YOSENSI.IO

YO Pulse

User guide v1.4

Release notes

Released	Version	Key changes
05.09.2022	1.0	Initial release.
21.07.2023	1.1	Added node configuration with Yosensi Management Platform. Changed description of connecting nodes with Yosensi Management Platform.
26.10.2023	1.2	Added configuration with Yosensi Mobile App.
13.06.2024	1.3	General content corrections.
30.07.2024	1.4	Added configuration parameter. Added change measinterval via Downlink. Minor description added.

Content

Product description

Overview

The YO Pulse is used for monitoring logical states, alarm detection or pulse counting. Based on the data collected by the device, it is possible to: monitor the states of devices and processes in automation. Collect the number of pulses from measuring devices, for example, from water meters. The device includes six configurable measuring inputs, each of which can operate in one of the three modes: normally open contact monitoring, normally closed contact monitoring, pulse counter. The device is tailored to the customer's needs. At the **order stage**, the customer determines the demand for contact type to be **potential-free** or **potential**.

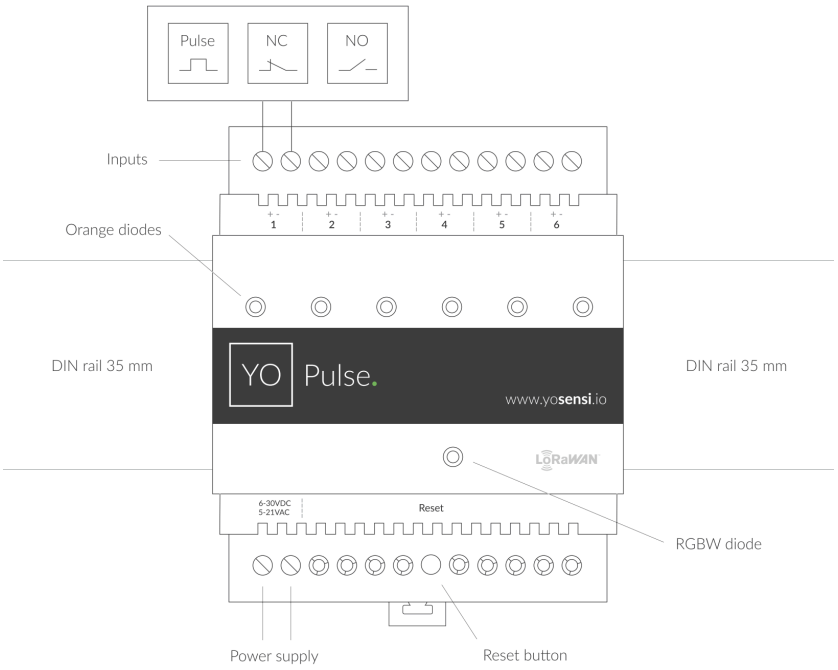

Figure 1 Device top view.

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.

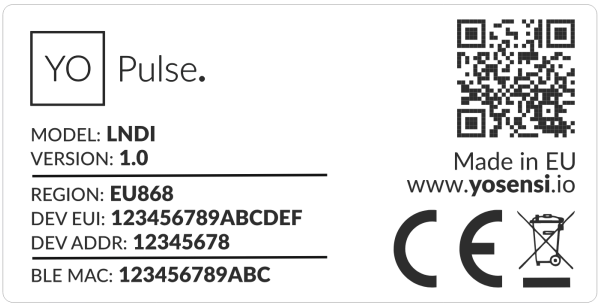

Figure 2 Device label.

Physical interfaces

LEDs

YO Pulse communicates its current behavior to the user by RGBW LED placed on the top of the device shown on figure one. It also has orange diodes which count pulses sent to the network.

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.
Rapid flashing	Orange	**Pulse counting:** pulse counter for sending signals to the network.

Buttons

Buttons YO Pulse is equipped with one reset button inside the device on the PCB board under the inscription “reset” shown on the figure 1. It is possible to press it with a thin stick.

