YOSENSI.IO

YO 360

User guide v1.3

Release notes

Released	Version	Key changes
25.08.2022	1.0	Initial release.
20.06.2023	1.1	Added configuration node with Yosensi Management Platform.
31.07.2023	1.2	Changed description of connecting nodes with Yosensi Management Platform.
26.10.2023	1.3	Added configuration with Yosensi Mobile App

Content

Product description

Overview

YO 360 measures temperature and humidity and sends information about its own position on the x, y and z axes (built-in accelerometer). Its small size, battery power supply and long data transmission range allow the device to be used in virtually any place. The enclosure is suitable for indoor use.

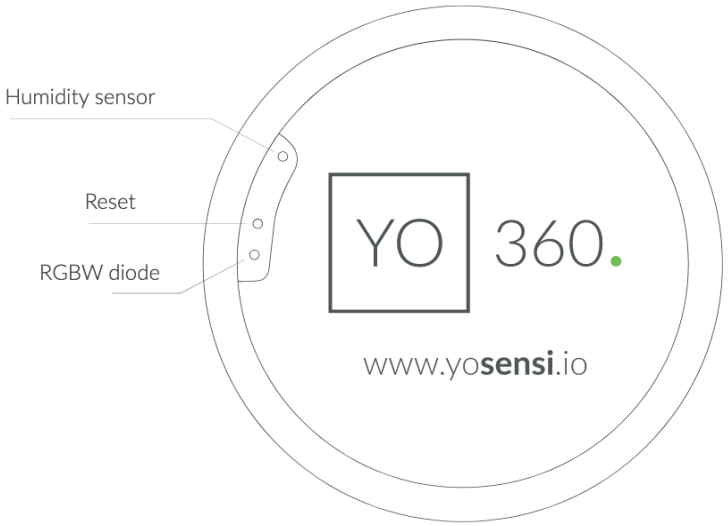

Figure 1 Device top view.

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 2 Device label.

Physical interfaces

LEDs

YO 360 communicates its current behaviour to the user by RGBW LED placed on the top.

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

YO 360 is equipped with one reset button inside the device on the PCB board next to the RGBW LED diode. It is shown on figure number 1 it is possible to press it with a thin stick.

Specifications

Physical

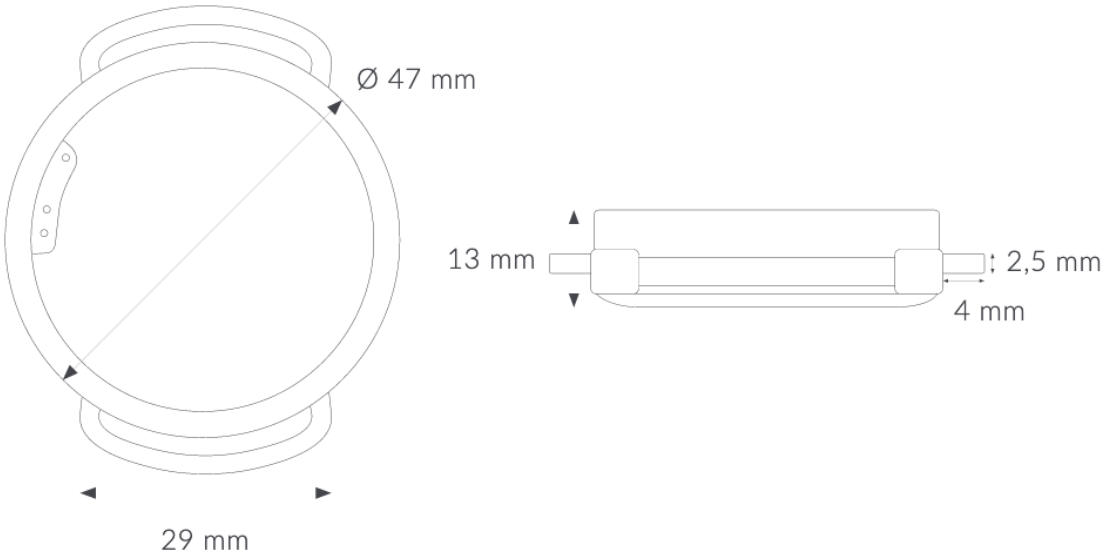

Figure 3 Dimensions of the device.

PHYSICAL SPECIFICATION	
Dimensions	Diameter: 47mm Height: 13mm
Colour	White Black
Mounting method	Chose from: • No handles • One handle (mounting hole) • Two oval handles • Strap
Enclosure material	ABS
Level of protection	IP40
Weight	18,6 g

Operating conditions

OPERATING CONDITIONS	
Temperature	0° to 70°C
Humidity	0 to 90%
Placement	Indoor use
Power supply	Battery CR2450 3 V
Power consumption	Maximum: 110 mA DC (3 V DC)

Measured values

MEASUREMENT RANGES

Parameter	Measuring range	Accuracy
Temperature (internal)	-40°C to 125°C	±0,2°C (from 5°C to 60°C)
Relative humidity	0% to 100%	±2% (at 20% to 80%)
Accelerometer	±180 ° on X, Y, Z axes	±0,1° (from -40°C to 85°C)

Internal Temperature and relative internal 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.

