Firmware v2.2 User Manual

Pow-U / Pow-K / Pow-P1

Table of content

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1 Introduction

This user manual describes the setup, parametrization and use of the firmware that powers the **Pow-K**, **Pow-U** and **Pow-P1** HAN-port readers sold by amsleser.no.

There is a separate document available for previous firmware version v2.1.x, please see the product page in the webshop https://amsleser.no.

For instructions related to use of the hardware, a User Manual for each device is available, please see the product page in the webshop https://amsleser.no.

In this manual, "Device" means any such Pow-unit.

The firmware is Open Source, source code and additional information is available on: https://github.com/UtilitechAS/amsreader-firmware

Users are encouraged to signal bugs or propose improvements under "issues" on the project GitHub page: https://github.com/UtilitechAS/amsreader-firmware/issues
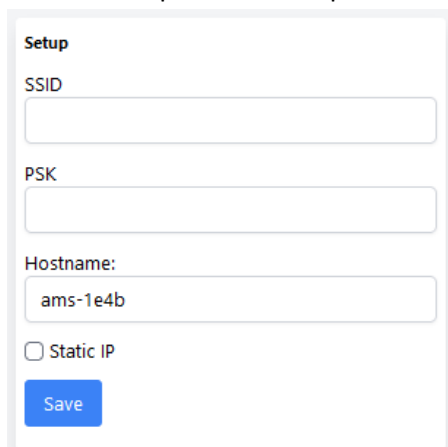
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2 Getting started with a new device

This is a short one-page instruction. If needed, consult more detailed description further down in this document.

1. Pow-K: Plug your device into the meter.
   Pow-U / Pow-P1: Power your device by the USB socket.
2. When device has charged and boots (could take a minute or so for Pow-U and Pow-K; LED blinks green/yellow/green):
   Device will start in Access Pint Mode, with LED blinking yellow. (There will after a while also be red blinks, which is not a problem at this stage)
3. Find and connect to the access point **AMS2MQTT** on your PC or device (no password needed). An "access point" is what many will call a "Wifi network".
4. Open an internet browser window on your PC or device and open this IP-address:
   http://192.168.4.1/
   The wifi setup screen will open:

   Setup

   SSID

   [   ]

   PSK

   [   ]

   Hostname:

   [ams-1e4b   ]

   ☐ Static IP

   [Save]

   a. SSID/PSK: Select the wifi network the device shall use, and provide password.
   b. Hostname: Change the indicated default name to one that is easier to remember.
   c. Optionally, select "Static IP" (recommended) and enter credentials according to your network configuration. You should not leave DNS empty. If you are uncertain, use "1.1.1.1". (The field "/24" means Subnet 255.255.255.0 which is the normal setting.)
   d. Press "Save" and wait for the device to restart.
5. After reboot you'll first need to verify if you want one-click upgrade activated (implies accepting some data collection).
6. Pow-U / Pow-P1 can now be connected to the power meter, and should after a few received payloads have detected baud rate and parity automatically and show data on the main screen.
7. Open the configuration screen by clicking the gear symbol (top right)
   a. In the "Meter" block: Select voltage used in your building. Look at the front of your meter. If 400V is mentioned at all, your system is 400V.
   b. Enter size of your main fuse (used to scale graphs)
   c. If you have solar cells, wind turbine or other energy producing installation, enter its maximum power output (kWp).
   d. Press "Save" to return to main screen

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3   Overview

The device is connected physically to the smart meter and delivers data to user by connecting the device to the user's wifi network.

Devices are delivered programmed and tested, but user must configure it to connect to Wi-Fi - and provide information on the installation (system voltage, main fuse size and optionally production capacity).

3.1   Configuration

Open the configuration page by clicking the gear symbol (top right):
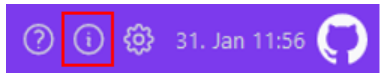

The configuration page has these sections (detail information in chapter 5):

1.   General
2.   Meter
3.   Wifi
4.   Network
5.   MQTT
6.   Tariff thresholds
7.   User interface
8.   Debugging

3.2   Information

Open the information page by clicking the info symbol (top right):

The information page has these sections (detail information in chapter 6):

1.   Device information
2.   Meter
3.   Network
4.   Firmware
5.   Configuration

3.3   Data presentation / delivery

Meter data are presented and delivered in various ways:

- **Graphical User Interface (GUI)**
  The GUI is accessed by entering the Device local IP address (or its mDNS hostname) into a web browser connected to the same Wifi SSID.
- **MQTT**
  Data is sent over wifi to an MQTT server, from which it can be read into smart house systems like Home Assistant, Domoticz etc.
- **HTTP / JSON**

JSON formatted data can be pulled from the Device by HTTP calls to the IP address or mDNS hostname.

All data delivered by the meter are accessible in GUI and over MQTT. Note that there are some minor variations in which data the various meter brands report, please consult documentation for your meter.

4   Initial setup

User should first familiarize her/himself with how to restart/reboot the Device (see the applicable device User Manual, available on the product page in the webshop https://amsleser.no).

Restart/reboot

- **Pow-U/Pow-P1**: Press RES button on top lid.
- **Pow-K**: Remove device from meter, press RES button available at the back of the board. (The board will work for a short period, powered by the supercapacitor.) Reinsert in meter.

