Application guide W-Modbus for Solar

This guide aims to give users some directions on how to operate a Modbus RTU network wirelessly with significant network load by having one unit, such as an Solar Inverter, polling an energy smart meter at a very fast pace.

Always remember that an unstable or non-functioning network can have three different root causes or a mix of all three.

1. Issue with individual nodes, such as a malfunctioning RS485 interface or too many EOL resistors. LumenRadio devices have EOL resistors built-in with no possibility to disable them.
2. Non ideal Modbus RTU network settings.
3. Unstable wireless network

Please refer to LumenRadio's LED behavior quick start guide for troubleshooting instructions.

Quick guide for best practice Modbus & wireless settings

- Minimum 1 second time-out on replies
- Minimum 3 retries per request
- PDR (Signal in Network Map on Mobile App) - Above 95 % on all nodes
- If your device is fast-polling, see section **Firmware update to W-Modbus Beta firmware.**
- See this installation guide on how to wire LumenRadio devices with solar inverters.

Most common issues when installing W-Modbus with Solar inverter and smart meter

1. **Issues on the node**:
   a. Issues with Smart meter: either wrong polarity of the cable or something wrong with the smart meter.
   b. Third LED flashed RED every five seconds: If this persist it can be a hardware fault on the smart meter or the LumenRadio device.
   c. The most common issue with "faulty" hardware on the LumenRadio device is that a user have put 24V on the RS485, this will break the RS485 circuit and void warranty.

2. **Wireless connection is weak or the pairing failed.**
    a. If the first LED is solid red then there is a weak connection. See the section "***Wireless network planning and external antennas***". If the Node LEDs is sweeping blue then pairing failed, redo the commissioning.
3. **Issues at the gateway**: If the two first issues are cleared and you have a network map looking like the map shown in the section "Validate your installation" but you still do not see the smart meter in the Inverter interface:
    a. If the mid LED flashing constantly then it is most likely the issue of too fast polling. Gateway then needs firmware update, see section "***Firmware update to W-Modbus Beta firmware***"
4. **Your installation consist of an EMS and inverter and not an inverter and smart meter.** An EMS (such as the Huawei EMMA) acts as the Modbus Client (Master) instead of Server (Slave). Therefore you need to place the LumenRadio gateway at the EMS and the LumenRadio node at the inverter.

Compatibility between LumenRadio W-Modbus and Solar inverters

In a Modbus system, it is important to be able to ask questions and receive answers within a certain time frame. When a Master asks a question, there is often a pre-configured waiting time ("timeout"). In many Modbus systems, this is configurable. W-Modbus often has a delay of 50-80 ms but can take up to 500 ms depending on the amount of data, the baud rate of the device and if repeaters are used. It has been found that some inverters have set their wait time to 100 ms or less, which means the system does not have time to respond before the next question is asked. LumenRadio cannot influence timeout in the inverter.

As of 4.0.20 (beta version of 4.0.0) there have been good results with several inverter & smart meter pairs that has a very fast poll rate, however LumenRadio can not guarantee functionality due to rapid firmware updates from Solar inverter companies. It is therefor recommended, if possible, to disable automatic updates on the inverter and smart meter, and update their firmware only if needed. There have been cases where inverter and smart meter firmware updates increase polling rate further, breaking compatibility. If you do decide to test with other combinations than the once found on our compatibility list or find current working systems no longer working, please create a ticket in our support portal:
LumenRadio Support

Tip: Refer to the *LumenRadio LED Behavior Quick Start Guide* for diagnostic codes and troubleshooting steps.

Compatibility list

Lumenradio tries to keep an accurate list of tested and validated combinations of Solar inverter and smart meter pairs. It is however important to remember that the Solar inverter company sometimes make firmware updates automatically that makes the solution incompatible. We do recommend users to turn off automatic updates in order to control when an update is done on the solar inverter. You will find the latest updated list.

https://lumenradio.com/support-materials/compatibility-between-lumenradio-w-modbus-and-solar-inverters/