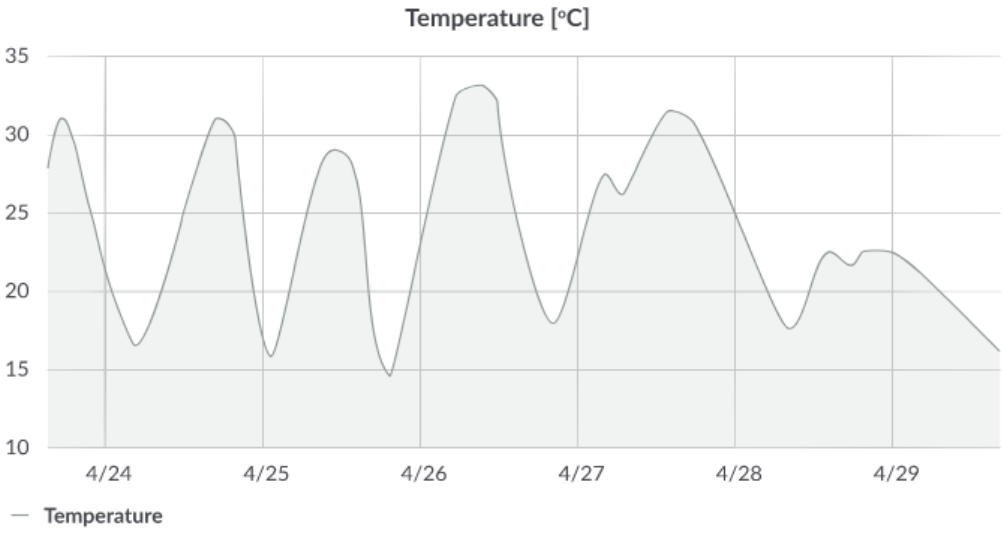

Figure 4 Exemplary internal temperature monitoring chart.

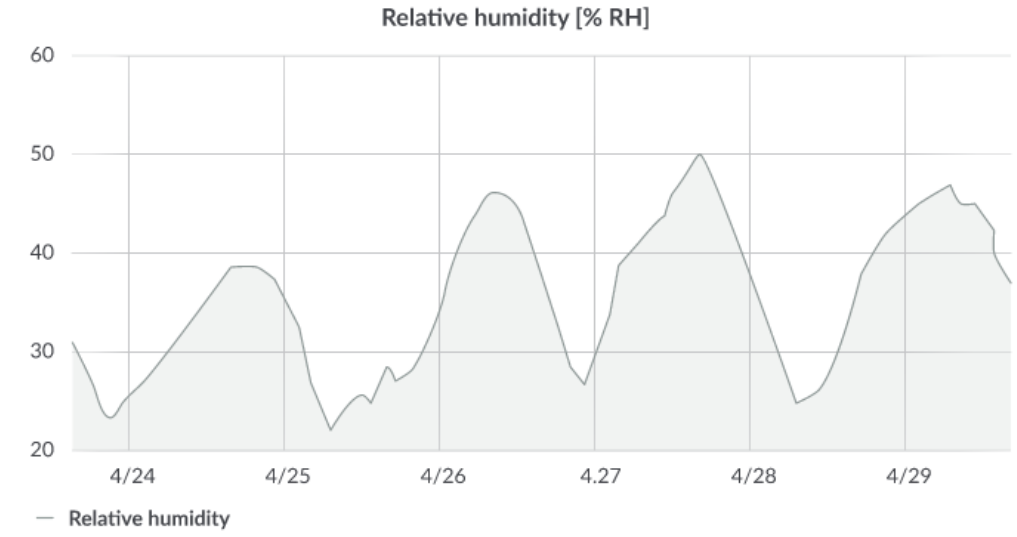

Figure 5 Exemplary relative humidity monitoring chart.

Accelerometer

The accelerometer sensor is providing position of a device in X, Y, Z axes and stores data about what time it was moved to another location. Accelerometer informs in which position measurements of temperature and humidity were done.

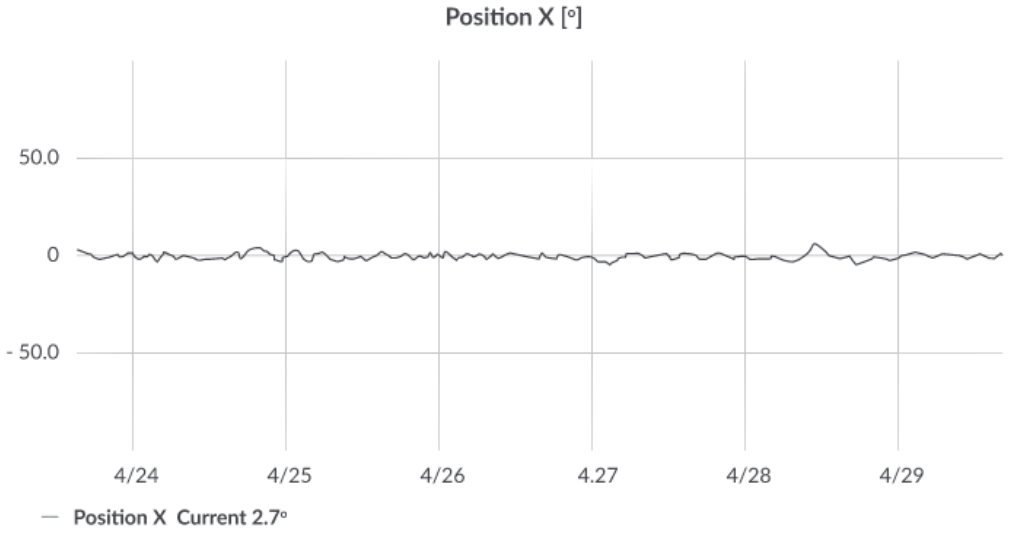

Figure 6 Exemplary accelerometer monitoring chart position X.

