

Installation instructions | for Electricians

sonnenBatterie hybrid 9.53

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

+44 3301 114559

Email

info@sonnen.de

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1 Information about this document

This document describes the installation of the sonnenBatterie hybrid 9.53.

- 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 hybrid 9.53	Storage system

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.



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

2 Safety

2.1 Intended Use

The sonnenBatterie hybrid 9.53 is a battery storage system which can be used to store electrical energy. Improper use of this system poses a risk of death or injury to the user or third parties as well as damage to the product and other items of value. The following points must therefore be observed in order to comply with the intended use of the product:

- 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 storage system is only allowed to be operated with PV generators of Class A rating according to IEC 61730.
- The storage system must only be used at a suitable installation location.
- The transport and storage conditions must be observed.

Especially the following uses are not permissible:

- Operation in flammable environments or areas at risk of explosion.
- Operation in locations at risk of flooding.
- Operation outdoors.
- Operation of the battery modules outside of its storage system.



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

2.2 Requirements for the electrician

Improper installation can result in personal injury and/or damage to components. For this reason, the storage system must only be installed and commissioned by authorized electricians. Authorized electricians must meet the following criteria:

- 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 company for which the electrician works must be certified by sonnen GmbH.
- The electrician must have successfully complete sonnen GmbH certification training for the product.

2.3 Operating the storage system

Incorrect operation can lead to injury to yourself or others and cause damage to property:

- The storage system must 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.

2.4 Product modifications or changes to the product environment

- Only use the storage system in its original state - without any unauthorised modifications - and when it is in proper working order.

- Safety devices must never be overridden, blocker or tampered with.
- The interfaces of the storage system must be wired in accordance with the product documentation.
- All repairs on the storage system must be performed by authorised service technicians only.

2.5 Voltage on and in the storage system



The storage system contains live electrical parts, which poses a risk of electrical shock. The storage system inverter also contains capacitors which carry voltage even after the storage system is switched off.

The PV generator of the PV system is directly connected to the storage system through the plug-in connectors on the top side of the storage system. This means, there is voltage present on the PV plug-in connectors when the PV system generates electricity, even if the storage system has been switched off to electrically isolate it. Therefore:

- ▶ Switch off the storage system to electrically isolate it before carrying out any work (see Switching the storage system off to electrically isolate it [P. 63]).

Only then can the storage system be opened.

2.6 Handling the battery modules



The battery modules installed in the storage system are protected by multiple protective devices and can be operated safely. Despite their careful design, the battery cells inside the battery modules may corrode or experience thermal runaway in the event of mechanical damage, heat or a fault.

This can have the following effects:

- High heat generation on the surface of the battery cells.
- Electrolyte may escape.
- The escaping electrolyte may ignite and cause an explosive flame.
- The smoke from burning battery modules can irritate the skin, eyes and throat.

Therefore, proceed as follows:

- ▶ Do not open the battery modules.
- ▶ Do not mechanically damage the battery modules (pierce, deform, strip down, etc.)
- ▶ Do not modify the battery modules.
- ▶ Do not allow the battery modules to come into contact with water (except when extinguishing a fire in the storage system).
- ▶ Do not heat the battery modules. Operate them only within the permissible temperature range.
- ▶ Keep the battery modules well away from sources of ignition.
- ▶ Do not short-circuit the battery modules. Do not allow them to come into contact with metal.
- ▶ Do not continue to use the battery modules after a short circuit.
- ▶ Do not deep-discharge the battery modules.

In the event that module contents are released:

- ▶ Do not enter the room under any circumstance.
- ▶ Avoid contact with the escaping electrolyte.

- ▶ Contact the fire services.

2.7 Conduct in case of a fire

Fire may occur with electrical equipment despite its careful design. Likewise, a fire in the vicinity of the equipment can cause the storage system to catch fire, releasing the contents of the battery modules.

In the event of a fire in the vicinity of the product or in the storage system itself, proceed as follows:

- ▶ Only firefighters with appropriate protective equipment (safety gloves, safety clothing, face guard, breathing protection) are permitted to enter the room where the burning storage system is located.

There is a danger of electrocution when extinguishing fire while the storage system is switched on. Therefore, before starting to extinguish the fire:

- ▶ Switch off the storage system to electrically isolate it.
- ▶ Switch off the mains fuses in the building.

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

- ▶ Observe the minimum distances specified for the extinguishing agent used. The storage system works with an output voltage of 230 V (AC) and is therefore considered a low-voltage system. However, the voltage of the PV system that is connected to the storage system (through the PV connectors on the top of the storage system) can be up to 750 V (DC).
- 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:

- The battery modules have a nominal voltage of 48 V (DC) and therefore fall into the range of protected extra-low voltage (under 60 V DC).
- The battery modules do not contain metallic lithium.

3 Product description

3.1 Technical data

sonnenBatterie hybrid	9.53/2,5	9.53/5	9.53/7,5	9.53/10	9.53/12,5	9.53/15
System data (AC)						
Nominal voltage	230 V					
Nominal frequency	50 Hz					
Nominal power	4,600 W					
Apparent power	4,600 VA					
Nominal current	20 A					
Charging / Discharging power	1,100 W	2,500 W	3,300 W	3,300 W	3,300 W	3,300 W
Charging / Discharging current	4.8 A	10.9 A	14.3 A	14.3 A	14.3 A	14.3 A
Power factor range	0.9 capacitive ... 0.9 inductive					
Max. THD	0.55 %					
Max. continous current	20 A					
Max. output fault current	120 mA					
Inrush current	0 A					
Mains connection	single-phase, L / N / PE					
Max. ext. overcurrent protection	25 A, 1ph					
Mains topology	TN / TT					
Mains connection fuse	Miniature circuit breaker Type B 20 - 25 A					
Photovoltaic (PV) input (DC)						
Number of PV inputs / MPP Tracker	2					
Min. input voltage	75 V					
Max. input voltage	750 V					
Initial input voltage	100 V					
MPP voltage range	75 V ... 600 V					
Max. input power	6,500 W					
Max. input current	13 A ¹					
Backfeed current to array	0 A					
Short-circuit current (I _{SC})	15 A					
Battery data (DC)						
Cell technology	lithium iron phosphate (LiFePO4)					
Nominal capacity	2.5 kWh	5.0 kWh	7.5 kWh	10.0 kWh	12.5 kWh	15.0 kWh
Usable capacity	2.25 kWh	4.5 kWh	6.75 kWh	9.0 kWh	11.25 kWh	13.5 kWh
Nominal voltage	48 V					
Current (Max. continous)	75 A					
Short-circuit current (I _{SC})	90 A					
Min. number of battery modules	1					
Max. number of battery modules	6					

¹ Higher input currents are allowed, but are limited internally to 13 A without damaging the unit. However, the maximum allowed short-circuit current must be respected.

Dimensions / weight without extension cabinet (from 2.5 up to 5 kWh)

Dimensions (H/W/D)	88/67/23 cm	-	-	-	-
Weight	58 kg	81 kg	-	-	-

Dimensions / weight with small extension cabinet (from 2.5 up to 10 kWh)

Dimensions (H/W/D)		137/67/23 cm			-	-
Weight	74 kg	97 kg	120 kg	143 kg	-	-

Dimensions / weight with big extension cabinet (from 2.5 up to 15 kWh)

Dimensions (H/W/D)	186/67/23 cm					
Weight	85 kg	108 kg	131 kg	154 kg	177 kg	200 kg

Safety

Protection class	I / PE conductor
Required fault current monitoring	Residual current device (RCD) Type B 30 mA
Degree of Protection	IP30
Rated short-withstand current (I_{cw})	10 kA
Separation principle PV -> AC	no galvanic isolation, transformer-less
Separation principle Batt. -> AC	galvanic isolation (functional insulation)

Power meter WM271

Voltage measurement inputs	Nominal voltage (AC): 230 V (L-N), 400 V (L-L) max. connectible conductor cross-section: 1.5 mm ²
Clamp-on current transformer	Max. measurable current: 60 A (standard), optional up to 400 A

Power meter EM357

Voltage measurement inputs	Nominal voltage (AC): 230 V (L-N), 400 V (L-L) connectible conductor cross-section: 1.5 mm ²
Measurable current	Max. 100 A

Ambient conditions

Environment	Indoor (conditional)
Operating temperature range ²	-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

Additional ambient conditions:

- The installation location must not be at risk of flooding.
- Installation room should be ventilated.
- The currently applicable building codes must be observed.
- Even floor, suitable for heavy loads.
- Observe fire control standards.
- Free from corrosive and explosive gases (ammonia content max. 20 ppm).
- Free from dust (especially flour dust or sawdust).
- Free from vibrations.
- Free access to the installation location.
- No direct sunlight.

² Optimal: 5 °C ... 30 °C | Derating possible below 5 °C / above 30 °C.

- Smoke detectors must be installed both at the installation location and in bedrooms.

3.2 System components

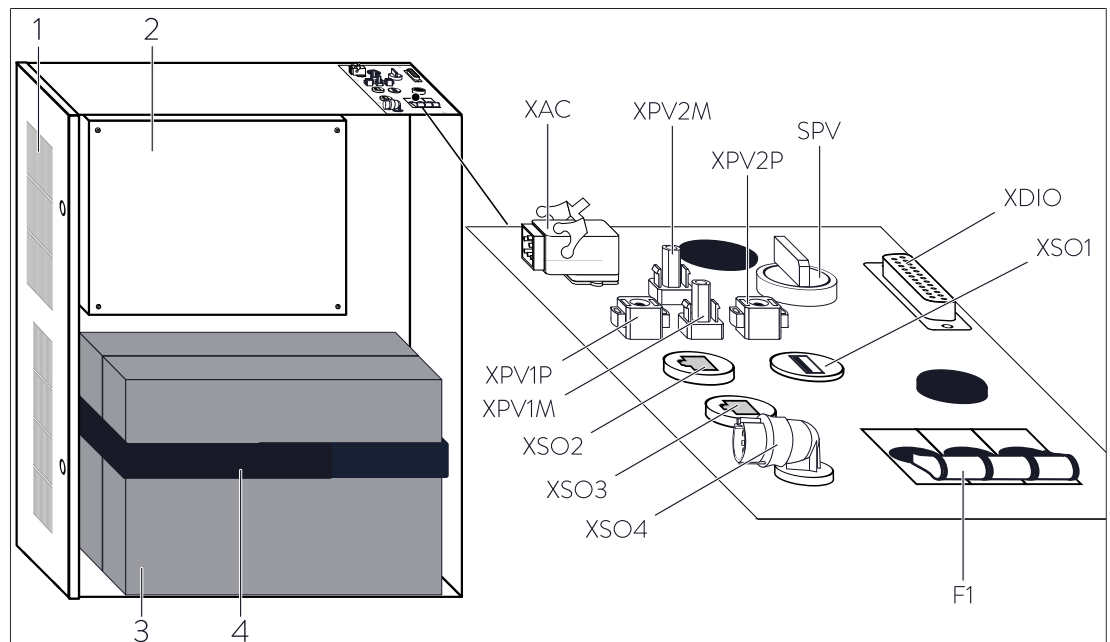


Illustration 1: System components of the storage system

No.	Designation	Function
1	Filter plate	Holder for filter pad.
2	Inverter	Conversion of batteries' direct current into alternating current.
3	Battery module(s)	Storage of electrical power.
4	Securing band	Fixation of the battery modules.
F1	Fuse switch F1	On / Off switch of the storage system.
SPV	PV disconnecter	Switch to isolate all poles of the DC connection between the photovoltaic system and the inverter.
XPV1P	1st PV plus connection	Connection to the first plus wire from the pv system.
XPV1M	1st PV minus connection	Connection to the first minus wire from the pv system.
XPV2P	2nd PV plus connection	Connection to the second plus wire from the pv system.
XPV2M	2nd PV minus connection	Connection to the second minus wire from the pv system.
XAC	Mains connection	Connection to the public electrical grid.
XDIO	Digital inputs and outputs	Interface to emit and receive digital signals.
XSO1	USB port	Socket for connecting a USB device.
XSO2	Modbus port	Data connection to power meter.
XSO3	Ethernet port	Data connection to router for home network.
XSO4	Backup power	Connection to sonnenProtect (optional accessories).

3.3 Type plate









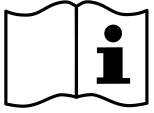
The type plate for the storage system is located on the outer surface of the system. The type plate can be used to uniquely identify the storage system. The information on the type plate is required for the safe use of the system and for service matters.

The following information is specified on the type plate:

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

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. 58]).

3.4 Symbols on the outside of the storage system

Symbol	Meaning
	Warning: flammable materials.
	Warning: hazards due to batteries.
	Warning: electrical voltage.
	Warning: electrical voltage. Wait five minutes after switching off (capacitor de-energising time).
	Warning: Equipment with multiple sources of supply (PV generator, AC mains and battery).
	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.

3.5 The function of the switches

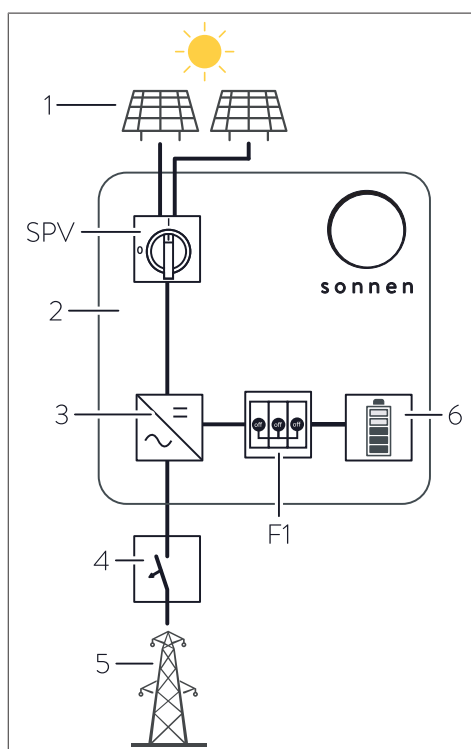


Illustration 2: Block diagram of the switching elements

- | | |
|-----|--------------------|
| 1 | PV system |
| 2 | Storage system |
| 3 | Inverter |
| 4 | AC circuit breaker |
| 5 | Mains connection |
| 6 | Battery |
| F1 | Fuse switch |
| SPV | PV disconnecter |

PV disconnect (SPV)

The PV disconnecter (SPV) is in the DC circuit between the PV system (1) and the inverter (3).

In switch setting **I** the PV system and the inverter are connected together. In switch setting **0** the PV system and the inverter are isolated from one another on all poles.

Fuse switch F1

The fuse switch F1 is in the DC circuit between the battery (6) and the inverter (3).

In switch setting **ON** the battery and the inverter are connected together. In switch setting **OFF** the battery and the inverter are isolated from one another.

AC circuit breaker

The circuit breaker (4) is in the AC circuit between the public electricity network (5) and the storage system (2).

4 Storage and transport

4.1 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.

4.1.1 Ambient conditions during storage

The ambient conditions specified in section Technical data [P. 9] must be observed during storage.

4.1.2 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 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:

- The battery modules must be charged to **60 %** (charging status upon delivery) when stored.
- Store the battery modules for **no longer than 6 months**.
- Install the battery modules in the storage system after 6 months at the most and commission the storage system.

4.2 Transport

4.2.1 Ambient conditions during transport

The ambient conditions specified in section Technical data [P. 9] must be observed during transport.

4.2.2 Transporting battery modules

CAUTION

Improper transport of battery modules

Fire outbreak at battery modules or emission of toxic substances!

- ▶ Transport the battery modules in their original packaging only. If you no longer have the original packaging, new packaging can be requested from sonnen GmbH.
- ▶ Never transport damaged battery modules.

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'	24 kg (incl. packaging)

Table 1: Battery module data relevant for transport

4.2.3 Inspecting for transport damage

⚠ CAUTION

Use of damaged battery modules

Fire outbreak at battery modules or emission of toxic substances!

- ▶ Unpack the battery modules immediately after transport and inspect them for transport damage.
- ▶ Check the temperature indicator on the back of the battery module.
 - ⇒ If the temperature indicator turned red or
 - ⇒ if damage (deformation, damage to the housing, emission of substances and the like) is discovered:
- ▶ Do not use the battery modules under any circumstance.
- ▶ Notify the service team.

⚠ CAUTION

Insulation fault when storage system is damaged

Danger of electric shock when touching damaged insulation elements!

- ▶ Unpack the storage system immediately after transport and inspect it for transport damage.
- ▶ Do not use a damaged storage system under any circumstance.

The shipping company can only be held liable for transport damage if it can be proven that the damage occurred during the course of transport. For this reason it is important to follow the instructions given here as closely as possible.

Transport damage is divided into open and hidden damage. Open damage is externally visible damage to the transported goods or their packaging. Hidden damage occurs when the packaging is not damaged but the transported goods inside are.

