Installation and Operating Manual
sonnenBatterie eco Gen 2

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This manual refers to:

Hardware version: 2.00
Software version: 8.0.5674

Latest revision: 01/12/17
Version: 1.1

If you need help or service, contact the company that commissioned your storage system.

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About this manual

This manual describes the installation and operation of the sonnenBatterie eco storage system. Read this manual carefully before beginning work and keep it near the storage system.

Target audience

This document is intended for the following audiences:

- Operator and end user of the storage system
- Trained and certified electrician

Some actions described in this document must only be performed by a trained and certified electrician. These actions are marked as follows:

Trained, electrically qualified person only!

Trained, electrically qualified persons are:

- Service partners authorized by sonnenBatterie Inc.
- Trained, electrically qualified persons with knowledge of all applicable regulations and standards.
- Trained, electrically qualified persons who have attended the training provided by sonnen.

Terminology

This document refers to the sonnenBatterie eco as a storage system.

This manual refers to the building being serviced by the storage system as a "house," but the sonnenBatterie eco can be installed in any number of buildings or sites powered by AC electricity.

For a full glossary of terms used in this manual, see page 53.

Symbols used

WARNING WORD

Warnings are indicated by this symbol and a warning word, which indicates the severity of the danger. Along with the warning are instructions for avoiding the danger.

Structure of warnings

The following warning words are used:

- **CAUTION** indicates a possible hazardous situation which could result in minor or moderate injury.
- **WARNING** indicates a possible hazardous situation which could result in death or serious injury.
- **DANGER** indicates an imminent hazardous situation which will result in death or serious injury.

Material damage

Attention

Possible material damages are indicated in this document with the warning word "Attention."

Important information

Important information without danger to injury, death, or material damage is indicated by this symbol.

Actions

Actions to be taken are marked with a ►. For example:

► Read this manually thoroughly before operating storage unit.

Electrical symbols

⏚ indicates protective earth (ground).

N indicates the connection for the neutral conductor on permanently installed equipment.

Safety

Intended use

Any use of the system other than the intended use can cause serious injury, death, and damage to the product or other assets.

- The storage system must only be used to store electrical power.
- The storage system must only be used with the battery modules provided.
- The storage system is intended for indoor use only.
- The intended use includes knowledge and application of the information in this installation and operating manual as well as all delivered product documentation.

Failure to comply with the warranty conditions and the information listed in this installation and operating manual will void any warranty claims.

Prohibited uses

DANGER

Danger to life due to electric shock!

Even if the utility grid fails, the storage system will continue delivering power. Before servicing the storage system:

► Turn off the storage system.

► Turn off the main disconnect circuit breaker.

Only authorized electrically qualified persons can perform work on electrical parts.

- Do not use the storage system in vehicles.
- Do not use the storage system in wet locations.
- Do not use the storage system in areas at risk of explosion (flour dust, sawdust, etc.).
- Do not expose the storage system to direct sunlight.
- Do not use the storage system in areas where the ammonia content of the air exceeds 20 ppm.
- Do not use the storage system when corrosive gases are present.
- Do not use the storage system higher than 9,842 feet (3,000 meters) above sea-level.
- Do not operate the storage system at temperatures outside of the allowed ambient temperature range of 41°F - 113°F (5°C - 45°C).
- Do not operate the storage system at a humidity higher than 90%.

General safety instructions

- Do not modify the storage system.
- Do not use the storage system if it has been damaged.
- Ensure the following regulations are observed in the installation and connection of the storage system and the PV system:
  - Local, regional, national, and international regulations and guidelines
  - National Electric Code
  - ANSI/NFPA 70
  - Requirements of the servicing utility
- Ensure that all safety systems are in perfect working order.
- Read this installation and operating manual with care.
- When installing and maintaining the storage system, wear personal protective equipment, including safety glasses, insulated gloves, and steel-toe shoes.

General warnings

Attention

Damaging of the battery modules by deep discharge!

If the battery modules are disconnected from a power source for longer than six months, they can be damaged by excessive discharge.

► If the storage system has been disconnected

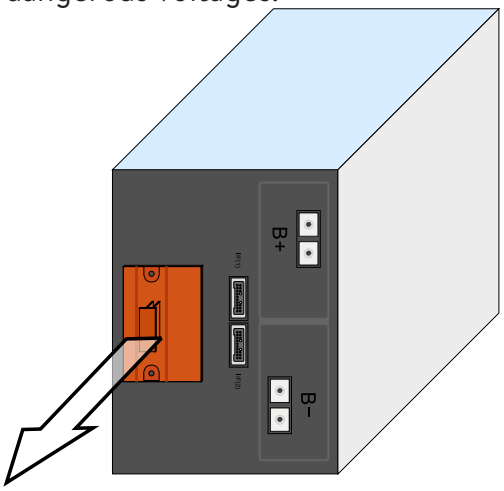
from the utility grid for six months, connect it to the utility grid and allow it to charge the battery modules.

- ► If a battery module has been disconnected from the storage system for six months, install it in the storage system and charge it.

WARNING

Risk of burns!

The orange safety plugs must be removed before working on or with the battery modules. As long as the plug is inserted in the battery, it is capable of producing potentially dangerous voltages.



When working on the storage system:

- ► Take off metallic jewelry.
- ► Turn off the storage system.
- ► Turn off the main disconnect.
- ► Remove all orange safety plugs from the battery modules.
- ► Use insulated tools
- ► Wear personal protective equipment, including safety glasses, insulated gloves, and steel-toe shoes.

Fire-related instructions

CAUTION

Risk of injury from escaping electrolyte

The battery modules in the storage system are protected by a number of security devices for safe operation. Despite diligent construction, cells inside the battery modules can still degrade or catch fire in the event of mechanical damage, heat, or a fault. Possible effects include:

- Heating of battery modules.
- Escaping electrolyte, which can ignite and produce an explosive flame.
- Smoke, which can irritate skin, eyes, and throat.

Consequently:

- Do not open battery modules.
- Do not physically damage battery modules (puncture, deform, disassemble, etc).
- Do not modify battery modules.
- Keep battery modules away from water (except to extinguish a fire in the storage system).
- Do not allow battery modules to heat up.
- Only operate battery modules in the allowed temperature range.
- Do not short circuit battery modules or bring them into contact with metal.
- Do not use a battery module after it has short-circuited.
- Do not exhaustively discharge battery modules.

If contents escape:

- Do not enter the room.
- Avoid contact with the escaping electrolyte.
- Contact your fire department.

Despite all of the care that goes into the design of the storage system, fires are still possible. A fire

can release substances contained in the battery modules.

In the event of a fire in the storage system or its surroundings:

- Only fire fighters wearing proper protective clothing (including gloves, masks, and breathing apparatus) may enter the room with the burning storage system.
- A fire in the storage system can be extinguished by conventional agents.
- The use of water is advisable to cool the battery modules and thus prevent the thermal runaway of modules that are still intact.

Pertinent information on battery modules include:

- The battery modules have a rated voltage of 51.2 VDC and are thus in the range of protective extra-low voltage (below 60 VDC).
- The battery modules contain no metallic lithium.

Description and Specifications

	eco 4	eco 6	eco 8	eco 10	eco 12	eco 14	eco 16
Usable capacity (100% DOD)	4 kWh	6 kWh	8 kWh	10 kWh	12 kWh	14 kWh	16 kWh
Continuous power output (at 25 deg C)	3kW	4kW	4kW	7kW	8 kW	8 kW	8 kW
Dimensions W"/H"/D" (approx.)	26x 55x 14	26x 55x 14	26x 55x 14	26x 75x 14	26x 75x 14	26x 75x 14	26x 75x 14
Weight (approx.)	377 lbs.	437 lbs.	496 lbs.	622 lbs.	683 lbs.	741 lbs.	800 lbs.
Nominal current		16.7A			33.3A		
Cell chemistry	Lithium iron phosphate ($LiFePo_4$)						
Nominal voltage	120/240VAC						
Device protection	Short circuit, overload, over temperature						
Ambient temperature	41°F - 113°F (5°C - 45°C)						
Maximum Humidity	90%, non-condensing						
Applications	self-consumption, backup						
Grid integration	AC coupled						

On-grid specifications

Nominal power	3kW	4kW	4kW	7kW	8kW	8kW	8kW
Nominal AC current	12.5A	16.67A	16.67A	29.16A	33.33A	33.33A	33.33A

Table 1 Specifications

	eco 4	eco 6	eco 8	eco 10	eco 12	eco 14	eco 16
Off-grid specifications							
Nominal power	3kW	4kW	4kW	7kW	8kW	8kW	8kW
Nominal AC current	12.5A	16.67A	16.67A	29.16A	33.33A	33.33A	33.33A
Max power	100 ms — 8.5KVA 5s — 6KVA 30m — 4.5KVA			100 ms — 16.97KVA 5s — 12KVA 30m — 9KVA			
Max AC current (charge/ discharge)	1 ms — 50A 100 ms — 35.35A 5s — 25A 30m — 18.75A			1 ms — 100A 100 ms —70.7A 5s — 50A 30m — 37.5A			
Overcurrent protection needed	30A			50A			
General specifications							
Transfer switch	Automatic, integrated						
Backup capacity	2 kilowatt-hours per battery module, up to 16 kilowatt-hours						
Certifications	UL Recognized Components: Battery modules –UL1973; Inverter – UL1741; ATS – UL1008; AC Breaker – UL489						
Warranty	Inverter, 10 years; battery modules, 10 years or 10,000 cycles; cabinet and components, 1 year						
Inverter efficiency	92.5% CEC weighted, 95.0% peak						
Roundtrip Eff% (Grid <> Battery)	>= 86%						
Comm. ports	Serial, Ethernet						
Comm. protocols	Modbus, Z-Wave						
Comm. and control standards	Open ADR 2.0, SunSpec Alliance						

	eco 4	eco 6	eco 8	eco 10	eco 12	eco 14	eco 16
EMC / EMI protection	FCC Part 15B						
Total harmonic distortion	<5% L1-L2, <2% L-N						
Cooling Method	Forced air						
Noise emission	< 35dBA						
AC Specifications							
AC input rated current	Pass through: 200 amps @ 240VAC Power plant: 33.33 amps @ 240VAC						
AC output voltage	120/240 volts						
AC grid voltage	120/240 volts						
Nominal frequency	60 Hz						
Adjustable frequency range	+/- 0.7 Hz from nominal						
Metering capability	Power meter for load and PV production; +/- 0.5 RDG (current/voltage)						
Tare losses (W)	60 watts						
Transient protection	IEEE C62.41 Class B						
Transfer switch specifications							
Current rating	200 amps switching and overcurrent protection						
Voltage rating	120/240 VAC						
Contacts	Silver-plated						
Certification	UL Recognized Component						
Fault Current @ 240VAC	22,000 amps						

Battery specifications

Voltage	48-56 VDC
Capacity	4-16kWh (2 kWh per module)
Charge current	30A per module nominal, 70A per module max
Cell discharge	100% DoD
Overcharge Protection	Fuse protection

Sizing requirements in relation to PV inverter

eco	Minimum PV size	Ideal PV size
4	1.6 KW	4 KW
6	2.4 KW	4 KW
8	3.2 KW	4 KW
10	4 KW	8 KW
12	4.8 KW	8 KW
14	5.6 KW	8 KW
16	6.4 KW	8 KW

Dimensions

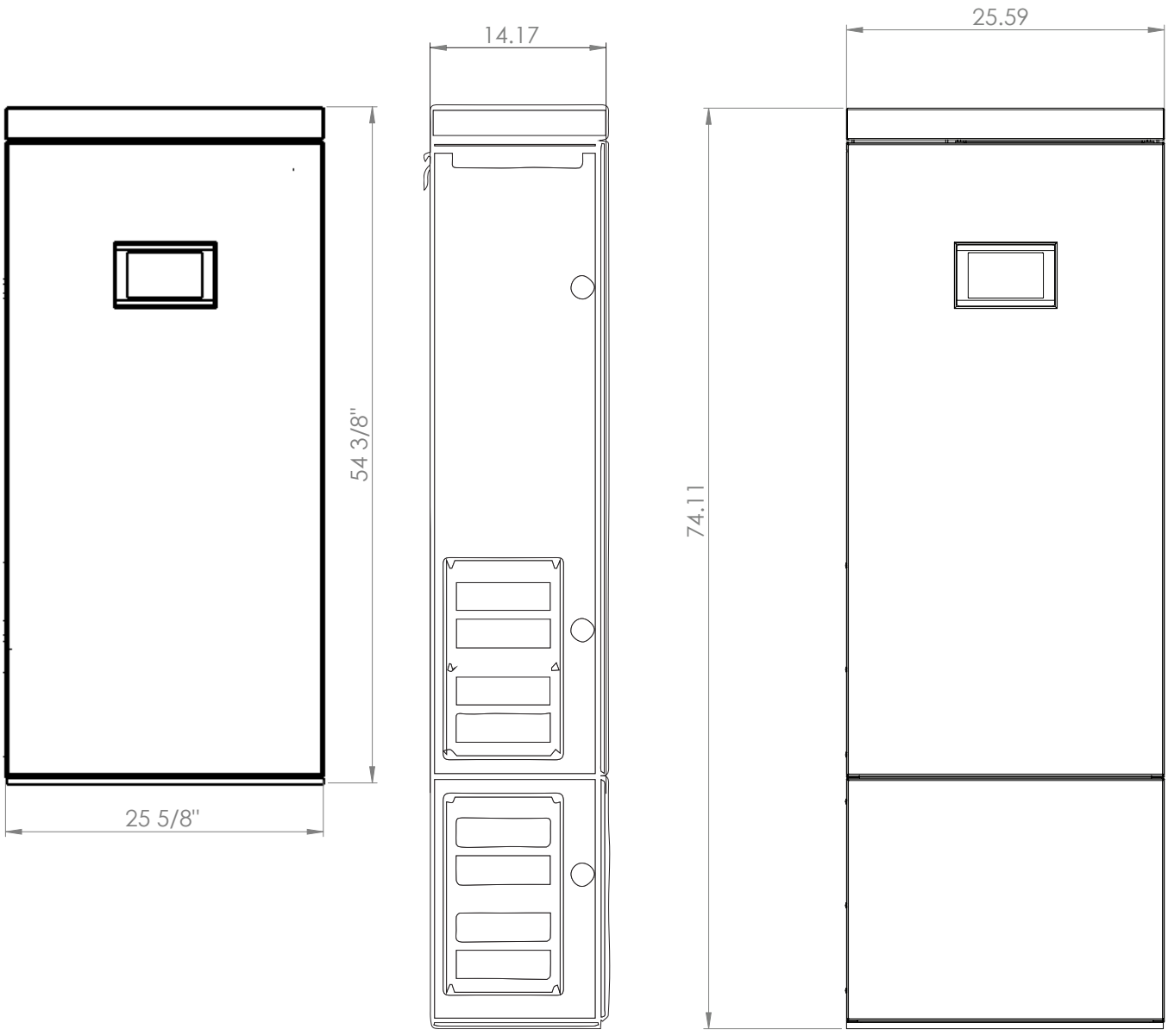


Fig. 1 Storage system dimensions

Description of use

The sonnenBatterie eco is an intelligent storage system that monitors and controls energy production, consumption, and storage in the house.

The sonnenBatterie eco can work with existing or newly installed PV systems. The solar inverter and eco storage system connect to the same distribution panel. Solar modules do not connect to the sonnenBatterie directly.

The storage system uses two power meters to monitor solar power production and energy consumption. When production is higher than consumption, such as at midday, the eco stores the excess energy in its lithium iron phosphate (LiFePo4) battery modules. When consumption is higher than production, such as in the evening, the storage system releases the energy. In doing so, the storage system allows you to use solar power at night, reducing your power bill and increasing the value of your investment in renewable energy.

The storage system also acts as a backup power supply, meaning that if the utility grid goes out, your appliances will remain powered.

The illustration below shows how the storage system manages solar power (1) and power from the utility grid (2) to maximize your energy independence and savings on your power bill.

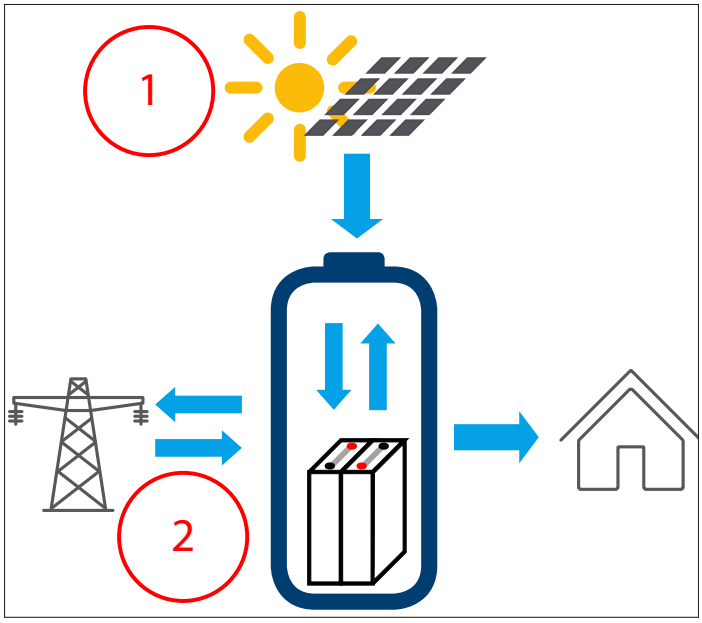


Fig. 2 Energy flow

Modes of operation

The sonnenBatterie eco offers two complementary modes of operation: Self-consumption and Backup. Self-consumption mode ensures that you are using the power you generated even when the utility grid power is available; backup mode makes that self-generated power available in the event of a grid power outage.

Many utility companies are moving to a Time of Use-based billing scheme, in which electricity costs more during high-demand time periods. The sonnenBatterie eco can maximize your cost savings by using employing “rate arbitrage” — using your stored battery power during the high-cost part of the day and recharging from solar and optionally with electricity purchased from the grid at the lowest offered rates.

Self-consumption mode

The following images illustrate the interaction between the storage system, the PV system, and the utility grid in self-consumption and backup modes:

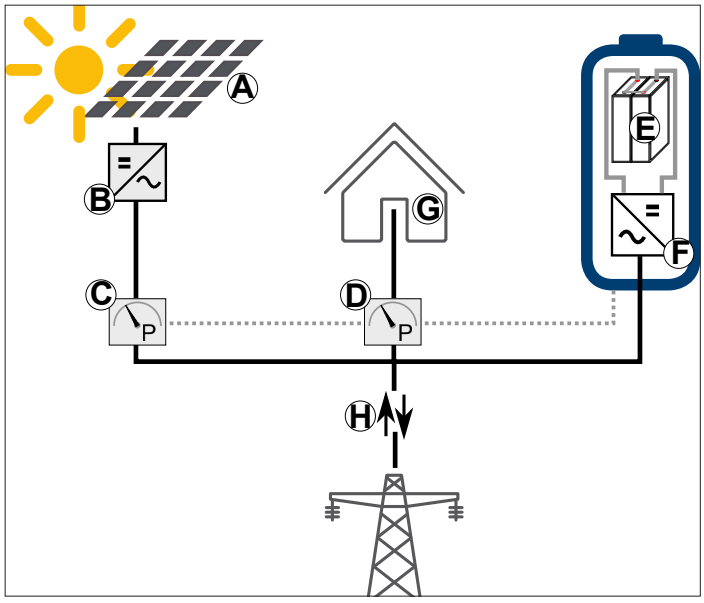


Fig. 3 Self-consumption mode

The DC power that is generated by the PV array (A) is converted to AC power by means of an inverter (B). The meters (C) and (D) measure the current electrical power in watts. The production meter (C) measures the power production, the consumption meter (D) measures the power

consumption in the house. If the production is higher than the consumption, the surplus will be stored in the battery modules (E). The storage system's inverter (F) converts the AC power to DC power while the battery modules (E) are charging. When the production is lower than the consumption, electric power will be released from the battery modules to power the loads. The storage system's inverter (F) converts the DC power of the battery modules (E) to AC power. The utility's power meter (G), measures the power supply and the power fed back to the grid (H) by the PV array (if applicable). The storage system will not discharge its batteries to the grid in normal operation.