In both cases, reboot is confirmed by a short green/yellow/green blink sequence on the RGB LED.
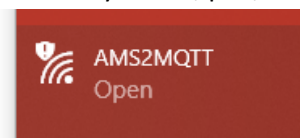
Access point mode

- o **Pow-U/Pow-P1**: Must be connected to external power (micro-USB port) during Access point mode. **Failing to do so could result in non-functional device!**
- o **Pow-K**: Can be done while Device is seated in power meter.

Press and hold the "AP" button until LED blinks yellow (short blinks, 3 second interval). A factory new device should enter this mode directly after power-up.

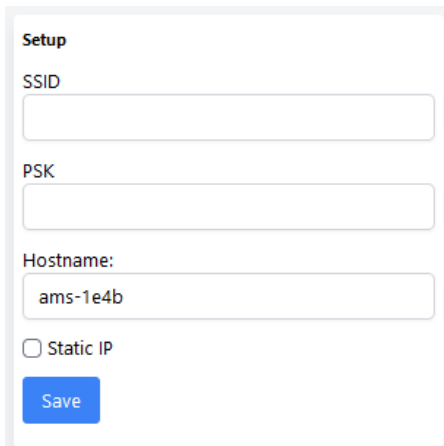## 4.1   Connection to user Wifi

Activate "Access point mode" as indicated above.

1. Activate "Access point mode" as indicated above.
   Confirmed by yellow blink signal.
2. The Device will now set up the Wi-Fi access point **AMS2MQTT** (with no password).
   Connect your PC, pad, or mobile phone to it.

3. Open this IP-address in a browser: http://192.168.4.1/

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4. You will now reach the Setup page for initial Wifi connection:

Setup

SSID

[   ]

PSK
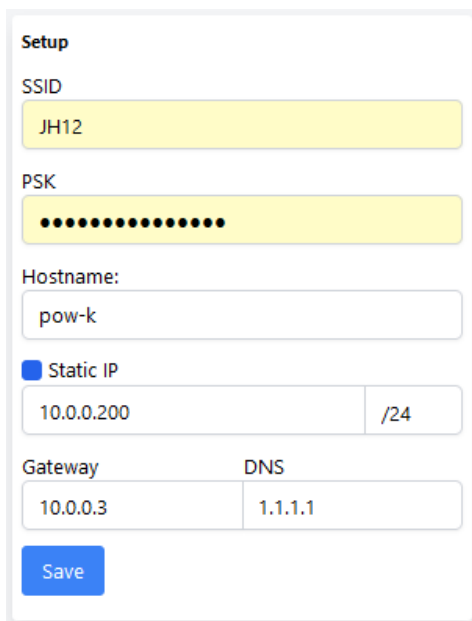
[   ]

Hostname:

[ams-1e4b   ]

☐ Static IP

[Save]

- **SSID**   Input your preferred Wifi access point on your network.
                  Note: Must be a 2,4GHz access point (not 5 GHz)
- **PSK**   Wifi access point password
- **Hostname**   You can replace the proposed default.:
    1) Will be registered if your router DNS service, if supported. Device can then be reached on http://hostname
    2) If your router supports mDNS, the Device can be reached on http://hostname.local

Static IP is recommended. If not selected, the Device will be assigned an unused IP address by the DHCP feature of your wifi router.

Setup

SSID

[JH12   ]

PSK

[●●●●●●●●●●●●●●   ]

Hostname:

[pow-k   ]

■ Static IP

[10.0.0.200   ] [/24]

Gateway   DNS

[10.0.0.3   ]   [1.1.1.1   ]

[Save]

Static IP parameters:

- **IP**   Enter an unused IP address on your network (consult router user panel)
- **Subnet**   The "/24" indication means Subnet 255.255.255.0 – which is correct for most users. Those needing other setting will know what to select. 😊


- **Gateway**   Your router IP address. (Run "ipconfig" from a PC command window; look for "Default Gateway")
- **DNS**   1.1.1.1 is a publicly available DNS server. Use this if in doubt.

→ **Save**

The Device will restart, connecting the device to your router. The AMS2MQTT access point will then disappear.

Reconnect your PC / pad / mobile phone to your router and connect to Device using its IP address or mDNS Hostname. In most cases this will be automatic, just wait for the browser window to reconnect.

If your device is new, you will be asked whether you accept some data collection that is needed to enable one-click firmware upgrade of your device:
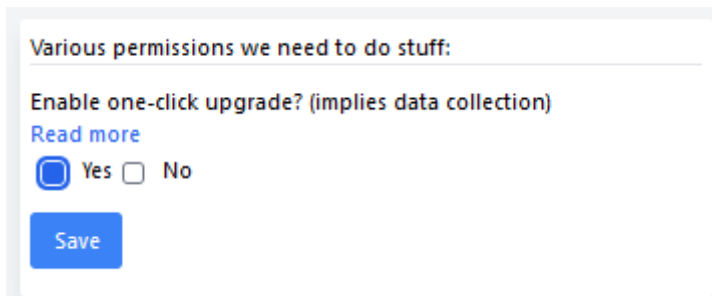
Select and click Save. The main screen will then open, initially without data:
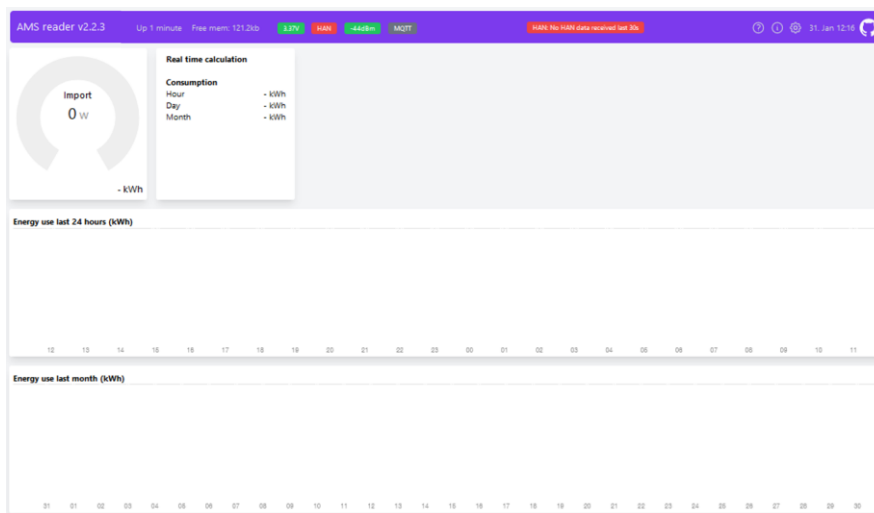
If you are on a Pow-U or Pow-P1, you can now remove the external power and connect the device to your meter using the appropriate cable.