Open transport damage must be reported to the shipping company immediately. The following time frames apply in the case of hidden transport damage:

- Deutsche Post / DHL / parcel services: report damage within 24 hours
- Shipping company: report damage within 7 days

Proceed as follows:

1. Check the shipping documents

- ▶ Check the recipient address and numbers of shipped goods in the presence of the shipper.

2. Inspect the goods for open damage

- ▶ Inspect the packaging and transport goods for external damage in the presence of the shipper.

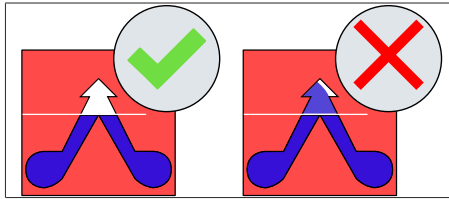


Illustration 3: Transport indicator affixed to the packaging

- ▶ Check the transport indicator affixed to the packaging of the main cabinet in the presence of the shipper.

The storage system has not been transported properly if blue powder has been transferred into the arrow of the transport indicator.

- ▶ Refuse to accept the goods if blue powder has been transferred into the arrow of the transport indicator.

3. Inspect the goods for hidden damage

This inspection should also take place in the presence of the shipper if possible.

- ▶ Unpack the goods.
- ▶ Inspect the goods for hidden (not immediately visible) transport damage.

If transport damage is discovered:

- ▶ Stop unpacking the product.
- ▶ Collect photographic evidence of the damage.
- ▶ Refuse to accept the goods if the discovered defects are serious.

4. Document the defects

- ▶ Document the defects identified on the consignment note.
- ▶ Additionally, document the following:
 - Notation 'Conditional acceptance'.
 - Registration number of the delivery vehicle.
 - Signature of the shipper.

5. Report the damage

- ▶ Report the damage to the responsible transport company and the manufacturer immediately.
- ▶ Send the consignment note/delivery note with the shipper's confirmation of the damage and photographic evidence to the manufacturer by email.



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

4.2.4 Transport to the installation location

WARNING

High weight of the storage system

Risk of injury by lifting/dropping the storage system!

- ▶ Wear safety footwear when setting up.
- ▶ Ensure a secure footing.
- ▶ At least two people are necessary to carry the main cabinet of the storage system.

4.2.5 Temperature adjustment after transport

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 storage system is lower than the ambient temperature of the room when it is delivered, condensation may form inside the storage system.

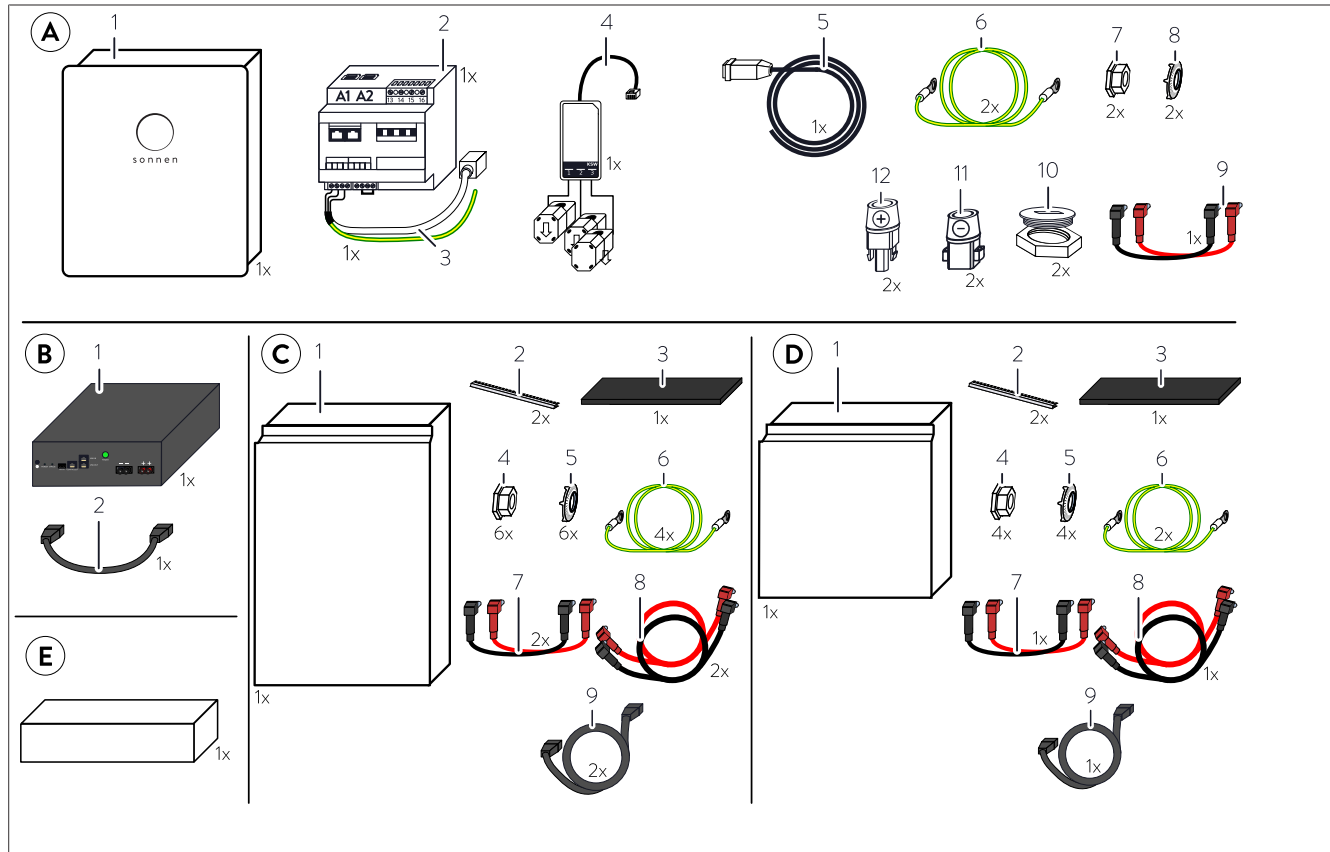
If the storage system has been transported in sub-zero temperatures, proceed as follows:

1. Set up the storage system in a suitable location.
2. Open all main cabinet doors.
3. Leave the storage system to stand for at least 24 hours with open main cabinet doors.
4. Only then can you commission the storage system.

5 Mounting

5.1 Scope of delivery

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



A For main cabinet

- 1 Main cabinet
- 2 Power meter WM271
- 3 Modbus line with RJ-45 coupling
- 4 Current transformer KSW 100-3
- 5 Mains line
- 6 Earthing line
- 7 Locking nut
- 8 Contact disc
- 9 Battery lines, short
- 10 Blanking plug with locknut
- 11 PV plug-in connector minus
- 12 PV plug-in connector plus

B For battery module

- 1 Battery module
- 2 BMS communication line, short

C For big extension cabinet

- 1 Big extension cabinet
- 2 Edge protection
- 3 Levelling mat
- 4 Locking nut
- 5 Contacting disc
- 6 Earthing lines
- 7 Battery lines, short
- 8 Battery lines, long
- 9 BMS communication line, long

D For small extension cabinet

- 1 Small extension cabinet
- 2 Edge protection
- 3 Levelling mat
- 4 Locking nut
- 5 Contacting disc
- 6 Earthing lines
- 7 Battery lines, short
- 8 Battery lines, long
- 9 BMS communication line, long

E Pedestal for extension cabinet (optional)

5.2 Selecting the installation location

5.2.1 Requirements for the installation location

- Observe the required ambient conditions (see Technical data [P. 9]).

5.2.2 Observing minimum distances

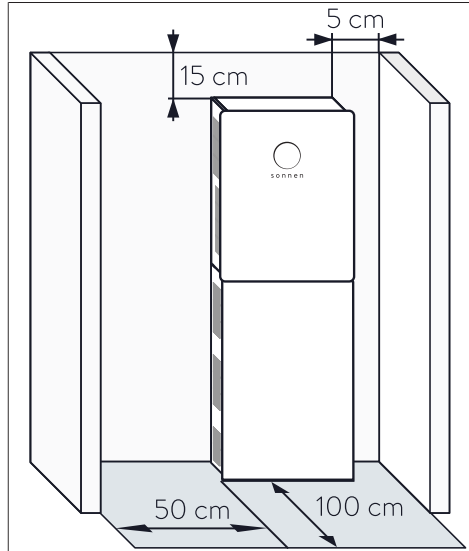


Illustration 4: Minimum distances

- Observe the specified minimum distances to neighbouring objects.

The minimum distances ensure that:

- there is sufficient heat dissipation,
- the storage system door can be opened easily and
- there is sufficient space for maintenance work.

5.3 Opening the storage system

5.3.1 Opening the main cabinet

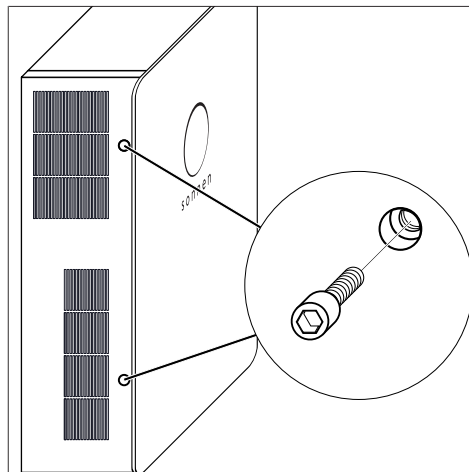


Illustration 5: Opening the door of the main cabinet

- Remove the two Allen screws on the left side of the main cabinet.
- Open the door of the main cabinet.

5.3.2 Removing the cover of the extension cabinet (optional)

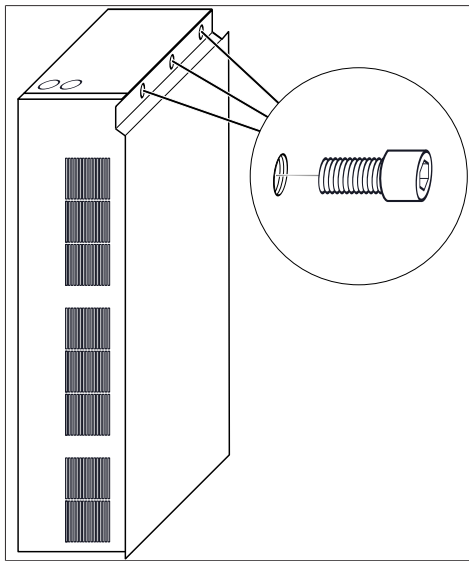


Illustration 6: Removing the cover of the extension cabinet

To remove the cover of the extension cabinet:

- Remove the three screws.
- Slide the cover up.

5.4 Mounting the storage system

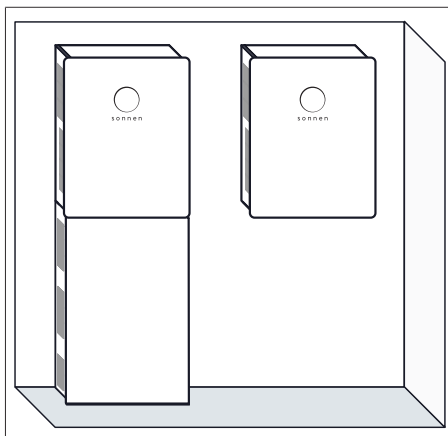


Illustration 7: Storage system with optional extension cabinet (floor mounted) / Storage system without extension cabinet (wall mounted)

- A storage system without the optional extension cabinet must be mounted to the wall with screws.
- A storage system with the extension cabinet must be floor mounted.

WARNING

Inadequate protection against contact if installed without base cabinet

Risk of injury from contact with the battery modules through the openings in the floor of the main cabinet!

- Ensure that both openings in the floor of the main cabinet are sealed with the provided blanking plugs on the inside and the locknuts on the outside of the storage systems.

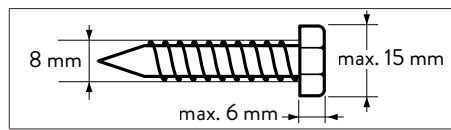
Permissible blanking plugs³ must meet the following requirements:

- Material: metal or plastic with a flammability class of V-1 in accordance with UL94
- Fine thread: M32x1,5
- External diameter: 35 mm
- Temperature range: -60 °C to +200 °C

³ Additional blanking plugs and nuts are available from sonnen.

5.4.1 Requirements for mounting material

- Use only screws with the following properties:



- Screw head diameter: max. 15 mm
- Screw diameter: 8 mm
- Height of screw head: max. 6 mm

Illustration 8: Parameters of the screw used

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

5.4.2 Placing the levelling mat or the pedestal

The levelling mat (1) is part of the scope of delivery for storage systems with extension cabinet. It is used to compensate uneven floors.

Alternatively the extension cabinet can be placed on an optional pedestal (3) instead of the levelling mat. This is helpful if the extension cabinet doesn't meet flush with the wall (e.g. because a skirting board (2) is mounted).

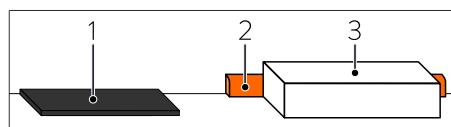


Illustration 9: Levelling mat or pedestal

- Place the levelling mat (1) or the pedestal (3) at the preferred installation location.

5.4.3 Drilling the holes

Holes must be drilled into the wall to mount the storage system. The arrangement of the holes depends on whether the big or the small extension cabinet is used.



A drilling template is part of the packaging of the main cabinet. Therewith it is easier to mark the position of the holes on the wall. Please note that the drilling template does not consider the levelling mat or the optional pedestal!

Without extension cabinet

If the storage system is used without extension cabinet it is a good idea to observe the dimensions provided in one of the two figures above. That way no new holes need to be drilled if the storage system is extended at a later time.

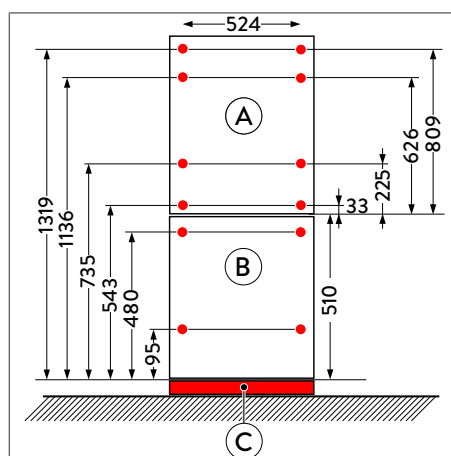


Illustration 10: Drill template for storage systems with small extension cabinet (figure is not to scale - all specifications are in millimetres)

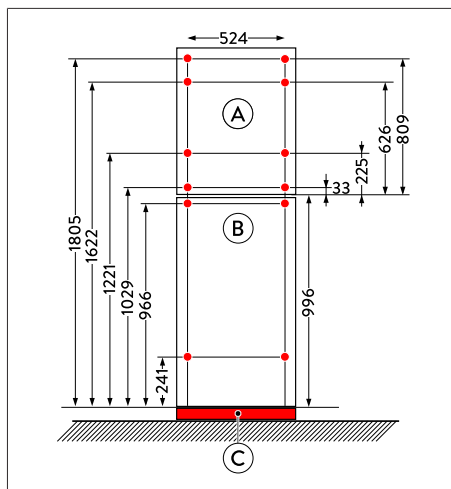
A Main cabinet

With small extension cabinet

For storage systems consisting of main and small extension cabinet:

- Note that the storage system must be placed on the levelling mat or the pedestal (C).
- Drill the holes shown in red in the figure on the left.

- B Small extension cabinet (from 2.5 up to 10 kWh)
- C Levelling mat (height: 10 mm) or pedestal (opt. - height: 80 mm)



With big extension cabinet

For storage systems consisting of main and big extension cabinet:

- Note that the storage system must be placed on the levelling mat or the pedestal (C).
- Drill the holes shown in red in the figure on the left.

Illustration 11: Drill template for storage system with big extension cabinet (figure is not to scale - all specifications are in millimetres)

- A Main cabinet
- B Big extension cabinet (from 2.5 up to 15 kWh)
- C Levelling mat (height: 10 mm) or pedestal (opt. - height: 80 mm)

5.4.4 Mounting the storage system

1. Mount the extension cabinet (optional)

An extension cabinet shall be secured against tilting by attaching it to the wall.

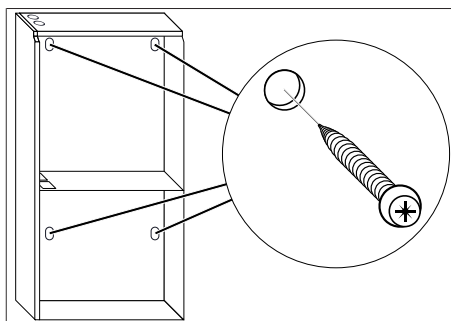


Illustration 12: Mounting the extension cabinet

- Mount the extension cabinet on the wall using suitable screws and dowels (see Requirements for mounting material [P. 21]).

2. Apply the screws

There are keyhole attachments on the rear of the main cabinet. The main cabinet is mounted using these attachments.

