

Modular Industrial DC Charger System

Gutor Modular DC Charger

Operation Manual

11/2023 Version 4



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Safety Information

Read these instructions carefully and look at the equipment to become familiar with it before trying to install, operate, service or maintain it. The following safety messages may appear throughout this manual or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

IMPORTANT: Save the safety information for future reference.



The addition of this symbol to a “Danger” or “Warning” safety message indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages with this symbol to avoid possible injury or death.

⚠ DANGER
DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.
Failure to follow these instructions will result in death or serious injury.

⚠ WARNING
WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.
Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ CAUTION
CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.
Failure to follow these instructions can result in injury or equipment damage.

NOTICE
NOTICE is used to address practices not related to physical injury.
Failure to follow these instructions can result in equipment damage.

Please Note

Electrical equipment should only be installed, operated, serviced, and maintained by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Safety Precautions

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Follow safe electrical work practices. See NFPA 70E or CSA Z462, or according to your local standards and regulations.
- Always use appropriate personal protective equipment (PPE).
- All safety information must be read, understood and followed.
- Only qualified personnel are allowed to install, operate and perform maintenance on the system.
- Isolate all power supplies (including the battery) before working on or inside the system.
- Always use a properly rated voltage sensing device to check for hazardous voltage between all terminals, including the protective earth (PE).
- Reinstall all parts and protective covers before turning on any AC power supply or connecting a DC power source to the system.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Always wait 5 minutes after turning off the system and isolating all the power supplies (including the battery) before removing any parts or protective covers. The system contains DC capacitors with long discharge time.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The system must be connected to protective earth (PE). Always connect the system to protective earth (PE) before connecting any power supply.

Failure to follow these instructions will result in death or serious injury.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Battery circuit breakers must be installed according to the specifications and requirements as defined by Schneider Electric.
- Battery maintenance must only be performed by qualified personnel knowledgeable of batteries and the required precautions.
- Always disconnect the charge source before you connect or disconnect the battery to the terminals.
- Never open, alter or damage batteries. This can release toxic electrolytes that are harmful to the skin and eyes.
- Never dispose of batteries in a fire as they can explode.

Failure to follow these instructions will result in death or serious injury.

⚠️⚠️ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

When replacing batteries, always replace with the same type and number of batteries or battery packs.

Failure to follow these instructions will result in death or serious injury.

⚠️⚠️ DANGER**HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH**

Never drill or cut holes in or near the system.

Failure to follow these instructions will result in death or serious injury.

⚠️ WARNING**HAZARDOUS VAPORS**

Fire inside the system can produce hazardous vapors that should not be inhaled.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠️ CAUTION**UNINTENDED EQUIPMENT OPERATION**

Never connect the system output to regenerative loads, for example, photovoltaic systems or speed drives.

Failure to follow these instructions can result in injury or equipment damage.

NOTICE**SYSTEM OVERHEATING**

Always be aware of the space requirements around the system for ventilation and operation.

Never cover the product's ventilation openings when the system is in operation.

Failure to follow these instructions can result in equipment damage.

NOTICE

Always recycle and dispose of any waste in accordance with local regulations and rules.

Electromagnetic Compatibility

NOTICE

RISK OF ELECTROMAGNETIC DISTURBANCE

This is a category C2 product according to IEC 62040-2. In a residential environment, this product may cause radio interference, in which case the user may be required to take additional measures.

Failure to follow these instructions can result in equipment damage.

NOTE: The first environment includes residential, commercial and light industrial premises directly connected, without intermediate transformers, to a public low-voltage mains supply.

NOTE: The second environment includes all commercial, light industry and industrial locations other than those included in the first environment.

General Information

This manual provides information about Gutor Modular systems.

In this manual “the system” refers to the complete system and “the cabinet” refers to the mechanical frame of the system.

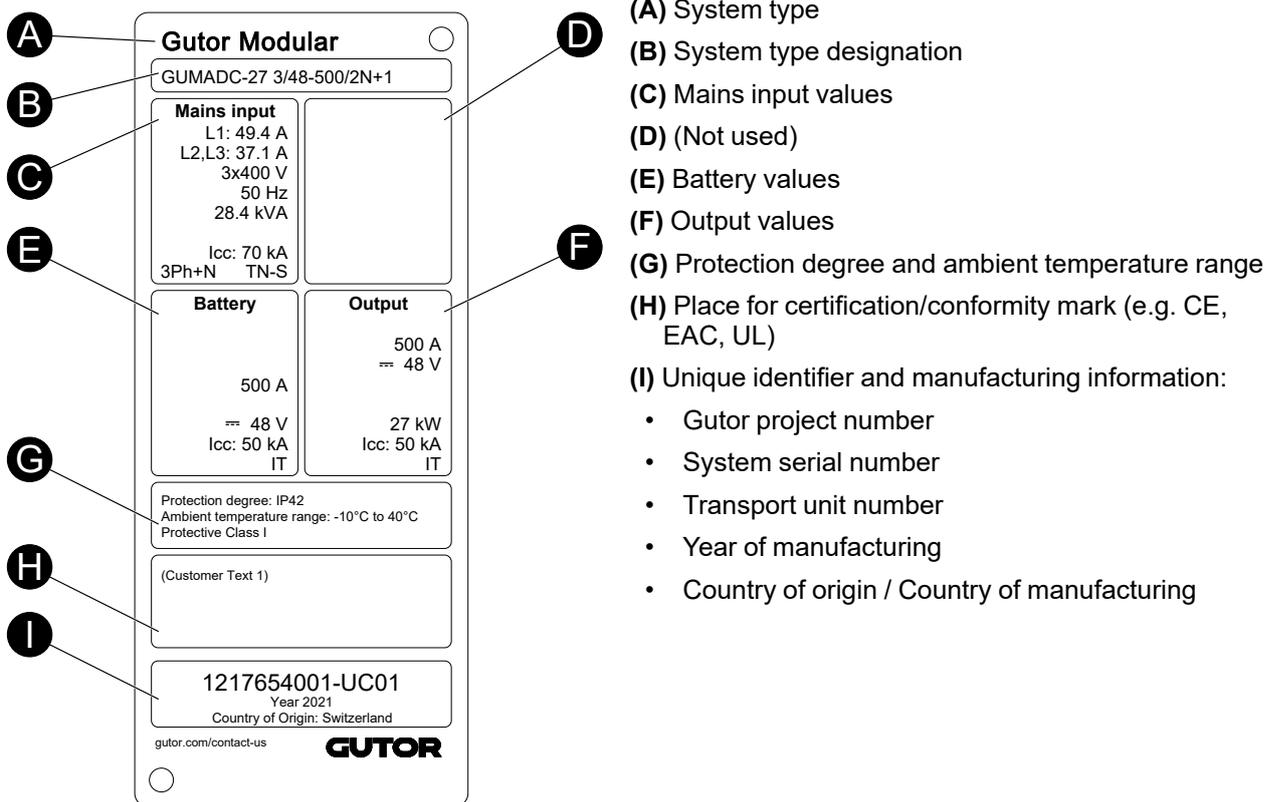
The customer specific documents *Single Line Diagram*, *Technical Data*, and *Drawings* are often referred to. It is required that you are familiar with the configuration of the system before installing, operating or performing maintenance on the system.

Any breaker or switch mentioned in this manual can be a switch-disconnector, fuse switch-disconnector or circuit breaker. Please see the *Single Line Diagram* for type used in your system.

The standard reference designators for parts are mentioned and might be different. For the actual reference designator refer to the *Drawings*.

All images are only for illustration. The shown examples might differ from the actual system.

Rating Plate



System Type Designation

The top section (**B**) of the rating plate contains the system type designation. The system type designation contains information about the system configuration.

GUMADC-27 3/48-500/2N+1

Position	Description	Options
(J)	Gutor Modular	Always GUM for all Gutor Modular systems
(K)	System type	ADC – Rectifier system, AC to DC
(L)	Maximum output power [kW]	Based on customer specification
(M)	Input phases	1 – Single phase input 3 – Three phase input
(N)	Nominal output voltage [V]	24, 48, 60, 110/125, 220 V DC
(O)	Maximum output current [A]	Based on customer specification
(P)	Number of rectifier mains inputs	None – One input 2 – Two inputs, also called dual input
(Q)	Rectifier module redundancy	None – No module redundancy, also called N + 0 N + 1 – One redundant module N + x – Customized number of redundant modules, selected number will be shown. For example, N + 3. N + N – Full module redundancy

Unique Identifier

The bottom section (**I**) on the rating plate contains the unique identifier. The unique identifier is built up of sections to make it possible to identify the cabinet.

1217654001 - UC01

Position	Name	Description
(R)	Gutor project number	A unique number for each project.
(S)	System serial number	Indicates a specific system number in the project.
(T)	Transport unit number	The number indicates a transport unit. A system may consist of multiple transport units that can be separated for transportation.

Modular System Functionality

The systems functionality depends on what type of modules are used and the configuration of the modules. For communication the NMC card is the default solution with other options available on request. Optional ADBUS card can be installed for additional inputs, outputs and features.

Module Functionality

The compact power module contains all the internal components for the power supply or converter system. No other external power components are required or recommended, but some options exist to cover specific requirements.

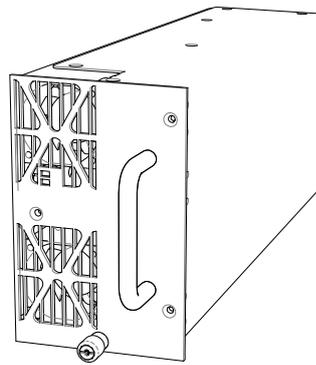
Multiple modules can be used in parallel to achieve different ratings and configurations. The modules are placed in racks inside the system.

Rectifier Modules

The rectifier module converts AC (input) to DC (output). The module is fan cooled.

Different modules are available depending on the DC output voltage.

Output DC voltage
24 V DC
48 V DC
60 V DC
110/125 V DC
220 V DC



DC Module Coding

DANGER

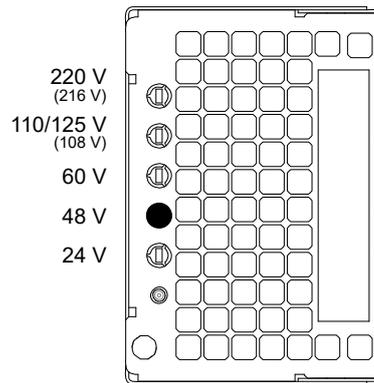
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

Never modify or change the coding on a module.

Failure to follow these instructions will result in death or serious injury.

Each module is coded for a specific output voltage. On the back of the module there are five circles that indicate the different DC voltages. The position of the open circle indicates the nominal DC output voltage of the module. The open circle on the module will correspond to a pin in the back of the rack in the system.

As an example, a 48 V DC module is shown:



Module Configurations

Depending on the customer requirement it is possible to have different types of module configurations, with or without redundancy. $N + 0$, $N + 1$ and $N + x$ module configurations use one input source.

A 2N rectifier module configuration uses two independent rectifier mains.

NOTE: N stands for the number of modules required to supply the full load that the system is designed for.

Module Configuration for $N + 0$, $N + 1$ and $N + x$

$N + 0$ Configuration

No redundancy of modules. The system has exactly as many modules installed as it needs to supply the full load and charge the battery.