After a few payloads, the device should now auto discover the baud rate and parity used by your meter, and display some data on the main screen.

You can proceed with remaining configuration.

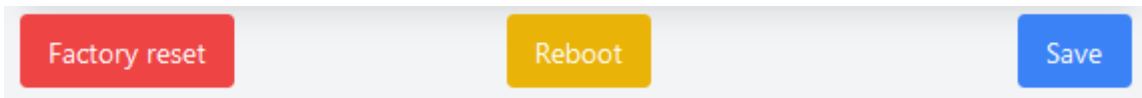
5 Configuration

This chapter will explain each of the sections of the configuration page (gear symbol / upper → right).

Each section has some help information available, via a link in the question mark:
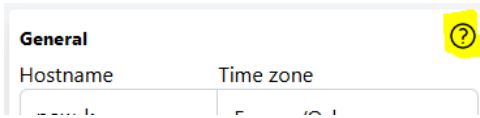
5.1 Action buttons on bottom of page

There are three buttons:

Save Use this button after parameter changes. Saves configuration and returns to main page.

Reboot Reboots the device. If settings are changed, do a Save first.

Factory reset Resets settings to factory default, and **erases stored consumption records**. It is a good idea to use Information / Configure first, to save current configuration. After a Factory reset, the device will go to access point mode (yellow blinking on the LED), see paragraph 4.1.

5.2 General
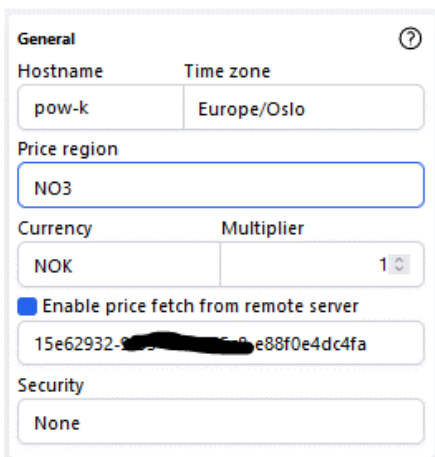
Hostname Set an easy-to-remember name that can be used in the URL

Time zone Select from drop-down list

Price region Select your region from drop-down list
If your country is missing, please write a request issue on the project GitHub page.[1]
Only European countries can be covered.

Currency Select currency for energy price from drop-down list

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[1] https://github.com/UtilitechAS/amsreader-firmware/issues

Multiplier   Can for instance be used to simulate VAT effect on energy price.

Example: For 25% VAT, use multiplier 1.25

Enable   Activate this to fetch and display prices.

Prices can be fetched in two ways:

1) Direct read from Entso-E API. You'll need to obtain API key from Entso-E, please follow these instructions: https://amsleser.no/blog/post/21-obtaining-api-token-from-entso-e
This method only works on devices with an ESP32 microcontroller.
2) If you leave the field for the API key empty, Entso-E prices will be fetched from an intermediate server set up by amsleser.no.
This method was introduced January 2023 and can be used also on older devices with an ESP8266 microcontroller.

Security   Used for password protection of your device. Select from the dropdown list if you want protection of everything, or only the configuration page.

5.3 Meter

Serial configuration   should be auto detected, so you should normally not touch the displayed settings.

Voltage   Select the voltage of your installation: 230 or 400V. If you are uncertain, read all the small text on the front of your power meter. If 400V is at all mentioned, your system is 400V.

Main fuse   Enter the value of your main fuse. This is used only for scaling the current graphic.

Production   If you have solar panels, wind turbine or other energy production:
Enter peak power potential from your production installation.

Meter is encrypted   If your meter is encrypted: Activate encryption and enter the two encryption keys provided by your grid company.

Note:

Your grid company will provide encryption keys when you request activation of the HAN port. Some meters brands can be configured for more than one encryption format.

You need to request encryption keys in double key format:

- Encryption key
- Authentication key

This format is sometimes referred to as "gpk60 and gpk61 keys".

Enter the keys in the two fields, be careful to copy them correctly.

Multipliers   Some larger ("industrial") installations may have current transformer installed. In order to display correct values on such installations, multipliers can be applied. Consult your grid company if the displayed values are incorrect.

There are some known cases of meters that report an extra digit on some parameters, so that they display 10x wrong. The multipliers can be used to correct this.

Example: If the displayed current is 10 times too high, enter 0.1 as current multiplier.

