

User Manual Pow-U

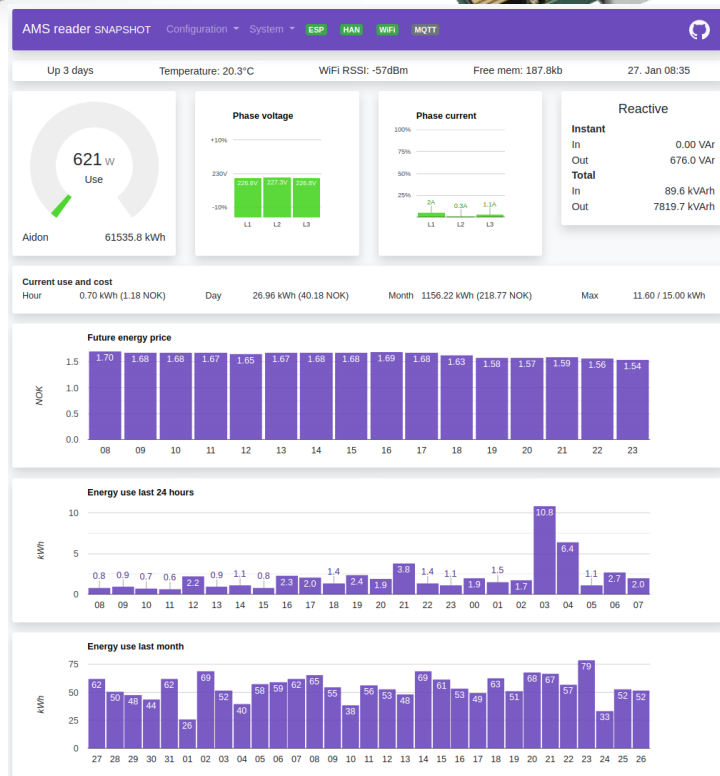
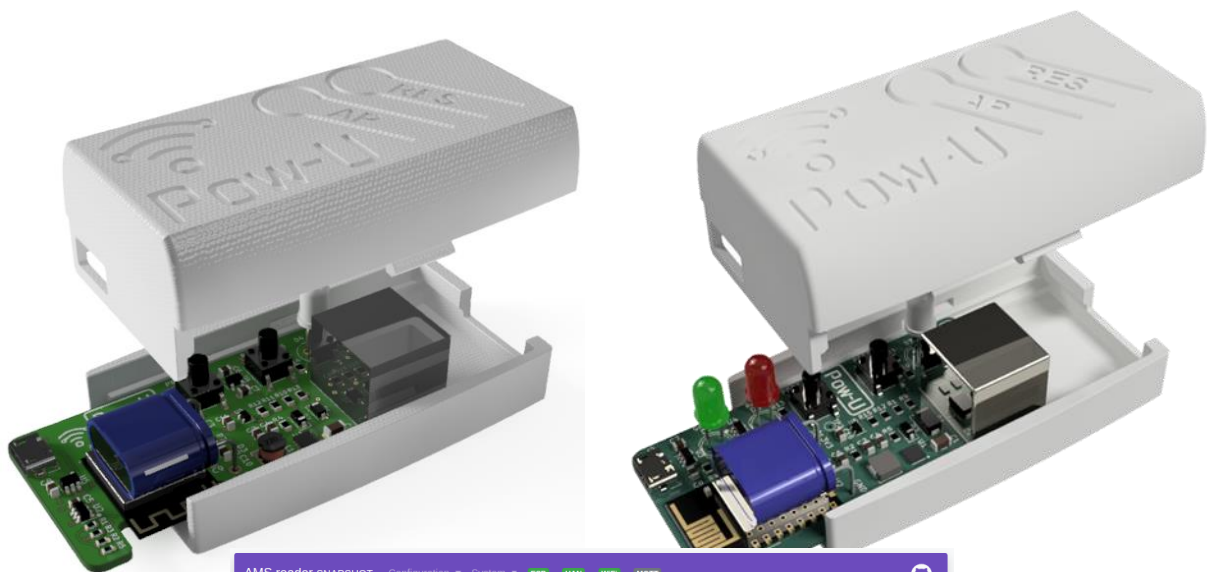


Table of Contents

1	Introduction.....	3
2	Overview.....	4
2.1	Connections.....	4
2.1.1	M-bus connection alternatives.....	4
2.2	Control buttons	7
2.3	Indicator LEDs.....	7
3	Programming.....	9
3.1	Programming over Wifi	9
3.2	Programming by cable.....	9
3.2.1	Pow-U with ESP32-S2	9
3.2.2	Pow-U med ESP8266	9
4	Configuration and operation	11
5	Known issues	11
5.1	Pow-U with ESP8266 loses voltage, reboots often	11
5.1.1	Background.....	11
5.1.2	Workarounds.....	11
5.1.3	Permanent solution	12

1 Introduction

User manual for **Pow-U** HAN-port reader for AMS power meters sold by amsleser.no.

