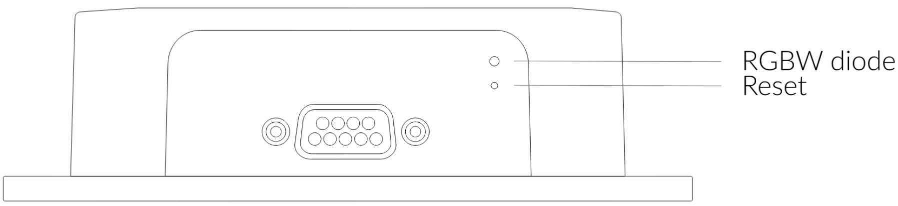


Figure 3 Reset button.

Specifications

Physical

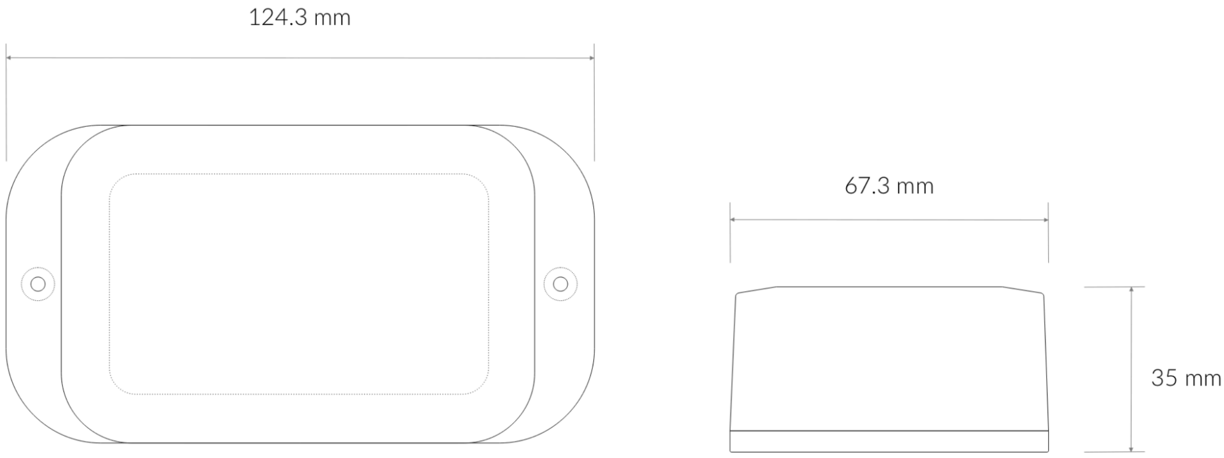


Figure 4 Dimensions of the device.

PHYSICAL SPECIFICATION OF THE DEVICE

Dimensions	Height: 35 mm Width: 67,3 mm Depth: 124,3 mm
Colour	White
Mounting method	Horizontal Vertical (can be screwed to the wall)
Enclosure material	ABS
Level of protection	IP40
Weight	106 g

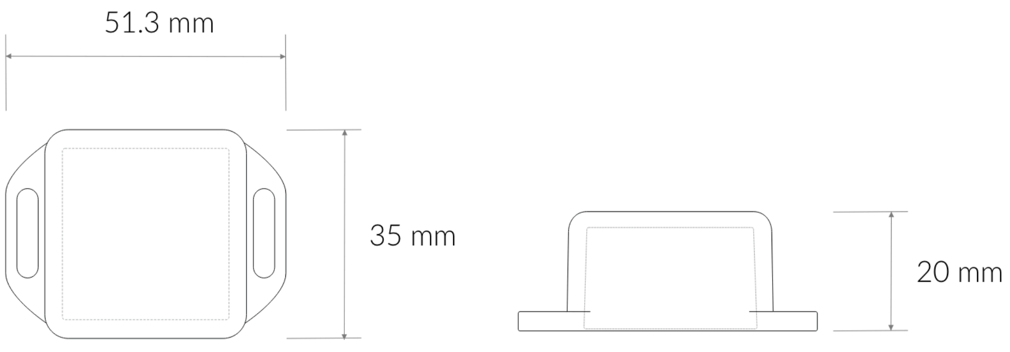


Figure 5 Dimensions of the vibration sensor.

PHYSICAL SPECIFICATION OF THE VIBRATION SENSOR

Dimensions	Height: 35 mm Width: 35 mm Depth: 20 mm
Colour	Grey
Mounting method	Magnet Mounting (on request) Internal Thread Mounting External Thread Mounting Mounting Bracket
Enclosure material	ABS
Level of protection	IP67
Weight	45 g

Operating conditions

OPERATING CONDITIONS	
Temperature	0° to 70°C
Humidity	0 to 90%
Placement	Indoor use
Power supply	3 x LR6 (AA) battery (3 x 1,5 V)
Power consumption	Maximum 120 mA DC (4,5 V DC)

Measured values

MEASUREMENT RANGES

Parameter	Measurement range	Accuracy
Temperature internal	-40° to 125°C	±0.2°C (5° to 60°C)
Relative humidity internal	0% to 100%	±2% (20% to 80%)
Temperature external	-40° to 125°C	±0.2°C (5° to 65°C)
XYZ RMS of acceleration	0 to 16g	0.001g
XYZ Peak of acceleration	0 to 16g	0.001g
XYZ Vibration velocity	0 to 45	0.1 mm/s
XYZ Displacement	0 to 10000	1 μm
XYZ Crest factor	0 to 160	0.01
XYZ Standard deviation	0 to 10	0.01
XYZ Kurtosis	-3 to 3	0.01
XYZ Skewness	-3 to 3	0.01

The YO Vibration Monitor is a device with an external port for connecting a vibration module which is equipped with a high precision accelerometer and temperature sensor.

The device reads accelerometer data for the X, Y and Z axes and then processes the data to obtain the specific physical measurements used to track vibrations in motors. These values are the acceleration RMS, Peak, Crest Factor, derivatives such as Velocity and Displacement, and statistical data of the input data, e.g. standard deviation, kurtosis or skewness.

RMS g refers to the measurement of root mean square (RMS) acceleration values along three perpendicular axes: X, Y, and Z. This measurement is commonly used in vibration analysis to quantify the overall intensity of vibrations in different directions.

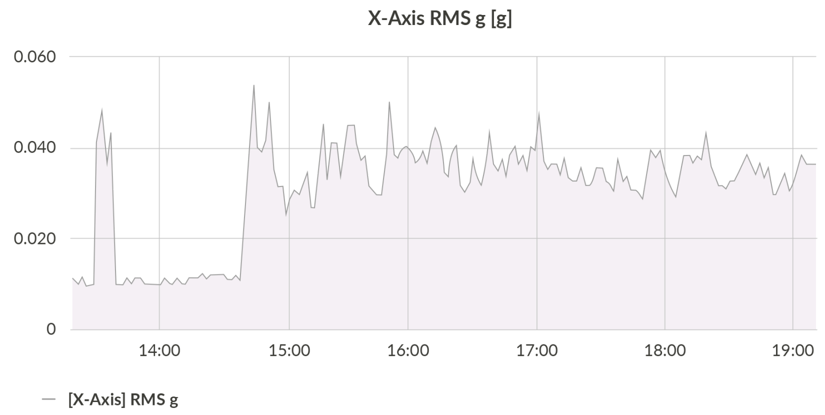


Figure 6 Example of RMS acceleration in X axis.

Peak g refers to the measurement of the highest instantaneous acceleration values along three perpendicular axes: X, Y, and Z. This measurement is critical in vibration analysis to identify the maximum forces acting on a system in different directions.

