ENcombi

ECgrid

User manual

Document change log

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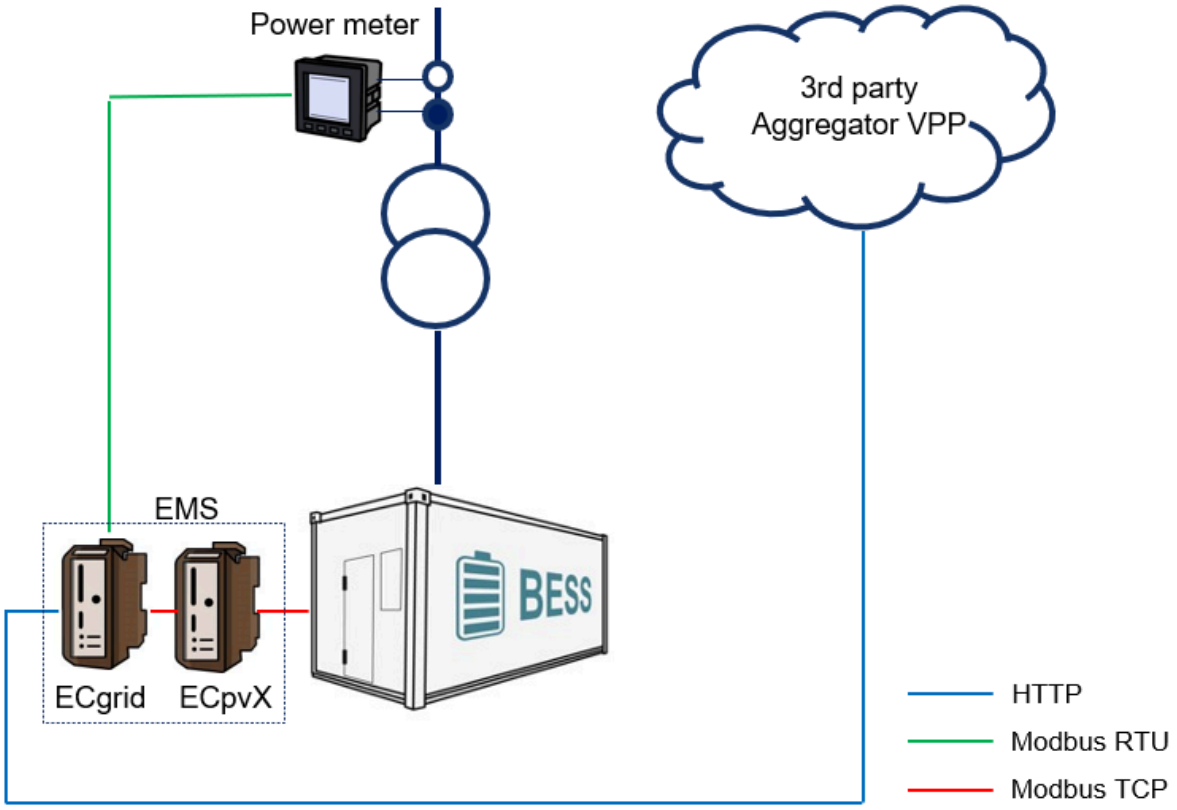
Introduction

The ECgrid from ENcombi is capable, in conjunction with an ECpvX, to perform the frequency ancillary services aFRR and mFRR as well as FFR, FCR-N and FCR-D for the nordic synchronous area and FCR for the central europe synchronous area.

The market biddings are handled in a 3rd party market VPP (Virtual Power Plant) and are not in the scope of the ECgrid. The ECgrid will have an online interaction with the 3rd party aggregator's VPP and get the won bids from there. This way, with the ECgrid, you are not limited to using a specific aggregator.
Consult the ECgrid product page on ENcombi website for detailed information about which aggregators that are supported. If the aggregator of your choice is not already on the list then contact us for the possibility of getting it added.
http://www.encombi.com/products/ECgrid/

Below schematic is an example of how the ECgrid are fitted into and interconnected to its surrounding environment.



ECgrid will measure the grid frequency using a power meter to which it will have a Modbus communication link. Based on the frequency reading, it will conduct the ancillary services and pass forward the associated power power commands to the ECpvX controller.

ECpvX is the device actually controlling the power in and out of the battery. ECpvX controls both the active and reactive power via Modbus. It has a wide range of control functions herunder zero-export, spot-price arbitrage etc. The ECpvX receives the control references from the ECgrid and instructs the battery accordingly. The ECpvX performs under laying control functions like LFSM-O/LFSM-U etc. to meet various grid interconnection requirements. Consult the ECpvX User Manual for more information on the ECpvX.

ECweb

ECweb is the built- in webserver of the ECgrid. All configuration and real time monitoring of the ECgrid is done via ECweb. Connection to ECweb is done with a standard web browser

Using a laptop/PC and Internet Explorer browser running on Java is the best option for connecting to ECweb. Other browsers and mobile devices can be used as well.

Connecting to ECweb with Internet Explorer or Pale Moon browser on PC/laptop

Java from oracle must be installed on PC/laptop. Java can be downloaded from the link below. Note that either the Internet Explorer or the Pale Moon browser must be used for the download.
Java download

1: Type in IP address of the ECgrid in the browser command line.
Default IP address is:
192.168.1.101.

2: Type in login credentials when prompted.
Default login credentials are:
user: web_user0
password: web_password0

3: Accept/Ignore all warnings populated.

4: If tiles on the front page are out of order, click on the page and they will fall into place. If any Icons are missing on the tiles, restart the browser and start over.

Connecting to ECweb using any other browser or mobile device

For all other browsers on PC/laptop or from any browser on mobile devices.

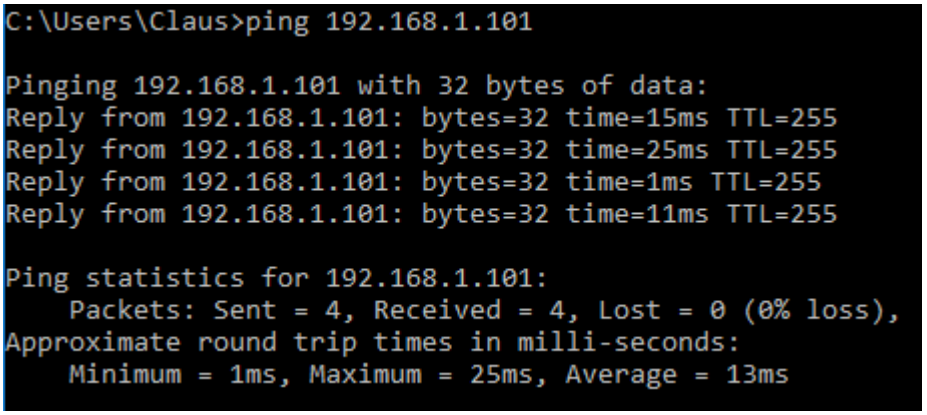
1: Type in IP address/webvisu.html in the browser command line.
Default IP address is:
192.168.1.101.

2: Type in login credentials when prompted.
Default login credentials are:
user: web_user0
password: web_password0

Troubleshooting

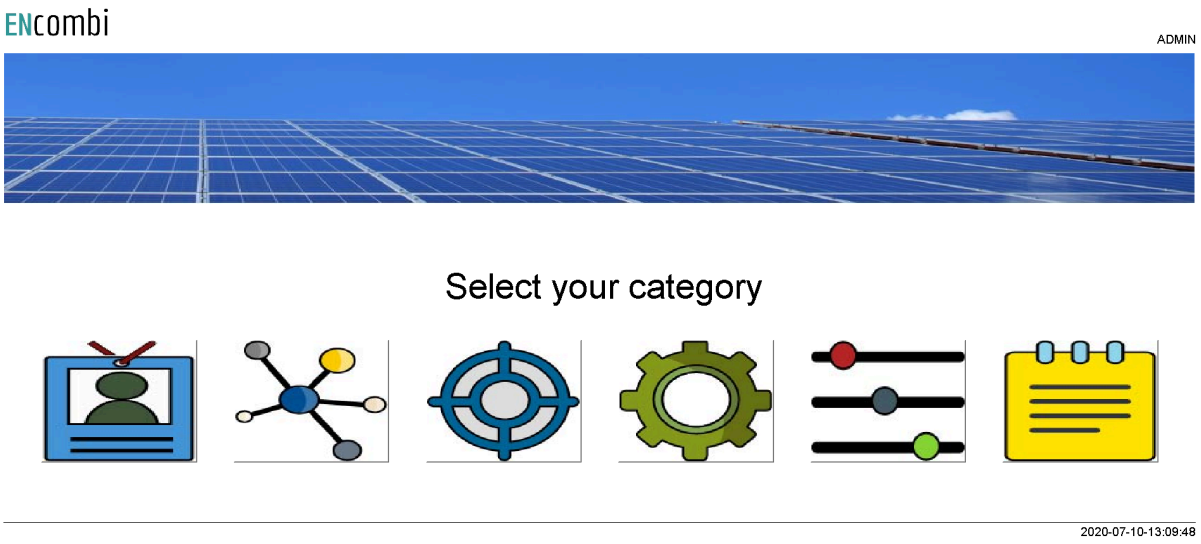
If connection can't be established verify that:

1. ECgrid is powered up and running. ECgrid must have 24VDC (+/- 15%) supply voltage. The green Power and the green Run LEDs in the front of the ECgrid must both be illuminated. Note that a two low supply voltage can result in a situation where sufficient voltage is present to power up the ECgrid but not to run the program. In this case the Power LED is illuminated but the Run LED. When powering up the ECgrid the Power LED will light up first and the Run LED will come approximately 30s after when ECgrid is initialized and the program is up and running.
2. Your laptop must be on the same subnet as the ECgrid. Even though you have an ethernet cable going directly from your laptop to the ECgrid you still need to make sure that your laptop is provided with a suitable IP address. In the case where the default IP address of the ECpvX 192.168.1.101 is kept a suitable IP address for your laptop would be 192.168.1.x, where x is a number in the range [2;249] excluding "101" as this is used by the ECgrid itself.
3. Once the IP of your laptop is in place you must be able to ping the ECgrid. This can be done by opening a command prompt and writing the command "ping xxx.yyy.zzz.www" where xxx.yyy.zzz.www is the IP address of the ECgrid as shown below. First when the ECgrid replies to the command it is verified that your laptop and the ECgrid can see each other on the network and you can connect to ECweb using the browser as described above.



Navigating the ECweb

The first page to be displayed after an initial welcome page when connection is established is the front page of ECweb.



Whenever navigating around the ECweb you can always return to this page by clicking the ENcombi logo in the upper left corner.

In the upper right corner you can see the current access login level. Find more information about this in the chapter revolving password scheme.

In the lower left corner ECgrid will display any info and warning messages it wants to communicate to the user. Some messages will clear themselves automatically. Others demand user action to be acknowledged first. In that case a dedicated button with a garbage can symbol will be presented alongside the messages. Furthermore when changing certain settings etc. a reboot of the ECgrid is required before the changes take effect. This will be communicated in the message as well and a dedicated button with refresh symbol will be presented alongside with the messages.

In the lower right corner is the internal clock of the ECgrid displayed.

In the lower center a total of six menu tiles are available. These are from the left:

1. “Identifiers” gives access to overview of SW version installed and extras present in the ECgrid, password scheme etc.
2. “EClogic” provides the possibility of making project specific logical expressions when required. That could be for linking physical digital inputs applied on power meters to the position of breakers or similar.
3. “Monitoring” provides a high level overview of the installation as well as detailed information about each individual inverter and power meter.

4. “Control” gives access to set up of ECgrid controller related parameters such as IP configuration, Internal clock handling etc.
5. “Settings” gives access to setup of site specific parameters such as ancillary service schemes.
6. “Logs” give access to setup of log specific parameters.

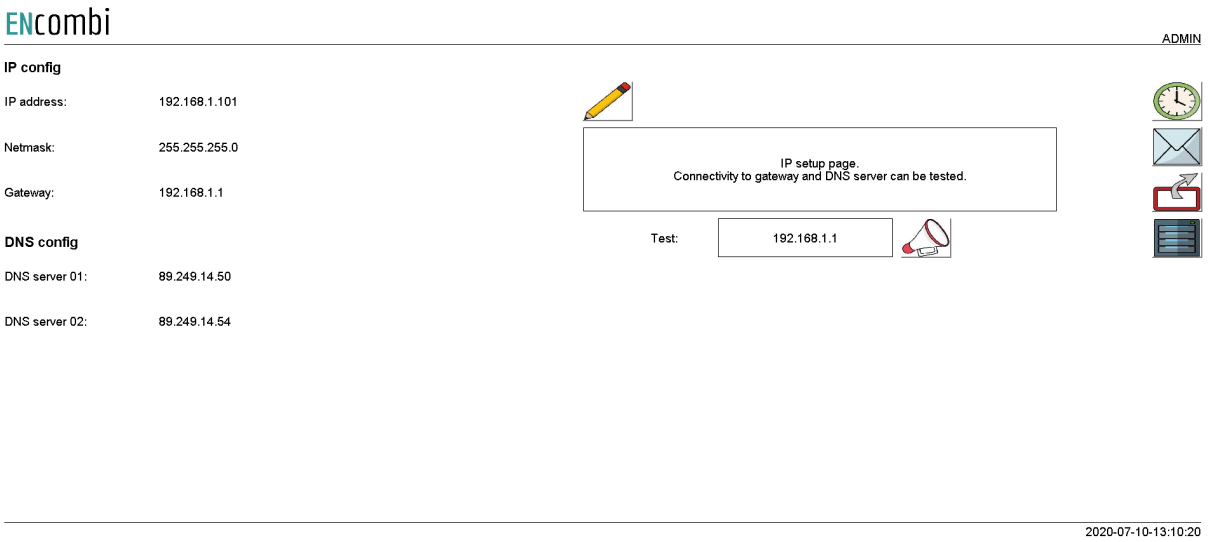
In the following chapters the content of the six menu tiles are discussed in detail.

Control

Under this tile set up of ECgrid controller related parameters for IP configuration, Internal clock handling etc. are found.

IP configuration

First page presented when clicking the Control tile is the page below where IP configuration is set up and connectivity to the gateway can be tested.



On the right hand side there are two submenus for.

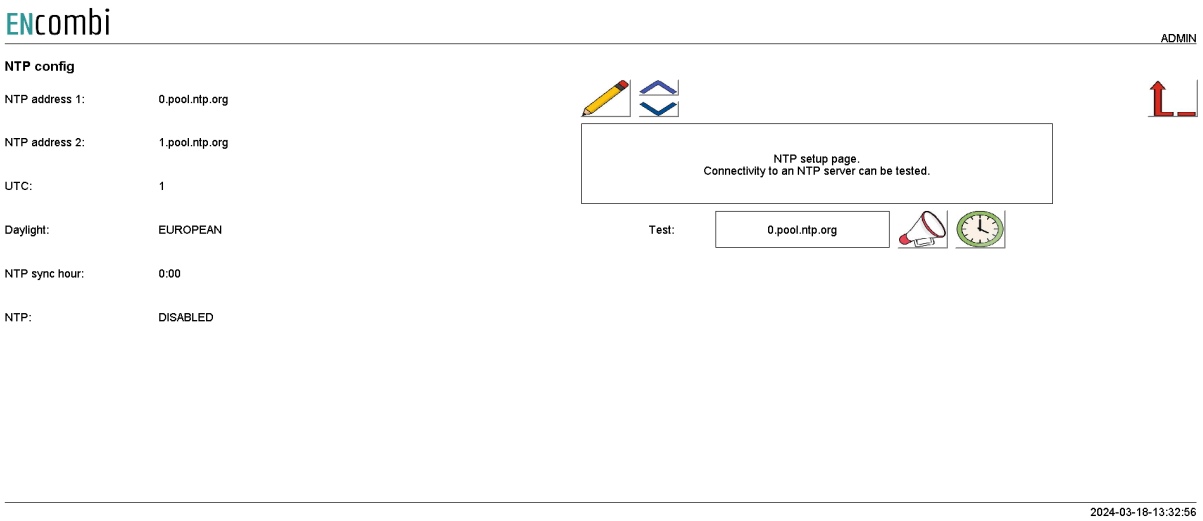
1. Internal clock.
2. ECgrid server access.

Internal clock

The internal clock can be synchronized against an NTP server as well as be set manually.

NTP synchronization

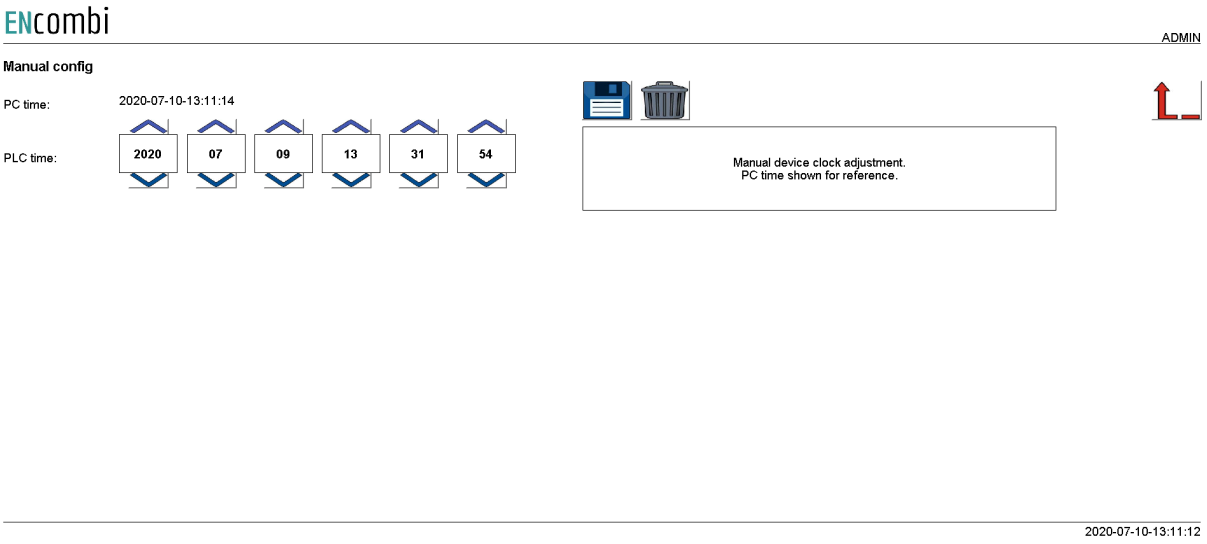
First page presented when clicking the clock button is the page below where NTP synchronization can be set up and connectivity to an NTP server and its functionality can be tested.



On the same submenu level the manual time adjustment of the internal clock is found. Clicking the up/down arrows will lead to it.

Manual time adjustment

On the page below the internal clock can be set manually. The time of the PC connected is presented and can be used to set the ECgrid clock against.



ECgrid server access

The ECpvX features three servers:

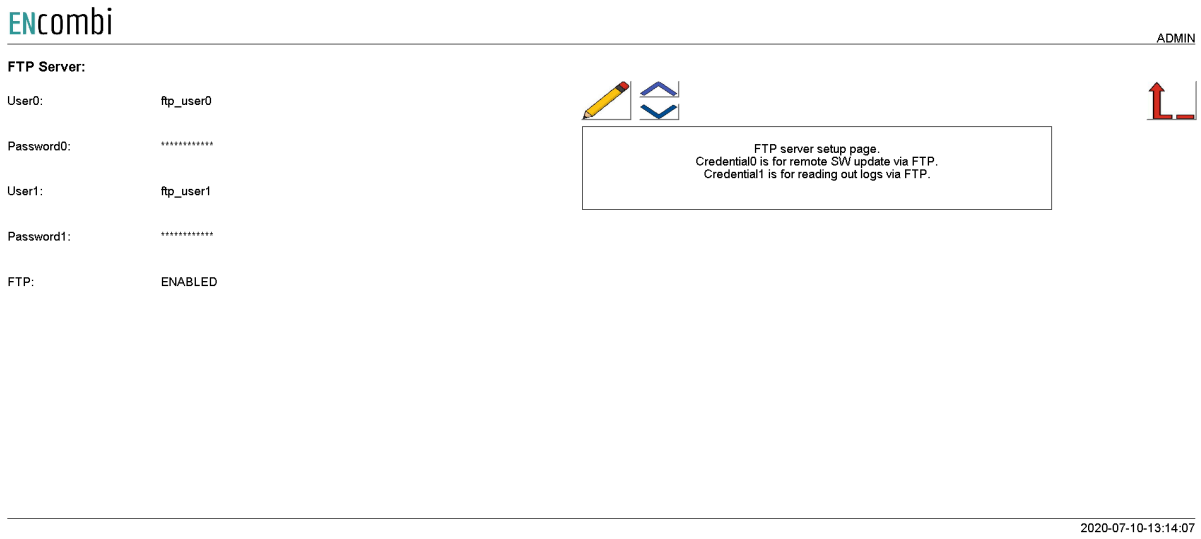
1. FTP server.
2. Telnet server.
3. Web server (ECweb).

ECgrid FTP server

First page presented when clicking the server button is the page below where the FTP server access details are set up.
Two sets of credentials exist.

1. Credential set0 will provide access to the PLC_PRG folder on the SD-card.
2. Credential set1 will provide access to the Logs folder on the SD-card.

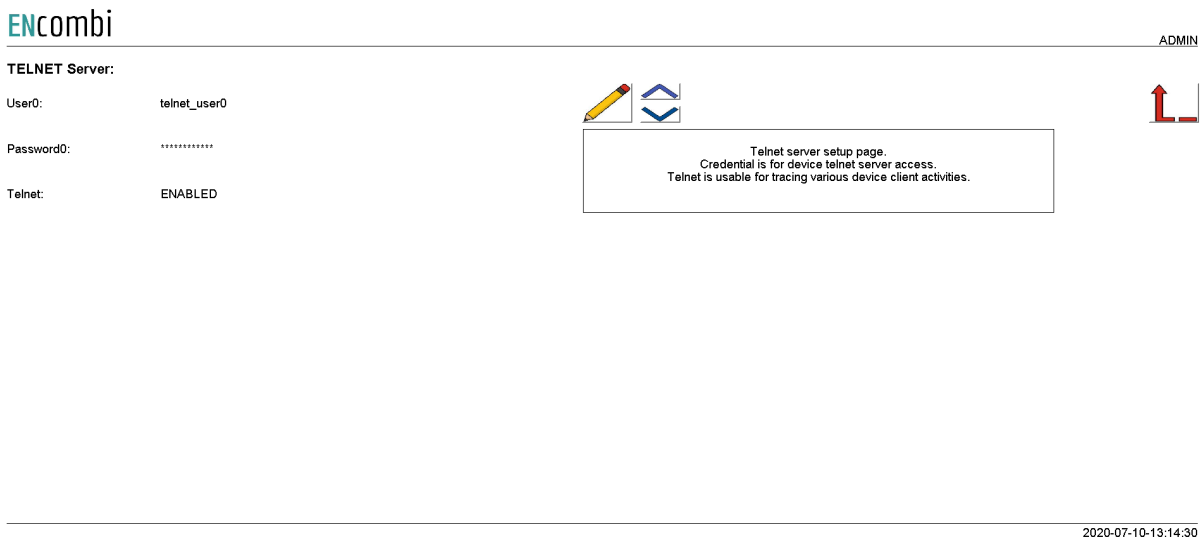
FTP server access in general can furthermore be enabled/disabled.



On the same submenu level the set up of telnet server access is found. Clicking the up/down arrows will lead to it.

ECgrid Telnet server

On the below page the telnet server access is set up. It is normally not used as it is intended for debug purposes only by tracing various ECgrid client activities.
Telnet server access in general can furthermore be enabled/disabled.



On the same submenu level the set up of web server access is found. Clicking the up/down arrows will lead to it.

ECgrid web server (ECweb)

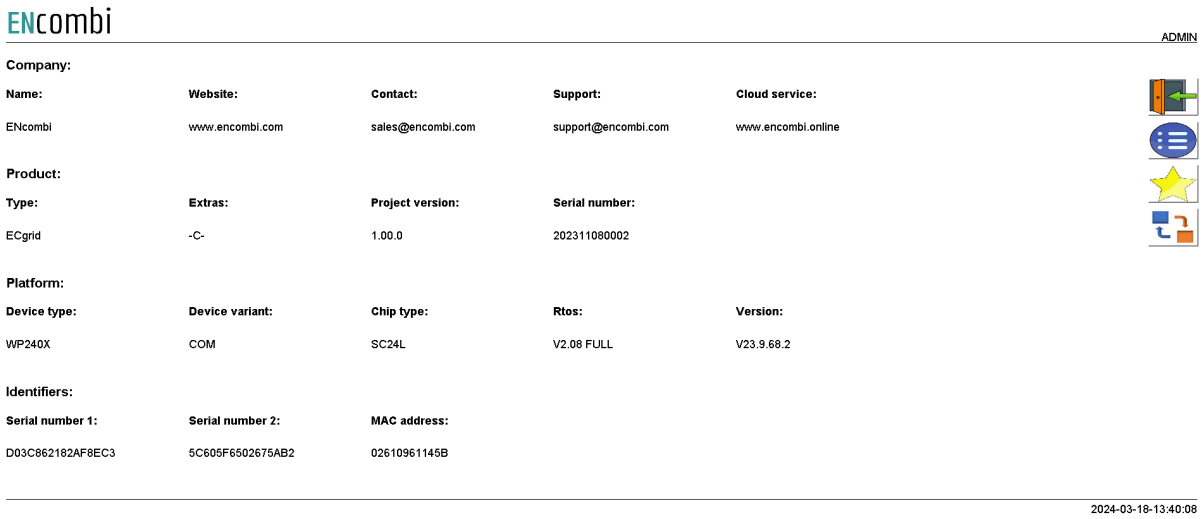
On the page below the web server access is set up.
The HTTP port can be changed. This can be useful if you are to access the ECgrid from outside the LAN using port forwarding and multiple ECgrids or other devices also featuring a web server are connected to the LAN as well.

