Amsreader firmware v2.3
User Manual

Table of content

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1   Introduction

This user manual provides detailed instructions on the setup, parameterisation, and usage of the firmware that powers the **Pow K**, **Pow-U**, and **Pow-P1** HAN-port readers sold by amsleser.no.

For hardware-related instructions, please refer to the User Manual for each device, available on the product pages at https://amsleser.no (→ Vedlegg/attachments).

You can access the source code etc. on our GitHub page:
https://github.com/UtilitechAS/amsreader-firmware

We encourage users to report bugs or suggest improvements under the "issues" section on our GitHub page: https://github.com/UtilitechAS/amsreader-firmware/issues

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2   Overview

The device, once physically connected to the smart meter, delivers data to the user by connecting to the user's Wi-Fi network by generating a web page, and optionally to an MQTT broker. While devices are delivered programmed and tested, users must configure them to connect to Wi-Fi and provide information about the installation (system voltage, main fuse size, and optionally production capacity).

2.1   Configuration

You can open the configuration page by clicking on the gear symbol (top right):
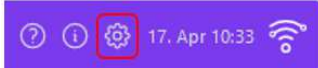
The configuration page is divided into several sections (detailed information can be found in Chapter 5):

1. General
2. Meter
3. Connection
4. Network
5. MQTT
6. Cloud connections
7. Tariff thresholds
8. User interface
9. Hardware
10. Debugging

2.2   Status/Information

You can open the Status/Information page by clicking on the info symbol (top right):
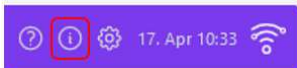
The information page is divided into several sections (detailed information can be found in Chapter 6):

1. Device information
2. Meter
3. Network
4. Firmware
5. Backup & restore

2.3   Data presentation / delivery

Meter data can be presented and delivered in various ways:

- **Graphical User Interface (GUI):** The GUI can be accessed by entering the device's local IP address (or its mDNS hostname) into a web browser connected to the same Wi-Fi SSID.
- **MQTT:** Data is sent over Wi-Fi 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.

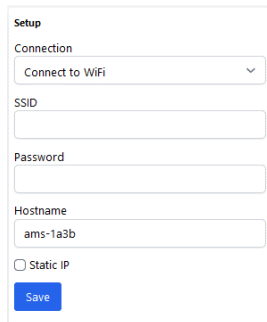All data received by the device from the meter are accessible in GUI and over MQTT. There are some minor variations in which data the various meter brands report, please consult documentation for your meter.

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3   Getting started with a new device

This section provides a brief, one-page instruction for setting up your new device. For more detailed information, please refer to the corresponding sections later in this document.

1. **Pow-K**: Plug your device into the meter or power it via the USB socket.
    Pow-U / Pow-P1: Power your device via the USB socket.
2. Once the device has charged (this could take a minute or so for Pow-U and Pow-K) and boots (LED blinks green/yellow/green), the device will start in Access Point Mode, with the LED steady yellow (white on Pow-U and Pow-P1). Red blinks in addition after a while is not a problem at this stage.
3. Locate and connect to the access point AMS2MQTT on your PC or device (no password required). An "access point" is what many refer to as a "Wi-Fi network".
4. Open an internet browser window on your PC or device and enter this IP-address: http://192.168.4.1/ .
    This will open the Wi-Fi setup screen:

Setup
Connection
Connect to WiFi ⌄
SSID
Password
Hostname
ams-1a3b
☐ Static IP
Save

    a. **Connection:** You will normally keep the preselected "Connect to WiFi"
    b. **SSID/PSK**: Select the Wi-Fi network that the device will use, enter the password.
    c. **Hostname**: Change the default name to one that is easier to remember.
    d. Optionally, select "Static IP" (recommended) and enter credentials according to your network configuration. Do 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.)
    e. Press "Save" and wait for the device to restart.
5. After rebooting, you'll first need to verify if you want one-click upgrade activated (this implies accepting some data collection).
6. The device can now be connected to the power meter, and after receiving a few payloads, should have automatically detected baud rate and parity and display data on the main screen.
7. Open the configuration screen by clicking on the gear symbol (top right):
    a. In the "Meter" block: Select the voltage used in your building. Examine the text on front of your power meter - if 400V is mentioned at all, your system is 400V.
    b. Enter the size of your main fuse (used to scale graphs).
    c. If you have solar cells, a wind turbine, or other energy-producing installation, enter its maximum power output (kWp).
    d. Press "Save" to return to the main screen.