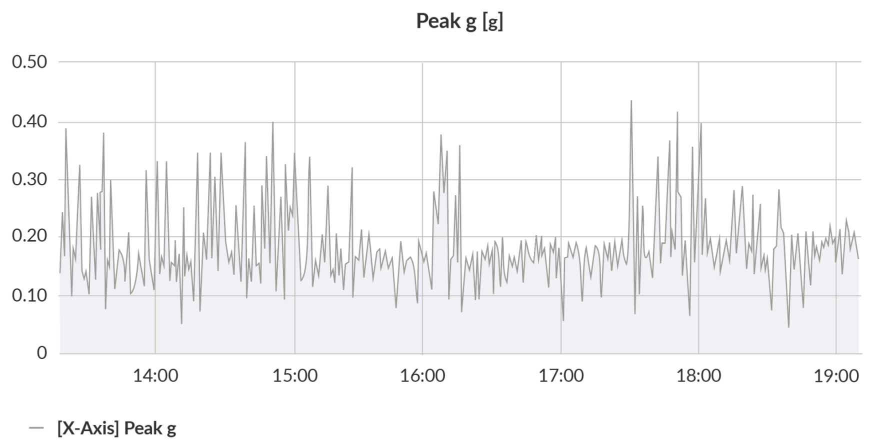


Figure 7 Example of Peak acceleration in X axis.

RMS Velocity refers to the measurement of root mean square (RMS) velocity values along three perpendicular axes: X, Y, and Z. This measurement is crucial in vibration analysis to assess the effective vibrational energy in different directions.

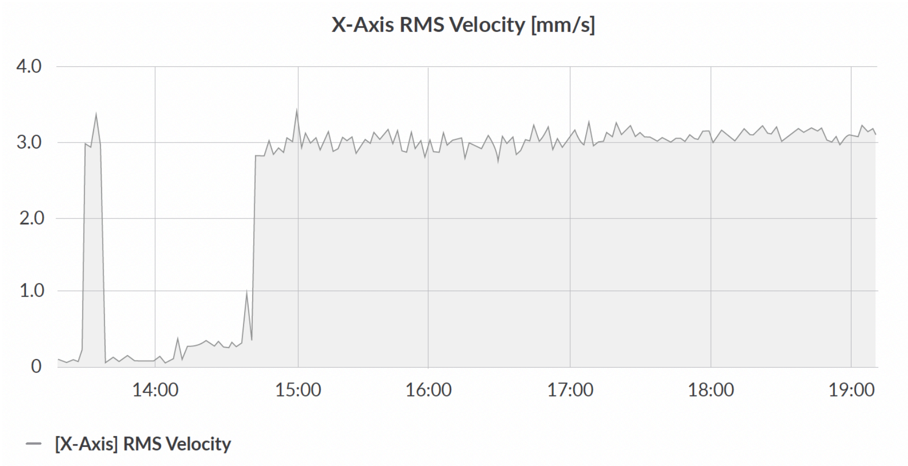


Figure 8 Example of RMS Velocity in X axis.

Peak-to-Peak Displacement refers to the measurement of the maximum displacement range of vibrations along three perpendicular axes: X, Y, and Z. This measurement is vital in vibration analysis to determine the total excursion of movement in different directions.

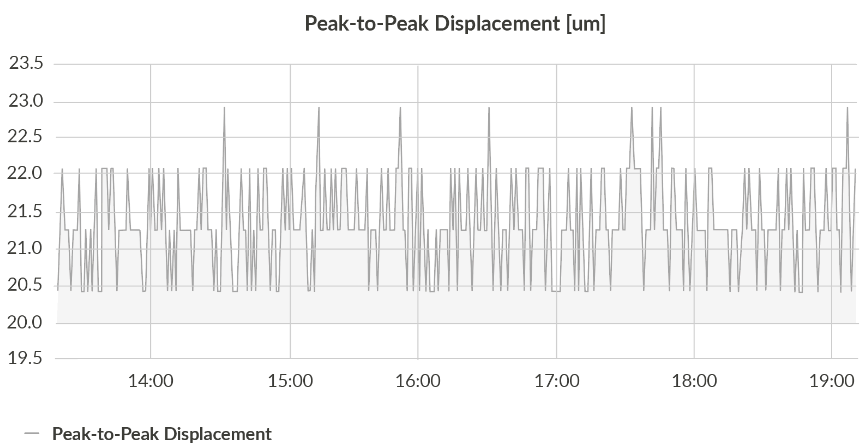


Figure 9 Example of Peak-to-Peak Displacement in X axis.

Crest Factor refers to the ratio of the peak value to the RMS (Root Mean Square) value of vibration signals measured along three perpendicular axes: X, Y, and Z. This metric is important in vibration analysis to assess the severity of peak events relative to the overall vibration level in different directions.

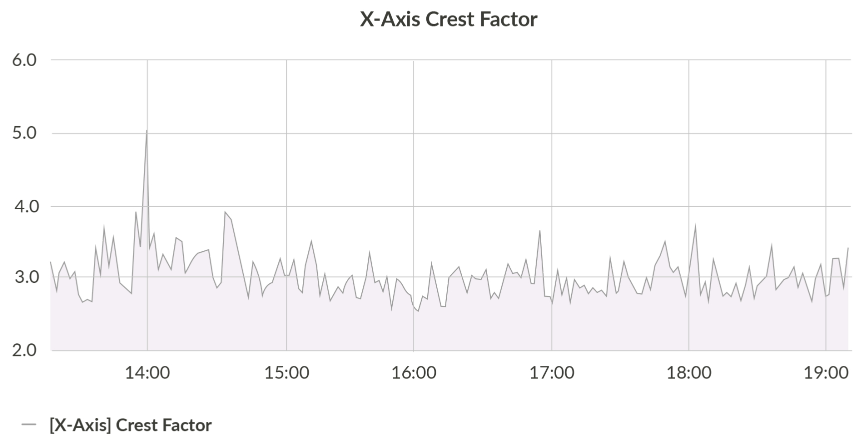


Figure 10 Example of Crest Factor in X axis.

Standard deviation refers to the measurement of the variability or dispersion of vibration signals along three perpendicular axes: X, Y, and Z. This statistical metric is essential in vibration analysis to understand the spread and consistency of the vibration data in different directions.

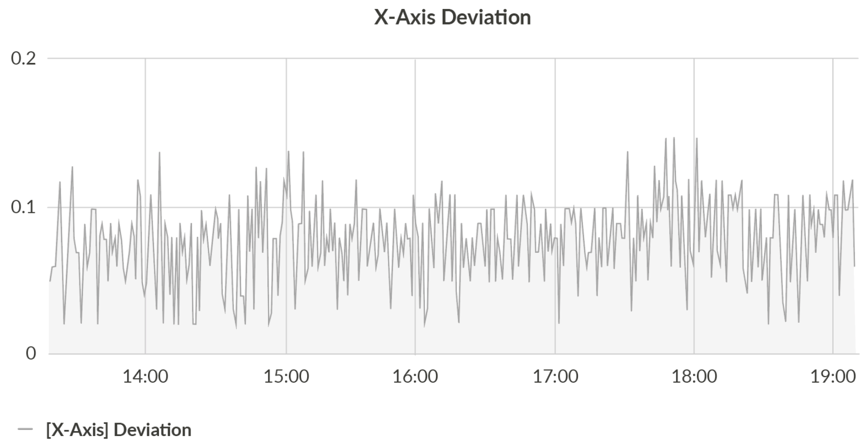


Figure 11 Example of Standard deviation in X axis.

Kurtosis refers to the measurement of the "tailedness" or extremity of the distribution of vibration signals along three perpendicular axes: X, Y, and Z. This metric is critical in vibration analysis to assess the presence of outliers and the propensity for extreme values in different directions.

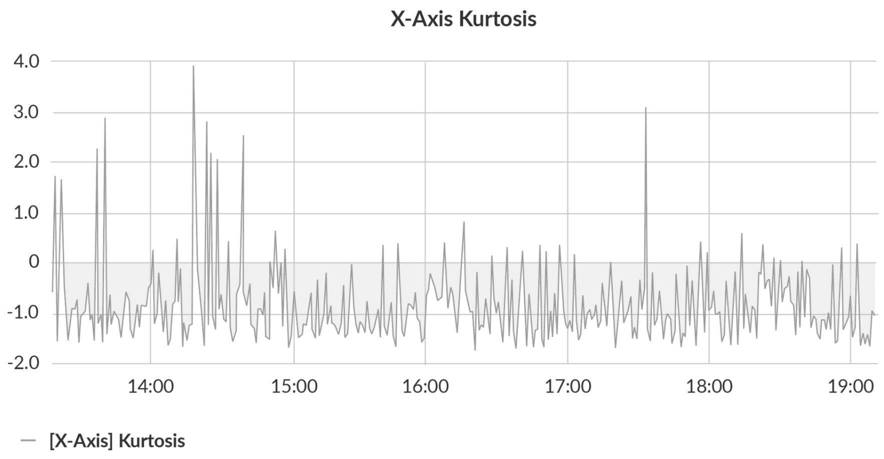


Figure 12 Example of Kurtosis in X axis.