Identifiers

Under this tile overview of SW version installed and extras present in the ECgrid as well as set up of project details (name, location etc.), password scheme etc. are found.

ECgrid information

First page presented when clicking the Identifiers is the below page where various details about the ECgrid such as extras available, SW version, serial number etc.

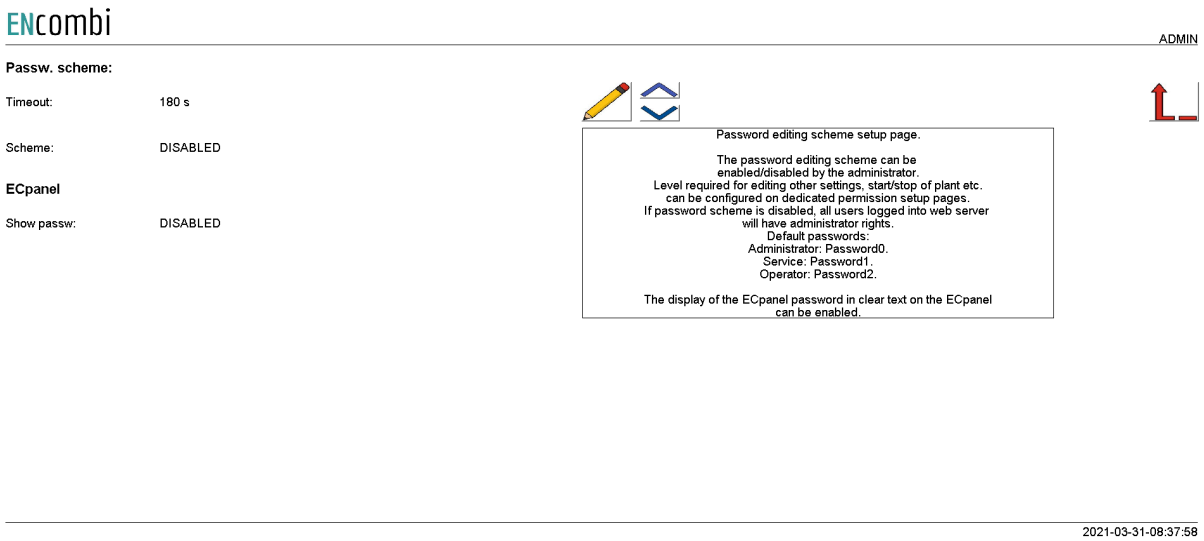


On the right hand side there are five submenus for.

1. Password scheme.
2. Extras.
3. Backups.
4. Application

Password scheme

Clicking the log-in button leads to the below page where the password scheme can be enabled/disabled.



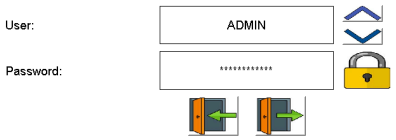
The password scheme holds four access levels:

1. Administrator.
2. Service.
3. Operator.
4. Viewer.

Required access levels of the various functionalities can be tailored by the customer as shown later. Whenever an attempt is made to alter/activate anything which is not allowed with the current access level, ECgrid will discard the command and populate a message text informing which access level is required to apply the command.

Viewer level is obtained just by logging on to ECweb.
When to change the access level the upper right text string informing about the current access level is to be clicked. Doing that leads to the below log-in page.

ENcombi



When logging in the requested access level and associated password is typed in. When the correct password is typed in the padlock will open. Hereafter the log-in button must be clicked. That will give the selected access level and take you back to the previous page.

When logging out just click the log-out button. The ECgrid will log out automatically when no editing occurs within the timeout period. Users will be degraded to Viewer level and must log in again as described above to regain the required access level.

When the password scheme is disabled as per default the user will have administrator rights.
Only an administrator can disable the password scheme.

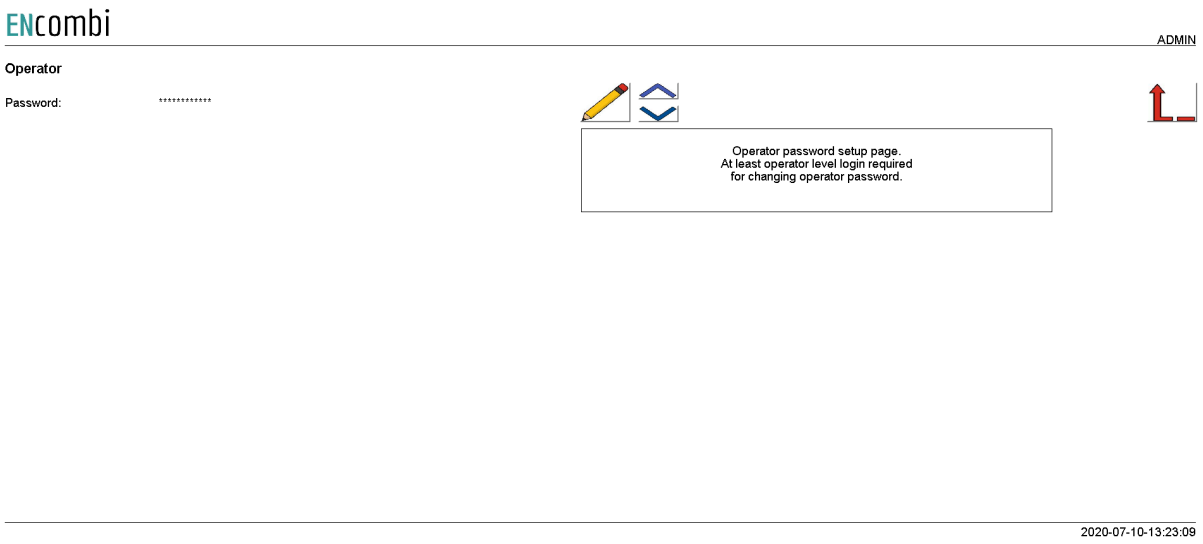
Besides the enabling of the password scheme for ECweb itself, there is a setting for enabling visualization of the ECpanel password in clear text on the ECpanel itself. When disabled the ECpanel password is hidden on the ECpanel.

On the same submenu level the set up pages for Operator, Service and Administrator level passwords are found. Clicking the up/down arrows will lead to them.

Passwords

Operator access or high is required for changing the Operator password.
Service access or high is required for changing the Service password.
Administrator access is required for changing the Administrator password.

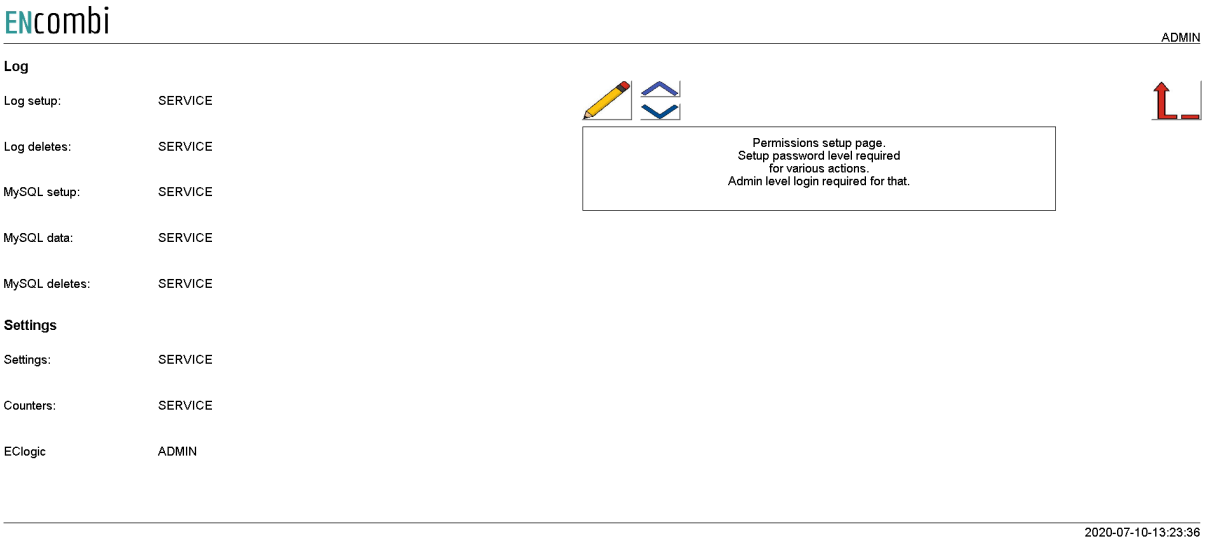
three dedicated menus exist for changing the passwords. Below example for changing Operator password.



On the same submenu level the set up pages for tailoring access level required for executing various commands are found. Clicking the up/down arrows will lead to them.

Permissions

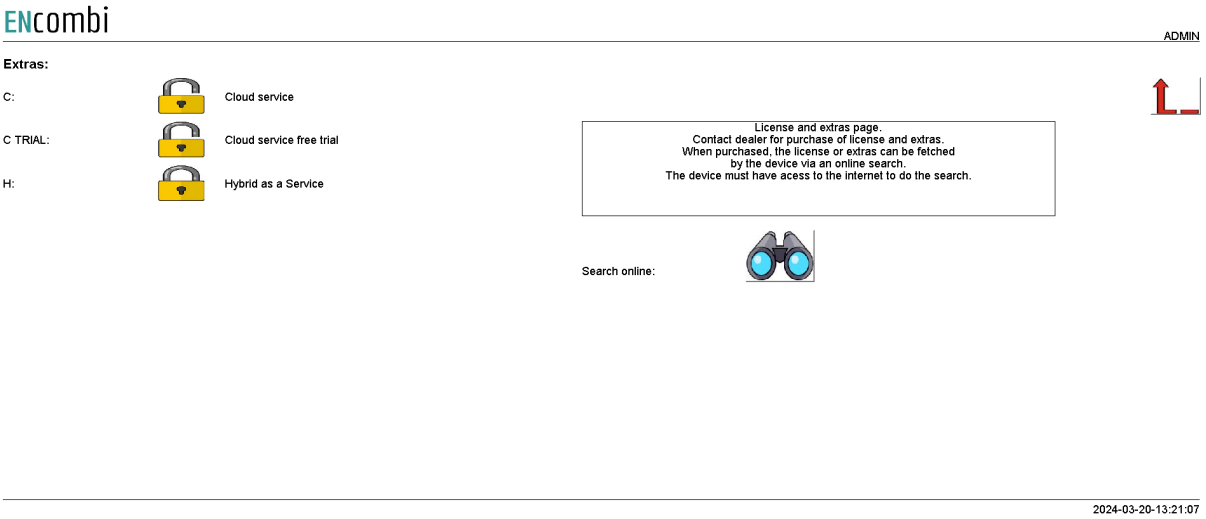
The various access levels required are set as below example.



Only an administrator can change the access level required for the various functionalities.

License & Extras

Clicking the extras button leads to the page below where the list of available extras are displayed alongside with which of them are present in the ECgrid. Activation of License as well as upgrading with new Extras are done from here.



After purchase of License or any additional Extra(s) the ECgrid is upgraded in one of the following ways.

Search online

The ECgrid will have to be connected to the internet for this approach. Click the binoculars button for “Search online”. When successfully completed the ECgrid will request a reboot.

Backups

Clicking the Backup button leads to the page below where the backups supported by ECgrid are managed. The ECpvX provides one type of backup.

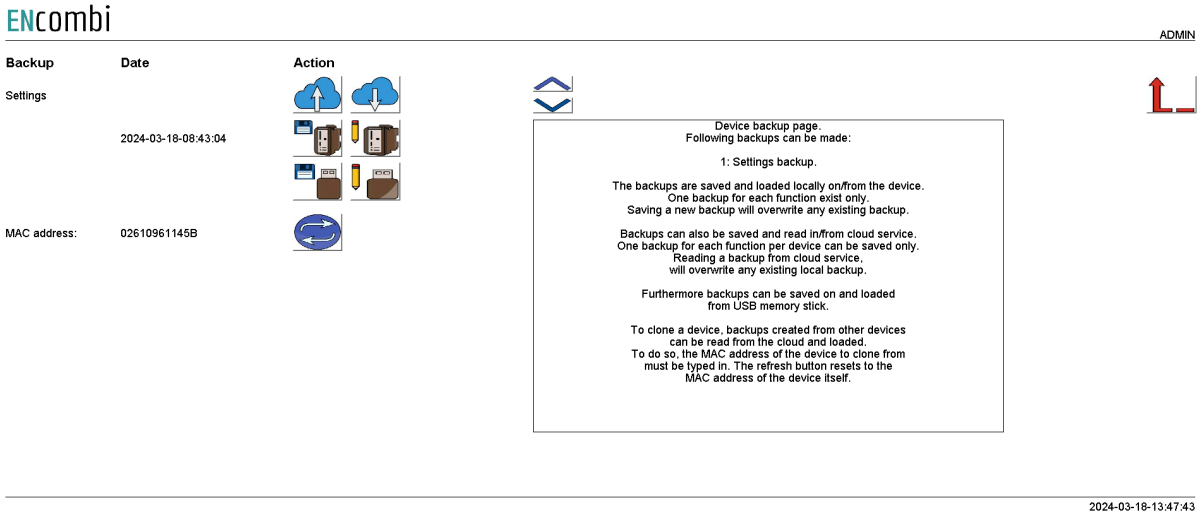
1. Settings.

Both types can be:

1. Generated and stored locally on internal memory of ECgrid.
2. Loaded into ECpvX project from internal memory of ECgrid.
3. Copied from internal memory of ECgrid to ENcombi cloud for safe storage.
4. Read from ENcombi cloud to internal memory of ECgrid.
5. Generated and stored on USB-stick.
6. Loaded into ECgrid project from USB-stick.

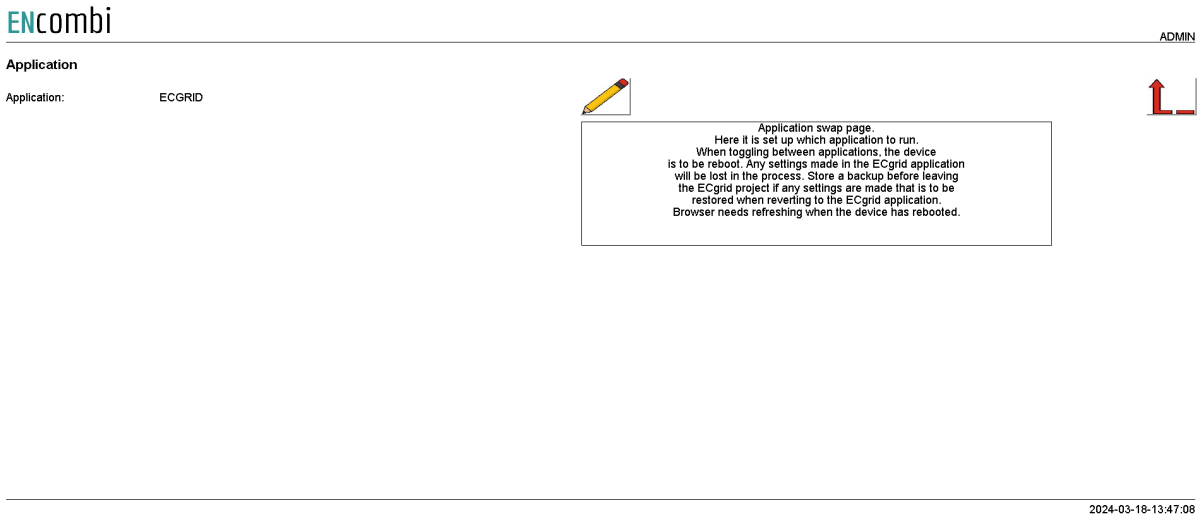
When reading backups from the cloud it will overwrite any existing backup already present on the internal memory of the ECgrid. The presents of and date of origin of the backups on internal memory are displayed.

By default when reading backups from ENcombi cloud, the ECgrid will read backups generated by itself. If to clone an ECgrid this can be done by typing in the MAC access of the ECgrid you request to clone. Doing this ECgrid will read backups generated by that ECgrid instead.



Application

Clicking the Application button leads to the page below. Here it can be selected which application is to be active.



The following applications are available.

1. ECgrid.
2. ECgrid Service Tool.
3. ECgrid Boot

ECgrid is the default application and the one to use for the normal operation of the ECgrid. ECgrid Service Tool is a separate application that offers various tests and configuration features and the ECgrid Boot is a tool for updating both the ECgrid and the ECgrid Service Tool SW. The ECgrid Service Tool and the ECgrid Boot are treated in separate chapters.

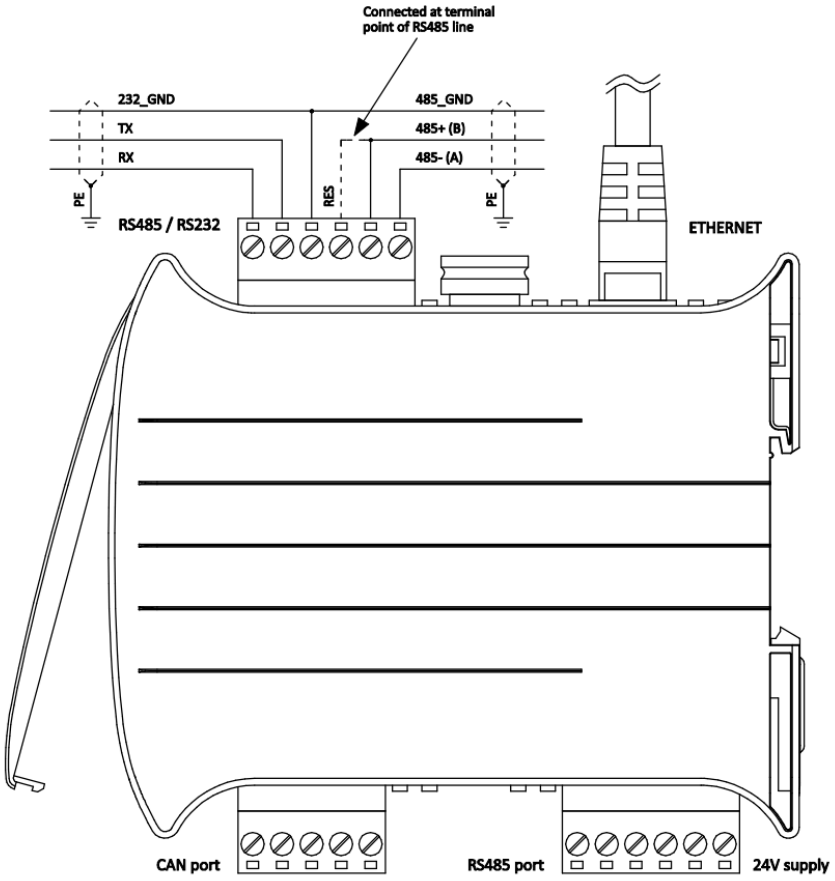
When toggling between applications the device is to be rebooted. Any settings made in the ECgrid application will be lost in the process. Make a backup before leaving the ECgrid application if any settings are made that are to be restored when reverting to the ECgrid application once again. The browser needs refreshing when the device is rebooted after switching the application.

Settings

Under this tile the setup of site specific parameters such as which power meter is used, ancillary service schemes etc. are found.

RS485 COM ports

The ECpvX features two RS485 COM ports which are referred to as COM2 and COM3.



COM2 is the one found next to the power supply and COM3 is the one found next to the ethernet port.

- COM2 is reserved for interfacing to power meters and/or IO modules.
  In case none of this is enabled, COM2 is acting as a slave port.
- COM3 is reserved for interfacing to IO modules.
  In case none of this is enabled, COM3 is acting as a slave port.

First page presented when clicking the Settings tile is the page below where COM2 configuration is set up.

Baud rates supported are:

- 9600, 19200, 38400 and 115200

Parity supported are:

- “Parity one stop bit”, “No parity”, “Even parity” and “Odd parity”.

When a COM2 port is acting as a master, the transmit rate can be used to control the rate at which the ECpvX transmits to the slaves.

The Slave ID is only used when a COM2 port is acting as a slave.

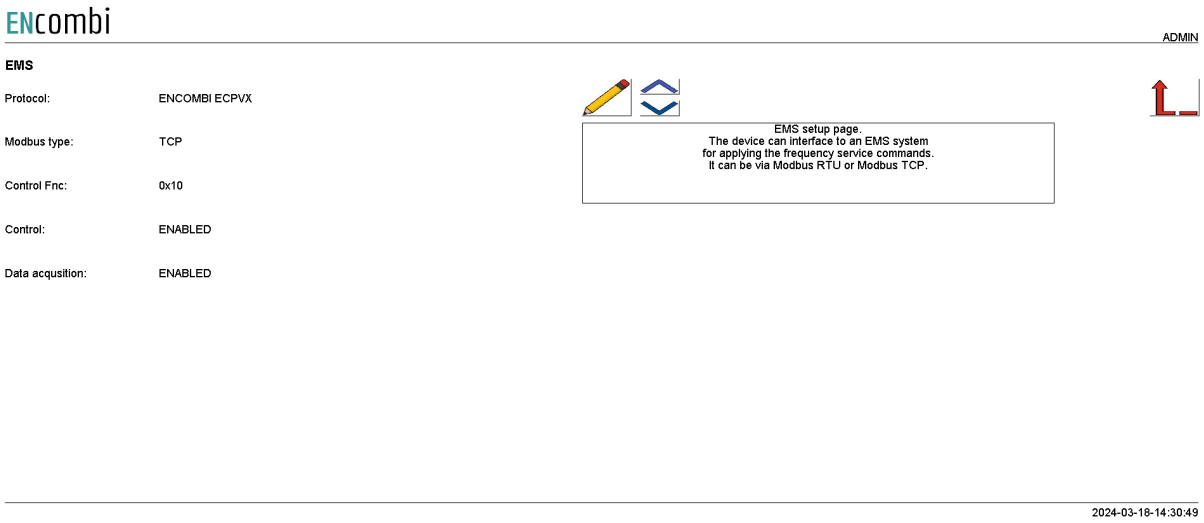
On the same menu level a similar setup page for COM3 configuration is found. Clicking the up/down arrows will lead to it.

On the right hand side there are five submenus for.

1. EMS related parameters.
2. Mains related parameters.
3. Battery related parameters.
4. IO module related parameters.
5. Alarm related parameters.

EMS

Clicking the EMS button leads to the following page.



A maximum of 1 EMS is supported by a single ECgrid. Check the link below to see which EMS that are supported by ECpvX.
http://www.encombi.com/products/ecgrid/
Should your preferred EMS not be on the list already, contact ENcombi to request the adding of it.

Controlling the EMS and data acquisition from the EMS can be enabled/disabled independently. ECgrid supports Modbus function code 0x06 and 0x10 for applying control commands. Some EMS support only one of the two. Consult the Modbus Master documentation on ENcombi website to learn which function code to use with your inverter:
http://www.encombi.com/products/ecgrid/

RTU

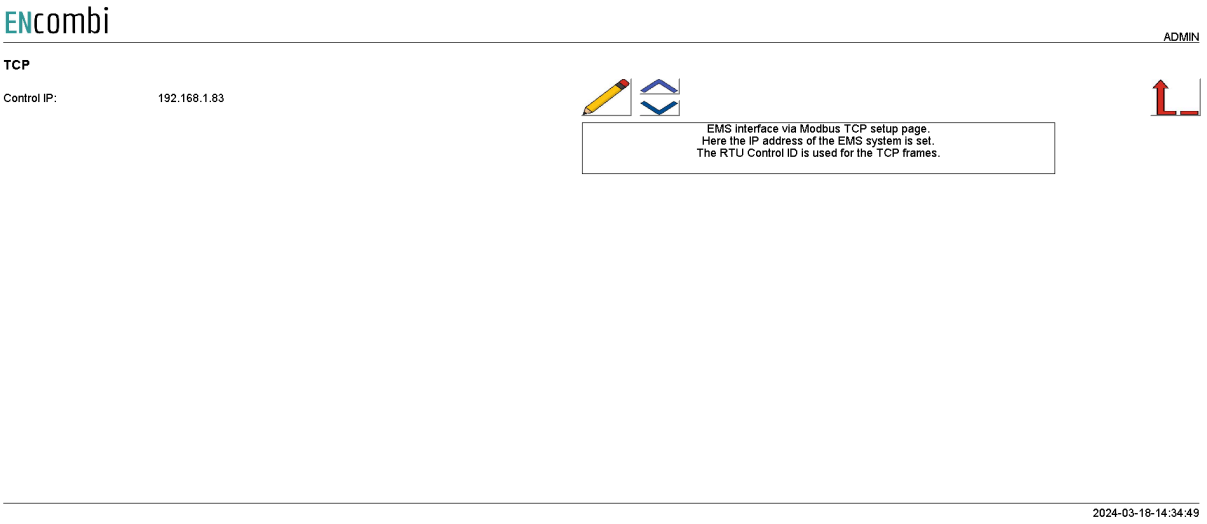
On the same submenu level the page for setting up Modbus RTU specifics for EMS communication is found. Clicking the up/down arrows will lead to it.

