

**sonnen**

# Installation instructions for Electricians

sonnenBatterie 10 performance+



EN

## IMPORTANT

- This entire document must be read carefully.
- This document must be kept for reference purposes.

## Publisher

sonnen GmbH

Am Riedbach 1

D-87499 Wildpoldsried

Service number +49 8304 92933 444

Email [info@sonnen.de](mailto:info@sonnen.de)

## Document

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## 1 Information about this document

This document describes the installation of the sonnenBatterie 10 performance+.  
→ Make sure you read this entire document carefully.  
→ Keep this document for reference purposes.

### 1.1 Target group of this document

This document is intended for authorized electricians. The actions described here must only be performed by authorized electricians.

### 1.2 Designations in this document

The following designations are used in this document:

Complete designation	Designation in this document
sonnenBatterie 10 performance+	Storage system
sonnenModule 4	Battery module
Authorised electrician	Electrician performing the installation/Installer
Person who purchased the storage system and on whose premises the system is installed	Operator

### 1.3 Explanation of symbols

#### ⚠ DANGER

Extremely dangerous situation leading to certain death or serious injury if the safety information is not observed.

#### ⚠ WARNING

Dangerous situation leading to potential death or serious injury if the safety information is not observed.

#### ⚠ CAUTION

Dangerous situation leading to potential injury if the safety information is not observed.

#### NOTICE

Indicates actions that may cause material damage.

#### ⓘ INFO

Important information not associated with any risks to people or property.

Symbol	Meaning
→	Work step
1. 2. 3. ...	Work steps in a defined order
✓	Condition
•	List

## 1.4 Change history

Version / Date	Changes compared to the previous version
02 / 18-02-2025	Position of change over switch adjusted in illustrations (Wiring the emergency power function [P. 74], Wiring an AC microgrid [P. 85]).
01 / 05-12-2024	Update of EnWG §14a description [P. 68]. House connection size for use of emergency power function [P. 69] increased. Information on switching off the storage system [P. 94] with emergency power function added. Values added to the Technical data [P. 101] section.
00 / 14-10-2024	Initial creation.

## 1.5 Further information

### ⓘ INFO

Information on the EU battery regulation: [sonnengroup.com/eu-battery-regulation](http://sonnengroup.com/eu-battery-regulation)

## 2 Safety

### 2.1 Proper use

The sonnenBatterie 10 performance+ is a battery storage system which can be used to store electrical energy and, when using the integrated emergency power function, can maintain the power supply in the event of a power failure.

Incorrect or improper use can result in danger to life and limb of the user or third parties or damage to the product and other property.

The following points must be observed at all times in order to ensure **proper use**:

- The transport and storage conditions must be observed.
- The storage system must only be used at a suitable installation location.
- The storage system must be fully installed in accordance with the installation instructions.
- The storage system must be installed by a authorized electrician. Country-specific regulations concerning electrical installations must be observed at all times.
- The interfaces of the storage system must be connected in accordance with the product documentation.
- The storage system must not be used long-term without connection to the public electricity grid.
- Generators (e. g. a PV system) must never be connected to the output of the emergency power function.
- Only use the storage system in its original state - without any unauthorised modifications - and when it is in proper working order.
- Repairs to the storage system must be carried out by authorised service technicians only.

**Especially the following uses are not permissible:**

- Operation in flammable environments or areas at risk of explosion.
- Operation in locations at risk of flooding.
- Outdoor operation.
- Operation of the battery modules outside of its storage system.
- Bypassing, blocking or tampering with protective devices.

#### Danger due to electrical voltage



The storage system contains live electrical parts, which poses a risk of electrical shock.

The storage system inverter also contains components with internal stored energy, which carry voltage even after the storage system is switched off.

Therefore:

→ Disconnect the storage system from the power supply before any work on the system is started (see Switching the storage system off to electrically isolate it [P. 95]).



#### Operating the storage system

- The storage system may only be operated as described in the product documentation.
- This device can be used by children from the age of eight (8) years old and individuals with impaired physical, sensory or mental capabilities or individuals with limited knowledge and/or experience of working with the device, as long as they are supervised or have been trained to safely use the device and understand the resulting risks of doing so. Children must not play with the device.

## ⓘ INFO

Failure to comply with the conditions of the warranty and the information specified in this document invalidates any warranty claims.

### 2.2 Qualified electricians

The storage system must be installed and commissioned by authorised electricians only. Installation by unqualified and/or unauthorised persons may cause injury and/or component damage.

People who meet the following requirements are generally considered authorised electricians:

- The electrician must be a person with a technical knowledge or sufficient experience to enable him/her to avoid dangers which electricity may create.
- The electrician has successfully completed the sonnen certification training.

### 2.3 Handling battery modules



The battery modules compatible with the storage system are protected by multiple protective devices and are safe when used properly. Improper use or a fault may cause the battery cells inside the battery modules to be damaged.



This can have the following effects:

- High heat generation on the surface of the battery cells.
- Leaking of electrolyte, vapours and/or smoke.
- The escaping electrolyte may ignite and cause an explosive flame.
- Irritation or burns to skin, eyes, respiratory tract and mucous membranes due to steam or smoke from burning battery modules.
- Irritation of skin, eyes, respiratory tract and mucous membranes due to leaking electrolyte.

In order to ensure proper use:

- Do not open the battery modules.
- Do not inflict mechanical damage (pierce, deform, disassemble, etc.) on the battery modules or otherwise modify them.
- Do not heat the battery modules. Keep them away from sources of ignition and operate them only within the permissible temperature range.
- Do not allow the battery modules to come into contact with water (except to extinguish a fire involving the storage system).
- Do not short-circuit the battery modules.
- Never continue to use the battery modules if they are damaged in any way.
- Do not deep-discharge the battery modules or charge them using external chargers.
- Do not operate battery modules outside of the storage system.
- Remove metal jewellery when handling battery modules.
- Do not place any tools or metal objects on the battery modules.

#### Transporting battery modules

The battery modules contain lithium-ion batteries. These are classed as hazardous goods and must be transported in compliance with certain regulations.

- Observe the information in section Transporting battery modules [P. 12] at all times.

## 2.4 Conduct in the event of a fault or fire

### If contents are escaping:

1. Leave or do not enter the room in which the storage system and battery modules are located.
2. Avoid contact with the escaping electrolyte. If contact occurs, rinse the affected area thoroughly with water. In the case of irritation of the skin, eyes or mucous membranes, seek medical attention.
3. Contact the sonnen service team (+49 8304 92933 444).

A fire may occur even with electrical devices that are designed with care. A nearby fire can also cause the storage system to ignite. This may also lead to the contents of the battery modules being released.

### If the battery modules or storage system is on fire:

1. Leave or do not enter the room in which the storage system and battery modules are located.
2. Avoid contact with escaping smoke or steam. If contact occurs, rinse the affected area thoroughly with water. In the case of irritation of the skin, eyes or mucous membranes, consult a doctor.
3. Contact the fire services.
4. Contact the sonnen service team (+49 8304 92933 444).

There is a danger of electrocution when extinguishing a fire while the storage system is switched on. In the event of a fire in the vicinity of the product or in the storage system itself, proceed as follows before beginning any extinguishing measures:

- Switching the storage system off to electrically isolate it [P. 95]. The battery modules will continue to carry voltage.
- Switch off the mains fuses in the building.
- Only firefighters with appropriate personal protective equipment are permitted to enter the room where the storage system is located.

If the storage system or mains fuses cannot be safely switched off:

- Observe the minimum distances applicable for the specific extinguishing means used. The storage system works with a nominal voltage of 400 V (AC) and 204.8 V (DC).

### Extinguishing agents

- A storage system fire can be extinguished using conventional extinguishing agents.
- Water is recommended as an extinguishing agent in order to cool the battery modules and therefore prevent thermal runaway in battery modules which are still intact.

### Information on the battery modules

- A single battery module has a nominal voltage of 102.4 V (DC).
- Two battery modules each are connected in series, resulting in a operating voltage of 204.8 V (DC).
- The battery modules do not contain metallic lithium.

**ⓘ INFO**

Further information can be found in the 'Information sheet for emergency services - Use on stationary lithium solar energy storage systems' ('Merkblatt für Einsatzkräfte - Einsatz an stationären Lithium-Solarstromspeichern', published by the German Solar Association).

## 2.5 Symbols on the product



Warning: electrical voltage. Wait ten minutes after switching off (capacitor de-energising time).



Warning: flammable materials.



Warning: hazards due to batteries.



Warning: product is heavy.



CE mark. The product meets the requirements of the applicable EU directives.



WEEE mark. The product must not be disposed of in household waste; dispose of it through environmentally friendly collection centres.



Observe the documentation. The documentation contains safety information.



Protective earthing. Labelling earthing points.

## 3 Storage and transport

### 3.1 Storage

Storage describes the condition when the storage system is not connected to the public electricity grid and the battery modules cannot be automatically charged.

#### 3.1.1 Ensuring correct ambient conditions during storage

→ Make sure during storage that the required ambient conditions (see Technical data [P. 101]) are met.

#### 3.1.2 Storing the battery modules

##### NOTICE

##### Deep-discharge of the battery modules

Destruction of the battery modules!

- Do not disconnect the storage system from the public electricity grid for long periods of time.
- Never continue to operate battery modules which have been deep-discharged.

During storage the battery modules automatically discharge at a minimal level. Battery modules are only permitted to be stored for a limited amount of time, as a deep discharge of the batteries may lead to damage to or destruction of the battery modules.

Observe the following points:

- Battery modules are delivered with a charging status of **30 %**.
- Battery modules are only allowed to be stored for **maximum 6 months**.
- After 6 months at the latest, the battery modules must be installed in a storage system and commissioned.

### 3.2 Transport

#### 3.2.1 Ensuring correct ambient conditions during transport

→ Make sure during transport that the required ambient conditions (see Technical data [P. 101]) are met.

#### 3.2.2 Transporting battery modules

##### ⚠ CAUTION

##### Improper transport of battery modules

Fire outbreak at battery modules or emission of toxic substances!

- Only transport battery modules in packaging that meets applicable regulations.
- Only transport damaged battery modules in accordance with the applicable regulations.

Lithium-ion batteries are hazardous goods. Therefore the following points must be observed when transporting the battery modules:

- Observe the general transport regulations based on the mode of transport as well as all legal regulations.
- Consult an external hazardous goods expert.
- Under the ADR treaty on dangerous goods, non-functional battery modules must be classified before they are transported. The sonnen Partner Portal contains a checklist for this. The battery module classification may incur additional requirements for dangerous goods transport.

Hazardous goods class	UN number	Battery module mass
9	UN 3480 'lithium-ion batteries'	40 kg max.

Table 1: Battery module data relevant for transport

### 3.2.3 Checking for transport damage

#### ⚠ CAUTION

##### Insulation fault when storage system is damaged

Danger of electric shock when touching damaged insulation elements!

- Inspect the storage system for transport damage.
- Do not use a damaged storage system under any circumstance.

#### ⚠ WARNING

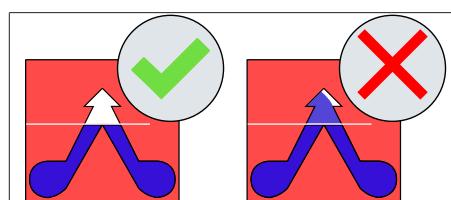
##### Fault due to use of damaged battery modules

Fire outbreak at battery modules or emission of toxic substances!

- Check each battery module for transport damage.
- If damage (deformation, defects, emission of substances and the like) is discovered:
- Never use damaged battery modules.

- Check each delivery upon arrival in the presence of the shipping agent for completeness and damage.

#### Transport indicator on the packaging



→ Check the transport indicator in the presence of the shipping agent.

The goods have not been transported properly if blue powder has reached the arrow of the transport indicator.

Illustration 1: Transport indicator on the packaging

#### Reporting transport damage

Report transport damage immediately to the shipping company and to sonnen GmbH.

- Refuse to accept the delivery if the discovered defects are serious.
- Document the defect in a brief report and make the notation 'Conditional acceptance' on the delivery note/shipping slip.
- Have the shipping agent review the report and confirm by countersigning.

- Make note of the name of the shipping agent and the registration number of the delivery vehicle.
- Create a detailed defect report if necessary. Send this within the reporting time frame (seven days for freight forwarders; 24 hours for parcel couriers) to the shipping company and sonnen GmbH.

 **ⓘ INFO**

Damage claims cannot be settled if the above mentioned documentation is not submitted within the stated reporting time frames.

### 3.2.4 Transport to the installation location

**⚠ WARNING****Risk of injury due to heavy weight of components**

Crushing or straining due to incorrect lifting or dropping of components of the storage system!

- Wear safety shoes when transporting and setting up the system.
- Use a manual or electric sack truck to move components.
- Ensure components are stable.

### 3.2.5 Acclimating the power module before installation

**NOTICE****Forming of condensation**

Damage to the storage system!

- Check the inside of the storage system for condensation before installation.
- Only install the storage system if there is no condensation on the surfaces.

If the temperature of the packed power unit or battery modules upon delivery is significantly lower than the ambient temperature at the place of installation, condensation may form on the surfaces of the electronic components.

→ Proceed as follows if the **power unit has been transported at temperatures below 0 °C**:

1. Unpack the power unit at a location with suitable ambient conditions (see Technical data [P. 101]).
2. Let the power unit sit until it can be ensured that there is no more condensation on the surfaces. Depending on ambient conditions, this may take up to 24 hours.
3. Only then can the power unit be installed and commissioned.

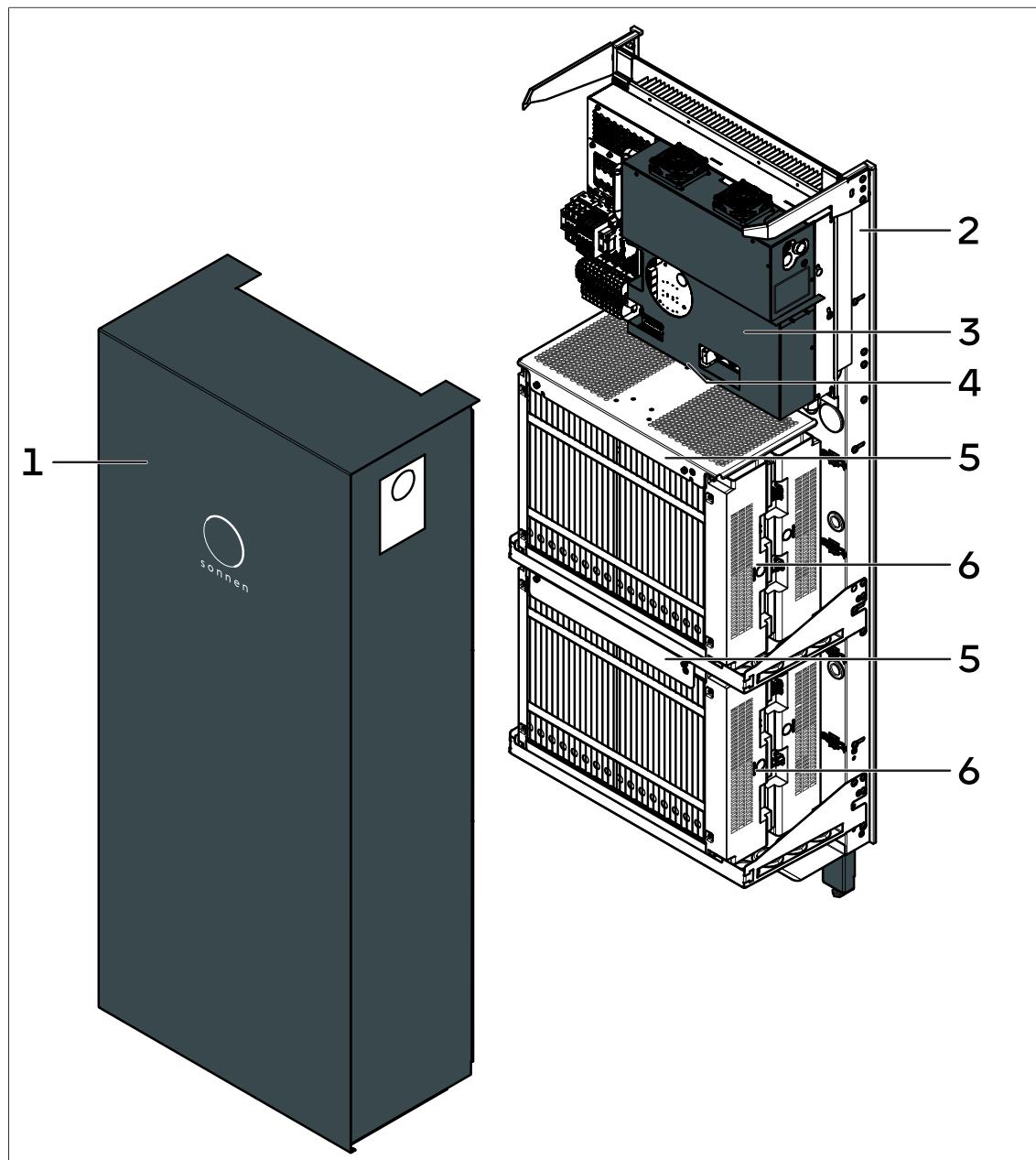
→ Proceed as follows if the **battery modules have been transported at temperatures below 5 °C**:

1. Unpack the battery modules at a location with suitable ambient conditions (see Technical data [P. 101]).
2. Let the battery modules sit until it can be ensured that there is no more condensation on the surfaces and the battery modules have completely warmed to at least 5 °C. Depending on ambient conditions, this may take up to 24 hours.
3. Only then can the battery modules be installed and commissioned.

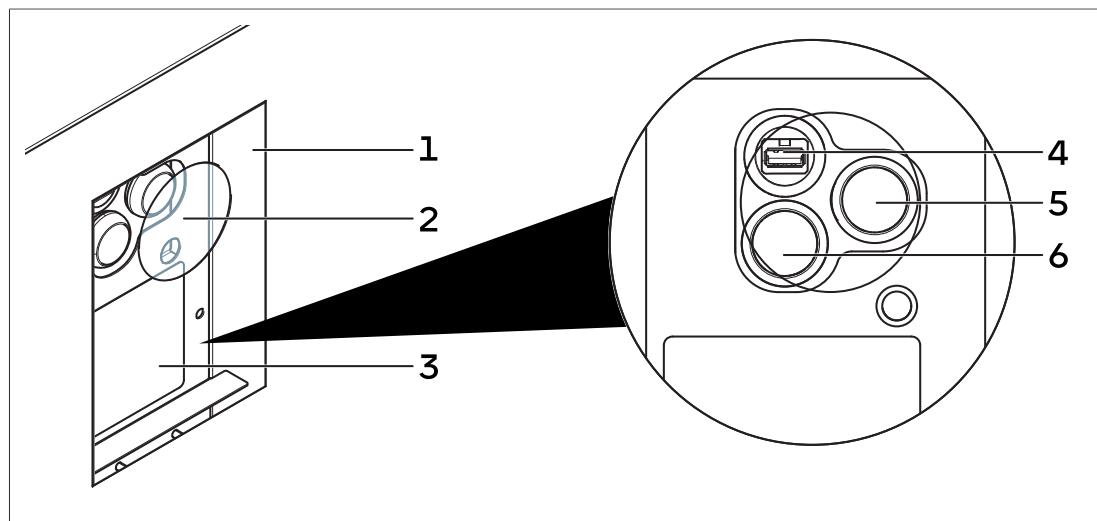
## 4 Product description

### 4.1 System components

#### Overview of storage system



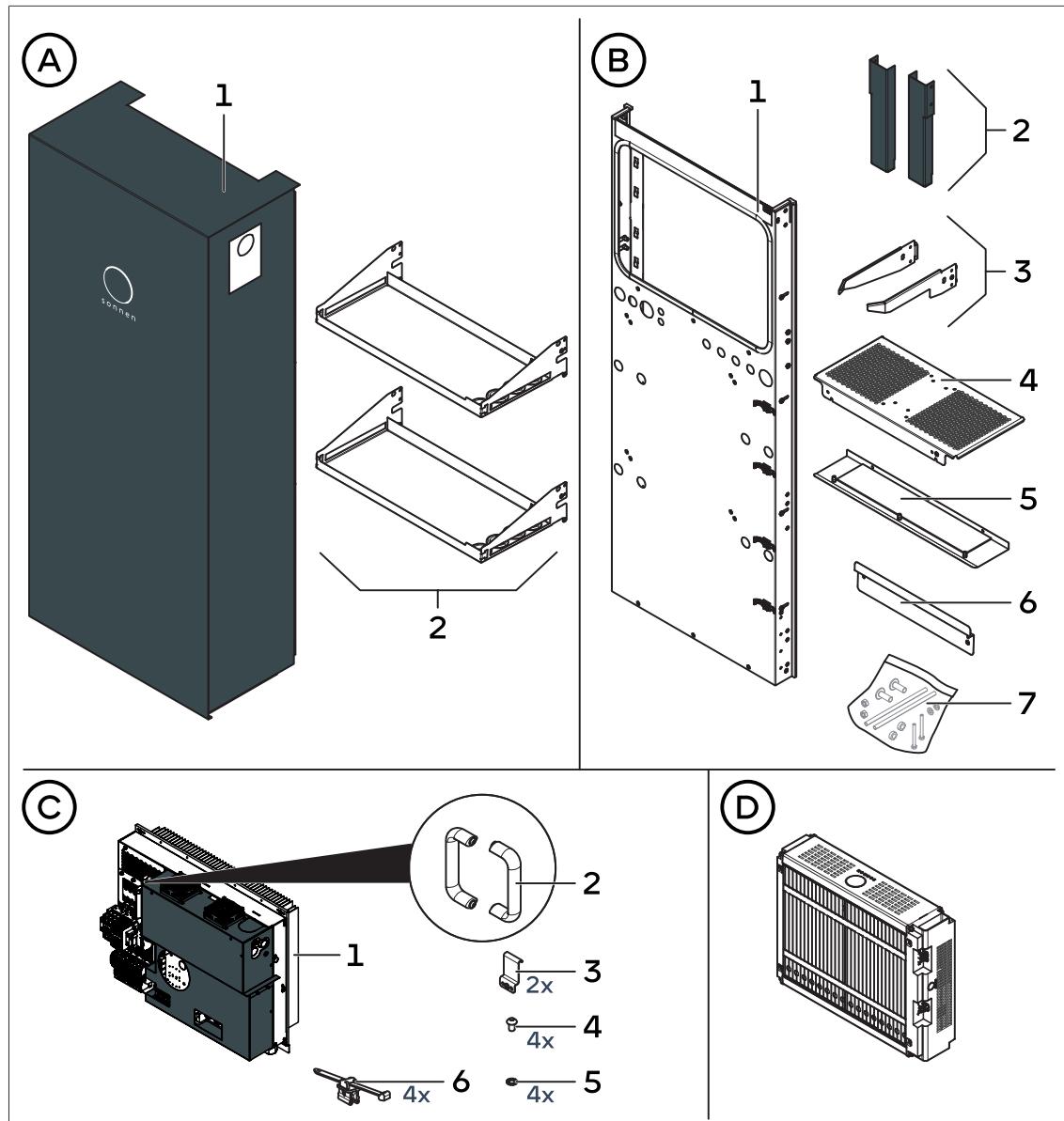
No.	Designation	Function
1	Cover	Cover for the storage system.
2	Mounting frame	Mounting frame with integrated bracket for securing it to the wall and for compensating for uneven surfaces.
3	Power module	Power module with integrated emergency power function and switch panel.
4	Cable entry point	Sealed entry point for lines to be routed into the storage system from the back.
5	Battery holder	For securing the battery modules.
6	Battery modules	Storage of electrical power.

**Overview of switch panel**

No.	Designation	Function
1	Inspection window	Cover and protection for control elements on the switch panel.
2	Switch cover	Silicone cap that can be removed for operating the storage system.
2	Type plate	Technical data and other information for identifying the storage system.
4	USB socket	Socket for connecting a USB device.
5	ON/OFF switch	Switch for switching the storage system on and off.
6	Illuminated switch	Button for restarting emergency power operation after an overload (if emergency power function is installed).

## 4.2 Scope of delivery

→ Check the following scope of delivery to ensure it is complete.



\* The illustrated battery modules are examples only.

### A Housing set

1	Cover	2	Battery shelves
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### B Mounting frame

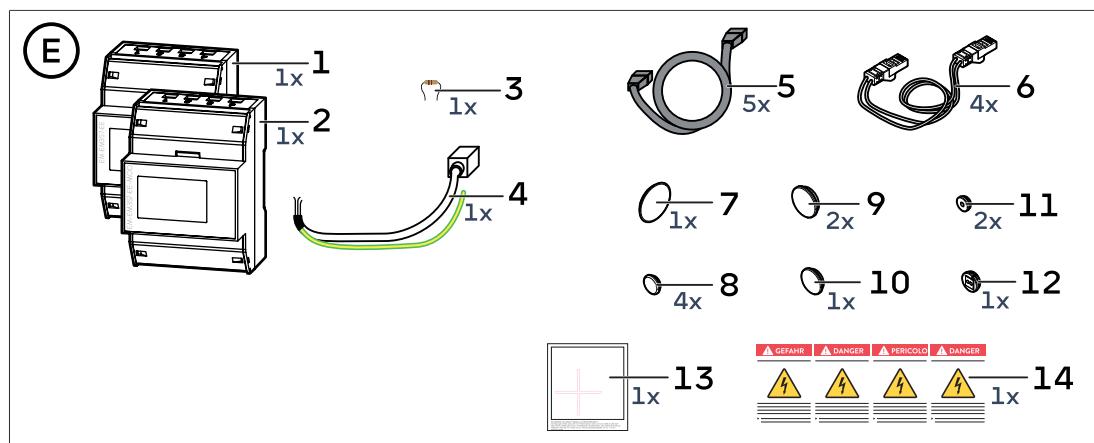
1	Mounting frame	2	Feet
3	Supports	4	Spacer plate
5	Floor plate	6	Fixing bracket

7 Installation equipment pack (see Content of the installation equipment pack [P. 19])

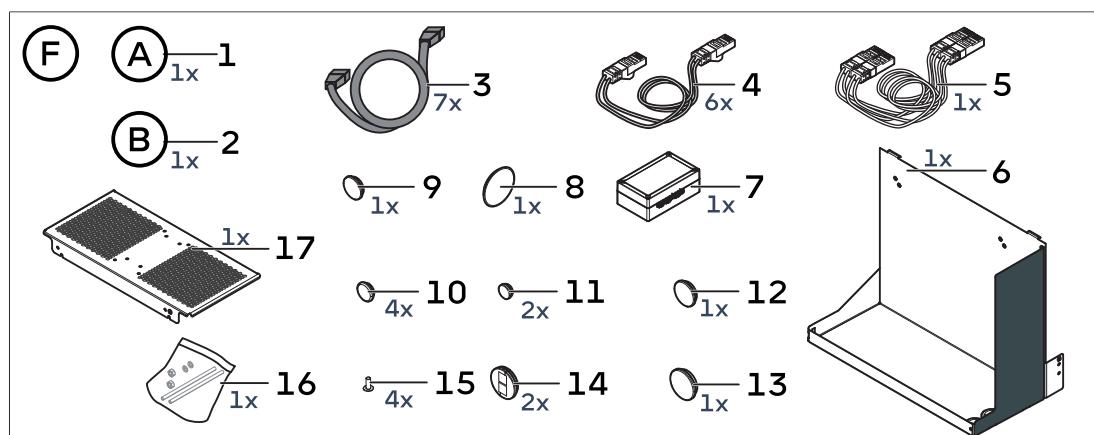
### C Power module

1	Power module	2	Mounting handles for Power module
3	Hook	4	Screw M6
5	Washer M6	6	Fixing tie

### D Battery module (sonnenModule 4)

**E Accessory kit**

1	EM357-EE power meter	2	EM357-EE-MOD power meter
3	Terminating resistor (part of EM357-EE-MOD)	4	Modbus line with RJ45 coupling
5	BMS communication line (grey)	6	Battery line (black)
7	Switch cover	8	Dummy plugs ( $\varnothing$ 27.8 mm)
9	Dummy plugs ( $\varnothing$ 50 mm)	10	Dummy plug ( $\varnothing$ 40 mm)
11	Cable entry plates ( $\varnothing$ 20.5 mm)	12	Cable entry plate ( $\varnothing$ 32 mm)
13	“+” label	14	Safety label (for emergency power function)

**F Extension set (optional)**

1	Housing set	2	Mounting frame
3	BMS communication line (grey)	4	Battery line (black)
5	Double battery line	6	Battery shelf
7	Battery coupling	8	Switch cover
9	Dummy plug ( $\varnothing$ 32 mm)	10	Dummy plugs ( $\varnothing$ 27.8 mm)
11	Dummy plugs ( $\varnothing$ 20,5 mm)	12	Dummy plug ( $\varnothing$ 40 mm)
13	Dummy plug ( $\varnothing$ 50 mm)	14	Cable entry plates ( $\varnothing$ 50 mm)
15	Screws, thread-forming, 50x16	16	Battery screws M6x286 and washers M6
17	Spacer plate		

#### 4.2.1 Content of the installation equipment pack

The installation equipment pack is part of the **B Mounting frame** scope of delivery and contains the following:

29 x	Hexagon socket screw M6x16 ISO 7380	4 x	Battery screws M6x286
18 x	Contact disc M6	4 x	Washer (plastic) M6 DIN 125
8 x	Dummy plug Ø 32 mm	2 x	Levelling element M8x50
6 x	Hexagon nut M6 DIN 934		

#### 4.3 Type plate

The type plate for the storage system is located on the Power module and can be viewed from the outside through the inspection window. The type plate can be used to uniquely identify the Power module and thus the storage system. You need the information on the type plate for safe use and to obtain assistance from sonnen service if you have any questions. The information on the type plate is required for safe use and for service matters.

The following information is specified on the type plate:

- Item designation
- Item number
- Technical data of the storage system
- Initial password

The battery capacity and the nominal power of the storage system differ depending on the number of battery modules installed. For this reason the installed battery capacity must be ticked on the type plate by the electrician installing the system (see Filling in the type plate [P. 89]).

#### 4.4 Optional accessories

The following optional accessories can be added to the storage system in order to extend its functionality:

Designation	Description	Item number
<b>Accessories for extending the sonnenBatterie 10 performance+</b>		
Extension set	Second mounting frame with cover. For installing up to six additional battery modules (see Installing the extension cabinet [P. 51]).	4000110 + 3000159
Power meter WM271 and clamp-on current transformers	For integration of further measurement points in the power measurement (e.g. additional electrical generator for AC microgrid).	30459 + 21028
Clamp-on current transformer up to 400 A	For measuring and recording amperages higher than 60 A. Available for maximum amperages up to 100 A, 200 A or 400 A.	11215, 11216, 11659
Power meter EM357-EE	For integration of further measurement points in the power measurement.	1002221
<b>Additional sonnen products for extending storage system functionality</b>		
sonnenCharger	Charging station for electric vehicles for intelligent control by the storage system.	Different versions available
sonnenKNX modules	Mounting rail modules for integration of the storage system in a KNX infrastructure.	4000050

#### 4.5 Additional parts and tools required

The following materials and tools must be provided. With these materials and tools, and the materials included in the scope of delivery, the storage system can be fully installed and connected.

