



# Installation and commissioning manual sonnenCore

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# About this manual

This manual describes the installation and operation of the sonnenCore 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:

- Installer 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 sonnen 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 sonnenCore as a storage system.

This manual refers to the building being serviced by the storage system as a “house,” but the sonnenCore can be installed in any number of buildings or sites powered by 240VAC split phase electricity. “ESS” refers to Energy Storage System.

For a full glossary of terms used in this manual, refer to Appendix.

## Symbols used

### Warnings

#### WARNING WORD

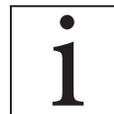


Warnings are indicated by this symbol and a warning word, which indicates the severity of the danger. Along with the warning are instructions for avoiding the danger.

The following warning words are used:

- **ATTENTION** indicates possible material damages.
- **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.

### 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 manual thoroughly before operating the 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 indoors, in a residential space, to store electrical power with the battery modules provided.



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

### **Do not use the storage system;**

- In vehicles
- In standing water or (>90%) humidity locations
- Do not use the storage system in areas at risk of filling with combustible dust (flour dust, sawdust, etc.)
- In direct sunlight
- In locations with the air ammonia content exceeds 20 ppm
- In presence of corrosive gases
- Elevations above 6,560 ft (2,000 meter) above sea-level
- Locations with ambient temperature outside -10°C - 50°C (14°F - 122 °F)

## 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.

- ▶ Bi-annually, connect to AC power source and allow it to charge the battery modules to 100%.

## General safety instructions

- Do not modify the storage system.
- Do not use a damaged storage system.
- 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 manual with care.
- When working with the storage system, wear personal protective equipment, including safety glasses, insulated gloves, and safety shoes.
- Illumination shall be provided for all working spaces around the electrical equipment. Control by automatic means only is not be permitted. The lighting outlets should be arranged so that persons changing lamps or making repairs on the lighting system are not endangered by live parts or other equipment.

**WARNING****RISK OF ELECTRIC SHOCK**

Residual voltage always present on DC terminals, and the battery modules cannot be turned off.

Avoid contact with terminals.

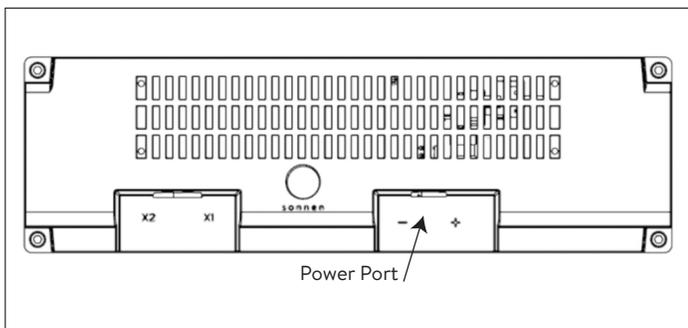


Fig. 1 sonnenModule 4 battery module

**WARNING****Risk of burns!**

When working on the storage system:

- ▶ Take off metallic jewelry.
- ▶ Turn off the storage system.
- ▶ Use insulated tools.
- ▶ Wear personal protective equipment, including safety glasses, insulated gloves, and safety shoes.

**Fire-related instructions****CAUTION****Risk of injury from escaping electrolyte**

Despite diligent construction, cells inside the battery modules can still degrade or melt components in the event of mechanical damage, heat, or a fault.

- Standard class ABC or BC fire-extinguishers should be used.

Possible effects include:

- Heating of battery modules.
- Escaping electrolyte fluid.
- 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.
- Do not allow battery modules to heat up or get wet.
- Only operate battery modules in the proper environments.
- 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 local fire department.

Despite diligent construction, fires are still possible. A fire can release substances contained in the battery modules.

In the event of a fire in or around the storage system:

- Only properly equipped fire fighters may enter the space.
- A fire in the storage system can be extinguished by conventional agents.
- As a last resort, water may be used to cool the battery modules that are still intact.

### Battery module information

- The battery modules have a rated voltage of 102 VDC.
- The battery modules contain no metallic Lithium.

# Specifications

Usable Capacity (95% DOD)	10 kWh
Nominal AC voltage	120/240 VAC Split phase
Nominal power rating (Grid-tied output at 40°C)	4.8 kW
Weight (approximate)	348 lbs
Install dimensions W"/H"/D" (adjustable height from ground)	27 / 68 / 11 27 / 73 / 11 (with elevated legs)
Grid integration	AC coupled
Applications	Time-of-use Self consumption Backup
Usable capacity	5 kWh per battery module
Inverter efficiency	94.4% peak
On-grid pass-through	35 A
Roundtrip efficiency % (Grid<>Battery)	≥85%
Operation temperature range	14°F - 122°F 41°F - 104°F (MAX power)
System cooling	Natural convection
Comm. ports	Ethernet
Control	API available to select partners
Noise emission	<25 dB
Total harmonic distortion	<5%
Maximum compatible PV inverter	6kW

Table 1 Specifications

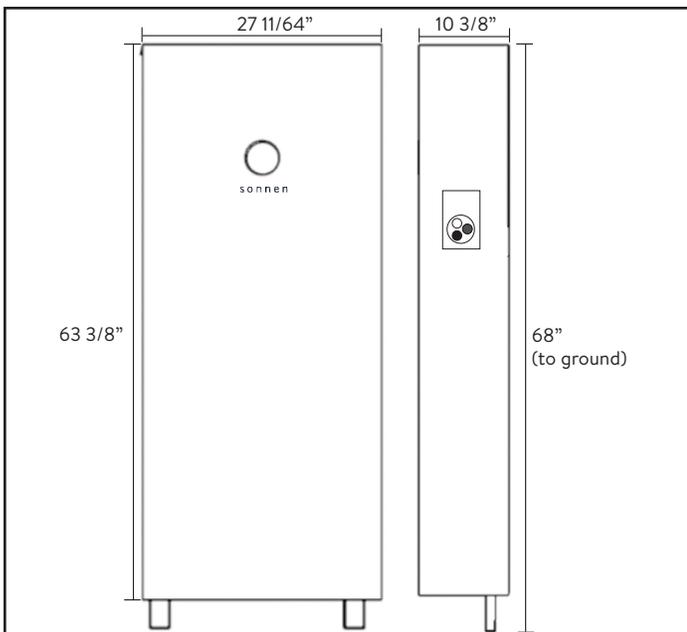


Fig. 2 Storage system dimensions

## Compliance information

Certifications	UL1741, UL1741SA, UL1973, UL9540, UN38.3
Grid connections	IEEE 1547, IEEE 2030.5, Rule 21
Transient protection	IEEE C62.41 Class B
EMC / EMI protection	FCC Part 15 Class B (inverter)
Enclosure Rating	Type 12

## Battery specification



Nominal DC voltage	102 VDC
DC battery input voltage	80 - 115 VDC
Max charge current	40 A per module
Cell discharge	5 kWh with 100% DoD
Cell chemistry	Lithium Iron Phosphate
Over-current Protection	Fuse protection

## Key components

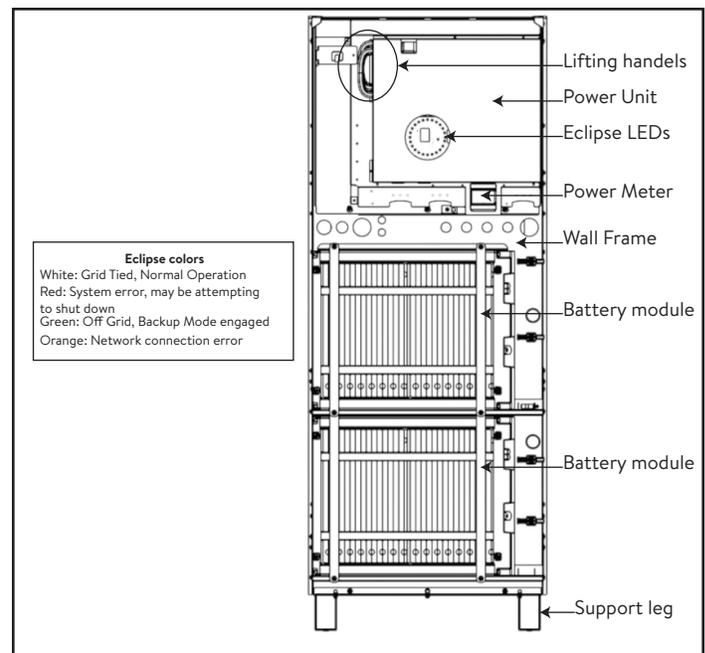


Fig. 3 sonnenCore key components

# Storage and transport

## Storing the system

**Trained, electrically qualified person only!**

### Environmental conditions

While not in use, the system and battery modules must be stored under the following conditions:

- Ambient storage temperature of battery modules (<6 months) -20°C - 45°C (-4°F - 113°F)
- Ambient storage temperature of Inverter -20°C - 60°C (-4°F - 140°F)
- Humidity max. 90% (non-condensing)
- Properly ventilated
- Maximum elevation of 6,560 feet (2,000 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, battery modules will gradually lose charge. 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, battery modules require charging. Contact service for guidance.

## Transporting the battery modules

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

- ▶ Follow national and international regulations for transport.
  - Transportation temperature range (<3 months) -20°C - 60°C (14°F - 140°F)
- ▶ 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: 88 lb (40 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.

Damages visible on packaging must be reported to the carrier immediately.

Concealed damages, 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

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## Inspecting the battery modules

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### CAUTION

#### Risk of injury using damaged battery modules!



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

- ▶ Inspect battery modules for damage immediately after transport.

