YOSENSI.IO

# YO CoMod

User guide v1.0

# Release notes

| Released | Version | Key changes |
|---|---|---|
| 11.06.2021 | 1.0 | Initial release. |

Content

# Product description

## Overview

YO CoMod is a tiny, ultra low-power, pre-programmed IoT communication module with possibilities for implementing new features. The main component is a MCU equipped with short- and long-range communications via in-built BLE 5.0 and LoRa radio.

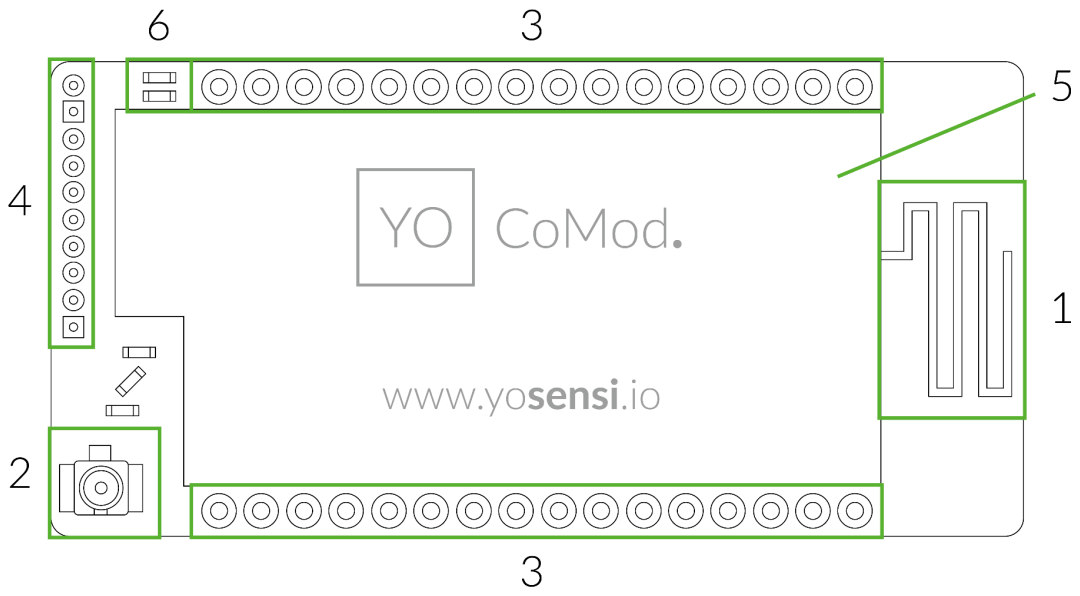


*Figure 1 Device top view.*

Visible device elements:

1) Bluetooth antenna,
2) U.FL socket for LoRa antenna,
3) peripheral connectors,
4) programming and debugging connector,
5) protective shield,
6) LoRa chip variant indicator.

The YO CoMod is available in two hardware variants, each of them has a dedicated firmware that applies to a specific LoRaWAN region, as shown in the table below. The frequency plan for each variant is a function of the RF LoRaWAN, which is described in the documentation "LoRa Alliance, LoRaWAN 1.0.2 Regional Parameters, Revision B".
The product may be operated in EU countries respecting the applicable requirements for use of radio spectrum.

*Table 1 YO CoMod versions.*

| Hardware variant | Region |
|---|---|
| SX1261 | EU868 |
| SX1262 | US915, AU915, AS923 |

YO CoMod version read from the label (LoRa radio). An example of the label can be found in the "Quick start guide" section of this document.

*Table 2 TX power specification.*

| Frequency | Tx power |
|---|---|
| LoRa EU868 [MHz] | to +14 [dBm] |
| LoRa US915, AU915, AS923 [MHz] | to +22 [dBm] |
| Bluetooth Low Energy (BLE) 2.4 [GHz] | -20 to +6 [dBm] |

## Applications

YO CoMod can be used as a standalone device (in conjunction with external sensors/components through available I/O pins) or as a part of a system that transfers data wirelessly. There is wide scope for IoT applications in conjunction with other Yosensi devices such as:

- smart building monitoring (YO Pure Pro),
- installation pressure monitoring, industrial IoT (YO Refrigerant Monitor),
- soil condition monitoring, agriculture (YO AgriBox).

