Modular Industrial DC Charger System

Gutor Modular DC Charger

Operation Manual

08/2022 Version 2

https://www.gutor.com

Schneider Electric

Legal Information

Table of Contents

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.

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.

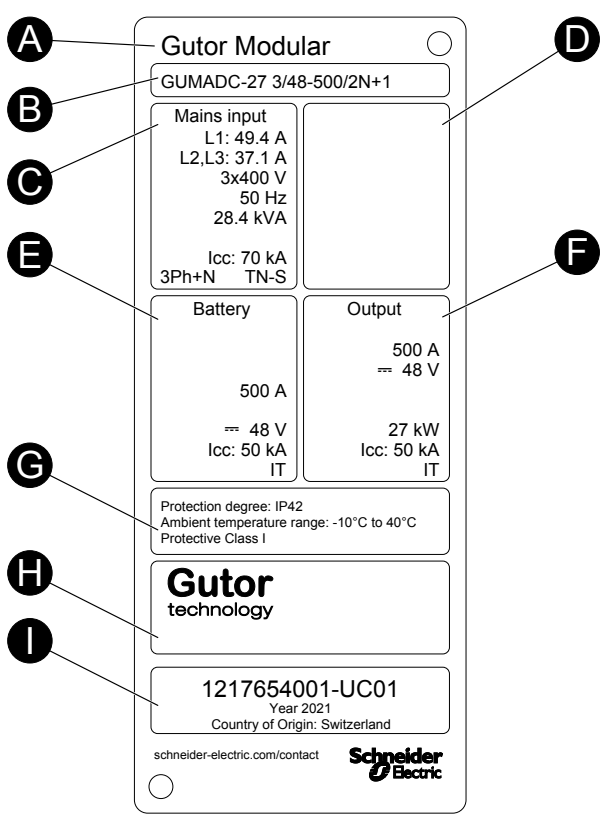
The customer specific documents *Single Line Diagram*, *Technical Data*, and *Drawings* are often referred to. It is required that you are familiar with the configuration of the system before installing, operating or performing maintenance on the system.

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



(A) System type

(B) System type designation

(C) Mains input values

(D) (Not used)

(E) Battery values

(F) Output values

(G) Protection degree and ambient temperature range

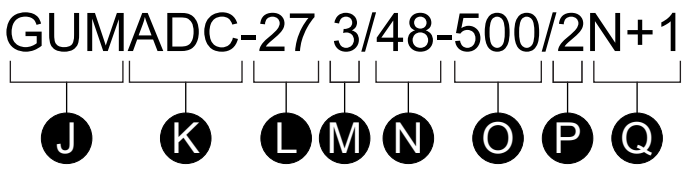
(H) Place for certification/conformity mark (e.g. CE, EAC, UL)

(I) Unique identifier and manufacturing information:

- Gutor project number
- System serial number
- Transport unit number
- Year of manufacturing
- Country of origin / Country of manufacturing

System Type Designation

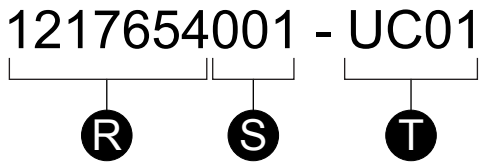
The top section **(B)** of the rating plate contains the system type designation. The system type designation contains information about the system configuration.



Position	Description	Options
(J)	**Gu**tor **M**odular	Always GUM for all Gutor Modular systems
(K)	System type	**ADC** – Rectifier system, **A**C 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 system inputs	**None** – One input **2** – Two inputs, also called dual input
(Q)	Module configuration	**None** – No 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** – Fully redundant

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.



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

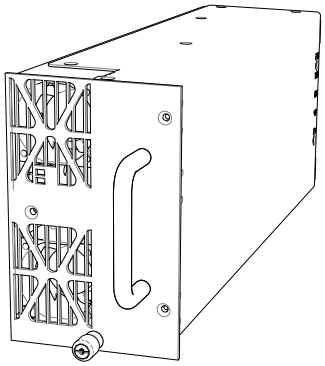
The compact power module contains all the internal components for the power supply or converter system. No other external power components are required or recommended, but some options exist to cover special requirements.

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 output voltage levels are available: 24, 48, 60, 110/125 and 220 V DC.



DC Module Coding

⚠⚠DANGER

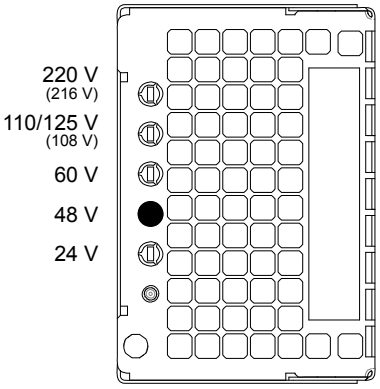
HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

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 voltage. On the back of the module there are five circles that indicate the different DC voltages. The position of the hole indicates the voltage DC voltage of the module. The hole 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. The N + 0, N + 1 and N + x have the same configuration and use the same input source. For the 2N configuration two independent input sources are required.

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.

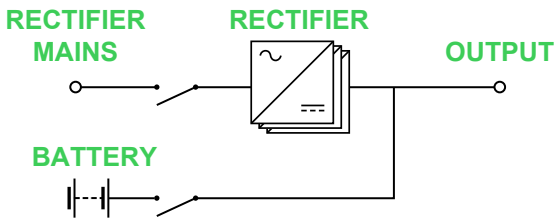
N + 1 Configuration

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

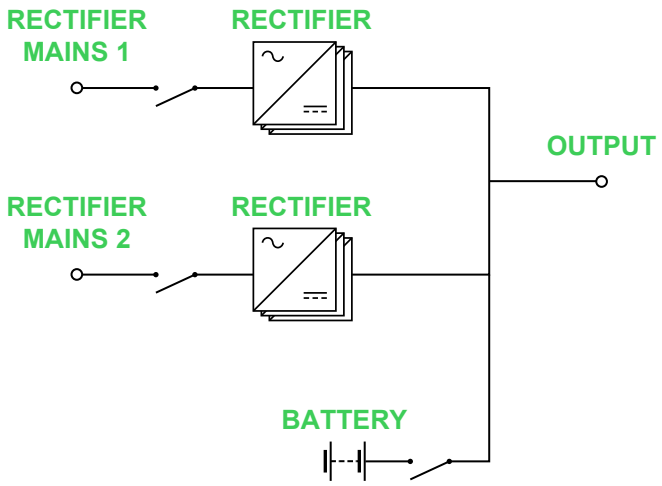


Module Configuration for 2N (Dual Input)

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 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
- Others on request

Emergency Power Off

⚠⚠DANGER

ENERGIZED BY EXTERNAL POWER SOURCES

When emergency power off (EPO) is activated, the rectifier modules no longer supply the load. The load and system are still energized by the batteries (unless the battery breaker is also tripped by the EPO).

Hazardous voltages are still present at some circuits, terminals and switches even when the EPO is activated (unless disconnected from the upstream supply 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.

- **EPO in a Gutor Modular DC Charger with internal battery:** The EPO will switch off the modules and trip the internal battery breaker.
- **EPO in a Gutor Modular DC Charger with external battery:** The EPO will switch off the modules. The disconnection of the external batteries needs to be handled by the customer.

  NOTE: Optionally, with external batteries the internal battery breaker (if installed) can be selected to trip if the EPO is activated.

How to Reset the System After EPO

If the modules have been turned off by an emergency power off (EPO) signal the modules need to be reset via the display.

1. Make sure that the EPO signal is no longer active.
2. Make sure you are logged in as a user with **Owner** access.
3. Press the **Settings icon** and navigate to **Service > General > Remote Control > Remote Control**.
4. Press the **Emergency switch RESET** button.
5. After a few seconds the modules will start up and supplies voltage.
6. If the battery breaker is wired to be tripped by the EPO, the battery breaker needs to be closed.

Functionality of Optional Selections

When configuring a system there are some selections that are optional 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, that 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.

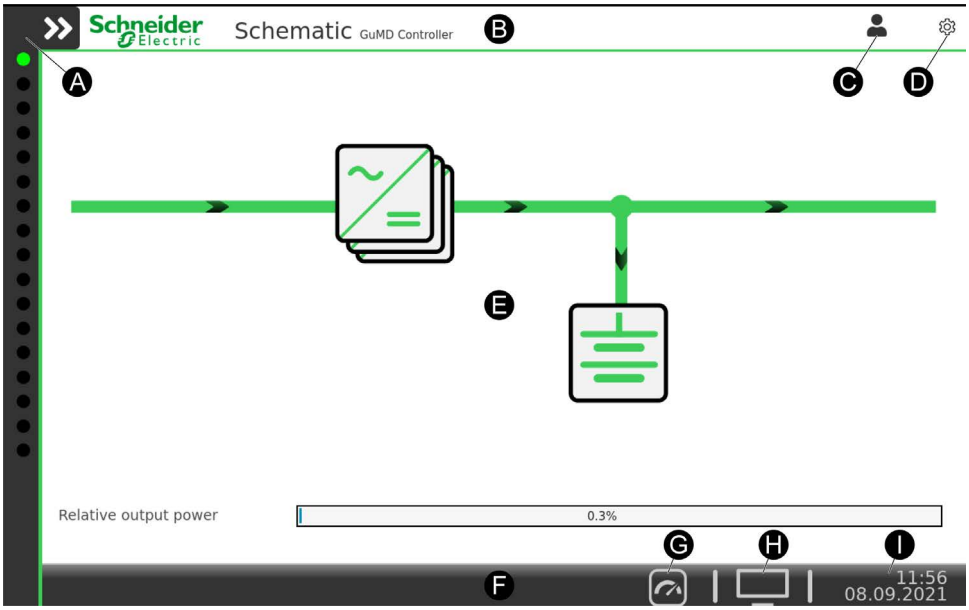
Any Gutor system with a battery can use the G.BMS solution since it is installed separately from the system. The G.BMS solution can also be installed on already existing batteries.