The Pow-U connects to the AMS meter HAN port with an RJ45 "Ethernet" cable or RJ12 cable (depending on power meter). It connects to the local Wi-Fi network and can relay measurement data from the meter to smart house systems via an MQTT broker.

Description and user manual for the firmware:

See separate document "Firmware User Manual" located on the product page in the online store (see the tab "Vedlegg").

The measurement data:

- Is presented as a browser page on the IP address of the unit
- Can be forwarded to an MQTT broker (internal or external/cloud)

The following data are available:

- Instantaneous consumption and production (if the facility has e.g. solar cells) [kW]
- Voltage on each phase of the main fuse
- Current related to each phase of the main fuse
- Accumulated energy purchased from and delivered to the grid [kWh]
- Information on Wifi and (optional) MQTT connection
- Electricity prices from Entso-E (<https://transparency.entsoe.eu/>)
- Some meters also report power per phase [kW]

In normal operation, Pow-U is powered from the AMS meter HAN port.

Due to limitations in available current on the HAN port, it must during reprogramming, firmware updating etc be powered externally via its USB plug. It can be connected to USB power and AMS meter at the same time.

When the POW-U is unplugged from the AMS meter, the LEDs will continue to light for quite some time. This is normal, as the module retains charged for a while.

Before you can use Pow-U, you must contact your grid company to request activation of the HAN port. Some grid companies have an online "My Page" where this can be done, and the process rarely takes more than a couple of days.

The firmware is actively maintained and updated, so some descriptions and screenshots may look slightly different than what is presented in this document. We recommend using the latest version firmware.

Pow-U can be purchased from our online store: <https://amsleser.no/>

2 Overview

2.1 Connections

The illustrations show two variants of the enclosure.

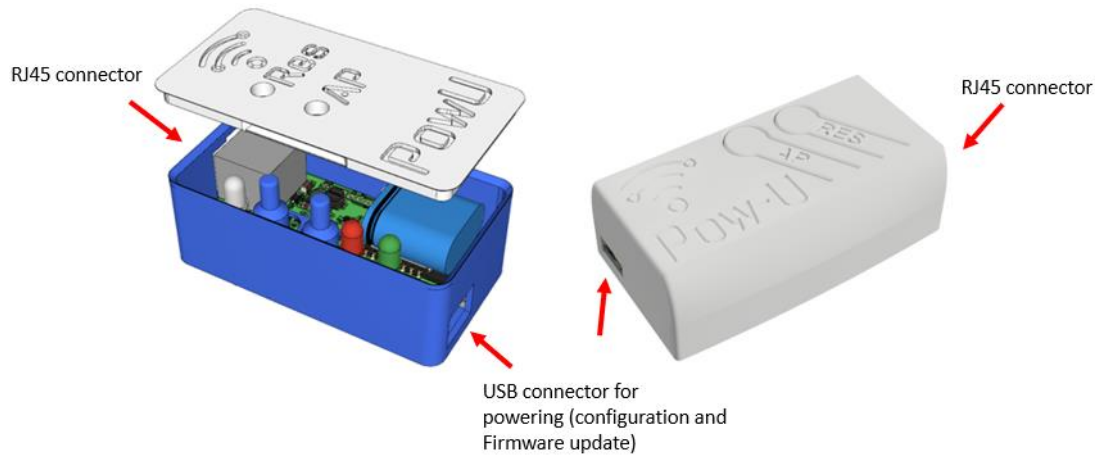


Fig 1: Connections

2.1.1 M-bus connection alternatives

We have so far seen two slightly different implementation of "M-bus" signals on power meters in Europe:

1. Nordic countries

- a. M-bus signal on pins 1 and 2 on an RJ45 connector.

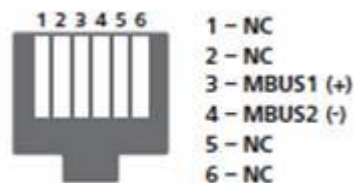
Pin	Functionality
1	Communication
2	GND
3-8	Not used

- b. Base voltage level: Approximately 24V, voltage dropping 12V when data bits arrive.