5.4 Wifi

This section is mainly only used if you need to change to another Wifi SSID.

SSID/Password   Select the SSID and enter its password.

Power saving   Recommended setting:
- Pow-P1:   Off
- Pow-K: Minimum

- Pow-U: This is the tricky one; default value is **Maximum**.

If the user interface feels too little responsive, you may want to adjust the setting to Minimum and monitor the device to see if it is able to stay online (not loose voltage). If OK: Stay on Minimum.
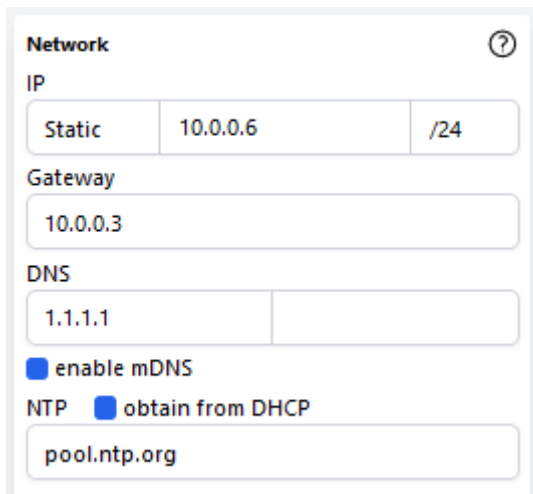
Additional information:

https://amsleser.no/blog/post/25-pow-u-and-power-saving

Power   The ESP module radio transmission power can be adjusted.
Consider this an "experimental feature", the default value should be fine.

Auto reboot   Causes the unit to reboot if it loses wifi connection and is not able to reconnect.
Enabled by default.

5.5 Network

Used for setting Static IP and NTP server – for more advanced users.

Default values are normally fine.

5.6   MQTT

Used to enable and configure connection to MQTT broker.

MQTT	⑦
Server	☐ SSL
10.0.0.38	1883 ↕
Username	
Password	
Client ID	Payload
Pow-K	JSON
Publish topic	
AMSdata	

Server
Internal (local IP address) or external (cloud based / URL) can be used.
Please note:
- If you have a domain name instead of IP address in Host, DNS server is required in Wi-Fi configuration if static IP is used.
- SSL is verified against the domain name of the server, so it is important that the domain name in Host matches the name used in the SSL certificate. Follow your MQTT broker's guidelines carefully. (SSL does not work on ESP8266 based devices)
- SSL requires the clock to be synchronized. Please adjust NTP configuration if the clock in your device is incorrect.

User/password   Use this if the MQTT broker is password protected.

Client ID   This is the name your device uses to present itself to the MQTT broker. Can be selected freely but must be unique amongst units connected to the same broker.

Payload   Select desired payload format from the dropdown list, see additional information on https://github.com/UtilitechAS/amsreader-firmware/wiki/MQTT-configuration. The **Home Assistant format** is popular with Home Assistant users.
This video by Danish YouTube channel *Kenneths Teknik* explains how to set it up: https://amsleser.no/blog/post/4-home-assistant-med-pow-k

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5.7   Tariff thresholds

Tariff thresholds ⑦

1	5 ⌄	kWh	2	10 ⌄	kWh
3	15 ⌄	kWh	4	20 ⌄	kWh
5	25 ⌄	kWh	6	50 ⌄	kWh
7	75 ⌄	kWh	8	100 ⌄	kWh
9	150 ⌄	kWh			

| Average of | 3 ⌄ | hours |

This is for Norwegian users, to support the "Peak power" fee introduced in Norway in 2022, as part of the grid fee. This configuration section is only visible if a Norwegian price region is selected in the "General" section (paragraph 5.2).

If your consumption surpasses a certain threshold, a penalty fee will be added to your next monthly bill. If you surpass also next threshold, the fee will increase – and so on.

The value that is compared with the threshold levels is defined as ***the average of the highest hour-interval consumptions of three different days of a calendar month.***

Note:
The actual threshold levels vary between grid companies, so you need to consult the web page of your grid operator and adjust the levels if needed.

Example
See paragraph 7.2.6 for interpretation of a displayed graph with the above settings.

5.8   User interface

This section allows the user to select which sections are displayed on the main page. Mainly used in situations where user wants to simplify the display for daily use.

Select Show, Hide or Dynamic from pulldown menus.

"Dynamic" means there will be a display if data is available.

(There is no temperature sensor on Pow-U, Pow-K or Pow-P1 devices.)

5.9   Debugging

Activate if there is an issue that needs "under the hood" investigations.

Explanation on how to use it: https://amsleser.no/blog/post/24-telnet-debug

Turn off debugging when you are done using it.

6   Information

This chapter will explain each of the sections of the Information page (ⓘ symbol / upper right).
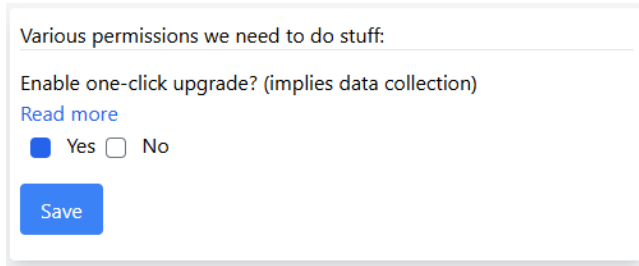
6.1   Device information

Chip   Identifies the generic microcontroller family

Device   Should identify your Pow-K/U/P1 device type

MAC   MAC address of device during normal operation

AP MAC   MAC address of device when in Access point (AP) mode

By clicking **Update consents** you can activate or revoke the permission to use one-click firmware upgrade of the device (during which some data is collected)

Pressing the Reboot button will reboot the device.