Firmware update to W-Modbus Beta firmware

If you experience issues while the MID led is constantly flashing, then the cause is most likely then it is most likely the issue of too fast polling. It is then worth trying LumenRadios beta firmware to see if that resolves the issue.
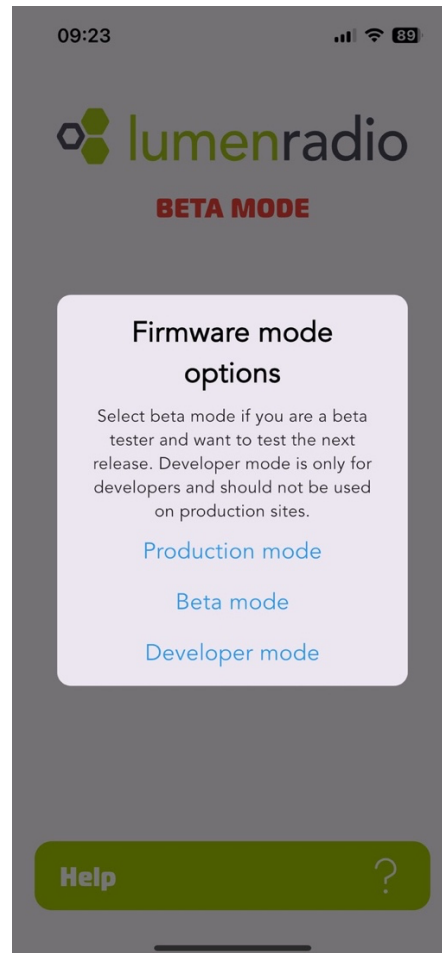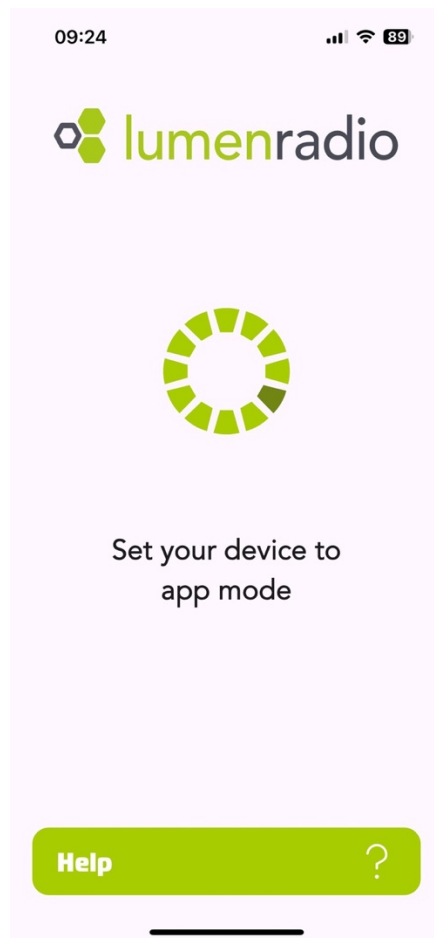
Install the mobile app
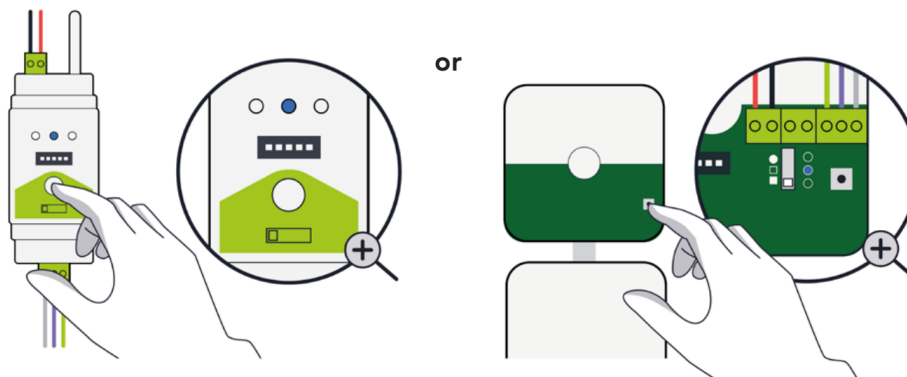
Google Play - W-Modbus
Apple App Store - W-Modbus

Activate Beta mode in the app

Tap the LumenRadio logo 8 times and select the Beta mode.

Activate Bluetooth on the gateway

Activate Bluetooth on the gateway by pressing the button 3 times. The middle LED should flash blue twice. The device will be connectable for 3 minutes.