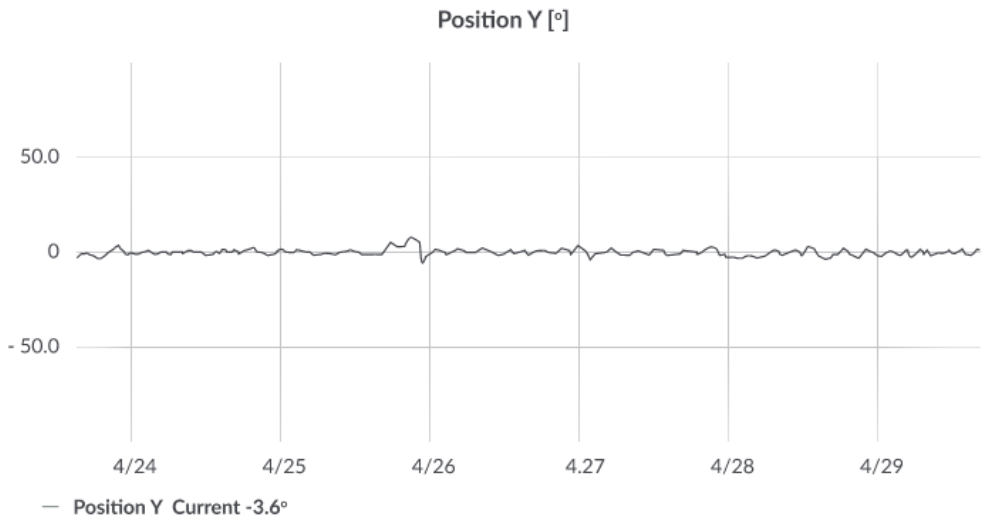

Figure 7Exemplary accelerometer monitoring exemplary chart position Y.

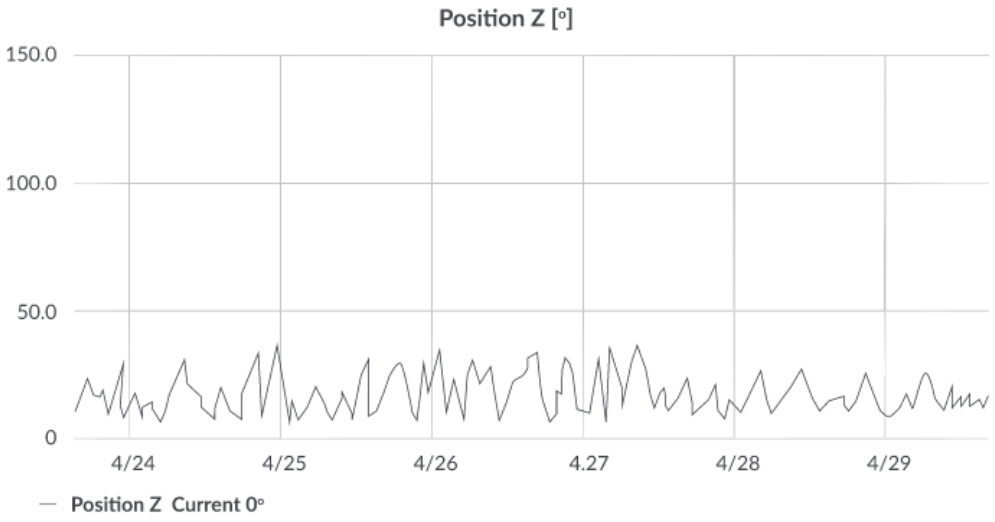

Figure 8 Accelerometer monitoring exemplary chart position Z.

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.

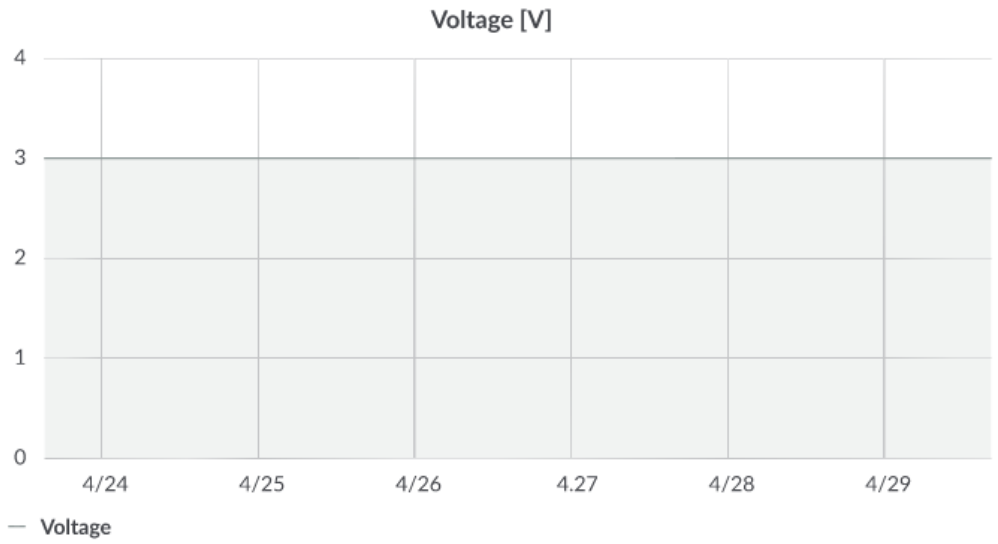

Figure 9 Battery voltage exemplary chart.