6.2 Meter

Shows energy meter brand, model, and ID number. This information is read from the meter.

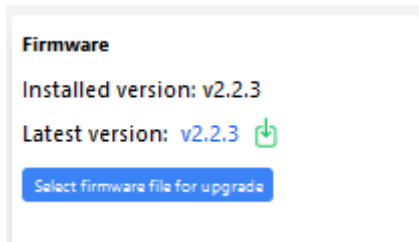## 6.3 Network

IP   IP address of the device

Mask   Subnet mask. The setting 255.255.255.0 corresponds to the "/24" setting on Configuration/Network

Gateway   The IP address of the gateway (access point / "wifi router") your device is connected to.

DNS   Currently used DNS server

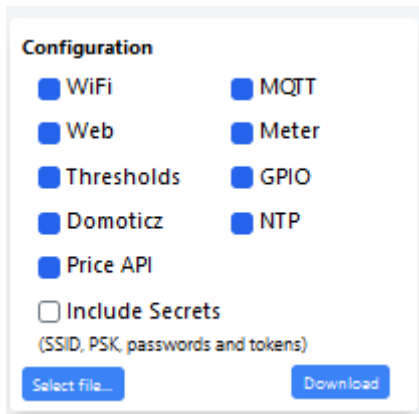
6.4   Firmware

Shows the currently installed firmware, and the latest version available. The download icon turns red if a new version is available. If one-click upgrade is enabled (see paragraph 6.1), upgrade can be started by clicking the symbol.
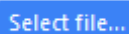
The **Select firmware file for upgrade** button can be used for installing a specific binary file. Typically used when testing new versions, bug fixes etc. Note that only the "firmware.bin" file needs to be selected.
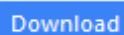
6.5   Configuration

This is used for up- and downloading the current configuration of your device to/from a text file. Can be useful before installing "experimental" firmware versions.

User can select which part of the configuration is down- or uploaded.

The Select file button is used for <u>uploading</u> configuration <u>from a text file to the device</u>.

The Download button is used for <u>downloading</u> configuration <u>from the device to a text file</u>.

Latest and previous releases, including release notes, is available here:
https://github.com/UtilitechAS/amsreader-firmware/releases

WARNING 1
Use the right firmware for your processor - or the unit will become unresponsive and require reprogramming by cable.

WARNING 2

Pow-U <u>must</u> be powered from Micro-USB during this procedure, or the unit could become unresponsive and require reprogramming by cable.

These devices can be reprogrammed over USB-cable if an accidental upload with wrong binary file is done, so that device is bricked:
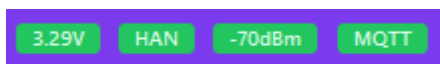
- Pow-P1
- Pow-U layout versions v1.6 and later (printed on PCB)
- Pow-K+ layout version v1.5 and later (printed on PCB)

7 Main screen

The various sections of the main screen are described here below, in the indicated paragraphs.

7.1 Status bar

Device voltage   Shows device operating voltage.

Green light indicates full nominal voltage. If yellow or red, voltage is low.

**Pow-K:** Should always be green.

Pow-U: Low voltage (yellow) is common, especially if GUI is exploited heavily.

Close GUI windows that are not in use. Red light indicates that device is

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close to a low-power reset. Device will be unresponsive while recharging from a low-power reset.

HAN   Green light indicates that latest payloads from the HAN-port are read without error. If packages arrive that are rejected, light will first turn yellow, then red.

Wi-Fi RSSI   Shows Received signal strength indication (RSSI) between wifi router and device. Yellow indicates low RSSI (weak Wifi-signal). Red indicates very weak signal. Yellow level will usually work fine.

If signal is too weak: Consider installing an access point (Wifi extender or dedicated wifi router) close to the device.

MQTT	Green	MQTT is activated, device is connected to MQTT server.
	Red	MQTT is activated but device cannot connect to configured MQTT server. (Check configuration settings!)
	Grey	MQTT is not activated.
	Yellow	Could potentially sometimes be seen during connection to server

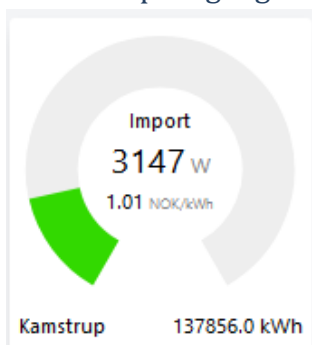If a new firmware version is released, there will be a reminder in the top bar:
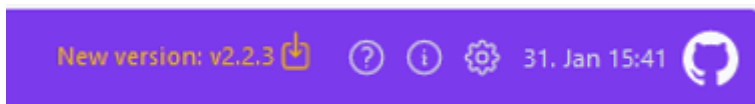
Users that have accepted one-click upgrade can click on the message to initiate the upgrade.

We recommend using the latest published firmware version.

7.2 Various gauges

7.2.1 Import gauge

- Imported power in Watt
- Current price (right now) in <selected currency> per kWh
- Power meter brand
- <u>Estimate</u> of total accumulated imported energy on the meter since it was installed [kWh]

The graphical indicator is scaled based on the setting in Configuration/Meter/Main fuse.
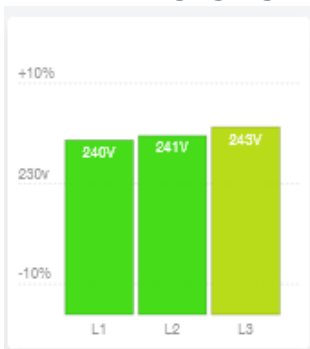
There is additional information on the estimated accumulated value in paragraph 7.6.