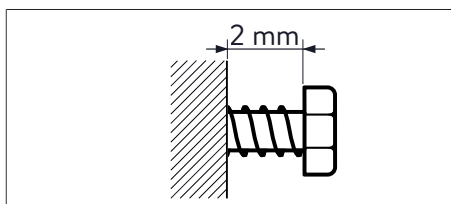


Illustration 13: Distance between screw head and wall

- Apply suitable screws and anchors (see Requirements for mounting material [P. 21]) to the previously drilled holes.

The screw should not be completely screwed in. The screw head should protrude from the wall by approx. 2 mm.

3. Attach blanking plugs (optional)

If no extension cabinet is used, the openings in the floor of the main cabinet need to be sealed.

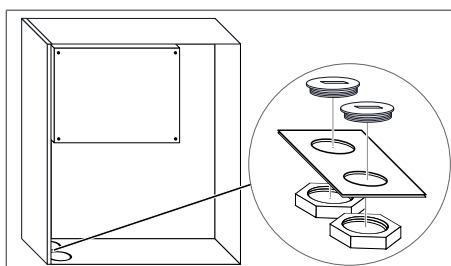


Illustration 14: Attaching blanking caps

- Attach the supplied blanking plugs and the matching nuts on the openings in the floor of the main cabinet.

4. Affix edge protection (optional)

If an extension cabinet is used edge protection needs to be installed at the openings in the floor of the main cabinet.

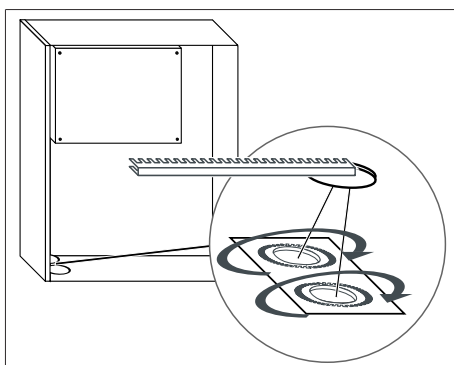


Illustration 15: Attaching the edge protection

- Affix the edge protection on both openings in the floor of the main cabinet.

5. Mount the main cabinet

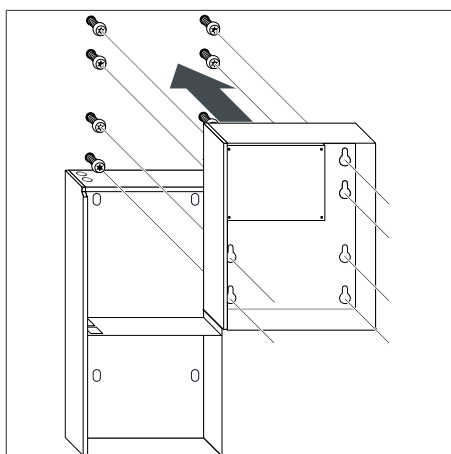


Illustration 16: Mounting the main cabinet

- Hang the main cabinet on the previously mounted screws.

6. Tighten the screws

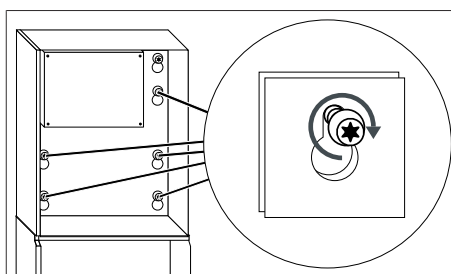


Illustration 17: Tightening the screws

- Tighten the five screws.

7. Connect the housing (optional)

If an extension cabinet is used both cabinets need to be connected. An earth conductor is already connected in the extension cabinet.

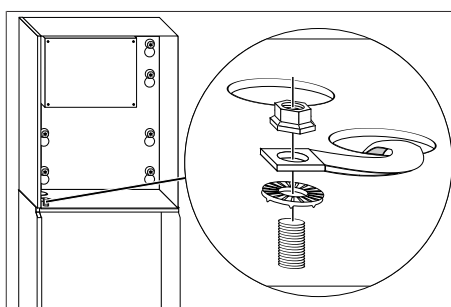


Illustration 18: Connecting the cabinets

- Connect the other end of the earth conductor to the earth bolt in the main cabinet.
- Tighten the self-locking nut with a torque of 5 Nm.

6 Electrical installation

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.

NOTICE

Observe maximum line lengths

- ▶ None of the lines connected to the storage system (mains line, ethernet line, other data lines) are allowed to exceed a maximum length of 30 m.

6.1 Working on the electrical distributor

DANGER

Touch voltage in the event of fault

Danger to life due to electrocution!

- ▶ Install residual current device (RCD | Type B | $I_{\Delta n} = 30 \text{ mA}$) upstream of the storage system.

6.1.1 Placing components in the electrical distributor

Several components must be placed in the electrical distributor for the electrical connection of the storage system. Up to approx. 15 cm of free space on a mounting rail is required for placing the components.

- ▶ Place the following components in the electrical distributor:

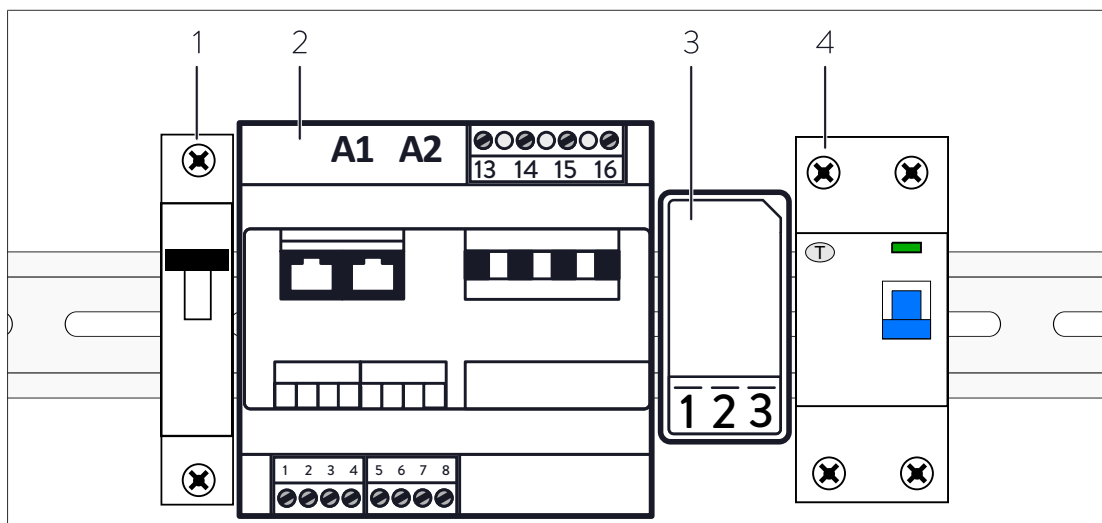


Illustration 19: Components to be placed in the distributor

1	Miniature circuit breaker B20/B25 (not included in scope of delivery)
2	Power meter WM271
3	Transformer interface
4	Residual current device (RCD) Type B 30 mA (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 generation of power in the building.
- The inverter of the storage system can cause a current with DC components. The RCD (4) protects against high touch voltage in the event of a fault. A RCD Type B with a rated differential current of 30 mA must be installed.

6.1.2 Wiring components in the electrical distributor



The power meter wiring shown here corresponds to the CP measurement concept / 'Consumption Measurement' in the commissioning assistant.

- Wire the components previously placed in the electrical distributor like it is shown in the Circuit diagram single-phase [P. 28] or Circuit diagram three-phase [P. 29], depending on whether it is a single-phase or three-phase network.

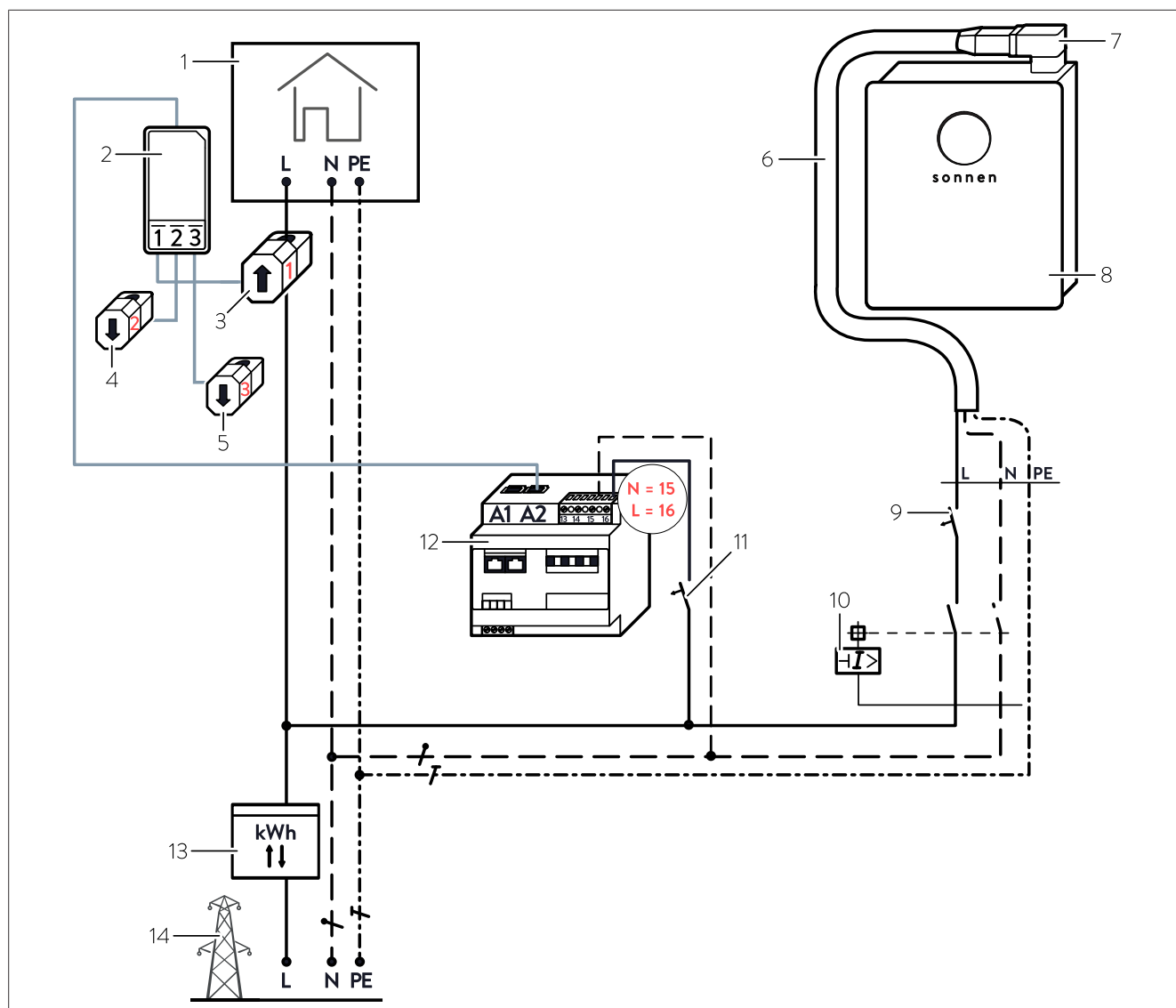


Illustration 20: Circuit diagram overview – electrical connection at single-phase mains

- | | |
|--|---|
| 1 Consumers in building | 8 Storage system |
| 2 Transformer interface for consumption (A2) | 9 Miniature circuit breaker B20/B25 |
| 3 Current transformer for consumption - L1 | 10 RCD Type B 30 mA |
| 4 Current transformer for consumption - L2 | 11 Miniature circuit breaker ⁴ |
| 5 Current transformer for consumption - L3 | 12 Power meter WM271 |
| 6 Mains line | 13 Bidirectional counter |
| 7 Mains connection socket XAC | 14 Public electrical mains |

⁴ Protection of the line must be ensured.

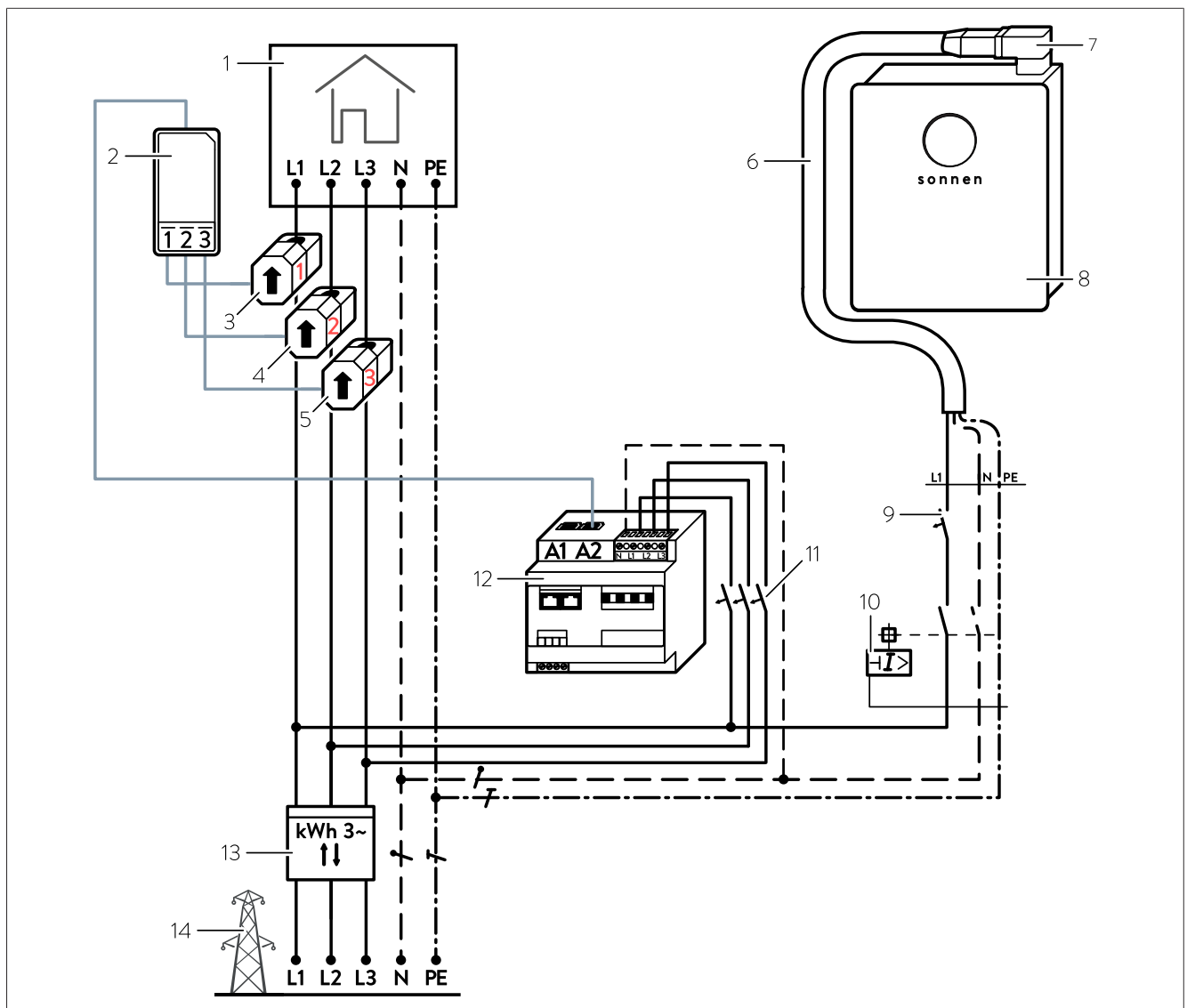


Illustration 21: Circuit diagram overview – electrical connection at three-phase mains

- | | | | |
|---|--|----|--|
| 1 | Consumers in building | 8 | Storage system |
| 2 | Transformer interface for consumption (A2) | 9 | Miniature circuit breaker B20/B25 |
| 3 | Current transformer for consumption - L1 | 10 | RCD Type B 30 mA |
| 4 | Current transformer for consumption - L2 | 11 | Miniature circuit breaker ⁵ |
| 5 | Current transformer for consumption - L3 | 12 | Power meter WM271 |
| 6 | Mains line | 13 | Public electrical mains |
| 7 | Mains connection socket XAC | 14 | Bidirectional counter |

⁵ Protection of the line must be ensured.

6.2 Connecting the power meter

- Connect the power meter as described in the previous section.

The following points must be observed when connecting power meters:

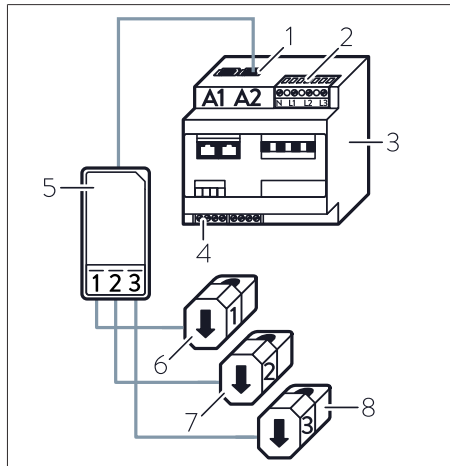


Illustration 22: Power meter components

- 1 A2 - input for consumption
- 2 Voltage measurement terminal strip
- 3 Power meter
- 4 Modbus terminal strip

- Never confuse inputs A1 and A2!
- 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.