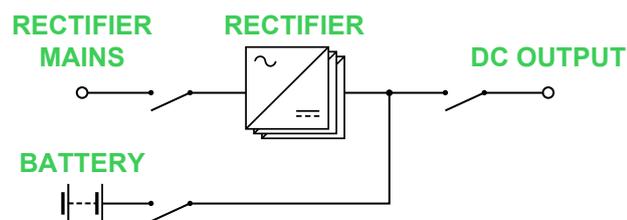
$N + 1$ Configuration

One redundant module. The recommended and standard configuration. If one module becomes inoperable or needs to be replaced, the remaining modules can still supply the full load and charge the battery.

$N + x$ Configuration

A specified number of redundant modules. In case additional redundancy is requested, x additional modules can be added. If x number of modules becomes inoperable, the remaining modules can still supply the full load and charge the battery.

Rectifier Module Configuration for $N + 0$, $N + 1$ and $N + x$

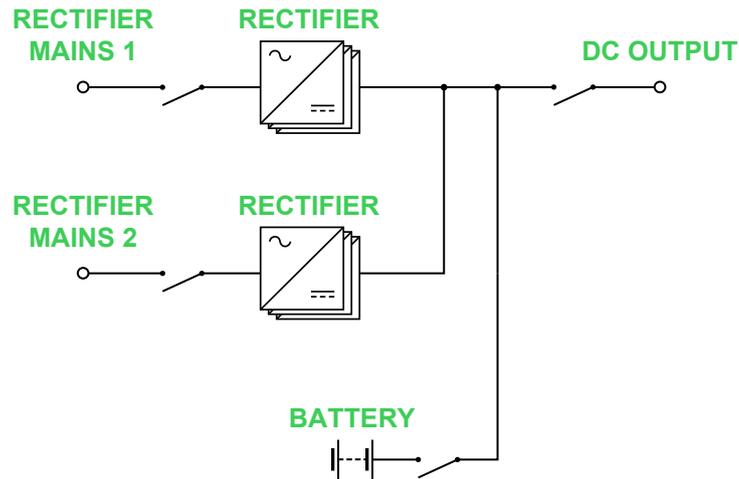


Rectifier Module Configuration for 2N (Dual Input)

For additional redundancy another input can be used to supply a second group of modules. Meaning that the number of modules needed to supply the nominal load is doubled. The modules are organized in two groups. With half of the total number of modules in each group. Each group is connected to an independent input source. One group of modules is enough to supply the full load and charge the battery.

It is possible to have both dual input and N+1, N+x, or N+N, for a total amount of modules equal to $2 * (N+x)$.

Rectifier Module Configuration for 2N (Dual Input)



Network Management Card (NMC) and Communication

In Gutor systems a network management card (NMC) can be used to send alarms, events and status indications over a local or remote network to a customer device for monitoring.

From the NMC the following communication options and protocols are available:

NOTE: Each communication option or protocol can be enabled/disabled and must be configured correctly before use.

- Web interface through HTTPS and HTTP
- Command line interface (CLI) through SSH and Telnet
- File transfer through SCP and FTP
- Modbus TCP/IP
- Modbus Serial/RTU with RS-485 2-wire and 4-wire full duplex
- SNMPv3 and SNMPv1

For more information about the NMC and how to configure the settings see the *Network Monitoring System* user guide.

The NMC can be combined with additional gateways for further protocols:

- IEC 61850
- Profibus DP
- EtherNet/IP
- Others on request

Emergency Power Off

DANGER

ENERGIZED BY EXTERNAL POWER SOURCES

When emergency power off (EPO) is activated the output breaker is tripped.

Hazardous voltages are still present. The system is still energized by the upstream supply and batteries (unless the system is disconnected from the upstream supply and the batteries with a separate EPO).

Failure to follow these instructions will result in death or serious injury.

According to UPS safety standard IEC 62040-1, a UPS with an emergency switch device should be able to prevent further supply of the load.

The emergency switching device interrupts the load via a terminal to an externally connected switching device. The EPO in a Gutor Modular system will trip the output breaker(s).

NOTE: All modules in the system are still in operation.

How to Reset the System After EPO

If the emergency power off (EPO) signal has tripped the output breaker, the signal needs to reset and the output breaker needs to be closed.

1. Make sure that the EPO signal is no longer active.
2. Check that the load is ready to be energized.
3. Reset the EPO signal from the **Display**:
 - a. Make sure you are logged in as a user with at least **Owner** access.
NOTE: If you are not logged in, a prompt to login will appear when trying to access the menu.
 - b. Press the **Main menu icon** and navigate to **Service > Remote control > Remote control** .
 - c. Press the **Emergency Switch RESET** on button.
The EPO signal is now reset.
4. Close the rectifier DC output breaker.

Functionality of Optional Selections

When configuring a system there are optional selections that adds additional functionality to the system design.

Overview of ADBUS Cards

There are multiple optional cards with inputs that can be added to monitor additional measurements and signals, and in some cases additional outputs.

A combination of up to 6 ADBUS cards can be used. The maximum number of a single type of card depends on the ADBUS card type.

NOTE: Each card of the same type needs to have a unique address assigned. The address is assigned with jumpers.

NOTE: The end of the ADBUS needs a resistor for bus termination.

Types of ADBUS cards:

- **Input/output card:** Provides 8 digital inputs and 4 outputs with potential-free relays. For more information see the *Installation Manual* and the *Drawings*.
- **DC measurement card:** Provides additional DC measurement inputs for 1 temperature, 1 voltage and 2 current signals.
- **AC measurement card:** Provides additional AC measurement inputs for 3 voltages.
- **Battery monitoring card:** For battery symmetry monitoring. There are two different cards depending on the DC voltage, 24–60 V DC and 110–220 V DC. Optionally, the 24–60 V DC card can instead also be used to monitor up to 5 individual battery cells/blocks.
- **Insulation monitoring card:** Used to monitor DC earth leakage and send the signals to the controller, which can be used for alarms in the system.

Gutor Battery Management System (G.BMS)

The Gutor battery management system (G.BMS) is a solution that actively balances the charge of each battery block. The G.BMS continuously monitors the voltage, impedance, temperature and as an option the electrolyte level. The measured information is used to equalize the charge of the individual blocks to help them reach their designed lifetime.

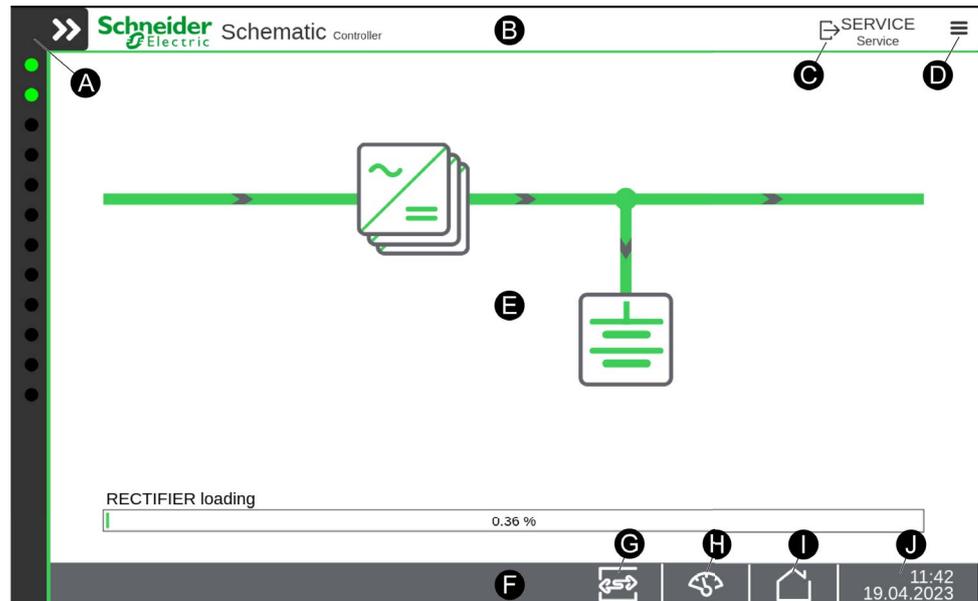
Any Gutor system with a battery can use the G.BMS solution since it is installed separately from the system. The G.BMS solution can also be installed on already existing batteries.

Display

The main human machine interface (HMI) is a 10" display with a touchscreen. To start the home screen press anywhere on the display.

Display Overview

On the home screen there are multiple buttons and sections with information.



- (A) **Virtual LED bar:** The **Virtual LED bar** on the left side shows the system virtual LEDs. Up to 39 virtual LEDs can be used. Press the **Double arrow icon** to show more information about the LEDs and to scroll in the list of LEDs.
- (B) **Header bar:** Shows the logo and the current screen name. In the top right corner of the **Header bar** there is a **Main menu icon** and a **Login / Logout icon**. If a buzzer alarm is active a **Mute icon** is also shown.
- (C) **Login / Logout:** If no one is logged in the **Login icon** is shown. Press the **Login icon** to login. If a user is logged in the username and access level will be displayed next to the **Logout icon**.
- (D) **Main menu icon:** Press to show the main menus. Press a menu to navigate to the page. To hide the main menu press anywhere outside the main menu or wait 10 seconds.
- (E) **Content area:** Shows the information on the current page. From the **Home screen**, also named the **Schematic screen**, the **Rectifier modules icon** and the **Battery icon** can be pressed to view additional information and measurements.
- (F) **Status bar:** The **Status bar** shows buttons for quick navigation. The buttons shown depend on the currently active menu or screen.
- (G) **Switch operation icon:** Press to enter the **Switching operations** page that shows voltage, current and output power measurements.
- (H) **Measurements icon:** Press to enter the **System measured values** page that shows voltage, current and output power measurements.
- (I) **Home icon:** Press to enter the **Schematic screen**, it shows a mimic of the system status. It is also called the **Home screen** since it is the first screen that is shown.
- (J) **Date and time:** Shows the current date and time. Press to enter the **Date and time** menu.