Skewness refers to the measurement of the asymmetry of vibration signals along three perpendicular axes: X, Y, and Z. This statistical metric is essential in vibration analysis to understand the direction and degree of asymmetry in the vibration data in different directions.

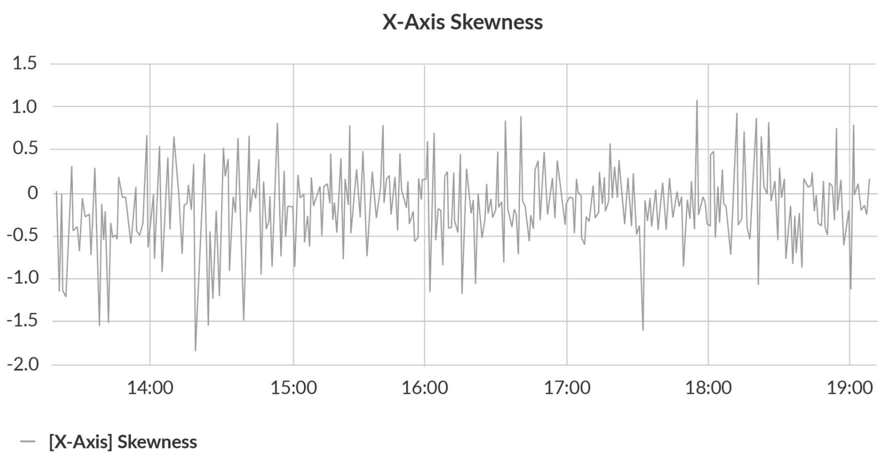


Figure 13 Example of Skewness in X axis.

Temperature and relative humidity

Temperature and relative humidity are measured by sensors placed inside the device enclosure. These measurements can be used to monitor if the device is working in recommended conditions.

External temperature measurement plays a crucial role in vibration monitoring of electric motors, providing valuable insights into the operational health and condition of the motor.

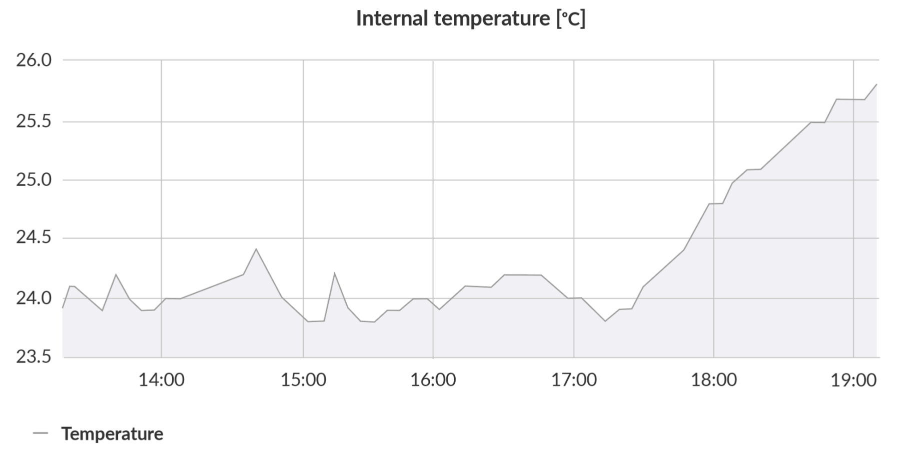


Figure 14 Internal temperature exemplary chart.

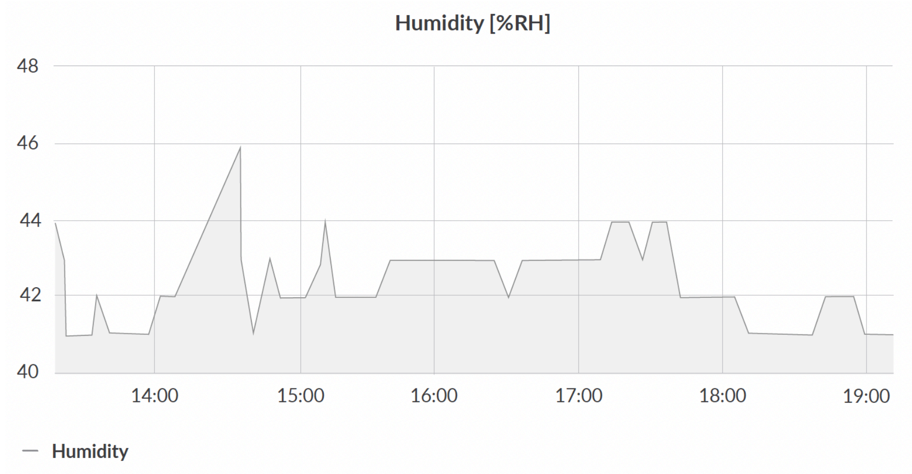


Figure 15 Internal humidity exemplary chart.

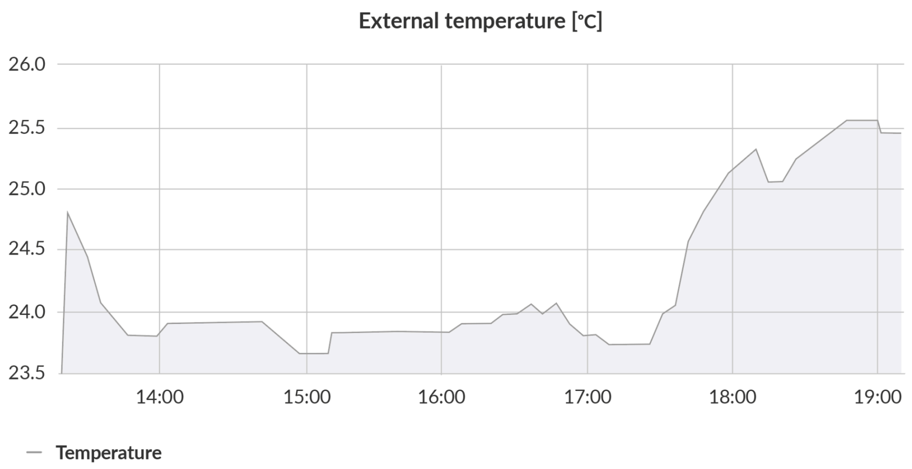


Figure 16 External temperature exemplary chart.

Battery condition

Battery voltage is used to monitor its condition – to spot anomalies (like sudden drop) or its current condition based on voltage drop over time in comparison to initial voltage rating.

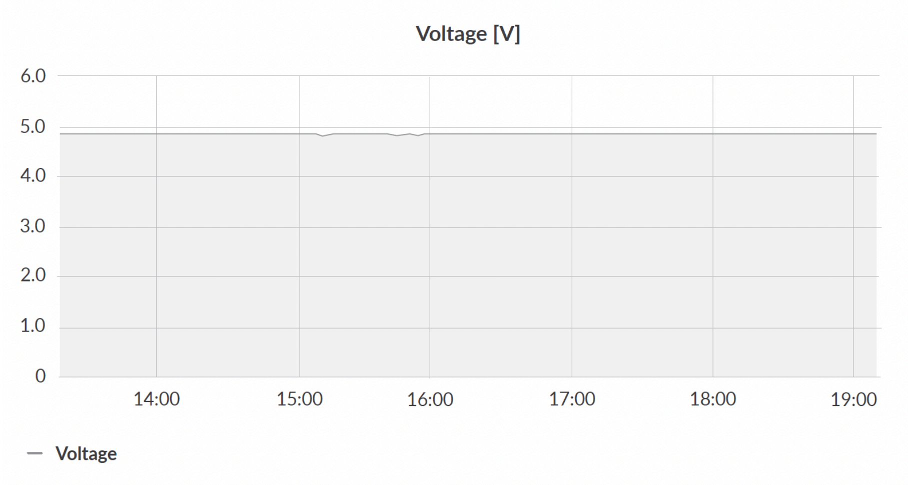


Figure 17 Battery voltage exemplary chart.