Specifications

Physical

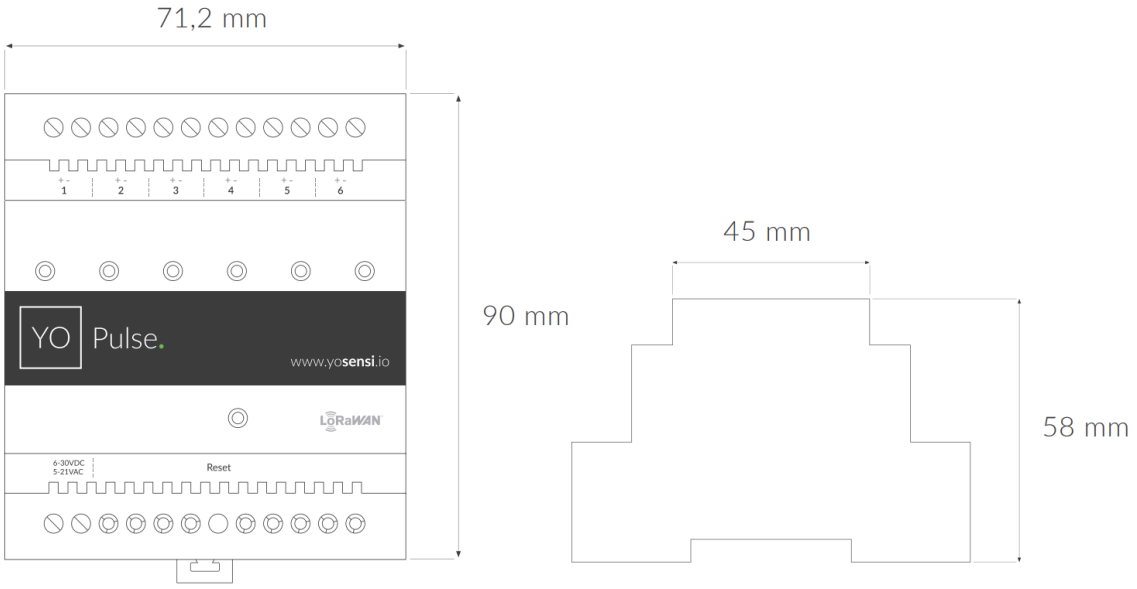

Figure 3 Dimensions of the device.

PHYSICAL SPECIFICATION	
Dimensions	Height: 90 mm Width: 71,2 (4 pole) mm Depth: 58 mm
Colour	Light grey
Mounting method	35 mm DIN rail Vertical (can be screwed to the wall)
Enclosure material	Polycarbonate
Fire resistance class	UL94-VO
Level of protection	IP20
Weight	151 g

Operating conditions

OPERATING CONDITIONS	
Temperature	0° to 70°C
Humidity	0 to 90%
Placement	Indoor use
Power supply	6 - 30 V DC 5 - 21 V AC
Power consumption	Typical: 20 mA DC (12 V DC) Maximum: 110 mA DC (12 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)
Counter	0-32767 (int16)	-
Open contact	0-1	-
Closed contact	0-1	-

The counter counts pulses cyclically with time interval defined by LoRa sending interval.

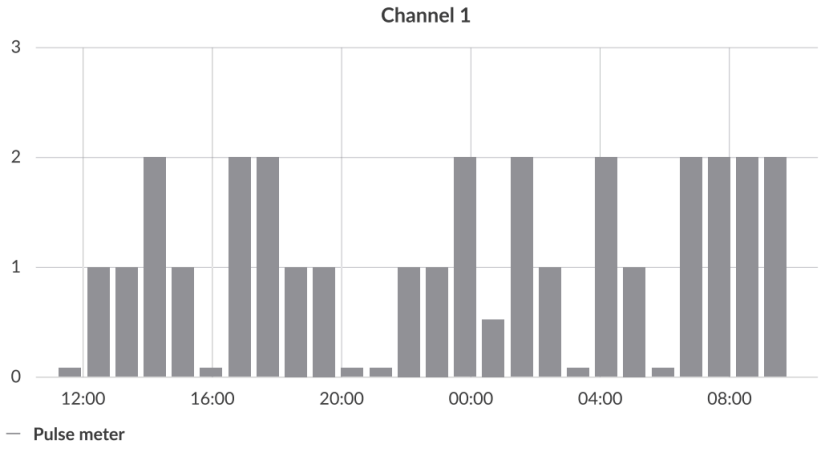

Figure 4 Periodic counter on first channel exemplary chart.

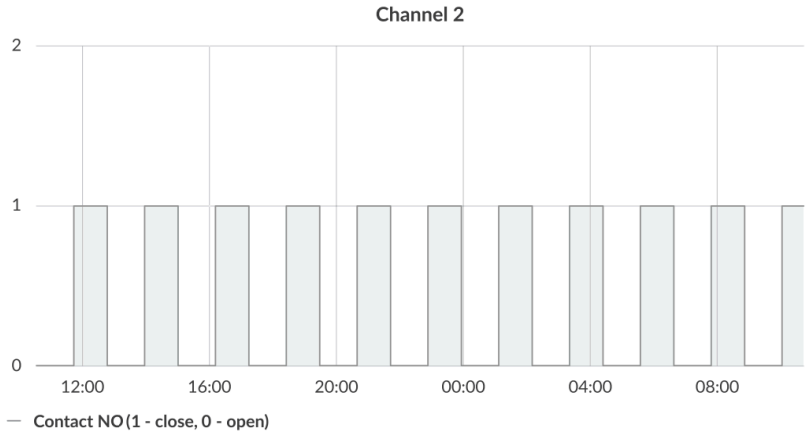

Figure 5 Example of a normally open contact monitoring chart.