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 **Settings icon** for the main menu and the **User icon** or the **Username**. If a buzzer alarm is active a **Mute icon** is also shown.

(C) User icon / **Username**: If no one is logged in the **User icon** is shown. Press the **User icon** to login. If a user is logged in the username and access level will be displayed.

(D) Settings icon: Press to show the main menu options. Press a menu option to navigate to the page. To hide the main menu press at the top of the bar, anywhere outside the main menu or wait 10 seconds.

(E) Content area: Shows the information on the current page. From the **Home 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) Measurements icon: Press to enter the **System measured values** page that shows voltage, current and output power measurements.

(H) 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.

(I) Date and time: Shows the current date and time. Press to enter the **Date and time** menu.

Display Navigation

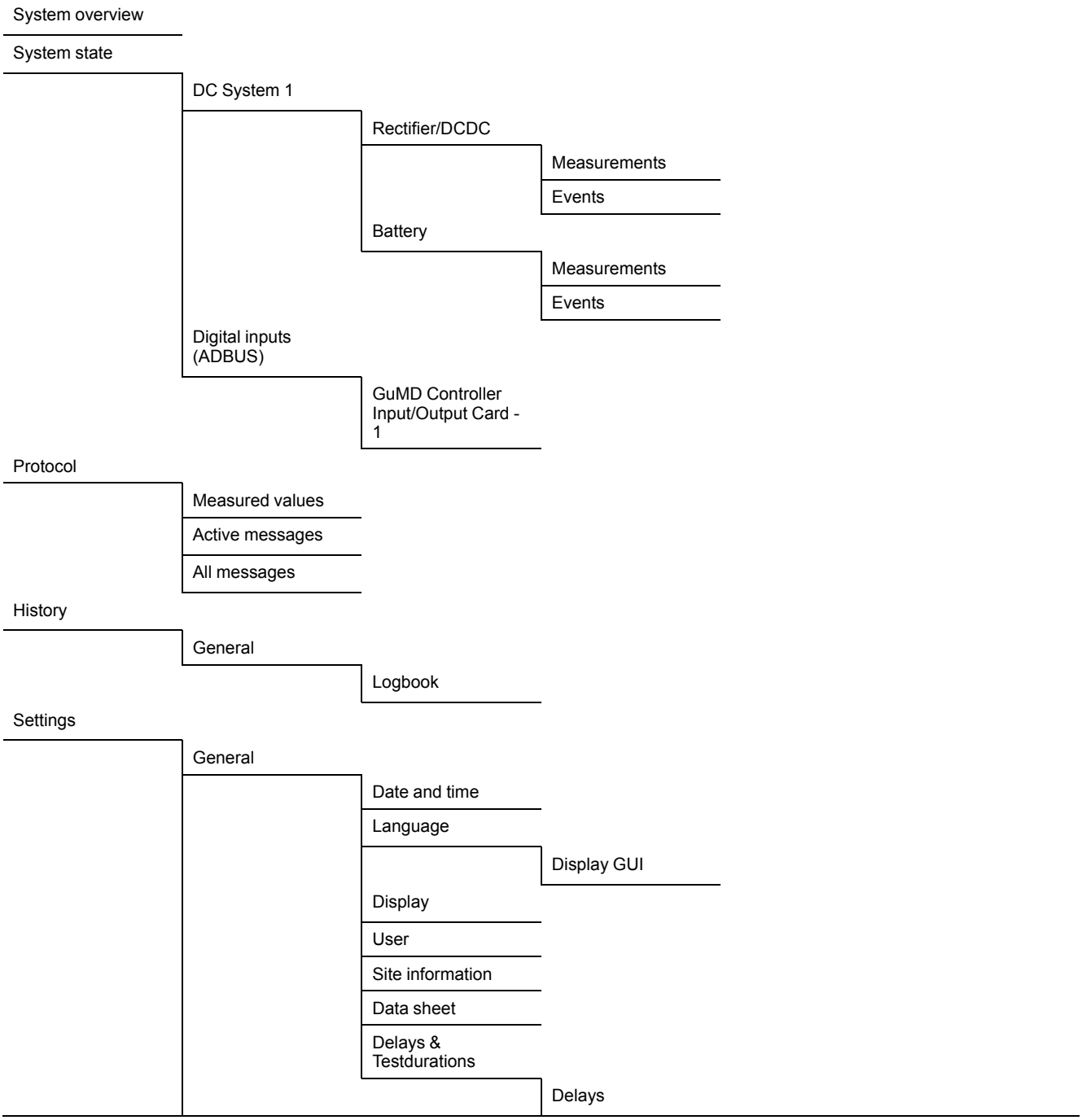
Some content in the display is adaptive and will show the most relevant information depending on the current system status.

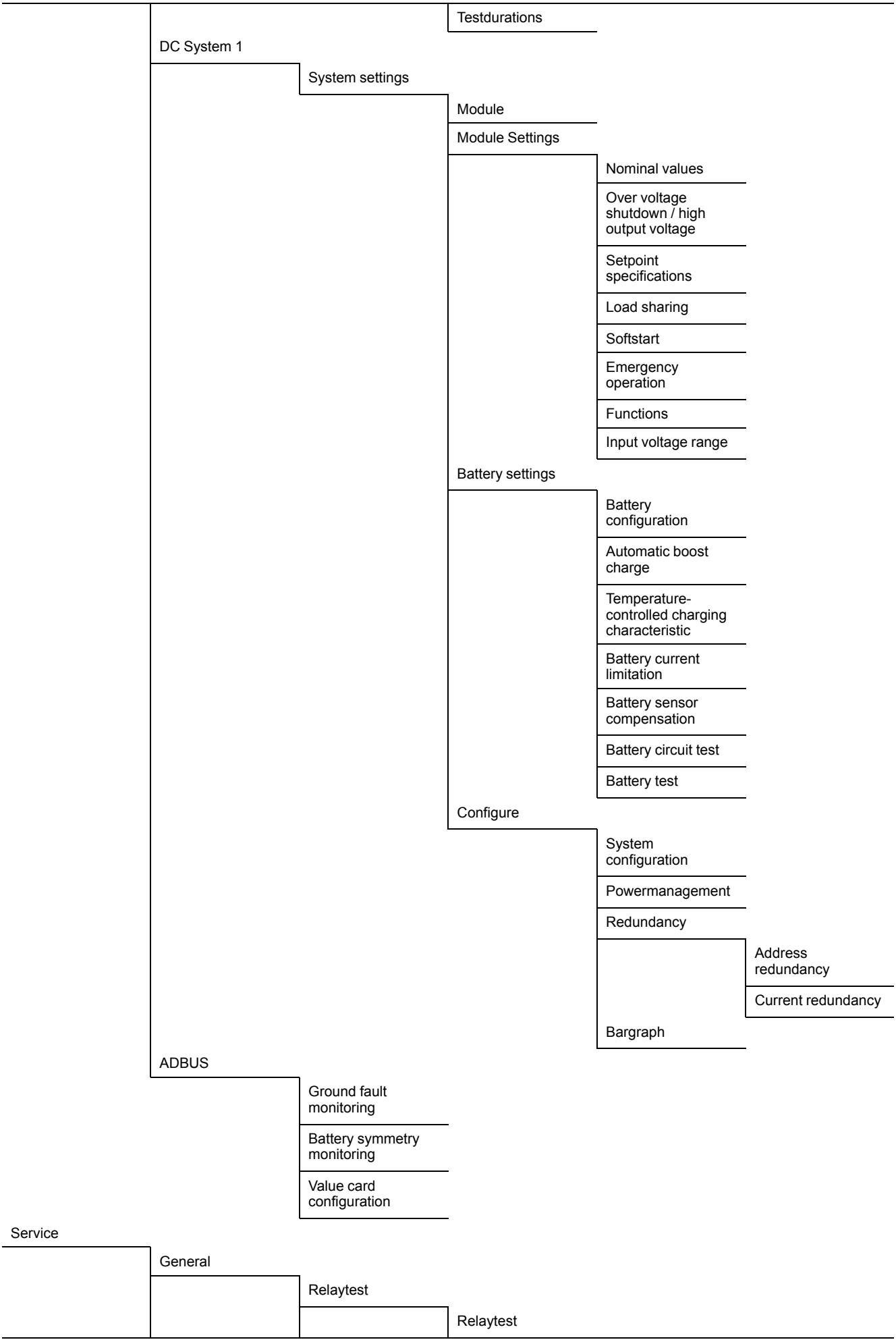
To navigate the display it is possible to:

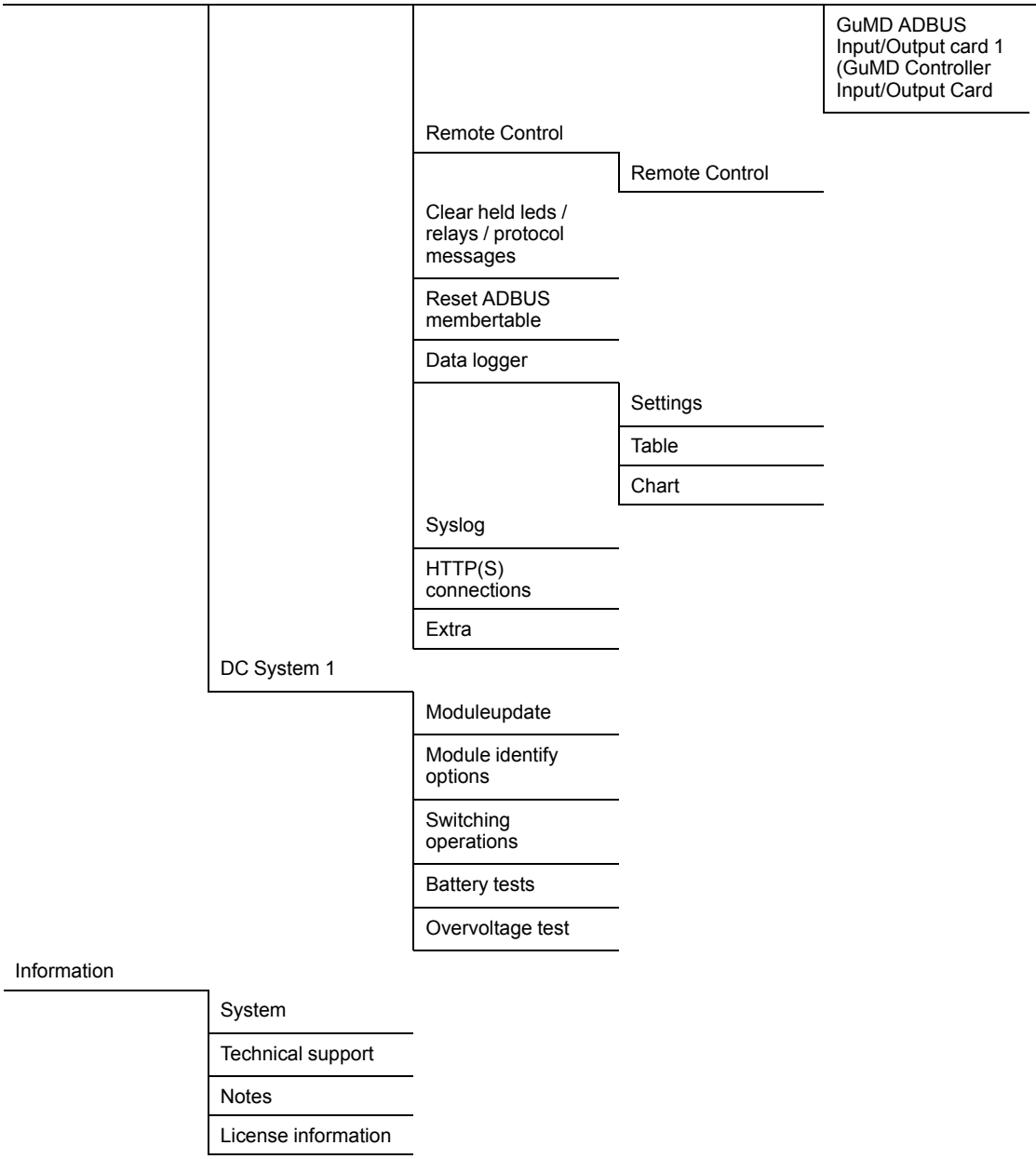
- Press icons to open pages.
- Press the gray bars to maximize/minimize content on a page.
- Scroll on a page or in a content window.
- Use the **Home icon** to return to the home screen.

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.




Testdurations
DC System 1
System settings
Module
Module Settings
Nominal values
Over voltage shutdown / high output voltage
Setpoint specifications
Load sharing
Softstart
Emergency operation
Functions
Input voltage range
Battery settings
Battery configuration
Automatic boost charge
Temperature-controlled charging characteristic
Battery current limitation
Battery sensor compensation
Battery circuit test
Battery test
Configure
System configuration
Powermanagement
Redundancy
Address redundancy
Current redundancy
Bargraph
ADBUS
Ground fault monitoring
Battery symmetry monitoring
Value card configuration
Service
General
Relaytest
Relaytest


GuMD ADBUS Input/Output card 1 (GuMD Controller Input/Output Card
Remote Control
Remote Control
Clear held leds / relays / protocol messages
Reset ADBUS membertable
Data logger
Settings
Table
Chart
Syslog
HTTP(S) connections
Extra
DC System 1
Moduleupdate
Module identify options
Switching operations
Battery tests
Overvoltage test
Information
System
Technical support
Notes
License information

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. Can also modify some general information like date, time, language and site information.
- **Service**: Can view and modify system settings, change operation modes 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.

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

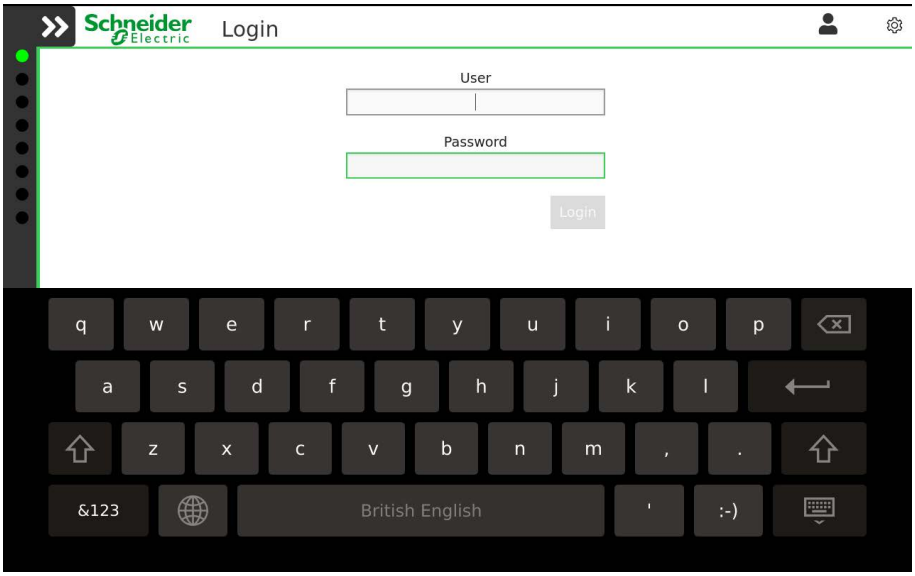
Access Level	Default Username	Default Password
Viewer	—	—
Owner	OWNER	OWNER
Service	SERVICE	SERVICE

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 **User icon** in the top left corner of the **Header bar**.
   – Press the **Settings 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 with a **Service** user.
2. Press the **Settings 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.

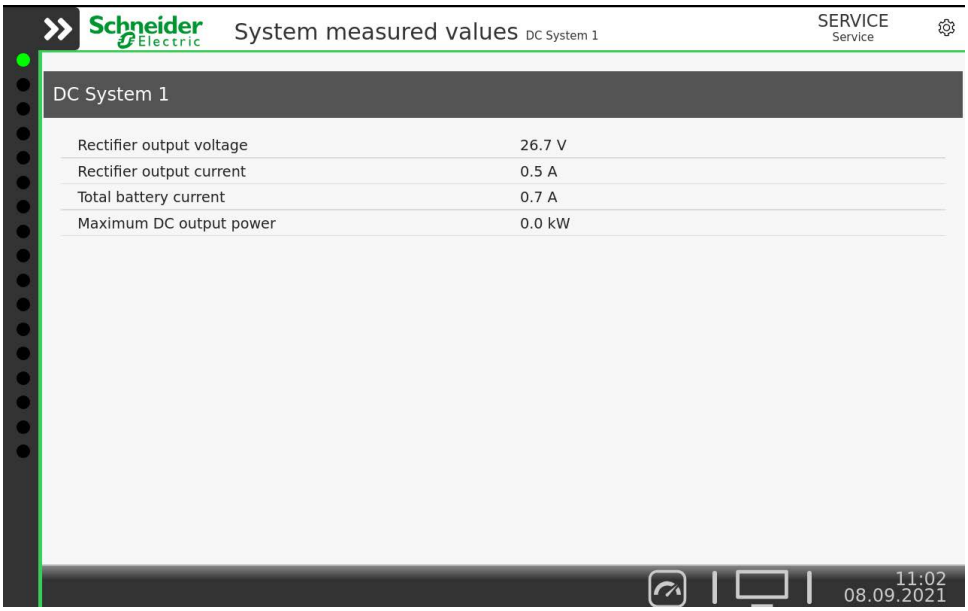
Measurements in the Display

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

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

System Measured Values

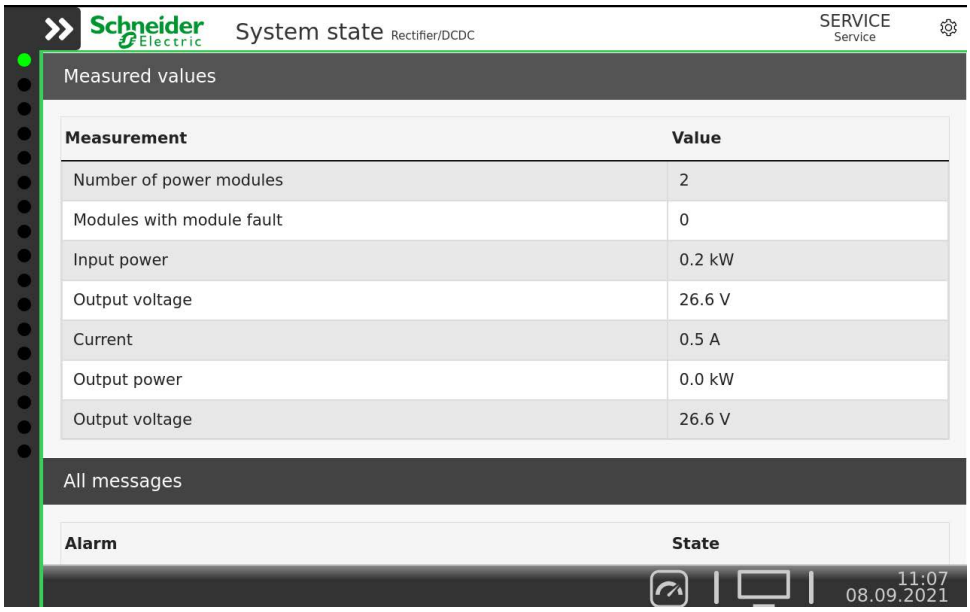
To view the **System measured values** click on **Measurement icon** in the **Status bar** at the bottom of the screen.