Display Navigation

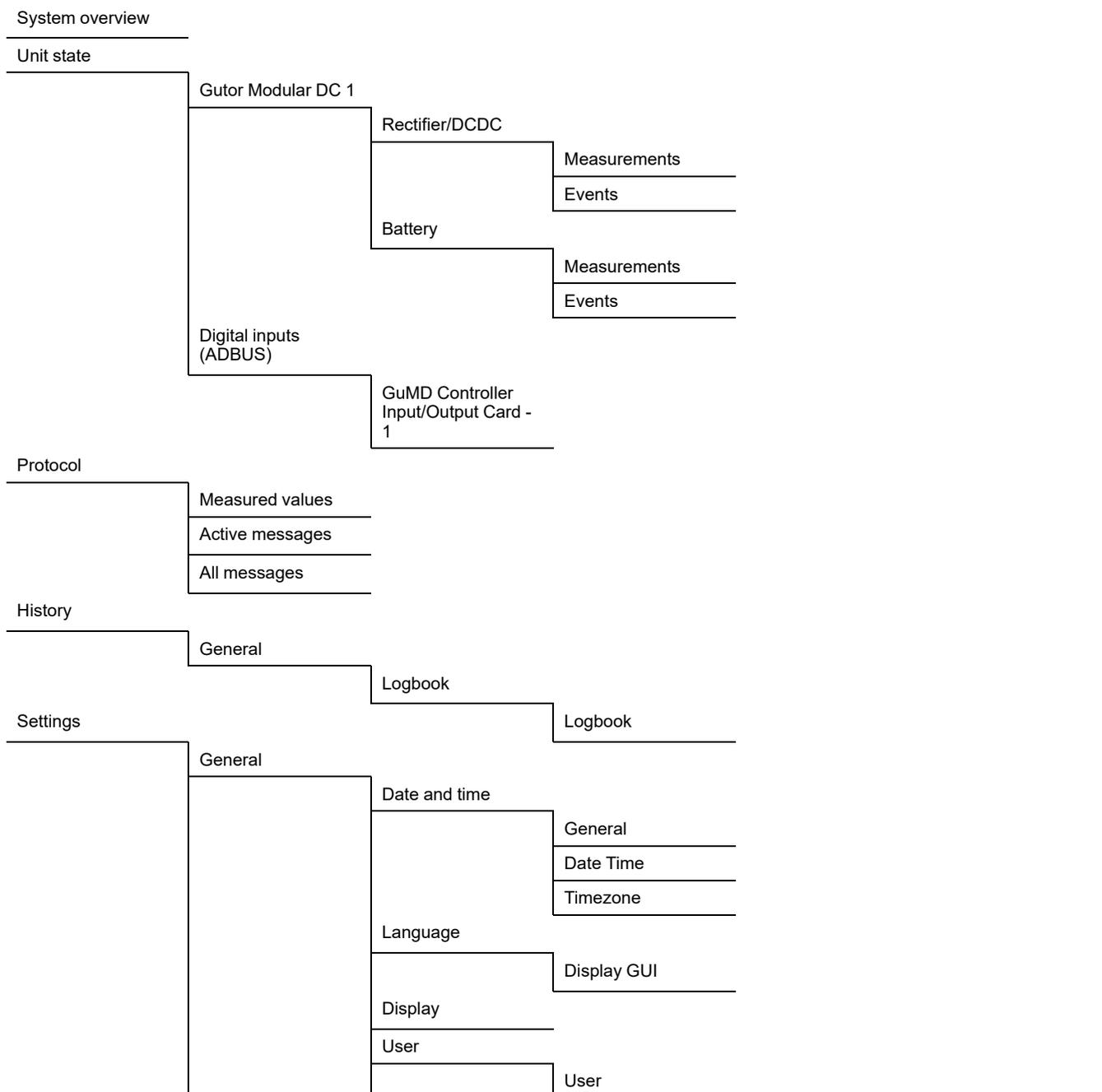
Some content in the display is adaptive and will show the most relevant information depending on the current system status.

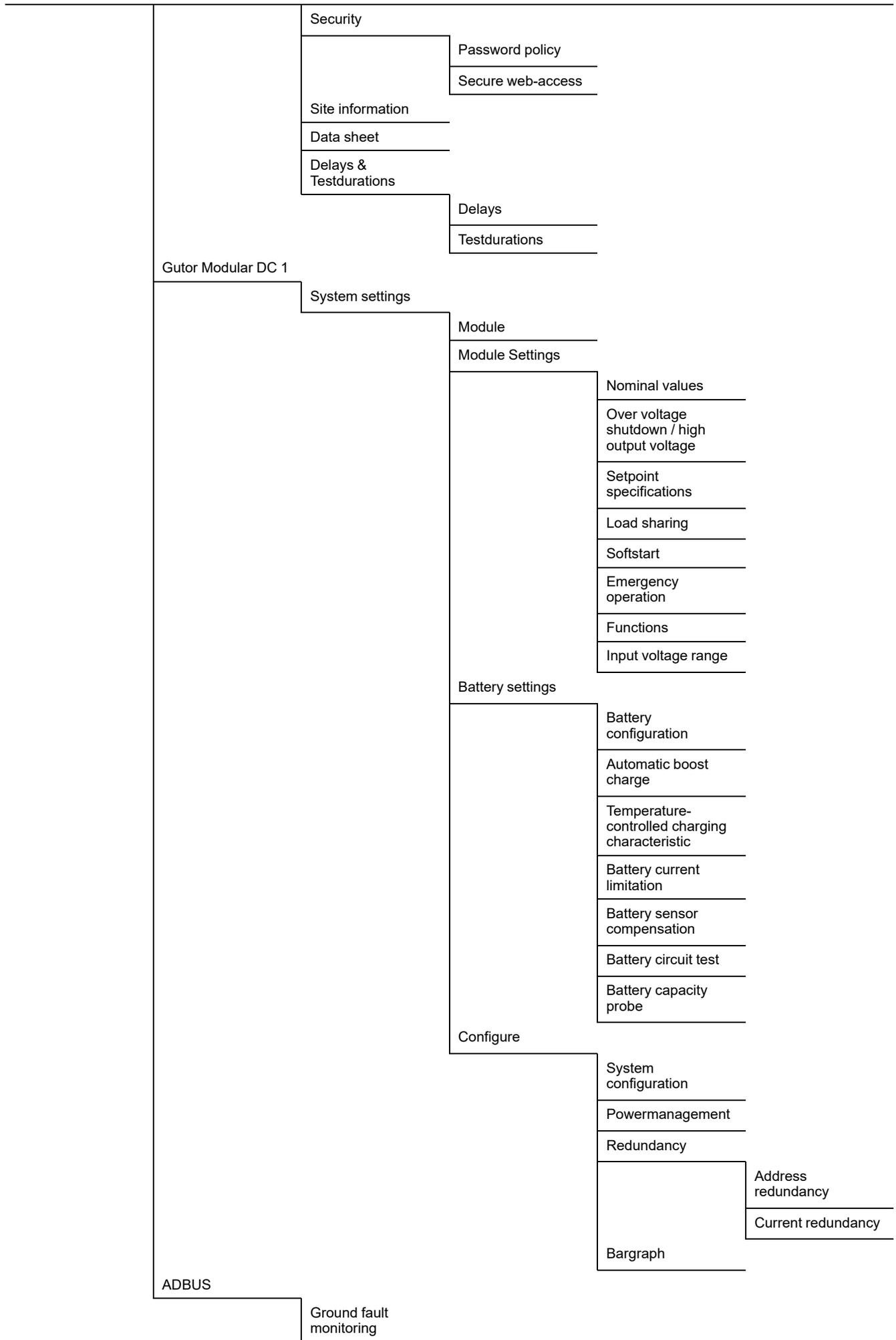
To navigate the display it is possible to:

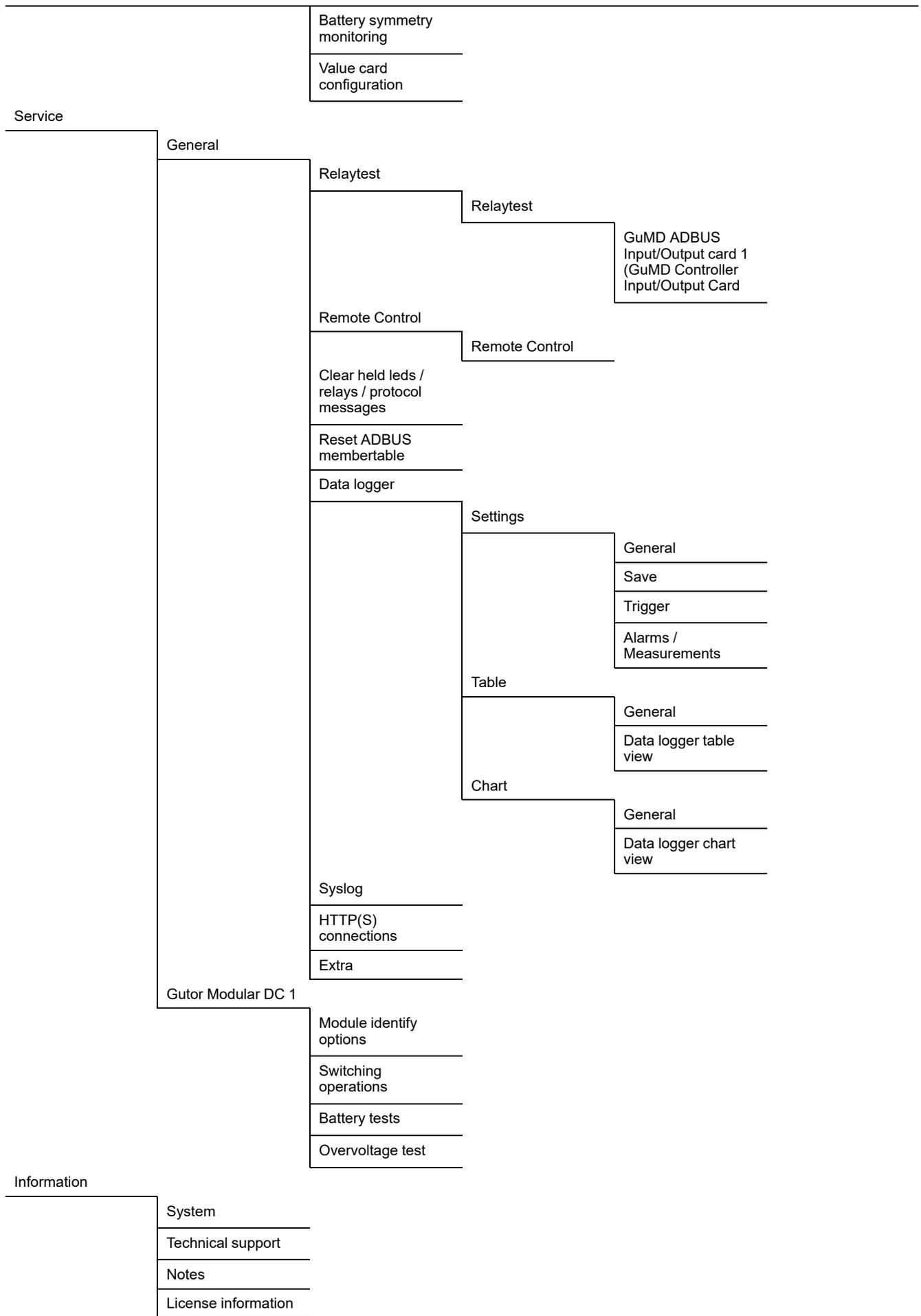
- Press icons to open pages.
- Press the gray bars to maximize/minimize content on a page.
- Scroll on a page or in a content window.
- Use the **Home icon** to return to the home screen.

Menu Tree

The visible content depends on the access level of the logged in user. The menu tree shows the content for a user with the **Service** access level in the **Display**.







User Accounts

To secure information and settings it is only possible to view some basic information from the display without a login.

To change settings and view more information a login is required. Depending on the access level of the user, different information and settings will be available from the display.

The different access levels are:

- **Viewer:** Can only view some basic information like measurements, events, general information and settings (no login).
- **Owner:** Can view a bit more information like logs and change operation mode. Can also modify some general information like date, time, language and site information.
- **Service:** Can view and modify system settings and perform tests.

NOTE: A gray input field means that the information cannot be modified.

Default User Settings

⚠ CAUTION

UNAUTHORIZED ACCESS

Always change your user settings (name and password) after the first login. Follow your site's security protocols when selecting a new name and password.

The settings for the password strength can be changed from the **Security** page by a user with **Service** access.

After a full controller reset the system resets the user settings and it is necessary to change the user settings again.

Failure to follow these instructions can result in injury or equipment damage.

The system is delivered with the default user settings. Change the default user settings directly after the first login.

It is recommended to store the new passwords in a secure way so that they are not forgotten, for example by using a password manager.