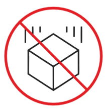
Installation

Package contents

1. Device (without batteries).
2. External vibration sensor.
3. Warranty card.

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.
	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. The device shouldn't be used without a cover.
	Any actions inside the device's enclosure (excluding replacing batteries) must be performed by trained personnel only.
	Clean the device only with a damp cloth.

Installation guide

1. Connect the sensor to the D-Sub socket on the device. Ensure that the connector is tightened on both sides.

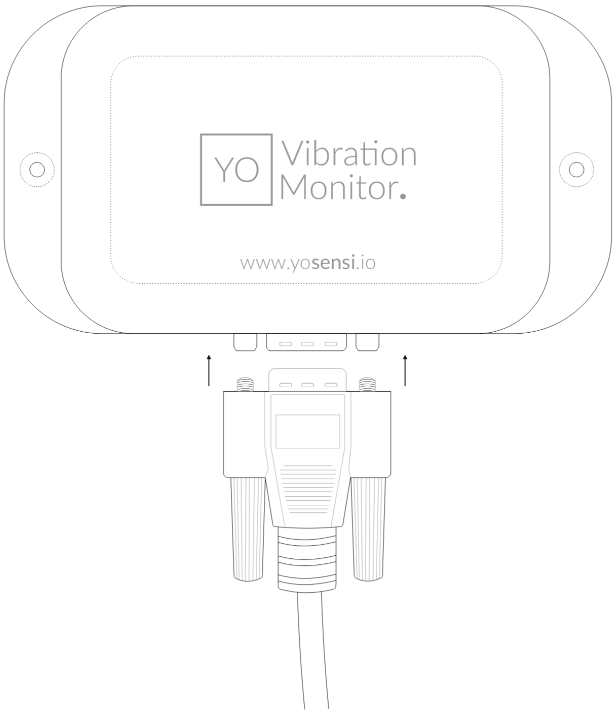


Figure 18 Connecting sensor to the device.

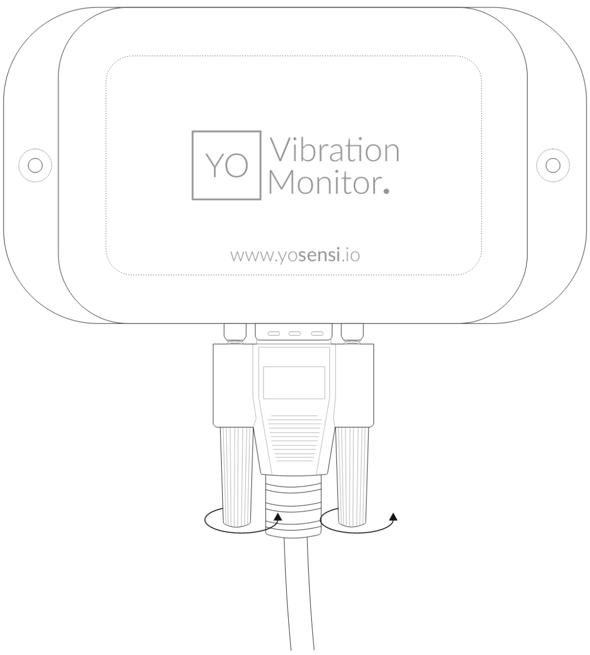


Figure 19 Tightening the sensor to the device.

2. Unscrew the device: remove 4 screws from the enclosure.

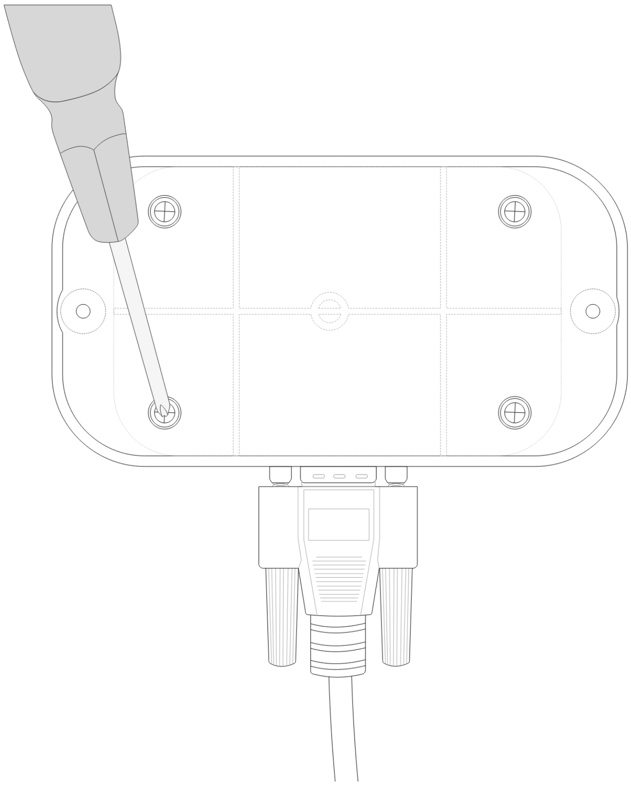


Figure 20 Back view of the device.

3. Place three LR6 (AA) batteries in the device according to the polarity indicated on the battery holder.

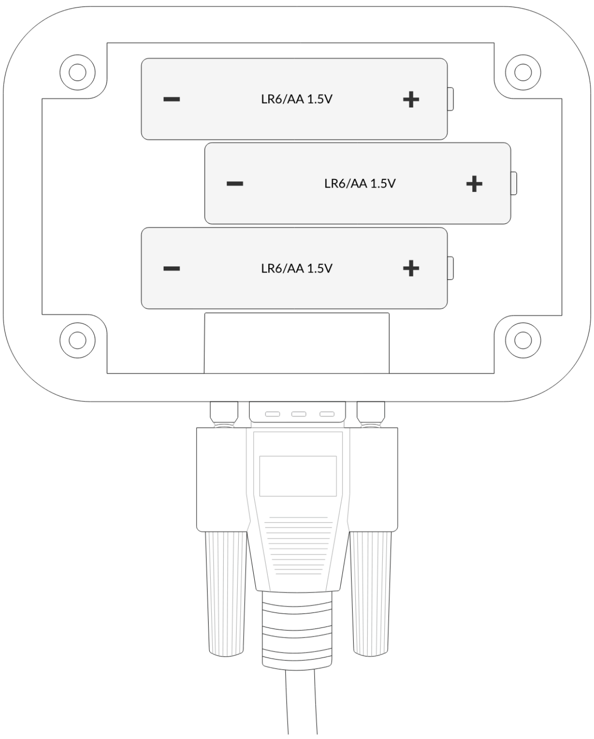


Figure 21 Battery placement instructions.

4. Assemble the device and screw it back together.
5. The device has an M5 thread. When placing an order, you can choose a different mounting option than the default one (magnet or external thread). Below are several recommended options for mounting the vibration sensor.

   A. **Magnet Mounting:** Screw the magnet into the M5 thread (if you are interested in this mounting option, select the magnet mount during the order process). Attach the device to the metal surface of the electric motor according to the X, Y, Z axes marked on the sensor enclosure.