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4   Initial setup (more detailed)

Before starting, users should familiarize themselves 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 the RES button on top lid.
- **Pow-K**: Remove the device from the power meter, press the RES button available at the back of the board. (The board will work for a short period, powered by the supercapacitor.) Reinsert in the power meter.

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

Access point mode

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

Press and hold the "AP" button until the LED is steady yellow (white on Pow-U and Pow-P1). A factory new device should enter this mode directly after power-up.

4.1   Connection to User Wi-Fi

1. Activate "Access point mode" as indicated above.
   This is 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.
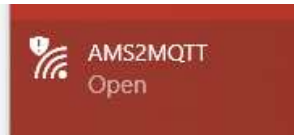
3. Open this IP-address in a browser: http://192.168.4.1/
4. You will now reach the Setup page for connecting the device to your Wi-Fi:

- **Connection**   Select **"Connect to WiFi"** for a normal setup. Most users will use this.
  Select **"Standalone access point"** if there is no WiFi on site, and user wants to connect to the device (for instance a cabin without WiFi). Probably

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very	limited number of use cases.
	NOTE: Pow-U units must in this case be powered via USB cable.

- **SSID**   Select from the detected SSIDs the preferred Wi-Fi access point.
  Note: Must be a 2,4 GHz access point (not 5 GHz)
- **PSK**   Wi-Fi access point password
- **Hostname**   You can replace the proposed default to something that is easier to remember.

  Depending on your Wi-Fi router:

  1) Hostname is registered in your router DNS service.
     Device can then be reached on http://hostname
  2) If your router supports mDNS, the Device can be reached on
     http://hostname.local . The default hostname can later be changed by the user in the configuration page.

Static IP is recommended. If not selected, the Device will be assigned an arbitrary unused IP address by the DHCP feature of your Wi-Fi 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]
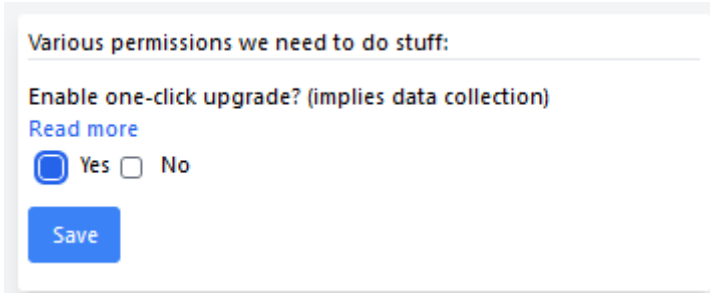
Parameters:

- **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.

Press "Save". The Device will restart, connecting it to your router. The AMS2MQTT access point will then disappear.

Reconnect your PC/pad/mobile phone to your router and connect to the 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, this can later be changed from the Status/Info page:
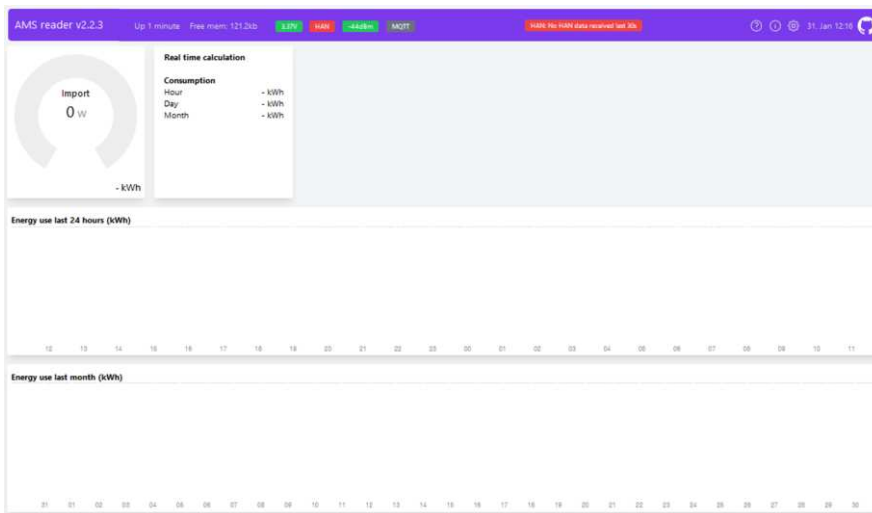

Select and click Save. The main screen will then open, initially without data:
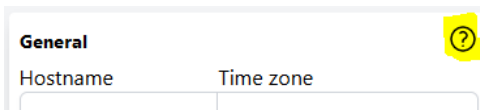
If your device is a Pow-U or Pow-P1, you can now remove the external power and connect the device to your meter using the appropriate cable.