- 5 Transformer interface for consumption
- 6 Current transformer for consumption – L1
- 7 Current transformer for consumption – L2
- 8 Current transformer for consumption – L3

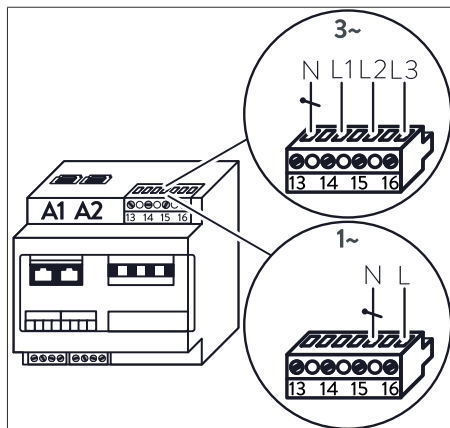


Illustration 23: Connection to the voltage terminal strip at single-phase (1~) and three-phase (3~) mains

- The connection to the voltage terminal strip depends on the number of phases. In the case of a single-phase (1~) mains, the voltage terminal strip must be wired like it is shown on the bottom part of the figure on the left. In case of a three-phase (3~) mains wire as shown on the top part of the figure.

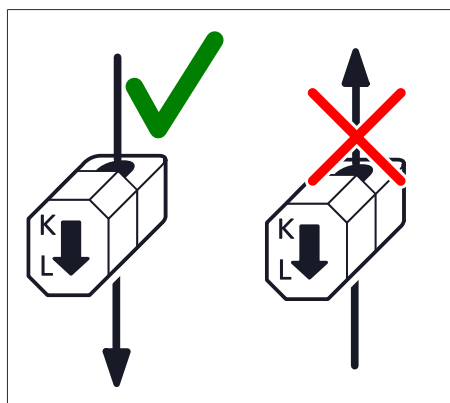


Illustration 24: left: correct energy flow direction / right: incorrect energy flow direction

- 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 or a single-phase mains, only the clamp-on current transformer for the phase in question is connected. The other two clamp-on current transformers must not be connected.

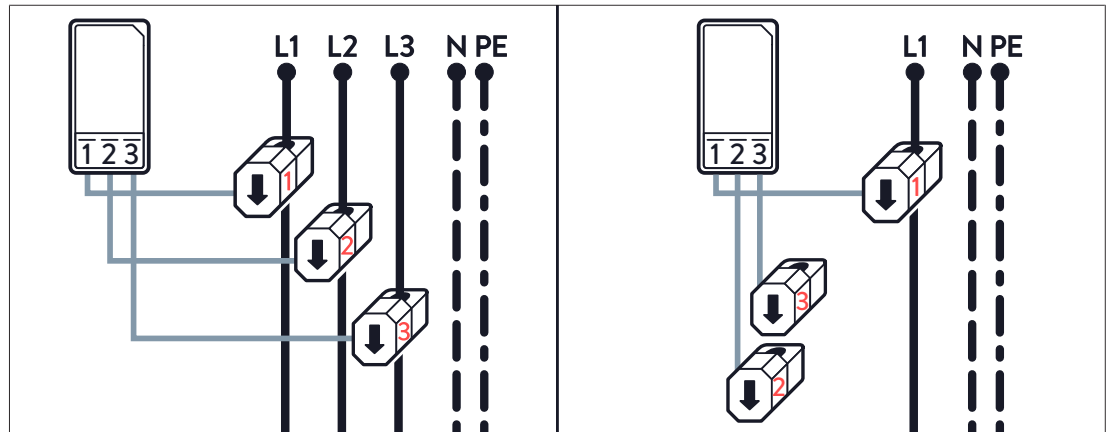


Illustration 25: Connecting the clamp-on current transformers for three-phase (left) and single-phase (right) installation

- **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.

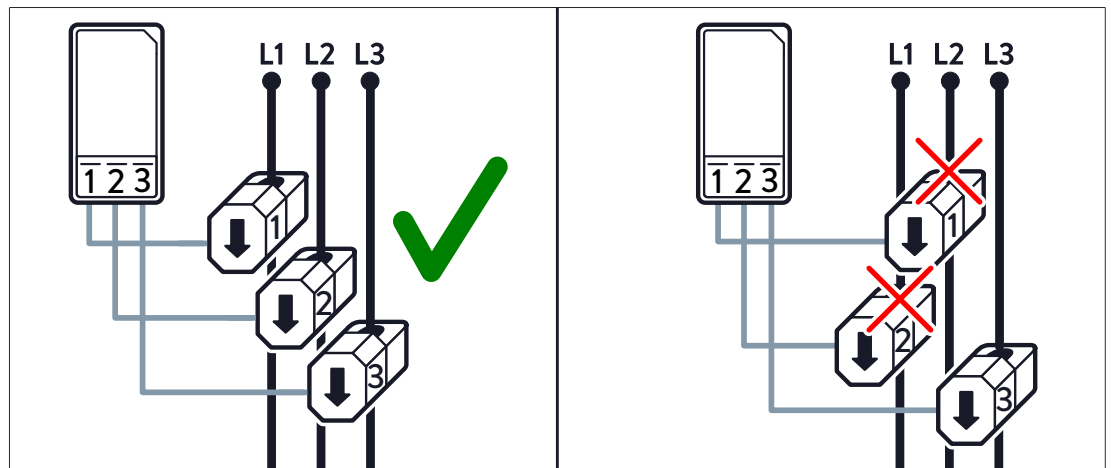


Illustration 26: Connecting the clamp-on current transformers: incorrect (right) and correct (left)

6.3 Configuring the power meter (optional)

Prerequisite:

- ✓ The power meter must be disconnected from the voltage supply in order to mount the touch display.

Tools:

- Touch display for power meter WM271

Three-phase measurement mode

The power meter only provides correct measured values when the right measurement mode is activated on the device. The **single-phase measurement mode** is the default setting. With a three-phase grid, then, the measurement mode must be switched to three-phase measurement.

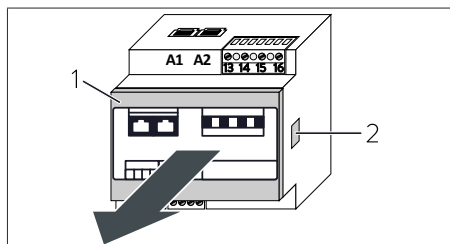


Illustration 27: Removing the front cover

- ▶ Press the clips (2) on both sides of the power meter. You might use a small screwdriver.
- ▶ Remove the front cover (1).

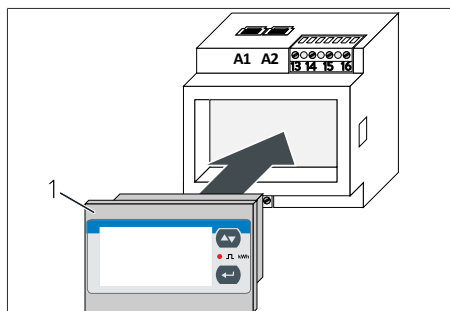



Illustration 28: Inserting the touch display

- ▶ Insert the touch display (1) into the power meter.
- ▶ Supply the power meter with energy.



Illustration 29: Touch display

- ▶ Press  for 3 seconds.
- The **PASS ?** screen appears.

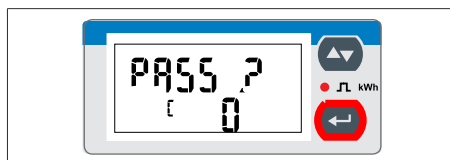



Illustration 30: Password entry screen

- ▶ Press  for 3 seconds.
- The **CnGPASS** screen appears. The power meter is now in programming mode.

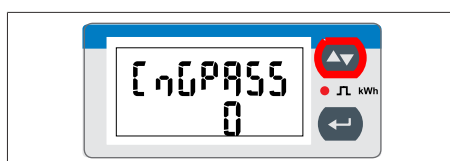



Illustration 31: CnGPASS screen

- ▶ Press  once.
- The **SYS** screen appears.

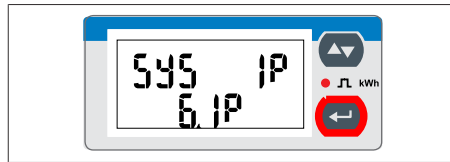


Illustration 32: SYS screen

- Press  once.

Now it is possible to change the measuring mode.

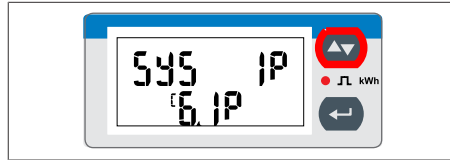



Illustration 33: SYS screen - change of measuring mode

- Press  twice until the setting 3P | 2.3P appears.

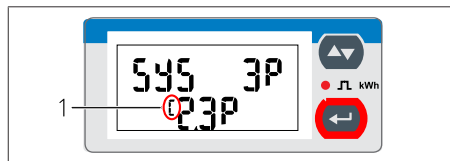



Illustration 34: SYS screen - setting 3P | 2.3P

- Press  for a longer period of time until the sign (1) disappears.

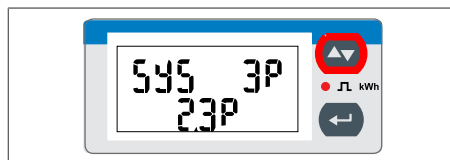


Illustration 35: SYS screen after changing the measuring mode


- Press  ten times. The **end** screen appears.



Illustration 36: End screen

- Press  once.

The three-phase measuring mode is now activated.

- Remove the touch display.
- Insert the front cover into the power meter.

6.4 Using an alternative power meter (EM357)



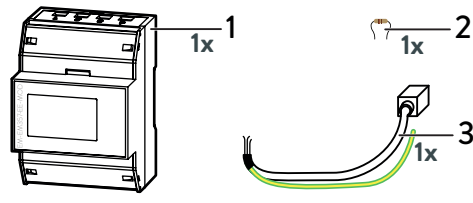
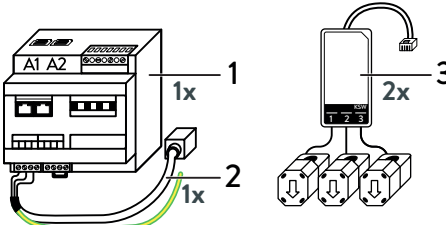
In addition to the standard accessories set, an alternative accessories set is offered which includes EM357 power meters.

- Note the following information regarding the use of the alternative power meter when installing the storage system.

- The EM357 power meter is a direct meter.
- An EM357 power meter represents one measurement point.
- Installing the power measurement with EM357 power meters differs from power measurement with the WM271 power meter as follows:
 - Instead of one WM271, one EM357 is required for the sonnenBatterie hybrid 9.53.
 - 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 (shown on the display), the measurement direction is from top to bottom.
 - The maximum measurable amperage is 100 A.

Scope of delivery

- The content of the alternative accessories set differs from the standard scope of delivery as follows:

	
Alternative accessories set	Standard accessories set
1 EM357-EE-MOD power meter	1 WM271 power meter
2 Terminating resistor (part of EM357-EE-MOD)	2 Modbus cable with RJ45 coupling
3 Modbus cable with RJ45 coupling	3 Inverter interface with clamp-on current transformer

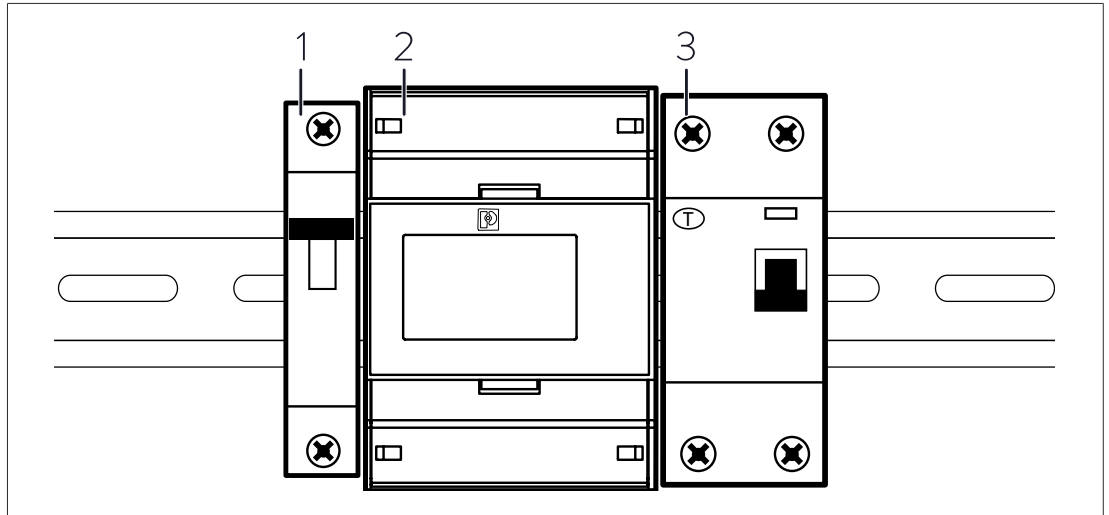
Placing components in the distributor



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.

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

Approx. 13 cm (corresponds to 7 TE) of free space on mounting rails is required for the components.



- 1 Miniature circuit breaker B20/B25 (not included in scope of delivery)
- 2 EM357-EE-MOD power meter (Modbus address 10)
- 3 Residual current device (RCD) | Type B | 30 mA (not included in scope of delivery)

Differences in the overview circuit diagram

The overview circuit diagrams in this document always show the power measurement using the standard power meter. The following illustration shows how the alternative power meter is installed in comparison.

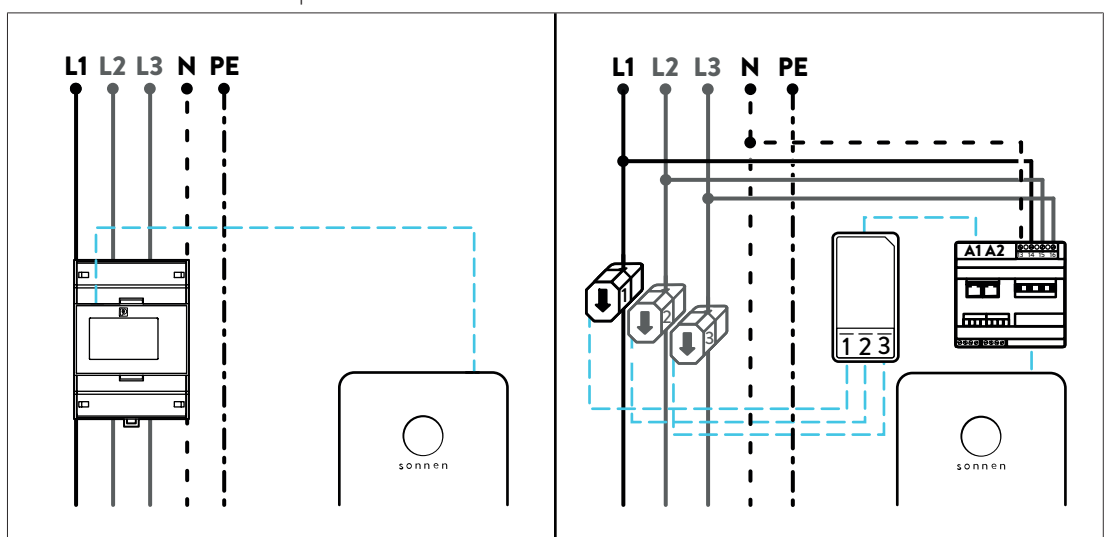


Illustration 37: Representation of a measurement point in single-phase or three-phase mains: EM357 power meter (left) and WM271 (right)

Connecting the AC lines



Cables with a conductor cross-section of 1.5 to 25 mm² can be connected to the power meter (torque for connection: 2.5 Nm).

- ▶ Open or remove the top flap on the power meter. Removal simplifies the connection of the cables.
- ▶ Open the bottom flap on the power meter.
- ▶ Remove the cover (communication shield) from the top.
- ▶ Connect the AC lines, single-phase (L1, N) or three-phase (L1, L2, L3, N), depending on the mains. Ensure that the direction of energy flow in the power meter is from top to bottom.

