YOSENSI.IO

YO Modbus

User guide v2.1

Release notes

Released	Version	Key changes
25.08.2022	1.0	Initial release.
27.07.2023	2.0	Configuration node description using Yosensi platform added. Description of MODBUS communication protocol Device parameters names and description modified. Configuration file modified. Changed description of connecting nodes with Yosensi Management Platform.
26.10.2023	2.1	Added configuration with Yosensi Mobile App, updated documentation.

Content

Product description

Overview

YO Modbus bridges between the Modbus network and the LoRaWAN. It allows users to read data via Modbus RTU from slave devices and to send it via LoRaWAN. One YO Modbus device provides capacity to create up to 150 Modbus queries and to send them in up to 30 different LoRa packets. These are sent in LoRA packets of up to 5 queries each (i.e. maximum of 30 packets).

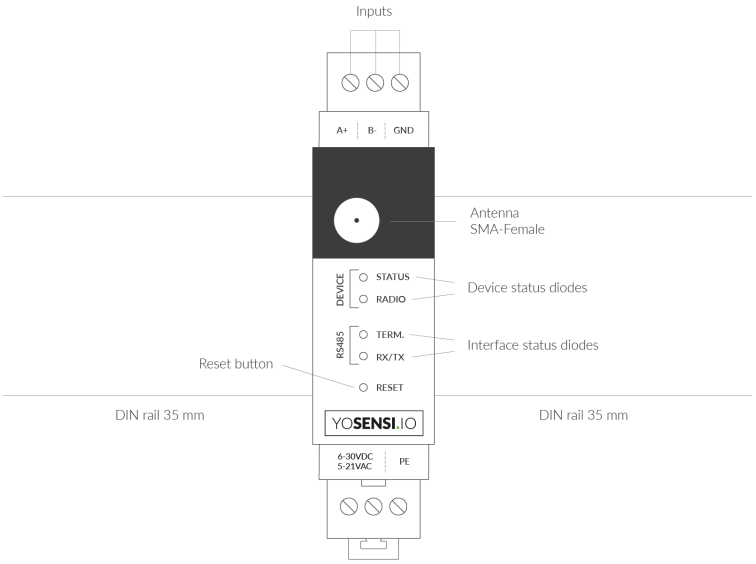

Figure 1 Device top view.

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 Modbus communicates its current behavior to the user by RGBW LED placed on the top of the device shown on figure 1.

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 packet sent \ confirmation from LoRaWAN Server after receiving the packet.
Slow flashing	Blue	**BLE communication:** connection to the device via BLE (configuration).
Rapid flashing	Blue	**LoRaWAN communication:** connecting to LoRaWAN network.
Continuous lit	Orange	**Term diode:** Terminating resistor connected.
Rapid flashing RS485	Red	**RX/TX diode:** RS485 packet sent
	Green	**RX/TX diode:** RS485 packet received

Buttons

YO Modbus is equipped with one reset button under the interference status diode RX/TX shown on the device top view. It is possible to press it with a thin pin.

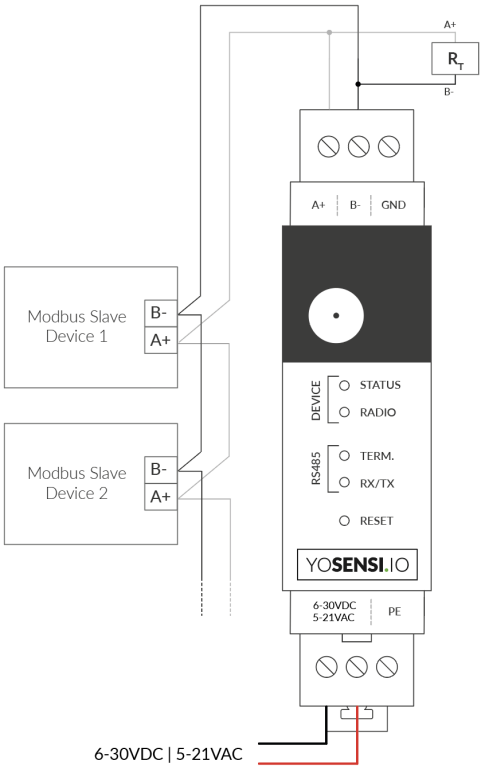

Figure 3 Connection the YO Modbus device with slave device.

RS485 interface

When connecting RS485 nodes to YO Modbus, connect the A+ line to the RS485 A bus and B− to the RS485 B bus. GND connects to the ground terminal of the RS485 bus.

This device can be supplied with 6–30 VDC or 5–21 AC.

Optionally, a protective earth cable can be connected. To prevent loop currents, an Earth connection should be made at only one point on the network.

Line topology may or may not require terminating loads depending on the length of cable used. The impedance of the termination load should match with line impedance on both ends. The termination load is usually 120 Ω on both sides, although the device contains an in-build terminating resistor R_T.

YO Modbus communicates by sending queries to each device and converting polls, with data from each slave, into LoRa frames for relay to the application server. Prior to communication between nodes and the master, it is necessary to configure the serial transmission in the YO Modbus device. For this, you will need to know the slave addresses and individual registers for reading data.

Specifications

Physical

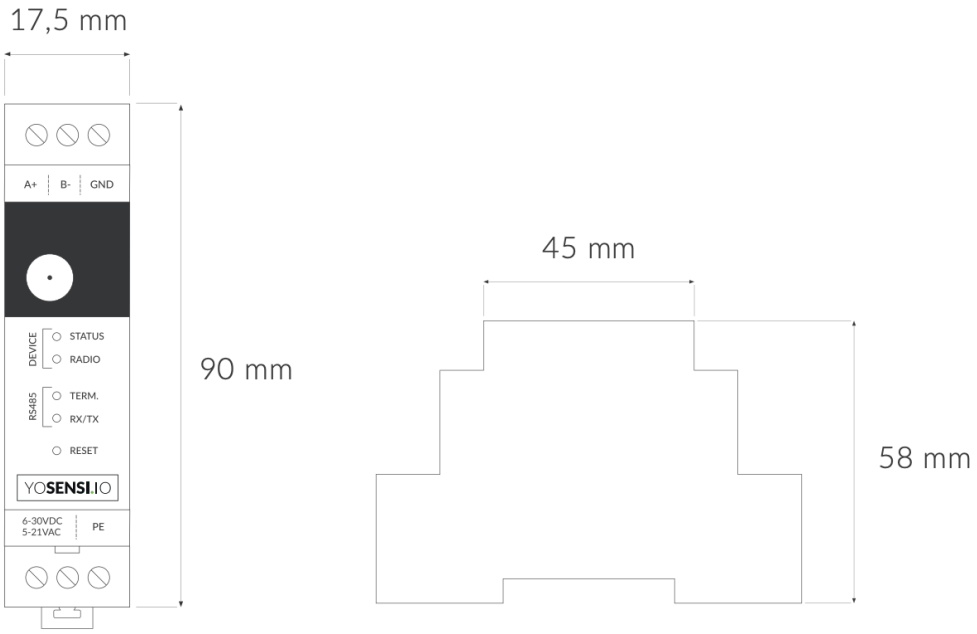

Figure 4 Dimensions of the device.