Backup mode

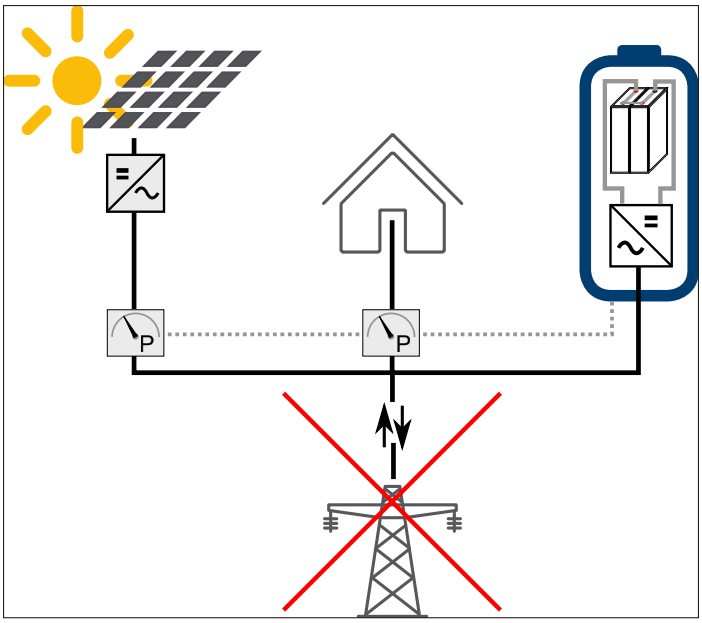


Fig. 4 Backup mode

In backup mode, the house is powered by the energy stored in the battery modules and generated by the PV array. During that time, the power from the PV array powers the house or charges the battery modules, depending on production and consumption levels. The storage system can also turn the PV array off if the battery modules become fully charged.

In backup mode operation, 10-, 12-, 14-, and 16-kilowatt models of the storage unit will isolate the microgrid from the utility grid using a 200A automatic transfer switch. When this occurs, the storage unit will produce grid-quality voltage and frequency so that any grid-tied PV inverters in the microgrid will continue to operate. The PV array will first power the loads on the AC panel, with any excess energy charging the batteries in the storage unit. If there is insufficient PV to cover the loads, the storage unit will discharge its batteries to meet demand.

To prevent battery overcharging while in backup mode, the storage unit will perform a frequency shift to 60.9 Hz when its state of charge reaches 95 percent. Because the PV inverter is still subject to UL1741 conditions, it will think that the "grid" is out of spec for the frequency threshold (59.3 - 60.5 Hz) and will disconnect from the microgrid. When the storage unit's state of charge drops to 89 percent, it will reduce the frequency to 60 Hz. The PV inverter will see that the frequency is within the UL1741 range and start its 5-minute countdown before it attempts to reconnect to the microgrid and produce power.

If the loads are small and the PV production is high, then this behavior could occur multiple times per day.

Generator autostart functionality

The sonnenBatterie eco can control a generator to provide power in the event that the storage system has reached a low state of charge, the grid is unavailable, and the PV system is not producing power. When these criteria are met, the storage system will start the generator and keep it running until the battery modules have reached a pre-configured state of charge, the grid becomes available, or the PV system begins producing power.

Storage and transport

Storing the system

Trained, electrically qualified person only!

Environmental conditions

The system and battery modules must be stored under the following conditions:

- Ambient temperature must be in the range of 41°F - 113°F (5°C - 45°C)
- Humidity max. 90%
- Properly ventilated
- Maximum elevation of 9,842 feet (3,000 meters) above sea level
- Fire safety regulations observed
- Free of dust
- Free of corrosive and explosive gases
- Free of vibrations
- Plain surface that can bear heavy weights
- Location meets local building codes

Attention

Damage of the battery modules by discharge!

While in storage, the battery modules will discharge. If they reach too low of a charge, the battery modules can be damaged or destroyed.

- Charge the battery modules to at least 85% before storing them.
- After six months, install the battery modules in the storage system and charge them.
- Do not store the battery modules with the orange safety plugs installed.

Transporting the system

Environmental conditions

The following environmental conditions must be observed when transporting the storage system or the battery modules:

- Ambient temperature between 41°F - 113°F (5°C - 45°C).
- Humidity max. 90%, non-condensing
- Properly ventilated
- Fire safety regulations observed
- Free of corrosive and explosive gases
- Plain surface that can bear heavy weights

Transporting the battery modules

Lithium ion battery modules are hazardous materials. Observe the following requirements:

► Follow national and international regulations for transport.

► Consult an expert for hazardous materials.

The following data is relevant for transport:

- Hazardous material: Class 9
- UN number: UN3480 “lithium ion battery modules”
- Weight of a battery module: 60 lb (27 kg)

Detecting damages in transit

The carrier can only be held liable for damage to the storage system if the damage is proven to have happened during transport. Thus, it is important to follow the instructions of this section closely.

Losses in transit are classified as either open or concealed damages. Damage is considered open if the damage is visible on the packaging; damage is considered concealed if the packaging is intact and the contents are damaged.

Open damages must be reported to the carrier immediately. For concealed damages, the time limits of the terms of the carrier apply. While the carrier is present, review the following:

- Recipient address and number of pieces
- Possible open damages
- Possible concealed damages

Checking the battery modules

CAUTION

Risk of injury using damaged battery modules!

Damaged battery modules can leak materials that are hazardous to your health.

- ► Unwrap battery modules immediately after transport and review for damages.

If a damage is visible (deformation, damaged enclosure, leakage of substances):

- ► Do not use the battery.
- ► Contact your installer or sonnen's service department.

Adjusting the temperature after transport

Attention

Damaging of the storage system by condensation!

If the storage system is colder than the ambient temperature, water may condense in the interior of the storage system, resulting in damage.

- ► Inspect the interior of the storage system before installing.
- ► Install the storage system only if no condensation is visible.

If the storage system was transported at temperatures below 32° F (0 °C):

- ► Place the storage system at a proper location (see "Choosing a mounting location" on page 14 for more information).
- ► Open all of the doors on the storage system.
- ► Leave the storage system in this state for at least 24 hours before commissioning the storage system.

Moving the storage system

WARNING

Risk of injury lifting the storage system!

The storage system is heavy.

- Wear safety boots.
- Ensure you have stable footing.
- Use hand trucks while moving the storage system up or down stairs.

The storage system must not be tilted more than 90 degrees. The touchscreen must be on top.

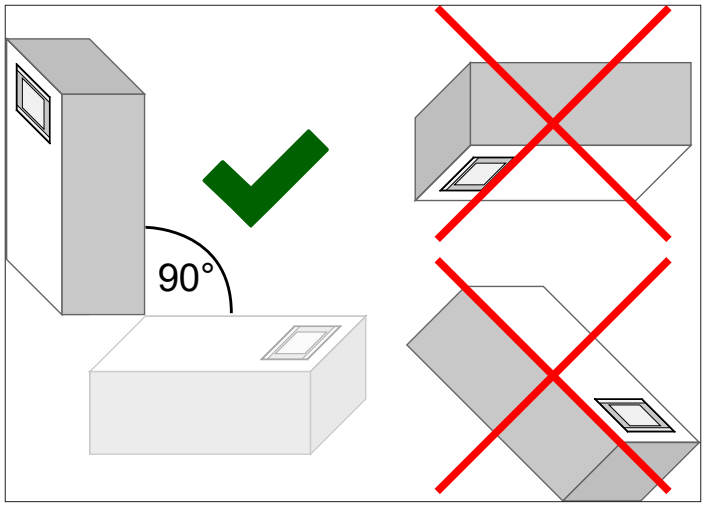


Fig. 5 Allowed tilt positions

Installation

Tools needed

- 1/2” drive ratchet
- 1/2” socket
- 10mm socket or wrench
- 3/16” bit
- 5mm hex wrench
- 7mm socket or wrench
- Drill
- Heat gun
- Heat shrink tubing
- Measuring tape
- #2 Phillips screwdriver
- 1/8-inch tip screwdriver
- Spirit level
- Voltmeter
- Wire stripping tool
- Utility knife

Choosing a mounting location

Select a location with the following attributes:

- Ambient temperature between 41°F - 113°F (5°C - 45°C).
- Humidity max. 90%, non-condensing
- Maximum elevation of 9,842 feet (3,000 meters) above sea-level
- Fire safety regulations observed (smoke detector recommended)
- Free of dust
- Free of corrosive and explosive gases
- Free of vibrations
- Plain surface that can bear heavy weights
- Easy access for installation team
- Compliant with local building codes

Clearance requirements

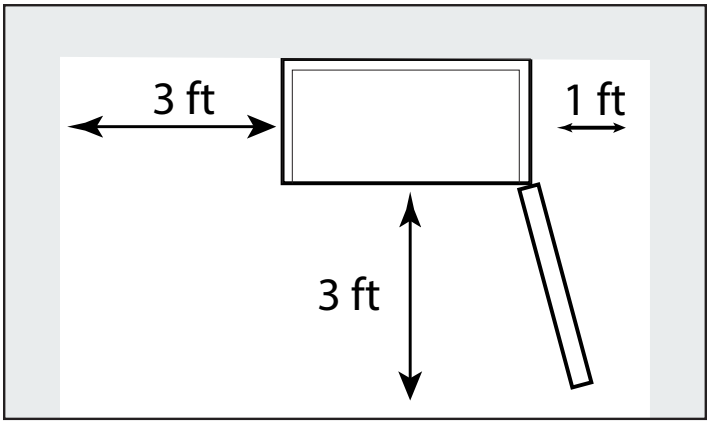


Fig. 6 Clearance requirements

Inspecting the storage system

1. Verify that the inverter is properly placed inside the enclosure and that no component has moved out of position.
2. Ensure that all the screws securing the inverter and other components to the cabinet are properly fastened.
3. Check that all cables and jumpers are properly connected and have not come loose during transport.

Mounting the storage system

WARNING

Risk of injury lifting the storage system!

The storage system is heavy.

- ► Wear safety boots.
- ► Ensure you have stable footing.
- ► Mount the storage system in an upright position.

Two people are required to mount the storage system.

1. Install the mounting cleat

Tools needed:

- Powered drill
- 3/16” bit

► Drill two holes into studs in the desired location with a 3/16” drill bit 16 inches on center. Furr out the wall as necessary. Secure the mounting cleat to the wall with at least two 5/16" lag screws driven to at least two inches of penetration. Center the screws at the following heights:

- With battery cabinet: 68 5/16”
- Main cabinet only: 48 5/8”

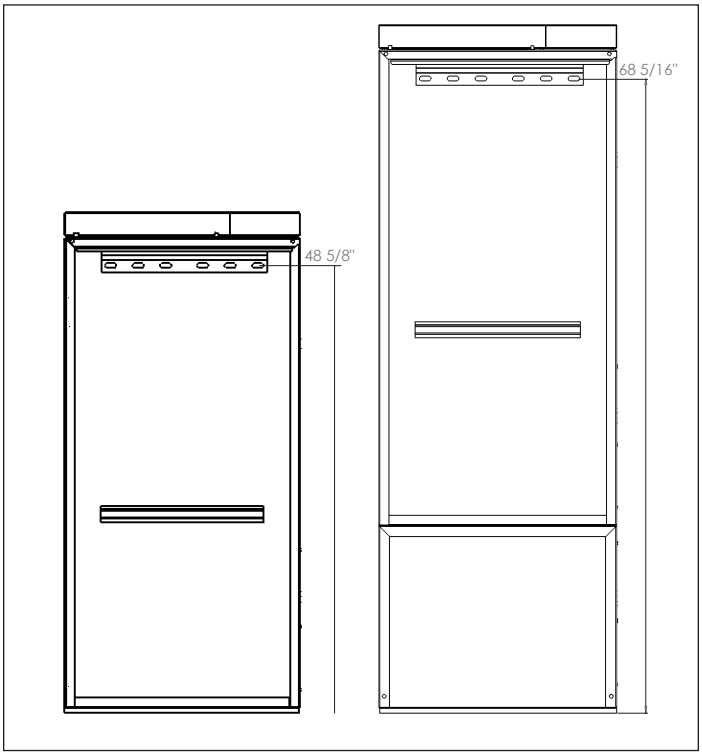


Fig. 7 Cleat mounting height

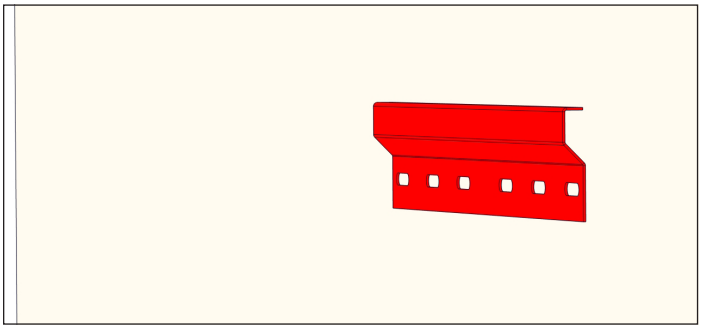


Fig. 8 Mounting cleat orientation

2. Place the leveling mat

► Clean the area where the storage system will be installed.

► Place the leveling mat where the storage system will be installed.

The leveling mat ensures a solid base for the storage system, even on unlevel surfaces.

3. Place the battery cabinet (if ordered)

► If your storage system shipped with a battery cabinet, place it on the leveling mat.

4. Mount the cabinet on the cleat

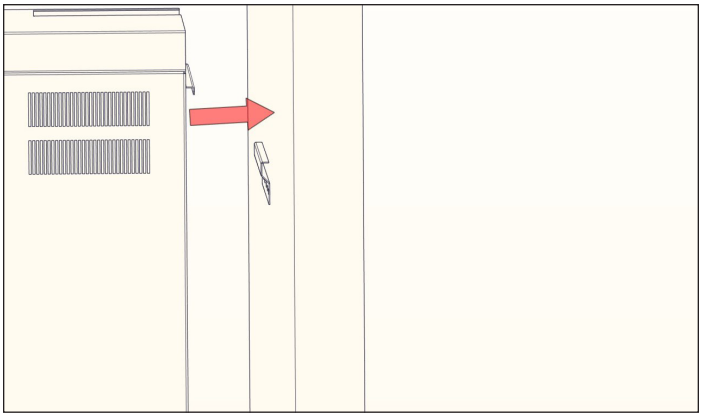


Fig. 9 Positioning the mounting bracket

► Position the cabinet so that the mounting bracket on the cabinet is above the mounting cleat on the wall.

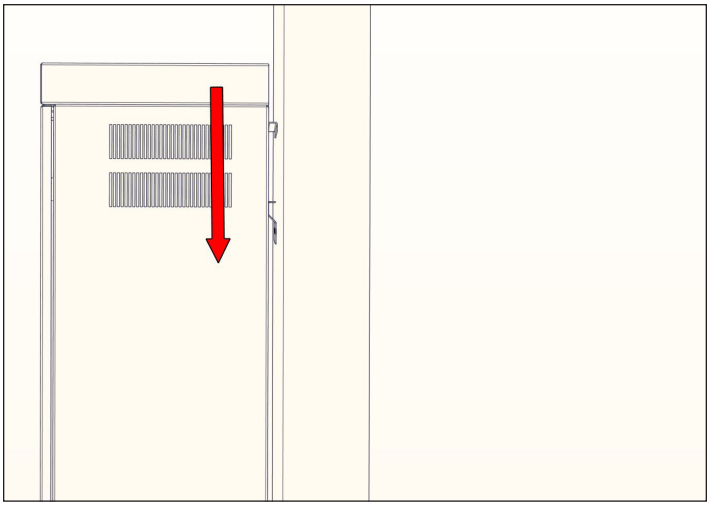


Fig. 10 Sliding the cabinet into the mounting cleat

► Slide the cabinet down so that the mounting bracket covers the cleat.

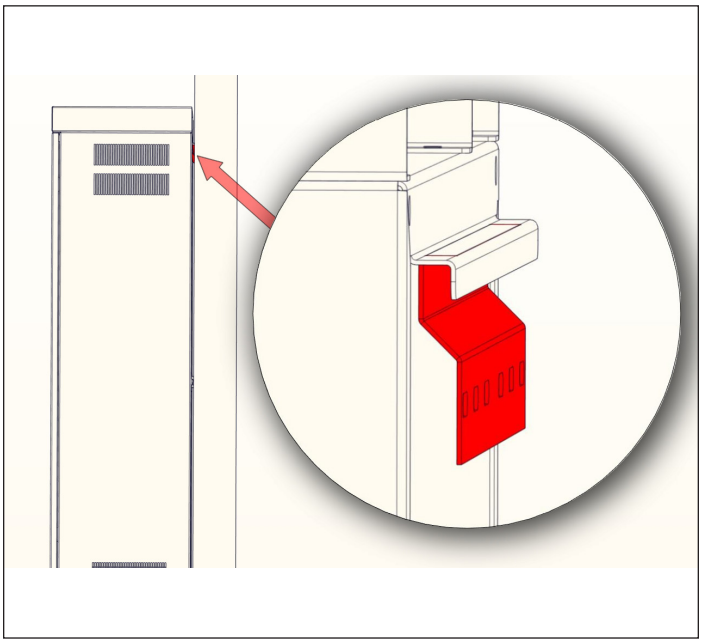


Fig. 11 Securing the mounting cleat

► Ensure the cabinet is secured before proceeding.

5. Open the door

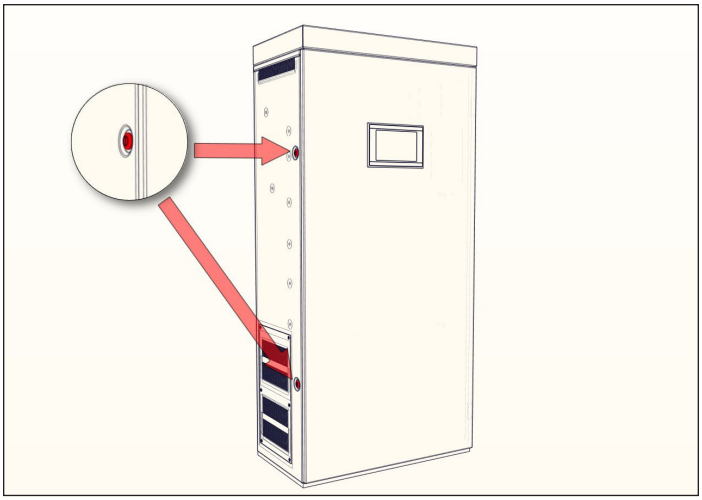


Fig. 12 Unlocking the inverter cabinet

► Using the keys shipped with the unit, open the cabinet door.

6. Remove the no-touch screen

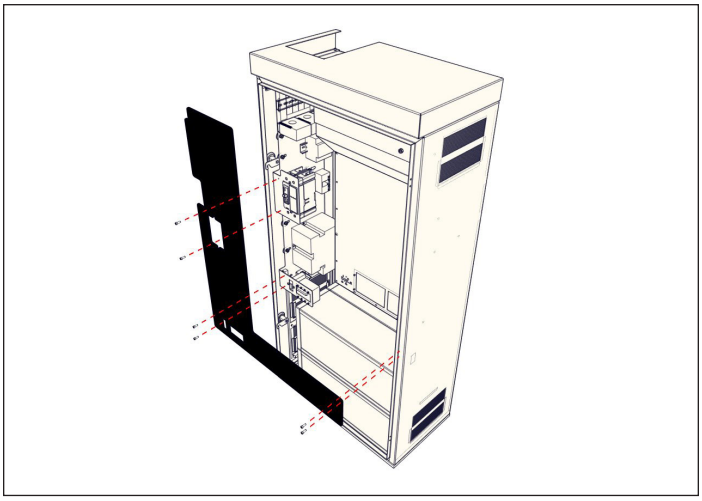


Fig. 13 Removing the no-touch screen

► Remove the no-touch screen to access the electrical connections.

Connecting the cabinets to each other

CAUTION

Risk of injury, cabinet may fall over!

Until the battery modules are installed, the cabinets are extremely top-heavy.

► Hold onto the storage system during installation.

The main cabinet must be placed on top of the battery cabinet and secured with four bolts.

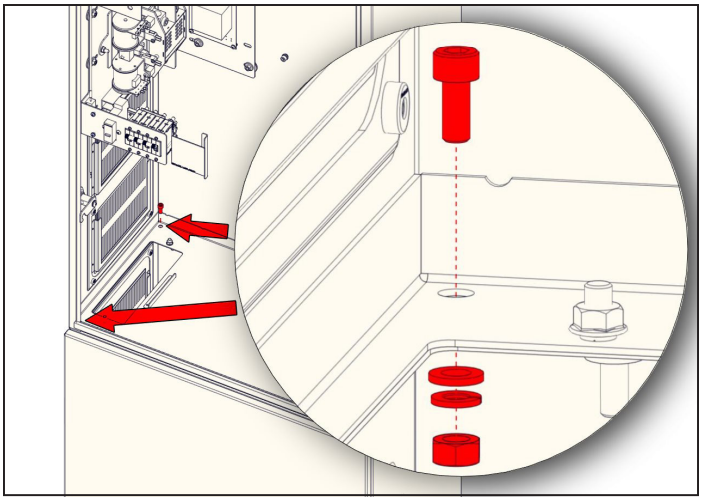


Fig. 14 Connecting cabinets (left side)

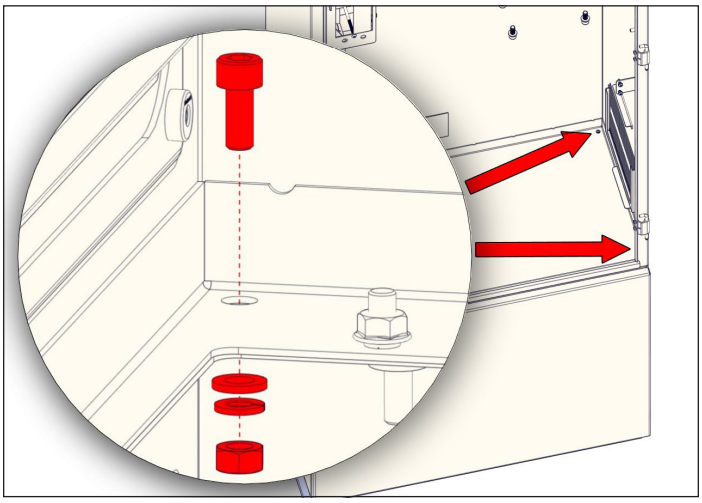


Fig. 15 Connecting cabinets (right side)

Tools needed:
- 5mm hex wrench

► Remove the caps in the four holes on the bottom of the main cabinet.