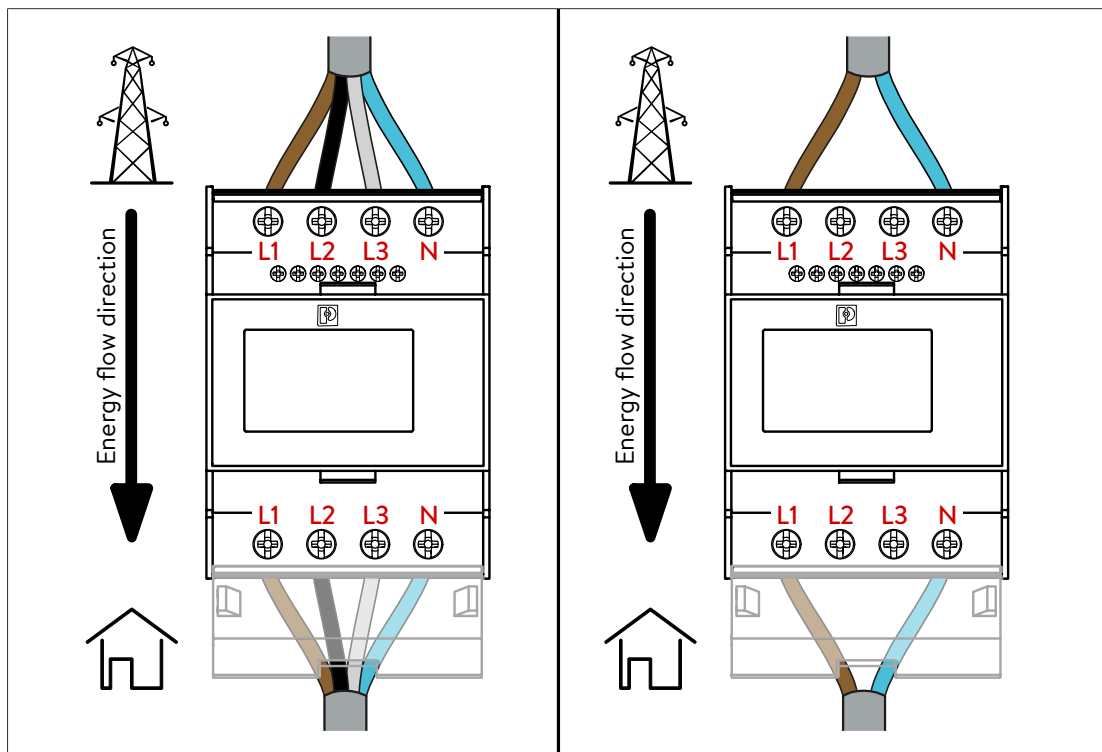
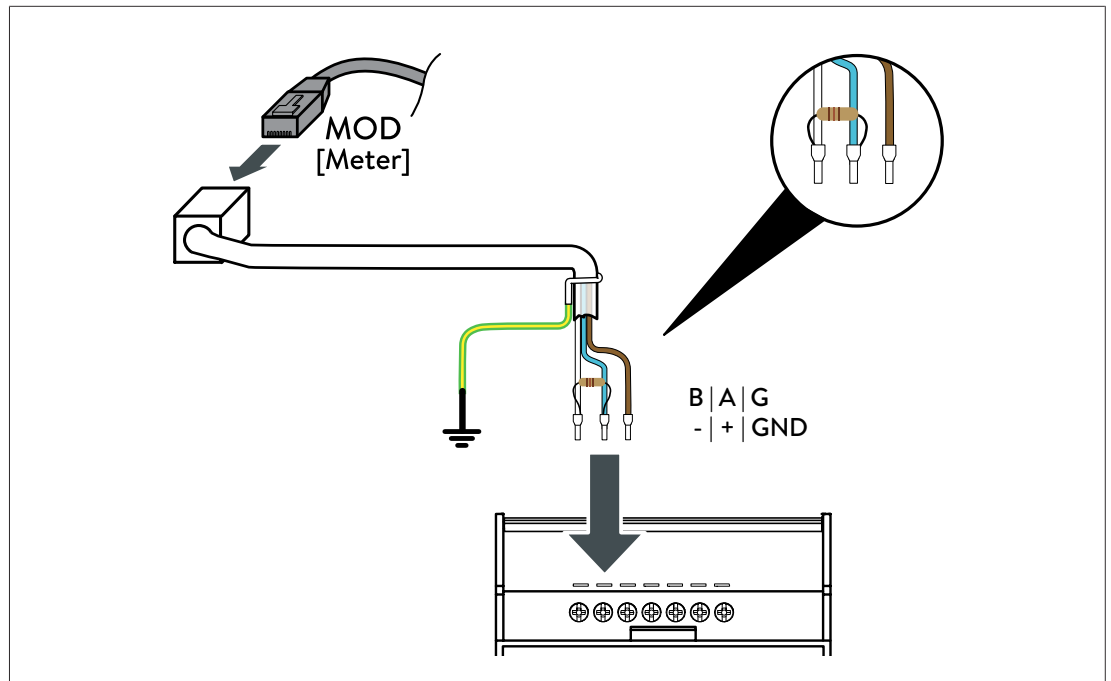


Illustration 38: Connection of EM357 power meter in three-phase (left) and single-phase (right) mains

- ▶ Attach the previously removed cover (communication shield) to the power meter.
- ▶ Close the bottom flap on the power meter.

Connecting the communication line

- ▶ Attach the terminating resistor (included in the scope of delivery) to the end of the Modbus cable supplied.
- ▶ Connect the Modbus cable to the power meter.
- Assignment of the Modbus cable:
 - white-blue = -
 - blue = +
 - brown = GND



- Earth the premounted earthing cable of the Modbus cable.
- Close the top flap (possibly removed beforehand) on the power meter.

Setting up the power meter

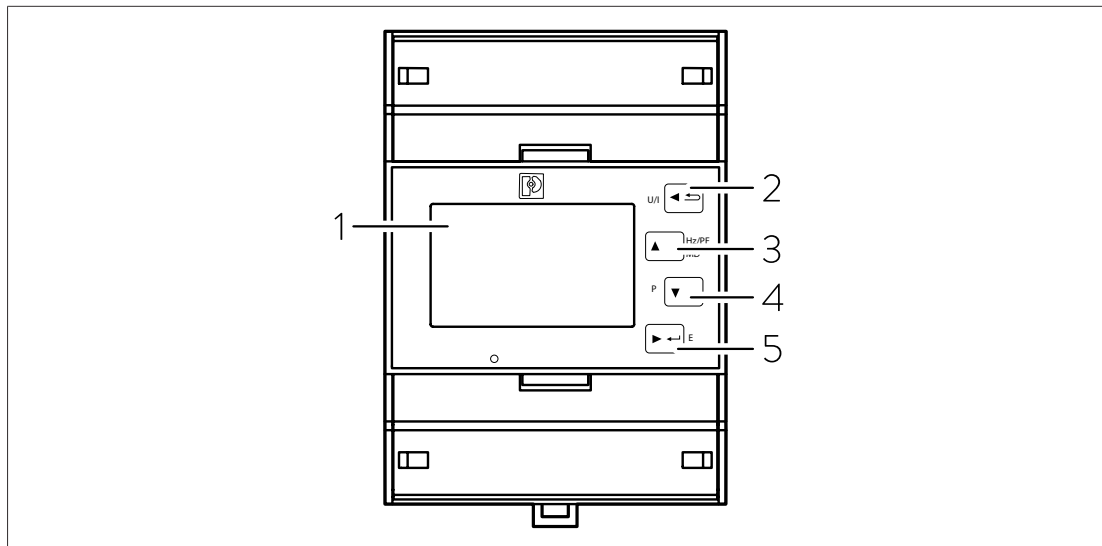
When commissioning the storage system using the commissioning assistant, the following must be taken into account when **configuring the power measurement**.

Meter	Direction	Modbus ID	Channel	Measurement value	Edit
EM357	C - Consumption	10	1	494.75 W	Delete
				-	Add

- Type EM357 must be selected as the **meter**.
- The correct **measurement point** type (consumption) must be assigned to the power meter based on the Modbus address.
- The EM357-EE-MOD power meter is preset to **Modbus address (Modbus ID) 10**.
- Select **1** as the **channel**.

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.

6.5 Connecting the mains line

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.

- ▶ Connect the wires for the mains line as shown in Figure 'Circuit diagram overview – electrical connection at single-phase mains [P. 28]' or 'Circuit diagram overview – electrical connection at three-phase mains [P. 29]'. Make sure that the mains line's coloured wires are correctly connected.

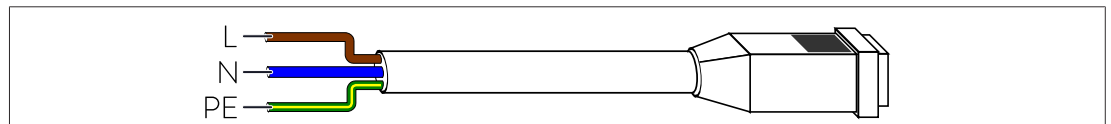


Illustration 39: The assignments of the coloured wires in the mains line

- ▶ Connect the socket (4) of the public network to the (XAC) connection on the storage system. Ensure that the stickers (1, 2) face upwards.
- ▶ Close the lock (3).

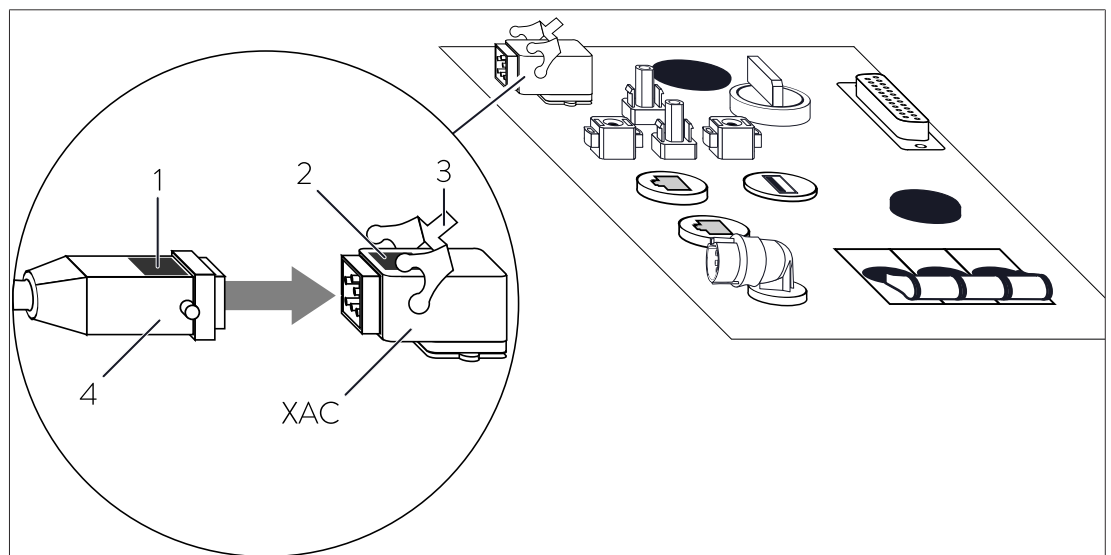


Illustration 40: Connection of the mains line to the connection socket

1, 2	Sticker	3	Lock
4	Mains connection socket	XAC	Mains connection on the storage system

6.6 Connecting the ethernet line

- ▶ Use a patch cable with the following properties as the Ethernet line:
 - The cable is Cat 6.
 - The cable is shielded.
- ▶ Connect the patch cable (1) as it is shown in the following illustration.
- ▶ Connect the other end of the Ethernet line to the router of the home network (2).

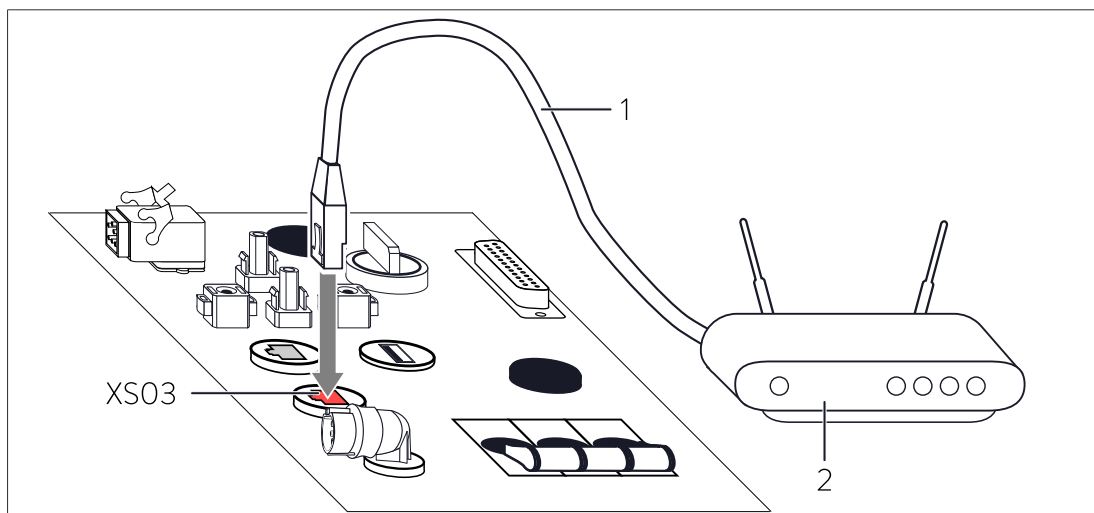


Illustration 41: Connecting the Ethernet line

- 1 Patch cable (not included in scope of delivery)
- 2 Home network router
- XS03 Ethernet port on the storage system

Upon commissioning, the storage system automatically establishes the connection to the internet once the patch cable has been correctly connected.

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

- ▶ Follow the instructions in section Troubleshooting [P. 64].

6.7 Connecting the modbus line

Measurement data is transmitted from the power meter to the storage system using the Modbus line.



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 a patch cable with the following properties as the Modbus line:
 - The cable is Cat 6.
 - The cable is shielded.
- Earth the screen of the Modbus line for the power meter.
- Connect the patch cable (1) as it is shown in the following figure.

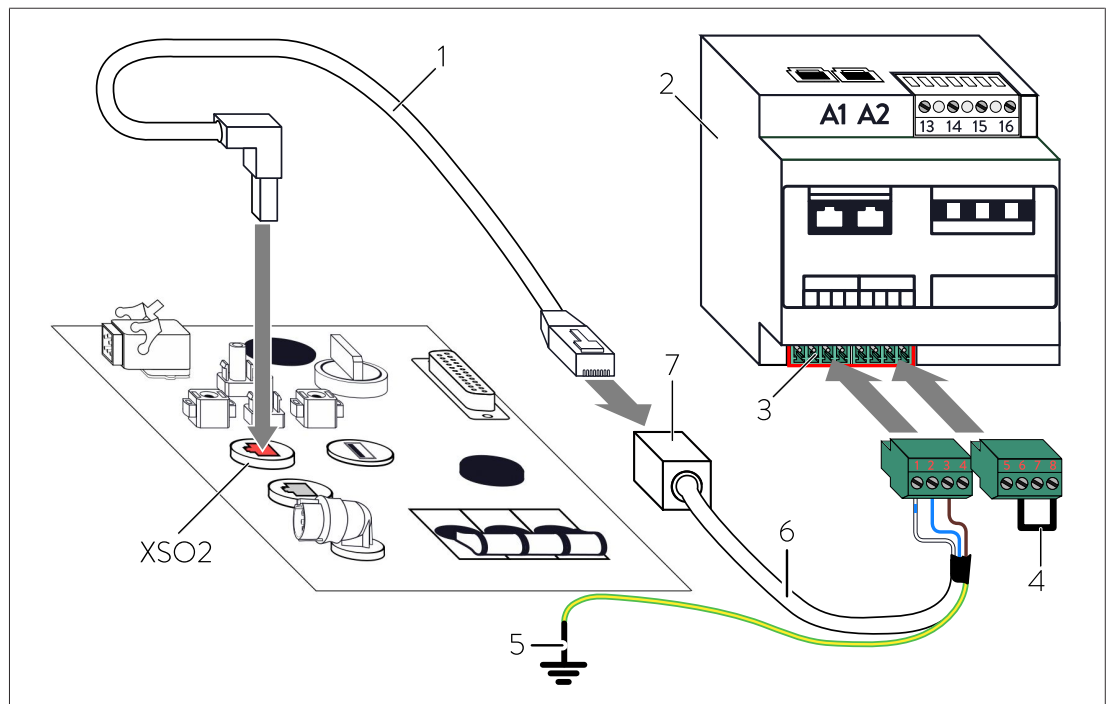


Illustration 42: Connecting the modbus line

- | | |
|------|---|
| 1 | Patch cable (not included in scope of delivery) |
| 2 | Power meter |
| 3 | Modbus terminal strip |
| 4 | Jumper for Modbus termination |
| 5 | Connection of the shield to the grounding system |
| 6 | Modbus line (A- = white/blue B+ = blue GND = brown) |
| 7 | RJ-45 coupling |
| XSO2 | Modbus port |

If there is no jumper (4) installed between the pins 6 and 8 on the plug of the Modbus terminal strip (3):

- Install a jumper (4) between pins 6 and 8 on the Modbus terminal strip (3) connector.

6.8 Using digital inputs/outputs

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.