The ECgrid can apply references as Unicast or as Broadcast.

The Control ID is used for Unicast and should be set equal to that of the EMS.

TCP

On the same submenu level the page for setting up Modbus TCP specifics for inverter communication is found. Clicking the up/down arrows will lead to it.

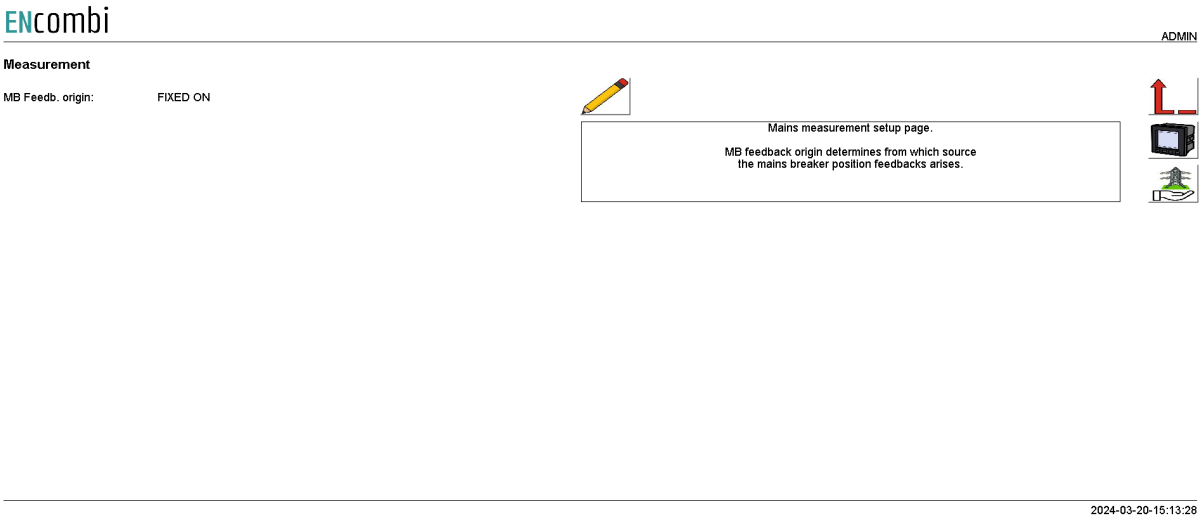


The Control IP shall be set equal to that of the EMS.

Mains

Measurements

Clicking the mains button leads to the page below where the measurements used for the grid can be set up.



MB feedback origin determines from which source the mains breaker position closed feedbacks arises.

- Fixed on.
- Power meter.
- EClogic.

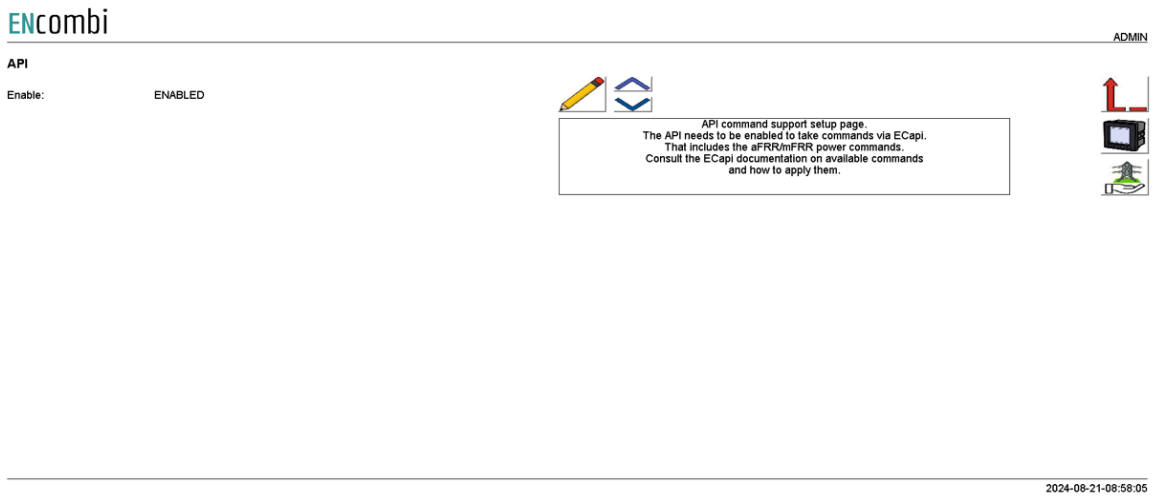
Fixed on
In case of sites without gensets where ECgrid is used for self consumption operation alone for example, the mains breaker position can always be assumed to be closed.

Power meter
In case a power meter is used the input1 of the power meter will be interpreted as mains breaker closed feedback.

EClogic
In more complex electrical infra structures having for instance sectional breakers separating the utility from the PV plant, a condition of whether the utility is at all connected to the same AC busbar section as the PV needs to be taken into consideration. Such conditions can be customized from within EClogic.

API

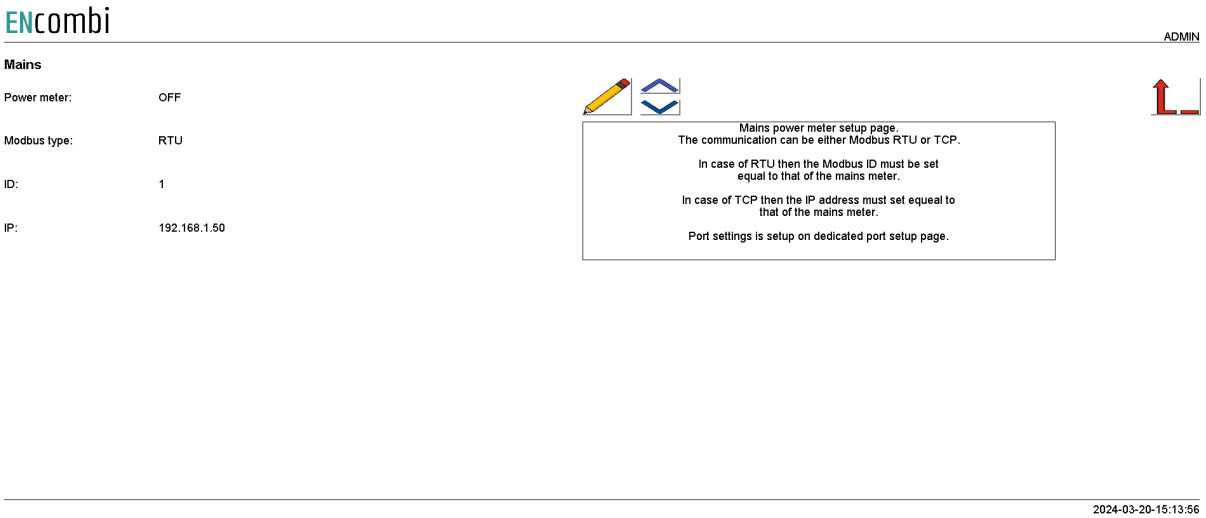
On the same submenu level the page for API commands is. Clicking the up/down arrows will lead to them.



The ECgrid can take various commands including setting up frequency service schedules and applying aFFR/mFRR commands via ECapi. The API setting must be enabled in order to have the ECgrid accept commands sent via ECapi. Consult the ECapi documentation on which commands are supported and how to apply them .

Meter

Clicking the power meter button on the right hand side of any of the above pages leads to the following page.



A maximum of 1 power meter for mains is supported. The communication can be either Modbus RTU or TCP. Check the link below to see which meters are supported by ECpvX.
http://www.encombi.com/products/ECgrid/

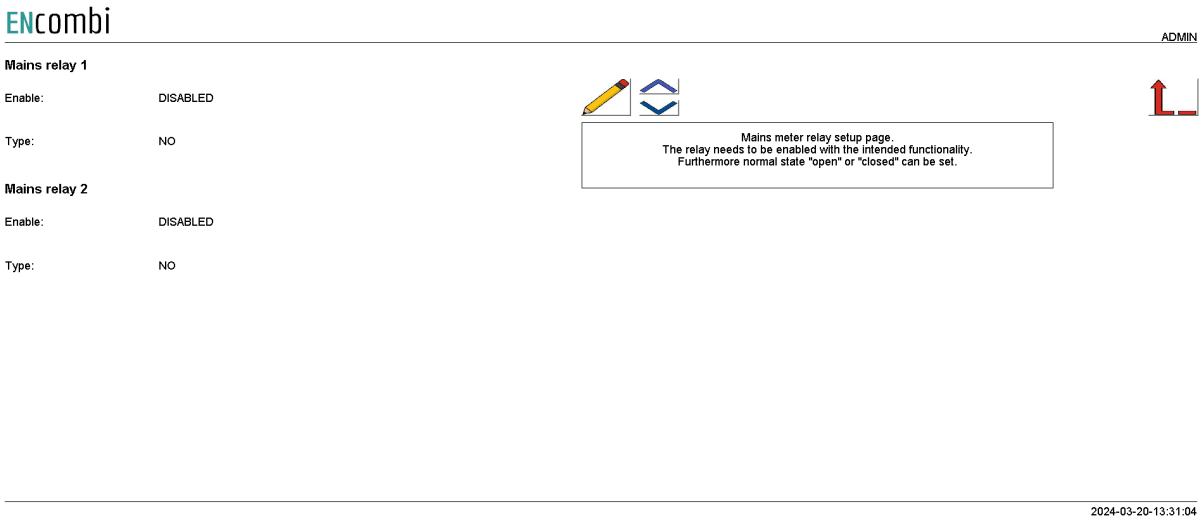
Should your preferred meter not be on the list already, contact ENcombi to request the adding of it.

In case of TCP, the Modbus ID selected is used in the TCP frames.

The power meter communication on Modbus RTU runs on RS485 COM2 port as discussed earlier in this chapter.

Relay

On the same submenu level the page for setting up relay outputs on the power meters is found. Clicking the up/down arrows will lead to them.



A total of two relay outputs can be controlled.

The relay needs to be enabled with the intended functionality.

1. Disabled
2. Alarm
3. EClogic

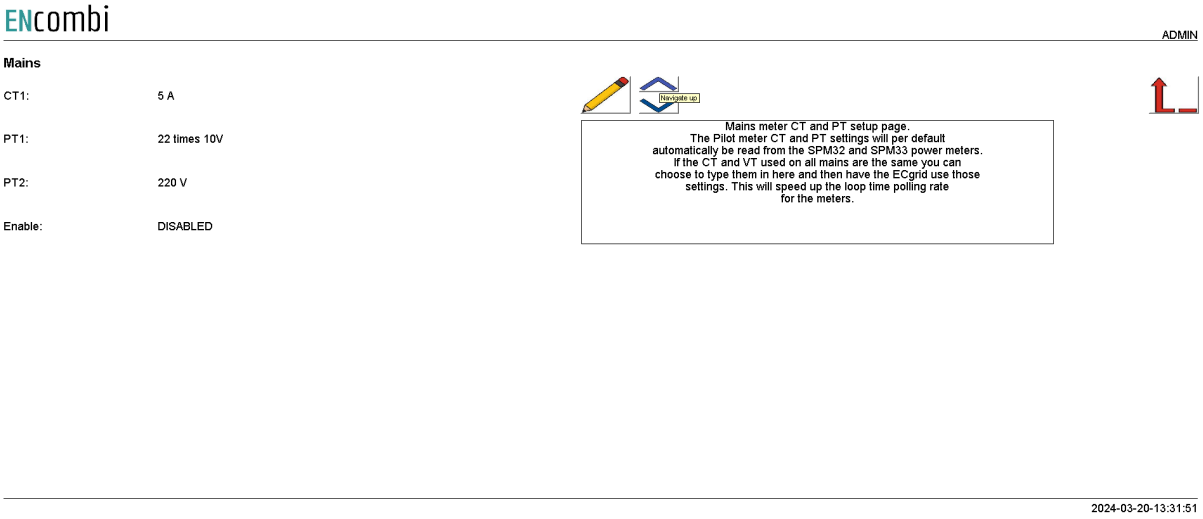
Furthermore the relay can be configured to be normally open or normally closed.

Relay control is not supported for all the power meters. Consult the Modbus Master documentation on ENcombi website to learn for which power meters relay feature is support:
http://www.encombi.com/products/ecgrid/

CT settings

On the same submenu level the page for setting up CT and VT settings for the power meters is found. Clicking the up/down arrows will lead to them. This feature applies for the Pilot SPM32 and SPM33 meters only. The Pilot meter CT and PT settings will by default automatically be read from the SPM32 and SPM33 power meters. If the CT and

VT used on all PV meters are the same you can choose to type them in here and then have the ECgrid use those settings. This will speed up the loop time polling rate.



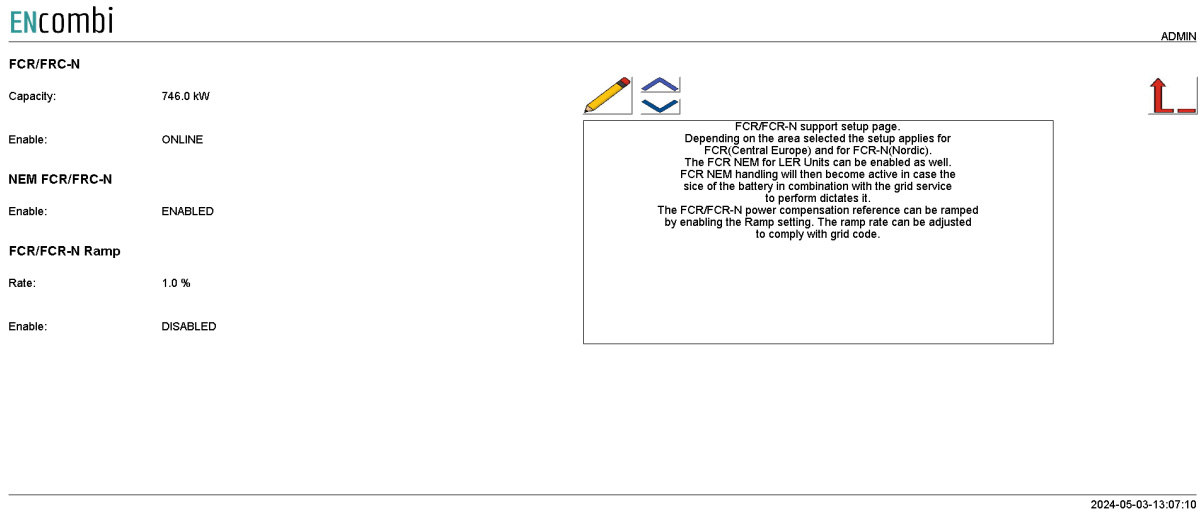
Ancillary services

Clicking the grid support button on the right hand side of any of the above pages leads to ancillary service configuration.

Note that the Line1 frequency needs to be part of the data read from the mains meter in order to use the frequency support. Consult the Modbus master documentation on the ENcombi website for detailed information about what data is read from the various meter models.
http://www.encombi.com/products/ecgrid/

FCR/FCR-N

In this menu the FCR service is set up. The menu is used both for FCR in Central Europe synchronous and for FCR-N in Nordic synchronous area. The area is set in another menu.



The FCR service can be enabled as per the below options.

1. Disabled
2. Enabled
3. Online

Disabled
The FCR service is disabled.

Enabled
The FCR service is enabled and ECgrid is using the set value for capacity.

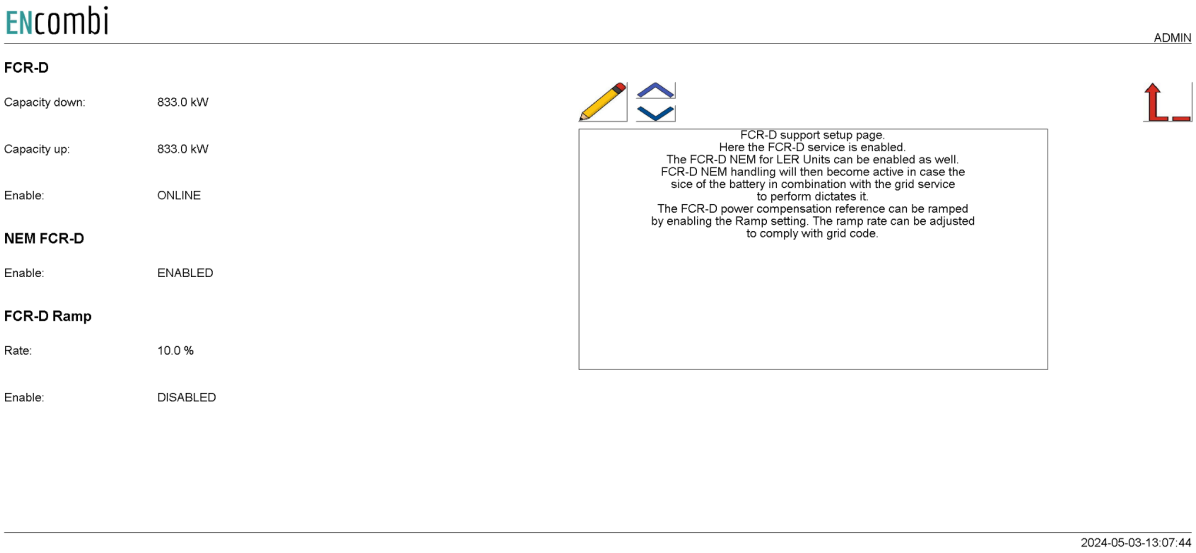
Online
The FCR service is enabled as per the market bids received from an aggregator's VPP. The setup of which aggregator to use is made on the Admin page in ECcloud for the respective ECpvX site.

Furthermore the NEM for LER units can be enabled. In case NEM is enabled, the ECgrid will perform NEM if the rated hour of the BESS calls for it.

The FCR/FCR-N power compensation reference can be ramped by enabling the Ramp setting. The ramp rate can be adjusted as well to comply with grid code.

FCR-D

On the same submenu level the setup page for FCR-D. Clicking the up/down arrows will lead to it.



The FCR-D service can be enabled as per the below options.

1. Disabled
2. Up
3. Down
4. Up/Down
5. Online

Disabled
The FCR-D service is disabled.

Up
The FCR-D Upwards service is enabled and ECgrid is using the set “Up” value for capacity.

Down
The FCR-D Downwards service is enabled and ECgrid is using the set “Down” value for capacity.

Up/Down

The FCR-D Upwards & Downwards service is enabled and ECgrid is using the set “Up” and “Down” values for capacity.

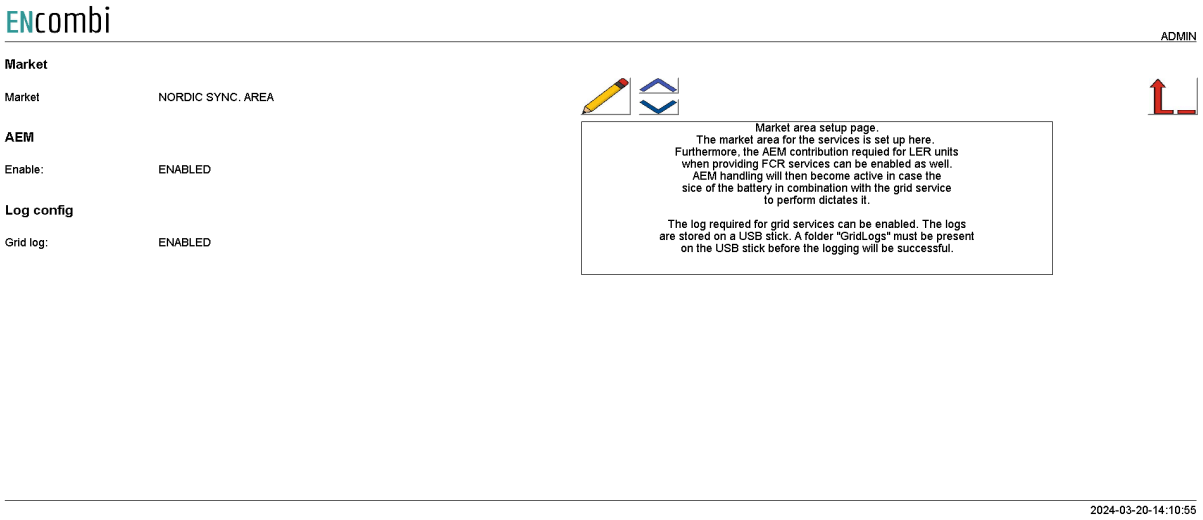
Online
The FCR-D service is enabled as per the market bids received from an aggregator's VPP. The setup of which aggregator to use is made on the Admin page in ECcloud for the respective ECpvX site.

Furthermore the NEM for LER units can be enabled. In case NEM is enabled, the ECgrid will perform NEM if the rated hour of the BESS in conjunction with the FCR-D service to perform calls for it.

The FCR-D power compensation reference can be ramped by enabling the Ramp setting. The ramp rate can be adjusted as well to comply with grid code.

Market area

On the same submenu level the setup page for the market area etc. is found. Clicking the up/down arrows will lead to it.



Here the Market area can be set. The following areas can be selected

1. Central Europe sync. area.
2. Nordic sync. area.

Central Europe sync area
Select this when your installation is in the Central Europe sync. area. That is from DK1 and downwards in europe.

Up
Select this when your installation is in the Nordic Europe sync. area. That is DK2 and upwards in europe.

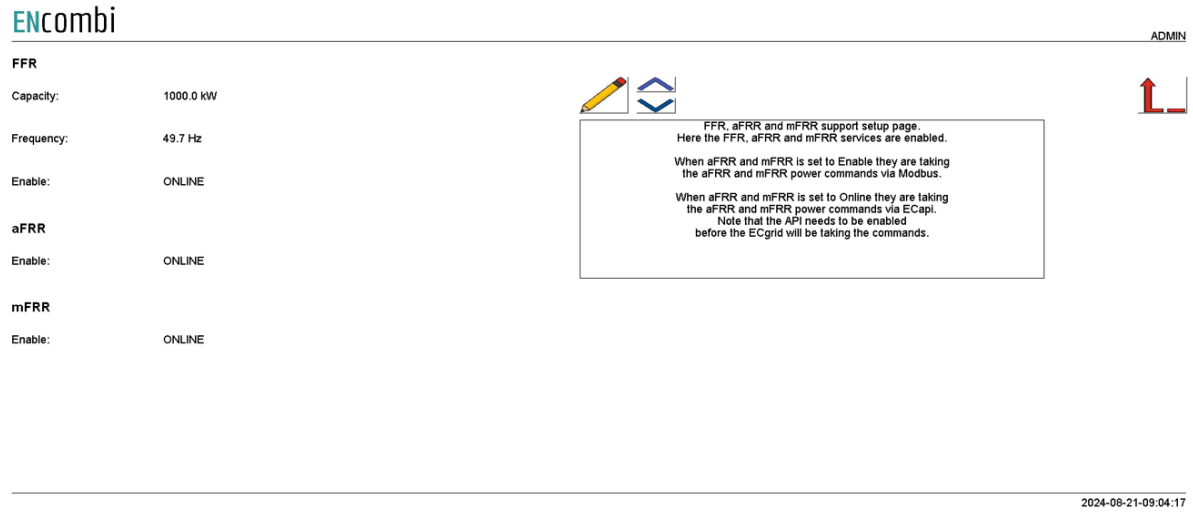
Furthermore the AEM for LER units can be enabled. In case AEM is enabled, the ECgrid will perform AEM if the rated hour of the BESS in conjunction with the FCR service to perform calls for it.

Finally the ancillary services logging can be enabled. The logs are stored on a USB stick inserted into the ECgrid. The USB stick has to be 32GB or less and FAT32 formatted. It is recommended to replace the USB stick as part of the site service routine. When ejecting the USB stick the logging should be disabled first. otherwise it will compromise any ongoing logging taking place. The log files are in semicolon separated csv file format and the column content is as below.