2. Mid European countries

Note: This is named "P1", which in Nordic countries is a completely different physical interface – so please do not be confused by the name!

- a. M-bus signal on pins 3 and 4 of an RJ12 connector



- b. Base voltage level: Approximately 32V or 36V, voltage dropping 12V when data bits arrive.

Newer Pow-U devices (PCB layout version 1.7 and newer) can be used on both meter types.

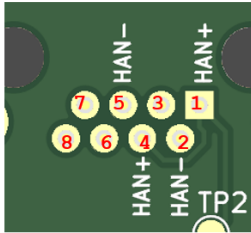


Revision: 15th Jan 2024

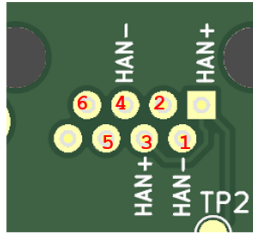
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Connection to both RJ45 pins 1 and 2 and RJ12 pins 3 and 4 is ensured by duplicating pins on the PCB layout:

RJ45/8p8c pin numbers



RJ12/6p6c pin numbers

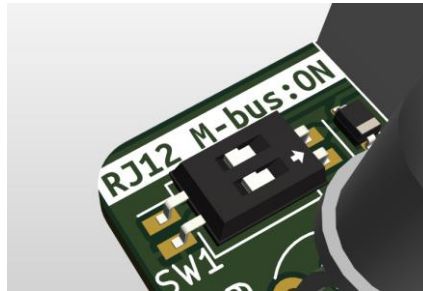


2.1.1.1 Connection to Nordic M-bus meters

Connect the Pow-U to the meter using an ordinary, straight RJ45 cable ("Ethernet cable"). Only one wire pair is used (pins 1 and 2).

Newer boards (v1.8.1 and newer, sold from early December 2023) have a dual DIP-switch.

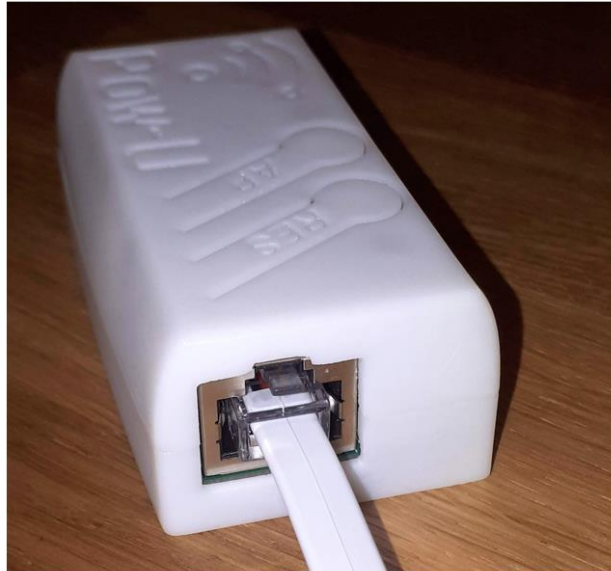
When the board is used with RJ45 cable, both DIP switch selectors shall be in the "OFF" position:



2.1.1.2 Connection to Mid European M-bus meters

Connect the Pow-U to the meter using a straight RJ12 cable. You can order such a cable (30 cm) with the Pow-U. The RJ12 cable is plugged into the RJ45 connector of the Pow-U.

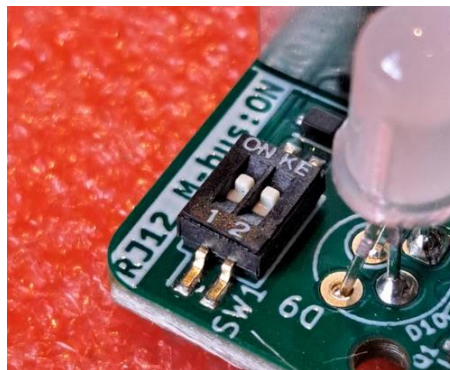
Due to the design of the locking tab of the plug, it can only be placed in the correct position, centred:



RJ12/6p6c cable in Pow-U RJ45 socket

Newer boards (v1.8.1 and newer, sold from early December 2023) have a dual DIP-switch.

