

YO**SENSI**.IO

YO CoMod

User guide v1.0

Release notes

Released	Version	Key changes
11.06.2021	1.0	Initial release.

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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.

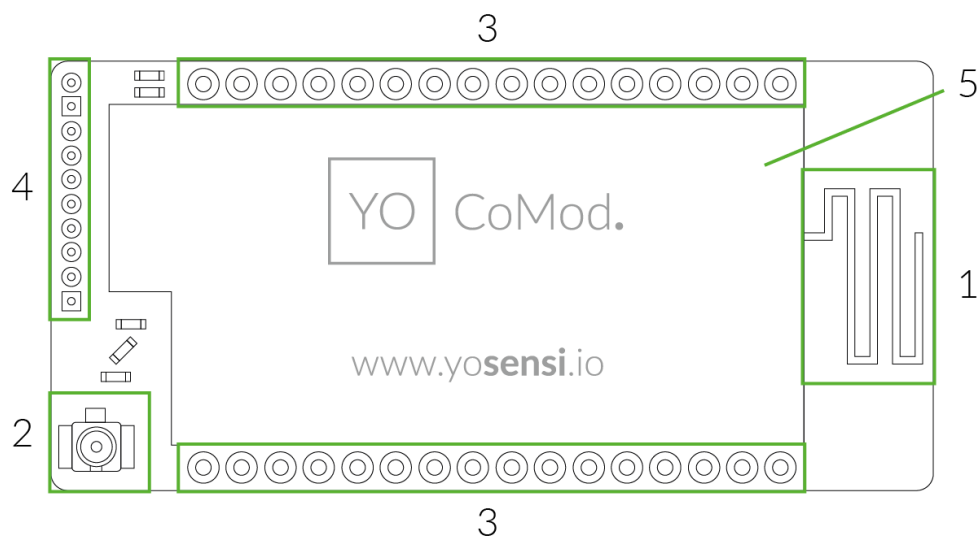


Figure 1 Device top view.

Visible device elements:

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

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 YO Suite (for IoT structure management) and Grafana (for data presentation).

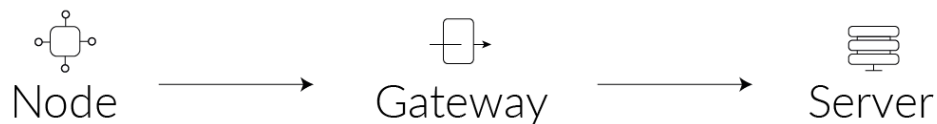


Figure 2 IoT system components.

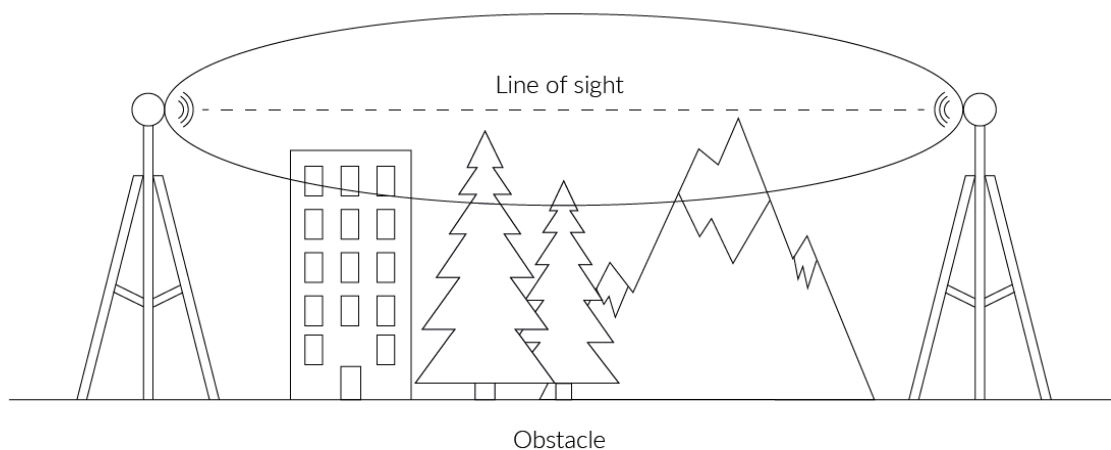


Figure 3 Fresnel zone where communication between two antennas can occur.