► Connect the main cabinet to the battery cabinet using the four 5mm bolts provided.

Connecting cabinets electrically

1. Unmount the cover on the bottom of the main cabinet (if using a battery cabinet)

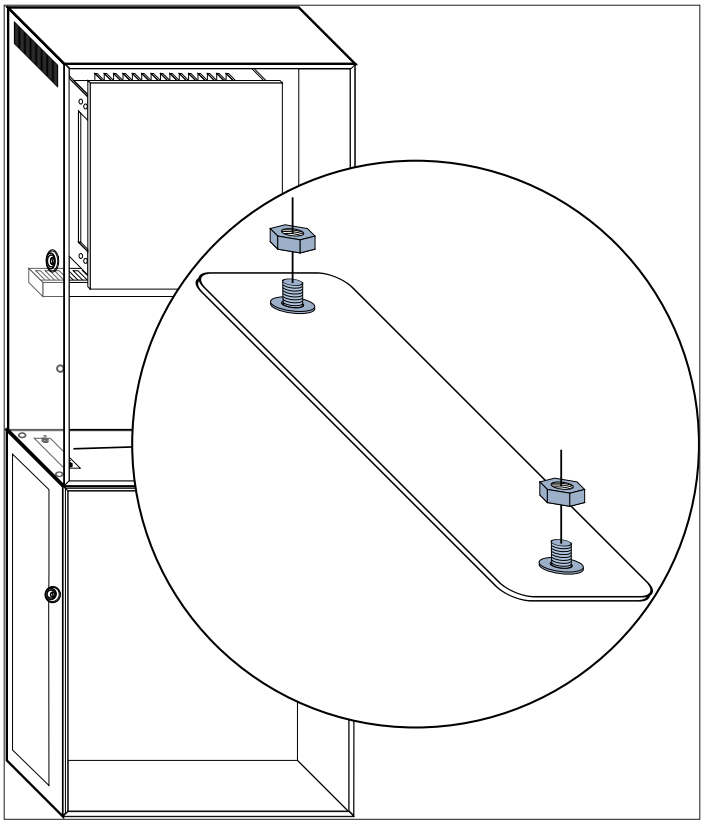


Fig. 16 Removing the cabinet cover

Tools needed:
- 10mm socket or wrench

► Remove the nuts securing the cover to the bottom of the main cabinet.

► Remove the cover.

2. Install edge protectors (if using a battery cabinet)

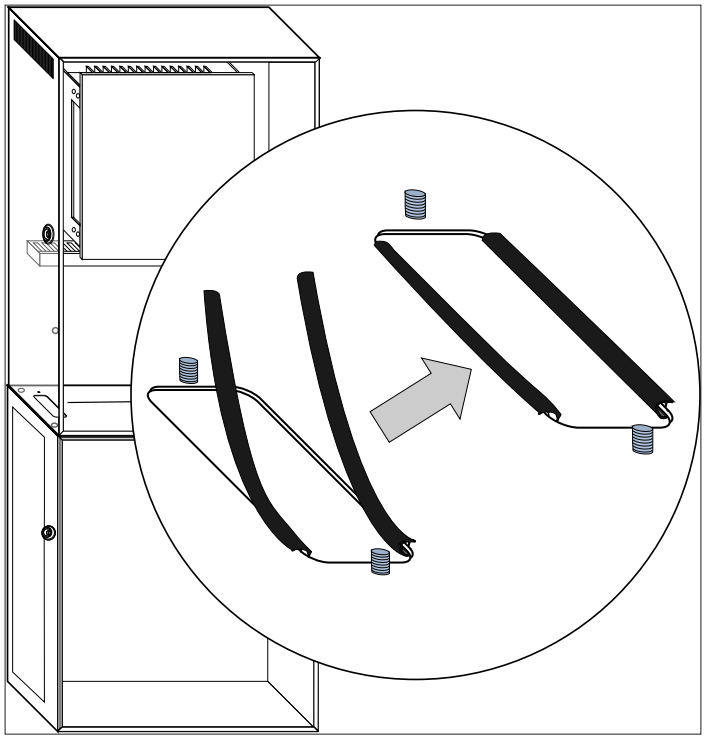


Fig. 17 Installing edge protectors

Tools needed:
- Utility knife

► Install the two edge protectors on the two long sides of the opening between the main and battery cabinets, making sure to cover the edges of both cabinets.

► Using a utility knife, trim the edge protectors to fit if necessary.

3. Connect flat band grounding (if using a battery cabinet)

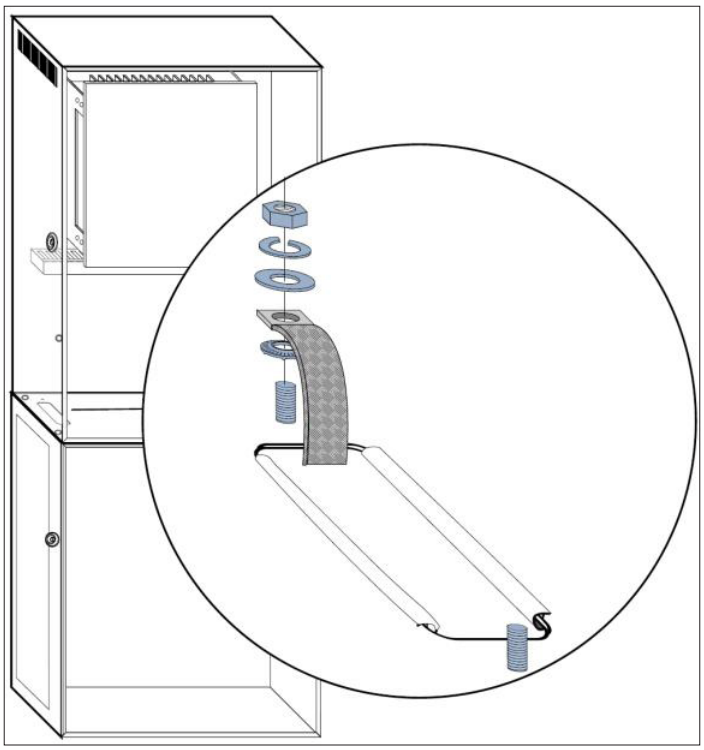


Fig. 18 Flat band grounding

Tools needed:

- 10mm socket or wrench

► Connect the flat band grounding of the battery cabinet to the main cabinet to ensure the battery cabinet has earth potential.

4. Confirm transfer switch has full range of movement

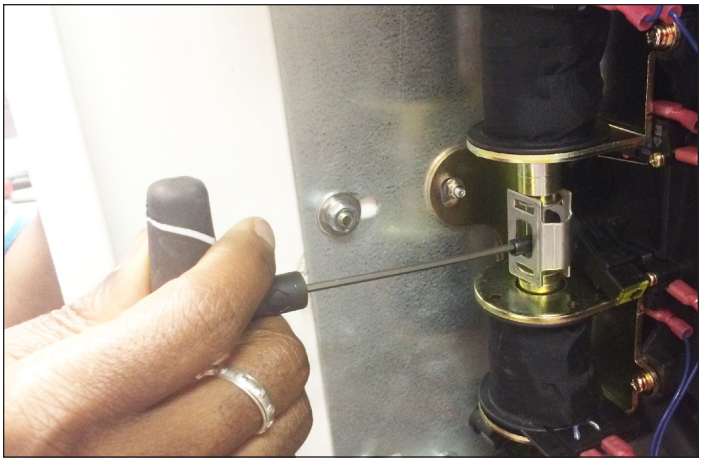


Fig. 19 Checking transfer switch movement

Tools needed:

- Small screwdriver or hex wrench

► Using a small screwdriver or hex wrench, ensure the automatic transfer switch has a full range of movement.

5. Place conduits

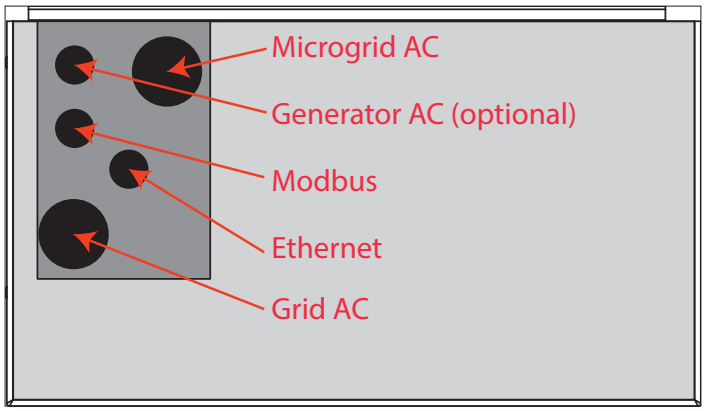


Fig. 20 Conduit entry location

► Use the holes in the top of the main cabinet to install your conduits.

► Seal unused holes with the provided caps.

Intended use	Conduit size	Wire gauge
Microgrid AC	2 inches	**eco 4-8:** 20 AWG - 8 AWG
		eco 10-16: 2 AWG - 3/0 AWG
Generator AC	1 inch	20 AWG - 8 AWG
Modbus	1 inch	24 AWG
Ethernet	1 inch	24 AWG
Grid AC	2 inches	**eco 4-8:** 20 AWG - 8 AWG
		eco 10-16: 2 AWG - 3/0 AWG

Table 2 Conduit entries and cable sizes

Using fewer conduit entry holes than provided is not supported by sonnen, will make installation more difficult, may cause you to violate bending radius guidelines, and may void your warranty.

6. Remove access panel

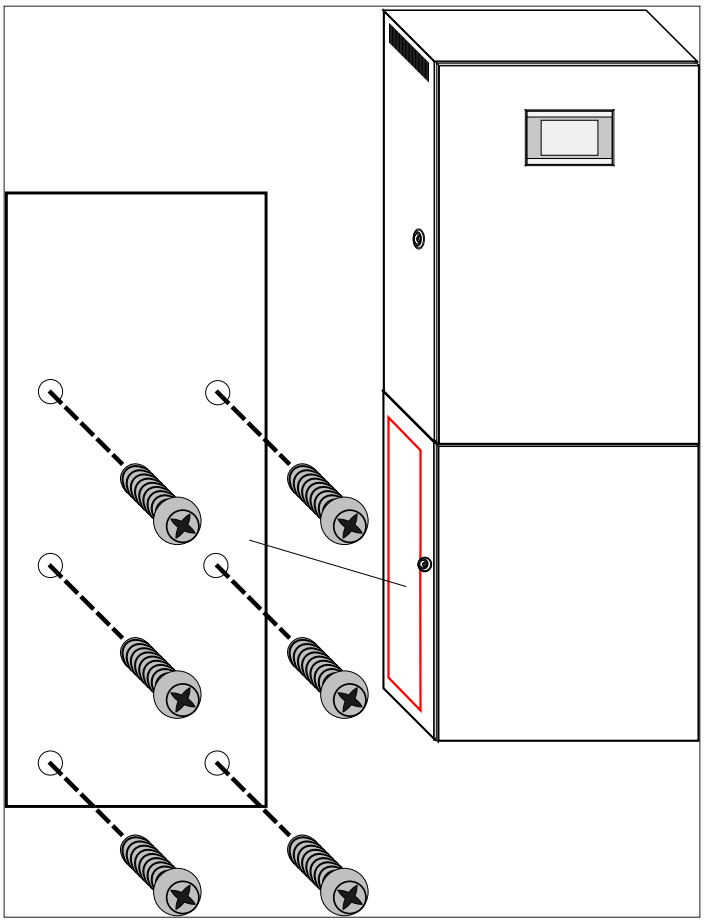


Fig. 21 Removing battery cabinet access panel cover

Tools needed:

- Phillips screwdriver

You can remove the access panel on the side of the battery cabinet to facilitate work on the battery module connections.

- ► Remove the screws using a Phillips screwdriver.
- ► Mount the cover after finishing work on the storage system.

Electrical connections

Only trained, electrically qualified persons that are certified by the manufacturer are allowed to perform the installation of the storage system. Any variation of the installation as it is described in this chapter must be arranged and approved by sonnen. Failure to comply with this condition will void any warranty claims.

DANGER

Danger to life by electric shock at improper electrical connection!

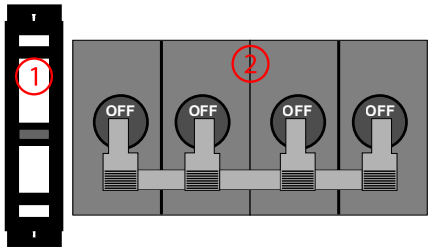
Improper attachment of the electrical connections may lead to death, injury, or material damages.

- ► Only trained, electrically qualified persons may perform the electrical installation.
- ► Observe all relevant regulations and standards.

WARNING

Danger to life by electric shock when working on the storage system or power distribution!

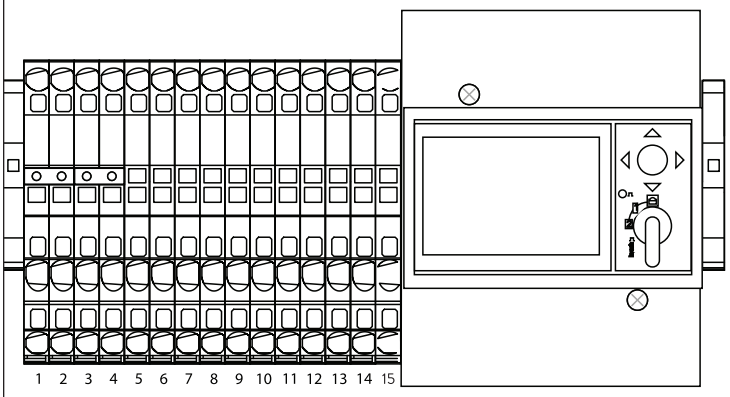
- ► Make sure no voltage is present.
- ► Ensure the main DC breaker is turned OFF.



sonnen

Terminal block map for installation and service

E-Stop, Generator, and Meter connections



1. Emergency Stop 1
2. Emergency Stop 2

page 29

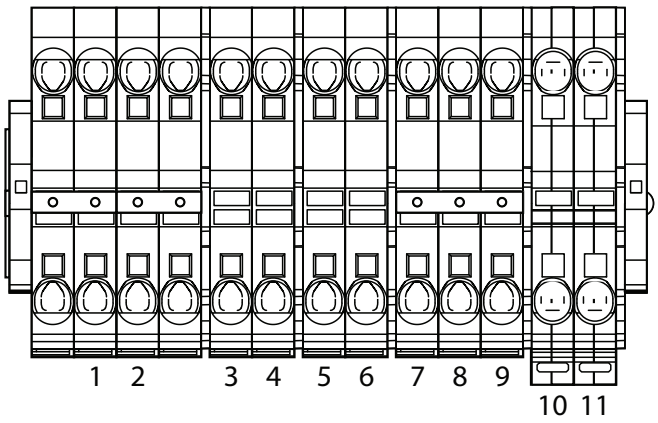
3. Generator Autostart 24V
4. Generator Autostart common
5. Generator Autostart 12V
6. Generator Autostart Normally Open
7. Generator Autostart Negative

page 26

8. PV CT2 S2
9. PV CT2 S1
10. PV CT1 S2
11. PV CT1 S1
12. PV N
13. PV L2
14 . PV L1
15. Ground

page 30

AC Connections



1. Microgrid L1
2. Microgrid L2

page 24

3. Grid L1
4. Grid L2

page 24

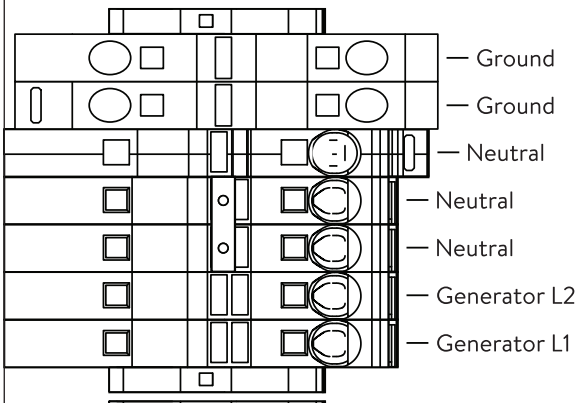
5. Generator L1
6. Generator L2
7. Grid N
8. Microgrid N
9. Generator N
10. Ground
11. Ground

page 25

Fig. 22 Terminal map for eco 4, 6, and 8

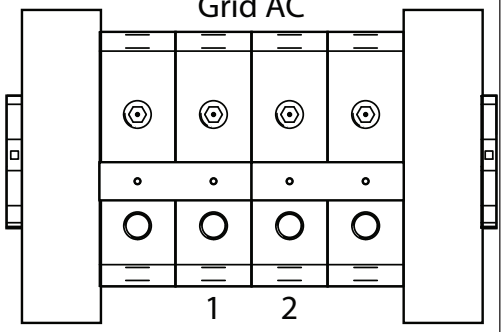
sonnen

Terminal block map for installation and service



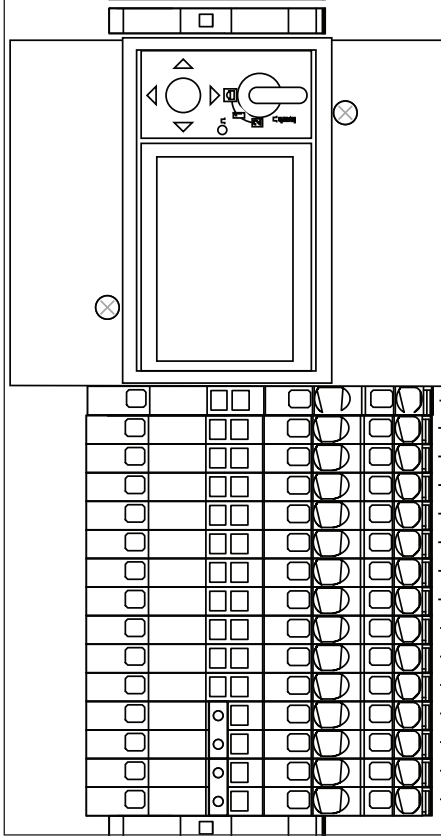
page 25

X1
Grid AC



1. Grid L1
2. Grid L2

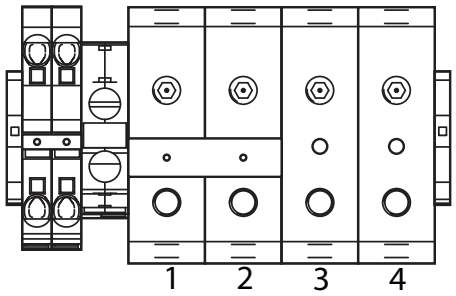
page 24



page 30

page 26

X10
Microgrid AC/Grid N



1. Grid N
2. Microgrid N
3. Microgrid L2
4. Microgrid L1

page 24

Fig. 23 Terminal map for eco 10, 12, 14, and 16

Connecting AC cables

DANGER

Danger to life by electric shock!

Touching live parts of the electrical connection may lead to death or serious injury.

- ► Turn off the storage system.
- ► Turn off the main disconnect circuit breaker.

Only trained, electrically qualified persons are allowed to perform the electrical installation.

Trained, electrically qualified person only!

The storage system has two AC primary connections: One for the utility grid and one for the microgrid. These connections must be made for the storage system to operate.

The utility grid port on the storage system must be connected to either the utility meter or the main utility panel. In either case, install a 200-amp main disconnect between the storage system and the utility grid.