## IoT system components

Typical IoT systems consist of 3 main elements (Figure 2), 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 push them to the Internet-connected server.
3. Server – in most cases, a cloud-based service where data are 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).

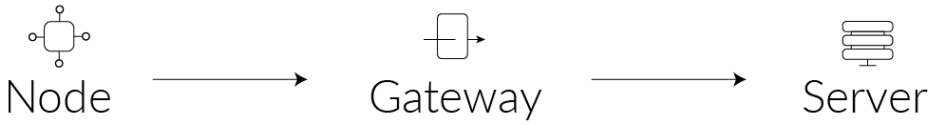


*Figure 2 IoT system components.*

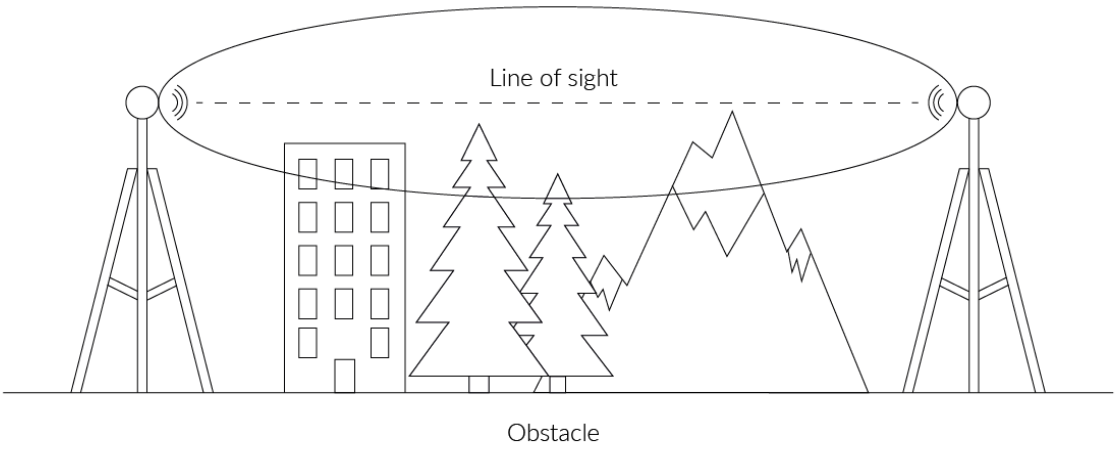


*Figure 3 Fresnel zone where communication between two antennas can occur.*

## Range analysis

Measurement configuration:

- gateway on the roof (10 m) with Mikrotik (TOF-0809-7V-S1) 100 cm, 868/915 MHz antenna,
- YO CoMod with Molex (211140) antenna.

Measured values:

- RSSI [dBm],
- SNR [dB].

The test results show the means of ten RSSI and SNR measurements at each location.

RANGE TEST RESULTS

| DISTANCE [km] | REGION [MHz] | SNR [dB] | RSSI [dBm] |
|---|---|---|---|
| 5,40 | 868 | −6,08 | −105,0 |
| | 915 | −4,84 | −102,0 |
| 7,00 | 868 | −14,6 | −105,8 |
| | 915 | −12,4 | −108,2 |
| 8,5 | 868 | −17,12 | −105,2 |
| | 915 | −11,84 | −108 |

# Device configuration

## Configurable parameters

A few parameters must be set in order to send data to the gateway. The default firmware is configured in ABP connection type with predefined *deveui*, *appkeyota*, *keyotaa*, *nwkskey* by MCU.