System State (Modules)

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

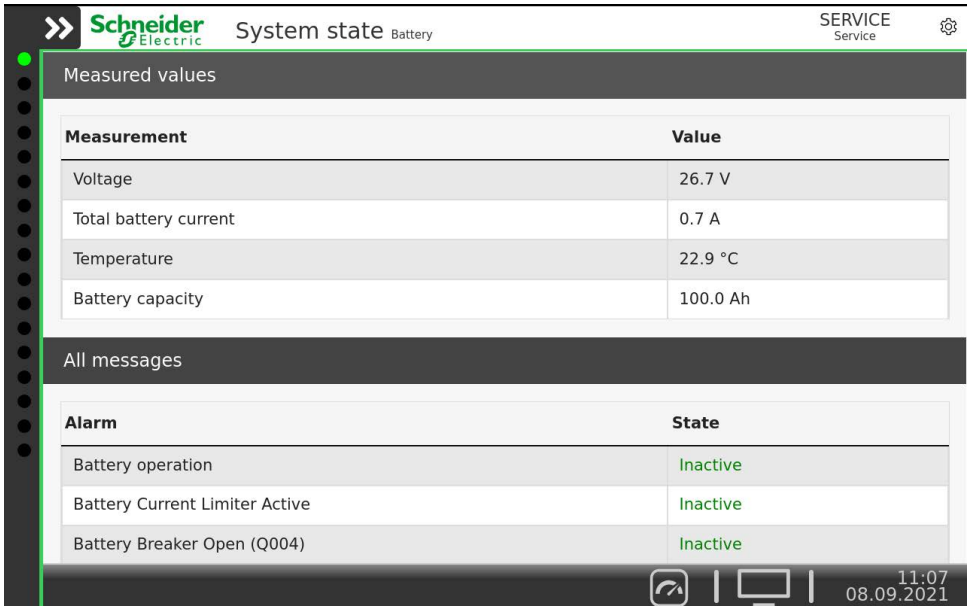
- Click on the **Rectifier modules icon** on the home screen.
- Navigating to **System state > DC System 1 > Rectifier/DCDC**.



System State (Batteries)

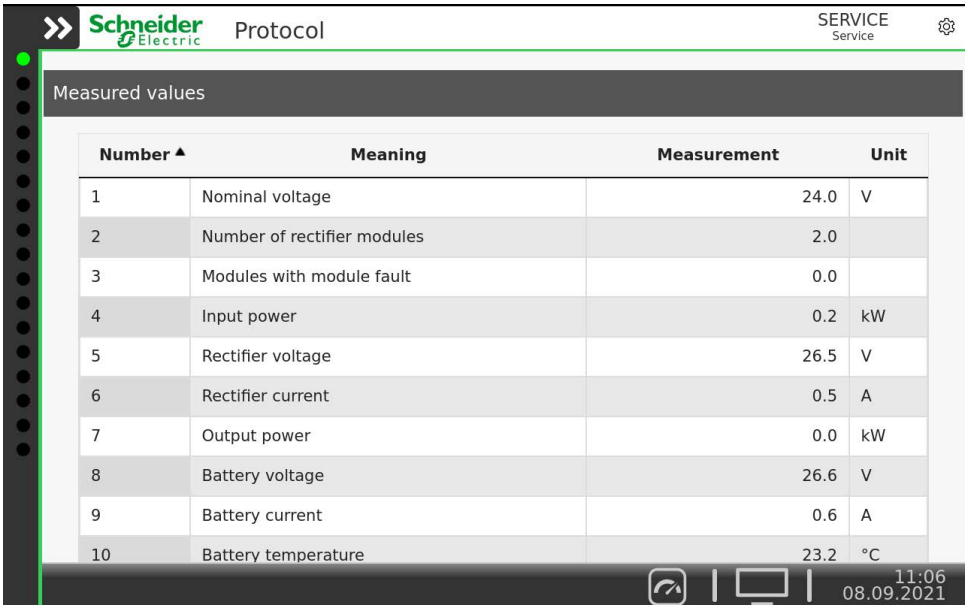
To view the **Measured values** for the battery it is possible to either:

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



Measured Values (Protocol)

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



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

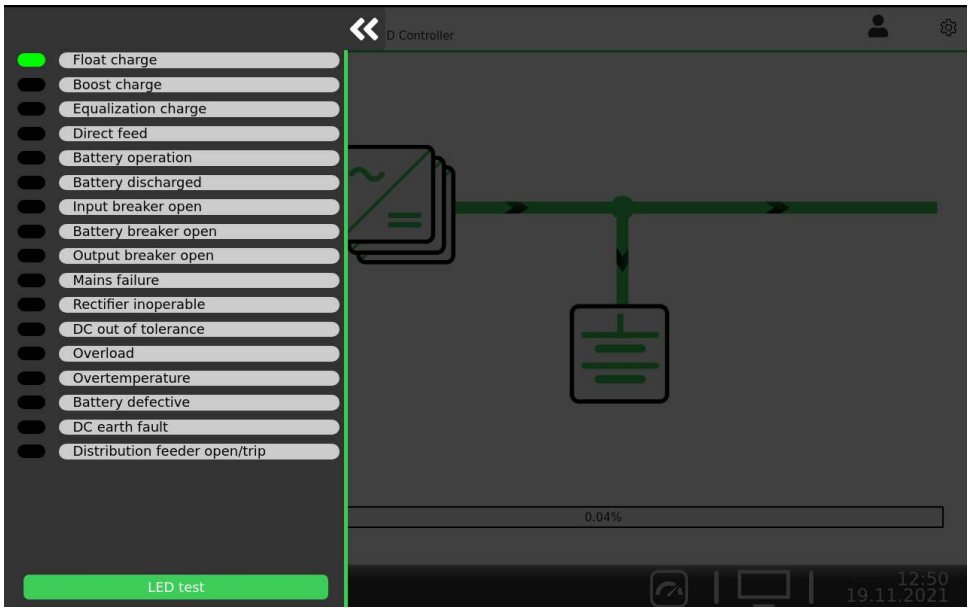
From the message list, a customized selection of indications and alarms will be visible as LEDs in the virtual LED bar. It is also possible to customize if any LED should be held until they are manually reset.

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.

Severity classification:

Critical: A critical alarm exists, which requires immediate action and will cause damage if it is not addressed.

Warning: An alarm condition requires attention and could cause damage if it is not addressed.

Information: An alarm to provide information. The system is operating normally.

NOTE: The severity is based on the system and does not necessary reflect the severity for the system application.

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

NOTE: User login with **Service** access level is needed to view the protocol page.

Message Name	Severity	Description
General		
Urgent alarm	Critical	One or more urgent alarms are present.
Non-urgent alarm	Warning	One or more non urgent alarms are present.
Common alarm	Critical	One or more alarms that are configured for the common alarm are present.[1]
Operation Mode		
Float charge	Indication	The rectifier float charge mode is active.
Charge (Boost charge)	Indication	The rectifier boost charge mode is active. The rectifier DC output voltage is higher than float charge voltage.
Equalizing charge	Warning	The rectifier equalizing charge mode is active. The rectifier DC output voltage is higher than float and boost charge voltage.
Direct feed	Warning	The rectifier direct feed mode is active. Battery might not be charged anymore.
Battery operation	Warning	The batteries are being discharged to supply the load.
Breaker Status		
Mains circuit breaker open	Critical	The input breaker is open.
Battery circuit breaker open	Critical	The internal battery breaker and/or the external battery breaker is open.
Output mcb tripped	Critical	The output breaker is open.
Surge voltage prot. tripped	Warning	The AC input surge arrester has tripped.
Input breaker trip or off	Critical	One or more individual module input breakers has tripped.
Distribution fault	Warning	One or more outgoing feeders in the system or in an external distribution has tripped

1. The common alarm is mainly intended to be used for external signals.

Message Name	Severity	Description
Mains circuit breaker open[2]	Critical	The input breaker and/or the dual input breaker is open.
Rectifier Mains		
Mains voltage out of range	Warning	The rectifier mains input is out of tolerance. Depending on the cause the modules might not run.
Mains error	Warning	The rectifier mains input is not available. The modules cannot operate.
Modules / Output		
Module fault	Warning/ Critical[3]	One or more modules are inoperable.
Fan fault	Warning	At least one of the fans is rotating too slowly or is inoperable.
Device temperature high	Warning	One or more rectifier modules are above the high temperature level.
Converter overtemperature shutdown	Critical	One or more rectifier modules are above the temperature shutdown level. The modules will run with reduced output power.
Output voltage out of range	Critical	The output voltage is above or below the tolerance level.
Converter overvoltage shutdown	Critical	One or more modules switched OFF because of too high output voltage.[4]
Output power warning	Warning	One or more rectifier modules have reached power limitation (modules are overloaded).
Current limiting	Warning	One or more rectifier modules have reached current limitation (modules are overloaded).
Battery		
Earth fault plus circuit	Warning	Leakage current from the positive pole detected.
Earth fault minus circuit	Warning	Leakage current from the negative pole detected.
Battery current limitation active	Indication	The battery charging current has reached its maximum limit. The rectifier will regulate the DC output current to not overcharge the batteries with a too high charging current.
Battery test	Indication	The battery test is running.
Battery test error	Critical	The battery is discharged or weak. The battery is unable to supply the DC load in case of an AC failure.
Battery test not allowed	Indication	The conditions to start the battery test is not meet.
Battery circuit test failed	Critical	The battery is discharged, weak or not correctly connected. The battery is unable to supply the DC load in case of an AC failure.
Battery circuit test blocked	Indication	The conditions to start the battery circuit test is not meet.
Temperature sensor fault	Warning	No signal available from the temperature sensor.
Output voltage high	Warning	The system output voltage is above the set high voltage level.
DC voltage low	Warning	The DC voltage is below the set low voltage level.
Battery exhaustive discharged	Critical	The battery is discharged. The connection between the battery and the load must be opened to avoid permanent damage to the battery.