If you will be using a protected loads panel, design the panel for a nominal current of 33A. The system is connected as illustrated here:

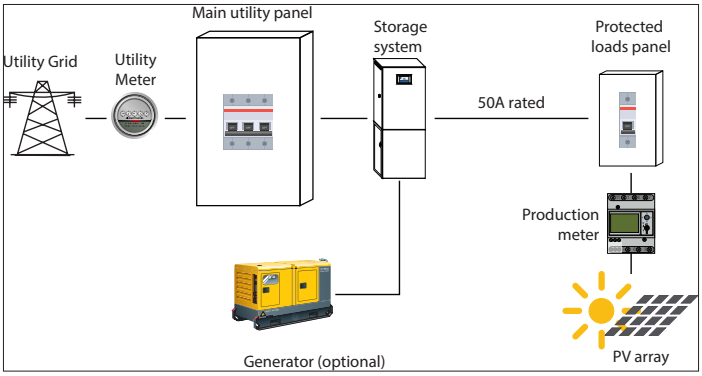


Fig. 24 Installation using protected loads panel

If you are not using a protected loads panel, you can use the storage system's built-in, 200-amp automatic transfer switch to provide backup power for your whole house. In that configuration, the system is installed as shown here:

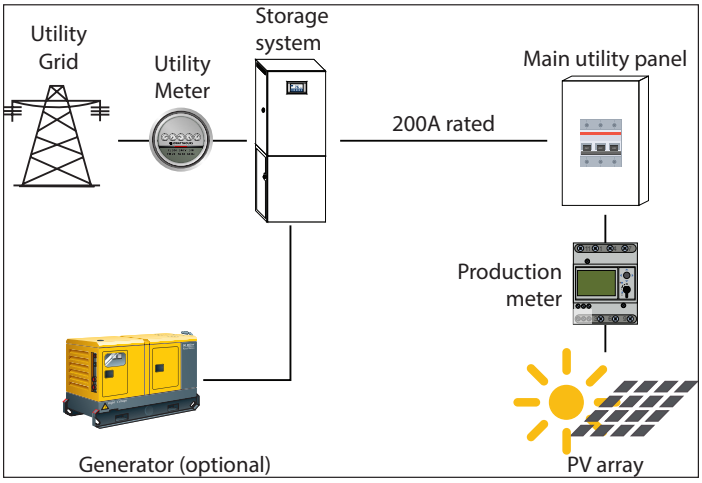


Fig. 25 Installation without protected loads panel

In either case, the load that will be powered by the eco is connected to the microgrid terminals inside the storage system. The storage system's built-in transfer switches will disconnect the utility connection should the utility grid stop providing power, and the microgrid will be powered by energy produced by the PV array and the energy stored in the eco's battery modules.

You can also connect a generator (up to 50 amps) to charge the batteries in the event they are discharged to the point that the storage system will not turn on and neither the grid nor solar power is available.

1. Install disconnect switch

Install a disconnect switch within eyesight of the storage system to remove power from the system during installation and service.

2. Install junction box for splicers (optional)

If desired, install a junction box to house in-line splicers such as a NSI Tork ISR-1/0 to reduce the size of the cable run from the distribution panel to the storage system.

3. Run cables into the storage system

Using the holes in the top left corner of the main cabinet as shown in "Place conduits" on page 18, insert cables of the appropriate wire gauge and ampacity for the utility grid connection, the microgrid connection, and the optional generator connection, if desired.

Using fewer conduit entry holes than provided is not supported by sonnen, may make installation more difficult, and may void your warranty.

4. Prepare cable and strip wires

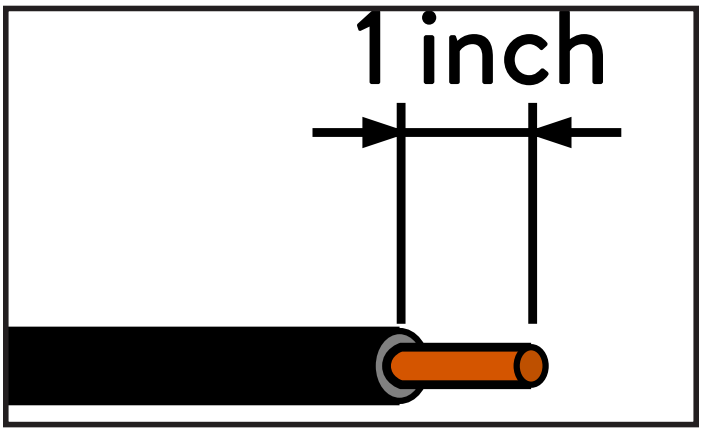


Fig. 26 Stripping cable

Strip 1 inch of insulation from the L1, L2, and N cables to insert them into the terminals inside the storage system.

5. Connect microgrid cables to storage system terminals

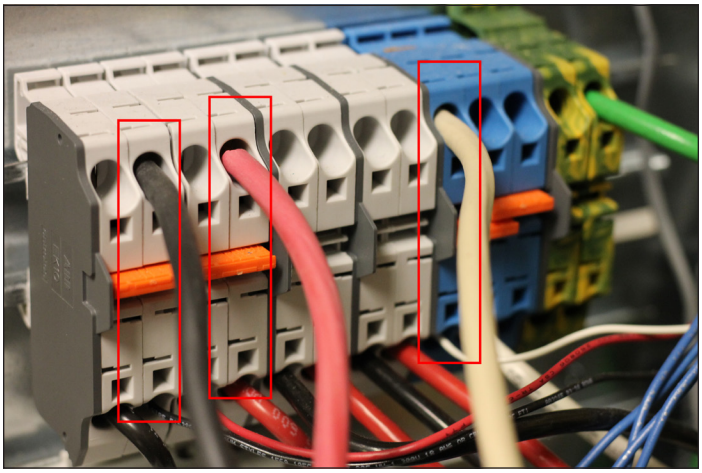


Fig. 27 Microgrid connections - eco 4-8

Tools needed:

- 1/8-inch tip screwdriver

The microgrid connection terminals are in the top left corner of the main cabinet. The L1 and L2 terminals are on the left end of the bank, and the N connection point is one of blue terminals toward the right end of the bank.

► Connect the microgrid L1, L2, and N cables to the storage system's terminals.

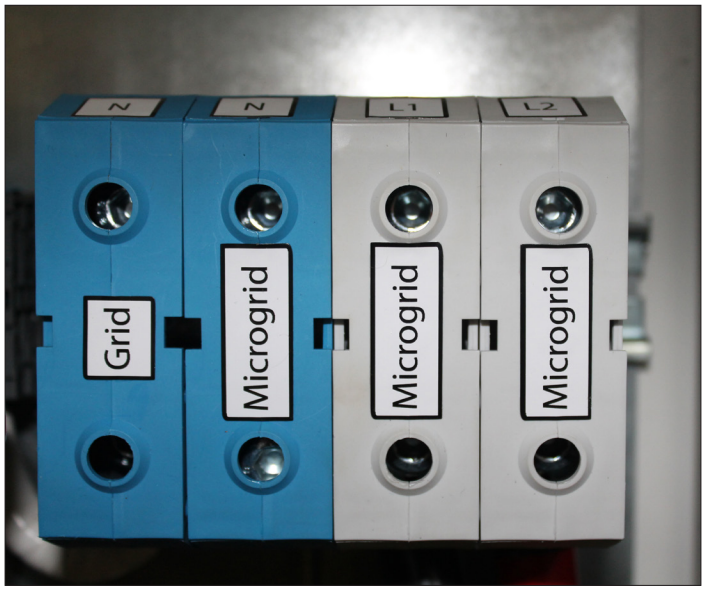


Fig. 28 Microgrid connections - eco 10-16

Tools needed:

- 5mm hex wrench

The microgrid connection terminals are in the top left corner of the main cabinet, in the bank on the back of the cabinet.

► Connect the microgrid L1, L2, and N cables to the storage system's terminals with the corresponding labels.

6. Connect grid cables to storage system terminals

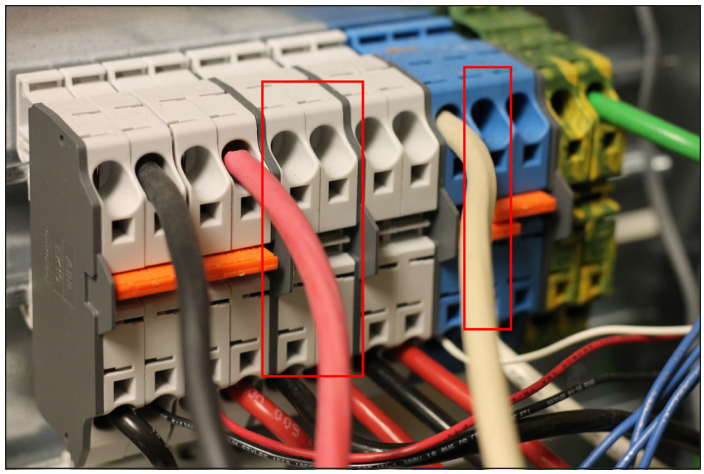


Fig. 29 Grid connections - eco 4-8

Tools needed:

- 1/8-inch tip screwdriver

The grid connection terminals are in the top left corner of the main cabinet. The L1 and L2 connection points are the second set from the

left, and the N connection point is one of blue terminals toward the right end of the bank.

- ► Connect the grid L1, L2, and N cables to the storage system's terminals with the corresponding labels.

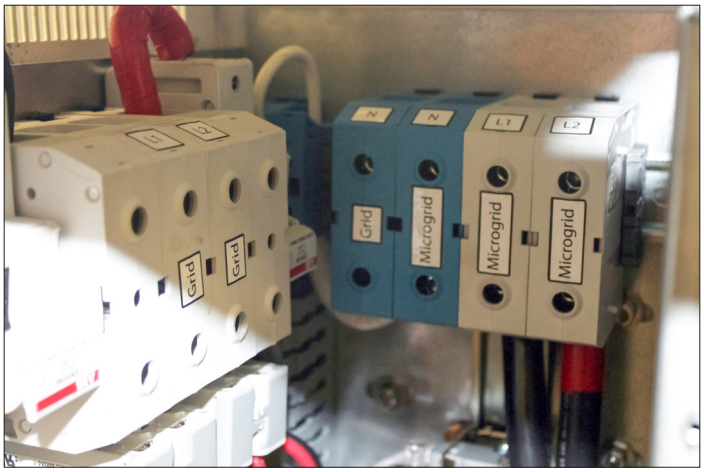


Fig. 30 Grid connections - eco 10-16

Tools needed:

- 5mm hex wrench

The utility grid connection terminals are in the top left corner of the main cabinet. The L1 and L2 terminals are in the bank on the left side, and the N terminal is in the bank in the back.

- ► Connect the utility grid L1, L2, and N cables to the storage system's terminals with the corresponding labels.

7. Connect ground cables

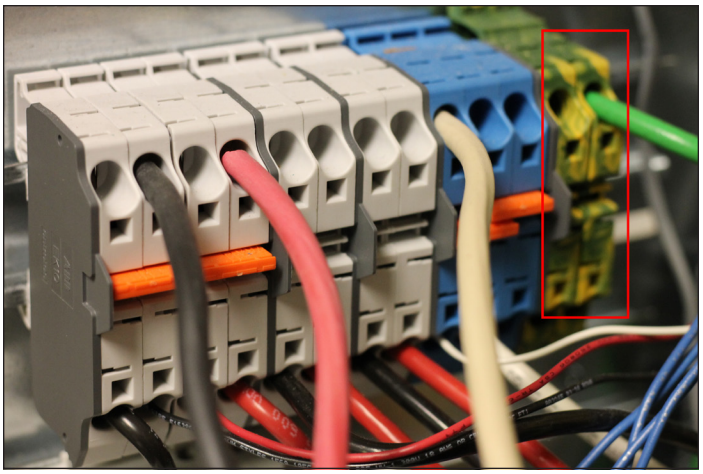


Fig. 31 Ground connections - eco 4-8

Tools needed:

- 1/8-inch tip screwdriver

- ► Connect your ground cables to the green ground terminals at the right end of the terminal block set.

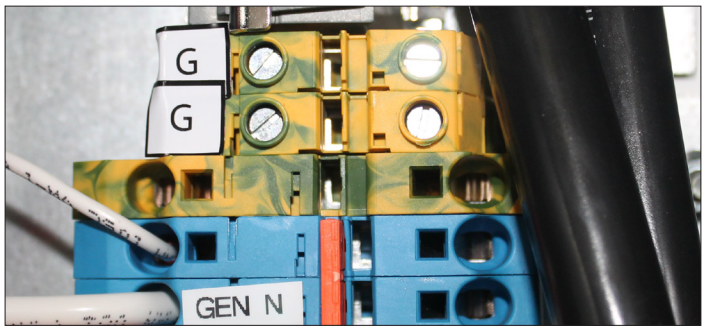


Fig. 32 Grounding connections - eco 10-16

Tools needed:

- 1/8-inch tip screwdriver

- ► Connect your ground cables to the green ground terminals at the top of the vertical DIN rail.

Connecting a generator (optional)

CAUTION

Risk of damaging equipment by connecting three-phase generator

Only "split-phase" generators can be used with the storage system. Connecting a three-phase generator may damage the storage system or generator.

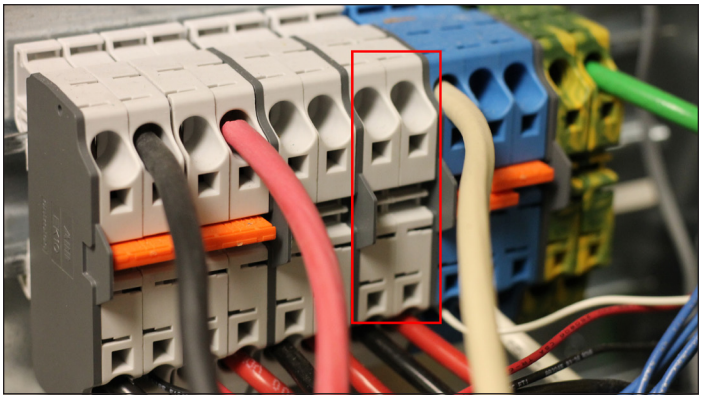


Fig. 33 Generator AC connections - eco 4-8

Tools needed:

- 1/8-inch tip screwdriver

The connections are in the middle of the terminal block bank in the upper left corner of the cabinet. To connect a generator:

► Connect the generator's L1, L2, and N AC connections to the appropriately labeled terminals in the storage system.

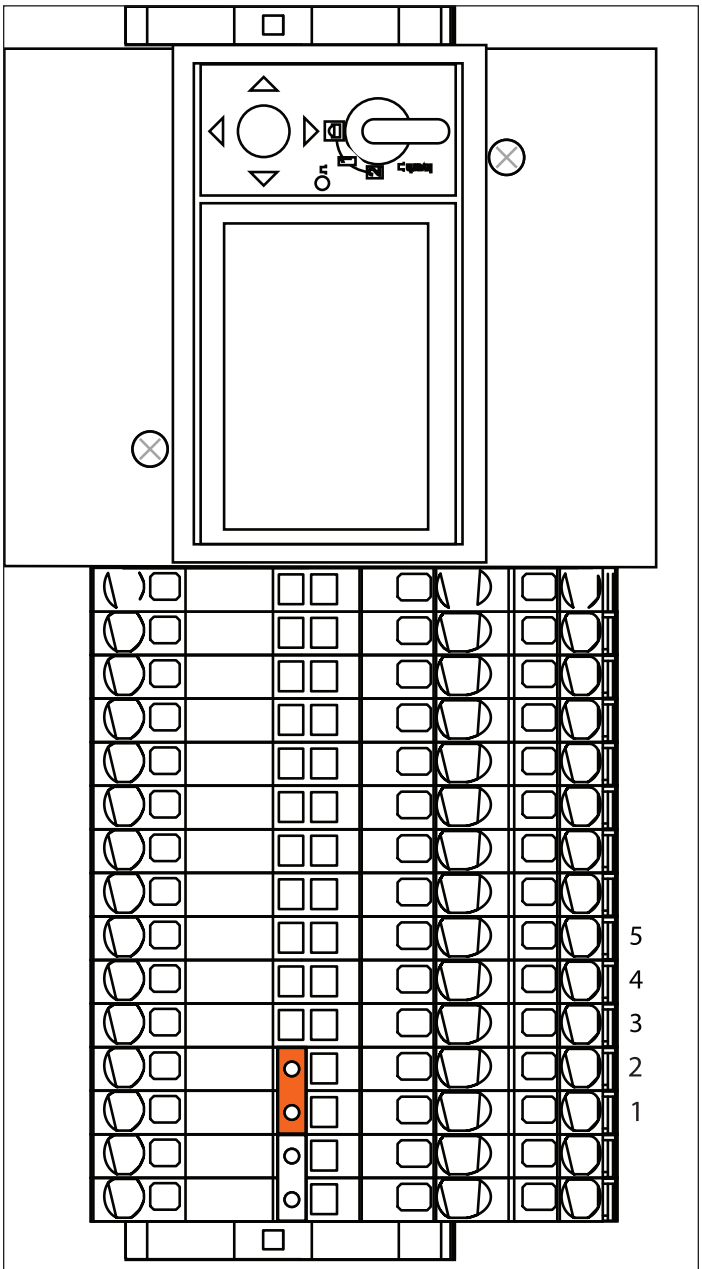
Fig. 34 Generator AC connections - eco 10-16

Tools needed:

- 1/8-inch tip screwdriver

The connections are on the main connection rail, directly above the internal power meter. To connect a generator:

► Connect the generator's L1, L2, and N AC connections to the appropriately labeled terminals in the storage system.



1. Generator Autostart 24V
2. Generator Autostart common
3. Generator Autostart 12V
4. Generator Autostart Normally Open
5. Generator Autostart Negative

Fig. 35 Generator autostart connections

There are three methods for wiring the autostart circuit, based on the requirements of the generator:

1. 12V signal
2. 24V signal
3. Dry contact (Continuity)

Refer to the illustration above to wire your two-wire start circuit to the storage unit. Use 18AWG wires to make the appropriate connections.

1. 12V Signal

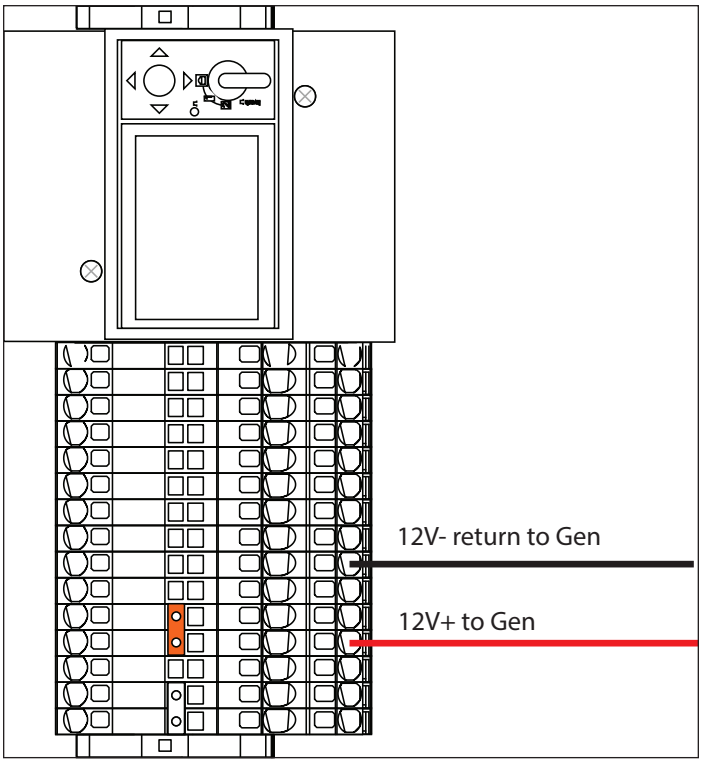


Fig. 36 12V Generator Autostart wiring

- ► Remove the orange jumper from between Generator Autostart 24V and Generator Autostart common (1 and 2 in the illustration.)
- ► Place the jumper between Generator Autostart Common and Generator Autostart 12V (2 and 3 in the illustration.)
- ► Connect the Generator's positive (+) wire to Generator Autostart common (2 in the illustration).
- ► Connect the Generator's negative (-) wire to Generator Autostart Negative (5 in the illustration).

2. 24V Signal

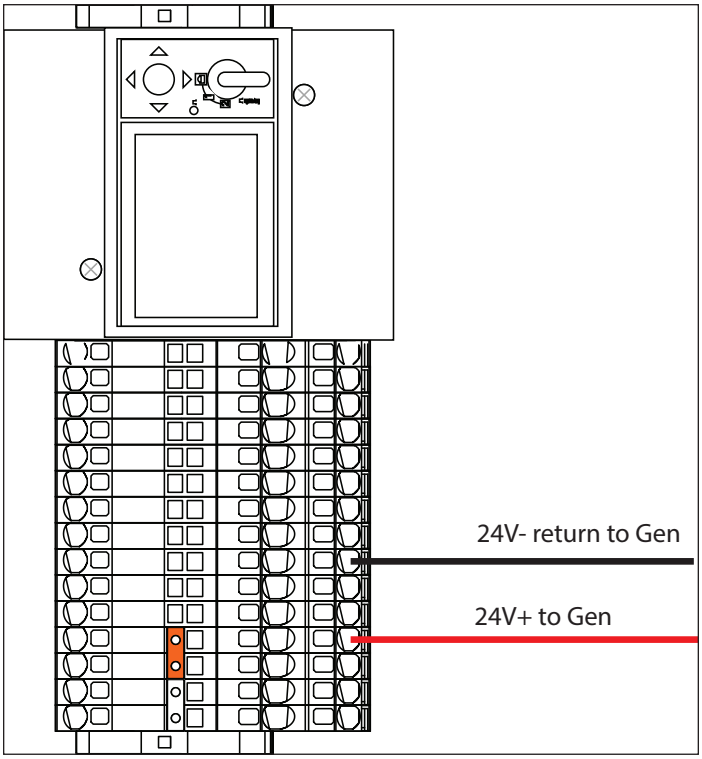


Fig. 37 24V Generator Autostart wiring

- Connect the Generator's positive (+) wire to Generator Autostart common (2 in the illustration).
- Connect the Generator's negative (-) wire to Generator Autostart Negative (5 in the illustration).