Default User and Password Settings

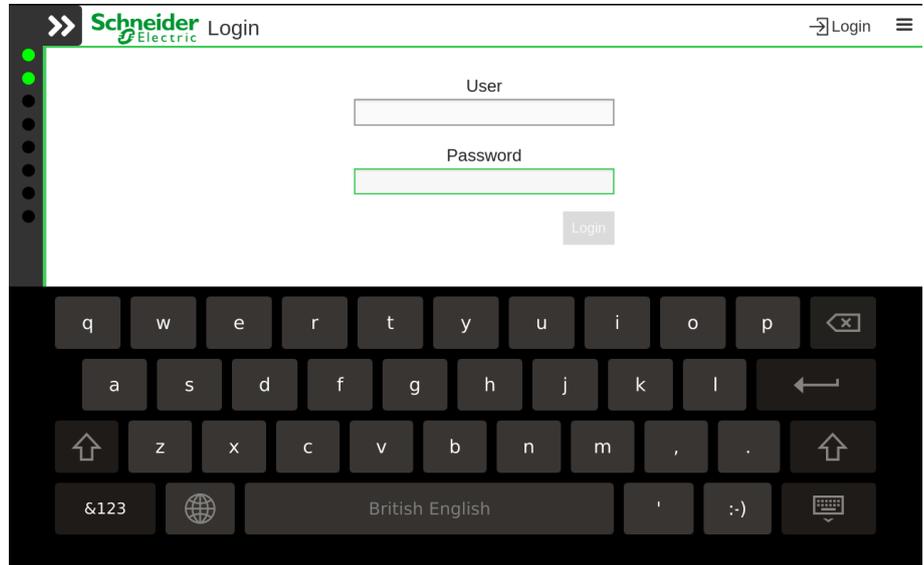
Access Level	Default Username	Default Password
Viewer	—	—
Owner	OWNER	OWNER
Service	SERVICE	SERVICE

NOTE: A user is automatically logged out when the screen turns off. Default setting is after 3.5 minutes of inactivity, this can be changed under **Settings > General > Display**.

Login

1. To log in either:
 - Press the **Login icon** in the top left corner of the **Header bar**.
 - Press the **Main menu icon** and select **Login**.
2. Enter your username and password and press **Login**.

NOTE: For the first login use the default user settings.



If you navigate and try to change something that the current user does not have access to, the login screen will appear and ask for a higher access login.

Change User Settings

User settings can only be changed when logged in with **Service** access. With **Service** access it is also possible to add new users, delete old users or change a user password.

Reset Owner Password

To reset an **Owner** password:

1. Log in as a user with **Service** access.
2. Press the **Main menu icon** and navigate to **Settings > General > User**.
3. Select the user with **Owner** access level and press **Change password**.
4. Enter a new password and press **Apply** to set the new password.

Reset Service Password

To reset a **Service** user's password please contact your local Gutor Service Center.

Measurements

The available measurements can be viewed from the display. As an option, additional measuring instruments can be installed in the door.

Measurements in the Display

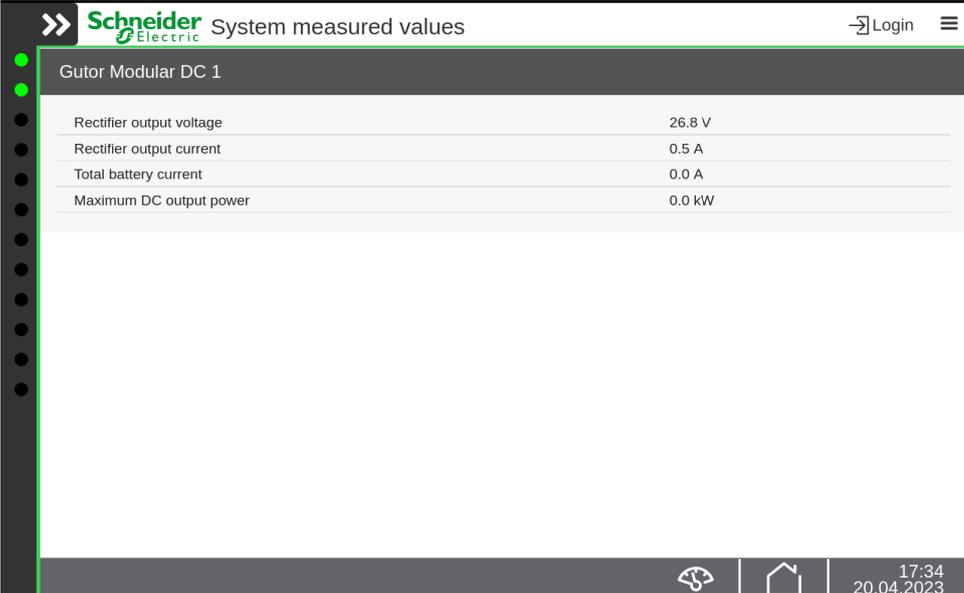
There are multiple different measurements that can be viewed in the display, and some can be accessed in multiple ways.

NOTE: The screenshots are only samples. The available measurements depends on configurations, settings and system state.

- **System Measured Values:** Quick access to main measurements about the output.
- **Unit State (Rectifier Modules):** Detailed measurements about the rectifier modules.
- **Unit State (Batteries):** Detailed measurements about the batteries.
- **Measured Values (Protocol):** Detailed configured list of measurements about the system, modules and batteries.

System Measured Values

To view the **System measured values** click on **Measurement icon** in the **Status bar** at the bottom of the screen.



Gutor Modular DC 1	
Rectifier output voltage	26.8 V
Rectifier output current	0.5 A
Total battery current	0.0 A
Maximum DC output power	0.0 kW

Unit State (Rectifier Modules)

To view the **Measured values** for the rectifier modules it is possible to either:

- Click on the **Rectifier modules icon** on the home screen.
- Navigate to **Unit state > Gutor Modular DC 1 > Rectifier/DCDC**.

Screenshot of the Schneider Electric interface showing 'Measured values' for Rectifier/DCDC. The table lists various measurements and their values:

Measurement	Value
REC nom Vout DC	220.00 Vdc
REC nom Pout [kW]	6.00 kW
Input power	0.4 kW
Output power	0.1 kW
Rectifier output voltage	242.1 V
Rectifier current/total	0.3 A
Battery current	0.00
Load current	0.3 A

Unit State (Batteries)

To view the **Measured values** for the battery it is possible to either:

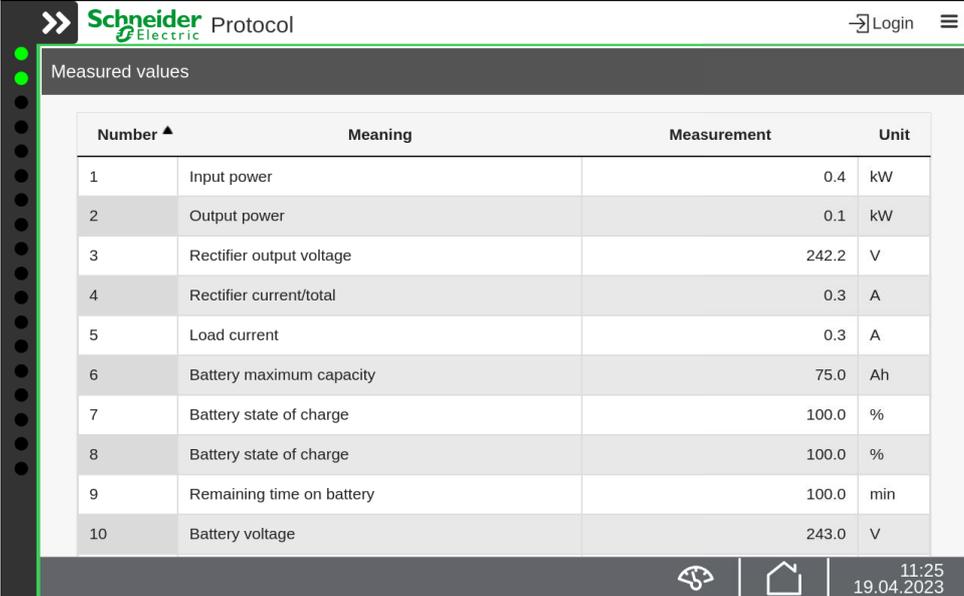
- Click on the **Battery icon** on the home screen.
- Navigating to **Unit state > Gutor Modular DC 1 > Battery**.

Screenshot of the Schneider Electric interface showing 'Measured values' for Battery. The table lists various measurements and their values:

Measurement	Value
Battery maximum capacity	75.0 Ah
Battery state of charge	100 %
State of health	100 %
Remaining time on battery	50 min
Battery voltage	243.0 V
Battery current (total)	0.0 A
Battery temperature	23.5 °C

Measured Values (Protocol)

To view the configured list of **Measured values**, navigate to **Protocol > Measured values**.



Number ▲	Meaning	Measurement	Unit
1	Input power	0.4	kW
2	Output power	0.1	kW
3	Rectifier output voltage	242.2	V
4	Rectifier current/total	0.3	A
5	Load current	0.3	A
6	Battery maximum capacity	75.0	Ah
7	Battery state of charge	100.0	%
8	Battery state of charge	100.0	%
9	Remaining time on battery	100.0	min
10	Battery voltage	243.0	V

Additional Measurement Devices

As an option, additional measurement devices for certain voltages, currents and frequencies can be installed on the cabinet door. The additional measurement devices need to be specified when the system is ordered.

For details about any installed instruments refer to the *Single Line Diagram* and the *Drawings*.

LEDs, Status Indications and Alarms

The system has one physical LED above the display and a configured virtual LED bar in the display. The message list shows all configured status indications and alarms.

Display LED

At the top of the display there is a LED. The LED gives a quick system status indication.

Display LED Colors	Display LED Description
Green	No alarms are present.
Yellow	One or more non urgent alarms are present.
Red	One or more urgent alarms are present.
Blue	The display is starting up.

Virtual LED Bar

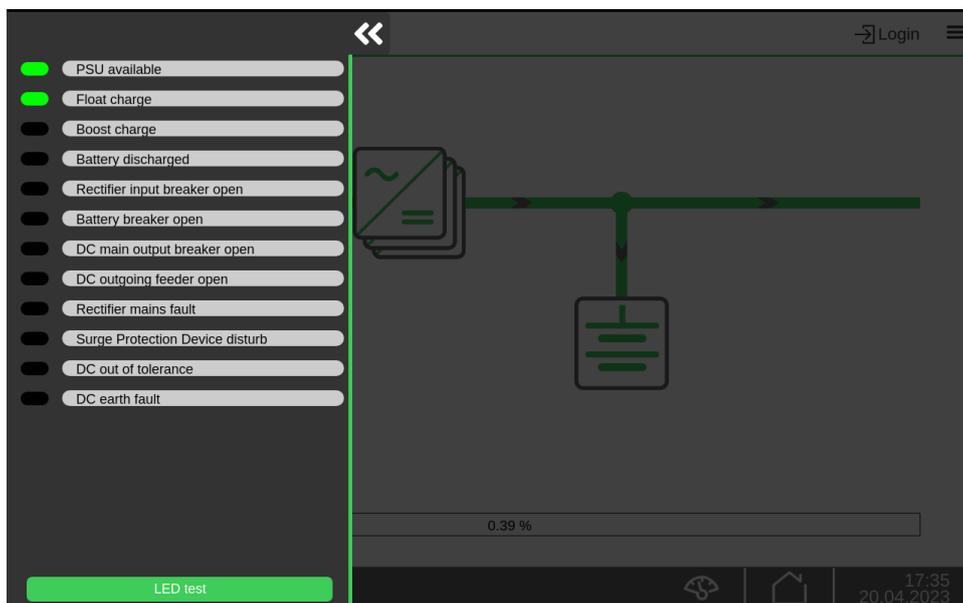
From the message list, a customized selection of indications and alarms will be visible as LEDs in the virtual LED bar. It is also possible to customize if any LED should be held until they are manually reset.