2. The same alarm message name is used for both breakers in a 2N system.
3. If the system is configured with at least one redundant module action is not required immediately.
4. The red LED will flash fast 3 times.

Message Name	Severity	Description
Redundancy and Blocks		
Current redundancy error	Critical	Only for redundant N+x and N+N module configurations. The redundancy is currently not available because of some inoperable modules. (Calculated based on output current).
Address redundancy error	Critical	Only for redundant N+x and N+N module configurations. The redundancy is currently not available because of some inoperable modules. (Calculated based on number of modules).
Address redundancy warning	Warning	Only for redundant N+x and N+N module configurations. The redundancy is currently reduced because of some inoperable modules. (Calculated based on number of modules).
Boost charging blocked	Indication	Boost charge mode is blocked. The mode can be blocked by an external/internal signal.
Equalize charging blocked	Indication	Equalizing charge mode is blocked. The mode can be blocked by an external/internal signal.

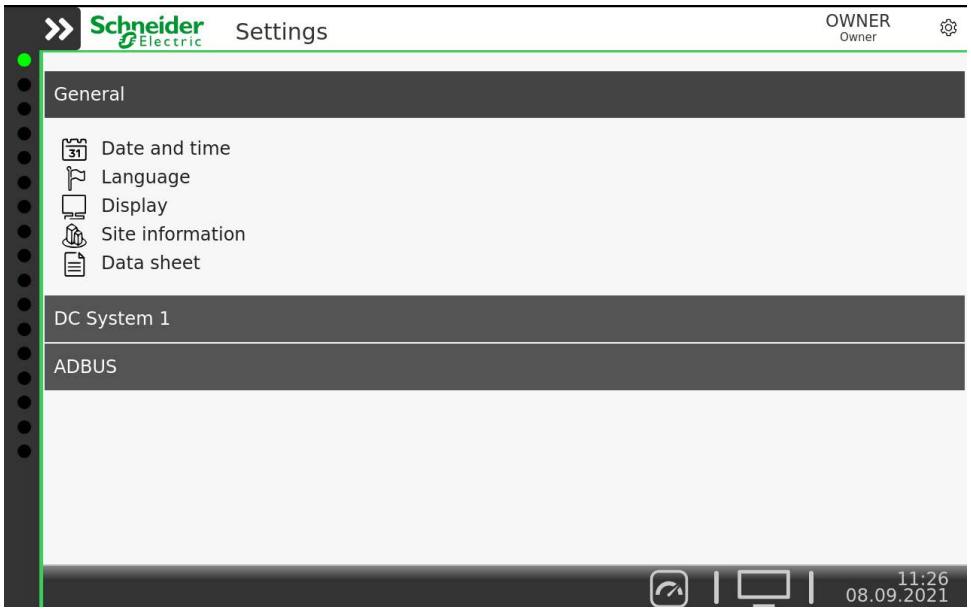
General Settings

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

Press the **Settings icon** and navigate to **Settings > General**. The pages that can be accessed for 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.
- **Site information**: Information about the system owner's site.
- **Data sheet**: General data about the system.

NOTE: User login with **Owner** access level or higher is needed to change the general settings.



Operation 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.

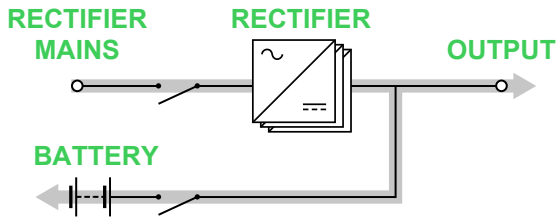
For more information about each operation mode and system state see the sections:

- Float Charge, page 31
- Boost Charge, page 32
- Equalizing Charge, page 33
- Battery Operation, page 34
- Emergency Operation, page 35
- Off, page 35
- 2N Configuration with One of the Rectifier Mains Unavailable, page 36

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 load and charge the battery. In case the mains input supply is unavailable, the battery supplies the load.



Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier mains breaker	Closed
Rectifier modules	Supplying float voltage to the battery and the load
Battery	Available / Charging
Battery breaker	Closed
Output	Available and within the tolerance range. The load is supplied.

Boost Charge

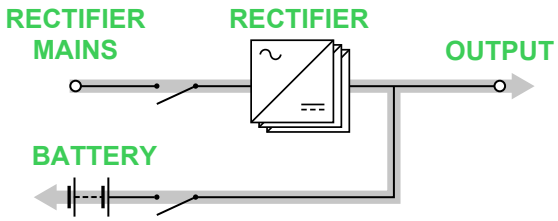
NOTICE
HIGH OUTPUT VOLTAGE Before you change to boost charge mode: • Make sure the boost charge voltage level does not damage the load. • For critical or sensitive loads always check the boost charge settings. • If necessary, disconnect the load. **Failure to follow these instructions can result in equipment damage.**

Boost 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 load and charge the battery but at a higher voltage. In case the mains input supply is unavailable, the battery will supply the load.

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 mains breaker	Closed
Rectifier modules	Supplying boost voltage to the battery and the load.
Battery	Available / Charging
Battery breaker	Closed
Output	Available and the load is supplied if the load is approved for the higher voltage, else disconnected to protect the load.

Equalizing Charge

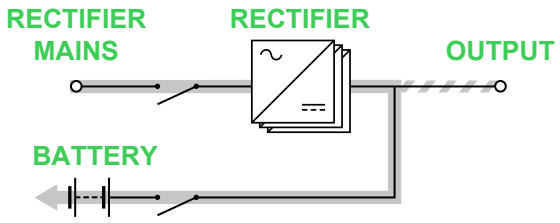
NOTICE
HIGH OUTPUT VOLTAGE Before you change to equalizing charge mode: • Make sure the equalizing charge voltage level does not damage the load. • For critical or sensitive loads always check the equalizing charge settings. • If necessary, disconnect the load. **Failure to follow these instructions can result in equipment damage.**

Equalizing charge mode uses a high output voltage to overcharge the battery, to for example help remove sulfate crystals, as part of maintenance for the battery.

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

NOTE: Equalizing charge can only be activated manually.

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



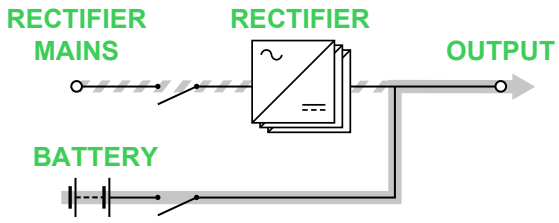
Part	Status
Rectifier mains	Available and within the tolerance range.
Rectifier mains breaker	Closed
Rectifier modules	Running at a higher voltage setting to intentionally overcharge and condition the batteries.
Battery	Charging at a higher volt.
Battery breaker	Closed
Output	Available and the load is supplied if the load is approved for the higher voltage, else disconnected to protect the load.

Battery Operation

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 the battery is being discharged to supply the load. The system switches to battery operation in case the mains supply becomes unavailable. It is also possible to manually switch to battery operation.

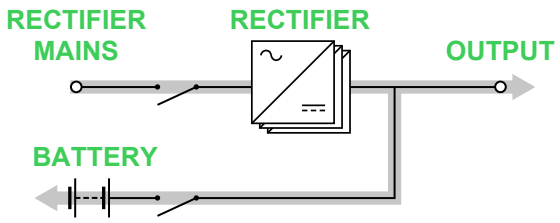


Part	Status
Rectifier mains	Unavailable and/or outside the tolerance range.
Rectifier mains breaker	Closed
Rectifier modules	Ready to operate when the mains return.
Battery	Discharging and supplying the load.
Battery breaker	Closed
Output	Available and within the tolerance range. The load is supplied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

Emergency Operation

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

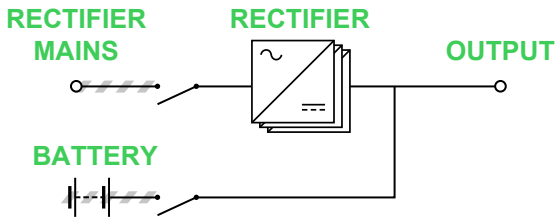
The parameters for emergency operation are pre-configured and cannot be changed. The set voltage level depends on the modules, for the value see the *Technical Data*.



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

Off

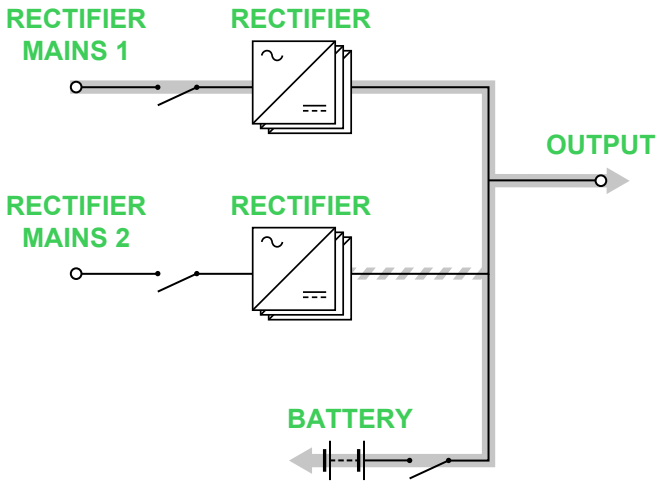
The system is turned off and the battery is disconnected.