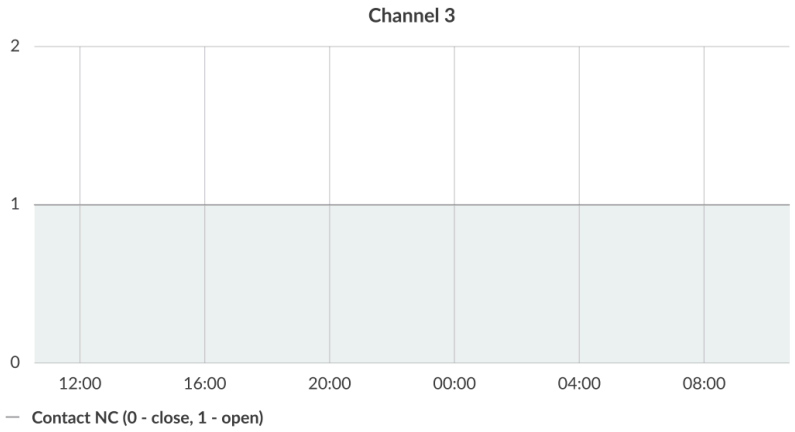

Figure 6 Example of a normally closed contact monitoring chart.

Installation

Package contents

1. Device.
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. Mount the device on a 35 mm DIN rail.

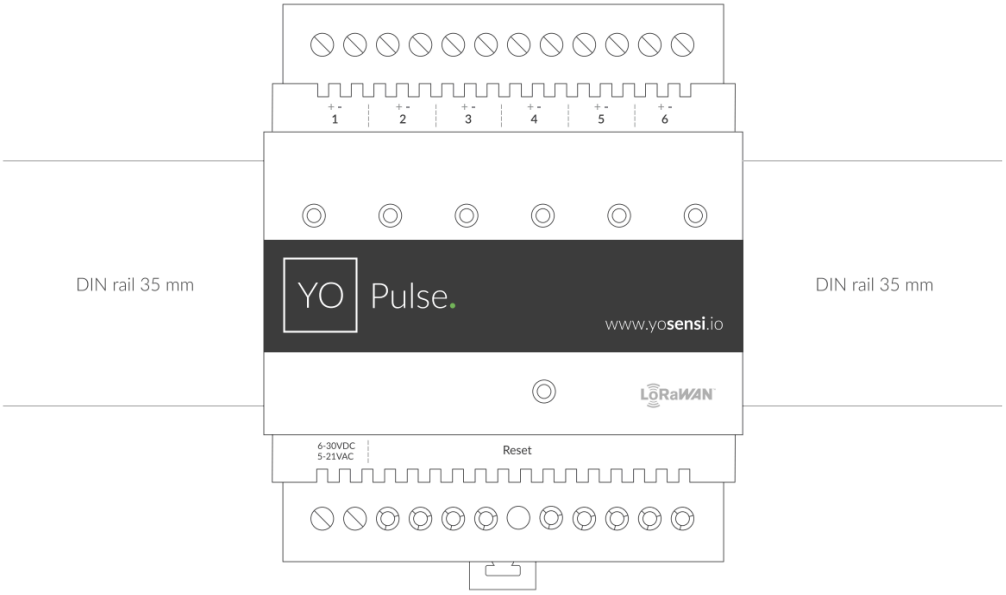

Figure 7 Device mounting instructions.

2. Connect the inputs to the individual channels of the device according to the polarity shown on the enclosure label.

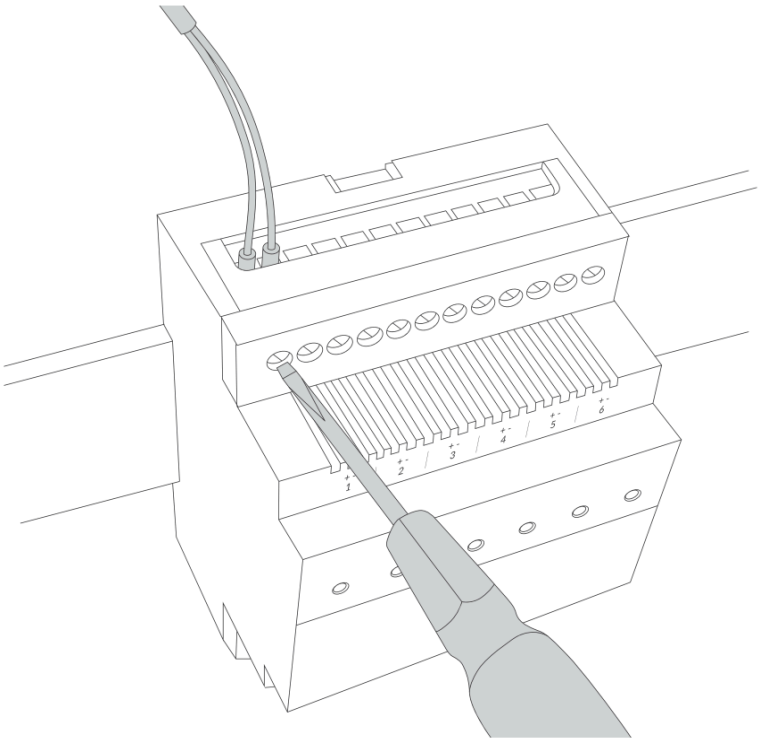

Figure 8 Connect the inputs to the individual channels of the device instruction.