7.2.2   Export gauge

- Exported power in Watt
- Total accumulated exported energy on the meter since it was installed [kWh]
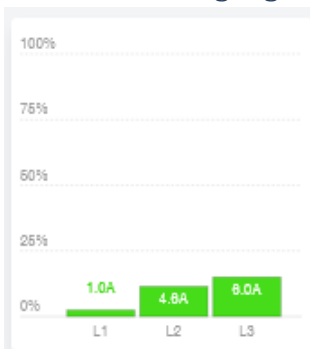
7.2.3   Voltage gauge

Depending on installation, the graph shows:

- 400V system: Voltage on each phase relative to Neutral
- 230V system: Voltage between each phase pair

Colour will change from green to yellow/orange/red as voltage deviates from nominal 230V.

7.2.4   Current gauge

Shows reported current per phase wire. The graphical presentation is scaled according to setting of Configuration/Meter/Main fuse.

NOTE:

In a 3-phase system it is not possible to calculate (current * voltage) per phase and sum them to obtain total power. Please read up on 3-phase installations if interested.


7.2.5 Real time calculation

Real time calculation	
Hour	0.83 kWh
Day	57.1 kWh
Month	2627 kWh
Hour	0.84 NOK
Day	32.28 NOK
Month	1746.28 NOK

Continuously updated counters:

- Energy use ongoing hour
- Energy use ongoing day (24-hour period)
- Energy use ongoing calendar month
- Estimated energy cost ongoing hour
- Estimated energy cost ongoing day (24-hour period)
- Estimated energy cost ongoing calendar month

7.2.6 Tariff peaks
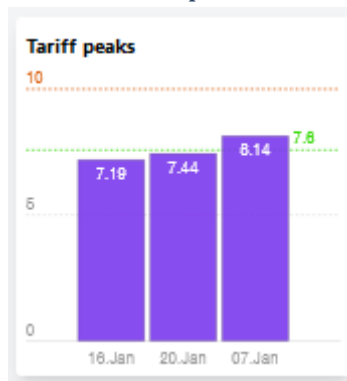
This graph is a graphical presentation of the current status on the Norwegian "Peak power" fee explained in paragraph 5.7. It is only visible if a Norwegian price region is selected in the Configuration / General section.

The status shown above means:

- The current Peak Power average is 7.8 kW.
- The 7.8 kW is the average of peak consumption on the 3 dates 16th, 20th and 16th January.
- The next "penalty level" (where a higher penalty fee would be applied) is 10 kW (indicated by red line)
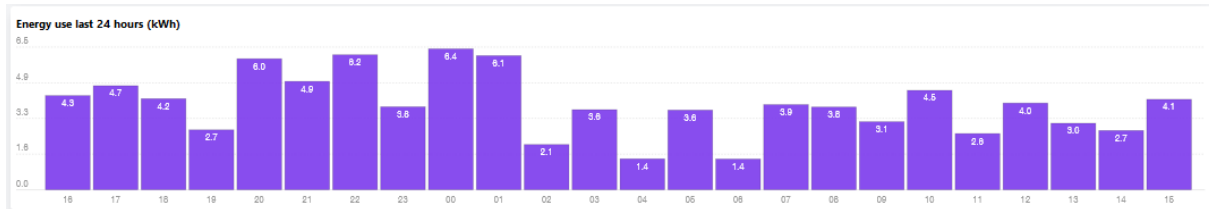
7.3 Future energy price
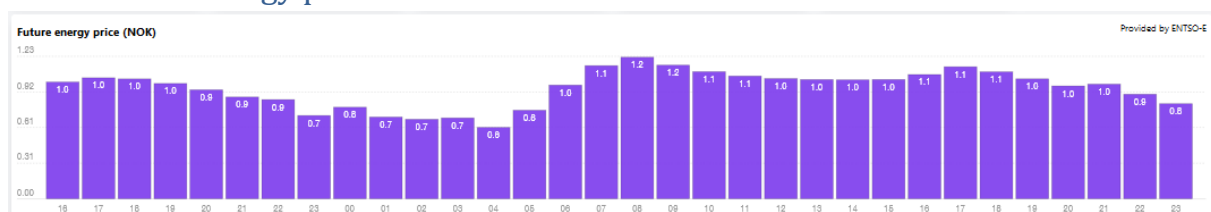
Hour by hour current and future energy price based on settings in Configuration/General.

The leftmost bar is always the current price ("now"). Prices for next 24 hour period is published between 13 and 14h (CET), and will then be added to the graph.

Graph data are provided by https://transparency.entsoe.eu/

7.4 Energy use last 24 hours

Energy use [kWh] per clock hour over last 24 hour interval. There is no bar for the ongoing hour, the rightmost bar shows the previous whole hour.

Example: The bar denoted 15 is the consumption from 15:00:00 to 15:59:59.

7.5 Energy use last month

Energy use per day/date (24-hour period) during last month. There is no bar for the ongoing date, the rightmost bar shows yesterday's consumption.

7.6 Estimation of total accumulated energy

Most power meter reports total accumulated energy only once per hour, read at xx:00:00, sent to HAN port at approx. xx:00:05.