If damage is visible;

- ▶ Do not use the battery.
  - ▶ Contact sonnen's service department.  
(818) 824-6363 (8am-8pm EST)
- 

## Adjusting the temperature after transport

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### ATTENTION

#### Damage of 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.
  - ▶ Leave the storage system in this state for at least 24 hours before commissioning the storage system.
- 

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## Moving the storage system

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### WARNING

#### Risk of injury lifting the storage system!



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

# Installation

## Tools needed

- Wire stripping tool
- #4,6 Hex wrench
- Hand drill
- Utility knife
- Measuring tape
- Multimeter
- 10mm socket wrench
- Magnetic bubble level
- Laptop or other Internet-connected device
- 8x (2" wood screws with >1" washers)

## Parts List

- 1x PV CT with cable "1000705"
- 1x Line 1 CT with cable "1000707"
- 1x Line 2 CT with cable "1000704"
- 1x Short Cat5e cable "1000541"
- 1x Medium Cat5e cable "1000532"
- 1x Long Cat5e cable "1000524"
- 2x Battery module power cable "1000625"
- 1x Power Unit
- 2x Battery module
- 28x M6x16mm screw
- 18x Lock washer
- 2x M6 Nut
- x Cable entry plug
- 8x Mounting access plug
- 1x Control panel access plug
- 1x Cover
- 1x Wall Frame
- 4x Wall Bracket
- 2x Battery Module shelf V2
- 1x Battery Module Protection Cover V2
- 1x Top Shelf Brace Adapter
- 4x Battery Module Brace
- 2x Support Leg

## Installation basic steps

- ▶ Prepare installation location
- ▶ Inspect system for damage
- ▶ Run wire and cabling to installation location
- ▶ Install and secure Wall Frame
- ▶ Install Power Unit/Install shelves
- ▶ Place and secure battery modules
- ▶ Complete all battery module communication connections
- ▶ Complete all battery module power connections
- ▶ Complete Grid and Microgrid wiring

connections

- ▶ Power up and commission system

### Choosing a mounting location

Select a location with the following attributes:

- Ambient temperature between -10°C - 50°C (14°F - 122 °F)
- Humidity max. 90%, non-condensing
- Maximum elevation of 6,560 feet (2,000 meters) above sea-level
- Fire safety regulations observed (smoke detector recommended)
- Free of dust
- Free of corrosive and explosive gases
- Free of vibrations
- Flat surface of sufficient load-bearing capacity
- Easy access for installation team
- Compliant with all NFPA, NEC, and local building codes

### Clearance requirements

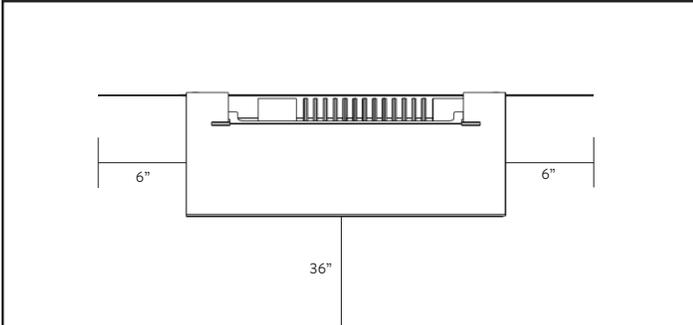


Fig. 4 Top view - clearance requirements

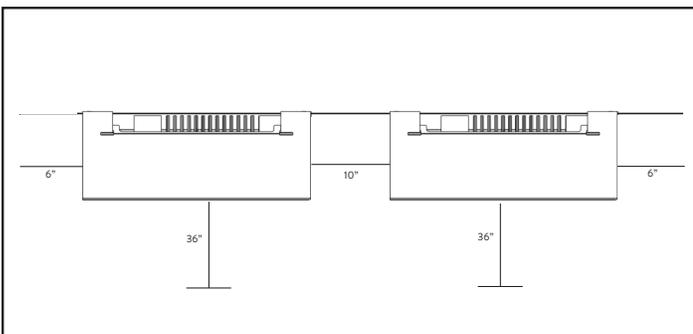


Fig. 5 Top view - multi-unit clearance requirements

### Inspecting the storage system

- ▶ If there is any suspected damage or loose parts, stop installation, photograph the affected area, and contact sonnen's service department.  
Service Support Line: +1 (818) 824-6363  
Service@sonnen-batterie.com  
Hours: M - F; 8 a.m. to 8 p.m. EST

### Installing storage system components

#### 1. Running wiring and cables to installation location

- ▶ Cables and wires of the appropriate wire gauge, type and ampacity should be run site.
- Grid & Mircogrid
- Ethernet
- Included CT wires (if connected outside the ESS)
- E-Stop (Optional)

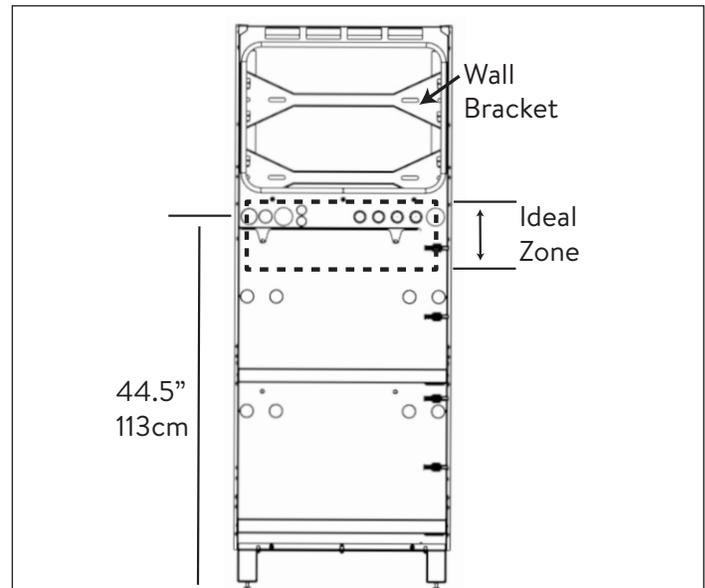


Fig. 6 Wiring and cable wall entry options

Cable entry into the system can be made through any opening in the Wall Frame in Ideal Zone.

- External conduit should be run AFTER the Wall Frame is installed and from BELOW.
- External conduit entry from ABOVE can be accommodated on the left 4"/10cm of the Wall Frame, to avoid the Heat Sink.

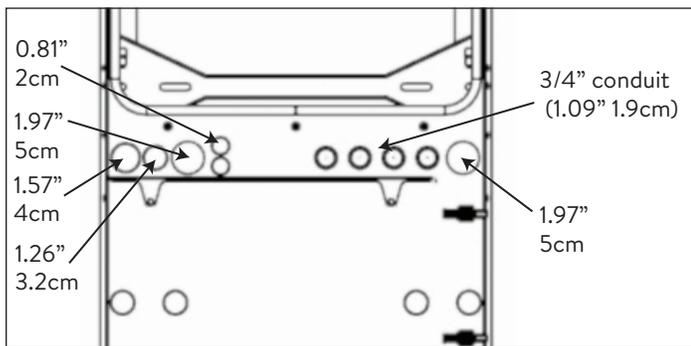


Fig. 7 Conduit sizes

- Grid connection
- Microgrid connection
- 3x Current transformer wires
- Ethernet connection
- E-Stop (Optional)

## 2. Prepare Wall Frame for installation on wall

- ▶ Remove the Wall Frame from the box and lay it down with the wall side facing up.

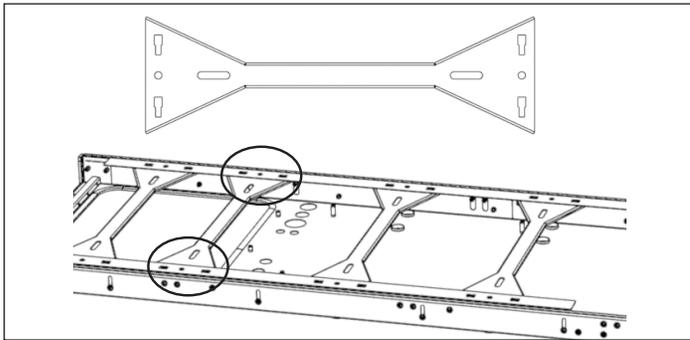


Fig. 8 Installing Wall Brackets

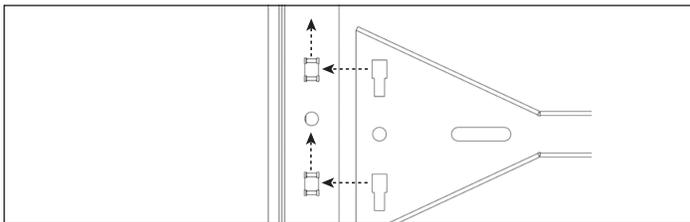


Fig. 9 Installing Wall Brackets-Close up

- ▶ Each Wall Bracket has four slots that allow it to hook onto the Wall frame. Slide each Wall Bracket in from one end of the Wall Frame and hook it onto the Wall Frame at each of the four locations. The round holes on either side of the Wall Bracket will line up with the one in the Wall Frame. Lifting the frame up slightly will make the Wall Brackets fit more easily.

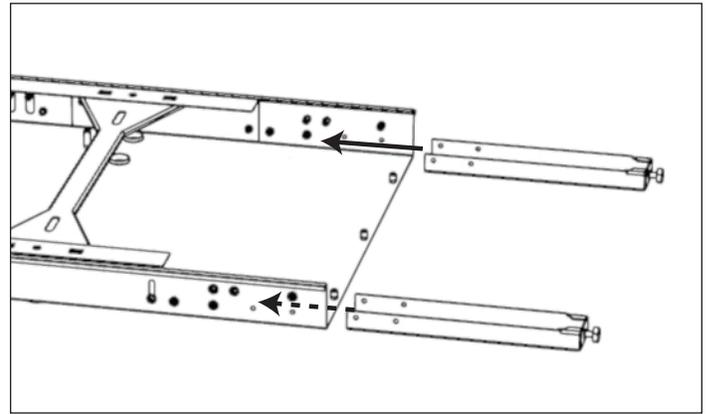


Fig. 10 Support leg screw locations

- ▶ Insert each Adjustment Foot into a Support Leg.
- ▶ Install the Wall Frame
- ▶ Tools needed:
  - Power hand-drill
  - Magnetic bubble level
  - #4 Hex wrench
- ▶ (OPTIONAL) If the wall is not flat or plum, the unit comes with screws that allow it to adjust slightly to the wall.
  - ▶ With the Wall Frame on the ground, slightly loosen all eight wall plumb screws on either side of the Wall Frame edge.

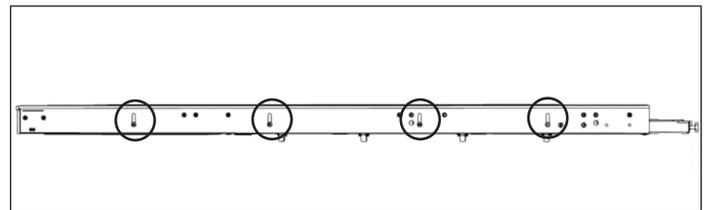


Fig. 11 Wall Plumb Screw locations

## 3. Wall installation

- ▶ Find and mark stud locations on the wall.
- ▶ Feed the cables through their appropriate openings.
- ▶ Lean the Wall Frame against the wall such that the Wall Bracket slots align with the stud line.
- ▶ Place a magnetic bubble level on the Wall Frame and rotate the leveling screws under each Support Leg until the Wall Frame is level left to right.