Lines, circuit breakers

Designation	Use	Specification
Plastic-sheathed cable	AC connection	<ul style="list-style-type: none"> <li>• Line cross-section 4 – 10 mm<sup>2</sup></li> <li>• Selection of the type depending on the conditions on site.</li> <li>• Length adapted to installation situation.</li> </ul>
RJ45 line	Data transfer between router and storage system	<ul style="list-style-type: none"> <li>• RJ45 connector, category Cat 6, shielded.</li> <li>• Cable diameter: 6 mm</li> <li>• Length adapted to installation situation.</li> </ul>
RJ45 line	Data transfer between power meter and storage system	<ul style="list-style-type: none"> <li>• RJ45 connector, category Cat 6, shielded.</li> <li>• Cable diameter: 6 mm</li> <li>• Length adapted to installation situation.</li> </ul>
Signal lines	Digital inputs/outputs	<ul style="list-style-type: none"> <li>• Type: LiYY</li> <li>• Line cross-section of single conductors: 0.25-0.75 mm<sup>2</sup></li> <li>• Number of single conductors adapted to installation situation.</li> </ul> <p><i>Other required components (terminals, contactors, relays, etc.) must be acquired as needed for the individual installation situation (see Digital inputs and outputs [P. 58]).</i></p>
Residual current device (RCD)	Personal protection	<ul style="list-style-type: none"> <li>• Required in networks with TT earthing.</li> <li>• For specification see section Placing components in the distributor [P. 33].</li> </ul>
Miniature circuit breaker (MCB)	Fault protection for storage system	<ul style="list-style-type: none"> <li>• Tripping characteristic: B</li> <li>• Rated current: 20 A</li> </ul>

Material

Quantity	Designation	Use
8 /16*	Screws	<ul style="list-style-type: none"> <li>• For securing the mounting frame to the wall. For specification see section mounting materials [P. 24].</li> </ul>
8 /16*	Washers	<ul style="list-style-type: none"> <li>• For establishing contact between the screws and mounting frame.</li> </ul>
8 /16*	Wall plugs	<ul style="list-style-type: none"> <li>• For anchoring the screws to the wall. Type and length adapted to suit the screws used.</li> </ul>
1	Laptop with LAN connection	<ul style="list-style-type: none"> <li>• For establishing a connection to the storage system.</li> <li>• For running the commissioning assistant.</li> </ul>
1	Permanent marker	<ul style="list-style-type: none"> <li>• For filling out the type plate.</li> </ul>

\*When mounting with extension cabinet.

#### INFO

The list of tools refers to the materials contained in the scope of delivery for the storage system. Other individual tools are required based on the type of building installation and the additional parts selected.

Tool

Designation	Use
Drill	<ul style="list-style-type: none"> <li>• For drilling holes for securing the mounting frame.</li> </ul>

Designation	Use
Utility knife	<ul style="list-style-type: none"> <li>• For opening packaging.</li> </ul>
Rotary field measuring device	<ul style="list-style-type: none"> <li>• Set clockwise phase sequence.</li> </ul>
Hexagonal torque screwdriver   AF 3, AF 4 (adjustable to 8 Nm)	<ul style="list-style-type: none"> <li>• For securing feet to the mounting frame.</li> <li>• For completing the mounting frame.</li> <li>• For securing the power module to the mounting frame.</li> <li>• For securing the cover.</li> <li>• For securing the battery modules.</li> </ul>
Torque spanner   AF 10 (adjustable to 4 Nm)	
Allen key   AF 4	<ul style="list-style-type: none"> <li>• For straightening and levelling the mounting frame.</li> </ul>
Torx screwdriver   TX 25	<ul style="list-style-type: none"> <li>• <b>If necessary:</b> Mount the battery coupling in the extension cabinet.</li> </ul>
Cross-slot screwdriver   PZ 2	<ul style="list-style-type: none"> <li>• For opening and closing screw-type terminals on circuit breakers.</li> </ul>
Multimeter	<ul style="list-style-type: none"> <li>• For measuring the battery module voltages.</li> </ul>
Flat-head screwdriver   max. 5.5 mm	<ul style="list-style-type: none"> <li>• <b>If necessary:</b> for removing the cover of the power meter.</li> </ul>
Sack truck	<ul style="list-style-type: none"> <li>• For transporting components to the installation location.</li> </ul>
Wire cutters	<ul style="list-style-type: none"> <li>• For cutting electrical lines or wires.</li> </ul>
Spirit level	<ul style="list-style-type: none"> <li>• For straightening and levelling the mounting frame.</li> </ul>

## 5 Installing the storage system

- The storage system is installed with the accompanying feet so that while it is secured to the wall, part of the load is still supported by the feet.

Level	Total height of storage system
Lowest	172 cm
Middle	178 cm
Highest	184 cm

Table 2: Height of the storage system depending on the mounting of the feet

### 5.1 Selecting the installation location

#### NOTICE

#### Failure to observe ambient conditions

Damage to the electronic components of the storage system!

- Observe the required ambient conditions when selecting the installation location (see Technical data [P. 102]).

#### NOTICE

#### Insufficient load-bearing capacity of wall for mounting

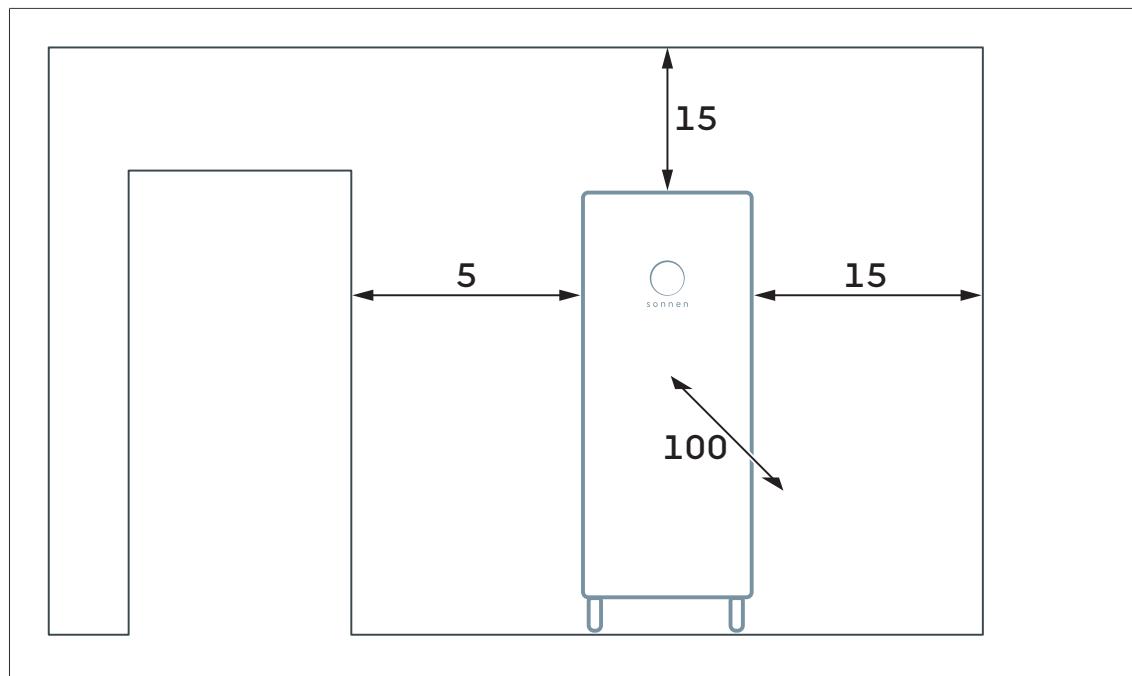
Damage to storage system and surrounding area!

The wall mounting selected for the installation of a storage system must be able to support a total weight of 990 kg.

- Ensure that the mounting material and the wall have the required load-bearing capacity.
- Use all of the mounting points on the mounting frame of the storage system.

#### 5.1.1 Observing minimum distances

- Observe the specified minimum distances to neighbouring objects, walls and ceilings.

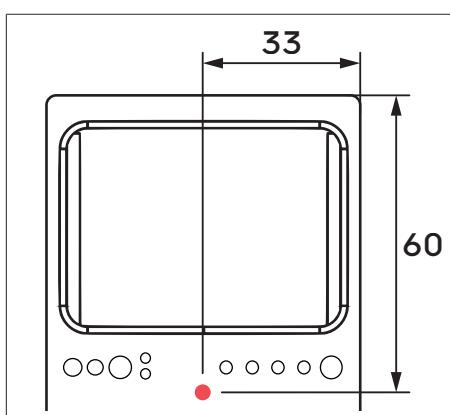


*Illustration 2:* Minimum distances around the storage system (figure not true to scale – all measurements in centimetres)

The minimum distances ensure that the following conditions are met:

- Sufficient heat dissipation.
- Easy opening of the storage system.
- Sufficient space for installation and maintenance work.

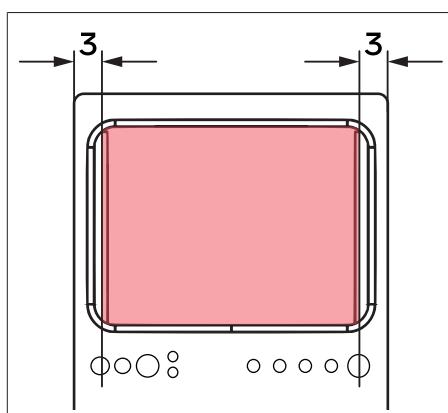
### 5.1.2 Planning line entry



*Illustration 3:* Position for optimal line entry (figure not true to scale – all measurements in centimetres)

sonnen recommends routing the lines for the storage systems out of one opening in the wall directly behind the storage system.

The position of the optimal origin of the lines is shown in the figure here.



*Illustration 4: Area to be cut out for line routing (figure not true to scale – all measurements in centimetres)*

Alternatively, the lines can be routed from below or above behind the mounting frame of the storage system.

→ Ensure that no lines are in the area marked in red in the figure. These may otherwise be damaged by the inverter heat sink.

#### Tips for line routing from above

- Route the lines through a cable duct up to approx. 10 cm above the storage system.
- Route the right and left lines past the heat sink of the inverter behind the mounting frame.
- Secure the lines to the back of the mounting frame using cable ties.

#### Tips for line routing from below

- Route the lines through a cable duct to the right of the storage system up to approx. 15 cm above the floor.
- Route the lines from there behind the feet into the mounting frame.
- If an extension cabinet is installed, the lines for this can be routed through the same cable duct and to the storage system.

### 5.2 Securing the mounting frame

#### **DANGER**

#### Insufficient earthing due to incorrect installation

Danger to life due to electrocution!

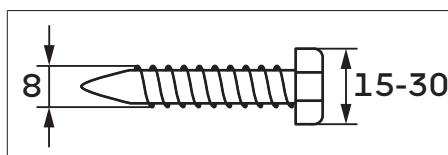
The connections on the storage system that are relevant for protective earthing are labelled with earthing symbols.

- Ensure that all components at the marked earthing points are installed in the correct order.
- Tighten the screw connections with the prescribed torque in each case.

#### 5.2.1 Selecting the mounting materials

- The lengths of the screws and wall plugs used must be suitable for the nature of the wall.

→ Use screws with the following properties:



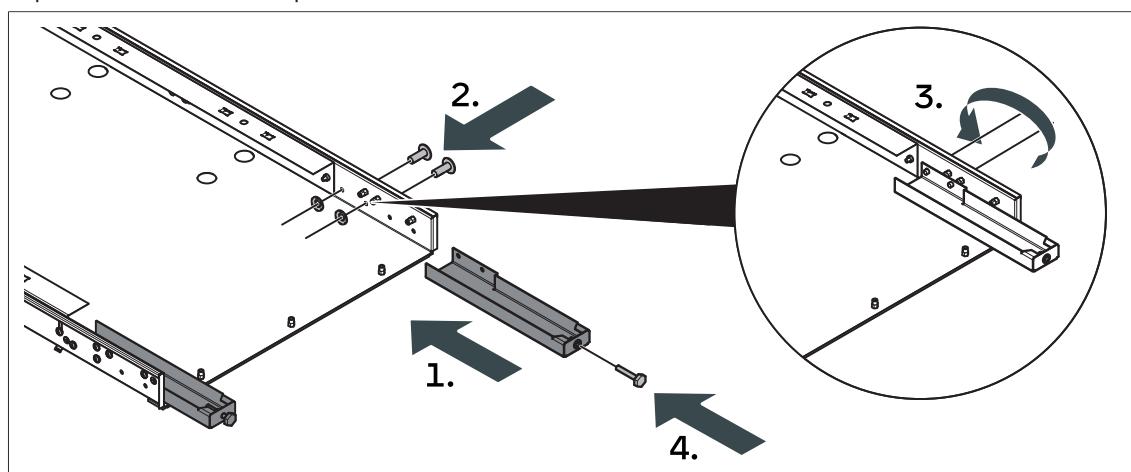
*Illustration 5:* Parameters for screws to be used (figure not true to scale – all measurements in millimetres)

- Minimum diameter of screw head: 15 mm
- Maximum diameter of screw head: 30 mm including any tools
- Screw diameter: 8 mm

→ Select washers and wall plugs that suit the screws.

### 5.2.2 Installing the feet

- The total height of storage system may vary depending on how the feet are set. The height can be changed in three stages by a maximum of 12 cm by choosing the highest or lowest setting (see table with total height options [P. 22]).
- The levelling elements from the installation equipment pack can be used to compensate for uneven points in the floor.



→ Use two of the four possible drilled holes on the mounting frame each to define the height of the storage system.

→ Install the two feet using the screws and contact discs from the installation equipment pack (1. - 2.).

→ Tighten the screws with a torque of **8 Nm** (3.).

→ Install the levelling elements on the feet (4.).

### 5.2.3 Drilling the holes

→ Lean the mounting frame with the installed feet on the wall at the installation location.

→ Mark out the eight holes for the wall bracket. The **outer openings** for wall mounting should be used in each case.

→ Drill the holes with a suitable diameter for the selected mounting material.

→ Insert suitable wall plugs in the holes.

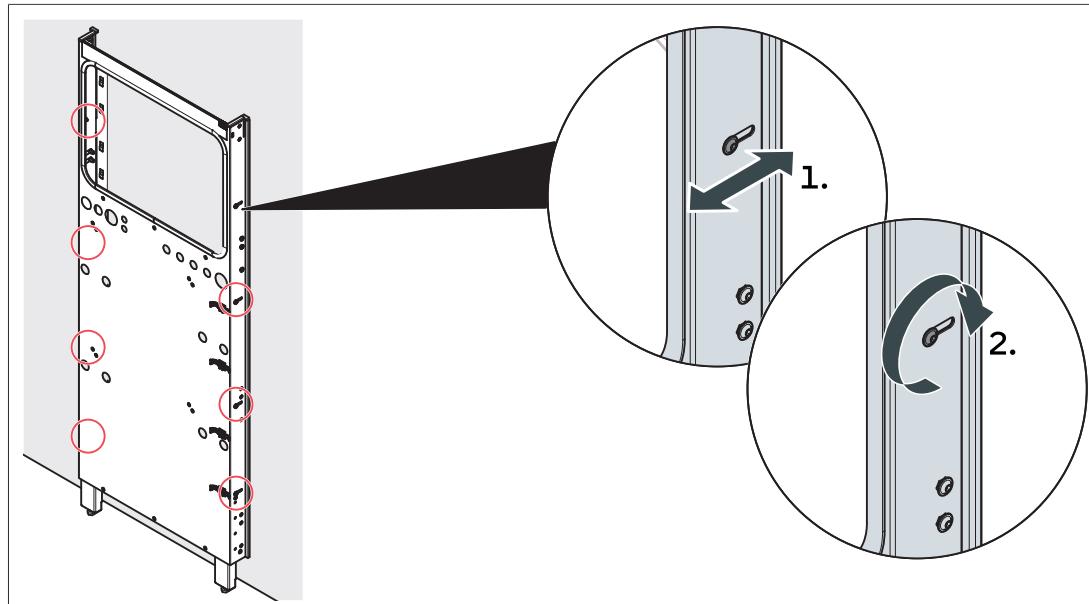
### 5.2.4 Securing the mounting frame to the wall

→ Use suitable screws and washers to secure the mounting frame to the wall (see Selecting the mounting materials [P. 24]).

→ Ensure that the mounting frame is flat against the wall.

### 5.2.5 Straightening and levelling the mounting frame

- Use the slotted holes and screws (four per side) on the outer edges of the mounting frame to straighten it.



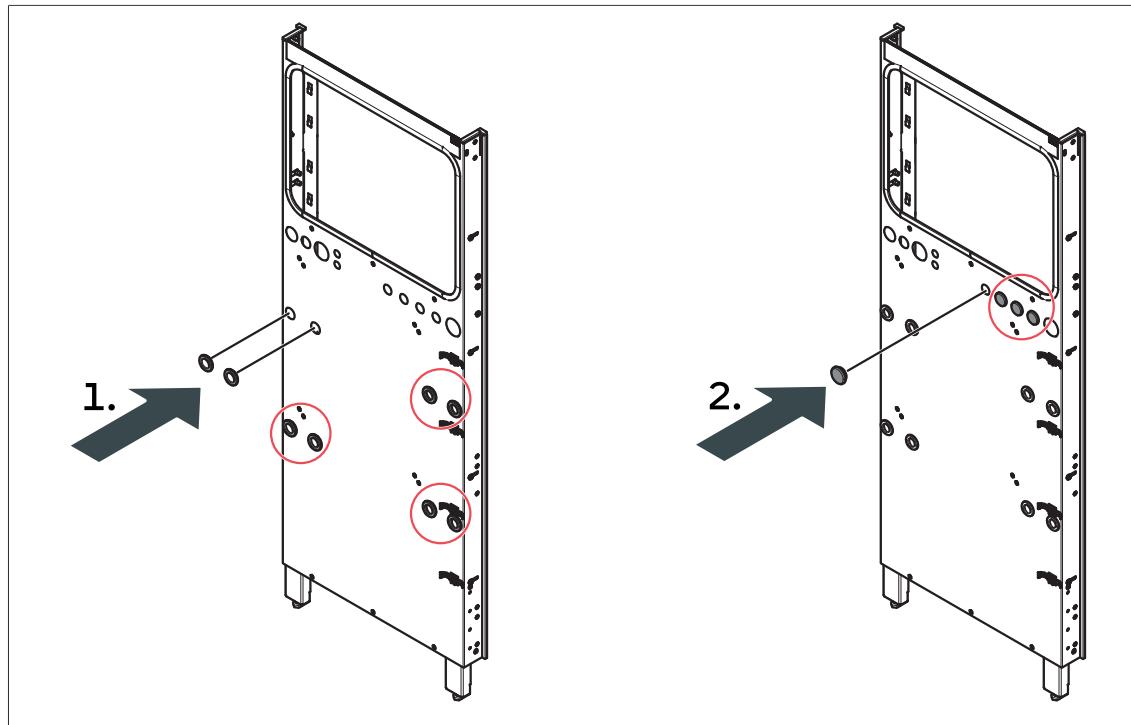
- Loosen the screws in the slotted holes. The screws are not fully tightened when delivered. The contact discs must not be removed.
- Push the mounting frame into the desired position. Use a spirit level to ensure that the mounting frame is straight and level (1.).
- Tighten the screws with a torque of **6 Nm** (2.).

### 5.2.6 Sealing the openings

#### ⓘ INFO

The specified degree of protection for the storage system and therefore touch protection and protection against the ingress of foreign bodies is only achieved when all openings on the storage system are sealed as described in the product documentation.

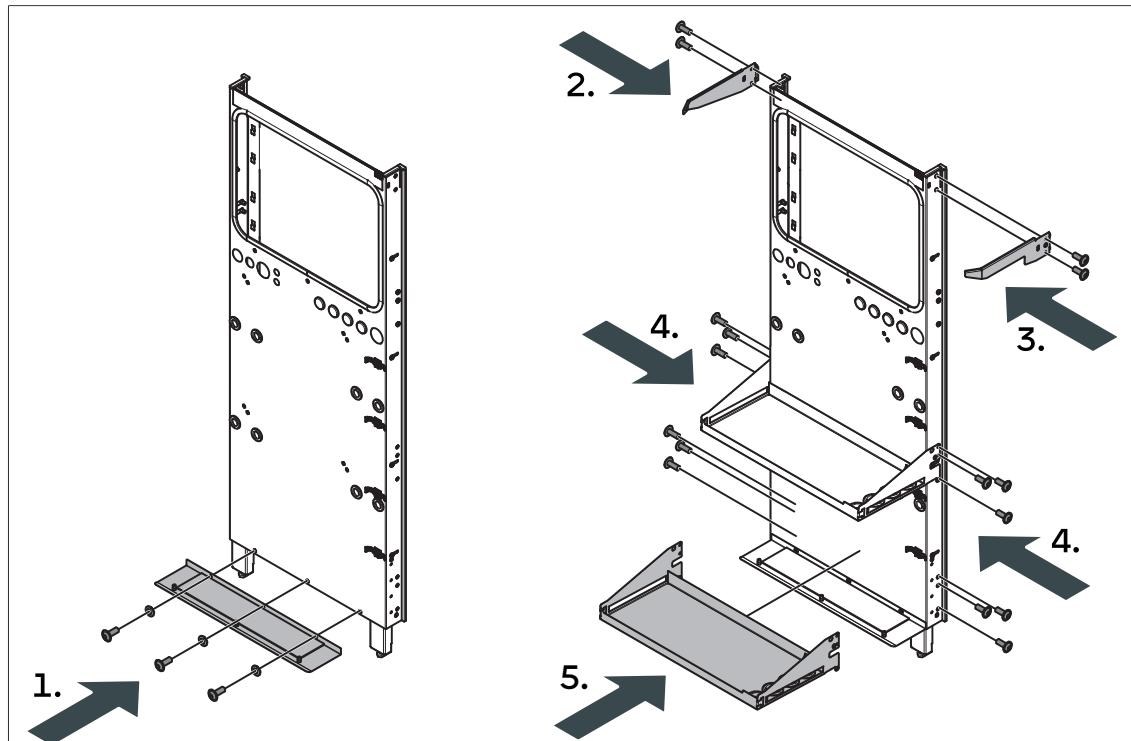
- The openings on the mounting frame must be sealed in order for the specified degree of protection for the storage system to be achieved.



- Seal the eight openings on the mounting frame shown in the figure using the dummy plugs (diameter: 32 mm) from the installation equipment pack (1.).
- Seal the four openings in the top right section of the mounting frame using suitable dummy plugs (diameter: 27.8 mm) from the accessory kit (2.).

### 5.2.7 Completing the mounting frame

- The individual components of the housing set must be added to the mounting frame.



- Mount the floor plate to the mounting frame with three screws and contact discs from the installation equipment pack (1.).

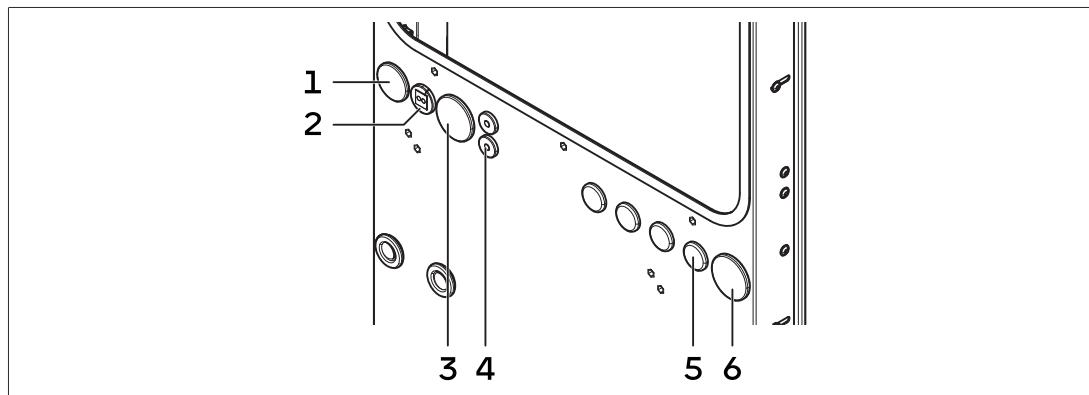
- Mount the two supports for the cover and the two battery shelves on the mounting frame as shown in the figure. Use the screws from the installation equipment pack for this purpose (2. - 5.).
- Tighten the screws with a torque of **6 Nm**.

### 5.3 Routing lines into the system

#### ⓘ INFO

The specified degree of protection for the storage system and therefore touch protection and protection against the ingress of foreign bodies is only achieved when all openings on the storage system are sealed as described in the product documentation.

- The openings on the mounting frame are sealed with cable entry plates and dummy plugs.
- All lines to be routed into the storage system must be directed through the designated cable entry plate.



No.	Type	Use
1	Dummy plug ( $\varnothing$ 40)	Reserve (Emergency power function)
2	Cable entry point ( $\varnothing$ 32) with grommet for two lines	Modbus line, Ethernet line
3	Dummy plug ( $\varnothing$ 50)	Reserve (Emergency power function)
4	Cable entry point ( $\varnothing$ 20.5) for one line	Signal line for digital input/outputs
5	Cable entry point ( $\varnothing$ 20.5) for one line	Mains line (AC connection)
6	Dummy plug ( $\varnothing$ 50)	Reserve (extension cabinet)

#### ⓘ INFO

Correct assembly must be observed when inserting the grommets into the cable entry plates. The flat side of the grommet must always be facing the flat side in the cutout of the cable entry plate.

- The position and type of cable entry point designated in each case can be seen in the figure.
- Use the cable entry points and grommets, if any, from the accessory kit to direct the lines into the storage system.
- Seal the remaining openings using the dummy plugs provided for this purpose in the accessory kit.

## 5.4 Installing the power module

### NOTICE

#### Danger due to touching live components on the power module

Damage to components of the power module due to electrostatic discharge (ESD)!

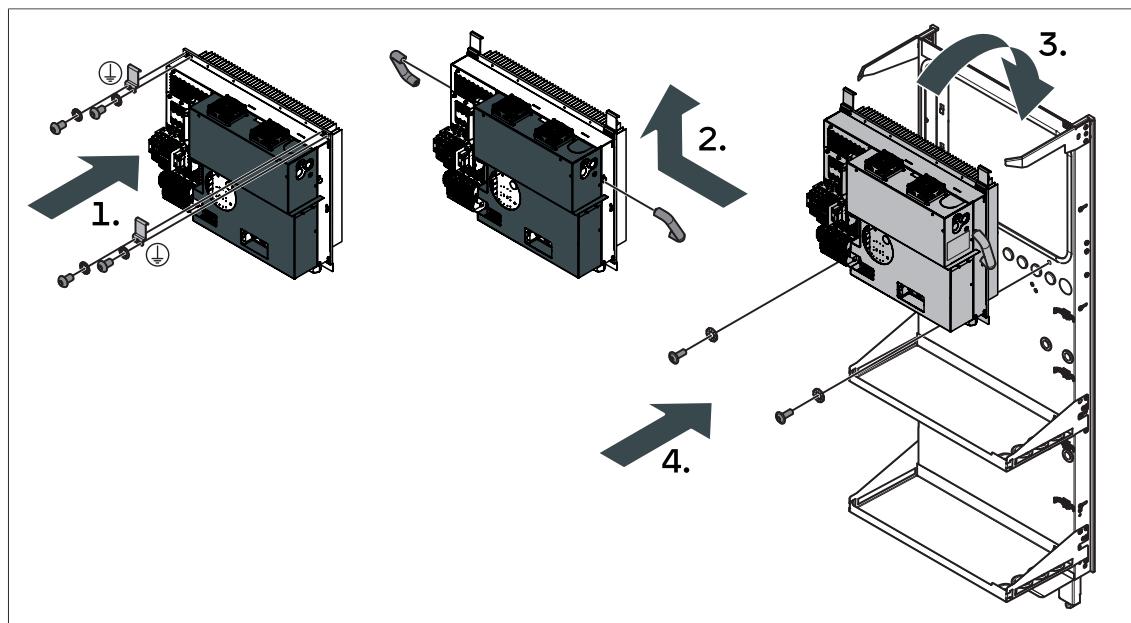
- Do not remove the touch guard on the power module and do not open the power module.
- Do not touch any components under the touch guard on the power module.
- Do not touch any components of the inverter by opening the power module.

### NOTICE

#### Danger due to lifting the power module by the touch guard

Damage to the power module!

- Never lift the power module by the touch guard.



- Secure the two hooks to the top of the power module using the screws and contact discs provided in the installation equipment pack (1.).
- Tighten the screws with a torque of **6 Nm**.
- Lift the power module by bringing the mounting handles on the right and left side of the module into the openings and moving them up (2.).
- Hang the power module in the middle on the top edge of the mounting frame (3.).
- Secure the power module to the two outer holes using the screws and contact discs from the installation equipment pack (4.). Attachment to the centre hole is optional.
- Tighten the screws with a torque of **6 Nm**.
- Hang the two mounting handles on the touch guard. The mounting handles remain in the storage system.

## 6 Connecting the storage system

### DANGER

#### Electrical work on the storage system and electrical distributor

Danger to life due to electrocution!

- Switch off the storage system to electrically isolate it.
- Disconnect the relevant electrical circuits.
- Secure against anyone switching on the device again.
- Wait five minutes so the capacitors can discharge.
- Check that the device is disconnected from the power supply.
- Only authorized electricians are permitted to carry out electrical work.

### DANGER

#### Touch voltage in the event of a fault

Danger to life due to electrocution!

- Install a selective residual current device with a nominal differential current of 300 mA in TT networks. Nominal differential currents of 100 mA or 30 mA are also possible. The type of RCD must be selected depending upon the local conditions of the network.

### NOTICE

#### Danger due to touching live components on the power module

Damage to components of the power module due to electrostatic discharge (ESD)!

- Do not remove the touch guard on the power module and do not open the power module.
- Do not touch any components under the touch guard on the power module.
- Do not touch any components of the inverter by opening the power module.

## 6.1 Electrical connection overview

### ⓘ INFO

All of the circuit diagram overviews are for illustrative purposes only. Specific DNO requirements concerning the connection must be taken into account and observed. As a result, the connection to be actually implemented may differ from the following circuit diagram overviews.

- Choose the right installation version before you start the installation. The differences between the installation versions are as follows:
  - There are three different measurement concepts for recording the power. The following figure shows the **consumption measurement** (standard measurement concept).
  - The **PV inverter** can be single-phase or three-phase regardless of the building mains. The power measurement for production must be installed accordingly.
- If the storage system needs to be installed with emergency power function, use the instructions provided in the section Emergency power function (optional) [P. 69] to install the components.
- For installation with **AC microgrid**, see section Connecting an AC microgrid [P. 82].