PHYSICAL SPECIFICATION	
Dimensions	Height: 90 mm Width: 17,5 (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	90 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: 12 mA DC (12 V DC) Maximum: 120 mA DC (12 V DC)

Measured values

Internal voltage is used to monitor device condition to detect anomalies (like sudden drop) or its current condition from voltage drop over time below the initial voltage rating.

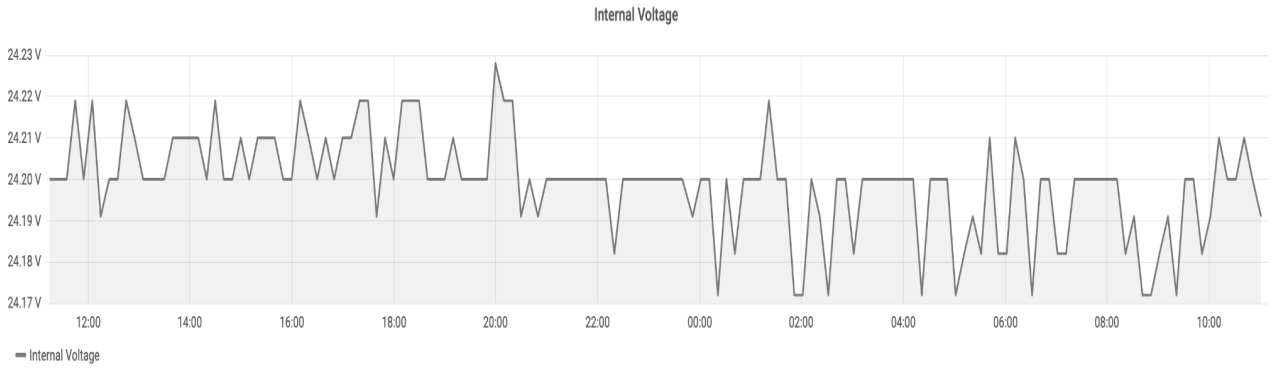

Figure 4 Internal voltage chart.

Queries and polls

YO Modbus can request up to 150 different queries from slave devices. Establishing communication requires advance knowledge of the device's starting registers, slave address and function codes. This device supports the following read functions:

- 01 (0x01) Read coils
- 02 (0x02) Read discrete inputs
- 03 (0x03) Read holding registers
- 04 (0x04) Read input registers

The query data are read by Modbus RTU and sent by LoRaWAN. Each LoRa packet contains data from the read registers. One LoRa packet can contain 5 five user-created polls, each up to 4 bytes.

NOTE **More information about queries and polls can be found in the device configuration section.**

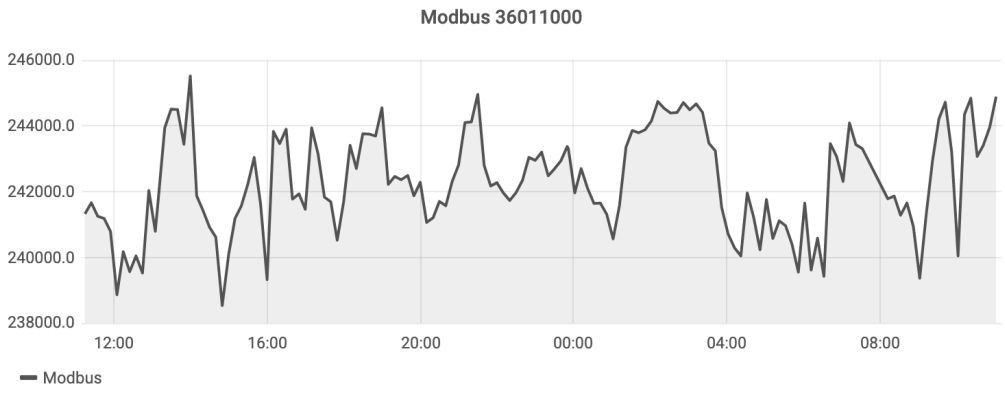

Figure 4 Measurements from register 0x1000.

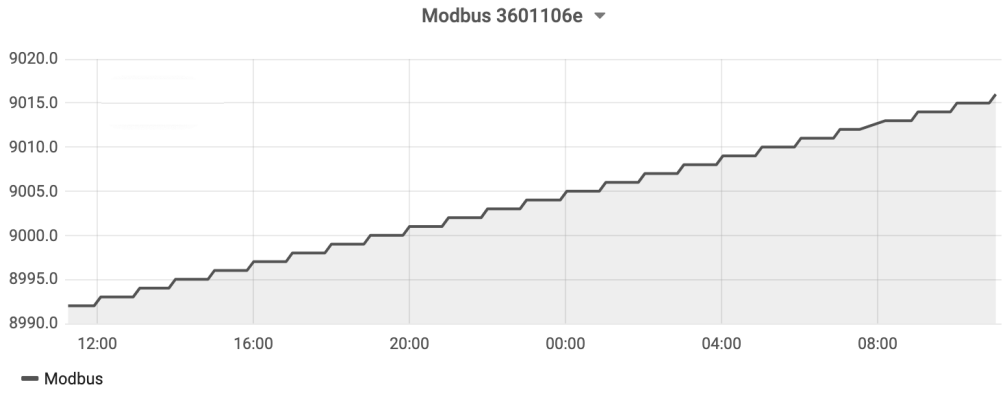

Figure 5 Measurements from register 0x106e.

Installation

Package contents

1. Device.
2. Warranty card.
3. Antenna.

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 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.