#### 4. Prepare Wall Frame for installation on wall

- ▶ Remove the Wall Frame from the box and lay it down with the wall side facing up.

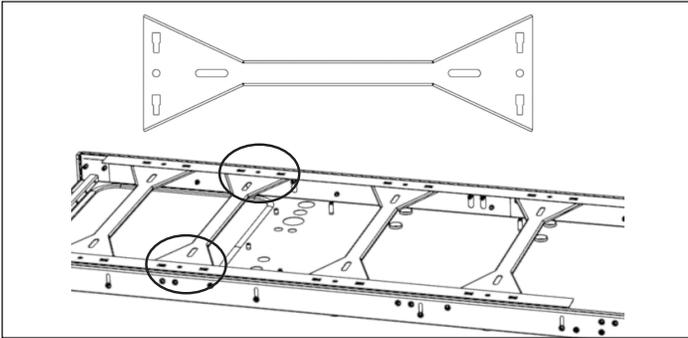


Fig. 12 Installing Wall Brackets

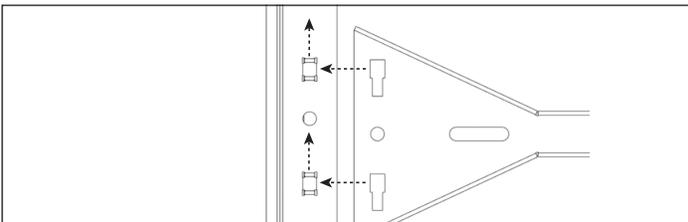
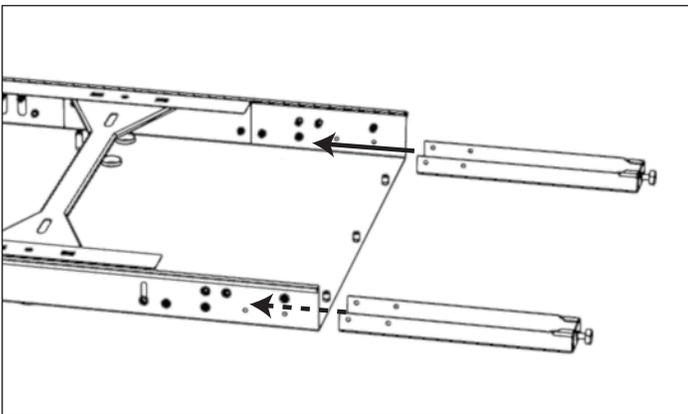


Fig. 13 Installing Wall Brackets-Close up

- ▶ Each Wall Bracket has four slots that allow it to hook onto the Wall frame. Slide each Wall Bracket in from one end of the Wall Frame and hook it onto the Wall Frame at each of the four locations. The round holes on either side of the Wall Bracket will line up with the one in the Wall Frame. Lifting the frame up slightly will make the Wall Brackets fit more easily.



- ▶ With the Wall Frame against the wall, ensuring it makes contact with the wall at each location, mark the drill location points.
- ▶ Put down the Wall Frame and drill all holes into the wall with a 3/16" drill bit. Furr out the holes

in the wall if necessary.

- ▶ Lean the Wall Frame against the wall and secure with x (2"/5cm Wood screw and >1"/2.5cm washer or comparable fastener).
- ▶ (OPTIONAL) If loosening plumb screws was required, place magnetic bubble level on the Wall Frame and tighten each of the eight Wall Plumb Screws to make the unit plumb.

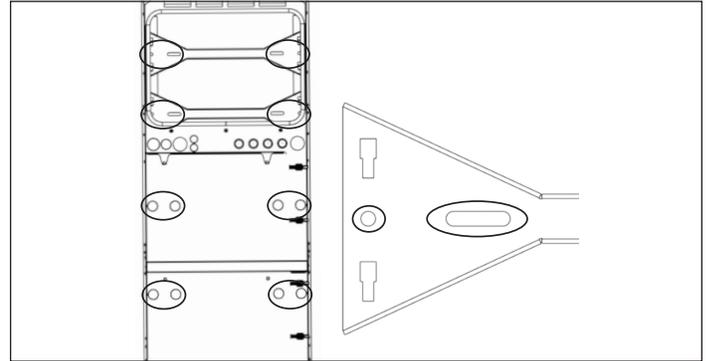


Fig. 14 Fastening the Wall Frame to the wall

- ▶ Fasten the Wall Frame in these locations. The Wall Brackets have slots if required. **Optional Support Leg removal**

### ATTENTION

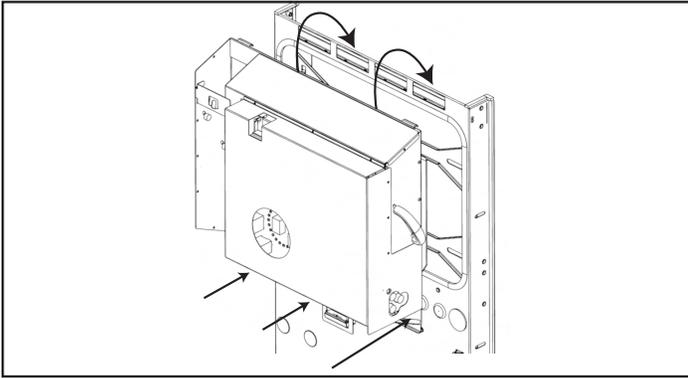
#### Risk damaging battery ESS!



Wall must be capable of supporting 350lb/160kg across two vertical studs. Damage to ESS or property due to Removal of Support feet is not covered under warranty.

- ▶ Once the Wall Frame is secured to the wall, the Support Legs may be removed if desired. (Keep Adjustment Foot attached to Support Legs when storing)
- ▶ Install the Power Unit
- ▶ Remove installation handles from the Power Unit storage location and slot them in on either side of the Power Unit to prepare for lifting.
- ▶ Holding the Installation Handles, and using the

two hooks on the back of the Power Unit, hang the Power Unit on the Wall Frame from the very top edge.



*Fig. 15 Hanging Power Unit*

- ▶ Align the 3x holes on the underside of the Power Unit with the corresponding threaded holes on the Wall Frame.
- ▶ Fasten the Power Unit to the Wall Frame using 3xM6 screws and washer.

THIS WILL ELECTRICALLY GROUND THE FRAME.

# Electrical connections

## Electrical requirements external to ESS

- 40A circuit breaker required for Grid and Microgrid connections.
- L1, L2, Ground and Neutral wires (8AWG).
- All equipment must have a 10kA short circuit current rating.

## sonnenModule 4 battery modules

### The sonnenModule 4 battery module

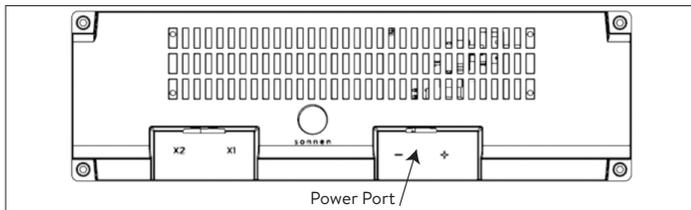


Fig. 16 sonnenModule 4 Battery module main connections

- ▶ X1 & X2- Used to connect battery modules together for communication.
- ▶ Power port - Used for power cable connections.

### 1. Install disconnect switch (Optional)

It is recommended to install a service disconnect switch between the storage system and grid power. Consult local NEC (National Electric Code) and AHJ (Authority having jurisdiction) for guidance.

### 2. Run power cables into the storage system

- ▶ Cables and wires of the appropriate wire gauge, type and ampacity should already be run through the Wall Frame conduit holes using appropriate connectors:
  1. Grid connection
  2. Microgrid connection
  3. 3x CT wires
  4. Ethernet

## E-stop (Optional)

### WARNING

#### Risk of burns!



When working on the storage system:

- ▶ Take off metallic jewelry.
- ▶ Turn off the storage system.
- ▶ Use insulated tools.
- ▶ Wear personal protective equipment, including safety glasses, insulated gloves, and safety shoes.

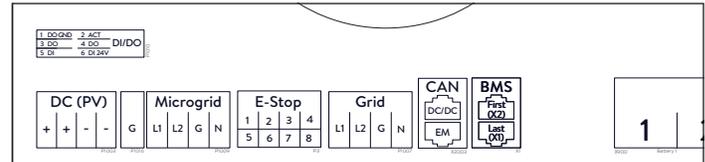


Fig. 17 E-Stop header location

### Tools needed

- 24V 2-pole normally closed plunger
- 16 AWG UL10007 300V wire
- ▶ Remove the jumper from position 1 and 2 in the E-Stop header and run a section of cable from 1 and 2 to the first normally closed pole on the plunger.
- ▶ Remove the second jumper from position 3 and 4 in the E-Stop header and run a section of cable from 3 and 4 to the second normally closed pole on the plunger.

### ATTENTION



The E-Stop plunger does not cut the AC Voltage or break the Pass-through circuit on the Energy Storage System. Additional design may be required if breaking AC voltage is required.

### 1. Current transformers (CT)

Each split-core CT can open to clamp around the conductor and has a 10ft cable. The Meter has 30ft of cabling connected to the Power Unit.

### 2. Connect current-measuring wires

Each CT assembly has 40ft of wire and therefore requires a maximum of 40ft of conduit length between the ESS and the CT site, including the amount inside the ESS. This cable assembly length cannot be extended.

- 1x PV CT
- 1x L1 CT
- 1x L2 CT

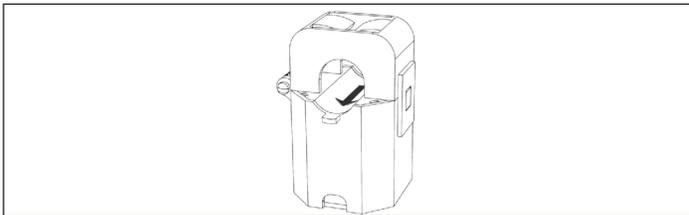


Fig. 18 Current transformers

- Production measurement
  - ▶ Clamp the "PV" CT to either the L1 or L2 AC output conductor from the PV inverter with the arrow towards the PV breaker.
- Protected loads measurement scenario
  - ▶ Clamp the "L1" CT to the L1 microgrid conductor inside the ESS with the arrow pointing away from the ESS AC terminals.
  - ▶ Clamp the "L2" CT to the L2 microgrid conductor inside the ESS with the arrow pointing away from the ESS AC terminals.
- Whole home measurement scenario
  - ▶ Clamp the "L1" CT to the L1 grid conductor inside the main load center with the arrow pointing towards the main lugs.
  - ▶ Clamp the "L2" CT to the L2 grid conductor inside the main load center with the arrow pointing towards the ESS breaker.