CONFIGURABLE PARAMETERS

| NAME | DESCRIPTION | POSSIBLE VALUES | DEFAULT VALUE | READ/WRITE |
|---|---|---|---|---|
| devname | Device name | HWCM | HWCM | R |
| conntype | Connection type | 0 – OTAA<br>1 – ABP | 1 | R/W |
| deveui | Device address EUI | 8 B (HEX) | predefined | R/W |
| appkeyota | OTAA application EUI | 8 B (HEX) | predefined | R/W |
| keyotaa | OTAA key | 16 B (HEX) | predefined | R/W |
| addrabp | ABP 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 |
| advble | Interval advertising Bluetooth [s] | MS_INPUT[1] | 9999 [~ 6 s] | R/W |
| measinter | Measuring and/or sending interval LoRa [s] | 1–999999 | 3600 [1 h] | R/W |

[1] Calculation formula: MS_INPUT = INTERVAL_MS × 1.6

Parameters description:

1. Connection type (*conntype*)

   Used for setting the device in ABP – value “1” or OTAA – value “0” mode.

2. Predefined addresses and keys (*deveui*, *appkeyota*, *keyotaa*, *addrabp*, *nwkskey*, *appskey*)

   These parameters are generated using multiple IDs specific to the particular MCU and are unique for each device. They can be changed if needed.

3. Interval advertising Bluetooth (*advble*)

   Determines the interval for sending broadcast packets, for connecting to nearby BLE receivers.

4. Measuring and/or sending interval in seconds (*measinter*)

   Time interval between sending LoRa payloads ($t_{li}$ in figure 4). This can be dynamically changed in response to the number of peaks in the buffer (i.e. when a threshold is exceeded) in order to keep the server updated with the latest data. For example, if the payload can hold 4 points and we have 6 points to send, the algorithm will send these 4 points first and reduce the time interval between future payloads (see figure 4) to maintain measurement currency and to avoid buffer overflow.

# Quick start guide

Required equipment/software:

- PC with Bluetooth adapter (USB dongle or built-in),
- Power supply (2,6–3,3 V),
- Yosensi CLI tool.

**NOTE** **Yosensi CLI tool works only with YO CoMod default Yosensi firmware. For official firmware updates, contact us on support@yosensi.io.**

## Node configuration

Connect to the device following these instructions:

1. Read the *macBLE* address from the sticker on the device shield. Alternatively, you can identify the device by RSSI parameter (which correlates with distance between transmitter and receiver).


*Figure 4 Device information sticker/nameplate example.*

2. Make sure you have your Bluetooth LE adapter turned on and working properly.
3. Download and run the CLI tool in the terminal/console application.
4. Power your YO CoMod, connecting VCC (PIN 32/31) and GND (PIN 30/29). See datasheet for device pinout.
5. Run `yosensi-cli-tool_vX.X.X_WIN.exe list` to scan for Bluetooth devices. You can see all commands by typing `yosensi-cli-tool_vX.X.X_WIN.exe --help` or add `-h` to your current command to see all needed parameters.
6. If you find your MAC address in the `list` command results, you can connect and reconfigure the device by using one of the available commands. You should use *change_dev_params* subcommand to change device settings. Additional information, including the commands supported by the CLI, are available at https://yosensi.io/support.

Command help view:

```
.\yosensi-cli-tool_vX.X.X_WIN.exe change_dev_params --help
usage: yosensi-cli-tool change_dev_params [-h] mac dev_param [dev_param ...]

positional arguments:
  mac         Bluetooth public MAC address
  dev_param   device parameter(s) name and value, in format 'name=value'
```

Example of use:

```
.\yosensi-cli-tool_vX.X.X_WIN.exe change_dev_param 80:e1:26:1d:2a:33 conntype=0 measinter=1000
It will take up to 180s to find and write new device param(s) into memory, please wait ...
Searching for a device ...
Trying to connect to the device ...
Updated 'conntype' device parameter: SUCCESS
Updated 'measinter' device parameter: SUCCESS
```

After node reconfiguration, you need to have access to the gateway and server. Remember that LoRaWAN network can be set in either of **public** or **private** (default) mode. If you have your gateway prepared and configured, you can start to customize the server side. We'll go through an example in our recommended Yosensi Management Platform software.