3. Dry contact (Continuity)

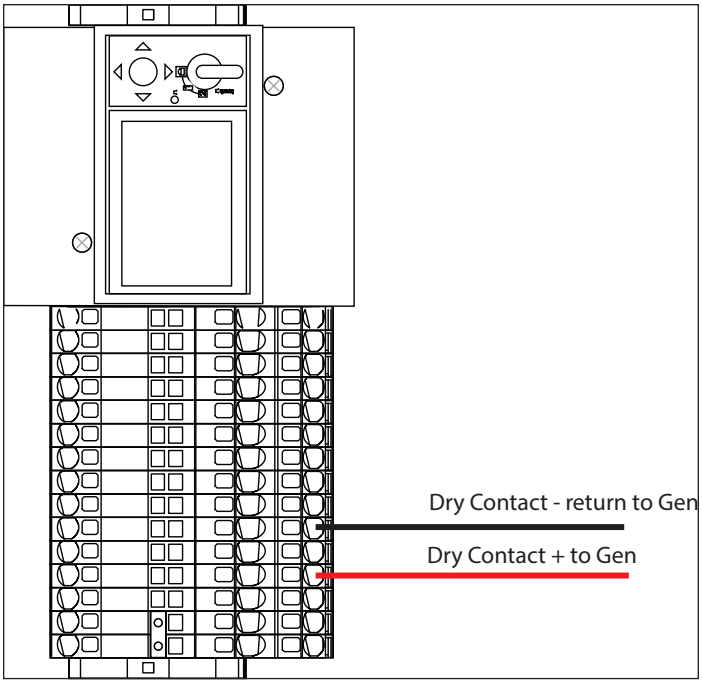


Fig. 38 Dry Contact Generator Autostart wiring

- Remove the orange jumper from between Generator Autostart 24V and Generator Autostart common (1 and 2 in the illustration.)
- Connect the Generator's positive (+) wire to Generator Autostart common (2 in the illustration).
- Connect the Generator's negative (-) wire to Generator Autostart Normally Open (4 in the illustration).

Connecting an Ethernet cable

► Connect a shielded ethernet cable to the ethernet socket.

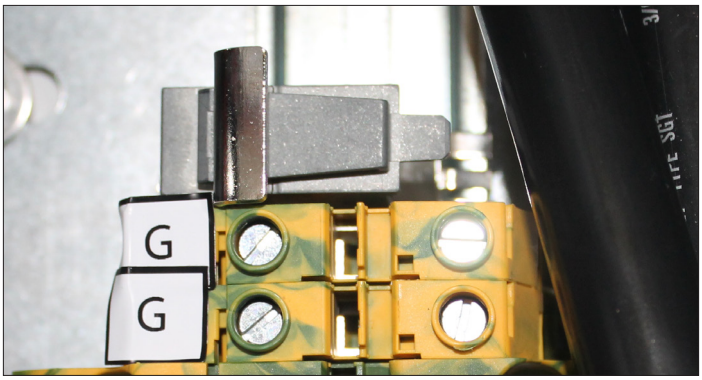


Fig. 39 Ethernet socket

Installing an emergency switch (optional)

The circuits are not appropriate for all circumstances and are provided as examples only. In some cases, approval of the utility company may be required.

Trained, electrically qualified person only!

The external emergency switch allows you to deactivate the storage system in the event of an emergency. You must install the switch at an easily accessible location in the house. When you press the emergency switch, the storage system is deactivated as a voltage source and turned off completely.

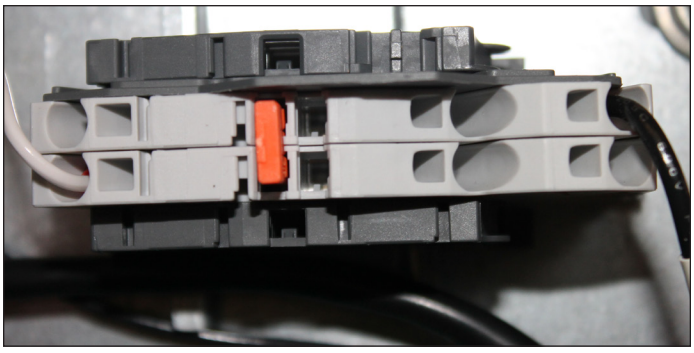


Fig. 40 E-Stop wiring

Tools needed:

- Small flathead screwdriver

To install an emergency switch:

► Remove the orange jumper from Terminal blocks X8:1-2, located on the bottom of the vertical Main Din Rail.

► Connect a normally closed, plunger-style, 24V-rated switch to the supplied two-terminal connector.

► Install the switch at an accessible location.

Connecting PV Production Meter

The PV production meter, which the storage unit uses to determine how much renewable AC power is available, is located inside the main cabinet on the vertical main DIN rail. The current transformers must be installed on the L1 and L2 outputs of the PV inverter.

1. Current transformers

► Mount the current transformers in a location with access to L1 and L2, no more than three meters away from the storage unit.

2. Connect current-measuring wires

The current-measuring wires are connected by one end to terminal blocks on the main vertical DIN rail. They are labeled on the unattached end as follows:

- L1 CT S1
- L1 CT S2
- L2 CT S1
- L2 CT S2

Remove any wire ties or other attachments and run them out of the top of the unit.

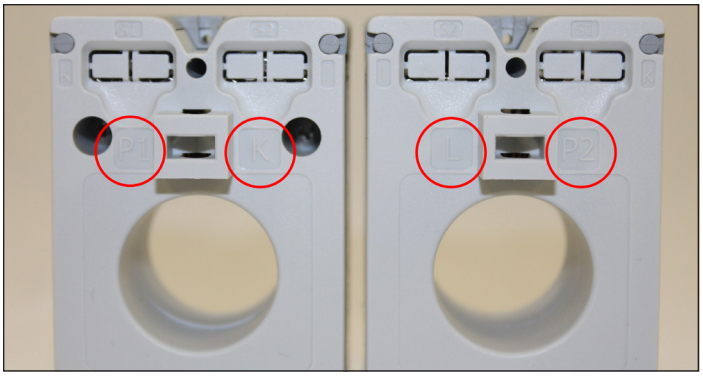


Fig. 41 Current transformer markings

► Run L1 through current transformer 1

The side of the current transformer with P1 and K must face the PV inverter. The side with L and P2 must face the distribution panel.

► Connect the current transformer to the meter

  ► Connect the wire labeled "L1 CT S1" to the S1 connection on the top of the L1 current transformer.

  ► Connect the wire labeled "L1 CT S2" to the S2 connection on the top of the L1 current transformer.

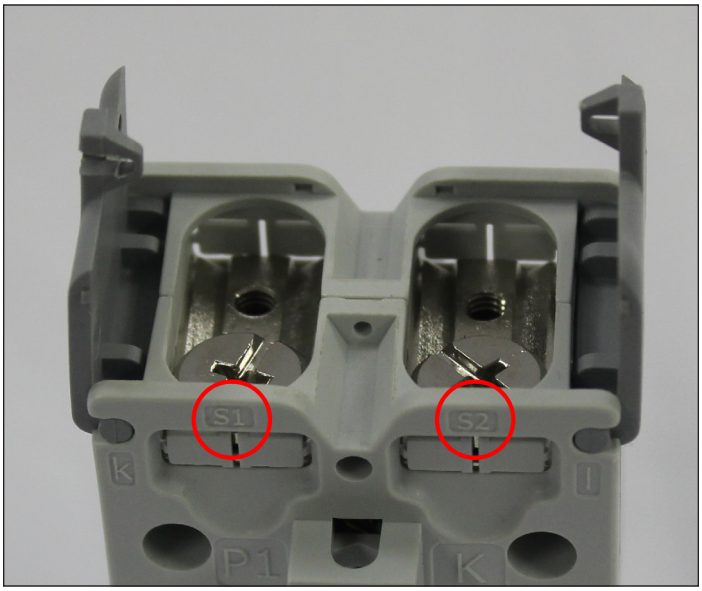


Fig. 42 Current transformers S1 and S2

► Run L2 through current transformer 2

The side of the current transformer with P1 and K must face the PV inverter. The side with L and P2 must face the distribution panel.

► Connect the current transformer to the meter.

  ► Connect the wire labeled "L2 CT S1" to the S1 connection on the top of the L2 current transformer.

  ► Connect the wire labeled "L2 CT S2" to the S2 connection on the top of the L2 current transformer.

3. Connect voltage-measuring cables

Next, you must connect the power source to the meter to measure the voltage.

► Install a two-pole breaker in the distribution panel the storage unit will power.

► Using the breaker, run appropriately sized cables for L1, L2, and N to the meter.

► Connect L1 to Terminal Block X8:14c on the vertical main DIN rail.

► Connect L2 to Terminal Block X8:13c on the vertical main DIN rail.

► Connect N to Terminal Block X8:12c on the vertical main DIN rail.

► See the decal on the inside of the door or page 21 to identify the correct terminal blocks.

Programming the power meters

The power meters ship from the factory pre-programmed. If you need to reprogram the meters, follow the steps below:

1. Move the switch to an unlocked position.
2. Hold joystick in for 3 seconds to access programming mode.
3. A screen will appear asking for the password (“PASS ?”). Enter 0 by moving the joystick up and down. Press in on the joystick to enter.
4. Press right on the Joystick once to enter Application Type. Press in on the joy stick to change the entry, and move the joystick left and right to select E.
5. Press right on the joystick twice to reach the System (“SYS”) page. Click in on the joystick to change the entry, and move the joystick left and right to select 2P.
6. Click to set the entry.
7. Press right twice reach the CT Ratio Screen (“Ct rAtio”). Click in on the joystick to change the entry, and move left and right and up and down as necessary to enter 10 for the production meter or 40 for internal consumption meter. Click to set the entry.
8. Press right four times on the joystick to reach the Address screen (“AddrESS”) screen. Click in on the joystick to change the entry, and move up and down to select 4 for the production meter or 5 for consumption meter. Click to set the entry.
9. The Baud rate screen will appear (“bAudrAtE”). Click in on the joystick to change the entry, and move the joystick left and right to select 9600. Click to set the entry.
10. Press right twice to reach the End screen (“End”). Click to exit programming mode.

Installing battery modules

WARNING

Risk of burns!

Very high short circuit currents are possible!

- ► Ensure the orange safety plugs are not installed in the battery modules until told they are needed in the installation process.
- ► Take off metallic jewelry.
- ► Turn off the storage system.
- ► Turn off main disconnect switch.

Trained electrically qualified person only!

Attention

Damage of the battery cells by short circuit!

If the battery cells short-circuit:

- ► Do not connect the affected modules to the storage system!
- ► Contact sonnen's service department.

1. Check battery module voltage

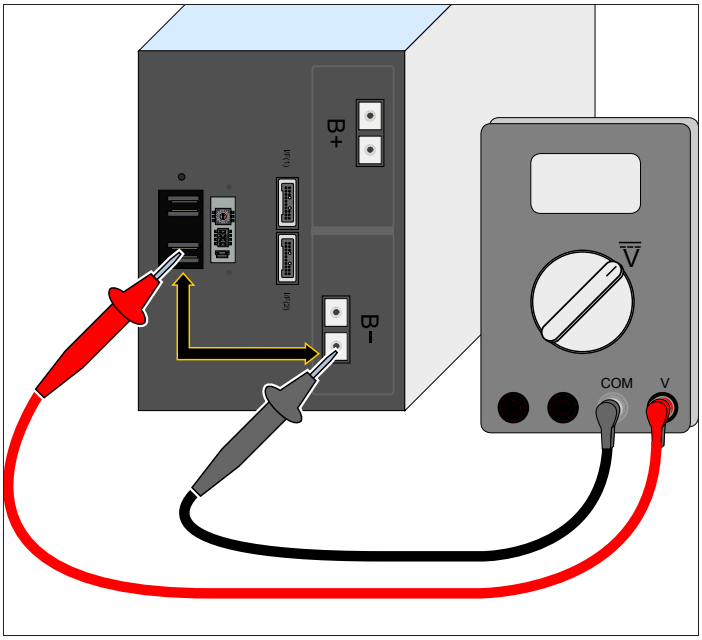


Fig. 43 Measuring voltage on battery modules

Tools needed:

- Voltmeter

- ► Measure and note all voltages between the internal plus pole and the negative terminal of all battery modules.

► Use the following table to record the voltages:

Module	Voltage	Module	Voltage
0		4	
1		5	
2		6	
3		7	

Table 3 Battery module voltages

► Only install the battery modules if the maximum deviation between the measured voltages is less than 1V. If the deviation is higher, contact sonnen's service department.

Attention

Damage of the battery modules by high balancing currents!

Differing voltages between the battery modules can lead to high balancing currents when turning on the storage system.

2. Label the battery modules

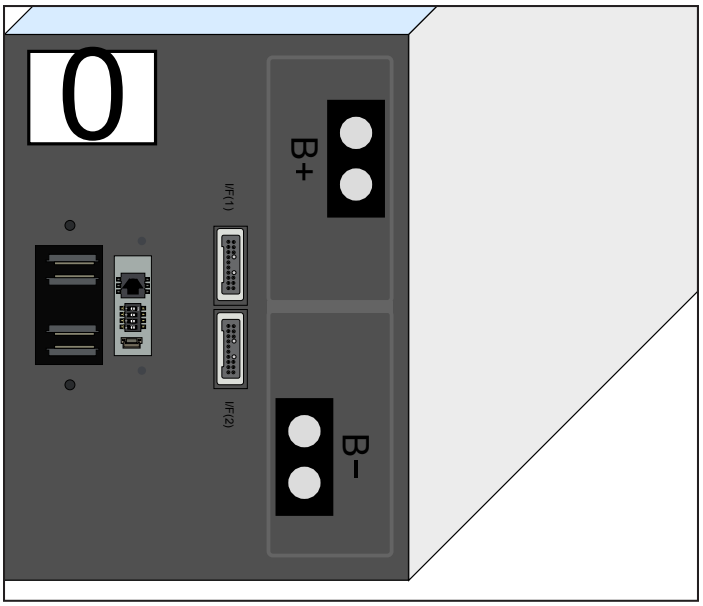


Fig. 44 Labeling battery modules

► Place the supplied stickers.

Start the numbering with zero and continue consecutively.

3. Set communication address on each module

Tools needed:

- 1/8-inch tip screwdriver

► Set the communication addresses of the battery modules by using the rotary switch to select the number placed on the module.

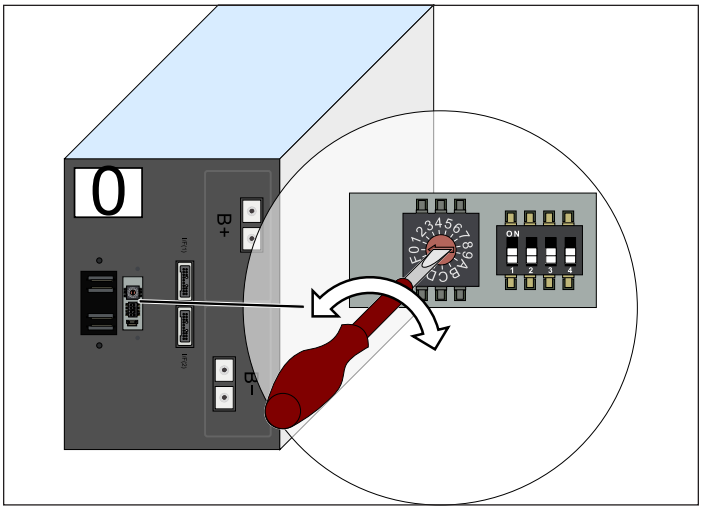


Fig. 45 Defining address of battery modules

4. Set the termination switch on highest-numbered module

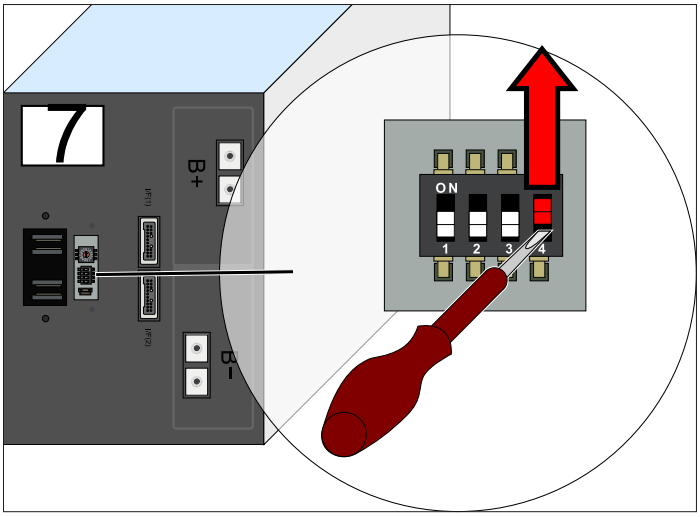


Fig. 46 Setting termination switch on final module

Tools needed:

- 1/8-inch tip screwdriver

► Set the termination switch (switch No. 4) on the highest-numbered battery module to the ON position. All other battery modules must have switch No. 4 set to OFF.

5. Place battery modules

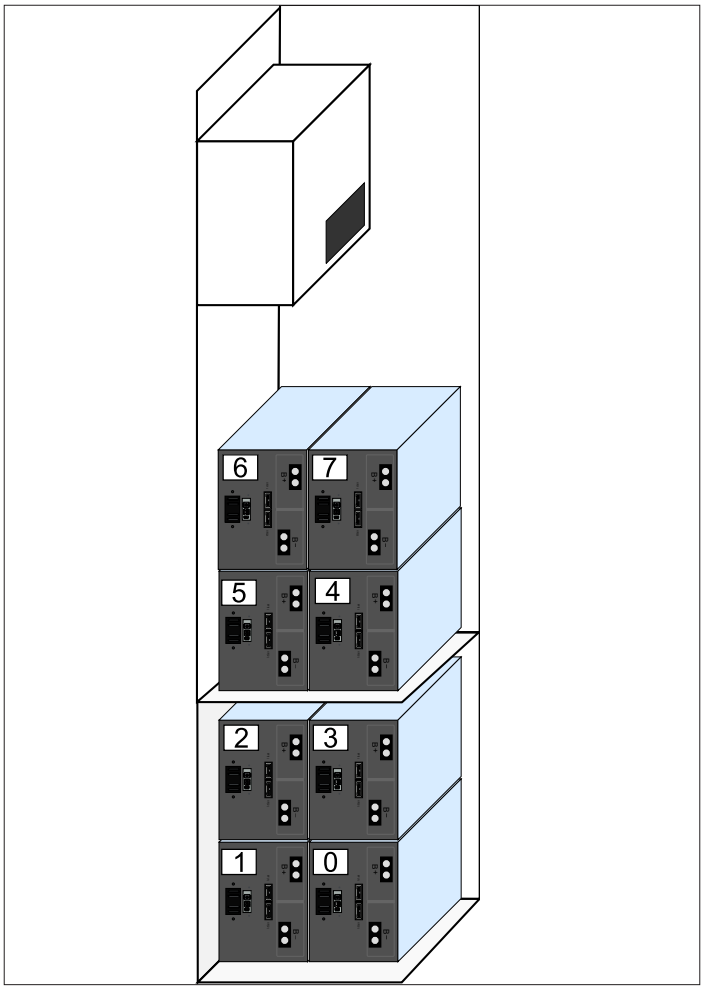


Fig. 47 Placing battery modules

► Stack the battery modules so the battery modules designated No. 0 and No. 7 are closer to the access door.

Keeping battery modules No. 0 and No. 7 accessible makes the rest of the installation process easier and safer.

6. Connect battery modules

DANGER

Danger to life by electric shock by improper DC connection!

Connecting the battery modules in series can cause life-threatening voltages.

► Connect the battery modules in parallel; i.e., connect all of the positive poles of the battery modules to each other and all of the negative poles of the battery modules to each other.