3. Screw the power supply wires to the device regardless of polarity (6 - 30 V DC, 5 - 21 V AC).

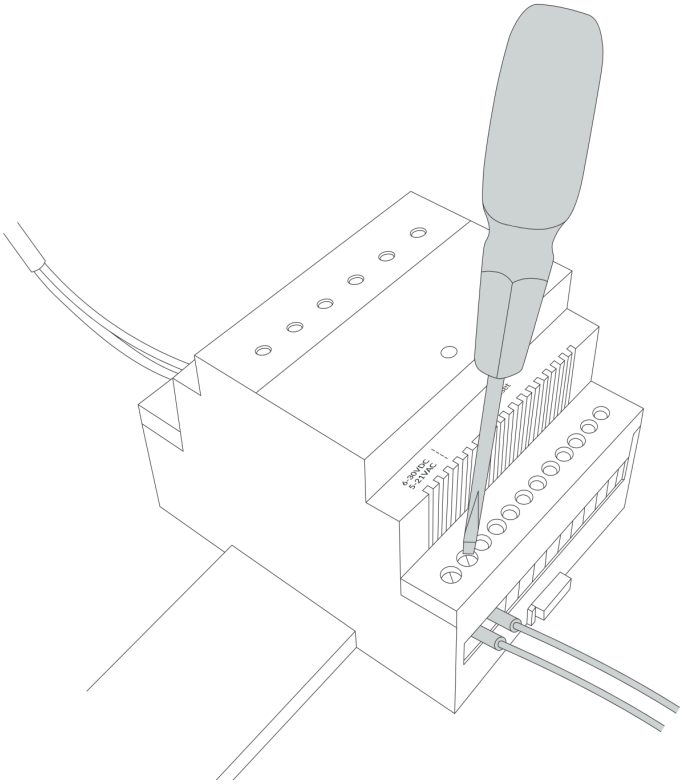

Figure 9 Input cable passing through the cable gland instructions.

4. After connecting the wires diodes should behave as it is described on physical interfaces of the LEDs.

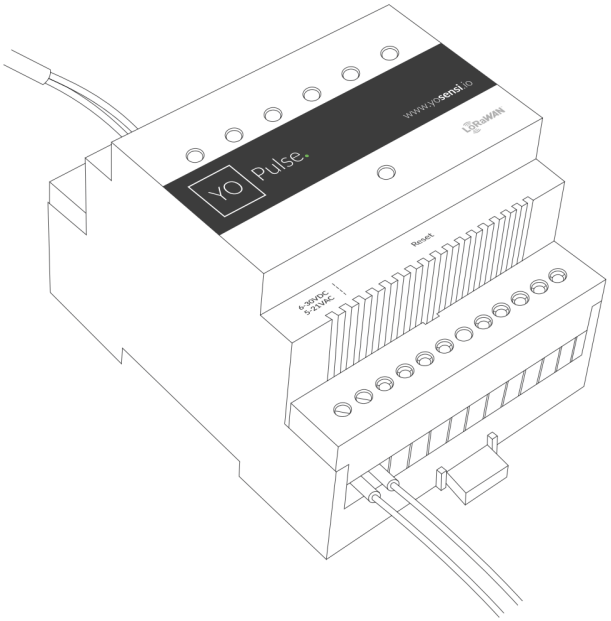

Figure 10 Final look of the device after connecting wires.

Operation

IoT system components

Typical IoT systems consist of 3 main elements *(Figure 11)*, 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).

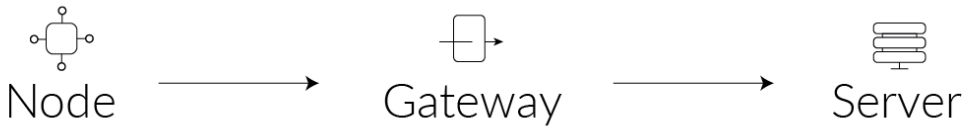

Figure 11 IoT system components.

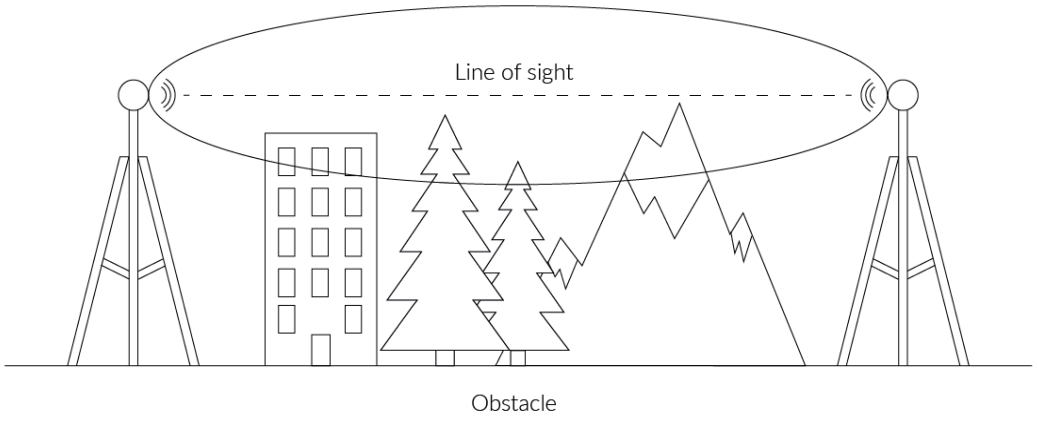

Figure 12 Fresnel zone where communication between two antennas can occur.