Column Description
Time stamp in DATETIME format
Grid frequency [Hz]
Battery power [kW]
Battery power percentage of the total service capacity [%]
FCR-N capacity [kW]
Power compensation from FCR-N [kW]
FCR-D Down capacity [kW]
FCR-D Up capacity [kW]
Power compensation power FCR-D [kW]
NEM FCR-N current value in [-1;1] range
NEM FCR-N Power compensation [kW]
NEM FCR-D current value in [-1;1] range
NEM FCR-D Power compensation [kW]
Frequency reference for the FCR generated by AEM [Hz]
Battery total FCR compensation inclusive NEM [kW]
Battery SOC [%}
Time left in battery with full dicsharge [minutes]
FFR capacity [kW]
Power compensation from FFR [kW]
aFRR Down capacity [kW]
aFRR Up capacity [kW]
Power compensation from aFRR [kW]
mFRR capacity [kW]
Power compensation from mFRR [kW]

FFR, aFRR & mFRR

On the same submenu level the setup page for FFR, aFRR and mFRR is found. Clicking the up/down arrows will lead to it.



The FFR service can be enabled as per the options below.

4. Disabled
5. Enabled
6. Online

Disabled
The FFR service is disabled.

Enabled
The FFR service is enabled and ECgrid is using the set value for capacity.

Online
The FFR service is enabled as per the market bids received from an aggregator's VPP. The setup of which aggregator to use is made on the Admin page in ECcloud for the respective ECpvX site.

The aFRR and mFRR service can be enabled as per the options below.

7. Disabled
8. Enabled
9. Online

Disabled
The aFRR/mFRR service is disabled.

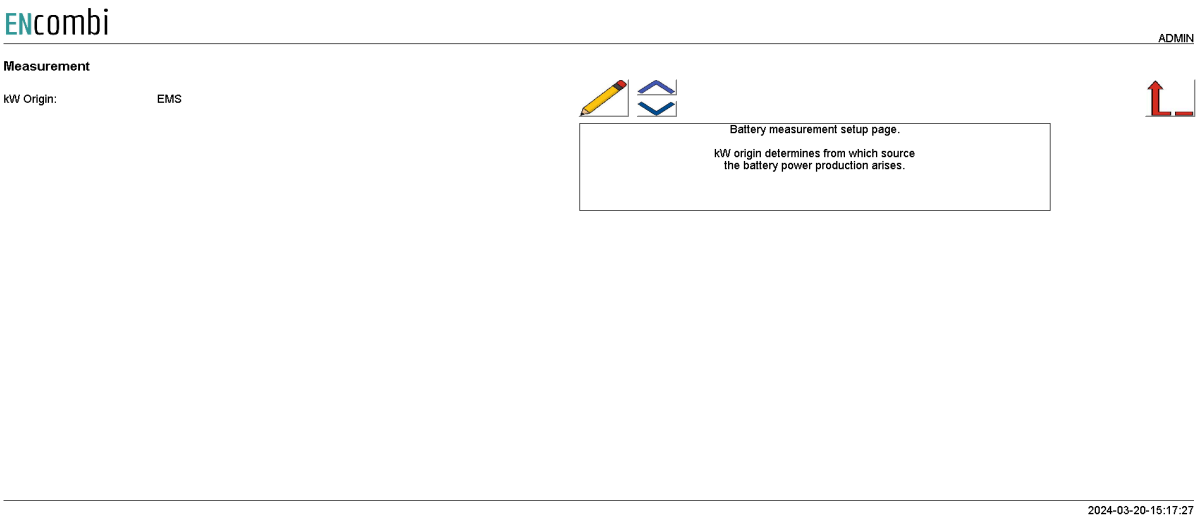
Enabled
The aFRR/mFRR service is enabled and ECgrid is receiving the capacity and the power demand via Modbus. Consult the ModbusSlave documentation on how to apply the commands.

Online
The aFRR/mFRR service is enabled and the ECgrid is getting the capacity and the power demand via ECapi. Consult the ECapi documentation on how to apply the commands. Note that the API setting needs to be enabled as well before the ECgrid will accept the commands applied via ECapi.

Battery

Measurements

Clicking the Battery button leads to the below page.



kW origin determines from where to retrieve the battery power production. Supported methods are:

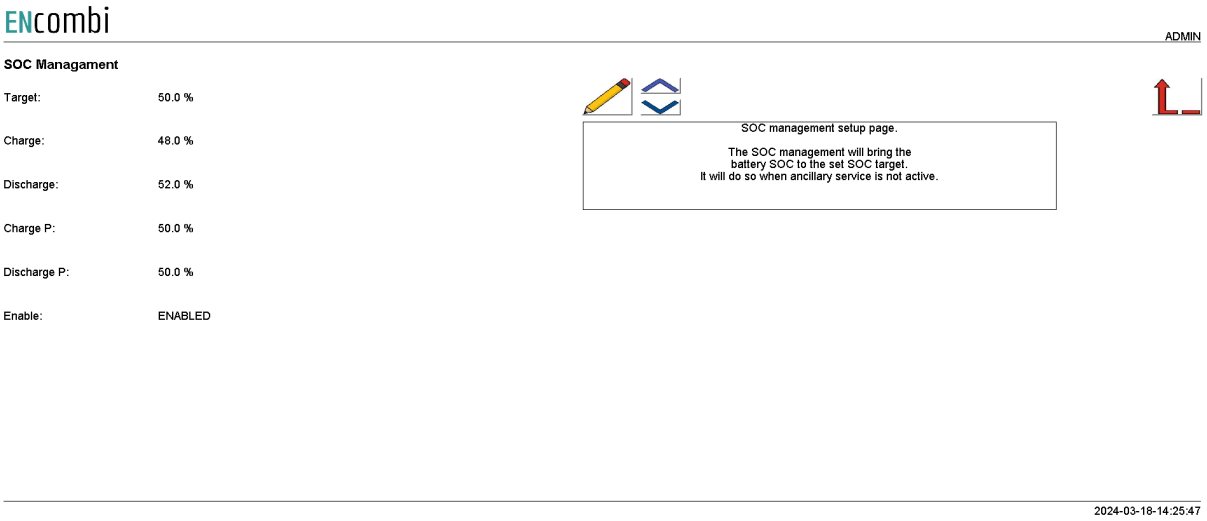
1. EMS.
2. Mains reading.

EMS
The ECgrid will take the power contribution of the BESS directly from its communication with the EMS controller.

Mains reading
This will have ECgrid use the Mains power readings as an expression for the BESS production as well. This can be used in an On-grid BESS plant without any site load being present.

SOC management

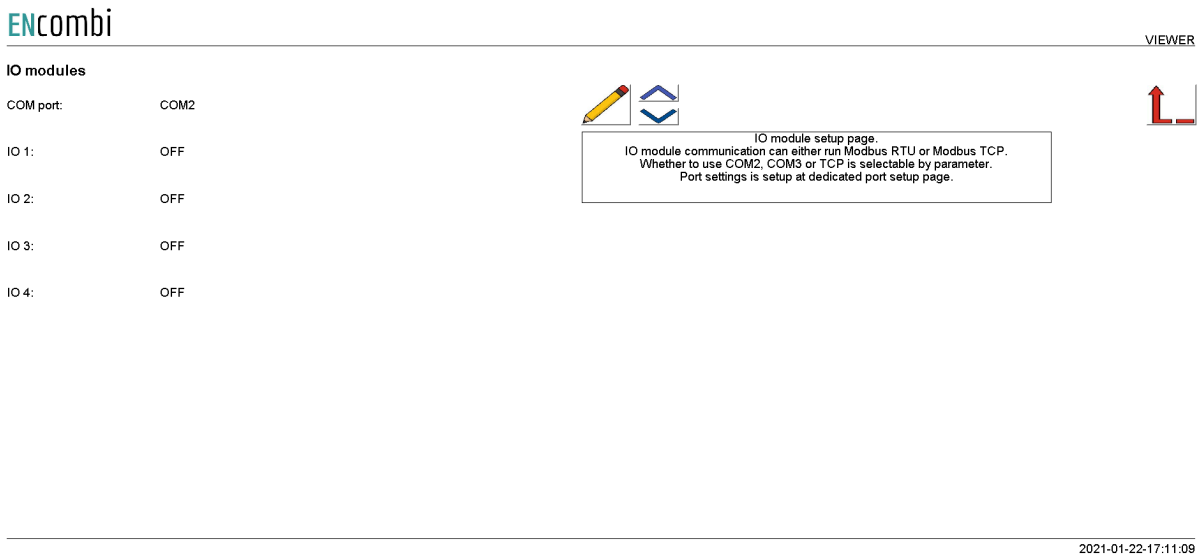
On the same submenu level the setup page for SOC management is found. Clicking the up/down arrows will lead to them.



When ancillary service is not ongoing the ECgrid can bring the SOC back to a set target value. The power level to charge/discharge with for reaching the target value can be set.

IO modules

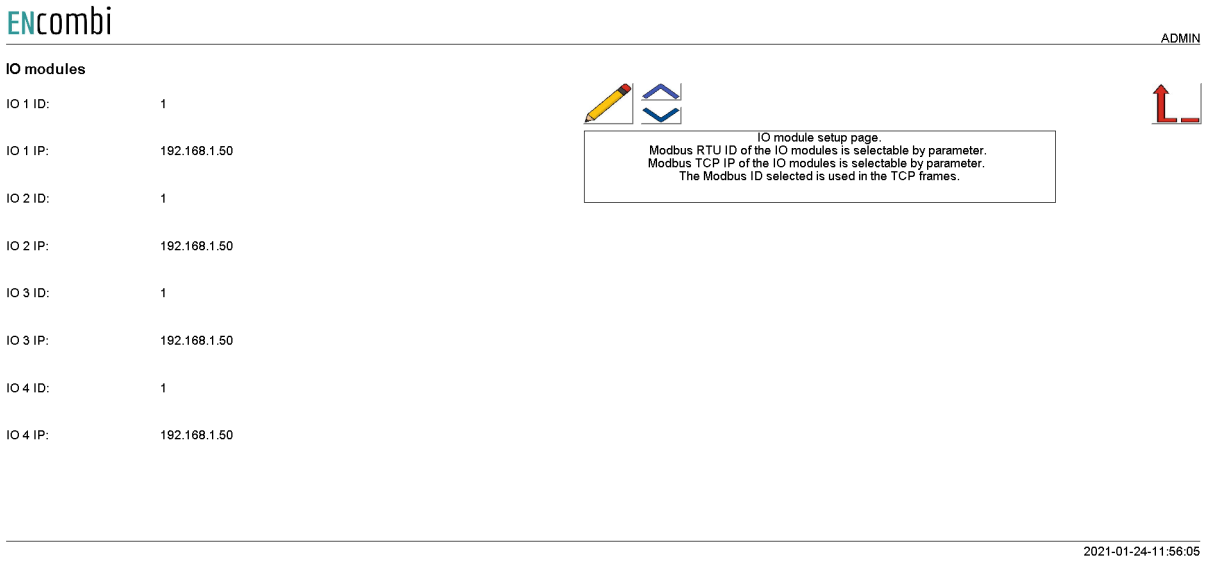
Clicking the IO module button leads to the following page.



Above page holds the setting up Modbus IO module communication. IO module communication runs either Modbus RTU or Modbus TCP. Whether to use IO modules on COM2, COM3 or TCP is selectable by parameter. A maximum of 4 Modbus IO modules can be connected to the ECgrid. The ECgrid can also read IO data directly from another ECpgrid. This is selectable by parameter.

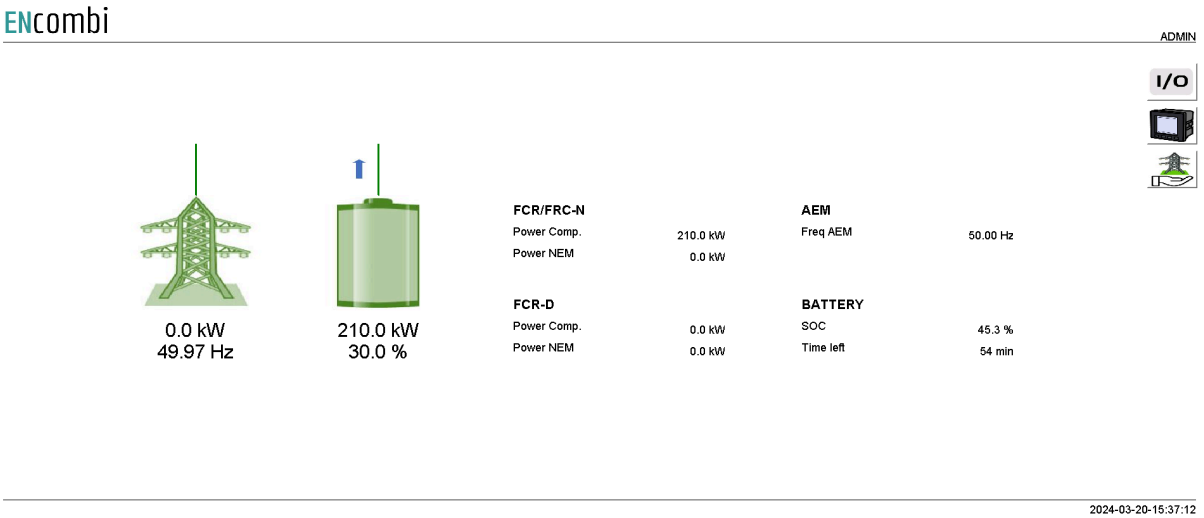
Check the link below to see which IO modules are supported by ECgrid.
http://www.encombi.com/products/ecgrid/

Clicking the up/down arrows leads to the page below where the Modbus ID and IP addresses for the respective IO modules are set up.

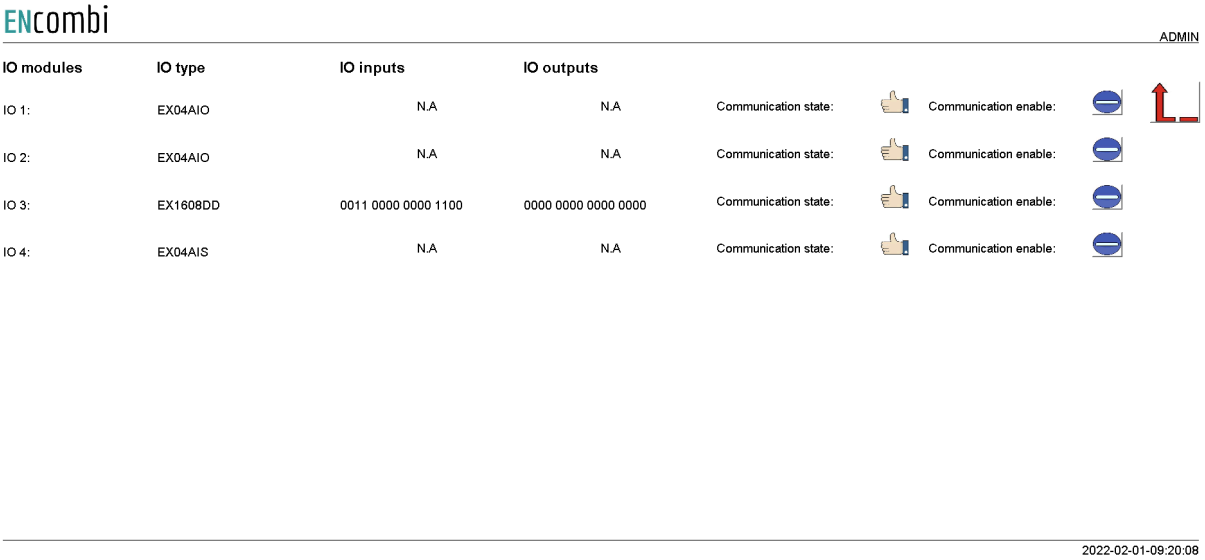


Analogue input/output

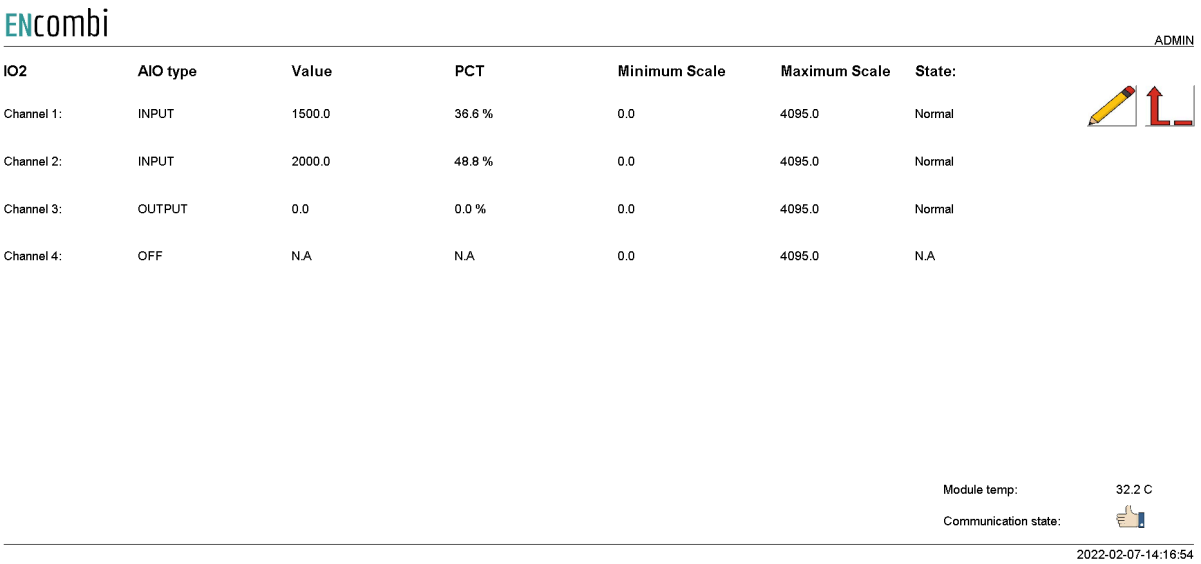
The ECgrid supports analogue input/output modules. When the analogue module is selected in the IO window setup, all settings are placed in the monitoring of the IO module.



When pressing the IO button, it will lead to the following page.



From this page it is possible to select which IO module to set up and monitor values.
If the IO module is digital input/output, it is not possible to click on the module, the actual bit value is present at this page.
By clicking on the IOx module, it will lead to the following page.



From this page it is possible to scale the input/output on each channel of the IO module. The input value can be used for Pref, Qref or other data points. This is set in EClogic. The value shown is the scaled value and the percentage is the percentage of the range from 0-100%. The maximum range is 0-4095.
The module temperature is shown in the lower right corner and the state of each channel can be read to the right.

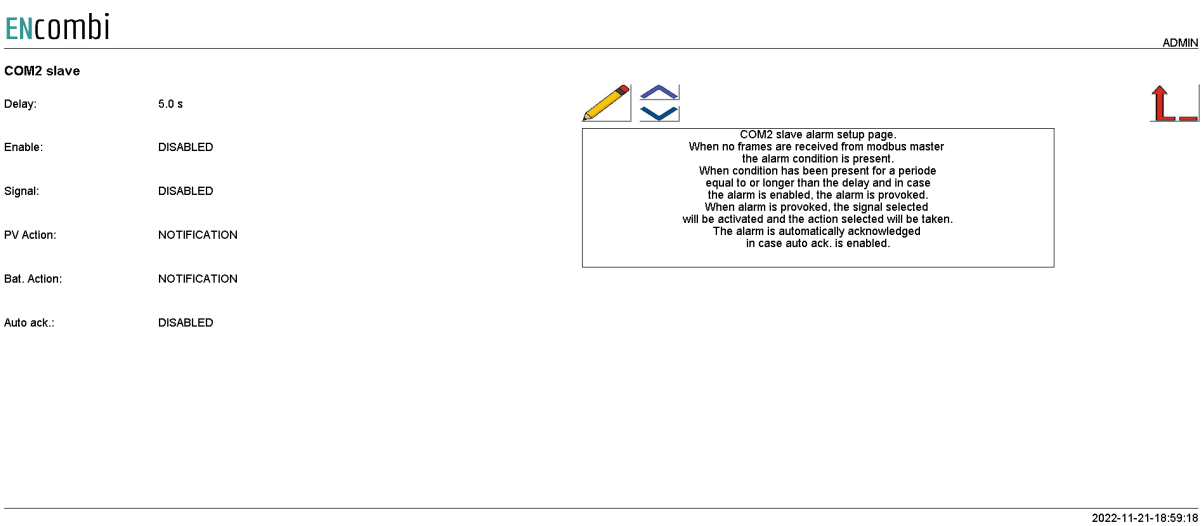
Alarms

Clicking the alarm button leads to menus of customizable alarms.

- COM2 port slave alarm.
- COM3 port slave alarm.
- TCP port slave alarm.

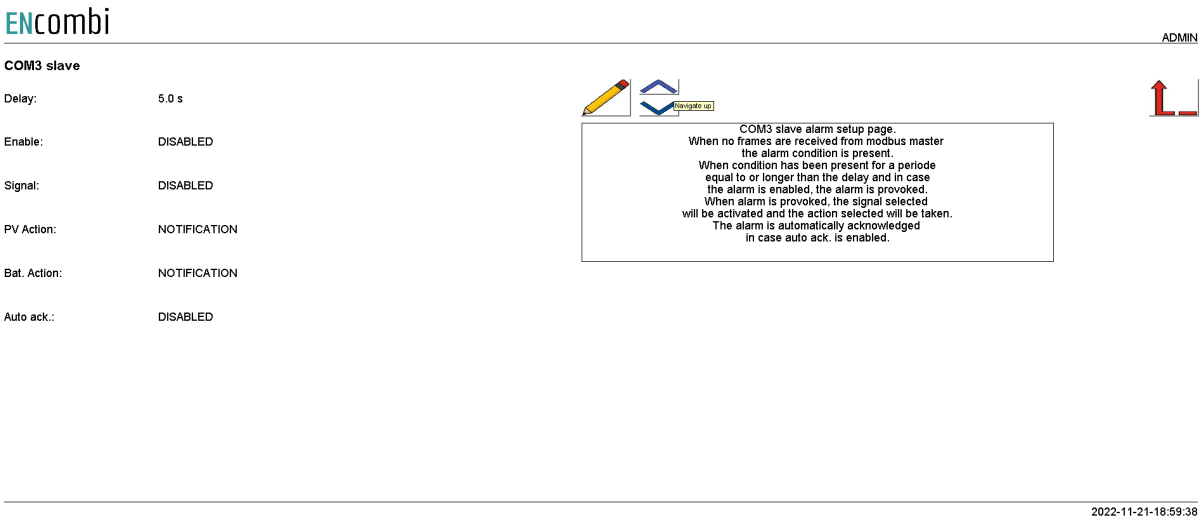
Other alarms exist as well but they are not customizable alarms as the ones listed above.

COM2 slave



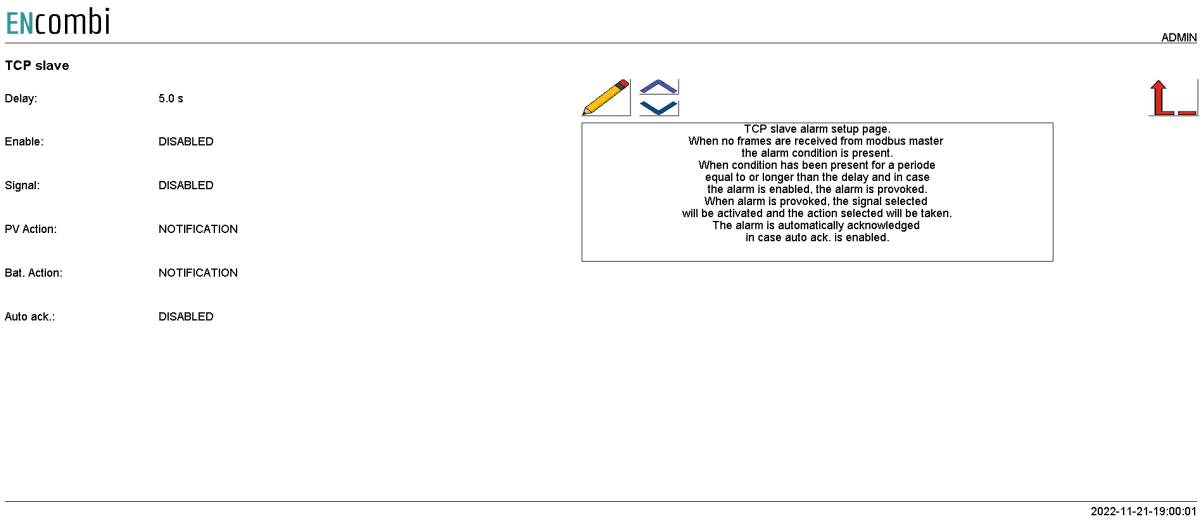
When no frames are received from the modbus RTU master, the alarm condition is present. When the condition has been present for a period equal to or longer than the delay and in case the alarm is enabled, the alarm is provoked. When the alarm is provoked, the signal selected will be activated and the action selected will be taken. The alarm is automatically acknowledged
in case auto ack. is enabled.