Installation

Package contents

1. Device (without batteries).
2. 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. 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. Make sure that device is not exposed for long term UV rays and in an environment in the immediate vicinity of water which may flood the device

Installation guide

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

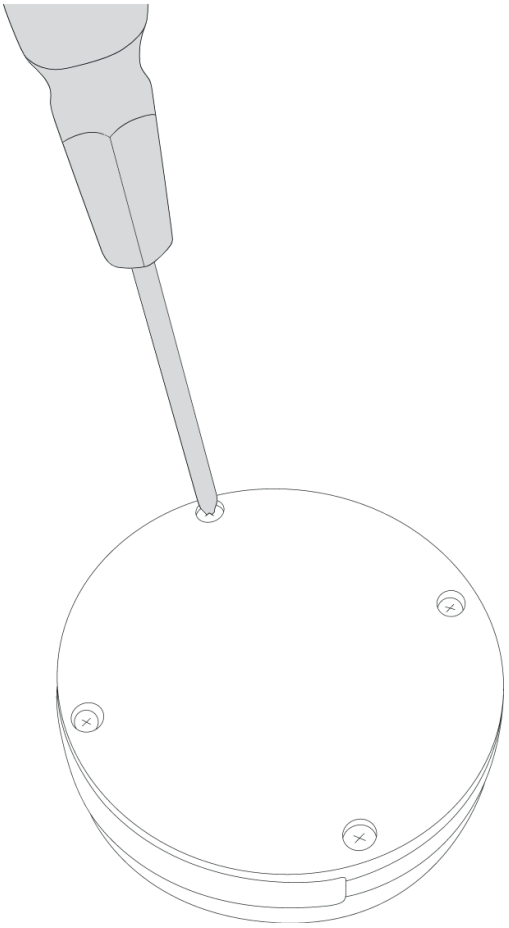

Figure 10 Device opening instructions.

2. Place CR2450 3 V battery in the device according to the polarity.

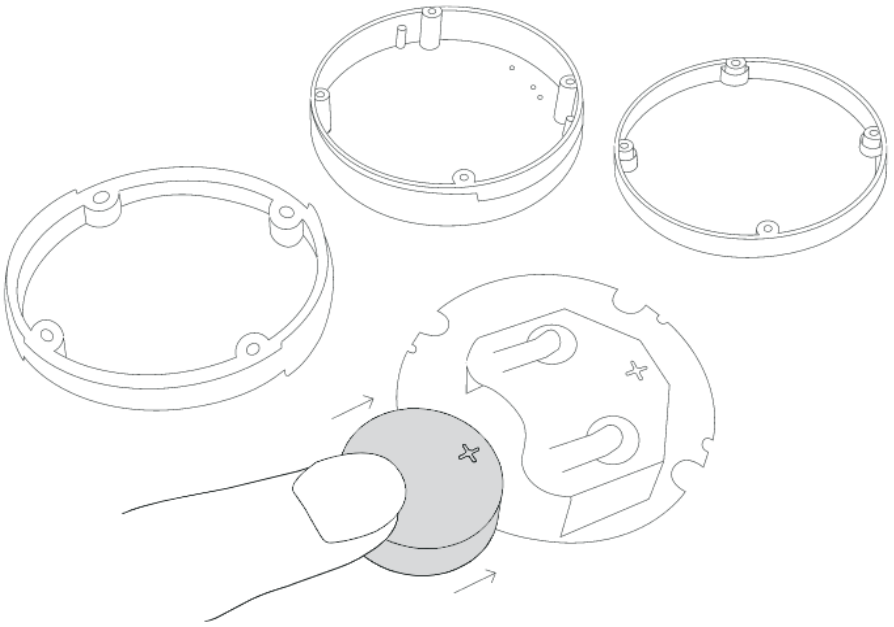

Figure 11 Device battery assembling instructions.

3. Assemble the device. The order of the elements is important:

- Place the PCB (B) at the top of the enclosure (A)
- Then insert the seal (C)
- Fit the bottom part of the enclosure (D)

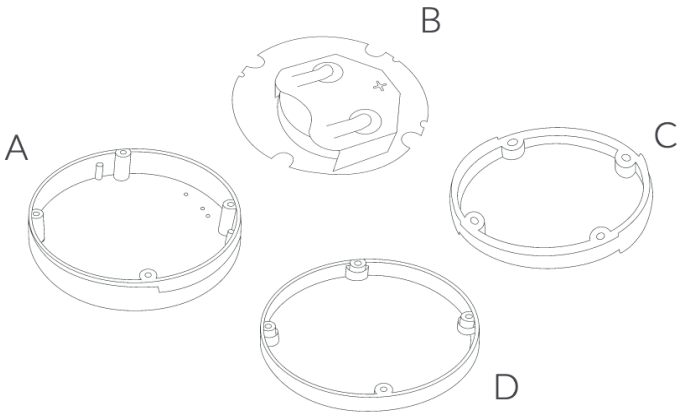

Figure 12 Assemble device instruction.