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 *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).
-

Sample configuration file for the YO Pulse device.

```
{
        "info": {
                "devmodel": "LNDI",
                "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": 300,
                "debouncetime": 25,
                "ch1func": "counter",
                "ch2func": "counter",
                "ch3func": "counter",
                "ch4func": "counter",
                "ch5func": "counter",
                "ch6func": "counter",
                "sendimmediatechange": "disable",
        }
}
```

GENERICS PARAMETERS

SECTION	NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
info	devmodel	Device name	-	LNDI	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	300	R/W
debouncetime	Delay for pulse counting preventing from contact vibration of the device [ms]	1-1000	25	R/W
chxfunc	Chanel with periodic counters where x stands for the number from 1 to 6	contact_NO, contact_NC, counter	counter	R/W
sendimmediate change	Enable or disable feature of queue to payload each contact NO/NC change	disable, enable	disable	RW

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:*** interval of sending each LoRa payload.
- **debouncetime:** delay from contact vibration.
- **ch1func…ch6func:** numbers of channels for counting periodic pulses.
- **sendimmediatechange:** feature that enables instant queueing of state changes to payload. Works for contact type: contact_NO and contact_NC.

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*

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.

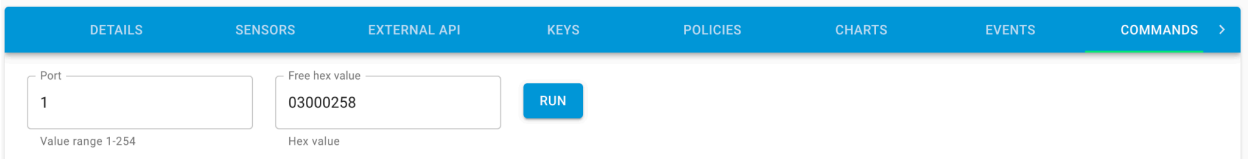

Figure 28 Downlink message example.

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.

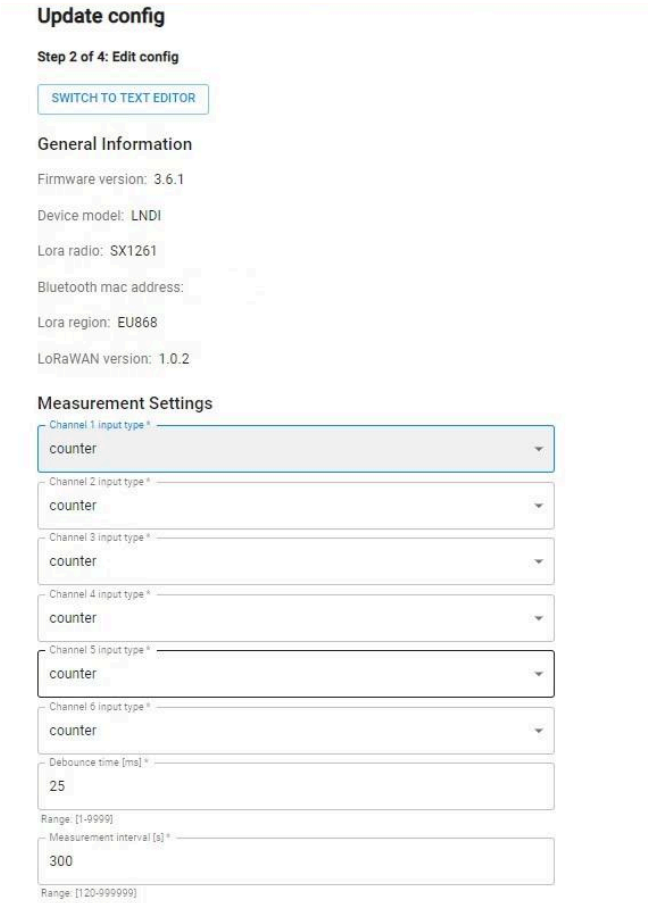

Figure 13 Update configuration section view.

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 your account using the Yosensi mobile app.
2. Go to the device section (the middle button) and choose the device or your organization with the devices attached to it.
3. After selecting the device, go to the “Configuration” option. Now wait. Your mobile will pair with the node.
4. 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.

