LORAWAN Node – CONNECTIPHY HUB USER MANUAL

1. What is LoRaWAN ConnectiPhy HUB?

ConnectiPhy HUB is an A-Class LoRaWAN version 1.0.3 end node with Modbus RTU interface over RS-485 with a tested uplink of +11km. Operates at 868 Mhz, EU ISM band. Device can easily be configured using the dedicated app "Modbus HUB - LoRaWAN ConnectiPhy" available on the Microsoft Store.

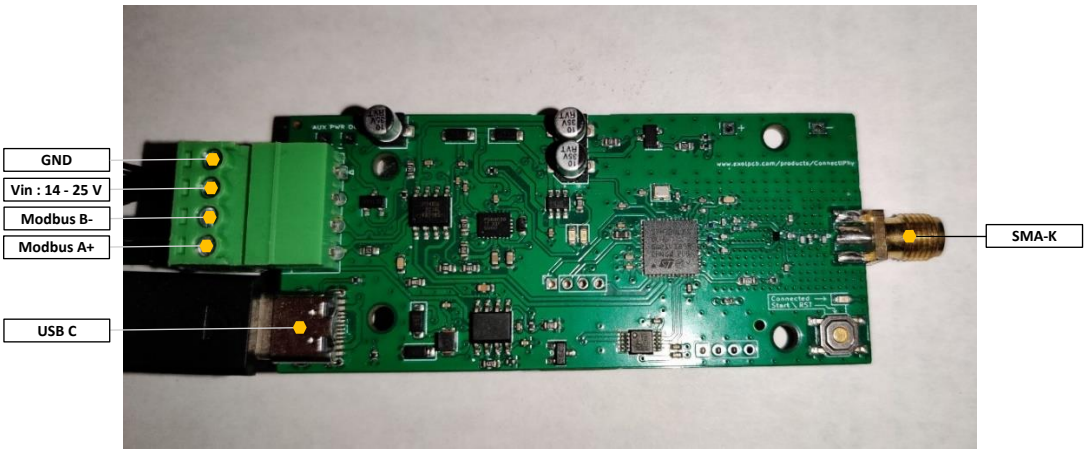
2. How does it work?

All Modbus sensors receive Modbus requests then send back a reply. Modbus ConnectiPhy makes it possible to regularly poll up to 10 sensors/devices, and then send all the collected data to the LoRaWAN cloud server. It's then up to you to harvest your data to generate valuable insights. Upon receiving and storing data on appropriate databases, dashboards like the one below can be established:

LoRaWAN ConnectiPhy enables wireless data transfer across up to 11 Km for uplinks using maximum legal effective radiated TX power allowed for the ISM band. And up to 6 Km for uplink+downlink with an antenna gain of 2.5 dBi.

The configuration of your LoRaWAN ConnectiPhy HUB is done through our free application that can be downloaded from the Microsoft Store. Search “Modbus HUB - LoRaWAN ConnectiPhy” and download our application free of charge.

Device can be powered using USB C. It can also accept input voltage ranging from 14 up to 25V. Pinout defined below:



NB: For the best signal integrity performance, it advised that Modbus and Power share a common ground.

3. How to set up your ConnectiPhy Node?

Step 1: Sensor/machine Configuration

Get your Modbus RTU commands from your sensor or machine datasheet. Modbus frames always look like this:

Device Addr (1 byte) + Command Type (1byte) + Register Addr (2 bytes) + Register Size (2bytes) + CRC1 (1byte) + CRC2 (1byte)

Please note that the LoRaWAN ConnectiPhy windows app will compute CRC1 and CRC2 automatically for you. You will only need to enter the first 6 command bytes.

Please read your sensor or machine datasheet to determine the right Modbus frame that you need. Once you determine the exact Modbus frame for each of your sensors, you may move on to the next step.

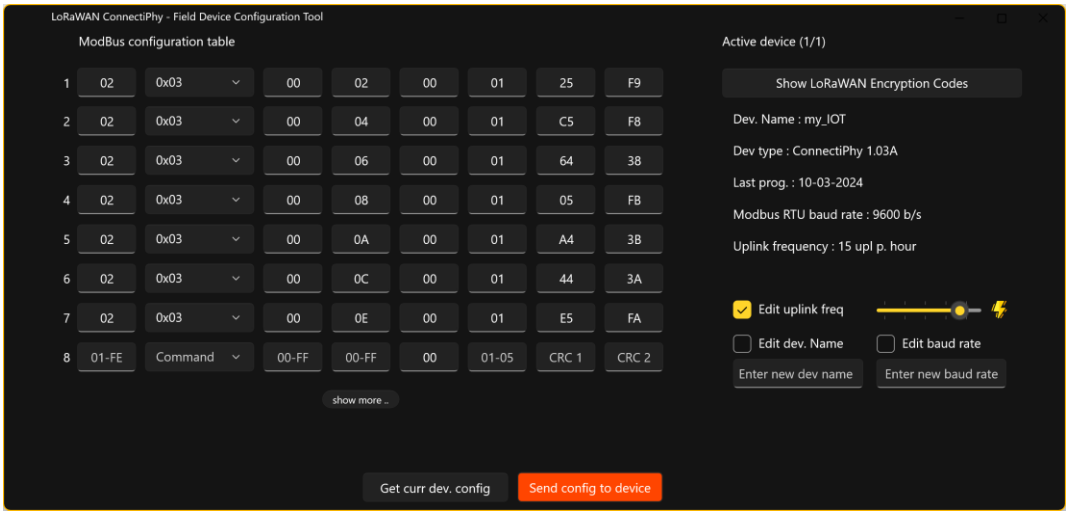
Step 2: Modbus HUB configuration

First connect your ConnectiPhy HUB to your PC. Then launch the configuration app on your computer. Wait a couple of seconds to allow device detection, then start logging your first Modbus command into the first row, the second command in second row and so on. You can also rename your device, set the Modbus baud rate, as well as set your desired uplink frequency (times per hour data is uploaded to your cloud server)

Once you’re done, click the orange button “Send config to device”.