4. Match the PCB (marked components) to the enclosure according to the diagram. Place the PCB in the enclosure with the battery basket facing up

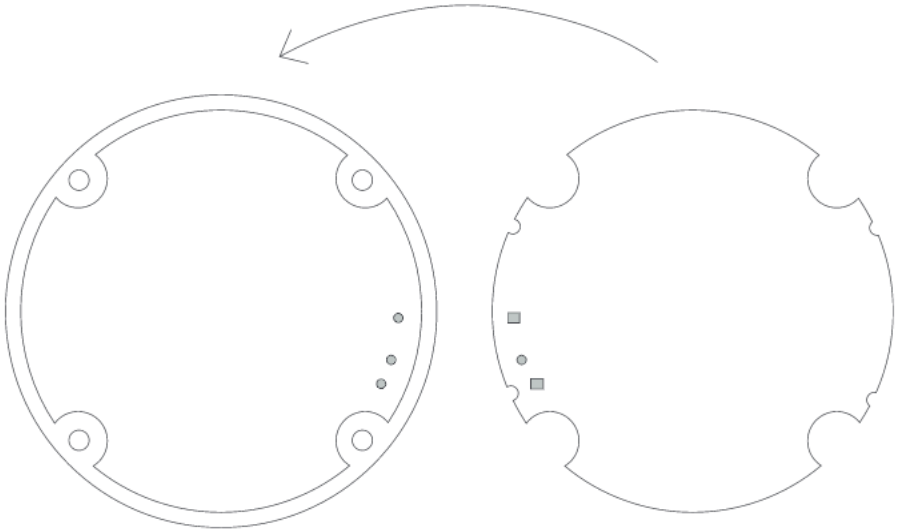

Figure 13 Matching the PCB to the enclosure instructions.

5. The device is on. Screw it back together.

Figure 14 Assembled device top view.

Operation

IoT system components

Typical IoT systems consist of 3 main elements *(Figure 15)*, 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).

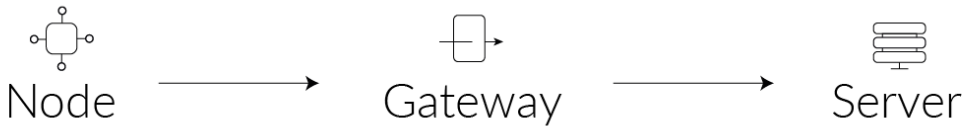

Figure 15 IoT system components.

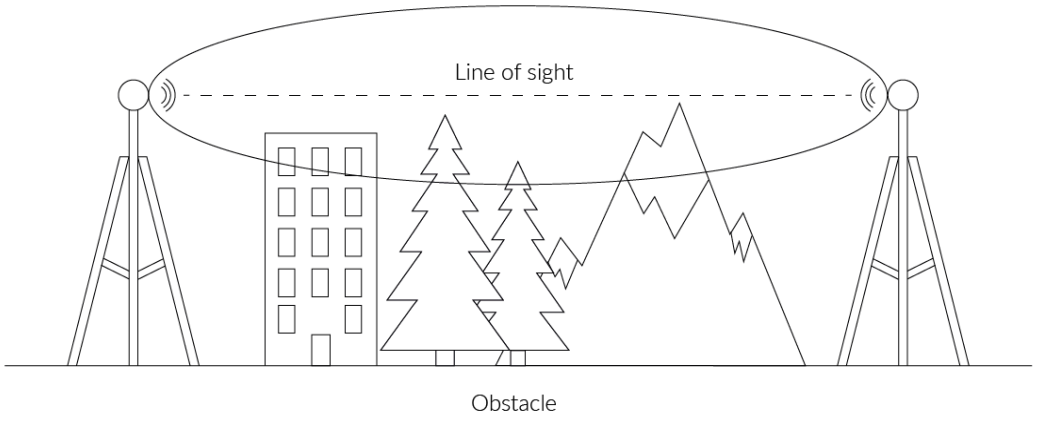

Figure 16 Fresnel zone where communication between two antennas can occur.

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 360 device.

```
{
        "info": {
                "devmodel": "LNPC",
                "fwver": "3.6.1",
                "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": 7200
        }
}
```

GENERICS PARAMETERS

SECTION	NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
info	devmodel	Device name	-	LNPC	R
	fwver	Firmware version	-	3.6.1	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]	120–999999	7200	R/W

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.

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 is not supported*

Configuration node 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 to version 3.4.0 and newer.
    - 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 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.