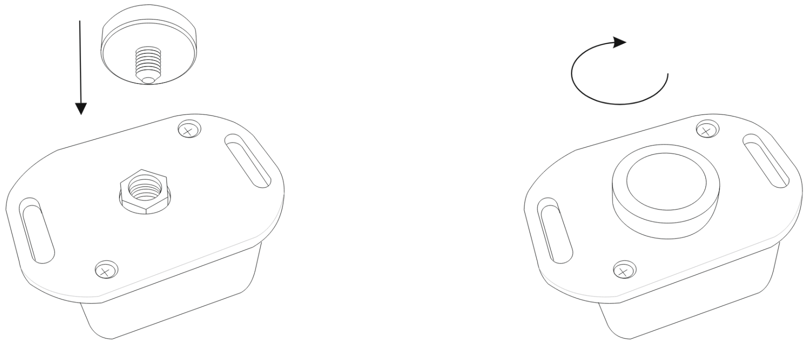


Figure 22 Magnet mounting view.

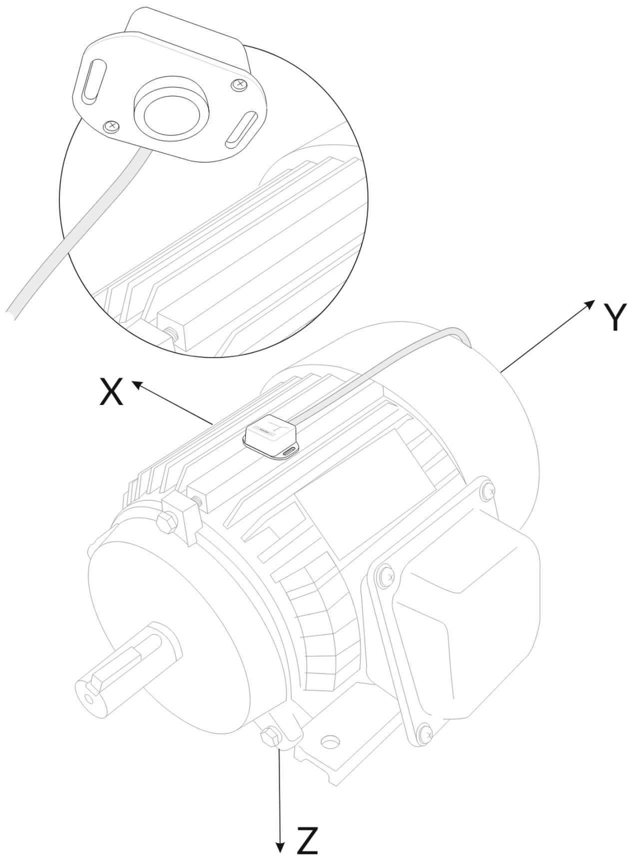


Figure 23 Magnet mounting view.

B. **Internal Thread Mounting:** Attach a screw fitting the M5 thread to the surface of the motor and screw the vibration sensor into it according to the X, Y, Z axes marked on the sensor enclosure.

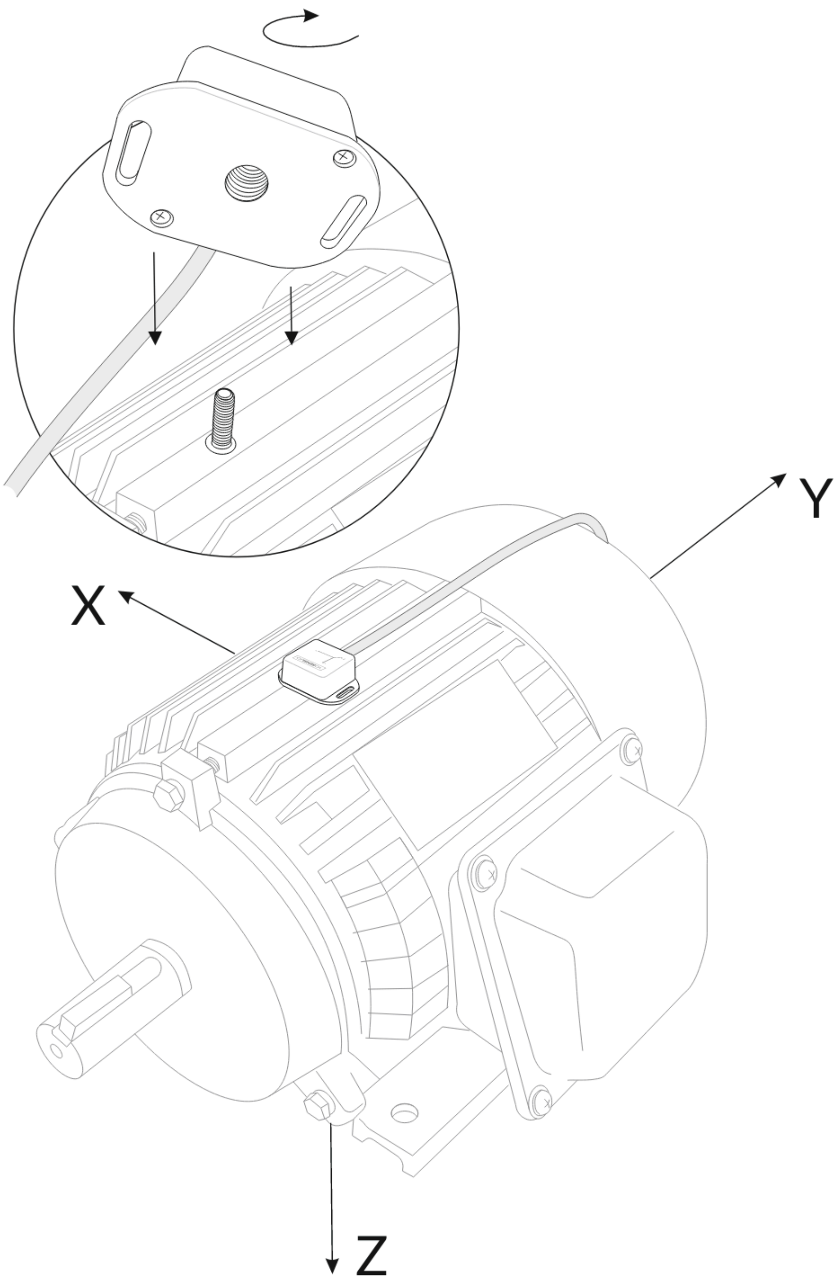


Figure 24 Internal thread mounting view.

C. **External Thread Mounting:** Attach an M5 thread fitting the screw in the device to the surface of the motor. Mount the vibration sensor on the electric motor according to the X, Y, Z axes marked on the sensor enclosure.