Update firmware

Make sure that the version ends with .20, for example 4.1.20, before you proceed to the Update firmware. You can leave the site and let the firmware update automatically update the node once the update is complete and you have validated that the node has rejoin. The firmware update of the node process takes around 1 hour.
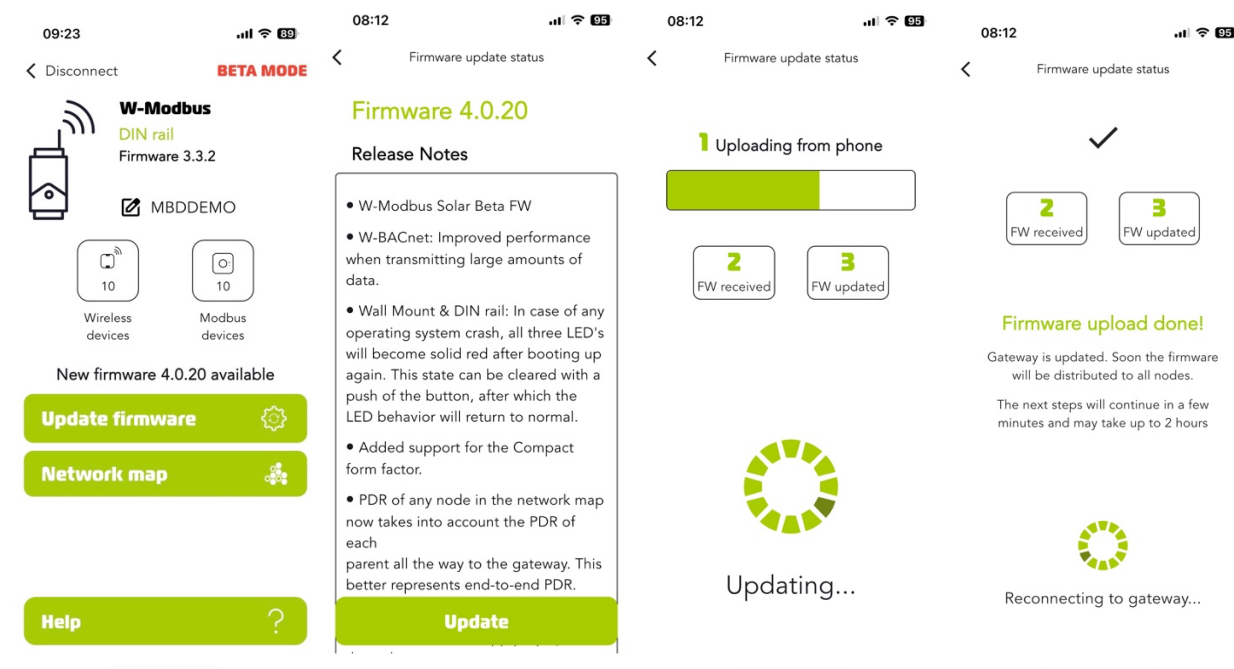
Wireless Network Planning & External Antennas

A consistent, high quality wireless network is key for a stable Modbus RTU network. This section aims to give a small introduction on how that can be achieved.

Metal Enclosures

Metal enclosures, such as electrical cabinets, will reduce range significantly of your wireless installation. **Before making any other adjustments, ensure that all devices and any external antennas, if applicable are placed outside of metal enclosures.**
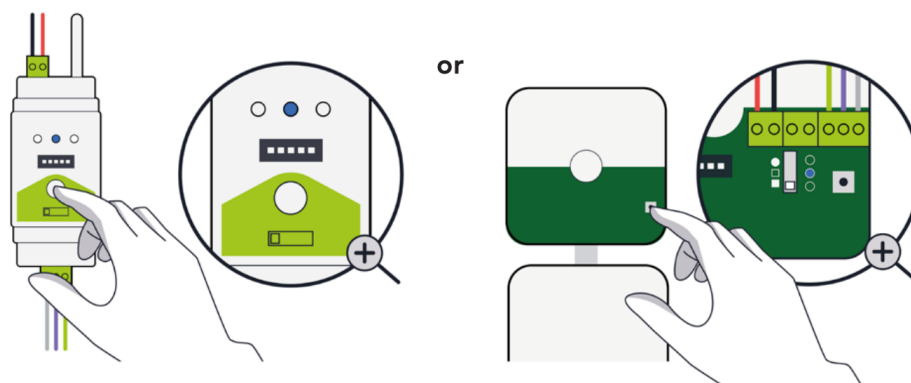
Installation validation

Install the mobile app

Google Play - W-Modbus
Apple App Store - W-Modbus

Activate Bluetooth on the gateway

Activate Bluetooth on the gateway by pressing the button 3 times. The middle LED should flash blue twice. The device will be connectable for 3 minutes.