### Connect AC connectors cables

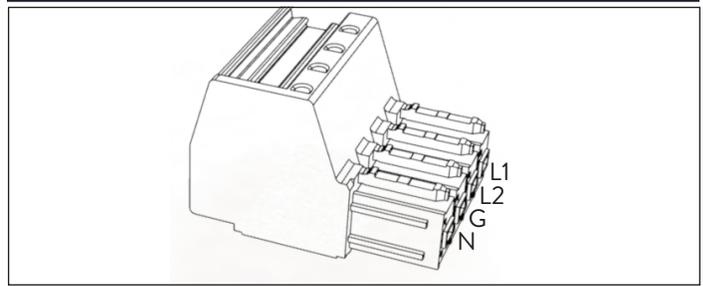


Fig. 19 Grid/Microgrid connectors

Tools needed:

- M4 hex wrench
- 1/8" narrow head screw driver

All external cabling will run through the provided openings in the Wall Frame to the Power Unit connections. Check the Power Unit Terminal Block Map for the wire placement to ensure they are placed in the correct ports.

- ▶ Use service loops for all conductors when cutting.
- ▶ Strip 5/8" from the L1, L2, Ground and Neutral wires (8-20AWG).

### 3. Install conduit plugs

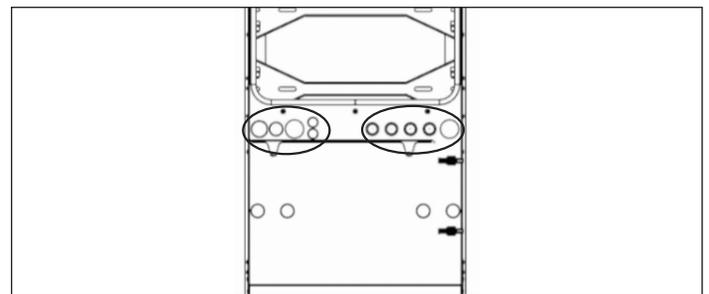


Fig. 20 Conduit plug location

- ▶ Install all conduit plugs over all conductors before attaching connectors. The conductor is required to pass through the plug, sealing around the cable.
- ▶ Place all plugs not being used to seal ESS from debris.
- ▶ Insert **Grid** L1, L2, G, N wires into a terminal connector and label it "Grid", pull back on the wire to ensure a secure connection.
- ▶ Insert **Microgrid** L1, L2, G, N wires into a terminal connector and label it "Microgrid", pull back on the wire to ensure a secure connection.



## Ethernet connection

### 1. Connect Ethernet cable

Fig. 23 Ethernet ferrite core loop

- ▶ Loop the Ethernet cable through the provided ferrite core in the accessory kit, three times before plugging it into the Power Unit port X301 "ETH".

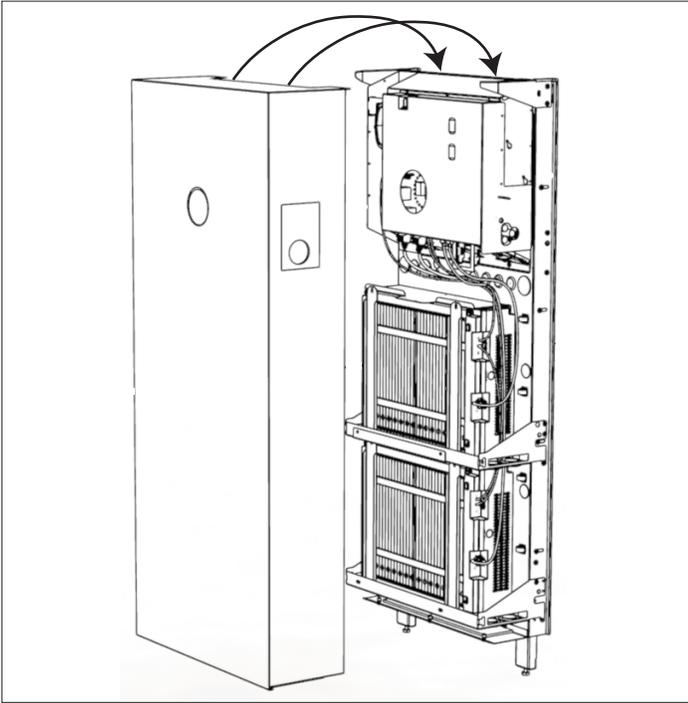


Fig. 24 Cover installation

Tools needed:

- 6mm hex wrench

- ▶ Hang the storage system cover on the same ledge as the Power Unit, located on the top-front edge of the Wall Frame.

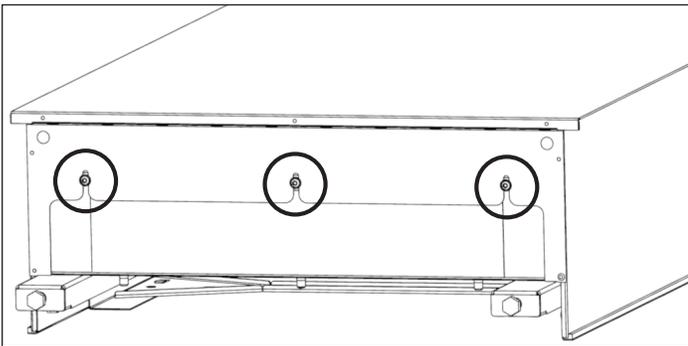


Fig. 25 Fastening the Cover

- ▶ Ensure the Bottom Cover Shelf is inside the system.

- ▶ Fasten the Cover to the Bottom Cover Shelf. Torque down screws to 10 in/lb.

THIS WILL ELECTRICALLY GROUND THE COVER.

## Commissioning checklist

### Prerequisites

- The mounting location fulfills the requirements.
- All power wires are connected properly.
- All BMS communication cables are connected properly.
- The electrical connections fulfill all requirements of local, regional, and national regulations.
- The main distribution panel and protected loads panel are electrically isolated
- The electrical connections of the storage system have been performed correctly.
- The storage system has been connected to the Internet.

Table 2 Commissioning prerequisites

# Commissioning

The commissioning process is accomplished using an Internet connection and is required.

If a wired Internet service is not available, using a wireless router or network extender and pairing it with a smart-phone will work.

## Turn on the storage system

### WARNING

#### Risk of burns!



The battery modules are always capable of producing potentially dangerous voltages, and cannot be turned off.

### 1. Start boot up sequence

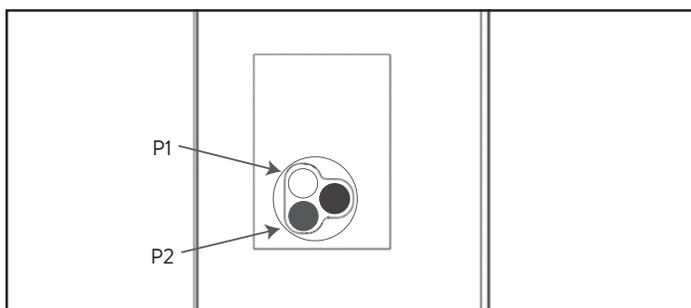


Fig. 26 Control panel

System power disconnect button (P1)

In=Disconnected

Off-grid power up charge button (P2)

### 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.

- If an emergency switch is installed, ensure it is not activated.
- On-Grid start: Ensure green Power Disconnect button is in the out position (P1), then turn on supply breaker in main load center.
- Off-grid start (no utility grid): Press in and hold button (P2) until the eclipse is lit up green, this may take up to 3 minutes.
- The sonnen Logo will turn WHITE: On-Grid or GREEN: Off-grid when the start-up sequence has completed successfully.

## Commissioning assistant

### 1. Identify the storage system



Fig. 27 Identifying the storage system

- ▶ Visit <https://find-my.sonnen-batterie.com>.

Ensure the computer accessing the system is on the same network and identify the system you are commissioning from the list and click "Configure".

### 2. Log in to the storage unit

Fig. 28 Logging in to the storage system

- ▶ Log in to the storage unit.
- ▶ Login information:

Account: Installer

Password: one-time password is found on nameplate of ESS



**The one-time password is used during commissioning and a new password is created and saved by the owner.**

- ▶ Click "login".



**The Commissioning Assistant must be completed to use the storage system.**

### 3. Select system type

- ▶ Click "sonnenCore"

### 4. Install system updates

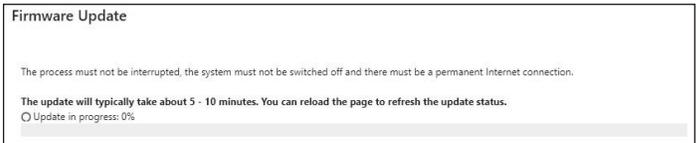


Fig. 29 Installing system updates

- ▶ Wait for the update to complete.
- ▶ Press "Continue".

### 5. Set installation details

Fig. 30 Setting installation details

- ▶ Have the Installer certification number available.
- ▶ Fill out the Owner, Installation, Installer & Time zone details.
- ▶ Press "Continue".

## 6. Enter notifications settings

Fig. 31 Enter notifications settings

- ▶ Select automatic email notification recipient and frequency, currently not used.
- ▶ Press "Continue".



The system will skip the "Inverter Settings" page, this is normal and not required.

## 7. Inverter Setting

- ▶ For mainland US installations USA/IEEE 1547 is used.
- ▶ For AHJ rule 21 requirements USA / UL 1741 SA is used.

## 8. Enter PV system information

Fig. 32 Entering PV system information

- ▶ Enter the maximum AC power of your PV system, in watts.
- ▶ Input connection phase type
- ▶ Press "Continue".

## 9. Select power meter setup

Fig. 33 Enter Power Meter Modes

- ▶ If measuring whole home self-consumption with CTs located upstream of the ESS, select "Grid Measurement" If measuring loads with CTs at downstream of ESS, select "Differential Measurement", the factory default.
- ▶ Press "Continue".