COM3 slave



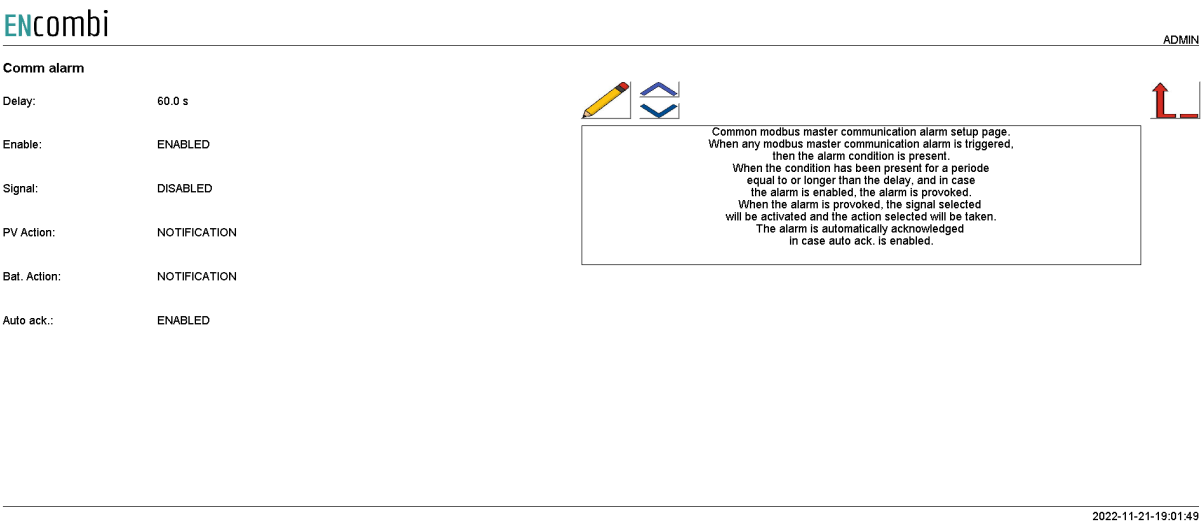
When no frames are received from the modbus RTU master, the alarm condition is present. When the condition has been present for a period equal to or longer than the delay and in case the alarm is enabled, the alarm is provoked. When the alarm is provoked, the signal selected will be activated and the action selected will be taken. The alarm is automatically acknowledged
in case auto ack. is enabled.

TCP slave



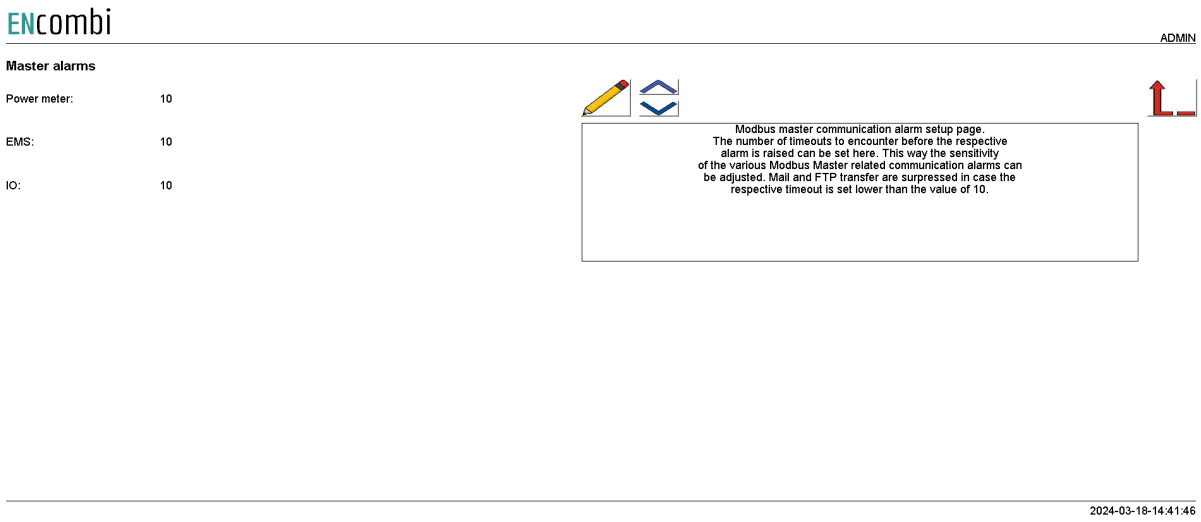
When no frames are received from the modbus TCP master, the alarm condition is present. When the condition has been present for a period equal to or longer than the delay and in case the alarm is enabled, the alarm is provoked. When the alarm is provoked, the signal selected will be activated and the action selected will be taken. The alarm is automatically acknowledged
in case auto ack. is enabled.

Common master communication



This alarm condition is present in case any of the modbus master communication alarms for the inverter, power meter, sensor or IO communication are raised. When the condition has been present for a period equal to or longer than the delay and in case the alarm is enabled, the alarm is provoked. When the alarm is provoked, the signal selected will be activated and the action selected will be taken. The alarm is automatically acknowledged in case auto ack. is enabled.

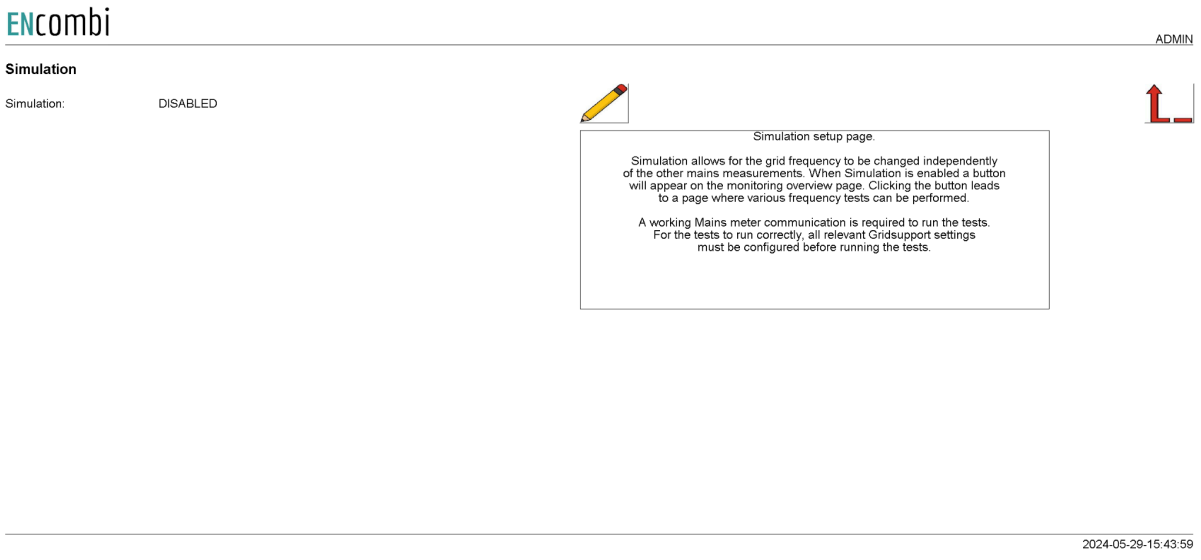
Modbus Master comm. alarms



Here the sensitivity of the Modbus Master communication alarms can be adjusted. The settings dictates the number of timeouts to encounter before the respective Modus Master alarm is raised.

Simulation

Clicking the Simulation button leads to the simulation settings page.



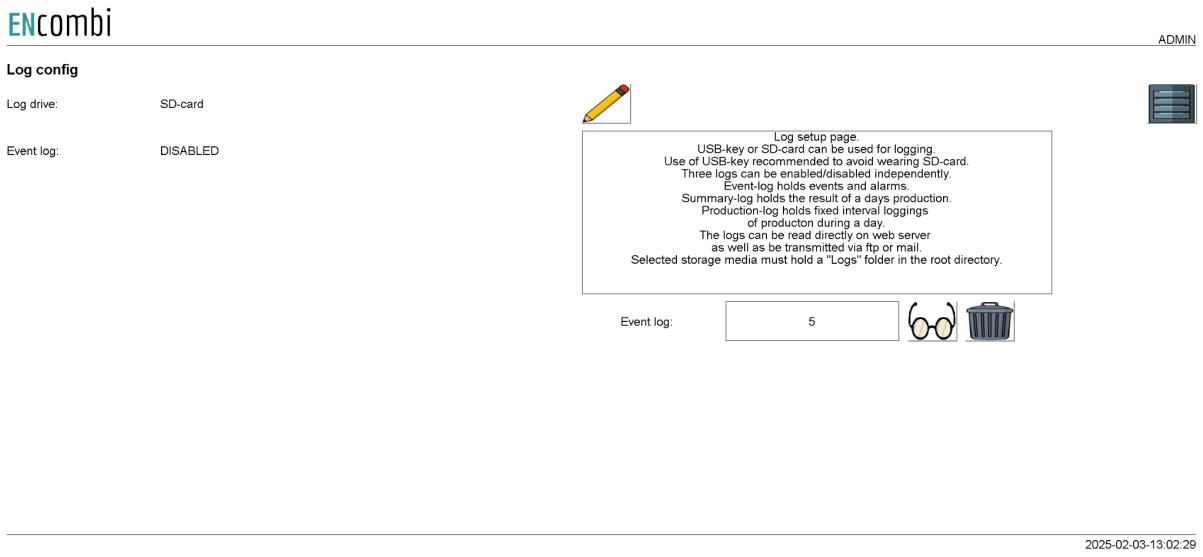
The Simulation allows for the grid frequency to be manipulated independently from the Mains meter measurements. Pre-defined pre-qualification tests can be performed in simulation mode. A working Mains meter communication is required to run the tests.

Logs

The ECgrid offers logging as time series data pushed to an online database.

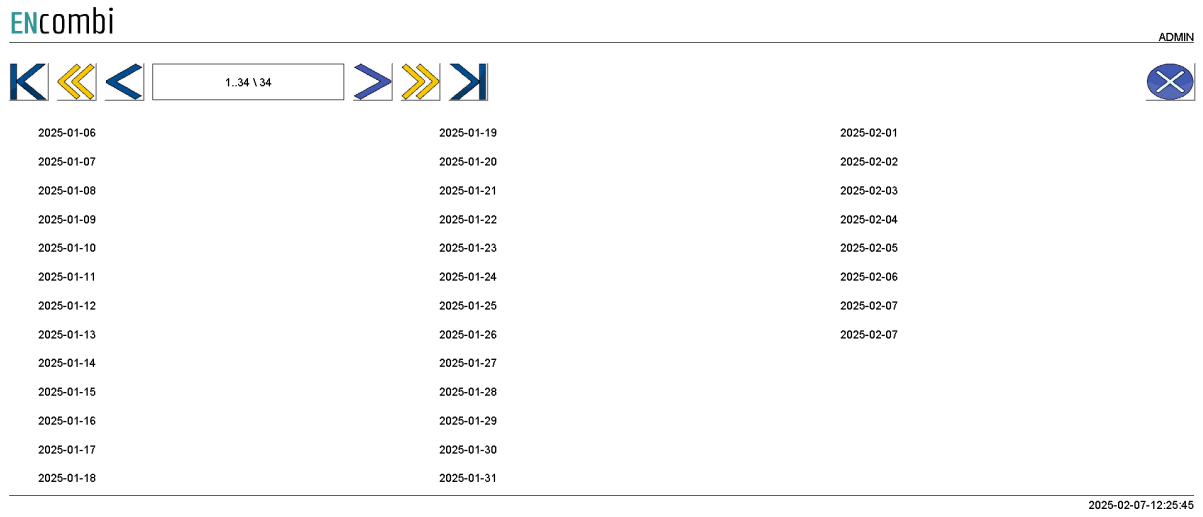
Local logs with transmission via ftp

The ECgrid features an event log stored locally on SD-card or on USB stick.



A new Event log is generated every day. The event log holds entries of any events taking place or any occurrences of alarms on that particular day. All entries are time stamped.

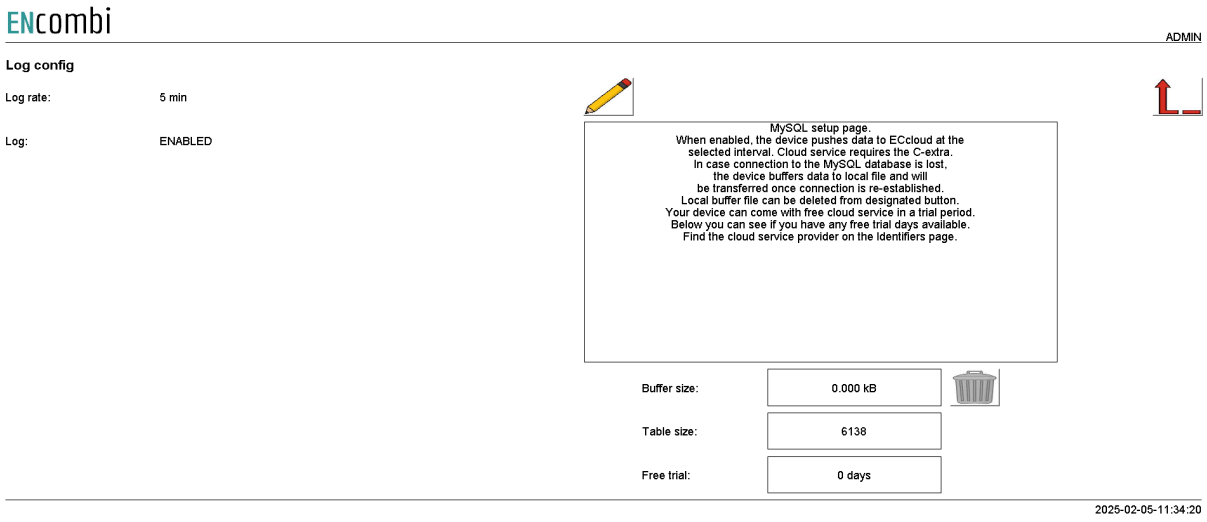
All Eventlogs can be displayed directly on ECweb. Below example shows how the Eventlog looks on ECweb. The first page is a list of all the Eventlogs available. Second page is showing data from one of those logs:



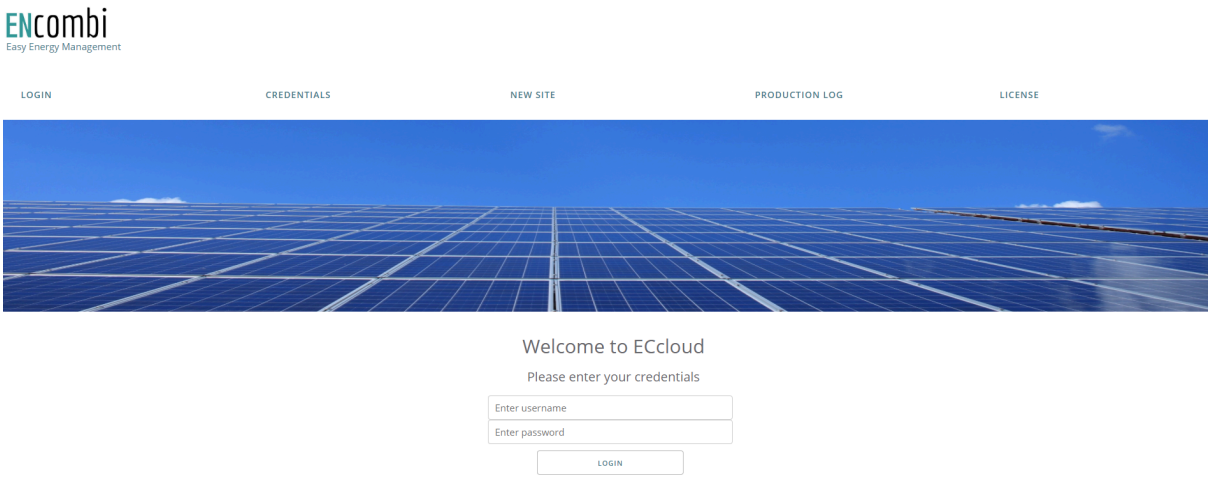
Consult the “Control” chapter in this document for details on how to set up the various automatic file transmissions.

Log to MySQL database

The ECpvX can push time series data to an ENcombi hosted MySQL database.

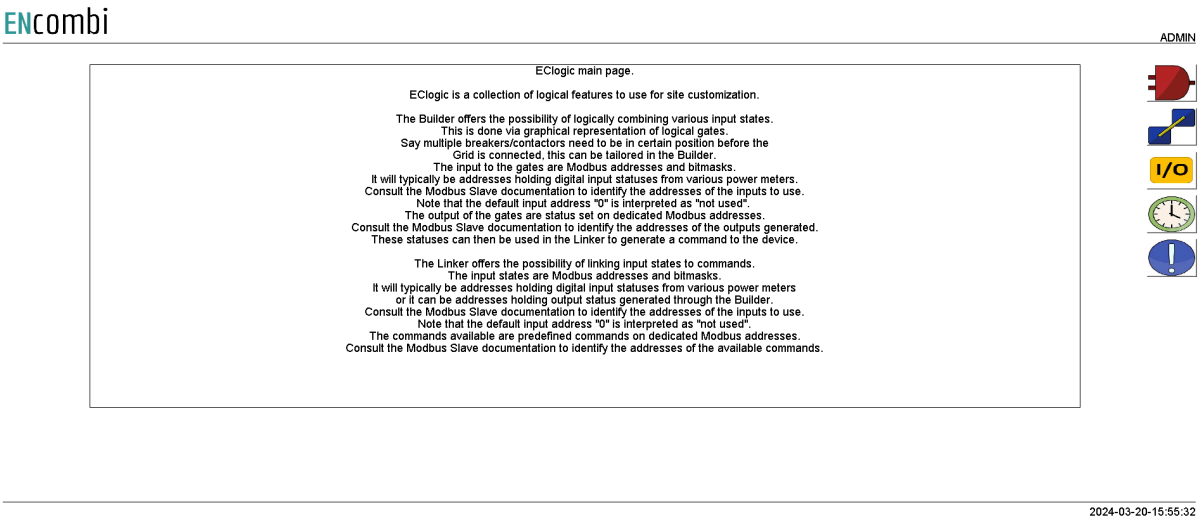


The option of using the ENcombi database requires the dedicated SW-extra “C” or time left of any complimentary free “C” trial period. The front-end for data visualization provided by ENcombi is called ECcloud. After the ECpvX has started pushing data to the ENcombi database the customer/installer can register it in ECcloud where data will be visualized immediately.
www.encombi.online



EClogic

EClogic provides the possibility of making project specific logical expressions when required. That could be for linking physical digital inputs applied on power meters to the position of circuit breakers or similar. Also here, RRCR can be set up providing the option of a superior control system to give power references for the ECpv to follow. First page presented when clicking the EClogic tile is the page below.



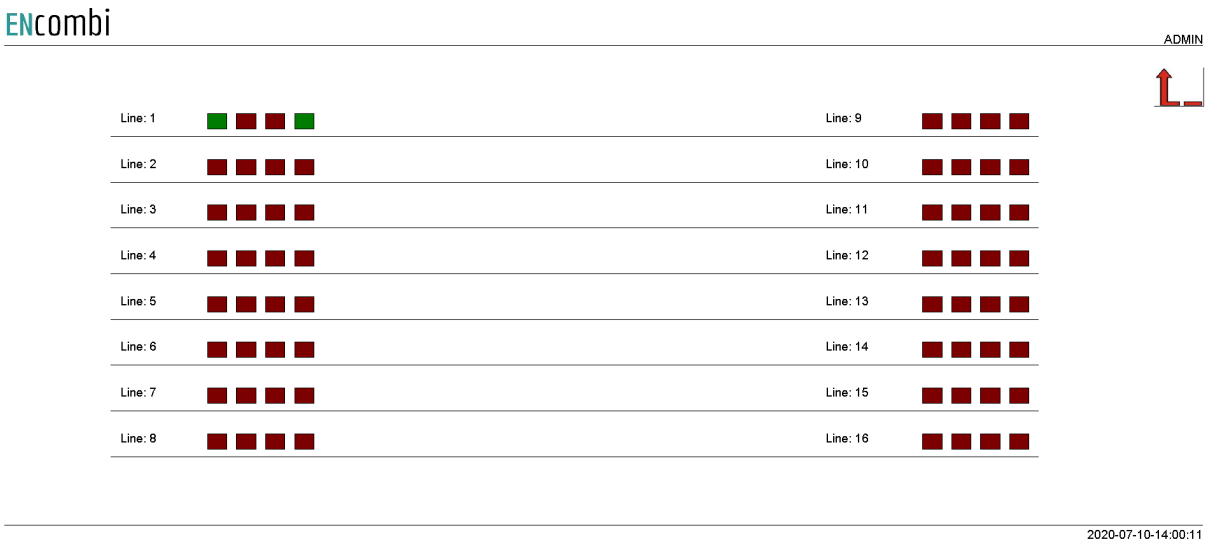
EClogic is divided into five sub categories.

1. Builder
2. Linker
3. IO
4. Command timers
5. Alarms

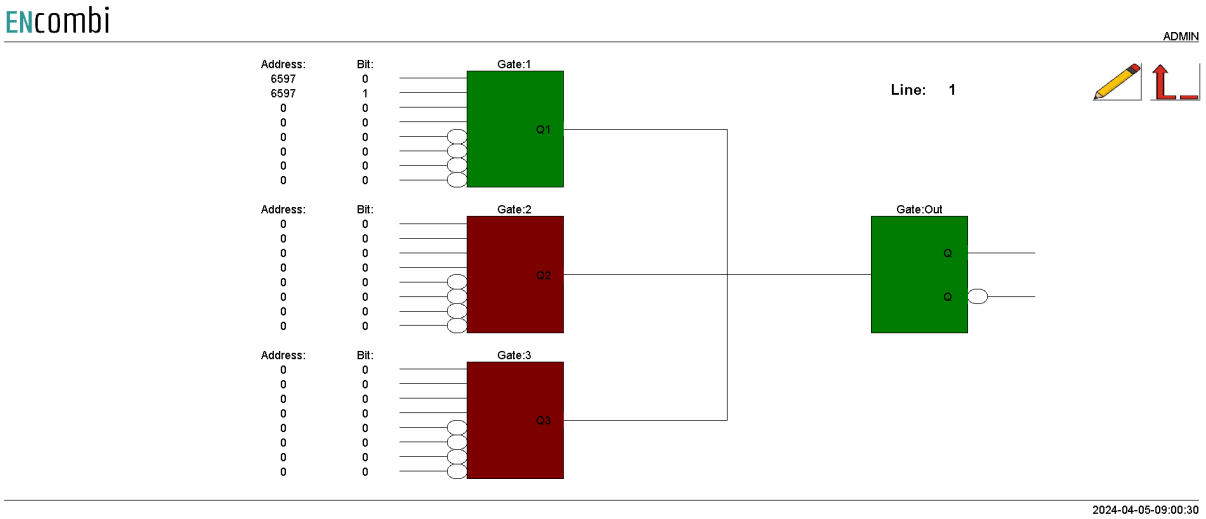
Builder

The Builder offers the possibility of logically combining various input states. This is done via graphical representation of logical gates. Say multiple breakers/contactors need to be in a certain position before the system is connected to the Grid, this can be tailored in the Builder.
The input to the gates are function code 0x04 Modbus addresses and bitmasks. It will typically be addresses holding digital input statuses from various power meters. Consult the Modbus Slave documentation to identify the addresses of the inputs to use. Note that the default input address "0" is interpreted as "not used".
The output/status of the gates are set on dedicated Modbus addresses. Consult the Modbus Slave documentation to identify the addresses of the outputs generated. These statuses can then be used in the Linker to generate a command to the device.

First page presented when clicking the builder button is the page below. Here an overview of the 16 builder lines supported is presented.



Each builder line consists of four gates. The status of the gates are represented by the color. Red means that the gate is false and green that the gate is true.



Clicking the line number will lead to the set up page for the specific line.

Each of the first three gates take four AND inputs and four AND NOT inputs. These three inputs are OR'ed together to generate one input to the output gate.

Example

In the configuration shown above, address 6597 bit0 is used as input to Gate1.
From Modbus Slave documentation this is found to be input1 on PV meter1. As the input1 is active the Gate1 state is true which again results in the output gate to be true. This will generate the following statuses in the designated modbus area to go high.