When the board is used with RJ12 cable, both DIP switch selectors shall be in the "ON" position:



2.2 Control buttons

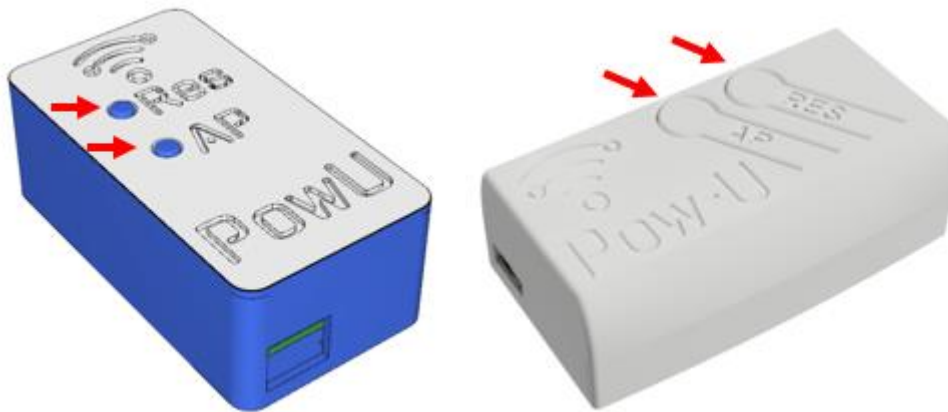


Fig 2: Two control buttons

Control buttons

The buttons have the following functions:

- **RES**
Restarts the microcontroller. Press it if the unit is no longer responding or has disconnected from Wifi. Reset is indicated by a blink sequence on the LED (see below)
- **AP (Access Point)**
Use it if you no longer can access the unit, have forgotten IP address etc.
In Access Point Mode the Pow-U needs to be powered via the USB connector.
The unit will go to Access point mode (see Firmware User Manual) by pressing and holding the button for 5-10 seconds.
The unit will then restart in Access point mode as follows:
 - **SSID: AMS2MQTT**, no password
 - After connecting your wireless device (PC, mobile, pad, ...) to this SSID you can reach the unit in a browser window on this URL: <http://192.168.4.1/>

Pow-U can now be reconfigured with IP-address etc, restarted as WiFi client og then reached on its IP address.

2.3 Indicator LEDs

Older units have 3 indicator LEDs hidden under the lid (light shines through the plastic).

Newer Pow-U med ESP32-S2 do not have the red and green LEDs, only the multicolour LED.

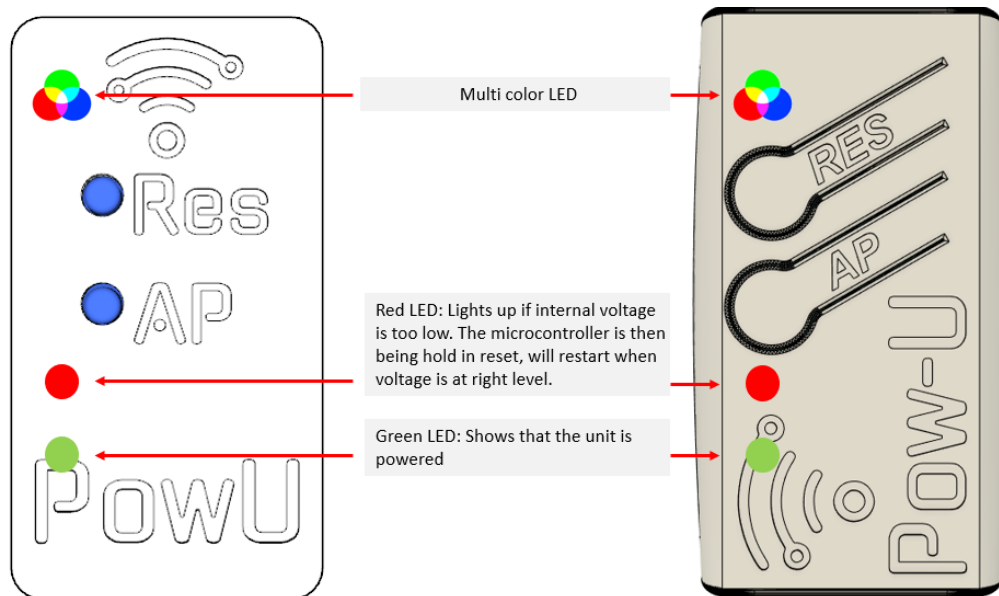


Fig 3: Indicator LEDs

The multicolour LED gives the following indications::

- Boot confirmation sequence (green/red/yellow)
- **Yellow repetitive blinks:**
Unit is in Access Point mode, see paragraph **Error! Reference source not found..**
- **Blue blinking:**
Blinks while datagrams arrive from the power meter.
- **Short green blink following incoming datagram**
Confirms the incoming datagram is recognized as valid.
- **Red blink codes to indicate errors**
See "Firmware User Manual".
- **Steady blue light**
When Pow-U is powered but not connected to the power meter.