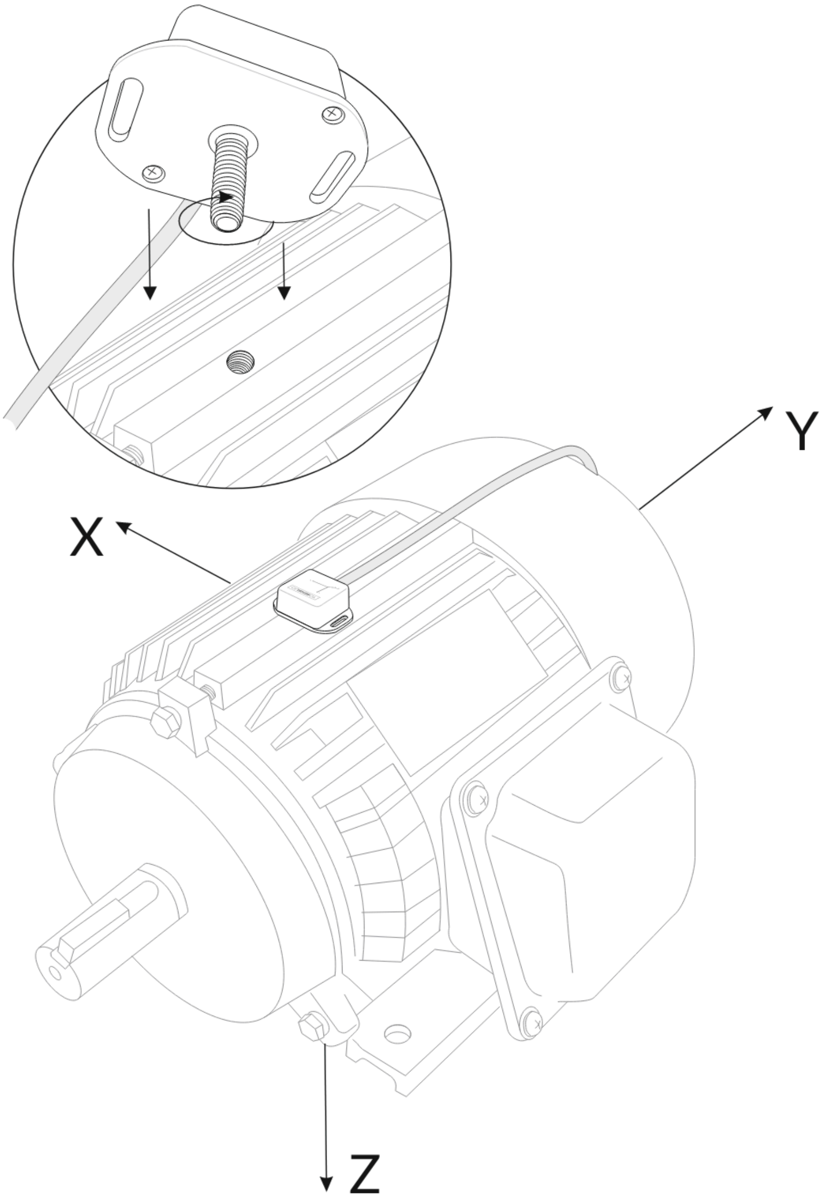


Figure 25 External thread mounting view.

D. **Mounting Bracket (Mounting Lugs):** Using the mounting lugs on the enclosure, attach the vibration sensor to the electric motor with, for example, zip ties or screws. Remember to position the sensor according to the X, Y, Z axes marked on the sensor enclosure.

Operation

IoT system components

Typical IoT systems consist of 3 main elements *(Figure 14)*, 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 send 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).

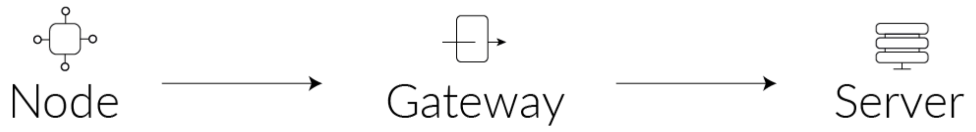


Figure 26 IoT system components.

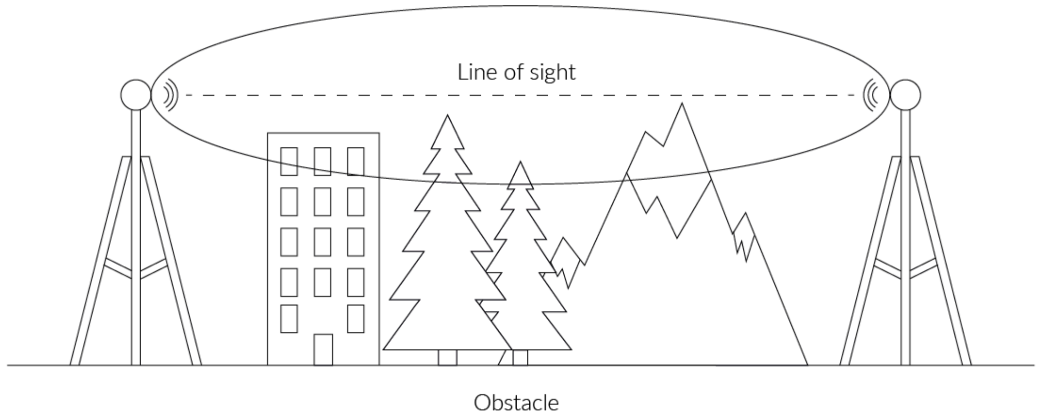


Figure 27 Fresnel zone where communication between two antennas can occur.

Device configuration

Configurable parameters

A few parameters must be set before sending data to the gateway. The default firmware is configured in OTAA mode with predefined *deveui*, *appkey* (OTAA) and *appskey*, *nwkskey* (ABP).

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

- **info** (generic, read only): information about the device,
- **lorawan** (generic): configuration data for LoRaWAN connection,
- **ble** (generic): bluetooth settings,
- **device** (dynamic): individual configuration for a specific device (this section's structure differs for each device),

Sample configuration file for the YO Vibration Monitor device.

```
{
        "info": {
                "devmodel": "LNVM",
                "fwver": "1.0.0",
                "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": 3600
        }
}
```

GENERICS PARAMETERS

SECTION	NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
info	devmodel	Device name	-	LNVM	R
	fwver	Firmware version	-	1.0.0	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]	60* –999999	3600	R/W

60 - OTAA minimum 60 [s], ABP minimum 120 [s]*

Parameters description

- ***nwktype:*** used for setting the device in public or private network type.
- ***acttype:*** used for setting the device in ABP or OTAA mode.
- ***deveui, … , appskey:*** predefined addresses and keys, these parameters are generated using multiple IDs specific to the particular MCU and are unique for each device. They can be changed if needed.
- ***interval:*** determines the interval of sending broadcast packets, used to connect to every BLE receiver around the device.
- ***subband:*** used for setting the communication frequency sub-band in LoRaWAN.
- ***measinterval:*** measurement interval [s] between sending LoRa packets.

FREQUENCY PLAN

<table>
<tr><th>REGION</th><th>DESCRIPTION</th><th>POSSIBLE VALUES</th><th>DEFAULT VALUE</th><th>READ/ WRITE</th></tr>
<tr><td>EU868</td><td>Sub-band 1; 867.1 - 868.5 MHz; channels 0-7</td><td>1</td><td>1</td><td>R</td></tr>
<tr><td rowspan="8">US915</td><td>Sub-band 1; 902.3 - 903.7 MHz; channels 0-7</td><td>1</td><td rowspan="8">2</td><td rowspan="8">R/W</td></tr>
<tr><td>Sub-band 2; 903.9 - 905.3 MHz; channels 8-15</td><td>2</td></tr>
<tr><td>Sub-band 3; 905.5 - 906.9 MHz; channels 16-23</td><td>3</td></tr>
<tr><td>Sub-band 4; 907.1 - 908.5 MHz; channels 24-31</td><td>4</td></tr>
<tr><td>Sub-band 5; 908.7 - 910.1 MHz; channels 32-39</td><td>5</td></tr>
<tr><td>Sub-band 6; 910.3 - 911.7 MHz; channels 40-47</td><td>6</td></tr>
<tr><td>Sub-band 7; 911.9 - 913.3 MHz; channels 48-55</td><td>7</td></tr>
<tr><td>Sub-band 8; 915.5 - 914.9 MHz; channels 56-63</td><td>8</td></tr>
<tr><td></td><td>Sub-band 1; 915.2 -916.6 MHz; channels 0-7</td><td>1</td><td>2</td><td>R/W</td></tr>
</table>

AU915	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 is 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

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

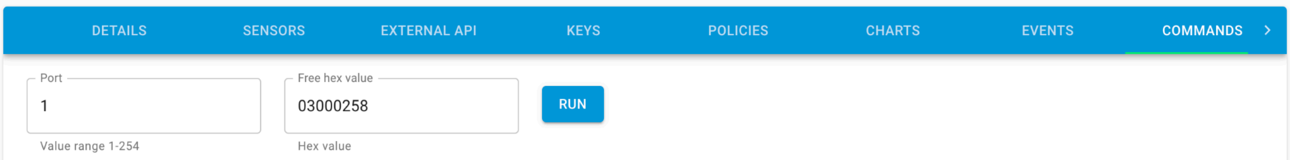


Figure 28 Downlink message example.

Node configuration with 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.
    - Recover device – this section restores 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 to configure parameters. 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.