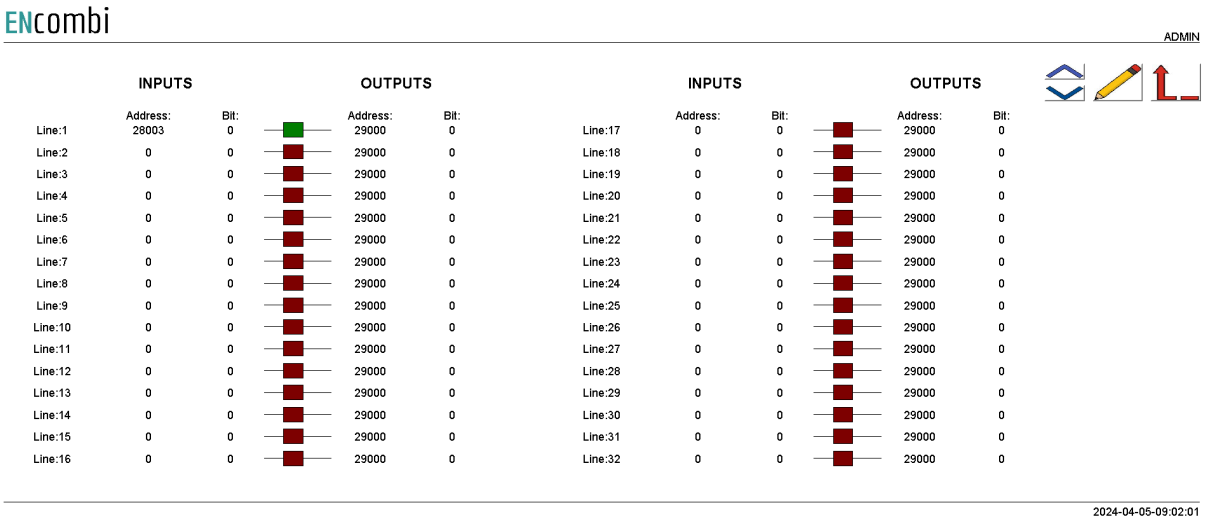
ECLOGIC BUILDER AREA 1				
28000	Q1 gate output status line 1-16	16 unsigned int	bitwise	Not defined
28001	Q2 gate output status line 1-16	16 unsigned int	bitwise	Not defined
28002	Q3 gate output status line 1-16	16 unsigned int	bitwise	Not defined
28003	Q-out gate output status line 1-16	16 unsigned int	bitwise	Not defined
28004	Inverted Q-out gate output status line	16 unsigned int	bitwise	Not defined
28005..28999	RESERVED	Not defined	Reserved for later use	Not defined

Address 28000 bit0: Gate1, line1
Address 28003 bit0: Output Gate, line1

Linker

The Linker offers the possibility of linking input states to commands. The input states are Modbus addresses and bitmasks. It will typically be addresses holding digital input statuses from various power meters or it can be addresses holding output status generated through the Builder. Consult the Modbus Slave documentation to identify the addresses of the inputs to use. Note that the default input address "0" is interpreted as "not used".
The commands available are predefined commands on dedicated Modbus addresses. Consult the Modbus Slave documentation to identify the addresses of the available commands.

First page presented when clicking the linker button is the page below. Here the 32 linker lines supported can be set up. Furthermore, the status of each link is indicated by green and red color.



Example continued

In the configuration shown above address 28003 bit0 being the status of the output gate of builder line1 is used to set commands on address 29000 bit0. From Modbus Slave documentation this is found to be the commands for Mains breaker ON.

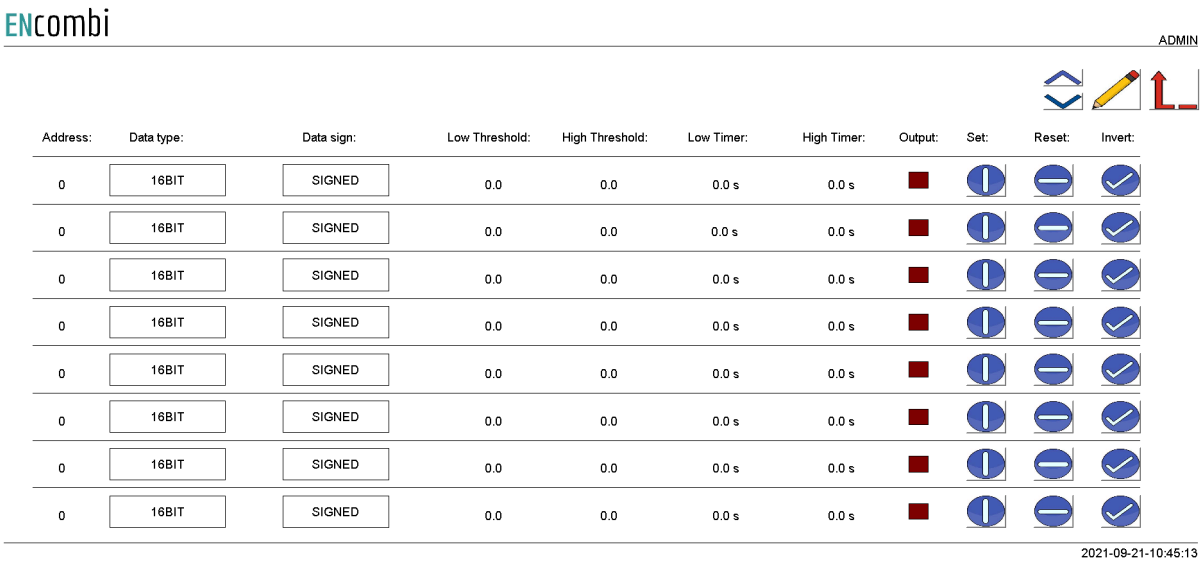
29000	MB ON 1-16	16 unsigned int	bitwise

Hence activating input1 and input2 on the mains meter has the effect of:

1. The ECgrid sees the grid as being connected.

General Purpose Hysteresis

General purpose hysteresis is a generic configuration tool to trigger alarms based on different inputs.
General purpose hysteresis enables you to trigger a status in modbus based on thresholds limits of various measurements. Via the EClogic Builder/Linker the status triggered can be used to activate relates, set an ECloig general purpose alarm etc. A total of 8 such hysteresis are available.



The address column is the input for the hysteresis. The data type and sign for the selected address must be changed according to the modbus manual for the address. The hysteresis is built up with a low threshold and a high threshold.
If the value from the address is lower than the low threshold value, the low timer will start. After the lower timer has expired, the output box will change color to green which indicates that the line is present. The status of each line can also be read out on modbus.
If the value from the address is higher than the high threshold value, the high timer will start. After the high timer expires, the output box will change color to red which indicates that the line is not present any more.

It is possible to manually force the line to be set or reset by clicking on the buttons corresponding to the line which should be forced.

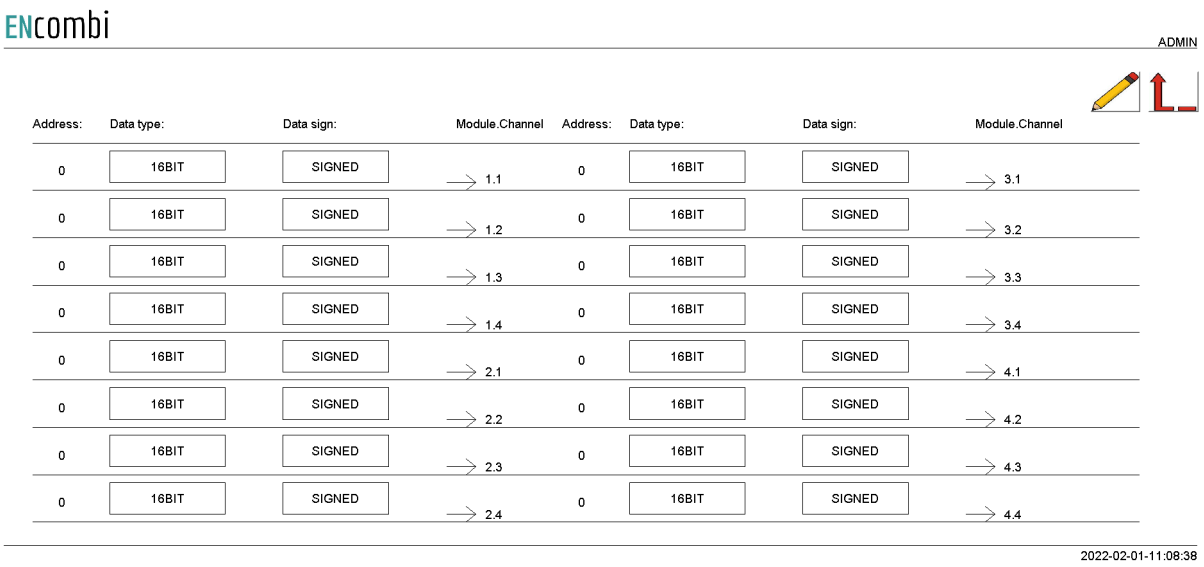
Furthermore it is possible to inverse the output by clicking the button.

The hysteresis output status can be used in the EClogic Builder/Linker using the addresses below.

31002	BITFIELD_3	16 unsigned int	EClogic Threshold output 01..16

IO

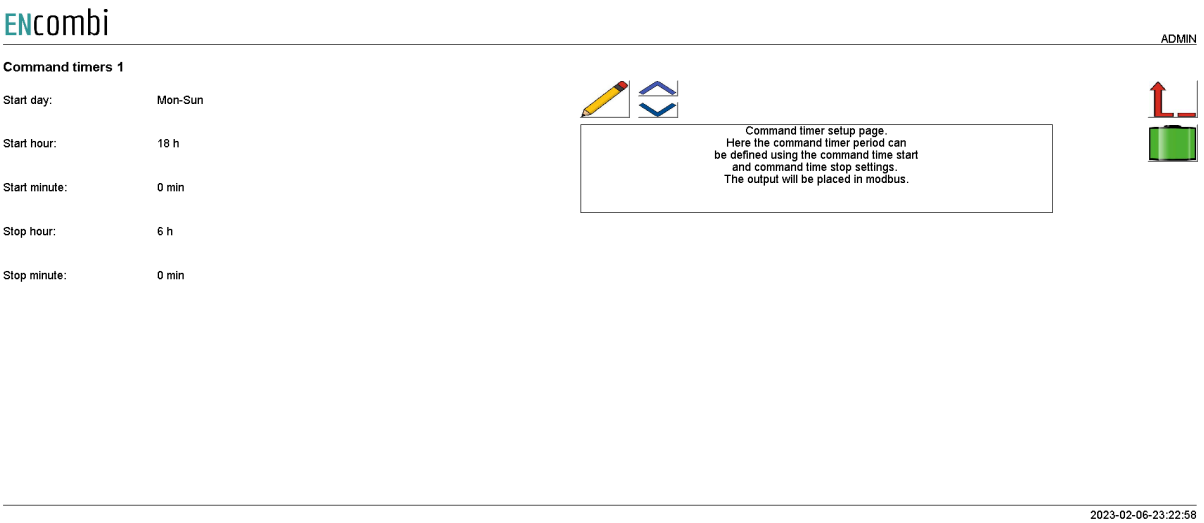
By clicking on the IO icon, it will lead to the following page.



From here it is possible to set up which data should be linked to each output of the AIO module. All 16 outputs are present and it is possible to select which data to be sent out on each channel.

Command timers

By clicking on the command timer icon, it will lead to the following page.

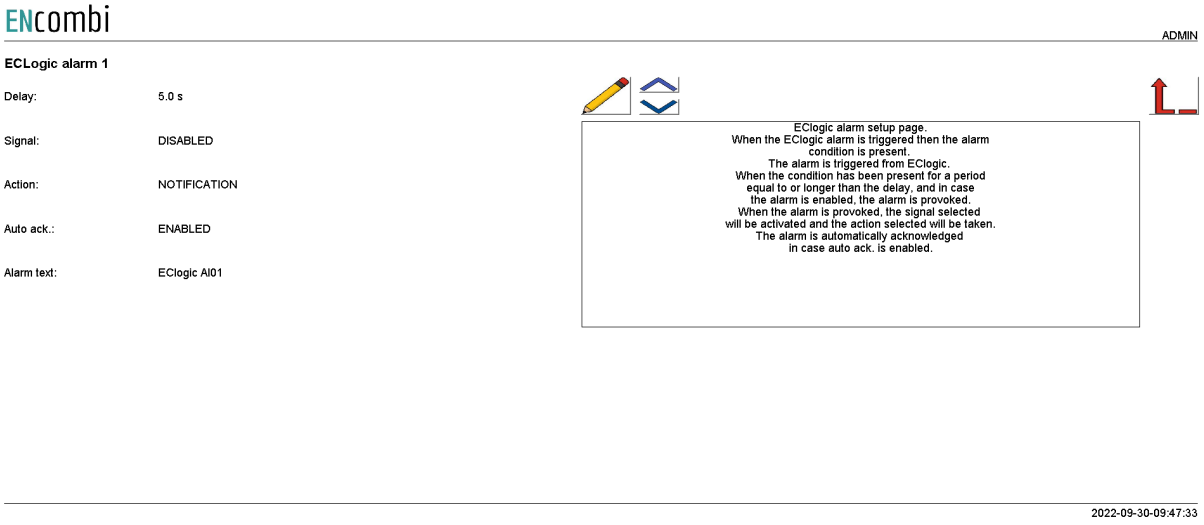


It is possible to set up 4 command timers. Type in the start day and time and stop time for the command timer. The outputs are available on modbus and can be used for EClogic status/commands.

31003	BITFIELD_4	16 unsigned int	BIT0: Command timer 01 active BIT1: Command timer 02 active BIT2: Command timer 03 active BIT3: Command timer 04 active

General purpose alarms

General purpose alarms enable you to trigger your own custom made alarm. Via the EClogic Builder/Linker the trigger for the alarm is set up. A total of 8 such alarms are available.

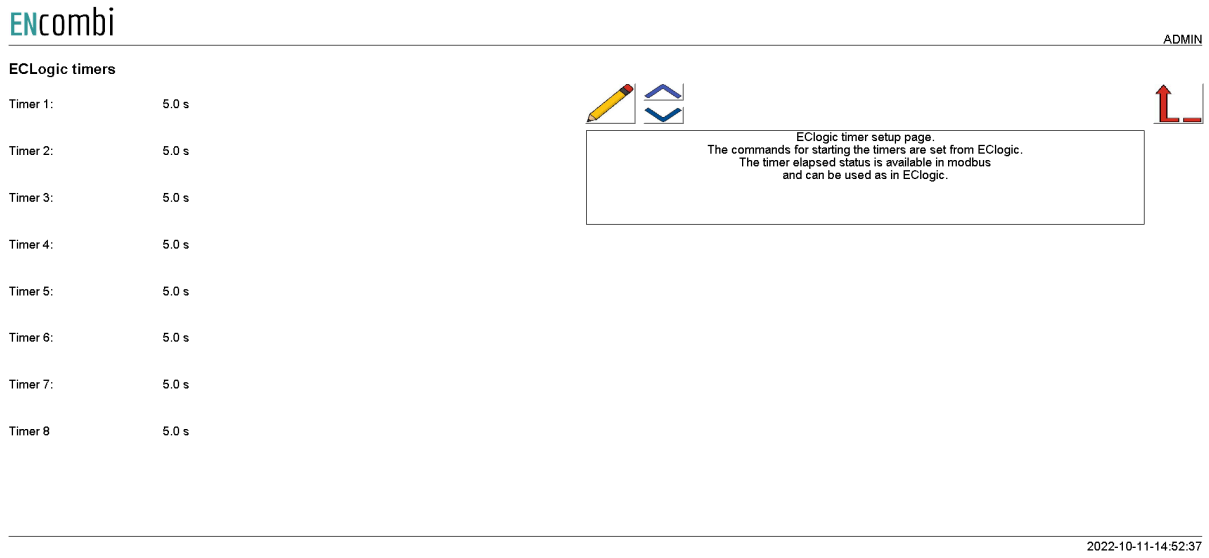


The alarm trigger is set up in the EClogic Builder/Linker using the addresses below.

29013	EClogic Alarms 01..08	16 unsigned int	bitwise

General purpose timers

General purpose timers enable you to trigger your own custom made timer. Via the EClogic Builder/Linker the trigger for the timer to be set up. A total of 8 such timers are available.



The timer triggers is set up in the EClogic builder/Linker using the addresses below:

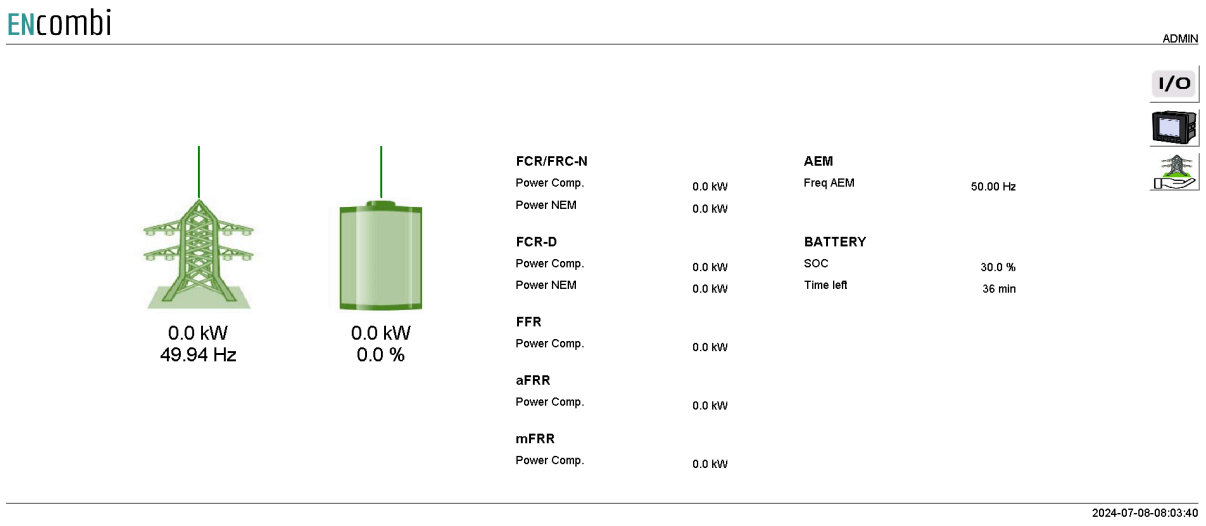
29014	EClogic Timers 01..08	16 unsigned int	bitwise

The output of the timers when they are elapsed are found on the addresses below:

31005	BITFIELD_6	16 unsigned int	EClogic Timers elapsed 01..16

Monitoring

The ECweb provides a high level overview of the installation and the ongoing service that is provided as well as detailed information about the grid power meter readings and the ancillary service schedule received from the VPP. Below is an example of the first page presented under the Monitoring tile.

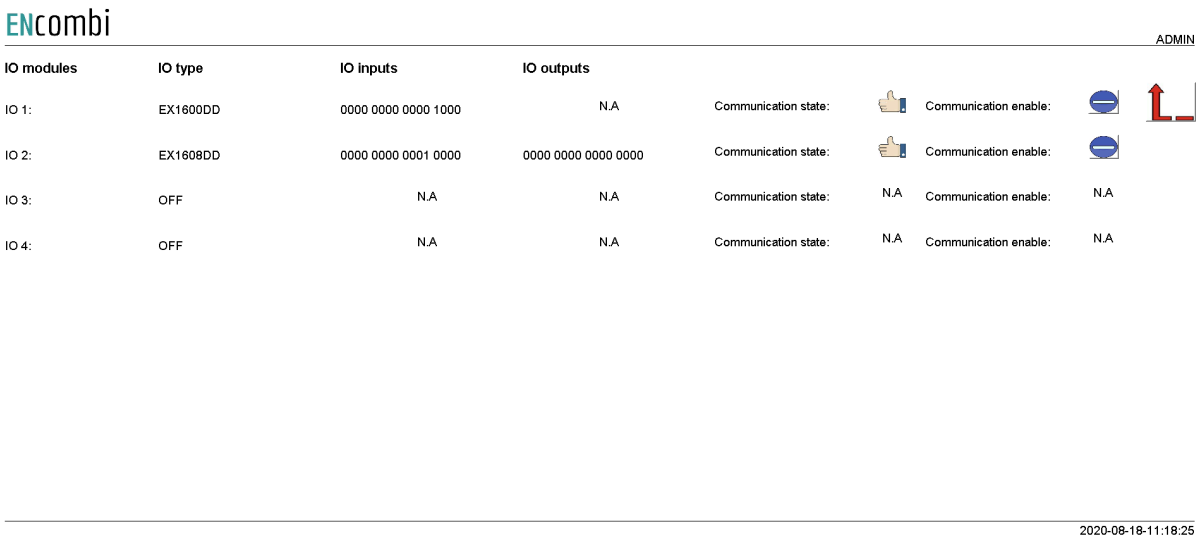


In the upper right corner four buttons are shown.

1. IO module data.
2. Mains power meter.
3. Grid support.

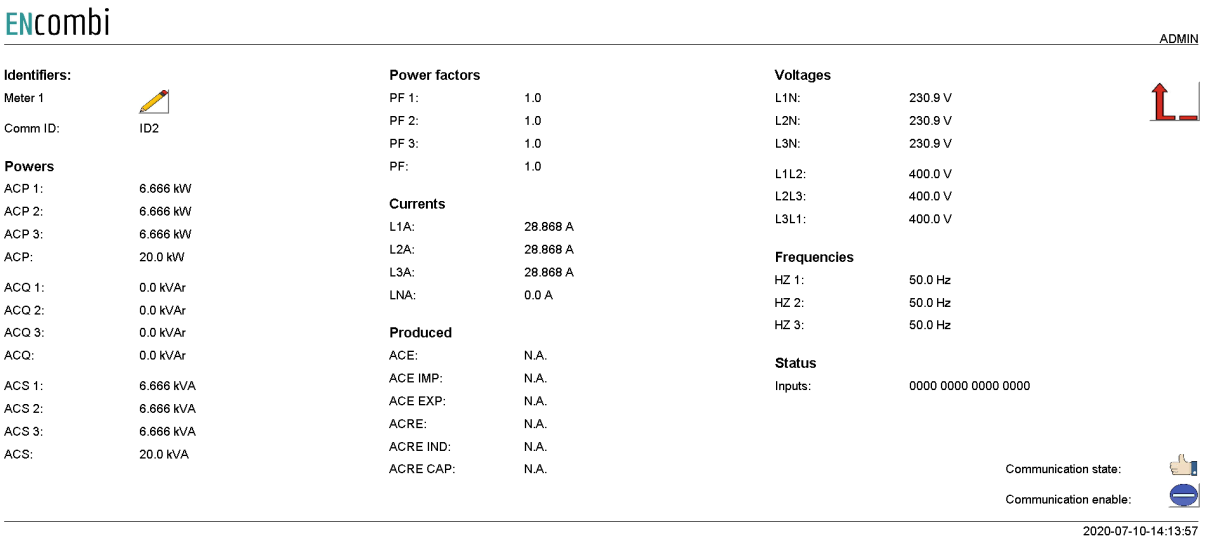
IO module data

Clicking the IO module button will lead to the below page where an overview of all the readings from the IO modules is provided. In case a reading is not supported or communication to the IO module is failing, the readings will be displayed as “N.A”.



Mains power meter

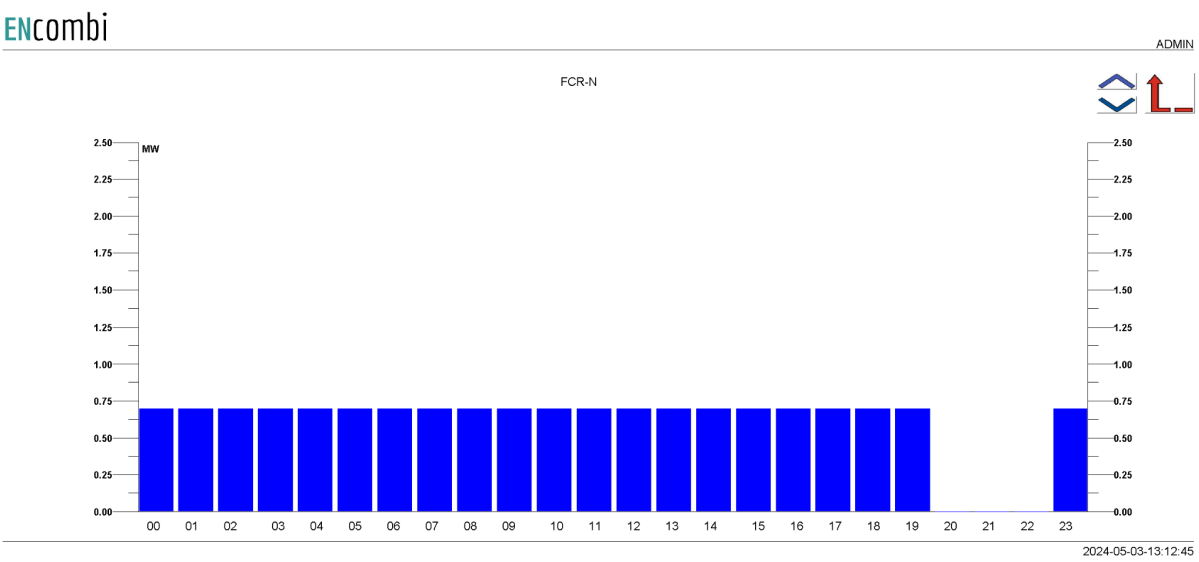
Clicking the utility icon leads to the below page where more detailed information about the grid meter readings can be found.