Newer boards (v1.8.1 and newer, sold from early December 2023) have an LED beside the USB-C socket that gives a visual indication that the board is powered from USB:

Newer boards (v1.8.1 and newer, sold from early December 2023) have an LED close to the USB-C socket that indicates whether the board is powered from USB:



3 Programming

Units are delivered pre-programmed. Newer units will go direct to Access Point mode when powered for the first time. Firmware updated (binary file) can be uploaded to the unit via Wifi.

During programming/updating, Pow-U needs to be powered on the USB connector. If this is not done, the update/programming may fail, and the unit stop working. It must then be reprogrammed by cable as described in paragraph 3.2.

3.1 Programming over Wifi

Described in "Firmware user manual" which is downloadable from the product page in the webshop <https://amsleser.no>

3.2 Programming by cable

3.2.1 Pow-U with ESP32-S2

Can be programmed over USB cable. The procedure is described in "Firmware v2.2 User Manual" downloadable from the product page in the webshop <https://amsleser.no>.

3.2.2 Pow-U med ESP8266

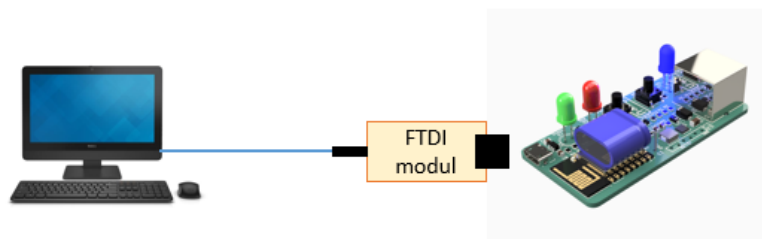
These units cannot be programmed by USB cable.

You'll need:

- FTDI-module
- PC or Mac med Python installed
- The Python-program **esptool.py** available here: <https://github.com/espressif/esptool>

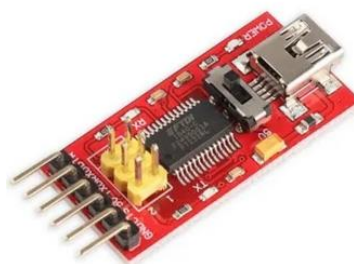
3.2.2.1 FTDI-module

An FTDI-module is connected to a USB port on a PC/Mac:



FTDI module can as an example be procured here:

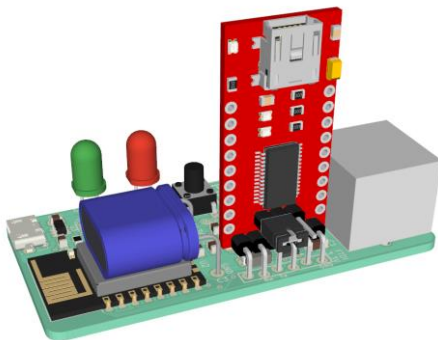
<https://www.kjell.com/no/produkter/elektro-og-verktoy/arduino/moduler/luxorparts-usb-til-seriell-adapter-for-arduino-p88064>



Important:

1. The signal voltage for programming is 3,3V. Programming using 5V signals fra the FTDI module may harm the device. FTDI-modules have a jumper or a switch to set the voltage level.
2. The Pow-U must be powered **for** connecting the FTDI module. Connecting a powered FTDI module before unit is powered can very likely damage your Pow-U unit.

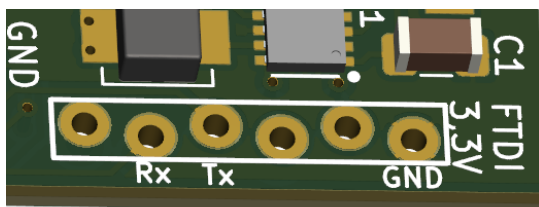
Remove the Pow-U board from its enclosure and plug in the FTDI module as shown below. The holes in the PCB are arranged in a zigzag pattern to ensure good contact (soldering of a header socket is not needed).