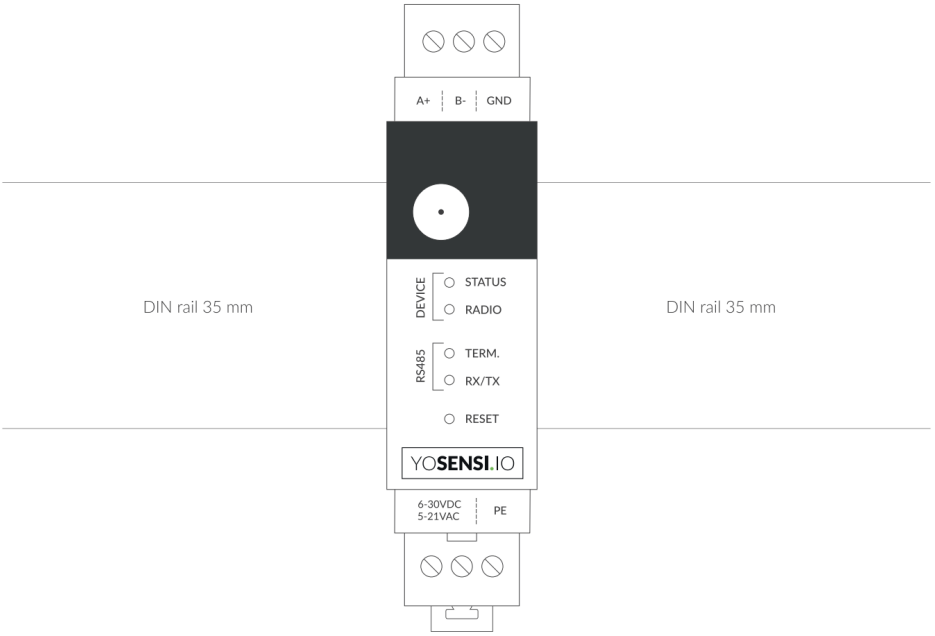

Figure 6 Device mounted on 35 mm DIN rail.

2. Screw RS485 protocol communication wires to the device's A+ and B− terminal blocks. Optionally, connect cable shielding to the device's GND terminal block.

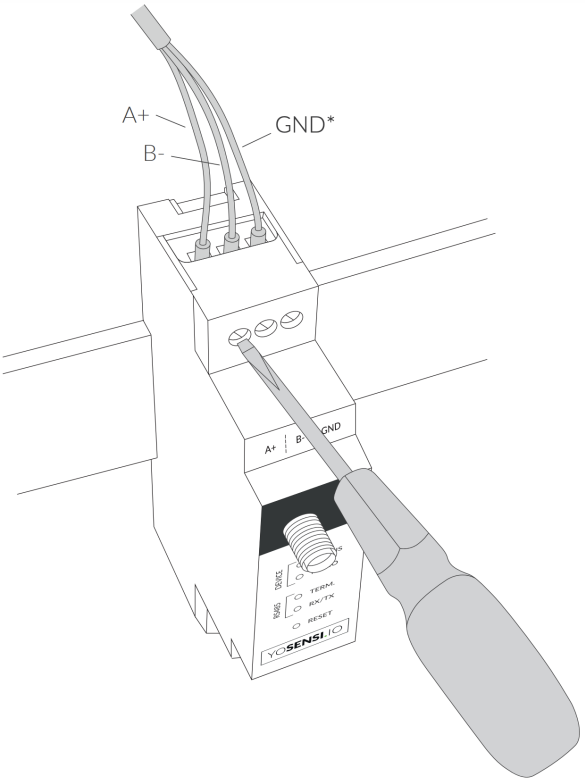

Figure 7 Connecting communication wires to device terminal blocks .

3. Screw the power supply wires to the device (6–30 V DC, 5–21 V AC). Optionally, connect a protective earth (PE) cable. Once power is connected, the indicator diodes should behave as described on physical interfaces of the LEDs.

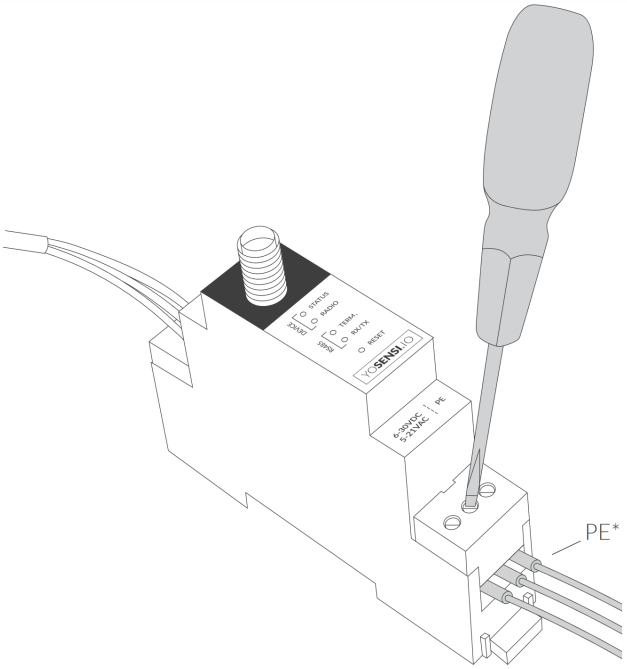

Figure 8 Connecting power supply to the device .

4. Connect the antenna to the device.

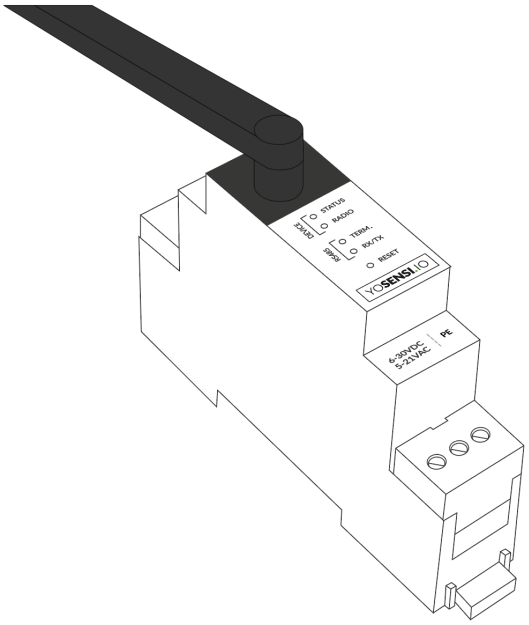

Figure 9 *Device with antenna.*

Operation

IoT system components

Typical IoT systems consist of 3 main elements *(Figure 10)*, 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).

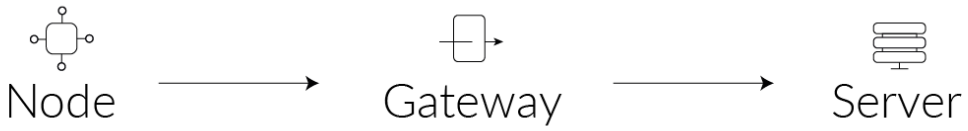

Figure 10 IoT system components.