In the upper left corner the label of the meter can be changed. In the lower right corner communication status for the specific mains meter is shown. In case the mains meter is failing to communicate for whatever reason, communication to that specific meter can be disabled and enabled again at a later stage on the start/stop button.
Not all data shown is read/displayed from all meter models supported and will in that case show “N.A”. Consult the Modbus master documentation on the ENcombi website for detailed information about what data is read from the various meter models.
http://www.encombi.com/products/ecgrid/

Grid support

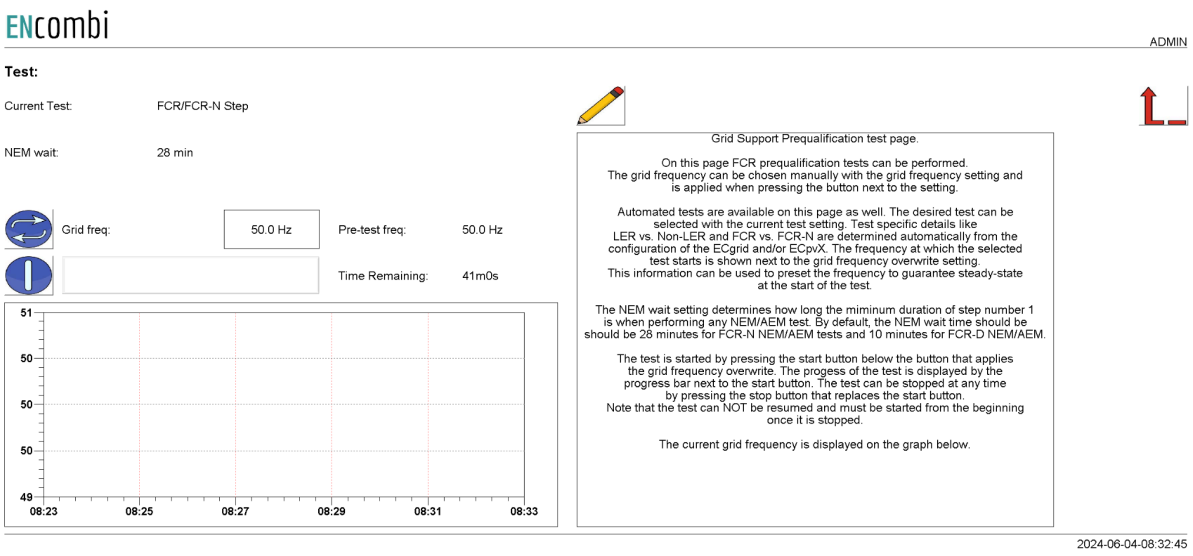
Clicking the grid support button will lead to the below page where an overview of the ancillary service bids won for the respective day are listed. The different services can be viewed by clicking the up and down arrows.



Simulation Stimuli

When simulation is enabled in the settings, the monitoring page will show an additional button to the right side of the screen.

Clicking it leads to the Simulation stimuli page.



On this page, the grid frequency can be manipulated independently from the Mains meter measurements. A working mains meter communication is required for the simulated frequency to be applied.

The following pre-defined FCR pre-qualification tests can be performed from this page.

1. FCR/FCR-N Step
2. FCR-N Sine
3. FCR-N Linearity
4. FCR-D Fast Ramp Up
5. FCR-D Fast Ramp Down
6. FCR-D Sine Up
7. FCR-D Sine Down
8. FCR-N NEM/AEM Up
9. FCR-N NEM/AEM Down
10. FCR-D NEM/AEM Up
11. FCR-D NEM/AEM Down

The desired test can be selected by choosing it with the “Current test” setting. Test specific details like LER vs Non-LER and FCR vs. FCR-N are determined automatically from the configuration of the ECgrid and/or ECpvX. The frequency at which the selected test will start is shown next to the grid frequency overwrite setting. The grid frequency can be preset to this test frequency to ensure steady-state before starting the test.

The NEM wait setting determines how long the minimum duration of step number 1 is when performing any NEM/AEM test. By default the NEM wait time should be 28 minutes for FCR-N NEM/AEM tests and 10 minutes for FCR-D NEM/AEM tests.

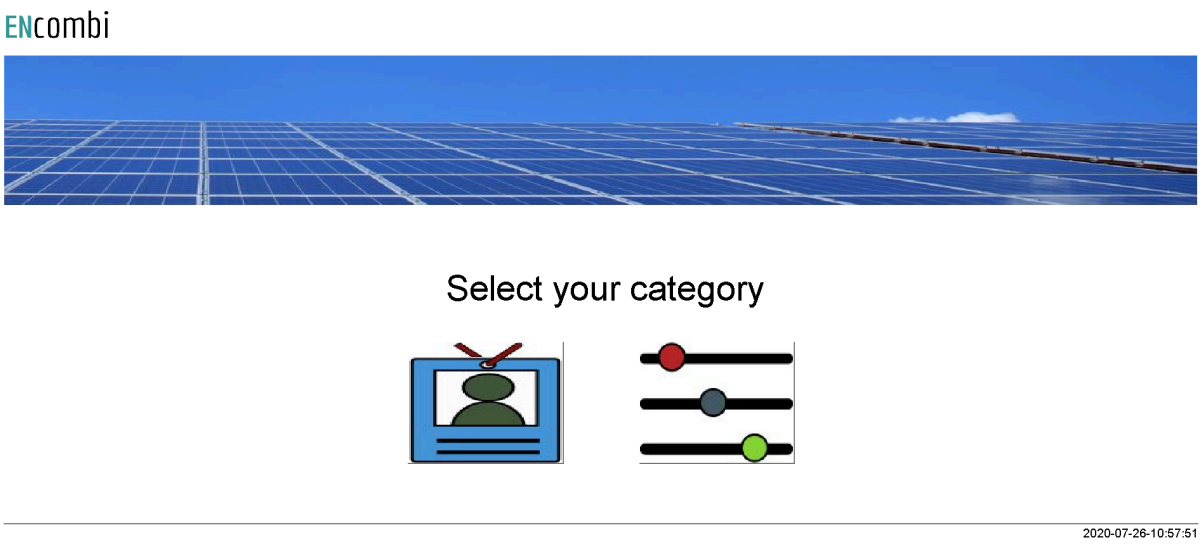
The test can be started by pressing the start button underneath the button that applies the grid frequency overwrite. The progress of the current test is displayed by the progress bar next to the start button. The remaining time of the test is shown next to the progress bar.

The test can be stopped at any time by pressing the stop button that replaces the start button.
NOTE that the test can NOT be resumed and must be started from the beginning once it is stopped.

The current grid frequency is shown on the graph below the progress bar.

Service Tool

First page to be displayed after an initial welcome page when switching to the Service Tool application is the front page of ECweb.



Navigating around in the Service Tool is done in the same manner as in the ECgrid application.

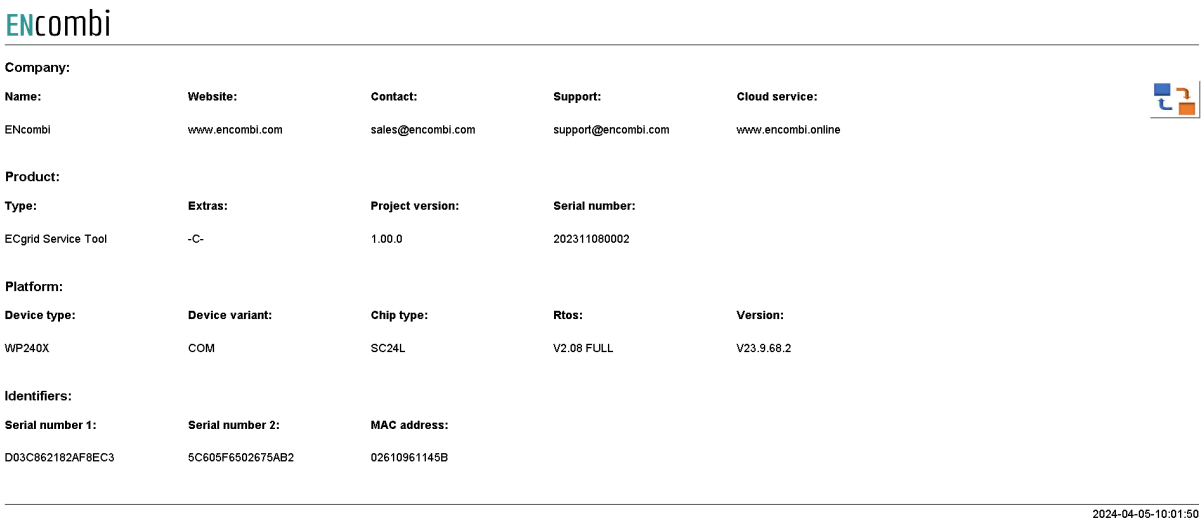
In the lower center two menu tiles are available. These are from the left:

1. “Identifiers” gives access to an overview of the SW version installed as well as to the menu for switching between the applications.
2. “Settings” give access to the set up of various features.

In the following chapters the content of the two menu tiles are discussed in detail.

Identifiers

Under this tile overview of SW version installed and extras present in the ECgrid as well as to the menu for switching between the applications.

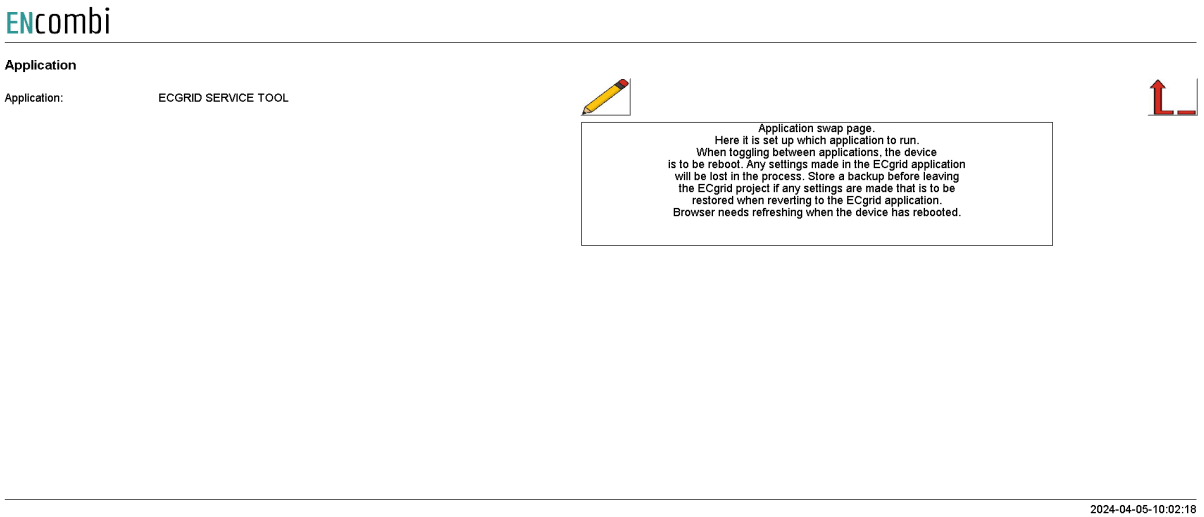


On the right hand side there is one submenu for.

1. Application switch.

Application

Clicking the Application button leads to the page below. Here it can be selected which application is to be active.



The following applications are available.

1. ECgrid.

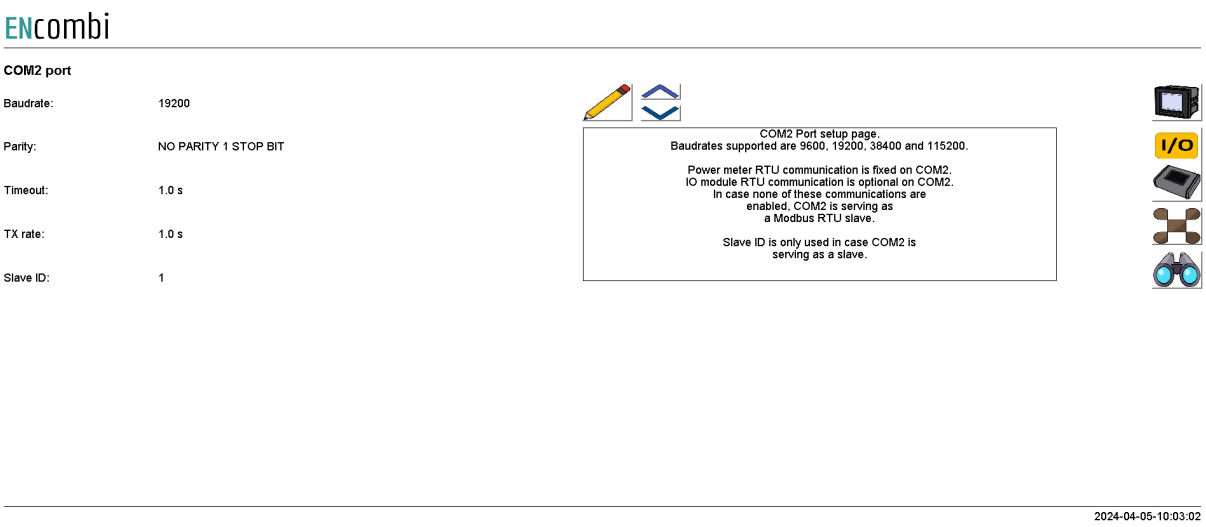
2. ECgrid Service Tool.
3. ECgrid Boot.

ECgrid is the default application and the one to use for the normal operation of the ECgrid. ECgrid Service Tool is a separate application that offers various tests and configuration features and the ECgrid Boot is a tool for updating both the ECgrid and the ECgrid Service Tool SW.

When toggling between applications the device is to be rebooted. Any settings made in the ECgrid application will be lost in the process. Make a backup before leaving the ECgrid application if any settings are made that are to be restored when reverting to the ECgrid application once again. The browser needs refreshing when the device is rebooted after switching the application.

Settings

Under this tile the setup of various features are found.
First page presented when clicking the Settings tile is the page below where COM2 configuration is set up.



Baud rates supported are:

- 9600, 19200, 38400 and 115200

Parity supported are:

- “Parity one stop bit”, “No parity”, “Even parity” and “Odd parity”.

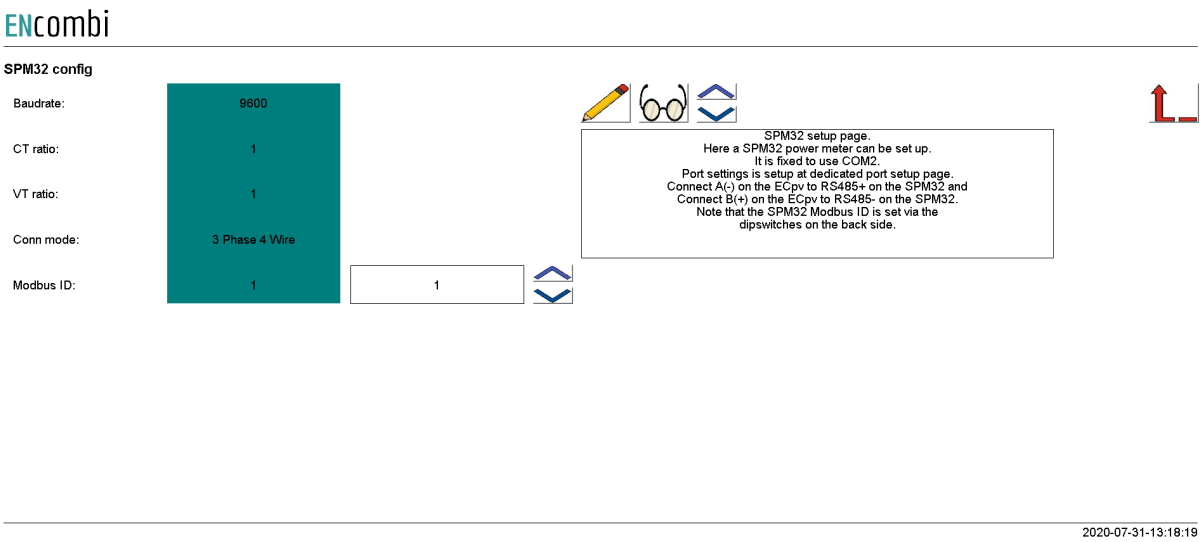
On the same menu level, a similar setup page for COM3 configuration is found. Clicking the up/down arrows will lead to it.

On the right hand side there are two submenus for.

1. Power meter configuration.
2. IO modules
3. Modbus Tester.
4. Client Trace.

Power meter configuration

Power meter configuration allows you to read and write the configurations of various power meters over Modbus. Clicking the Power meter button leads to the page below where a Pilot SPM32 power meter can be configured.

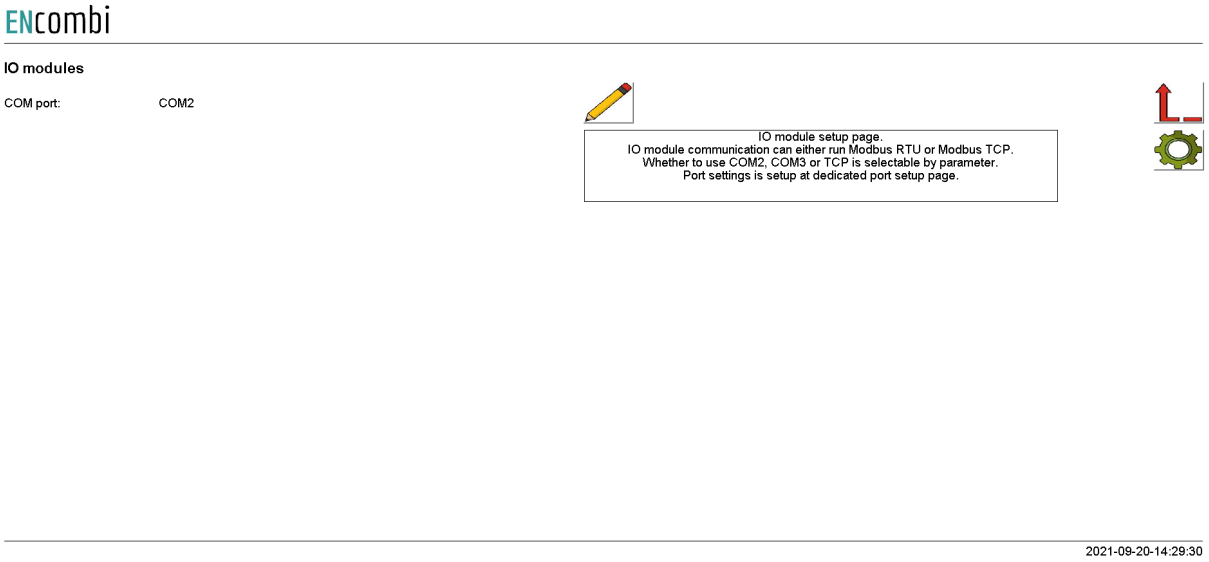


Clicking up/down buttons will navigate through all the meter power meter configurators supported. Currently the following are supported:

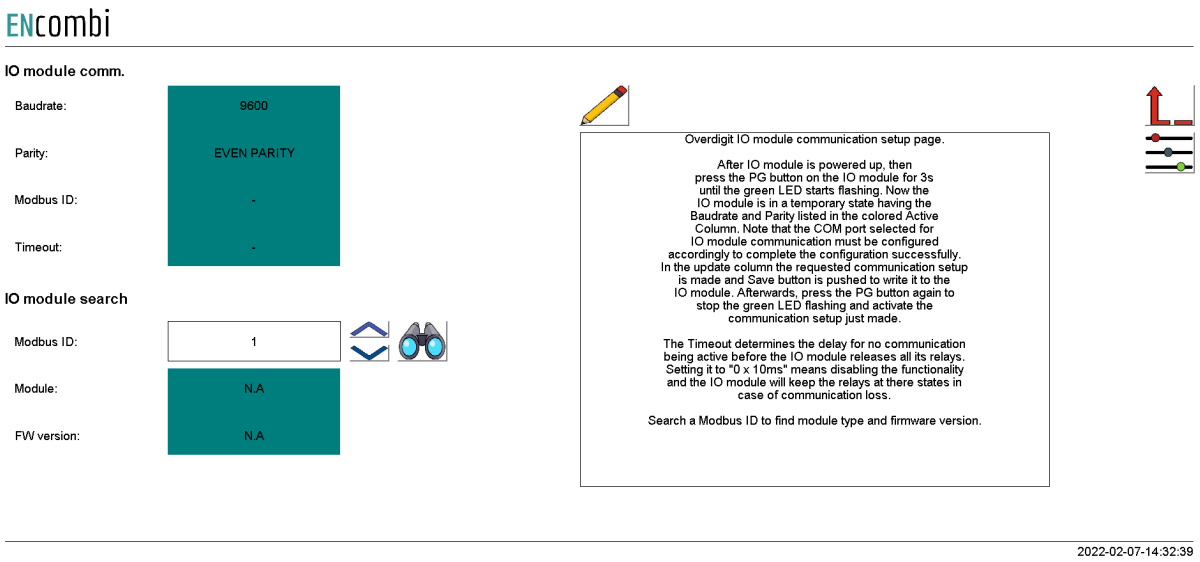
1. Pilot SPM32.
2. Pilot SPM33.

IO configuration

IO configuration allows you to read and write the configurations of IO modules over Modbus. Clicking the IO button leads to the page below where COM2 or COM3 can be selected.



Afterwards clicking on the IO configuration button on the right hand side leads to the IO configuration page.



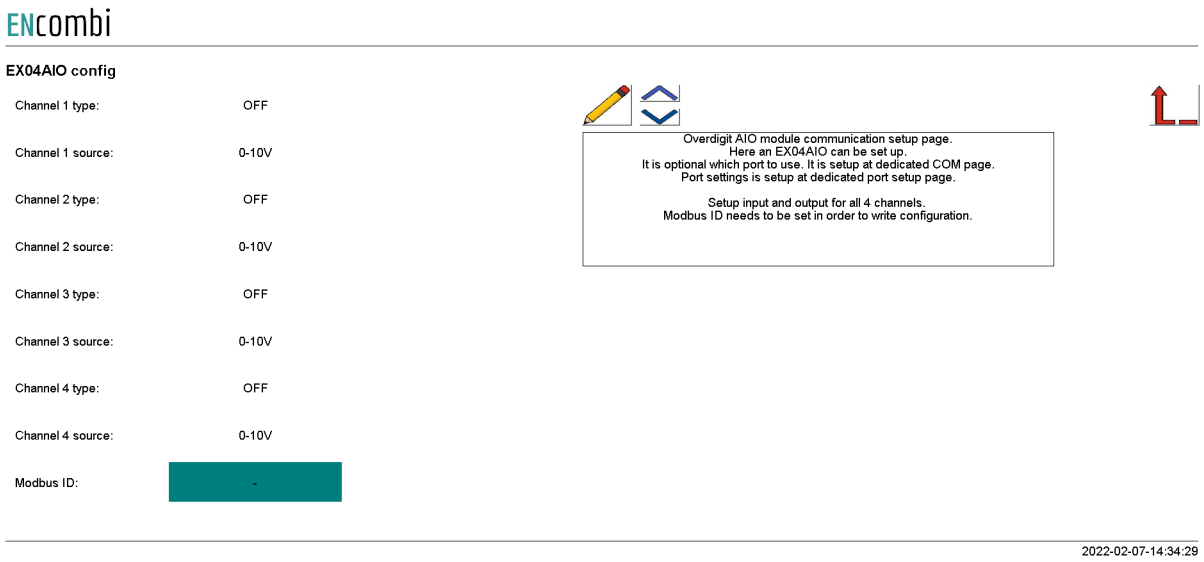
It is possible to set up the Overdigit IO module with the tool.

After the IO module is powered up, then press the PG button on the IO module for 3s until the green LED starts flashing. Now the IO module is in a temporary state, having the Baudrate and Parity listed in the colored Active Column. Note that the COM port selected for IO module communication must be configured accordingly to complete the configuration successfully. In the update column the requested communication setup is made and the Save button is pushed to write it to the IO module. Afterwards, press the PG button again to stop the green LED flashing and activate the communication setup just made.

The Timeout determines the delay for no communication being active before the IO module releases all its relays. Setting it to "0 x 10ms" means disabling the functionality and the IO module will keep the relays at their states in case of communication loss.