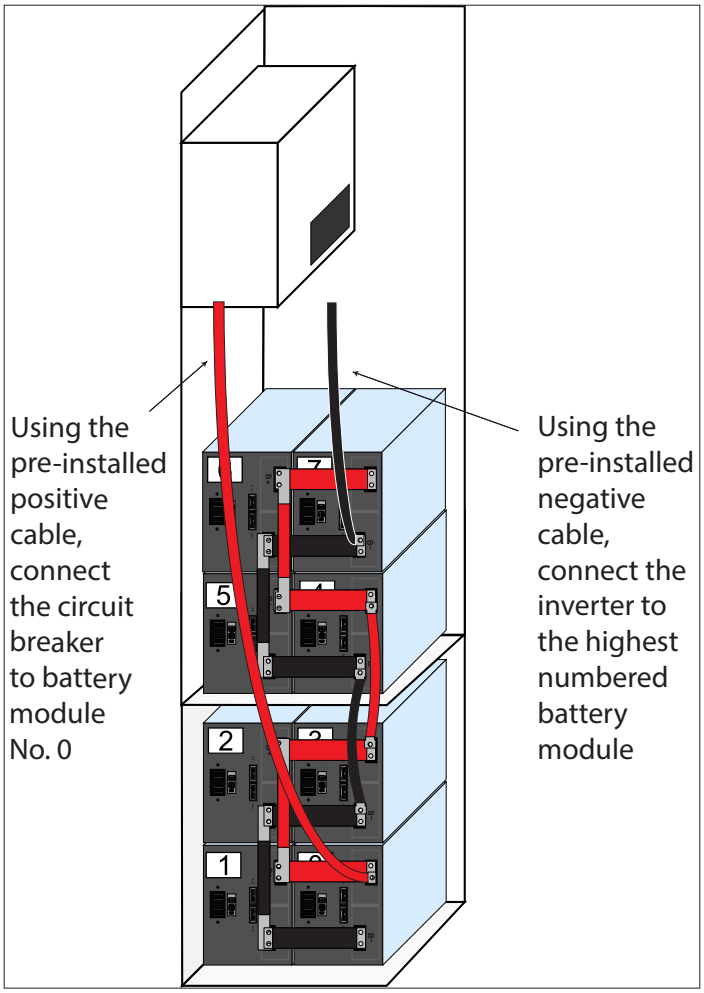


Fig. 48 Connecting battery modules

Tools needed:

- 5mm hex wrench

► Connect the battery modules to each other using the supplied bus bars. As illustrated above, connect all of the positive terminals to each other using the bus bars with red insulation and

all of the negative terminals to each other using the bus bars with black insulation.

► If applicable, connect battery module No. 3 in the battery cabinet to battery module No. 4 in the main cabinet using the supplied red and black 2/0 “jumper” cables.

For your convenience, the eco has two 2/0 “home run” cables pre-installed.

► Connect the red cable to battery module No. 0.

► Connect the black cable to the highest-numbered battery module.

► Torque the screws to 3 ft lb.

WARNING

Possible fire hazard by high contact resistances and short circuit!

Incorrectly torqued DC wires and bus bars can lead to short circuit and excessive heating This can cause a fire, personal injury, and damage to the battery modules.

► Check all DC connections. Only red DC cables and bus bars are permitted to be connected to positive connections on the battery modules. The black DC cables and bus bars are only permitted to be connected to negative connections of the battery modules.

► Torque all DC cables and bus bars to 3 lb ft (4 Nm).

7. Connect BMS communication cables

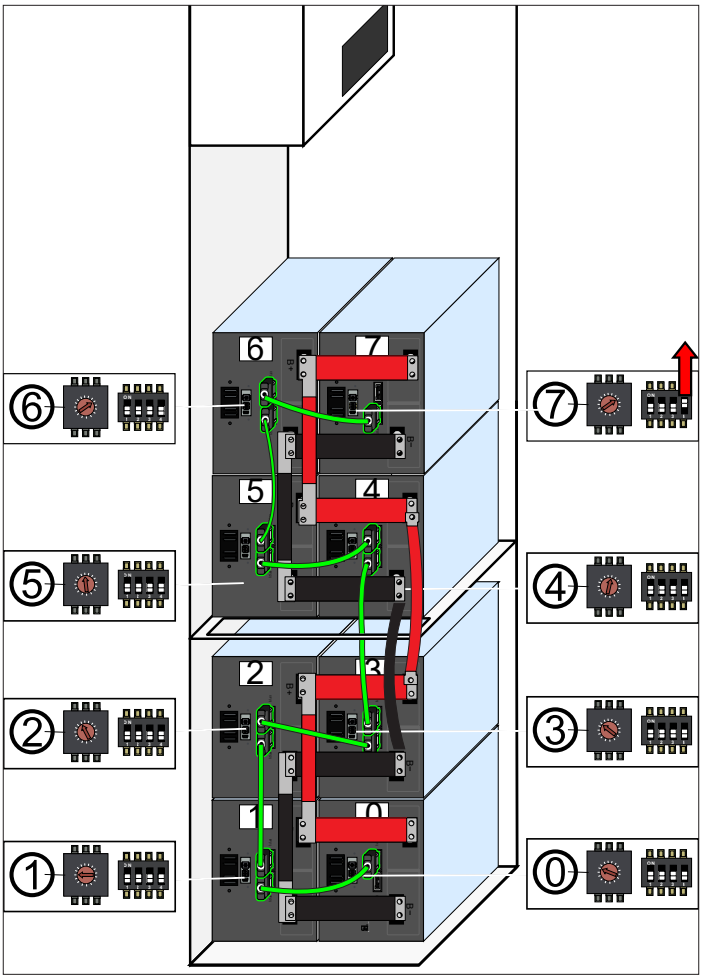


Fig. 49 Connecting BMS communication cable

► Plug one end of the longest BMS communication cable into battery module No. 0. You will plug in the other end in the next step.

► Starting with battery module No. 0, daisy-chain the battery modules using the communication cables in sequence (i.e., module 0 to module 1, module 1 to module 2, etc.) The communication wire must click into place.

If you must unplug a BMS communication cable:

► Press the nose on the plug.

► Remove the BMS communication cable.

8. Connect battery modules to the charge controller

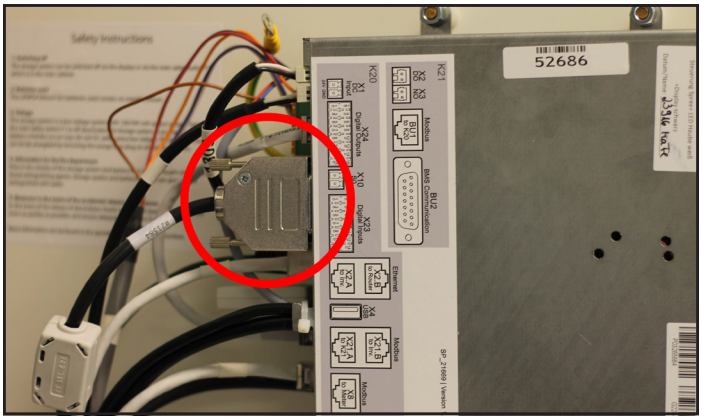


Fig. 50 Connecting to charge controller

► Connect the BMS communication cable to the charge controller as illustrated above.

The charge controller is located on the back of the the main cabinet door.

9. Check wiring

► Check DC screw connections.

► Make sure the modules are connected in parallel.

10. Insert safety plugs

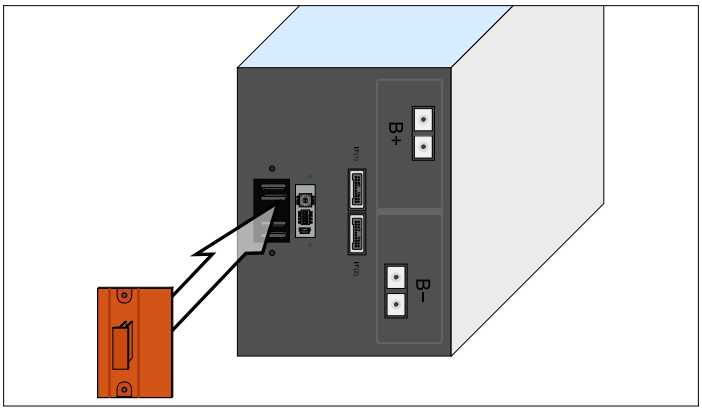


Fig. 51 Inserting safety plug

► Insert the orange safety plugs into all battery modules.

Be very careful, as the battery modules are now voltage sources.

11. Replace access panels

12. Replace shielding panel

Commissioning

This chapter describes the commissioning process.

The commissioning process is accomplished using the storage system's internal web server. Therefore, an Internet connection is required for commissioning the unit.

If internet service to the house has not been installed, you can create a network using a wireless router or network extender and pairing it with a smartphone.

If a network connection has not been established, the commissioning process cannot be completed.

Commissioning checklist

► The following items should be checked before starting the system.

Prerequisites

☐	The mounting location fulfills the requirements listed on page 14.
☐	All DC bus bars and wires are connected properly.
☐	All Modbus cables are connected properly.
☐	The overcurrent protection of the storage system is sized properly.
☐	The electrical connections fulfills all requirements of local, regional, and national regulations.
☐	The electrical connections of the storage system have been performed correctly.
☐	The storage system has been connected to the Internet.

Table 4 Commissioning prerequisites

Turn on the storage system

The main DC circuit breaker F1 and the switch S1 are located in the interior of the main cabinet.

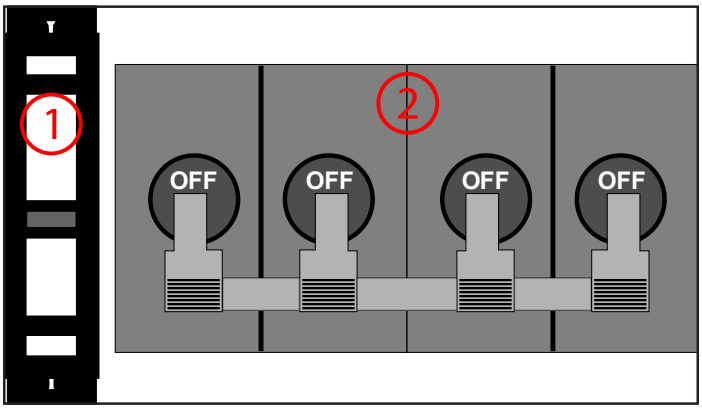


Fig. 52 Switch and circuit breaker

(1) Switch

(2) Main circuit breaker

Attention

Damage of the storage system by high currents!

High currents can damage components of the storage system if the process is not followed properly.

► Turn on the storage system only according to the steps below.

1. Make sure the battery emergency switch is turned on (if available). See "Ethernet socket" on page 29 for more information.
2. Press switch S1 for at least 30 seconds and keep it pressed for the next step.
3. Turn on main circuit breaker F1 of the main cabinet.
4. Release switch S1.

1. Determine the storage system's IP address

Fig. 53 Identifying the storage system

- Visit https://find-my.sonnen-batterie.com/. This website will list all of the units on the network. Identify the system you are commissioning and press the "Konfigurieren" button.

2. Log in to the storage unit

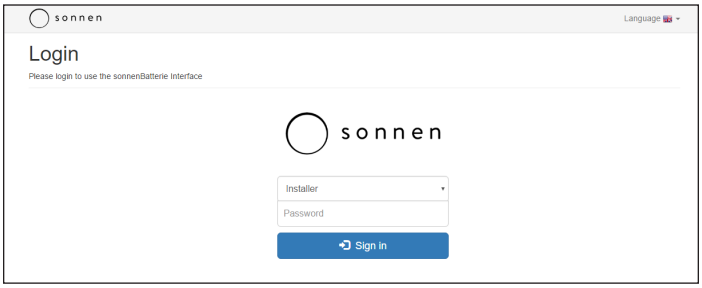


Fig. 54 Logging in to the storage system

- To begin the commissioning process, log in to the storage unit.
- Use the following login information to access the storage unit.

Account	Password
Installer	Sonnen@Installer2016

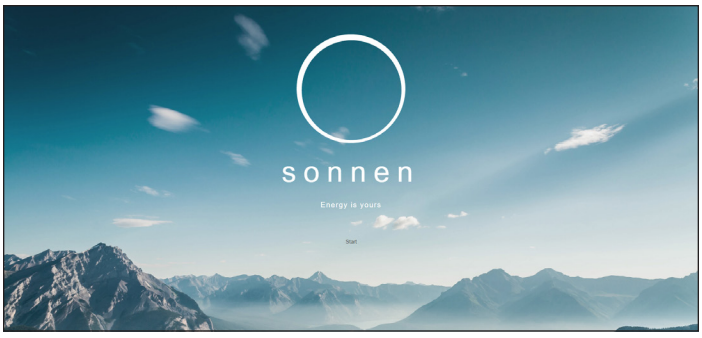


Fig. 55 Start page

- Press start to begin the Commissioning Assistant.

The Commissioning Assistant has 11 steps that must be completed before the unit can be used.

3. Set installation location

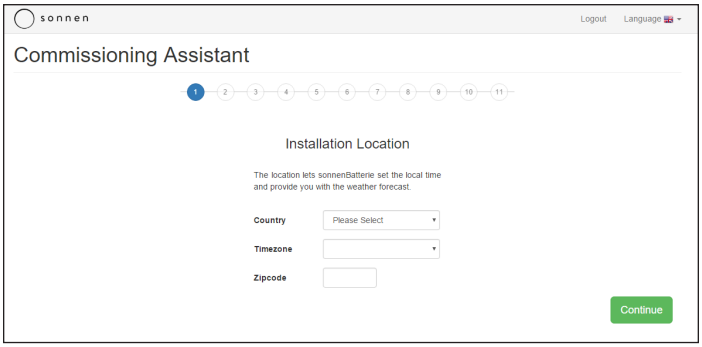


Fig. 56 Setting the installation location

- Set the location and timezone for the storage system.
- Press Continue.

4. Set Date and Time

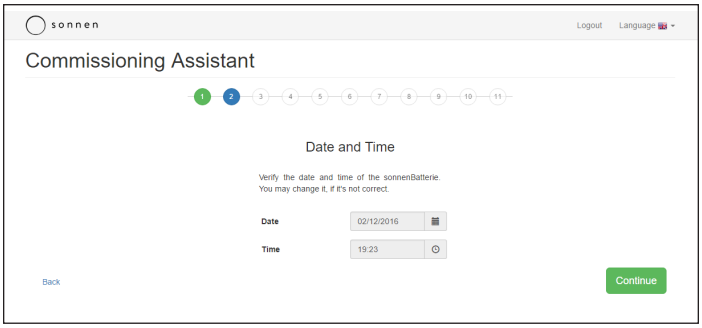


Fig. 57 Setting the date and time

- Set the date and time.
- Press Continue.

5. Enter PV System information

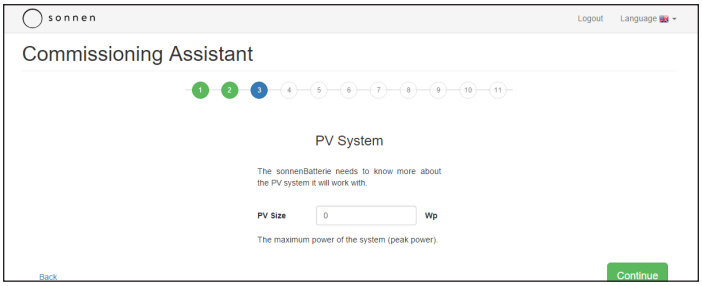


Fig. 58 PV System Size input

- Enter the maximum power of the solar inverter.
- Press Continue.

6. Enter Generator Autostart information

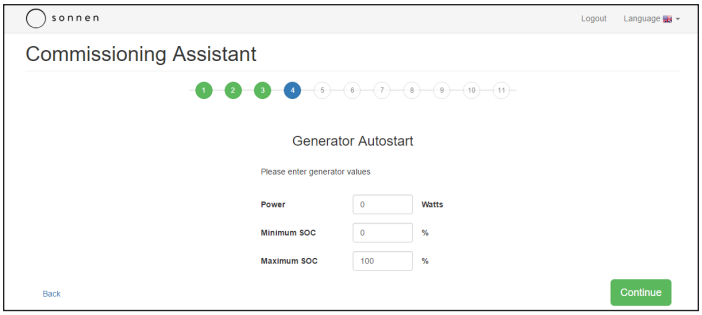


Fig. 59 Generator Autostart information

The sonnenBatterie eco can control a generator to provide power in the event that the storage system has reached a low state of charge, the grid is unavailable, and the PV system is not producing power. When these criteria are met, the storage system will start the generator and keep it running until the battery modules have reached a pre-configured state of charge, the grid becomes available, or the PV system begins producing power.

► Enter the following information:

- Power: Set this value to the power of your generator, up to a maximum of 3000 watts for eco 4, 6, and 8 units and 6000 watts for eco 10, 12, 14, and 16 units. Set to 0 if you won't be using a generator. This setting dictates only the power that will be used to charge the battery modules. Any additional power the generator produces will go to loads.
- Minimum SOC: Set this to the state of charge at which the generator should start. Most users will not want this value to be less than 10 percent. Set to 0 if you won't be using a generator.
- Maximum SOC: Set this to the state of charge at which the generator should stop providing power. Set to 0 if you won't be using a generator.

► Press Continue.

7. Enter PV system information

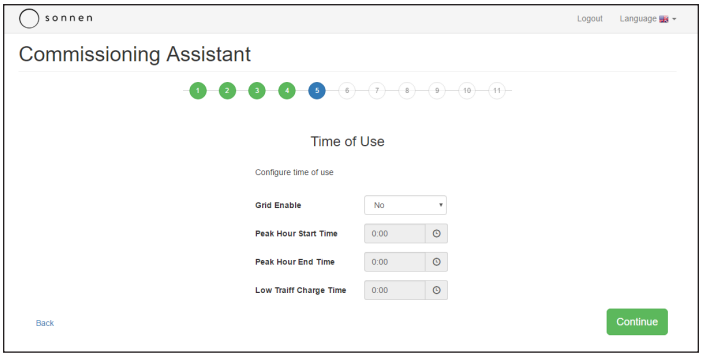


Fig. 60 Time of Use information

Many utility companies are moving to a Time of Use-based billing scheme, in which electricity costs more during high-demand time periods. The storage system can maximize your cost savings by using employing “rate arbitrage” - using your stored battery power during the high-cost part of the day and recharging from solar and optionally with electricity purchased from the grid at the lowest offered rates.

If you enable Time of Use, the storage system will only discharge during the high-tariff time. The rest of the day, it will charge its batteries.

► Before entering these values, obtain information from the utility provider about their time of use scheme, if applicable.

► Enter the following information:

- Grid Enable: If you set it to “No,” the storage unit will not purchase power from the utility to charge its batteries even during low-tariff times; instead, it will only charge the batteries from solar power generation. If you set it to “Yes,” it will purchase power to charge the batteries from the grid during low-tariff times only to ensure the system receives a full charge.
- Peak Hour Start Time: When the high-tariff period begins.
- Peak Hour End Time: When the high-tariff period ends.
- Low Tariff Charge Time: If your utility has a low-tariff period, the storage system will charge from the grid during this time if Grid Enable is set to Yes.

► Press Continue.

8. Configure Microgrid "wake-up" times

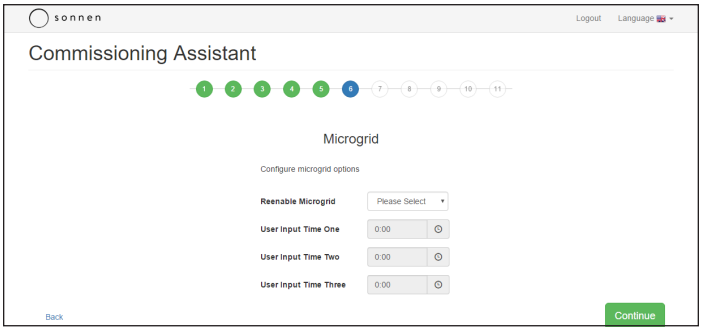


Fig. 61 Configuring Microgrid "wake-up" times

If the storage system reaches too low of a charge to remain active until it can charge from the PV array, it can shut turn off the microgrid until preset times to attempt to charge. When these times occur, the storage system will re-enable the microgrid for seven minutes to attempt charging from solar power.

► Enter the following information:

- Reenable Microgrid: Select Yes to enable this feature, or not to leave it disabled.
- User Input Time One: Set this to the earliest time you want to attempt charging.
- User Input Time Two: Set this to the next time you want to attempt charging.
- User Input Time Three: Set this to final time you want to attempt charging.

► Press Continue.