ConnectiPhy HUB configuration is successful when a green mark is displayed next to your Modbus commands.

Check example below for a ConnectiPhy HUB named my_IOT which is connected to 7 Modbus sensors over RS-485 communicating at 9600 baud rate. Uploading data to LoRaWAN server 15 times every hour:



HUB device can be freely reconfigured. If you need to update device configuration, you redo step 2 again with your new configuration (commands, dev name, baud rate ..)

If you connect a previously configured node, click “Get curr dev. config” to fetch and display all previously stored commands as well as other relevant data.

Step 3: LoRaWAN registration

Your ConnectiPhy HUB communicates with the LoRaWAN server using a DevEUI, an AES encryption Key and a JoinEUI. You will need these codes to register your HUB into the LoRaWAN network (TTN or equivalent).

Click “Show LoRaWAN Encryption Codes” on the PC app while the Hub is connected to your computer. (You may need to wait a couple of seconds to allow device detection). Use displayed codes to register your HUB into the LoRaWAN network. The Join EUI is by default set to “01 01 01 01 01 01 01 01”.

These codes are unique to each device. Therefore, your data is secured during transfer to the LoRaWAN cloud server using end to end 128-bit AES encryption.

Now head on to your LoRaWAN network provider and register your HUB. Configuration example using The Things Network is shown below:

Register end device

Does your end device have a LoRaWAN® Device Identification QR Code? Scan it to speed up onboarding.

Scan end device QR code | Device registration help

End device type

Input method

- ○ Select the end device in the LoRaWAN Device Repository
- ◉ Enter end device specifics manually

Frequency plan *

Europe 863-870 MHz (SF12 for RX2)

LoRaWAN version *

LoRaWAN Specification 1.0.3

Regional Parameters version *

RP001 Regional Parameters 1.0.3 revision A

Show advanced activation, LoRaWAN class and cluster settings

Provisioning information

JoinEUI *

01 01 01 01 01 01 01 01 Reset

This end device can be registered on the network

DevEUI *

00 80 E1 [redacted] Generate 1/50 used

AppKey *

.. .. Generate

End device ID *

eui-0080e1150517cf24

This value is automatically prefilled using the DevEUI

After registration

- ◉ View registered end device
- ○ Register another end device of this type

Register end device

Step 4: Deployment

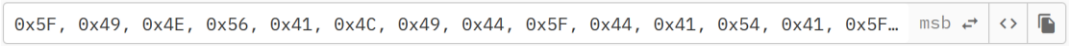
That's it. No more steps! You can deploy the HUB in the field and connect all your Modbus sensors/devices to it using the data bus wires (A+ & B-)! The HUB will then automatically join the LoRaWAN Network and start sending sensor/device data to your server at the frequency you specified in step 2.

4. What happens when you deploy ConnectiPhy Node ?

After correctly following all the steps listed in chapter 3 above, connecting the Modbus signal pair to your ConnectiPhy HUB and then powering it on will trigger the following actions:

1. HUB boots up and loads the LoRaWAN protocol onto memory.
2. If first boot after shipping, the HUB will generate a new secure AES encryption Key then save it. If not first boot, this step will be skipped.
3. Now HUB will send a Join Request to the nearest LoRaWAN gateway. Will keep retrying a couple of times until successful. Blue LED will then light up.
4. HUB will now send the registered Modbus commands in step 2 to the connected sensors
5. If connected sensors recognize the Modbus commands received, sensors will reply back. And ConnectiPhy HUB will save those replies in its internal buffer for later processing.
6. Finally, after HUB checks each reply's data integrity, it will forward all payloads to the LoRaWAN Gateway, which in turn will forward them to the LoRaWAN server. Data transmission is triggered at the frequency specified during step 2. Payloads are sent one after the other: Payload response bytes for command 1, Payload response bytes for command 2 and so on. All in one single LoRaWAN frame, left-most byte being that of first command response. Screenshot example from TTN console below:

In case Modbus commands are incorrect or in case of Modbus wiring fault, the following ASCII payload will be sent meaning "_INVALID_DATA_":



You can now place hundreds of ConnectiPhy hubs to connect thousands of sensors or machines to the cloud. The massive amount of data you will be collecting will provide you with deep insights, trends. Other use cases include active alerts based of specific criteria, or advanced statistics for preventive maintenance, or plant digital twin based on live data from the field.

Contact:

Inquiries can be sent to contact@exolpcb.com

Update history:

Revision date	Comments
31 – 01 – 2024	User manual for HW/SW V1.1