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

You can now proceed with remaining configuration.

5 Configuration

This chapter explains each of the sections on the configuration page (accessed by clicking the gear symbol in the upper right corner). Each section has some help information available, which can be accessed via a link in the question mark:

5.1   Action buttons on bottom of page

There are three buttons:

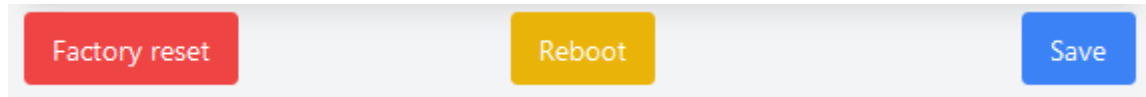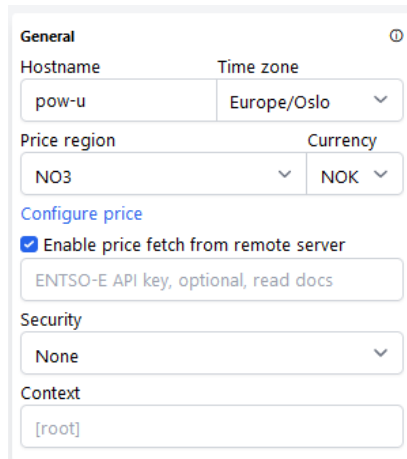- **Factory reset:** Resets settings to factory default and **erases stored consumption records**. It's a good idea to make a backup of the settings (Information / Backup & restore) first, to save current configuration. After a Factory Reset, the device will go into access point mode (indicate by yellow LED), as described in paragraph 4.1.
- **Reboot:** Reboots the device. If settings are changed, make sure to save first.
- **Save**: Use this button after making parameter changes. It saves configuration and returns to main page (and reboots if needed depending on the change).

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 countries that are members of Entso-E can be covered. This is mainly European countries, but Turkey and Morocco are also members.
Currency	Select desired energy price currency from drop-down list.
Configure price	See paragraph 5.2.1
Enable	Activate "Enable price fetch from remote server" to fetch and display energy prices. The field below ("ENTSO-E API key, optional, read docs") can be used to enter your Entso-E API key. If left blank (recommended) you will read prices from our intermediate server, which is a more reliable API.

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

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

Context   If you have secured your device behind a web proxy and set a path for it, set this here as well.

Example: If you proxy from https://mydomain.tld/amsreader, you should set "amsreader" as the context.

5.2.1   Configure price (Price modifiers)

The price configuration gives an option to configure price modifiers that modify the published spot price to fit with the contract you have with your energy supplier, regarding import (consumption) or export (production).

Defined modifiers are applied in the order they are configured/listed, and can be configured with restrictions on:

- Direction (import/export)
- Day(s) of the week
- Hour(s) of the day(s)
- Date range (from and to)

In the first field you give the modifier a suitable name, then:

Import/export selection

"Import" is power you buy (normal consumption).
"Export" is power you deliver to the grid, from solar panels, wind turbine etc.

- **Import** - Only applied to import power (consumed)
- **Export** - Only applied to export power (produced)
- **Both** - Will be applied to both import and export

Operations that can be selected

- **Fixed** - A fixed price that will override the published price
- **+ (Addition to price)** - Will be added on top of the current price
- **- (Deduction from price)** - Will be subtracted from the current price
- **%** - Will add a percentage on top of the price. Useful for adding VAT/moms

The below examples should be useful to understand how to use this feature. When hours or days are green, they are selected.

Examples of price modifiers. They will be applied in the order they are listed:

5.3 Meter

Communication	Should in most cases be stay on "Passive (push)". (The "Pulse" option is for an experimental feature, reading data from pulsed meters.)
Serial conf.	Baud rate and parity should be auto detected, so you should normally not touch these settings.
Buffer size	Size of a read buffer. Increase it if you see payload error messages.
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 (often called GPK60/61) provided by your grid company.