A **Hold alarm** LED will flash after the active alarm condition is no longer present. It will continue to flash until is it manually reset. When a **Hold alarm** LED flashes the **Reset held alarms** button is shown above the **LED test** button.

Press the **Double arrow icon** to expand the list and view the names. If there are more LEDs defined than can fit on one screen it is also possible to scroll in the list of LEDs.

It is not recommended to define more LEDs that can fit on the screen as the LEDs have a fix position.

NOTE: An example virtual LED bar is shown. Customized systems might have different LED alarms.



Message List

The system status indications and alarms are available in the message list. By default, a standard configuration of the message list is available. On request the message list can be customized.

The alarms and indications can be configured as a **Hold alarm**. A **Hold alarm** requires a manual reset to remove the active state.

It is also possible to configure activation of an internal buzzer in case the alarm or indication is active. An icon for muting the buzzer is shown in the **Header bar** at the top of the display if the buzzer is active. Press the **Mute icon** to mute the active buzzer.

To view the message list in the display navigate to **Protocol > All messages**.

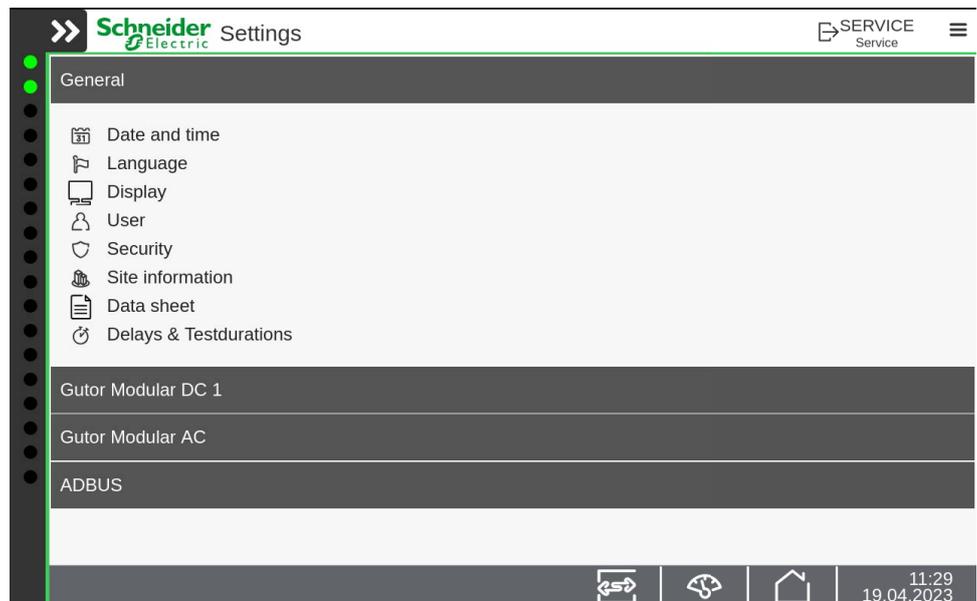
General Settings

After startup but before operation, the site information should be filled in and some basic system settings should be configured.

Press the **Manu menu icon** and navigate to **Settings > General**. The pages that can be accessed from here are:

- **Date and time:** Set the system date, time, time zone and clock display format.
- **Language:** Set the language for the system display.
- **Display:** Change the display brightness and time until the display turns off after inactivity.
- **User:** Manage user access and settings.
- **Security:** Specify user password security settings.
- **Site information:** Information about the system owner's site.
- **Data sheet:** General data about the system.
- **Delays & Testduration:** Set alarm delay for each severity and set duration for relay tests.

NOTE: User login with **SERVICE** access level is needed to change all the general settings.



Module Modes and System States

⚡ ⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

The modules will automatically start up as soon as the rectifier mains is available. There is no standby mode.

Failure to follow these instructions will result in death or serious injury.

The systems operation mode depends on different settings and status of the system. The system will automatically detect the appropriate operation mode and automatically switch to it, depending on its configuration. It is also possible to manually switch to most operation modes.

Some modes are only valid for certain system types or configurations. For more information about the operation modes and system states see the sections:

Rectifier Operation Modes

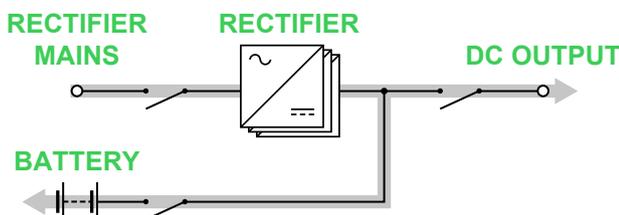
- Float Charge, page 30
- Boost Charge (Charge), page 31
- Equalization Charge, page 32
- Battery Operation (Batterytest), page 33

System States

- Emergency Operation, page 34
- Off, page 34
- 2N Configuration with One of the Rectifier Mains Unavailable, page 35

Float Charge

Float charge mode is the standard operation mode for the rectifier modules. The output voltage depends on the float charge settings. The rectifier modules supply the DC output and charge the battery. In case the mains input supply is unavailable, the battery supplies the DC output.



Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier AC mains breaker	Closed
Rectifier modules	Supplying float voltage to the battery and the DC output.
Battery	Available / Charging

Part	Status
Battery breaker	Closed
DC Output	Available and within the tolerance range. The load is supplied.
Rectifier DC output breaker	Closed

Boost Charge (Charge)

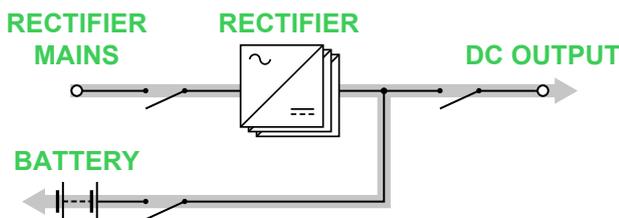
NOTICE
<p>HIGH OUTPUT VOLTAGE</p> <p>Before you change to boost charge mode:</p> <ul style="list-style-type: none"> • Make sure the boost charge voltage level does not damage the DC load. • For critical or sensitive DC loads always check the boost charge settings. • If necessary, disconnect the DC load. <p>Failure to follow these instructions can result in equipment damage.</p>

Boost charge (charge) mode charges the battery faster than float charge. Automatic boost charge can be used to define if and when the system should switch to boost charge automatically. It is also possible to manually switch to boost charge.

The rectifier modules supply the DC output and charge the battery but at a higher voltage. In case the mains input supply is unavailable, the battery will supply the DC output.

This mode is a temporary mode and is only used for a limited period.

NOTE: It is possible to inhibit boost charge mode. If boost charge mode is inhibited, the rectifier modules cannot automatically or manually change to boost charge mode. Boost charge mode can be inhibited permanently (not available for the system) or by an external signal.



Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier AC mains breaker	Closed
Rectifier modules	Supplying boost voltage to the battery and the DC load.
Battery	Available / Charging
Battery breaker	Closed
DC Output	Available and the load is supplied if the load is approved for the higher voltage, else disconnected to protect the load.
Rectifier DC output breaker	Closed

Equalization Charge

NOTICE

HIGH OUTPUT VOLTAGE AND REDUCED CURRENT

Never enable equalization charge mode with a load connected to the DC output.

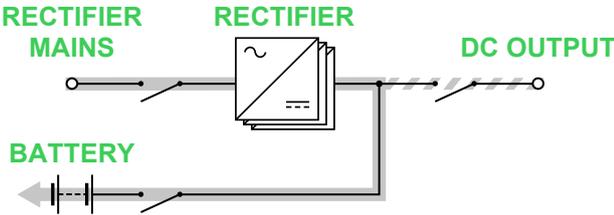
Failure to follow these instructions can result in equipment damage.

Equalization charge mode uses a high output voltage to overcharge the battery. Equalization charge is mainly used to condition the battery during its commissioning.

This mode is a temporary mode and is only used for a limited period.

NOTE: Equalization charge can only be activated manually.

NOTE: It is possible to inhibit equalization charge. If equalization charge is inhibited, the rectifier modules cannot manually change to equalization charge. Equalization charge can be inhibited permanently (not available for the system) or by an external signal.



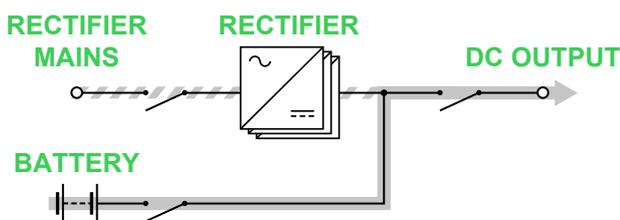
Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier AC mains breaker	Closed
Rectifier modules	Running at a higher voltage setting to intentionally overcharge and condition the batteries.
Battery	Charging at a higher volt.
Battery breaker	Closed
DC Output	Unavailable, the load is not supplied.
Rectifier DC output breaker	Open

Battery Operation (Batterytest)

NOTICE
BATTERY DAMAGE
When the battery is at the end of discharge, the connection between the battery and the load must be opened to avoid permanent damage to the battery.
Failure to follow these instructions can result in equipment damage.

NOTICE
LOSS OF OUTPUT VOLTAGE
After battery operation the battery is discharged it may take several hours to recharge the battery. Recharge duration depends on battery data and state of charge.
Failure to follow these instructions can result in equipment damage.

In battery operation (batterytest) the battery is being discharged to supply the DC output. The system switches to battery operation in case the mains supply becomes unavailable. It is also possible to manually switch to battery operation.

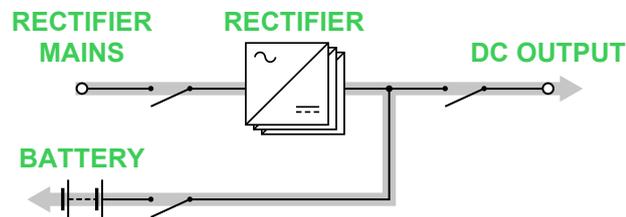


Part	Status
Rectifier mains	Unavailable and/or outside the tolerance range.
Rectifier AC mains breaker	Closed
Rectifier modules	Ready to operate when the mains return.
Battery	Discharging and supplying the load.
Battery breaker	Closed
DC Output	Available and within the tolerance range. The load is supplied by the battery.
Rectifier DC output breaker	Closed

Emergency Operation

If the communication between the controller and the modules is interrupted, the modules switch to emergency operation.

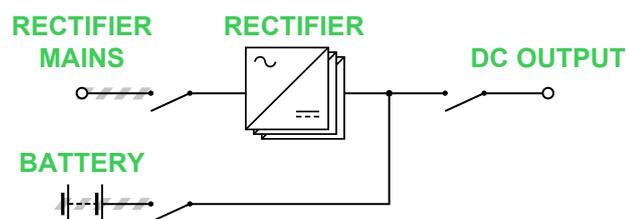
The parameters for emergency operation are pre-configured and cannot be changed. The set voltage level depends on the modules, for the value see the *Technical Data*.



Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier AC mains breaker	Closed
Rectifier modules	Running and supplying the load with the default voltage setting. Connection with controller is interrupted.
Battery	Available
Battery breaker	Closed
DC Output	Available and within the tolerance range. The load is supplied.
Rectifier DC output breaker	Closed

Off

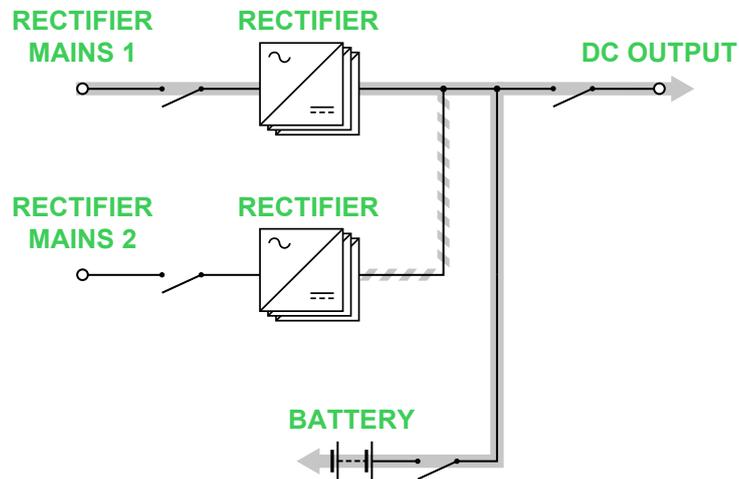
The system is turned off and the battery is disconnected.



Part	Status
Rectifier mains	Unknown
Rectifier AC mains breaker	Open
Rectifier modules	Off
Battery	Unknown
Battery breaker	Open
DC Output	Unavailable, the load is not supplied.
Rectifier DC output breaker	Open

2N Configuration with One of the Rectifier Mains Unavailable

If one of the rectifier mains becomes unavailable in a system with a 2N configuration, the other rectifier mains will still supply one group of modules. One group of modules is enough to supply the full load and charge the battery. The group of modules can be N, N+1, N+x or N+N.



Part	Status
Rectifier mains 1	Available and within the tolerance range.
Rectifier mains 2	Unavailable / Unknown
Rectifier mains 1 breaker	Closed
Rectifier mains 2 breaker	Closed / Open
Rectifier modules	Half of the modules connected to the rectifier mains that is still available are running and supplying the load. The other half is ready to operate when the unavailable rectifier mains return.
Battery	Available / Charging
Battery breaker	Closed
DC Output	Available and within the tolerance range. The load is supplied.
Rectifier DC output breaker	Closed

Operate the System

NOTICE

UNINTENDED EQUIPMENT OPERATION

Only operate the system if you are qualified and familiar with the system. For the actual name, location and number of breakers check the *Single Line Diagram* for your configured/engineered system.

Failure to follow these instructions can result in equipment damage.

- How to Turn On the System, page 36
- How to Turn Off the System, page 37
- Change Rectifier Module Operation, page 38

How to Turn On the System

Prerequisites:

- The system has been commissioned.
- The batteries have been commissioned and are ready to be connected.
- The rectifier mains is available and within tolerance.

IMPORTANT: The modules will start to run as soon as the input supply is available. When the modules run the output(s) will be energized. If the system does not have any output breakers or output feeders, the output terminal will also be energized as soon as the modules run.

NOTE: Read the complete procedure before you turn on the system.

NOTE: If active, turn off the audible buzzer by pressing the **Mute icon** in the upper right corner of the **Display**. The **Mute icon** is only visible if the audible buzzer is active.

NOTE: If needed, reset any held alarms. Press the **Double arrow icon** and then press the **Reset held alarms** button.

1. Check that all main breakers and module switches are open and that the load is disconnected.
2. Close the rectifier AC mains breaker(s).
3. The **Display** starts and after a few moments and shows the **Home screen**.
NOTE: If the **Display** has not started, check that the internal PSU switches are closed.
4. If available, close all the rectifier module input switches.
5. Check that all rectifier modules have started up. Check that the green LED is illuminated on all rectifier modules and that all red LEDs are off.
6. From the **Home screen** click on the **Rectifier modules icon**. Check that the rectifier output voltage is according to the float voltage on the *Data sheet*.
7. Close the battery breaker(s).
8. Close the rectifier DC output breaker. The output is energized.
9. If available, close any output feeders.
10. Press the **Double arrow icon** and check that no system alarms are active.
11. Check that the system runs correctly and that no alarms are active.

The system is ready to supply the load.

How to Turn Off the System

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Always wait 5 minutes after turning off the system and isolating all the power supplies (including the battery). The system contains DC capacitors with long discharge time.
- Hazardous voltages are still present at some circuits, terminals and switches even when the system is turned off.

Failure to follow these instructions will result in death or serious injury.

NOTICE

LOSS OF OUTPUT VOLTAGE

Always coordinate maintenance and turning off or on the system with the users of the consumers. Make sure that users of the connected consumers are informed before proceeding.

Failure to follow these instructions can result in equipment damage.

NOTE: If active, turn off the audible buzzer by pressing the **Mute icon** in the upper right corner of the **Display**. The **Mute icon** is only visible if the audible buzzer is active.

1. If available, open any output feeders.
2. Open the rectifier DC output breaker.
3. Make sure that the load is disconnected.
4. Open the battery breaker(s).
5. If available, open all the rectifier module input switches.
6. Open the rectifier AC mains breaker(s).

After about 30 seconds the **Display** and all LEDs are off. The system is turned off.

Change Rectifier Module Operation

A user login with **Owner** access is required to change operation mode manually.

- How to Change to Battery Operation (Batterytest), page 40
- How to Change to Float Charge, page 38
- How to Change to Boost Charge (Charge), page 39
- How to Change to Direct Feed, page 41
- How to Change to Equalization Charge, page 42

How to Change to Float Charge

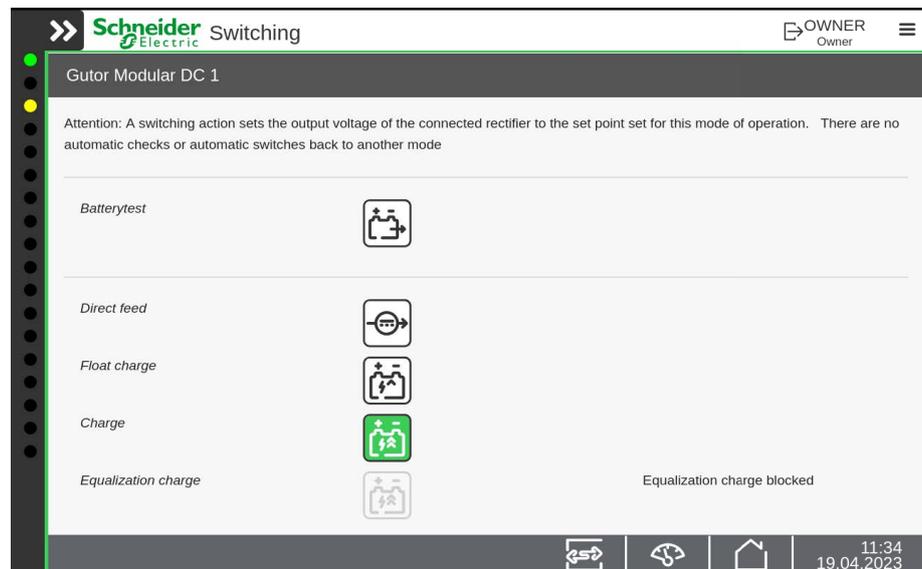
1. Make sure you are logged in as a user with at least **Owner** access.

NOTE: If you are not logged in, a prompt to login will appear when you attempt to change mode.

2. Press the **Switch operation icon** in the **Status bar**.

3. Press the **Float charge** button.

NOTE: The current active operation mode is indicated by the green icon.



4. Confirm the change.

The rectifier modules have changed to float charge.

How to Change to Boost Charge (Charge)

NOTICE

HIGH OUTPUT VOLTAGE

Before you change to boost charge mode:

- Make sure the boost charge voltage level does not damage the DC load.
- For critical or sensitive DC loads always check the boost charge settings.
- If necessary, disconnect the DC load.

Failure to follow these instructions can result in equipment damage.

To check the boost charge settings for your system, refer to the *Data sheet*.

NOTE: It is possible to inhibit boost charge mode. If boost charge mode is inhibited, the rectifier modules cannot automatically or manually change to boost charge mode. Boost charge mode can be inhibited permanently (not available for the system) or by an external signal.

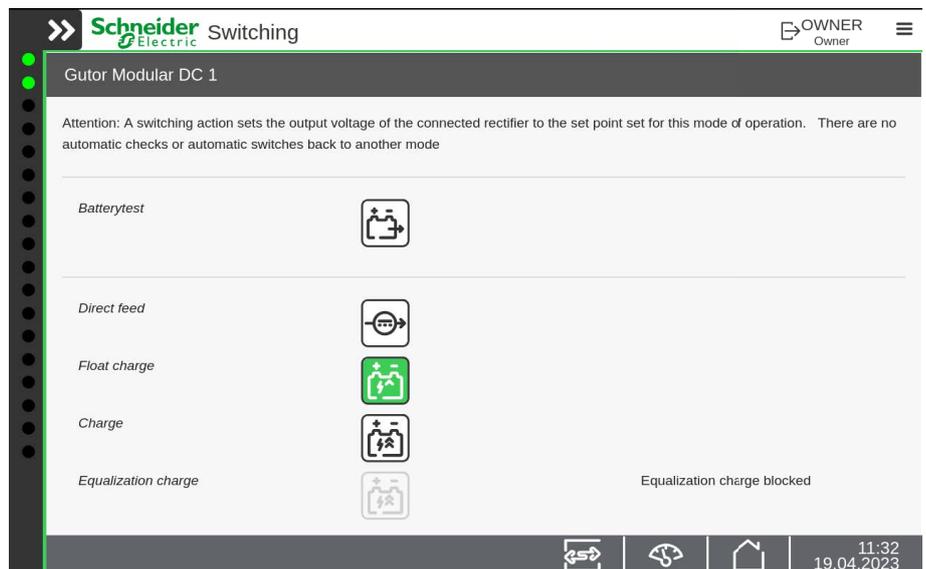
If available, check the condition for the external signal before you change to boost charge.

1. Make sure you are logged in as a user with at least **Owner** access.

NOTE: If you are not logged in, a prompt to login will appear when you attempt to change mode.

2. Press the **Switch operation icon** in the **Status bar**.
3. Press the **Charge** button.

NOTE: The current active operation mode is indicated by the green icon.



4. Confirm the change.

The rectifier modules have changed to boost charge (charge). The rectifier modules will automatically switch back to float charge when the configured duration for boost charge has elapsed.

How to Change to Battery Operation (Batterytest)

NOTICE

BATTERY DAMAGE

When the battery is at the end of discharge, the connection between the battery and the load must be opened to avoid permanent damage to the battery.

Failure to follow these instructions can result in equipment damage.

NOTICE

LOSS OF OUTPUT VOLTAGE

After battery operation the battery is discharged it may take several hours to recharge the battery. Recharge duration depends on battery data and state of charge.

Failure to follow these instructions can result in equipment damage.

If battery operation is manually enabled the rectifier modules output is reduced to simulate that the rectifier mains is unavailable and to discharge the battery.

IMPORTANT: It is not recommended to manually enable battery operation. It should only be used for service and troubleshooting.