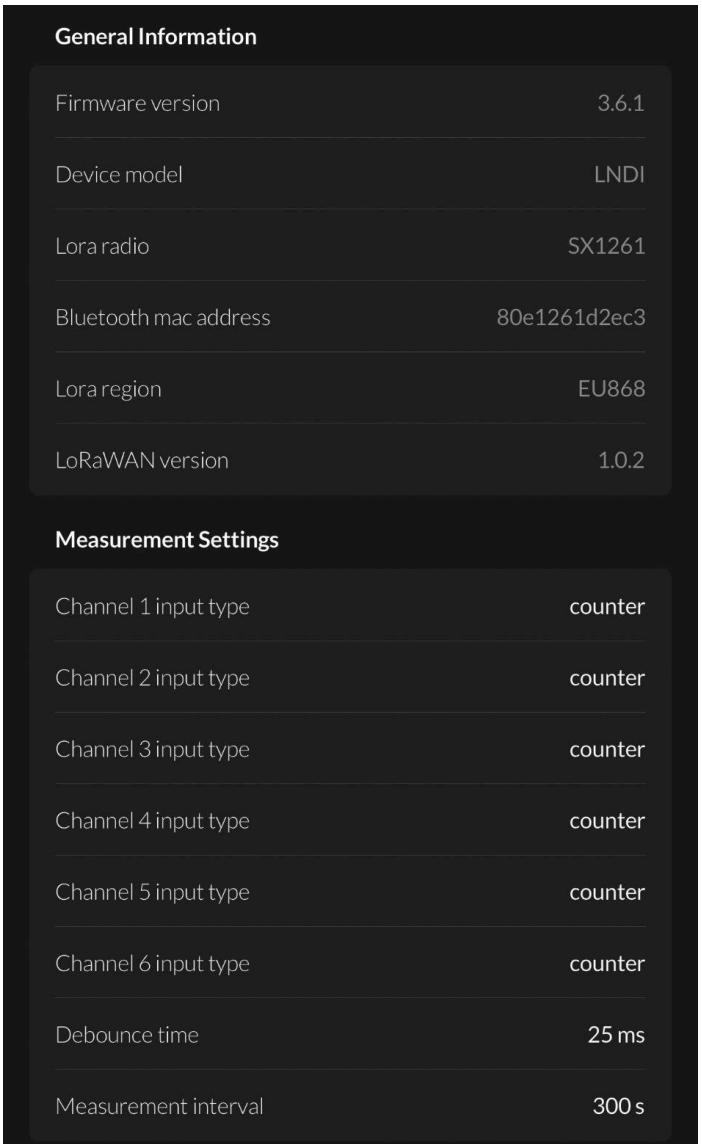

Figure 14 Configuration view in mobile app.

5. After changing parameters press ‘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.

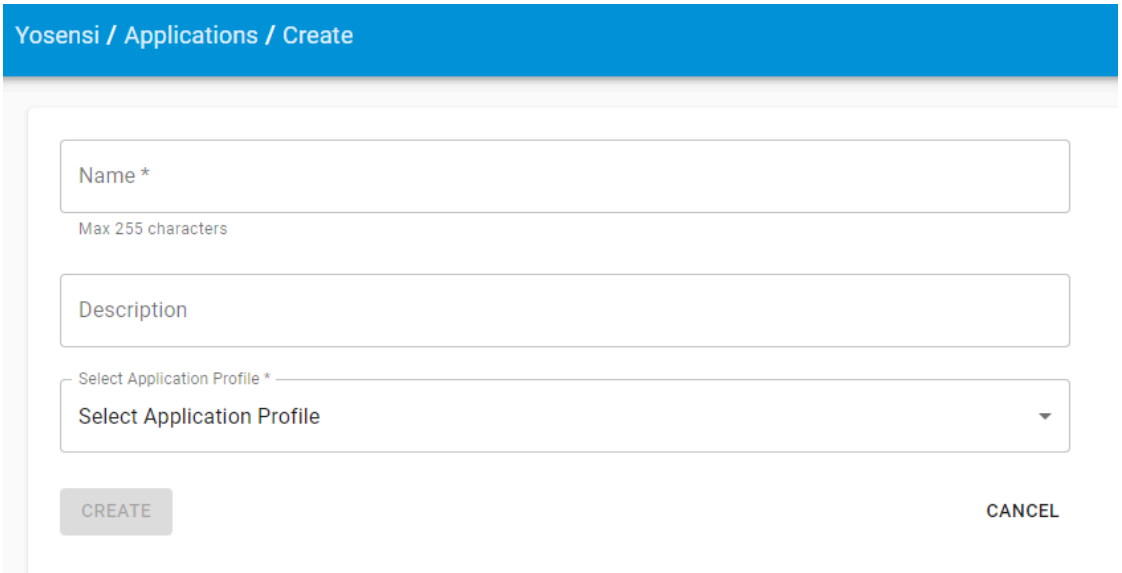

Figure 15 Application creation form.

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 Pulse). 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>.