🟦 Meter is encrypted

00000000000000000000000000000000

Authentication key

00000000000000000000000000000000

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 (GPK60/61):
- Encryption key
- Authentication key
Enter the keys in the two fields, be careful to copy them correctly.

Multipliers   Some larger ("industrial") installations may have current transformer installed. To display correct values on such installations, multipliers can be applied. Consult your grid company if the readings you see in the amsleser user interface are incorrect.

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

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

5.4   Connection

Connection	ⓘ
Connect to Wi-Fi	∨

SSID

JH12

Password

•••

Power saving	Power	
Maximum ∨	19.5 ⌃⌄	dBm

☐ Allow 802.11b legacy rates

This section is used if you need to change to another Wi-Fi SSID.

Connection   Select "Connect to WiFi" for a normal setup.

Select "Connect to WiFi" for a normal setup. Most users will use this.

Select "Standalone access point" if there is no WiFi on site, and user wants to connect to the device (for instance a cabin without WiFi). Probably very limited number of use cases.

NOTE: Pow-U units must in this case be powered via USB cable.

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.

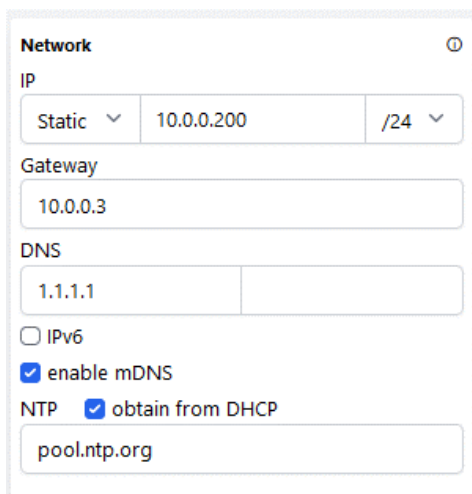This is an "experimental feature", the default value should be fine.

802.11b legacy rates

Wi-Fi standard 802.11b is an old standard, not needed by newer Wi-Fi routers.

Enable it if you have a very old router and experience issues.

5.5   Network

This section is used for setting Static IP and NTP server – for more advanced users.

Default values are normally fine.

Setting static IP address is explained in chapter 2, paragraph .

5.6 MQTT

This section provides instructions on enabling and configuring a connection to an MQTT broker.

Server	You can use either an internal (local IP address) or external (cloud-based/hostname) MQTT broker.
	Please note:
	- If you enter a domain name instead of an IP address in the Server field, a DNS server is required in the Wi-Fi configuration if a static IP is used.
	- SSL is verified against the domain name of the server. Therefore, it's crucial that the domain name in Host matches the name used in the SSL certificate. Please follow your MQTT broker's guidelines carefully.
	- SSL requires the clock to be synchronized. If the clock in your device is incorrect, please adjust the NTP configuration.
	-Note: SSL does not work on ESP8266 based devices due to its limitations.
User/password	Use this if the MQTT broker requires password protection.
Client ID	This is how your device identifies itself to the MQTT broker. It can be freely chosen but must be unique among units connected to the same broker.
Payload	Select your desired payload format from the dropdown list.
	For information on payload formats and setup, visit 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
	See also: https://github.com/UtilitechAS/amsreader-firmware/wiki/How-to-add-to-Home-Assistant

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5.7 Tariff thresholds

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

If your consumption exceeds a certain threshold, a penalty fee will be added to your next monthly bill. If you also surpass the 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
Refer to paragraph 7.2.6 for an interpretation of a displayed graph with these settings.

5.8   User interface

This section allows you to customize which sections are displayed on the main page. This is particularly useful if you want to simplify the display for daily use.

From the pulldown menus, select Show, Hide, or Dynamic. The "Dynamic" option means that a section will be displayed if such data is available.

Please note that there is no temperature sensor on Pow-U, Pow-K, or Pow-P1 devices. You can install temperature sensor yourself on newer versions of Pow-K and Pow-P1 that are in sale from end 2023. See their respective User manuals.

5.9   Hardware

On newer devices the LED can be disabled.

Useful for situations where the power meter is exposed, so that the blinking is disturbing.