## Electrical connection of the storage system in a three-phase building mains system

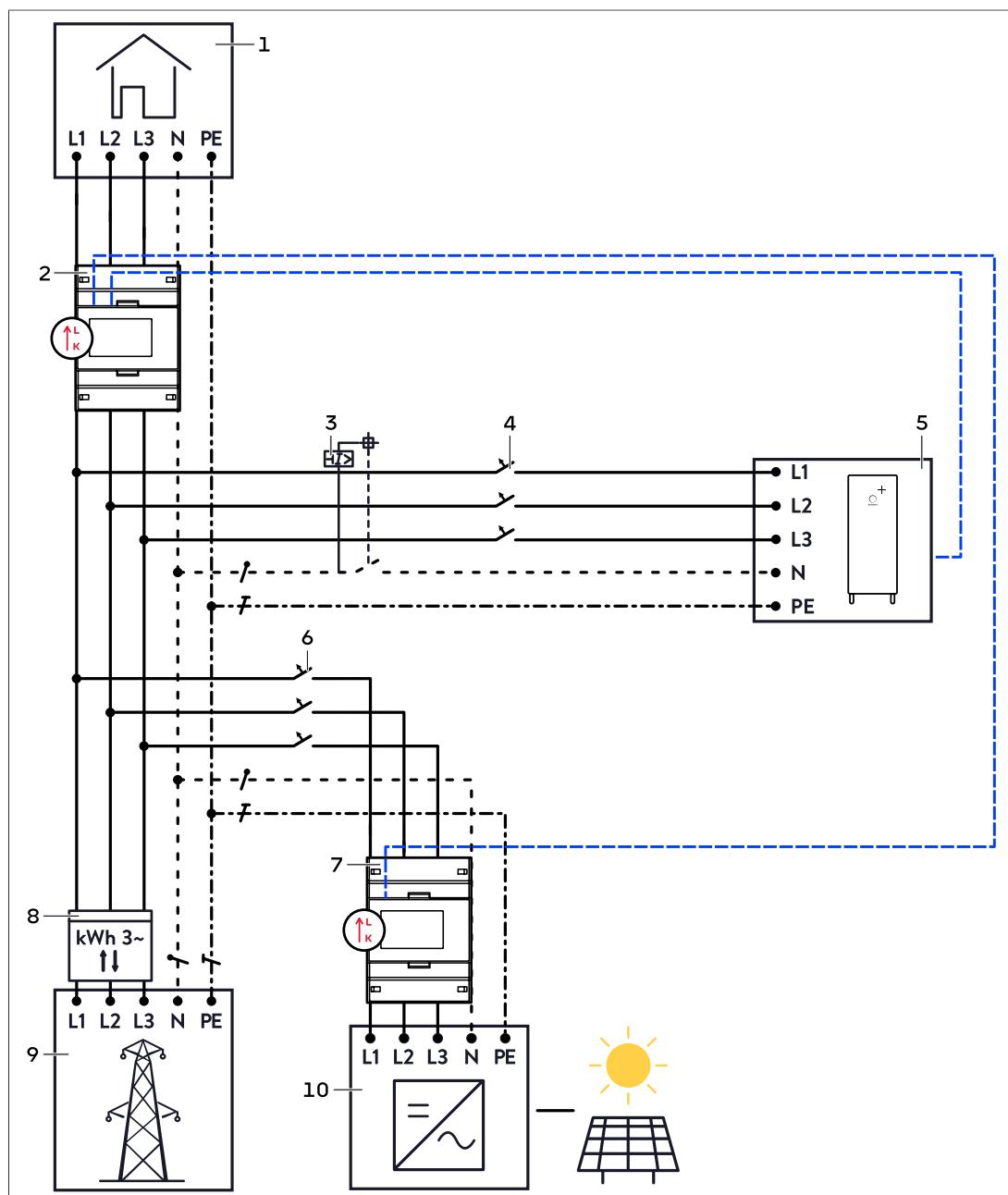


Illustration 6: Circuit diagram overview - sonnenBatterie 10 performance+

1 Consumers in building	6 MCB for PV inverter
2 Power meter EM357-EE	7 Power meter EM357-EE-MOD
3 RCD (in TT networks <sup>1</sup> )	8 Bidirectional counter
4 MCB B20	9 Public electrical mains
5 Storage system	10 PV inverter

<sup>1</sup> Nominal differential current of 300 mA, 100 mA or 30 mA. Type of RCD depends on local conditions. Observe country-specific requirements.

## 6.2 Placing components in the distributor

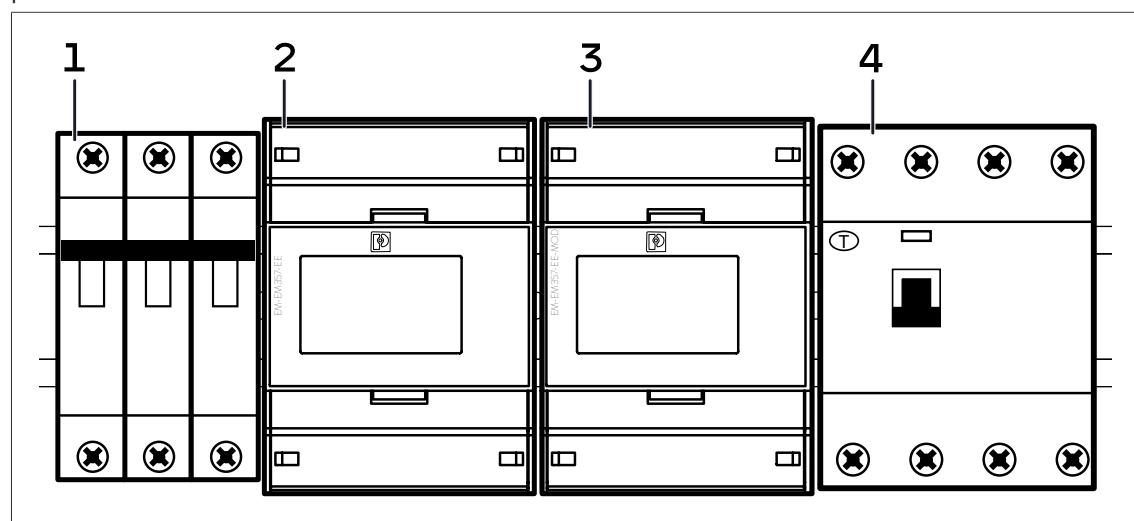
→ Mount the following components necessary for electrical connection of the storage system in the electrical distributor.

With power meter EM357 (scope of delivery)

**INFO**

The power meters must be protected by fault protection with max. 100 A on the AC side. If this is already done, for example, by the SMCB switch of the on-site connection, no additional MCB switch has to be installed.

Up to 27 cm (equals 15 MW) of free space on mounting rails is needed for the components.



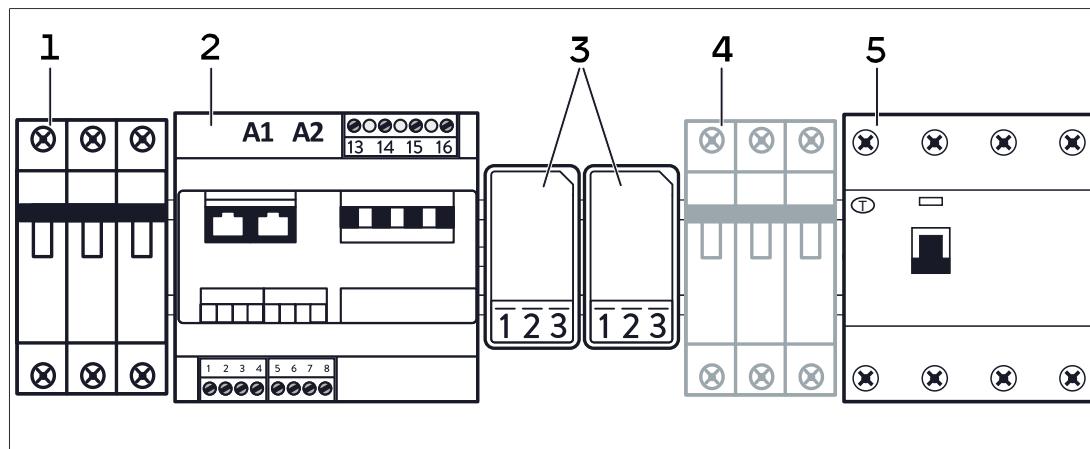
- 1 Miniature circuit breaker B20 (not included in scope of delivery)
- 2 EM357-EE power meter (Modbus address 1)
- 3 EM357-EE-MOD power meter (Modbus address 10)
- 4 Residual current device (not included in scope of delivery)

**Explanations for the components:**

- The miniature circuit breaker (1) protect the mains line of the storage system.
- The power meters (2,3) are used to measure consumption and production in the house.
- A residual current circuit breaker (4) must be installed in networks with TT earthing. An RCCB type A with a rated differential current of 300 mA is sufficient for this. RCCBs with a rated differential current of 100 mA or 30 mA can also be used. This has been tested under EN 62109-1, EN 62109-2 and EN IEC 62040; country-specific requirements must be observed in each case. Depending on the local conditions of the public electricity grid, a different type may be required.

### With power meter WM271

Up to 30 cm (equals 17 MW) of free space on mounting rails is needed for the components.



- 1 Miniature circuit breaker B20 (not included in scope of delivery)
- 2 WM271 power meter
- 3 Transformer interfaces
- 4 Miniature circuit breaker (B6) for power meter (not included in scope of delivery)
- 5 Residual current device (not included in scope of delivery)

#### Explanations for the components:

- The miniature circuit breaker (1) protect the mains line of the storage system.
- The power meter (2) and the transformer interfaces (3) are used to measure the consumption and production of power in the building.
- The power meter is protected using a type B6 miniature circuit breaker (4). An additional miniature circuit breaker can be avoided if there is already an appropriate circuit breaker.
- A residual current circuit breaker (5) must be installed in networks with TT earthing. An RCCB type A with a rated differential current of 300 mA is sufficient for this. RCCBs with a rated differential current of 100 mA or 30 mA can also be used. This has been tested under EN 62109-1, EN 62109-2 and EN IEC 62040; country-specific requirements must be observed in each case. Depending on the local conditions of the public electricity grid, a different type may be required.

### 6.3 Wiring the components and storage system

→ Wire the components previously placed in the electrical distributor. Follow the instructions in the **following sections** for this.

The circuit diagram overview shows the building installation after all components have been fully connected.

### 6.4 Installing the power meter

#### INFO

Further information on power measurement and the power meter can be found in the power meter instructions<sup>2</sup>. These instructions explain, among other things, the different measurement concepts and how to use multiple power meters.

<sup>2</sup> Document number: 300

### 6.4.1 Using an alternative power meter (EM357)

#### ⓘ INFO

The power meters must be protected by fault protection with max. 100 A on the AC side. If this is already done, for example, by the SMCB switch of the on-site connection, no additional MCB switch has to be installed.

- The EM357 power meter is a direct meter.
- An EM357 power meter represents one measurement point.
- No transformer interfaces or clamp-on current transformers are used.
- Positioning in the electrical distributor must take place where the cables to be measured are installed.
- Programming for single-phase or three-phase measurement is not required. The power meter automatically detects the connected phases.
- The direction of energy flow is indicated by arrows on the power meter. With the standard installation (Display readable), the measurement direction is from top to bottom.
  - The maximum measurable amperage is 100 A.

#### Connecting AC lines (three-phase mains)

#### ⓘ INFO

Cables with a conductor cross-section of 1.5 to 25 mm<sup>2</sup> can be connected to the power meter (torque for connection: 2.5 Nm).

- Open or remove the top flaps on the power meters. Removal simplifies the connection of the cables.
- Open the bottom flaps on the power meters.
- Remove the cover (communication shield) from the top of the power meters.
- Connect the AC lines (L1, L2, L3, N). Ensure that the direction of energy flow for each power meter is from top to bottom.

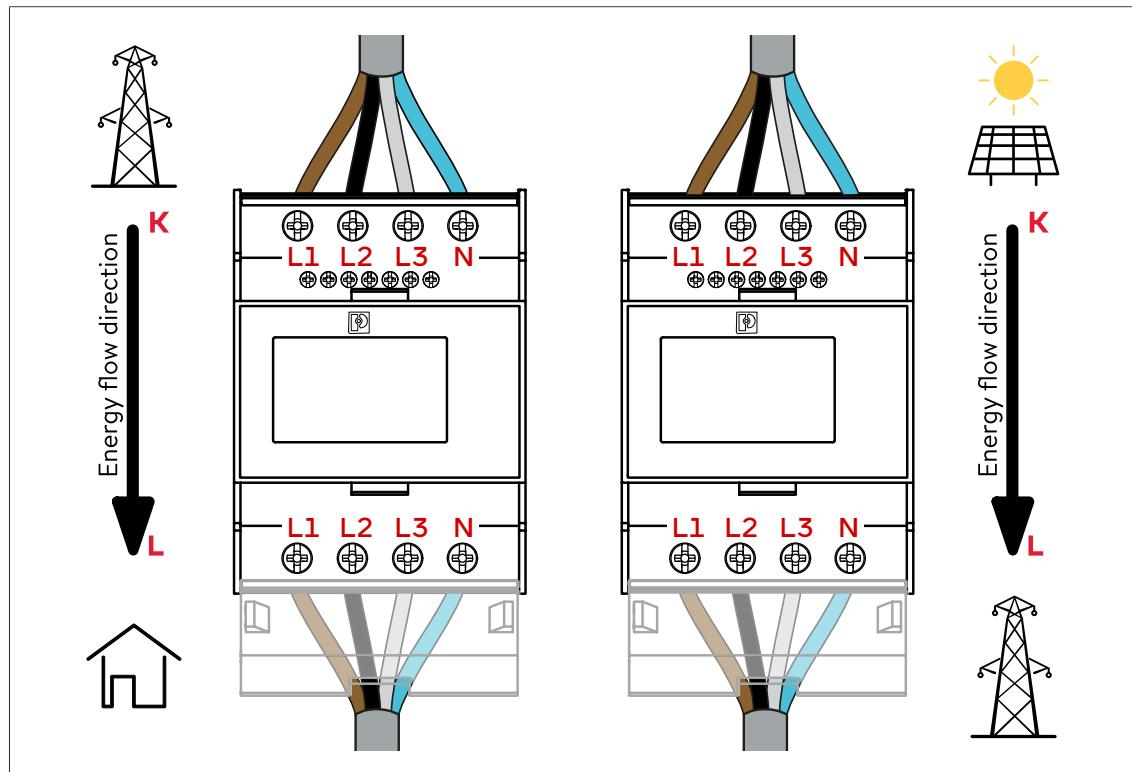


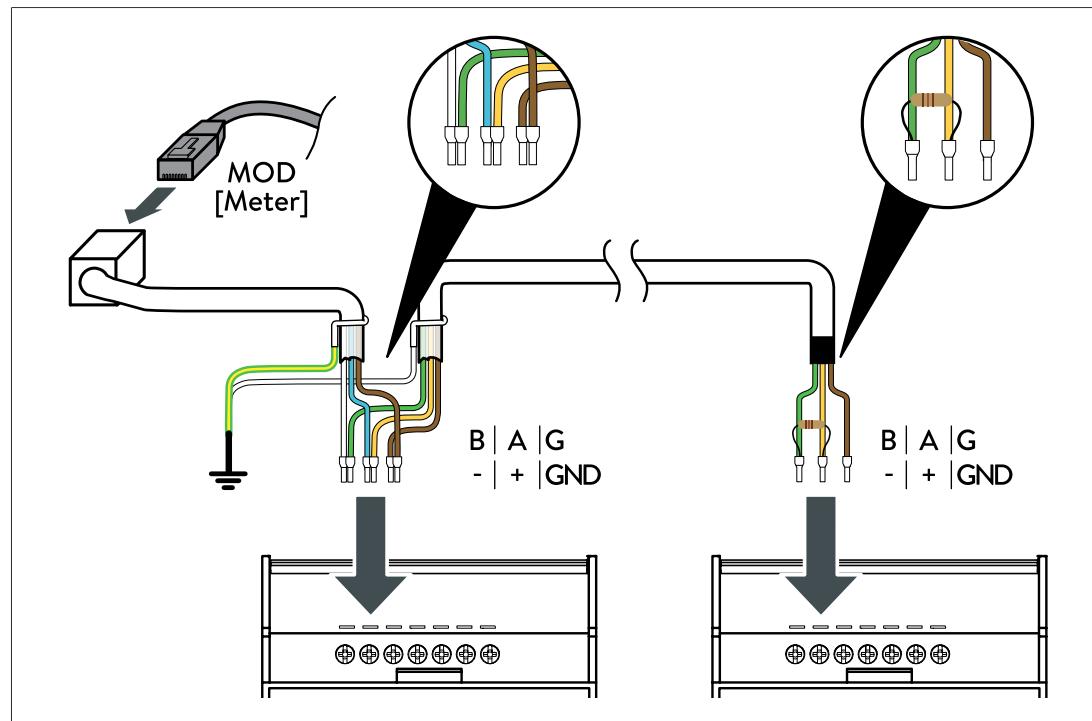
Illustration 7: Connection of EM357 power meter in three-phase mains

- Attach the previously removed cover (communication shield) to the power meters.

→ Close the bottom flaps on the power meters.

#### Connecting the communication lines

- Use cable UNITRONIC® BUS LD 2x2x0.22 (Manufacturer: Lapp) or a patch cable (Cat 6/screened) as the communication lines.
- Attach wire end ferrules and the terminating resistor (included in the scope of delivery) to one end of the communication line.
- Attach wire end ferrules to the other end of the communication line and prepare a shield tap for the earth connection.



→ Connect the communication line and the Modbus line (included in the scope of delivery) to the two power meters.

- Assignment of the premounted Modbus cable:
  - white-blue = -
  - blue = +
  - brown = GND

→ Earth the screen tap and the premounted earthing line of the Modbus line.

→ Close the top flaps (possibly previously removed) on the power meters.

#### Setting up the power meter

When commissioning the storage system using the commissioning assistant [P. 92], the following must be taken into account when **configuring the power measurement**.

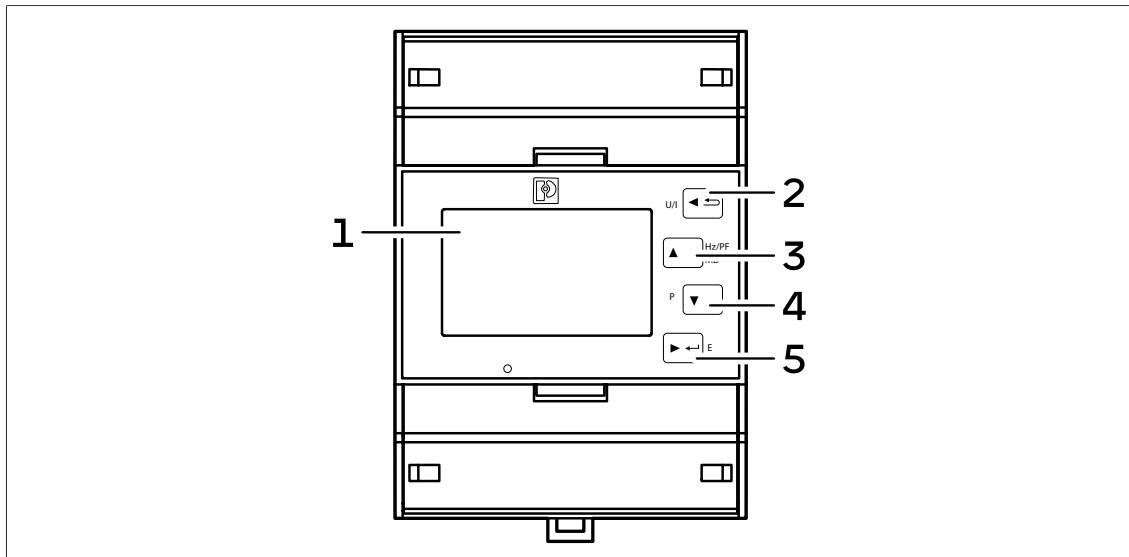
Meter	Direction	Modbus ID	Channel	Measurement value	Edit
EM357	P - Production	10	1	3260.98 W	<a href="#">Delete</a>
EM357	C - Consumption	1	1	494.75 W	<a href="#">Delete</a>
				-	<a href="#">Add</a>

- Type EM357 must be selected as the **meter**.
- The correct **measurement point type** (consumption or generation) must be assigned to both power meters based on the Modbus address.
- The EM357-EE power meter is preset to **Modbus address (Modbus ID) 1**.

- The EM357-EE-MOD power meter is preset to **Modbus address (Modbus ID) 10**.
- **Channel 1** must be selected for both power meters.

### Configuring the power meter (optional)

The keys and the display can be used to make settings on the power meter. By default, the power meter is in display mode and displays current energy values.



1	LCD screen	4	Down key
2	Left/ESC key	5	Right/enter key
3	Up key		

#### Switch to setting mode

To switch to setting mode:

→ Press enter key for at least three seconds.

**PASS** appears on the display.

→ Enter the password (the default is '1000').

→ Press enter key for at least three seconds.

If the password is correct, the setting mode is opened.

The display **PASS Err** appears if the password is incorrect.

#### Changing the Modbus address

To change the default Modbus address:

→ Press the down key until the display **SEt Addr** appears.

→ Press enter key for at least three seconds.

The value flashes when it is in edit mode.

→ Press the up or down key to change the value.

→ Press the enter key to save the set value.

The value is saved. The next setting value flashes automatically.

→ Press enter key for at least three seconds.

The power meter is still in setting mode.

#### Exiting setting mode

→ Press the ESC key to return to display mode.

If no operation is performed for more than 60 seconds, the power meter automatically returns to display mode.

#### 6.4.2 Connecting the power meter

→ Connect the AC connection and communication lines to the power meter. Note the following:

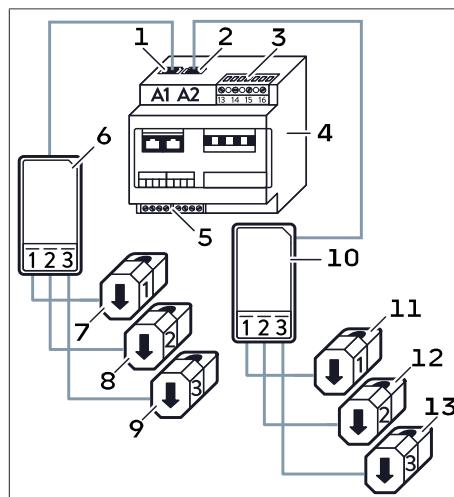


Illustration 8: Power meter WM271 components

1 A1 - input for production	8 CT for production - L2
2 A2 - input for consumption	9 CT for production - L3
3 Terminal strip for voltage measurement	10 Transformer interface for consumption
4 Power meter	11 CT for consumption - L1
5 Modbus terminal strip	12 CT for consumption - L2
6 Transformer interface for production	13 CT for consumption - L3
7 CT for production - L1	

#### AC connection (3-phase grids)

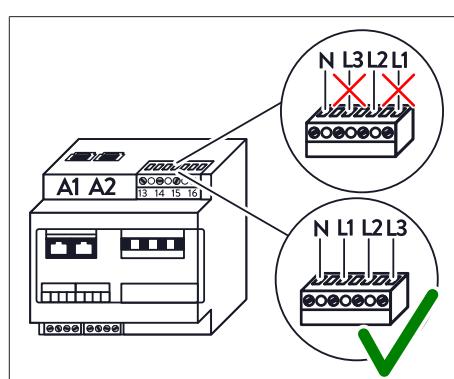


Illustration 9: Connection to the voltage terminal strip

- Never confuse inputs A1 (input for generation) and A2 (input for consumption)!
- The lines connected to the voltage measurement terminal strip must be protected by suitable miniature circuit breakers. Additional miniature circuit breakers do not have to be installed if the lines are already protected in accordance to the relevant, currently applicable regulations and standards.

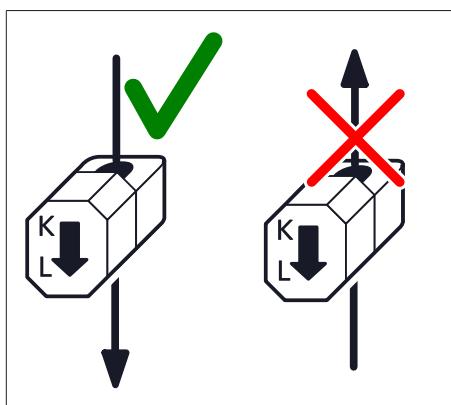


Illustration 10: left: correct energy flow direction / right: incorrect energy flow direction

- The clamp-on current transformers are clamped across the affected lines. The energy flow direction of the clamp-on current transformer must be observed.

The energy flow in the line must run from **K to L**.

- In the case of a one-phase PV inverter only the clamp-on current transformer for the phase in question is connected. The other two clamp-on current transformers must not be connected.

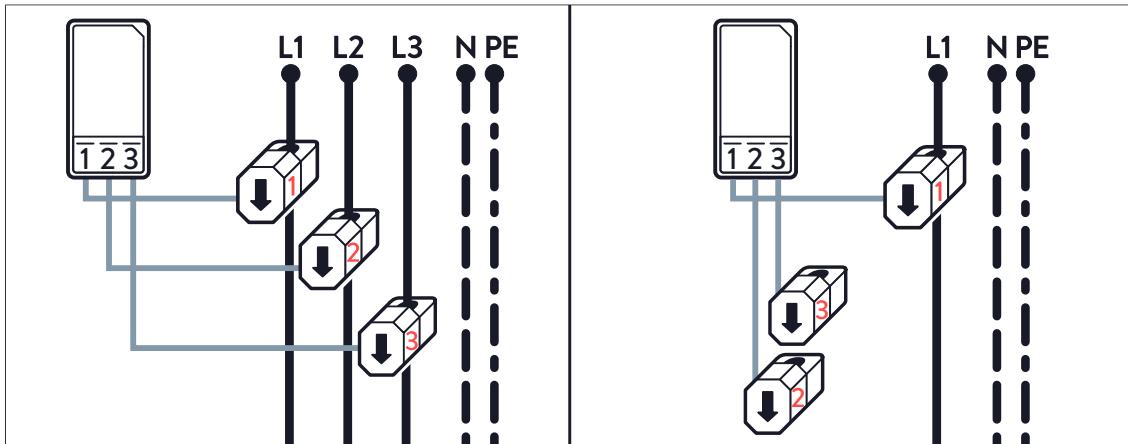


Illustration 11: Connecting the clamp-on current transformers for three-phase (left) and single-phase (right) installation

- Do not confuse the phases!** Power measurement only works if the current and voltage of the same phase are measured.

**Example:** The clamp-on current transformer L1 (marked with number 1) must be connected to phase L1. This phase L1 must also be connected to terminal L1 of the voltage measurement terminal strip. Only then the correct power for phase L1 can be determined.

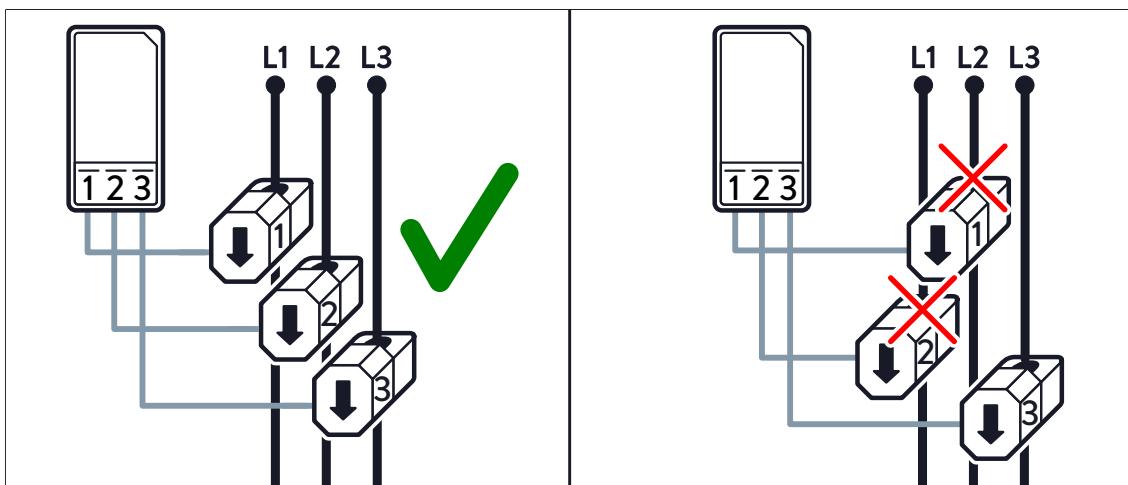
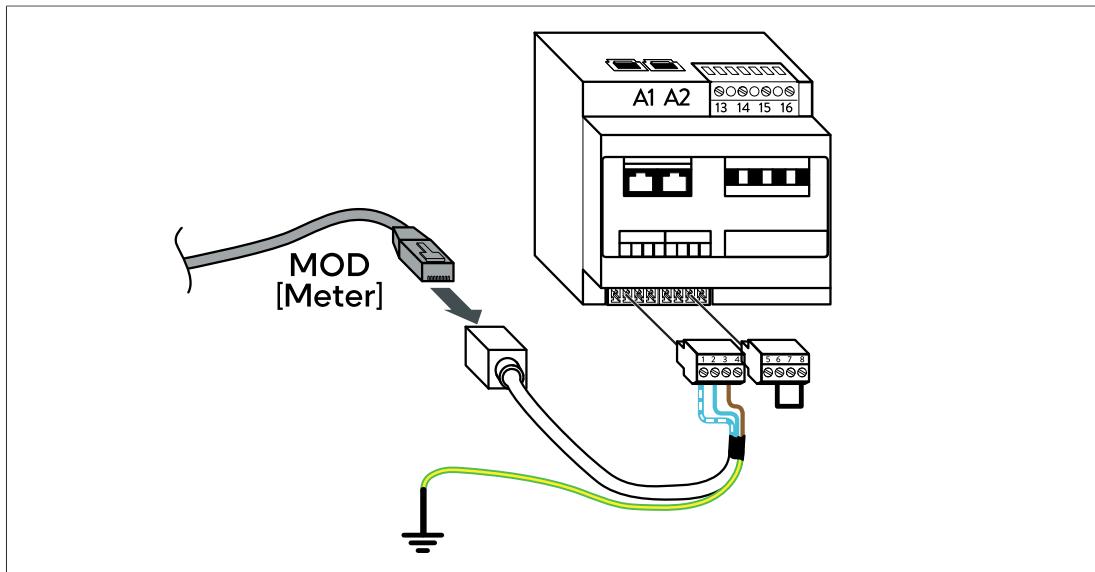


Illustration 12: Connecting the clamp-on current transformers: incorrect (right) and correct (left)

**Connecting the communication line**

→ Connect the power meter as shown in the illustration.

**Note:**

- Use cable UNITRONIC® BUS LD 2x2x0.22 (Manufacturer: Lapp) or a patch cable (Cat 6/screened) as the communication lines.
- Earth the screen tap and the premounted earthing line of the Modbus line.
- Ensure that a wire jumper is fitted between pins 6 and 8 on the Modbus terminal strip.

If this is not the case:

- Ensure that a wire jumper is fitted between pins 6 and 8 of the Modbus terminal strip.

### 6.4.3 Connecting the Modbus line

#### NOTICE

#### Communication lines too long

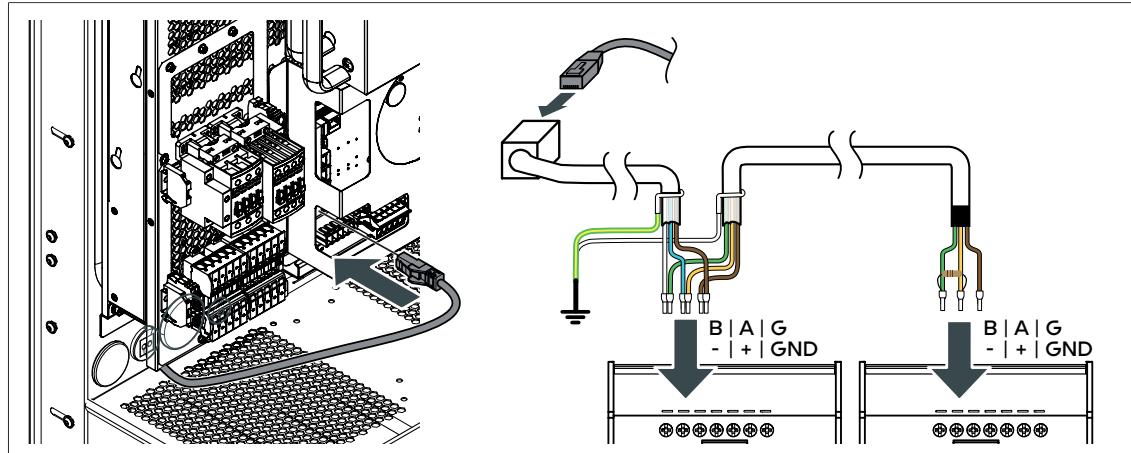
- The Ethernet line connected to the storage system must not exceed a maximum length of **100 m**.
- The Modbus line connected to the storage system must not exceed a maximum length of **150 m**.

- Measurement data is transmitted from the power meter to the storage system using the Modbus line.
- The Modbus line is connected to the power meter and the central unit of the storage system.

#### INFO

It is essential to ensure that a screened line is used and that the screen of the Modbus line is earthed in order to ensure optimal data transmission.