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

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 suppling the load. The other half is ready to operate when the unavailable rectifier mains return.
Battery	Available / Charging
Battery breaker	Closed
Output	Available and within the tolerance range. The load is supplied.

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 37
- How to Turn Off the System, page 38
- Change Operation Mode, page 39

How to Turn On the System

IMPORTANT: The modules will start to run as soon as the input supply is available. When the modules run the rectifier output 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.

1. Check that all main breakers and module switches are open and that the load is disconnected.
2. Close the rectifier mains breaker(s). The **Display** starts and after a few moments and shows the **Home screen**.

   NOTE: If active, turn of 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 the **Display** has not started, check that the internal PSU switches are closed.
3. If available, close all the rectifier module input switches.
4. Check that all rectifier modules have started up. Check that the green LED is illuminated on all rectifier modules, and that no red LED is illuminated or flashing.
5. 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*.
6. Close the battery breaker(s).
7. Press the **Double arrow icon** and check that no alarms are active, except for any open output breaker or output feeders.
8. If available, close the output breaker(s) and any output feeders.
9. If needed, reset any held alarms. Press the **Double arrow icon** and then press the **Reset held alarms** button.
10. 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. 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.

1. If available, open the output breaker(s) and any output feeders.

   NOTE: If active, turn of 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.

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

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

Change Operation Mode

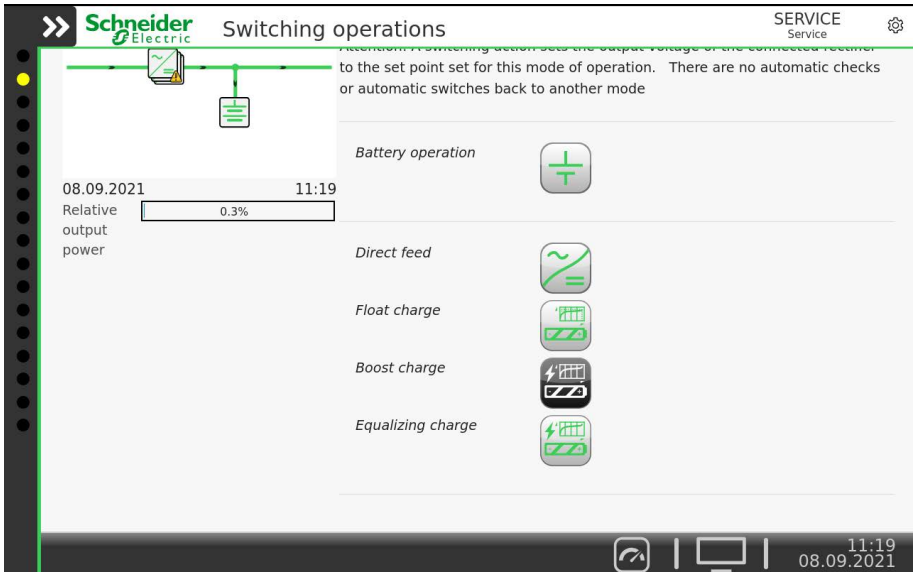
A user login with **Service** access is required to change operation mode manually.

- How to Change to Battery Operation, page 41
- How to Change to Float Charge, page 39
- How to Change to Boost Charge, page 40
- How to Change to Direct Feed, page 42
- How to Change to Equalizing Charge, page 43

How to Change to Float Charge

1. Make sure you are logged in as a user with **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Switching operations**.
3. Press the **Float charge** button.

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



4. Confirm the change.

The system has changed to float charge.

How to Change to Boost Charge

NOTICE

HIGH OUTPUT VOLTAGE

Before you change to boost charge mode:

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

Failure to follow these instructions can result in equipment damage.

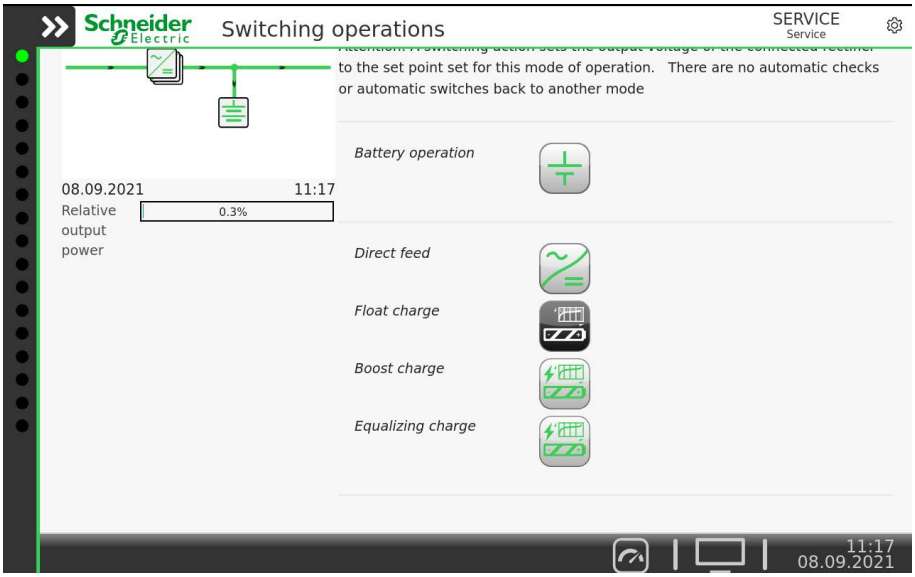
To check the boost charge settings for your system, refer to the *Data sheet*.

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 **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Switching operations**.
3. Press the **Boost charge** button.

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



4. Confirm the change.

The system has changed to boost charge. The system will automatically switch back to float charge when the configured duration for boost charge has elapsed.

How to Change to Battery Operation

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.**

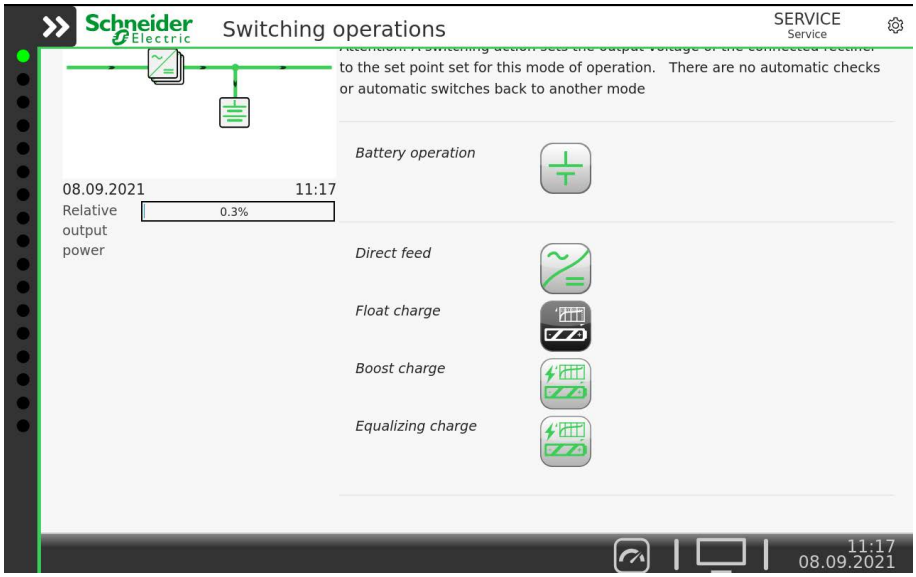
NOTICE
LOSS OF OUTPUT VOLTAGE After battery operation the battery is discharged it may take several hours to recharge the battery. Recharge duration depends on battery data and state of charge. **Failure to follow these instructions can result in equipment damage.**

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 **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Switching operations**.
3. Press the **Battery operation** button.

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



4. Confirm the change.

The system has changed to battery operation. When battery operation is manually enabled the system will not automatically switch back to float charge.

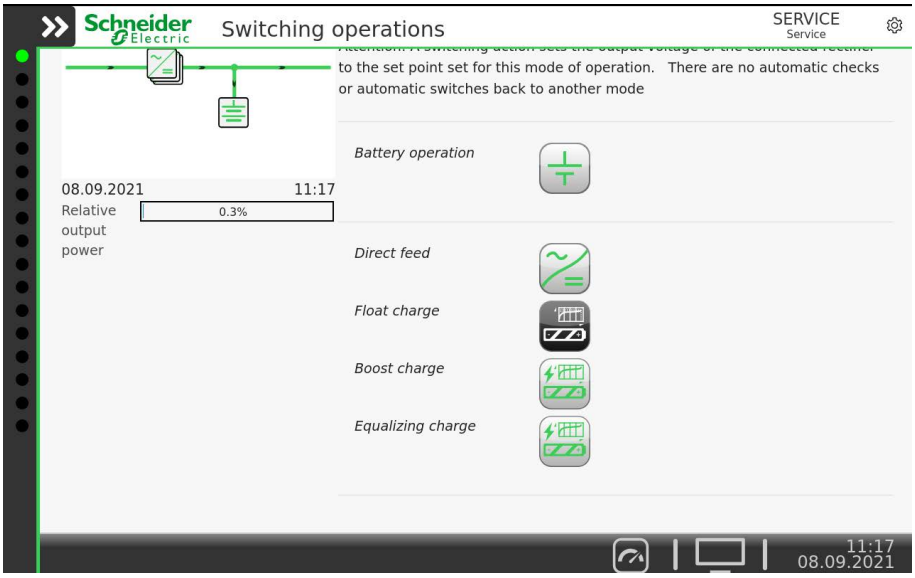
When the battery voltage has reached the reduced voltage level of the rectifier modules, the rectifier modules will take over and supply the load, but the system will still indicate that it is in battery operation. The system needs to be manually switched back to float charge.