5.10 Debugging

Activate this feature if you encounter an issue that requires in-depth investigation.
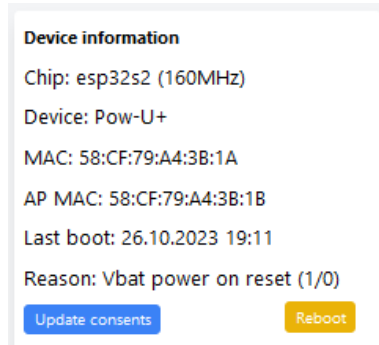
For instructions on how to use it, visit https://amsleser.no/blog/post/24-telnet-debug

Remember to turn off debugging when you are done using it.

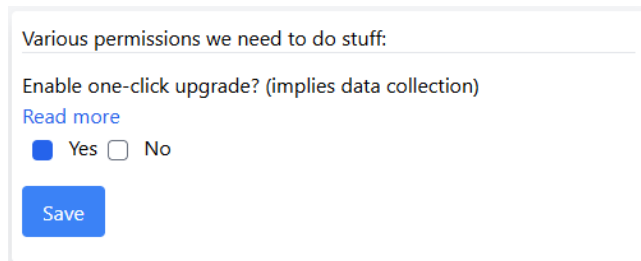
6   Status/information

This chapter explains each of the sections on the Status/Information page (accessed via the ⓘ symbol in the upper right corner).

6.1   Device information

Device information

Chip: esp32s2 (160MHz)

Device: Pow-U+

MAC: 58:CF:79:A4:3B:1A

AP MAC: 58:CF:79:A4:3B:1B

Last boot: 26.10.2023 19:11

Reason: Vbat power on reset (1/0)

[Update consents]   [Reboot]

Chip	Identifies the microcontroller.
Device	Identifies your specific Pow-K/U/P1 device type.
MAC	Displays the MAC address of the device during normal operation.
AP MAC	Shows the MAC address of the device when in Access Point (AP) mode.
Last boot	Displays the time of the last reboot.
Reason	Shows the identified reason for the last reboot.

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)

Various permissions we need to do stuff:

Enable one-click upgrade? (implies data collection)
Read more
■ Yes ☐ No

[Save]

[Reboot]

Pressing the "Reboot" button will reboot the device.

6.2   Meter

Meter

Manufacturer: Kamstrup

Model: 6841131BN243101040

ID: 5706567277656672

This section displays the brand, model, and ID number of your energy meter. Most (but not all) power meters send this information on the HAN port.
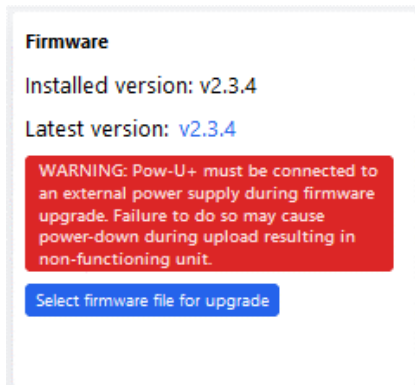
6.3   Network

```
Network
IP: 10.0.0.6
Mask: 255.255.255.0
Gateway: 10.0.0.3
DNS: 1.1.1.1
```
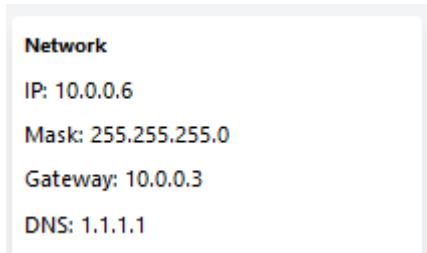
IP   Displays the IP address of the device.

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

Gateway   Displays the IP address of the gateway (access point / "Wi-Fi router") your device is connected to.

DNS   Shows the currently used DNS server.

6.4   Firmware

```
Firmware
Installed version: v2.3.4
Latest version: v2.3.4

WARNING: Pow-U+ must be connected to
an external power supply during firmware
upgrade. Failure to do so may cause
power-down during upload resulting in
non-functioning unit.

Select firmware file for upgrade
```

Displays the currently installed firmware version, and the latest version available.

After "Latest version", the version name is a link that turns red if a new version is available. If one-click upgrade is enabled (see paragraph 6.1), you can start the upgrade by clicking the symbol/link.

The "Select firmware file for upgrade" button can be used for installing a specific binary file. This is typically used when testing new versions, bug fixes, etc. When using this, only the "firmware.bin" file needs to be selected.