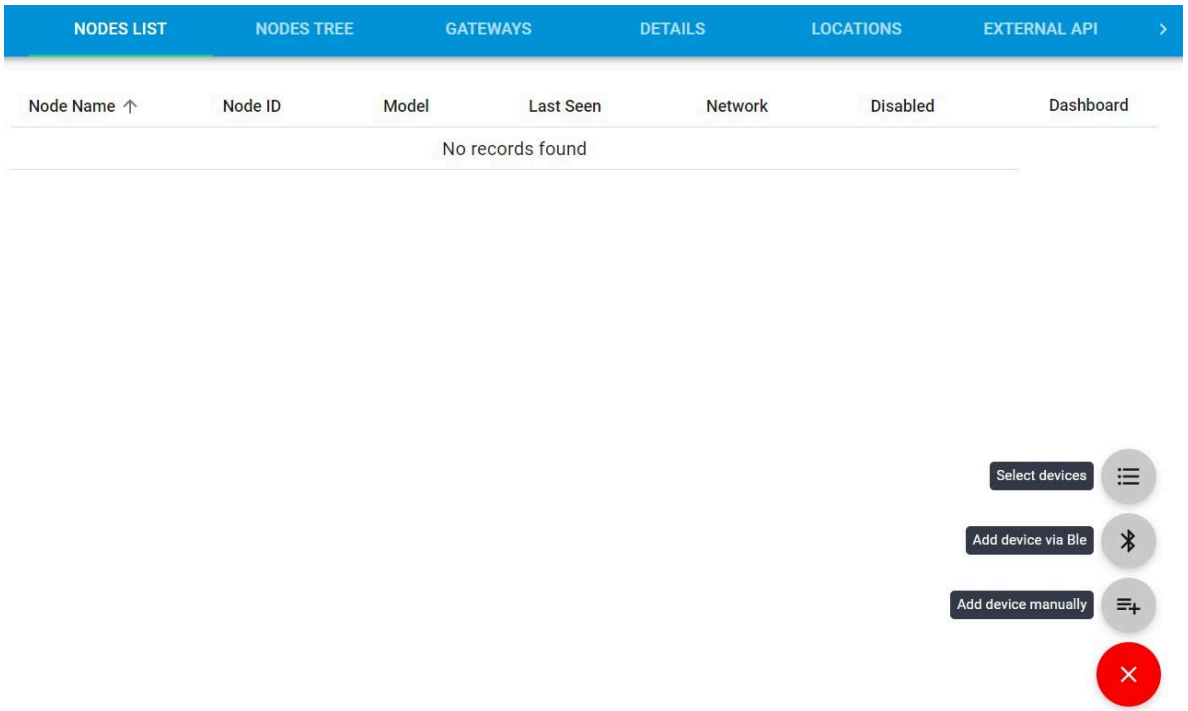

Figure 16 Adding node to the Yosensi Management Platform section view.

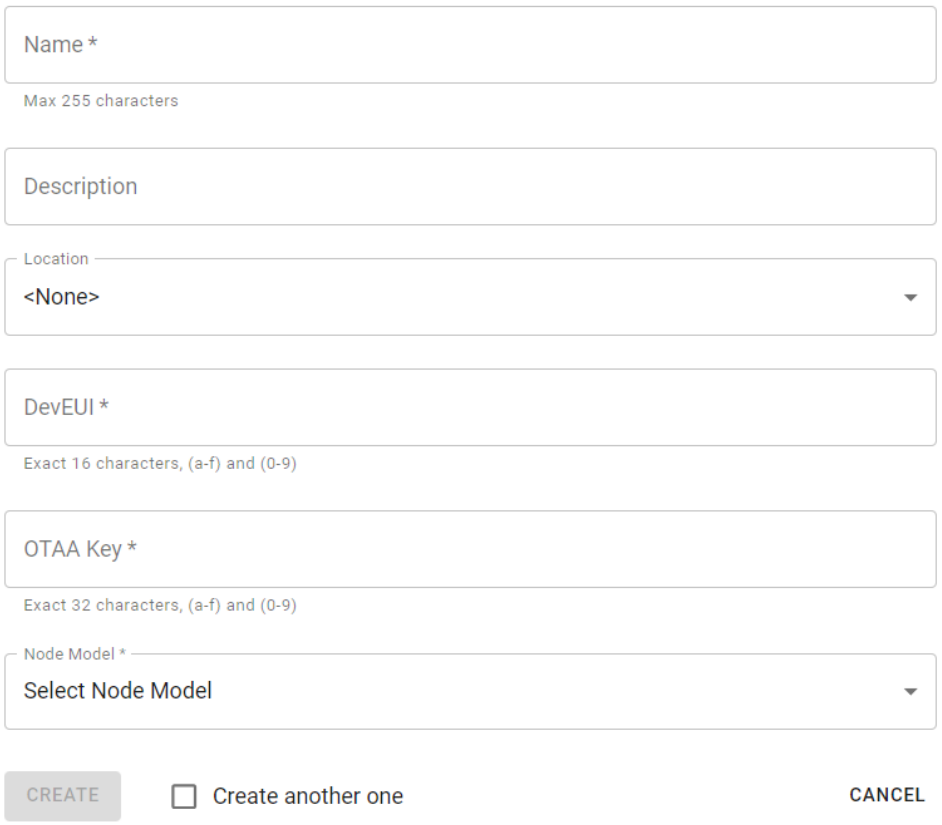

Figure 17 Node creation form.