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 **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Switching operations**.
3. Press the **Direct feed** button.

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



4. Confirm the change.

The system has changed to direct feed.

How to Change to Equalizing Charge

NOTICE
HIGH OUTPUT VOLTAGE Before you change to equalizing charge mode: • Make sure the equalizing charge voltage level does not damage the load. • For critical or sensitive loads always check the equalizing charge settings. • If necessary, disconnect the load. **Failure to follow these instructions can result in equipment damage.**

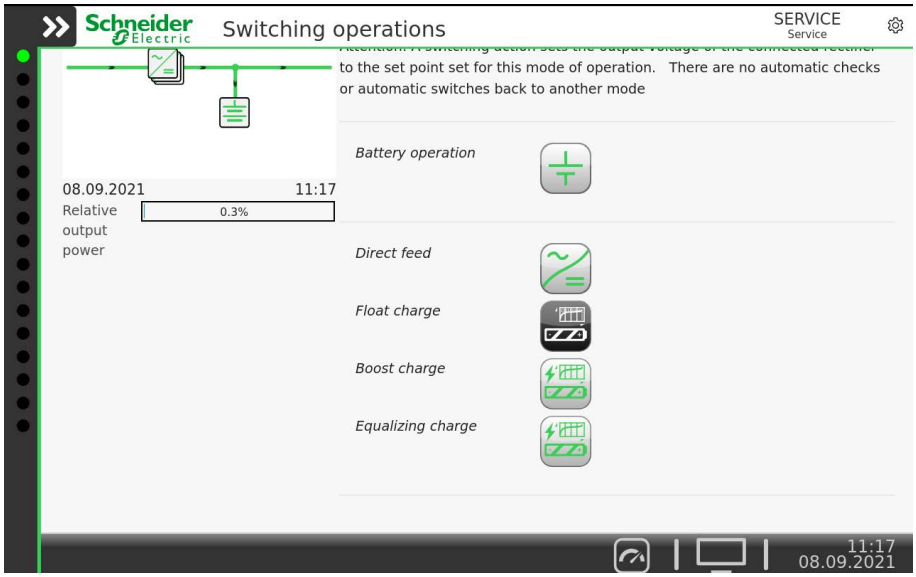
To check the equalizing charge settings for your system, refer to the *Data sheet*.

NOTE: It is possible to inhibit equalizing charge. If equalizing charge is inhibited, the rectifier modules cannot manually change to equalizing charge. Equalizing charge 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 equalizing charge.

1. Make sure you are logged in as a user with **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Switching operations**.
3. Press the **Equalizing charge** button.

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



4. Confirm the change.

The system has changed to equalizing charge. The system will automatically switch back to float charge when the configured duration for equalizing 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.

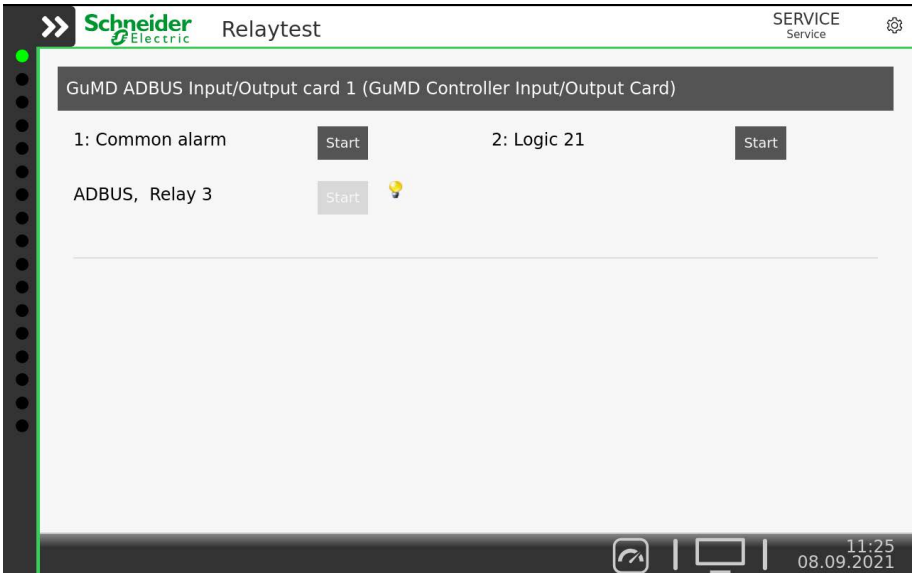
The test will illuminate all the virtual LEDs and flash the physical LED above the display for a few seconds. Check that all virtual LEDs are illuminated in their correct color and that the physical LED above the display flashes in all four colors (green, yellow, red and blue).

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 an remote action.

1. Make sure you are logged in as a user with **Service** access.
2. Press the **Settings 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 two types of battery tests. Both 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 test is a battery capacity test with a partial discharge of the battery. 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 meet for a successful battery test.

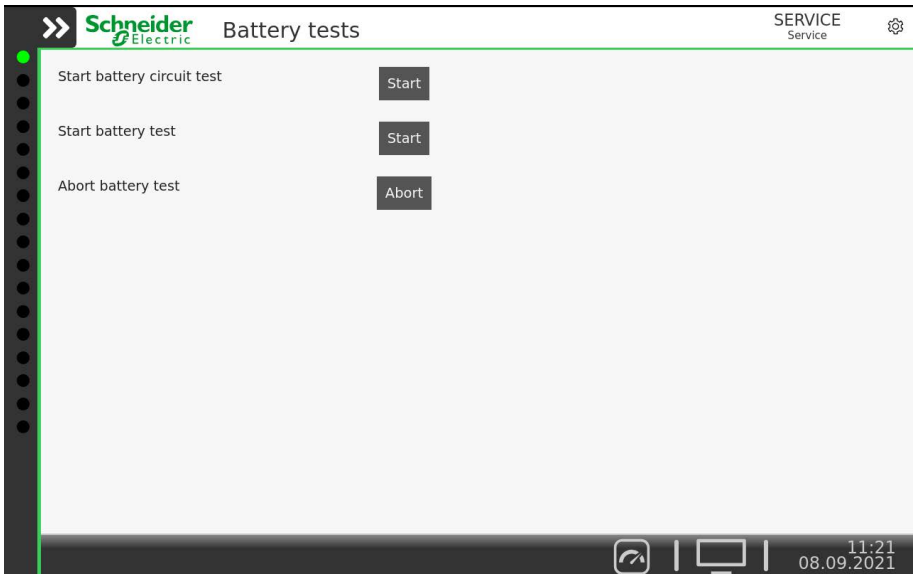
How to Start the Battery Circuit Test

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, equalizing charge or battery operation.

1. Make sure you are logged in as a user with **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 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 Test

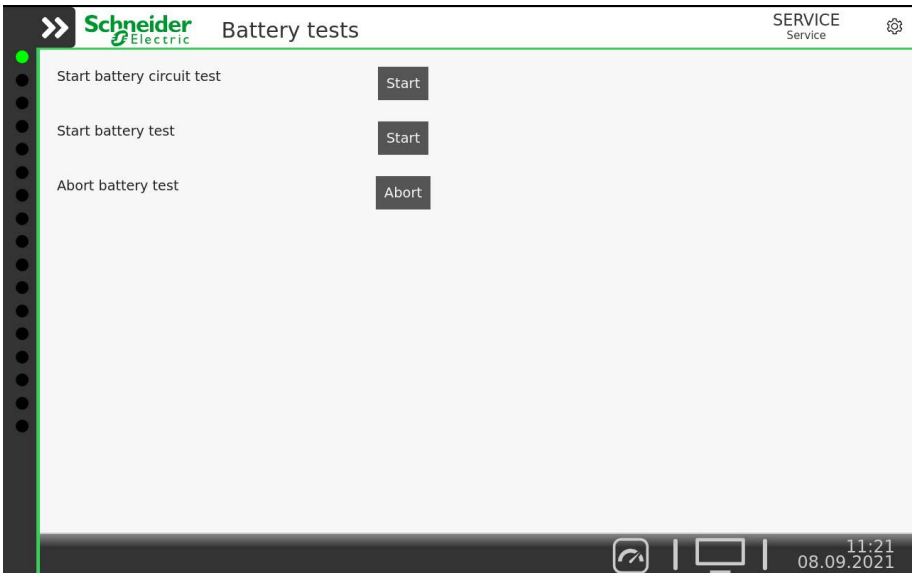
NOTICE
LOSS OF OUTPUT VOLTAGE After a battery test the battery is discharged and it may take up to 24 hours to fully recharge it again. Make sure to coordinate and schedule the test with the responsible personnel and users of the connected consumers. **Failure to follow these instructions can result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

Before you start the battery test check:

- That the settings for the test is correct.
- That the battery is connected.
- That the battery breaker is closed.
- That a DC load equal to the nominal load is connected.
- That the duration since the last time the mains was unavailable (or the rectifier mains breaker was opened) is greater than the programmed waiting period.
- That the rectifier modules are in float charge.

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

1. Make sure you are logged in as a user with **Service** access.
2. Press the **Settings icon** and navigate to **Service > DC System 1 > Battery tests**.
3. Press the **Start** button in line with **Start battery test** to start the test.



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

The test will run for the defined requirement or both requirements, 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 test is unsuccessful.

Troubleshoot System

This section contains information about possible causes for activation of indications and alarms in the message list. It also describes the different LED behaviors on the modules and the ADBUS cards.