9. Configure meters

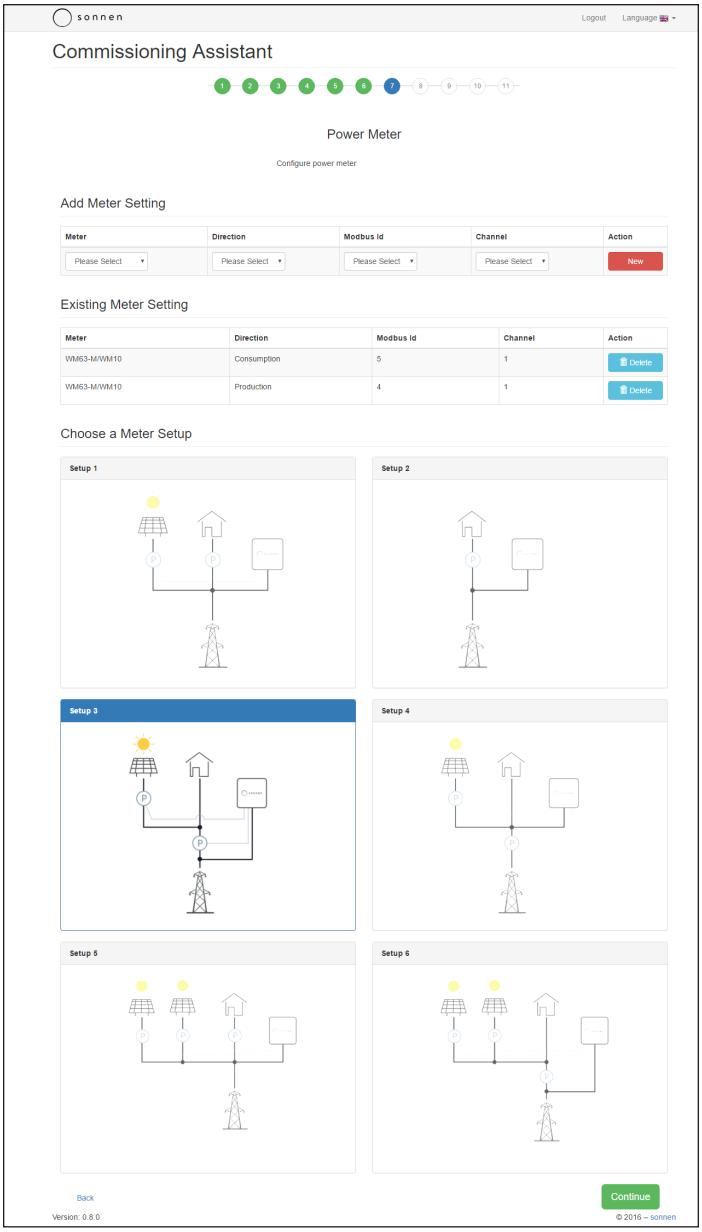


Fig. 62 Configuring meters

► On this step, configure the meter(s) you have installed.

► Select WM63-M/WM10 if you are using an EM24 meter (default).

► Select whether the meter is a production or consumption meter.

► Select a unique Modbus ID: 4 for production or 5 for consumption.

► Select channel 1.

► Press Continue.3

10. Provide information about owner

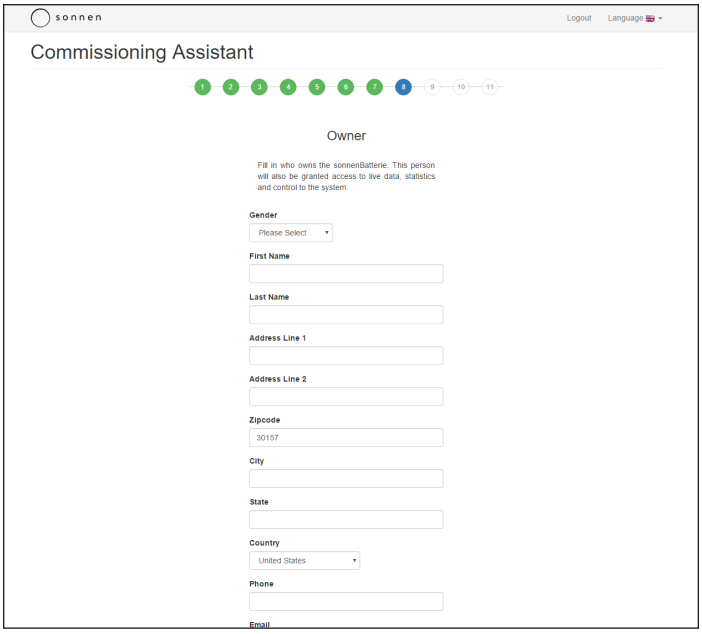


Fig. 63 Inputting owner information

- ► Enter the owner's information.
- ► Press Continue.

11. Provide information about installer

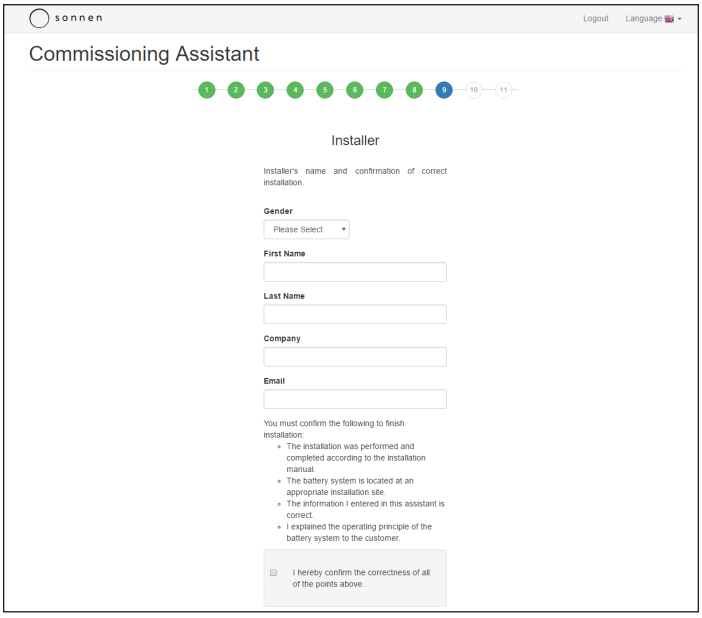


Fig. 64 Providing information about installer

- ► Input information about the installer.
- ► Check the confirmation box at the end.
- ► Press Continue.

12. Install System Updates

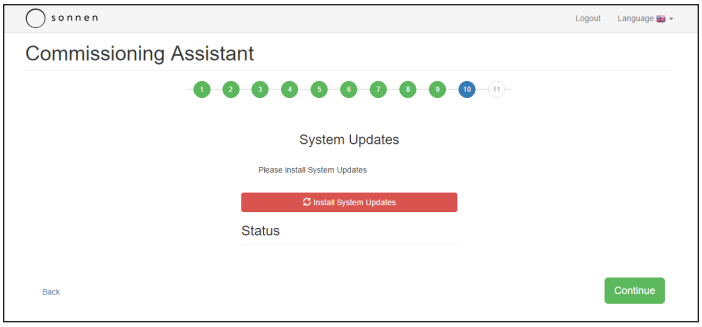


Fig. 65 Launching the storage system

- ► Press "Install System Updates."
- ► Press Continue.

13. Launch storage system

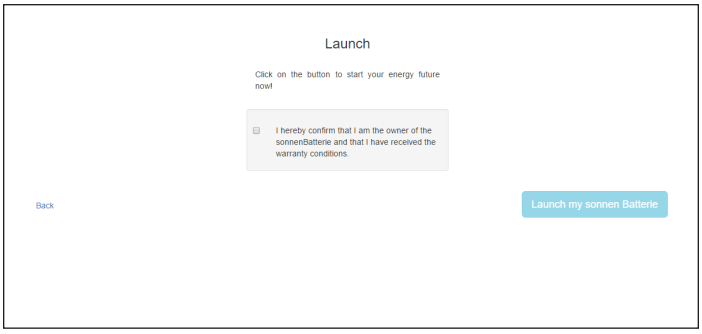


Fig. 66 Launching the storage system

- ► Read the text.
- ► Click on the check box.
- ► Press "Launch my sonnen Batterie."

14. Change operating mode

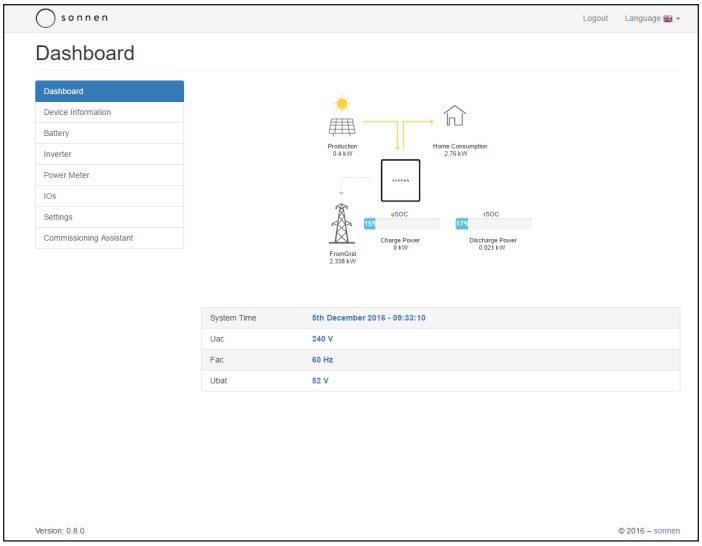


Fig. 67 sonnenBatterie dashboard

When you launch the sonnenBatterie, you will be taken to the dashboard. From here, you can view information about the storage system and change some settings.

The first setting you will need to change is the application. To do so, click on "Settings."

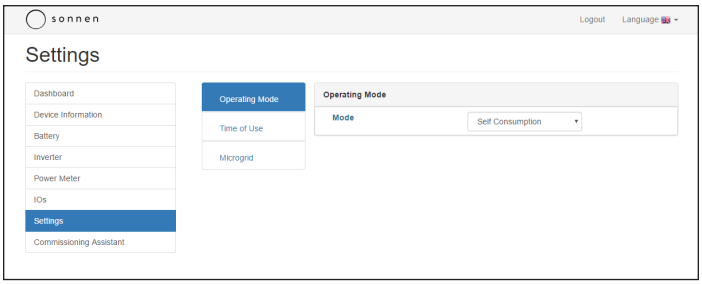


Fig. 68 Setting the operating mode

Here, you can select from the following four options:

- Manual: Charge and discharge the unit manually
- Backup power: Use the storage unit to provide power when the grid is unavailable
- Self-consumption: Use stored energy when solar production is less than household consumption
- Time of Use: Use stored energy only during specified high-tariff times.

The settings page also has tabs for configuring Time of Use and Microgrid. The options are identical to the ones offered during the commissioning assistant.

15. System check

The following commissioning protocol will ensure all aspects of your storage system are working as expected.

1. Verify that the batteries are at 100% SOC and that the solar inverter is producing good power.
2. Shut down the grid feed into the storage system.
3. Verify the automatic transfer switch switches over to microgrid.
4. Verify all protected loads are being powered by the storage system.
5. Verify the frequency shift occurs and grid tie inverter shuts down. You should see the following error message on the storage system" "High SOC: Disable microgrid power production".
6. Allow the state of charge to drop to 89%.
7. Verify the storage system resets the frequency to 60 Hz and the solar inverter restarts.
8. Monitor the SOC with solar contribution and verify that when SOC reaches 95% the storage system frequency shift occurs and the grid tie inverter shuts down.
9. Restore the grid feed in to the sonnen.
10. Verify the automatic transfer switch switches back to grid.
11. Verify the solar inverter restarts.
12. Verify all protected loads are operational.

Decommissioning

Attention

Damage of the battery cells by deep discharge!

If the storage system is not connected to the utility grid, the battery modules can be damaged by excessive and prolonged discharge.

► Do not leave the storage system disconnected for longer than six months (see "Storing the system" on page 12 for more information.)

Shutting the storage system down

Attention

Damage of system parts by forced disconnect!

If there is no emergency:

► Shut the storage system down.

If there is no emergency, do not turn off the storage system by forcibly removing power, by turning off the DC circuit breaker, or by using the battery emergency switch, as these methods may result in undesirable behavior.

Shut down the storage system

Follow these steps to shut the storage system down properly:

1. Press "Shutdown" button

► Press the grid of six dots in the upper right corner of the screen.

► Press the "Settings" icon.

► Press "Shutdown" button.

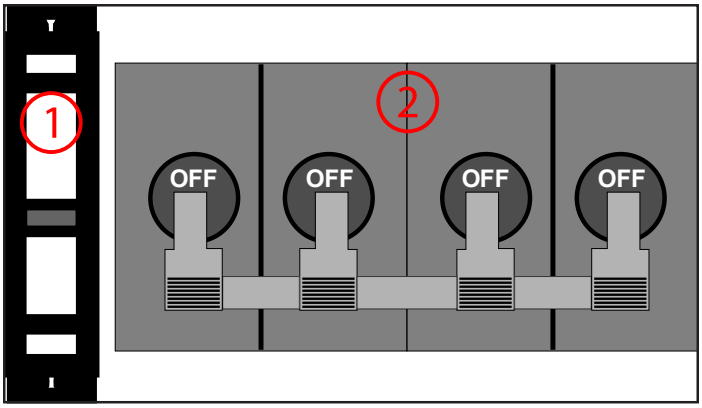
2. Confirm shut-down

► Press "Yes" to confirm shut-down.

The shut down takes approximately 60 seconds.

Emergency switch-off

In case of an emergency, the storage system can be switched off by the main circuit breaker F1 or the external emergency switch (if installed).



► In case of an emergency, switch off the main circuit breaker F1 in the interior of the main cabinet or the external emergency switch (if installed).

► Only switch off the main circuit breaker F1 if it can be reached without danger.

Recycling and certificates

This battery system complies with RoHS and contains none of the following substances: lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE).

► To dispose of the storage system:

- Do not dispose of the storage system and its battery modules in your household refuse!
- Contact service or the company that installed your storage system and commission them to disassemble and dispose of the storage system.
- You can also call Call2Recycle at (877) 723-1297.

Your battery modules will be recycled and disposed of in an environmentally friendly manner.

Internet access

The eco must connect to sonnenBatterie's servers to enable control of the storage system via the Web portal and smartphone app. This connection is protected by industry-standard security against unauthorized access. SonnenBatterie and service partners will only access the storage system for maintenance and monitoring.

A anonymized evaluation of log data enables further improvements and monitoring of hardware and software.

Establish connection to the Internet

- ► Connect the storage system's Ethernet cable to your router.
- ► Make sure your router acts as a DHCP server and configures newly connected network devices automatically.
- ► Ensure the following outbound TCP and UDP ports are permitted for the following services in the router:

Only in rare cases configuration changes must be done regarding port permissions in the router. The listed ports are generally preconfigured on the routers.

TCP Port	Service
22	SecureShell (ssh)
37	Time Server (ntp)
80	Online Check (http)
222	VPN (Server connection, ssl)
232	VPN (backup)
443	App control (https)

UDP Port	Service
1196	(Server connection, ssl)

Table 5 Required open ports for storage system

The storage system connects automatically with the Internet. There are no further steps required.

Internet portal

You can observe real-time and historical data regarding your storage system via the Internet portal.

- ► Log in to the portal

1. Type the following address to your Internet browser: https://my.sonnen-batterie.com/

The following login window will appear:

Fig. 69 Login window

2. Enter the login information that you received with your delivery.
3. Click on the Log in button.

For demo mode, use 'demo' as user name and password.

User interface

The sonnenBatterie eco is designed to run without user intervention in most cases. The LCD screen on the physical unit has a number of menus to display information and control the unit.

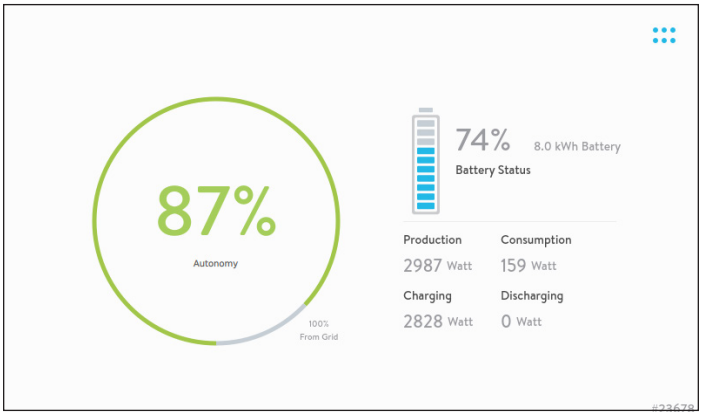


Fig. 70 Home screen - Ongrid

In an ongrid installation, the screen above will serve as the home screen. This screen displays the unit's state of charge, the home's energy autonomy, production and consumption statistics, and the amount of power the unit is charging or discharging.

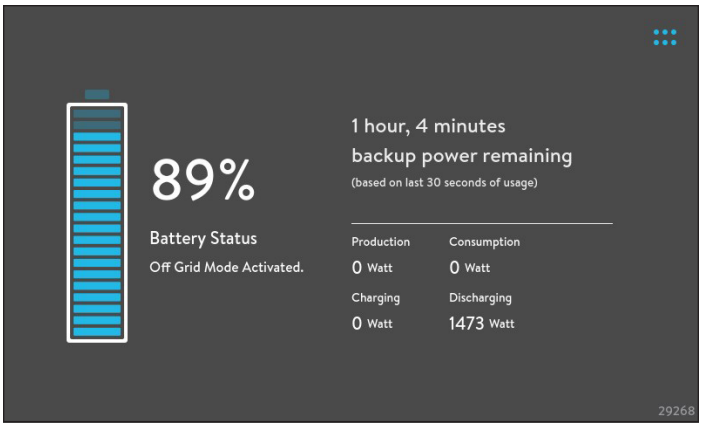


Fig. 71 Off Grid Mode screen

When the storage unit is in Off Grid Mode, the screen above will be the home screen. This screen displays the unit's state of charge, production and consumption statistics, and the amount of power the unit is charging or discharging. The screen will also show an estimated length of backup power remaining. This estimate is based on energy usage in the microgrid for the last 30 seconds and therefore may change frequently.

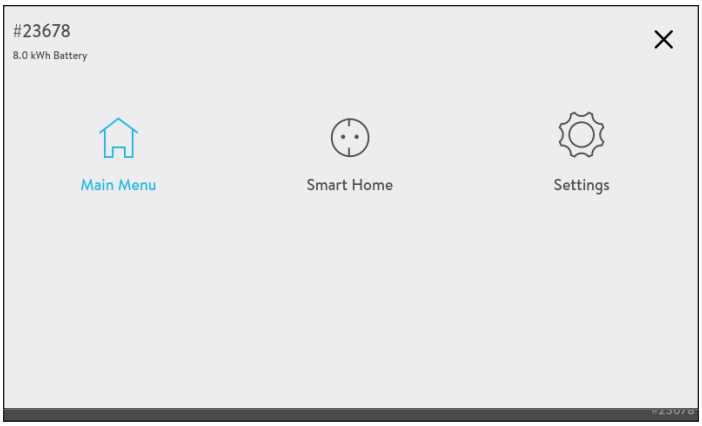


Fig. 72 Menu screen

The menu screen, accessed by pressing the grid of six dots in the upper right corner of the screen, allows you to access the Smart Home and Settings screens.

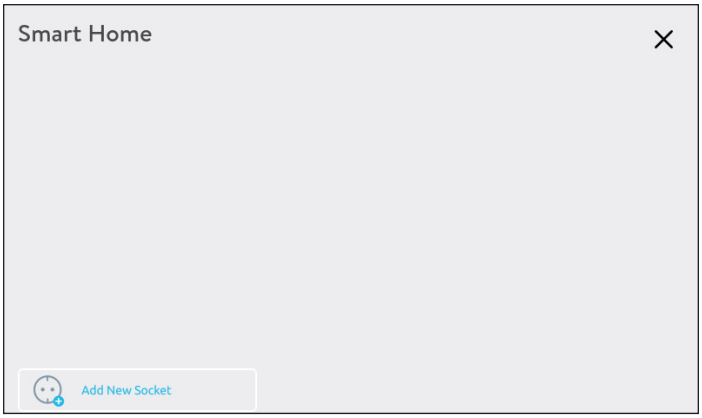


Fig. 73 Smart Home screen

The Smart Home Screen allows you to add new smart sockets and control the sockets already paired with the storage system.

- Automatic mode allows the storage unit to turn the socket off and on based on load.
- Status displays whether the socket is activated.
- Power shows the amount of power, measured in watts, that the socket is drawing.

Fig. 74 Settings screen

The Settings screen allows you to shut down the unit by pressing the Shutdown button.

Maintenance and care

To ensure failure-free operation, safety, reliability and longevity, you must perform periodic cleaning and function control of the storage system.

Function control

Every two weeks, check if messages are shown on the screen.

Care of the storage system

Attention

Risk of damage by improper cleaning utensils!

- Only use cleaning solutions and tools listed in this chapter.
- Do not use high-pressure cleaning equipment.
- Do not use abrasive cleaners.

Cleaning the screen

► When the screen appears dirty, clean it carefully with a damp cloth with a small amount of dish liquid.

Cleaning the enclosure

► When the cabinet appears dirty, clean the exterior with a soft, damp cloth. Do not clean the interior of the cabinet.