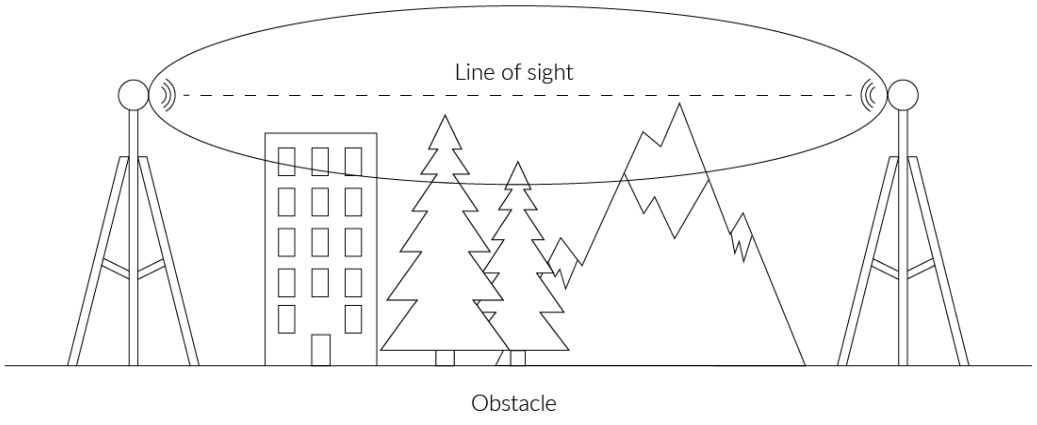

Figure 11 Fresnel zone where communication between two antennas can occur.

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),
- **modbus** (dynamic): individual configuration of Modbus RTU communication,
- **serial** (dynamic): asynchronous serial communication parameters for Modbus RTU protocol,
- **timings** (dynamic): timings for response and delays between master–slave communications,
- **queries** (dynamic): queries configured and executed by the user,
- **pollstosend** (dynamic): polls sent by slave to the master; data collections prepared to send via LoRaWAN

Sample configuration file for the YO Modbus device.

```
{
  "info": {
    "devmodel": "LNRM",
    "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": "1234009864628194612728",
      "appkey": "432103321120453212123876 6",
      "trials": 3
    },
    "abp": {
      "devaddr": "01234567",
      "nwkskey": "0123456789abcdef0123456789abcdef",
      "appskey": "000102030405060708090a0b0c0d0e0f"
    }
  },
  "ble": {
    "power": 0,
    "interval": 1600
  },

  "device": {
    "measinterval": 600
  },
```

```
  "modbus": {
    "terminationresistor": false,
    "driverswitchidletime": 5
  },
  "serial": {
    "baudrate": 9600,
    "databits": 8,
    "parity": "none",
    "stopbits": 1
  },
  "timings": {
    "responsetimeout": 1000,
    "delaybetweenpolls": 100
  },
  "queries": [
    {
      "name": "01Ph1V",
      "slaveaddr": 1,
      "funccode": 3,
      "startreg": "1000",
      "regnbr": 2
    },
    {
      "name": "RunHour",
      "slaveaddr": 1,
      "funccode": 3,
      "startreg": "106e",
      "regnbr": 1
    },
    {
      "name": "3PHpwrfctr",
      "slaveaddr": 1,
      "funccode": 3,
      "startreg": "1024",
      "regnbr": 1
    },
    {
      "name": "1PHactpwr",
      "slaveaddr": 1,
      "funccode": 3,
      "startreg": "102c",
      "regnbr": 2
    }
  ],
  "pollstosend": [
    {
      "cnt": 1,
      "out": [
        "01Ph1V",
        "RunHour",
        "3PHpwrfctr",
        "1PHactpwr",
      ]
    }
  ]
}
```

GENERICS PARAMETERS

SECTION	NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
info	devmodel	Device name	-	LNRM	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	600	R/W

MODBUS PARAMETERS

NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
terminationresistor	Presence of termination resistor in RS485 standard	true, false	false	R/W
driverswitchidletime	Delay [ms] of TX and RX parameters in serial communication between devices in the network.	1-100	5	R/W

SERIAL AND TIMINGS PARAMETERS

NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
baudrate	Bus speed [bps]	1200, 2400, 4800 ,9600	9600	R/W
databits	Number of data bytes per packet.	7,8,9	8	R/W
parity	Data integrity validation type	none, odd, even	none	R/W
stopbits	Last bit type of a one-byte transmission.	1, 2	1	R/W
responsetimeout	Response timeout from slave device in [ms].	10–10000	1000	R/W
delaybetweenpolls	Delay [ms] before the next query.	1–10000	100	R/W

POLL AND QUERY PARAMETERS

NAME	DESCRIPTION	POSSIBLE VALUES	DEFAULT VALUE	READ/ WRITE
name	Name of query, up to 10 characters	"0-9, A-Z, a-z,_ . ," e.g. aB.cD-01	—	R/W
slaveaddr	Number of slave addresses to communicate with	0–255	1	R/W
funccode	Supported Modbus function codes	1, 2, 3, 4	3	R/W
startreg	Start register to read data from	2B (HEX), e.g. 1000	—	R/W
regnbr	Number of words (2 bytes) to read from registers, begins from 'startreg'	1–8	1	R/W
cnt	LoRa packet collection index number. Each packet can contain 5 queries.	1–30	—	R/W
out	Name of the query to be transmitted in a LoRa packet.	"0–9 A–Z a–z . ,"e.g. aB.cD-01	—	R/W

Parameters description

- ***nwktype:*** network type, for setting the device operation to public or private.
- ***acttype:*** activation type 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:*** the interval between broadcast packets, used to connect to every BLE receiver around the device.
- ***subband:*** the communication frequency sub-band.
- ***measinterval:*** measurement interval [s] between sending LoRa packets.
- **teminationresistor**: whether a resistor is applied to the end line to prevent signal reflections for correct signal transmission. Value "TRUE" means that the resistor is installed.

- **driverswitchiddletime**: Delay [ms] from 1 ms up to 100 ms for serial TX and RX parameters between devices in the network.
- **baudrate**: information transfer rate bits per second. Supported baud rates are 1200, 2400, 4800 ,9600
- **databits**: the amount of data in each packet. 7,8,9 formats are not supported with parity "none" value.
- **parity**: The parity bit, unlike the start and stop bits, is an optional parameter, used in serial communications to determine if the data character being transmitted is correctly received by the remote device.
- **stopbits:** the last bit of a one-byte transmission, used for timing or synchronization.
- **responsetimeout**: how long Modbus Poll should wait for a slave device response before giving up. Default is 1000 ms.
- **delaybetweenpolls**: the minimum delay until the next request is transmitted. Default is 100 ms.
- **name:** name of the query parameter, up to 10 characters. The name can be freely modified by the user to correspond to the parameter to be read out.
- **slaveaddr:** address of the target slave device.
- **funccode:** function code for the Modbus RTU protocol. Value 1 indicates "read coils", value 2 = "read contacts", 3 = "read holding registers", 4 = "read input registers".
- **startreg:** starting register, which is the address from which the reading of data from a particular slave will start.
- **regnbr:** register number of data to read from the slave. Value "1" means that 2 bytes will be read, value "2" = 4 bytes will be read over the Modbus network..
- **cnt:** packet counter index. The YO Modbus device can handle up to 150 queries. Limitation is 5 variables per query.
- **out:** the query name for output from the slave. Maximum of 5 queries per packet (along with maximum of 150 queries per Modbus).