- Use cable UNITRONIC® BUS LD 2x2x0.22 (Manufacturer: Lapp) or a patch cable (Cat 6/screened) as the communication lines.
- Attach wire end ferrules and the terminating resistor (supplied) to one end of the communication line.
- Attach wire end ferrules to the other end of the communication cable and prepare a shield tap for the earth connection



- Connect the communication line and the modbus line (included in scope of delivery) to the two power meters.
- Assignment of the Modbus cable:
  - white-blue = --
  - blue = +-
  - brown = GND
- Earth the screen connector and the pre-assembled earthing line of the modbus line.
- Connect the line to the central unit of the storage system (**MOD [Meter]**).
- Use the fixing straps provided in the scope of delivery to secure the connected line to the power module. Fasten the fixing straps to a free edge of the power module to do this.
- Connect the other end of the cable to RJ-45 socket of the pre-assembled modbus line on the power meter.

## 6.5 Establishing an internet connection

### NOTICE

#### Communication lines too long

- The Ethernet line connected to the storage system must not exceed a maximum length of **100 m**.
- The Modbus line connected to the storage system must not exceed a maximum length of **150 m**.

Having a constant internet connection is one of the conditions of the warranty, as sonnen can use this to access the storage system and monitor it for correct function and import software updates.

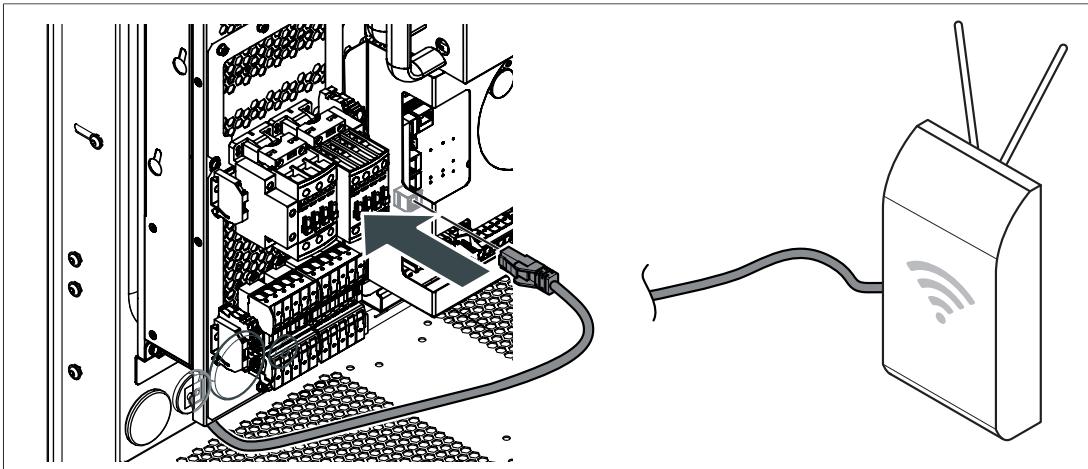
### INFO

- Please inform the operator of the storage system that the internet connection should not be interrupted for long periods of time.
- Additional information can be found in the currently applicable warranty conditions.

- The storage system establishes a connection to the internet using the Ethernet line.
- The Ethernet line is connected to the building network router and the central unit of the storage system.

→ Use a cable with the following properties as the Ethernet line:

- The cable is Cat 6.
- The cable is shielded.



- Connect the line to the central unit of the storage system (**ETH [Router]**).
- Use the fixing straps provided in the scope of delivery to secure the connected line to the power module. Fasten the fixing straps to a free edge of the power module to do this.
- Connect the other end of the cable to the building network router.

When the Ethernet line has been connected correctly, the storage system will automatically establish a connection once it has been commissioned for the first time.

If the connection to the internet is not established after commissioning:

- Follow the instructions in section Troubleshooting [P. 97].

## 6.6 Connecting the mains line

### INFO

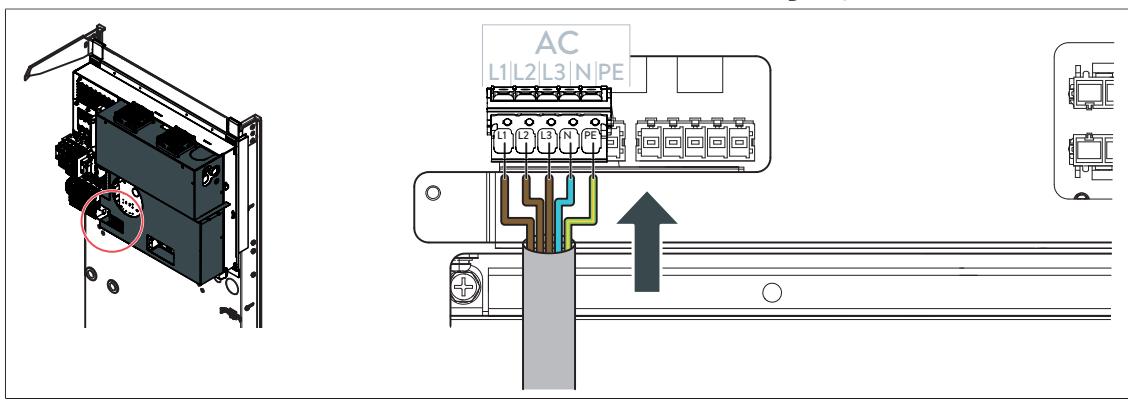
When connecting the three-phase mains line, observe the clockwise phase sequence. If there is no clockwise phase sequence, this is detected by the storage system inverter and the sonnen Eclipse lights up red.

### NOTICE

#### Connection lines too long

→ Ensure that the mains and signal lines are dimensioned so that the selected conductor cross-section is sufficient for the required line length. sonnen recommends a maximum line length of 30 m for the mains and signal lines.

- The mains line is connected to the central unit of the storage system.



- Select the mains line based on the specification (see Parts required [P. 20]).
- Connect the individual wires (L1, L2, L3, N, PE) of the mains line as labelled on the central unit (**AC**). A clockwise phase sequence must be achieved.

## 6.7 Installing the battery modules

### ⚠ WARNING

#### Risk of injury due to heavy weight of battery modules

Crushing or straining due to lifting or dropping of the battery modules!

- Wear safety shoes when transporting and installing the modules.
- Ensure modules are stable.
- Two people should carry the battery modules, if possible.

### NOTICE

#### Risk due to lifting battery modules on steel straps

Damage to the battery modules!

- Never lift battery modules on steel straps.

- Correctly installed battery modules are completely controlled by the storage system. They cannot be switched on and off manually.
- The battery modules are connected to the central unit of the storage system.
- The battery lines run from the individual battery module to the corresponding socket on the central unit of the storage system. As a result, two battery modules each are connected in series. The battery module pairs are connected in parallel on the central unit.

### 6.7.1 Measuring the battery module voltage

### NOTICE

#### High compensating currents

Damage to the battery modules!

- Do not install battery modules when the voltage between the modules differs by more than 2 V.

- Measure the voltage between the battery module plus pole (+) and the battery module minus pole (-) in each case and note down the measured voltage.
- Use this method to measure the voltage of all battery modules to be installed in the storage system.
- Compare the measured voltages for the battery modules and determine the maximum difference.

If the maximum difference is greater than 2 V:

- Do not install the battery modules.
- Contact the sonnen service team for more information.

If the maximum difference does not exceed the threshold, you can continue with the installation.

- It is ideal when the battery module pairs have a low voltage difference between the individual modules. In line with this, pair up battery modules with similar voltages.

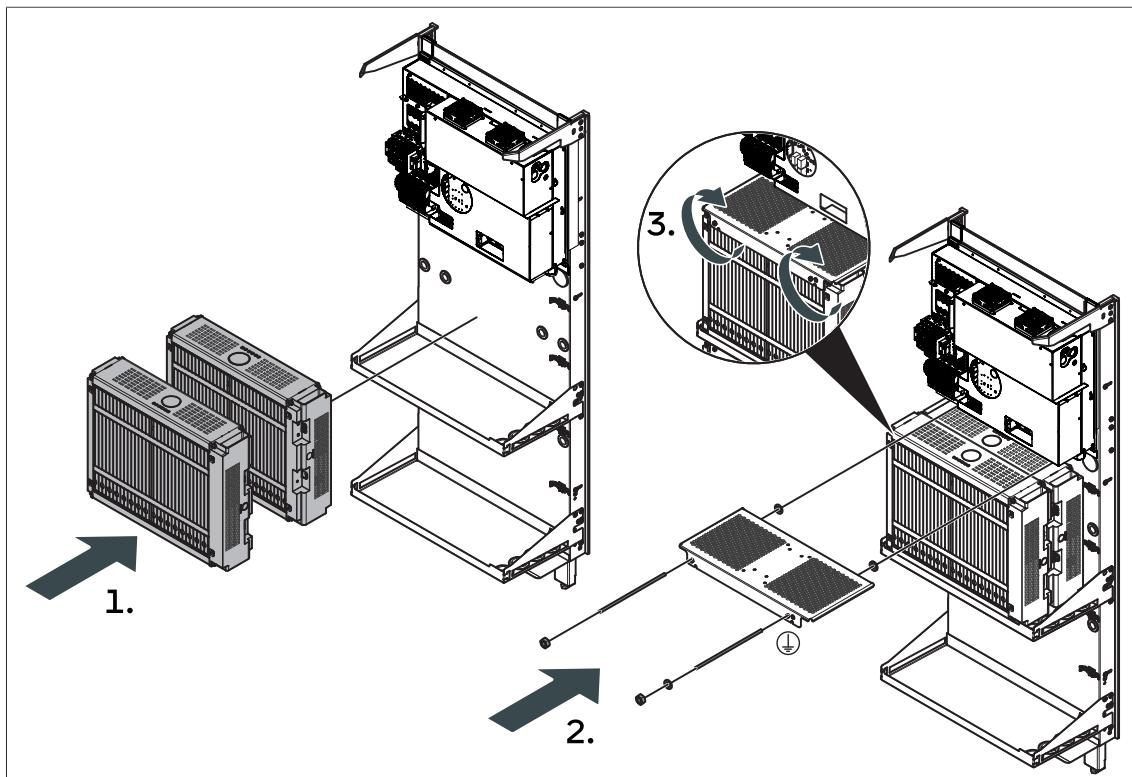
### 6.7.2 Mounting the battery modules

- The battery module connections must face right in each case.
- The sides with the dents for the connections are facing each other.

**INFO**

If just two battery modules are installed, they must always be mounted with the spacer plate on the top battery shelf.

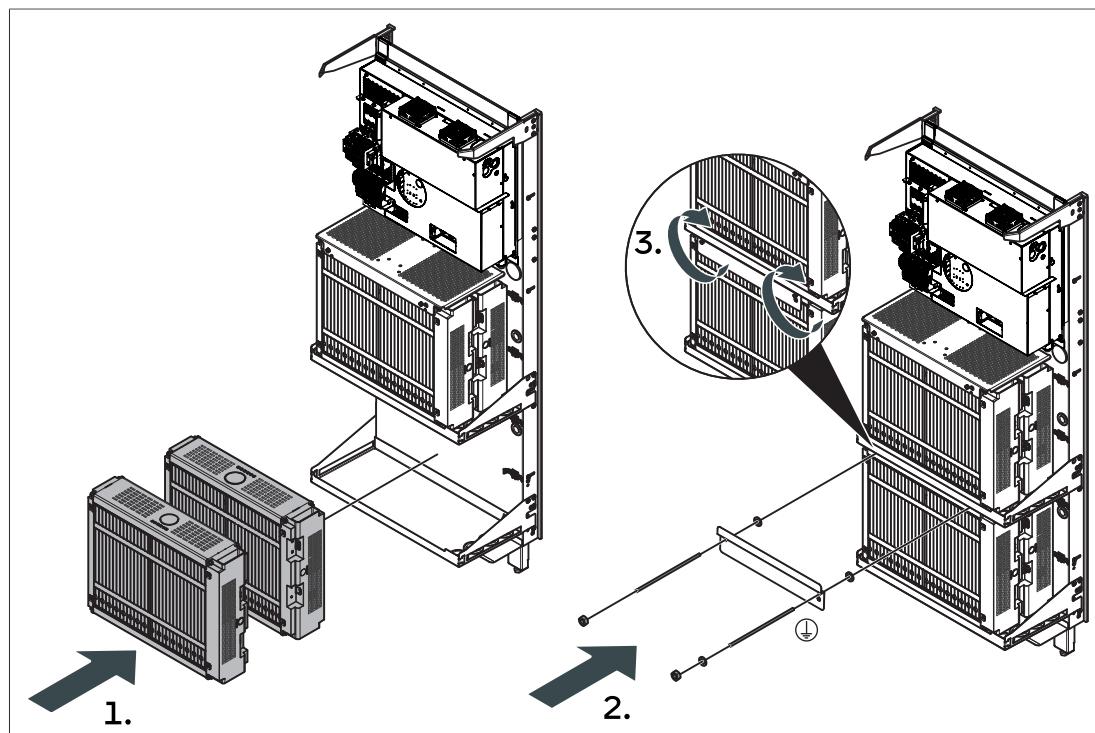
#### Mounting two battery modules



- Place the two battery modules one in front of the other on the top battery shelf (1.).
- Use the battery screws to fasten the spacer plate to the mounting frame. A washer (plastic) must be installed on the left battery screw. A contact disc and washer (plastic) must be installed on the right (2.).
- Install the contact disc between the nut for the battery screw and the spacer plate (2.).
- Install the two washers (plastic) between the spacer plate and the front battery module (2.).
- Tighten the battery screws with a torque of **4 Nm** (3.).

The front battery module is battery module 1 and the back module is battery module 2.

## Mounting four battery modules



- Place two battery modules one in front of the other on the bottom battery shelf (1.).
- Secure the bracket using the battery screws, so that it fastens the battery modules. A washer (plastic) must be installed on the left battery screw. A contact disc and washer (plastic) must be installed on the right (2.).
- Install the contact disc between the nut for the battery screw and the spacer plate (2.).
- Install the two washers (plastic) between the bracket and the front battery module (2.).
- Tighten the battery screws with a torque of **4 Nm** (3.).

The front battery module is battery module 3 and the back module is battery module 4.

### 6.7.3 Connecting the battery modules

#### DANGER

##### High battery voltage (> 200 V)

Danger to life due to electrocution!

When battery lines are connected, the central unit always carries the voltage of the battery modules, even if the storage system and mains voltage are switched off.

To disconnect the battery voltage from the central unit:

→ Unplug the battery lines from **all** battery modules.

#### WARNING

##### Damage to battery lines due to improper routing

Danger to life due to electrocution!

→ Direct the battery lines through the openings in the battery shelves and secure with cable clips.

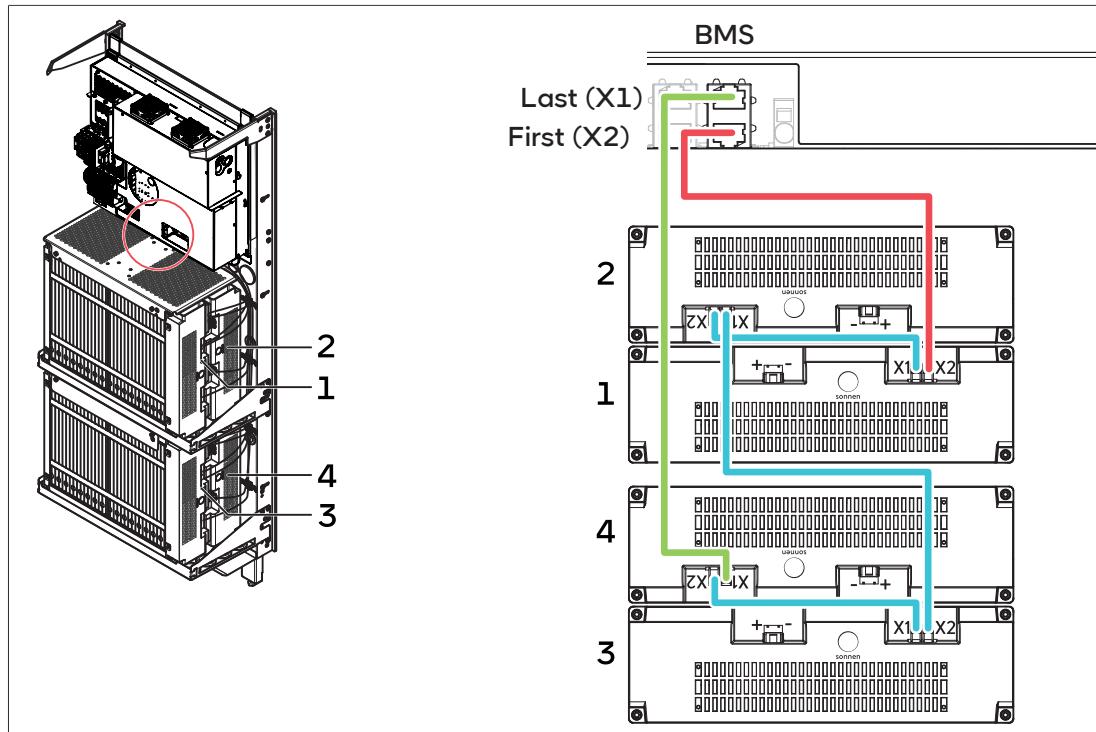
→ Route the battery lines so that they are not kinked or crushed when the cover is mounted or removed.

The scope of delivery includes the battery lines, BMS communication lines and battery screws for the highest extension level of the storage system. If the maximum number of battery modules is not being installed:

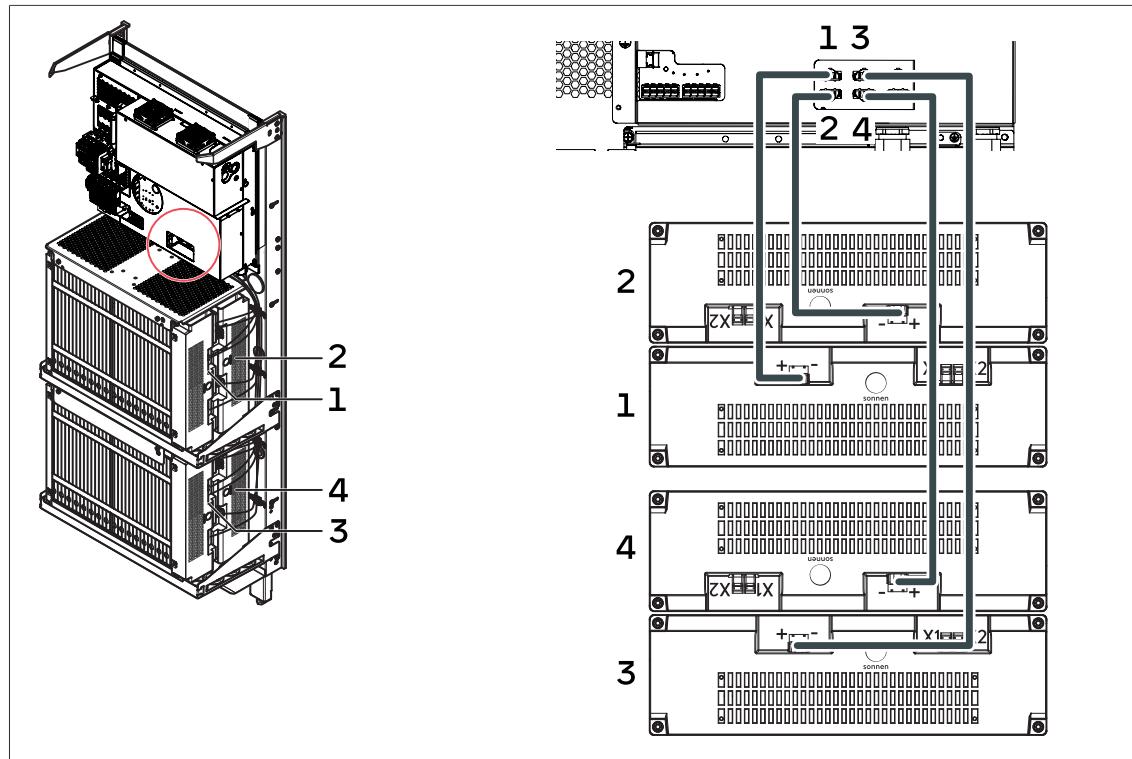
#### INFO

- Store the surplus components in the storage system (e.g. on the floor plate). These will then be on hand if additional battery modules are installed later.
- Ensure that the components are not damaged (e.g. when the cover is attached and removed).

- The battery modules are connected to the central unit of the storage system.
- The battery lines run from the individual battery module to the corresponding socket on the central unit of the storage system. As a result, two battery modules each are connected in series. The battery module pairs are connected in parallel on the central unit.



- Connect the first BMS communication line to socket **BMS First (X2)** on the central unit. Connect the other end to battery module 1 (**X2**).
- Connect the BMS communication line for the last battery module (number 2 or 4) to socket **BMS Last (X1)** on the central unit. Connect the other end to the battery module (**X1**).
- Connect the remaining battery modules one after the other by connecting the BMS communication lines from socket **X1** to socket **X2** of the next battery module in each case.



- Connect a battery line between battery module 1 and socket DC (BATT) - 1 on the central unit.
- Connect a battery line between battery module 2 and socket DC (BATT) - 2 on the central unit.
- Connect the battery lines for additional battery modules in the same way.

#### 6.7.4 Subsequent extension of storage capacity

##### NOTICE

##### Destruction of the battery modules or storage system if specifications for extending storage capacity are not observed.

Damage to or destruction of the battery modules if storage capacity is extended without observing the relevant specifications and if the battery modules are connected in series in the storage system.

→ Always extend the storage capacity by two additional battery modules.

- Observe the serial connection between the battery modules when extending the storage capacity. This means you must always install at least two battery modules.
- The battery modules to be installed must have an SOC of approx. 30 %. Observe the information in section Storing the battery modules [P. 12] concerning this.
- Use the commissioning assistant to set the Operating Mode Battery-Module-Extension (30%). **NOTICE!** This must take place at least 24 hours before extension, as this is the only way the voltage of the installed battery modules can sufficiently adjust to the voltage of the new battery modules to be installed.
- Switch the storage system off to electrically isolate it [P. 95].
- Remove the cover.
- Measure the voltage of the additional battery modules and that of the already installed battery modules (see Measuring the battery module voltage [P. 44]). The voltage difference must not be greater than 2 V.
- Mount the additional battery modules [P. 45].
- Check or add to the battery lines and BMS communication lines of all installed battery modules. The connection sequence described in section Connecting the battery modules [P. 47] must be followed.
- Mark the new storage capacity on the type plate of the storage system (on the switch panel of the power module). Clearly void out the marking for the old storage capacity.
- Attach and earth the cover [P. 89].
- Switch on the storage system [P. 92].
- Change the operating mode from module extension to the right operating mode (e.g. Automatic - Self-Consumption) in the commissioning assistant.

## 7 Installing the extension cabinet (optional)

### NOTICE

#### Damage to the battery modules when installing the extension cabinet after initial commissioning

If an extension cabinet is added to the storage system after the system has already been commissioned, the battery modules may be damaged. Therefore:

→ Observe the information in section Extension of storage capacity [P. 50] if you are retrofitting an extension cabinet to the storage system.

- One extension cabinet can be added to the storage system. An extension set, housing set with mounting frame and the desired number of battery modules are required for this (for list of components, see Scope of delivery [P. 17]).
- The nominal storage capacity of the storage system can be extended from 22 kWh (four battery modules) to up to 55 kWh (total of 10 battery modules).

### 7.1 Mounting the extension cabinet

- The extension cabinet is essentially mounted similarly to the storage system (see Installing the storage system [P. 22]).
- Differences in mounting are described in the following sections.

#### 7.1.1 Selecting the installation location

### NOTICE

#### Insufficient load-bearing capacity of wall fixing for mounting

Damage to storage system and surrounding area!

The wall fixing selected for the installation of the storage system must be able to support a weight of 990 kg. The wall fixing selected for the extension cabinet must be able to support a weight of 1170 kg.

→ Ensure that the mounting material and the wall have the required load-bearing capacity. Ensure that the correct distances between the storage system and extension cabinet are observed.

→ Use all of the mounting points on the mounting frame of the storage system and the extension cabinet.

- The extension cabinet can be mounted to the left or right of the storage system.
- Maintain the minimum distances for the storage system and for the extension cabinet (see Minimum distances [P. 22]). The distance between the storage system and the extension cabinet can be reduced compared to the required minimum distances, but must always be **at least 15 cm**.
- Do not select a distance that is too great between the storage system and extension cabinet.

### INFO

The supplied double battery line (length: 5 m) must be routed from the power unit of the storage system through the cable entry points to the battery coupling inside the extension cabinet. The double battery line must not be extended because this would cause increased voltage drops and malfunctions.

→ Note the size of the connector on the battery lines in terms of routing the line (e.g. when guiding it through the cable ducts).

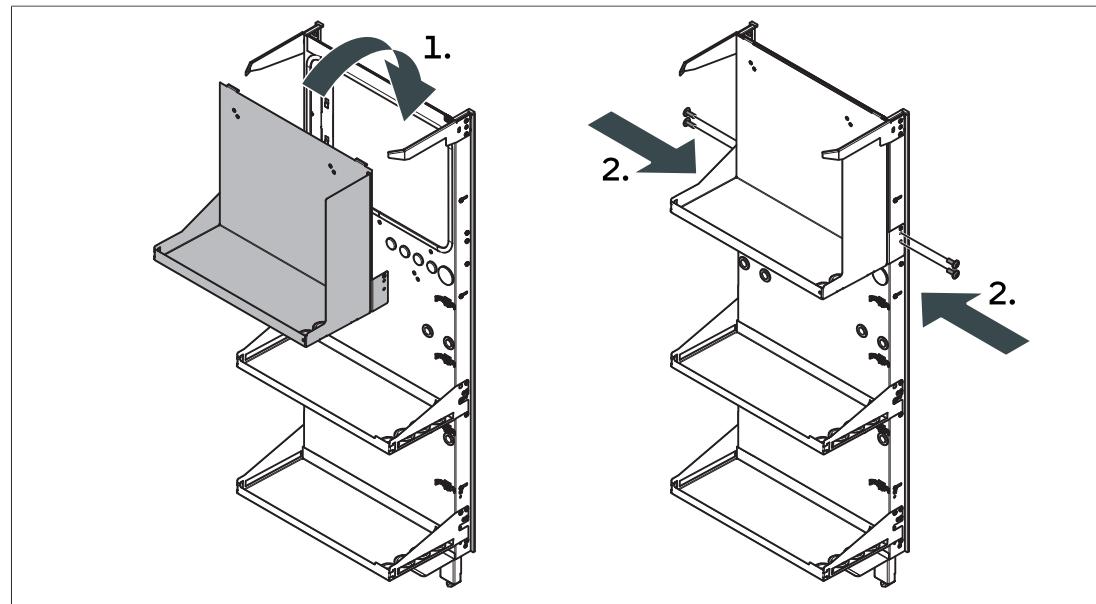
### 7.1.2 Installing the mounting frame

→ Install the mounting frame on the wall as described in section Securing the mounting frame [P. 24].

Sealing the openings [P. 26]:

→ Remove the four dummy plugs (diameter: 27.8 mm) for the extension cabinet from the extension set.

Completing the mounting frame [P. 27]:



→ Install the battery shelves included in the extension set with the screws already pre-mounted on the mounting frame, as shown in the figure.

→ Tighten the screws with a torque of **6 Nm**.

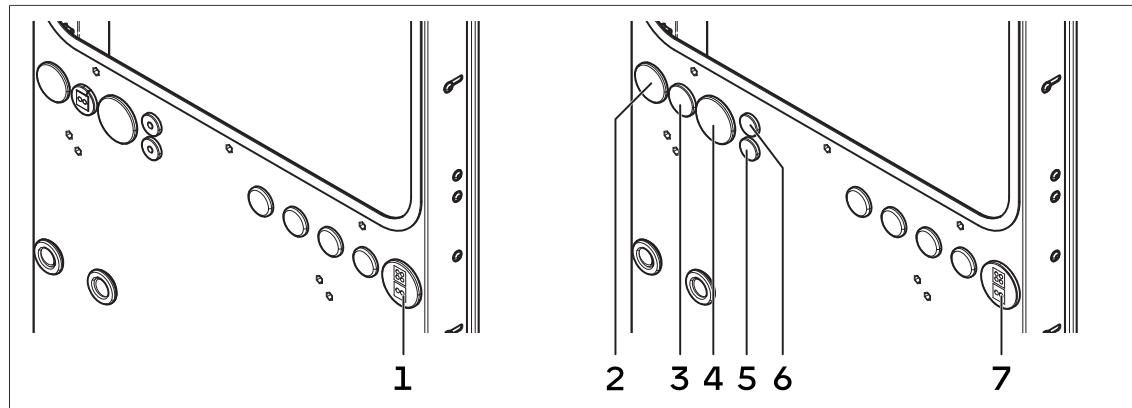
### 7.1.3 Line entry point

#### ⓘ INFO

The specified degree of protection for the storage system and therefore touch protection and protection against the ingress of foreign bodies is only achieved when all openings on the storage system are sealed as described in the product documentation.

→ Remove the reserve dummy plug ( $\varnothing$  50) for the extension cabinet on the storage system.

→ Use the cable entry points and grommets, if any, from the extension set to direct the lines into the storage system and the extension cabinet.



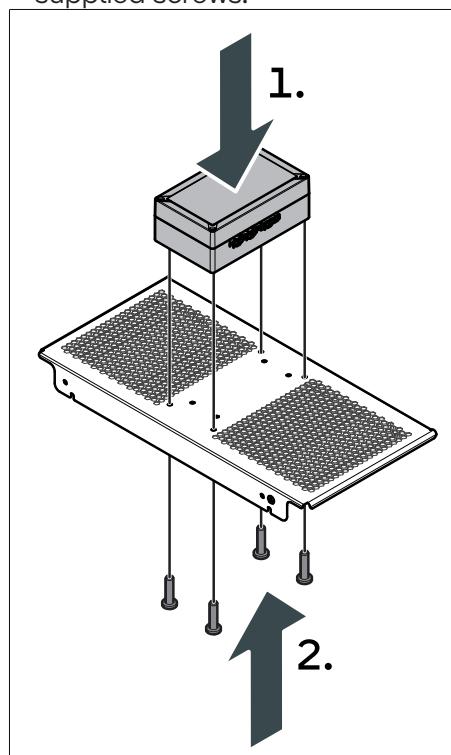
No.	Type	Use
1	Cable entry plate ( $\varnothing$ 50)	<b>Top:</b> battery line (four individual lines) <b>Bottom:</b> 2 x BMS communication lines
2	Dummy plug ( $\varnothing$ 40)	For sealing
3	Dummy plug ( $\varnothing$ 32)	For sealing
4	Dummy plug ( $\varnothing$ 50)	For sealing
5	Dummy plug ( $\varnothing$ 20.5)	For sealing
6	Dummy plug ( $\varnothing$ 20.5)	For sealing
7	Cable entry plate ( $\varnothing$ 50)	<b>Top:</b> battery line (four individual lines) <b>Bottom:</b> 2 x BMS communication lines

**INFO**

Correct assembly must be observed when inserting the grommets into the cable entry plates. The flat side of the grommet must always be facing the flat side in the cutout of the cable entry plate.

#### 7.1.4 Mounting the battery coupling

→ Mount the battery coupling from the extension set to the spacer plate using the four supplied screws.