You can find the latest and previous releases, including release notes, here: https://github.com/UtilitechAS/amsreader-firmware/releases

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

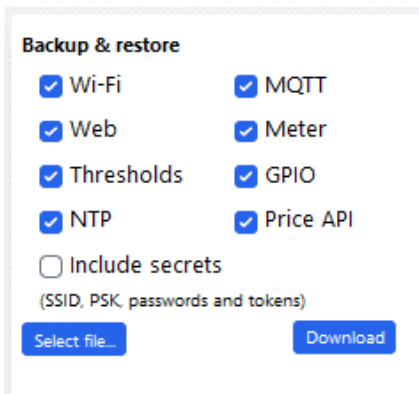
NOTE 2

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

The following devices can be reprogrammed over USB-cable if an accidental upload with wrong binary file is done, so that device is bricked:

- Pow-P1, all versions
- Pow-U layout versions v1.6 and later (layout version is printed on the circuit board)
- Pow-K+ layout version v1.5 and later (layout version is printed on the circuit board)

6.5   Backup & restore

Backup & restore

- ☑ Wi-Fi   ☑ MQTT
- ☑ Web   ☑ Meter
- ☑ Thresholds ☑ GPIO
- ☑ NTP   ☑ Price API
- ☐ Include secrets

(SSID, PSK, passwords and tokens)

[Select file...]   [Download]

Used for making and restoring backup of the current configuration to/from a text file. This can be useful before installing "experimental" firmware versions, and before upgrades.

You can select which part of the configuration is downloaded or uploaded.

[Download]

The "Download" button is used for downloading backup of configuration from the device to a text file.

[Select file...]

The "Select file" button is used for restoring configuration from a text file to the device.

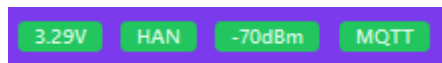
7   Main screen

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

User can select which elements are shown, see paragraph 5.8.

Paragraph
→ 7.1
→ 7.2
→ 7.3
→ 7.4
→ 7.5
→ 7.6

7.1   Status bar

Device voltage	Displays the device operating voltage. Green light indicates correct voltage. If yellow or red, voltage is low.
	For Pow-K and Pow-P1, the light should always be green.
	For Pow-U, a low voltage (yellow) is relatively common, especially if the GUI is heavily used. Close GUI windows that are not in use. A red light indicates that the device is close to a low-power reset. The device will be unresponsive while recharging from a low-power reset.
HAN	Green light indicates that the latest payloads from the HAN-port are read without error. If packages arrive that are rejected, the light will first turn yellow, then red.

| **Wi-Fi RSSI**		Shows Received Signal Strength Indication (RSSI) between Wi-Fi router and device. Yellow indicates low RSSI (weak Wi-Fi signal). Red indicates a very weak signal. Yellow level will usually work fine. If the signal is too weak, consider installing an access point (Wi-Fi extender or dedicated Wi-Fi router) close to the device.
MQTT	Green	MQTT is activated, and the device is connected to an MQTT broker.
	Red	MQTT is activated but device cannot connect to the configured MQTT broker. (Check configuration settings!)
	Grey	MQTT is not activated.
	Yellow	Could potentially sometimes be seen during connection to MQTT broker

If a new firmware version is released, there will be a reminder in the top bar:

Users who 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
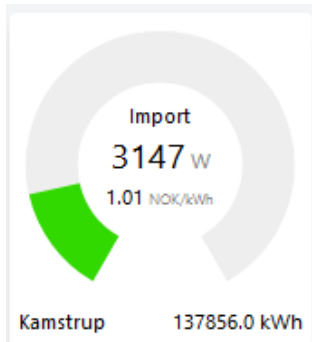
This gauge displays the following information:

- Imported power in Watt
- Energy price (right now) in your selected currency per kWh
- Power meter brand
- Estimate 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. Additional information on the estimated accumulated value can be found in paragraph 7.7.

7.2.2   Export gauge

This gauge shows:

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

7.2.3   Voltage gauge

Depending on the installation, the graph shows:

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

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

7.2.4   Current gauge

This gauge shows the reported current per phase wire. The graphical presentation is scaled according to the 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

This section displays continuously updated counters for:

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

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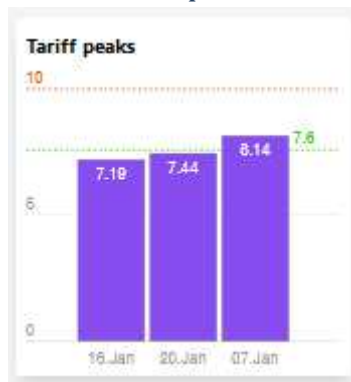
This graph shows the current status on the Norwegian "Peak power" fee explained in paragraph 5.7. It is only visible if a Norwegian price region is selected in the Configuration / General section.