## 10. Enter configuration settings

Meter	Direction	Modbus ID	Channel	Measurement value	Edit
EM210	G - Grid	4	1	462 W	Delete
EM210	P - Production	4	2	0 W	Delete
				-	Add

> Service Entrance Rating 0

Fig. 34 Configuration settings

- ▶ Configure the meter settings as shown above ONLY if they are not already set.
- ▶ IF meter settings are incomplete or not set at all:
  - ▶ Select EM210 as meter type.
  - ▶ Select "Grid" for grid measurements and "Differential" for differential measurement selected earlier in the setup process.
  - ▶ Select Modbus ID 4.
  - ▶ Select channel 1.
  - ▶ Select a second EM210 as meter type.
  - ▶ Select "Production" for PV measurement.
  - ▶ Select Modbus ID 4.

- ▶ Select channel 2.

Please verify the real time measurement value is feasible.

- ▶ Press "Continue".

## 11. Configure Operating Mode, Backup Buffer, Microgrid settings

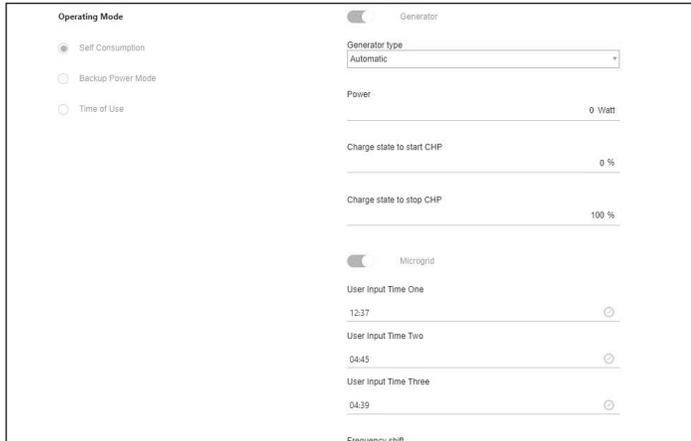


Fig. 35 Configuring Micro-grid settings

- ▶ Select the operating mode to start the system.
- ▶ Frequency shift: Frequency at which the system will operate at when the system is off-grid and the SOC >= 95%. This will essentially turn the PV system off. Once the sonnen reaches 89%, it will adjust the operating frequency back to 60Hz. This value can be changed between 60.9-64.9 depending on the settings on the PV system.
- ▶ Enable and set Micro-grid start stop timing options.
- ▶ Re-enable Time One: If the storage system reaches a low state of charge while off-grid it will stop providing power to the micro-grid until the three preset times occur. When these times occur, the storage system will re-enable the micro-grid for 7 minutes, allowing the PV system 5 minutes to turn on and attempt to charge the batteries. If the system does not begin charging after 7 minutes because of little PV production or if consumption is greater than PV production, then the system will go back into stand-by waiting for the next preset time to occur.
- ▶ Re-enable Time Two: Second attempt to enable inverter output to detect PV production.

- ▶ Re-enable Time Three: Third attempt to enable inverter output to detect PV production.
- ▶ Refer to Digital Interface section on definitions of the operating modes and setting them up.



**This system is not compatible with a generator, skip this option.**

- ▶ Press "Continue".

## 12. System test

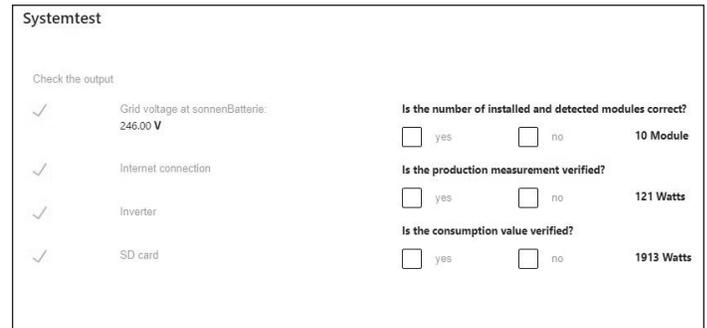


Fig. 36 System test

- ▶ Verify the system output is correct and click "yes" or "no"
- ▶ Press "Continue".

## 13. Completion

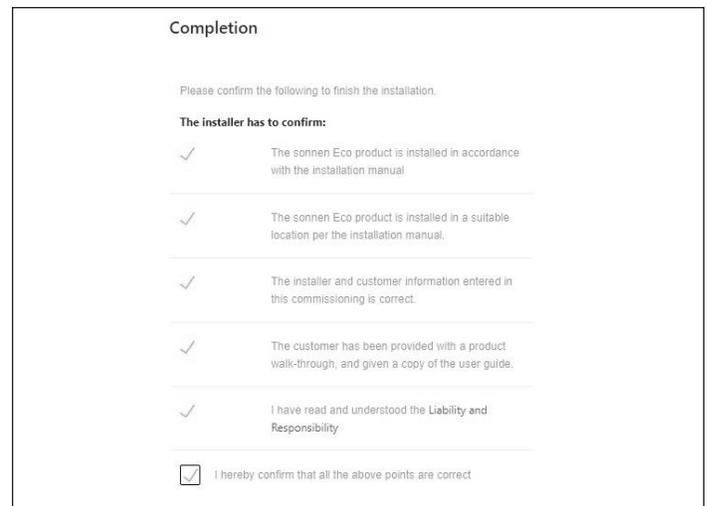


Fig. 37 Completion

- ▶ Read and follow through with the checklist.
- ▶ Check the box confirming all the points are correct.
- ▶ Press "Continue".

## 14. Completion confirmation

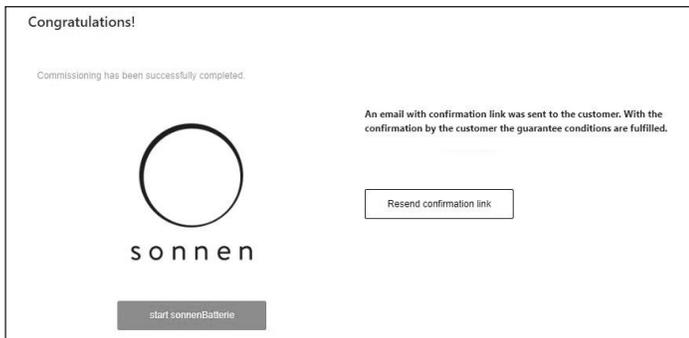


Fig. 38 Completion confirmation

- ▶ Verify the email was sent to the provided address.
- ▶ Click "start sonnenBatterie".

## 15. System check

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 system can switch over to micro-grid.
4. Verify all protected loads are being powered by the storage system.
5. Verify the frequency shift occurs and grid tied PV inverter shuts down.
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-tied inverter shuts down.
9. Restore the grid feed to the sonnen.
10. Verify the system switches back to grid (up to 5 minutes depending on location).
11. Verify the solar inverter restarts.
12. Verify all protected loads are operational.

# Digital interface

## Internet portal

The sonnenCore must connect to sonnen's servers to enable control of the storage system via the web portal and smart-phone app. This connection is protected by industry-standard security against unauthorized access. sonnen and service partners will only access the storage system for maintenance and monitoring.

An anonymous evaluation of log data enables further improvements and monitoring of hardware and software.

## Establish connection to the Internet

- ▶ Ensure the 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:



The listed ports are generally pre-configured 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	
1196	(Server connection, ssl)

Table 3 Required open ports for storage system

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

## Internet portal

Real-time and historical data regarding the storage system can be viewed via the Internet portal.

- ▶ Log in to the portal
  - ▶ Type the following address to your Internet browser: **https://my.sonnen-batterie.com/**

### Login

Please log in with your user name and your password:

User name:

Password:

Fig. 39 Login window

- ▶ Enter the login information received with delivery. This is NOT the same login used for direct access to the storage system parameters.

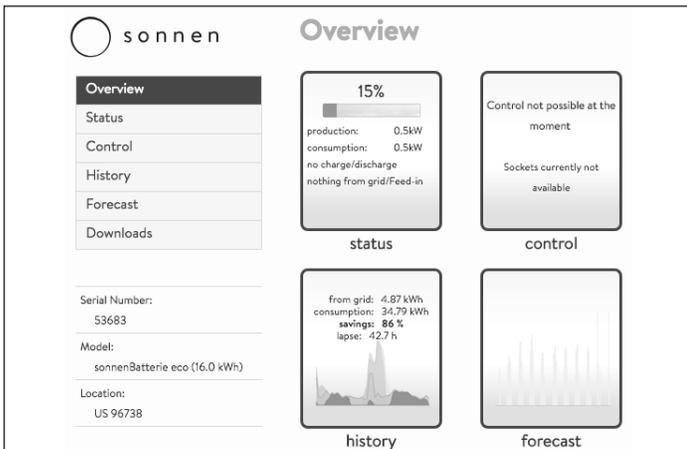


Fig. 40 Portal overview screen

There are 4 icons that are also labeled on the left side pane of the page.

- Status - shows the overall flow of power for the storage system and associated components.
- Control - not used in the U.S. (Future development.)
- History - displays system data in an easy to read graph in various time formats.
- Forecast - shows past production and consumption data and predicted PV production and consumption data. (Does not influence the charging/discharging behavior of the storage system.)
- Downloads - allows user to gather various data in a spreadsheet compatible format.

### Status view

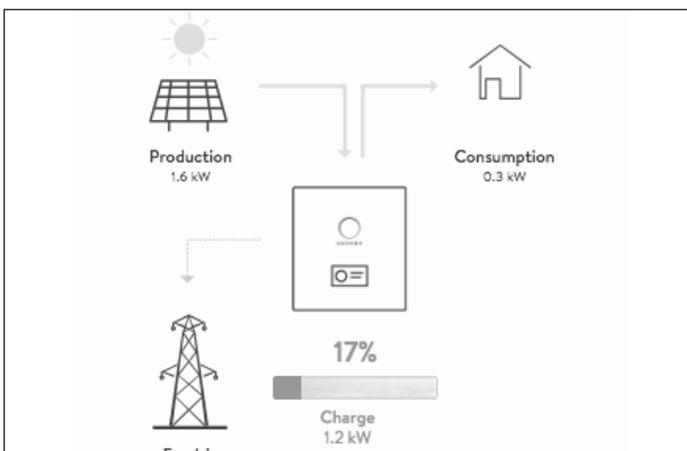


Fig. 41 Status view

This display shows 5 key pieces of information regarding where the power is going in the entire system using yellow line indicators:

- Production - indicates the amount of power the PV system is producing as measured by the storage system.
- Consumption - a measure of how much power is being consumed by the loads the storage system is supplying.
- Feed-In - the amount of excess PV that is passed through the storage system towards the utility.