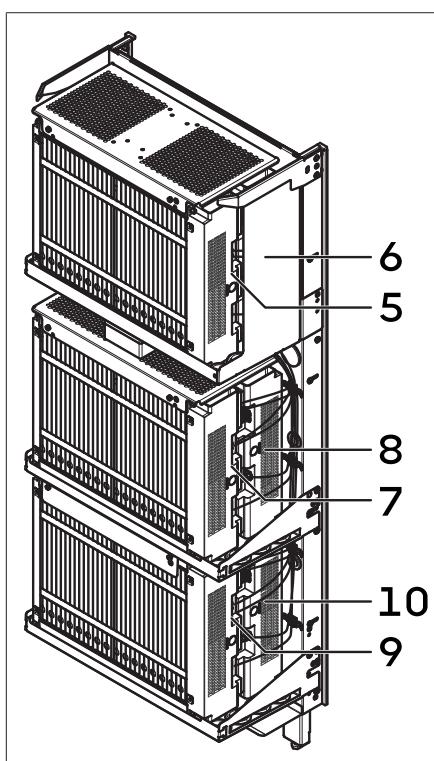
## 7.2 Connecting the extension cabinet

The scope of delivery includes the battery lines, BMS communication lines and battery screws for the highest extension level of the storage system. If the maximum number of battery modules is not being installed:

### ⓘ INFO

- Store the surplus components in the storage system (e.g. on the floor plate). These will then be on hand if additional battery modules are installed later.
- Ensure that the components are not damaged (e.g. when the cover is attached and removed).

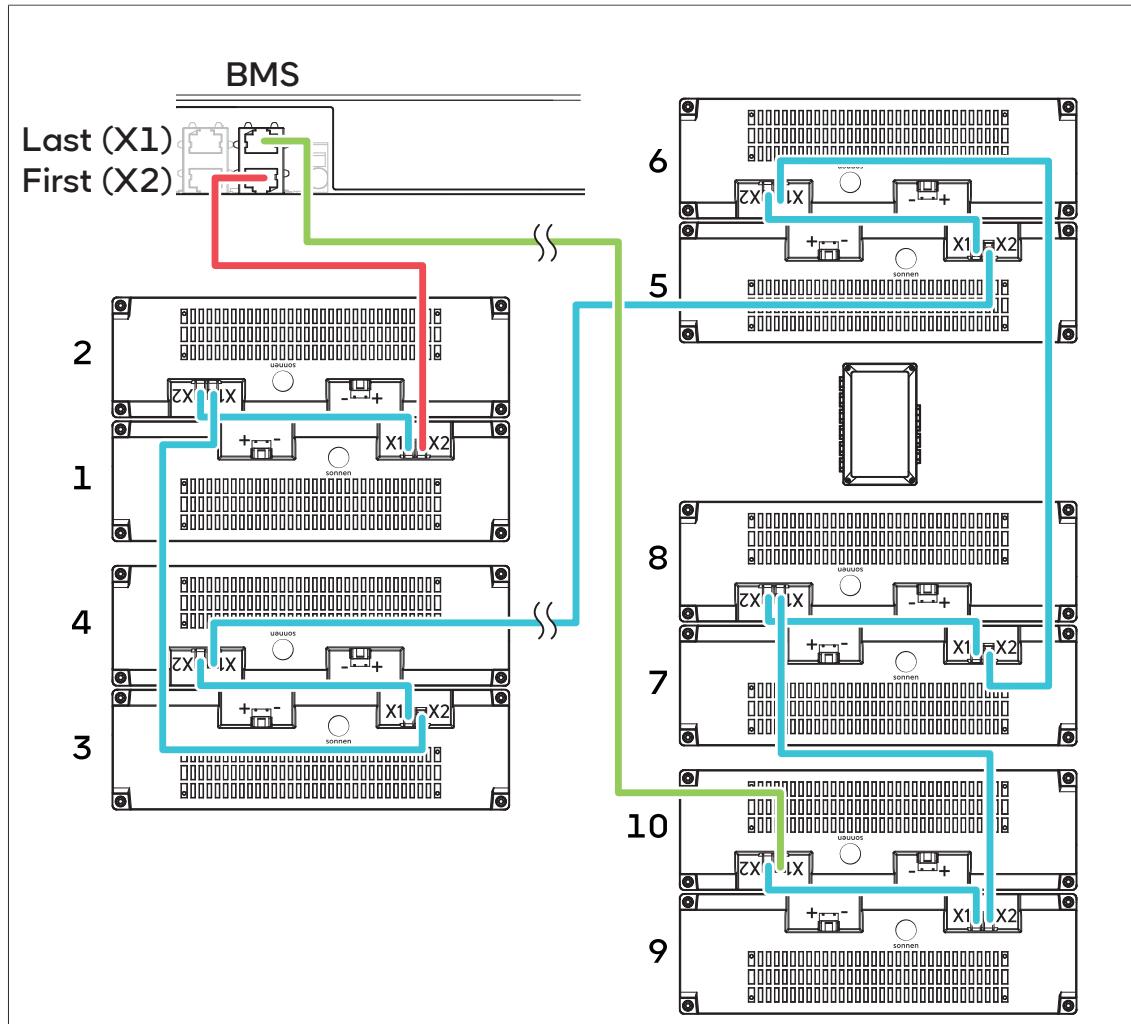
### 7.2.1 Positioning the battery modules



- Arrange the battery modules in the extension cabinet as shown in the figure.
- Mount the battery modules like those in the storage system (see Mounting the battery modules [P. 45]).

### 7.2.2 Connecting the BMS communication lines

- The first and last battery module are connected to the central unit of the storage system using two BMS communication lines. These two lines are guided through the cable entry plates on the storage system and on the extension cabinet.
- The battery modules are connected to each other via the BMS communication lines as described in section Connecting the battery modules [P. 47].



→ Connect the BMS communication lines as shown in the figure.

The first battery module (in the storage system) is connected to the **BMS First (X2)** socket on the central unit of the storage system. The last battery module (in the extension cabinet) is connected to the **BMS Last (X1)** socket on the central unit of the storage system.

### 7.2.3 Connecting the battery lines

## ⚠ DANGER

### High battery voltage (> 200 V)

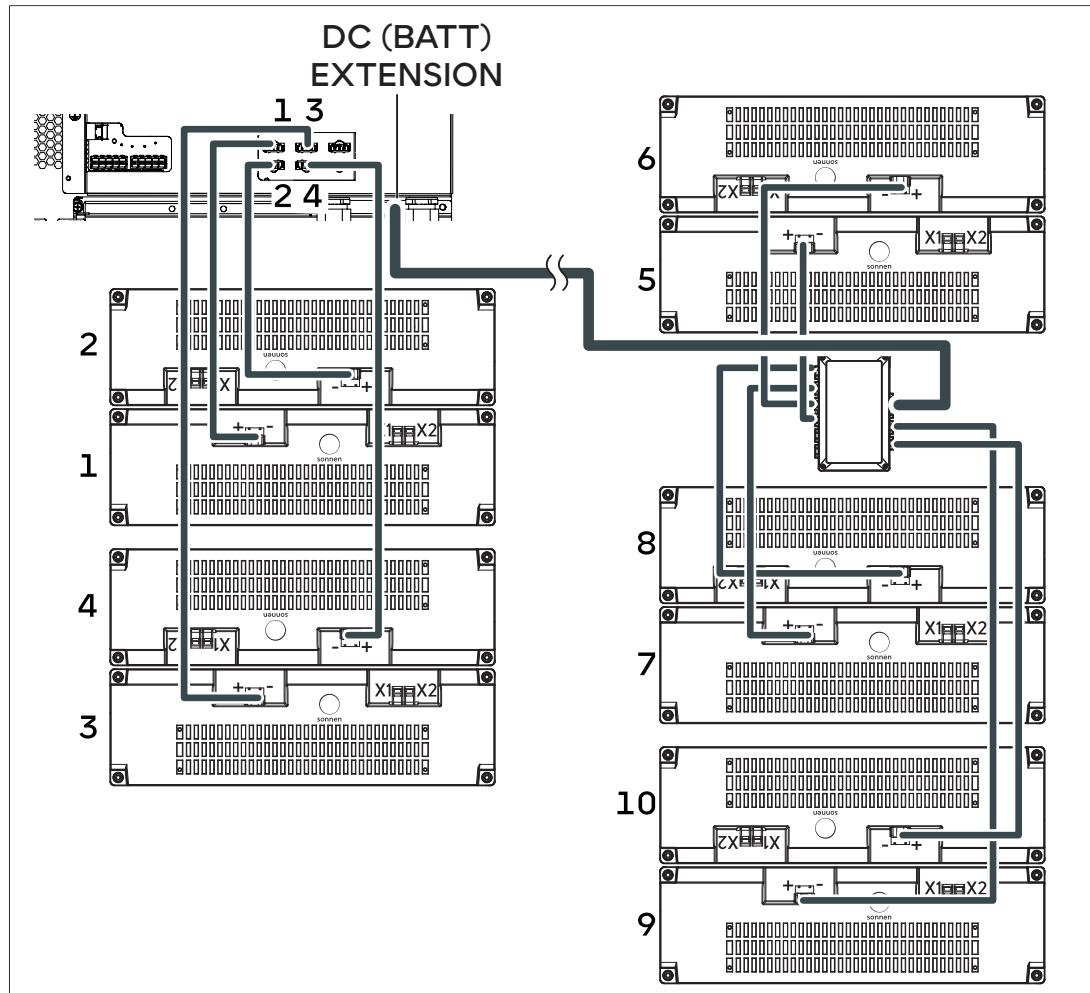
Danger to life due to electrocution!

When battery lines are connected, the battery coupling always carries the voltage of the battery modules, even if the storage system and mains voltage are switched off.

To disconnect the battery voltage from the battery coupling:

→ Unplug the battery lines from **all** battery modules.

- The battery modules in the extension cabinet are connected to the battery coupling using the battery lines.
- The battery coupling is connected to the central unit of the storage system using the double battery line.



The placement of the battery modules (see Positioning the battery modules [P. 54]) determines the number for connection to the battery coupling.

- Note the numbering on the battery coupling for connection of the battery modules.
- Connect the battery lines as shown in the figure.

### 7.3 Completing the extension cabinet installation

#### Filling out and adding to the type plate

- ✓ If the storage system is being commissioned with the extension cabinet for the first time:
  - Mark the relevant values on the type plate (see Filling in the type plate [P. 89]).
- ✓ If the storage system has already been commissioned for the first time without an extension cabinet:
  - Invalidate the existing storage capacity notation on the type plate of the storage system.
  - Mark the new installed storage capacity on the type plate.

**Mounting the cover and switch cover**

→ Mount the extension cabinet completely, similarly to the storage system (see Attaching the cover [P. 89] and Attaching the switch cover [P. 90]).

**Continuing the installation of the storage system**

→ When the extension cabinet is completely mounted and sealed, continue with section Checking the installation [P. 90].

## 8 Using digital inputs/outputs (optional)

### NOTICE

#### Connection lines too long

→ Ensure that the mains and signal lines are dimensioned so that the selected conductor cross-section is sufficient for the required line length. sonnen recommends a maximum line length of 30 m for the mains and signal lines.

### NOTICE

#### Over voltage when switching off electromagnetic relays

Damage to components!

→ Only use electromagnetic relays with a protective circuit (e.g. with a free-wheeling diode) or semiconductor relays.

### INFO

The wiring configurations described in the following are examples only; they do not apply universally and serve only as a guide for the electrician performing the installation. The electrician performing the installation is responsible for connecting the system correctly. In some cases, the permission of the distribution network operator (DNO) or power supply company may be required.

### INFO

External components (terminals, contactors, relays, etc.) needed to wire up the digital inputs/outputs are not supplied.

### 8.1 Overview of digital inputs and outputs

- The signal line for using digital inputs and outputs is connected directly to the central unit of the storage system. This approach ensures flexible use of the special functions, as only the required connections are used and the line lengths can be adapted individually to the on-site conditions.
- The connections on the central unit of the storage system are marked as **DI/DO** with numbers 1-20. The following table shows which number stands for which digital input or output and indicates the possible wire cross-sections for the signal lines used.
- Two relays are additionally installed on the central unit, which are required in order to use PV reduction. These relays are labelled as **PV red.**

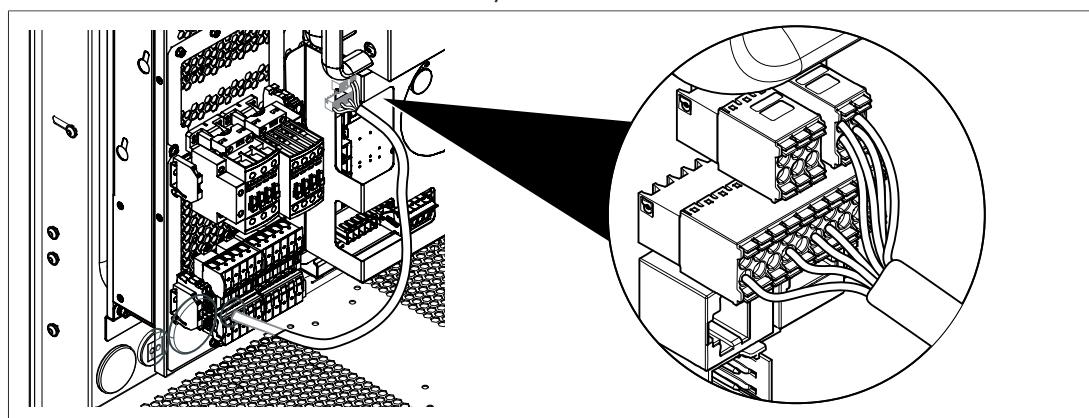


Illustration 13: Position of connections on the central unit

→ Use the fixing straps provided in the scope of delivery to secure the connected line to the power module. Fasten the fixing straps to a free edge of the power module to do this.

Label	Function	Wire cross-section	Voltage [VDC]	Max. amperage [mA]
		[mm <sup>2</sup> ] <sup>3</sup>		
1 DO GND	Digital output GND	0.25-1.5	0	350
2 DO GND	Digital output GND	0.25-1.5	0	350
3 DO RES	Reserve	0.25-1.5	-	-
4 DO RES	Reserve	0.25-1.5	-	-
5 DO CHP	Digital output CHP	0.25-1.5	24	50
6 DO SCR	Digital output for self-consumption switch	0.25-1.5	24	50
7 DO GEN	Reserve	0.25-1.5	-	-
8 DO RES	Reserve	0.25-1.5	-	-
9 DI 24V	Supply voltage for digital inputs	0.25-1.5	24	50
10 DI 24V	Supply voltage for digital inputs	0.25-1.5	24	50
11 DI FLAT	Digital input Regulative	0.25-1.5	24	50
12 DI CHP	Digital input CHP	0.25-1.5	24	50
13 DI RES	Reserve	0.25-1.5	-	-
14 DI RES	Reserve	0.25-1.5	-	-
15 DI RES	Reserve	0.25-1.5	-	-
16 DI RS	Reserve	0.25-1.5	-	-
17 N.C.	Reserve	0.25-1.5	-	-
18 RS VCC	Reserve	0.25-1.5	-	-
19 ATS	Reserve	0.25-1.5	-	-
20 ATS GND	Reserve	0.25-1.5	-	-

Table 3: Technical data for digital inputs (DI) and outputs (DO)

PV red. (3, 4)	PV reduction 1	0.25-1.5	5-60 (SELV)	300
PV red. (1, 2)	PV reduction 2	0.25-1.5	5-60 (SELV)	300

Table 4: Load capacity of relays for PV reduction

<sup>3</sup> The use of flexible conductors with end ferrules with plastic sleeves allows the following conductor cross-sections: 0.14–0.75 mm<sup>2</sup>.

## 8.2 Connecting digital inputs/outputs

### 8.2.1 Implementing PV reduction

**INFO**

No external relays are needed for PV reduction, as the necessary relays are already integrated in the central unit of the storage system.

**NOTICE**

**Overloading of relays for PV reduction**

Damage to relays on the central unit!

→ Only load the relays for PV reduction (PV red. 1 and PV red. 2) up to a maximum voltage of 60 V (SELV) and a maximum amperage of 300 mA.

Using the PV reduction digital outputs - PV reduction 1 and 2 - is a good idea if the feed-in power of the PV system must not exceed a fixed value (feed-in limit).

The PV reduction digital outputs can be used to automatically control the output power of the PV inverter so that the feed-in power does not exceed the required value in a 10-minute average interval.

**Function**

The **PV red. 1** and **PV red. 2** connections on the central unit of the storage system are **potential-free contacts**. PV reduction 1 and 2 are activated and deactivated automatically by the storage system depending on the current feed-in power.

When the feed-in power falls below the feed-in limit, both contacts are deactivated. This corresponds to level 0. As soon as power reduction is required, the contacts are activated in levels as shown in the following table. If level 1 does not achieve the desired effect, for example, then level 2 is activated, and so forth.

Relay / Level	0	1	2	3
PV red. 1				
PV red. 2				

Table 5: Make contact positions depending on activated level

## Connecting PV reduction

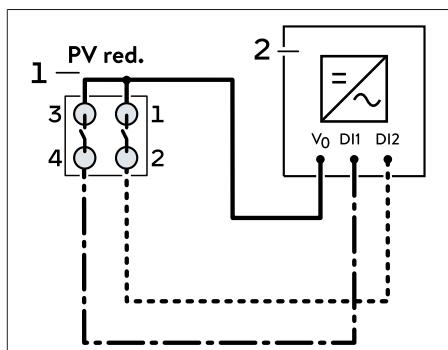


Illustration 14: Connecting PV reduction

- 1 Connecting PV reduction to the storage system
- 2 PV inverter with interface for power control

### Prerequisite:

- ✓ The PV inverter has a suitable interface for power control (e.g. an interface for a ripple control receiver).
- Wire the PV reduction as shown in the figure here. Connections 3 and 4 form **PV reduction 1**, connections 1 and 2 form **PV reduction 2**.

## Configuring settings

- The reduction levels for the PV system are set in the commissioning assistant and on the PV inverter of the PV system.
- Set the desired reduction levels in the commissioning assistant of the storage system on page PV System and on the PV inverter.

Level	Max. active power
0	100 % of the PV system power
1	Feed-in limit of PV system in % <b>plus</b> 10
2	Feed-in limit of PV system in % <b>minus</b> 15
3	1 %

### INFO

A power specification of 0 % causes some PV inverters to disconnect from the grid, stopping energy production and leading to a complete restart. This behaviour is not required to operate the storage system and may reduce the service life of the PV inverter. Sonnen therefore recommends setting reduction level 3 to 1 % as a default.

The values for levels 1 and 2 depend on the **individual** feed-in limit of the PV system in question. The addition or subtraction of the stated percent values leads to an optimal regulation by the storage system.

### Example

- The feed-in of the PV system is limited to 70% of the rated power.

The following values need to be set on the PV inverter:

Level 1	80 % (70 % plus 10)
Level 2	55 % (70 % minus 15)
Level 3	1 %

**Important note:** The percentages specified refer to the nominal power of the PV system in each case. If the inverter power is not identical to the PV system power, it may be necessary to convert the percentages to the inverter power, depending on the type of inverter and the setting options.

For the above example:

- The PV power is 9 kWp and the inverter power is 8 kWac.

Calculation:  $80\% * 9 \text{ kWp} = 7.2 \text{ kW}$ ;  $7.2 \text{ kW} / 8 \text{ kWac} = 90\%$

Result: Enter 90 % (not 80 %) on the inverter for level 1!

## 8.2.2 Using electrical consumers for self-consumption optimisation

When **digital output (DO) Self-consumption switch** is used, the controls of the storage system activate an external electrical consumer in certain circumstances, which holds the existing surplus of electricity.

### Function

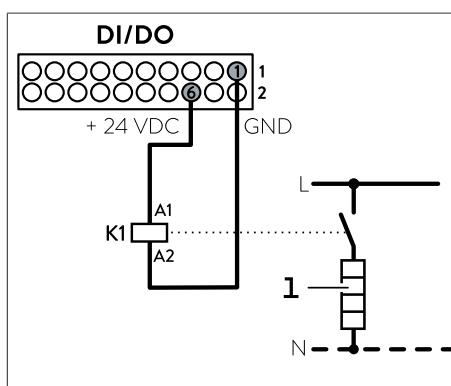
Digital output 'Self-consumption switch' is activated as soon as a defined production surplus (= production - consumption - charging of storage system) has been reached. The production surplus is defined by the Threshold to start (in watts). If the surplus electricity exceeds this limit, the digital output remains activated for the duration of the defined Minimal on time (in seconds).

### Configuring settings

The switching behaviour of the self-consumption switch is controlled using the commissioning assistant.

→ Adapt the Threshold to start and Minimal on time for the connected electrical consumer.

### Application example



1 Heating element

K1 External contactor

### Activating and deactivating a heating element

The heating element (1) is connected to digital output 'Self-consumption switch' via an external contactor and can be activated or deactivated as needed. The nominal power of the heating element (1) was set as Threshold to start.

**NOTICE!** The heating medium must be prevented from excessive heating using suitable safety measures.

### 8.2.3 Using additional external electrical generators

If **digital output (DO) CHP** is used, the controls of the storage system activate an external electrical generator, e.g. a combined heat and power station, as soon as defined charging state conditions are met.

#### Function

As soon as the state of charge (SOC) of the storage system drops below a defined value (Charge state to start CHP), the digital output is activated. The digital output and thus the electrical generator remain activated until the state of charge (SOC) of the storage system reaches a defined maximum charging state (Charge state to stop CHP). Surpluses of electricity from the electrical generator are used to charge the storage system. In order for this to be included in calculations correctly when controlling the flows of energy in the building, the power output of the electrical generator must be recorded (see Recording constant power of an electrical generator [P. 64]).

#### Using a combined heat and power station as an electrical generator

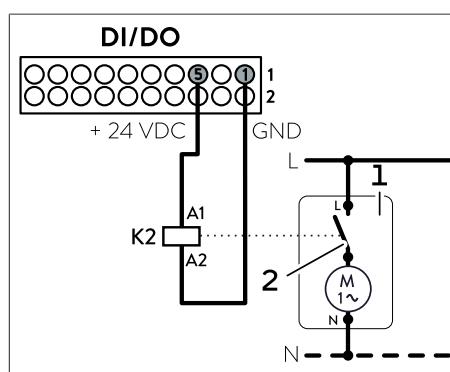
If a combined heat and power station is used as an electrical generator, it must be ensured that it mostly functions as a heat provider, i.e. the highest priority for production is the hot water supply, while production of electricity generally takes second priority. This means that when digital output CHP of the storage system is activated, the combined heat and power station may not start producing electricity immediately.

#### Configuring settings

The switching behaviour of the digital output is controlled using the commissioning assistant.

- Set the lower limit of the charging state at which the digital output and therefore the electrical generator are activated (Charge state to start CHP).
- Set the upper limit of the charging state at which the digital output and therefore the electrical generator are deactivated (Charge state to stop CHP).

#### Application example



1 CHP

2 Contact for activating CHP unit

K2 External relay

#### Activating and deactivating a CHP unit

The combined heat and power station (1) is activated or deactivated using digital output CHP. The prerequisite for this is that the CHP unit must be available via a suitable interface (2) for activation/deactivation.

### 8.2.4 Recording constant power of an electrical generator

#### INFO

The use of digital inputs/outputs described here is **only permitted for electrical generators with a constant power output**.

Generators with fluctuating power output, such as modulating combined heat and power stations, must **not** be connected in this way.

If **digital input (DI) CHP** is used, the controls of the storage system include the power of the connected electrical generator (e.g. a combined heat and power station) in calculations for controlling flows of energy.

#### Function

When digital input CHP is activated, the storage system adds the power output of the electrical generator to current production calculations. The power output of the electrical generator must be constant for this, as the digital input only detects the statuses of activated or deactivated.

#### Configuring settings

The power generated by the electrical generator is specified in the commissioning assistant.

→ Activate the combined heat and power station on page Features.

→ Specify the constant power of the combined heat and power station (Power).

#### Application example

The type of connection for digital input CHP depends on whether the CHP unit has a potential-free operating contact or not.

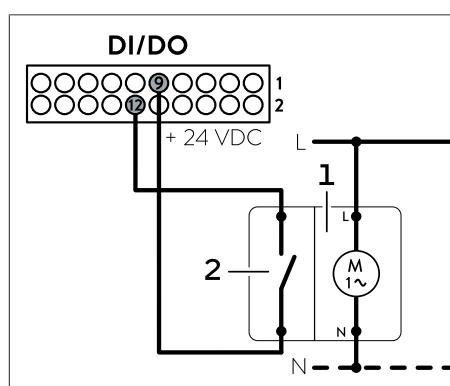
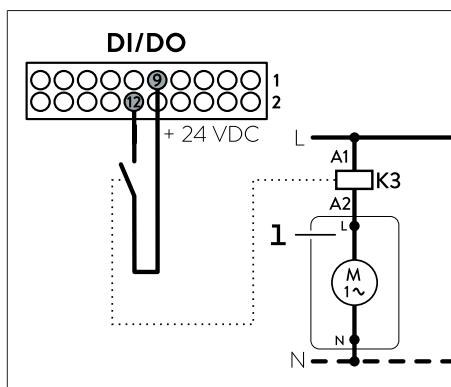


Illustration 15: Example: CHP unit with operating contact

#### Combined heat and power station with operating contact

If the combined heat and power station (1) has a potential-free operating contact (2), it can be connected as shown in the figure. As soon as the operating contact (2) closes, digital input CHP will be activated.

- 1 Combined heat and power station
- 2 Potential-free operating contacts of the CHP unit (open if the station is not operating, closed if it is)



*Illustration 16: Example: CHP unit without operating contact*

#### Combined heat and power station without operating contact

If the combined heat and power station (1) does not have a potential-free operating contact, it can be connected as shown in the figure. In this set-up, a relay is used to detect whether the generator is active. This information is forwarded to the storage system via a potential-free make contact in the relay.

1 Combined heat and power station

tion

K3 Relay

### 8.2.5 Recording fluctuating power of an electrical generator

- The power of an electrical generator that does not produce constant output cannot be recorded via digital input CHP (see Recording constant power [P. 64]).
- Instead, the electrical generator has to be integrated in the power measurement via a separate measurement point. This may require an additional power meter and the corresponding setting of the additional measurement point in the commissioning assistant.

#### INFO

Further information on power measurement and the power meter can be found in the power meter instructions<sup>4</sup>. These instructions explain, among other things, the different measurement concepts and how to use multiple power meters.

#### Example: combined heat and power station with CP measurement concept

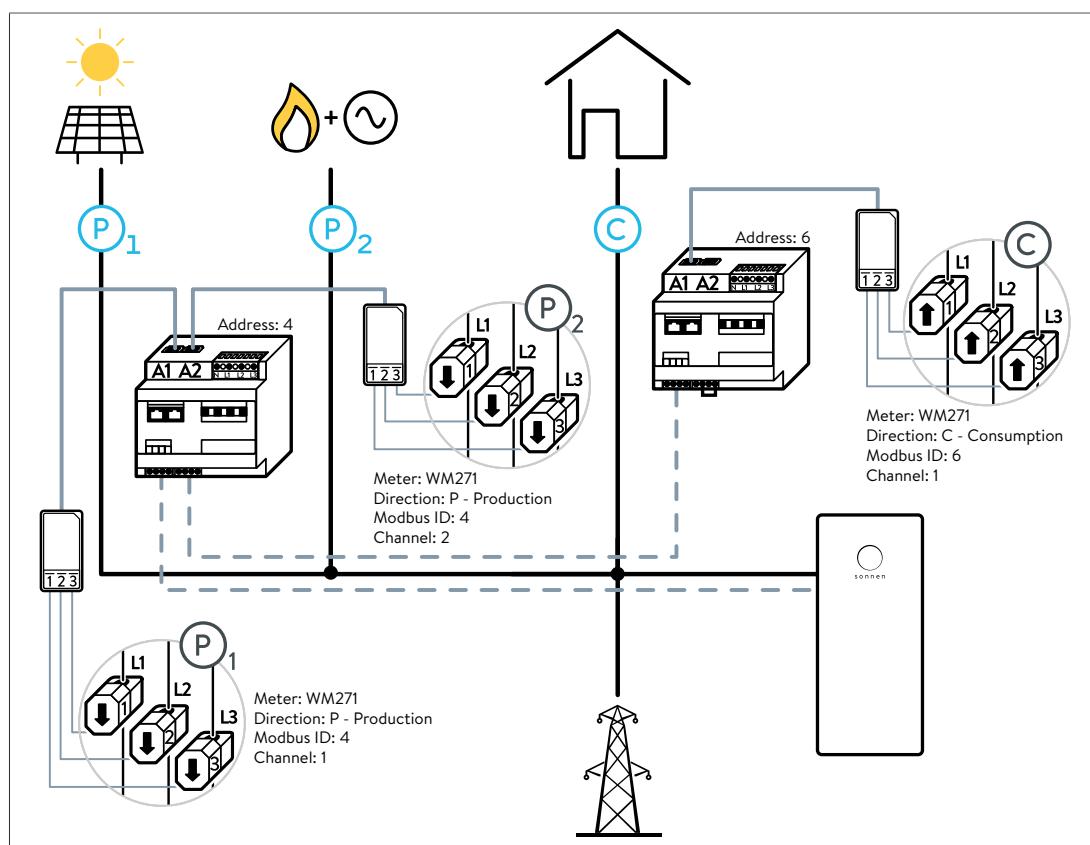


Illustration 17: Example of implementation of CP measurement concept with a CHP unit as additional generator

#### Information for the example

- Storage system without PV connection.
- Use of WM271 power meters.
- Measurement concept: CP (Consumption Measurement).
- Measurement point C: measurement point for recording consumption in the building.
- Measurement point P<sub>1</sub>: measurement point for recording production for the PV system.
- Measurement point P<sub>2</sub>: measurement point for recording production for the CHP unit.
- The circuits show the connection of the clamp-on current transformer at the measurement points.

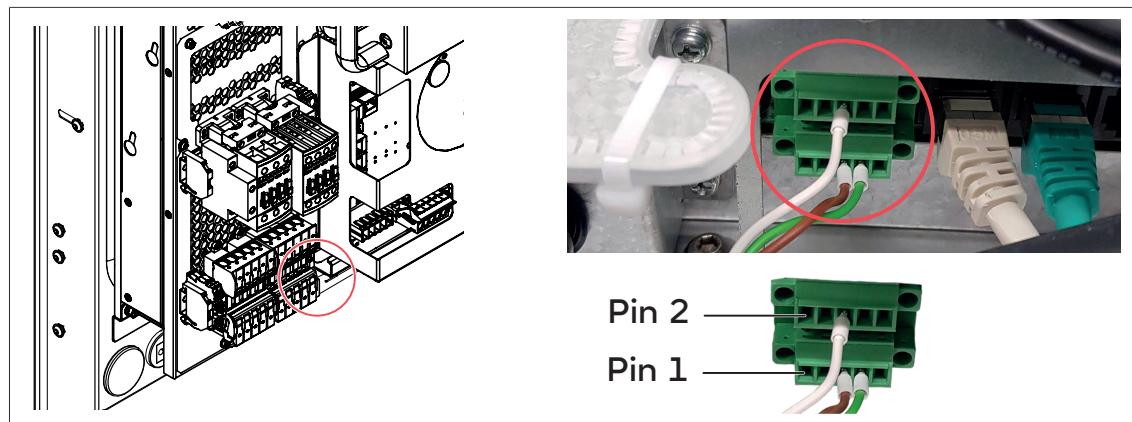
<sup>4</sup> Document number: 300

### 8.2.6 Implementing rapid shutdown

The rapid shutdown function of the storage system stops the release of active power from the inverter within five seconds once a corresponding signal is received from the DNO. Through this function, the system meets the requirements of application rule VDE AR-N 4105 and the Technical and organisational rules for generators ('TOR Erzeuger').

With the signal from the grid operator, the storage system can be forced to disconnect from the mains by connecting pins 1 and 2.

- There are contacts on the connectors of the storage system power unit for the rapid shutdown connection.
- Rapid shutdown must be performed with a potential-free break contact.



- Guide the rapid shutdown line into the storage system interior. To do so, use one of the four openings (diameter: 27.8 mm) in the top section of the mounting frame (see Sealing the openings [P. 26]) and use a cable entry point that is appropriate for the protection rating of the storage system.
- Loosen the screws on the connectors and remove them.
- Connect the rapid shutdown line to pin 1 and pin 2 of the connectors. The positions of pins 1 and 2 can be seen in the figure.
- Then reconnect the two connectors to the power unit and secure them with the screws.