Checking the storage unit

Monthly:

► Check the area around storage unit for safety hazards or potential maintenance issues, including debris and chemical vapors that can degrade electrical insulation.

Annually:

Trained electrically qualified person only!

► Wear personal protective equipment, including safety glasses, insulated gloves, and steel-toe shoes.

► Turn off the main AC disconnect.

► Open the cabinet.

► Turn off the DC breaker.

► Remove the orange safety plugs from the battery modules.

► Check for and tighten any loose electrical connections, which can present a fire hazard. Look for cracked, blistered, or discolored insulation, which can indicate poor electrical connections.

► Check for pitting or cracking on contactors.

► Check for and tighten any loose mechanical connections.

► Using a multimeter with a continuity test function, open and close the AC breaker and ensure that the circuit is opened and closed correctly.

Nameplates

sonnen

Fuse replacement chart

F1-F2: 315mA, 250V, 35AIC
GDB-315mA
F3-F4: 50A, 690V, 200KAIC
5012406.50

WARNING

Replace only with the same ratings and type of fuse.

AVERTISSEMENT

N'utiliser que des fusibles de même calibre et de même type que le fusible d'origine.

sonnen

Fuse replacement chart

F1-F2: 2A, 600V, 100KAIC
KTK-2
F3-F4: 50A, 690V, 100KAIC
B093910

WARNING

Replace only with the same ratings and type of fuse.

AVERTISSEMENT

N'utiliser que des fusibles de même calibre et de même type que le fusible d'origine.

Quality Control

sonnen

Serial Number _____

Model Number _____

Functions and safety

Conducted by _____

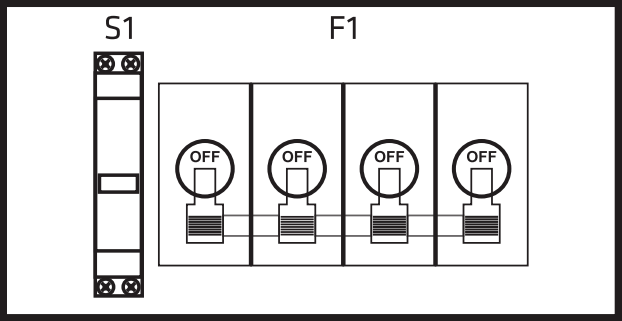
Date _____

Final Inspection

Conducted by _____

Date _____

0	1	2	3
4	5	6	7



Turning on the storage system

1. Press and hold button S1 for at least 30 seconds
2. Turn circuit breaker F1 on
3. Release S1

Emergency shutoff

▶ Turn circuit breaker F1 off

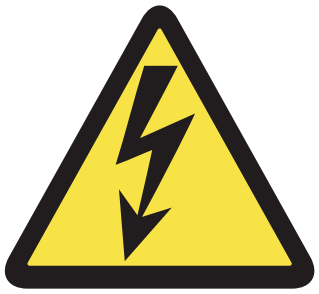
If there is no emergency, shut down the storage system using the ⏻ button on the touchscreen.

WARNING

HAZARDOUS VOLTAGE
Contact will cause electrical shock or burn
Remove orange plugs from battery modules before servicing

AVERTISSEMENT

TENSION DANGEREUSE
Contactez pourrait provoquer un choc électrique ou des brûlures
Retirer les bouchons orange des modules de batterie avant l'entretien



WARNING

RISK OF ELECTRIC SHOCK.
Hazardous live parts inside this power suppy are engergized from the battery supply even when the input AC power is disconnected.

AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE.
Risque de choc électrique. Ce bloc d'alimentation comporte des pièces sous tension dangereuse alimentées par les piles même lorsqu'il est débranché du secteur.

Manufacturer
Sonnen Inc
10800 Burbank Blvd., Suite C
Los Angeles, California 91601

sonnen

Product name:	sonnenBatterie eco						
SKU:	38192						
Serial number:	_____						
Version:	_____						
Mains voltage/frequency:	120/240 VAC 60Hz						
Backup output current:	16.5A						
DC short circuit rating:	10kA						
Active power:	max. 4000W						
Protection class / protection:	NEMA 12						
Battery voltage:	nom. 51.2V						
Power factor:	-1 to 1						
Battery manufacturer:	Sony						
Battery catalogue number:	IJ1101M						
Number of batteries:	2	3	4	5	6	7	8
Total battery capacity (KWH):	4	6	8	10	12	14	16

The critical components included are all components certified by these UL standards

Product name	Manufacturer	UL Certification
Radian 4048/8048 Inverter	Outback Power	UL1741
Battery modules (2.1 kWh)	Sony	UL1973

Made in North America

WARNING

HAZARDOUS VOLTAGE
To reduce the risk of injury, read all instructions.

AVERTISSEMENT

TENSION DANGEREUSE
Pour réduire le risque de blessure, lire toutes les instructions.

WARNING

RISK OF ELECTRIC SHOCK.
More than one live circuit. See diagram.

AVERTISSEMENT

RISQUE DE CHOC ÉLECTRIQUE.
Cet appareil est alimenté par plusieurs circuits sous tension. Voir le schéma.

Manufacturer
Sonnen Inc
10800 Burbank Blvd., Suite C
Los Angeles, California 91601

sonnen

Product name:	sonnenBatterie eco						
SKU:	38191						
Serial number:	_____						
Version:	_____						
Rated feed-through current:	200A						
Mains voltage/frequency:	120/240 VAC 60Hz						
Backup output current:	33A						
DC short circuit rating:	10kA						
Active power:	max. 8000W						
Protection class / protection:	NEMA 12						
Battery voltage:	nom. 51.2V						
Power factor:	-1 to 1						
Battery manufacturer:	Sony						
Battery catalogue number:	IJ1101M						
Number of batteries:	2	3	4	5	6	7	8
Total battery capacity (KWH):	4	6	8	10	12	14	16

The critical components included are recognized by these UL standards

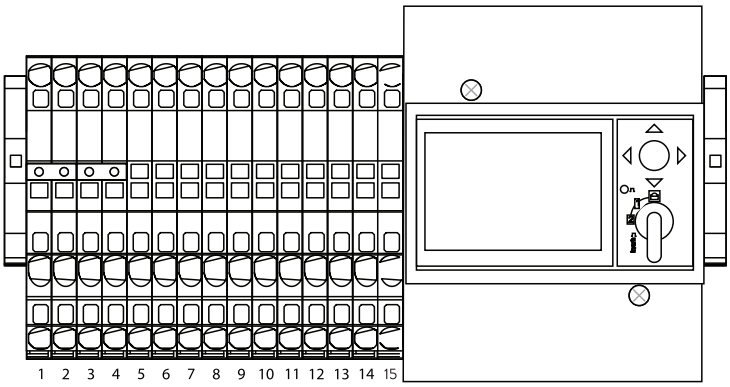
Product name	Manufacturer	UL Certification
Radian 4048/8048 Inverter	Outback Power	UL1741
Battery modules (2.1 kWh)	Sony	UL1973
200A ATS	Aichi	UL1008
200A Circuit breaker ED2200L	Eaton	UL489

Made in North America

sonnen

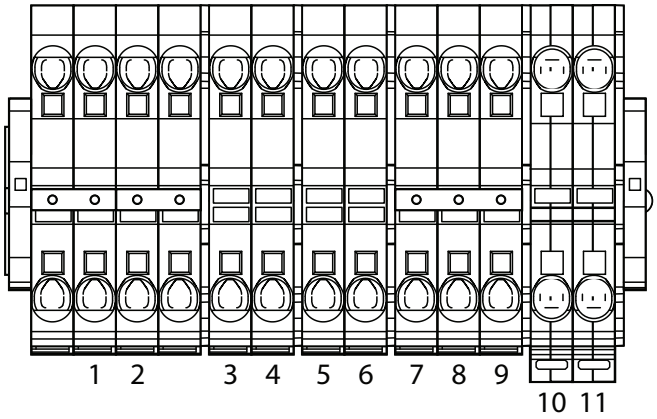
Terminal block map for installation and service

E-Stop, Generator, and Meter connections



1. Emergency Stop 1
2. Emergency Stop 2
3. Generator Autostart 24V
4. Generator Autostart common
5. Generator Autostart 12V
6. Generator Autostart Normally Open
7. Generator Autostart Negative
8. PV CT2 S2
9. PV CT2 S1
10. PV CT1 S2
11. PV CT1 S1
12. PV N
13. PV L2
14 . PV L1
15. Ground

AC Connections



1. Microgrid L1
2. Microgrid L2
3. Grid L1
4. Grid L2
5. Generator L1
6. Generator L2
7. Grid N
8. Microgrid N
9. Generator N
10. Ground
11. Ground

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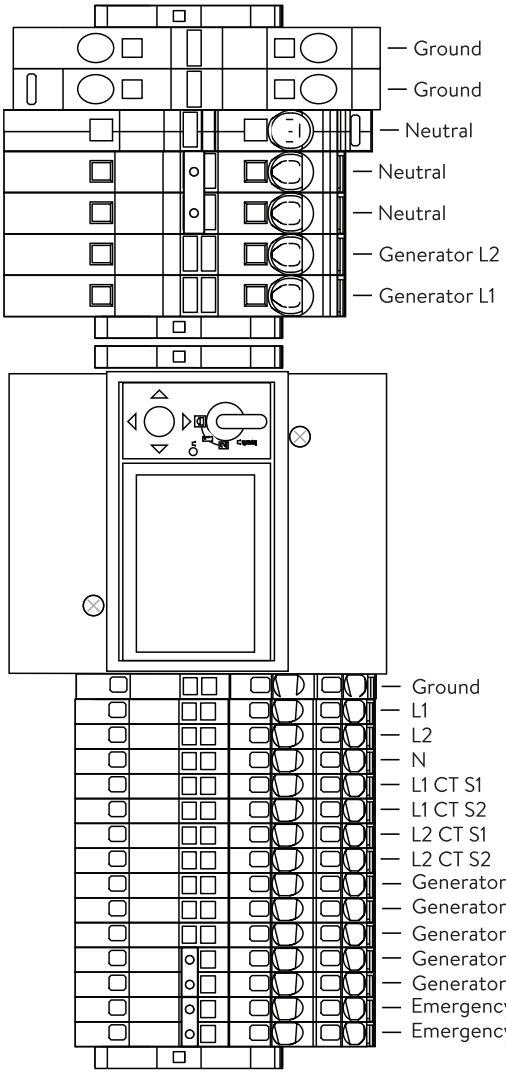
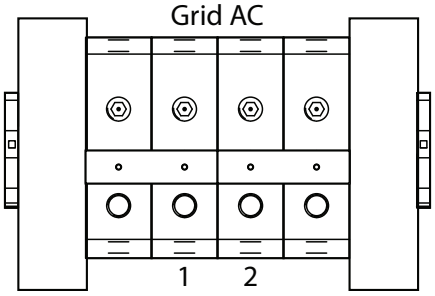
Terminal block map for installation and service

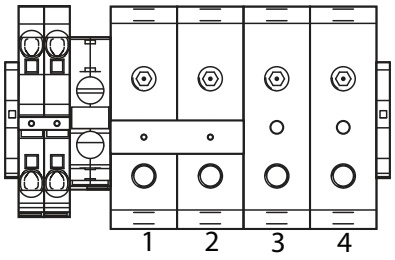


X1
Grid AC



1. Grid L1
2. Grid L2

X10
Microgrid AC/Grid N



1. Grid N
2. Microgrid N
3. Microgrid L2
4. Microgrid L1

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Quick Guide:

1. Measure and note all module voltages
2. Proceed with installation only when the module voltage difference is less than 1 V. If greater than 1 V refer to the manual
3. Determine the module number and set up the communication addresses and terminal switches
4. Install the batteries in the appropriate order
5. Connect the DC cables +/-
6. Connect the communication cables
7. IMPORTANT: The orange safety plug must be installed as the last step!

Guide rapide :

1. Mesurez et notez toutes les tensions de module
2. N'effectuez l'installation que lorsque la différence de tension de module est inférieure à 1 V (si elle est supérieure à 1 V, voir le manuel)
3. Déterminez le numéro du module et mettre en place les adresses de communication et les commutateurs de borne
4. Installez les piles dans l'ordre approprié
5. Branchez les bornes +/- des câbles à courant continu
6. Branchez les câbles de communication
7. IMPORTANT : La prise de sécurité orange doit être installée en dernier!

CAUTION

This module is specifically designed for Sonnenbatterie and therefore may only be used with Sonnenbatterie products. Other battery modules are not to be used with Sonnenbatterie products.

The system must be disconnected by the main switch and all orange safety plugs of the battery modules must be removed before working on the system.

ATTENTION

Ce module est spécialement conçu pour sonnen et ne doit être utilisé qu'avec des produits sonnen. Les autres supports de batterie ne doiventpas être utilisés avec les produits sonnen.

Le système doit être débranché par le commutateur principal et toutes les prises de sécurité orange des supports de batterie doivent être retirés avant de travailler sur le système.

Safety Instructions

1. Switching off
The storage system can be switched off via the display or via the main safety switch F1, which is in the main cabinet.

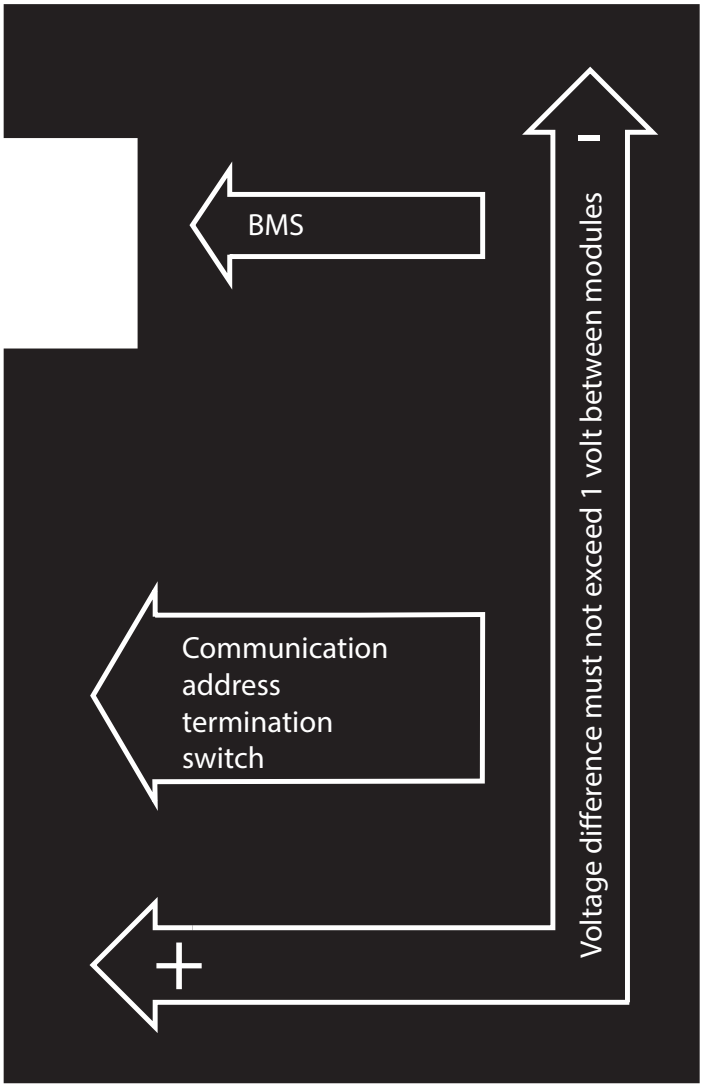
2. Batteries used
The LiFePO4 lithium-ion batteries used contain no metallic lithium.

3. Voltage
The storage system is a low-voltage system with 120/240 volt output voltage. Setting the main safety switch F1 to off deactivates the storage system as an energy source. The battery modules run on max. 60 volt DC safety extra-low voltage. The battery contacts can be de-energized by removing the orange fuse plug on all battery modules.

4. Information for the fire department
Fires in the vicinity of the storage system and battery fires must be fought with conventional extinguishing agents. Storage system and battery cell fires can generally be extinguished with water.

5. Measures in the event of the accidental release of substances
In the event of the release of electrolytes: Avoid contact with eyes and skin, leave the room as quickly as possible, and ensure adequate ventilation if possible.

More information can be found in the operating and installation instructions.



Sequence of operations

Grid-Tied Operation

1. The photovoltaic system is generating power and the Automatic Transfer Switch detects that the utility grid is active.
2. The sonnenBatterie eco storage system monitors solar power production levels and load consumption levels.
3. Solar power production exceeds load consumption.
4. The storage system charges its battery modules.
5. The battery modules reach full charge.
6. The Solar panels continue to generate power at least 1000 W (adjustable) over load consumption.
7. The Storage system activates the 24V digital signal for the optional self-consumption circuit for a preset time (30 minutes, adjustable).
8. The Storage system activates desired Z-Wave self-consumption outlets for a preset time (30 minutes, adjustable).
9. The preset self-consumption time elapses.
10. The storage system compares power production to consumption.
11. If power production exceeds consumption by present amount (1000 watts, adjustable), the storage system does nothing. If production is less than the threshold, the storage system deactivates 24V digital signal and Z-Wave outlets.

Off-Grid Operation

1. The automatic transfer switch detects that the grid has gone down and/or the storage system detects that the grid is no longer present.
2. The storage system informs the automatic transfer switch that it is ready to provide power.
3. The automatic transfer switch connects the main service panel to the storage system by disconnecting the utility grid first.
4. The main service panel is powered by the storage system now.
5. After the reconnection delay of five minutes, the PV system generates power.
6. If the solar panels' power generation drops below load consumption, the storage system powers the main service panel from energy stored in its battery modules. Otherwise, the PV system powers the main service panel and the excess production is stored in the storage system.
7. If the state of charge is below a series of critical limits, non-essential loads identified by the customers will be disconnected from the micro-grid to extend the utilization time of the energy stored.
8. If power production exceeds consumption the storage system and the battery modules are fully charged, the system shutdowns the PV inverter power source and provides power to the loads via the battery modules. After a period of time, the system allows for the PV system to reconnect.
9. Grid power is restored.
10. The automatic transfer switch senses that the utility grid is now active.
11. The automatic transfer switch connects the main service panel to the utility grid after 5 minutes of stable grid presence.
12. The storage system's inverter reconnects after a stable grid has been detected.
13. The storage system begins charging its battery modules, if needed.

Glossary

Appliances: Devices that consume power. These may include small appliances, such as a blender, or large ones, such as a water heater.

Backup mode (or offgrid mode): A mode of operation in which the sonnenBatterie eco provides power stored in its battery modules when the utility grid power is unavailable.

Backup readiness: When the storage system emphasizes backup readiness, it maintains a specified state of charge, such as 85%, in its battery modules to be ready to provide power in the event of an outage.

Battery modules: The energy storage modules in the sonnenBatterie eco.

Capacity: The amount of energy that can be stored in the sonnenBatterie eco, measured in kilowatt-hours.

Consumption: The amount of power being used by appliances.

Deep discharge: Bringing the battery module's charge to such a low level that it damages the battery. For the modules used by the eco, this requires leaving a module at an extremely low level (0%-1%) for weeks or months.

Discharge: When the storage system provides power to your house or building.

Feed-In: When the storage system provides power to the utility grid.

Grid: The power source provided by utility companies, as opposed to self-generated power.

Kilowatt-hour: A measurement of energy equal to one kilowatt delivered for one hour.

Load-shedding: The method of removing power to appliances either to keep the load within power requirements or to maximize battery time.

Main disconnect circuit breaker: A circuit breaker that cuts all power to and from the storage system when opened.

Main service panel: The main panel to which all appliances are connected.

Microgrid: The grid created by your power generation system, as opposed to the utility grid.

Modbus: A serial protocol that enables communications between smart devices.

Photovoltaic: A photovoltaic system of solar-power panels.

Production: The power generated by your solar panels.

Protected loads panel: A panel providing power to the most important appliances in the house or building, such as a refrigerator, freezer, or heater. This subpanel is isolated from the main service panel by a switch to prevent electrical feedback.

Self-consumption: The method of using solar power to power appliances rather than using grid power.

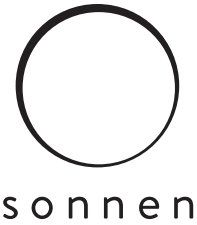
State of charge: The percentage of charge available in the storage system's battery modules.

Storage system: The sonnenBatterie eco, which combines an inverter, battery modules, and other hardware and proprietary algorithms to make solar power an even more cost-effective power source.

Transfer switch: A switch, either manual or automatic, that changes the power source from the utility grid to self-generated power in the event of a loss of power.

Torque values

Item	Imperial	Metric
Battery terminals	3 ftlbs	4Nm
Inverter DC cables	60 inlbs	6.9Nm
Inverter ground wire	25 inlbs	2.8Nm
Cabinet connections	31 inlbs	3.5Nm
Access panel	25 inlbs	2.8Nm
Grounding strap	40 inlbs	4.5Nm
No-touch screen	12 inlbs	1.4Nm



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