### History view

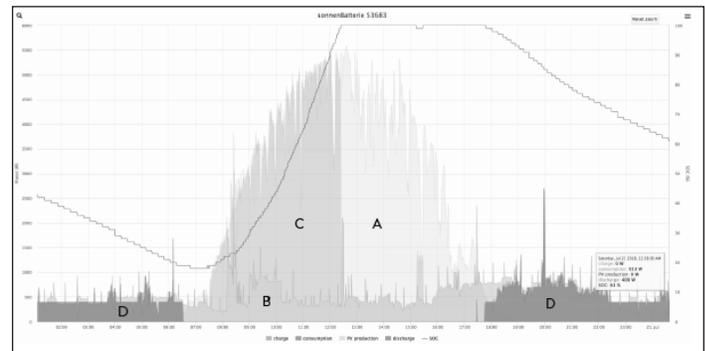


Fig. 42 History view

This display is the most informative and provides a visual indication of PV production, consumption, battery charge, battery discharge, and state of charge.

- Left axis - PV or consumption power measured in watts
- Right axis - battery state of charge
- Bottom axis - time (24 hour)
- There are also labeled overlays associated with each color on the graph:
  - "A" - PV production as measured by the storage system
  - "B" - amount of power sent to the loads
  - "C" - amount of power being used to charge the batteries
  - "D" - amount of power the batteries are discharging to meet demand

The overlays can be toggled to either show or leave out the selected color.

- Click on the name of overlay to toggle. The next image is an example of all overlays toggled off except for the PV production:

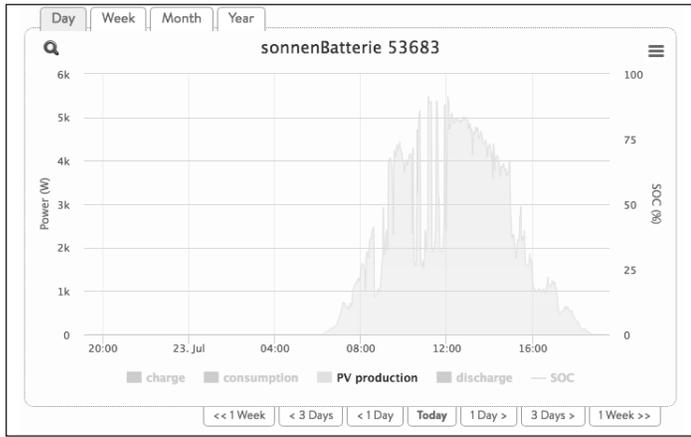


Fig. 43 History view overlays

Based on the PV production, the morning hours were probably cloudy and reduced production, causing the batteries to take longer to reach a full charge.

Historical information can be displayed in four different time periods: by day (default), week, month or year.

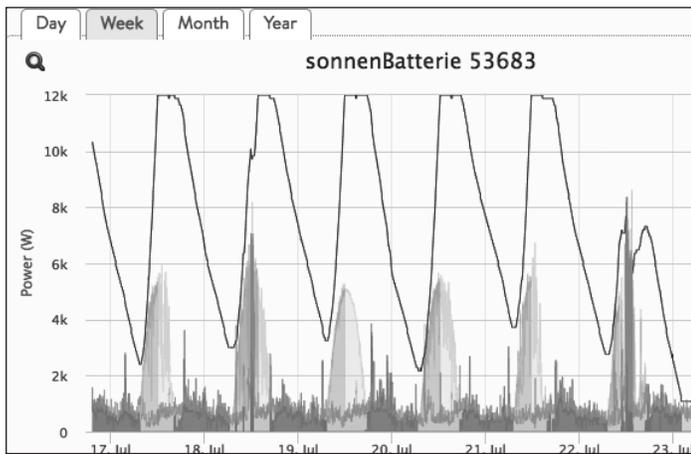


Fig. 44 History view week view

While in any of the multiple views, click and highlight the time frame that is of interest.

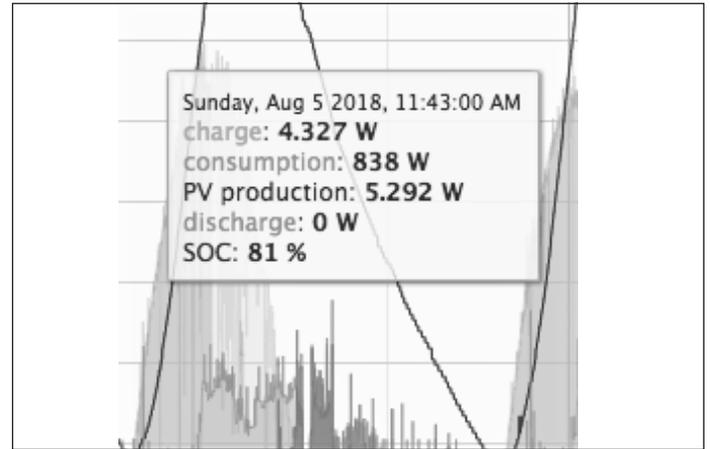


Fig. 45 Specific data history

The cursor displays specific data on the history view when the area is hovered over. In this example, the cursor box shows the date, charging watts (from solar), consumption watts (from loads and other appliances), solar inverter production watts, the battery discharge in watts, and the current state of charge (SOC).

By analyzing the behavior of the PV, loads, battery charging and discharging, the homeowner can see just how much power throughout the entire day is being consumed, at what times, and where their energy is coming from: the PV system, the battery bank, the utility grid, or a combination of all three.

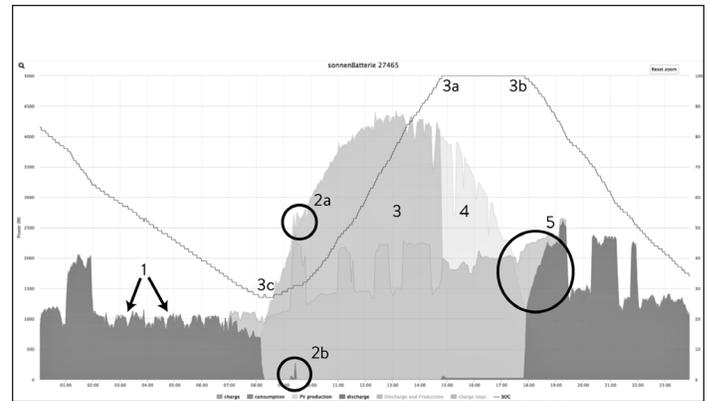


Fig. 46 Typical history graph

- 1 - These spikes throughout the nighttime hours are caused by the kitchen refrigerator.
- 2a - There is a spike of consumption during this time of the morning that the solar production could not sustain since the tip of the blue spike is outside of the yellow curve.
- 2b - The storage unit recognized the spike

was beyond the PV production value and discharged a small amount of energy to cover the spike.

- **3** - This system completed the battery charging process around 3 p.m.
  - 3a** - The state of charge line shows a 100% capacity at the same time the green line stopped.
  - 3b** - the state of charge started to go down as the batteries started to discharge due to decreased PV production.
  - 3c** - The low state of charge for this day was 28% before the batteries started charging from solar.
- Since the batteries are full at 3 p.m. and there is still excess solar production, this 2.5 hours of yellow indicates that the excess was sent to the grid.
- At first glance it may appear that the storage unit did not start discharging to cover this light blue event in the late afternoon when the solar production started to decline. Using the cursor will help to clarify what is being displayed.

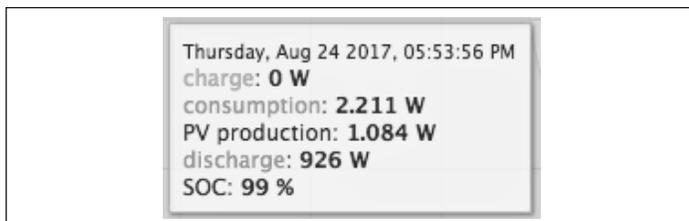


Fig. 47 Typical history graph values

At 5:53 the system was no longer charging the batteries (0W) and the load on the system was 2,211W. There was still 1,084W of solar production but it was not enough to supply the demand so the storage system only discharged enough to fulfill the remainder (926W). We can see this same behavior at point **2b** when the system discharged just enough to cover what the solar could not.

## Direct access to the storage unit

To log in:

- ▶ Ensure you are using a device that can be connected to the Internet (computer, laptop, tablet, etc.)
- ▶ Verify that the device is on the same network as

the storage unit.

- ▶ Open a web browser

### 1. Identify storage unit

- ▶ Navigate to this URL:

**<https://find-my.sonnen-batterie.com>**

This website will list all of the units on the network.

- ▶ Identify the system
- ▶ Select the “Configure” button
- ▶ The login page can also be accessed via the LAN IP assign to each ESS by the connected network device.



Fig. 48 Storage unit configure

- ▶ Log into the storage unit
- ▶ Dashboard

Fig. 49 Storage unit dashboard

The dashboard provides an informative overview of the energy flow, including;

- Solar production, home consumption, solar feed-in to the grid (if any), and grid power to the home.
- Battery state of charge (SOC), power provided by the battery or to charge the battery.

Charge power represents the amount of power that is currently being used to charge the batteries. This source could be either the grid or the solar. Discharge power is the amount of power the storage system is sending to the home from the batteries.

The green state of charge indicator will change based on how full the battery bank is.

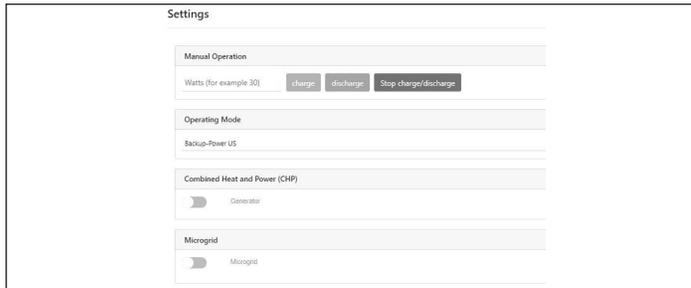


Fig. 50 Operating mode settings

Operating Mode - selects the operating mode for the storage system.