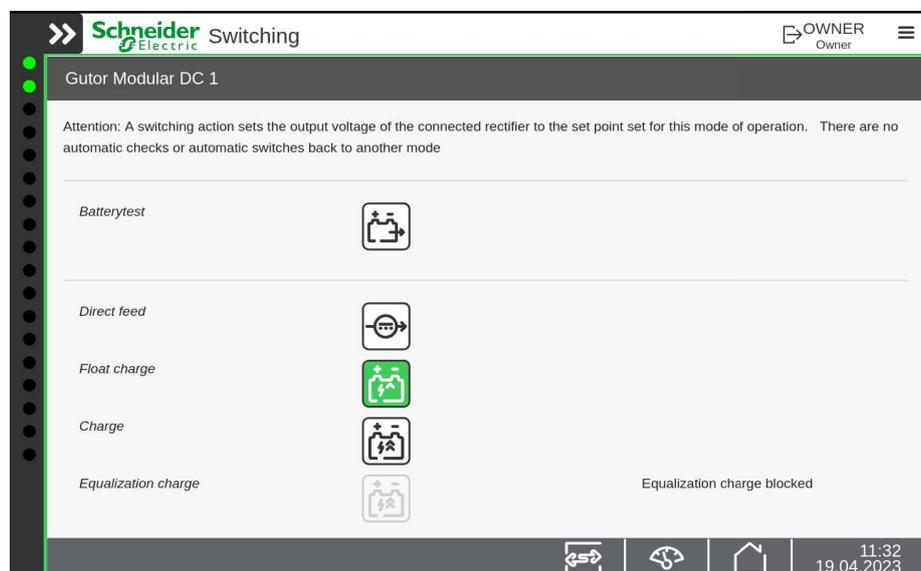
1. Make sure you are logged in as a user with at least **Owner** access.

NOTE: If you are not logged in, a prompt to login will appear when you attempt to change mode.

2. Press the **Switch operation icon** in the **Status bar**.

3. Press the **Batterytest** button.

NOTE: The current active operation mode is indicated by the green icon.



4. Confirm the change.

The rectifier modules have changed to battery operation (batterytest). When battery operation is manually enabled the rectifier modules will not automatically switch back to float charge.

When the battery voltage has reached the reduced voltage level of the rectifier modules, the rectifier modules will take over and supply the load, but the rectifier modules will still indicate that they are in battery operation. The rectifier modules need to be manually switched back to float charge.

How to Change to Direct Feed

NOTICE

INCORRECT OUTPUT VALUES

Never enable direct feed in systems with a battery.

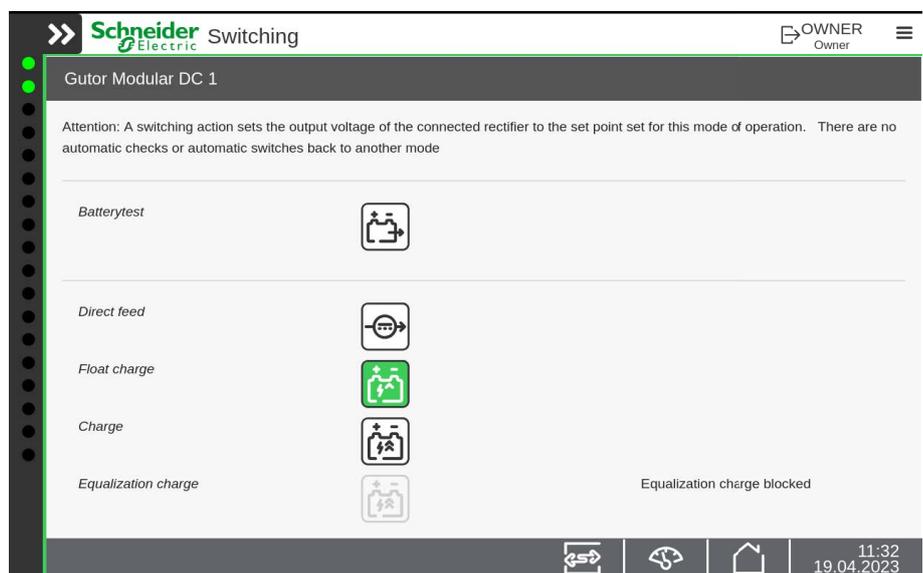
Failure to follow these instructions can result in equipment damage.

1. Make sure you are logged in as a user with at least **Owner** access.

NOTE: If you are not logged in, a prompt to login will appear when you attempt to change mode.

2. Press the **Switch operation icon** in the **Status bar**.
3. Press the **Direct feed** button.

NOTE: The current active operation mode is indicated by the green icon.



4. Confirm the change.

The rectifier modules have changed to direct feed. When direct feed is manually enabled the rectifier modules will not automatically switch to another operation mode.

How to Change to Equalization Charge

NOTICE

HIGH OUTPUT VOLTAGE AND REDUCED CURRENT

Never enable equalization charge mode with a load connected to the DC output.

Failure to follow these instructions can result in equipment damage.

To check the equalization charge settings for your system, refer to the *Data sheet*.

NOTE: It is possible to inhibit equalization charge. If equalization charge is inhibited, the rectifier modules cannot manually change to equalization charge. Equalization charge can be inhibited permanently (not available for the system) or by an external signal.

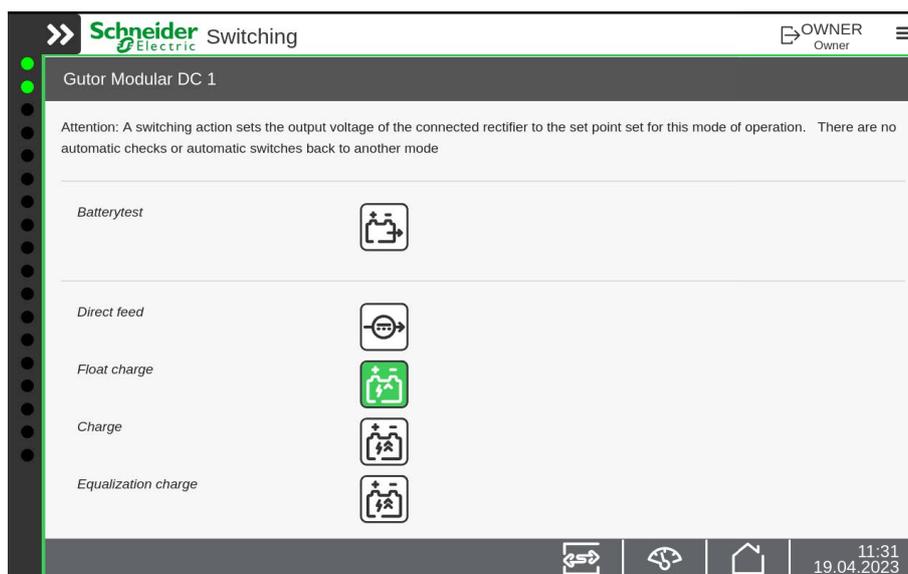
If available, check the condition for the external signal before you change to equalization charge.

1. Make sure you are logged in as a user with at least **Owner** access.

NOTE: If you are not logged in, a prompt to login will appear when you attempt to change mode.

2. Press the **Switch operation icon** in the **Status bar**.
3. Press the **Equalization charge** button.

NOTE: The current active operation mode is indicated by the green icon.



4. Confirm the change.

The rectifier modules have changed to equalization charge. The rectifier modules will automatically switch back to float charge when the configured duration for equalization charge has elapsed.

System Tests

Tests to check the function of LEDs and relays. It is recommended to perform the tests regularly to check that they are functioning correctly.

How to Start the LED Test

NOTE: The LED test is available for all user access levels, it does not require a login.

1. Press the **Double arrow icon** to expand the **Virtual LED bar**.
2. Press the **LED test** button at the bottom of the **Virtual LED bar** to start the test.

The test will illuminate all the virtual LEDs and flash the physical LED above the display for a few seconds. Check that all virtual LEDs are illuminated in their correct color and that the physical LED above the display flashes in all four colors (green, yellow, red and blue).

How to Start the Relay Tests

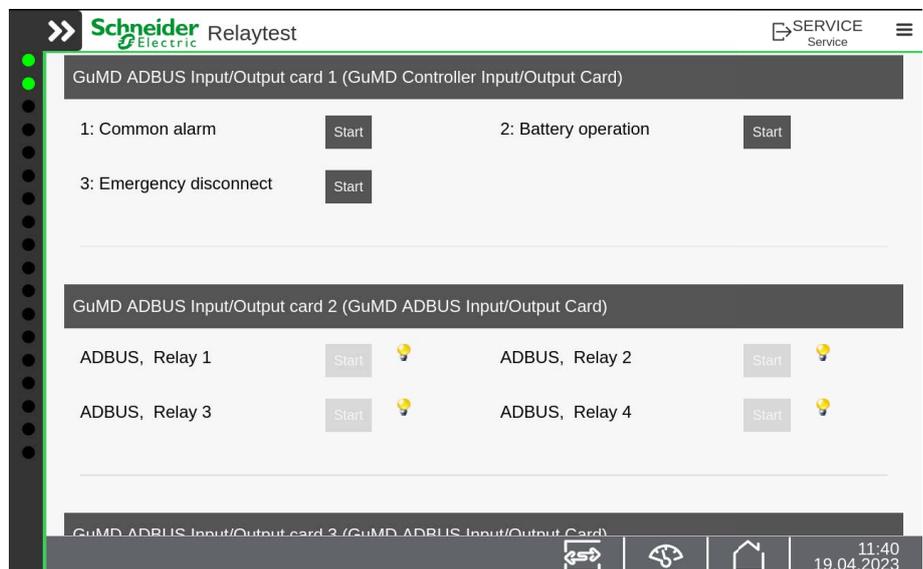
During the relay test the relay switches to its active state. Before starting make sure that it is approved to perform the test, especially if the active relay signal triggers a remote action.

IMPORTANT: If a relay is tested that opens a system breaker, like the EPO signal, the load will no longer be supplied.

1. Make sure you are logged in as a user with **Service** access.

NOTE: If you are not logged in, a prompt to login will appear when trying to change mode.
2. Press the **Main menu icon** and navigate to **Service > General > Relaytest > Relaytest**.
3. If necessary, expand the section for the input/output card to show the programmed relays.

NOTE: For more information about the relays refer to the *Drawings*.
4. Press on the **Start** button for the relay you want to test.



For a few seconds the relay will change to its active state for a short time (open if normally closed, closed if normally open). Check that the connected signal was correctly activated when the relay state changes.

Battery Tests

There are three types of battery tests. The tests can be started manually and configured to automatically start at certain interval, if allowed to start.

The battery circuit test checks that the battery is connected and ready to supply the load if the rectifier output is reduced.

The battery capacity probe is a test with a partial discharge of the battery with the actual load current as discharge current. Different requirements for the test can be specified:

- Discharge over a specific period of time.
- Discharge with a specified capacity.

NOTE: It is possible to select if only one or both criteria must be met for a successful battery test.

The battery capacity test will discharge the battery with a constant current and the rectifier will provide the remaining current needed for the load. The test will also provide an estimate of the current battery health. The test will run until the cell voltage is below a set value or the battery health is too low.