**Note: FTDI-modules may have differing pinout**

Check carefully the marking of the FTDI-module before connecting it.

Only 2 pins are used: GND, Rx and Tx.

The Marking on the PCB indicates the pin names of the FTDI module:



- Connect GND to GND of the FTDI module
- Connect Rx to Rx of the FTDI module
- Connect Tx to Tx of the FTDI module

3.2.2.2 Procedure

Download the correct binary file from <https://github.com/gskjold/AmsToMqttBridge/releases>

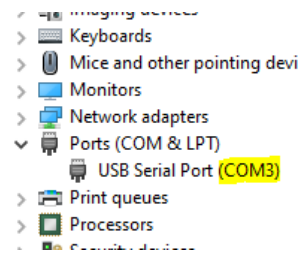
Use latest version, and use the file for ESP8266, named **ams2mqtt-esp8266-x.yy.zzz.bin**

1. Download the binary file to your PC/Mac
2. Remove Pow-U from enclosure
3. Power the Pow-U on the USB connector, wait for it to boot

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4. Connect the FTDI module to PC/Mac, then to the Pow-U as described above.
5. The FTDI module will present itself as a COM-port on your PC/Mac. Check in Device Manager which port it is, and note it down →
6. To set the ESP8266 in programming mode:
 - a. Hold the AP button
 - b. Press and release the RESet button
 - c. Release the AP button
7. Open a command window on the PC and write this (one long line):
`esptool.py --chip esp8266 --port <port> --baud 115200 --before default_reset --after hard_reset write_flash 0x0 firmware.bin`
Replacing "<port>" with your COM-port, e.g. COM3.
8. Press ENTER.
9. If successful, you will see confirmation in the command window as the programming proceeds.
10. When upload is finished, press the RESet button.
11. The Pow-U card will now start in Access Point mode.
You will see this by a blue blink on the ESP-12 module with some seconds interval.
12. You can now connect to the access point, open <http://192.168.4.1> and configure the card.



4 Configuration and operation

See "Firmware user manual" downloadable from the product page in the webshop <https://amsleser.no>.

5 Known issues

5.1 Pow-U with ESP8266 loses voltage, reboots often

Some users may encounter this problem.

5.1.1 Background

Pow-U draws its power from the HAN port M-bus signal, but the power available is limited, and not identical on all power meters.

To save power, the firmware exploits the "Auto modem sleep" feature of the microcontroller, to which the microcontroller shall drop when it is idle between reception of datagrams from the power meter.

The available documentation is a bit thin, but we find rumours of a hardware bug in the ESP8266 microcontroller that in some situations prevents it from going to modem sleep. In particular, it seems to be kept awake if there is multicast/broadcast activity on your WiFi system. This will typically be in a Wifi network where there are active Apple-TV and/or Chromecast units.

5.1.2 Workarounds

The problem can be remedied by moving the Pow-U to a network/ SSID without multi-/broadcast units.

Depending on the Wifi router, you could do this by activating a separate SSID, or moving the Pow-U to a guest network, which is often configured to block multi-/broadcast. But please note that some routers seem to block access to IP addresses on other SSIDs – in which case using guest SSID will not work.

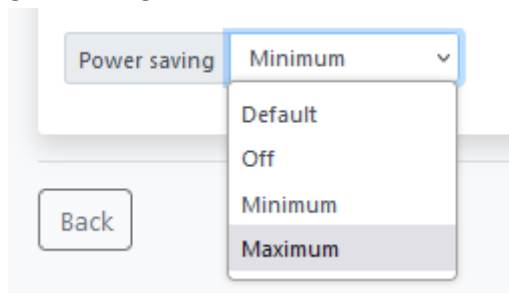
An alternative workaround is to buy a separate (simple, low cost) wifi router set up as an extension of the existing router.

5.1.3 Permanent solution

The problem is solved on newer versions of Pow-U med ESP32-S2 modules, by using a "Power saving" feature.

Unfortunately, the most aggressive power saving mode seems to create issues in some Wifi environments, where the user interface becomes less responsive, and the Pow-U appears as unavailable for shorter or longer periods. It might even require a reboot (press the button).

The firmware has from v2.1.12 a feature where the power saving level can be adjusted by the user, go to Configuration → Wifi:



New Pow-U units with ESP32-S2 are by default set to Maximum. If slow response is an issue, the user could try changing the setting to Minimum, and only use Maximum setting if the unit then reboots often.