**INFO**

#### Activating rapid shutdown

The RS function must be activated in the Commissioning assistant. If the function is activated without the line being connected to the power unit, the storage system may not function properly.

### 8.2.7 External regulatory signal (§14a EnWG for DE)

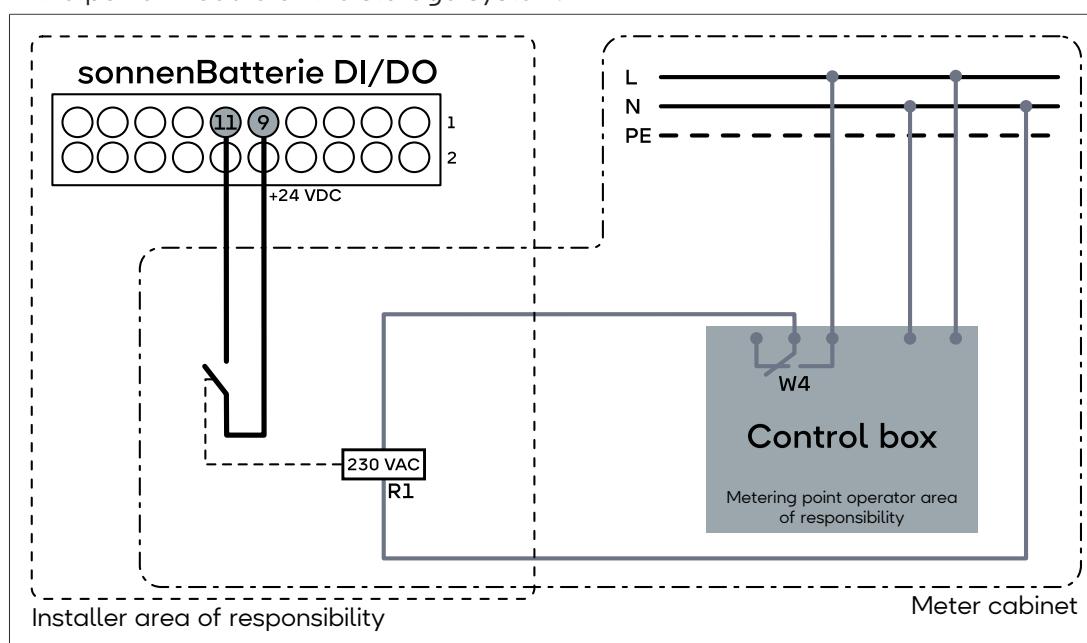
#### ⓘ INFO

With the procedure described here, the storage system can function as a 'controllable consumption device' in accordance with Section 14a of the German Energy Industry Act (EnWG). If there is a sonnenCharger in the system in addition to the storage system, registration as a 'controllable grid connection' is recommended

The **digital input (DI) 11 FLAT** can be used to connect a coupling relay. This allows future control signals from the DSO to reach the storage system from a control box.

→ Install a coupling relay in the meter cabinet (connection compartment on the system side, unless otherwise specified by the DSO).

→ Connect the make contact of the relay (R1) to input 9 DI 24V and 11 DI FLAT on the power module of the storage system.



#### Assignment of the inputs:

- DI 11 = Input E1 corresponds to relay 1 (R1)

#### Value of the inputs for consumer units 'FNN-2bit'<sup>5</sup>:

Relay W4	Consumption (§14a SteuVE / EMS)
0	Release (unrestricted operation)
1	Assured minimum value §14a (dimming)

→ Document the final planned wiring for the meter operators in the meter cabinet. The illustration in this chapter or the entire page can be used for this, which can be printed out and attached to the inside of the meter cabinet door, for example.

<sup>5</sup> Source: VDE/FNN Impuls "Anforderungen an die technische Ausgestaltung der physikalischen und logischen Schnittstellen der Steuerungseinrichtung zum Anschluss und zur Übermittlung des Steuerbefehls an eine steuerbare Verbrauchseinrichtung oder ein Energie-Management-System" As of 10/2024.

## 9 Emergency power function (optional)

- Both when the sonnenBatterie 10 performance+ is first being installed and after the fact, the emergency power function can be added to the system.
- Note that if installed after the fact (after the storage system has already been commissioned without emergency power function), changes may be needed to the power measurement and electrical installation in the building.

### Connection options for the storage system with emergency power function

The emergency power function of the storage system is designed as standard to provide backup power for all three phases of an entire household in the event of a grid outage (**connection option 1**). This is possible for house connections with a **maximum fuse rating of 63 A per phase**. However, the thermal throughput must not exceed 30 kW.

If the building has a larger connection, three-phase **backup circuits** must be installed **separately (connection option 2)**. In this case, when there is a grid outage only the electrical consumers connected to the backup circuits are supplied with electricity from the storage system.

Both connection options can be implemented as a standalone power system using an electrical generator (e. g. PV system) (see Connecting AC microgrid (optional) [P. 82]).

→ Note that the following descriptions indicate which connection option they are valid for.

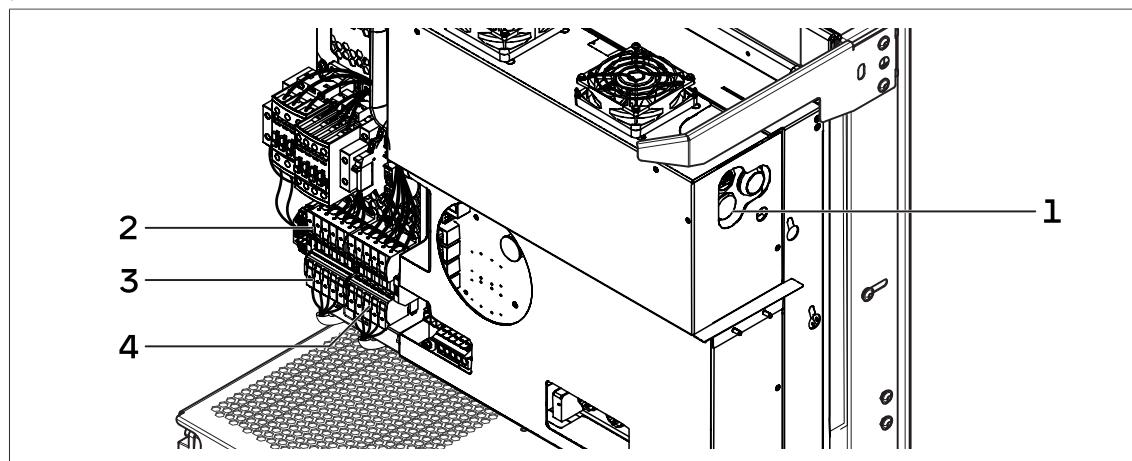
### INFO

Adding the emergency power function to the storage system allows the system, once installed, to be able to operate both with backup power and in an isolated network. These are functionalities that must be specified when a storage system is registered with a DNO.

→ Check whether the storage system data needs to be changed with the DNO or whether the system needs to be re-registered.

### 9.1 Components of the emergency power function

The emergency power function is made possible by additional components on the power module.



- 1 Illuminated switch on the switch panel
- 2 Switching relay Backup-Active
- 3 Supply line from the house distribution board
- 4 Line to the house circuit/backup circuit

## 9.2 Illuminated switch function

- The illumination of the illuminated switch indicates that the electrical consumers connected to the emergency power function are causing excessive power consumption.
- Backup operation is stopped when an overload is detected until there is no more overload and the illuminated switch has been pressed for approx. 2 seconds.

### When the illuminated switch lights up:

- Switch off electrical consumers or do not connect any electrical consumers if their power consumption exceeds the nominal power or (when switching on) the maximum power of the backup operation.
- Press the illuminated switch for approx. 2 seconds.
  - ⇒ Backup operation has started successfully when the illuminated switch no longer lights up.

### ⓘ INFO

In certain situations it may take up to three minutes for backup operation to start after the illuminated switch is pressed.

- Further information for specific situations can be found in section Troubleshooting [P. 97].

## 9.3 Additional parts required

- In addition to the materials specified in section Additional parts and tools required [P. 20], the following parts are required to install the emergency power function.
- The lines and circuit breakers required differ depending on the selected connection option and on whether this option is installed as an AC microgrid.

Lines, circuit breakers

Designation	Use	Specification
<b>Connection option 1 (backup power supplied to the entire on-site connection)</b>		
Residual current device (RCD)	Personal protection	<ul style="list-style-type: none"> <li>• Fuse protection for on-site connection during backup operation.</li> <li>• Nominal differential current: max. 300 mA</li> <li>• Type depends on local grid conditions.</li> <li>• Nominal current: max. 63 A<sup>6</sup></li> </ul>
Miniature circuit breaker (MCB)	Fault protection for on-site connection	
Miniature circuit breaker (MCB)	Fault protection for electrical generators (e.g. PV inverters) <i>(for AC microgrid only)</i>	<ul style="list-style-type: none"> <li>• Observe the manufacturer's specifications.</li> </ul>
Earth line	Earth connection for main earth bar	<ul style="list-style-type: none"> <li>• Cable cross-section: 10 mm<sup>2</sup> (CU cross-section)</li> </ul>
Plastic-sheathed cable	Connection of emergency power function to building mains	<ul style="list-style-type: none"> <li>• Type: 5×10mm<sup>2</sup> or 5×16mm<sup>2</sup></li> <li>• External diameter: 16 - 28 mm</li> <li>• Selection of type and length depends on local conditions</li> </ul>
Plastic-sheathed cable	Connection of electrical generators (e.g. PV inverters) <i>(for AC microgrid only)</i>	<ul style="list-style-type: none"> <li>• Observe the manufacturer's specifications.</li> </ul>

<sup>6</sup> Max. thermal throughput: 30 kW

Designation	Use	Specification
<b>Connection option 2 (backup power supplied to separate backup circuits)</b>		
Residual current device (RCD)	Personal protection	<ul style="list-style-type: none"> <li>Fuse protection for backup circuits during backup operation.</li> <li>Nominal differential current: max. 300 mA</li> <li>Type: depends on local grid conditions.</li> </ul>
Miniature circuit breaker (MCB)	Fault protection for sonnenProtect	<ul style="list-style-type: none"> <li>Tripping characteristic: B</li> <li>Nominal current: max. 63 A<sup>7</sup></li> </ul>
Miniature circuit breaker (MCB)	Fault protection for electrical generators (e.g. PV inverters) <i>(for AC microgrid only)</i>	<ul style="list-style-type: none"> <li>Observe the manufacturer's specifications.</li> </ul>
Earth line	Earth connection for main earth bar	<ul style="list-style-type: none"> <li>Cable cross-section: 10 mm<sup>2</sup> (CU cross-section)</li> </ul>
Plastic-sheathed cable	Connection of emergency power function in backup circuit	<ul style="list-style-type: none"> <li>Type: 5×10mm<sup>2</sup> or 5×16mm<sup>2</sup></li> <li>External diameter: 16–28 mm</li> <li>Selection of type and length depends on local conditions</li> </ul>
Plastic-sheathed cable	Connection of electrical generators (e.g. PV inverters) <i>(for AC microgrid only)</i>	<ul style="list-style-type: none"> <li>Observe the manufacturer's specifications.</li> </ul>
Additional electrical lines, circuit breakers and other components (e.g. distributor housing)	Creation of backup circuit(s)	<ul style="list-style-type: none"> <li>Depends on local conditions and the planned execution of the backup circuits.</li> </ul>

<sup>7</sup> Max. thermal throughput: 30 kW

## 9.4 Connecting the emergency power function

### ⚠ DANGER

#### Electrical work on the storage system and electrical distributor

Danger to life due to electrocution!

- Switch off the storage system to electrically isolate it.
- Disconnect the relevant electrical circuits.
- Secure against anyone switching on the device again.
- Wait five minutes so the capacitors can discharge.
- Check that the device is disconnected from the power supply.
- Only authorized electricians are permitted to carry out electrical work.

### ⚠ DANGER

#### Touch voltage in the event of a fault during emergency power supply operation

Danger to life due to electrocution!

- A selective RCD with a rated residual current of 300 mA must be installed downstream of the AC connection to the building mains/backup circuit (OUT). Rated residual currents of 100 mA or 30 mA are also possible. The type must be selected on site depending on the mains conditions.

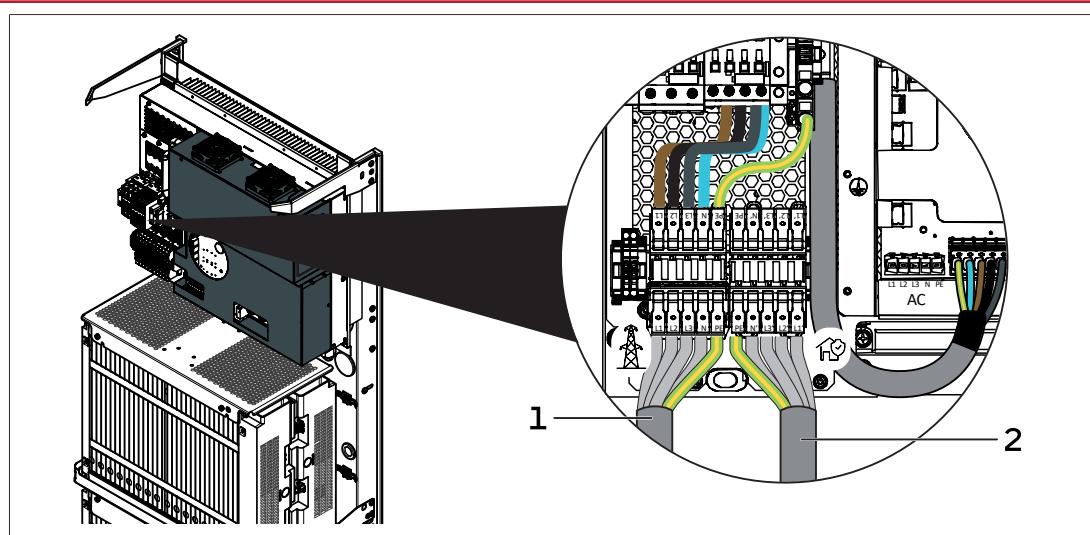


Illustration 18: Overview- Connection of emergency power function to power module

- 1 Connection of AC line from the mains (GRID)
- 2 Connection of AC line to house circuit or backup circuit (OUT)

#### Recommended order for the electrical installation

→ Carry out the steps in the following order to ensure a smooth electrical installation. Note that there are different procedures depending on the connection option used.

1. **For connection option 1:** Note section consumers in backup operation [P. 73] before starting the installation.

2. **For connection option 2:** Read sections consumers in backup operation [P. 73] and Implementing the backup circuit(s) [P. 74] and, together with the operator, define how the backup circuit or circuits are to be set up. The on-site circumstances must always be taken into account during this process, because with electrical installations where there are few separate circuits, it can be difficult to integrate all of the desired electrical consumers in the backup circuit or to integrate only the consumers which should be supplied with backup power.
3. Carry out the necessary revision work on the distributor in the building. It is essential to ensure that all electrical lines meet local and national regulations in terms of their dimensioning and that they are suitably fuse-protected (e.g. with a miniature circuit breaker (MCB)).
4. If the backup circuit or circuits are installed accordingly, the emergency power function can be connected to the storage system (see the following sections).
5. When all steps have been implemented and the electrical installation is complete, continue with section Commissioning the storage system with emergency power function [P. 80].

#### 9.4.1 Electrical consumers in backup operation

Prior to installation, the following points must be explained to or clarified with the operator by the electrician performing the installation:

- Backup operation does not offer the same output as grid operation.
- Electrical consumers can sometimes not be operated in backup operation (e.g. due to high switch-on currents).
- **How much capacity of the storage system should be reserved as an backup buffer?** The following example, in which a utility room and other important functions within a single-family home are to be supplied with power, can be used to determine this. This example is based on a grid outage lasting one hour (the individual power consumption values are estimated values).

Electrical consumer	Power consumption [kW]	Active during grid outage [h]	Electrical work [kWh]
Lighting	0.5	1	0.5
Freezer	0.6	0.25	0.15
Heating	0.7	0.25	0.175
Router, telephone	0.01	1	0.01
Refrigerator	0.6	0.25	0.15
Alarm system, grid-connected smoke detector	0.05	1	0.05
		<b>Total</b>	<b>1.04</b>

In this example, the total power requirement for a grid outage lasting one hour is approx. 1.1 kWh, which must be covered in order to maintain the function of all of the listed consumers.

- If connection option 2 is used, not all electrical consumers are supplied with power in backup operation. **Which electrical consumers should be supplied with power in backup operation?** The current paths in the building network must be installed in such a way that the consumers which are relevant in the event of a grid outage are connected to an independent circuit (backup circuit). The electrical consumers which are crucial for the electrical supply to the building in backup operation are relevant here.

#### 9.4.2 Implementing the backup circuit(s)

##### INFO

This section refers to the installation of backup circuits for **connection option 2**.

**Basics for the formation of the backup circuits:**

- For systems with backup power capability, the power distribution must be separated into backup power authorised and not backup power authorised parts.
- All components within the backup power authorised part must be clearly identified by lettering (or graphic symbols).

→ **At any time observe further local and national requirements and guidelines regarding backup power supply!**

When undertaking electrical work on the distributor in the building, the following must be taken into account, among other things:

1. How is the wiring set up to the desired backup consumers?
  - Is independent wiring already in place?
  - Do the existing circuits include electrical consumers that should not be supplied with power in backup operation?
  - Can the existing wiring be split?
  - If the circuits cannot be split, the connected wattage of the consumers which should not be supplied with backup power needs to be taken into account. If loads are too high, the circuit breaker for the emergency power function will trip, and then none of the electrical consumers in the backup circuit will be supplied with power.
2. Can the electrical distributor in the building be adapted to suit the new circumstances?
  - Is there enough space to install the necessary circuit breakers and other components in the distributor?

#### 9.4.3 Positioning components in the electrical distributor

The following components must be installed in the electrical distributor for the emergency power function:

- **Miniature circuit breaker (MCB)**

A circuit breaker (max. 63 A) must be installed at the input of the emergency power function (IN).

- **Residual current device (RCD)**

A residual current device (RCD) must be installed at the output of the emergency power function (OUT). This ensures protection against electric shock in the backup circuit. The residual current device (RCD) must comply with the respective country-specific regulations and local grid conditions.

- **Optional: Change over switch**

A change over switch (emergency power/mains) can be installed after the output of the emergency power function. This enables the emergency power function to be bypassed manually (e.g. for servicing), even by the operator. The selection must be made according to the respective connection variant, e.g. 'Diverter switch 1-0-2 (emergency power/mains), 4-pole (3+N), 63A'.

#### 9.4.4 Wiring the emergency power function

→ Connect the components to the power module and the other components in the electrical distribution board as shown in the following overview circuit diagrams (depending on the selected connection variant and type of power measurement!).

- The overview circuit diagrams each show the installation of the storage system with emergency power function **without AC Microgrid** and in a **three-phase grid**.

→ For installation with **AC microgrid**, see section Connecting an AC microgrid [P. 82].

- The grey areas mark the (installation of the) emergency power function.

**Measuring power when using a storage system with emergency power function:**

- The set-up shown in the circuit diagram overview [P. 76] for **connection option 1** follows the **consumption measurement** concept (standard measurement concept).

There are two ways of measuring power when implementing **connection option 2**:

- If the two power meters included in the scope of delivery are installed, the consumption in the house during backup operation is not explicitly recorded as consumption and displayed in the Internet portal. The emergency power function is not affected by this.
  - The set-up in the circuit diagram overview follows the **consumption measurement** concept with two EM357 power meters.
- If an additional power meter is installed (in addition to the scope of delivery), consumption is also recorded precisely during backup operation and displayed on the Internet portal. The additional power meter can be purchased from sonnen; see **Optional accessories** [P. 19].
  - The set-up in the circuit diagram overview [P. 78] follows the **consumption measurement** concept with two EM357 power meters and an additional WM271 power meter.

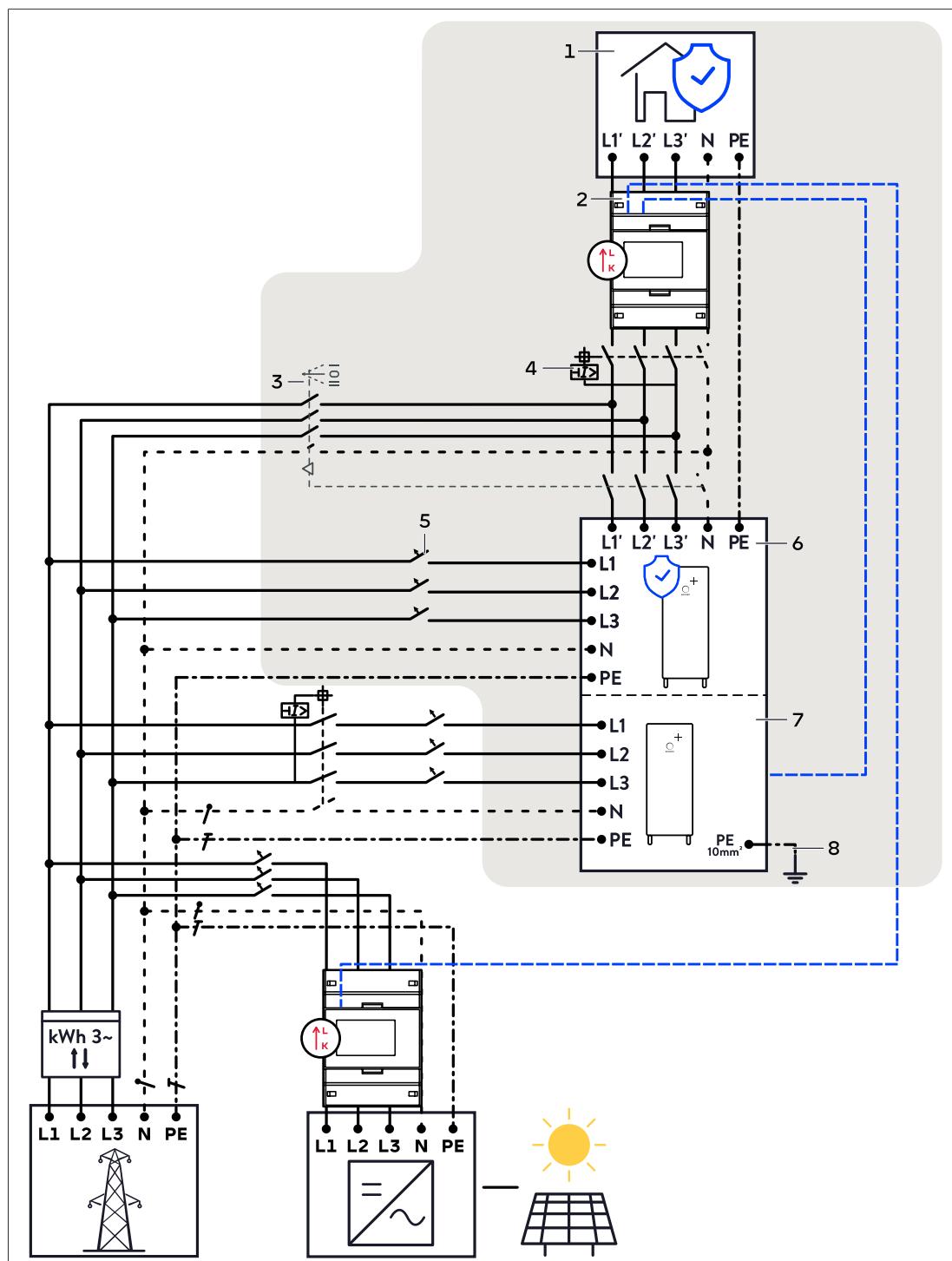


Illustration 19: Circuit diagram overview – sonnenBatterie 10 performance+ with emergency power function - Connection option 1

1 Consumers in building	5 MCB
2 Power meter EM357-EE	6 Storage system - emergency power function
3 Change over switch (optional)	7 Storage system
4 RCD	8 Earthing connection

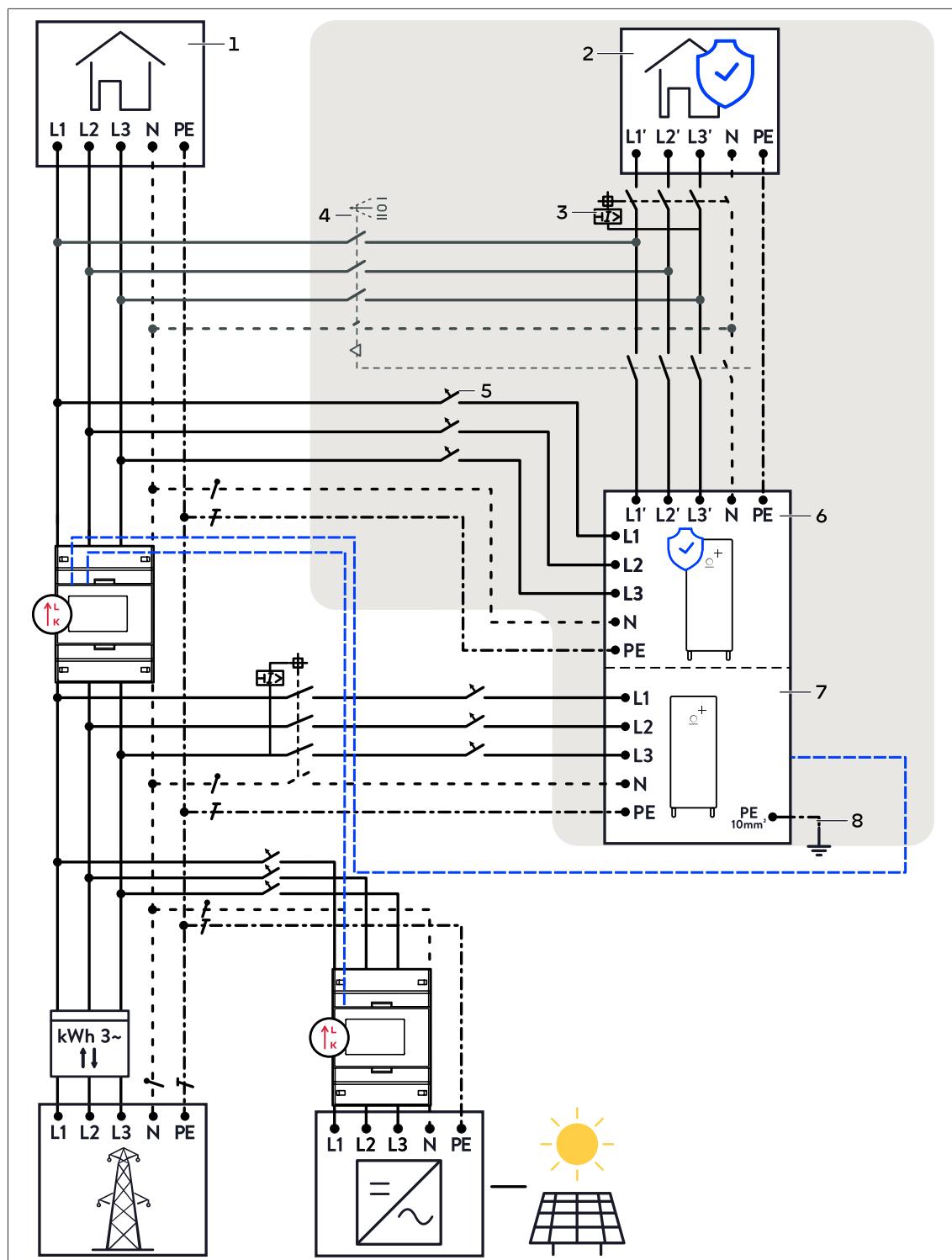


Illustration 20: Circuit diagram overview – sonnenBatterie 10 performance+ with emergency power function - Connection option 2 with two EM357 power meters (standard scope of delivery)

1 Consumers in building	5 MCB
2 Consumers in backup circuit	6 Storage system – emergency power function
3 RCD	7 Storage system
4 Change over switch (optional)	8 Earthing connection

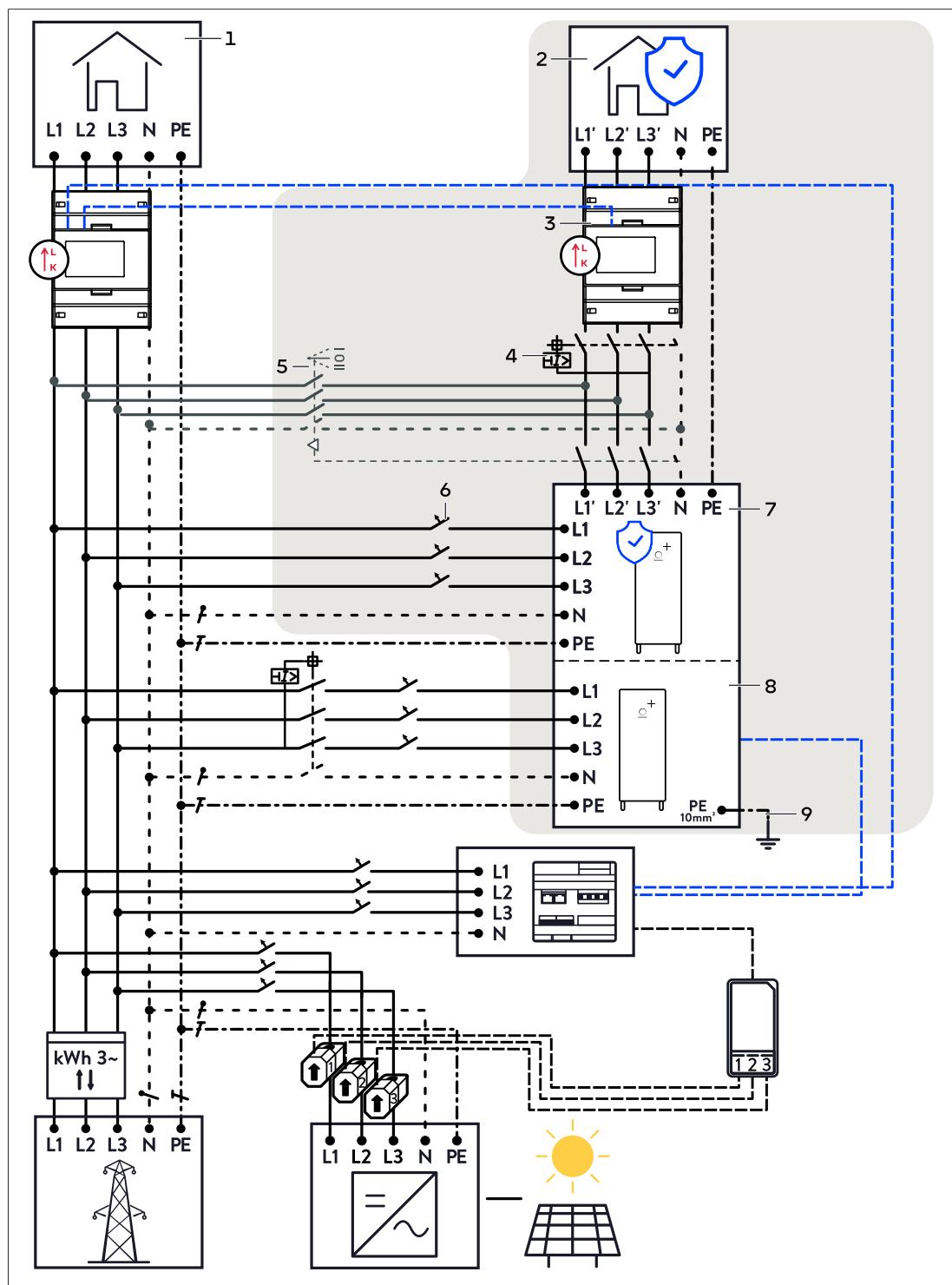
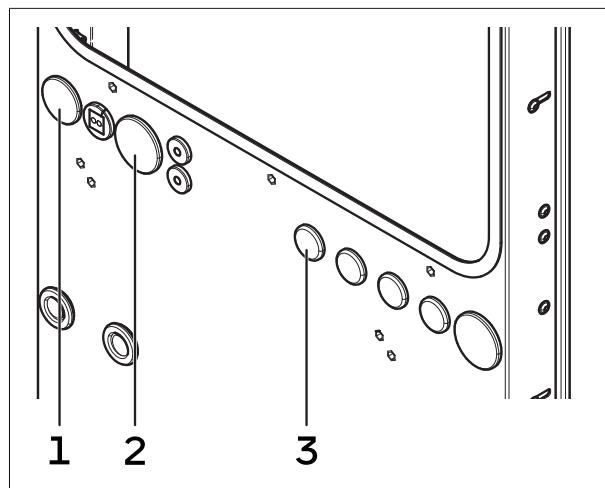


Illustration 21: Circuit diagram overview – sonnenBatterie 10 performance+ with emergency power function - Connection option 2 with two EM357 power meters and WM271 power meter

1 Consumers in building	6 MCB
2 Consumers in backup circuit	7 Storage system – emergency power function
3 Power meter EM357-EE-MOD	8 Storage system
4 RCD	9 Earthing connection
5 Change over switch (optional)	

#### 9.4.4.1 Connecting lines

##### Routing lines on the storage system



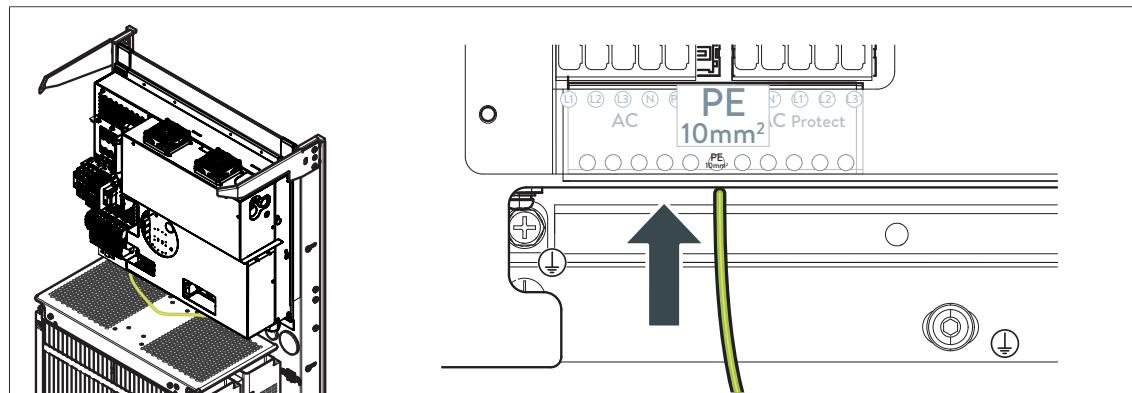
No.	Type	Use
1	Dummy plug Ø 40	AC line GRID
2	Dummy plug Ø 50	AC OUT
3	Dummy plug Ø 27,8	Earthing line 10 mm <sup>2</sup>

**INFO**

Correct assembly must be observed when inserting the grommets into the cable entry plates. The flat side of the grommet must always be facing the flat side in the cutout of the cable entry plate.