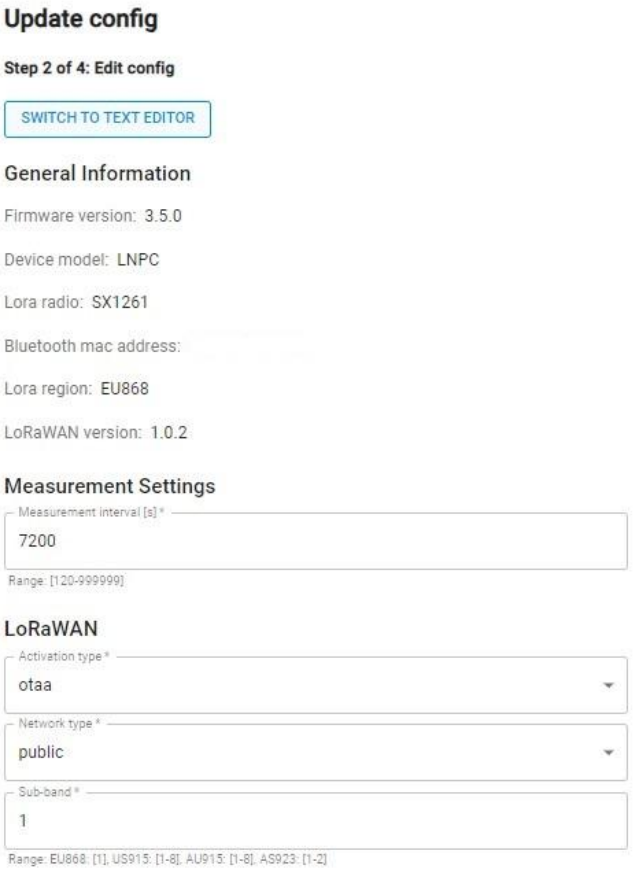

Figure 17 Update configuration section view.

6. Press the Upload button and wait.

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

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.

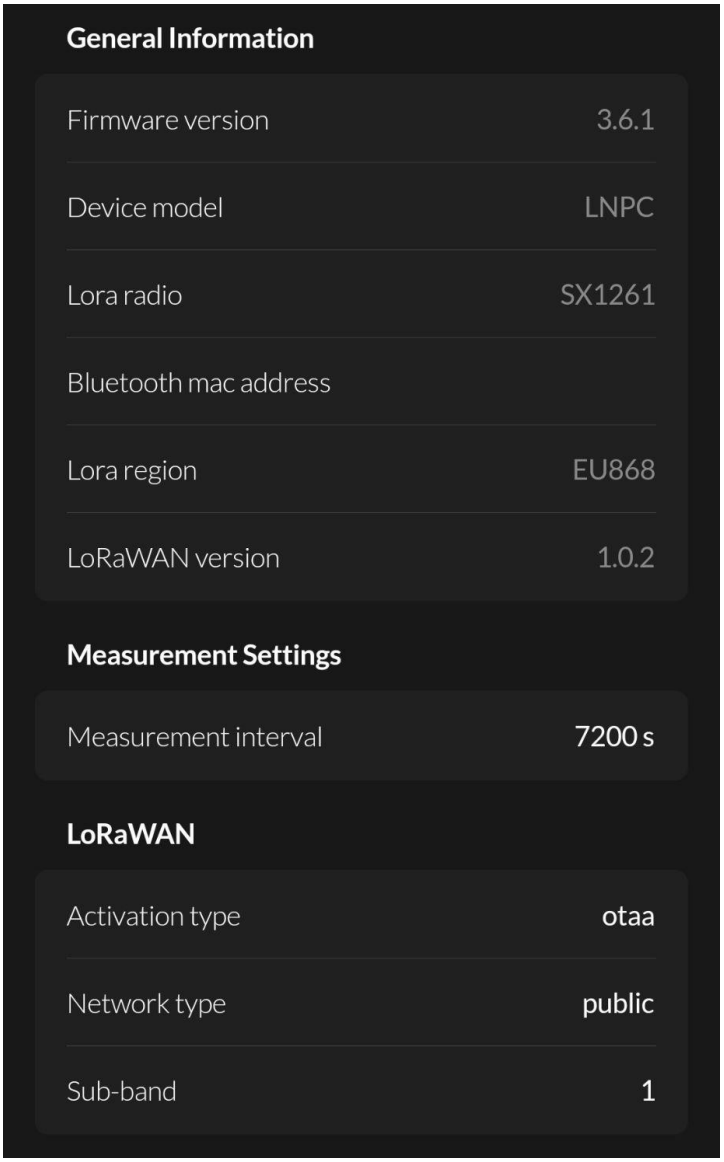

Figure 18 Configuration view in mobile app.

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. 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.