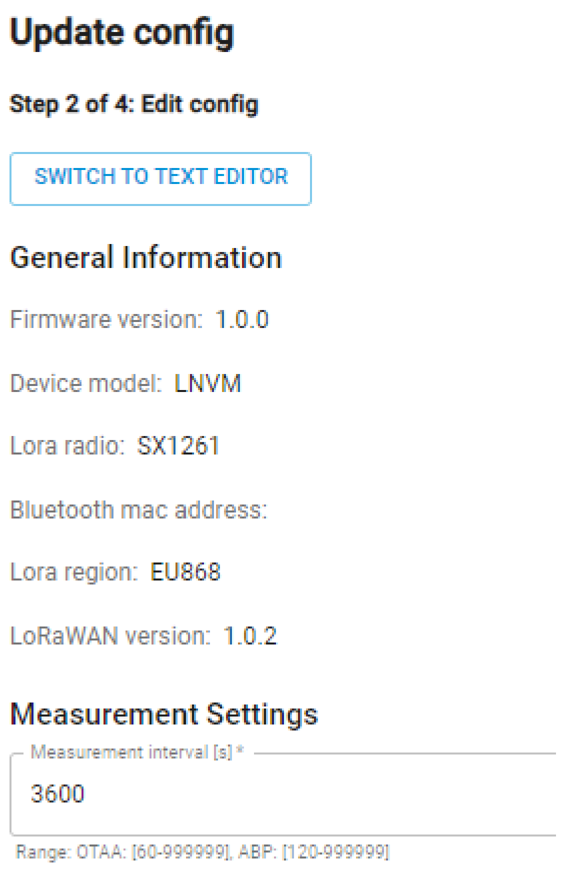


Figure 29 Update configuration section view.

6. Press the upload button and wait.

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

Node configuration via 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.

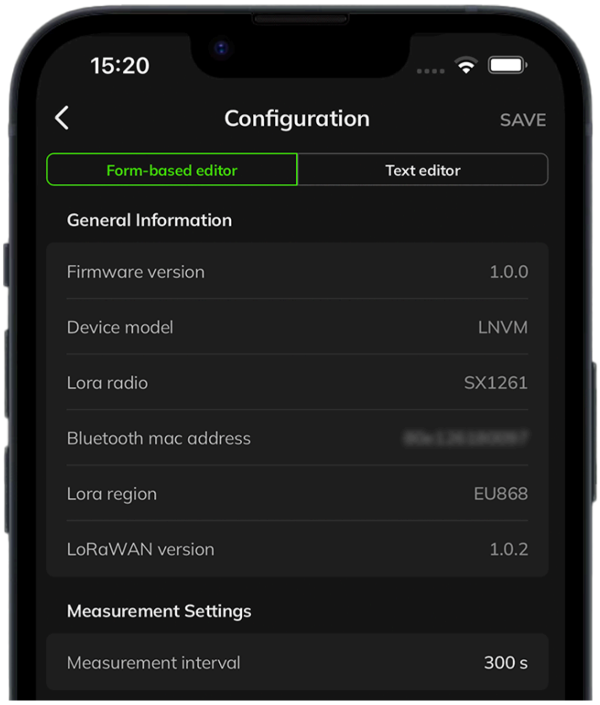


Figure 30 Configuration view in mobile app.

5. After changing parameters press the 'save' button.

Connecting node to the 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. Contact us on contact@yosensi.io for more information and pricing.**

Adding a node manually

Yosensi Management Platform integration instructions:

1. Log in to 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 a new application, press the bottom right '+' button. Fill in the 'Name' and 'Description' fields and select an 'Application Profile', which is the region definition.

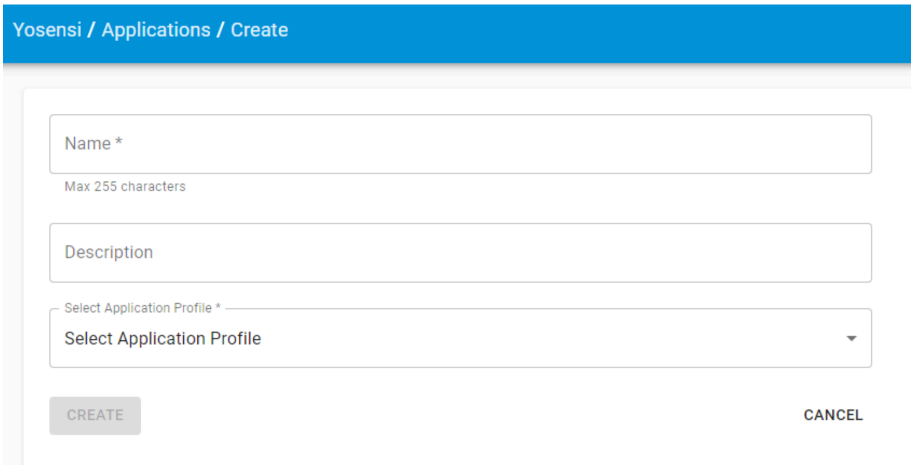


Figure 31 Application creation form.

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, 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 Vibration Monitor). 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>.

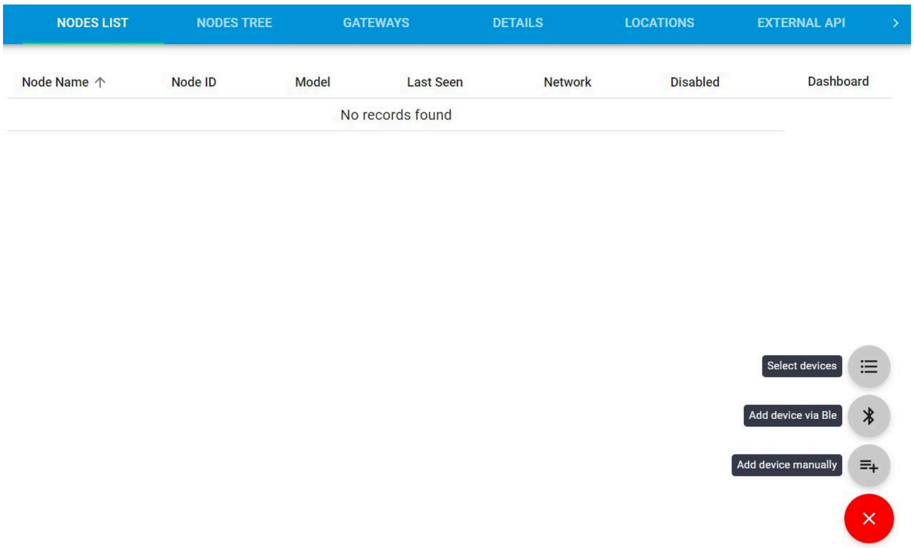


Figure 32 Adding node to the Yosensi Management Platform section view.

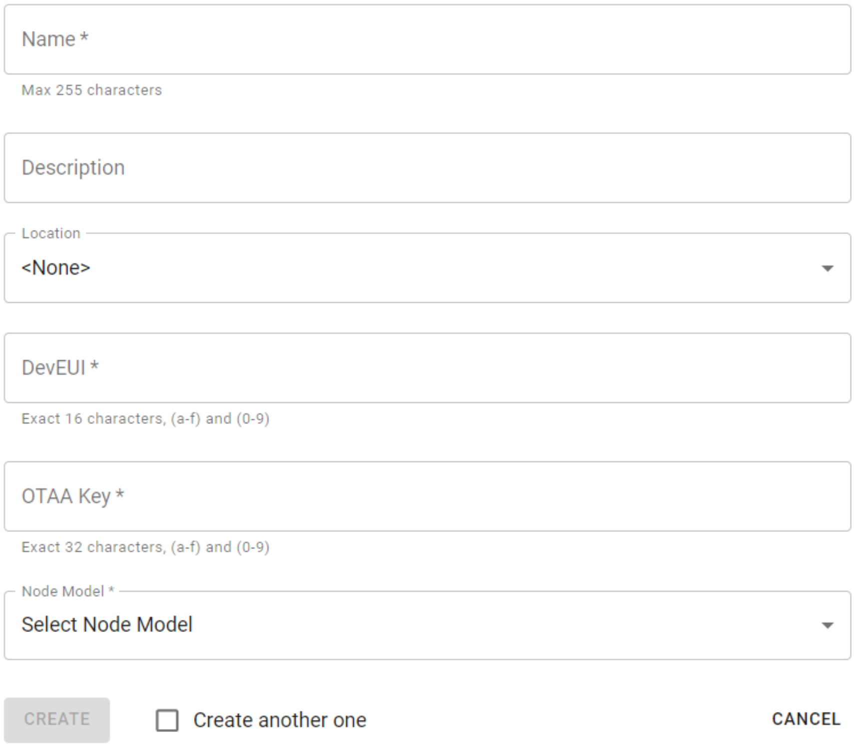


Figure 33 Node creation form.