The estimated "live" total accumulated energy consumption presented in the GUI is intended to mimic the value shown on the meter screen. It is estimated as follows:

- Read and store value read from meter at whole hour
- For each accepted payload received from meter, Power*time is added to Accumulated energy.
- The value is reset at each whole hour when updated accumulated energy is reported by the meter.

Notes:

1. If there are many HAN read errors, the estimate will become increasingly inaccurate as time since last accumulated value read increases.
2. After a reboot, the indicated value will not reflect meter display until next whole hour has passed.
- **Kamstrup meters in Denmark** (it is unclear if this is valid for all or only some meters) seem to send accumulated energy in all payloads. The value displayed will in this case always reflect the latest received payload value.

8   Emergency factory reset

There is an option in the firmware to recover from a lockout (forgotten password etc) from an otherwise operational device by performing an **Emergency factory reset**.

1. **RESET the device**
   On Pow-K this is done by pulling the device from the meter, pressing RESET until there is no activity on the LED, then re-insert it in the meter.
   On Pow-U and Pow-P1: Press the RESET button.
2. When the device boots, it starts with a short period of green steady light. **Press AP button while LED is green, then release it when LED turns red.** Factory reset is confirmed by a short sequence of rapid red blinks.
3. The device will now restart in Access point mode, proceed with configuration as explained in Chapter 4.
4. If AP button is not released <u>while LED is red</u> there will be no factory reset, just a normal reset.

After a factory reset all settings are lost.

Alternative description of the procedure: https://amsleser.no/blog/post/15-emergency-factory-reset

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9   Flashing the device over USB cable

This is the procedure for flashing (uploading firmware) over the USB cable.

9.1   Prerequisites

What you need, hardware and tools.

- Depending on your device: A USB-C or Micro USB cable connected to your PC. Make sure it is a full cable with data lines, not a cable for just charging devices. Most cables are full cables with data lines.
- **esptool.exe**
  This is the tool used for flashing ESP devices.
  Download and unzip the latest version: https://github.com/espressif/esptool/releases
  Documentation is available here:
  https://docs.espressif.com/projects/esptool/en/latest/esp32/

9.2   Flashing procedure

Follow these steps to flash your device. The description is for a Windows environment. (Mac users need to follow a corresponding procedure for Mac OS.)
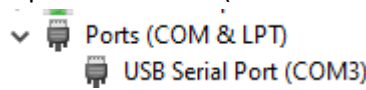
1. Connect the device to the PC with the USB cable. Wait a minute to ensure device is fully charged (not needed for Pow-P1).
2. Download the ZIP file made for your device from
   https://github.com/UtilitechAS/amsreader-firmware/releases
   All Pow-K, U and P1 devices that can be flashed over USB cable has an ESP32-S2 microcontroller. You want the file that has "esp32s2" as part of the file name, and you want the ZIP file.
   Example: ams2mqtt-esp32s2-2.2.4.zip
3. Extract the files from the zip file (right-click the downloaded file and choose "Extract All…"
4. Open a command window on the PC
5. Navigate to the directory where the extracted files are stored. For simplicity, this could be the same folder where esptool.exe is located
   Example:

   ```
   C:\Users\Egil>cd C:\Users\Egil\Desktop\esptool-v4.6.2-win64

   C:\Users\Egil\Desktop\esptool-v4.6.2-win64>
   ```
6. Find out which COM port to use for the flashing:
   a. Open Device Manager (Right-click the Windows symbol in bottom left of the screen and select Device Manager)
   b. Expand the "Ports (COM & LPT)" section:

      ```
      ∨ 🖵 Ports (COM & LPT)
           🖵 USB Serial Port (COM3)
      ```
   c. On your device:
      i.   Press and hold AP button
      ii. Press and release RES button
      iii. Release AP button

----

    d. A new COM port will now open on the PC, visible in Device Manager.

        In this case, COM4 is the new port:

        ∨ 🖶 Ports (COM & LPT)
               🖶 USB Serial Device (COM4)
               🖶 USB Serial Port (COM3)
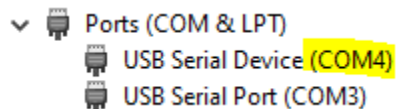
7. Start by erasing what is currently installed on the device, using this command:

```
esptool –port COM4 erase_flash
```

(Use the COM port you found in previous step)

This should happen:

```
C:\Users\Egil\Desktop\esptool-v4.6.2-win64>esptool --port COM4 erase_flash
esptool.py v4.6.2
Serial port COM4
Connecting....
Detecting chip type... Unsupported detection protocol, switching and trying again...
Detecting chip type... ESP32-S2
Chip is ESP32-S2FH4 (revision v0.0)
Features: WiFi, Embedded Flash 4MB, No Embedded PSRAM, ADC and temperature sensor calibration in BLK2 of efuse V1
Crystal is 40MHz
MAC: d4:f9:8d:6e:43:ce
Uploading stub...
Running stub...
Stub running...
Erasing flash (this may take a while)...
Chip erase completed successfully in 17.2s
WARNING: ESP32-S2FH4 (revision v0.0) chip was placed into download mode using GPIO0.
esptool.py can not exit the download mode over USB. To run the app, reset the chip manually.
To suppress this note, set --after option to 'no_reset'.
```

----

8. You can now flash the firmware, using this command (all on one line). Replace "COM4" with the COM port you use.

```
esptool --port COM4 --before default_reset --after hard_reset
write_flash -z --flash_mode dio --flash_freq 40m --flash_size detect
0x1000 bootloader.bin 0x8000 partitions.bin 0x10000 firmware.bin
```