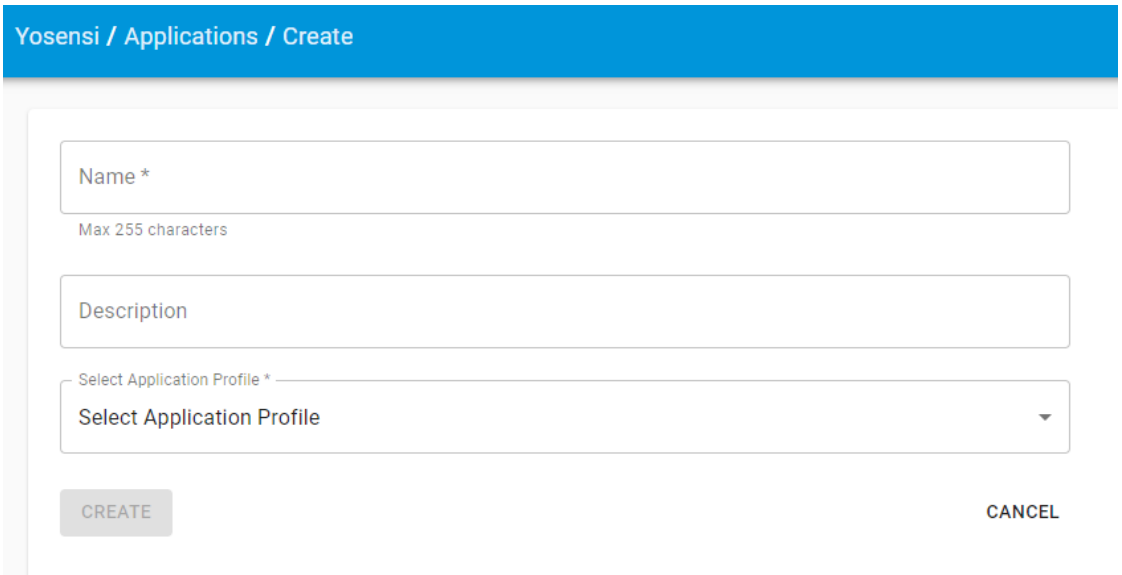

Figure 19 Application creation form.

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 360). 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>.

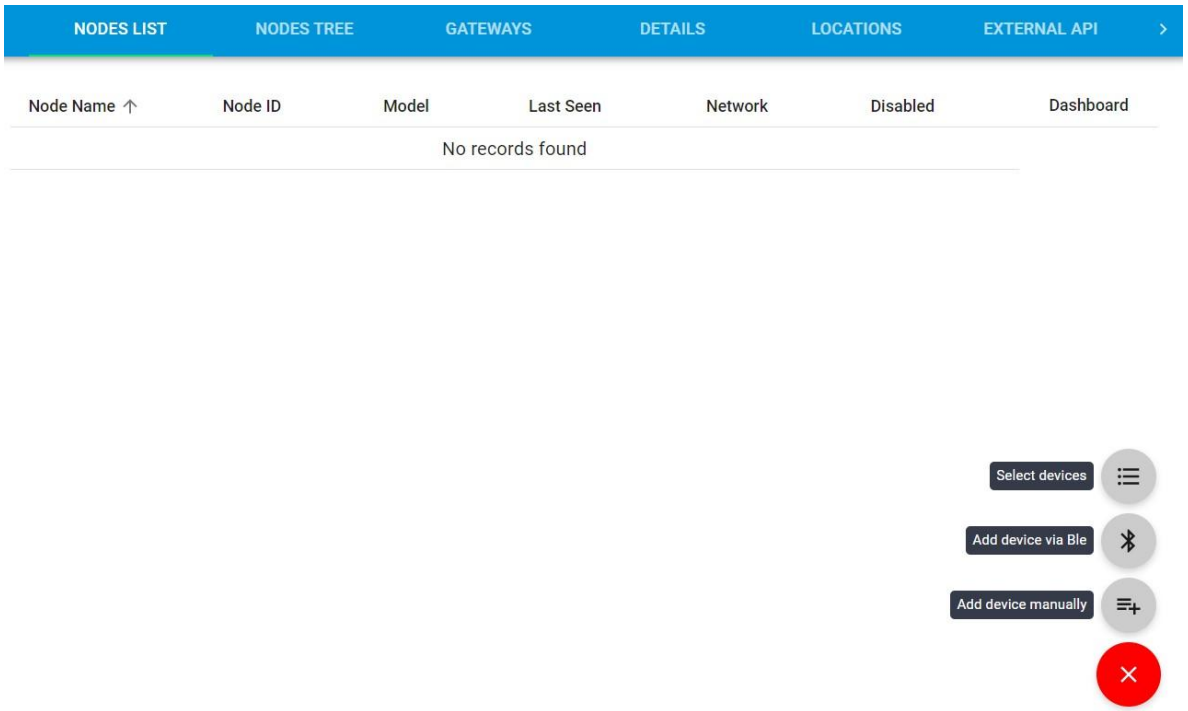

Figure 20 Adding node to the Yosensi Management Platform section view.