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.

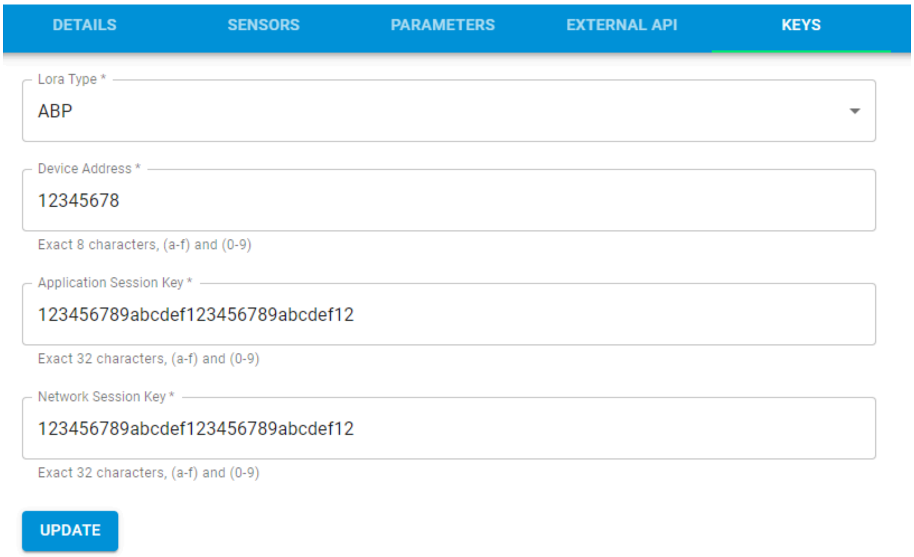


Figure 34 Node LoRa type configuration form.

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 decoder

If you want to connect to your own server, it is necessary to decode the specific payload for each device. To accomplish this, a payload decoder is required, which can be downloaded using the following link: Payload decoder. Extended documentation of the protocol can be found in the Payload description on our website. An example payload produced by YO Vibration Monitor is presented below with divisions for each measurement and marked with decoded values, whose interpretation is described in the Payload description.

Example of YO Vibration Monitor payload with description:

First frame (uplink):

02:3d:00:01:08:00:01:12:b0:0d:00:01:00:fc:10:00:00:29:0d:00:11:4a:00:f6:43:00:15:00:00:46:00:88:00:57:43:00:15:01:00:63:00:bf:00:7a

Payload header				**First measurement (battery voltage)**				
0x02	0x3d	0x00	0x01	0x08	0x00	0x01	0x12	0xb0
ver = 2	cnt = 61	pct [s] = 1		type = 2 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 4784 (4784 [mV])	

Second measurement (internal temperature)

0x0d	0x00	0x01	0x00	0xfc
type = 3 prec = 1	md [s] = 0	addr_len = 0 meas_len = 2	val = 252 (25,2 [°C])	

Third measurement (internal relative humidity)

0x10	0x00	0x00	0x29
type = 4 prec = 0	md [s] = 0	addr_len = 0 meas_len = 1	val = 41 (41 [%])

Fourth measurement (external temperature)

0x0d	0x00	0x11	0x4a	0x00	0xf6
type = 3 prec = 1	md [s] = 0	addr_len = 1 meas_len = 2	addr = 74	val = 243 (24,3 [°C])	

Fifth measurement (accelerometer - RMS g X/Y/Z)

0x43	0x00	0x15	0x00	0x00	0x46	0x00	0x88	0x00	0x57
type = 16, prec = 3	md [s] = 0	addr_len = 1, meas_len = 6	addr = 0	val = 70 (X = 0,07[g])		val = 136 (Y = 0,136 [g])		val = 87 (Z = 0,087 [g])	

Sixth measurement (accelerometer - Peak g X/Y/Z)

0x43	0x00	0x15	0x01	0x00	0x63	0x00	0xbf	0x00	0x7a
type = 16, prec = 3	md [s] = 0	addr_len = 1, meas_len = 6	addr = 1	val = 99 (X = 0,099 [g])		val = 191 (Y = 0,191 [g])		val = 122 (Z = 0,122 [g])	

Second frame (uplink):

02:3e:00:1e:42:00:15:02:01:1b:00:f2:00:f7:42:00:15:03:00:07:00:0e:00:09:42:00:15:04:00:03:00:06:00:16:42:00:15:05:ff:df:ff:bc:ff:aa

Payload header

0x02	0x3e	0x00	0x1e
ver = 2	cnt = 62	pct [s] = 30	

First measurement (accelerometer - Crest Factor X/Y/Z)

0x42	0x00	0x15	0x02	0x01	0x1b	0x00	0xf2	0x00	0xf7
type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6	addr = 2	val = 283 (X =2,83)		val = 242 (Y = 2,42)		val = 247 (Z =2,47)	

Second measurement (accelerometer - Standard Deviation X/Y/Z)

0x42	0x00	0x15	0x03	0x00	0x07	0x00	0x0e	0x00	0x09
type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6	addr = 3	val = 7 (X = 0,0)		val = 14 (Y = 0,14)		val = 9 (Z = 0,09)	

Third measurement (accelerometer - Skewness X/Y/Z)

0x42	0x00	0x15	0x04	0x00	0x03	0x00	0x06	0x00	0x16
type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6	addr = 4	val = 3 (X = 0,03)		val = 6 (Y = 0,06)		val = 22 (Z = 0,22)	

Fourth measurement (accelerometer - Kurtosis X/Y/Z)

0x42	0x00	0x15	0x05	0xff	0xdf	0xff	0xbc	0xff	0xaa
type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6	addr = 5	val = -33 (X = -0,33)		val = -68 (Y = -0,68)		val = -86 (Z = -0,86)	

Third frame (uplink):

02:3f:00:3c:42:00:15:06:00:31:00:71:00:70:40:00:15:07:00:04:00:08:00:08

Payload header

0x02	0x3f	0x00	0x3c
ver = 2	cnt = 63	pct [s] = 60	

First measurement (accelerometer - Velocity RMS X/Y/Z)

0x42	0x00	0x15	0x06	0x00	0x31	0x00	0x71	0x00	0x70
type = 16, prec = 2	md [s] = 0	addr_len = 1, meas_len = 6	addr = 6	val = 49 (X = 0,49 [mm/s])		val = 113 (Y = 1,13 [mm/s])		val = 112 (Z = 1,12 [mm/s])	

Third measurement (accelerometer - Peak-to-Peak Displacement X/Y/Z)

0x40	0x00	0x15	0x07	0x00	0x04	0x00	0x08	0x00	0x08
type = 16, prec = 0	md [s] = 0	addr_len = 1, meas_len = 6	addr = 7	val = 4 (X = 4 [µm])		val = 8 (Y = 8 [µm])		val = 8 (Z = 8 [µm])	

Compliance statements

CE

EC DECLARATION OF CONFORMITY
No. 02/2024/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 Vibration Monitor**
Technical data	**Voltage 4,5 V DC; current max 120mA; 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 L153/62of 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:

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
EN IEC 61326-1:2021	Electrical equipment for measurement, control and laboratory use -- EMC requirements -- Part 1: General requirements (IEC 61326-1:2020)
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: 24

Founder/R&D Director
Paweł Popławski

Białystok, 2024-05-15

Place and date of issue

Name, surname and signature of the authorized person

YOSENSI.IO

CE

UNITED KINGDOM CONFORMITY ASSESSED
No. 02/2024/UKCA

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

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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)
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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
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Founder/R&D Director
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Białystok, 2024-05-15
....
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Name, surname and signature of the authorized person

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