Validate network map

The full mesh network is displayed on the Network Map page in the mobile app. The large hexagon in the top-left corner of each node represents the Packet Delivery Rate

(PDR), measured end-to-end across all mesh hops starting from version 4.0.0. Previously, it only indicated single-hop PDR. The value is updated every 3 minutes, and you might not be seeing the current PDR value. If your network is newly established, you will see yellow and red values initially. Allow the network to stabilize for at least 15 min before making any adjustments.

This value should be at least 95 % for all nodes to have good performance. For Modbus devices where you only monitor then a fair performance (yellow) can be acceptable. You need to either adjust the placement of the devices or add repeater units if the PDR values are green.
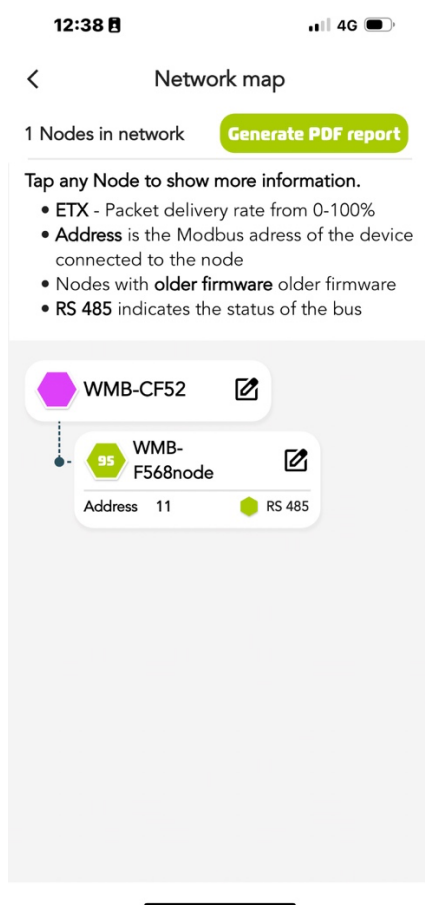
External antennas

Note: This section is aimed towards the US market where the FCC certification allows up to 27 dBm of output power for the W-Modbus DIN rail products. This allows to replace the antenna with stronger antennas.

The responsibility is on the user to assure CE compliance below 20 dBm **if the original antenna is replaced**. If you are unsure we recommend to use LumenRadio's DIN rail original antenna inside an IP67 plastic enclosure with as good line-of-sight as possible.

Generic antenna placement guidance

- Ensure antenna isn't touching any obstructions or cables, as it can affect the radiation pattern and effectively reduce the radio range. No obstructions at least 2cm around the antenna is a good rule-of-thumb.
- The antenna should be mounted perpendicular to the floor plane to have optimal radiation pattern.
- Install W-Modbus devices or its external antenna, if applicable at minimum 1.5m above the floor level.
- Antenna cables are in general very sensitive, avoid excessive bending and looping of the cable when installing and at its permanent state.
- **Do not install inside a metal enclosure or with the W-Modbus device surrounded by metal objects.**
- Water attenuates signals and it is therefore important to select an antenna that cannot be covered with significant amount of snow if the placement for the antenna is outdoors, see more under the outdoor section.
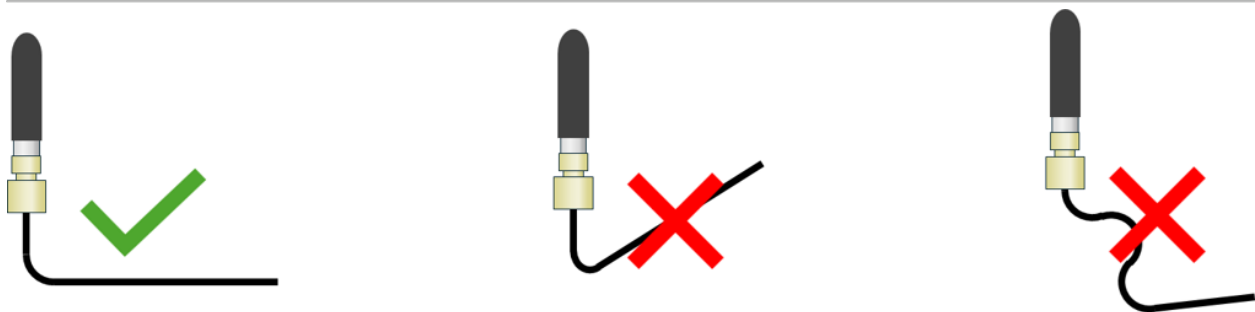
It is recommended that, to the greatest extent possible, not to twist or bend the antenna cable.