- Manual - used to manually charge and discharge the ESS.
- Backup-Power US - the storage system remains at a full charge until the grid power is lost. Solar will work during the grid outage and can be used to both power loads and charge the batteries if there is any excess solar to do so. The grid is also used to charge the batteries.
- Automatic -Self Consumption US - maximizes solar self consumption. The solar is used to power loads and charge batteries. When there is not enough solar to power loads the batteries will discharge to cover consumption. This mode does not use the grid to charge the batteries.
- Time-Of-Use (TOU) - used in areas with high peak rates during specific times. The grid is used to charge the batteries during off peak times.

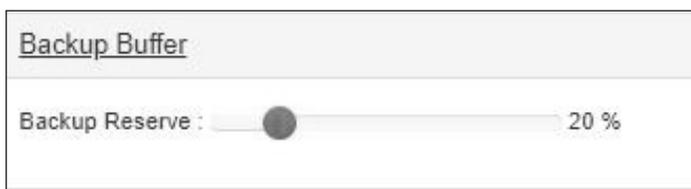


Fig. 51 Backup buffer

Backup Buffer - Only used in TOU and self-consumption modes.

- Sets a battery reserve for a grid outage. For example, if the backup buffer is set to 20%, then the batteries will stop discharging at 20%. The homeowner would have 15% of usable capacity when the system switches to backup mode. If backup buffer is set to 0%, the batteries will not stop discharging at 5%, and will go all the way to 0%. This means if at 0% on-grid and power is lost, the system will shut down immediately.

Time of Use - Allows user to set the high peak time periods for focused self consumption. Check with the local utility for the rate schedule.

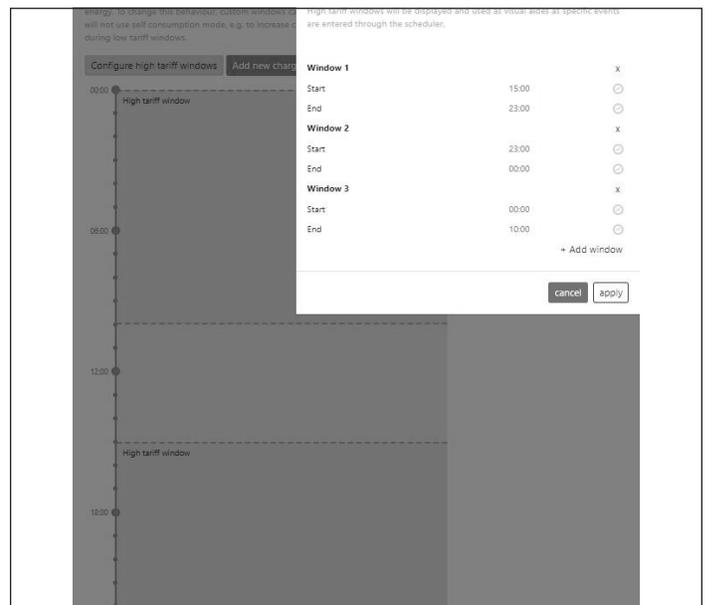


Fig. 52 Grid enable option

- Configure high tariff window - Click "Configure high tariff windows" and set the "Start" and "End" time of the high tariff window. If there are multiple windows, click "Add window" and fill them out.
- Configure charge event - Click "Add new charge event" and set the start and end time. Setting "Max. power from grid" to zero will prevent the system from drawing power from the grid and only from PV.

Max. power from grid - The maximum total amount the system will demand from the grid, the amount of this that can be used to charge the battery modules will be the difference between this value and the current consumption of the house.

## Microgrid settings



Fig. 53 Microgrid

Used to set three different “wake up” time periods for grid outage, under the scenario that the system has reached a very low state of charge and has stopped discharging to the microgrid. When at this very low SOC, the system will go into standby, automatically waking up during these three time periods to allow the PV to provide power; however, if the consumption is greater than the production from the PV, the system will revert to standby and wait for the next scheduled wakeup time.

Although the times can be customized, a suggested setting for the microgrid times are 0800, 1000 and 1200. If the system can’t find a charging source by noon, then there is probably a bigger issue with the system charging, e.g. low PV production etc. The timers will be disregarded by the system if the Re-enable Microgrid setting is switched to NO.

## System information

General Information	
System Time	Tuesday, January 14, 2020 11:39 AM
Capacity	16 kWh (8 modules)
Hardware Version	3
Inverter Max. Power	8000 W
MAC Adresse	5026f607ba1a
Model	ECOLX 12kWh, 1.5, Screen, Zone = Sit
Serialnumber	1234567890
Software	
Firmware Version	1.1.1.388962
Release Channel	virtual-stable
Software Version	1.1.1
Network	
WAN IP	192.168.1.1
Local IP (eth0)	192.168.1.1
VPN IP (tund)	192.168.1.1
Grid & BMS Information	
Grid Voltage	230 V
BMS State	OK

Fig. 54 System information

This screen shows various information about the storage system that could be useful in troubleshooting.

# Decommissioning

## Shutting the storage system down

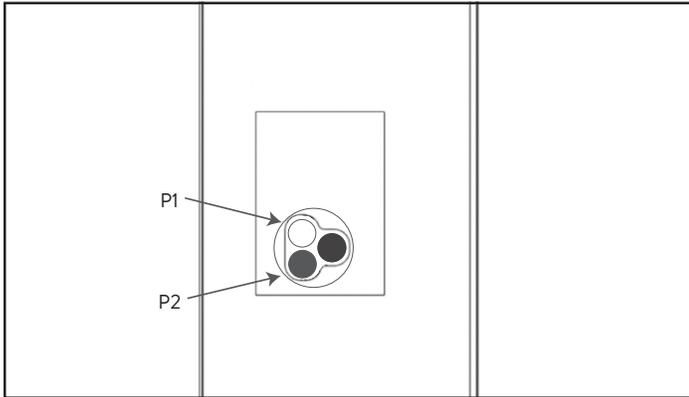


Fig. 55 Power disconnect button (P1)

### Shut down the storage system

#### 1. Physical shutdown

- ▶ Press in Power disconnect button (P1)

#### Emergency switch-off

- ▶ Press Emergency button

## Recycling and certificates

The sonnen energy storage system battery modules comply with RoHS and contains none of the following substances: lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl (PBB) and polybrominated diphenyl ether (PBDE).

Do not dispose of the sonnen energy storage system or its battery modules in anywhere other than certified electronics and battery facility! You must comply with Federal, state, and local laws regarding battery disposal, which vary by location.

As per the limited warranty, the battery module replacement is free of charge during the warranty period, provided that it is part of a qualifying Covered Product that has been operated and maintained in accordance with the terms of the limited warranty and the Terms & Conditions provided with the product. In the case of failure outside of the limited warranty, the battery module will be replaced at the end user's expense. All battery module or sonnen energy storage system equipment replacements must be carried

out by a sonnen certified installer. Contact sonnen service or the company that installed the storage system to coordinate the these actions.

For all returned electrical equipment, sonnen uses R2 Certified recycling facilities.

### Preparing battery modules for shipment (RMA)

#### WARNING

##### Risk of burns!



When working on the storage system:

- ▶ Take off metallic jewelry.
- ▶ Turn off the storage system.
- ▶ Turn off the main disconnect.
- ▶ Use insulated tools
- ▶ Wear personal protective equipment.

- ▶ Ensure entire storage system is turned off.
- ▶ Disconnect all batteries near the affected battery, cables, etc.
- ▶ Remove affected battery.

# Maintenance and care

To ensure proper operation, periodic cleaning and software function control of the storage system are required.

## 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 enclosure

- ▶ When the cover appears dirty, clean the exterior with a soft, damp cloth. Do not clean the interior of the system.

### 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 system.
- ▶ Open the cover.
- ▶ Check for and tighten any loose electrical connections. Look for cracked, blistered, or discolored insulation, which can indicate poor electrical connections.
- ▶ Check for pitting or cracking on connectors.
- ▶ Check for and tighten any loose mechanical connections.
- ▶ Using a multimeter with a continuity test function.

## Appendix 1. Glossary

---

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

**Autonomy:** A measurement of how little you rely on the grid for energy. The more renewable energy you produce and consume, the higher your autonomy.

**Backup mode (or off-grid mode):** A mode of operation in which the sonnenCore 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 provide power in the event of an outage.

**Battery modules:** The energy storage modules in the sonnenCore.

**Capacity:** The amount of energy that can be stored in the sonnenCore, 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 sonnenCore, 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.

**Micro-grid:** 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 sub-panel 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 sonnenCore, which combines an inverter, battery modules, and other hardware and proprietary algorithms to make solar power an even more cost-effective power source.