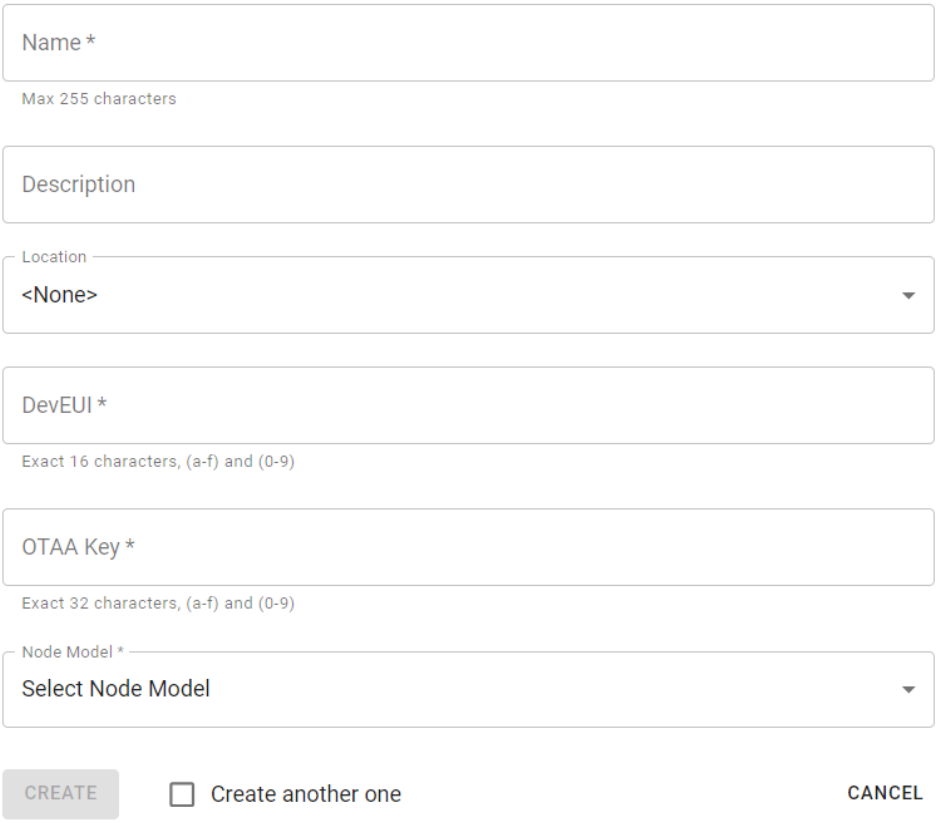

Figure 21 Node creation form.

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.

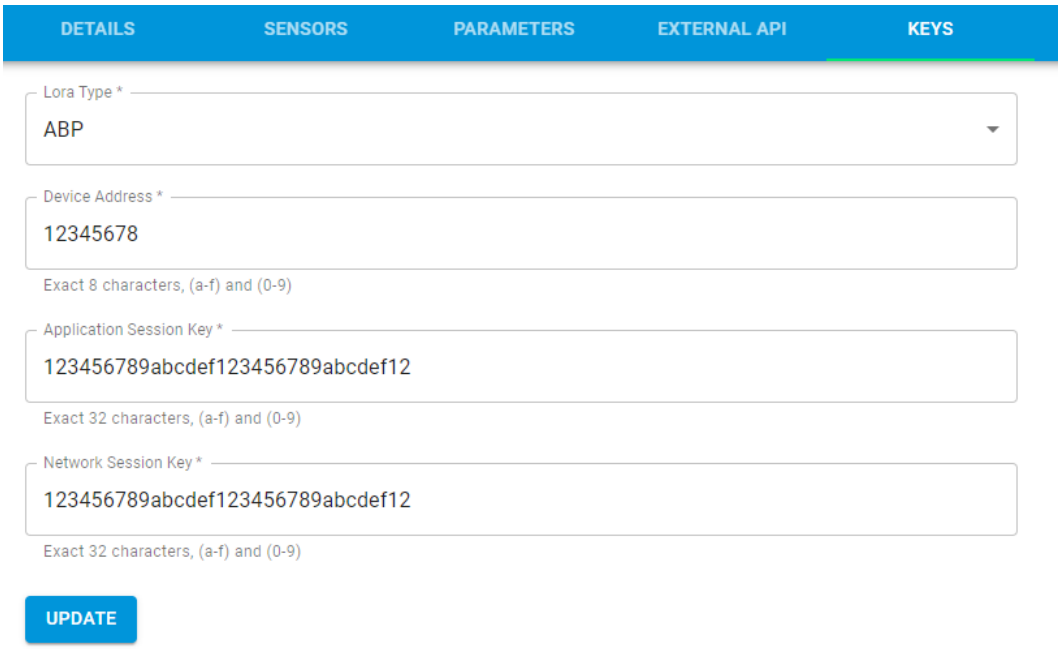

Figure 22 Node LoRa type configuration form.

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, 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 360 is presented below with divisions for each measurement and marked with decoded values, whose interpretation is described in the Payload description.

Example of YO 360 payload with description:

02:00:00:00:08:00:01:0b:62:0d:00:01:00:f6:10:00:00:2f:41:00:15:19:ff:f9:00:1e:00:5b

Payload header				**First measurement (battery voltage)**				
0x02	0x00	0x00	0x00	0x08	0x00	0x01	0x11	0xCE
ver = 2	cnt = 0	pct [s] = 0		type = 2 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 2914 (2914[mV])	

Second measurement (temperature)

0x0D	0x00	0x01	0x00	0xF6
type = 3 prec = 1	md [s] = 0	addr_len = 0 meas_len = 2	val = 246 (24,6[°C])	

Third measurement (relative humidity)

0x10	0x00	0x00	0x2F
type = 4 prec = 0	md [s] = 0	addr_len = 0 meas_len = 1	val = 47 (47[%])

Fourth measurement (accelerometer - angles)

0x41	0x00	0x15	0x19	0xFF	0xF9	0x00	0x1E	0x00	0x5B
type = 16, prec = 1	md [s] = 0	addr_len = 1, meas_len = 6	addr=19	val = -7 (-0,7[°])		val = 30 (3,0 [°])		val = 91 (9,1 [°])	