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 via Yosensi Management platform

Connect to the device following these instructions:

1. Go to app.yosensi.io and log in.
2. You'll see the dashboard organization view. Now 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 recovers the firmware of the device. This button helps if you lose connection while uploading firmware.
5. Once the configure button has been selected and the node has been connected, the next step is to configure the parameters. It is necessary to follow the communication Modbus RTU protocol and the variables given in the datasheet. This depends on which parameters you want to read from the slave device.
6. There are two options to configure the device. First recommended is "form based editor", second is "text editor". To add queries and responses to the slave, you can refer to the configuration file and images given below. It is possible to add up to 150 queries, make sure that each query is separate. YO Modbus can send 30 LoRa packets, that means in each poll you can create 30 **cnt** (counter parameter) with 5 **out** variables with the name of configured queries. Example **pollstosend** parameters are also given in the configuration file. Remember that for each packet counter you can send up to 5 different variable responses from slaves. Below is a guide to configuration of the YO Modbus device with an example slave device.

First let's look at sample variables of Modbus Communication Protocol. We will add a query and response of Phase 1 : phase voltage and (register 0x1000) and run hour meter (register 0x1026). First case is shown how to make queries and poll to send with one LoRa packet. In the second example it is shown with sending 2 LoRa packets.

Address	Format	Description	Unit
0x1000	UD_WORD	Phase 1 : phase voltage	mV
0x1002	UD_WORD	Phase 2 : phase voltage	mV
0x1004	UD_WORD	Phase 3 : phase voltage	mV
0x1006	UD_WORD	Phase 1 : current	mA
0x1008	UD_WORD	Phase 2 : current	mA
0x100a	UD_WORD	Phase 3 : current	mA
0x100c	UD_WORD	Neutral current	mA
0x100e	UD_WORD	Chained voltage : L1-L2	mV
0x1010	UD_WORD	Chained voltage : L2-L3	mV
0x1012	UD_WORD	Chained voltage : L3-L1	mV

Figure 12 Example variables of the Modbus communication protocol. Source Communication Modbus protocol MF274 NEMO 72Le.

0x105e	UD_WORD	Phase 1 : V1 min	mV
0x1060	UD_WORD	Phase 2 : V2 min	mV
0x1062	UD_WORD	Phase 3 : V3 min	mV
0x1064	UD_WORD	Phase 1 : V1 max	mV
0x1066	UD_WORD	Phase 2 : V2 max	mV
0x1068	UD_WORD	Phase 3 : V3 max	mV
0x106a	UD_WORD	3-phase : active partial energy	(4)
0x106c	UD_WORD	3-phase : reactive partial energy	(4)
0x106e	U_WORD	Run hour meter	Hour
0x106f	U_WORD	Output relay status	(2)
0x1070	UD_WORD	3-phase : active average power	(3)
0x1072	UD_WORD	3-phase : reactive average power	(3)
0x1074	UD_WORD	3-phase : apparent average power	(3)
0x1076	UD_WORD	3-phase : active PMD power	(3)
0x1078	UD_WORD	3-phase : reactive PMD power	(3)
0x107a	UD_WORD	3-phase : apparent PMD power	(3)
0x107c	UD_WORD	Run hour meter	minutes

Figure 13 Example variables of the Modbus communication protocol. Source Communication Modbus protocol MF274 NEMO 72Le.

```
"timings": {
    "responsetimeout": 1000,
    "delaybetweenpolls": 100
 },
"queries": [
    {
      "name": "01Ph1V",    <-- Phase 1: phase voltage
      "slaveaddr": 1,      <-- slave address : 1
      "funccode": 3,       <-- function code : 3 (read holding registers)
      "startreg": "1000",  <-- register variable : 0x1000
      "regnbr": 2          <-- format UD_WORD value regnbr: 2 (meaning, read 4 bytes)
    },
    {
      "name": "RunHour",   <-- Phase 1: phase voltage
      "slaveaddr": 1,      <-- slave address : 1
      "funccode": 3,       <-- function code : 3 (read holding registers)
      "startreg": "106e",  <-- register variable : 0x106e
      "regnbr": 1          <-- format U_WORD value regnbr: 1 (meaning, read 2 bytes)
    }
  ],
  "pollstosend": [
    {
      "cnt": 1,            <-- cnt: 1 , one packet containing replies to both queries
      "out": [
        "01Ph1V",
        "RunHour",
      ]
    }
  ]
}
```

Figure 14 YO Modbus example configuration in text editor of queries and polls to send with one LoRa packet.

```
"timings": {
    "responsetimeout": 1000,
    "delaybetweenpolls": 100
 },
"queries": [
    {
      "name": "01Ph1V",   ←— Phase 1: phase voltage
      "slaveaddr": 1,     ←— slave address :1
      "funccode": 3,      ←— function code : 3 ( read holding registers)
      "startreg": "1000", ←— register variable : 0x1000
      "regnbr": 2         ←– format UD_WORD value regnbr: 2 (meaning, read 4 bytes)
    },
    {
      "name": "RunHour",  ←— Phase 1: phase voltage
      "slaveaddr": 1,     ←— slave address :1
      "funccode": 3,      ←— function code : 3 ( read holding registers)
      "startreg": "106e", ←— register variable : 0x106e
      "regnbr": 1        ←– format U_WORD value regnbr: 1 (meaning, read 2 bytes)
    }
  ],
  "pollstosend": [
    {
      "cnt": 1,  ←— cnt:1 , first LoRa containing reply to query “01Ph1V”
      "out": [
        "01Ph1V"
      ]
   },
    {
      "cnt": 2,  ←— cnt:2 , second LoRa containing reply to query “RunHour”
      "out": [
        "RunHour"
      ]
    }
  ]
}
```

Figure 15 YO Modbus example configuration in text editor of queries and polls to send with two LoRa packets.