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.



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.



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

6.8.1 Connecting the signal line



The signal line for using the digital inputs/outputs can be obtained from sonnen⁶. Only this original signal line may be used.

The digital inputs and outputs (XDIO) are on the top side of the storage system. These can be used to control external devices. The digital signals are transmitted via the signal line (4). We recommend connecting the signal line to a terminal strip (6). The individual cores of the signal line from the terminal strip can then be distributed to the corresponding downstream external components.

The white wire of the signal line (4) represents the earth (GND). If more than one digital output is used, then several wires must be connected to earth. For this reason we recommend installing multiple terminals which are connected via a bridge (5) to earth (GND).

- ▶ Connect the signal line as shown in the following illustration.

⁶ 'Additional accessories Digital inputs/outputs D-SUB'

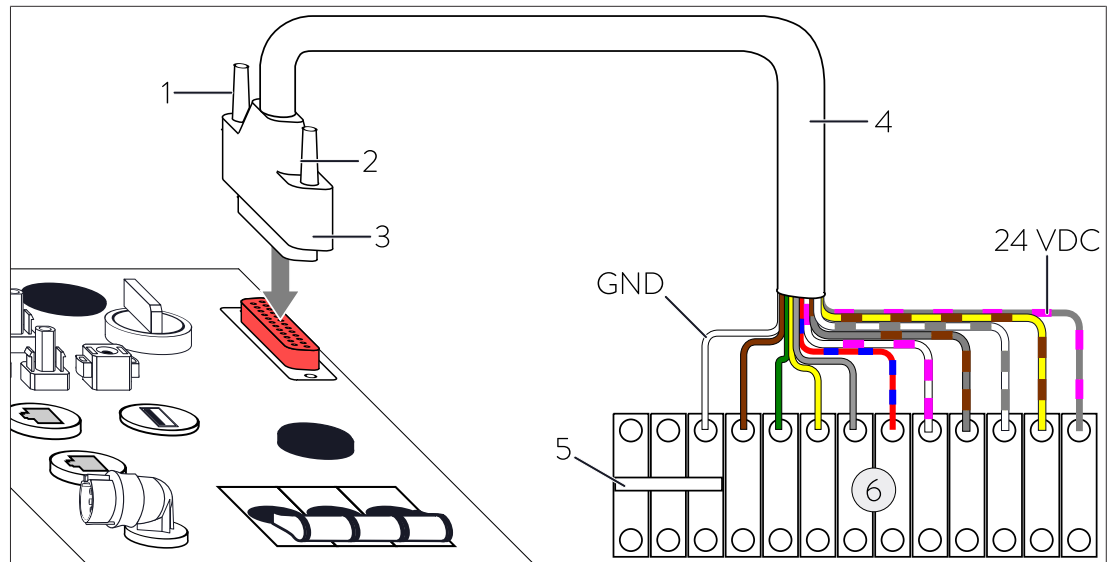


Illustration 43: Connecting the signal line

- 1, 2 Knurled screw
- 3 Signal line connector
- 4 Signal line
- 5 Bridge to connect terminals (not included in scope of delivery)
- 6 Terminal strip (not included in scope of delivery)
- XDIO Digital inputs and outputs

Wire colour	Wire cross-section	Voltage	Max. Amperage	Function
	[mm ²]	[VDC]	[mA]	
white	0.25/0.5	0	350	GND (Earth)
brown	0.25/0.5	24	50	DO self-consumption switch
green	0.25/0.5	24	50	DO PV reduction 1
yellow	0.25/0.5	24	50	DO PV reduction 2
grey	0.25/0.5	24	50	DO min/max SOC
red-blue	0.25/0.5	24	50	DI CHP (BHKW)
white-pink	0.25/0.5	24	50	DI CEI 0-21 Remote shutdown
grey-brown	0.25/0.5			CEI 0-21 Inverter
white-grey	0.25/0.5	24	50	DI CEI 0-21 Signal Local
yellow-brown	0.25/0.5	24	50	DI CEI 0-21 Signal External
grey-pink	0.25/0.5	24	50	Supply voltage 24 VDC

Table 2: Technical data of the digital inputs (DI) and outputs (DO)

6.8.2 Using digital output pv reduction



The digital outputs cannot be used directly. Additional relays are required, which are not included in the scope of delivery.

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.

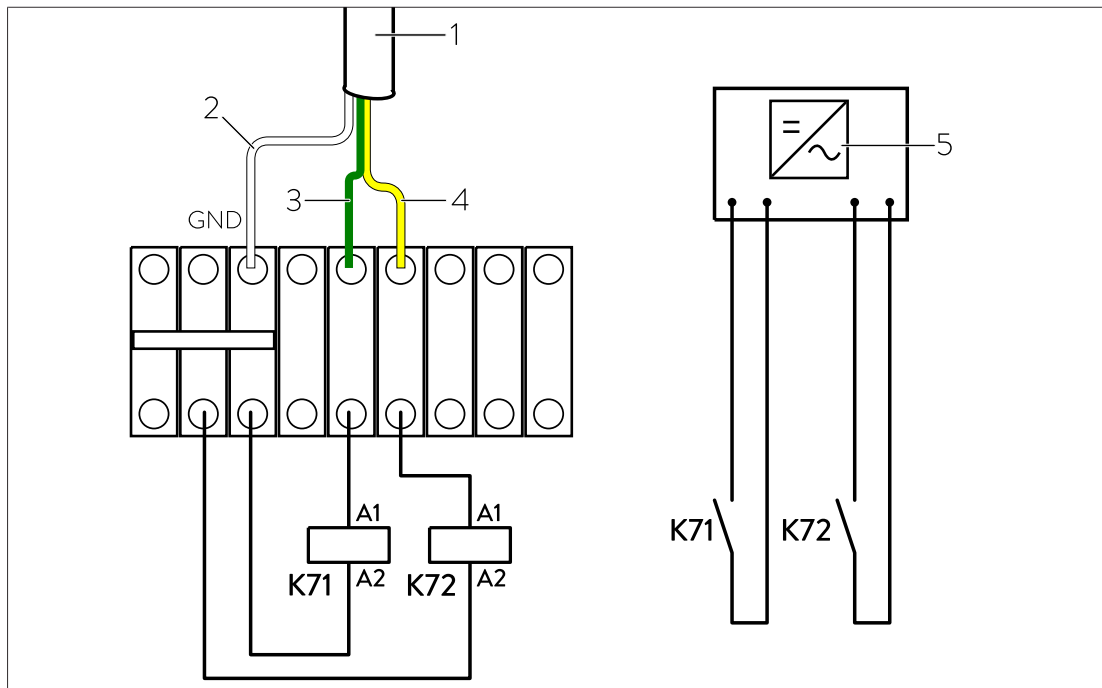


Illustration 44: PV reduction

- 1 Signal line
- 2 Earth (GND)
- 3 DO PV reduction 1
- 4 DO PV reduction 2
- 5 PV inverter with suitable interface for power control
- K71 External relay (not included in scope of delivery)
- K72 External relay (not included in scope of delivery)

Function

Relays K71 and K72 are connected to the green (PV reduction 1) and yellow (PV reduction 2) wires, respectively. If PV reduction 1 is activated (24VDC applied to the green wire), K71 energises and the K71 make contact closes. K72 energises as soon as PV reduction 2 is activated (24VDC applied to the yellow wire).

PV reductions 1 and 2 are activated/deactivated automatically by the storage system depending on the current feed-in power. If the feed-in power is within the permissible range, PV reduction 1 and PV reduction 2 are deactivated. K71 and K72 are not energised. This corresponds to level 0.

As soon as a power reduction is required, K71 and K72 are energised according to the data provided 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
K71				
K72				

Table 3: Make contact positions of K71 and K72 relays depending on activated level

Wiring the PV reduction digital output

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.

Tools:

- 2 relays with the following properties:
 - Coil voltage: 24 VDC
 - Max. control current: 50 mA
 - 1 make contact
- sonnen recommends using the following relays: Manufacturer: Finder | Item no.: 483170240050 | Item designation: 48 Series Modular interface

Prerequisite

- ✓ The PV inverter has a suitable interface for power control (e.g. an interface for a ripple control receiver).
- Wire the PV reduction digital outputs as shown in Figure PV reduction [P. 44].
- Set the following values on the PV inverter:

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

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 50 % of the rated power. The following values need to be entered in the commissioning assistant.

Level 1	60 % (50 % plus 10 %)
Level 2	35 % (50 % minus 15 %)
Level 3	0 %

6.8.3 Using digital output self-consumption switch

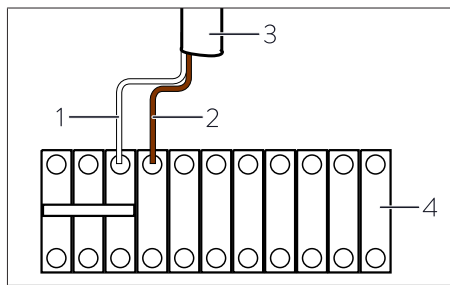


Illustration 45: Self-consumption switch

- 1 Earth (GND)
- 2 Self-consumption switch
- 3 Signal line
- 4 Terminal strip

Function

The storage system software can be used to set a switch-on threshold and a minimum switch-on duration.

If the generation surplus (= generation – consumption – charging of the storage system) exceeds the set switch-on threshold, the self-consumption switch is activated. The self-consumption switch then remains active for the set minimum switch-on duration.

Configuring software settings

The switching behavior of the self-consumption switch can be configured using the commissioning assistant (see Commissioning assistant [P. 59]).

- Adjust the switch-on threshold and minimum switch-on duration to suit the consumers that are activated using the self-consumption switch.

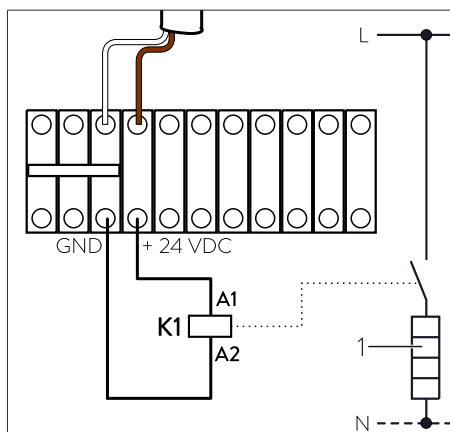


Illustration 46: Activating/deactivating a thermal resistor

- 1 Heating element
- K1 External contactor

Application example: heating element

As an example, a heating element (1) can be activated/deactivated using the self-consumption switch. In this case it is a good idea to set the nominal power of the heating element as the switch-on threshold. Note that suitable safety measures must be in place to prevent the heating medium from overheating.

6.8.4 Using digital output min/max SOC

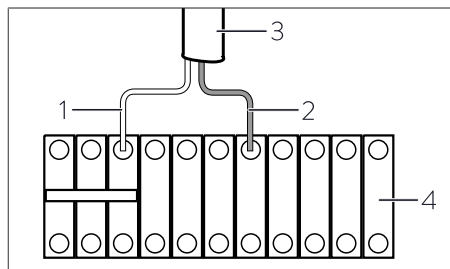


Illustration 47: Digital output min/max SOC

- 1 Earth (GND)
- 2 DO min/max SOC
- 3 Signal line
- 4 Terminal strip

Function

The storage system software can be used to set a *minimum state of charge* (min SOC) and a *maximum state of charge* (max SOC).

If the state of charge of the storage system drops below the min SOC value, the digital output is activated. The digital output is only then deactivated when the state of charge exceeds the max SOC value.

Configuring software settings

The switching behavior of the min/max SoC digital output can be configured using the commissioning assistant (see Commissioning assistant [P. 59]).

- Set suitable values for the min SoC and max SoC variables.

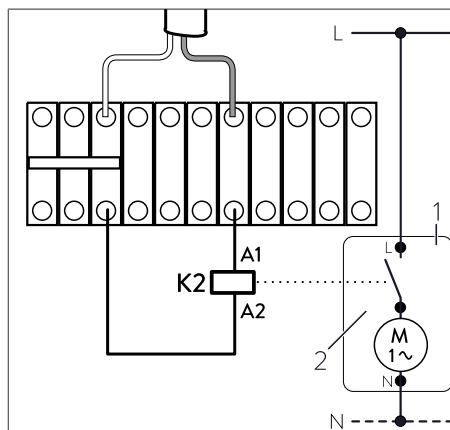


Illustration 48: Activating/deactivating a CHP

- 1 CHP
- 2 Contact for activating CHP
- K2 External relay

Application example

As an example, a CHP unit (1) can be activated/deactivated using the min/max SoC digital output.

The CHP unit must be available via a suitable interface (2) for activation/deactivation. In this example, the generation surplus produced by the CHP unit can be used to charge the storage system. The power output of the CHP unit must be recorded for this.

6.8.5 Using digital input CHP



The CHP digital input may only be used in the way described here in combination with a combined heat and power station (CHP) which provides a constant supply of electrical power. Modulating combined heat and power stations, which supply a variable amount of power, **must not** be connected like this.

Function

Using the storage system's software the power produced by the combined heat and power station, or some other constant source of power, can be set. If the digital CHP input is activated, then the set power will be added to the power currently being produced.

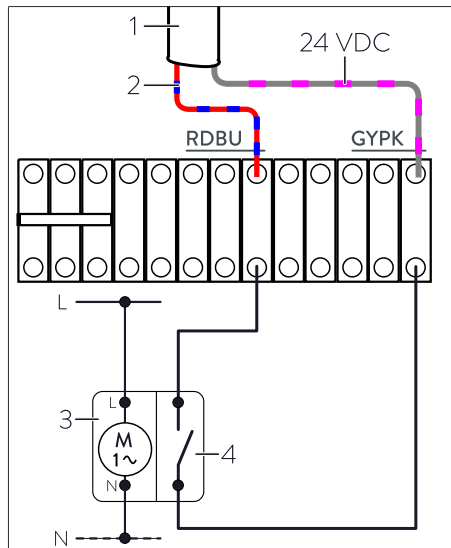


Illustration 49: CHP with operating contacts

- 1 Signal line
- 2 Digital input CHP
- 3 CHP
- K3 Floating operating contacts for the combined heat and power station (open if the station is not operating, closed if it is)

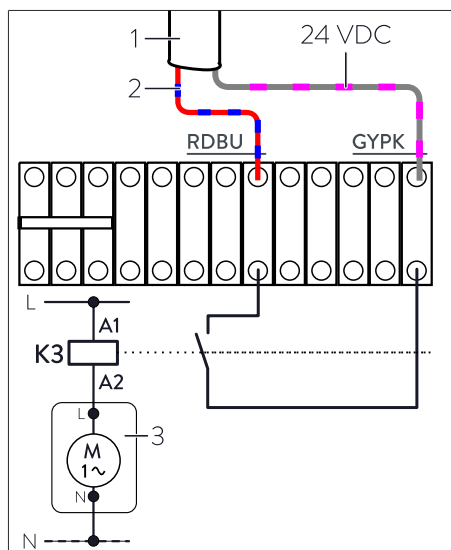


Illustration 50: CHP without operating contacts

- 1 Signal line
- 2 Digital input CHP
- 3 CHP
- K3 Current-operated relay

Application example – Combined heat and power station with operating contacts

A combined heat and power station (3) with operating contacts (4) can be wired up as shown in the left figure.

If the operating contacts (4) close, the digital CHP (2) input will be activated.

Application example – Combined heat and power station without operating contacts

A combined heat and power station (3) without operating contacts (3) can be wired up as shown in the left illustration.

A current-operated relay (K3) detects whether the station (3) is currently active. If the normally open contacts of K3 close, the digital CHP input will be activated.

6.9 Installing the battery modules

DANGER

Live voltage at the poles when battery modules are not switched off

Danger to life due to electrocution!

- ✓ The battery modules must remain switched off at all times during installation. Therefore:
 - Before installation, ensure that the 'Power' and 'Status' lights are off.
 - Do not press the power button on the battery module.

- Switching the battery modules on/off manually by pressing the green Power key is not necessary. When the battery modules are connected correctly, they will be fully operated by the storage system controls and **do not need to be switched on/off manually.**
- The Power key is only intended for service purposes and only authorised service technicians are permitted to use it.

Nevertheless, if a battery module has been switched on manually:

- Press and hold the Power key on the battery module for 3 seconds until all status lights on the battery module are off.



The voltage of the battery modules does not need to be measured before installation. The modules connect to each other after the storage system is commissioned and the voltages are automatically adjusted.

The 'Power' and 'Status' lights give you information about the current state of the battery module:

LED 'Power'	LED 'Status'	Description	Necessary action
ON	OFF	The battery module is charging.	-
0,5 s ON 1,5 s OFF	OFF	The battery module is discharging.	-
0,25 s ON 3,75 s OFF	OFF	The battery module is in standby mode.	-
OFF	0,5 s ON 1,5 s OFF	The battery module is charging, limitation is active.	-
0,5 s ON 1,5 s OFF	0,5 s ON 1,5 s OFF	The battery module is discharging, limitation is active.	-
OFF	0,5 s ON 1,5 s OFF	The battery module is in standby mode, limitation is active.	-
OFF	ON	The battery module is not working properly.	Please contact the service for help with troubleshooting.