**NOTE** **The firmware update process is described in CLI tool manual page 13. Visit https://yosensi.io/support to see all available documentation.**

### 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 it created for them by default (in case of any problems you can find us on support@yosensi.io). The application is a representation of each system and, together with nodes definitions, are created by customers. Basic integration of a Node and Yosensi Management Platform is described below.

**NOTE** **A subscription is needed to use Yosensi Management Platform. Visit https://yosensi.io/ for more information and pricing.**

Yosensi Management Platform integration instructions:

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

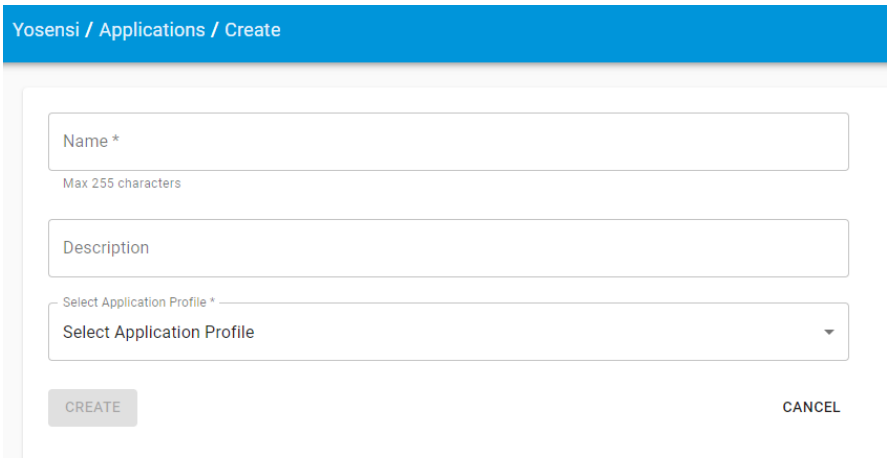


*Figure 5 Application creation form.*

4. Proceed to the application by clicking its name on the list, and press the '+' button to add a node. Select 'Lora' in 'Node Type' field. Set the 'Name', 'Description' fields and fill in 'Node ID' (*deveui*) and 'OTAA Key' (*keyotaa*) **which can be found using the CLI tool (*list_dev_params*).** Select a model that is compatible with your device—it affects the number of charts, its placement and data source (model). 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>.