The status shown in above illustration means:

- The current Peak Power average is 7.8 kW, and is the average of peak consumption on the dates 16th, 20th and 7th January.
- The next "penalty level" (where a higher penalty fee would be applied) is 10 kW (indicated by red line)

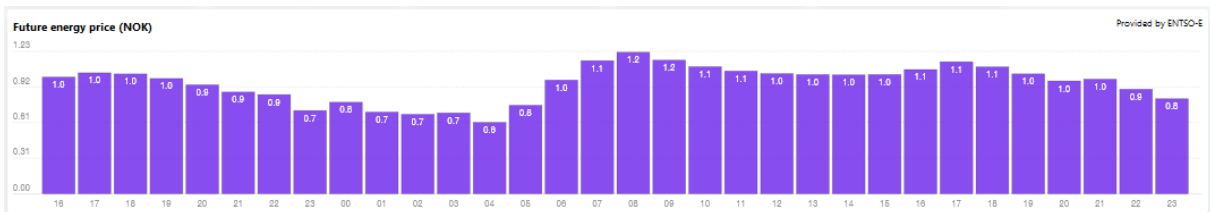
7.3   Real-time plot
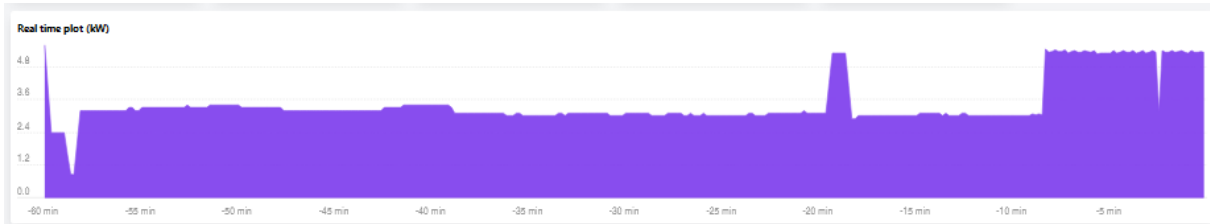
This plots instantaneous power consumption over the last 60 minutes.

The graph goes negative if there is more power produced from solar panels etc than what is consumed.

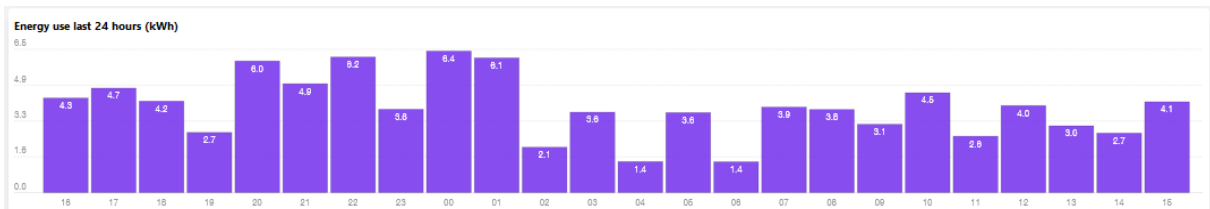## 7.4   Future energy price

This section displays hour by hour future energy prices 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 (mostly) provided by https://transparency.entsoe.eu/

7.5   Energy use last 24 hours

This section displays energy use [kWh] per clock hour over the 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.

The graph goes negative if there is more power produced from solar panels etc than what is consumed.

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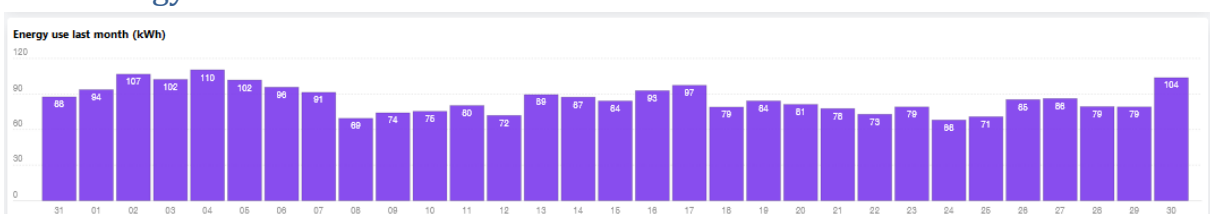
This section displays energy use per day/date (24-hour period) during last month. There is no bar for the ongoing date, the rightmost bar shows yesterday's consumption.