6.9.1 Positioning and earthing the battery modules

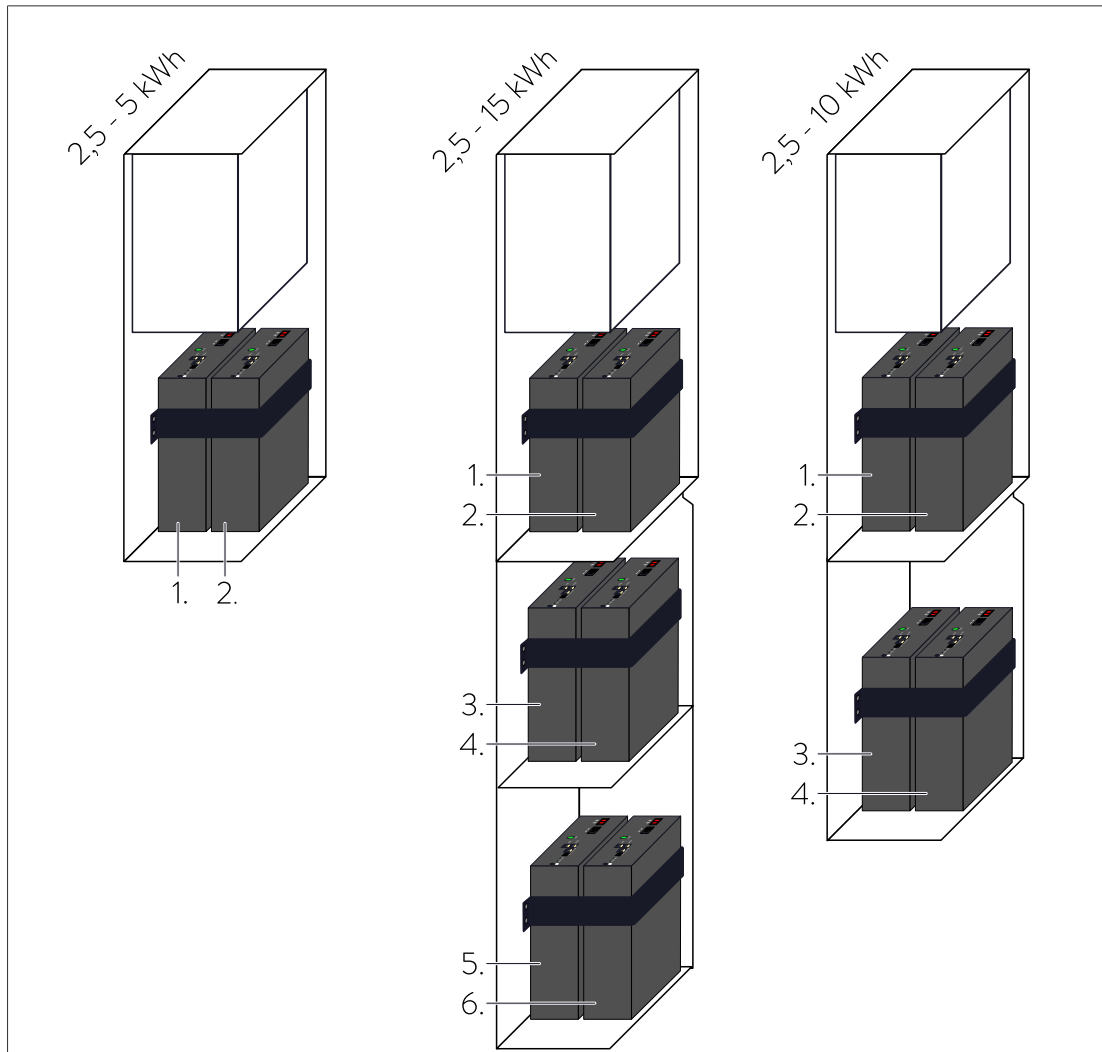


Illustration 51: Positioning the battery modules depending on the total capacity to be installed

- ▶ Connect an earth line to each battery module using the pre-assembled screw. Ensure that the components are arranged correctly, as shown in illustration 'Earthing the battery modules [P. 51]'.
- ▶ Tighten the screw(s) with a torque of 7 Nm.
- ▶ Position the battery modules as shown in the illustration above, based on the total number.
- ▶ Secure the battery modules using the pre-assembled securing bands inside the cabinets. The securing bands should fit tightly.
- ▶ Connect each earth line to the respective earth bolt in the main or extension cabinet. Ensure that the components are arranged correctly, as shown in illustration 'Earthing the battery modules [P. 51]'.
- ▶ Tighten the self-locking nut(s) with a torque of 5 Nm.

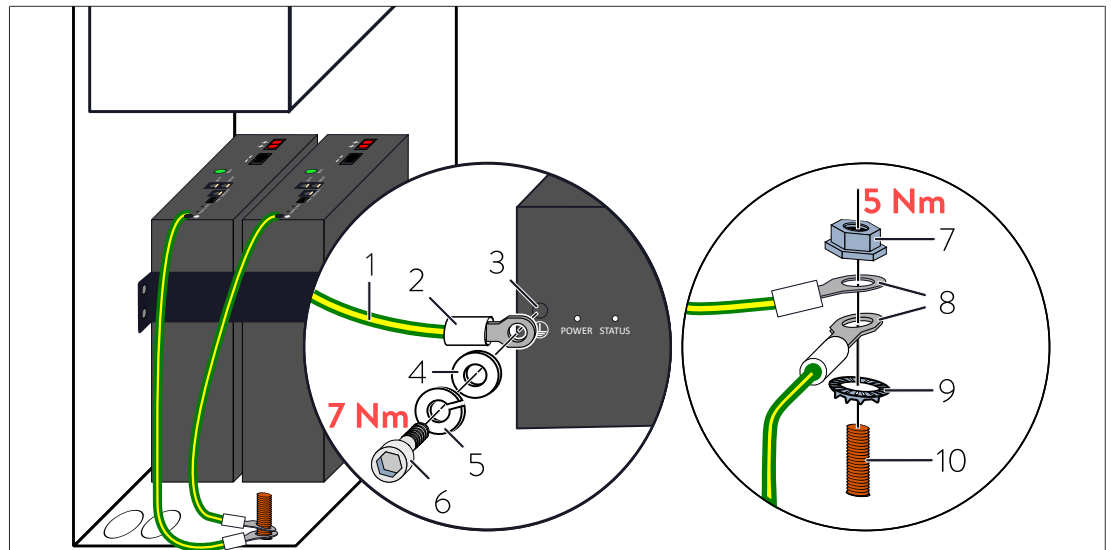


Illustration 52: Earthing the battery modules

- | | | | |
|---|------------------------------------|----|------------------|
| 1 | Earth line | 6 | Screw |
| 2 | Cable lug | 7 | Self-locking nut |
| 3 | Earth connection on battery module | 8 | Cable lug |
| 4 | Washer | 9 | Contact washer |
| 5 | Lock washer | 10 | Earth bolt |

6.9.2 Connecting the BMS communication lines

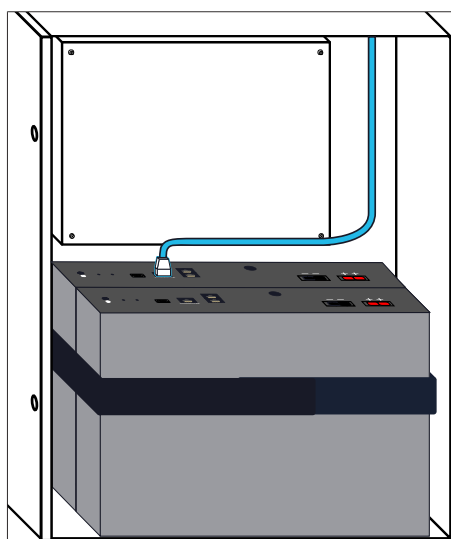


Illustration 53: Connecting the *CONTROLLER* line

- Connect the patch cable installed in the main cabinet to the *CONTROLLER* socket on the first battery module.

- Connect the supplied patch cable as shown in the following illustration. The connection for each one runs from **LINK-OUT to LINK-IN**.

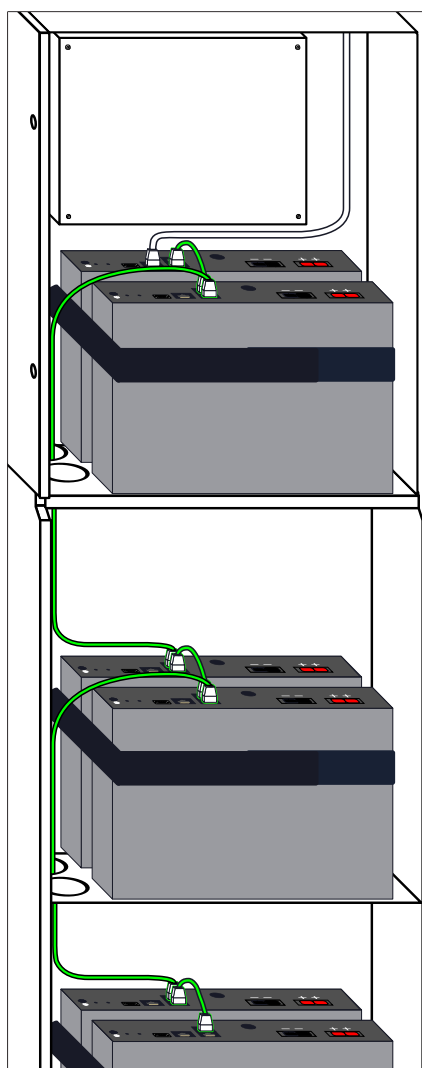


Illustration 54: Connecting the *BMS* communication lines

6.9.3 Connecting the battery lines

⚠ DANGER

Incorrectly connected battery lines

Danger to life due to electrocution / Risk of fire outbreak!

- ▶ Ensure that all battery modules are connected in parallel, i. e. all plus poles of the battery modules are connected together (red to red). Likewise, ensure that all minus poles of the battery modules are connected together (black to black).
- ▶ **Ensure that the battery line plugs noticeably click into the sockets.**

When connecting the battery lines, observe the following:

- The plus line is connected to the plus pole of the first battery module. The first battery module is the one connected to the CONTROLLER line.
- The minus line is connected to the minus pole of the last battery module.

If **no** extension cabinet is used:

- ▶ Connect the battery lines as shown in the following illustration.

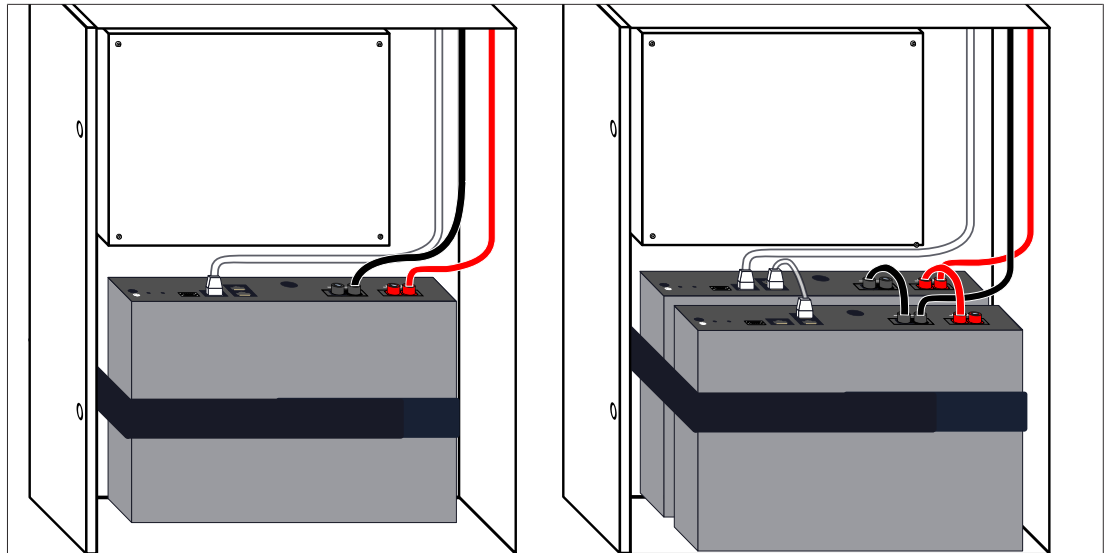


Illustration 55: Connecting the battery lines for 2.5 kWh and 5 kWh storage capacity without an extension cabinet

If an extension cabinet is used:

- Connect the battery lines as shown in the following illustration.

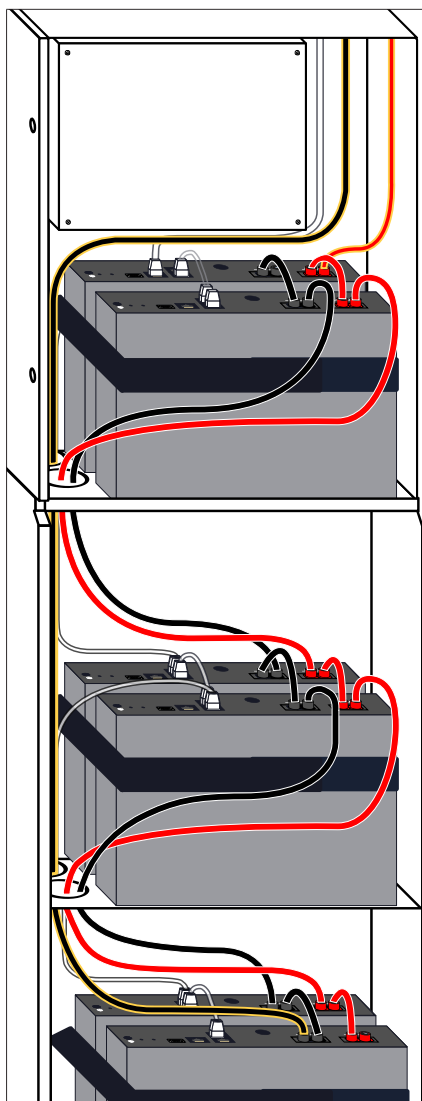


Illustration 56: Connecting the battery lines for up to 15 kWh storage capacity with an extension cabinet

6.10 Installing covers

6.10.1 Connecting earthing conductor

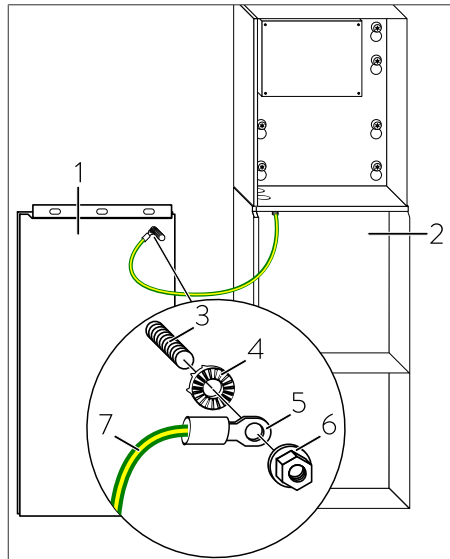


Illustration 57: Earthing line between extension cabinet and cover

- 1 Cover of the extension cabinet
- 2 Extension cabinet
- 3 Earth bolt
- 4 Contact disc
- 5 Cable lug
- 6 Locking nut
- 7 Earth conductor

An earthing conductor (7) is connected to the optional extension cabinet (2).

- Connect the other end of the earthing conductor to the earth bolt (3) on the cover (1).

Take care of the positioning of the components (4 to 6).

- Tighten the locking nut (6) with a torque of 5 Nm.

6.10.2 Installing the cover of the extension cabinet

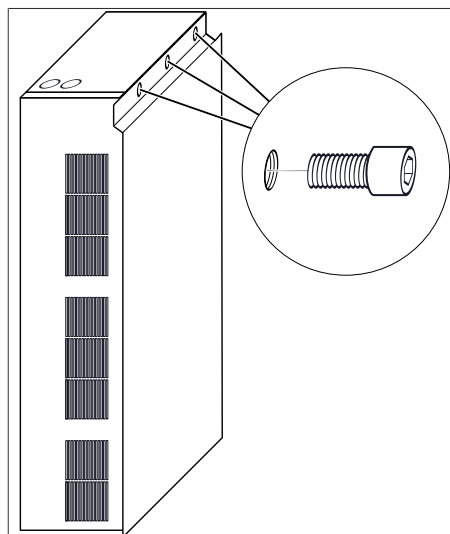


Illustration 58: Mounting the cover of the extension cabinet

- Hook the cover into the front of the extension cabinet.
- Mount the cover with the three screws. Tighten the screws only slightly, making sure that the cover can still be moved.
- Close the door of the main cabinet and align the cover.
- Fully tighten the screws.

6.11 Connecting the photovoltaic system

DANGER

Electrical work on the storage system

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.