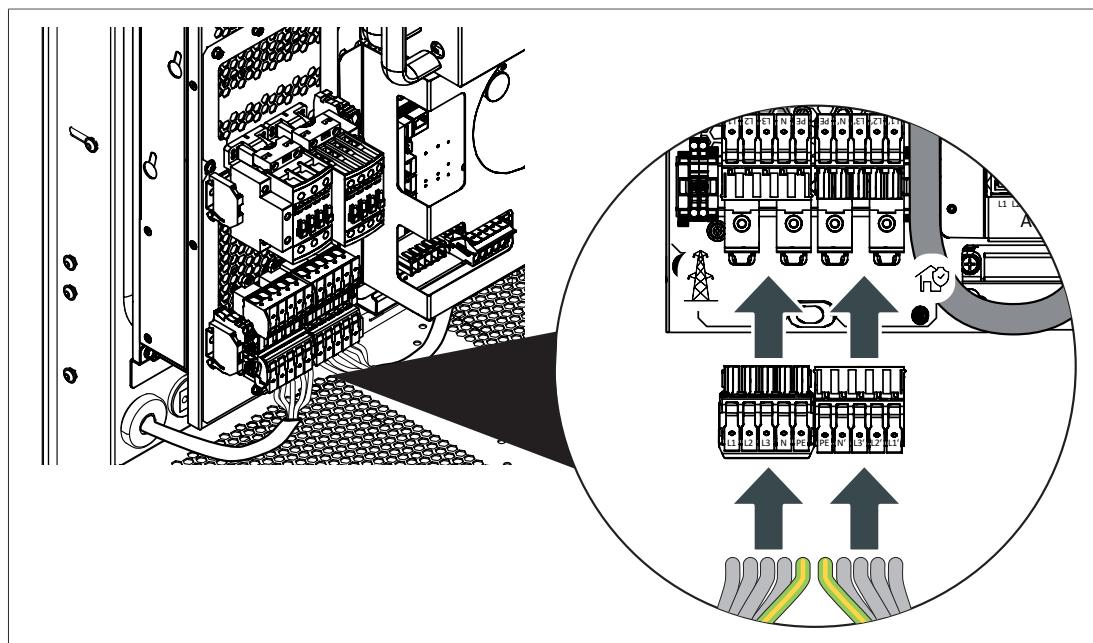
##### Connecting the earthing line

- An earthing conductor with a cross-section of 10 mm<sup>2</sup> (CU cross-section) must be installed between the storage system and the main earthing terminal.



- Connect the earthing line to the central unit of the storage system (PE 10 mm<sup>2</sup>).
- Connect the earthing line to the main earthing terminal of the building.

### Connecting the AC line



- Connect the AC line from the building mains to the central unit using the left-hand pre-assembled plug (GRID).
- Connect the AC line to the building mains/backup circuit to the central unit using the right-hand pre-assembled plug (OUT).

#### 9.4.5 Attaching safety label to the distributor

##### **DANGER**

##### Electrical installation remains live in event of grid outage

Danger to life due to electrocution!

To warn electricians:

- Attach the safety label shown below (included in scope of delivery) to the relevant electrical distributor.

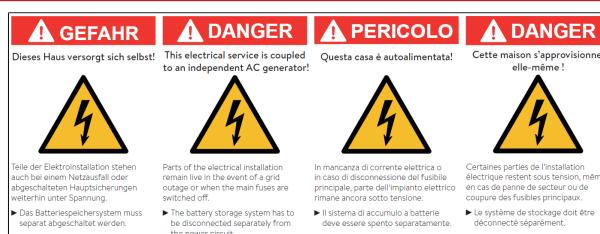
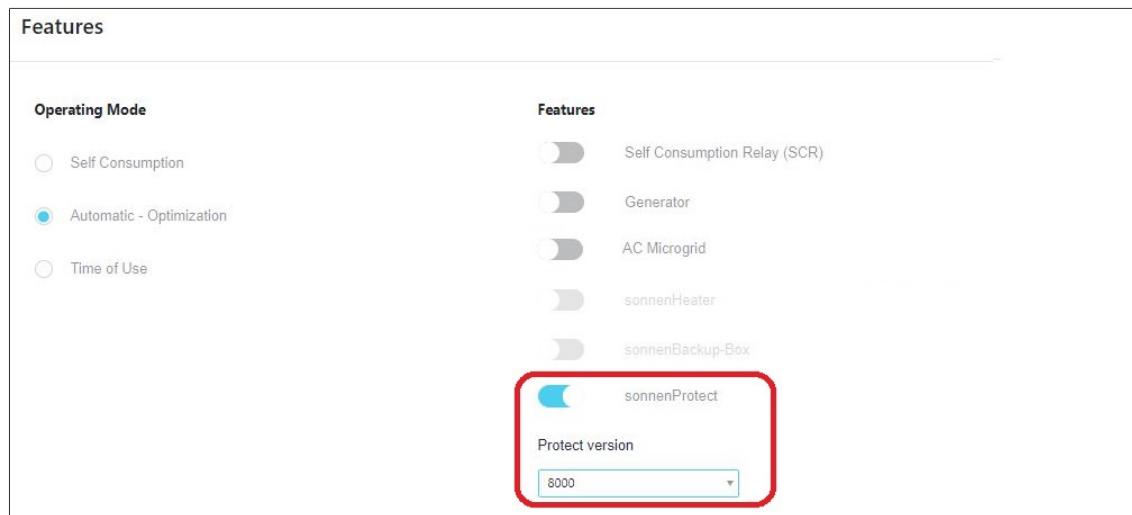


Illustration 22: Label for attachment to the electrical distributor

#### 9.5 Commissioning the storage system with emergency power function

- The emergency power function is activated as soon as the storage system has been properly commissioned (see Carrying out first-time commissioning [P. 92]) and switched on (see Switching the storage system on [P. 92]).

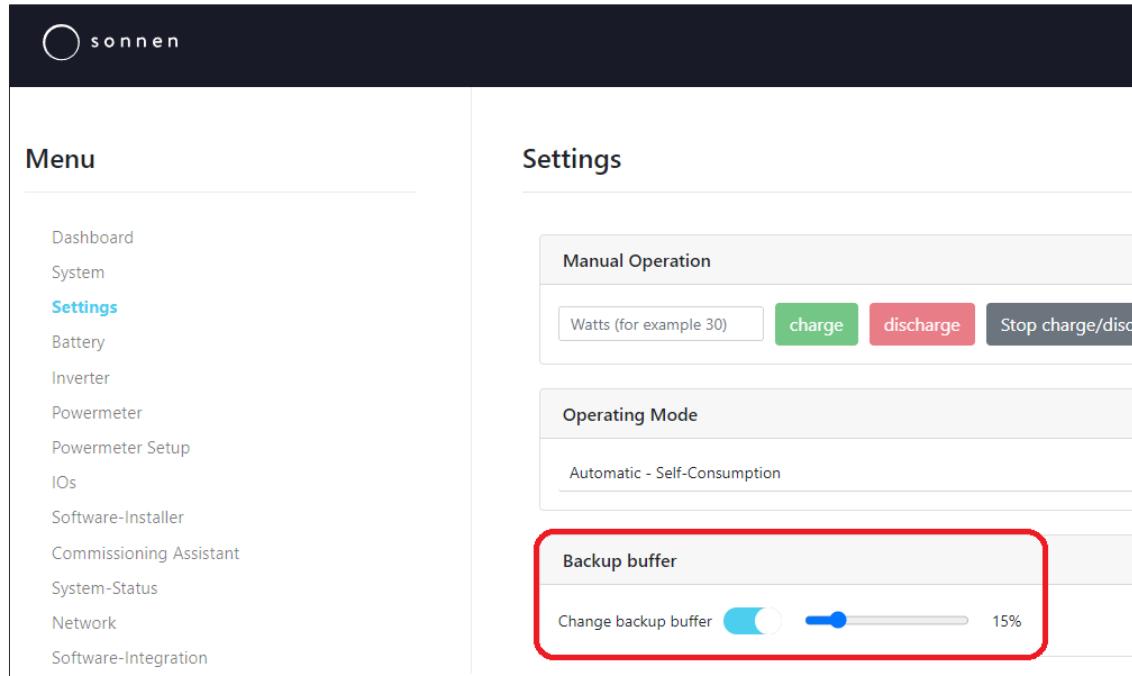


→ Activate the emergency power function (referred to as sonnenProtect 8000) at the appropriate point during the CA (see Commissioning assistant [P. 92]). The backup buffer can also be set there.

### 9.5.1 Setting the backup buffer

Proceed as follows to set what percentage of the capacity of the storage system should be available for the emergency power function in the event of a grid outage.

- On the web interface of the storage system, navigate to the Settings page.
- Change the percentage for Backup buffer to a desired value.



### 9.5.2 Testing backup/standalone operation

#### INFO

Backup operation cannot be tested if the storage system performs a full charge after initial commissioning. The full charge can be stopped to perform the test and postponed to a later time (on the Dashboard page of the storage system web interface).

### 1. Simulate a grid outage

Switch the main fuses in the building off, so that the synonym and storage system are no longer connected to the public electricity grid. The storage system switches to backup operation after switching off the fuses.

### 2. Activate a consumer

→ Activate an electrical consumer connected to one of the three phases in the building (for connection option 1) or to the backup circuit (for connection option 2).

### 3. Switch on the PV inverter (with AC microgrid)

→ Check whether the PV inverter switches on after a short time.

### 4. Test the backup supply

Backup/standalone operation (with AC microgrid) is working properly when the activated consumers are supplied with electrical power.

If the backup operation does not work:

1. Check the electrical wiring (see Connecting the emergency power function [P. 72]).
2. Check if there is a malfunction which is mentioned in the Troubleshooting [P. 97] section and follow the suggestions for rectification.
3. Contact the sonnen service team if the problem cannot be resolved.

## 9.6 Decommissioning the storage system with emergency power function

The emergency power function is switched off together with the storage system (see Switching the storage system off [P. 95]).

To be able to work safely on the storage system, all components in the storage system must be de-energised:

1. Disconnect the storage system from the power supply. [P. 95]
2. Switch off the miniature circuit breaker in the mains line and in the PV inverter supply line (with AC microgrid).
3. Take steps to ensure that these switches cannot be switched on again.
4. Carefully check that there is no voltage inside the storage system.

## 9.7 Connecting AC microgrid (optional)

When certain prerequisites are met, the **storage system with emergency power function** can form an 'off-the-grid' standalone power system together with an external electrical generator. The PV inverter of a PV system is used in the following example as the external electrical generator.

In standalone operation, electrical power can be produced by the PV inverter off the grid, then stored in the battery modules of the storage system and provided to the building. The batteries are charged and discharged based on the requirements of the connected electrical consumers.

### Automatic stop and start of standalone operation

The storage system continues to provide electrical power to the consumers until a minimum battery charging status is reached and there is no (or no sufficient) PV generation. From this point on, no further discharge is allowed, and the backup operation stops completely.

The storage system tries to restore standalone operation at predefined restart times by checking whether there is sufficient PV production to supply the active electrical consumers with power.

To increase the possibility of standalone operation restarting, there should be as few electrical consumers in the building at the restart time(s) as possible. Therefore:

→ Do not switch on any electrical consumers with high power consumption (e.g. heating, lighting, pumps, compressors).

### Overload protection through frequency shift

To ensure that the standalone operation is not switched off as battery modules are getting full and cannot take the pv surplus energy anymore, the storage system inverter increases the frequency from 50 Hz to 52.2 Hz when the state of charge (SOC) reaches a level greater than or equal to 91 %.

The PV inverter detects this frequency increase and stops production and therefore charging of the storage system battery modules. The electrical consumers in the building are supplied with power from the storage system battery modules from this point in time.

The frequency is reset to 50 Hz and production starts up again when the state of charge of the battery modules drops below 85 % and standalone operation is active again.

## 9.7.1 PV system as an electrical generator

### 9.7.1.1 Requirements for the PV inverter

#### ⓘ INFO

The PV inverter should have a maximum output of 8 kW or 7 kW (with sonnenBatterie 10p+/11). If the output is higher, a power limit must be implemented in standalone operation, e.g. using a relay; see Power reduction for PV inverter with output > 8 kW.

#### PV inverter with up to 8 kW output:

- Meets currently applicable grid codes (VDE-AR-N 4105, Technical and organisation rules for generators (TOR-Erzeuger))
- Mains connection detection via mains frequency shift

#### Additional requirements for PV inverter with 8-25 kW output:

- Digital inputs for power reduction.
- Check of renewable energy surcharge requirement / meter concept. Meter concept: storage system with emergency power function sits between PV production meter and feed-in point.

### 9.7.1.2 Connecting the PV inverter

The PV inverter is connected as an electrical generator in the building's network (with connection option 1) or in the backup circuit (with connection option 2); see wiring AC microgrid [P. 85].

→ Connect the PV inverter and a MCB (if required, also a RCD) according to the specifications of the PV inverter manufacturer. Country-specific requirements must be observed at all times.

### 9.7.1.3 Power reduction for PV inverter with output > 8 kW

To ensure the correct function of the AC microgrid, the AC output of the PV inverter must not exceed the power input of the storage system (7 kW for sB10p+/11, 8 kW for sB10p+/22 or higher). This means that the power output of the PV inverter must be adapted to the nominal power of the storage system.

If the output power of the PV inverter is greater than the nominal power of the storage system, the output power of the PV inverter must be statically reduced during standalone operation. The switching relay integrated in the emergency power components (**Backup-Active**) is used for this purpose. In addition, the PV inverter must have a suitable interface for power control (e. g. an interface for a ripple control receiver).

#### Function

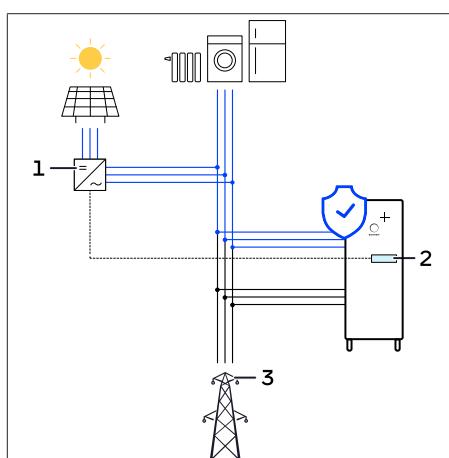


Illustration 23: AC microgrid concept with power reduction (for emergency power function with connection option 1)

In grid operation, the potential-free contact (2) is open, there is no reduction signal at the PV inverter (1).

If the public electricity grid (3) fails and the AC microgrid is activated by the storage system, the **Backup-Active** contact is closed and the PV inverter can reduce to the set power.

#### Option 1: PV power reduction via storage system

If the storage system is already connected to the PV inverter (for power limit at 70%), the signal line for the corresponding PV reduction level can be connected in parallel via the break contact on the relay.

- Select the contact on the PV inverter, which is connected to the right PV reduction level, for connecting the relay.
- Connect the relay in parallel to the PV reduction inputs already connected.

If the reduction levels are set in accordance with sonnen specifications (see Implementing PV reduction [P. 60]), the PV output is reduced based on the following levels:

Level	Maximum active power (at 70% limit)
0	100% of PV system power
1	Feed-in limit of PV system in % plus 10 (80%)
2	Feed-in limit of PV system in % minus 15 (55%)
3	0%

#### Option 2: PV power reduction with fixed reduction levels

The storage system is not connected to the PV inverter for PV reduction. An external data logger / wireless ripple control receiver limits the power to 70% via PV reduction contacts (permanently set levels on the inverter).

First you need to determine which reduction levels correspond to the reduction contacts. It is a good idea to use the reduction contact that permits the inverter to have a power output of up to 8 kW but ensures that 8 kW is not exceeded.

### Example

- Inverter power output: 12 kW
- External data logger with four contacts / reduction levels:
  - Reduction level 1: 90% = 10.8 kW
  - Reduction level 2: 75% = 9 kW
  - Reduction level 3: 65% = 7.8 kW
  - Reduction level 4: 50% = 6 kW

In this case the break contacts of the relay should be connected to contact 3 of the inverter because reduction levels 1 and 2 do not reduce the power output enough and reduction level 4 reduces the power output too much.

### Option 3: PV power reduction with freely programmable reduction levels

The storage system is not connected to the PV inverter for PV reduction.

If the PV inverter has a free reduction contact and this contact is freely programmable, this contact can be used for PV reduction. To this end the potential-free break contacts of the relay are connected to the free input on the PV inverter. Any power value can then be set as a percentage on the PV inverter.

### Example

If the PV inverter has a power output of 12 kW, the reduction contact can be set to 66%. The PV inverter then feeds in a maximum of 7.920 W in standalone operation.

## 9.7.2 Wiring an AC microgrid

- Connect the storage system, the emergency power function and other components in the electrical distributor as shown in the following circuit diagram overviews (based on selected connection option and type of power measurement).
- The circuit diagram overviews each show the installation of a sonnenBatterie 10 performance+ with emergency power function **with AC microgrid for three-phase building mains**.
- The power measurement follows the **consumption measurement concept**.
- In the circuit diagram overview for connection option 1 [P. 86], only **one electrical generator** (PV system) is connected. In the circuit diagram overview for connection option 2 [P. 87], production is measured for **two electrical generators** (PV systems) using **two different power meter types**.

### Measuring power when using a storage system with emergency power function and AC microgrid

- The power meters, which measure the energy flows in standalone operation, must be connected so that they are supplied with voltage even in the event of a grid outage.
- If there is more than one generator or consumer path, an additional power meter must be installed to measure the power, as one measuring point can be recorded for each EM357 power meter.
- The consumption measurement concept is recommended as standard for measuring power with emergency power function with AC microgrid.

**INFO**

Further information on power measurement and the power meter can be found in the power meter instructions<sup>8</sup>. These instructions explain, among other things, the different measurement concepts and how to use multiple power meters.

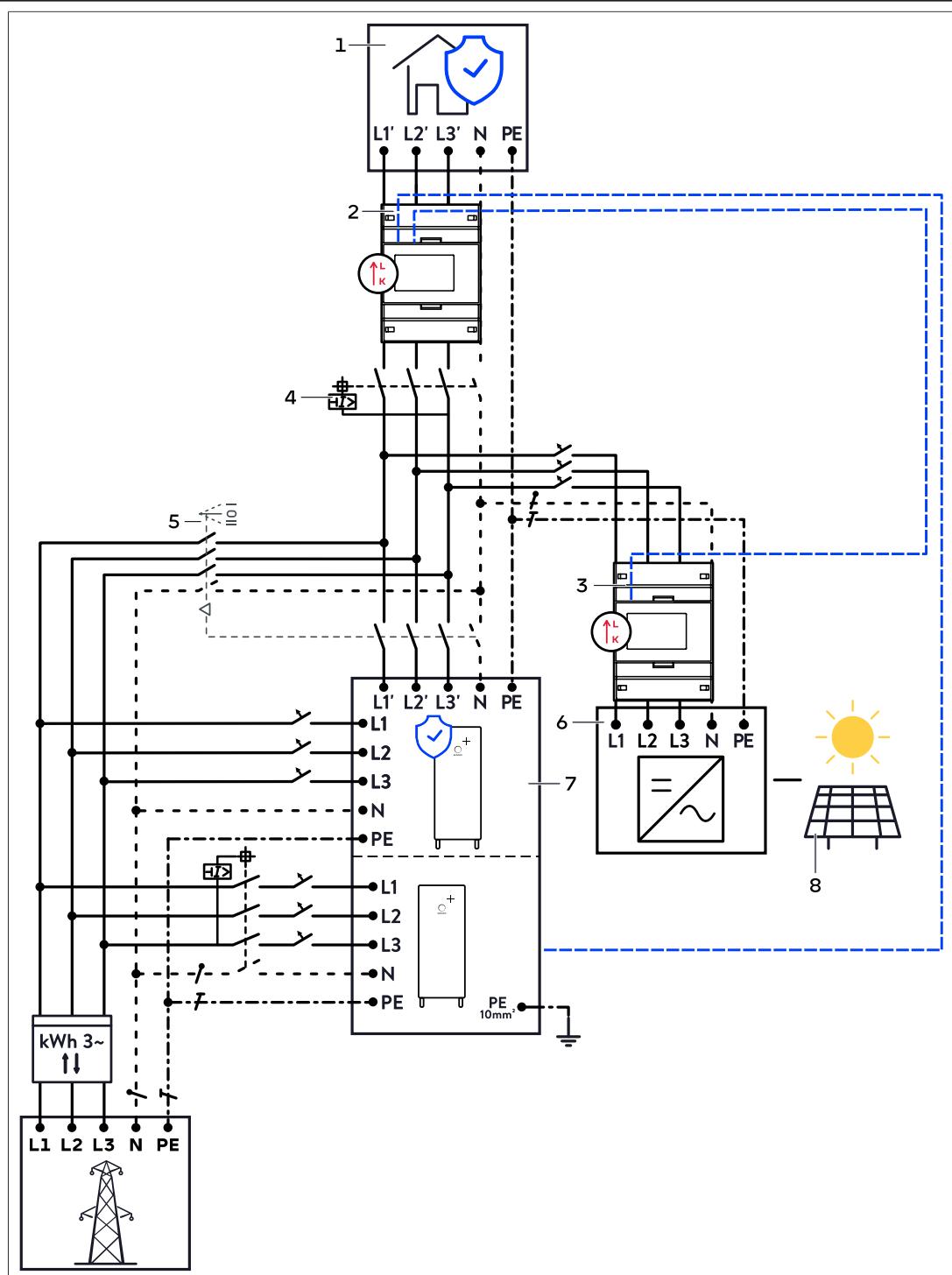


Illustration 24: Circuit diagram overview – sonnenBatterie 10 performance+ with emergency power function - Connection option 1 with AC microgrid

- 1 Consumer in building
- 2 Power meter EM357, Consumption measurement
- 3 Power meter EM357, Production measurement
- 4 RCD

<sup>8</sup> Document number: 300

- 5 Change over switch (optional)
- 6 PV inverter (1- or 3-phase, max. 25 kW)
- 7 Storage system - Emergency power function
- 8 PV system

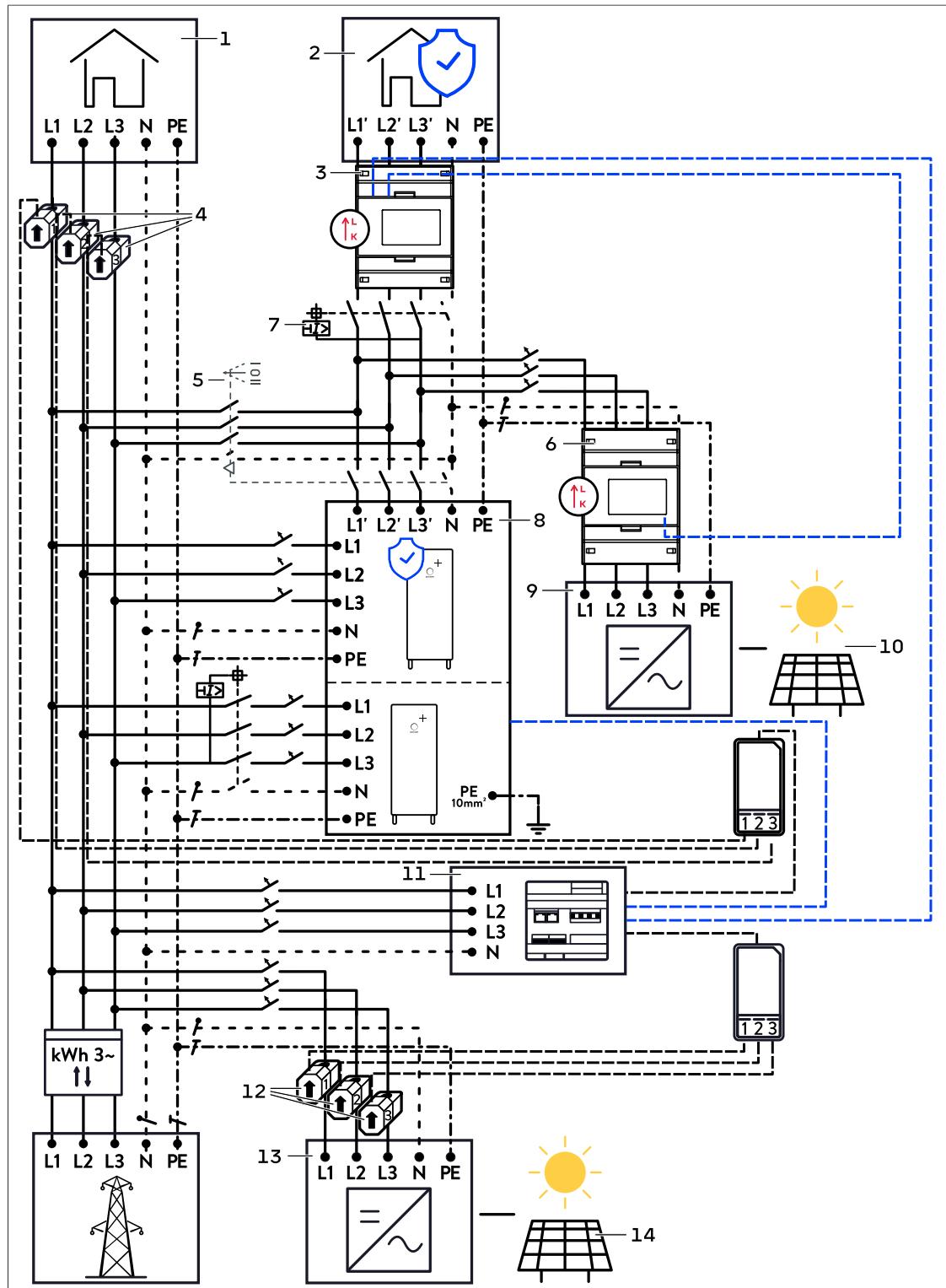


Illustration 25: Circuit diagram overview - sonnenBatterie 10 performance+ with emergency power function - Connection option 2 with AC microgrid

1 Consumer in building	8 Storage system - Emergency power function
2 Consumer in backup circuit	9 PV inverter AC microgrid
3 Power meter EM357, Consumption	(1- or 3-phase, max. 25 kW)

in backup circuit measurement	10 PV system AC microgrid
4 CT for Consumption	11 Power meter WM271
5 Change over switch (optional)	12 1 or 3 CT for Production
6 Power meter EM357, Production measurement AC microgrid	(depending on pv inverter)
7 RCD	13 PV inverter (1- or 3-phase)
	14 Additional pv system (optional)

### 9.7.3 Setting up an AC microgrid

- Standalone operation can be activated when setting up the emergency power function (see Commissioning the storage system with emergency power function [P. 80]).

AC Microgrid	
<input checked="" type="checkbox"/>	AC Microgrid
Reenabling time One	System-Time 09:00
09:00	09:00
Reenabling time Two	System-Time 10:00
10:00	10:00
Reenabling time Three	System-Time 11:00
11:00	11:00
<b>save</b>	

→ Activate the Microgrid.

The Reenabling time determines the times at which the storage system tries to restore standalone operation using PV system production after standalone operation has been stopped because there was no PV production and the batteries had reached their minimum state of charge.

→ Define the Reenabling time. In doing so, consider the PV system setup (e.g. its orientation, shading, etc.) and the PV production to be expected as a result.

### 9.7.4 Testing standalone operation

→ Perform the steps described in section Testing backup/standalone operation [P. 81] to test backup operation with AC microgrid.

## 9.8 Alternative: Installation of a sonnenProtect 8000

If a sonnenProtect 8000 is to be installed instead of the internal emergency power function of the storage system, the internal emergency power function must be deactivated. To do this, the control line and the AC line of the internal emergency power function must be disconnected.

The sonnenProtect 8000 must be connected and installed as described in the installation instructions for the sonnenBatterie 10 performance (Chapter 9 in document KD-640: <https://documents.sonnen.de/s/manual-sB10-p-en>).

## 10 Completing installation

### 10.1 Filling in the type plate

**Tools:**

- Permanent marker

**INFO**

The energy capacity marked on the type plate always refers to the total energy installed in the storage system and extension cabinet, if any.