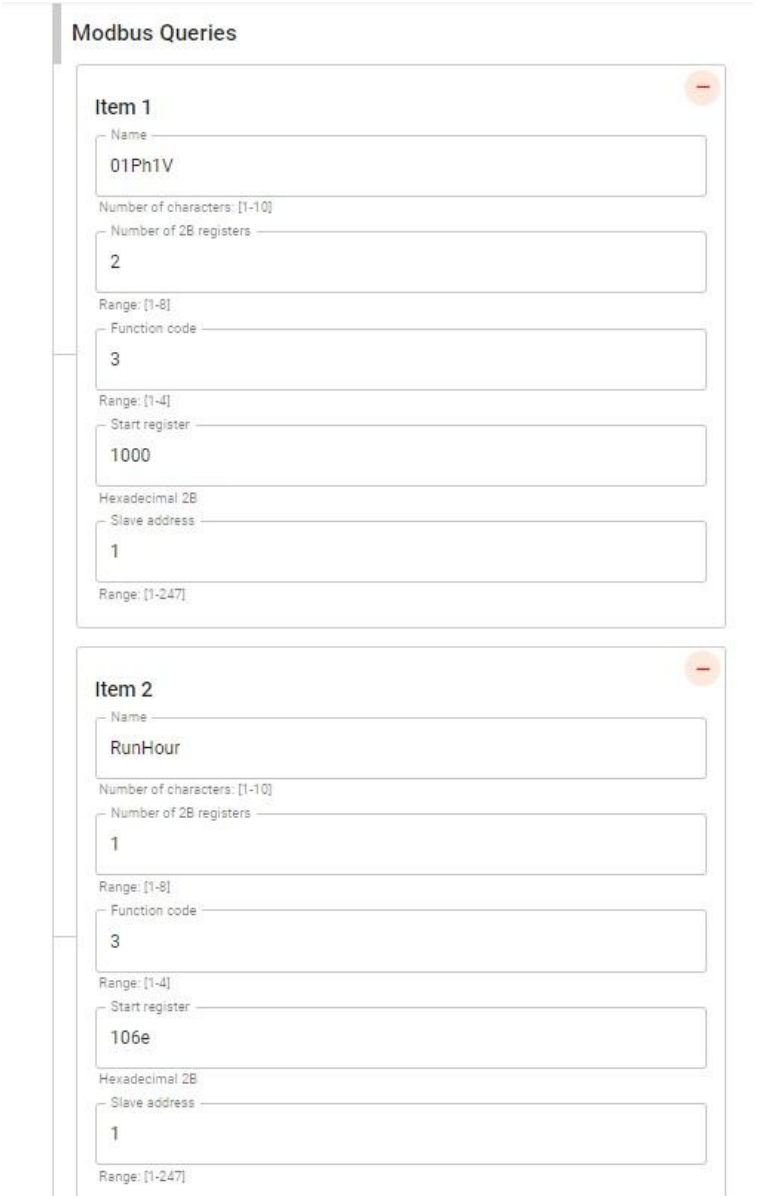

Figure 16 Configuration with added queries for first phase voltage and run hour using form based editor.

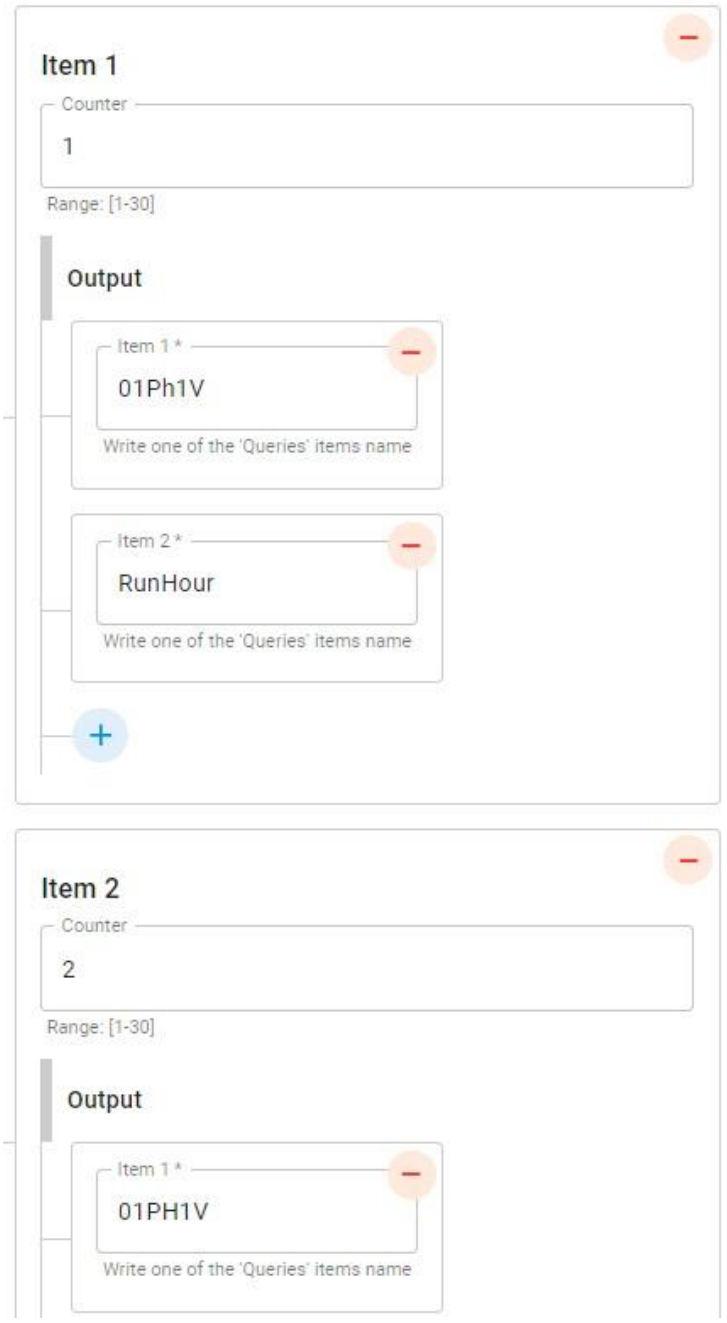

Figure 17 Configuration with polls to send for first phase voltage and run hour using form based editor.

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.