Outdoor Enclosure

The W-Modbus product must be placed in a properly rated enclosure for outdoor installations.

LumenRadio offers an outdoor kit for the DIN rail form factor that is IP67 rated for use with outdoor installations.

Outdoor Kit Contents (SKU 800-2324):

- 1x IP67-rated plastic enclosure
- 1x 24 VDC power supply
- 1x N-Type antenna connector
- 1x 2 dBi outdoor antenna
- 1x Sheet metal vandal cover

 Using this kit is the **recommended method** for outdoor W-BACnet DIN rail installations.

Alternative Outdoor Setup:

- If you prefer to source **24 VAC power from your electrical cabinet** and do not require a vandal cover, you can purchase the enclosure and antenna separately:
  - **SKU 800-2322:** IP67 DIN rail enclosure with N-Type female connector
  - **SKU 104-1002:** 2 dBi outdoor antenna with N-Type male connector

External Puck Antenna Option

- An **external puck antenna** (SKU 104-1033) offers a simpler outdoor installation alternative.
- Note: This option carries a higher risk of **incorrect antenna placement**.
- The antenna cable is very sensitive — avoid excessive bending or looping to maintain optimal wireless range.

Recommended installation for outdoor installation
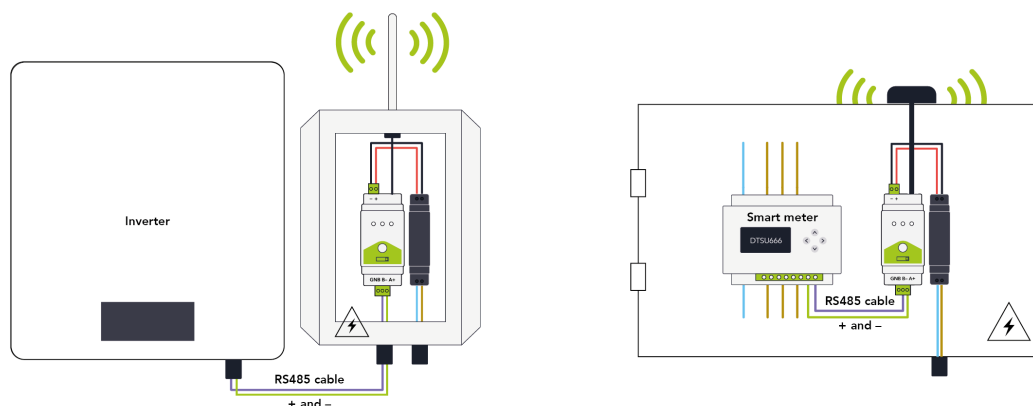
Tip: Refer to the alignment video for proper installation guidance.

Ensure all connectors and cables are properly secured and avoid excessive bending or twisting of the cable to maintain signal integrity.

Support ticket

You are welcome to reach out to our partners or create a support ticket if you still have issues after following this guide.

For us to help you as good as possible, please attach a screenshot of the network map from the mobile app (see section "Installation Validation") as well as a five second movie recording the Gateway and a five second movie of the node. This will assist us in determining the most common issues very fast and can provide you with help much faster.

You create a support ticket here. Try to be as detailed as you can including appending a screenshot of the network map or the pdf report from the mobile app. This helps us speed up the resolution of your issue.