6.11.1 Assembling the PV plug-in connectors

WARNING

Improper assembly of the PV plugs

Risk of fire outbreak because of improperly assembled PV plug-in connectors, which can get very hot.

- ▶ Assemble the plug-in connectors correctly.
- ▶ Follow the manufacturer's instructions.

- Four PV plug-in connectors and the manufacturer's assembly instructions are provided.

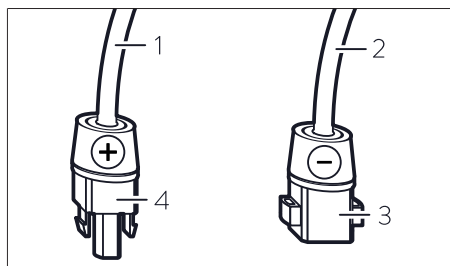


Illustration 59: PV plug-in connectors

- 1 Plus wire
- 2 Minus wire
- 3 PV plug-in connector minus
- 4 PV plug-in connector plus

- ▶ Connect the PV plug-in connectors as specified by the manufacturer to the plus and minus wires.
- ▶ Pay careful attention to the polarity of the PV plug-in connector.

6.11.2 Connecting the PV system

DANGER

DC voltage too high!

Danger to life due to electrocution!

- ▶ Only connect PV systems whose unloaded voltage does not exceed the maximum voltage for the PV inputs.

⚠ WARNING

Plugging in/unplugging PV lines during operation

Serious burns through arcing!

Before plugging in/unplugging PV lines:

- ▶ Switch the PV disconnecter (SPV) off.

Prerequisite:

- ✓ The maximum input current of the PV inputs (see Technical data [P. 9]) must not be exceeded.
- ✓ The unloaded voltage of the PV system must never exceed the maximum input voltage for the PV inputs (see Technical data [P. 9]).
- ▶ Please note that the unloaded voltage of PV systems depends upon the ambient conditions (particularly the temperature).

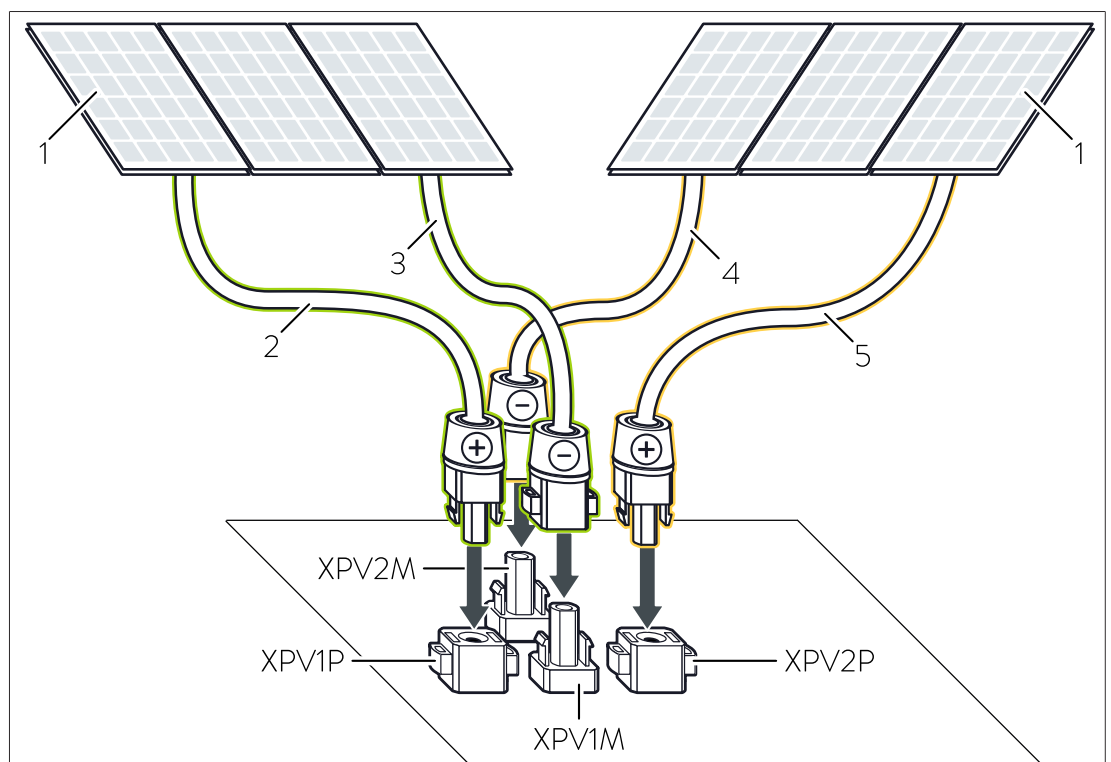


Illustration 60: Connecting the PV system to the storage system

1	PV system	2	PV plus line 1
3	PV minus line 1	4	PV minus line 2
5	PV plus line 2	XPV1P	1 st PV plus connection
XPV1M	1 st PV minus connection	XPV2P	2 nd PV plus connection
XPV2M	2 nd PV minus connection		

- ▶ Connect the PV plus wire 1 (2) to the **XPV1P** connection.
- ▶ Connect the PV minus wire 1 (3) to the **XPV1M** connection.

If you want to connect a second string of the PV system:

- ▶ Connect the PV plus wire 2 (5) to the **XPV2P** connection.
- ▶ Connect the PV minus wire 2 (4) to the **XPV2M** connection.

7 Commissioning

7.1 Initial commissioning

7.1.1 Filling in the type plate

Tools:

- Permanent marker

- ▶ Mark off the installed battery capacity on the type plate on the outside of the storage system.

The possible battery capacities and corresponding nominal power can be found in the Technical data [P. 9]

7.2 Switching on the storage system



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

7.2.1 Closing the storage system

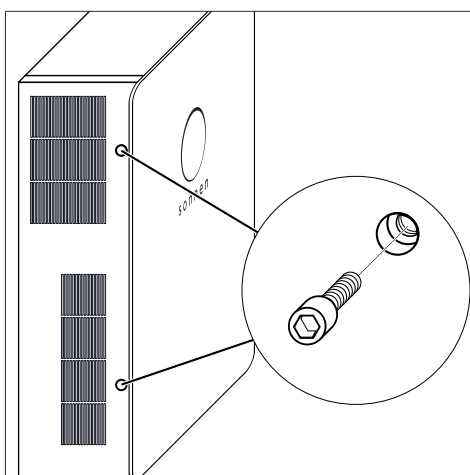


Illustration 61: Closing the main cabinet

- ▶ Close the door of the main cabinet.
- ▶ Install the two Allen screws on the left side of the main cabinet.

7.2.2 Switching on the grid voltage

- ▶ Switch on the grid voltage using the AC miniature circuit breaker.

7.2.3 Switching on the PV disconnecter SPV

The PV disconnecter (SPV) makes the connection between the PV system and the inverter.

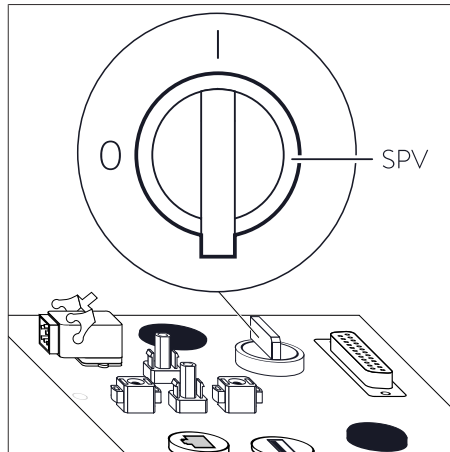


Illustration 62: Switching SPV on

- Switch the PV disconnecter (SPV) on.
- If there are external DC isolating switches:
- Switch these on too.

7.2.4 Switching on the fuse switch F1

NOTICE

If the storage system can't be switched on:

- Do not attempt switching on the storage system more than three times.
- Contact the sonnen service.
- ⇒ Further attempts can damage the battery modules.

Fuse switch F1 establishes the connection between the battery and the inverter.

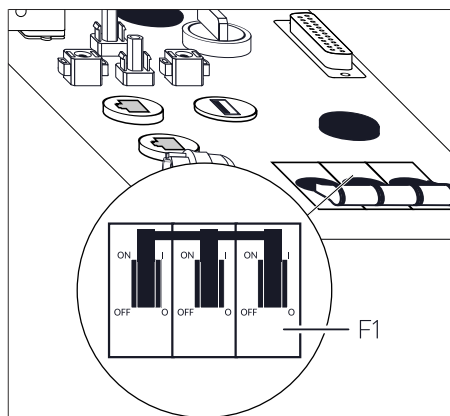


Illustration 63: Fuse switch F1 at the top side of the storage system

- Switch on fuse switch F1.

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

When the storage system has started up and is running in normal operation, the sonnen Eclipse pulses white.

7.3 Commissioning assistant

With the help of the commissioning assistant the storage system can be configured. The operator as well as the electrician have to enter some information while the commissioning assistant is running.



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

7.3.1 Establishing connection to the storage system

- Connect your laptop/PC (4) to the router of the home network (2). The storage system must also be connected to the router of the home network.

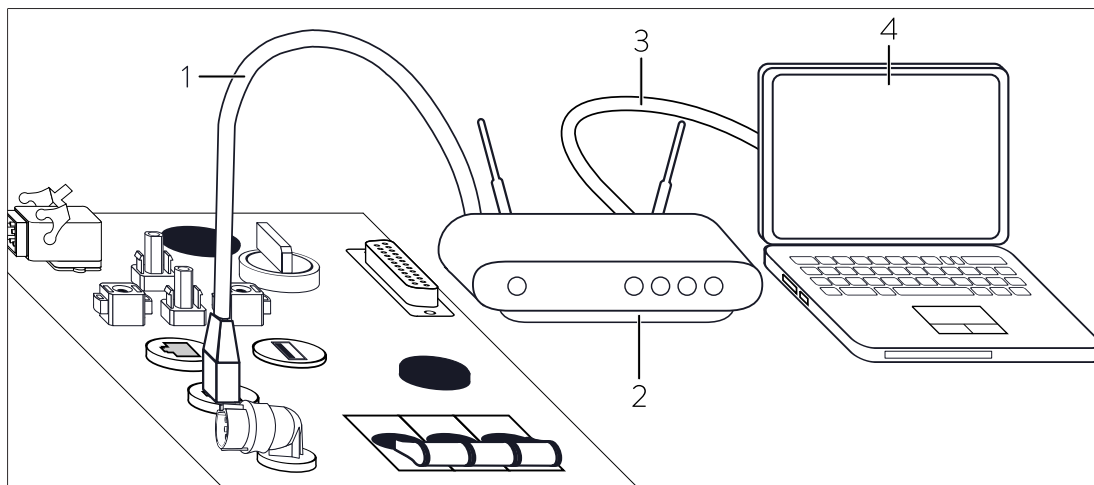


Illustration 64: Ethernet wiring

- 1, 3 Ethernet line
- 2 Router of the home network
- 4 Laptop/PC

7.3.2 Running the commissioning assistant

- ▶ Navigate to the following internet address: <https://find-my.sonnen-batterie.com>

The following window appears:



- ▶ Select the storage system to be configured and click on the **Configure Assistant** button.
- ▶ Log in as Installer. Use the password that you received throughout the certification training.
- ▶ Run the commissioning assistant until it is fully completed.

If the storage system is not displayed:

- ▶ Follow the instructions in section Troubleshooting [P. 64].

8 Decommissioning

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. 14]).
- ▶ Never continue to operate battery modules which have been deep-discharged.

8.1 Switching the storage system off

This section describes how the storage system is switched off and is thus put out of operation. To be able to work safely on the storage system, additional steps are necessary (see Switching the storage system off to electrically isolate it [P. 63]).

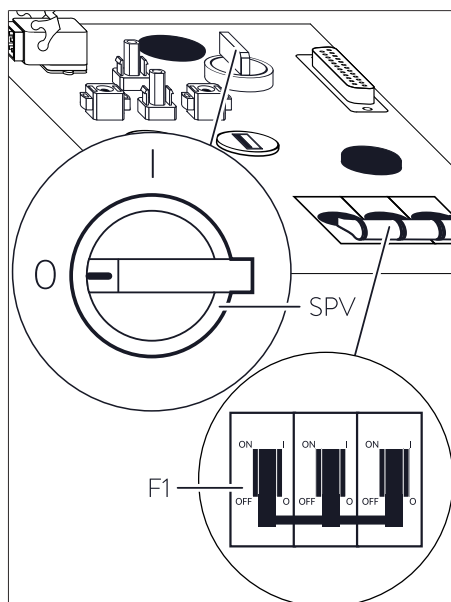


Illustration 65: Fuse switch F1 and PV disconnect

- ▶ Switch off fuse switch F1.
- ▶ Switch off the PV disconnect (SPV).
- ▶ Switch off the grid voltage using the AC miniature circuit breaker.

8.2 Switching the storage system off to electrically isolate it

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

1. Switch off fuse switch F1 and PV disconnecter SPV, as described in the previous section.
2. Switch off the grid voltage using the AC miniature circuit breaker.
3. Take steps to ensure that these switches cannot be switched on again.

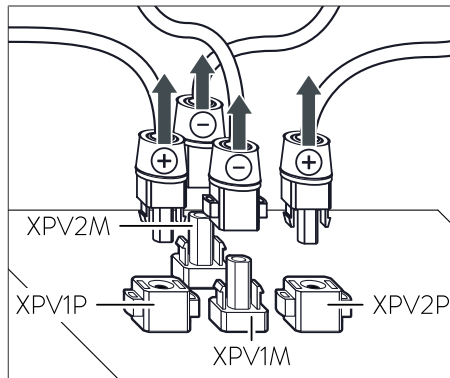


Illustration 66: Removing the PV plug-in connectors

4. Pull all of the PV plug-in connectors out of the storage system. When doing this, observe the specifications of the connector's manufacturer.

5. Wait at least 5 minutes until the capacitors in the inverter have fully discharged.
6. Carefully check that there is no voltage inside the storage system.

The battery modules are the sole remaining sources of voltage in the storage system.

9 Troubleshooting

Disturbance	Possible reasons(s)	Correction																				
No online connection to the storage system.	No connection between the storage system and the server.	<div><div>► Make sure that the Ethernet line between the storage system and the Router of the home network is correctly connected.</div><div>► Make sure that the Router of the home network allows connections on the following ports:</div><table><tr><th>TCP Port</th><th>Service</th></tr><tr><td>22</td><td>ssh</td></tr><tr><td>80</td><td>http</td></tr><tr><td>8080</td><td>http</td></tr><tr><td>443</td><td>https</td></tr><tr><td>3333</td><td>debug</td></tr><tr><th>UDP Port</th><th>Service</th></tr><tr><td>1194</td><td>VPN</td></tr><tr><td>123</td><td>NTP</td></tr><tr><td>1196</td><td>VPN</td></tr></table></div>	TCP Port	Service	22	ssh	80	http	8080	http	443	https	3333	debug	UDP Port	Service	1194	VPN	123	NTP	1196	VPN
TCP Port	Service																					
22	ssh																					
80	http																					
8080	http																					
443	https																					
3333	debug																					
UDP Port	Service																					
1194	VPN																					
123	NTP																					
1196	VPN																					
The sonnen Eclipse of the storage system pulses orange.	The internet connection to the storage system has been interrupted.	<div><div>► Check whether the home network router is able to establish an internet connection.</div><div>If so:<div>► Ensure that the network line for the storage system is connected to the home network router.</div></div></div>																				
The sonnen Eclipse of the storage system lights up red.	The storage system has detected a problem that is preventing normal operation or may cause damage to the storage system.	<div><div>► Contact the sonnen service team to get help resolving the problem.</div></div>																				
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.	<div><div>► Check that the circuit breaker in the supply line of the storage system is switched on.</div><div>If so:<div>The public electricity grid does not provide any electrical energy (grid outage).</div><div>► It can only be waited until the public electricity grid supplies energy again. Thereafter, the storage systems resumes normal operation.</div></div></div>																				
	Storage system with backup power function only ⁷ : The storage system is not connected to the public electricity grid and is in backup operation.	No troubleshooting necessary.																				

⁷ Optional accessories sonnenProtect.

10 Uninstallation and disposal

10.1 Uninstallation

DANGER

Improper uninstallation of the storage system

Danger to life due to electrocution!

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

10.2 Disposal

CAUTION

Improper transport of battery modules

Fire outbreak at battery modules or emission of toxic substances!

- ▶ Transport the battery modules in their original packaging only. If you no longer have the original packaging, new packaging can be requested from sonnen GmbH.
- ▶ Never transport damaged battery modules.

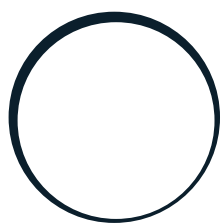
The storage system and the batteries it contains **must not** be disposed of as domestic waste!



Illustration 67: 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.



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sonnen GmbH

Am Riedbach 1

D-87499 Wildpoldsried