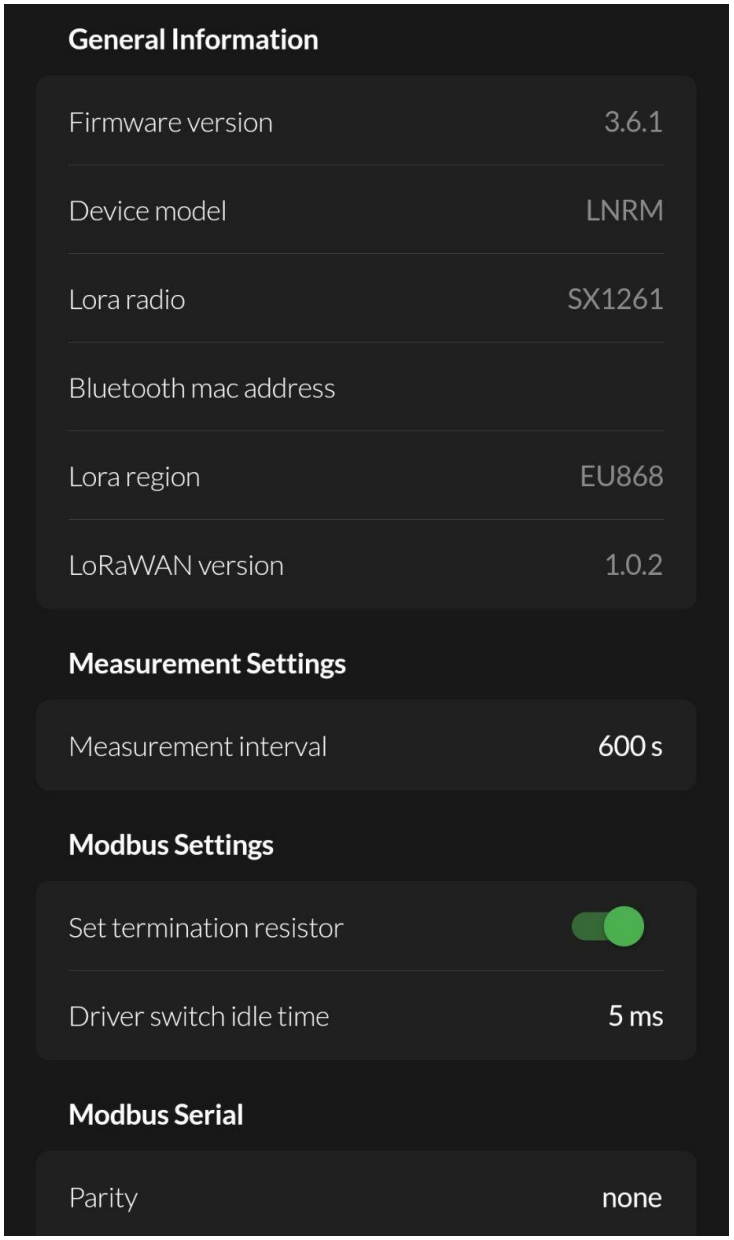

Figure 18 Configuration view in mobile app.

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 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.

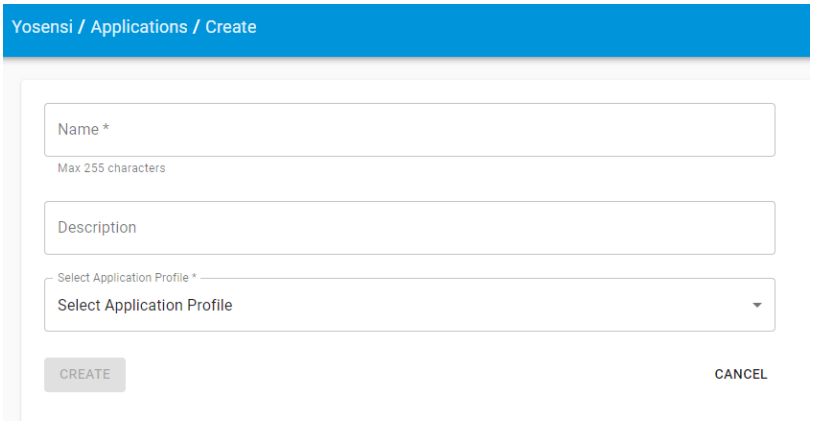

Figure 19 Application creation form.

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 Modbus). 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>.

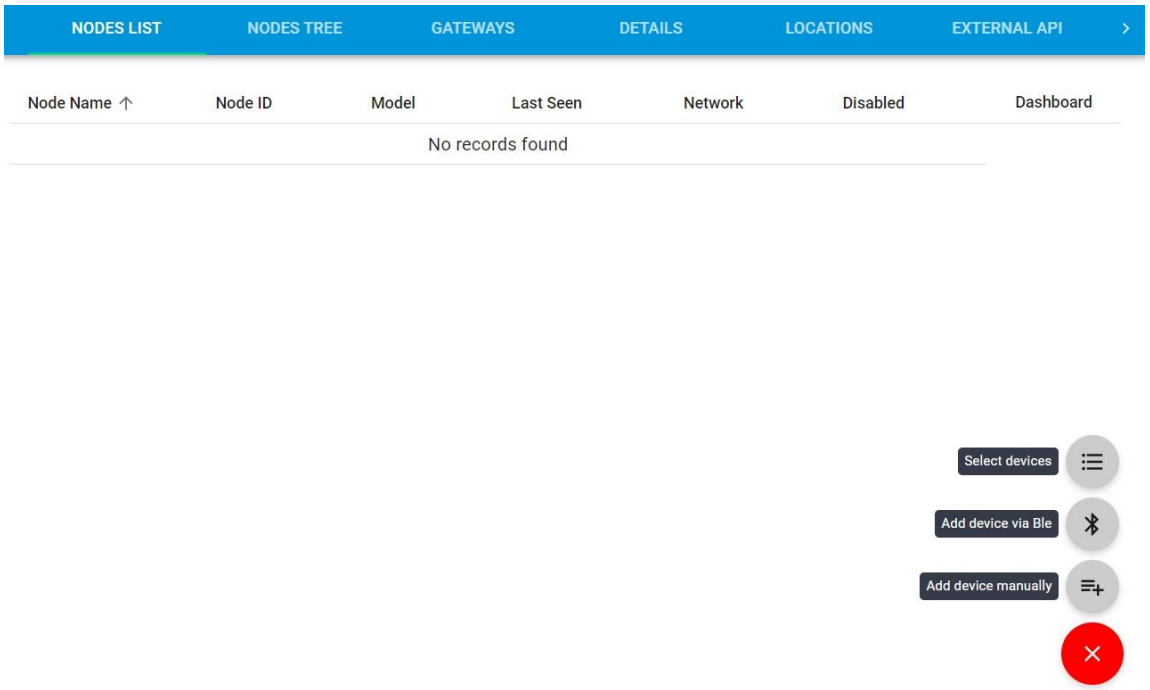

Figure 20 Adding node to the Yosensi Management Platform section view.