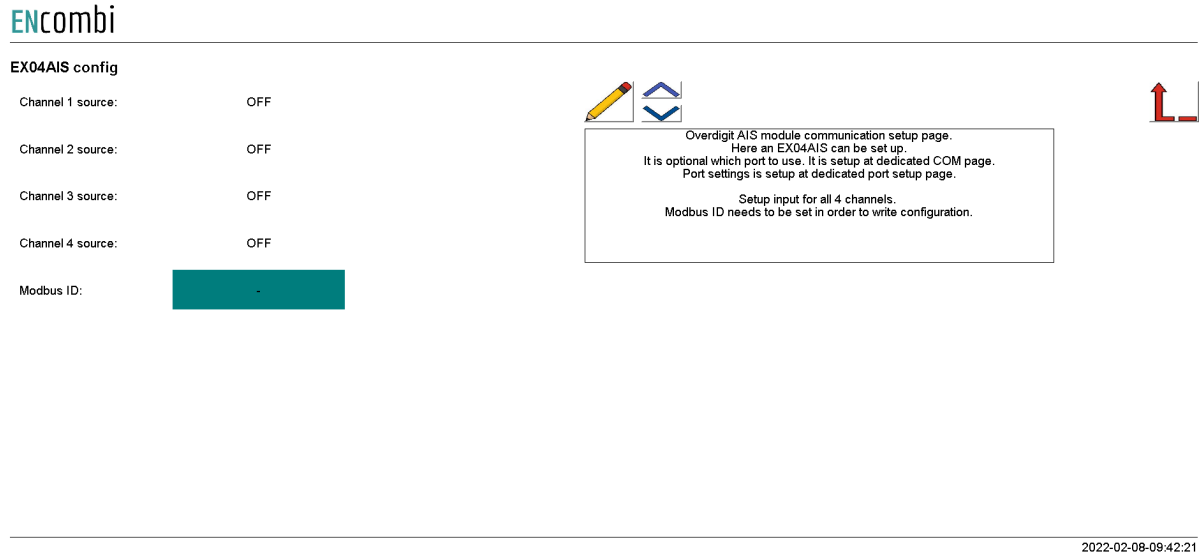
AIO

When pressing the settings icon, it will lead to the following page.



From there it is possible to set up an EX04AIO module. From here it is selectable which channel to use for input and output.
All 4 channels can be selected as off, input and output. It is also selectable which source the input or output should work with. The two options are 0-10 or 4-20mA.
When the configuration is ready, the modbus ID must be set and after that it is possible to write the configuration to the module. An icon will show if the writing was successful or failed.

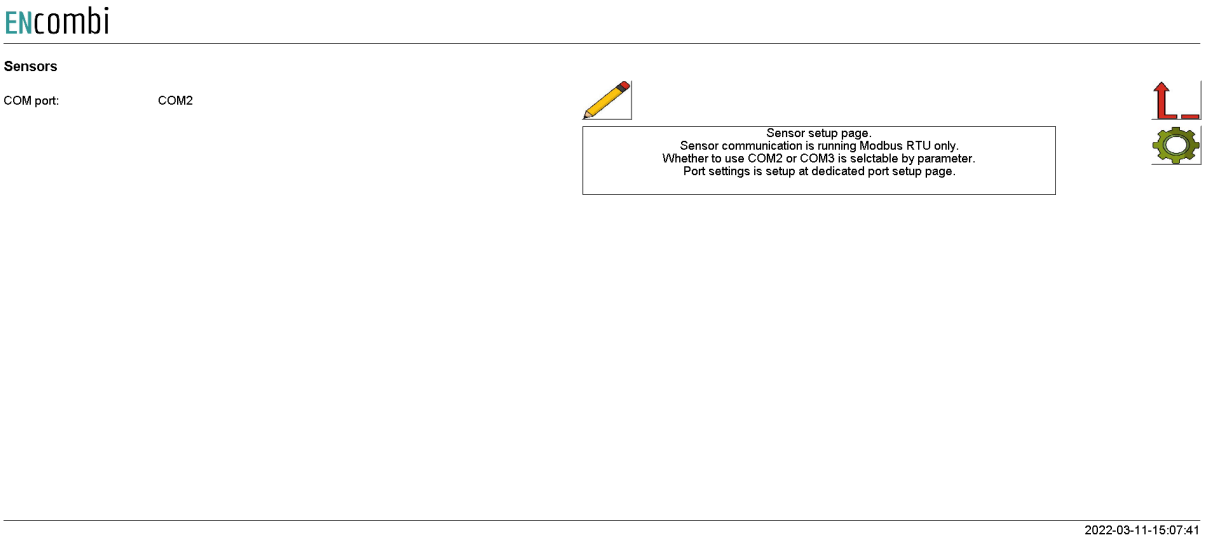
Toggle to the next page will lead to the set up of EX04AIS.



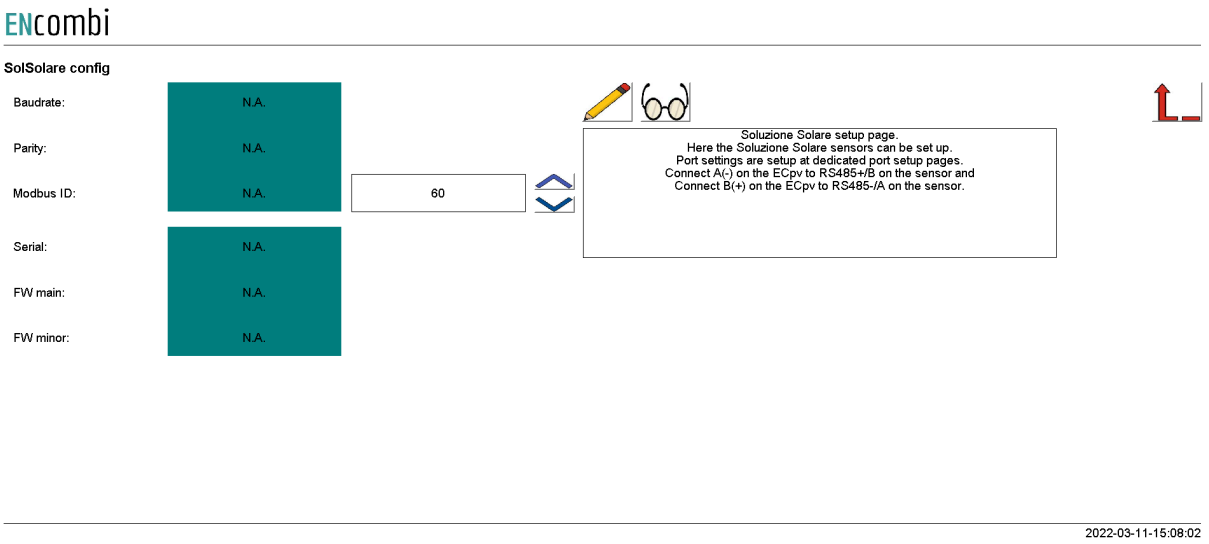
These are only inputs, so the only configuration is which source the channels should be. It can also be selected as OFF, which means the channel is deactivated.

Sensor Configuration

The Sensor configuration allows you to read and write the configurations of various sensors over Modbus. Clicking the Sensor button leads to the page below where it is set up whether the Sensor configuration is to use COM2 or COM3.



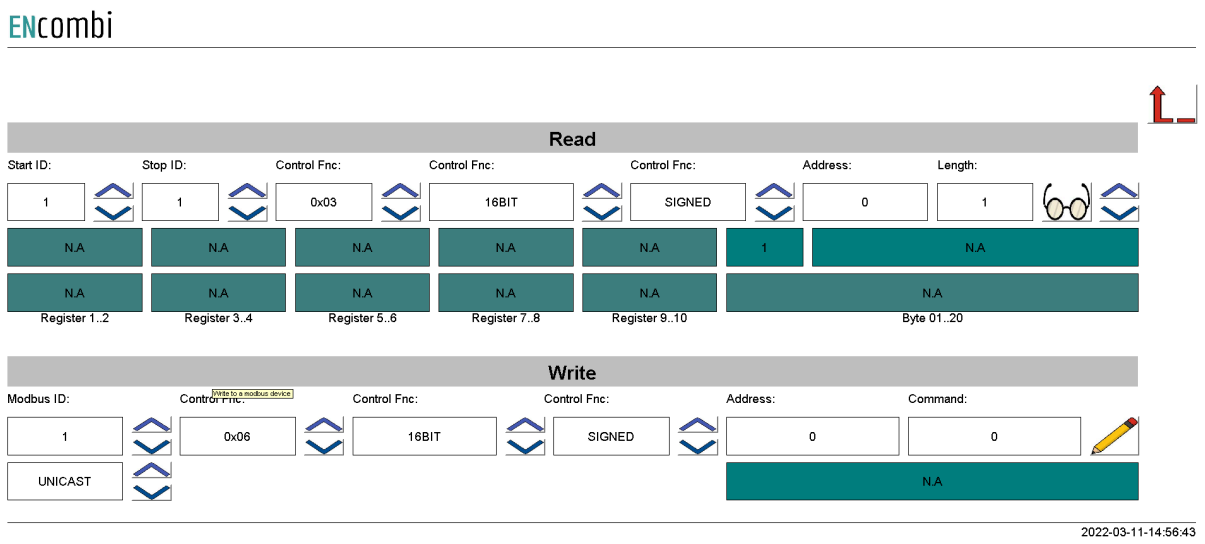
Afterwards, clicking on the setup button on the right hand side leads to the Sensor configuration itself where the Sensor modules communication settings can be adjusted and the Sensor modules can be searched and identified.



Modbus Tester

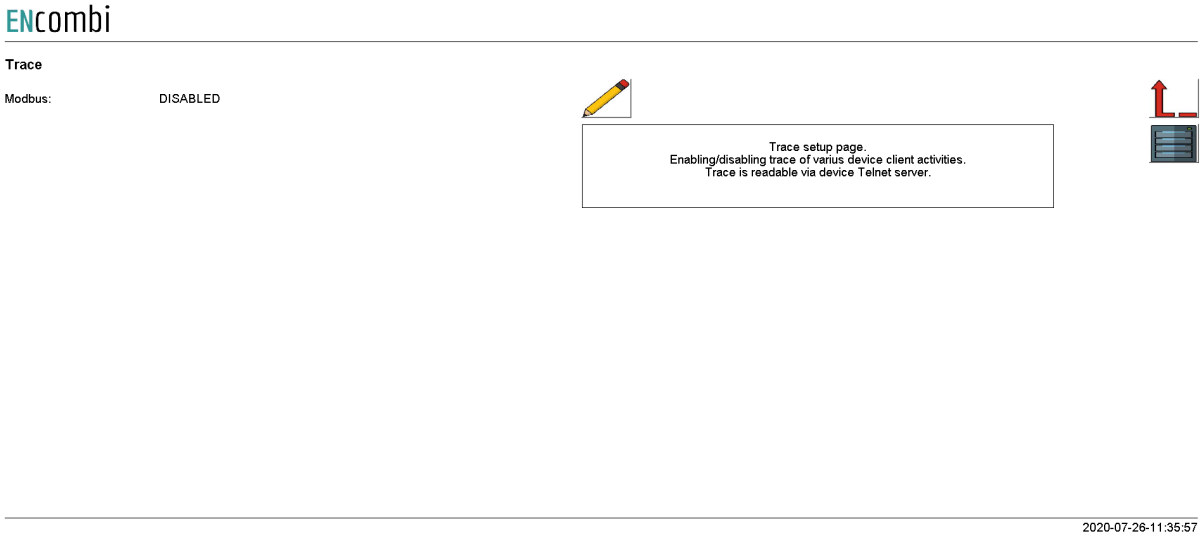
Modbus Tester is a feature where the Service Tool acts as a Modbus RTU Master and communication with a Modbus RTU Slave can be tested. Clicking the Modbus Tester button leads to the page below where it is set up whether the Modbus Tester is to use COM2 or COM3.

Afterwards, clicking on the Modbus Tester button on the right hand side leads to the Modbus Tester itself where Modbus RTU read and write commands of various length and function codes can be transmitted and the response received is shown.



Client trace

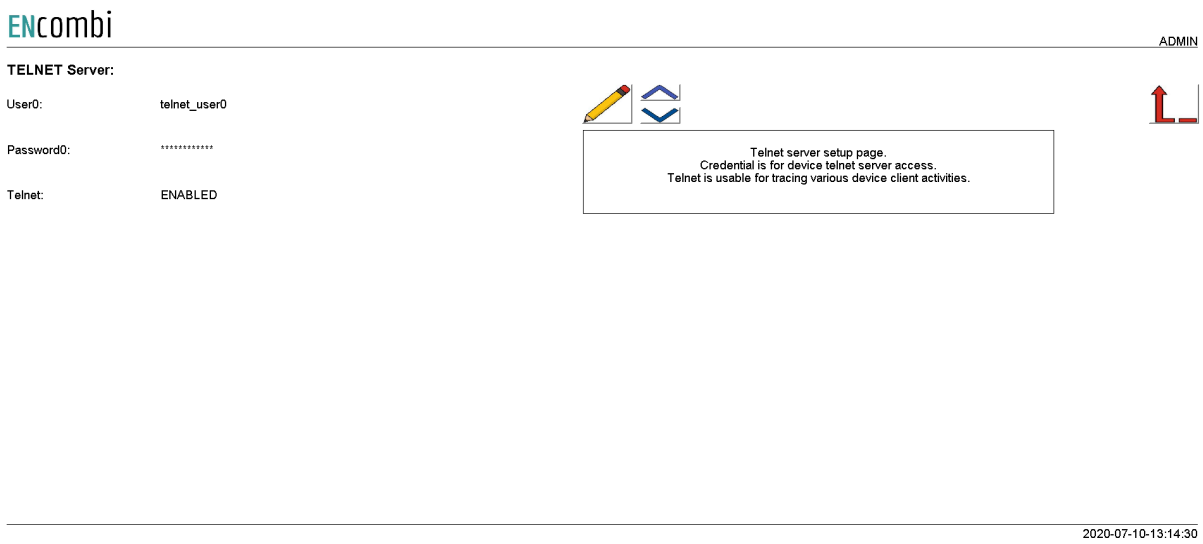
Clicking the Client Trace button leads to the page below where trace of Modbus communication can be enabled/disabled. The Modbus Tester only shows the result/content of valid Modbus frames received. The Trace, on the other hand, provides information on any communication being detected on the RS485 line even if it is not perceived as valid Modbus frames.



Trace is available via the built-in Telnet server. Clicking on the Telnet server button on the right hand side leads to the Telnet server setup.

Telnet server

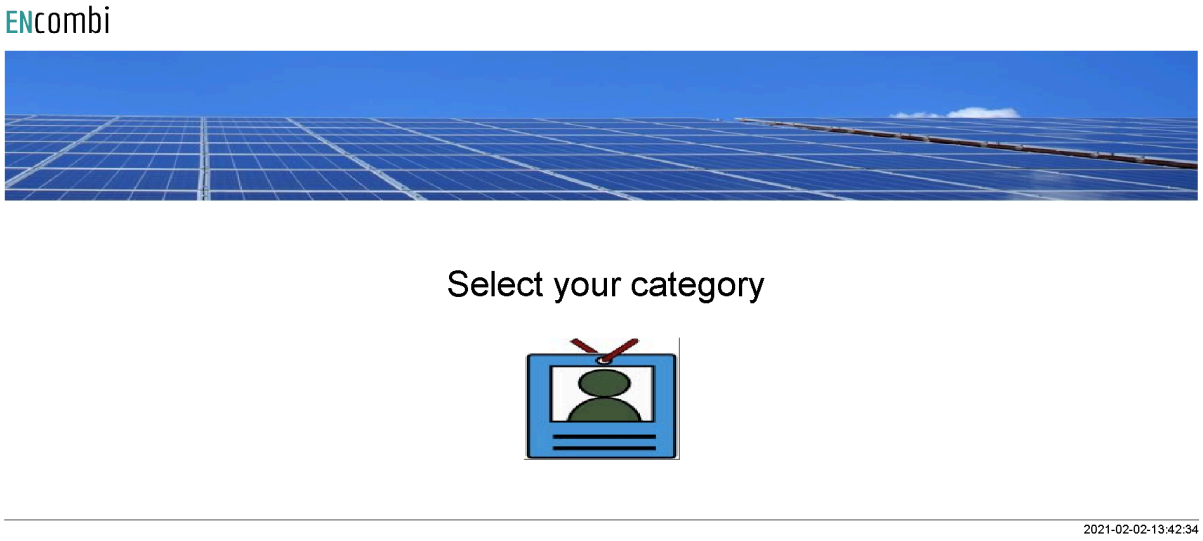
On the page below the telnet server access is set up.



Use the PC application “Chiptool” to connect to the Telnet Server to follow activities such as the Modbus trace.

Boot

First page to be displayed after an initial welcome page when switching to the Boot application is the front page of ECweb.



Navigating around in the Boot application is done in the same manner as in the ECgrid application.

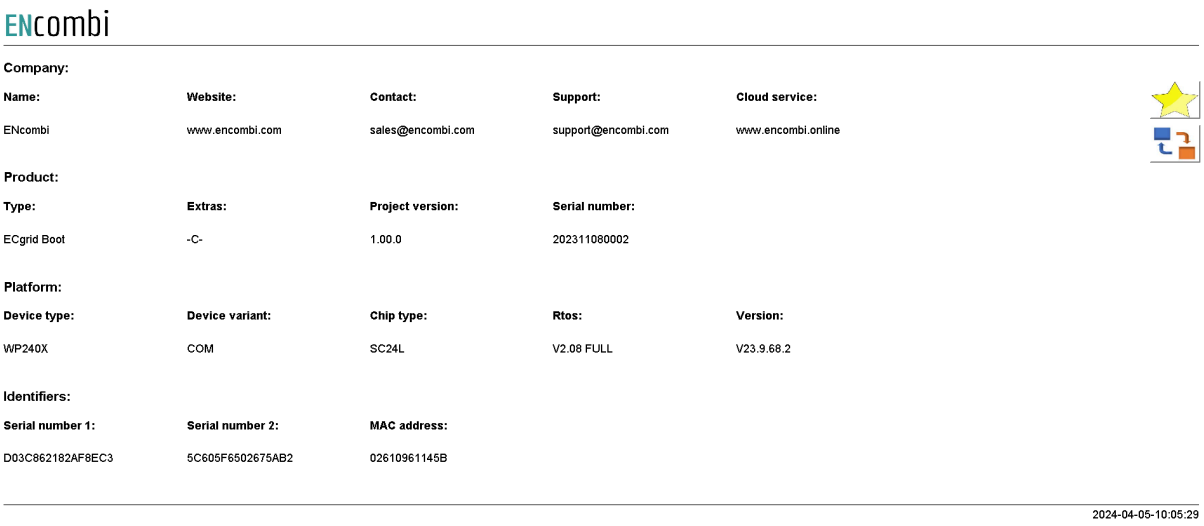
In the lower center one menu tile is available:

1. “Identifiers” gives access to an overview of the SW version as well as to the menus for updating SW and switching between the applications.

In the following chapters the content of the menu tile is discussed in detail.

Identifiers

Under this tile overview of SW version installed and extras present in the ECgrid.

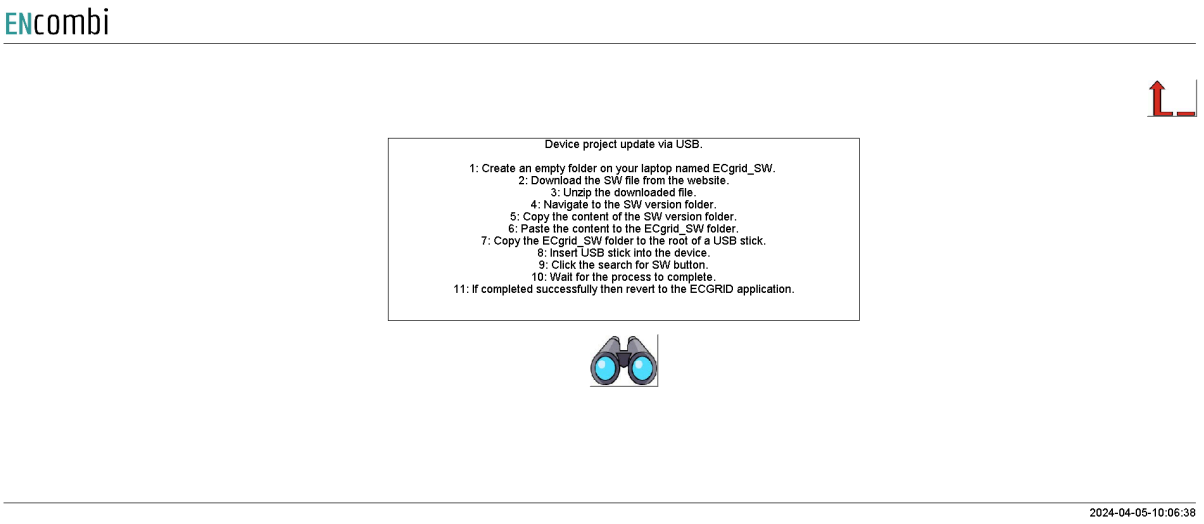


On the right hand side there are submenus for.

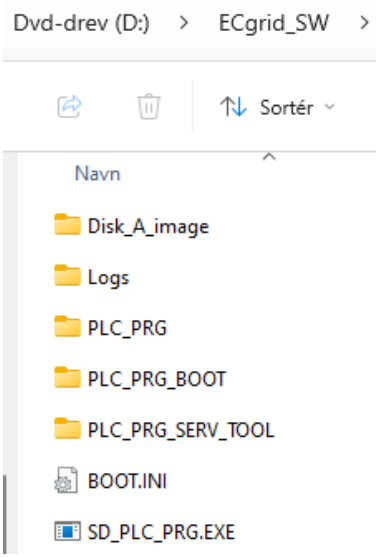
1. SW update.
2. Application switch.

SW update

Clicking the SW update button leads to the page below. From here the ECgrid and the ECgrid Service Tool SW can be updated from a USB stick.



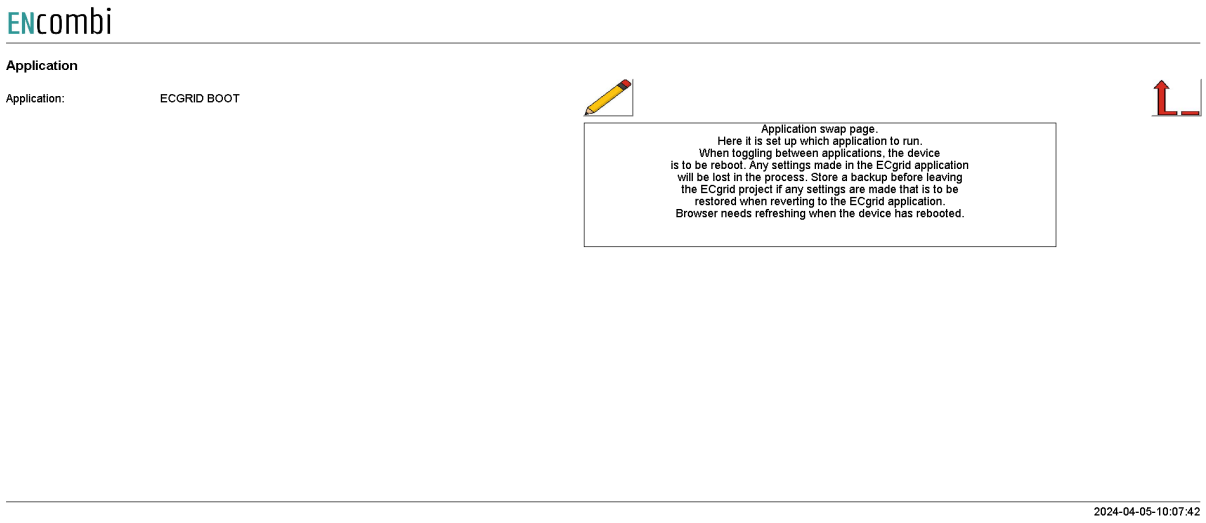
Download the SW from the website and place it in a folder named “ECgrid_SW” in the root of a USB stick like shown below:



Then insert the USB stick into the ECgrid and press the binoculars button to start the SW update. When the SW update is completed successfully, then you can safely revert to the ECgrid application. If the SW is interrupted and it fails, then remain in the Boot application and try to update the SW once again. Do not return to the ECgrid application until the SW update is completed successfully.

Application

Clicking the Application button leads to the page below. Here it can be selected which application is to be active.



The following applications are available.

1. ECgrid.
2. ECgrid Service Tool.
3. ECgrid Boot.

ECgrid is the default application and the one to use for the normal operation of the ECgrid. ECgrid Service Tool is a separate application that offers various tests and configuration features and the ECgrid Boot is a tool for updating both the ECgrid and the ECgrid Service Tool SW.

When toggling between applications the device is to be rebooted. Any settings made in the ECgrid application will be lost in the process. Make a backup before leaving the ECgrid application if any settings are made that are to be restored when reverting to the ECgrid application once again. The browser needs refreshing when the device is rebooted after switching the application.