7.7 Estimation of total accumulated energy

Most power meters report total accumulated energy only once per hour, read at xx:00:00, sent to the HAN port at approximately 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** seem to send accumulated energy in all payloads. The value displayed will in this case always reflect the latest received payload value.

8 Troubleshooting

8.1 Emergency factory reset

The firmware includes an option to recover from a lockout (e.g., forgotten password) 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-inserting 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 the AP button while the LED is green, then release it when the LED turns red. The 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 0.
4. If the AP button is not released while the LED is red there will be no factory reset, just a normal reset.

After a factory reset, all settings are lost.

An alternative description of the procedure can be found here:
https://amsleser.no/blog/post/15-emergency-factory-reset

8.2   Flashing the device over USB cable

This chapter describes the procedure for flashing (uploading firmware) over the USB cable.
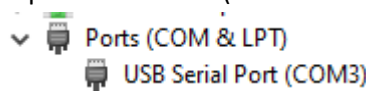
8.2.1   Prerequisites

Here's what you need in terms of 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 here: https://github.com/espressif/esptool/releases
  Documentation is available here:
  https://docs.espressif.com/projects/esptool/en/latest/esp32/

8.2.2   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)
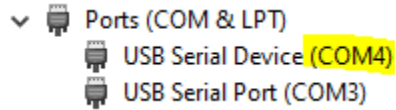
7. Start by erasing what is currently installed on the device, using this command:

```
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
```
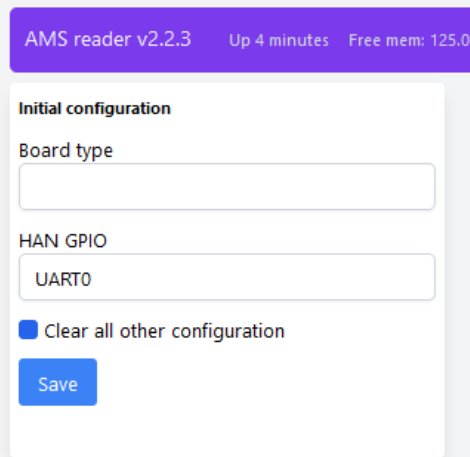
This should be the result:

```
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'.
```
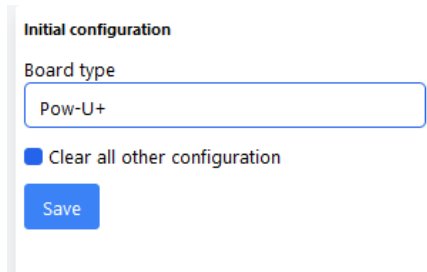
9. Press and release the "RES" button on the device.
10. As the device is not yet configured, note that it will start up in Access Point (AP) mode, setting up the Wi-Fi access point AMS2MQTT, and that LED will not blink (it appears to be "dead").
11. Connect your PC to the AMS2MQTT access point, and wait for it to connect:

----
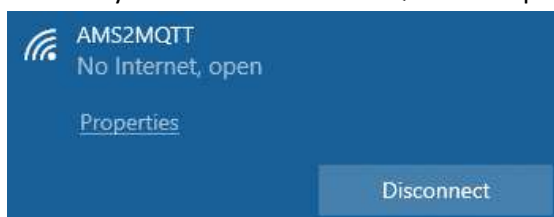
12. Go to a browser and open http://192.168.4.1

   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.

8.2.3 Simplified method for flashing over USB cable

See the blog post Updating device over USB cable, simplified method.[2]

8.3 Error codes on the LED

Certain errors will be indicated on the device's LED.

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. The same applies 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 broker
- Three flashes: No contact with specified Wi-Fi access point

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[2] https://www.amsleser.no/module/ets_blog/blog?id_post=34

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9   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 day plot: 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 can be found here:

https://github.com/UtilitechAS/amsreader-firmware/wiki/Message-formats