Troubleshoot from the Message List

NOTE: The message list can be customized on request. Not all messages in the list might be shown or might be used in your system.

Message Name	Severity	Description	Possible Source or Action
General			
Urgent alarm	Critical	One or more urgent alarms are present.	One or more alarms requires immediate action. Identify what other alarms are active and check the description/ troubleshooting for those alarms.
Non-urgent alarm	Warning	One or more non urgent alarms are present.	One or more alarms requires action. Identify what other alarms are active and check the description/troubleshooting for those alarms.
Common alarm	Critical	One or more alarms that are configured for the common alarm are present.[5]	One or more alarms requires action or immediate action. Identify what other alarms are active and check the description/troubleshooting for those alarms.
Operation Mode			
Float charge	Indication	The rectifier float charge mode is active.	_
Charge (Boost charge)	Indication	The rectifier boost charge mode is active. The rectifier DC output voltage is higher than float charge voltage.	_
Equalizing charge	Warning	The rectifier equalizing charge mode is active. The rectifier DC output voltage is higher than float and boost charge voltage.	Check if the connected load is approved for the higher voltage, else switch back to float charge or disconnect the load, see How to Change to Float Charge, page 39.
Direct feed	Warning	The rectifier direct feed mode is active. Battery might not be charged anymore.	Check the reason for changing to direct feed. If necessary, switch back to float charge, see How to Change to Float Charge, page 39.
Battery operation	Warning	The batteries are being discharged to supply the load.	Check availability of supply mains.
Breaker Status			
Mains circuit breaker open	Critical	The input breaker is open.	Close the input breaker.
Battery circuit breaker open	Critical	The internal battery breaker and/or the external battery breaker is open.	Close the battery breaker(s).
Output mcb tripped	Critical	The output breaker is open.	Close the output breaker.
Surge voltage prot. tripped	Warning	The AC input surge arrester has tripped.	Replace the surge arrester.
Input breaker trip or off	Critical	One or more individual module input breakers has tripped.	Check the module where the input breaker tripped for any indication of possible cause, for example check if the Module fault alarm is active, the logbook and visually inspect the module.

5. The common alarm is mainly intended to be used for external signals.

Message Name	Severity	Description	Possible Source or Action
			Close the breaker and check if the module is running.
Distribution fault	Warning	One or more outgoing feeders in the system or in an external distribution has tripped	Check if the load is ready to be connected and that no short circuit is pending, then close the breaker(s).
Mains circuit breaker open[6]	Critical	The input breaker and/or the dual input breaker is open.	Close the input breaker(s).
Rectifier Mains			
Mains voltage out of range	Warning	The rectifier mains input is out of tolerance. Depending on the cause the modules might not run.	Unstable rectifier mains input. The input voltage (average) is out of tolerance. Check wiring at the rectifier mains input terminal.
Mains error	Warning	The rectifier mains input is not available. The modules cannot operate.	Unstable rectifier mains input. The input voltage (average) is out of tolerance. The input frequency is out of tolerance. At least one phase is not connected. Check wiring at the rectifier mains input terminal.
Modules / Output			
Module fault	Warning/ Critical[7]	One or more modules are inoperable.	Check the status of the modules, for more information see Module LEDs, page 51.
Fan fault	Warning	At least one of the fans is rotating too slowly or is inoperable.	Check the status of the modules, for more information see Module LEDs, page 51. Replace the inoperable module.[8]
Device temperature high	Warning	One or more rectifier modules are above the high temperature level.	Check the cabinet temperature. Check that the cabinet air inlet/outlet are not covered. Check the systems total load.
Converter overtemperature shutdown	Critical	One or more rectifier modules are above the temperature shutdown level. The modules will run with reduced output power.	Check the cabinet temperature. Check that the cabinet air inlet/outlet are not covered. Check the systems total load.
Output voltage out of range	Critical	The output voltage is above or below the tolerance level.	Check if the rectifier modules are running. Check that the rectifier mains is available. Check if that battery is connected. Check battery charge status.
Converter overvoltage shutdown	Critical	One or more modules switched OFF because of too high output voltage.[9]	To fully restart a module it has to be disconnected from the system back plate. Loosen the module screw and pull out the module about 1-2 cm. Wait a minute and insert the module and tighten the screw.
Output power warning	Warning	One or more rectifier modules have reached power limitation (modules are overloaded).	Reduced fan speed or inoperable fan. High module temperature. Rectifier mains input is too low/out of tolerance. The system is overloaded. If necessary, replace the inoperable module.

6. The same alarm message name is used for both breakers in a 2N system.
7. If the system is configured with at least one redundant module action is not required immediately.
8. Fan cooled modules with one inoperable fan can still run with up to 30% load.
9. The red LED will flash fast 3 times.

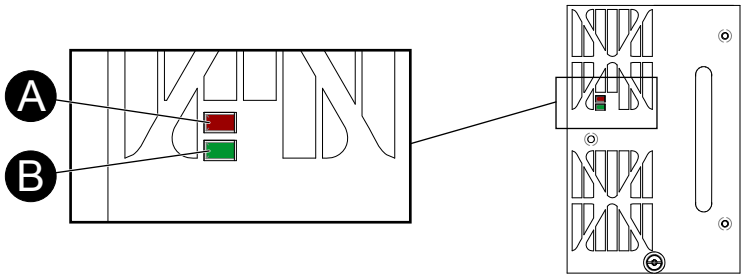
Message Name	Severity	Description	Possible Source or Action
Current limiting	Warning	One or more rectifier modules have reached current limitation (modules are overloaded).	Reduced fan speed or inoperable fan. High module temperature. Rectifier mains input is too low/out of tolerance. The system is overloaded. If necessary, replace the inoperable module.
Battery			
Earth fault plus circuit	Warning	Leakage current from the positive pole detected.	DC output mains is floating (IT), a single/first DC earth fault is not critical. Check the installation in view of positive earth fault.
Earth fault minus circuit	Warning	Leakage current from the negative pole detected.	DC output mains is floating (IT), a single/first DC earth fault is not critical. Check the installation in view of negative earth fault.
Battery current limitation active	Indication	The battery charging current has reached its maximum limit. The rectifier will regulate the DC output current to not overcharge the batteries with a too high charging current.	The battery is heavily discharged.
Battery test	Indication	The battery test is running.	_
Battery test error	Critical	The battery is discharged or weak. The battery is unable to supply the DC load in case of an AC failure.	Check the battery bank. If there is no visual damage to the batteries, it might help to enable boost charge or equalize charge for a limited period.[10] If necessary, replace battery cells.
Battery test not allowed	Indication	The conditions to start the battery test is not meet.	Check conditions for the battery test. Wait until the conditions are meet.
Battery circuit test failed	Critical	The battery is discharged, weak or not correctly connected. The battery is unable to supply the DC load in case of an AC failure.	Check that the battery breaker(s) are closed. Check the battery cables and connections. Check the condition of the battery cells.
Battery circuit test blocked	Indication	The conditions to start the battery circuit test is not meet.	Check conditions for the battery test. Wait until the conditions are meet.
Temperature sensor fault	Warning	No signal available from the temperature sensor.	Check the temperature sensor cable and connection. Check the temperature sensor for damage. If necessary, replace the battery temperature sensor.
Output voltage high	Warning	The system output voltage is above the set high voltage level.	Module output voltage is too high.
DC voltage low	Warning	The DC voltage is below the set low voltage level.	Check connection to the battery, it might be open or interrupted. The battery is discharged.
Battery exhaustive discharged	Critical	The battery is discharged. The connection between the battery and the load must be opened to avoid permanent damage to the battery.	The battery needs to be charged.
Redundancy and Blocks			
Current redundancy error	Critical	Only for redundant N+x and N+N module configurations. The redundancy is currently not available because of some inoperable modules. (Calculated based on output current).	Replace the inoperable modules.
Address redundancy error	Critical	Only for redundant N+x and N+N module configurations. The redundancy is currently not available because of some inoperable	Replace the inoperable modules.

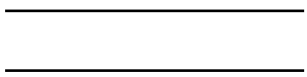
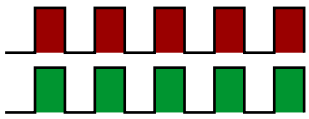
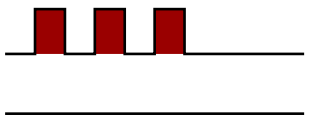
10. Remember to verify that any connected load is approved for the higher output voltage.

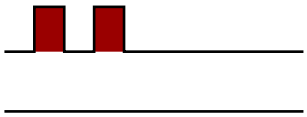
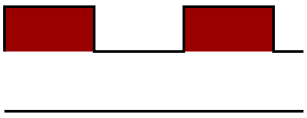
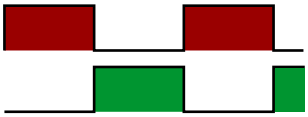
Message Name	Severity	Description	Possible Source or Action
		modules. (Calculated based on number of modules).	
Address redundancy warning	Warning	Only for redundant N+x and N+N module configurations. The redundancy is currently reduced because of some inoperable modules. (Calculated based on number of modules).	Replace the inoperable modules.
Boost charging blocked	Indication	Boost charge mode is blocked. The mode can be blocked by an external/internal signal.	Check the customized condition that blocks the boost charge mode.
Equalize charging blocked	Indication	Equalizing charge mode is blocked. The mode can be blocked by an external/internal signal.	Check the customized condition that blocks the equalizing charge mode.

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	
Overvoltage	Red: Flashes fast 3 times Green: Off	

Status	LED Description	LED Visualization
Overtemperature	Red: Flashes fast 2 times Green: Off	
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

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.

LED Name	Color	Name Description	LED Status	Status Description
			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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