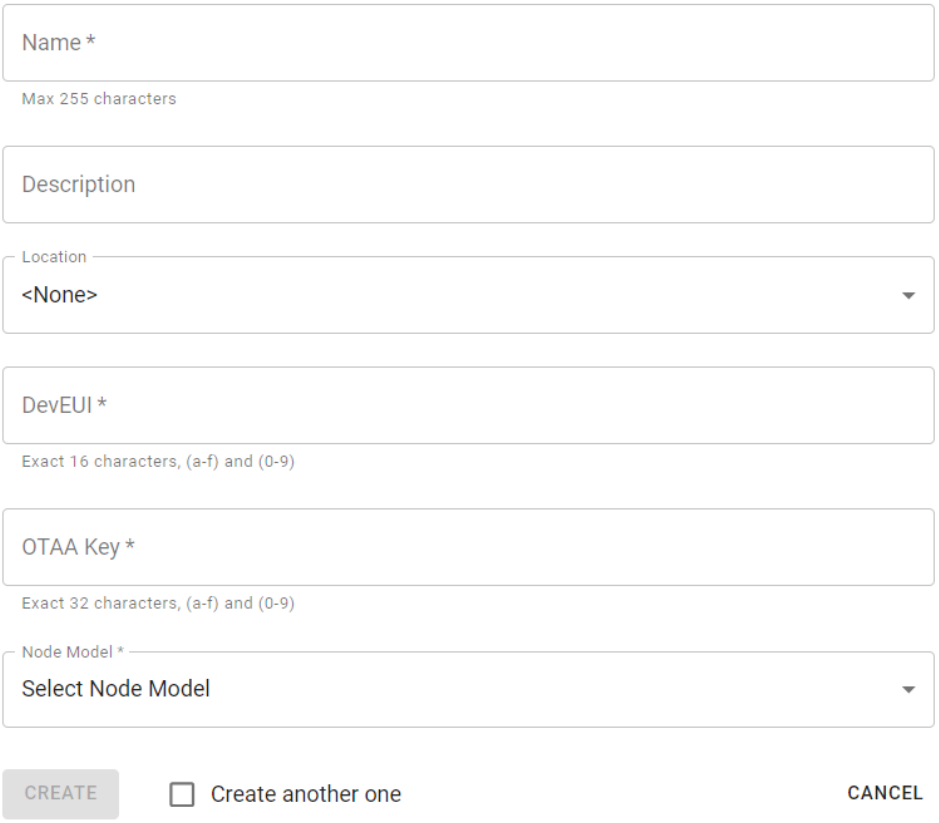

Figure 21 Node creation form.

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.

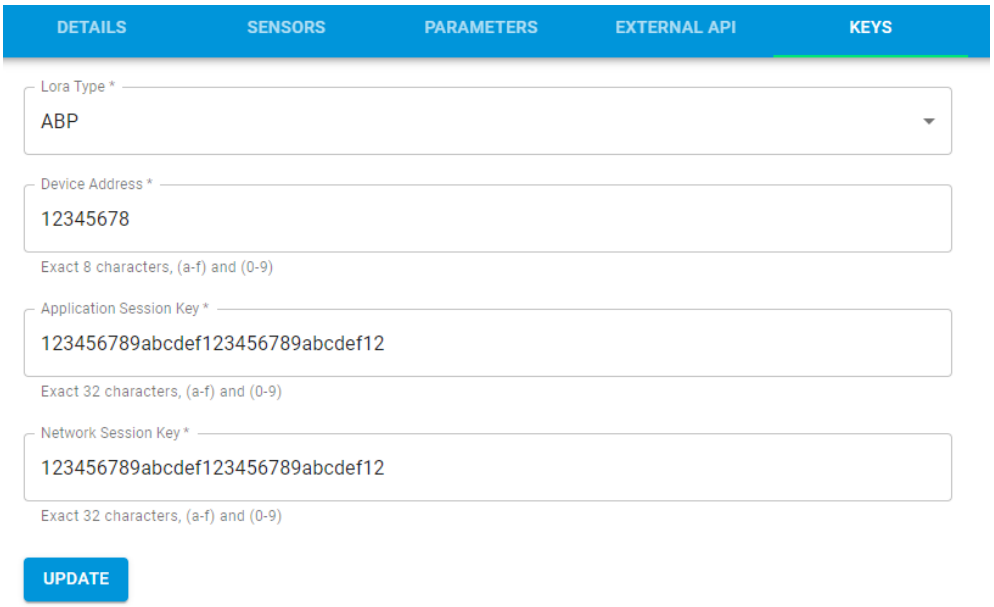

Figure 22 Node LoRa type configuration form.

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

Format of displayed data is measurement type/slave id/register. Example sensor ID: 36011000 where 36 is measurement type, 01 slave id, 1000 register.

Example of YO Modbus payload with description:

1fst frame:
02:4C:00:7A:08:00:01:5E:9B

Payload header				**First measurement (voltage)**				
0x02	0x4C	0x00	0x7A	0x08	0x00	0x01	0X5E	0x9B
ver = 2	cnt = 76	pct [s] = 122		type = 2 prec = 0	md [s] = 0	addr_len = 0 meas_len = 2	val = 24219 (24219 [mV])	

2nd frame:
02:00:00:00:90:00:33:01:10:00:00:03:AD:E0:90:00:31:01:10:6E:05:DE

Payload header				**First measurement (CH1 - phase voltage)**									
0x02	0x00	0x00	0x00	0x90	0x00	0x33	0x01	0x10	0x00	0X00	0X03	0xAD	0xE0
ver = 2	cnt = 0	pct [s] = 10		type = 36 prec = 0	md [s] = 0	addr_len = 3 meas_len = 4	slave_addr = 0x01 start_Reg = 0x1000			val = 241120 (241120 [mV])			

Second measurement (Runhour)

0x90	0x00	0x31	0x01	0x10	0x6E	0x05	0xDE
type = 36, prec = 2	md [s] = 0	addr_len = 3, meas_len = 2	slave_ addr = 0x01 start_Reg = 0x106E			val=1502 (Hour)	

3rd frame:

02:01:00:0A:90:00:33:01:10:2C:00:00:00:00:90:00:31:01:10:26:01:F4

Payload header				First measurement (Active power)									
0x02	0x01	0x00	0x0A	0x90	0x00	0x33	0x01	0x10	0x2C	0x00	0x00	0x00	0x00
ver = 2	cnt = 1	pct [s] = 10		type = 36 prec = 0	md [s] = 0	addr_len = 3 meas_len = 4	slave_addr = 0x01 start_Reg = 0x102c			val = 0 (0 [W])			

Second measurement (Frequency)

0x90	0x00	0x31	0x01	0x10	0x26	0x01	0xF4
type = 36, prec = 2	md [s] = 0	addr_len = 3, meas_len = 2	slave_addr = 0x01 start_Reg = 0x1026			val=500 (50 [Hz])	

Compliance statements

CE

UNITED KINGDOM CONFORMITY ASSESSED
No. 01/2022/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 Modbus**
Technical data	**Voltage 6÷30 V DC/5÷21V AC; current mx 120 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. 01/2022/EN

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

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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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