This should be the result:

```
C:\Users\Egil\Desktop\esptool-v4.6.2-win64>esptool --port COM4 --before default_reset --after hard_reset write_flash -z --flash_mode
 dio --flash_freq 40m --flash_size detect 0x1000 bootloader.bin 0x8000 partitions.bin 0x10000 firmware.bin
esptool.py v4.6.2
Serial port COM4
Connecting...
Detecting chip type... Unsupported detection protocol, switching and trying again...
Detecting chip type... ESP32-S2
Chip is ESP32-S2FH4 (revision v0.0)
Features: WiFi, Embedded Flash 4MB, No Embedded PSRAM, ADC and temperature sensor calibration in BLK2 of efuse V1
Crystal is 40MHz
MAC: d4:f9:8d:6e:43:ce
Uploading stub...
Running stub...
Stub running...
Configuring flash size...
Auto-detected Flash size: 4MB
Flash will be erased from 0x00001000 to 0x00004fff...
Flash will be erased from 0x00008000 to 0x00008fff...
Flash will be erased from 0x00010000 to 0x0012bfff...
Warning: Image file at 0x1000 is protected with a hash checksum, so not changing the flash frequency setting. Use the --flash_freque
ncy=keep option instead of --flash_frequency=40m in order to remove this warning, or use the --dont-append-digest option for the elf
2image command in order to generate an image file without a hash checksum
Compressed 13088 bytes to 9236...
Wrote 13088 bytes (9236 compressed) at 0x00001000 in 0.2 seconds (effective 527.1 kbit/s)...
Hash of data verified.
Compressed 3072 bytes to 146...
Wrote 3072 bytes (146 compressed) at 0x00008000 in 0.0 seconds (effective 566.7 kbit/s)...
Hash of data verified.
Compressed 1159568 bytes to 799450...
Wrote 1159568 bytes (799450 compressed) at 0x00010000 in 9.9 seconds (effective 933.2 kbit/s)...
Hash of data verified.

Leaving...
WARNING: ESP32-S2FH4 (revision v0.0) chip was placed into download mode using GPIO0.
esptool.py can not exit the download mode over USB. To run the app, reset the chip manually.
To suppress this note, set --after option to 'no_reset'.
```
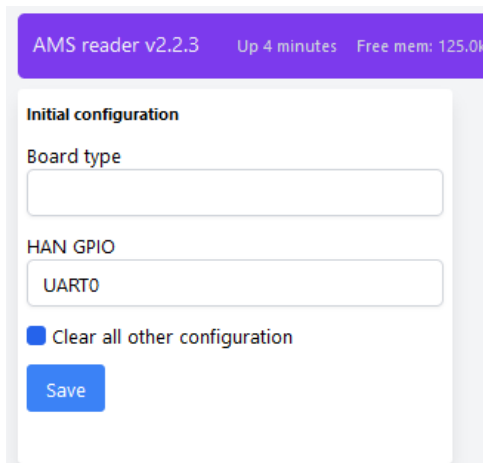
9. Press and release RES button on the device.

10. As the device is not configured, note the following:

   a. It will start up in Access point (AP) mode, setting up the Wifi access point AMS2MQTT.

   b. The LED will not blink (it appears to be "dead")

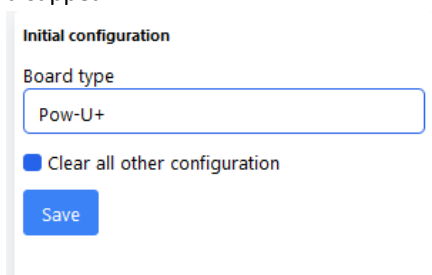11. Connect PC to the AMS2MQTT access point, and wait for it to connect:

----
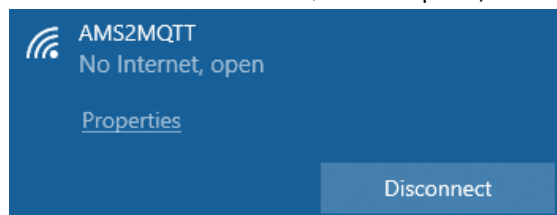
12. Go to a browser and open the IP address http://192.168.4.1
    You will see this Initial configuration screen:

13. Select Board type from the dropdown list. When selecting a Pow device, the "HAN GPIO" field will disappear:

14. Click Save
15. Proceed with configuration as explained earlier in this document.

10 Error codes on the LED

Certain errors will be indicated on the LED of the device.

Error codes are indicated with one code each 3 seconds. If two error codes are active at the same time, error code 1 will be shown, then after 3 seconds error code 2, then code 1 and so on. Correspondingly if all three error codes are active at the same time.

- One flash: Not reading valid data from power meter
- Two flashes: No contact with specified MQTT server
- Three flashes: No contact with specified Wifi access point

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11 JSON data formats

Some data is available in JSON format by doing a HTTP GET call.

In the following, "ams_hostname" is Device IP-address or hostname.

The following JSON calls are available:

- Latest data from meter: http://<ams_hostname>/data.json
- Values displayed in GUI dayplot: http://<ams_hostname>/dayplot.json
- Values displayed in GUI month plot: http://<ams_hostname>/monthplot.json
- Hourly energy prices: http://<ams_hostname>/energyprice.json

Format descriptions:
https://github.com/UtilitechAS/amsreader-firmware/wiki/Message-formats#httpams_hostnamedatajson