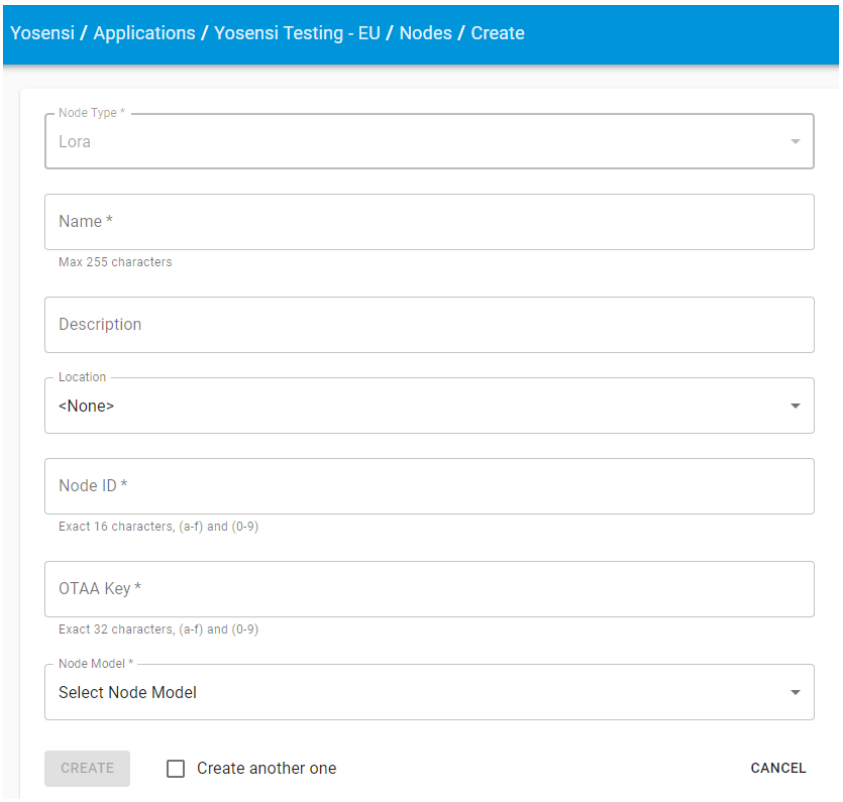


*Figure 6 Node creation form.*

5. **Every new node must be added in OTAA mode**. You must then switch its type to ABP after activation in 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 'Device Address' (*addrabp*), 'Application Session Key' (*appskey*) and 'Network Session Key' (*nwkskey*) with **values from the CLI tool,** and press UPDATE.

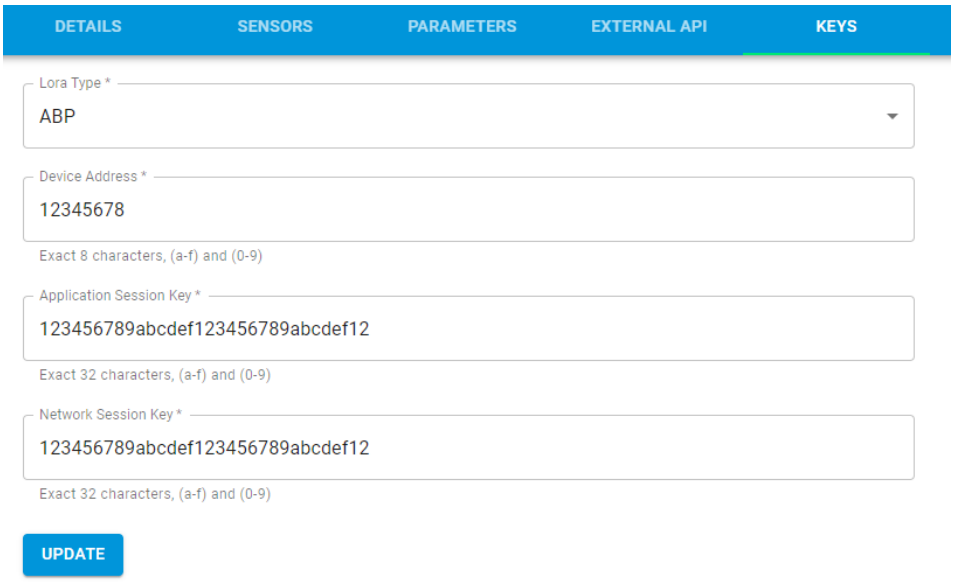


*Figure 7 Node LoRa type configuration form.*

6. When data are received by the server, 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'.

## Payload description

If you want to connect to your own server you need the payload decoder which can be found at https://yosensi.io/support. Example of YO CoMod payload with description:

02:00:00:0a:08:00:01:0c:05

| **Payload header** | | | | **First measurement** | | | | |
|---|---|---|---|---|---|---|---|---|
| 0x02 | 0x00 | 0x00 | 0x0A | 0x08 | 0x00 | 0x01 | 0x0C | 0x05 |
| ver = 2 | cnt = 0 | pct [s] = 10 | | type = 2, prec = 0 | md [s] = 0 | addr_len = 0, meas_len = 2 | val = 3077 | |

# Revision history

| Date | Version | Changes |
|---|---|---|
| 11.06.2021 | 1.0 | Initial release |