How to Start the Battery Circuit Test

Before you start the battery circuit test check:

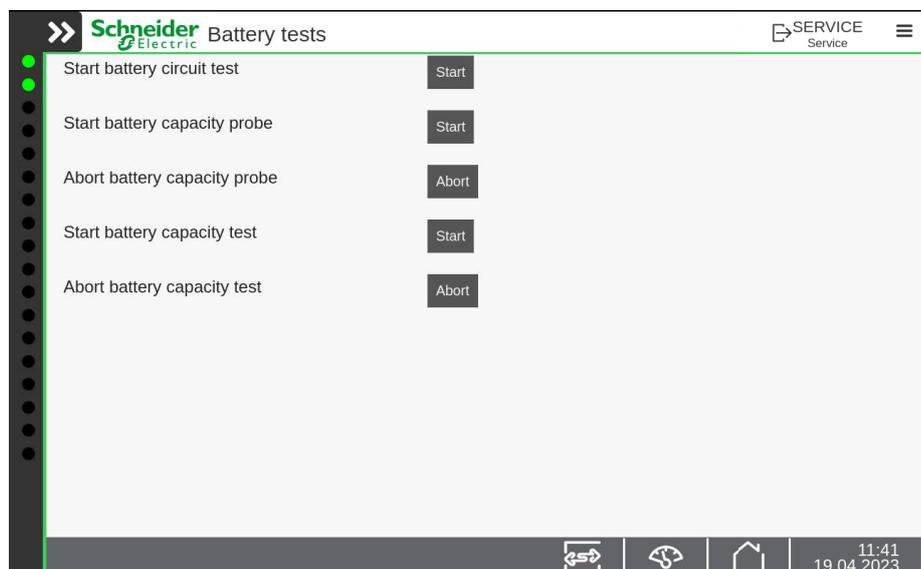
- That the settings for the test is correct.
- That the battery is connected.
- That the battery breaker is closed.
- That the rectifier modules are in float charge.

NOTE: It is not possible to start the test with the rectifier modules in boost charge (charge), equalization charge or battery operation (batterytest).

1. Make sure you are logged in as a user with **Service** access.

NOTE: If you are not logged in, a prompt to login will appear when trying to change mode.

2. Press the **Main menu icon** and navigate to **Service > Gutor Modular DC 1 > Battery tests**.
3. Press the **Start** button in line with **Start battery circuit test** to start the test.



This test does not discharge the battery, it only checks that the battery is correctly connected to the circuit.

If the voltage stays above the set voltage level for the set time, the battery circuit test is successful.

In case the voltage drops below the set voltage level at any time, the test is interrupted and considered unsuccessful.

How to Start the Battery Capacity Probe

NOTICE

LOSS OF OUTPUT VOLTAGE

After a battery test the battery is discharged or partially discharged and it may take up to 24 hours to fully recharge it again.

Make sure to coordinate and schedule the test with the responsible personnel and users of the connected consumers.

Failure to follow these instructions can result in equipment damage.

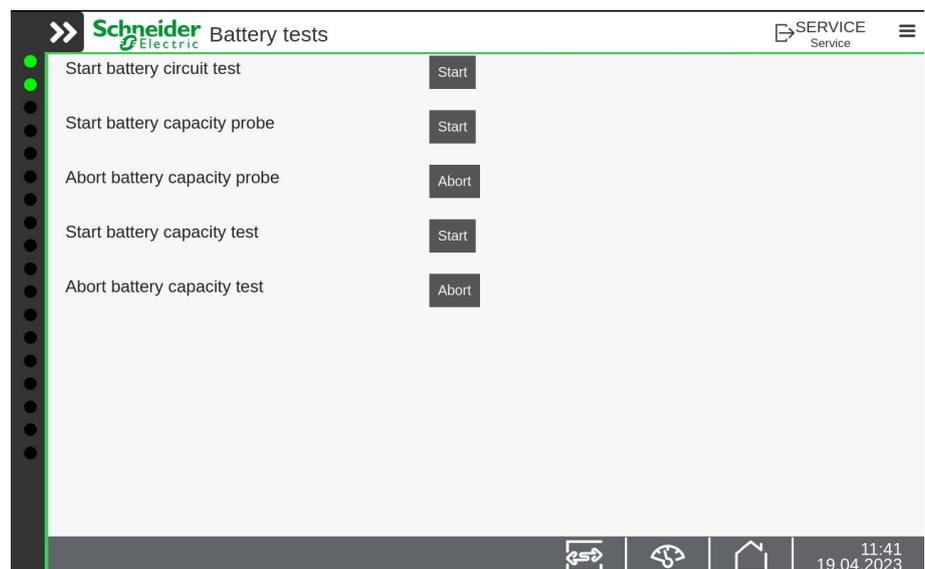
If it is not possible to start the battery test (button is gray), it could be because:

- That the duration since the last time the mains was unavailable (or the rectifier mains breaker was opened) is too short.
- That the load current is too low.
- That the battery breaker is open.
- Rectifier modules are in boost charge (charge), equalization charge or battery operation (batterytest).

1. Make sure you are logged in as a user with **Service** access.

NOTE: If you are not logged in, a prompt to login will appear when trying to change mode.

2. Press the **Main menu icon** and navigate to **Service > Gutor Modular DC 1 > Battery tests**.
3. Press the **Start** button in line with **Start battery capacity probe** to start the test.



- To end the battery test early, press the **Abort** in line with **Abort battery capacity probe**.

The test will run for the defined requirement (time or capacity) or both requirements (time and capacity), depending on the settings.

If the voltage stays above the set voltage level during the whole test, the battery test is successful.

In case the voltage drops below the set voltage level at any time, the test is interrupted and considered unsuccessful.

NOTE: Depending on the alarm configuration, an alarm might activate if a battery capacity probe is unsuccessful.

How to Start the Battery Capacity Test

NOTICE
LOSS OF OUTPUT VOLTAGE
After a battery test the battery is discharged or partially discharged and it may take up to 24 hours to fully recharge it again.
Make sure to coordinate and schedule the test with the responsible personnel and users of the connected consumers.
Failure to follow these instructions can result in equipment damage.

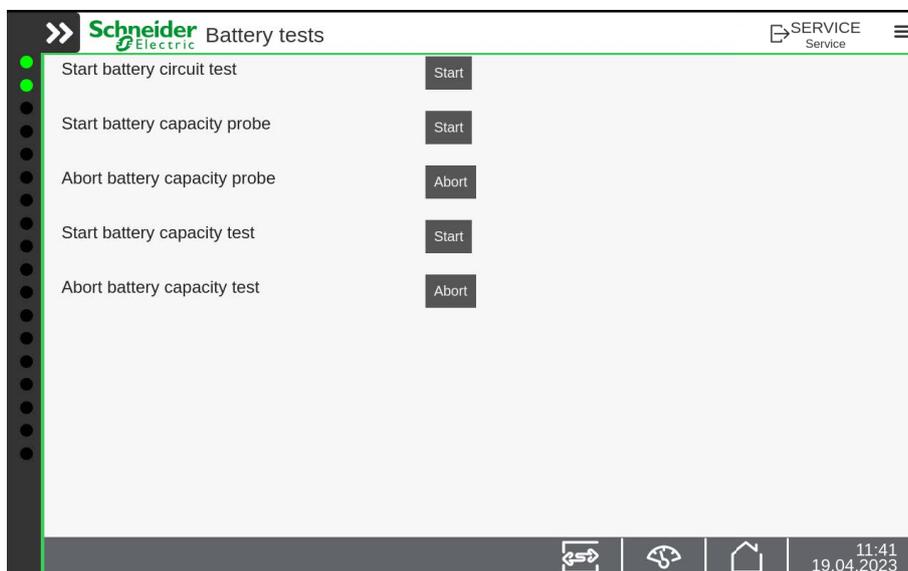
If it is not possible to start the battery test (button is gray), it could be because:

- That the duration since the last time the mains was unavailable (or the rectifier mains breaker was opened) is too short.
- The battery are not fully charged.
- That the load current is too low.
- That the battery breaker is open.

- Make sure you are logged in as a user with **Service** access.

NOTE: If you are not logged in, a prompt to login will appear when trying to change mode.

- Press the **Main menu icon** and navigate to **Service > Gutor Modular DC 1 > Battery tests**.
- Press the **Start** button in line with **Start battery capacity test** to start the test.



4. To end the battery test early, press the **Abort** in line with **Abort battery capacity test**.

The test will run until the cell voltage is below a set value or the battery health is too low.

NOTE: The first time this test is done there is not battery health to compare with, so this end criteria is only possible after the first test is completed.

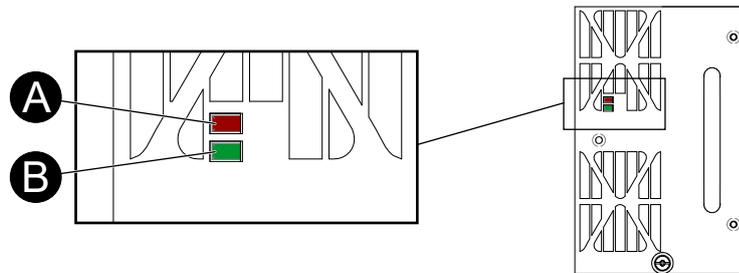
The health of the battery is calculated after the test.

Troubleshoot System

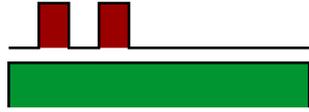
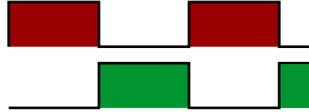
This section contains information about potential causes for activation of the different LED on the modules and the ADBUS cards.

Rectifier Module LEDs

On the front of the modules there are two LEDs. One red **(A)** and one green **(B)**. The LEDs indicate the status of the individual module.



Status	LED Description	LED Visualization
Not in operation	Red: Off Green: Off	
Initialization	Red: Flashing fast Green: Flashing fast	
Operation	Red: Off Green: On	
Standby	Red: Off Green: Flashing fast	
Module inoperable	Red: On Green: Off	
Overtoltage	Red: Flashes fast 3 times Green: Off	
Overtemperature	Red: Flashes fast 2 times Green: Off	

Status	LED Description	LED Visualization
Output out of tolerance	Red: Flashing slow Green: Off	
Fan warning	Red: Flashes fast 1 time Green: On	
Fan inoperable	Red: Flashes fast 2 times Green: On	
Mains missing	Red: Flashing slow Green: Flashing slow	

LEDs on ADBUS Cards

The ADBUS cards are optional. The available cards depend on the system configuration. For more information see *Parts List* or *Drawings*.

Input/output Card

LED Name	Color	Name Description	LED Status	Status Description
H1	Red	Transmission indicator	Briefly flashes	Normal operation.
			Flashes for long periods	No connection possible.
			On	Card inoperable, check bus communication/ connection and card address.
H2	Yellow	Receive indicator	Briefly flashes	Normal operation.
			On with brief flashes	At least one relay is de-energized (alarm).

DC measurement card

LED Name	Color	Name Description	LED Status	Status Description
H1	Red	Transmission indicator	Briefly flashes	Normal operation.
			Flashes for long periods	No connection possible.
			On	Card inoperable, check bus communication/ connection and card address.
H2	Yellow	Receive indicator	Briefly flashes	Normal operation.
			On	Temperature sensor signal missing (alarm).

AC measurement card

LED Name	Color	Name Description	LED Status	Status Description
H1	Red	Transmission indicator	Briefly flashes	Normal operation.
			Flashes for long periods	No connection possible.
			On	Card inoperable, check bus communication/ connection and card address.
H2	Yellow	Receive indicator	Briefly flashes	Normal operation.

Battery monitoring card

LED Name	Color	Name Description	LED Status	Status Description
H1	Red	Transmission indicator	Briefly flashes	Normal operation.
			Flashes for long periods	No connection possible.
			On	Card inoperable, check bus communication/ connection and card address.
H2	Yellow	Receive indicator	Briefly flashes	Normal operation.

Insulation monitoring card

LED Name	Color	Name Description	LED Status	Status Description
H1	Red	Transmission indicator	Briefly flashes	Normal operation.
			Flashes for long periods	No connection possible.
			On	Card inoperable, check bus communication/ connection and card address.
H2	Yellow	Receive indicator	Briefly flashes	Normal operation.
			On	Measuring error, measurement is outside of the tolerance range (alarm).

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