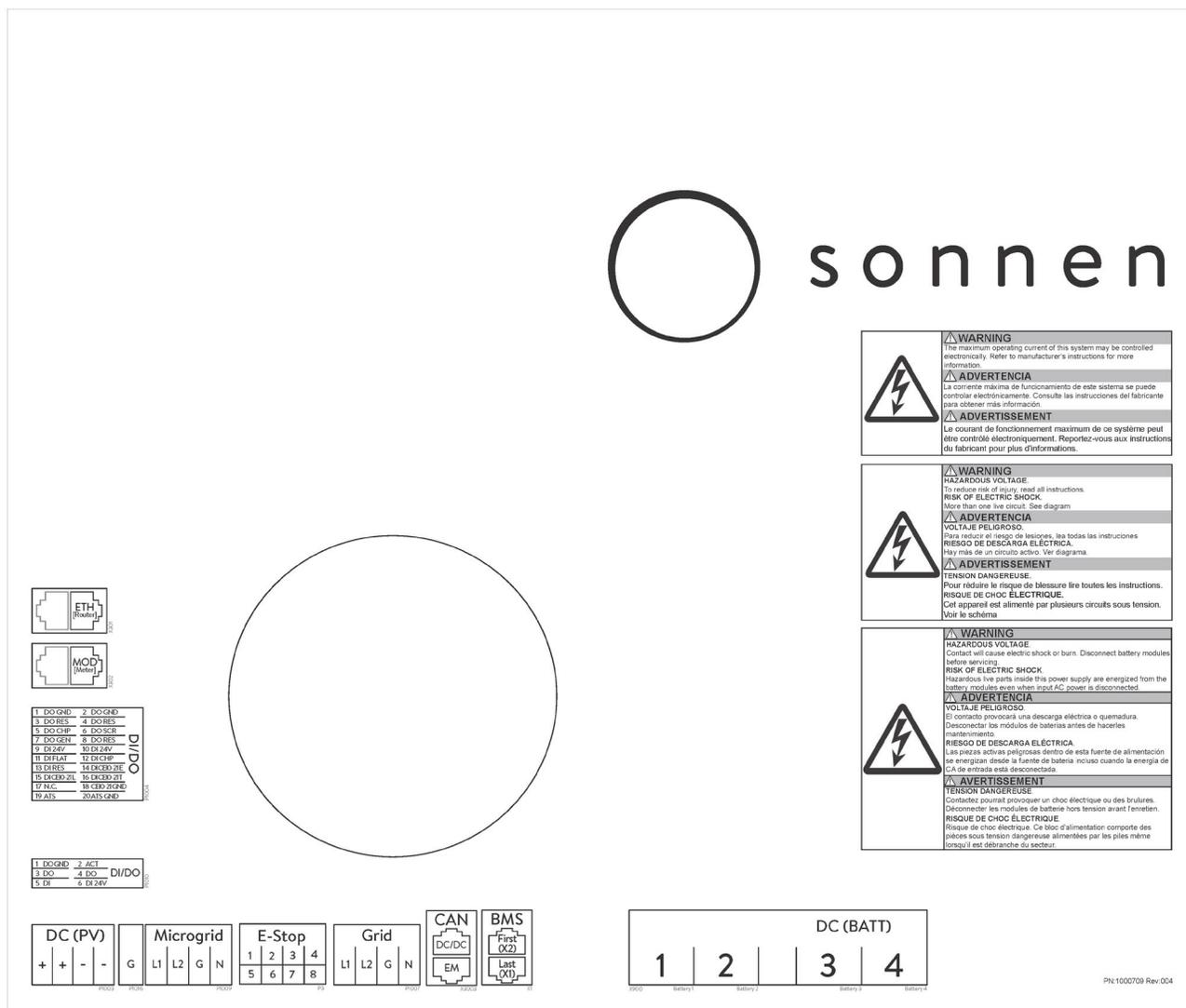
**Transfer switch:** A switch, either manual or automatic, that changes the power source from the utility grid to self-generated power in the event of a loss of power.

## Appendix 2. Warranty

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The warranty provided at <https://sonnenusa.com/en/warranty/> overrides any printed versions of sonnen's warranty.

# Appendix 3. Nameplates and labels



sonnen, Inc.  
1578 Litton Drive  
Stone Mountain, GA 30083



**sonnenCore**

model SCORE10  
 serial number #####  
 initial password \*\*\*\*\*  
 voltage 120/240VAC  
 frequency/ph 60Hz/split phase  
 output current max 20A  
 utility interactive current max 20A  
 output power max 4800W  
 utility interactive power max 4800W  
 energy output max 10kWh  
 short circuit rating max 10kA

certified to ANSI/CAN/UL STD 9540  
 cell technology lithium iron phosphate  
 ambient temperature range -10°C - 50°C  
 environment indoor only  
 protection class/protection TYPE 12



	<b>WARNING</b> The maximum operating current of this system may be controlled electronically. Refer to manufacturer's instructions for more information.
	<b>ADVERTENCIA</b> La corriente máxima de funcionamiento de este sistema puede controlarse electrónicamente. Consulte las instrucciones del fabricante para obtener más información.
	<b>AVERTISSEMENT</b> Le courant de fonctionnement maximal de ce système peut être contrôlé électroniquement. Reportez-vous aux instructions du fabricant pour plus d'informations.

## Appendix 4. Battery installation parts

	Number per battery	Quantity
Battery Module	-	2
Battery power cable	1	2
Short BMS cable	-	1
Medium BMS cable	-	1
Long BMS Cable	-	1

## Appendix 5. Battery voltage values

---

<b>Battery</b>	Voltage
1	
2	
3	
4	

*Table 4 Battery Voltage values*

## Appendix 6. PCS data & operation mode limits

### PCS general specifications

PCS controlled current	20A
PCS controlled voltage	240VAC
Devices compatible with PCS	Carlo Gavazzi Meter, EM210 Carlo Gavazzi CT CTV1X60A333MV Carlo Gavazzi CT CTV4X200A333MV SonnenInverter3

Table 5 PCS general specifications

### ATTENTION



PCS configuration access is reserved to sonnen approved representatives, including installers who have successfully completed the sonnen university certification course. PCS login credentials must remain confidential, and cannot be shared without the consent of sonnen inc.

### ATTENTION



PCS shall be programmed such that the system does not exceed the limitations of the over-current devices in the panel-board and connected circuit. The PCS shall be coordinated with the limits defined by NEC 210.20, 705.12 or NFPA 70 2020 edition section 705.13.

### ATTENTION

This system is equipped with a power control system (PCS) which is suitably rated to provide branch circuit over-current protection. The controlled current setting shall not exceed the rating of any controlled busbars or conductor ampacity.



Configuration of power control settings system or changes to settings shall be made by qualified personnel only. Incorrect configuration or setting of the power control settings may result in unsafe conditions.

## Operation modes, limits and definitions

---

### Import only mode

---

<b>Corresponding operating modes</b>	Manual charge only
--------------------------------------	--------------------

---

<b>Maximum charge</b>	2x20A AC
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---

<b>Maximum discharge</b>	0A AC
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### Export only mode

---

<b>Corresponding operating modes</b>	Manual discharge only
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---

<b>Maximum charge</b>	0A AC
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---

<b>Maximum discharge</b>	20A AC
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---

### No exchange mode

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<b>Corresponding operating modes</b>	Manual charge only
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---

<b>Maximum charge</b>	0A AC
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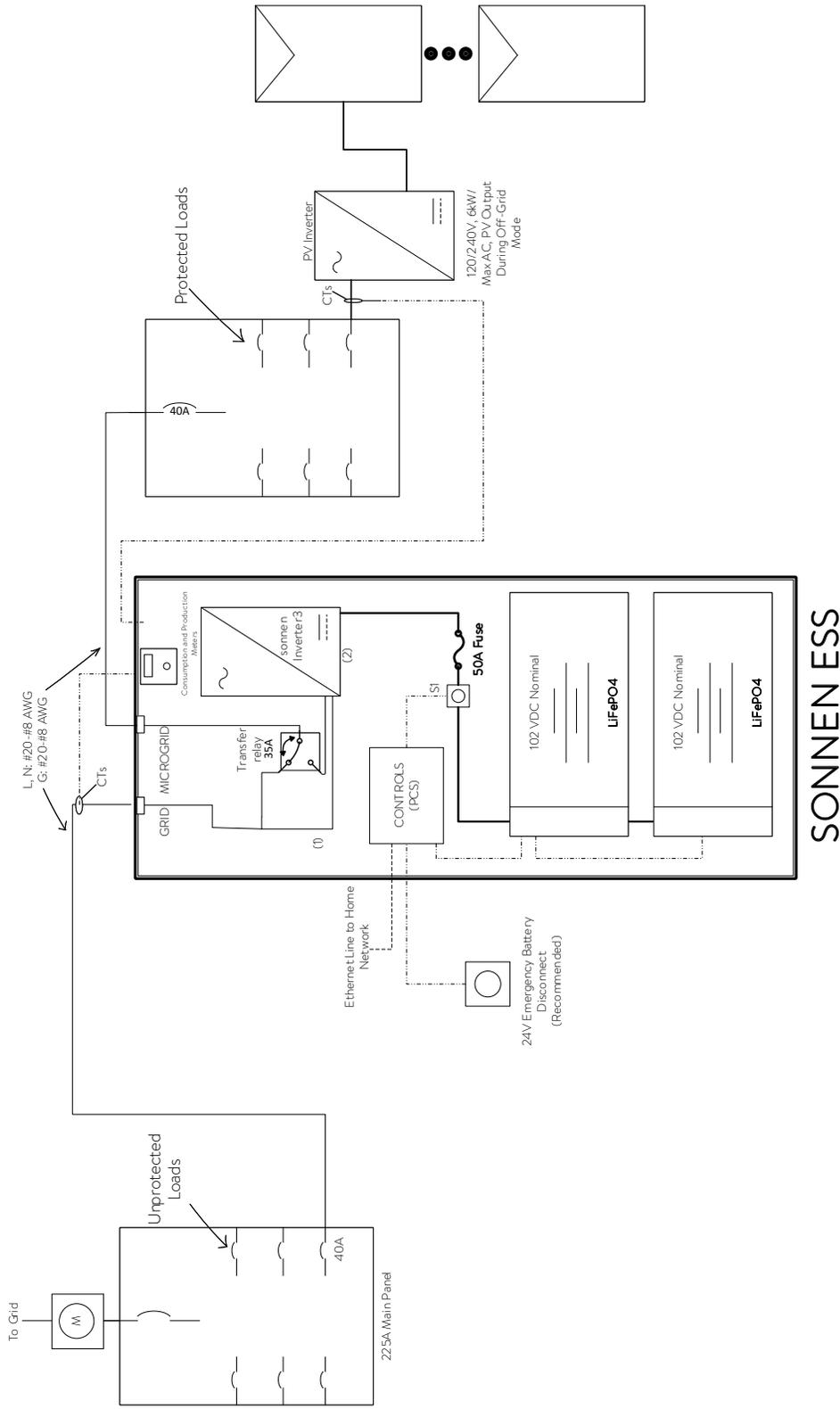
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<b>Maximum discharge</b>	0A AC
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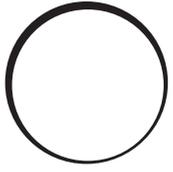
*Fig. 56 Operation modes, limits and definitions*

# Appendix 7. System single line diagram



 <b>sonnen</b> SONNEN, INC. 1578 Litton Dr, Stone Mountain, GA 30084, USA		SINGLE LINE DIAGRAM	
		SONNEN CORE ENERGY STORAGE SYSTEM	
SIZE	DATE	DWG NO	REV
LTR			1.0
SCALE	N.T.S.	Rev by RR/JAB	SHEET 1 OF 1

- 1. PCS controlled conductor
- 2. PCS controlled device



sonnen

**sonnen Inc.**

1578 Litton Dr, Stone Mountain, GA 30083

**T** +1 (310) 853-2404

**O** [info@sonnen-batterie.com](mailto:info@sonnen-batterie.com)

P/N:5000334 Rev:005