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.

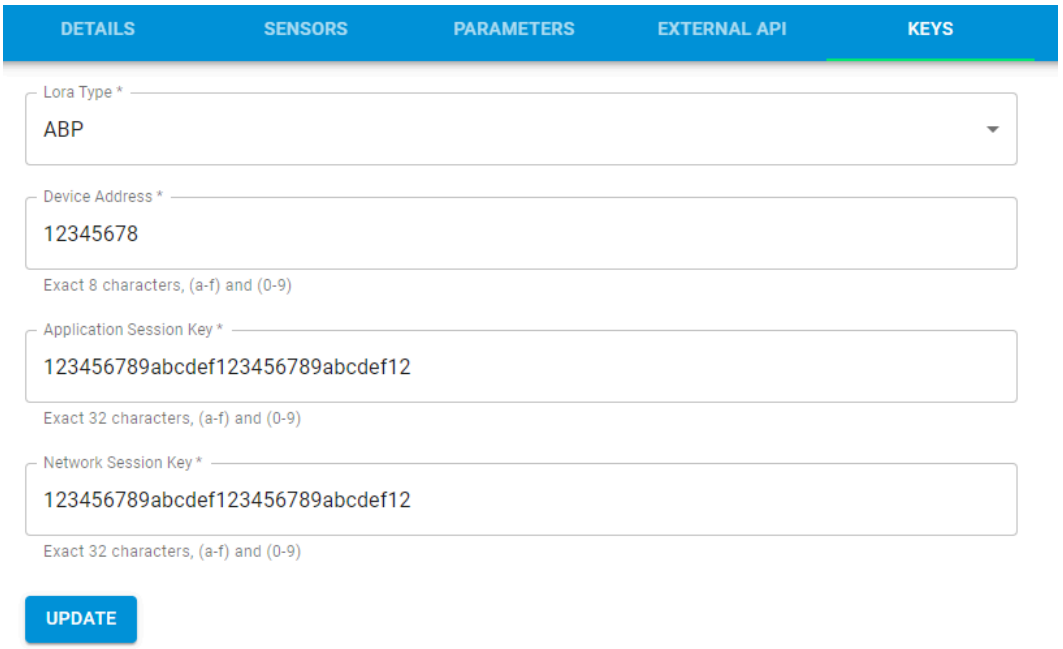

Figure 18 Node LoRa type configuration form.

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

Example of YO Pulse payload with description:

02:01:00:00:04:00:11:01:00:00:04:00:11:12:00:01:04:00:11:13:00:00:60:00:11:04:00:3d:60:00:11:05:00:14:60:00:11:06:00:0b

Payload header				**First measurement (CH1 - NO state)**					
0x02	0x01	0x00	0x00	0x04	0x00	0x11	0x01[1]	0x00	0x00
ver = 2	cnt = 1	pct [s] = 0		type = 1 prec = 0	md [s] = 0	addr_len = 1 meas_len = 2	state = 0* addr = 1	val = 0 (0 [contact open])	

Second measurement (CH2 - NC state)

0x04	0x00	0x11	0x12[2]	0x00	0x01
type = 1, prec = 0	md [s] = 0	addr_len = 1, meas_len = 2	state = 1* addr = 2	val = 1 (1 [contact open])	

[1] contact_NO address byte is represented by value 0 in the high nibble, eg. 0x**0**1, 0x**0**2 … 0x**0**6,
[2] contact_NC address byte is represented by value 1 in the high nibble, e.g., 0x**1**1, 0x**1**2, ..., 0x**1**6.

Third measurement (CH3 - NC state)

0x04	0x00	0x11	0x13	0x00	0x00
type = 1, prec = 0	md [s] = 0	addr_len = 1, meas_len = 2	state = 1* addr = 3	val = 0 (0 [contact closed])	

Fourth measurement (CH4 - pulse counter)

0x60	0x00	0x11	0x04	0x00	0x3D
type = 24, prec = 0	md [s] = 0	addr_len = 1, meas_len = 2	addr = 4	val = 61 (61 [pulses])	

Fifth measurement (CH5 - pulse counter)

0x60	0x00	0x11	0x05	0x00	0x14
type = 24, prec = 0	md [s] = 0	addr_len = 1, meas_len = 2	addr = 5	val = 20 (20 [pulses])	

Sixth measurement (CH6 - pulse counter)

0x60	0x00	0x11	0x06	0x00	0x0B
type = 24, prec = 0	md [s] = 0	addr_len = 1, meas_len = 2	addr = 6	val = 11 (11 [pulses])	

*state - type of INPUT, 0 - Normally Open, 1 - Normally Closed

Compliance statements

CE

UNITED KINGDOM CONFORMITY ASSESSED
No. 09/2021/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 Pulse**
Technical data	**Voltage 6÷30 V DC/5÷21V AC; current mx 110 mA DC (12 V DC); IP20**

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 61000-6-2: 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. 09/2021/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 Pulse**
Technical data	**Voltage 6÷30 V DC/5÷21V AC; current mx 110 mA (12 V DC); IP20**

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