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 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: $MS_INPUT = INTERVAL_MS \times 1.6$

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_{ii} 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 YO Suite software.

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

YO Suite 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 YO Suite 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 YO Suite is described below.

NOTE A subscription is needed to use YO Suite. Visit <https://yosensi.io/> for more information and pricing.

YO Suite 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.

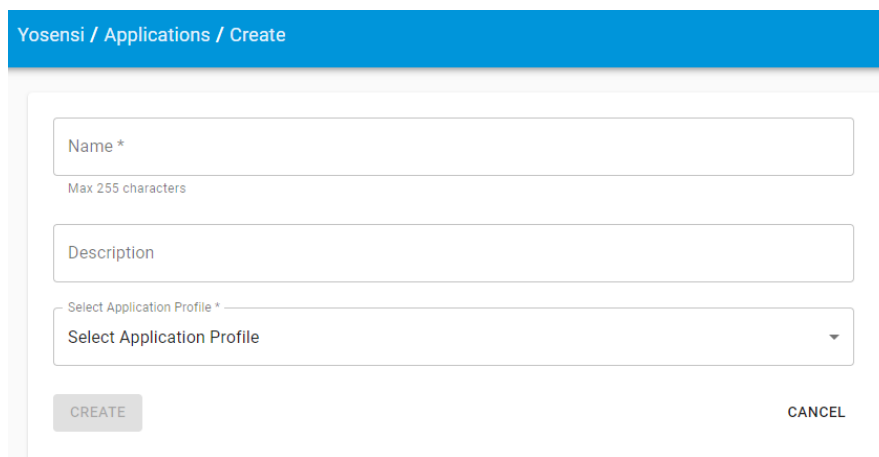


Figure 5 Application creation form.

- 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>.

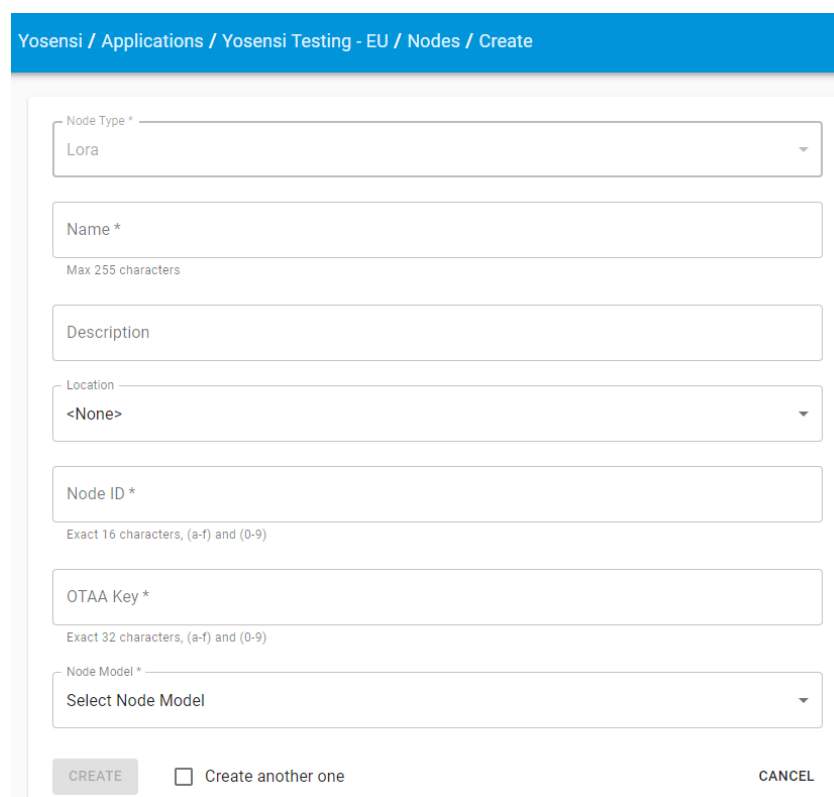


Figure 6 Node creation form.

5. **Every new node must be added in OTAA mode.** You must then switch its type to ABP after activation in YO Suite 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