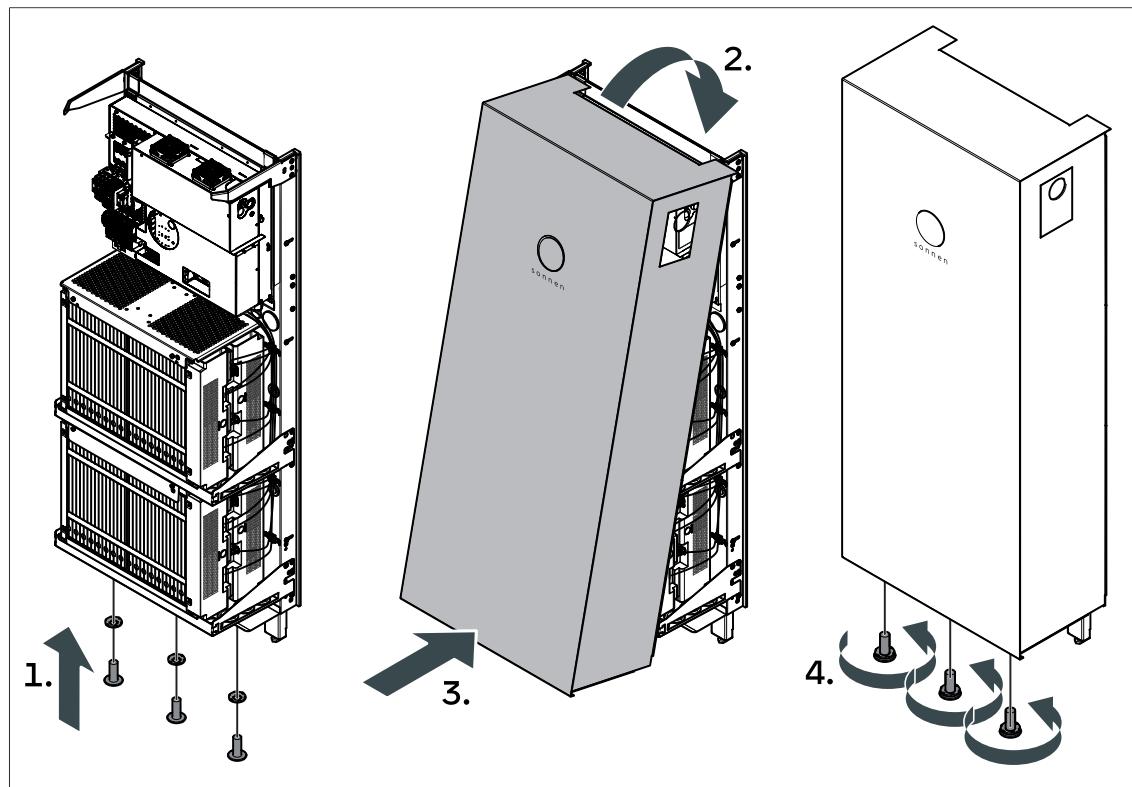
The possible battery capacities with the associated nominal power values can be found in section Technical data [P. 101].

→ Mark the installed battery capacity on the type plate, which is affixed to the switch panel of the storage system.

### 10.2 Attaching and earthing the cover

- The earth connection between the cover and mounting frame is established via the screw connection.
- The inspection window and sonnen Eclipse have protective film on the inside and outside.

→ Remove all protective film before mounting the cover.



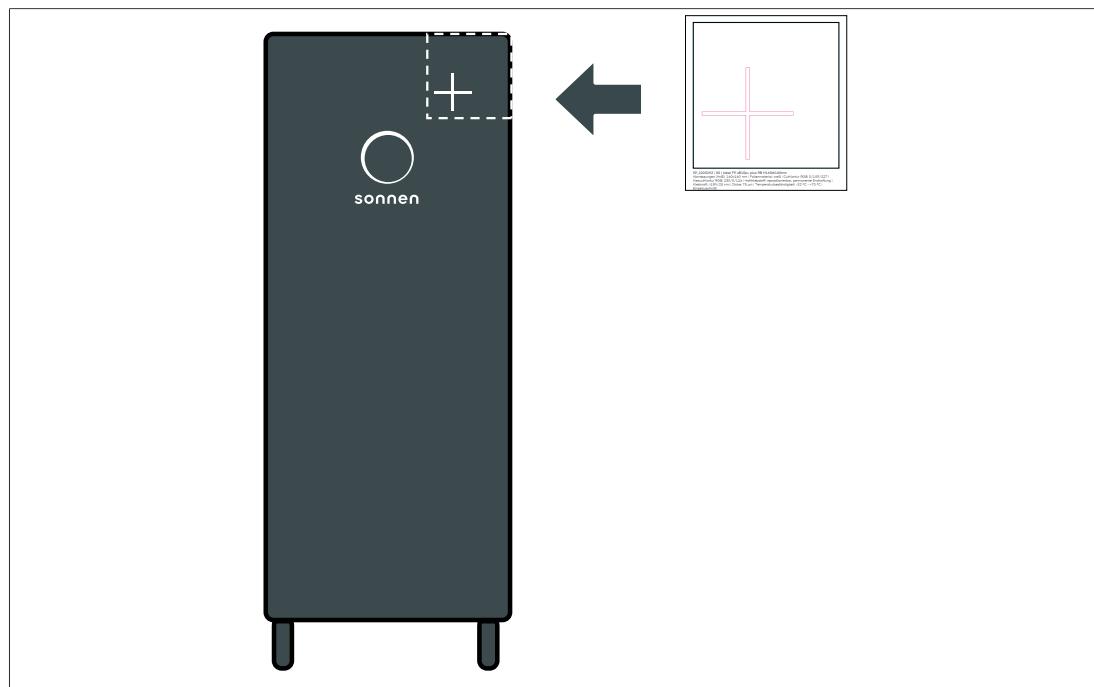
→ Use three screws with contact discs from the installation equipment pack to secure and earth the cover.

→ Tilt the cover forward when lifting it, so it can be hung on the mounting frame.

→ Centre and then hang the cover on the mounting frame. **WARNING! Do not kink or crush any cables between the cover and the mounting frame.**

→ Tighten the screws with a torque of 8 Nm.

### 10.3 Attach the label to the cover



Apply the ‘+’ label from the accessory kit to the front of the cover:

- Ensure that the adhesive surface is free of any dirt or clean thoroughly.
- Brush vigorously over the surface of the label to strengthen the adhesion between the label and the transfer film.
- Separate the transfer film with the label from the backing paper.
- Position the transfer film straight at the top right-hand corner of the bonnet and press the label firmly.
- Finally, carefully peel off the transfer film so that the label remains on the cover.

### 10.4 Attaching the switch cover

#### ⓘ INFO

The specified degree of protection for the storage system and therefore touch protection and protection against the ingress of foreign bodies is only achieved when the switch cover of the storage system is mounted.

- Mount the switch cover from the accessory kit onto the inspection window on the cover.

### 10.5 Checking the installation

- Use the following criteria to check whether the installation has been performed correctly and is complete.
- Only commission the storage system for the first time after first ensuring that the criteria have been successfully met.
  1. **Component earthing:**
    - The feet are secured to the mounting frame using contact discs. All screws have been tightened with the correct torque.
    - The individual components are mounted correctly on the mounting frame. All screws have been tightened with the correct torque.

2. **Line routing:**
  - All of the lines going into the storage system have been routed through the appropriate cable entry points.
  - All other openings have been sealed with the corresponding dummy plugs.
3. **Cover mounting:**
  - The cover is form-fitted to the mounting frame.
  - The earth connection for the cover has been correctly established using screws and contact discs.
  - The switch cover has been correctly attached to the inspection window.
4. **Electrical connections:**
  - The mains line is properly connected and the necessary safety devices (miniature circuit breaker and residual current device) are installed. The components are connected in such a way that a clockwise phase sequence is achieved.
  - The battery lines and communication lines for the battery modules are connected correctly.
  - The connection to the power meter and the connection to the internet have been correctly established. The electrical connection of the power meter is protected with a miniature circuit breaker according to specifications.
5. **Completed type plate:**
  - The required information is marked on the type plate.
6. **Emergency power function (optional):**
  - All lines are completely and correctly connected.
  - The safety devices required for the selected connection option (miniature circuit breakers and residual current devices) are installed.
  - The electrical lines meet the requirements of all local and national guidelines for line dimensions.
  - The additional earth connection between the storage system and the main earthing terminal is in place and has a cross-section of 10 mm<sup>2</sup> (CU cross-section or equivalent).

Table 6: Installation checklist

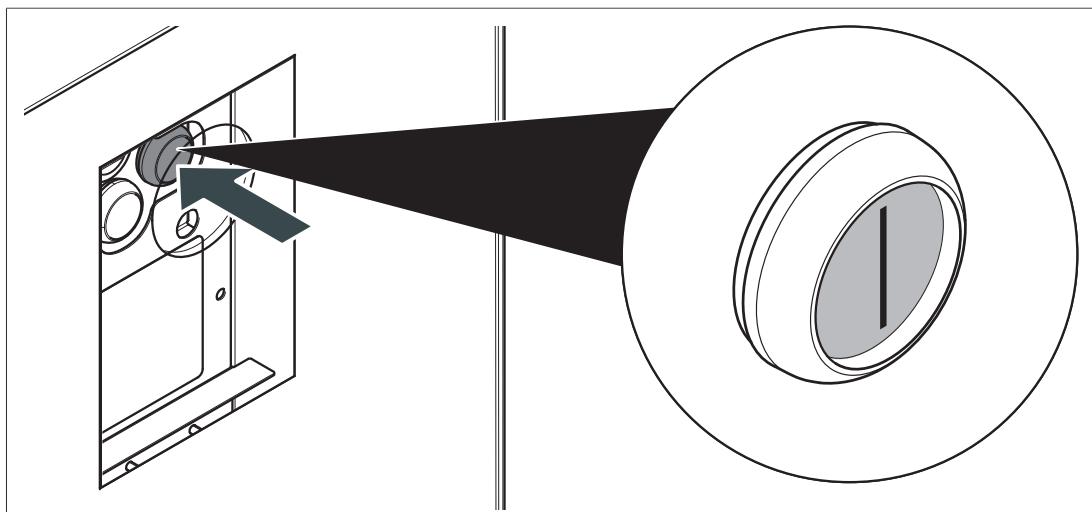
## 11 Commissioning

### 11.1 Switching the storage system on

#### ⓘ INFO

The storage system can only be switched on if the public grid voltage has been switched on first.

1. Switch on the grid voltage using the miniature circuit breaker for the mains line.
2. Remove the switch cover on the inspection window of the switch panel.



3. Press the ON/OFF switch so it clicks into the **ON (I)** position.
4. Reattach the switch cover to the inspection window.

The storage system then starts and runs a self-test. Once the self-test is successful, the storage system is ready to operate.

When the storage system is in normal operation, the sonnen Eclipse pulses white. The other operating statuses and the associated indications of the sonnen Eclipse are described in section Troubleshooting [P. 97].

### 11.2 Carrying out first-time commissioning

First-time commissioning must be carried out when the storage system has been installed, set up and connected for the first time.

#### 11.2.1 Commissioning assistant

#### ⓘ INFO

The storage system is only ready for operation if the commissioning assistant is fully completed.

##### Conditions:

- ✓ Storage system installation is complete.
- ✓ The storage system is switched on (see Switching the storage system on [P. 92]).

→ The commissioning assistant is used to set up the storage system, whereby the following data is recorded and settings configured:

- Check the installed software version and update if necessary.
- Record the operator's customer information.
- Configure the notifications.

- Select the country code for the inverter.
- Provide details on the PV system.
- Select the power measurement concept and configure power measurement.
- Perform a system test.
- Confirmation of the information by the installing electrician and the operator. Subsequent sending of a confirmation to the operator by e-mail.

### 11.2.1.1 Establishing connection to the storage system

→ Connect your laptop/PC to the router of the home network to which the storage system is also connected.

### 11.2.1.2 Running the commissioning assistant

→ Navigate to the following internet address: <https://finde-meine.sonnenbatterie.de>

The following window appears:



→ Select the storage system to be configured and click on the Configure Assistant button.

→ Log in as the **Installer**.

Use the initial password the first time you log in. This password can be found on the type plate of the storage system.

→ Assign an individual password for the storage system after you have logged in successfully using the initial password.

#### INFO

Contact the sonnen service team if you have forgotten the individually assigned password or need to reset the password for another reason.

→ Run the commissioning assistant until it is fully completed.

If the storage system is not displayed:

→ Follow the instructions in section Troubleshooting [P. 97].

## 12 Decommissioning

### 12.1 Switching the storage system off

#### NOTICE

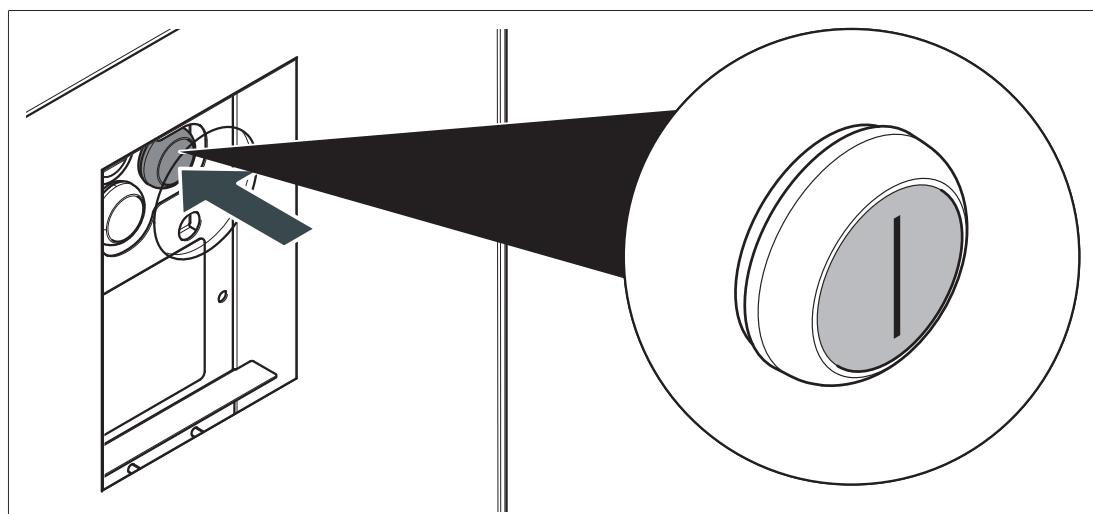
#### Deep-discharge of the battery modules

Destruction of the battery modules!

- Do not disconnect the storage system from the public electricity grid for long periods of time (see Storing the battery modules [P. 12]).
- Never continue to operate battery modules which have been deep-discharged.

#### INFO

If the **storage system** is installed with **emergency power function**, switching off the miniature circuit breaker de-energizes the entire house or all connected backup power circuits.



1. Remove the switch cover on the inspection window of the switch panel.
2. Press the ON/OFF switch. The sonnen Eclipse switches off.
3. Switch off the grid voltage using the miniature circuit breaker for the mains line.
4. Reattach the switch cover to the inspection window.

The storage system must be disconnected from the power [P. 95] before any work is carried out!

## 12.2 Switching the storage system off to electrically isolate it

### DANGER

#### High battery voltage (> 200 V)

Danger to life due to electrocution!

When battery lines are connected, the central unit always carries the voltage of the battery modules, even if the storage system and mains voltage are switched off.

To disconnect the battery voltage from the central unit:

→ Unplug the battery lines from **all** battery modules.

### INFO

If the **storage system** is installed with **emergency power function**, switching off the miniature circuit breaker de-energizes the entire house or all connected backup power circuits.

Before working on the **storage system** it must be completely switched off to be electrically isolated.

1. Remove the switch cover on the inspection window of the switch panel.
2. Press the ON/OFF switch. The sonnen Eclipse switches off.
3. Reattach the switch cover to the inspection window.
4. Switch off the grid voltage using the miniature circuit breaker for the mains line.
5. Take steps to ensure that these switches cannot be switched on again.
6. Wait at least five minutes until the internally stored energy in the inverter has fully discharged.

## 13 Uninstallation and disposal

### 13.1 Uninstallation

#### **⚠ DANGER**

#### Improper uninstallation of the storage system

Danger to life due to electrocution!

- The storage system must only be uninstalled by authorised electricians.

### 13.2 Disposal

#### **⚠ CAUTION**

#### Improper transport of battery modules

Fire outbreak at battery modules or emission of toxic substances!

- Only transport battery modules in packaging that meets applicable regulations.
- Only transport damaged battery modules in accordance with the applicable regulations.

The storage system and the batteries it contains **must not** be disposed of as domestic waste!

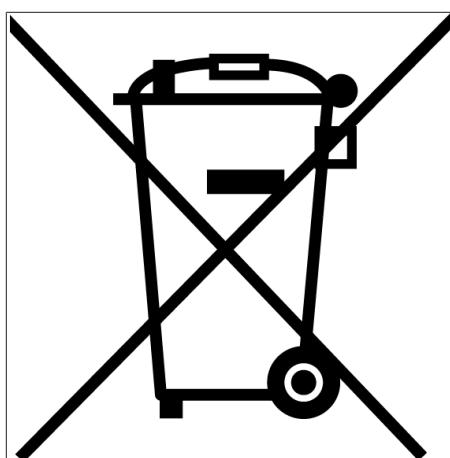


Illustration 26: WEEE symbol

→ Dispose of the storage system and the batteries it contains in an environmentally friendly way through suitable collection systems.

→ Contact sonnen GmbH to dispose of old batteries.

In accordance with the German Battery Act (BattG 2009), sonnen GmbH will accept old batteries free of charge. Please note that the cost of transporting old batteries is not covered.

## 14 Troubleshooting

### 14.1 sonnenBatterie 10 performance+

Fault	Possible cause(s)	Solution
The sonnen Eclipse of the storage system pulses white.	The storage system is in normal operation.	No troubleshooting necessary.
The sonnen Eclipse of the storage system pulses continuously green or pulses green and turns off after about 5 minutes.	The storage system is not connected to the public electricity grid.	<ul style="list-style-type: none"> <li>→ Check that the circuit breaker in the supply line of the storage system is switched on.</li> </ul> <p>If so:</p> <ul style="list-style-type: none"> <li>The public electricity grid does not provide any electrical energy (grid outage).</li> <li>→ It can only be waited until the public electricity grid supplies energy again. Thereafter, the storage systems resumes normal operation.</li> </ul>
The sonnen Eclipse of the storage system pulses orange.	The internet connection to the storage system has been interrupted.	<ul style="list-style-type: none"> <li>→ Check whether the home network router is able to establish an internet connection.</li> </ul> <p>If so:</p> <ul style="list-style-type: none"> <li>→ Ensure that the network line for the storage system is connected to the home network router.</li> </ul>
The sonnen Eclipse of the storage system lights up red.	<p>There is no clockwise phase sequence on the storage system.</p> <p>The storage system has detected a problem that is preventing normal operation or may cause damage to the storage system.</p>	<ul style="list-style-type: none"> <li>→ Check whether there is a clockwise phase sequence on the AC connection (mains line) of the storage system.</li> </ul> <p>If there is no clockwise phase sequence on the connection:</p> <ul style="list-style-type: none"> <li>→ Correct the electrical connection of the mains line for the storage system.</li> </ul> <ul style="list-style-type: none"> <li>→ Check the connection of the storage system and the battery modules in line with the installation instructions.</li> </ul> <p>If none of the specified errors apply:</p> <ul style="list-style-type: none"> <li>→ Contact the sonnen service team to get help resolving the problem.</li> </ul>
No online connection to the storage system.	No connection between the storage system and the server.	<ul style="list-style-type: none"> <li>→ Make sure that the ethernet line between the storage system and the router of the home network is correctly connected.</li> <li>→ Make sure that the TCP or UDP ports of the following services are enabled for outgoing connections in the router:           <ul style="list-style-type: none"> <li><b>TCP ports:</b> 443 (https); 18883 (MQTT-TLS)</li> <li><b>UDP ports:</b> 123 (NTP); 1196 (VPN)</li> </ul> </li> </ul>

## 14.2 sonnenBatterie 10 performance+ with emergency power function

Fault	Possible cause(s)	Solution
<b>Grid operation (no grid outage)</b> The electrical consumers are not supplied with energy in grid operation.	The lines have not been correctly connected. The MCB in the supply line to the storage system is switched off. The RCD or another circuit breaker is switched off. The RCD or another circuit breaker has tripped.	→ Check the electrical wiring. → Switch on the MCB. → Switch on all circuit breakers. → Check the electrical wiring and the connected electrical consumers for faults. → Switch on the affected circuit breaker once any faults are corrected. → Contact the sonnen service team to get help resolving the problem.
<b>Backup operation (grid outage) - backup operation does not start</b> Backup operation does not start. The sonnen Eclipse pulses <b>green</b> and switches <b>off</b> after several minutes. The illuminated switch <b>does not light up</b> .	Problem in the power module of the storage system.  No backup buffer is set. The batteries of the storage system have discharged so much that further discharging would lead to a deep discharge state and therefore damage the batteries.  <b>With AC Microgrid:</b> The PV system produces no or insufficient electrical energy to start the backup operation.	To ensure the power supply to the house during this time: <b>With change over switch:</b> → Set the change over switch to grid operation. <b>Without change over switch:</b> → Open the storage system and connect the two plugs of the emergency power function (GRID and OUT) to each other. The emergency power function is bridged and the emergency power circuit(s) are supplied with electrical energy from the mains.
<b>Backup operation does not start. The sonnen Eclipse pulses <b>green</b>. The illuminated switch <b>does not light up</b>.</b>	The storage system is switched off.  The residual current device (RCD) or another circuit breaker is switched off.  The residual current device (RCD) or another circuit breaker has tripped.	When the grid outage is over and the public electricity grid once again begins supplying electrical energy, the storage system automatically switches to grid operation.  <b>With AC Microgrid:</b> If the PV system produces sufficient electrical energy at one of the defined reenabling times and the grid outage continues, the backup operation starts again. → Switch on the storage system. → Switch on all circuit breakers. → Check the electrical wiring and the connected electrical consumers for faults.

Backup operation does not start. The sonnen Eclipse pulses **orange**. The illuminated switch **lights up**.

Electrical consumers with too high of a power consumption are connected to the circuit.

→ Switch on the affected circuit breaker once any faults are corrected.

→ Switch off electrical consumers or reduce their power consumption.

→ Press the illuminated switch for approx. 2 seconds. Backup operation restarts.

→ Only connect electrical consumers when they have a power consumption that does not exceed the maximum power (see Technical data [P. 101]).

→ Contact the sonnen service team to get help resolving the problem.

To ensure the power supply to the house during this time:

**With change over switch:**

→ Set the change over switch to grid operation.

**Without change over switch:**

→ Open the storage system and connect the two plugs of the emergency power function (GRID and OUT) to each other. The emergency power function is bridged and the emergency power circuit(s) are supplied with electrical energy from the mains.

Backup operation does not start. The sonnen Eclipse and the illuminated switch **do not light up**.

Problem in the power module of the storage system.

#### Backup operation (grid outage) – backup operation stops

Backup operation stops. The miniature circuit breaker (MCB) in the supply line and the circuit breakers in the circuit have not tripped. The sonnen Eclipse pulses **green** and goes **off** after several minutes. The illuminated switch **does not light up**.

The backup buffer of the storage system batteries is depleted. The batteries have discharged so much that further discharging would lead to a deep discharge state and therefore damage the batteries

**With AC Microgrid:** The PV production of the PV system has stopped or has decreased to such an extent that there is not enough electrical energy available for backup operation.

When the grid outage is over and the public electricity grid once again begins supplying electrical energy, the storage system automatically switches to grid operation.

**With AC Microgrid:** If the PV system produces sufficient electrical energy at one of the defined reenabling times and the grid outage continues, the backup operation starts again.

Backup operation stops. The miniature circuit breaker (MCB) in the supply line or a circuit breaker in the circuit has switched off. The sonnen Eclipse pulses **green**. The illuminated switch **does not light up**.

The residual current device (RCD) or another circuit breaker has tripped.

→ Check the electrical wiring and the connected electrical consumers for faults.

→ Switch on the circuit breaker once any faults are corrected.

Backup operation stops. The miniature circuit breaker (MCB) in the supply line and the circuit breakers in the backup circuit have not tripped. The sonnen Eclipse pulses **orange**. The illuminated switch **lights up**.

Electrical consumers with too high of a power consumption are connected to the backup circuit.

→ Switch off electrical consumers in the backup circuit or reduce their power consumption.

→ Press the illuminated switch for approx. 2 seconds. Backup operation restarts.

Backup operation stops. The switch **do not light up**.

Problem in the power module of sonnen Eclipse and the illuminated the storage system.

→ Only connect electrical consumers to the backup circuit when they have a power consumption that does not exceed the maximum power (see Technical data [P. 101]).

→ Contact the sonnen service team to get help resolving the problem.

To ensure the power supply to the house during this time:

***With change over switch:***

→ Set the change over switch to grid operation.

***Without change over switch:***

→ Open the storage system and connect the two plugs of the emergency power function (GRID and OUT) to each other.

The emergency power function is bridged and the emergency power circuit(s) are supplied with electrical energy from the mains.

## 15 Technical data

### 15.1 sonnenBatterie 10 performance+

System data (AC)		sonnenBatterie 10 performance+					
General						sonnenBatterie 10 performance+	
	Nominal voltage					400 V	
	Nominal frequency					50 Hz	
	Nominal power* <sup>9</sup>					12,000 W	
	Apparent power					12,000 VA	
	Nominal current					17.4 A	
	Max. inverter efficiency					97.2 %	
	Power factor range					0.9 capacitive ... 0.9 inductive	
	Max. THD					4 %	
	Max. continuous current					17.4 A	
	Max. output fault current					120 mA	
	Inrush current					3 A	
	Mains connection					three-phase, L1 / L2 / L3 / N / PE	
	Max. ext. overcurrent protection					20 A, 3ph	
	Mains topology					TN / TT	
Depends on capacity <sup>10</sup>	Mains connection fuse					Miniature circuit breaker   Type B   20 A	
	Self-consumption					37 W	
	Noise emission					max. 34 dB(A)	
	sonnenBatterie	10p+/11	10p+/22	10p+/33	10p+/44	10p+/55	
	Number of battery modules	2	4	6	8	10	
Battery data (DC)	Nominal capacity	11 kWh	22 kWh	33 kWh	44 kWh	55 kWh	sonnenBatterie 10 performance+
	Usable capacity	10 kWh	20 kWh	30 kWh	40 kWh	50 kWh	
	Charging/discharging power*	7,000 W	12,000 W	12,000 W	12,000 W	12,000 W	
	Charging/discharging current	10.1 A	17.4 A	17.4 A	17.4 A	17.4 A	
	Cell technology						
	Nominal voltage					102.4 V	
	Operating voltage					204.8 V	
Emergency power function	Current (Max. continuous)					40 A	sonnenBatterie 10 performance+
	Short-circuit current (I <sub>SC</sub> )					80 A	
	Max. battery efficiency					95.9 %	
	Min. number of battery modules					2	
	Max. number of battery modules					10	
Emergency power function	sonnenBatterie	10p+/11	10p+/22	10p+/33	10p+/44	10p+/55	sonnenBatterie 10 performance+
	Nominal power Discharging	5,000 W*				8,000 W*	
	Nominal power Charging	7,000 W*				8,000 W*	
	Overload (5 min)	5,500 VA				8,000 VA	
	Max. apparent power per phase	8,800 VA				9,600 VA	

<sup>9</sup> at power factor cos phi = 1

<sup>10</sup> from 33 kWh: storage system with extension

Safety	Mains connection fuse	Miniature circuit breaker 63 A max. <sup>11</sup>							
	Switchover time	approx. 10 s							
	Switchback time	approx. 3 s <sup>12</sup>							
	Protection class	I / PE conductor							
	Required fault current monitoring	In TT networks: Residual current device (RCD) with a rated differential current of max. 300 mA; requirements on site must be observed.							
Regulatory requirements	Degree of Protection	IP30							
	Overvoltage category	2							
	Rated short-withstand current	10 kA							
	Separation principle	no galvanic isolation, transformer-less							
	Fulfilled standards and directives	IEC 60529; IEC 60730-1; IEC 61000-6-1; IEC 61000-6-3; IEC 62040-1; IEC 62109-1; IEC 62109-2; UN 38.8 / IEC 62281; IEC 62619; TOR Erzeuger; VDE-AR-E 2510-2; VDE-AR-N 2510-50; VDE-AR-N 4105							
Power measurement with WM271	Voltage measurement inputs	Nominal voltage (AC): 230 V (L-N), 400 V (L-L)   max. connectible conductor cross-section: 1.5 mm <sup>2</sup>							
	Clamp-on current transformer	Max. measurable current: 60 A (standard), optional up to 400 A							
Power measurement with EM357	Voltage measurement inputs	Nominal voltage (AC): 230 V (L-N), 400 V (L-L)   connectible conductor cross-section: 1.5 mm <sup>2</sup>							
Dimensions/weight <sup>13</sup>	Measurable current	Max. 100 A							
	<b>sonnenBatterie</b>	<b>10p+/11</b>	<b>10p+/22</b>	<b>10p+/33</b>	<b>10p+/44</b>	<b>10p+/55</b>			
	Dimensions (H/W/D)	172-184/69/36 cm		2 x 172-184/69/36 cm					
	Height without feet	161 cm							
	Total weight	166 kg	246 kg	376 kg	456 kg	536 kg			
Ambient conditions	Environment	Indoor (conditional)							
	Operating temperature range <sup>14</sup>	-5 °C ... 45 °C							
	Storage temperature range	0 °C ... 40 °C							
	Transport temperature range	-15 °C ... 50 °C							
	Max. rel. humidity	90 %, non-condensing							
	Permissible installation altitude	2,000 m above sea level							
	Pollution degree	2							
Requirements for the installation location	<ul style="list-style-type: none"> <li>• No direct sunlight.</li> <li>• No danger due to flooding.</li> <li>• No corrosive and explosive gases. The maximum permissible ammonia content is 20 ppm.</li> <li>• No dust, especially flour dust or sawdust.</li> <li>• No vibrations.</li> <li>• Ventilation possible.</li> <li>• Easy access.</li> <li>• Floor is suitable for heavy loads.</li> <li>• Observe all fire safety guidelines and regulations.</li> <li>• Observe applicable local building codes.</li> <li>• Smoke detectors must be installed both at the installation location and in bedrooms. The smoke detectors must meet the requirements of the DIN EN 14604 standard.</li> </ul>								

<sup>11</sup> Max. thermal throughput: 30 kW<sup>12</sup> After grid return the waiting time before switch back can be up to 5.5 minutes due to country-specific regulation.<sup>13</sup> From 33 kWh: storage system with extension<sup>14</sup> Optimal: 5 °C ... 30 °C | Derating possible below 5 °C / above 30 °C.

## Glossary

### AC

Alternating current

### ADR

Accord européen relatif au transport international des marchandises Dangereuses par Route [fr] - European Agreement concerning the International Carriage of Dangerous Goods by Road

### BMS

Battery management system

### CA

Commissioning assistant

### CHP

Combined heat and power station

### CT

Clamp-on current transformers

### CT

Clamp-on current transformers. These are connected to the transformer interface of the power meter and are clamped over the electrical line in question.

### DC

Direct current

### DI

Digital input

### DNO

Distribution network operator

### DO

Digital output

### DOD

Depth of discharge

### ESD

Electrostatic discharge

### EVU

Energieversorgungsunternehmen [de] - energy supply company

### GND

Ground

### Grid and system protection

Protective measures for ensuring the safety of the grid and systems installed

### IP

International protection - degree of protection used to classify systems in terms of their suitable for different ambient environments

### LED

Light-emitting diode

### MCB

Miniature circuit breaker. Overcurrent safety device that protects the lines from damage caused by overheating as a result of excessive current.

### MW

Module width. A unit of measurement used to describe the width of components in the electrical installation. One module width is equal to 18 mm.

### PV

Photovoltaics

### PV reduction

Reduction of the power output by the PV system through communication with the inverter

### RCD

Residual current device

### RS

Rapid shutdown

### SELV

Safety extra low voltage

### SMCB

Selective miniature circuit breaker or main miniature circuit breaker. This special circuit breaker meets selectivity requirements for upstream and downstream overcurrent protective devices and is used upstream of the electricity meter.

**SOC**

State of charge

**Technical connection conditions**

The technical connection conditions govern the connection to the electricity grid of the distribution network operators in Germany.

**USB**

Universal serial bus

**VPN**

Virtual private network









<https://documents.sonnen.de/s/manual-sB10p-plus-en>

